EBC

Energy in Buildings and Communities Programme

International Energy Agency

Implementation of Energy Strategies in Communities (Annex 63)
Volume 2: Development of strategic measures

Energy in Buildings and Communities Programme

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EBC is a programme of the International Energy Agency (IEA)

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Preface

THE INTERNATIONAL ENERGY AGENCY

The International Energy Agency (IEA) was established in 1974 within the framework of the Organisation for Economic Co-operation and Development (OECD) to implement an international energy programme. A basic aim of the IEA is to foster international co-operation among the 29 IEA participating countries and to increase energy security through energy research, development and demonstration in the fields of technologies for energy efficiency and renewable energy sources.

THE IEA ENERGY IN BUILDINGS AND COMMUNITIES PROGRAMME

The IEA co-ordinates international energy research and development (R&D) activities through a comprehensive portfolio of Technology Collaboration Programmes. The mission of the IEA Energy in Buildings and Communities (IEA EBC) Programme is to develop and facilitate the integration of technologies and processes for energy efficiency and conservation into healthy, low emission, and sustainable buildings and communities, through innovation and research. (Until March 2013, the IEA EBC Programme was known as the IEA Energy Conservation in Buildings and Community Systems Programme, ECBCS.)

The R&D strategies of the IEA EBC Programme are derived from research drivers, national programmes within IEA countries, and the IEA Future Buildings Forum Think Tank Workshops. These R&D strategies aim to exploit technological opportunities to save energy in the buildings sector, and to remove technical obstacles to market penetration of new energy efficient technologies. The R&D strategies apply to residential, commercial, office buildings and community systems, and will impact the building industry in five areas of focus for R&D activities:

- Integrated planning and building design
- Building energy systems
- Building envelope
- Community scale methods
- Real building energy use

THE EXECUTIVE COMMITTEE

Overall control of the IEA EBC Programme is maintained by an Executive Committee, which not only monitors existing projects, but also identifies new strategic areas in which collaborative efforts may be beneficial. As the Programme is based on a contract with the IEA, the projects are legally established as Annexes to the IEA EBC Implementing Agreement. At the present time, the following projects have been initiated by the IEA EBC Executive Committee, with completed projects identified by (*)

and joint projects with the IEA Solar Heating and Cooling Technology Collaboration Programme by (☼):

Annex 1: Load Energy Determination of Buildings (*)
Annex 2: Ekistics and Advanced Community Energy Systems (*)
Annex 3: Energy Conservation in Residential Buildings (*)
Annex 4: Glasgow Commercial Building Monitoring (*)
Annex 5: Air Infiltration and Ventilation Centre
Annex 6: Energy Systems and Design of Communities (*)
Annex 7: Local Government Energy Planning (*)
Annex 8: Inhabitants Behaviour with Regard to Ventilation (*)
Annex 9: Minimum Ventilation Rates (*)
Annex 10: Building HVAC System Simulation (*)
Annex 11: Energy Auditing (*)
Annex 12: Windows and Fenestration (*)
Annex 13: Energy Management in Hospitals (*)
Annex 14: Condensation and Energy (*)
Annex 15: Energy Efficiency in Schools (*)
Annex 16: BEMS 1- User Interfaces and System Integration (*)
Annex 17: BEMS 2- Evaluation and Emulation Techniques (*)
Annex 18: Demand Controlled Ventilation Systems (*)
Annex 19: Low Slope Roof Systems (*)
Annex 20: Air Flow Patterns within Buildings (*)
Annex 21: Thermal Modelling (*)
Annex 22: Energy Efficient Communities (*)
Annex 23: Multi Zone Air Flow Modelling (COMIS) (*)
Annex 24: Heat, Air and Moisture Transfer in Envelopes (*)
Annex 25: Real time HVAC Simulation (*)
Annex 26: Energy Efficient Ventilation of Large Enclosures (*)
Annex 27: Evaluation and Demonstration of Domestic Ventilation Systems (*)
Annex 28: Low Energy Cooling Systems (*)
Annex 29: ☼ Daylight in Buildings (*)
Annex 30: Bringing Simulation to Application (*)
Annex 31: Energy-Related Environmental Impact of Buildings (*)
Annex 32: Integral Building Envelope Performance Assessment (*)
Annex 33: Advanced Local Energy Planning (*)
Annex 34: Computer-Aided Evaluation of HVAC System Performance (*)
Annex 35: Design of Energy Efficient Hybrid Ventilation (HYBVENT) (*)
Annex 36: Retrofitting of Educational Buildings (*)
Annex 37: Low Exergy Systems for Heating and Cooling of Buildings (LowEx) (*)
Annex 38: ☼ Solar Sustainable Housing (*)
Annex 39: High Performance Insulation Systems (*)

Annex 40: Building Commissioning to Improve Energy Performance (*)
Annex 41: Whole Building Heat, Air and Moisture Response (MOIST-ENG) (*)
Annex 42: The Simulation of Building-Integrated Fuel Cell and Other Cogeneration Systems (FC+COGEN-SIM) (*)
Annex 43: ☼ Testing and Validation of Building Energy Simulation Tools (*)
Annex 44: Integrating Environmentally Responsive Elements in Buildings (*)
Annex 45: Energy Efficient Electric Lighting for Buildings (*)
Annex 46: Holistic Assessment Tool-kit on Energy Efficient Retrofit Measures for Government Buildings (EnERGo) (*)
Annex 47: Cost-Effective Commissioning for Existing and Low Energy Buildings (*)
Annex 48: Heat Pumping and Reversible Air Conditioning (*)
Annex 49: Low Exergy Systems for High Performance Buildings and Communities (*)
Annex 50: Prefabricated Systems for Low Energy Renovation of Residential Buildings (*)
Annex 51: Energy Efficient Communities (*)
Annex 52: ☼ Towards Net Zero Energy Solar Buildings (*)
Annex 53: Total Energy Use in Buildings: Analysis and Evaluation Methods (*)
Annex 54: Integration of Micro-Generation and Related Energy Technologies in Buildings (*)
Annex 55: Reliability of Energy Efficient Building Retrofitting - Probability Assessment of Performance and Cost (RAP-RETRO) (*)
Annex 56: Cost Effective Energy and CO_2 Emissions Optimization in Building Renovation (*)
Annex 57: Evaluation of Embodied Energy and CO_2 Equivalent Emissions for Building Construction (*)
Annex 58: Reliable Building Energy Performance Characterisation Based on Full Scale Dynamic Measurements (*)
Annex 59: High Temperature Cooling and Low Temperature Heating in Buildings (*)
Annex 60: New Generation Computational Tools for Building and Community Energy Systems (*)
Annex 61: Business and Technical Concepts for Deep Energy Retrofit of Public Buildings (*)
Annex 62: Ventilative Cooling
Annex 63: Implementation of Energy Strategies in Communities
Annex 64: LowEx Communities - Optimised Performance of Energy Supply Systems with Exergy Principles
Annex 65: Long-Term Performance of Super-Insulating Materials in Building Components and Systems
Annex 66: Definition and Simulation of Occupant Behavior in Buildings
Annex 67: Energy Flexible Buildings

Annex 68: Indoor Air Quality Design and Control in Low Energy Residential Buildings
Annex 69: Strategy and Practice of Adaptive Thermal Comfort in Low Energy Buildings
Annex 70: Energy Epidemiology: Analysis of Real Building Energy Use at Scale
Annex 71: Building Energy Performance Assessment Based on In-situ Measurements
Annex 72: Assessing Life Cycle Related Environmental Impacts Caused by Buildings
Annex 73: Towards Net Zero Energy Public Communities
Annex 74: Competition and Living Lab Platform
Annex 75: Cost-effective Building Renovation at District Level Combining Energy Efficiency and Renewables
Annex 76: ☼ Deep Renovation of Historic Buildings Towards Lowest Possible Energy Demand and CO_2 Emissions
Annex 77: ☼ Integrated Solutions for Daylight and Electric Lighting

Working Group - Energy Efficiency in Educational Buildings (*)
Working Group - Indicators of Energy Efficiency in Cold Climate Buildings (*)
Working Group - Annex 36 Extension: The Energy Concept Adviser (*)
Working Group - HVAC Energy Calculation Methodologies for Non-residential Buildings

Project Overview

BACKGROUND

Energy Efficient Communities (IEA-EBC Annex 51) suggested that successful urban energy planning is only possible, if energy planning is integrated in the entire urban planning process. However, research in both Annex 51 and Annex 63 has found that in many countries consideration of energy issues is missing in urban planning processes. This is of great concern, since, with the growing challenge of climate change, municipalities and energy utilities are charged with implementing both measures that adapt to the present conditions and measures that mitigate against future impacts. Both parties, municipalities and energy utilities, must coordinate their actions and both need a comprehensive set of tools and strategies to manage their resources so as to minimise the generation of greenhouse gases.

The linkage between urban form, energy use and climate change has been recognised for many years yet there still remain significant barriers separating the goals of urban planning and those of efficient energy delivery. In current practices energy related issues are still isolated from virtually all other municipal services; building codes for example often limit their scope to building safety and ignore the impact of energy consumption. By integrating strategies about optimizing supply, delivery and consumption of energy with (municipal or utility) planning protocols both municipalities and utilities can deliver to their constituents a powerful set of strategies with which to address climate change.

A natural connection should exist between urban development and energy development. Historically, the separation of each field's priorities and practices has created an energy efficiency challenge that requires a new and improved set of planning tools and strategies.

CONTENT

IEA-EBC-Annex 63 aims to identify strategies that can unify urban and energy planning communities and allow both parties to engage in the process of change to reach long term targets. The research addresses key barriers that expand the scope of planning and lead to a more comprehensive understanding of the new, urban, low-carbon environment. The outcome of this project is that governments, urban decision makers, utilities and urban planning departments can develop a clearer understanding as to how they integrate energy issues into urban planning processes and what actions they must undertake and when, in order to be successful.

PARTICIPATING COUNTRIES

Following countries (represented by 19 organisations) have been participating in Annex 63: Austria, Canada, Denmark, France, Germany, Ireland, Japan, the Netherlands, Norway, Switzerland and the United States of America.

INVOLVED CITIES

Following cities were involved in Annex 63: Salzburg, Vienna (Austria), Burlington, Guelph, London (Ontario), Toronto (Canada), Egedal, Middelfart, Roskilde, Skive (Denmark), Lille, Strasbourg (France), Aachen, Ludwigsburg, Karlsruhe (Germany), Kitakyushu, Yokohama (Japan), Maastricht (the Netherlands), Oslo, Bergen (Norway), Basel (Switzerland), Minneapolis (USA). Also Graz (Austria), Ottawa, Pickering (Canada), Ballerup, Lyngby (Denmark), Bottrop (Germany), Amsterdam, Parkstad (the Netherlands) and Zürich (Switzerland) supported the project team with information and case studies.

METHODOLOGY

To better understand the composition of suitable energy strategies, the research program adopted the following approach:

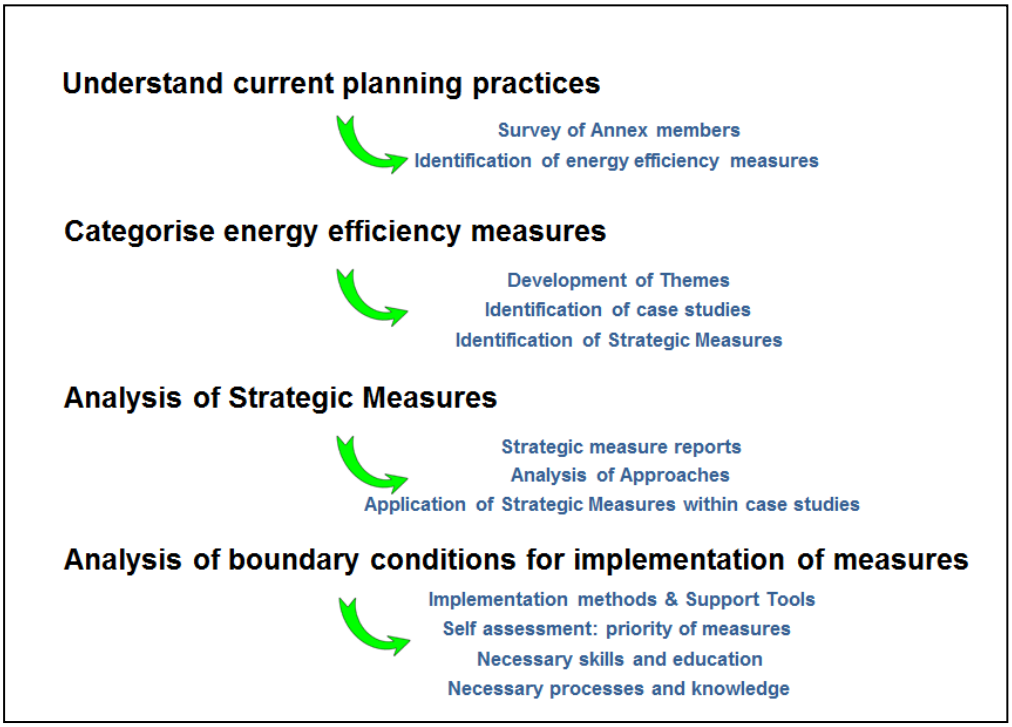

Figure A: Research Methodology (NRCan, 2017)

OUTPUTS

The results of Annex 63 (Implementation of Energy Strategies in Communities) are documented in six Volumes (sequenced according to the development progress). For orientation, the name and content of each Volume is described in the following overview:

Volume 0 – Documentation of workshops and involvement of cities: This report describes the information exchange and dissemination activities undertaken within this research. The information exchange activities were essential to get and understand all relevant information for answering the research question and to contribute to practical appropriability. In total 143 information exchange activities with 2,394 people were carried out.

Volume 1 – Inventory of measures: This report describes the existing national political framework conditions, energy and land-use planning processes, strategies for energy planning and existing national measures in the field of urban and energy planning. In this research, the term measure refers to any action, program, policy or other activity that can demonstrate or influence a change in process. Amongst other background information, 22 planning processes and 89 measures from 11 countries are described in detail in this report.

Volume 2 – Development of strategic measures: This report describes the further development of the analysed measures from Volume 1 into strategic measures. As with the term measure, a strategic measure refers to an essential measure in concept that can be used to develop individual implementation strategies on a local level for part or the whole life cycle of a project (from the first vision to monitoring of the implemented solution). The developed strategic measures deal with the following topics:

- Setting Vision and Targets
- Developing Renewable Energy Strategies
- Making Full use of Legal Frameworks
- Designing an Urban Competition Processes
- Making use of Tools Supporting the Decision Making Process
- Implementing Monitoring of Energy Consumption and GHG Emission practices
- Enhancing Stakeholder Engagement & Involvement
- Including Socio Economic Criteria
- Implementing Effective and Efficient Organisational Processes

The report includes both a summary of each strategic measure supported by nine appendices, each a detailed description of each strategic measure.

Volume 3 – Application of strategic measures: This report describes, for different scales (city, district and project level) and for 29 conceptualised case studies, how implementation champions can apply the strategic measaues from Volume 2. Implementation champions are hereby understood as stakeholders in the city who take the initiative to lead and facilitate implementation processes.

Volume 4 – Stakeholder support materials: This report describes, in more detail, within the framework of Annex 63 elaborated stakeholder support materials and their application. The materials deal with the following topics:

- Municipality Self-Assessment tool
- Capacity building and skills
- Workshop format and procedures
- Informational slides for presentations
- Education materials

Volume 5 – Recommendations: This report contains central recommendations for different target groups (e.g. policy makers, researchers, planners), for implementation and for further investigation. Justifications and examples in the field of urban and energy planning are central elements of this report.

HOW TO READ

Depending of the interest of the reader whether the focus might be on the application of results or on the methodology of producing the results, figure B shows the sequence of how best to use the Volumes.

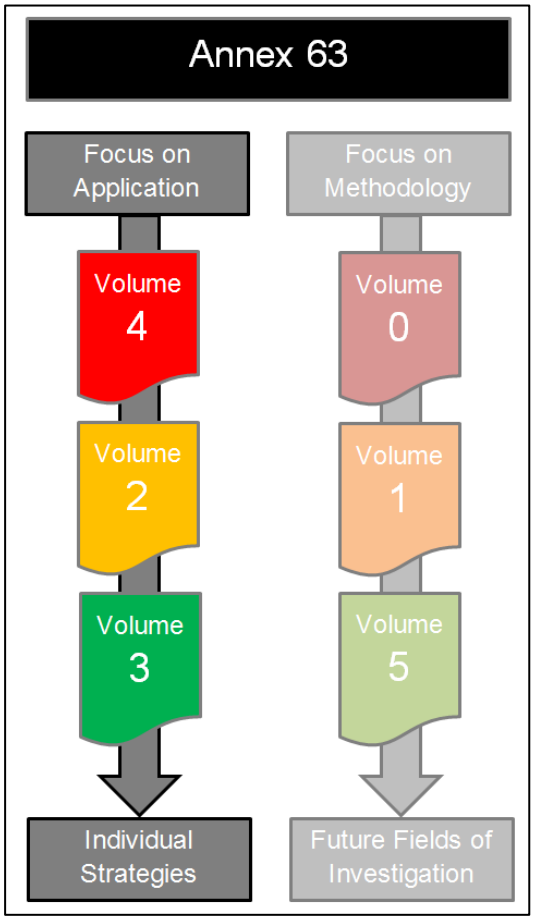

Figure B: How readers should apply the produced documents (SIR, 2017)

If the focus of the reader lies on the application of the elaborated results, the Volume 4 should be read first. The appendix of Volume 4 contains a municipality self-assessment tool that allows the reader to identify the strengths and weaknesses within the current municipal structure. Volume 4 also contains additional working materials (e.g. necessary capacities and skills, suitable workshop formats, informational slides for presentations and education materials) that support the implementation of strategic measures. Recommendations for the successful implementation of specific strategic measures can be found in appendix of Volume 2, leading to the application of different strategic measures as outlined in Volume 3. In this way, the reader gains from the three reports all relevant information for the development of individual implementation strategies.

If the reader is interested on methodological aspects of Annex 63, Volume 0 should be read first. Volume 0 contains the central information regarding the information exchange activities and input from the variety of annex stakeholders (cities, local stakeholder groups, project team, national and international networks, IEA Technology Collaboration Programmes). Principal output of this consultation process is also described in detail in Volume 1 (local framework conditions in 11 countries and 22

cities). Finally, all relevant recommendations for different target groups are summarised in Volume 5. Again, the reader gets in the three reports all the relevant information for further fields of investigation.

Contents

1. Introduction

The initial phase of Annex 63 was a survey of member countries to create an inventory of existing measures and their effectiveness. The results are documented in *Volume 1 – Inventory of measures.* The findings can be summarised as follows:

"*Examination of the land use and energy infrastructure planning procedures in eleven countries appears to confirm that a separation exists between the energy and urban planning practices. It is common to many countries that that limited discussion or sharing of information exists between the two planning groups as regards potential energy savings*

Only in the event of a special project is a special effort made by one or other party to change the status quo and pursue an alternative approach such as for energy generation, delivery or distribution. As often as not though, the lessons learned from such initiatives rarely become absorbed within the standard urban development process. Societal or political barriers are well entrenched in the procedures and the accountability protocols within either party effectively prevents ongoing collaboration or consideration of improved energy use on a larger than single project basis.

An approach must be created that allows the planner (typically the planner involved with assessing and approving urban development or the installation of energy infrastructure) to move towards a consensus position with all parties and stakeholders sharing an understanding of the benefits and risks of an alternative approach and are prepared to share in the project itself.

Through the use of a questionnaire a series of research challenges were identified that present barriers to many planners, either knowingly or unknowingly.

- *Setting environmental targets and goals for municipal development*
- *Developing an implementable strategy around the wide-scale use of renewable energy*
- *Creating and using enabling legislation to encourage the transition process*
- *Creating the framework for competitive design that maximises environmental benefit*
- *Developing and using planning and decision support tools based on available information*
- *Establishing a workable monitoring program*
- *Gaining stakeholder engagement, input and uptake of the process*
- *Monetising the non-financial benefits of the transition process*
- *How to structure the organisation to ensure fluidity of action."*

The central output of Volume 1 was therefore a group of nine strategic measures supported by one generalized planning process as visualised in figure 1-1.

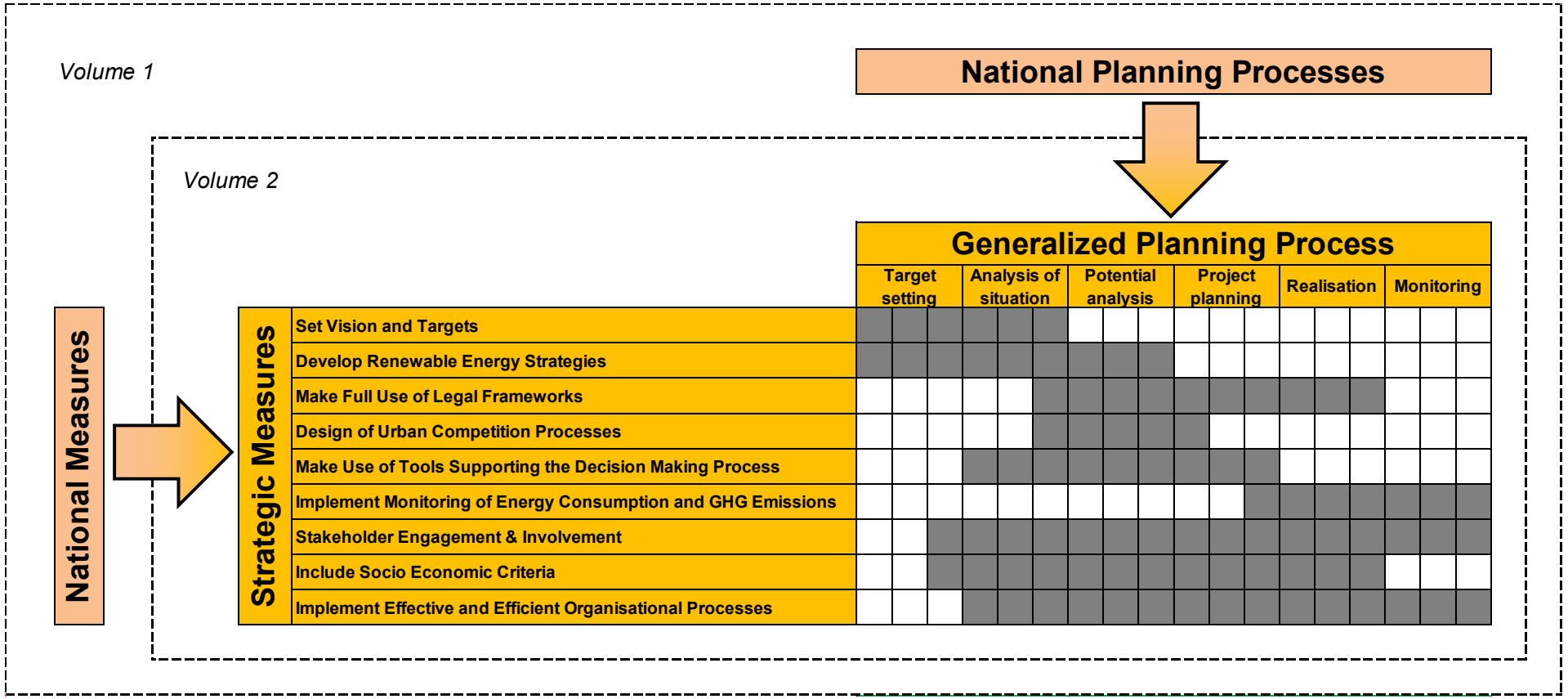

Figure 1-1: Methodology and results from the analysis carried out in volume 1 (SIR, 2017)

1.1. Overview of Strategic Measures

These descriptions explain the focus of each strategic measure and can be used as orientation

1.1.1. Set Vision and Targets

This measure focused on how urban and project planning processes can be enriched with an overarching vision, as well as clear targets. Applying this measure will make planning more productive by orienting planning actions toward a common vision and set of targets. Building early and broad acceptance of visions and targets will increase their success.

1.1.2. Develop Renewable Energy Strategies

This measure focuses on developing strategies, ideally in alignment with vision and targets, to shift the existing energy supply mix to include a higher amount of renewable energy. Strategies informed by stakeholder engagement and that rely on the range of implementation tools are more likely to be successful.

1.1.3. Make Full Use of Legal Frameworks

This measure supports the analysis of existing legal frameworks to identify opportunities to integrate energy and urban planning, such as through memoranda of understanding, joint powers agreements, and shared decision making, governance, and funding structures.

1.1.4. Design of Urban Competition Processes

This measure offers recommendations as to when and how climate and energy-related issues can be entered into competitions (sometimes called requests for proposals – RFPs) to produce projects that have enhanced urban design quality, as well as features that advance climate and energy goals.

1.1.5. Make Use of Tools Supporting the Decision Making Process

This measure is focused on tools that can help to analyze and apply energy and other information in decision-making and planning processes. Tools can be helpful in integrating multiple data sources (e.g. energy, economic, social), conducting analysis across large data sets, and exploring potential scenarios.

1.1.6. Implement Monitoring of Energy Consumption and GHG Emissions

This measure highlights the importance of monitoring energy and GHG data at multiple scales, from the building to the community. Establishing an initial baseline and tracking data over time can be used to identify progress toward and updates to Targets and Renewable Energy Strategies.

1.1.7. Stakeholder Engagement & Involvement

This measure emphasizes that successful stakeholder engagement involves a two-way exchange of information via an early, frequent, and ongoing process. Engagement is acknowledged as helping to build consensus, improve the outcomes of planning efforts, and build support for implementation.

1.1.8. Include Socio Economic Criteria

This measure emphasizes the significance of early analysis and integration of multiple benefits (e.g. cost savings, environmental equity) of energy efficiency practices. Socio-economic criteria can be relevant at both the project and planning scales.

1.1.9. Implement Effective and Efficient Organisational Processes

This measure outlines mechanisms to assist in moving the principles of a sustainable project beyond its project lifetime through the creation of a functional organisation. It compares the organisation of process within the local administration for cross-sectoral initiatives and helps to identify relevant local/regional (key) stakeholders.

2. Strategic measures

The second stage of this analysis, described in this report (*Volume 2 – Development of strategic measures*) addresses each strategic measure, providing ideas and concepts to move a community towards a more comprehensive position. “Community” is hereby understood as a functioning part of a city and can be a municipality or a smaller sub-area, for example a district or a neighbourhood. The nature and impact of each strategic measure has been analysed in detail by internal working groups, comprising members of the Annex participating countries as listed in Table 2-1.

Table 2-1: Composition of the individual working groups

Strategic Measure	**Working Group**
Set Vision and Targets	ENCO, Natural Resources Canada, ElfER, IREES, ZUYD University
Develop Renewable Energy Strategies	DTU, Fraunhofer ISE
Make Full Use of Legal Frameworks	SIR, B.&S.U., Intep GmbH
Design of Urban Competition Processes	Intep GmbH, SIR, ElfER, Osaka University
Make Use of Tools Supporting the Decision Making Process	RWTH Aachen University, University of Minnesota, ENCO
Implement Monitoring of Energy Consumption and GHG Emissions	B.&S.U., ElfER
Stakeholder Engagement & Involvement	Natural Resources Canada, Aalborg University, RWTH Aachen University, University of Minnesota
Include Socio Economic Criteria	ZUYD University, Natural Resources Canada, Cenergia a part of Kuben Management, Intep GmbH, Tokyo Gas
Implement Effective and Efficient Organisational Processes	DV e.V., SIR, DTU, ElfER, RWTH Aachen University

Each working group developed their own approaches for the collection of information and for the further assessment of each strategic measure. These included: questionnaires, literature review and analyses of best-practices. The output from each working group is described in Appendix A, presented according to the following structure:

- Introduction of the measure
- Barriers to current implementation
- Compelling conditions that support its implementation
- Content of the strategic measure
- Findings of its implementation
- Recommendations regarding its use

Each strategic measure was assessed for use within the localised conditions of each annex member country and the experience gained was incorporated within the report. This provided confidence to support their transferability to other jurisdictions.

Furthermore, an overview of involvement of each strategic measure in terms of its entry into the planning discussion was assessed and is given. This enables the reader to better develop implementation strategies for communities (see also section 3).

More details about each strategic measure are described in appendix A. These descriptions can be used as working material, when it is clear, what the most relevant action field is. To identify the most relevant action field, a self-assessment guide in *Volume 4* is offered (see also section 4).

2.1. Set Vision and Targets

2.1.1. Introduction

In urban transition initiatives, municipalities face the need to motivate and maintain a long-term process while at the same time delivering immediate actions and inducing short term quantifiable actions or measures (Nevens et al., 2013). Accordingly, in order to create a linkage between urban planning and energy planning, a municipality must develop a community-based vision identifying the main goal and possible pathways by which to get there. Helm (Helm, 2009) points out the importance of a "community vision [as] an actor network (and facilitation) tool, to a large extent aimed at holding the different actors together". Once a community-wide vision is established, the identification of concrete measures and actions that help to approach the common goal becomes a key task. In this second stage, setting realistic and measurable targets is of vital importance to ensure that the local actions are leading towards the common goals and progress can be assessed. Both aspects are closely linked as "[w]ithout a vision, a transformation effort can easily dissolve into a list of confusing and incompatible projects" (Kotter, 1995). On the other hand, a vision alone will inspire but not implement transition.

Basis for the development of this strategic measure lies in the following measures as described in Volume 1:

Table 2-1-1: Link between measures and strategic measure. Measure = any action, program, policy or other activity that can demonstrate or influence a change in process.

No	Country	Measures	Intent	Related Themes
1	Austria	Joining Climate Alliances / Self-commitment	Encourage	Authority
10	Canada	Aligning targets with zoning requirements	Enable	Targets
20	Denmark	GHG emissions reduction agreements (Eco-Cities)	Encourage	Targets
30	Germany	Climate Action Programme 2020	Enable Enforce	Targets, Information, Feedback
31	Germany	NAPE: National Action Plan on Energy Efficiency	Encourage Enable Enforce	Targets, Information, Tool
32	Germany	Energy Efficiency Strategy for Buildings (part of the NAPE)	Encourage Enable	Targets, Information, Tool
40	Germany	Joining Climate Alliances (eea	Encourage	Targets, Tool,

No	Country	Measures	Intent	Related Themes
		Certification/ Covenant of Mayors)		Feedback
70	Netherlands	Strength of the regions	Enable, encourage	Information, Feedback
79	Switzerland	2000-Watt-Society	Encourage Enforce (when in special use plan)	Targets
86	USA	Climate action planning targets	Enable	Authority
59	Japan	Eco-Model City / Future city	Encourage	Authority
65	Netherlands	The application of the ISRS (Integral Spatial Realistic Scenario) for reaching zero-energy on a city level	Encourage Enable	Authority, Targets, Tools

2.1.2. Barriers

Municipalities or Communities lack knowledge about how to start the process of defining both a useful and realistic vision and identifying targets. A lack of a common vision makes it difficult to streamline the activities of involved partners throughout the process and to measure the impact at the end of the project. In addition, long-term visions need to be broken down into realistic, measurable and concrete targets. These targets need strengthening by the commitment of responsible actors; otherwise, there is a high risk that activities considered are not fully in line with the long-term vision.

2.1.3. Compelling condition

Visions developed by municipalities are most helpful if they are embedded in a wider system, for instance, if they are related to regional, national or international (European) development goals. Very often, national or international targets (UN-Paris Agreement, European Union) goals are the basis for national legislation and therefore need to be considered. This means that existing visions and goals should be analysed and checked against their influence on the certain municipality or community before creating their own vision.

2.1.4. Content

The detailed description of this strategic measure explains the path from the creation of a vision, defining targets supporting the vision and the gaining of commitment from the important stakeholders, actors and decision makers. Existing, successful examples of visions, targets and commitments were analyzed and presented, e.g. the long-term

vision of the 2000-Watt-society, the commitment created regarding this vision by a referendum voted for by the citizens of Zurich and the breakdown to specific targets by the title “2000-Watt-site” (2000-Watt, 2017).

2.1.5. Findings

The working group recommends the development of a common vision for a municipality, breaking it down to specific targets and in order to get local commitment to achieve those targets. Following this approach should help reduce the risk of rejection. Involvement of stakeholders (see section 2.7) is an important factor for gaining support for the implementation.

2.1.6. Recommendations

The working group recommends the following:

- **Consider procedures to define the targets**

  A target has to be accepted by all stakeholders. This can only be achieved when the stakeholders are involved in the definition process. In order to be able to monitor success they should be measurable. This includes quantitative (e.g. kW, kWh or MJ energy, m^2 ground floor public use, etc.) as well as qualitative criteria (e.g. design of attractive public area, marketing of energy and mobility measures, etc.).

- **Create involvement and awareness**

  Targets can only be reached if the people are involved to the maximum. The question is here how to get the link between the target and the commitment in order to reach a personal involvement for the targets. One has to find measures to translate/transfer targets to the level of action and stakeholders. There is a need to find a way to have stakeholders, citizens, politicians and engineers at the same table to assess the options.

- **Refer to role models**

  One option could be to identify leading cities to serve as role models and encourages other stakeholders to identify comparable roles within these communities. Role model “parallels” can be individually developed (e.g. peer to peer) or be a common movement (e.g. partnering associations)

More details regarding this strategic measure can be found in appendix A-1.

2.2. Develop Renewable Energy Strategies

2.2.1. Introduction

As communities work to enhance renewable energy and reduce GHGs relative to urban development, strategy setting that integrates energy and urban planning expertise and tools is essential. (Bryson, 2011), describes strategic planning around energy and GHG reduction as the systematic organization of actions around community goals, energy strategies might relate to the following action areas:

- Increase energy efficiency in energy production,
- Decrease energy demand in the existing building stock,
- Design new buildings for low-energy or zero-energy performance, and
- Shift the energy supply system toward the exclusive use of renewable energy.

Basis for the development of this strategic measure lies in the following measures as described in Volume 1:

Table 2-2-1: Link between measures and strategic measure. Measure = any action, program, policy or other activity that can demonstrate or influence a change in process.

No	Country	Measures	Intent	Related Themes
18	Denmark	Municipal Heating Plan	Enforce	Authority, Tools
19	Denmark	Strategic Energy Plan	Encourage Enforce (in case it gets mandatory)	Tools
24	France	PCET	Enforcing	Authority
49	Ireland	LARES methodology	Encourage	Authority, Targets
50	Ireland	Development Plans	Enable	Authority, Targets
54	Ireland	National Spatial Strategy	Enforce	Targets
68	Netherlands	Energy Atlas	Encourage Enable	Authority, Tools, Feedback
74	Norway	Green Strategies	Encourage	Information
77	Norway	Strategy for charging stations	Encourage	Information
80	Switzerland	Spatial Energy Planning	Enforce (when obligations for landowners)	Tools

No	Country	Measures	Intent	Related Themes
			Encourage (when coordination between energy suppliers)	
65	Netherlands	The application of the ISRS (Integral Spatial Realistic Scenario) for reaching zero-energy on a city level	Encourage Enable	Authority, Targets, Tools
81	Switzerland	Energy City	Encourage	Tools, Feedback

2.2.2. Barriers

Without neglecting the increasingly important role private investors play in sustainable community development, municipalities and public urban developers can still be seen as the main driver in a community's transition to a low carbon environment. The extensive planning competencies of municipalities, and their comprehensive area of responsibility based on the common good enable a strategic approach in community development. Depending on the action area, municipalities and public entities – in cooperation with private actors – can influence the use of renewable energy within the community through roles that can be characterized as such: enforcer; consumer, producer, developer, facilitator and cheerleader (Bulkeley & Kern, 2006; Danish Energy Agency, 2013 and Lybæk & Kjær, 2015). Even if the roles and responsibilities are various, municipalities implementing activities in the field of renewable energy strategies (RES) often do this in a disconnected and uncoordinated fashion that makes the achievement of energy targets difficult.

2.2.3. Compelling conditions

National energy plans are of a visionary character, setting general GHG reduction targets, with delineated connections to supranational grids. Regional plans are often presented as a coordinating function of local activities. Municipal RESs, by contrast are concerned with the spatial implications of energy demand and areas for energy supply infrastructure, such as photovoltaics or thermal grids. Their focus on spatial needs implies that the RES must include specific directives when downscaling national level targets to community level applications.

2.2.4. Content

The description of this strategic measure identifies four important steps in the preparation of an RES: Target Setting and Analysis, Technical Scenarios, Actions Plans and Implementation and Evaluation. The theoretical outline of how to develop a RES strategy is demonstrated by several examples.

2.2.5. Findings

In some countries national level renewable energy strategies offer a basis for community-scale renewable energy strategy development. The cases make it clear that communities are a relevant scale for strategic energy planning, including the development of goals and specification for local actions to advance plan implementation. The plan should integrate the needs and aspirations of the community, but should also be cognizant of the community's capacity to take action. Renewable energy targets are a typical part of a community energy plan, along with responsibilities and timelines for key actions.

Strategic energy plans can relate to all components of energy systems, including production, conversion, delivery, and use of energy, as well as all scales from global down to single buildings and building components. Community-scale renewable energy strategies are typically focused on spatial implications of energy demand and community energy infrastructure. Plans focus on public and sector activities, including urban development, and rely on local tools (e.g. regulations, incentives, public-private partnerships) for implementation. Local stakeholders and political considerations play an important role in advancing implementation. Monitoring of implementation is also essential in assessing fulfilment of goals and addressing any operational barriers.

2.2.6. Recommendations

A strategic approach for reaching energy and emission reduction targets at a community scale increases the likelihood of implementation. The development of a renewable energy strategy (RES) as an iterative process can be a supportive measure, because it systematizes actions and coordinates the use of other tools to address the challenge of implementation. The strategy presents a series of distinct characteristics:

1 A RES can be used as a guiding document or strategy that should be integrated into municipal and private stakeholders' future plans and in ongoing development projects to achieve desired energy targets.
2 The RES does not explain how to implement energy targets; it proposes a framework of measures that contribute to the implementation of renewable energies.
3 The RES should be under constant and simultaneous development, implementation and critical reassessment.
4 The RES defines the roles, mandates, responsibilities, and competencies of the municipality and private stakeholders. It requires an understanding of both possibilities and restrictions arising from the RES.
5 The RES is a strategic document that can be understood as a platform to contextualize and coordinate the measures needed to attain the GHG reduction targets

More details regarding this strategic measure can be found in the appendix A-2.

2.3. Make Full Use of Legal Frameworks

2.3.1. Introduction

Adequate legislation sets the supportive framework for the sustainable development of communities. The legal framework usually consists of general laws, secondary regulations and more or less formal/informal guidelines and recommendations. This strategic measure supports the analysis of existing legal frameworks to identify opportunities to integrate energy and urban planning, such as through memoranda of understanding, joint powers agreements and shared decision making, governance, and funding structures.

Basis for the development of this strategic measure lies in the following measures as described in Volume 1:

Table 2-3-1: Link between measures and strategic measure. Measure = any action, program, policy or other activity that can demonstrate or influence a change in process.

No	Country	Measures	Intent	Related Themes
2	Austria	Using legally binding instruments to set climate goals. Regional Development Concept	Enforce	Authority
5	Austria	Using legally binding instruments to set climate goals. Local Development Plan	Enforce	Authority
14	Canada	Service Area Bylaws	Enforce	Tools
33	Germany	Zoning Plan (Flächennutzungsplan)	Enforce	Authority
34	Germany	Land Use Plan (Bebauungsplan)	Enforce	Authority
35	Germany	Legally binding instruments to set climate goals (EnEV, EEWärmeG, EEG)	Enforce (EnEV, EEWärmeG) Enable (EEG)	Autorithy, Targets, Tools
36	Germany	Regional/Urban Development Concepts (ISEK)	Encourage	Autorithy, Targets, Tools
47	Germany	District heating priority zones	Enforce, encourage	Authority
60	Japan	Low-Carbon City Act	Enable	Authority
73	Norway	Prosumer Agreements	Enabling	Authority, Tools
82	Switzerland	Special Use Planning	Enforce	Authority

2.3.2. Barriers

Existing legal frameworks for planning often presents opportunities to integrate energy planning into spatial planning. National legislation supports a much broader approach to implementation as it constitutes legal duties for municipalities. The inclusion of all relevant stakeholders is important to the process, often addressing market conditions that can be a barrier to progress.

2.3.3. Compelling conditions

It is crucial that a legal framework for urban and energy planning exist. This form of the framework differs from country to country regarding the targets, different territorial levels and the details of regulation.

2.3.4. Content

A legal framework is a central element to ensuring effectiveness and efficient planning at the local level. As immigration and a changing demand for housing are typical phenomena that operate over many decades, the regulatory frameworks for such spatial planning are specific to each country and are therefore not the focus of this work.

Energy planning is a relatively new discipline and is therefore subject to rapid change. Energy planning on community level covers a broad range, from energy efficient buildings and infrastructure to the access to energy, environmental and friendly production and distribution of heat and electricity. It also covers district management systems and public visibility. Therefore, the focus of this section, making full use of legal frameworks, lies in the use of these regulatory frameworks for energy planning so as to take into account the urban development process. Different types of regulatory frameworks are described in detail with the basis of the analysis lying in Switzerland, Denmark, Germany, Austria and Norway.

2.3.5. Findings

Mobility and immigration, limited resources and climate change are three global trends. To manage their impact, legal frameworks for spatial and energy planning are set in place in each country. Generally, these legal frameworks have the following characteristics:

1. Frameworks for energy planning: The explicit inclusion of energy efficiency and energy planning in regional/federal or state/national legislation supports a much broader approach to energy planning implementation as a legal duty to municipalities.
2. Frameworks for spatial planning – utilized for energy planning: Clear regulations increase the planning security for investors and building owners and ensure their synergistic use. The involvement of all relevant stakeholders is seen as a success factor.

3. Beyond legislation: Contracts are a further possibility to organise urban and energy planning. Municipalities can use this instrument in their role as the authority (if the law allow the usage) or as a private citizen (if the municipality is the land owners). The success of this instrument depends on market conditions.

As the use of legal frameworks differs between countries, operational recommendations were detailed. The recommendations describe the way that communities can make full use of legal frameworks for the implementation of energy strategies on site.

2.3.6. Recommendations

To make full use of legal frameworks, the following features are required:

1) Ask the right questions: The workshops undertaken as part of the research illustrated how questions help to create a common understanding and language. Therefore, several guiding questions to the following three topics were developed:
    a. How relevant is spatial and energy planning in your country's urban development?
    b. Which policy instruments are already influential in encouraging change and which could be enhanced through further regulation?
    c. Beyond legislation: How are contracts used for energy planning?
2) Ask the right persons: For answering these questions, it is important to have a deep understanding of urban planning, energy planning and legislation. Examples for different expert groups that could answer these questions are listed in Appendix A-3.
3) Make the possibilities visible: The results of such analysis should be made available for the target groups in a simple way. This can be in different forms as outlined in the examples listed in Appendix A-3.

More details regarding this strategic measure can be found in the appendix A-3.

2.4. Design of Urban Competition Processes

2.4.1. Introduction

Urban design is the process of designing and shaping cities, towns and villages. In contrast to architecture (which focuses on the design of individual buildings,) urban design deals with the larger scale of groups of buildings, traffic area and public spaces, whole neighbourhoods and districts, and entire cities, with the goal of making urban areas functional, attractive, and sustainable (Boeing et al.,2014).

There are different ways to optimise urban design solutions. Once the functionalities to be achieved are defined as the basis for further development and planning of buildings, public spaces etc. a common way in Europe is to propose an urban design competition.

Basis for the development of this strategic measure lies in the following measures as described in Volume 1:

Table 2-4-1: Link between measures and strategic measure. Measure = any action, program, policy or other activity that can demonstrate or influence a change in process.

No	Country	Measures	Intent	Related Themes
4	Austria	Urban Design Competitions	Encourage	Tools
27	France	HQE Aménagement	Encourage	Tools
28	France	ÉcoQuartier	Encourage	Information
46	Germany	DGNB certificate	Encourage	Information
63	Japan	CASBEE	Encourage	Tools
78	Switzerland	2000-Watt-Site Certification Scheme	Encourage (when voluntary) Enforce (when in special use plan)	Targets, Information, Tools

2.4.2. Barrier

Urban design competitions are complex processes, starting with the election of the jury, followed by the definition of criteria and then the elaboration of the competition program (Request for Proposals). Additional steps follow until the evaluation of the winning project. During this process there are several barriers to be addressed regarding the targets and limits on energy and carbon emissions.

2.4.3. Compelling conditions

To maximise the impact of the competition process, the municipality must have in place the relevant legal regulations that supports the use of energy and global warming related assumptions as a selection criteria for competition processes. In cases however where national legislation is in place the scope of urban design competitions is effectively defined, encouraging the integration of design aspects than those of conventional urban design.

2.4.4. Content

The description of this strategic measure highlights several ways to achieve sustainable design solutions by creating competitive programs using Swiss, Austrian and Japanese examples. Each country's context (political system, legislation, planning and construction approaches) is seen as influencing the design of the program although the success factors are presented in a generalized way for use by municipalities, regardless of their location.

2.4.5. Findings

Figure 2-4-1 highlights the entry points regarding the role of a sustainability expert. The expert, the competition program, the assessment methodology and the jury composition are discussed later in more detail with recommendations.

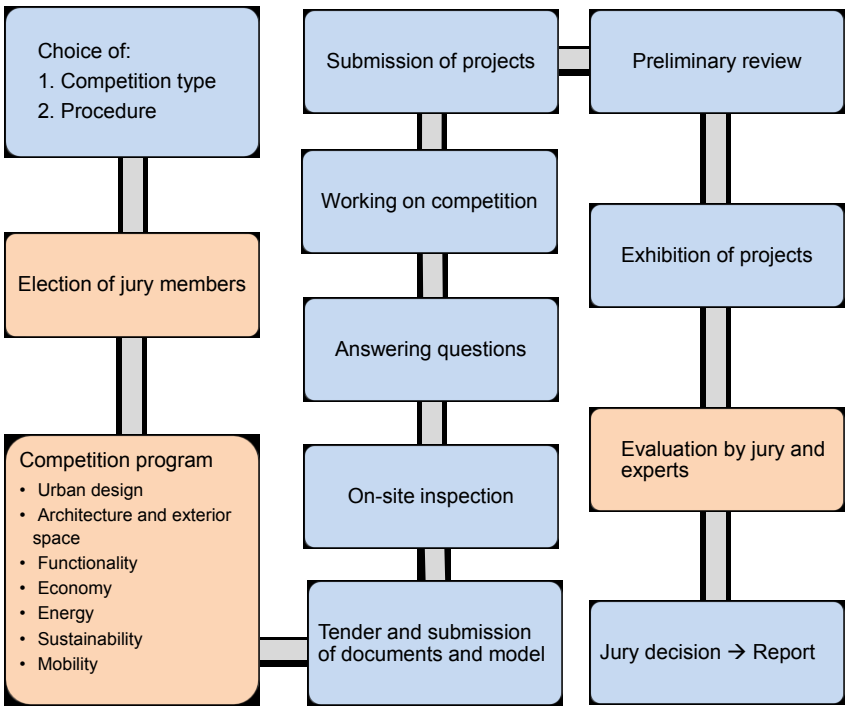

Figure 2-4-1: Competition process and sustainability-relevant entry points in the Swiss context

2.4.6. Recommendations

There are recommendations for the following entry-points in the competition process:

Role of "sustainability expert"

A professional adviser is key to a successful competition: as a consultant to the sponsor (municipality), the adviser is the individual directly responsible for planning, organizing and running the competition. The adviser's responsibilities fall into four key areas: program development, organization and structure, assistance in selecting a highly qualified jury capable of exercising sound judgment, and in conducting the competition so that all competitors receive fair and equitable treatment. This requires the adviser to be an impartial liaison between sponsor, jury, and competitors. To ensure a sustainable result, the adviser must be an independent entity who is capable of objectively approaching a competition and combine design quality with sustainability.

Requirements for competition program

In the early stages of the development process for a community it is important to define the requirements in such a way that the projects are developed under certain aspects of sustainability. The full report in the appendix includes standard clauses that can be utilised within documentation for a competition program (e.g. Request for Proposal).

Weighting of the energy and carbon requirement

An urban design competition should publish the assessment rules in the request for proposal. This provides all participating project teams advance knowledge of just how their project will be assessed. Besides energy, carbon and other sustainability parameters, urban design and architectural and exterior space quality, functionality, mobility and price play important roles.

To assure that sustainability aspects such as energy, carbon and other indicators will play an important enough role in the "best" project, it is important to assign weights to these aspects. Alternatively minimum requirements for the most important criteria could be defined as mandatory. If these criteria are not fulfilled then the whole project will not be evaluated further. This creates a GO / NO-GO checkpoint with sustainability on the one side and negotiable criteria on the other.

Jury composition

The composition of the jury of urban design competitions affects strongly the outcome for the sponsor and the sustainability strategy. Based on the specific national and/or municipal requirements it is important to decide together with the municipality on how to compose the jury. Often clients or institutions form the jury from their own stakeholders, with board members, staff, local community leaders, or local politicians on the selection committee. In this case they are favouring specific understanding of the particular project and its community in picking a winner. Moreover they bring in outside experts or designers of some renown to give greater importance to sustainability and visibility to the competition and to pick the winner based on larger trends and ideas in the greater design community.

More details regarding this strategic measure can be found in the appendix A-4.

2.5. Make Use of Tools Supporting the Decision Making Process

2.5.1. Introduction

Planning and Decision Support Systems (PDSS) are able to support decision making in the urban planning context, integrating data from multiple sources and the knowledge of the various stakeholders within different phases in the project planning process. Based on combined input, the PDSS can provide information, support analyses and advance monitoring and evaluation processes. Furthermore, PDSS can be used to enable more robust public participation, by its information distribution or feedback functions.

While less complex tools and instruments can be appropriate for the larger public audience, they may be limited when answering more detailed design questions. Expert tools may be required, demanding specific knowledge and expertise for the operation and interpretation necessary to account for the complexity within urban and energy planning environment.

As shown in the case study for the city of Bottrop, Germany, coordinated information infrastructure can support processes and planning at the municipal level. However, the process of integration of new systems requires change by depending heavily on socio-political issues and less so on technical ones. By demonstrating the benefit of easy and fast information and data access to and from participants, the implementation process can gain better support.

Basis for the development of this strategic measure lies in the following measures as described in Volume 1:

Table 2-5-1: Link between measures and strategic measure. Measure = any action, program, policy or other activity that can demonstrate or influence a change in process.

No	Country	Measures	Intent	Related Themes
25	France	Observatoire PCET	Enforcing	Feedback
42	Germany	Urban Communication Strategy (Energetikom in Lugwigsburg)	Encourage	Information
43	Germany	Consulting Services for Private Households	Encourage Enable	Information, Tools
44	Germany	Platform Energy Efficiency/ Initiative Energy Efficiency Networks	Encourage Enable	Information, Tools
56	Ireland	Wind Atlas	Enable	Information
66	Netherlands	Energy Potential Mapping	Enable	Tools

No	Country	Measures	Intent	Related Themes
67	Netherlands	Urban Harvest Approach (UHA)	Enable Enforce	Tools
72	Norway	Enova Funding	Encourage	Tools
73	Norway	Prosumer Agreements	Enabling	Authority, Tools
76	Norway	El Hub	Enable	Tools, Feedback
88	USA	Solar potential mapping	Enable	Tools

2.5.2. Barrier

In order to take reliable decisions during the planning process, up-to-date, detailed and well prepared information is needed. Historically much of this has often been missing or insufficiently processed (e.g. by using inadequate tools).

Three main challenges within decision-making have been identified: (a) data uncertainty; (b) legal and organizational boundaries; (c) public acceptance. All three factors hold the risk of leading to bad decisions or project failure. Data uncertainty is primarily based on a lack of specific data or low data quality. Decision support is often seen as lacking in transparency or the integration of relevant stakeholders. Thus, a lack of public acceptance of the decision and its outcomes may result. Furthermore, urban and energy planning are traditionally separate disciplines that lead to decision making based on limited views and responsibilities.

2.5.3. Compelling conditions

The drivers behind many of the stakeholders in urban development can lead to conflicting goals. For instance, the municipality may desire the minimization of greenhouse gas emissions whereas the energy providers might have concerns over the reduced revenue and the costs of energy system conversion. This leads to a conflict of objectives that needs to be resolved. In designing the PDSS, a balance must be made between the complex urban scale of the many input factors and interrelations and the user demands for a simple and intuitive process.

2.5.4. Content

Different available tools dealing with the presentation, visualization and processing of information have been collected and compared regarding their opportunities and limitations. The following aspects of PDSS have been identified in discussions with municipalities and experts, that of a centralised data management system with simple access, usage of tools to support the planning process, integration of local expertise and the combination of urban and energy planning.

2.5.5. Findings

The planners receive an overview of project needs and a recommendation as to what is to be considered when developing appropriate information tools. The overview will assist in selecting the format for their specific needs for the decision-making process.

In many municipalities, every department has its own data pool and data management structure. Datasets are often stored in different structures and formats, which results in higher effort when exchanging or merging data between departments. This data management structure impacts data access or at worst, makes an integrated data system impossible. When integration is possible however, as in the city of Bottrop, Germany (Figure 2-5-2) every department has access yet can remain responsible for its own data gathering and data management. Specific datasets are automatically synchronized with a central database to enable an easy data access to a large data pool. Citizens and other external partners are granted varying levels of access. Central departments for data management are often only seen as a cost driver. In this way, urban and energy planning projects might benefit from easier data access and analysis; the process of data gathering and exchange is simplified, giving the potential to reduce cost and effort in the overall municipal structure. Structured data management is one option to reduce uncertainty in decision making processes. Moreover, tools can be used to process and analyze data. For a broader usage, this might be simple tools, such as GIS-tools with online access. Tool usage in early planning phases for scenario generation and visualization might save time and money in later project phases.

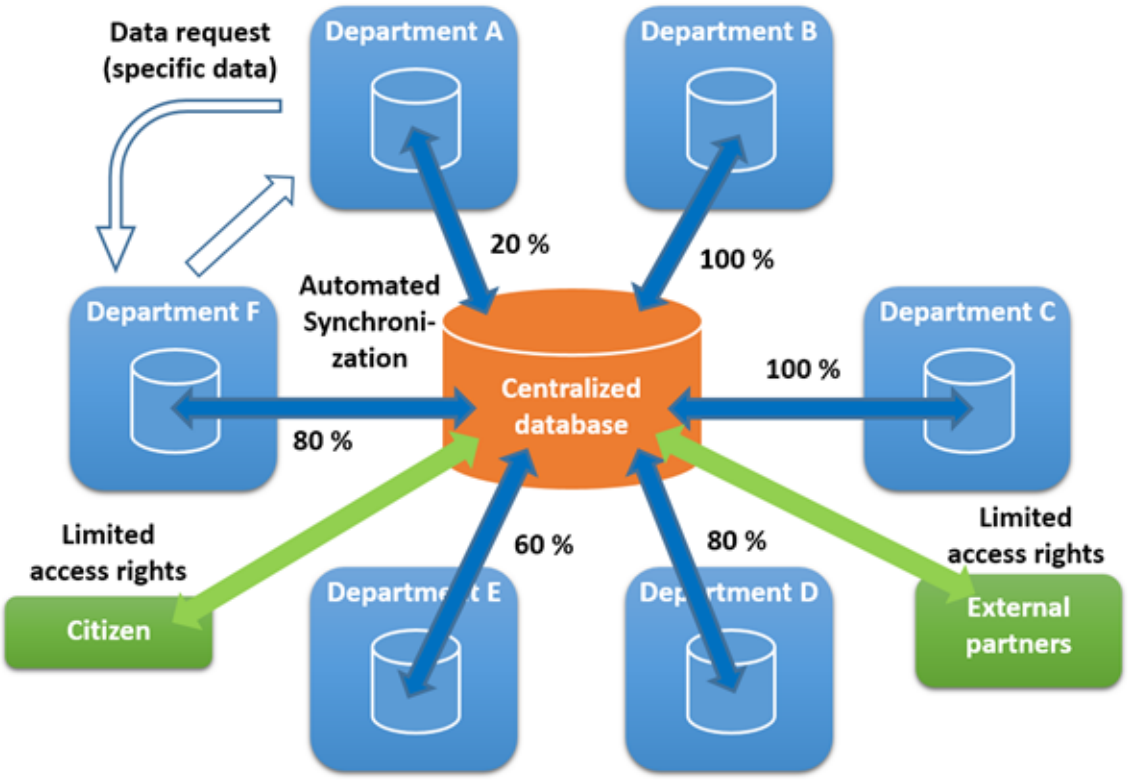

Figure 2-5-2: Central entity data management structure (Source: RWTH Aachen University)

Next to data management and tool usage, integration of local expertise can be an important element for decision support. Firstly, different perspectives and local knowledge are brought into the decision making process. Secondly, stakeholder involvement within the decision making process strengthens the linkage between local stakeholders and the decisions made. These advantages encourage municipalities to bring the disciplines of urban and energy planning together and enable interdisciplinary decision making. This holds the potential to better account for important aspects of urban and energy planning.

2.5.6. Recommendations

Recommendations when considering Decision Support Systems are:

- Accessing reliable data is undoubtedly beneficial to integrating urban and energy planning. Planners and stakeholders should recognize the positive effect of shared and organized data within the planning processes.
- The right tools for the task. Tool usage in early planning phases for scenario building and visualisation can save time and money in later phases.
- Not every tool needs to be complex. Stakeholders are often more comfortable with simpler, more intuitive tools such as web browser access to GIS-databases or smartphone apps, allowing access to monitored data.
- Visualization can transform data into a form or language that can be more easily understood by the target audience. For instance, a graphical representation of a city district is often easier to understand than tables of parameters.
- Due diligence. It is recommended in general to take the validity of data for granted. The data, methods and the results must be interpreted and assessed critically. Use stakeholders to validate the data.
- Expert tools require expert knowledge. However, expert or intuitive tools can also support the planning process at a variety of levels. Thus, consider external support for expert tool knowledge, especially when detailed analyses are required.
- Communicate with others. To support both data management and the use of tools, report to stakeholders on their benefits, such as a better foundation for decision making or reduced time and effort for data gathering.

More details regarding this strategic measure can be found in the appendix A-5.

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2.6. Implement Monitoring of Energy Consumption and GHG Emissions

2.6.1. Introduction

Monitoring is understood as the tracking and analysis of the impact of measures. Within a project and a specific strategy, monitoring aims to evaluate the extent to which the actual implementation of a project is aligned with predefined goals. Monitoring is not only a required condition to evaluate a project, but also to ensure that the acquired know-how is transferred to future projects. The importance of a monitoring program at the municipal level is often underestimated and not pursued with adequate means either due to a lack of resources or a lack of strategy. Monitoring should not be seen as an additional and resource-consuming “must do”, but rather as an opportunity to expand the horizons of our available knowledge. When monitoring is part of urban planning, it enhances analysis and evaluation and supports the political will for more sustainable cities, turning wishes into tangible reality.

Basis for the development of this strategic measure lies in the following measures as described in Volume 1:

Table 2-6-1: Link between measures and strategic measure. Measure = any action, program, policy or other activity that can demonstrate or influence a change in process.

No	Country	Measures	Intent	Related Themes
6	Austria	European Energy Award (eea)	Encourage	Targets, Feedback
15	Canada	Annual GHG Inventories	Enforce	Feedback
21	Denmark	Annual GHG Inventories	Enforce	Feedback
23	France	Bilan Carbon	Enforce	Tools
41	Germany	Monitoring of energy consumption on public buildings	Encourage	Tools, Feedback
45	Germany	European Energy Award (eea)	Encourage	Information, Feedback
57	Ireland	Public Bodies Monitoring	Enforce	Authority, Targets, Information, Feedback
75	Norway	Large scale deployment of smart meters	Enforce	Feedback
78	Switzerland	2000-Watt-Site Certification Scheme	Encourage (when voluntary) Enforce (in special use	Targets, Information, Tools

No	Country	Measures	Intent	Related Themes
			plan)	
85	USA	Greenhouse gas inventory	Enable	Tools
81	Switzerland	Energy City	Encourage	Tools, Feedback

2.6.2. Barrier

Monitoring is often neglected by municipalities, considered too complicated and too resource intensive that it does not deliver added value. However, monitoring defines and interprets the collected data that evaluates progress and target achievement. In many instances, only results and not the process of a project are monitored, an interim measure that misses the opportunity to learn valuable lessons for future project implementation.

2.6.3. Compelling conditions

To implement a successful monitoring strategy, the municipality needs to consider the allocation of financial and human resources at the outset to define the indicators, methodology and tools that best collect and interpret the progress of the project. It is crucial that the stakeholders and partners involved exchange their knowledge in order not to identify opportunities for project and process improvements. Joint agreements with developers, owners and building-users need to be established to address financing of monitoring infrastructure and data handling.

2.6.4. Content

The description of this strategic measure presents and evaluates 31 best-practice examples of successful monitoring of urban development across the Annex 63 partner countries. From these best-practise examples and a literature review, the benefits and challenges of monitoring are derived.

2.6.5. Findings

The report points out the importance and benefits of monitoring in order to deliver an argument that municipalities allocate sufficient resources and develop a monitoring strategy from the outset.

When looking at individual measures or development projects, outside of a city context, the tendency is to focus on the monitoring system’s effectiveness; objectives are compared to outcomes. While this is an important step in any monitoring strategy, the overall success of an urban strategy is holistic and must be measured by comparing initial goals (i.e. societal challenges) with the final impacts of an intervention.

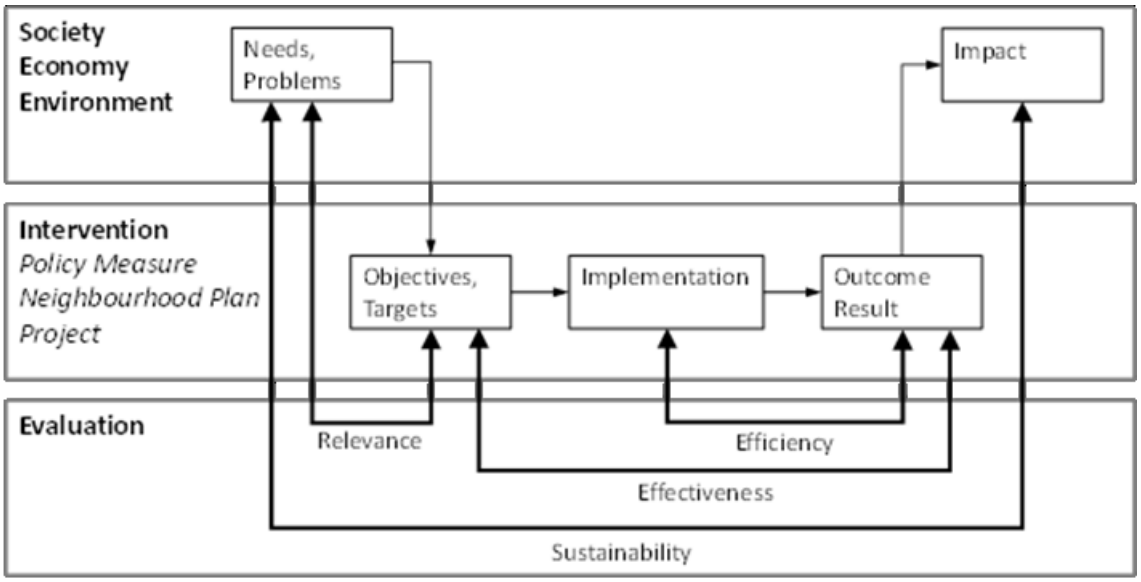

Figure 2-6-3: Policy Evaluation framework, (Koch, 2016 adapted from Vreuls, 2005)

As proposed by Vreuls (Vreuls, 2005) this comprehensive evaluation can be reached by agreeing on common objectives, directly derived from the municipal vision or strategy. The agreed objectives should be linked to measurable indicators in connection with realistic target values or benchmarks. While the relationship between the addressed needs and the objectives describes the relevance of the intervention, the comparison against the measured outcomes relates to a measure's effectiveness (Figure 2-6-3).

The benefit of monitoring both process and results lies in the possibility of assessing the level of target achievement as well of identifying challenges that were encountered at different project phases. Such an evaluation provides valuable information for the conceptual design of future projects. Ideally, planners should avoid past mistakes and repeat successful strategies.

2.6.6. Recommendations

The following recommendations can be used to guide the monitoring strategy:

- Successful strategies often include the active participation of a wide range of actors and stakeholders from various sectors such as utilities, local government, universities, ICT companies, and others.
- The increasing degree of digitalisation of many sectors of the economy has resulted in new opportunities to implement monitoring strategies at affordable costs based on standardised and often already existing infrastructure. This suggests a diffusion of installed sensors and connected infrastructures is possible and that for monitoring energy consumption and efficiency, a bottom-up approach could be easier and more precise to implement compared to classic top-down analysis.

- Consumers of electricity tend to minimize their costs either by reducing their consumption or by changing to a supply company with lower prices.
- A major challenge remains the stakeholders' acceptance of the monitoring, which is strongly linked to not only data security and privacy, but also to a clear communication of possible benefits.
- Organizing "competitions" (e.g. the most user-friendly household within a neighbourhood) are proven to have a very positive impact on consumer behaviour.

More details regarding this strategic measure can be found in the appendix A-6.

2.7. Stakeholder Engagement & Involvement

2.7.1. Introduction

The benefits of positive stakeholder involvement are clear. Engaging diverse and interested parties to integrate an energy and urban planning process may present an organisational challenge but nevertheless provides benefits that are essential to successful implementation (Burby, 2003). Developing a workable strategy to integrate stakeholders within a project's development should therefore be seen as a fundamental part of the overall planning process.

Basis for the development of this strategic measure lies in the following measures as described in Volume 1:

Table 2-7-1: Link between measures and strategic measure. Measure = any action, program, policy or other activity that can demonstrate or influence a change in process.

No	Country	Measures	Intent	Related Themes
3	Austria	Specification of energy goals voluntarily. Smart City Masterplan	Encourage	Targets
7	Austria	Stakeholder involvement in site planning	Encourage	Authority
8	Canada	Project Champion	Encourage	Authority, Targets
9	Canada	Energy Manager	Enable	Authority
11	Canada	Short or long term cooperation through projects/institutions	Encourage	Information
22	Denmark	CITIES Project Smart Cities - Quadruple Helix	Encourage, Enable	Tools
26	France	Multi Energy Model	Enable	Tools
29	France	AEU2	Enable	Tools
38	Germany	Public Participation Processes	Enable	Autorithy, Information, Tools
53	Ireland	National Energy Forum	Encourage	Targets, Information, Feedback
55	Ireland	SEC Programme (Sustainable Energy Communities)	Enable & Encourage	Information

No	Country	Measures	Intent	Related Themes
58	Ireland	LECP Local Economic Community Plan	Enable & Encourage	Information
62	Japan	Stakeholder Cooperation	Enable	Authority
69	Netherlands	Long term agreements	Enforce	Authority, Feedback
76	Norway	El Hub	Enable	Tools, Feedback
78	Switzerland	2000-Watt-Site Certification Scheme	Encourage (when voluntary) Enforce (in special use plan)	Targets, Information, Tools
87	USA	Climate action planning engagement	Enable	Feedback

2.7.2. Barrier

While municipal government is in the business of providing quality services to the public, it often struggles with the challenge of designing participation processes that will meaningfully engage stakeholders in decision making. Missing involvement of stakeholders can also cause problems because it can lead to opposition at a late stage in the planning process. In addition, valuable input to the project from important stakeholders could be missing.

2.7.3. Compelling conditions

Municipalities often communicate in a straightforward, unilateral way to inform of a “fait accompli” by inviting the public to comment on a proposed development with limited possibilities to change. Stakeholder Engagement must be seen as a central part of a project and has to be taken into account in its early stage or in advance to develop optimum impact.

2.7.4. Content

The scientific theory of stakeholder involvement is explained and underlined with examples from case studies from Canada, the Netherlands and the United States in order to generate an understanding how to deal with stakeholders’ interests.

2.7.5. Findings

To persuade priority stakeholders to share their time, expertise and input, the Stakeholder identification process can be based on roles (Figure 2-7-2). In the case of a city-wide community energy planning project in the City of Guelph (Canada), stakeholder groups were identified and then classified as decision makers, transactors, active interests, and audiences, so that targeted communication and engagement strategies could be developed for each class of interests.

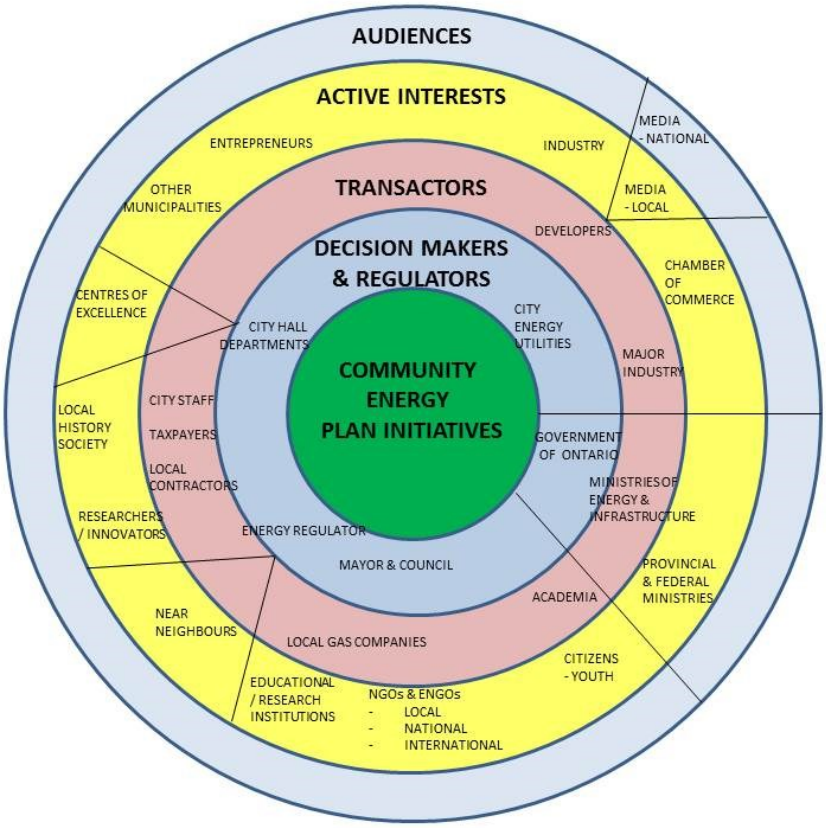

Figure 2-7-2: Stakeholder identification based on roles (Source: City of Guelph Community Energy Plan: Strategic Plan and Critical Path, 2009)

It is essential that identified stakeholders are engaged early, given time to understand key issues, become invested in a process and position to contribute meaninfully. In addition to stakeholders, technical and political champions can be developed. The specifically assigned role of a technical champion (e.g. energy manager) can be to care about large, dramatic initiatives such as introduction of energy mapping or district energy. Political Champions are highly visible to the public and the stakeholders and represent a practical way to move a project forward.

In order to optimize results of the stakeholder process under limited ressources (stakeholder time schedule etc.), stakeholder committees, such as advisory, technical or steering committees can be created. To increase the cooperation between stakeholder groups, the inter-relationships between stakeholders should be understood and targetted specifically.

2.7.6. Recommendations

Successful stakeholder engagement emphasize a two-way exchange of information in an early, often and ongoing process.

The following engagement pathway that planners of all stripes could apply to their projects can help to build consensus, improve the outcomes of planning efforts and build support for implementation:

1. Identify the lead person / organisation for the plan or project initiative – who is responsible and under what authority does that lead person operate? Is there a similar role in the energy delivery sector? Is there a critical technical or political champion that should be engaged?
2. What are the driving principles and goals of the plan or project in terms of energy / emission related benefits for the community?
3. What stakeholders share the project territory, have related expertise, have interests, and/or have power that can influence the outcomes of the project or plan?
4. What impact could the project bring to each of the stakeholder groups and where are the contact points?
5. In what ways can stakeholders and the public contribute expertise, knowledge of the local context, and resources that can help to enhance the plan or project?
6. What role will the stakeholders play in your project; what are the possible ways to interact with them and when should that interaction begin?
7. How and when should ongoing interactions and results be documented and shared?

More details regarding this strategic measure can be found in the appendix A-7.

2.8. Include Socio Economic Criteria

2.8.1. Introduction

Investments in energy efficiency can provide many different benefits to stakeholders, often overlooked by traditional accounting methods. The challenge is to build knowledge and understanding of the nature and scope of these benefits derived from energy efficiency, and to provide practical guidance on how to apply policy development, business and assessment tools to account for these impacts. Since multiple stakeholders have the potential to experience multiple benefits, a stronger business case that engages public and private interests can be created.

The International Energy Agency, in their report *Capturing the Multiple Benefits of Energy Efficiency* used the term “multiple benefits” to describe the externalities and conditions where investment of time and resources related to energy efficiency actions can create improvements for the community.

Basis for the development of this strategic measure lies in the following measures as described in Volume 1:

Table 2-8-1: Link between measures and strategic measure. Measure = any action, program, policy or other activity that can demonstrate or influence a change in process.

No	Country	Measures	Intent	Related Themes
13	Canada	Energy assessment process	Enable	Tools
16	Canada	Annual review of investment strategies	Enforce	Feedback
17	Denmark	Societal Costs (as decision criterion)	Enable / Enforce	Authority, Targets
39	Germany	Funding from KfW Bankgroup/ EnEff:Stadt	Enable Encourage	Tools
48	Germany	Convoy	Encourage	Information
58	Ireland	LECP Local Economic Community Plan	Enable & Encourage	Information
89	USA	Environmental impact assessment	Enable	Information

2.8.2. Barrier

From the consumer’s perspective, the transition challenge to low-carbon urban development represents a change in value systems; from one which priced development at its lowest cost to one that is more holistic and identifies a product’s value by its impact on the environment. As noted, an investment in energy efficiency

can provide many different benefits to many different stakeholders who have a potential to create a stronger business case; one that engages public and private interests. Therefore, although the inclusion of socio-economic impact in the business cases for the implementation of energy efficient measures is a new, it can be of significant benefit to a project.

2.8.3. Compelling conditions

Awareness of the high potential of measures to create multiple effects in social and economic dimension offers the basis for developers to benefit from these effects. Further, the extended time delay between the implementation of measures and their impact offers the developer or municipality further flexibility and opportunity to reach long-term sustainability goals.

2.8.4. Content

Content of this strategic measure is the analysis of approaches in several IEA member countries and an inventory of cases describing initiatives where co-benefits have been included in the respective business cases.

The benefits are identified in the fields of economic impact, social impact and environmental impact. With respect to the implementation process, the working group recognised four steps:

1. Inventory possible co-benefits
2. Value and monetise the co-benefits and broaden the business-case
3. Involve stakeholders, including the inhabitants, in the selection of the co-benefits for a specific district
4. Ensure commitment of relevant stakeholders and investors to a broad business-case; one that includes the added values of the co-benefits. (figure 2-8-1)

2.8.5. Findings

The importance of including socio-economic criteria can be seen in the case for public-private business partnership. The coordinator of this effort must have a broad overview of both (or all) partners' aims and positions and present a more or less independent position. This role can be that of an unbiased party such as a government organisation or a municipality. The success of the venture depends on the level of trust developed between stakeholders, how solid the business case is and how the risks are managed.

The local culture often determines the willingness to accommodate the inclusion of co-benefits in the accounting process and their interpretation and allocation of those benefits. An example from Japan (figure 2-8-2) proposes that the benefits over the cost ratio (B/C) is calculated for every stakeholder, including the Non-Energy-Benefits (NEB). In this way also indirect (non-)energy benefits are made clear for every investor. (Kuzuki et al., 2011) also added a sensitivity analysis in order to estimate the risks.

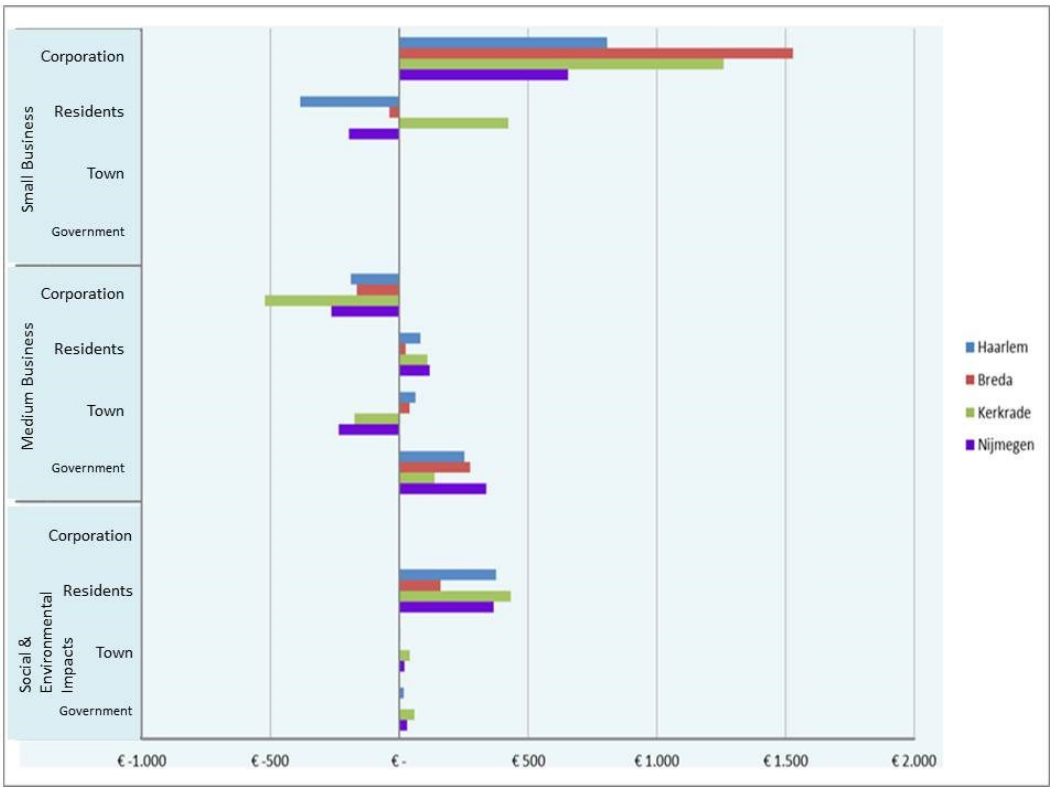

Figure 2-8-1 Evaluation of Broader Business Case Options for four Dutch projects on a district level (Kortman et al., 2016)

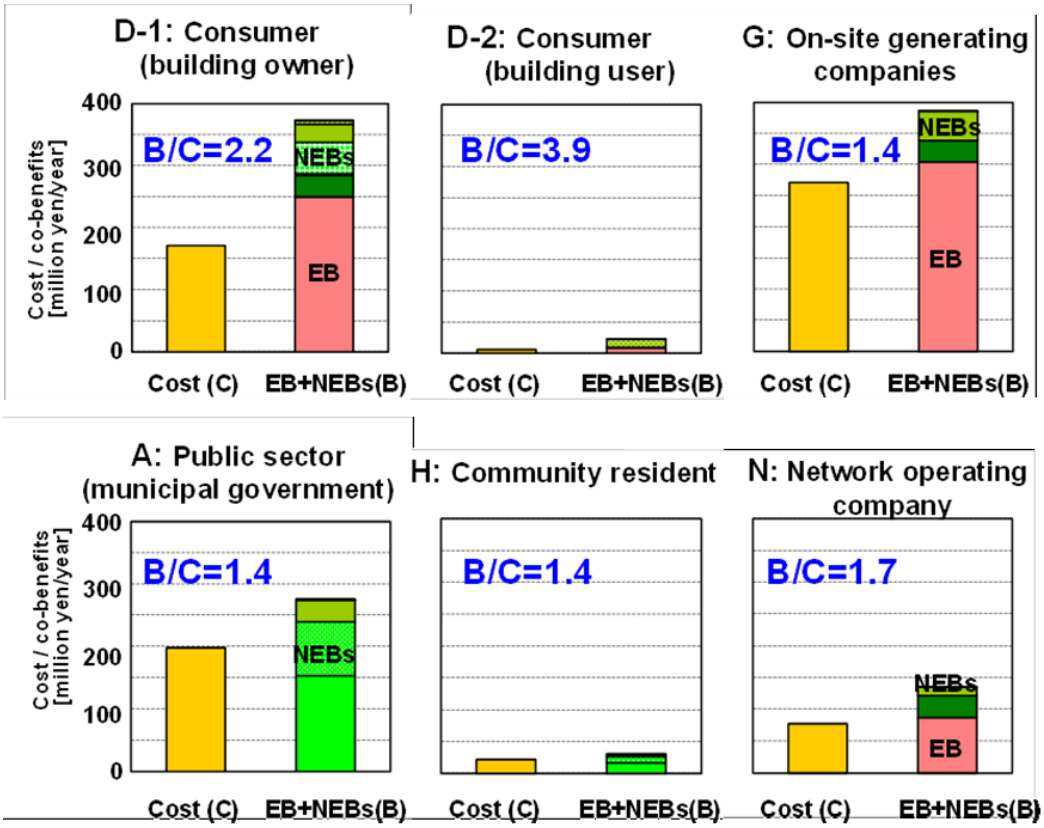

Figure 2-8-2: Example allocation of cost and co-benefits in terms of the benefits-costs ratio among stakeholders (Japan Sustainable Building Consortium, 2014). EB= energy benefits, NEB= Non-energy-benefits

2.8.6. Recommendations

There is a strong case for municipalities to examine and consider the co-benefits generated by a transition to renewable energy in their business model and financing decisions:

- Identify which stakeholders benefit from a broader business model. Use stakeholder engagement supported by suitable planning support and decision making tools to identify those stakeholders - politicians, agencies working for the government, decision makers, municipal elected officials, planners of urban and energy plans, policies and infrastructure, energy companies, ESCO's, tenants/house owners, building industry, investors etc. - who could be involved with the project.
- Investment in the pre-planning phase, gaining commitment from stakeholders and bringing them together, will result in a business case that is more profitable and more stable over the long term.
- Identify a localised set of benefits that relate to the stakeholders' needs.
- Identify those stakeholders who will profit from the broader business model.
- Employ impact assessment models to assess the impact of transition options on the community.
- Address and include localised socio-economic benefits in the broader business decision making case.
- Involve long and short-term investors (e.g. pension funds?).
- Develop the organisational process, with respect to the development and operation of the initiative, the financing of the broader business-case and the governance of risks and commitments.
- Develop financing based on added value, avoided costs, etc through a variety of funds such as revolving funds, insurance funds, pension funds and private investors.

More details regarding this strategic measure can be found in the appendix A-8.

2.9. Implement Effective and Efficient Organisational Processes

2.9.1. Introduction

Energy planning and organisation is an issue that concerns multiple actors and stakeholders. These range from the private and public sector to those involved with municipal issues such as infrastructure, energy provision, building or housing. This cross-cutting nature of the issue necessitates that energy planning finds cannot be treated in isolation but needs to be approached in an integrated fashion. Consequently, all who aim to integrate energy planning and sustainability are faced with the same question of how to set up a body that can fulfil this task.

Basis for the development of this strategic measure lies in the following measures as described in Volume 1:

Table 2-9-1: Link between measures and strategic measure. Measure = any action, program, policy or other activity that can demonstrate or influence a change in process.

No	Country	Measures	Intent	Related Themes
22	Denmark	CITIES Project Smart Cities - Quadruple Helix	Encourage, Enable	Tools
37	Germany	Set up of Energy Consulting Local Organizations (AltbauPlus + Energetikom)	Encourage Enable	Information, Tools
51	Ireland	Climate Change Officers	Enable	Authority, Information, Feedback
52	Ireland	National Expert Advisory Council	Encourage	Targets, Feedback
61	Japan	Liberalization of Energy Market	Encourage	Authority
64	Netherlands	Trajectory approach - (Research / Demonstration / Implementation)	Encourage	Authority, Targets
71	Netherlands	Integration of urban and energy planning	Enable , enforce	Authority, Tool
83	USA	Municipal – utility partnership	Encourage	Tools

2.9.2. Barrier

The internal structure of the lead organisation and the manner in which they approach the urban planning is often seen as a barrier for successful integration of energy strategies in urban planning. The key challenge relates to enabling multiple sources of information to be exchanged and integrated and how the shared issues can be treated in an integrated way. Additionally, how can the information be disseminated to all respective institutions and actors who are already concerned with energy planning?

2.9.3. Compelling conditions

It is critical that the existing structure have in place those legal regulations, protocols and political support that allows the participation of, and information sharing by, multiple stakeholders. Smooth operation of the an integrated project also necessitates adequate resources and administrative capacity. In addition, familiarisation of all parties with the limitations of the current planning process such as boundary conditions, steering committee membership, etc. is important.

2.9.4. Content

Several organisational structures for planning issues on local and regional level have been analysed. The description of this strategic measure includes the following aspects:

- How to ensure the sustainability of a new organisational body beyond a project lifetime?
- Comparison of best practice examples and the extraction of common features.
- Organisation of process in the local administration (cross-sectoral work groups, external moderator etc.).
- Identification of the relevant local/regional (key) stakeholders (energy consultants, home owners, energy provider, real estate developer, council, administration, etc.).

2.9.5. Findings

From various municipalities there are examples of the different approaches taken to create an integrated organisational structure. Typically, they range from a top-down approach (champion driven) to the bottom-up approach (public demand driven).

The top-down approach is a public authority activity characterized by a political champion, pre-defined objectives and implementation by technical experts. It is a deductive approach based on the application of a valid or legal concept or strategy to specific measures.

The bottom-up process might be led by NGOs, local stakeholders, interest groups or non-profit organisations with a specific local context and initial projects. Experiences gained are the basis for the transfer of the results into a new common concept or

strategy (inductive approach). Both approaches are suitable for local urban and energy planning processes.

Table 2-9-2: Different approaches for local urban energy planning (Jens Freudenberg, DV, 2016)

***Concept* oriented top-down approach from district concept to pilot project**	***Project* oriented bottom-up approach from pilot project to district concept**
1. Set up of a local project team	1. Set up of a local project team
2. Clarification of the local institutional framework	2. Definition of energy objectives of the local pilot project
3. Physical analysis and potentials	3. Feasibility study for the pilot project:
4. Involvement of local key actors	technical, financial criteria to assure implementation
5. Development of a local common vision of the long-term energy goals	4. Detailed definition of the pilot project
6. Derivation of specific objectives and sub goals	5. Public tender / competition
7. Definition of indicators to measure success	6. Involvement of local key actors (stakeholder analysis)
8. Definition of an action plan: ranking and a time frame for the implementation of projects/measures	7. Implementation of the local pilot project
9. Discussion and resolution of the energy concept by the local government	8. Documentation, discussion, evaluation and dissemination of results
	9. Conceptual design for the development of a district concept

Within the framework of Annex 63, innovative governance instruments, organisational frameworks and methods were analysed and structured. Based on these analyses, the following topics were identified as success factors to set up sufficient organisational frameworks worldwide.

1. Strong ties to existing municipal structures: There needs to be awareness of the needs of the stakeholders and of all conflicts that might arise during the process of the urban and energy improvement. There are identified two ways to integrate sustainability into the existing structures 1) As a project with limited duration but with the aim to raise awareness and to create a network and 2) the creation of a new structure within the municipal administration that is integrated into the existing organisation. In both cases, the municipality must be visible as a central actor that is interested in creating real impact.
2. Secured financing: Networking and coordination are time and resource intensive. New solutions can only be implemented in an optimal way, if there is budgetary allowance for the exchange of information, networking and development before, during and after the project. Annex 63 demonstrated that in many cases the municipal or government funding could be augmented by financial commitments from the local businesses, the local energy providers or network operators.

3. Involvement of energy suppliers and network providers: Energy suppliers and network providers can take an active role in developing the existing organisational structure. This is of great importance, because the implementation of line-based solutions needs a commitment of several stakeholders on an early stage.
4. Monitoring process and cyclical thinking: Organisation structures need an installed monitoring instrument. Typical instruments are steering committees and committees of higher administrative authorities.
5. Strong local involvement and impulse: ProjectZeo in Sønderborg demonstrated local businesses as being a starting point for the creation of new management structures. The Norwegian example showed that local initiatives must be taken into account, because they are the basis for new and innovative structures that will be used to approach their possible clients.
6. Government requirements: Many countries have created the incentives or legal basis for municipalities to play a lead role in urban and energy planning. This gives to the municipalities more responsibilities or if given to the cities the legal right to take over more liability in working on urban and energy planning.
7. Create exchange of knowledge: The exchange of knowledge is the most important topic if the intent is to implement energy strategies within communities. Therefore, networking, participatory and information exchange should be an integral part of all processes.

2.9.6. Recommendations

Integrated and strategic urban energy planning includes a series of repetitive tasks, usually not connected in linear succession, but with numerous feedback loops used in an iterative way. Within the working process of urban energy planning, the following elements are of key importance:

1. Coordinating and networking: Process management through an administrative body having sufficient capacity in terms of staff and experience. This body can be an appointed team in the administration or a public institution (i.e. local energy agency). It is important to agree on an institution that can manage all of the administrative procedures and act as trustworthy and competent partner for private and public actors. This builds trust between the partners.
2. Monitoring: to manage institution would be to monitor the development process of the addressed area by appropriate indicators. It is necessary to recognize upcoming problems and reporting them to decision makers.
3. Planning Fundamentals: The inventory and analysis of the current situation helps to precisely determine the needs and fields of action to be addressed in the process of urban and energy planning. It is also the basis to design target-oriented actions for energy efficient measures in the addressed area.

More details regarding this strategic measure can be found in the appendix A-9.

3. Entry Points

Each section describing a strategic measure ends with a sub-section on recommendations suggesting approaches to address the particular challenge and opportunities to integrate energy planning into the urban planning process. These will be of particularly useful and relevant to urban planners and those involved with energy efficiency or in planning energy infrastructure for delivery within municipalities.

As has been demonstrated in Volume 1 – Inventory of measures, activities have been developed that attempt to address the issue of energy efficiency within the task of urban development. However, in current practice, many or most of these activities function in isolation, they have limited impact on attaining municipal goals, whether environmental, social or economic. One reason is that each measure was designed to address a specific issue rather than to integrate with other activities: in many cases the entry and exit points for the urban or energy measures are not harmonized.

Creating an integrated planning process whereby energy and urban form are, to some degree, optimised will be an iterative process with the strategic measures being applied multiple times, maybe for different reasons at different stages within the process. Therefore a range of entry points of each strategic measures exists within the generalized urban and energy planning process was identified by an analysis of the entry points of the linked national measures that are described in Volume 1 (see also Appendix B). Figure 3-1 shows the identified entry points of the strategic measures within the generalized urban and energy planning process.

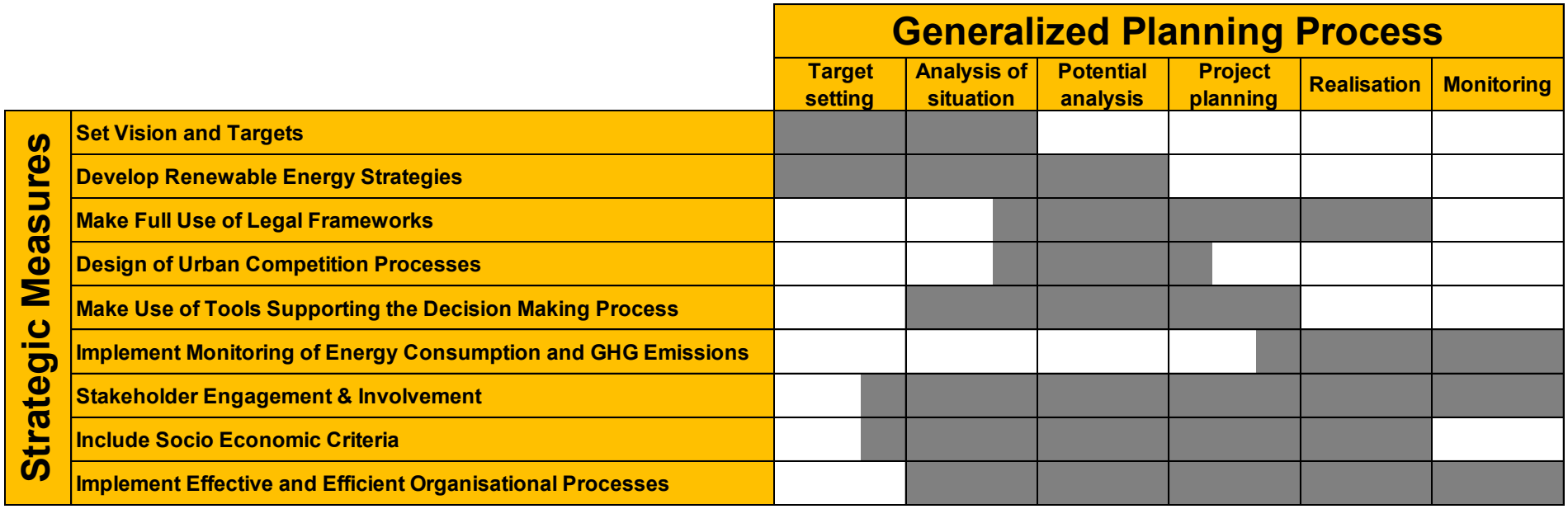

Figure 3-1: Entry point of the strategic measures in the generalized urban and project planning process (SIR, 2017)

The strategic measure **"Set Vision and Targets"** includes ideas on how municipalities can implement an overarching (urban and energy) vision as well as clear targets to support a more focused development. The analysis of the linked measures from Volume 1 has shown that vision and targets for urban issues will be set on a early planning stage. However, vision and target setting isn't a priority task for energy planners. Therefore it is recommended that municipalities set also vision and targets for energy issues at a early stage and break them down to an urban planning and building project scale (for planners and engineers). This will make planning much simpler due to the fact that all (urban and energy) planners have to work based on one vision and towards one common target.

The strategic measure **"Develop Renewable Energy Strategies"** helps to develop strategies (ideally in line with the vision and targets) which should move the existing energy supply to one containing a greater renewable energy fraction. The analysis of the linked measures from Volume 1 has shown that most specific measure are climate action plans, project concepts or development scenarios. These are usually initiated very early in the planing process to ensure, that its implementation has the desired effect.

The strategic measure **"Make Full Use of Legal Frameworks"** helps to analyse existing legal frameworks regarding previously ignored opportunities to integrate energy planning in urban planning processes. The analysis of the linked measures from Volume 1 has shown that each legal instrument has its own entry point. This analysis can therefore be done at the municipal level or even on a specific urban planning and building project scale. In the latter case the analysis should be done ideally before any decision has been made as to the use of the existing energy supplies. The recommended entry point of this strategic measure on the planning stage depends of the existing legal instruments.

The strategic measure **"Design of Urban Competition Processes"** gives recommendations when and how climate and energy relevant issues can be used within a competition to ensure that the resulting projects are not just of high urban design quality but also of high climate and energy quality.

The strategic measure **"Make Use of Tools Supporting the Decision Making Process"** offers the planners an overview of examples of tools and design recommendations, what to consider when applying information tools and how to choose the right one for their specific needs during the decision-making process. When analysing the situation it is recommended to also include an analysis of existing decision support tools. The analysis of the linked measures from Volume 1 has shown that the entry points of the different tools are throughout the planning process, ranging from tools to identify suitable sites to tools that assist facilitation of multiple stakeholder meetings during the operation phase.

The strategic measure **"Implement Monitoring of Energy Consumption and GHG Emissions"** presents and evaluates best-practice examples of successful monitoring of urban development across the Annex 63 member countries. From these best-practise examples and from an associated literature review the benefits and challenges of monitoring are derived and presented. The analysis of the linked measures from Volume 1 has shown that the planning of the monitoring measures within a project should start as early as possible; the monitoring itself can then only start after the project is finalised. The recommendations given for the strategic measure "Implement

Monitoring of Energy Consumption and GHG Emissions" can also be used on municipal level. The best case would be if energy consumption and GHG emissions measured on single building or community level will feed into a municipal database. So the recommended entry point of this strategic measure is on a early and late planning stage

The strategic measure **"Stakeholder Engegament & Involvement"** emphasizes for a successful stakeholder engagement a two-way exchange of information and an early, often and ongoing process. An engagement pathway for planners of all stripes is offered which could be applied to the projects helping to build consensus, improve the outcomes of the planning efforts and to build support for implementation. To make most use of, it is recommended to involve stakeholders through the whole planning process.

The strategic measure **"Include Socio-Economic Criteria"** presents four specific options on how to implement socio economic criteria in the planning process. The analysis of the linked measures from Volume 1 has shown that socio-economic criteria can be included on a municipal level or on a specific urban planning and building project scale over the whole planning process.

The strategic measure **"Implement Effective and Efficient Organisational Processes"** has identified seven topics as success features to set up sufficient organisational frameworks worldwide. As this measure is focused on the organisation it is independent of specific projects and certain measures can be implemented anytime.

4. From Strategic Measures to Action

4.1. Guideline

To maximise the effectiveness of the Annex 63 research it is necessary to align the assumptions used within the analysis with the real-life situation. It is therefore important to get a clear understanding of the current energy and urban planning practices within the municipality. This is achieved through the application of the self-assessment tool, located within *Volume 4 – Stakeholder support materials*, to the municipality in question. Through a deep and honest assessment of several (possibly 3) previous planning projects (where both energy and infrastructure was involved) it will be possible to identify the strengths and weaknesses of the current planning practices. The analysis should go beyond the technical components of the projects to address associated issues such as: the capability of the involved people, the structure of the organisation, the use of supporting tools, the interaction between the involved persons and departments and others.

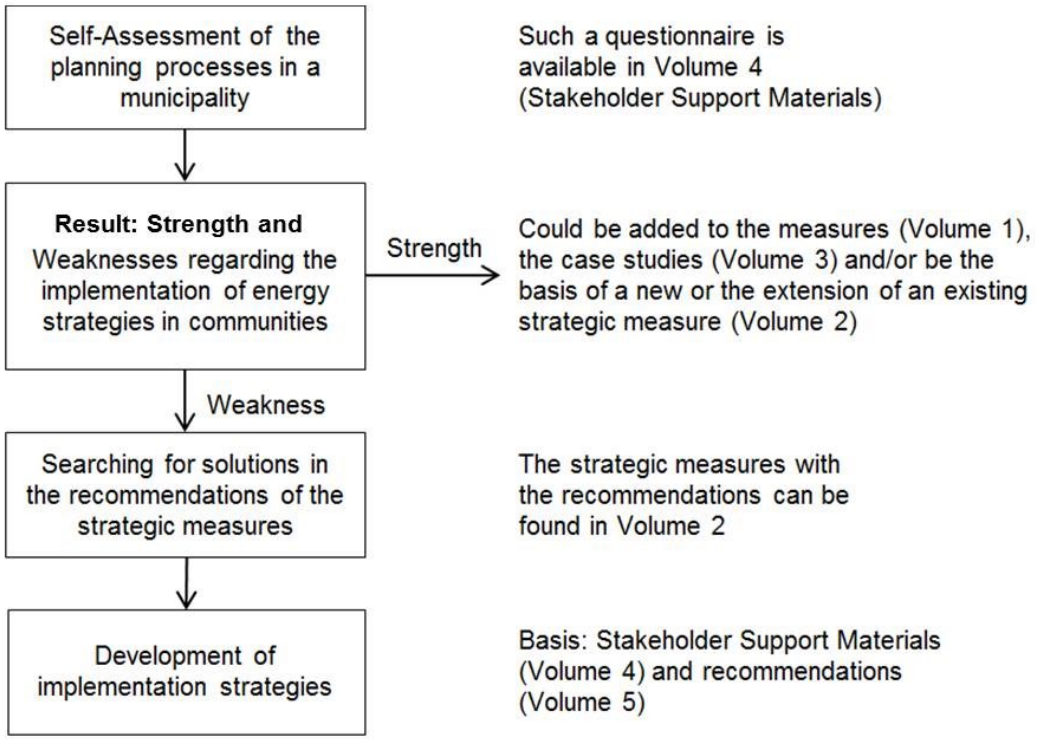

Figure 4-1: Recommended sequence, how to use Volume 1 to 5 as working material (Intep, 2017).

For such a self-assessment the participants should include key persons from all departments and utilities within the municipality dealing with issues related to energy and/or urban planning. It is recommended that preparatory material is arranged for these participants describing the projects, the issues and the questions. This will provide focus and direction for the workshop. The result will be identification of the strong and weak areas of a municipality's organisation and processes, aligned with the nine strategic measures as presented in this report.

In addressing the weaknesses identified through this process, research into the strategic measures as outlined in Appendix A of Volume 2 will provide direction and recommendations on possible solutions. Integrating these activities within existing planning processes allows the municipality to develop an implementation strategy that best suits their capacity to implement.

4.2. Content of Volume 3

The aim of the report on the case studies (see report *"Volume 3 – Application of strategic measures*") is to demonstrate how these strategic measures manifest themselves in frontrunner cases, and how their combined application contributes to the successful implementation of energy targets in various local communities.

In highlighting the strategic character of implementations, by indicating how different strategic measures serve deliberate purposes in terms of providing arguments to convince members of the involved communities, other factors are presented that influence the implementation of energy targets in urban development projects. The case studies have a specific focus on how urban development processes can be exploited as a window of opportunity for implementing energy strategies in local communities.

The following case studies have been studied and can be used as good examples for the implementation of strategic measures on a national, municipal, communal or project scale:

Table 4-1: Case studies linked to the strategic measures. Abbreviations: o: Most important strategic measure(s) used in the case study. x: Used strategic measure(s) in the case study

Case study	Strategic Measures								
	Set Vision and Targets	Develop Renewable Energy Strategies	Make Full Use of Legal Frameworks	Design of Urban Competition Processes	Make Use of Tools Supporting the Decision Making Process	Implement Monitoring of Energy Consumption and GHG Emissions	Stakeholder Engagement & Involvement	Include Socio Economic Criteria	Implement Effective and Efficient Organizational Processes
Strategic scale									
Minneapolis, Minnesota	X				X	X	O	X	X
Bottrop	X	X			X		X	X	X
Lille									
Dundalk									
Sønderborg (Project zero)	O	O			X	X	X	X	X
Karlsruhe				X		X		X	
Nordhavn	X	X		X	X	O	X		
2000-Watt-site label	X	X		X		O	(X)		X
Energiestadt Label	X	O				X	X		X
Regulatory Tax Basel			O						
Zone planning Basel	X		O	X		X	X		X
Planning scale									
Erlenmatt West_Basel	X		X	X	X	O	(X)		
Stenløse South, Egedal	X	X	X		X		X	X	
Strasbourg									x
Salzburg Gnigl	X			O	X		X		X
Schlösslesfeld, Ludwigsburg	O	X		X	X	X	X		X
Zero Village Bergen	X	O		X					
Oslo	X	X		X	X		O	X	
Guelph, Ontario	X		X				O		
Aachen	X		X	X	X	X	X		O
Graz Zanklhof	X							X	
Stiegl Gründe V3		X				X	X	X	
Project scale									
Salzburg Lehen	X			X	X		X	X	O
Tamachi	X		X	X		X	X	X	X
Parkstad (Kerkrade-West)	O	X		X	X		X	X	X
Jono	X	X	X			X	O		X
Minatomirai21	X	X	X			X	X	X	X

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Appendix A – Strategic measures – Details

A-1. Set Vision and Targets

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*"If you want to build a ship, don't drum up the men to gather wood, divide the work and give orders. Instead, teach them to yearn for the vast and endless sea." (*Antoine de Saint-Exupery, "The Wisdom of the Sands")

A-1.1. Introduction

In urban transition processes municipalities are faced with the need to motivate and maintain a long term process while at the same time delivering actions and inducing short term measurable actions or measures (Nevens et al., 2013). This is particularly important in a context in which "local authorities [are] moving away from a strictly regulatory or service provision role to one of enabling action" (Bulkeley and Betsil, 2005). Thus, in order to enable the linkage between urban planning and energy planning, municipality should develop a community based vision identifying the main goal to reach und possible pathways to get there. (Helm, 2009) points out the importance of a "community vision [as] an actor network (and facilitation) tool, to a large extent aimed at holding the different actors together". Once a community wide vision is established a key task becomes the identification of concrete measures and actions that help to move towards the common goal. In this second stage setting realistic and measurable targets is of vital importance to ensure that the local actions are leading towards the common goals and progress can be assessed. Both aspects are closely linked as "[w]ithout a vision, a transformation effort can easily dissolve into a list of confusing and incompatible projects" (Kotter, 1995). On the other hand a vision alone will inspire but not implement transition.

A-1.2. Compelling Condition

Visions developed by municipalities are most helpful if they are embedded in wider systems, for instance if they are related to regional, national (European) or international development goals. While a vision describes the long term positive perspective targets give an orientation how to take concrete steps toward the long term goals in a certain period. Most countries and case studies have defined specific targets, while the vision is not always apparent from the case study documentation. Interim targets enable to break down the target from an abstract level to a viable pathway. This is crucial for the development of areas and sites within a municipality. Political targets on city level need to be translated and broken down to smaller scales e.g. neighbourhoods and need to be streamlined.

A-1.3. From Vision to Commitment

A-1.3.1. Creating a Vision

In the “Guide to Strategic Community Energy Planning” the US Department of Energy (DOE, 2013) suggests the definition of a vision as an important step in each community energy planning process. In order to develop a vision first guiding principles and priorities have to be agreed and then be synthesised in a comprehensible vision statement which in the last step is shared with the wider community to agree on a common vision.

Such a community wide vision should therefore relate to the most relevant issues (e.g. economic development, social impact) but be general enough to allow for changes over a period of 10-20 years. In order to motivate stakeholders and attach citizens to the goals a vision statement should be inspirational and meaningful but also simply stated and easy to understand (DOE, 2013).

A long-term vision helps to create a common view and a coordinated approach across all stakeholders, regardless of their technical expertise, political orientation, age or gender. Visions are often not that much focussed on technical aspects like CO2 reduction or efficiency targets but “emotional” pictures of an attractive, desirable future. Visions therefore create a sense of “community” between the citizens and stakeholders that share the same vision. Therefore, it is important that the vision incorporates different interests and creates a “big picture” out of these. Energy experts as well as urban planners need to be careful to not only focus on their own field of interest. A vision can be a “wish-list” for various topics besides energy or urban design: quality of life, wealth, health, other socio-economic aspects etc. During the creation of a vision, conflicts of targets and interests do not need to be addressed in detail - this needs to be done during target setting.

A common vision will help later to gather support for the implementation of concrete measures leading to the long-term targets, even if the activities themselves are rather unpopular (costs, efforts, etc.). It also helps to overcome conflicts of interest which will definitely appear as soon as it comes to concrete target setting and the implementation of activities.

Figure 1: Example of the vision 2050 for Limburg, Zuid University (Source: ENCO, 2017)

2000-Watt Society

In Switzerland, ten years ago, the vision of a "2000-Watt Society" was developed at the Swiss Federal Institute of Technology (ETH) in Zürich. Several cities like e.g. the city of Zurich have adopted this vision in order to define their way to a sustainable future. The core element of the vision is to consume only as much energy as worldwide energy reserves permit and which is justifiable in terms of the impact on the environment. This idea is broken down to the target of a maximum energy use for every person in every society limited to 2000 watts (17,500 kWh/a). Furthermore, at least 75% of energy needs need to be met using renewable energy sources, meaning that on an annual basis only one ton of greenhouse gas is given off per person per year.

The 2000-Watt Society was for example adapted by the city of Zürich's to meet the challenges of climate change and future conflicts for resources.

In Switzerland the figure is three times higher – 6000 watts per person – while people in some Asian and African countries need barely a fraction of that figure. The vision of a 2000-Watt society makes it possible to strike a balance between industrialized and developing countries and for everyone to thus enjoy a good standard of living.

The quality of life in the 2000-Watt Society does not entail any restrictions. On the contrary, security, health, comfort and the development of the individual are all improved, with incomes increasing by around 60 percent over 50 years. On a global level, sustainability will be a necessary condition for peaceful social co-existence (Stadt Zürich, 2017).

This description underlines the importance of going beyond CO_2 and kWh when defining a vision. Quality of life, peaceful social co-existence and security, health and comfort are emphasized.

A-1.3.2. From vision to target setting

Why do we need targets?

Target setting is a crucial next step to break down visions to concrete activities for certain parts of the city as well as to identify feasible monitoring approaches.

When it comes to concrete target setting, the different interests and motivations of stakeholders will become more visible and need to be coordinated. The earlier achieved common vision then can help to not divide up and to find compromises.

How do we define targets?

Contrary to the vision, a target is a measurable issue. Targets should be ambitious, but realistic referring to the SMART approach: **S**pecific **M**easurable **A**ccepted **R**ealistic **T**ime Bound

"By _____ (target year), (locality) will _____ (increase/reduce) _____ (resource) by ___ percent below _____ (base year) levels."

Visions and targets need to be designed in order to be understood also by non-experts, as they should provide a common agreement. Therefore, it is important to have in mind that targets should be easy to communicate on a wider scale. In addition, the direct link to the citizens and stakeholders environment should be obvious.

The discussion on the impact of a vision/target leads to the level that can be reached: To what extent a target may be motivating and get people involved and from which point on the target may become discouraging and is something that is not attractive any more to achieve. Targets that are too ambitious will lose their attractiveness. How to set targets, find new procedures to define targets. A target has to be a common and accepted target otherwise people do not see themselves involved, the planning process cannot be started.

The city of Zurich decided to define on the basis of the vision of the 2000-Watt-society concrete targets for certain sectors to create the link between the "big picture" and what this means for the environment and the daily life for the citizens.

To achieve this goal by 2050, the city of Zürich is making commitments in the following areas (Stadt Zürich, 2017):

Energy efficiency and renewable energies Comprehensive energy services are offered along with consulting for construction companies to pass on the necessary expertise.

Sustainable buildings
Almost all new constructions such as housing estates, school buildings and retirement homes, correspond to the Minergie Standard (for low-energy housing).

Mobility for the future
Zürich promotes means of transport which make efficient use of urban spaces and energy resources, namely public transport, pedestrian and bicycle traffic.

Awareness
Regular events to increase public awareness are held, such as the annual environment days and the Zürich Multimobil action day (where the inner-city is closed to cars).

In order to develop a tool for the implementation of these targets for communities in the city and Zurich and beyond, the concept of the label of the 2000-Watt-site has been developed. Currently 15 sites in Switzerland are certified with this new label, following a common vision and implementing activities to achieve the long-term targets.

A 2000-Watt Site is more than the sum of the houses. The "2000-Watt Site" certificate allows for the first time to evaluate large site developments in terms of building quality, density, mixed usage and mobility. The integrative view on the entire site rather than individual buildings fills a gap. It opens up the perspective by depicting the whole living environment. The certificate is based on the SIA (Swiss Society of Engineers and Architects) "Energy Path of Efficiency" and the certification scheme "Energiestadt" for municipalities, which labels settlement areas with a sustainable use of resources and efforts towards climate protection. The assessment includes embodied energy for the construction, operational energy for the operation as well as everyday mobility caused by the use and location of the building. The continuous improvement process is assessed analogous to the "Energiestadt" certification process. The outcome of this is an added value for all stakeholders – users, investors and municipalities – with considerable lower resource consumption (2000-Watt, 2017).

For a realistic target setting, municipalities and communities should check possible role models or examples, which can be compared with their own situation and probably easily applied. A layout of applied targets can be helpful: existing targets on national or regional level; targets applied by other communities (e.g. like the 2000-Watt-certificate).

When fixing concrete, binding targets, decision-makers want to be clear about the ambition of the targets: do we want to become front runners or will we go for a "conservative" path? Will we have the support from all stakeholders that are important to achieve the goals? What time period should be considered for achievement? How do we organize monitoring of the target achievement?

Only if these questions are clarified and communicated, a reliable commitment of the stakeholders can be achieved.

A-1.3.3. From target setting to commitment

Why do we need a commitment?

Targets can only be reached if the people are involved to the maximum. It is easy to agree to a long-term vision or interim targets as long as one doesn't need to act to achieve it.

How to achieve commitment?

The question is here how to get the link between the target and the commitment in order to reach a personal involvement for the targets. One has to find measures to translate/transfer targets to the level of action and stakeholders. How is it possible to have stakeholders, citizens, politics, engineers at the same table and let them discuss what are the main targets for e.g. an urban design competition or a climate strategy?

Example of Karlsruhe

The city of Karlsruhe published in 2009 the climate protection plan. The city wants to be climate neutral by 2050. In a study published in 2011, they elaborated different scenarios and measures for different sectors. Some of these measures have been implemented or will be implemented such as the energy efficiency networks or the retrofitting convoy. However, the city of Karlsruhe, stated that it will not reach the goal if they do not intensify their efforts. End of 2015, they decided to install a climate board that will support the municipal council in energy issues. This advisory board will meet for the first time in October 2016.

The people of Zürich say yes to the 2000-Watt Society (Stadt Zürich, 2017)

In a referendum held in 2008, three-quarters of the Zürich population voted in favour of achieving the 2000-Watt Society by 2050, making it the first city in the world to give these ambitious goals a democratic legitimacy and enshrine them in the constitution.

Stakeholder involvement is a key for a sustainable long-term process and commitment and can be achieved by e.g.:

Participation in decision-making: Involvement of stakeholder in an early project phase can help to avoid critics and resistance at a later stage. Participation in the decision making process can be a very powerful but also time-consuming approach, which needs a lot of preparation, moderation and compromises, e.g. with "future workshops", round tables or public discussion groups. The referendum about the 2000-Watt-society in Zurich is a successful example of achieving broad commitment by engaging the citizens in the decision-making process.

Creating a “Trustee” or “steering group”: By the involvement of stakeholders in a long-term (even after the decision-making process) the projects can benefit from additional expertise and engagement. The certificate of the 2000-Watt-site for example demands for the foundation of a “site trustee” responsible for the fulfilment of the certified aspects in a long-term, involving the stakeholders of the site. This “site trustee” can be an association or any other organisational form suitable for this purpose. Stakeholders engaged in these “trustees” have the opportunity of a long-term influence on the development of the site and this creates an important sense of “ownership”.

A-1.4. Recommendations

Consider procedures to define the targets

A target has to be a common and accepted target otherwise people do not see themselves involved, the planning process cannot be started. In addition, consider quantitative and qualitative targets and define a process for monitoring and evaluating both.

Create Involvement and awareness

Targets can only be reached if the people are involved to the maximum. The question is here how to get the link between the target and the commitment in order to reach a personal involvement for the targets. One has to find measures to translate/transfer targets to the level of action and stakeholders. How is it possible to have stakeholders, citizens, politics, engineers at the same table and let them discuss what are the five main targets for an urban design competition?

Refer to role models

One option could be to choose a city that serves as a role model and encourages other stakeholders to follow. Role models can be individually developed (e.g. city of Karlsruhe) or be a common movement (e.g. Energiestadt in Switzerland).

A-2. Develop Renewable Energy Strategies

Authors: Jens-Phillip Petersen, DTU (Denmark); Ken Church, Natural Ressources Canada (Canada); Carissa Schively Slotterback, University of Minnesota (USA)

A-2.1. Introduction

A-2.1.1. Barriers

The transition of society towards sustainability and a more circular material flow requires not only a shift in energy supply from fossil fuels to renewables, but also a shift in the perception and use of energy. The pursuit of GHG emission reduction from the built environment poses a technical and socio-economic challenge, as actions are pursued across the energy and built environment sectors. This requires an integrated and strategic proceeding, including policies addressing various problem and action areas. If we think about strategic planning around energy and GHG reduction as the systematic organization of actions around communities goals (Bryson, 2011), renewable energy strategies (RESs) can include the following action areas:

- increase energy efficiency in energy production,
- decrease energy demand to achieve energy savings in the existing building stock,
- design new buildings designed as low-energy or zero-energy buildings, and
- shift of the energy supply system toward the exclusive use of renewable energy.

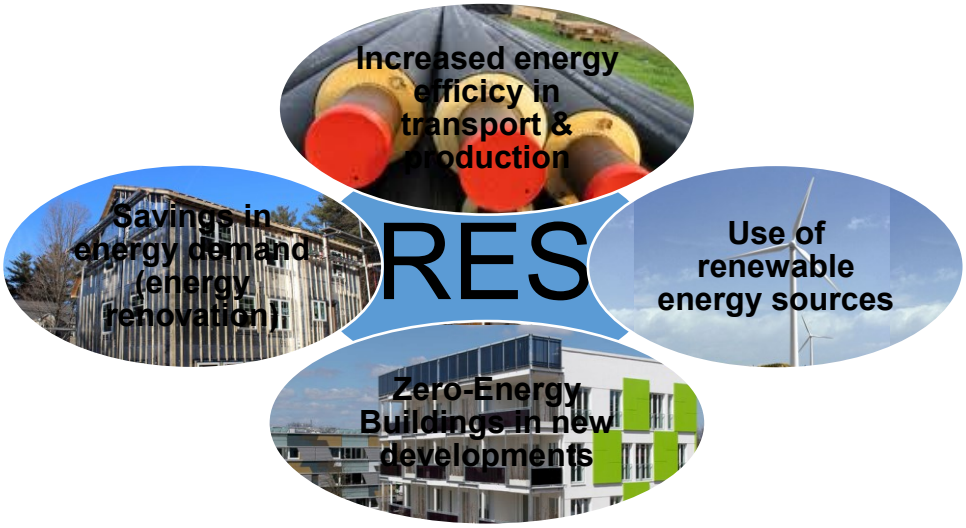

Figure 2: Typical action areas in a renewable energy strategy (RES) contributing to the reduction of GHG emissions (Source: DTU, 2017)

In the coming years the reduction of the embodied energy in buildings might emerge as a fifth action area, but this item will not be elaborated upon within this report. These

four action areas require measures on both the demand side and on the supply side in order to achieve the required reductions in GHG emissions. An integrated approach is necessary along with a strategy that visualises how these visions or targets can be fulfilled.

Renewable energy strategies should be compiled by governmental entities to coordinate actions and synchronize measures taken as part of a broader energy transition. Due to the presence of local stakeholders affected by the energy transition the most tangible energy strategies are those constituted at the local level. This requires municipalities, as local legislative-administrative entities, to take a proactive role in the energy transition. Within the scope of the IEA EBC Annex 63 project *Implementation of Energy Strategies in Communities* it is possible to observe that municipal energy strategies play important roles in the development of goals and implementation of energy-focused actions at the community scale. Despite different approaches and procedures in the participating countries, the use of municipal renewable energy strategies is identified as a crucial to the successful implementation of renewable energies (e.g. Denmark, France, Ireland, Switzerland, and Netherlands).

A-2.1.2. The Role of Municipalities

Without neglecting the increasingly important role private investors play in sustainable community development, municipalities and public urban developers can still be seen as the main driver in a community's transition to a low carbon environment. The extensive planning competencies of municipalities, and their comprehensive area of responsibility based on the common good enable a strategic approach in community development. Depending on the action area municipalities and public entities – in cooperation with private actors – can influence the use of renewable energy within the community through roles that can be characterized as such: enforcer; consumer, producer, developer, facilitator and cheerleader (Bulkeley and Kern, 2006; Danish Energy Agency, 2013; Lybaek and Kjaer, 2015).

1 *Enforcer* – while the municipality may not have total control over the generation and distribution of energy within the community it does have the opportunity to influence the manner by which its citizen access and consume it. Such actions might include the use of zoning criteria or the development of bylaws that encourage compact development or construction types and locations supported by the policing of building codes and standards.
2 *Consumer* – leading by example, local governments ensure that energy efficiency and the use of low carbon or renewable energy is a standard practice within the municipal facilities. Approaches might include green purchasing protocols.
3 *Producer* – some municipalities are still in the comfortable situation of owning public utilities, including energy generation sites and grid infrastructure. This

enables direct influence on investments in green technologies, if politically supported.

4 *Developer* – advancing private sector investment to undertake high efficiency urban development employing renewable energy or other sustainable features.

5 *Facilitator* – leveraging positive change through the use of municipal resources and assets, bringing together practitioners, energy providers and private sector investors to work toward community interests.

6 *Cheerleader* – raising public and stakeholder awareness through outreach as to the need for and benefits of a low carbon society.

The way in which these activities interact and support each other and enhance long term viability of the community is often expressed within the RES. Knowing which roles to fulfil require project steering competencies, energy technology knowledge, and an understanding of local context with its oddities and the ability to active peer groups in the right language. RES-documents define the long term targets and goals, the purpose and the roles of both the municipality and the stakeholders. They integrate the needs and aspirations of the municipality with the capacity of the community at large to attain a set of mutually accepted environmental targets while also maintaining and improving the overall quality of life within the community. The strategy also typically sets forth actions to be taken and associated responsibilities and timelines.

A-2.1.3. Aim, scope and structure of this section

This section will give an overview of the typical and important elements of a RES when developed at a municipal scale. It will outline key steps and preconditions in developing a RES, and different approaches as derived from existing cases. Further, it explains what RESs, as a tool of urban energy planning can achieve and what limitations they are subject to. Concluding the report are recommendations for engineers, consultants, research institutions, and urban planners on how to develop a RES and how to integrate technical concepts with the strategic targets of city development.

A-2.2. Compelling Conditions of Renewable Energy Strategies

Traditionally Renewable Energy Strategies are understood as technical scenarios for the transformation of fossil energy systems to sustainable energy systems based on energy sources such as wind, solar or biomass. As GHG reduction targets are set at national and local levels, jurisdictions began to explore ways to increase their use of renewable energy and levels of energy efficiency within the built environment. To fulfil these targets it is essential to develop strategies. RES historically only demonstrated the technical feasibility on transforming energy systems towards the exclusive use of renewable energy sources. Recently this paradigm has shifted from solely technical

scenarios to action-oriented plans including economic, social and cultural policy instruments to facilitate the implementation of a technical scenario.

This implies for our understanding that a RES is a technical scenario to transform a defined energy system coupled to a 'timetable-and-action-plan' that outlines a path for the continuous work to complete the energy systems' transformation. The availability of targets for the desired state of the energy system is fundamental to develop the energy scenario. By contrast the target achievement is depending on the 'timetable-and-action-plan' that organizes and plans the most appropriate and strategic measures.

Energy Systems & Scales

Energy systems, as defined in the fifth IPCC assessment report, include "all components related to the production, conversion, delivery, and use of energy" (IPCC, 2014). This implies that various stakeholders, legal matters, business models and properties are touched. Further, energy systems can be divided by scales – from global scale down to single buildings or even building components (see Figure 3, Fuchs and Hinderer, 2014). The same applies for RES and energy targets: National energy plans are of visionary character, set general GHG reduction targets, and delineate connections to supranational grids. Regional plans are often attributed with a coordinating function of local activities. Municipal RESs, by contrast are concerned with the spatial implications of energy demand and areas for energy supply infrastructure, such as photovoltaics or thermal grids. Their focus on the spatial needs implies that the RES must include specific directives when downscaling national level targets to community level applications. Community based RESs are typically created at municipal level and often offer a concretization of the municipal RES for local activities down to building scale. Because of the higher impact and coordinating function, we focus in this report on municipal RES as supporting tool and framework for the implementation of community energy strategies.

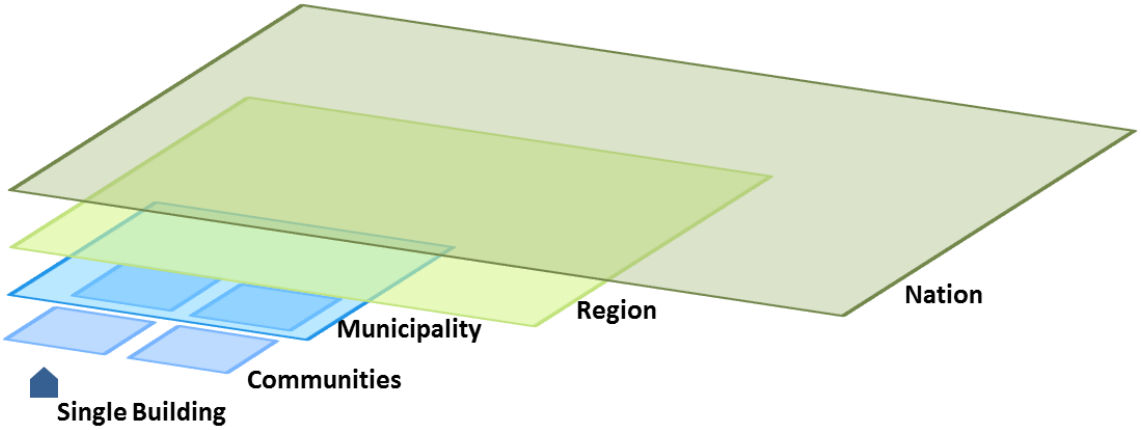

Figure 3: Scales of RES and spatial location of communities as defined in this section (Source: DTU, 2017)

Ideally national RES are in accordance with regional and municipal RES, to complement and support each other but in reality, political priorities create incoherencies between the different functions. This incoherence, if left unaddressed, can create obsta-

cles for project developments at community scale (Blake, 2007; Corfee-Morlot et al., 2009).

Role of renewable energy strategies and linkage to other planning documents

Whether informed by national or municipal expectations or driven locally, the RES offers essential information for the municipality, energy providers and other stakeholders identifying the renewable energy potential within the community and defining priority areas for interventions. The impact of RES varies and is often depending on its legal character: from informal memorandum of understandings between stakeholders (without a technical concept or implementation measures), over legally binding stipulations with direct consequences for individual house owners, up to prescriptive strategic documents that carefully align targets with actions, even in some cases adding monitoring and progress assessment components.

Some RESs may incorporate issues beyond energy, driven by key stakeholders and/or other community priorities. The inclusion of the local stakeholders ensures that critical socio-economic factors and political realities are accounted for as actions for reaching energy targets are identified. A RES, understood as strategic document guiding the development of a low carbon energy system at municipal or community scale, incorporating and in line with existing local policies and interests is a powerful tool to facilitate energy target implementation (see Figure 4).

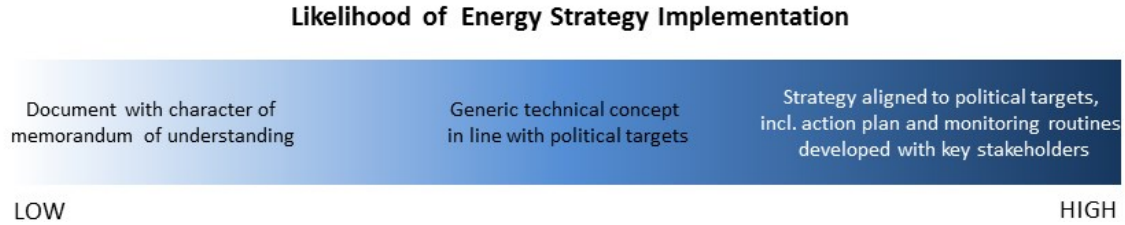

Figure 4: Different conceptions of energy strategies and their general likelihood to be implemented (Source: DTU, 2017)

Renewable Energy Strategies as a form of strategic planning

Strategies, in relation to governmental energy planning, are developed to deal with barriers that hinder the fulfilment of societies' energy targets (Poister and Streib, 1999; Poister et al., 2010). Instead of following a fixed route, strategic planning is about working into the direction of an abstract goal or a vision. This induces a constant reassessment if the taken actions are contributing to the fulfilment of the goal (Bryson, 2011). That requires having a short-term action plan, a constant information gathering and monitoring how successful these actions were, and the willingness and ability to try out other options, to act and learn in an iterative process while having the strategic goal in mind. Hence, the RES can only be a document or platform of understanding that outlines the path for the continuous work of the municipality regarding energy related planning of the municipality. For instance how a political target or vision, such as the building sector can become climate neutral in the year X can be fulfilled, if a specific set of actions is taken.

RES should not be understood as a strictly to follow guideline with a linear succession of actions that definitely will lead to the desired target achievement. Its purpose is to develop a continuing (internal and external) commitment to a goal or vision, to engender an environment that constantly supports the achievement of the goal and maintains a clear focus on the strategic agenda throughout all decision processes and actions taken. The necessity for RES arises from the complexity of transforming and planning an energy system based on renewable energy sources. In particular RES can help with the following challenges:

1 *Spatial coordination of interests* - historically energy production and energy demand were spatially decoupled, which results in energy not being addressed by municipal land-use planning. With the shift to renewable energies that are mainly accessed at the Earth's surface, more space-demanding, decentral, and more difficult to transport the access to renewable energies is in conflict with other land-uses (Broersma et al., 2013). The required spatial coordination is a task that is, without RESs, unaddressed.

2 *Implementation of energy targets* - RESs are manifestations of energy targets. The targets are broken down into technical concepts, describing how the target could be realized, followed by interim targets, actions how to achieve it and responsible stakeholders.

3 *Consensus building around visions and energy targets* - the challenge of transforming a municipal energy system is often exacerbated by the lack of authority within the municipality itself. In most cases studied, municipalities owned neither their grid infrastructure and production facilities, nor their local energy utilities. This lack of legislated authority outcrops if public bodies face energy use reduction targets that include the demand side. The impossibility to enforce energy renovation measures within the privately owned building stock forces municipalities to adopt a role of facilitator to integrate the activities of the private actors and citizens (Islar and Busch, 2016). This has led some municipalities to create their visions around those of the local actor networks so as to make use of the commitments from these private actors (Innes and Booher, 1999). As described in *Target Setting* below, visions or targets become critical components in the energy transition process.

4 *Systematic guidance for municipal actions* - RESs can serve as "collection tank" for existing stand-alone projects, thereby strengthening each, or single projects may be developed to contribute to the whole achievement of energy targets. In this way the RES works as internal document and systematic guide or check list for project approval. With the formulation of interim energy targets a RES is also the central document to which all monitoring activities become related, presenting the ideal scenario for an energy transition under the given local conditions that can be contrasted with the measured outcomes of actual actions taken.

2.3 Strategic Implementation of Energy Targets through Municipal Renewable Energy Strategies

A-2.2.1. From linear approaches to circular strategic learning

The renewable energy strategy, as a document that outlines the path for the continuous work of the municipality regarding energy related planning, shouldn't be understood as a linear schedule on what project to initiate when, which measure to use to foster it and what output to expect. The objective of a renewable energy strategy is to show how a specific area can be supplied solely by renewable energies, which scenario is the most appropriate, and which actions are needed to implement this scenario.

During the first phase of the development of a RES it is crucial to find the right starting point: Having a basic idea of the target and direction of the desired development, backed up by adequate technical scenarios and which steps should be taken to move in the direction of the desired target (hence, an idea about key stakeholders, drivers and subserving measures). It is not about having an already fully elaborated concept that depicts energy scenarios into the minutest detail and is predetermining actions until the final target. Unforeseen internal and external developments will thwart this linear route, which requires a constant reassessment that allows amendments and consolidations in reaction on new developments along the process of implementation. Strategic learning of all stakeholders should be an important element of RES to improve the quality of the energy strategy during the simultaneous process of development and implementation.

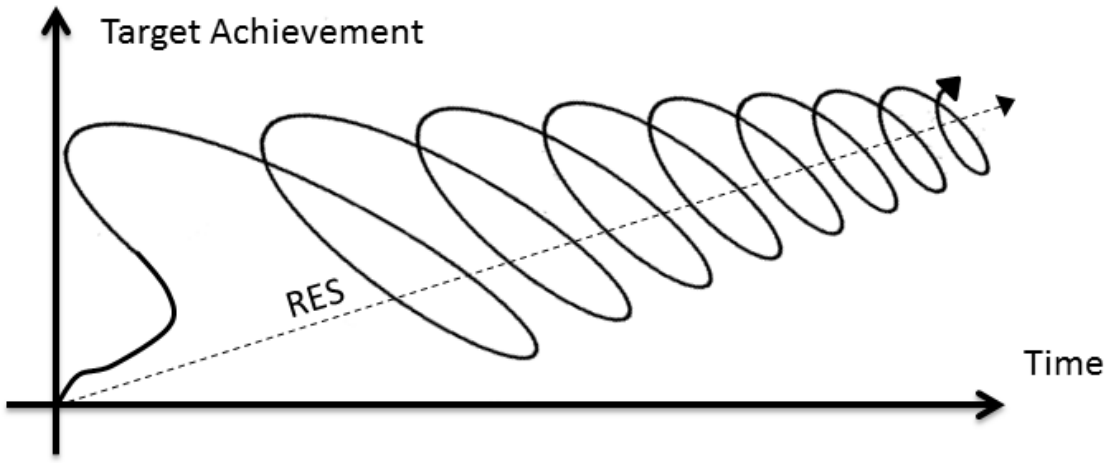

Figure 5: Development of a RES as spiral movement towards energy target through an iterative process (Source: DTU, 2017)

Hence, a RES should be understood as circular strategic management process and not only as a strategic plan, because it links planning and implementation while managing the development of an area (for instance the municipality) on an ongoing basis (see Figure 5). This iterative process has the objective to get closer to the desired energy

target which each repetition. In saying that we argue that RES should be developed on the principles of the "Strategy Change Cycle" (Bryson, 2011) with four main steps:

1. To be able to formulate an energy strategy, a target might be useful, which marks is in most cases the beginning of a process.
2. Several technical scenarios on how to reach the energy targets must be developed – along with barriers for their implementation, such as socio-economics or other factors (e.g. energy prices, varying stakeholder interests or energy reliability).
3. Proposals on how to overcome barriers for implementation backed up with measures or tools on how this can be done and the technical concept implemented should be summed up in a short- or mid-term action plan.
4. To follow up the action plan a monitoring routine should be included to assess if the actions taken are contributing to the implementation of energy concepts and the achievement of energy targets.

After the fourth step targets can be reassessed and the following steps could be adapted. RES should always be developed with an idea on how to implement them. This requires that the necessary resources for implementation are considered already in the process of strategy formulation to appropriate these in time and to define responsible stakeholders (Hill and Hupe, 2009). In this connotation the RES is the platform that coordinates the use of all energy planning measures and bundles them towards the direction of the energy target implementation. The measures and respectively formed strategic-measures described in the *IEA EBC Annex 63 Vol. I* report ideally contribute all to the implementation of a RES. But their impact and usability is specific for each of the four mentioned phases of a RES. For instance measures from the strategic-measure 'Make Full Use of Legal Frameworks' contribute mostly as tools in phase 3 when it is about overcoming barriers for implementation of technical concepts. Or measures from strategic-measure 'Make Use of Tools Supporting the Decision Making Process' are mainly used to develop technical energy scenarios (see Figure 6). Depending on the local situation for that the RES is developed, the RES includes potentially measures from all of the described strategic-measures in this report and is hence used as the conceptualization for when different measures can be used to foster the implementation of energy targets. The four steps including the relation to the other strategic-measures are described further in the following chapters.

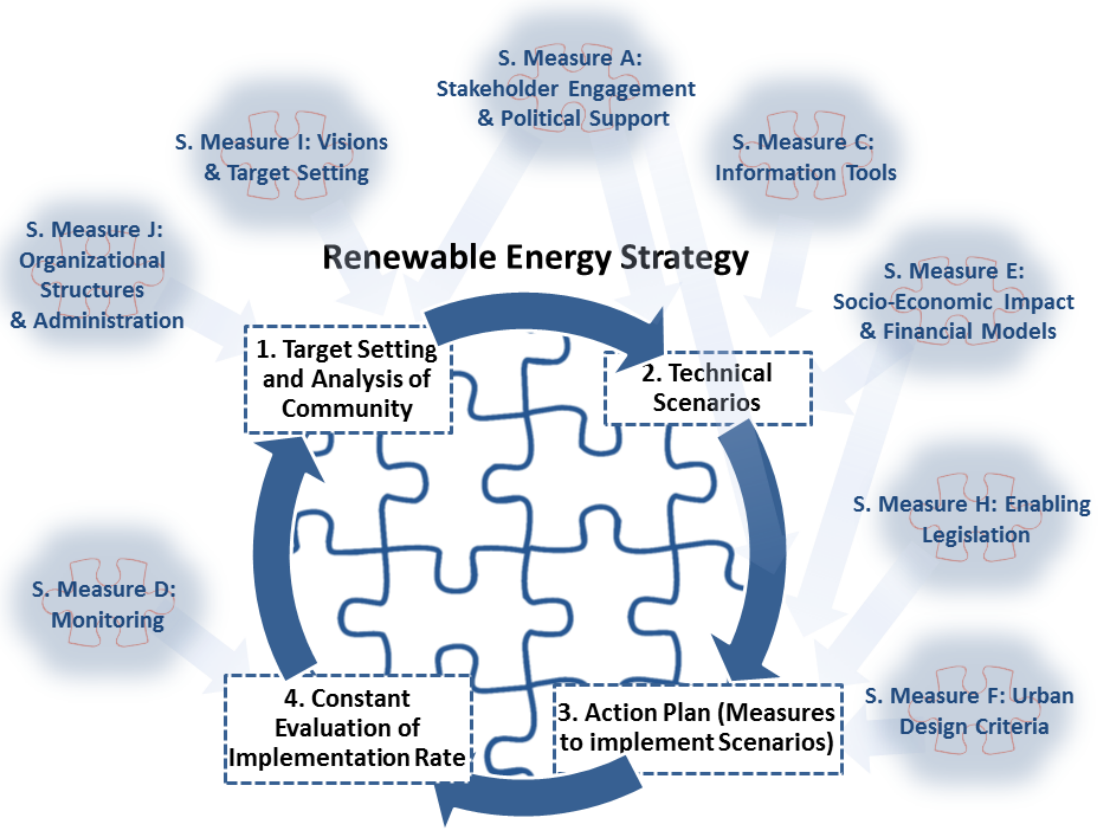

Figure 6: Renewable Energy Strategy Cycle as a "Carrier" for other strategic-measures (S. Measure) that are embedded as essential parts of a Renewable Energy Strategy (Source: DTU, 2017)

A-2.2.2. Target setting

The advantage of having clear and mutually agreed energy targets is that a direction for the energy strategy is clear. The development of the energy reduction or emission reduction targets can take several forms: bottom up from public discussion, top down from national directives or some degree of hybrid model involving both national and public debate. As seen in *volume 1* of this report, the majority of countries have their emission targets defined at the national or provincial / state level with the city or municipal authority providing guidance on how the targets are to be achieved. While the national targets may be relatively straightforward to understand – for example, 30% reduction by 2030 – implementation at the local level requires the task to be divided amongst a number of emitting sectors: power, heating, lighting, transportation, buildings, etc. To agree on the local targets is not always so straightforward.

The target development process can be driven from the municipality or external, for instance through local business associations that have goals for regional business development and want to promote their technical solutions. Both approaches require detailed analysis of the local conditions: both the level of investment and the resulting impact on stakeholders and local economy, or the organisational structure required to invest and maintain the momentum required for the necessary growth in technology. Depending on the source of the targets, acceptance may vary for different stakeholders.

Before targets should be set and the process is initiated, an analysis of the local setting is important to identify in a first step all relevant stakeholders and to include the ones that are most relevant. An actor-interest analysis as described in *Stakeholder Engagement* can help here to team up with the most supportive stakeholders and to be clear about organizational mandates and competencies of the stakeholders as early as possible.

Understanding organizational mandates is important to assign tasks to stakeholders. They may be unclear as to their own capacities and responsibilities and it is sometimes necessary to seek legal advice on administrative and organizational mandates so as to provide greater clarity. The expectations regarding contributions of financial, time, and other resources by stakeholders to the RES should be addressed early on, to ensure clarity of responsibilities in later stages of the RES process. This requires that the role definitions of the stakeholders are clear. Particularly municipalities should be aware of their role as possible facilitator and main driver of the process. Here, the relationship between the internal organization of the municipality and those of the stakeholders will identify whether the stakeholders' internal organization has the capacity and authority to reach or commit to the desired targets. *Stakeholder Engagement* and *Organisational Structures* provide input into addressing these issues.

A-2.2.3. Technical concepts for future energy systems

Two approaches (at least) are available to develop a comprehensive technical energy concept. The most commonly used is the assumption of an ideal energy system according to the energy target is available in "year X" and a backcasting analysis is used to define interim energy scenarios and interim targets for the interval between present and "year X". A second approach involves scenario building with incremental growth of the scenario until the long-term energy target is reached. Both approaches have validity: the first is more suitable for situations without existing technologies or infrastructure while the second requires an elaborated analysis of the current situation, economic growth predictions and is therefore more often used in areas that already have existing technology applications.

Either analysis should involve the identification of technical, physical, administrative and social assumptions so as to exploit local potential as support for the RES. A comprehensive analysis exceeds the scope of most municipalities, consultants or energy utilities and requires a cooperative effort and sharing of information. For most analyses energy calculation methods or even computerised modelling tools are required (Keirstead, 2012); details of these can be found in *Planning & Decision Support Systems* and *Information Tools*.

The complexity of the decision-making tools often requires specialised and highly technical knowledge, further emphasising the need for collaboration among stakeholders (Weick and Sutcliffe, 2007). In practice though an initial scoping evaluation that can be undertaken in-house, if a basic knowledge is available, the technology options that

would satisfy the community's overall goals can be assessed. Table 1 illustrates some of the most common technologies that could be implemented within a community and used to develop larger scale energy networks. Each technology in the list is described from a planning perspective. Tried and tested solutions as described in table1 will be preferred for a broad scale implementation. It is unlikely that new and innovative technologies or those considered as yet undiscovered will be accepted by investors involved in a transition to a low carbon economy. Yet, it is not debarred that new technologies with a higher level of risk are accepted in demo projects.

Table 1: Technology Comparison (Source: DTU, 2017)

	District Heating	Combined Heat & Power	micro-hydro	Wind	Biomass
Operation	Heating & Cooling	Electricity & Heating	Electricity	Electricity	Heating
Construction Cost	Distribution piping requires access to roads and buildings. Established technology and construction practices. Suitable for new build and retrofits.	More complex than district energy. Requires access to electrical distribution node / transformer. Can be integrated within existing buildings	Location and seasonally dependent. More specialised construction techniques.	Low costs and adaptable to urban environment. Small generation levels. Large scale generation more suited for rural or offshore locations	High construction costs related to fuel handling and emission cleaning
Electricity	Power for pumping and general operational issues. No generation	Needs interconnection with grid and resale agreement	Needs interconnection with grid and resale agreement	Needs interconnection with grid and resale agreement	Can generate power and / or heat. Power for pumping and general operational issues.
Lifetime	50 - 80 years	20 - 30 years	50 - 100 years	20 years	20 - 30 years
Land-Use	Distribution network incorprated within existing Rights of Way. Trenches typically less than 2 m below grade. Energy plant integrated within existing street scale buildings	City scale building structure with adequate noise proofing. Access for maintenance machinery	Fast moving river or waterfall. System includes weir and associated machinery building	For tower mounted systems public safety suggests clearance area. Smaller building mounted units require minimal space.	City scale building structure with adequate noise proofing. Short term storage facilities fro fuel. Additional long term storage off site. Pollution control equipment can double the original spatial needs and flue stack must exceed the height of adjacent buildings. Access for maintenance machinery
Water requirements	Hot water system required initial fill, water treatment to prevent corrosion and periodic top-up	Heat recovered from generator uses hot water loop connected to district energy system or thermal load. Water treatment required to prevent corrosion.	n/a	n/a	Water requirements limited to associated district energy connection if included.
CO2 Emissions	GHG emissions limited to the heat source technology	Increased local emissions due to fuel for electricity generation compensated by displaced power elsewhere	n/a	n/a	biomass fuel considered GHG neutral. Power generated displaces grid generation elswhere.
Other Emissions / Waste	None	Small quantities of waste oil	None	None	Combustion ash possibly containing heavy metals, trace elements. Fly ash from flue gases
Operational Flexibility	Can use a variety of fuels or energy sources at a variety of temperatures. Load following capability is dependent upon the heating supply but generally covers the entire operating range	Limited to the combustion fuel, typically natural gas, biogas or syngas. Limited load following capacity - 100% to 60%	Supply side driven, limited if any direct load following capability, requires connection to the grid or battery storage	Supply side driven, limited if any direct load following capability, requires connection to the grid or battery storage	Can accommodate some other solid fuels depending on boiler design. Load following capacity - 100% to 60%
Local Component (typical)	Civil engineering, pipe installation and building hook-up. Energy centre and boiler operation.	Civil engineering, pipe installation and building hook-up. Energy centre and engine operation	Civil engineering, weir installation and turbine hook-up. Energy centre and operation	Site preparation, concrete base installation and electrical hook-up	Fuel supply and delivery, civil engineering, pipe installation and building hook-up. Energy centre and boiler operation.
Noise	None	In accordance with existing standards	None	None	Fuel delivery traffic

	Geoexchange	Solar PhotoVoltaic	Solar Thermal	Biogas (Digestion)	Waste to Energy (gasification)
Operation	Heating & Cooling	Electricity	Heating	Heating	Heating
Construction Cost	High upfront cost for borehole drilling, can be hidden within buildings, carparks, parkland, etc. Drilling may impact water tables, flood plains, etc	Economies of scale impact small capacity systems. Can be integrated withinexisting roofing structure, roadways, and other buildings	Least expensive of all options but needs storage capacity for efficiency. Distance to user load should be minimise. Could integarted well with district energy.	Capital cost influenced by storage if undertaken at site. If generated remotely then existing gas infrastructure could be used.	Not viable at the neighbourhood scale. Potentially costly pre- and post-treatment facilities required.
Electricity	Power for pumping, compressors, and general operational issues. No generation	Low voltage but multi-directional power system. Possible interconnecton issues with grid.	Power for pumping (possibly PV) and general operational issues. No generation	Can generate power and / or heat. Power for pumping and general operational issues.	Can generate power and / or heat. Power for pumping and general operational issues.
Lifetime	20 - 100 years	25 - 40 years	10 - 25 years	30 - 50 years	30 - 50 years
Land-Use	Bore hole field size depends on local geology but will need access for periodic maintenance. Can be integrated with recreational parkland or light commercial area.	Although roof tops are common for PV installations , ground mounted installations offer ease of maintenance at the expense of space.	Roof mounted solar avoids shadow and incorporates gravity feed to thermal storage integrated within the building structure.	City scale building structure with adequate noise proofing. Short term storage facilities fro fuel. Additional long term storage off site. Generation and pollution control equipment can double the original spatial needs and flue stack must exceed the height of adjacent buildings. Access for maintenance machinery	City scale building structure with adequate noise proofing. Short term storage facilities fro fuel. Additional long term storage off site. Generation and pollution control equipment can double the original spatial needs and flue stack must exceed the height of adjacent buildings. Access for maintenance machinery
Water requirements	Water loop may contain treatment chemicals to prevent corrosion, etc. Open loop systems where groundwater is extracted and returned elswhere should be avoided.	n/a	n/a	Water requirements limited to associated district energy connection if included.	Water requirements limited to associated district energy connection if included.
CO2 Emissions	Equivalent emmissions depend upon the carbon content of the compressor motive force (electricity, gas, etc)	n/a	n/a	GHG emissions displaces the original methane emissions	GHG emissions depndent on fuel composition.
Other Emissions / Waste	None	None	None	Solids residue from digestion process	Combustion ash possibly containing heavy metals, trace elements. Fly ash from flue gases
Operational Flexibility	Does not accommodate a change in fuel type. Load following capacity is dependent upon geological factors.	Supply side driven, limited if any direct load following capability, requires connection to the grid or battery storage	Supply side driven, limited if any direct load following capability, requires connection thermal storage capacity.	Digester technology provides a constant stream of syngas. Load following capacity depends on conversion technology - boiler, engine, etc.	Gasifier technology provides a constant stream of syngas. Load following capacity depends on conversion technology - boiler, engine, etc.
Local Component (typical)	Bore hole drilling, piping installation and heat pump connections.	Support framework, panel installation and connection. Energy centre and grid connection	Support framework, panel installation and connection. Energy centre and storage tank hook-up.	Fuel supply & delivery, civil engineering, piping installation and building hook-up. Energy centre and operation.	Fuel supply, delivery & pretreatment, civil engineering, piping installation and building hook-up. Energy centre and operation.
Noise	None	None	None	Fuel delivery traffic	Fuel delivery traffic

The more detailed evaluation of the technical energy concepts should find feasible approaches to satisfy a community's future energy service needs and to reach given energy targets. The energy data needed to assess the current situation should reflect the current and projected future energy demand for an area. This should correlate with the growth projections of existing energy suppliers and the potential impact of energy reduction programs. Further, the technical energy potential of the area in relation to economy must be identified in terms of which technologies can provide greatest local employment, utilise the most local industry, and be easily maintained and publicly acceptable. This information is merged in estimations for the future community energy system. Hence, different energy technology scenarios are developed on how to achieve the targets reached (or what target is possible to be reached under the given conditions) (Huang et al., 2015). Besides cost-efficiency, multiple sustainability objectives were added in recent years as decision criteria. For instance the use of sustainability certifications schemes as LEED, BREEM or DGNB led to a high degree of renewable energy being suggested – even without explicit targets (Neves et al., 2015). By creating several technical scenarios an understanding of the desired future energy system can be created along with the estimated margins of error, developed through what-if or sensitivity evaluations (see report in information tools for details).

A-2.2.4. Choosing adequate measures to implement energy systems

The technical energy scenarios should be analysed regarding their ability to be implemented. Strategic issues or barriers the municipality and other stakeholders are facing should be identified and where possible quantified in terms of resources – what is missing from the task (e.g. financial resources, expertise, or location). Once technical alternatives, energy targets and visions, along with barriers to their realization are listed, the project team can develop major proposals for achieving these goals directly, or else indirectly through pilot studies intended to overcome the barriers. This is generally done with an action plan that includes a schedule or a guidance which implementation barrier can be overcome with which measure.

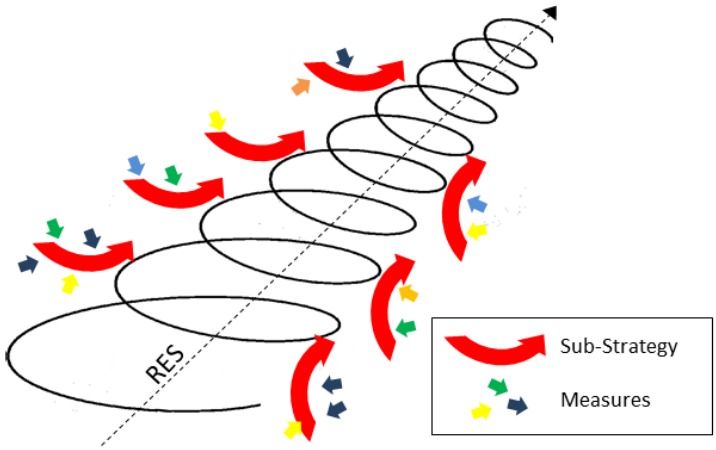

Figure 7: The use of Sub-Strategies (Actions) to promote the RES (Source: DTU, 2017)

The measures are assigned to sub-strategies of the RES. Such sub-strategies are e.g. energy retrofitting programs that contribute to the overall targets of the RES or programs to convince the homeowners to take action. The sub-strategies contain single measures that implement single elements of the technological energy concept (see Figure 7). It is important to understand the dependences and conditions under that a measure can be used – it is to a lesser extend about a temporal sequence of measures, but about bypassing emerging barriers with a specific combination of measures. In relation to the example of a retrofitting strategy for a community with private owned buildings this might be subsidies for energy consultancy, teaming up with local businesses in combination with information campaigns for the house owners etc. (see Figure 7).

Developing a protocol or process to address implementation barriers is especially useful in cooperative processes with many different stakeholders, avoiding the risk of appearing to favour or penalise specific groups. With an constantly updated action plan it is possible to assign a budget, a schedule, milestones and a communication strategy to a technical energy concept to prepare and plan its' implementation. Each type of renewable energy strategy requires specific measures to foster its implementation – depending on the local setting. The involvement of local stakeholders will create ownership, "soft" socio-economic benefits, and highlight different development priorities. This generates an understanding of the relationships between the stakeholders, energy technologies, proposed measures and the local context.

Activity	Result	Expected Effect
• Initiation of a working group between local businesses and citizens	• Alignment of stakeholder interests • Central committee to contact	• Ownership for project • Change momentum • Better informed feedback from users • Boost for local economy of 0.2% • Increase of annual energy renovation rate by 0.4%
• Subsidy for energy consultancy of 50%	• Lower barrier for citizens to use energy advisors • Expenses of 0.2mio€ for the municipality	• Increase of energy renovation rate by 0.3% • Local job increase • Increase of local tax incomes by 0.7mio € • More efficient housing renovation • Annual energy saving of 21MJ

Figure 8: Example for Action-Effect scheme on strategic measures (Source: DTU, 2017)

Visualisation of the impacts of the various plans and measures is often a good way to secure public support in a transition. It can be helpful to structure the different activities and the measures used in action-effect-schemes to be clear about what reaction is to be expected from using a specific measure. This can be presented schematically as in Figure 8 where the designated measures have been quantified to be able to assess the contribution to the achievement of interim- or long-term energy goals and in case the expected effects are not reached a reassessment of activities is possible. A more advanced form would be the action-oriented strategy mapping approach that involves the creation of word and-arrow diagrams in which possible actions are linked by arrows indicating the cause effect or influence relationships between them (e.g. action A may cause or influence B, which in turn may cause or influence C, and so on. If one does A, one can expect to produce outcome B, which in turn may be expected to produce outcome C and so on).

The measures are summarized in the named action plan identifying how to foster the implementation of the technical energy concept within subsequent years. The timeframe for implementation varies across RESs, but typically includes short and long term actions. These plans should address other strategic targets of the municipality that they touch along with (and how they influence them), what benefits to expect, when to initiate actions, and which measure to use and who has to be involved or is responsible. Strategies should positively affect a lot of areas and they need to create an extra value to create a momentum that is necessary to obtain the internal commitments from municipal officials and external stakeholders. Hence, an effective strategy should be: technically workable and administratively feasible, politically and socially acceptable for key stakeholders and citizens and it should be result-orientated. After an action plan has been set on how to implement the technical energy concept that allows the

achievement of the energy targets a final assessment and decision about the RES can be made and to enter the next cycle of strategy development and implementation.

A-2.2.5. Monitoring and Evaluation

Strategic learning is key to an iterative process that allows the planner to adjust targets and sub strategies in response to unforeseen events. In effect, a RES is simultaneously under redevelopment and implementation. To learn from and understand its impacts, positive or negative an evaluation process for the activities should be included. Since both RESs and targets can be set in timespans of decades and even interim targets may be set for a period of five years or more, thus requiring attention to changing assumptions and conditions over time. The recommendations of a RES inherently include a high degree of uncertainty, which requires constant assessment of the state of the energy system and progress towards energy targets.

To manage implementation, resilient and flexible strategies coupled with a monitoring routine should be part of the developed action plan. The monitoring routine should set specific milestones at which point the measures should be evaluated, who is responsible for this and which data is needed to be able to assess the success of a measure. Attention should be focused on successful activities and whether they should be maintained, replaced by other activities, or terminated. Unsuccessful measures should be identified as well and should be terminated and replaced with alternative measures. In general, the effectiveness monitoring is dependent on how effective the municipality and other stakeholders are at learning from and understanding changing conditions, being open to new information, and periodically assessing the situation and acting depending on this assessment. Reasons for change may be internal or external and inevitably demand responses. This fourth phase of the RES should not be considered as the last phase, but as the beginning of the next cycle of strategy development and implementation of energy targets.

A-2.3. Examples

Examples within the scope of the *IEA Annex 63 Implementation of Energy Strategies in Communities* that demonstrate the described approach for a guiding document of municipal actions are described below. It is noteworthy that the RES plays a major role in each case, but the RES does not necessarily mark the beginning of a development in temporal terms. In most examples the RES is gathering together smaller, independent projects and has combined these with other measures, such as information tools or participatory processes, effectively directing them towards long-term energy targets. In this way, the use of the RES as a platform of understanding and guidance for single measures in the daily work of municipalities can be observed. For further information and a conceptualization of the case studies see the *IEA EBC Annex 63 report Volume 3*.

A-2.3.1. Examples from Scandinavia

Furuset, Oslo (Norway)

The city of Oslo is expecting a population growth of about 25 % up until 2030. To react to the need for new housing areas a densification plan for the suburbs with new public transport lines is planned. Furuset, as one of these areas is presented as a pilot project for sustainable urban renewal. The goal of the project is to reduce the overall CO_2 emission by 50% by the year 2030 and long-term, to reach climate-neutrality, while still maintaining a high urban and architectural quality.

Oslo´s city planning department suggested a plan for climate-effective city development at Furuset. A mix of heat pumps and biomass will supply the district with energy, while the infrastructure should be “open” and flexible, meaning that an eventual linkage of distributed energy systems to central systems such as a district heating system will be possible. The area plan is an important governmental tool to ensure that the overall concept and guidelines for the individual properties contribute to climate-friendly city development. The planning proposal´s principles for city development are also in line with FutureBuilt´s criteria on climate-friendly area development. An important and innovative element in the RES are guidelines in the quality program for the area and the use of greenhouse gas accounting as management tools to enforce energy renovation and continuously measure progress.

Sønderborg (Denmark)

The target for Sonderborg is to emit zero GHG emissions in the municipality from 2029 onwards. The overall approach is called ProjectZERO and is based on a Public-Private Partnership (PPP) between the municipality and local technology companies. To realize the vision, a holistic RES was developed with cooperation between the municipality, local businesses, financial and research institutes. The strategy is based on energy efficiency coupled with electricity and heating systems. It is based on a mix of renewable energies, augmented by biofuels harvested from local resources to transform the transport emissions.

In Sonderborg they understood that energy planning isn’t just about modelling and technological possibilities, but about having a broad consensus between all stakeholders and the need to develop business models. Participation, learning and empowerment of citizens and local companies in particular have been a key challenge. An intermediate goal was to reach a reduction in GHG emission of 25% by 2015, in relation to 2007. Already in 2015 a 30% GHG reduction compared to 2007 has been achieved.

A-2.3.2. Examples from Central Europe

2000-Watt certification, e.g. used in Basel (Switzerland)

The 2000-Watt certification scheme is actually not a RES, but contains the strategic approach of lowering the energy use per capita in a given area. With the use of the 2000-Watt program an implementation plan has been developed (based on a toolbox of measures) and a regular monitoring is measuring whether the interim targets are being met. The 2000-Watt-site certification is currently awarded to 9 sites in Switzerland. Greencity in Zurich and Erlenmatt West in Basel are the first ones re-certificated in 2015. One very important benefit is the long-term approach of the 2000-Watt-certification compared to other building standards and labels. In addition, the long-term close cooperation between planning authority/municipality and developer/investor is helpful to achieve best results.

Parkstadt (Netherlands)

Bottom-up housing renovations to zero-energy standard under the use of innovative technical solutions from the industry - in cooperation with local universities – have demonstrated how it is possible to optimize the single building. The results and practical experiences from these renovations have been extrapolated to city level via an ”Integral Spatial Realistic Scenario (ISRS)” developed by the University of Wageningen. These technical scenarios,show how the municipality of Parkstadt can become fossil-free. The results have been adopted by the city council as strategy to achieve the long term goal to become a zero-energy city in 2040. The necessary actions are analysed for each of the 8 districts in the city of Parkstad. The municipalities are now in a dialogue with private stakeholders, to negotiate their role and contribution to achieve the long-term targets of the city.

Bottrop (Germany)

Due to the gradual decline of coal mining sector over the recent decades, Bottrop is undergoing a massive structural transformation. To counteract negative effects for local economy and labour market the Initiativkreis Ruhr, an association of local companies, initiated the InnovationCity initiative that has been a key driver for sustainable transformation. Within this initiative the city of Bottrop became a pilot-project for energy-related urban renewal. A public-private-partnership of leading corporations, research and development institutions and the municipality has been set up under the leadership of the major of Bottrop.

For the mixed-use area of 2.500 ha with 70.000 inhabitants a long-term masterplan has been developed, which incorporates a RES. The document was developed by an external consultant and is aiming at a CO_2 emission reduction of 50% from 2010 by 2020. The document defines the main strategy for the InnovationCity until 2020 with a detailed plan and schedule for measures and responsibilities. It also includes long term

goals beyond 2020. Besides the PPP between the municipality and local companies, citizen participation (e.g. via an online platform or citizen workshops) has been an important element of the masterplan development. The RES is focused on increased energy efficiency through energy renovation and energy-production on site within or at the building façade. This “bottom-up energy transition” is pooling more than 125 individual projects under the urban renewal strategy that, besides positive effects on energy efficiency, the strategy enables synergies to socio-economic interests. With its long-term visions, the integration of different stakeholders, plus measure- and monitoring plans the masterplan is consensus building. This far (2015) the CO_2 emissions have been reduced by 38%, which leaves the goal to reach 50% by 2020 within reach.

A-2.3.3. Examples from North America

Minneapolis Climate Action Plan (USA)

The City adopted its first Climate Action Plan in 2013, following an extensive stakeholder engagement process. The plan focuses on three primary areas: (a) Buildings and Energy, (b) Transportation and Land Use, (c) Waste and Recycling. The plan specifies a goal of reducing city-wide emissions by 15 percent by 2015 and 30 percent by 2025, using 2006 as a baseline. The plan includes data from Minneapolis’ detailed greenhouse gas inventory, which breaks local sources into multiple categories.

The plan includes five implementation goals that set forth a set of actions that the City will take following completion of the plan. The goals address prioritizing high impact, short timeframe, equitable, and cost effective strategies; seeking multiple benefits; advancing equity; monitoring progress and revisiting goals/strategies every three years; and building resiliency. The Plan’s implementation section outlines the City’s, including multiple departments, role in advancing and monitoring implementation. A unique aspect of Minneapolis’ efforts, for US standards, is the extensive focus on stakeholder engagement already at an early stage in the process.

Guelph (Canada)

The City of Guelph expected, in 2005, a population growth from 30-40 percent by 2030. To ensure a reasonable growth under the paradigm of ensuring long-term competitiveness and environmental performance of the city, the city committed to implement an energy plan. Under the participation of local businesses and citizens an abstract vision with quantitative, but vague goals leading to 2030 was formulated and approved by the city council. The main driver for the plan to increase energy efficiency is an interest in cheap and secure energy supply to maintain competitive and a high quality of living through a more efficient use of city infrastructure. Hence, the rather technical document with project proposals collected from best-practice cases from the US, Canada and Europe is emphasising on the co-benefits of energy efficiency measures in communities for all stakeholder groups.

Besides the vision the document sets interim goals, some on community scale, that are clear and easily measureable and can be adapted by the city administration in their daily work, so that these can become part of the daily fabric of the city's future development. Main innovations lay in the development of new governmental structures, such as the establishment of energy utilities within the city administration. The new utilities are responsible for the now initiated district-energy related projects based on CHP.

A-2.4. Recommendations

A strategic approach for reaching energy and emission reduction targets at a community scale increases the likelihood of implementation. The development of a renewable energy strategy (RES) as an iterative process can be a supportive measure, because it systematizes actions and coordinates the use of other tools to address implementation barriers. The strategy presents a series of distinct characteristics:

1) A RES can be used as a guiding document or strategy that should be integrated into municipal and private stakeholders' future plans and in ongoing development projects to achieve desired energy targets.
2) The RES does not explain how to implement energy targets; it proposes a framework of measures that contribute to the implementation of renewable energies.
3) The RES should be under constant and simultaneous development, implementation and critical reassessment.
4) The RES defines the roles, mandates, responsibilities, and competencies of the municipality and private stakeholders. It requires an understanding of both possibilities and restrictions arising from the RES.
5) The RES is a strategic document that can be understood as a platform to contextualize and coordinate the measures needed to attain the GHG reduction targets (for an overview about available measures see *section 2.2*).

Reviewing the cases of the Annex 63, fully integrated RES (including action plans and monitoring routines, besides energy targets and technical scenarios) are rather an exception. Using RES as guiding document for stakeholders' actions requires ongoing effort, availability of resources, communication and a constant learning process. RESs are not only a document; they are rather a strategic principle that has to be internalized by all driving stakeholders. Obtaining new kinds of knowledge and optimizing processes after experiences of successful or failed projects goes in hand with a constant resetting of the overall strategy, and an anchoring of the RES in local communities through action plans to achieve the desired energy targets.

A-3. Make Full Use of Legal Frameworks

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A-3.1. Introduction and compelling condition

Adequate legislation sets the supportive framework for the sustainable development of communities. The legal framework usually consists of general laws, secondary regulations and more or less formal/informal guidelines and recommendations. This framework differs from country to country regarding the targets, different territorial levels and the regulation of details. This paper aims at presenting a set of operational recommendations that can be used for making full use of legal frameworks for implementation of energy strategies on site, i.e. on the level of neighbourhoods, districts and similar urban areas. Target audience of this paper are local urban and energy planners and legislator. Compelling condition is that legal frameworks for urban and energy planning exist.

A-3.2. Legal frameworks as basis for planning – Barriers

Communities are confronted by several global trends:

1) Increasing mobility/migration: People are moving from one place to another and especially cities are growing fast. Migration is hereby understood as a permanently change of residence from people (e.g. move from the country into the city).
2) Limitation of resources versus increasing demand: Fossil energy sources are limited worldwide and energy demand by industry, transport, agriculture and construction increasing due to demographic development and rise in production and wages.
3) Climate change: The average global temperature is increasing and will probably influence national and urban economies and living and housing conditions.

Therefore, the United Nations has defined a Sustainable Development Agenda that include 17 goals (United Nations, 2017). The following three goals are of great importance in context with the Annex 63:

1) Make cities inclusive, safe, resilient and sustainable (goal 11)
2) Ensure access to affordable, reliable, sustainable and modern energy for all (goal 7)

3) Take urgent action to combat climate change and its impacts (goal 13)

Legal frameworks are hereby a central element to ensure the effective and efficient planning on a local level. As migration and the changing demand for housing are typical phenomena since many decades, the regulatory frameworks for spatial planning are optimised in many countries and will not be described in detail.
Energy planning is a relatively new discipline and is subject to rapid changes. Energy planning on community level includes several topics, such as energy efficient buildings and infrastructure, access to energy, environmentally friendly production and distribution of heat and electricity as well as district management systems and visibility. Therefore, the focus of this paper lies on the regulatory frameworks for energy planning that take into account the urban development. In the next sections, different types and regulatory frameworks will be described in detail. Basis was an analysis of legal frameworks in Switzerland, Denmark, Germany, Austria and Norway, which showed a variety of different approaches.

A-3.2.1. Existing regulatory frameworks for energy planning

Energy planning became an important issue during the oil crisis in the 70ies and leads to a slow development of regulatory frameworks in this area. Nowadays, the consideration of energy planning (with focus on regional planning) in existing regulatory frameworks differs from country to country. The following examples show typical types of regulations.

Switzerland: Energy planning is considered in Switzerland in the constitution: "*The Federal Government and the cantons, within the scope of their responsibilities, are committed to a sufficient, broad, secure, economical and environmentally compatible energy supply as well as to economical and rational energy consumption."* (Article 89, Energy Policy – Federal Constitution of Swiss Confederates)

Denmark: Energy planning is considered in Denmark in the national Heat Act: *"The climate, energy and construction minister must take into account the superordinate social considerations when setting regulations for the treatment of matters pursuant to § 4 regarding the use of heating material in a heat generation plant, if ..."* (§ 5, Paragraph. 2, Law on Heat Supply, the Law on Power Supply and the Building Code).

Germany: Energy planning is considered in Germany in the national Building Law: *„The following topics shall (remark: means mandatory) be taken into account in the drawing up of the land-use plans: 7. the interests of the environment, including nature conservation and landscape management, in particular f) the use of renewable energies as well as the economical and efficient use of energy"* (§ 1, Paragraph 6, Building Code).

Austria: Energy planning is considered in Austria in the Spatial Planning Laws of the federal states. E.g. Regional Planning Law of Salzburg: *"The support and development of an independent and sustainable energy supply must be supported"* (§ 2, Paragraph 1, Item 15, Regional Planning Law of Salzburg 2009)

Norway: Energy planning is considered in Norway in the regional Planning and Building Act: *"Plans pursuant to this Act shall (g) take the climate into account in energy supply and transport solutions"* (Part II, Chapter 3, Section 3-1, Planning and Building Act (2008)), and in the Energy Act: *"Anyone who has a licence pursuant to sections 3-1, 3-2 and 5-1 is obligated to take part in energy planning"* (Chap. 5B. Energy planning, Section 5B-1, Energy Act (1990)).

Many countries have **additional regulations** at the same level that influence the regional energy planning also. As example, the most relevant regulations from Norway are listed:

- The Energy Act regulates the licence to construct and operate electrical energy distribution and district heating networks. Such licences are given by the national energy directorate NVE, while the municipals can participate in the public hearing. The utility companies with licence are required to publish an energy study for each municipality every second year. According to regulation on energy studies (No. 1158), energy companies shall provide (not sensitive) information about the energy supply relevant for municipal climate and energy planning, upon request from municipalities.
- In the current Norwegian District Heating Regulation, municipalities may impose on buildings an obligation to connect to a district heating system within a defined concession area. The district heating company is not obliged to connect buildings to the district heating system.
- In regards to energy efficiency of buildings, the National building code (TEK) regulates the technical requirements for building works. Municipalities cannot easily request better building standards than regulated in the building code.
- For local electricity production, there is a simplified prosumer arrangement for end users with consumption and production behind connection point, where input power at the connection point at no time exceeds 100 kW. Advanced measuring systems (AMS) will be installed to all electricity customers by 2018, making it easier for both consumer and energy supplier to consider measures for better distribution and use of energy.

The analysed examples show, that energy planning is regulated in each country in different regulations, on different levels and has therefore different influence. So for example regulations on a local level can be developed voluntarily by proactive municipali-

ties, but this bottom up approach is based on the willingness of local politicians and city hall staff. **The explicit inclusion of energy efficiency and energy planning in regional/federal or state/national legislation supports a much broader approach of implementation as a legal duty to municipalities.**

A-3.2.2. Existing regulatory frameworks for spatial planning – utilizing for energy planning

Existing regulatory frameworks for spatial planning exists since many years and can enforce energy planning. Nowadays, the usage of existing regulatory frameworks in the area of spatial planning for energy planning differs from country to country. The following examples show typical types of regulations.

Switzerland: Spatial planning in Switzerland is regulated generally on a regional level. To ensure the optimal development also on a local level, so called “Richtpläne” were established. “Richtpläne” are the link between the regional and the local planning and describe the status-quo of the planning in a municipality and should ensure the planned spatial development. “Richtpläne” are authority binding instruments and can be used also for the energy planning. To use this instrument for energy planning, it must be activated by planning or energy laws. Relevant special instruments for energy planning are called “Energierichtpläne” and ensure integrated spatial and energy planning. “Energierichtpläne” create also a trusted basis for long term investments and encourage the active participation of all relevant stakeholders (e.g. communities plus energy suppliers).

Germany: Spatial planning in Germany is regulated on a national, regional and local level (Raumordnungsgesetz, Landesplanungsgesetz, Baugesetzbuch). The regulations contain the necessity to include energy efficiency and renewable energies into the mandatory topics list (§ 1, Paragraph 6, Building Code, and also via urban development contracts; § 11, Paragraph 1, Building Code). On the other hand no national climate protection law yet exists, only a climate protection plan with measures to get carbon free until 2050, Several German Länder (federal states) came up with climate protection law during last years including voluntary and non voluntary measures and actions to be taken by municipalities (North Rhine Westphalia and Baden-Württemberg, Bremen, Berlin and others). More than 3.000 municipalities developed energy efficiency planning for new housing areas, refurbishment of existing areas and sectoral planning tools for transport/mobility, heating and the use of local renewable energy sources.

Austria: Spatial planning in Austria is regulated on a regional level. The most important regulations are the spatial planning laws from the federal states. The regulations con-

tain text passages that allow energy planning. But the history showed that the existing elements will not be used active for energy planning, because the regulations are not clear enough and the legal security is not granted. Therefore a valid legal background is necessary, to make full use of this instrument. One example is the spatial planning law from Styria that refer to the Immission Protection Law. If the limit for air will be exceeded, a communal energy concept with focus on district heating must be elaborated. A similar basis for climate protection is missing.

Norway: Spatial planning in Norway is regulated on a regional and a municipal level in the Planning and Building Act. The municipal master plan shall promote municipal, regional and national goals, interests and functions, and should cover all important goals and functions in the municipality. There exist central government planning guidelines for municipal climate and energy planning.

The analysed examples show, that Switzerland represents a very good example for a clear regulation for spatial and energy planning. **Clear regulations increase the planning security for investors and building owners and ensure the optimal usage of synergies. The involvement of all relevant stakeholders is hereby a success factor.**

A-3.2.3. Beyond legislation: Contracts for energy planning

Contracts are a third possibility to manage spatial and energy planning. In this case, the legal frameworks can be set within general legal frameworks. The usage of contracts differs from country to country. The following examples show the experiences with such instruments in two countries.

Germany: Several German cities use contracts to set the supportive framework for energy planning. So for example the city of Freiburg uses contracts as basis for the negotiation phase with private investors (urban development contracts) or for the sale of land (public-private urban development contracts). The type of contract depends on the role of the city (authority or land owner). So for example, the city of Freiburg ensures with contracts that an energy concept will be elaborated for new building projects. The contract contains also the information that this energy concept must be paid by the land owner. Other possible content that can be regulated by contracts: e.g. better energy related building standards than actual EnEV, the National regulation on energy efficiency of buildings (not so relevant for residential buildings, as the legal binding standard is relatively high), obligation to connect to district heating, maximal return temperature or usage of local renewable energy sources (actual hot topic, as there is no other legal instrument for regulation). Experiences from Germany show that these contracts will not be used in many cases for the definition of the energetic quality of buildings (topic was listed in only 120 of 757 contracts; source of survey: Daab, Nordheim, Reutler; reason:

existing legal uncertainties). But contracts are attractive instruments for municipalities, if the city is the landowner and if large commercial and industrial sites will be developed.

Austria: In Austria, the usage of contracts is not very common. So for example, only 5 contracts were closed in the context of urban and energy planning in Vienna. One reason is that contracts must be “of public interest, suitable and proportionate”.

Many countries have **other types of legislation** in usage that can be used to influence design: financial bonds, performance agreements, bylaws, density bonusing, variable development charges, fast-track approvals, labelling, certification and many others. These elements can support the usage of legal instruments also, but will not be described in detail.

The analysed examples show: Public-private contracts need at least two contract partners. If the municipality is involved in the process as authority an urban development contract can be used as an instrument to negotiate for example better energy efficiency standards or the kind of energy supply with an investor as long as they are economically feasible. The municipality can also negotiate for example a higher energy efficiency standards or the kind of energy supply if an investor needs new building permits for a certain site and is willing to cooperate. In this case, the influence by the municipality for energy planning is big. In case of derelict sites and/or old damaged urban areas with low development prospects the influence usually is quite small. If the municipality is the land owner, a public-private purchase contract may offer even better options as long as there is an urgent customer demand for the sites or if customers are eco-friendly and agree to higher energy efficiency standards by intrinsic motivation. **So the usage of urban development contracts depends on the strength of the municipality in the negotiation process with the investor. The success of this instrument depends if the market/the investor accepts the contract content.**

A-3.2.4. Findings

Mobility/migration, limited resources and climate change are three global trends. To manage them, legal frameworks for spatial and energy planning are set in each country. Generally, the existing legal frameworks in this context have the following characteristics:

1. Frameworks for energy planning: The explicit inclusion of energy efficiency and energy planning in regional/federal or state/national legislation supports a much broader approach of implementation as a legal duty to municipalities.
2. Frameworks for spatial planning – utilizing for energy planning: Clear regulations increase the planning security for investors and building owners and en-

sure the optimal usage of synergies. The involvement of all relevant stakeholders is hereby a success factor.

3. Beyond legislation: Contracts are a further possibility to organise urban and energy planning. Municipalities can use this instrument as authority (if the law allow the usage) or as private persons (if the municipality is the land owners). The success of this instrument depends on market conditions.

As the legal frameworks differ from country to country, operational recommendations were elaborated. The recommendations describe the way how communities can make full use of legal frameworks for the implementation of energy strategies on site.

A-3.3. Recommendations

The following section was elaborated based on the presented analysis of the legal frameworks from Switzerland, Denmark, Germany, Austria and Norway. These countries represent different planning cultures and legal frameworks and show the variety of approaches. To make full use of legal frameworks, the following success features were identified:

1) Ask the right questions
2) Ask the right persons
3) Make the possibilities visible

Details to each success features will be described in the following sections.

A-3.3.1. Ask the right questions

The workshops in different communities, regions and countries showed that the legal frameworks are different in each country. Therefore it was really difficult for representatives from different territorial levels, to have a discussion about the topic “legal frameworks”. The experiences from these workshops showed, that questions help to create a common understanding and a common language. Based on the answers, individual strategies to make full use of legal frameworks can be elaborated. The categories and questions that were identified as relevant are listed in the following sessions.

HOW RELEVANT IS SPATIAL AND ENERGY PLANNING IN YOUR COUNTRY?

As visualised in Figure 9, spatial and energy planning are regulated on different levels.

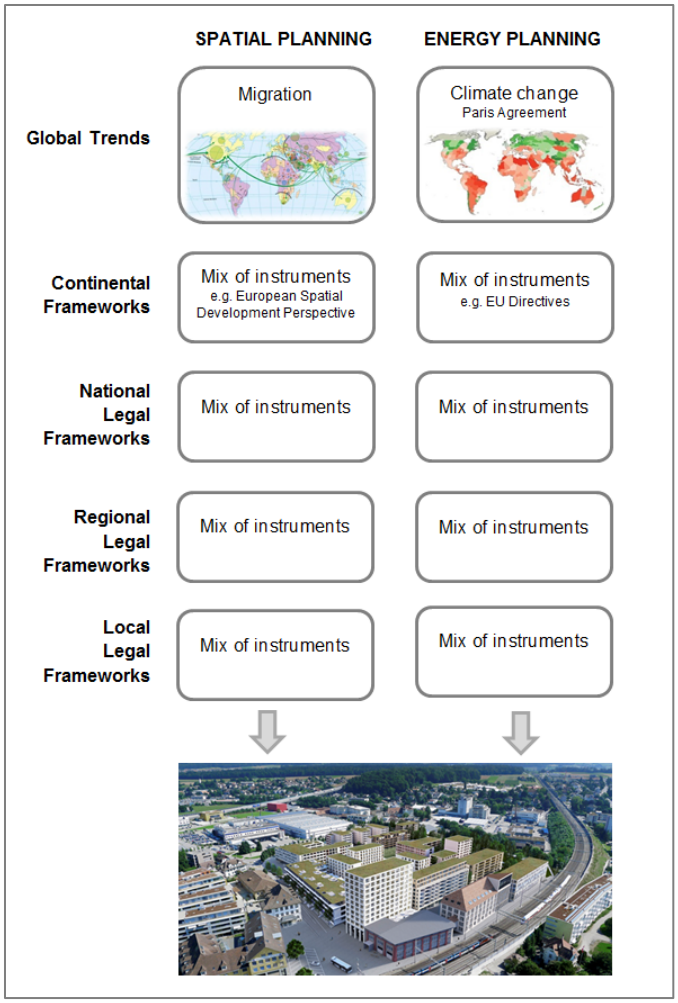


Figure 9: Illustration of the different levels of legal frameworks (SIR, 2016)

To identify regulatory frameworks for energy planning in your community, please answer the following questions:

a) Is energy planning named in your constitution? If yes: Please copy the text passage.
b) Is energy planning integrated in energy or climate-related laws? If yes: Please copy the text passage.
c) In energy planning integrated in spatial laws? If yes: Please copy the text passage.
d) After analyses of the text passages: Is something missing to make full use of the existing instrument? On which level (see Figure 9)? Why?

Possible outputs:

- **Salzburg:** Energy planning is integrated in spatial laws. The analysis of the text passage showed, that the existing possibilities are not clear enough for energy planning.
- **Germany:** The legal options are complete, precise and suitable for municipalities and communities.

WHICH INSTRUMENTS ARE RELEVANT AND WHAT COULD BE REGULATED?

To identify existing regulatory frameworks for spatial planning – utilizing for energy planning in your community, please answer the following questions:

a) Is there an instrument that regulates priority / exclusion areas for special energy sources? If yes, how it is regulated (voluntary; obliged for all; what are the arguments that allow this regulation; what is the basis for decision making (e.g. energy concept); who pays the effort for the creation of the basis for decision making; who is allowed to create the basis for decision making; will be technological, ecological or economic changes of energy supply systems considered and how)?

b) Is there an instrument that prescribes a higher energy standard than the legal standard? If yes, how it is regulated (voluntary; obliged for all; what are the arguments that allow this regulation; what is the basis for decision making (e.g. energy concept); who pays the effort for the creation of the basis for decision making; who is allowed to create the basis for decision making; will be technological, ecological or economic changes of energy supply systems considered and how)?

c) Is there an instrument that prescribes an energy system solution for everybody? If yes, how it is regulated (voluntary; obliged for all; what are the arguments that allow this regulation; what is the basis for decision making (e.g. energy concept); who pays the effort for the creation of the basis for decision making; who is allowed to create the basis for decision making; will be technological, ecological or economic changes of energy supply systems considered and how)?

d) Is there an instrument that prescribes a connection to the district heating? If yes, how it is regulated (voluntary; obliged for all; what are the arguments that allow this regulation; what is the basis for decision making (e.g. energy concept); who pays the effort for the creation of the basis for decision making; who is allowed to create the basis for decision making; will be technological, ecological or economic changes of energy supply systems considered and how)?

e) Is there an instrument that allow local electricity sale from a building? If yes, how it is regulated? How does the instrument function for single buildings, building blocks with several owners, a community etc.?
f) Are there anyone responsible for mapping local heating and electricity potential?
g) Is information about energy use and production in a community available for the municipality? Which information is available? How is the information used in municipal planning and visibility?

Possible outputs:

Salzburg: All listed possibilities are not described in detail in the existing regulations and will therefore not be used active. E.g. development plan: "The kind of energy supply can be set." → It is not strong enough. Possible ways to change that:

1. Show, that existing regulatory frameworks for spatial planning can be used for energy planning by implementation of pilot projects, studies and distribution of the results.
2. Amendment of existing regulation (e.g. adaptation of the Spatial Planning Law of Salzburg).

Germany: The existing legislation on energy efficiency, further expansion of renewable energy sources and energy planning in municipalities and communities is sufficient and complete. Legislation on all levels from National regulations via federal state regulations/secondary regulations towards local guidelines and technical standards do encourage and facilitate planning for energy efficient communities and the expansion of renewable energy sources. Carbon free communities are supported via National and federal state strategies and action plans and funding. Germany offers a broad toolkit for energy planning to its communities. Since German municipalities enjoy the local autonomy on their territorial and development planning by National law, be it for energy or other tasks, it is their decision how much to use from the tool kit.

BEYOND LEGISLATION: CONTRACTS FOR ENERGY PLANNING?

To identify, if contracts are a possibility for regulating energy planning in your community, please answer the following questions:

a) Are urban development contracts (between the municipality as authority and the land owner) allowed?
    a. If yes:
        i. What topics could be regulated with urban development contracts?
        ii. Who pays the effort for the contract (e.g. studies as decision basis)?
    b. If no:
        i. What must be changed, that urban development contracts are allowed?
        ii. Is the market open for such regulations?
b) Are private contracts (between the municipality as land owner and the buyer) allowed?
    a. If yes:
        i. What topics could be regulated with private contracts?
        ii. Who pays the effort for the contract (e.g. studies as decision basis)?
    b. If no:
        i. What must be changed, that private contracts are allowed?
        ii. Is the market open for such regulations?
c) Are other types of legislation in usage (financial bonds, performance agreements, bylaws, density bonusing, variable development charges, fast-track approvals, labelling, certification)?
    a. If yes: How they will be used for urban and energy planning?
    b. If no: Is there an element, that can be used in the future for urban and energy planning?

Possible outputs:

Salzburg: The city of Salzburg isn't in many cases the land owner. Therefore, the city of Salzburg doesn't make private contract with buyers. On the other hand, the other involved stakeholders (land owner and interested project developer) are not interested in private contracts, because land is limited and the demand is great. So the most important topic is to get the best price. Additional (energy) criteria could reduce the profit. Urban development contracts don't play a relevant role in Salzburg, but will be tried out in other Austrian Cities.

Germany: Despite the usual problems of increasing density and growing demand for locations in the bigger German cities there is a broad common understanding of the need for energy efficiency and related planning. Within the given planning autonomy many German municipalities implement energy and climate protection strategies and action plans. The use of energy planning for new sites is becoming normal. For existing sites, energy planning is more complicated due to technical, financial and social effects but that is not due to a lack of planning legislation.

A-3.3.2. Ask the right persons

The carried workshops showed, that answering the questions need a deep understanding of urban planning, energy planning and legislation. As many organisations are specialised in one topic, it is recommended to answer and discuss the listed questions with an expert group or organisations that have an interdisciplinary competence. The following Table 2 shows examples, what kinds of stakeholders should be brought together:

Table 2: Examples for relevant stakeholder groups

Clients (asks questions)	**Experts (gives answers)**
• Federal State of Salzburg – Unit: Spatial Planning • Department for Housing and Spatial Planning of the federal state of Salzburg (10) • Department for Spatial Planning and Building Authority of the city of Salzburg (05)	Salzburg Institute for Regional Planning and Housing: Competence in urban and energy planning. Used in advice on legal topics.
• Department for Energy Planning of the city of Vienna (MA 20)	University of Vienna | Institute for Urban Management and Governance
• City of Oslo	SINTEF, NTNU
• German municipalities	Staff of local administration i.e. energy teams, local and regional energy agencies, certified independent energy experts on the list of the ministry of energy, urban development consultants who have specialised on energy planning, eea advisers, B.&S.U. as an example of an independent consultancy and German secretariat of eea (European Energy Award)

Additional information to the topic capacity building and skills of the involved people is described also in **Volume 5** (Stakeholder Support Materials).

A-3.3.3. Make the possibilities visible

The results of these discussions should be made available for the target group. Legal frameworks are described in general laws, secondary regulations and more or less formal/informal guidelines. The content of these documents is not easy to understand in some cases without a legal background. Therefore, the outputs of such interdisciplinary discussion rounds should be made available for all interested people in a simple language. Possible dissemination activities: production of a fact sheet, oral presentations, production of a report with additional information, organisation of workshops, creation of information hubs.

BEST PRACTICES:

Examples from Austria (viewed: 26.01.2017):

- Fact-Sheet: „Städtebauliche Verträge als Instrument für Energieplanung: Beispiel Freiburg im Breisgau“
- Report „Leitfaden Energie im REK“
- Report: „Potenziale im Raumordnungs- und Baurecht für energetisch nachhaltige Stadtstrukturen“
- Workshop: „Expertenforum Städtebauliche Verträge – Investitionsbeschleunigung oder Ablasshandel?“
- e5-knowledge-plattform „Raumordnung und Energie“

Examples from Germany (viewed: 26.01.2017):

- Overview over Germany’s planning systems and competences of Federal, State, Regional and Municipal (explanation of the municipal planning autonomy)
- General information on the German planning system
- German energy conservation legislation (Energy Conservation Act and Amendments in the Energy Conservation Ordinance (EnEV))
- Regulatory framework for energy efficiency
- Integrated Energy and Climate Programme (IEKP) (August 2007)
- Government's priorities for an energy policy concept (June 2011)
- Federal German Laws and Regulations (by the Berliner Informationsstelle Klimaschutz)
- Framework Conditions for Energy Performance Contracting - National Report Germany
- Article by the BMWI concerning EPC

National Climate Initiatives (viewed: 26.01.2017):

- Summary of the National Climate Action Plan 2050 - Principles and goals of the German government's climate policy
- Video about local climate protection – projects supported by the National Climate Initiative
- Short overview of local climate action (projects managed by Adelphi)

Energy efficiency strategy for buildings (viewed: 26.01.2017):

- Publications (Brochures)
- Article on the energy efficiency strategy for buildings by the BMWi

Climate protection legislation of NRW (viewed: 26.01.2017):

- General information
- Climate protection plan
- Climate protection policy

Climate protection legislation of Baden-Württemberg (viewed: 26.01.2017):

- General information
- Act Governing the Mitigation of Climate Change
- Integrated Urban Development Planning and Urban Development Management – Strategies and instruments for sustainable urban development (Position Paper by the German Association of Cities)
- Environment and Spatial Planning - Summary reports on Research and Development Projects by the UBA

Energy efficient urban redevelopment – programs supported by the KfW (viewed: 26.01.2017):

- General information
- Representative project: München Neuaubing – further information: Sustainable and energy-efficient urban development in Munich: Summary (PDF, 54 KB)
- Article about the purchase of green bonds by the KfW

Federal Institute for Research on Building, Urban Affairs and Spatial Development

- Perspectives of Spatial Development in Germany, Eds.: BMVBS/BBR, Bonn/Berlin November 2006
- Energy and climate policy of the BBSR
- Projects on Climate protection and energy concepts by the BBSR
- Demonstration Projects of Spatial Planning (MORO)
- Regional energy concepts as a strategic instrument of state and regional planning
- Contribution of regional planning to increase the share of renewable energies: Legal possibilities of regional planning in the area of "repowering"
- Innovative energy-efficient urban renewal in cities of the German federal states of Brandenburg and Saxony-Anhalt

EnEff:Stadt and EnEff:Wärme

- Funding for innovative, locally-based holistic solutions for higher energy efficiency and for the integration of renewable energy
- Case Studies and Guidelines for Energy Efficient Communities - A Guidebook on Successful Urban Energy Planning
- Energy planning in Bavaria

A-4. Design of Urban Competition Processes

Authors: Daniel Kellenberger, Intep – Integrale Planung GmbH (Switzerland); Helmut Strasser, SIR (Austria); Maren Kornmann, ENCO (Switzerland); Yoshiyuki Shimoda, Osaka University (Japan)

A-4.1. Introduction

Urban design is the process of designing and shaping cities, towns and villages. In contrast to architecture (which focuses on the design of individual buildings,) urban design deals with the larger scale of groups of buildings, traffic area and public spaces, whole neighbourhoods and districts, and entire cities, with the goal of making urban areas functional, attractive, and sustainable. (Boeing; et al. (2014)

There are different ways to find best urban design solutions. Once the functionalities to be achieved are defined and as basis for further development and planning of buildings, public spaces etc. a quite common way in Europe is the urban design competition.

A-4.2. Barriers

Urban design competitions are a complex process, starting by the election of the jury followed by the definition of criteria and the elaboration of the competition program (Request for Proposals) and many further steps until it usually ends with the evaluation of the winning project. During this process there are several obstacles which prevent the inclusion of restrictions regarding energy and carbon emissions.

A-4.3. Compelling Condition

To make full use of this field of intervention it is important that the municipality has the legal regulations in place that allows the implementation of energy and global warming relevant criteria in competition processes. On the other hand national legislation often has defined the scope of urban design competitions, which do not allow integration of other aspects than those of urban design.

A-4.4. Content

This section highlights several ways to achieve sustainable design solutions by creating competitive programs using Swiss, Austrian and Japanese examples. Each coun-

try's context (political system, legislation, planning and construction approaches) is seen as influencing the design of the program although the success factors as shown later in this report, are presented in a generalized way for use by municipalities, regardless of their location .

A-4.5. Urban design Process

Starting point for an urban design process is in many cases, that the municipality need new living space and therefore new buildings. In some cases, existing settlements will be expanded or existing areas are re-developed or transformed (e.g. from industrial to residential areas); in other cases new settlements will be built. In this case the search for a suitable land is the first step.

"Suitable" means, that land is located close to the city centre, big enough (under consideration of the maximal floor area number) and affordable. After that, representatives from the city start with the negotiation with the land owner and interested developers. In many cases, the land owner and interested developers are interested to reach quickly the highest/lowest price for the land and start with the construction. But it happens more and more frequently, that representatives from the municipality have clear ideas and goals related to sustainable topics. These must be considered before and during the selling process, because they influence the quality of the future settlement and at the end the suitability and price of the land (e.g. potential of renewable sources, mobility, social aspects). But it is difficult to discuss these topics without a first concept of the future settlement.

The subsequent urban design process (Figure 10) is based on the following specifications:

- Basic statutory provisions (e.g. regulations)
- Basic planning framework (e.g. sectoral plans and concepts)
- Higher-ranking overall targets (e.g. municipal guidelines)

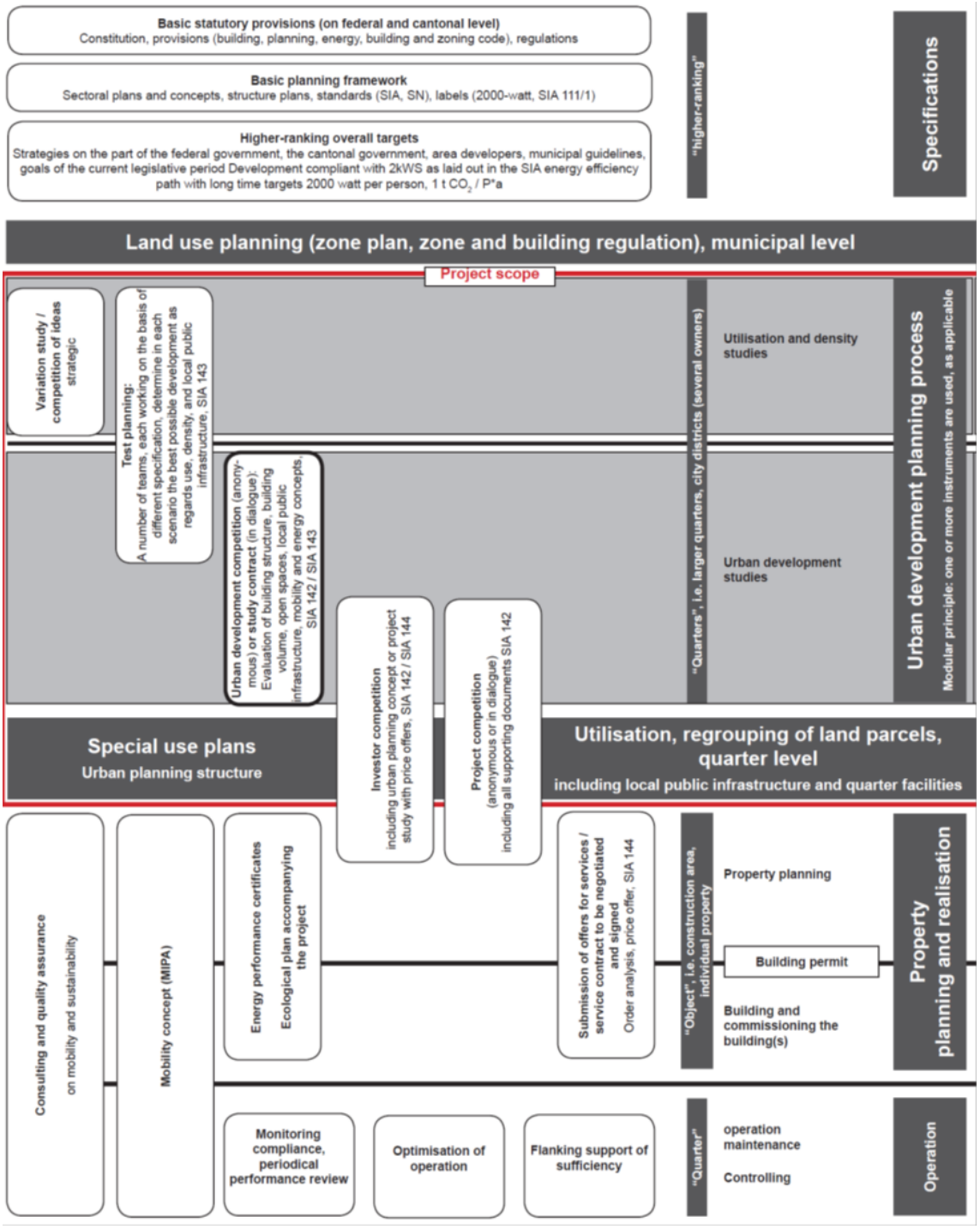


Figure 10: Urban design process in the Swiss context (from German version of report Kellenberger et al., 2015)

Within the urban development planning process on a settlement scale, utilisation and density studies are carried out followed by urban development studies (see section 2.2 for different competition types). In most cases the planning process result in definitions in existing planning instruments such as special land-use plans, design plans, master plans, depending on the specific national definition, name and range of regulations on instruments. Special land-use plans ensure appropriate development and high level of

settlement quality in a well-defined area. They specify the layout of buildings, building use, access to streets and squares, footpaths and cycle tracks as well as noise protection measurements, supply and disposal and aesthetic integration into landscape and locality.

The urban development planning process is followed by the property planning and realisation process (building scale) and finally by the operation of the whole settlement.

Excursus: CASBEE – Multi-criteria evaluation of community development in Japan

Due to the fact, that other countries do not perform competitions, this example shows how an existing certification scheme (CASBEE) is used in Japan to define requirements on the basis of the assessment criteria.

Comprehensive Assessment System for Built Environment Efficiency (CASBEE) is a method for evaluating and rating the environmental performance of buildings and the built environment. The overriding objective is to enhance the quality of people's lives and to reduce the life-cycle resource use and environmental loads associated with the built environment, from a single home to a whole city.

CASBEE is widely used in Japan and is comprised of a suite of assessment tools tailored to different scales: housing and buildings, district and city. The tool which is used for community development is CASBEE for Urban Development (district scale).

In the CASBEE tool for urban development two categories are evaluated separately:

1. Environmental Quality in the district (QUD)
2. Environmental Load of urban development on the outside (LUD)

Assessment items of QUD are as follows:

Environment	Water Resource
	Resources recycling
	Greenery
	Biodiversity
	Environmentally friendly buildings
Society	Compliance
	Area management
	Disaster prevention
	Traffic Safety
	Crime prevention
	Convenience/welfare
	Culture
Economy	Traffic
	Urban Structure
	Population
	Economic development
	Information system
	Energy system

Figure 11: QUD Assessment items

A-4.5.1. Competition types

Typically the sponsor has the choice between different competition types in different stages of the development. These types vary from country to country. Following section gives ideas on different types, within this range urban design competition – which is in focus of this report - is likely available in many countries:

Variation study / Competition of ideas

These competitions are held for projects that are not intended to be built. They are useful as explorations of significant design issues but are limited insofar as they stop short of realization.

Test planning

Test planning has shown to be a good new methodology for complex urban planning challenges. The nominations of a variety of teams are compared in an interdisciplinary and open communication process. Thereby soon viable approaches and at the same time arguments and discursive strategies which supports the political implementation are detected

Urban design competition / Study contract

This leads to a masterplan for a specific neighbourhood or urban area. The goal is to select the design solution that is judged to be the best and to select a procedure for further development of the specific urban area. This report is focussing on this type of competition.

Investor competition

This leads to the planning and erection by a general planner and/or general contractor of a specific project on a defined site. The goal is to select the design solution that is judged to be the best and financially most appropriate and to select the contractor and the planning team who will be commissioned to develop the design and realize the project.

Project competition

This leads to the erection of a specific project on a defined site. The goal is to select the design solution that is judged to be the best and to select the architect who will be commissioned to develop the design and realize the project.

A-4.5.2. Organisation of the urban design competition process

The procedure of a design competition may be organized as

- Open competitions: These competitions are addressed to the entire local, national or international architectural community. They may be entered by any licensed architect.
- Limited competitions: These competitions restrict the submission of entries to a specific set of architects, such as those who reside within a specified area, or who satisfy other conditional requirements.
- Invited competitions: Invites through a pre-qualification process a limited number of designers to enter.

A-4.6. Success factors

The well-run urban design competition with focus on sustainability requires:

- A sustainability-conscientious client
- A competent professional adviser with profound knowledge of sustainability aspects (see chapter A-4.6.1)
- A thorough and carefully written program with precise requirements for sustainability issues (see chapter A-4.6.2)
- Clear and transparent assessment methodology giving enough weight to the sustainability issues. (see chapter A-4.6.3)
- Complete graphic and other illustrative materials, sustainability requirements and norms to be fulfilled
- A clear statement and rules focussing on sustainability in the competition
- Clear submission requirements including presentation of specific sustainability issues
- A realistic schedule
- A qualified jury (see chapter A-4.6.4)
- Appropriate prizes
- Arrangements for publicizing the winning design and sustainability solutions

Within the following illustration of the competition process the entry points (in red) regarding the role of the sustainability expert, the competition program, the assessment methodology and the Jury composition is shown and discussed in more detail.

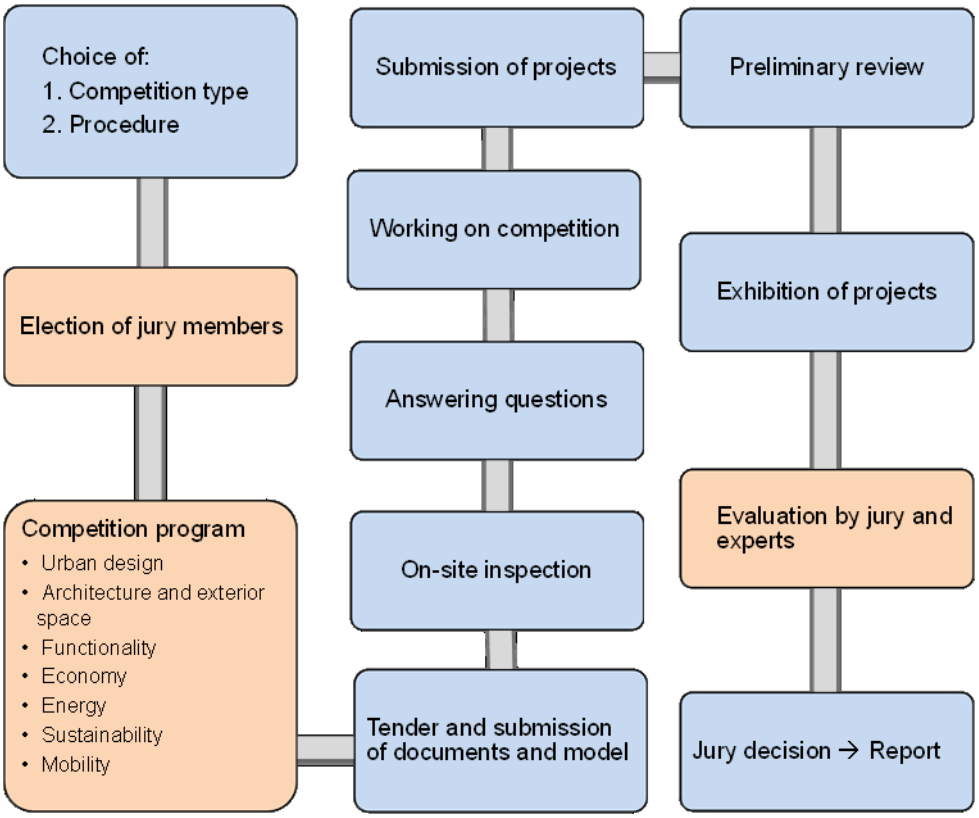


Figure 12: Competition process and sustainability-relevant entry points in the Swiss context (Source: Intep, 2017)

A-4.6.1. Role of "sustainability expert"

A capable and sustainability conscientious professional adviser is essential to a successful competition. As a consultant to the sponsor, the adviser is the individual who is most directly responsible for planning, organizing, and running a design competition. The adviser's responsibilities fall into four key areas: Program, organization and structure, assistance in selecting a highly qualified jury capable of exercising sound judgment, and conduct the competition so that all competitors receive fair and equitable treatment. These major duties require that the professional adviser serves as an impartial liaison among sponsor, jury, and competitors. To ensure a sustainable result, the adviser must be an independent architect or entity who is capable of objectively approaching a competition and combine design quality with sustainability.

A-4.6.2. Sustainability elements for urban design processes

Dependent on the phase of the project and the specific local conditions, the following sustainability elements should be inscribed in the competition program as project requirements. In the competition program the sustainability elements can either be grouped together in a sustainability chapter or incorporated separately in the thematically corresponding chapters. The requirements need to be phase-specific and as-

sessable, without limiting the creativity of the architects unnecessarily. The earlier in the project phases the sustainability requirements are given, the less effort it is to comply with them. It is assumed that the project location and perimeter is already set in the competition.

These requirements are mainly derived from the Swiss 2000 Watt Site label (for more information see Volume 1 and 3) and focus on embodied energy, operational energy and energy for everyday mobility. For a more comprehensive consideration of sustainability, additional requirements may be adequate. Either compliance with several individual elements or a label can be prescribed.

Principles:

- The general concept of the project shall refer to sustainability. All three sustainability dimensions ecology, society and economy need to be considered.
- Impact and cost shall be considered over the whole lifecycle of the project and buildings.
- Use of the area, buildings and rooms shall be flexible and adaptable to future needs.
- The neighbourhood shall be of mixed-use and contain residential and office spaces as well as shops and other amenities. To determine a locally optimal mix of utilisations, the neighbourhood needs to be analysed and taken into account as well.

Table 3: Sustainability requirements and their assessment criteria / methodology

	Requirements for urban design processes	Assessment criteria / methodology
Neighbourhood and buildings	1. High building density 2. Compact building geometry 3. (Semi-)public spaces on ground floor	1. Maximal floor area / ground area ratio 2. Low building envelope area / energy reference area ratio 3. Maximal share of (semi-)public space on ground floor
Energy sources	4. Renewable and local energy sources 5. PV-optimised roofs and facades 6. Connection to existing or new district heating system with renewable energy, if possible	4. Maximal share of renewable and local energy provision 5. Maximal share of roof and façade area designated and suitable for PV 6. Connection to district heating system (yes / no)
Mobility and exterior space	7. Low number of parking lots 8. Low underground space area 9. Good access to public transportation 10. Direct, attractive and safe connections for pedestrians and cyclists 11. High design quality of the exterior space	7. Minimum parking lots / floor area ratio 8. Minimum underground floor area (m^2) 9. Qualitative assessment (*) 10. Qualitative assessment (*) 11. Qualitative assessment (*) (*) Assessment based on arguments instead of numbers (quantitative).

A-4.6.3. Requirements for competition program

In this early phase the rather general requirements (see Table 1) need to be set to guide the project in a sustainable direction. The following sentences can be copied into a competition program (e.g. Request for Proposal):

Buildings:

- The building geometry shall be highly compact.
- The spaces on the ground floor shall be foreseen for (semi-)public use.

Energy sources:

- The buildings shall be operated by renewable energy sources.
- The buildings shall be operated by local energy sources.
- Roofs and facades shall be optimised for PV.
- The connection to existing or new district heating systems shall be favoured.

Mobility and exterior space:

- The number of parking spaces for cars shall be reduced.
- The size of basements shall be low, because they increase the share of the "grey energy".
- The access to public transportation stops shall be optimal, e.g. paths from the building entrances to the stops shall be short and direct.
- Direct, attractive and safe connections for pedestrians and cyclists shall be implemented.
- The design quality of the exterior space shall be high.

A-4.6.4. Weighting

An urban design competition will usually publish the assessment rules in the request for proposal. This means that all participating project teams know in advance how their project will be assessed. Besides energy, carbon and other sustainability parameter usually urban design and architectural and exterior space quality, functionality, mobility and of course the price play an important role.

To assure that sustainability aspects as for example energy, carbon and other indicators will play an important enough role in the "best" project, it is important to weigh these aspects high enough. Alternatively minimum requirements for the most important criteria could be defined. If these criteria are not fulfilled at one point the whole project will not be evaluated further along those criteria specified by urban design. This allows specification of "no go´s" regarding sustainability on the one hand side and negotiable criteria on the other hand side.

Example: Usually, urban development and price are the most important criteria. But experiences show, that if energy and climate criteria have a quarter or one-third of the total amount, a positive influence on the final result can be expected.

A-4.6.5. Jury composition

The composition of the jury of urban design competitions affects strongly the outcome for the sponsor and the sustainability strategy. Based on the specific national and/or municipal requirements it is important to decide together with the municipality on how to compose the jury. Often clients or institutions form the jury from their own stakeholders, with board members, staff, local community leaders, or local politicians on the selection committee. In this case they are favouring specific understanding of the particular project and its community in picking a winner. Moreover they bring in outside experts or designers of some renown to give greater importance to sustainability and visibility to the competition and to pick the winner based on larger trends and ideas in the greater design community.

A-5. Make Use of Tools Supporting the Decision-Making Process

Authors: Jan Schiefelbein, RWTH Aachen University (Germany); Carissa Schively Slotterback, University of Minnesota (USA); Maren Kornmann, ENCO (Switzerland); Ken Church, Natural Resources Canada (Canada)

A-5.1. Introduction

Geertman and Stillwell (Geertman & Stillwell, 2003) described the challenge to modern planning: “the complexity of planning tasks has grown extensively due to: a greater involvement in planning processes of more parties with diverging interests; the increasing pace of development that shortens the time available for plan preparation and design; the need for better insights into real world processes that a more holistic approach to planning demands; the necessity for better information on which to monitor progress and base scenarios; and the difficulties associated with enhancing participation, collaboration and partnership.”

Given these constraints, the question becomes: can the decisions made by the urban and energy system planners be enhanced through holistic consideration of available data and local information? One possible approach is through the creation of a planning and decision support system (PDSS).

A Planning and Decision Support System (PDSS) aims to integrate spatial, technical and local information so as to guide the decision making process. Rather than providing definitive answers, such systems support the analysis, monitoring and evaluation process leading to the project plan. PDSS may be tuned to the needs of specific decision makers or experts within the decision making process or be used externally to provide supporting information for stakeholders and the broader public, thereby helping to facilitate their engagement and inform their perspectives. Through integration of data and local information, design assumptions can be developed and accommodated, risks can be identified and trends can be observed, integrated and reported. In this way opportunities are created to assess the potential impact of projects, policies, or other interventions.

A-5.2. Barriers

The term Planning and Decision Support System (PDSS) refers to the wider, cross-agency sharing of materials as well as the intent to take a broader perspective on planning. This may result in accessing data or outcomes developed by external parties and community organizations in order to strengthen the value of individual agency strategies. For instance, energy delivery within a new development may access unpublished

information generated by a utility energy efficiency program when applied to specific building types in order to better estimate real-life energy consumption of proposed development patterns. In other words, holistic planning is a multi-service approach to acquiring a wide breadth of information in order to orient activities towards high quality decisions.

In practical application, the drivers behind many of the actors in urban development can be competitive. For instance, the municipality may desire the minimization of greenhouse gas emissions whereas the energy providers might have concerns over the reduced revenue and the cost of energy system conversion. Likewise the energy provider might share concerns over the district heating network, the construction of which might create economic opportunities for local industry. Accordingly, planning a new development must foresee and shape the scope and character of the future construction, identify existing and emerging needs, and fashion new or amend existing plans and policies to ensure that those needs will be met and that communities will be able to continuously reproduce and revitalize themselves. Decision makers must also pursue a continuous process of monitoring to track the impacts of specific projects, management practices, and current plans. Monitoring could be used to determine whether the project, practice, or plan was implemented as intended and whether it had the expected impacts. In designing the PDSS, a balance must be made between the complex urban scale of the many input factors and interrelations and the user demands for a simple and intuitive process.

A-5.3. Requirements

Typically, urban planning for a new development has addressed the complex form of urban areas with its variety of buildings, infrastructure, energy systems and its objective functions. Energy consumption has largely remained a separate issue and responsibility lay with the energy provider or its overseeing authority. With the progression of time and the legislated requirement for public transparency, the process has evolved to include consideration of a wide variety of issues pertaining to a more holistic society: social impacts, economic development, environmental, energy, solid and liquid waste, transportation, resource management and water conservation. Information describing the status and needs of these concerns is often unavailable and in some cases cannot be measured. Alternative methods are required to assess their involvement and impact.

For example, assessing social issues requires access to skills, experience and knowledge that traditionally exist across sectors other than urban development or energy supply. Many of these socially-oriented organizations too, operate in isolation with only part of the information they need to address their issues in a comprehensive manner. Engaging these organisations to provide input to the decision making process not only allows the developer to better accommodate critical social issues but also provides the social sector with an opportunity to increase its engagement within the community.

A-5.4. Target groups

Different groups can provide input to and benefit from PDSS development and usage within urban energy system planning process. They include:

- Urban planners
- Architects
- Energy planners / engineers
- Municipal employees
- Local industry / commerce (investors)
- Energy suppliers / grid operators
- End users / house owners

For municipal employees it is important to make data and data analysis accessible as well as simplify the often technical processes related to energy planning. The better the overview and understanding, the more efficiently that better decisions can be made. The tool planning process should be closely linked to the municipal climatic aims. The complexity and usability of tools for experts may be an issue as well, as urban and energy planners may face issues in interacting with technology, including based on capacity, as well as access to relevant hardware and software (Slotterback, 2011).

For urban and energy planners, as well as architects and other subject experts, the main intent of the PDSS may be defined within the municipal official plan or equivalent. Information gathered within the PDSS provides details of the planning options allowing estimations to be made of the impact and cost of energy system implementation.

Likewise, for local industry, home owners and other end users the PDSS may enable and understanding of the impact and benefits that are linked to the inclusion of an urban energy system within the development. It can also highlight the financial benefits for industry and commerce along with the social benefits for end users. Financial as well as quality of life aspects, may also be accounted for. Many of these benefits and the calculation of their monetary values are listed in the chapter A-8 *Include Socio Economic Criteria*.

A-5.5. Timing

The form that a PDSS takes and its timing depends on its application to a project. It will vary with the phase of the development process and the available data and methods.

Some PDSSs may incorporate project-related climate change targets, relating to long term horizons such as 10 to 15 years. Within the initial planning stages the pathway to reach these targets as well as their interim milestones has to be examined and defined. In this phase the PDSS can support the development of design and community data,

the analysis of the status quo including the assessment of the social and economic impact on the community of the proposed transition. Energy and greenhouse gas emission balances are calculated or greenhouse gas reduction potentials are compared. Other planning activities supported might include: (1) the development of ideas and concepts, (2) the impact of integrating relevant stakeholders, (3) the level of project management, planning and monitoring required, and (4) the need for communication concepts. As noted in the *Stakeholder Engagement & Involvement*, a detailed and early communication strategy can solicit valuable input to the planning process, develop public and stakeholder support and improve the overall planning process and project.

At the planning application stage, the pathways to reach the planning targets must be defined. PDSS tools can assist by compiling information about the available technology and their possible interconnections within the area of interest; to other businesses, transportation, energy providers, and other resource centres. Cost, risks, efforts and benefits of different concepts can be estimated. Finally, the tools can point to which concepts should be selected.

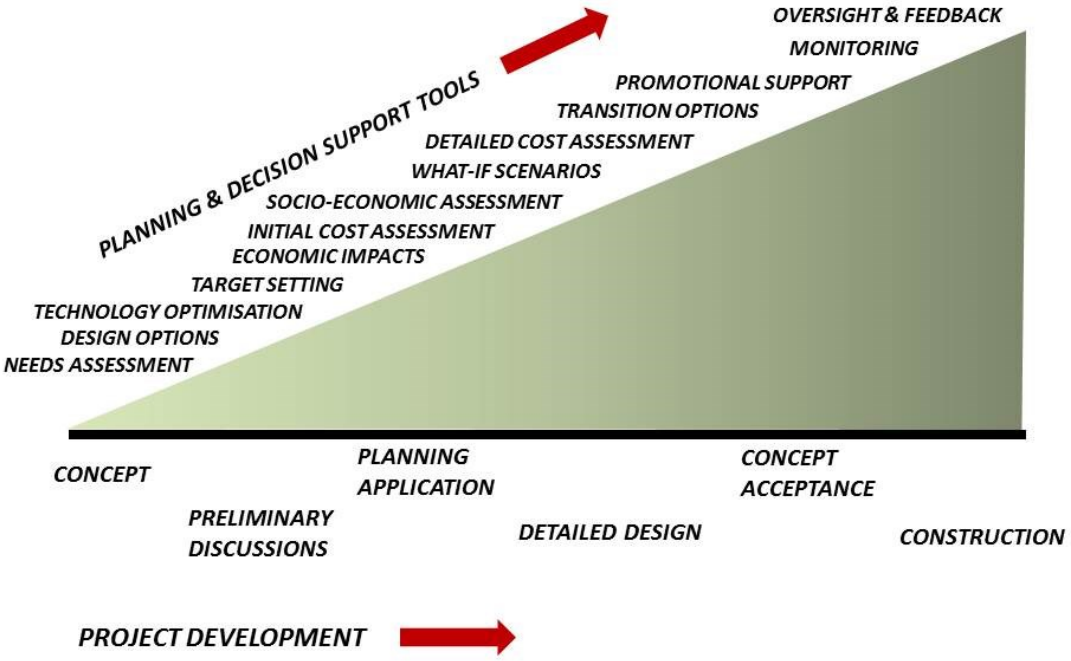


Figure 13: Planning & Decision Support tools through a project cycle (Source: Ken Church, Natural Resources Canada, 2017)

Within detailed design and planning, system dynamics can be confirmed. PDSS draws upon the project team to provide structure to the required project and energy systems. This relies extensively on tools using standards, simulations and optimizations. These three methods increase the level of complexity in the project, but offer additional analytical capability. Further complexity may be added as the scope of the project will ex-

pands to include possible partners for implementation and interpretation of legal regulations.

Within the concept acceptance and construction phases, such as described in Figure 13, the PDSS supports stakeholders and public awareness activities with information about overall system performance. Doing so also defines the degree of monitoring and future reporting for the project as well as supporting future maintenance evaluation of the energy systems. Furthermore, the PDSS can include features for user feedback on system behavior and comfort.

IEA-EBC report Annex 51: *Case Studies and Guidelines for Energy Efficient Communities (Jank, 2013)*, Chapter 4.4 to 4.6 details discussion on modelling approaches that assist the decision making process of energy efficient communities. Chapter 4.6 also includes a discussion of User Needs for the modelling techniques, describing the informational requirements and the modelling outputs.

Additional tools that could also fall within the bounds of a PDSS might include:

- Database and data management
- Geographical information systems (GIS)
- Static analysis / energy balances / CO_2 balances
- Scenario / Planning and Optimization
- Dynamic simulation models
- Monitoring (related to database and management)
- Visualization

The categories overlap and cannot be seen as exclusive. For instance, Geographical Information Systems (GIS) mostly include a graphical user interface (GUI) for visualization, but may also be linked to databases to make the information available digitally. The ability to use the digital output in further analysis warrants differentiation between data management and the tools, which use data for further processing. The integrity of the results and hence the decisions that are derived from the information depends upon the quality of the input information. As noted at the outset, accessing accurate and comprehensive energy or building data with which to model a new development is often a challenge. Management of the available data however creates the foundation for planning and decision making and a low-quality data foundation has a high chance to lead to poor decisions, even when high-quality tools are used to analyse that data and information. The inclusion of stakeholders and subject matter experts with local area expertise within the project team is meant to provide quality control and validation for the data and information used to create the decision-making foundation.

A-5.6. Data Management

As noted above, not all information is readily available and the information for decision making is available in a variety of formats: numerical, graphical, spatial, written text, financial, assumptions, etc. Management of this data and information needs to be rigorous yet allow easy access, depending on the desired issue under discussion. The sources of the information will vary from city tax data, building permits and topographical mapping through to other sources including energy providers and computer models. Stakeholder input, such as opinions, local experience and preferences also form part of the PDSS.

Not all information will be available and provided with 100 % certainty. Uncertainty will exist and thus a consistent approach to identifying uncertainty and risk is an essential part of the planning and decision making process. Discussion with stakeholders and experts to understand the implications of uncertain information, and the methods used to produce the information, will qualify and then quantify the nature of uncertainty in that information. Such discussion can lead to acknowledgement of data limitations and greater consensus for its use.

The design of urban development is an iterative process whereby scenarios are often created, evaluated and modified before conclusions are drawn and the process repeated. Applying PDSS in this context requires that they be simple and intuitive in usage. Accounting for complexity and being simple is often difficult to achieve. This conflict is often solved by creating a suite of tools that range in complexity from those for experts to those of a more general nature for external stakeholders. For example, the development of Public Participation Geographic Information Systems (PPGIS) systems has advanced significantly over the past decade, with many examples emerging as online tools for use by the general public.

A fast and simple data access is an important element for successful energy and urban planning. A best-practice example for data management is shown below, which accounts for the importance of easy data access and handling. In general, a centralized IT-Management can be advantageous. For instance, the city of Bottrop, Germany, implemented a centralized department for information technology and data management, where various data sets with geographical reference are collected and prepared for further usage.

Figure 14 shows an example for an unstandardized IT structure for data management within municipalities. Different departments are responsible for data management of different domains. However, data access and exchange beyond department boundaries is complicated. Datasets have to be requested manually. Though data is stored in different formats and no standardized interfaces exist, data import is time consuming and requires a lot of effort to prepare the data to match to the existing data models and structure within the specific department. This results in higher cost and larger time delays in projects, which require up-to-date datasets.

The city of Bottrop implemented a centralized structure, shown in Figure 15. A centralized database has been implemented, which automatically synchronises its data with different data levels of all connected departments. Depending on law regulations, data privacy issues and responsibilities, a different percentage of data is synchronized with the central entity. This data is directly available to every connected department without manual data request.

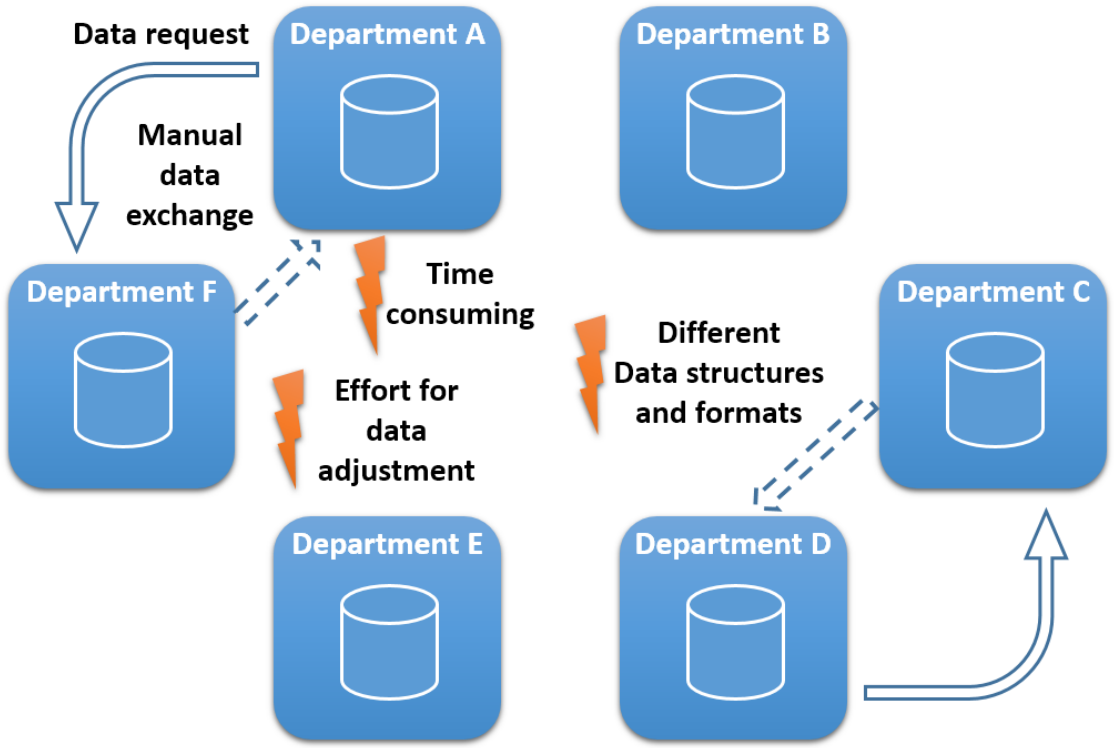


Figure 14: Decentralized, unstandardized IT-structure (Source: RWTH Aachen University, 2017)

Specific department data, which is not automatically synchronized, can be requested manually. Although a request has to be made, the standardized data interfaces can make a data exchange easier and faster. Citizens and external partner can be granted with specific permission rights.

Access is possible via web-browser, for employees of the municipality and citizens. Furthermore, Bottrop implemented a Smart Finder system. Users are able to search for data and data service tools within the centralized database. Contracts were made to frequently gather and update data, especially of external partners, such as energy suppliers. This ensures a better data availability and quality.

In comparison to geographical data management within every single department, data exchange and accessibility is simplified. Furthermore, redundant work for data requests or exchange can be minimized, which makes the data processing more efficient. Overall, processes within the municipality can be more efficient.

The way to implement a centralized IT-Management is less a technical question, but more a social-political one. Technical solutions for centralized geographical data management are available. Though, department and administration units have to change their responsibilities and usage regarding urban data. In the case of Bottrop, the centralized infrastructure has been implemented stepwise. Each step was primarily based on single, manual data request of one department. Instead of providing datasets once for a single source, datasets have been prepared and saved to the main database.

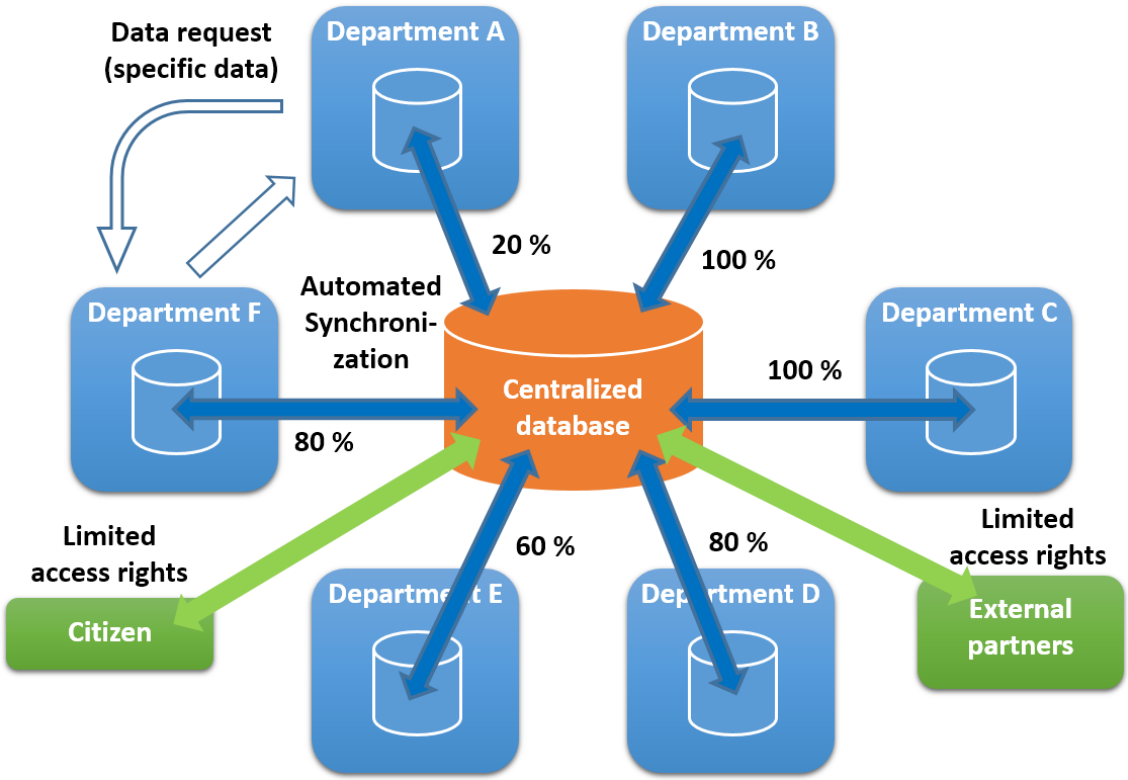


Figure 15: Centralized IT structure of the city of Bottrop, Germany (Source: RWTH Aachen University, 2017)

Especially the data preparation can be a complex task and does not directly show benefits within the departments. However, every planning phase depends on available data and knowledge. Thus, every project in urban planning can save time and effort of data gathering and start working at an earlier stage, which is the main benefit. This advantage is also valid for single departments, because they got direct access to more datasets, which are updated frequently.

A-5.7. Examples of Planning & Decision Support System Tools

Geographical information system (GIS) tools are suitable PDSS for data management and planning on urban scale. The advantage is the combination of geographical data, such as building positions, with further information. ArcGIS is a common commercial software solution for many municipalities and urban planners. QGIS is an open-source alternative. GIS tools can be linked to database systems, such as PostgreSQL data-

bases, to enable collaborative work and information sharing. Furthermore, GIS information can be provided online via web-interfaces or apps, such as in PPGIS approaches discussed earlier.

Figure 16: QGIS interface example with data analysis (Source: RWTH Aachen University, 2017)

Online solar atlas of the city of Bottrop (Germany): Providing information about the suitability and possible energetic outcome per rooftop area within the city..

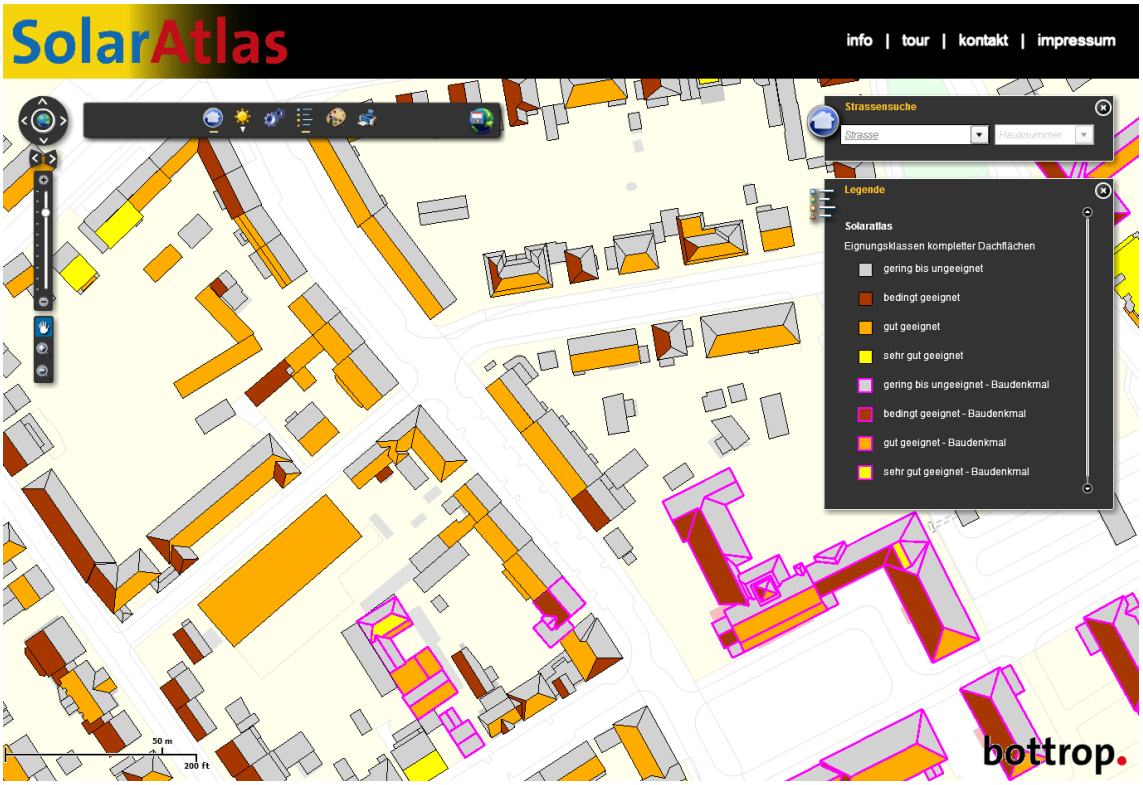


Figure 17: Solar atlas of city of Bottrop, Germany (Stadt Bottrop, 2016)

ICRIS (Germany): A platform to unite different kinds of GIS datasets related to energy and the environment, providing them as open data. ICRIS (InnovationCity Ruhr Information System) is an information source for different stakeholders (Stadt Bottrop - InnovationCity Ruhr, 2016).

EGiBOT (Energetische Gebäudeinformation Bottrop, Germany): Calculates subsidies for building retrofitting with low user effort. Used by citizens to inform themselves about investing into retrofitting options. The tool also provides contact data for free energy consulting by the municipality.

Building Data set (Netherlands): Datasets of around ten-million buildings within the Netherlands are available via web browser. Thus, information about building type, year of construction and used area can easily be accessed by interested persons (kadaster, 2016).

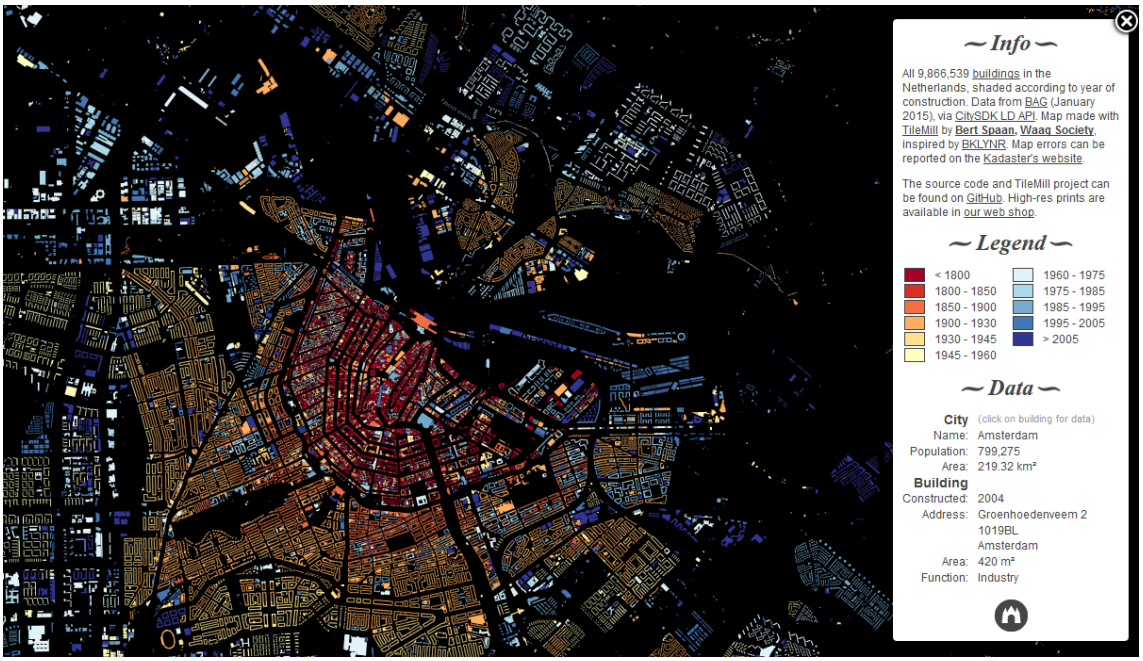


Figure 18: Building data visualization of the Netherlands (kadaster, 2016)

The Global Atlas for Renewable Energy estimates renewable energy around the globe. It provides data for wind, solar, hydro, marine, geothermal and bioenergy usage.

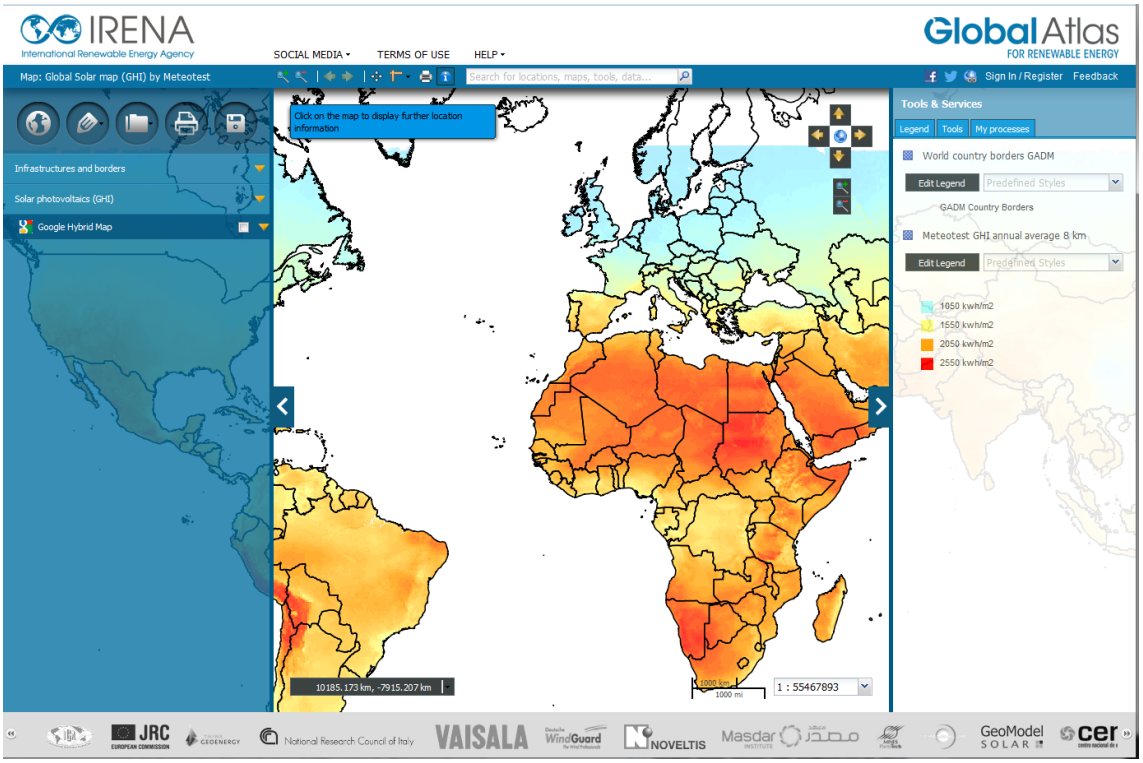


Figure 19: IRENA Global Atlas for Renewable Energy (International Renewable Energy Agency (IRENA), 2016)

Energyscope.ch (Switzerland): An information portal, energy calculator and an online course (Ecole Polytechnique Federale de Lausanne (EPFL), 2016). It increases knowledge and understanding in the field of Swiss energy transition and support citizens with information prior to public referendums.

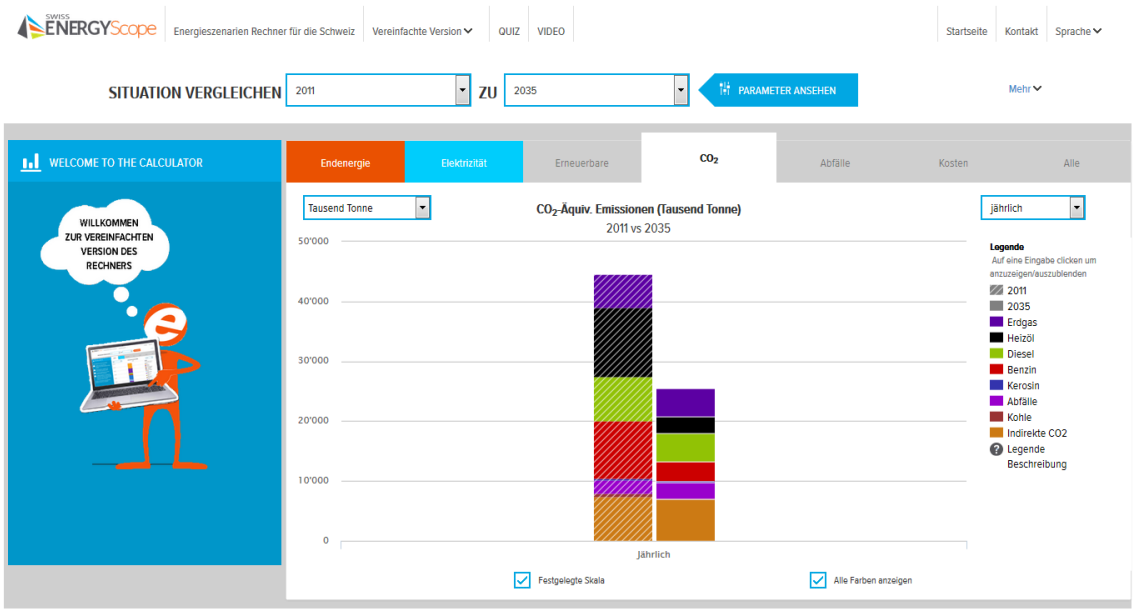


Figure 20: Energy calculator of energyscope.ch (Ecole Polytechnique Federale de Lausanne (EPFL), 2016)

Klimaaktiv-coach.at (Austria): An information website for sustainable development in Austria. The website has information for greenhouse gas emission reduction.

e-control.at (Austria): A website to estimate energy, emissions and cost reduction potential. It includes thermal and electrical building energy demand and energy consumption for mobility.

District Energy Concept Advisor tool (DECA): Developed by Fraunhofer IBP as part of IEA-EBC Annex 51, DECA is a modelling and analysis framework for city district energy systems. DECA has a graphical user interface and a simplified modeling of city districts. Different energy supply scenarios can be adapted to the city district model and static energy balance analyses can be performed. Furthermore, the DECA tool is holding a database with results and reference values of energy efficient city district projects of different countries.

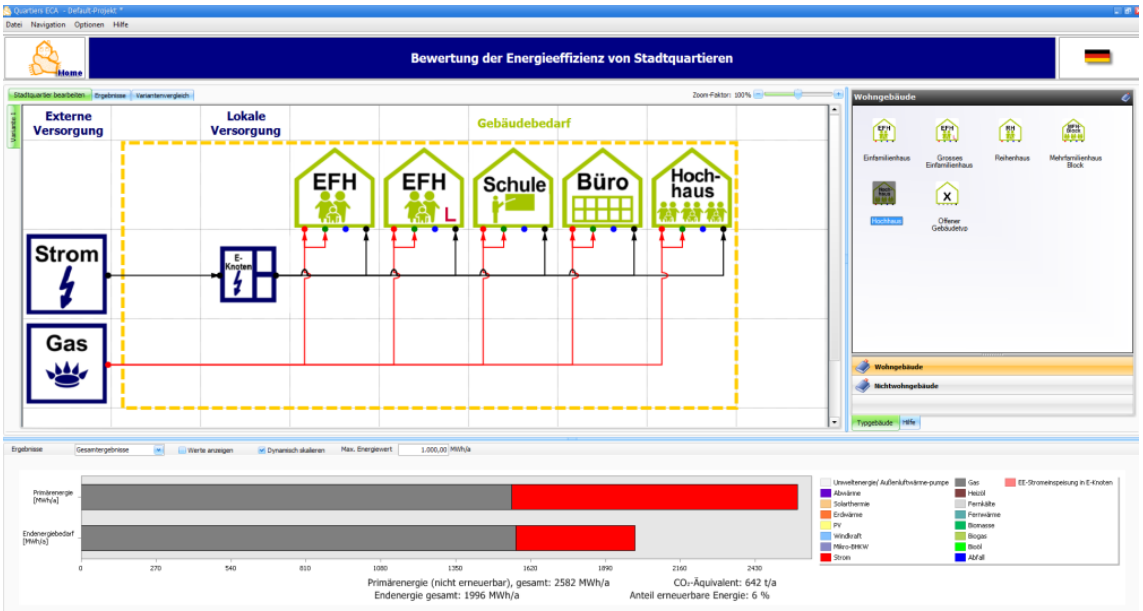


Figure 21: Screenshot of modeled district within DECA tool (Source: RWTH Aachen University, 2017)

TEK (Teilenergiekennwerte von Nicht-Wohngebäuden) (Germany): A software tool to calculate energy balances of non-residential buildings using the DIN V 18599 standard. It utilizes a simplified calculation method to account for data uncertainty. TEK also models non-residential buildings with reduced effort.

Modelica: Open source multi-physical modeling language for dynamic simulations. It can be used for detailed planning of energy systems. Its modularity and standard interfaces enable a good exchangeability and reusability. However, the usage requires expert knowledge.

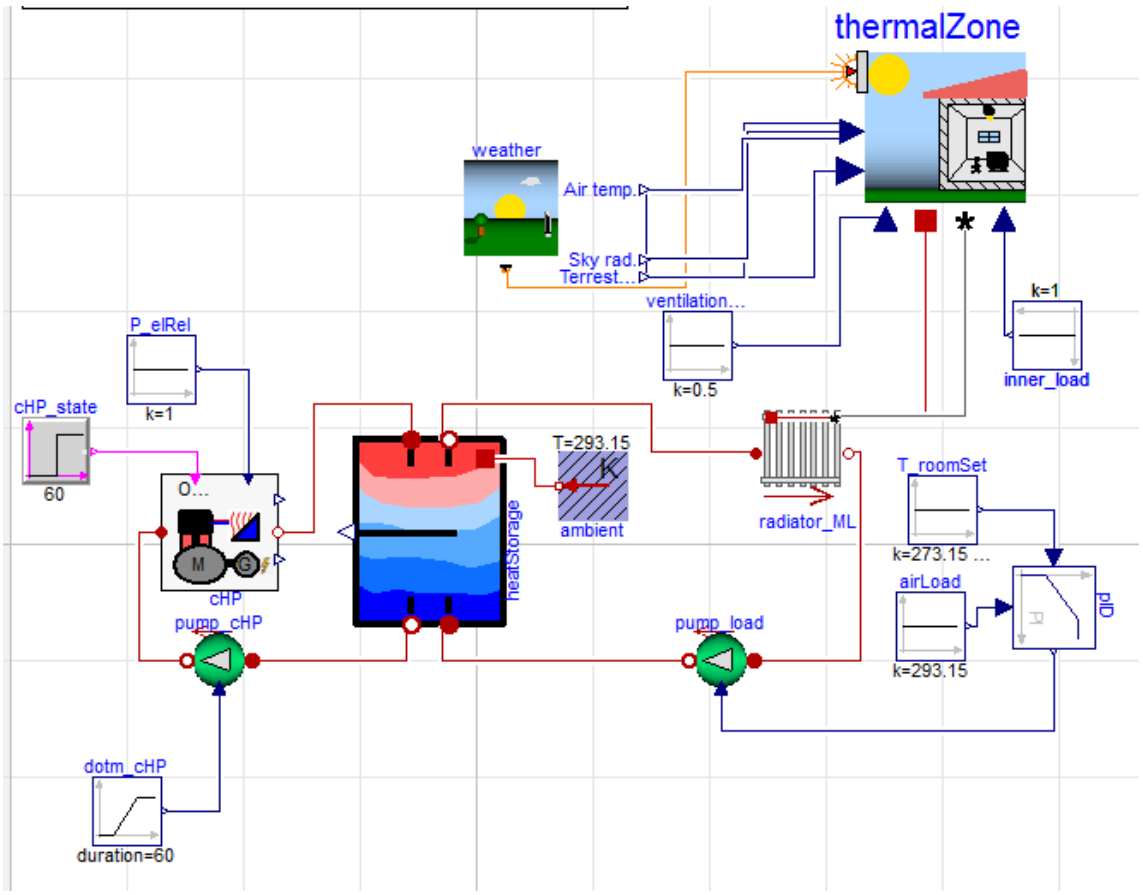
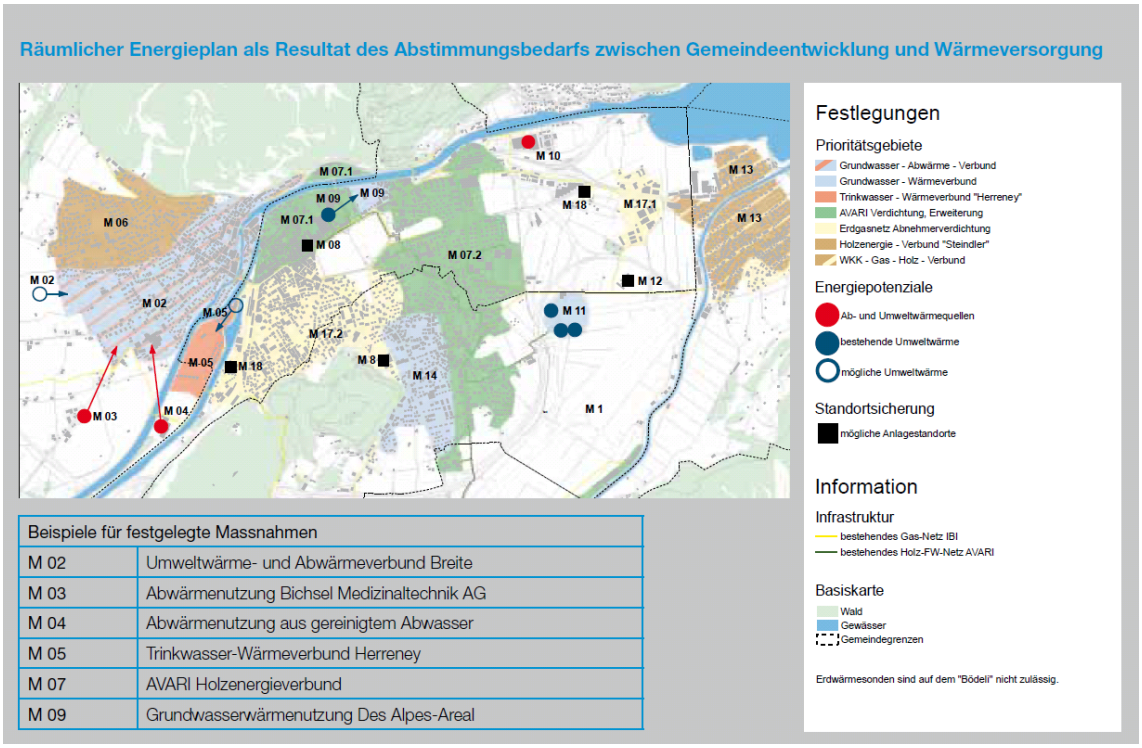


Figure 22: Building model with CHP and thermal storage system in Modelica (Source: RWTH Aachen University, 2017)

European Energy Award (eea): An international program of certification of energy efficiency in municipalities. The program incorporates a suite of tools for different aspects such as: management of measures, questionnaires about the status-quo and a process workbook. The program defines a framework for cities to aspire towards high level energy efficiency.

Plan4DE (Canada): A screening tool to assess the potential for district heating and/or cooling within the community. Understanding the spatial arrangement allows the model to select a technology that best suits the energy density of the neighbourhood.

Local Spatial Energy Plan (Switzerland): The tool coordinates the use of the different available heating energy systems and defines the future strategy for expansion. Mainly, the coordination focuses on grid-connected (mainly high temperature) heating systems, because they demand for complicated and expensive infrastructure (natural gas grid, district heating systems etc.). In order to make each system as efficient as possible (e.g. regarding number of connections per km) parallel expansion of grids should be avoided by fixing priorities in the Plan. Single heating systems (heat pumps, solar thermal installations etc.) are captured and documented on the map in order to evaluate, if there is a short-term potential for expansion of grid-connected system.



Beispiele für festgelegte Massnahmen	
M 02	Umweltwärme- und Abwärmeverbund Breite
M 03	Abwärmenutzung Bichsel Medizinaltechnik AG
M 04	Abwärmenutzung aus gereinigtem Abwasser
M 05	Trinkwasser-Wärmeverbund Herreney
M 07	AVARI Holzenergieverbund
M 09	Grundwasserwärmenutzung Des Alpes-Areal

Figure 23: Local Spatial Energy Plan Example (Source: ENCO, 2017)

The Local Spatial Energy Plan needs to be coordinated with higher level planning instrument and regulations like Regional or National Energy Plans. Once agreed by the responsible authorities, it can be used for information and consultancy during the building permission process, for the planning of development areas etc. Usually the Local Energy Plan is published on the municipalities' website.

Monitoring Building Energy Use at the City Scale (USA): Building energy use data can be difficult to access, due to access limitations, especially when energy is provided by private utilities. The City of Minneapolis, Minnesota, in the U.S. established an Energy Benchmarking Program in 2012 for public and large commercial buildings. As of 2016, over 20 U.S. cities have established some form of energy benchmarking policy (Institute for Market Transformation, 2016). The Minneapolis program requires annual reporting of energy use for public commercial buildings (e.g. schools, park buildings, public parking ramps) greater than or equal to 2,323 square meters and private commercial buildings (e.g. hotels, offices, medical facilities, religious facilities) greater than or equal to 4,645 square meters in size. Energy use data provided by building owners and managers is available on the City's website in spreadsheet format for 2012 – 2015. In addition, in 2015, the City of Minneapolis has developed a web-based map that shows performance metrics for the buildings covered by the Energy Benchmarking Program. The website identifies the locations of the buildings, ownership status, year built, property use type, square footage, and data related to various energy use metrics. Data are displayed for all of the reporting years that are available in pop up boxes when users click on circles representing public and private buildings. Users can also search for buildings by address. Multiple data layers and base data are available via

the interactive map. Figure 24 offers a screen shot of the web map, zoomed in to show building locations in the northern half of the City.

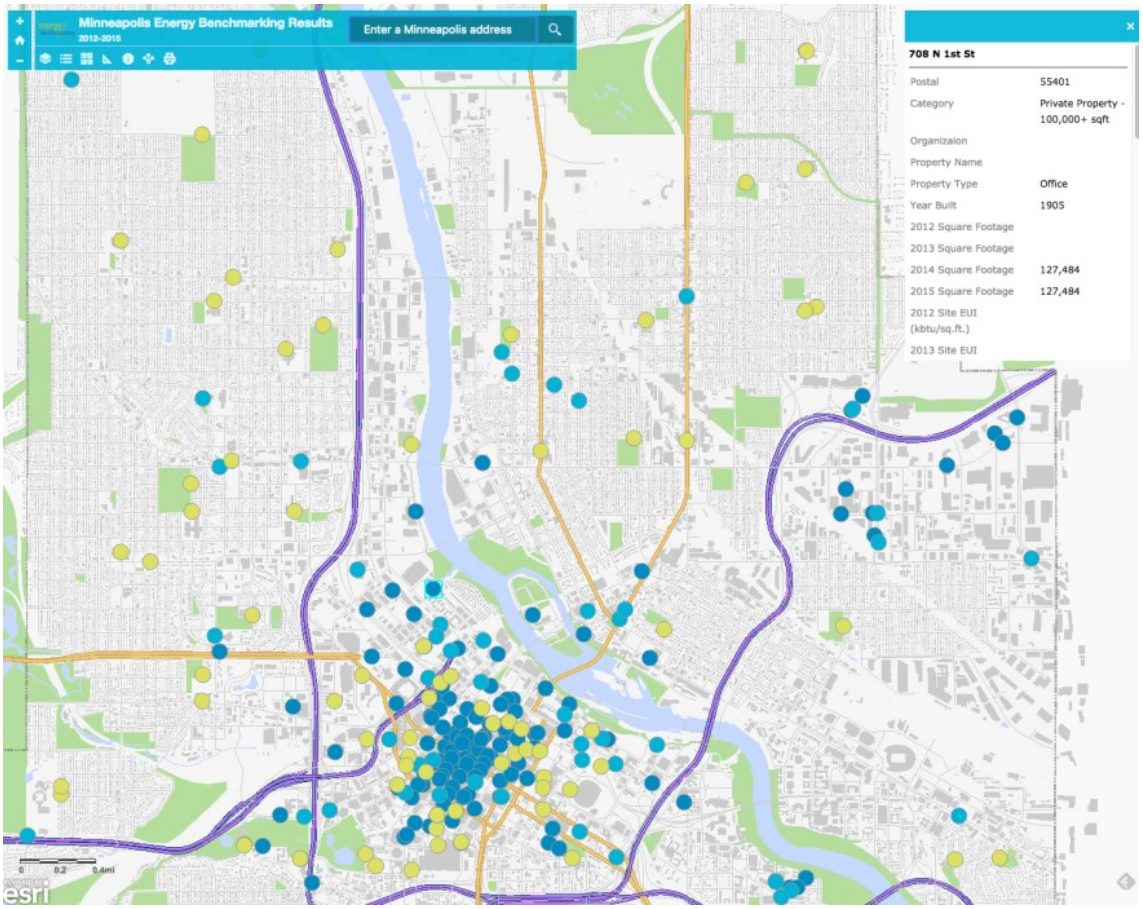


Figure 24: Monitoring Building Energy Use at the City Scale (Source: University of Minnesota, 2017)

The web map offers a spatial display of building energy location and energy use data. The City makes this data available not only to its staff, but also to utilities and energy-focused NGOs so that they can target energy efficiency programs to buildings with the greatest need. The data can be informative to building owners and managers, as they compare their performance with comparable buildings. In addition, the data are informative to current and potential tenants, thus increasing competition and offering a market motive for making efficiency improvements.

Minnesota Solar Suitability App (USA): This PDSS offers data on solar suitability for the entire state of Minnesota in the U.S. The tool offers address or point-and-click search capacity to determine solar suitability. The tool was developed at the University of Minnesota and is administered by the Minnesota Department of Commerce. It draws on Lidar data and technology and offers a free, open source online application. The app, as illustrated in Figure 25, reports data on the size of a system that would be need to meet a proportion of average household use, as well as the cost, and system payback period. As a northern state in the U.S., the app importantly also provides variation in sun exposure for each month. The app also links to information about nearby solar

installations, solar incentive programs, local utility service providers, and local solar installers.

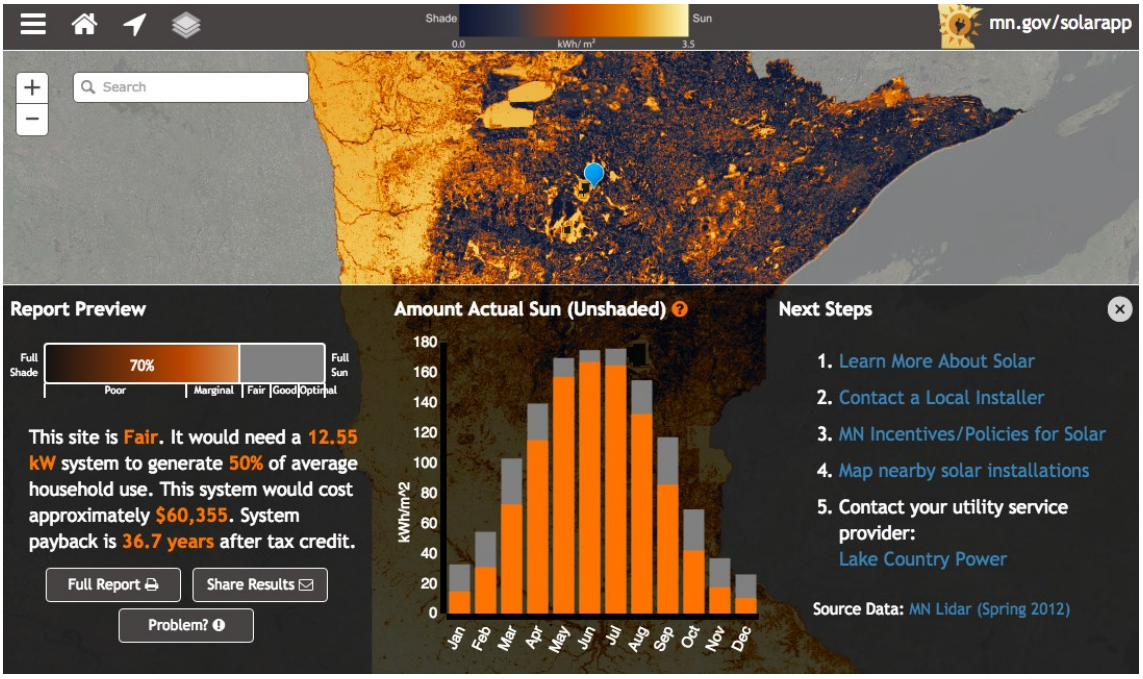


Figure 25: Reporting on solar suitability at the site scale (Source: University of Minnesota, 2017)

A-5.8. Recommendations

This section lists recommendations made by municipalities, planners and other stakeholders involved within the domain of decision support systems:

- Accessing reliable data is undoubtedly beneficial to integrating urban and energy planning. A centralized data management with flexible interfaces can be provided by cities to enable simple data access and provide a platform to share and access data. Coupling data frameworks with tools, such as GIS, can provide an easier way for usage and analysis. Planners and stakeholders should recognize the positive effect of shared and organized data within the planning processes. Savings in both money and time are possible as well as the risk of false decisions reduced throughout the multiple planning steps and investment in data management can be paid off quickly.
- The right tools for the task. Tool usage in early planning phases for scenario building and visualisation can save time and money in later phases.
- Not every tool needs to be complex. Stakeholders are often more comfortable with simpler, more intuitive tools such as web browser access to GIS-databases or smartphone apps, allowing access to monitored data.
- Visualization can transform data into a form or language that can be more easily understood by the target audience. For instance, a graphical representation

of a city district is often easier to understand than tables of parameters. Tools can support this transformation.

- Due diligence. Do not take data for granted. Interpret the data, methods and the results. Use stakeholders to validate the data.
- Expert tools require expert knowledge. However, expert or intuitive tools can also support the planning process at a variety of levels. Thus, consider external support for expert tool knowledge, especially when detailed analyses are required.
- Communicate with others. To support both data management and the use of tools, report to stakeholders on their benefits, such as a better foundation for decision making or reduced time and effort for data gathering.

Following on these general recommendations, the following paragraph gives examples for decision support system usage within different urban energy planning phases. The multiple planning steps are outlined in the following subsections to demonstrate PDSS usage in urban planning.

Strategic planning (Concept)

Within the strategic planning phase the pathways to reach energy efficiency goals must be defined. To accomplish this, it is necessary to understand the urban structure and its energy demands. Visualisation through the use of a centralized GIS-database can provide the mechanism by which to generate energy demand and emission balances. Accessing the required data and information is a perennial challenge and sometimes it can be advantageous to develop an ongoing agreement with local energy suppliers, grid operators and housing companies to facilitate sharing this information on a periodic basis. Access to the data within the limits of public confidentiality will define the limits and capability of database usage with high levels of data availability. Benefits for data providers should be presented to start the cooperation. This approach may be of increased interest for buildings of housing companies with modern energy systems that can identify business cases for alternative energy supply options.

Besides energy and emission balances, the potential for energy consumption and emission reduction measures should be estimated. Grid operator data as well as open source energy atlases can provide data about existing energy systems and renewable potential. For instance, the International Renewable Energy Agency (IRENA) provides an energy atlas for the whole world to estimate potential of renewables per region (International Renewable Energy Agency (IRENA), 2016).

The process followed by the European Energy Award (eea) provides support for planning and implementing change (Bundesgeschäftsstelle European Energy Award, 2016). Specific to strategic planning for example, different measures are suggested and analysed. Moreover the process provides templates for surveys aimed at public feedback and participation. In conjunction with *Stakeholder Engagement and Involvement* the planner can facilitate consensus building and gather information regarding the

impact of the proposed planning measures. In addition, multiple cities use city marketing departments or external marketing partners to take care of information distribution and public integration. In addition to classical print media, websites, social networks and other online tools can support the linkage between the public and further project partners. Via static tools, such as the DECA tool, effects of measures can be estimated with low effort (Fraunhofer UMSICHT, 2016).

Preplanning (Preliminary Discussions)

After strategic aims have been defined, preplanning assesses scenarios and pathways to reach those goals. Information and data must be refined making the speedy availability of high-quality data important. The coordination of technology departments both within the municipality and the energy providers / stakeholders could support the ongoing sharing of data with a high degree of confidence in the values.

A technology survey to assess the availability and performance of possible technology options is supportive of the final design. Both planners and stakeholders can develop significant direction and orientation from such surveys or pilot projects. Examples of such information can be provided by EnEff:Stadt website (Sunbeam GmbH, 2015) or the Smart Cities Information System (SCIS) (The Smart Cities Information System (SCIS), 2015). Standards or the eea cost calculator can support the estimation of project cost.

Detailed planning (Planning Application / Detailed Design)

The dimensioning of the proposed project or initiative is the major task of the detailed planning stage. Established standards, such as AHRAE, BS, CSA, DIN or ISO, will define the key safety related elements of the design although these may be limited in their ability to define system performance at a neighbourhood or city district scale. Additional guides such as developed within LEED, BREEAM, or the 2000W-certificate scheme can be adapted to consider energy and resources at a larger-than-single-building scale. Details of such rating schemes are included within IEA EBC Annex 51 report *Case Studies and Guidelines for Energy Efficient Communities*. In more detailed and complex situations, simulation languages, such as Modelica, or optimization tools, such as GenOpt (Wetter, 2011), offer powerful solutions for optimized energy system planning, but requires significant expertise to operate and interpretation to understand the results. Thus, subcontracts with experts might be reasonable to achieve better solutions. Furthermore, possible solutions have to be checked with relevant law regulations or available subsidies.

Monitoring

Project monitoring begins at the concept stage, well before the project is constructed. Decisions have been made within the planning process based upon data and information that reflect the existing status quo. As the project progresses and more knowledge acquired then early assumptions must be revalidated. An ongoing monitoring and validation program as described in the *Monitoring Report* must be developed as a “reality check” for the design process. Databases plus monitoring software can be

used in combination to evaluate energy consumption and overall system efficiency. Furthermore, monitoring results can indicate required maintenance of devices and can be used for certification, such as required by LEED or eea (Bundesgeschäftsstelle European Energy Award, 2016). In addition, technical monitoring, tools can be used for user feedback about comfort and acceptance of energy system changes.

A-5.9. Summary

Planning and Decision Support Systems (PDSS) are able to support decision making in urban planning context, integrating data from multiple sources and the knowledge of the various stakeholders within different phases in the project planning process. Based on combined input, the PDSS can provide information, support analyses and advance monitoring and evaluation processes. Furthermore, PDSS can be used to enable more robust public participation, by information distribution or feedback functions.

While less complex tools and instruments can be appropriate for the larger public audience, they may be limited when answering more detailed design questions. Expert tools may be required, demanding specific knowledge and expertise for the operation and interpretation necessary to account for the complexity within urban and energy planning.

As shown by the case of the city of Bottrop, Germany, a coordinated information infrastructure can support processes and planning at the municipal level. However, the process of integration of new systems requires changes, which strongly depend on social-political and less on technical issues. By demonstrating the benefit of easy and fast information and data access to different participants, the implementation process can find better support.

A-6. Implement Monitoring of Energy Consumption and GHG Emissions

Authors: Uta Schneider Gräfin zu Lynar, B.&S.U. (Germany); Luise Ebenbeck, B.&S.U. (Germany); Andreas Koch, EifER (France)

"You can only know where you are going if you know where you have been." (James Burke)

A-6.1. Introduction

Monitoring is understood as the tracking and analysis of the impact of measures. Within a project and a specific strategy, a monitoring aims at evaluating the extent to which the actual implementation of a project is aligned with the corresponding goals stated initially. Monitoring is not only a required condition to evaluate a project, but also to ensure that the acquired know-how is transferred to future projects. Monitoring is not to be seen as an additional and resource-consuming must do, but as the chance to expand the horizons of our available knowledge. When the monitoring process is brought to the sustainable urban planning field, it aims at analysing and evaluating to which extent the political will and wish for more sustainable cities and communities has been translated into a tangible reality. The importance of monitoring at municipal level is often underestimated and not pursued with adequate means eithers due to a lack of resources or a lack of strategy. This is where the work of this cluster in the framework of the Annex 63 project comes in.

Innovative and sustainable urban development strategies can be effectively and realistically developed if based on the pool of knowledge acquired through the progressive learning of projects and initiatives already implemented.

The goal of the cluster "Monitoring" is to clarify the different layers of monitoring urban development activities related to energy and the necessity of monitoring such activities at all.

The following analysis was elaborated in the frame of IEA EBC project Annex 63 (Implementation of Energy Strategies in Communities). EBC is a programme of the International Energy Agency (IEA).

At the Annex 63 meeting in Biel in 2016 the Annex 63 partners jointly elaborated a first picture of 9 good practise tools and examples used for monitoring of energy efficiency and GHG emissions related to public buildings and urban development projects for communities:

- Canada - Annual GHG Inventories
- Denmark - Annual GHG Inventories
- France -Bilan Carbon, CIT-FE

- Austria and Germany - Monitoring of energy consumption of public buildings via the EEA European Energy Award certification scheme (similar to the tool in Switzerland)
- Ireland - Public Bodies Monitoring
- Switzerland - Energy City Certification Scheme, 2000-Watt-Site Certification Scheme
- USA -Greenhouse gas inventory
- Japan - Eco-Model City / Future city.

These 9 tools and examples were amended by 22 additional good practise examples for monitoring measures by the Annex 63 partners and other cities in Europe in order to show a bigger picture of monitoring examples for different urban development plans and projects (see list of links below).

The focus of this report has been set on projects with an ex-post monitoring, leaving the modelling and result prediction aspect aside. This working group aims at providing a set of guidelines on how to make sound decisions within planning processes by relying on an effective and holistic monitoring strategy. Which parameters are to be analyzed to understand the level of achievement of higher energy efficiency rates, which indicators are to be used, who is to monitor and evaluate the gathered data and at which project phase these are to be undertaken are questions that this report aims to give an answer to. The presented know-how aims to ease the monitoring process for different cities and communities worldwide and to find the mechanisms to adapt these to their local realities.

The report starts with a definition of the monitoring process with a description of the different possible levels and approaches, of the diversity of targets, as well as with the presentation of the strengths and weaknesses of these approaches. In the second part the report presents a set of best-practice monitoring examples amongst the partner countries for which valuable know-how has been identified with potential of replication in other communities and countries. Finally, the gathered knowledge is conveyed in a set of recommendations that aim to facilitate the work of urban planners when it comes to the definition and implementation of their energy monitoring strategies.

A-6.2. Monitoring of energy strategies – a definition

Our point of concern within the framework of the Annex 63 is the promotion of sustainable urban development strategies worldwide and the development of standards for implementation of optimized energy strategies at the scale of communities. Monitoring in this sense will be applied to the targeting and analysis of three main fields: energy efficiency increase, increase of the use of renewable energies and greenhouse gas emission reduction. It is often the case that merely the project results (and not the project methodologies and process) are subject to monitoring, which leads to a significant loss of knowledge by the lack of process monitoring, through which potential for efficiency improvements in the project implementation remain untapped. The effective im-

plementation of a monitoring strategy will foster the credibility of the energy management projects, encourage further participation of investors and consumers, and ensure that the invested economic and social resources are optimally used both in the undertaken project as well as in future initiatives.

A-6.2.1. Levels of Monitoring

The monitoring task can be undertaken at three territorial levels or planning boundaries. The monitoring differs for the different territorial approaches in methodology, available data, available indicators and precision. It should therefore not be understood as one homogeneous process. Each level has its own methodology and idiosyncrasies:

- Building/Site/bottom-up approach – level 1
- District/Community/Neighbourhood/operative approach - level 2
- City level/top-down approach – level 3.

While a higher level of monitoring does not necessarily imply a more resource-intensive activity, the origin and use of the required data is often completely different.

There is extensive available data and case-studies involving the monitoring of both the building unit as well as the city level. A thorough and effective monitoring strategy at the neighbourhood level is however still to be explored and defined. It is in this sense that the undertaken initiatives by certain communities worldwide can imply a high value-added for urban planners in other municipalities, as this kind of monitoring activities are still on the “trial-and-fail” phase (see below).

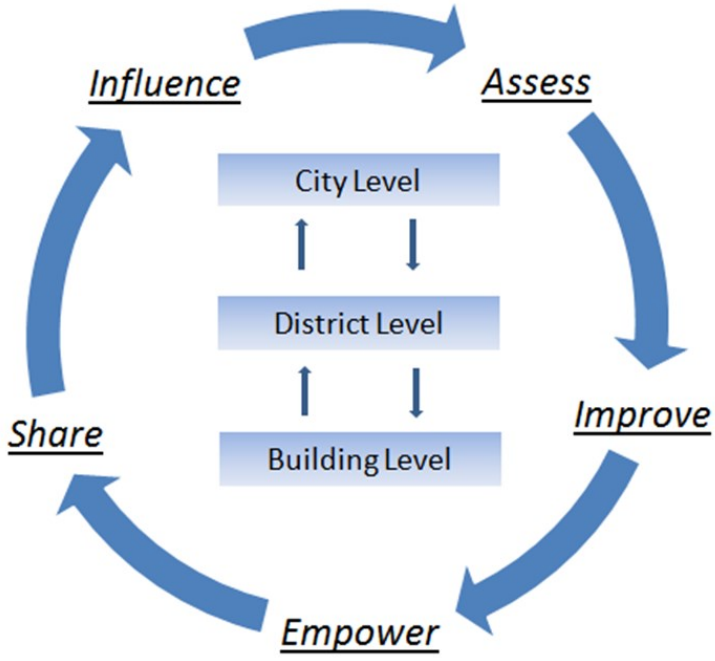


Figure 26: Monitoring Levels (Source: *B.&S.U.mbH, 2017)*

The monitoring of energy savings is usually either following the top-down or bottom-up approach. As Lapillonne defines it, the city or aggregated monitoring level refers to the energy savings evaluation where the “amount of energy savings or energy efficiency

progress are calculated using national or aggregated sectorial levels of energy saving as the starting point." (Bruno Lapillonne, 2009). With this purpose, periodic statistics and aggregated data are put into use. Amongst the advantages of this approach are the availability and easy access to data, with the corresponding spare of time and economic resources both on the gathering and analysis of the obtained information. The main disadvantage would however be the difficulty in identifying success and failure factors, provided that the "bigger picture" approach shades the details allowing for significant improvements.

On the other side, the building or household unit will be the base when it comes to relying on the bottom-up approach, where the sum of the parts will provide the required data for the neighbourhood, city or even national level. In this case, the electricity consumption of single households would be added up and compared to pre-project levels in order to obtain an overview of the impact of the initiative. This method will be more resource consuming. However, it can also provide for the necessary level of accuracy in order to effectively translate purposes into realities when it comes to fostering sustainable communities. Both approaches can lead to the data availability at the neighbourhood approach (Level 2), but they are however to be understood as supplements rather than substitutes.

As the CONCERTO initiative concluded, available means for data gathering at all levels of monitoring would be the use of a centralized monitoring systems, the distribution of questionnaires amongst consumers and data collection at housing and utility companies through the so-called billing procedures. The main challenge however will be the extent to which consumers and utilities are willing to provide this information. On the other hand, whether one or the other procedure is eventually used will depend mostly on the technology and budget available. When it comes to the monitoring at the Building Level, the main challenges are related to technical questions (e.g. which technology is to be used to measure the relevant parameters?) and to the issue of data privacy protection for the consumers. An additional question in this sense will be who will cover the expenses, the owner or the renter of the household.

Monitoring strategy at district/neighbourhood level

The necessity to develop monitoring types and methods for the neighbourhood level derives from the political decisions to implement energy efficiency and climate protection goals on that level. It derives also from the urban development approach to "think" urban planning on that level for many new and refurbishment projects and plans.

There are several reasons for developing monitoring tools and strategies on this specific level:

- Urban development projects are usually planned on this level, for example the plan for a new carbon free neighbourhood of single and semi-detached houses or the refurbishment and modernization plan for an existing derelict neighbourhood with bad insulation and individual fossil based heating systems.

- Quite a lot of these innovative energy efficient and climate friendly plans receive public or semi public funding.
- Monitoring is needed to check whether these pilot plans achieve their intrinsic goals and, may be more important, whether they can be disseminated and generalised in an economic and social feasible way.

Since monitoring is a relatively new task for public administration, especially on the district level, these innovative plans and their implementation usually need a specific person inside the city hall, who is committed and dedicated to make things work. This is especially true for the still methodologically difficult monitoring on level 2. Monitoring requires aggregated data produced and processed by smart meter systems – and the underlying hardware needs to be implemented and paid for. Data security questions need to be clarified according to National legislation. Urban development departments would definitely benefit from 2nd level monitoring but can hardly enforce installation nor do the monitoring by themselves.

Joint agreements with developers, owners and residents need to be negotiated and established. The question of financing the smart metering can be regulated according to energy provision laws (either the provider pays or the user or both).

A-6.2.2. Targets of Monitoring

A holistic sustainable urban development strategy takes into account four dimensions, each of which should have its own monitoring mechanisms: economic, social, environmental and institutional. How much energy is saved, how the change in consumption patterns affects the community, how cleaner the environment becomes through a decrease in CO_2 emissions and how effectively the projects and strategies are implemented are all parameters worthy of monitoring and evaluation. In order to develop sustainable urban communities all levels from societal analysis of the needs down to the effectiveness and efficiency of the implemented solutions are equally important (Figure 27).However, the main focus of this report is set on the economic and environmental dimensions of the monitoring process.

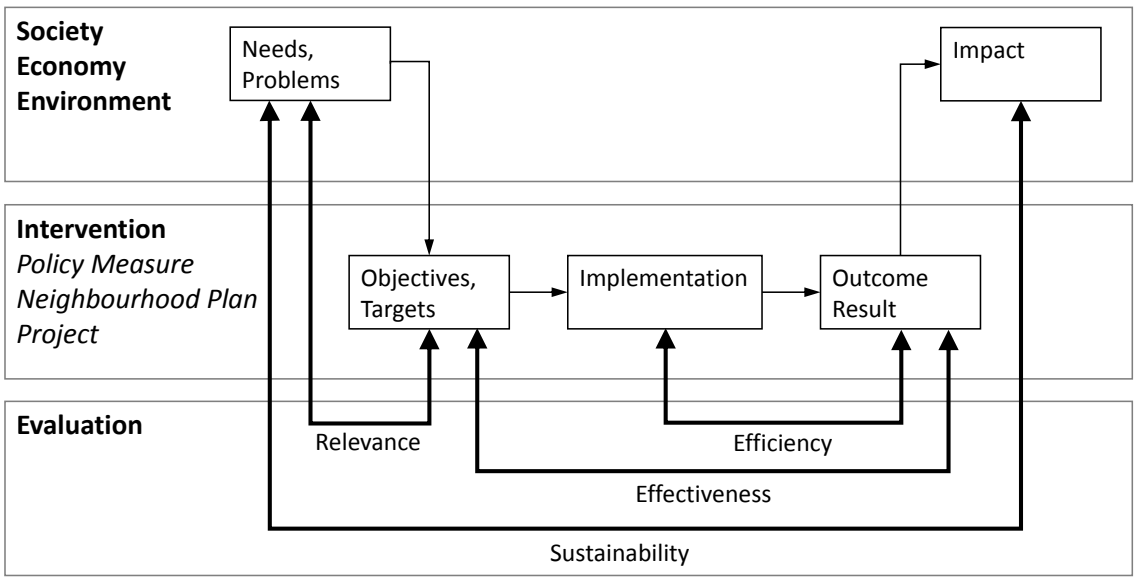


Figure 27: Policy Evaluation framework, (Koch, 2016, adapted from Vreuls, 2005)

Monitoring of municipal activities (e.g. such as the revitalisation of a rundown neighbourhood, the setting up a new residential neighbourhood of NZE homes or planning higher energy efficiency targets in an old residential area of the town) consists of several layers:

- Monitoring of the urban development targets: assessment of qualitative and quantitative urban development indicators (such as the number of new apartments for elderly or families, the number of available electrical vehicles, the total amount of green-areas available for the neighbours, etc.)
- Monitoring of the energy related targets: assessment or measurement of quantitative energy indicators (i.e. % of insulated houses, % of decentralised renewable resources installed by home owners in the area, end energy demand/heat demand/cooling demand...) Here the main parameters analysed tend to be energy production and consumption, although environmental factors such as solar radiation, room air temperature and pollution levels are also to be taken into account.
- Monitoring of performance of users compared to estimations in drop of energy consumption, which will eventually allow analysis to determineto what extent the undertaken measures have influenced the behaviour patterns of consumers. An additional factor to be taken into account is the rebound-effect, which sheds light on the fact that investments in energy efficiency might often lead to unexpected result like longer electricity use during periods were it was previously deemed as unnecessary, precisely as a consequence of the cost-saving nature of these investments.

The scale of the monitoring being implemented will ultimately depend on the monitoring target. Greenhouse gas balances will mostly be used when the analysis is undertaken at the city level, whereas the district heating system will be the point of focus in the case of Neighbourhood Level monitoring. On a simpler basis, the energy performance of households or buildings will often be the main parameter monitored when it comes to analysing the quality of a building block.

Examples of monitoring targets for the three levels are presented via the indicators of the following table:

Table 4: Monitoring Targets per Level (Source: B.&S.U.mbH, 2017); Indicators marked with * are the so called ECO indicators (DG TREN).

Building Level	Neighbourhood Level	City Level
Household energy intensities*	Efficiency of energy conversion and distribution*	Energy use per capita*
Renewable energy share in energy and electricity*	Renewable energy share in energy and electricity*	Energy use per unit of GDP*
Electricity consumption rate	Net energy import dependency*	Industrial energy intensities*
Heat consumption rate	Consumption patterns/peak points)	Net energy import dependency*
Air temperature and humidity	Recycling points	Service/commercial energy intensities*
Year of construction	Number of electrical vehicles	Transport energy intensities*
Embodied energy rates	Pedestrian surface	Renewable energy share in energy and electricity*

Means of monitoring are mainly of technical or statistical nature. An example of the latter is the aggregated data available through statistical sources. On the other hand, technical monitoring can also be classified in four different processes, as presented by the CONCERTO initiative. Metering and collection are the two main mechanisms of ex-post data collection.

- Metering is the measurement of data directly from the building during a time frame, which can take place through real-time energy management systems or ex-post, for which different kind of applications, such as smart meters, are used.
- Collection is the process by which the information is directly obtained from the consumers themselves or energy providers. This can imply the usage of metering as well as the use of questionnaires.
- The processes of calculation and estimation imply the ex-ante evaluation of projects, for which the main difference is the use of statistical mechanisms based on metering, collection or calculation (CONCERTO, 2007).

A-6.2.3. Needs for Monitoring

It often occurs that the time and resource consuming nature of the monitoring task shades the significant added value that monitoring can bring to both the ongoing as

well as to future projects. Monitoring however is not to be understood as an optional process but is a required part of any project that aims at measuring the impacts accurately and assessing the success of the undertaken measures. Monitoring shall not be seen as additional project expenditure but as an investment.

The monitoring dimension shall not be reduced to the analysis of ex-post results. It shall embrace the evaluation of these results as well as of the project process from beginning to end, (i.e. development of the project in its different phases, extent to which actual implementation is aligned with initially planned milestones, consumed resource tracking in comparison with remaining project implementation, etc.).

In this sense, parameters well beyond the technical measurements of energy efficiency increase or percentage of renewable energy come to play a crucial role. Are the milestones being achieved on time? How many work-time hours out of the overall planned budget have been consumed? How many times has the need to modify the initial project plan arisen following unpredicted factors? There is an incredible amount of knowledge that remains untapped due to the lack of project evaluation. As far as the costs for human resources are concerned, the derived knowledge from this process is a valuable asset with a corresponding economic value, which can eventually offset the initially incurred costs.

This assessment relates to good standard project management but is nevertheless also true for energy efficiency and climate protection projects planned by the urban development departments and/or supporting institutions. The public and/or private enterprises delivering energy infrastructure need to be included in the project management procedures as all other contributing service providers.

Monitoring both the process and results will allow the planners not only to measure the achieved success of the project implementation, but also to identify challenges that are faced at different phases of the project implementation and harden the smooth proceeding of the project milestones. This know-how is especially valuable when it comes to the conceptual design of future projects. Eventually, any project is to be subject to both ongoing and ex-post quality controls, especially when the project has been financed partially or fully by external investors.

Additional reasons behind the monitoring process are the need of all projects to optimise consumed resources, the need to ensure that the designed energy planning strategy is taking into account all existing strengths of the urban area to its best, as well as the need of considering its geographical, economic, social, institutional and cultural constraints. It is important to always keep the “bigger picture” relatively close during the project implementation and avoid getting lost in the challenges faced at each specific phase. Moreover, monitoring the final results of a project will ultimately provide the possibility to benchmark the optimal strategy to be followed for a specific urban framework.

Finally, for those cities where an active public participation and concern for urban project results is the norm rather than the exception, monitoring will be a task required in

order to provide reliable and truthful information to the residents: information about the project results and about the use of the (public) money.

Whether the project has been self-financed or supported by external investors, monitoring implies a significant added value to the assessment of the undertaken work. Whether the energy consumption in buildings, the reduction in CO_2 emissions or the extent to which all objectives are reached in a balanced way shall be assessed, the benefits of evaluating the achieved targets are likely to offset the necessary incurred costs, especially for projects that are bounded to be replicated in the future. Previous experiences from the Annex 51 initiative prove that many mistakes in urban development strategies could have often been avoided if urban planners had learned from finalised projects on the field of concern (EBC-ANNEX 51 SUBTASK C REPORT).

A-6.2.4. Strengths and Weaknesses of the Monitoring process

The extent to which an effective monitoring process can be undertaken is determined not only by economic but also by technological and institutional factors. The first question, especially with regard to the monitoring of parameters such as electricity and heat consumption, air temperature or humidity, is of technical nature. Is the necessary equipment available, such as (smart) meters or electricity bills?

This idea introduces immediately the second relevant factor, which is of economic nature. How much does the monitoring equipment cost and is the budget able to cover these expenses? In spite of the high added value of monitoring for ongoing and future projects, it is often the case that the costs of monitoring are high compared to their financial savings in one specific project. By monitoring costs, both the required equipment and the human resources needed to collect and evaluate the results are to be taken into account. There is a growing need for cheap but reliable systems.

An additional parameter to be taken into consideration is whether a city actually disposes of the staff to implement the monitoring activity (both in terms of time and know-how), and if so, at which point(s) during the project implementation and in which periodicity is the monitoring process to be realized. The possibility of outsourcing this activity to external agents is often available, either through district heating system operators, who dispose of the proper monitoring systems, or utility companies providing the electricity consumption data of residents (with the corresponding issues of data protection, which will be further presented), transmission system operators, as well as ICT companies or universities within the framework of research projects.

An additional parameter to be taken into consideration is whether a city actually provides the staff to implement the monitoring activity (both in terms of time and know-how), and if so, at which point(s) during the project implementation and in which time period is the monitoring process to begin. The possibility of outsourcing this activity to external agents is often available, either through district heating system operators, who provide the proper monitoring systems, or utility companies providing the electricity consumption data of residents (with the corresponding issues of data protection, which

will be further presented), transmission system operators, as well as ICT companies or universities within the framework of research projects.

In the cases where the task of monitoring and evaluation does take place, a further challenge often exists, namely the lack of knowledge exchange between partners, with the corresponding missed opportunities. This implies the need to integrate the monitoring practice within the planning and scheduling of the project. Taking into account the time- and resource-consuming nature of monitoring, the chances of it not taking place at all are high, unless the monitoring methodology is well defined at the outset.

Finally, the integration of the monitoring process within the project plan also implies the accurate definition of the tools to be utilised, the targets to be analysed, as well as the detail of the data to be collected. Different mechanisms are to be implemented to measure parameters such as electricity or heat consumption, household ventilation, etc. Moreover, some energy savings cannot be measured directly, provided they represent a parameter that was not realised, reason for which relying on a comparative analysis is deemed as necessary (RCREEE, 2014).

Finally, one of the main challenges of monitoring consumers' electricity consumption is data security, data protection and protection of privacy. The Smart Grids Model Region Salzburg, one of the analyzed best-practice examples in this report, has divided the concerning topic in three main pillars that necessarily need to be adequately insured, as represented on Figure 28:

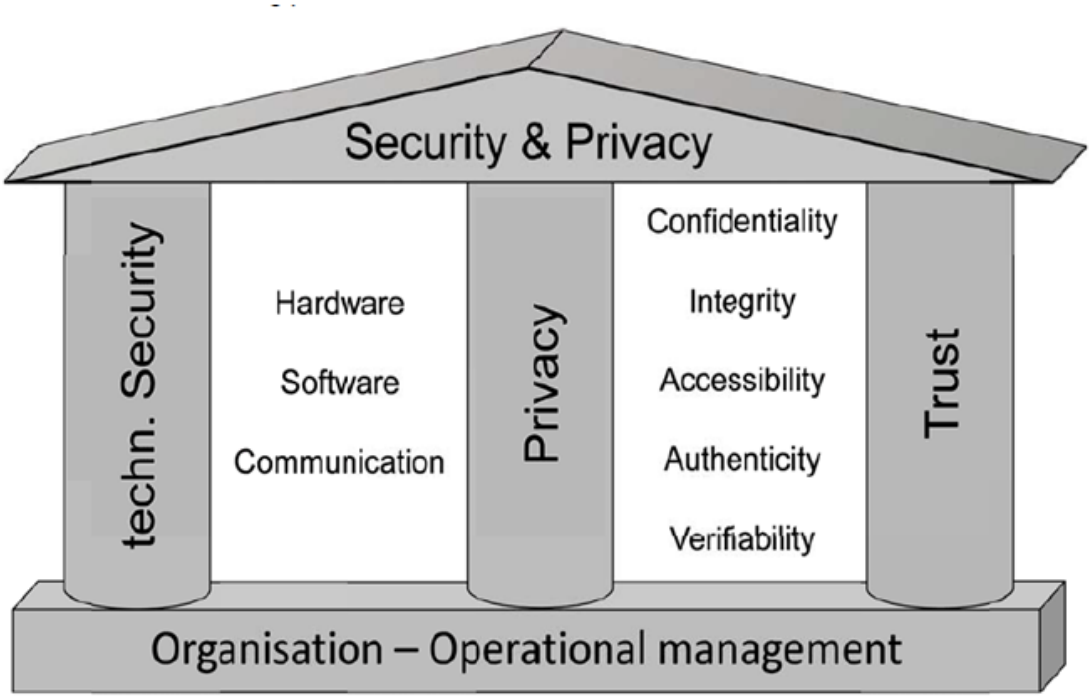


Figure 28: The Security & Privacy building in the smart grid (Source: SMARTGRIDS Model Region Salzburg, 2016)

The consistent maintenance of data protection for consumers is based on 3 main pillars, all supported by a solid operational management of the overall system:

1. Technical Security: the security of the actual technical components, such as smart meters, IP networks and energy management software.
2. Privacy – Data protection: the legal framework determining the conditions upon which monitoring, data gathering and analysis can be undertaken without violating consumers´ privacy rights.
3. Trust: the degree of consumer acceptability towards the idea of consumption monitoring, which can be influenced by a multiplicity of factors. The role of culture is for instance not to be underestimated. There are best-practice examples proving the high price-elasticity of consumers towards electricity (if kept well informed), e.g. “Your Energy Moment” project in the Netherlands, whereas there are alternative projects that have shown that consumers are unlikely to change their consumption patterns in spite of the information provided through the monitoring of their consumption levels, This pattern was e.g. proved by the Automation Systems for Demand Response implemented by the Danish Energy Industries Federation between 2006-09. The latter group is therefore less likely to facilitate the exchange of private data, provided the derived expected benefits ought not to be overestimated.

A-6.3. Best-Practice Examples

As the “Smart Grid projects in Europe” report stated, the pioneering countries in Smart Grid project investments are the United Kingdom, Germany, France and Italy. Denmark is the forerunner in R&D projects and has the highest number of smart grid projects per capita and per KWh consumed rates.

A table with the best-practice examples collected across the Annex 63 partner countries is provided here below. For further details see examples or contact: ULynar@bsu-berlin.de

Monitoring Program - organization	Monitoring Level	Goal of Monitoring (CO2 emissions, electricity/heat consumption, etc).	Brief Description	Impact	Strengths/Weaknesses of Program Relevance to Annex 63
Austria					
Smart Grid Model Region Salzburg	Building and Neighbourhood	Some of the relevant monitored areas are: • Rosa Zukunft: involves 130 households for which an Energy Management System has been set up aiming at optimizing energy supply and demand combined with the use of storage mechanisms and electrical vehicles. Building phase went from March 2012 to December 2013. • Köstendorf: involves 90 houses equipped with PV systems and High-end batteries.	The whole area is undertaking 20 different and parallel projects in order to set up a "think and experiment" laboratory in Salzburg aiming at exploring what the future smart electrical grid could look like. The project is funded by the Federal Ministry for Transport, Innovation and Technology and the Climate and Energy Fund, amongst others. The different projects aim at studying innovative active network control (DG Demo Net Concept), the effects of monitoring and analysis of low voltage networks (ISOLVES) and buildings (Building2Grid, 10 buildings), study the behaviour of consumer consumption in order to optimise network energy usage (Consumer2Grid, 290 households), what ICT infrastructure is necessary (SmartSynergy), the potential of electric vehicles (Vehicle2Go), how can buildings be bundled in order to settle an innovative housing community (HiT), possible ways to maximize the use of data exchange between different smart-grids (Smart Web Grid), etc.	• 1 industrial customer • 30 SMEs • 474 households • 58 buildings • approx. 22000 not highly involved customers in the areas	Holistic approach taking in consideration the household, neighbourhood, industry and electricity grid level, all with their corresponding monitoring techniques
klimaaktiv	Building Level	Measured indicators: • Consumption for heat supply (plus sub meters for ventilation, warm water) • Electrical consumption (ventilation, cooling systems, illumination) • Energy production of solar thermal systems and PV-systems • Water consumption	klimaaktiv is the Austrian climate protection initiative and part of the Austrian climate strategy (EU 20-20-20). People can get information in the fields: buildings, saving energy, renewable energy and mobility. klimaaktiv offers in the building sector a declaration system. The klimaaktiv building standard is an Austria-wide, neutral and transparent quality mark which provides all stakeholders with guidelines for sustainable, climate-friendly construction. To ensure the quality, the energy consumption of buildings with an area with more than 1.000 m², must be monitored. All declared buildings will be presented here: http://www.klimaaktiv-gebaut.at/	213,000 m² of all Austrian building are klimaaktiv buildings	Difficult to integrate the idea in traditional planning processes. Benefit often not visible. Legally prescribed standard is for many people enough.
Federal state of Salzburg	Building Level	Measured indicators: • Energy production of PV-systems • Consumption of heat pumps • Further indicators voluntary	To get a building permission or a funding, the Energy Performance Certificate must be uploaded on a central database, called ZEUS. The authority can check all information online and evaluate the energy-quality of the building project and check the requirements regarding energy/CO2-emissions. To	All buildings that get a funding for the installation of a PV-system system and a heat pump	Mandatory

			get fundings for the installation of PV systems and heat pumps, the upload of monitoring data on a regular basis is mandatory. This energy monitoring is integrated in the ZEUS database. The old system is the following: http://www.energiebuchhaltung.at/ (start of the initiative for solar thermal systems)	will be monitored.	
Energy management system in the city of Salzburg	City Level	Measured indicators: • Consumption for heat supply • Consumption of electricity • Consumption for water	The city of Salzburg has implemented an energy management system in 1999. The heart of this system is the energy control systems, that tracks energy related indicators in every (city related) building project. This systems builds also the basis for the implementation of the Masterplan 2025, that is part of the SMART CITY Salzburg initiative.	250 buildings in the city of Salzburg	+ Important measures can be identified. + Effect of measures is visible. - Costs of the monitoring systems.
EEA in Austria (called e5)	Municipality Level	The goal of monitoring depends on the measure that the municipality plans to implement. To get a certification, a check of the implemented measures is necessary every 3 years.	The e5 program support municipalities to check their energy policy and to develop energy related goals and to set measures in the field of energy and climate protection. Topics see description of EEA in Germany	108 municipalities in Austria use the program	Competitor through similar program (Klimabündnis Gemeinde) that offers a similar service. To get a plaque, not so much effort is necessary.
SIR, research project	Settlement level	Not clear yet	An Austrian certification system similar to the 2000 Watt certification system in Switzerland is under work. Project title: UrbanAreaParameters. Further information will be available in 2017.	-	-
Belgium					
Linear (2011-14) VITO	Household and community	Through the application of smart meters and smart appliances, the renewable energy consumption coming from solar and wind is monitored and used to study the behaviour of consumers towards electricity price changes.	It is one of the largest smart grid projects in Europe, composed of a consortium of 20 partners and using a typical Belgian residential area as a pilot project.	250 test households	The results of the project have been proved as promising

Canada					
Community Energy Emissions Inventory	community	Compliance with provincial (British Columbia) emission targets and the Climate Action Charter agreed to by the municipalities	Standardised approach to calculating emissions from buildings, transportation and waste. Instrumental in developing community energy plans and securing funding	Province of British Columbia, Canada	Provides the basis for further planning in alignment with voluntary measures of the Federation of Canadian Municipalities Partners for Climate Protection program.
Partners for Climate Protection	Community	Voluntary program aimed at reducing emission reduction within municipal buildings by 20% and within the community by 6%, based on 1990 baseline	A 5-step program to develop and implement a community energy plan. The first step involves an inventory of all emissions within the community	250 municipalities across Canada	Voluntary: many plans but limited results
Denmark					
Green accounts, DK Link 2	Building Level	• District heating • Electricity • Water • Raw materials • Emission in air • Emission in water • Garbage (safe and not safe)	The "Green Accounts" where established in 1995 with the goal to get public attention to private and official companies` environmental impact. Companies with a high negative environmental impact were forced to give in a report each year. But also companies with low negative impact have contributed with a "Green Account" reports. The municipality Albertslund has elaborated one for most of their public buildings (which also include dwellings) and also for the city areas in the municipality.	The conclusion after having run the program for 20 years was that the impact was too low to maintain it.	In 2015 the "Green Accounts" where removed while they no longer had the wished environmental effect and where replaced with PRTR (Pollutant Release and Transfer Register) which does not include the energy consumption.
Strategic Energy Planning in Municipalities (SEP), DK Link 2	Municipality and Region Level	• Energy consumption • Energy Supply in fossil fuel and RES • CO2 emissions	The Goal with Strategic Energy Planning is to promote the change for a more flexible energy system with a smaller energy consumption and more added RES. The report also includes estimations of the future energy consumptions and an analysis of how big the potential is for adding different kind of RES for the specific municipality.	A lot of Danish municipalities have made one but it is not possible to see them all in one database.	It covers the energy planning for a larger area.

France					
Cit'ergie (eea in *Germany*)	Building and City Level	Some of the measured indicators are: • Energy efficiency heating / electricity and water efficiency for municipal buildings • Energy efficiency of wastewater treatment plants • Energy efficiency of waste treatment plants • Energy efficiency of street lighting • Accounting of the CO2 and greenhouse gas emissions of municipal buildings	Holistic approach regarding different fields. It tracks the city´s evolution on the topics: 1. Urban development goals reached regarding energy efficiency standards 2. Public buildings energy usage. 3. Renewable energy usage 4. Mobility: usage of public transport, bikes and e-mobility 5. Internal Organisation: means to empower community members to help reach the targets (financial instruments, activity programs, etc). 6. Communication: initiatives to promote climate-friendly behaviour with the population	100 cities in France use the program.	Together with the holistic and complete picture the program provides of a given city comes the fact that it is highly time-consuming to collect all the information.
Observatoire PCET	City/Community, region	**Monitoring of local Energy and Climate Action Plans (Plan Climat-Energie Territoriaux)** The Monitoring describes the status of the Action Plan (preconfiguration, diagnosis, construction of the PCET, application), the method used for the GHG balance and the scope, as well as the involved actors and specific measures.	**Local Climate and Energy Plan (PCET)** The PCET is the local climate action and energy plan between the regional level (SRCAE) and local planning documents (SCoT/PLU/ZAC). It is obligatory for communities above 50'000 inhabitants and based on a greenhouse gas emission inventory. The PCET defines local strategies for mitigation and adaptation measures. The PCET includes an analysis of the state of emissions and energy use, work on future scenarios, quantified objectives, which are consistent with the French application of the European 3x20 targets and the national objectives (facteur 4). Furthermore, it defines suitable indicators and follow up measures.	470 PCETs are listed	The GIS based website lists a large number of PCET and enables decision makers to search for specific regions or actions and improve their practice
Observatoire BEPOS	Building level	Showcase for low energy (BBC - batiment base consomation) and energy positive (BEPOS - batiment energy positive) buildings. Indicators are specific energy needs for heating, cooling, ventilation, lighting and domestic hot water. On-site electricity generation	The project database provides a short description of more than 380 existing low energy end positive energy buildings. Technical installation as well as construction of the building envelop are described. Furthermore details on the involved actors are given.		Good overview on low energy buildings.

Guideline: Adapting to Climate Change	Community	Guide to monitoring of climate change adaptation measures in communities	The guideline delivers examples and best international practices on how to monitor climate adaptation measures		Good introduction in the process to set up a monitoring strategy
Observatoire Climat	Region	The Climate Observatory provides key indicators on climate change and is seen as a platform to stimulate exchange between local actors in the region. Provided indicators include energy use, electricity generation from renewable energy sources, direct GHG emissions, local adaptation measures, Ecosystem services, etc.	Climate observatories are installed on a regional level and are specific based on the region.		Function as an exchange platform for the various actors can be seen as a strength
Lyon Smart Community (2011-16) Toshiba and other partners	Community/neighbourhood level	The implemented Community Management System (CMS) tracks energy data from building to neighbourhood level. The monitored parameters are overall power consumption, air quality, local weather, permanent production of the Lyon Confluence heating network, the output of PV plants, etc. The aim is to acquire real time energy consumption for each building in order to provide an energy audit tool for the whole area.	Its main aim is directed to project on how future smart and sustainable cities could look and function like. The project cluster is composed of more than 30 partners. The project is composed of 4 pillars: 1. Positive Energy Smart buildings 2. Sustainable Mobility – a car-sharing scheme with a fleet of electric vehicles. 3. A residential energy monitoring system. 4. Community Energy Management System: data from building energy consumption, electric vehicle charging points, renewable energy production sources, etc., will be gathered in order to be evaluated as well as be used for forecasting. The core idea is to facilitate urban energy planning.	Largest “smart community” demonstration project in Europe. 150 hectares at the heart of Lyon.	The 4th pillar of the project, its CEMS, is of enormous relevance. The technology has been developed by Toshiba.
Germany					
Eea in Germany (European Energy Award) Link 2	Building and City Level	Some of the measured indicators are: • Energy efficiency heating / electricity and water efficiency for municipal buildings • Energy efficiency of wastewater treatment plants	Holistic approach regarding different fields. It tracks the city´s evolution on the topics: 1. Urban development goals reached regarding energy efficiency standards 2. Public buildings energy usage. 3. Renewable energy usage 4. Mobility: usage of public transport, bikes and e-mobility	308 cities in Germany use the program.	Together with the holistic and complete picture the program provides of a given city comes the fact that it is highly time-

		• Energy efficiency of waste treatment plants • Energy efficiency of street lighting • Accounting of the CO2 and greenhouse gas emissions of municipal buildings	5. Internal Organisation: means to empower community members to help reach the targets (financial instruments, activity programs, etc.). 6. Communication: initiatives to promote climate-friendly behaviour with the population		consuming to collect all the information.
E-energy Initiative – German Federal Ministry for Economic Affairs and Energy (BMWi) and Federal Ministry for the Environment, Nature Conservation, Building and Nuclear Safety (BMU)	Building, community and city	Advanced ICT software and hardware play an innovative role in measuring and monitoring: • Household electricity and heat consumption • GHG emissions • RE production • EE target increase	The main goal of the federal program is through the use of ICT decrease national electricity consumption and increase energy efficiency targets. The initiative is composed of 6 parallel projects all aiming to foster smart-grid technology in Germany: 1. eTelligence (2009-12) by EWE AG: integration of electricity generation and consumption to build an energy market running under power generation and demand side control systems 2. RegModHarz (2008-12) by Fraunhofer IWES 3. E-DeMa Modellregion Rhein-Ruhr 4. Smart W@tts Model Fegion Aachen (German Case Study) 5. MoMa - Modellstadt Mannheim: further presented below 6. MEREGIO – Model region Baden-Württemberg: achieve minimum GHG regions. The BMWi and BMU have participated with 60 Mio. Euro out of an overall investment of 140 Mio. Euro.	42 companies and research institutions in the 6 different pilot projects(number of inhabitants is not provided)	The pilot projects have and are showing very prosperous results regarding the potential of the available technology. The main conclusion turns to be that whether smart grids become or not a reality ultimately depends on the institutional and political framework, rather than on technological conditions.
Model City Mannheim (2008-12) MVV Energie Link 2	Building and community	Through a 3 level cellular structure the project aims at replicating the electricity system as an ecosystem, where through the use of ICT, electricity, heat, gas and water consumption are measured, monitored and forecasted. The different buildings are interconnected at district level, and the different districts are connected at city level through a broadband power line infrastructure.	The cluster composes 9 partners from different sectors and has provided very good results. The project proves a change of paradigm: people pass from being passive consumers to becoming *prosumers*, allowing for a decentralised energy system, where each neighbourhood/city consumes until the extent there is electricity production and saved amounts. The 3 structural levels are: 1. Object cells (Building, household). A smart meter and a so called *Energiebutler* measure and provide the data to the district server. 2. District cells - Smart Grid: which is provided by an intelli-	1000 households in Mannheim	+ when one energy provider falls, it only affects one single neighbourhood. + everyone connected to the grid can become part of it + the technology benefits both consumers and producers

		The project proves that consumers are sensitive to price and adapt their consumption accordingly.	gent feedback system. Demand and offer are balanced and data is provided to the upper level. 3. System cell - Alpha Core Platform. The data is analyzed and studied and sent back to household to foster optimal consumption, given electricity production and prices.		+The Energiebutler serves as a Firewall to foster data protection
AdaptiveSense (2011-13) part of the IT2Green initiative – Dresden Utility company, T-Systems Multimedia Solutions GmbH, T. Universität Dresden, Zentrum Mikoelektronik Dresden AG Link 2	Building (office)	• Measurement of office ICT usage together with its corresponding energy consumption • Creation and analysis of employee profiles and their energy consumption rates (secretary, project leader, etc).	The aim of the project has been the development of a technical energy management system which serves to turn on and off the electronic equipment in an office depending on the presence of the employees in their working space, making use of sensors, gateways and bridges and developing a central service platform to be used as an "energy manager" in order to gather and analyze energy data. As part of the IT2Green initiative (GreenIT Cockpit project), the following monitoring systems were analyzed: EMS von Avocent, CA Tech., deZem, JouleX, Nimsoft, CobWeb (proRZ), Paessler PRTG, Raritan, RiZone (Rittal), Speedikon DAMS, IBM, IT-Backbone	The project has showed that the rate of electricity consumption reduction depends largely on the profile user: high impact for project developers and managers, low office support staff	
Energy-Saving Smart Grid Pilot (2008-09) – Cisco Systems GmbH and Yello Strom GmbH Link 2	Household	A smart electricity meter and energy management system aiming at monitoring household power consumption as well as optimising the use of household appliances during off-peak periods in order to reduce energy bills.	Pilot project undertaken by the partnership of two German companies developing an intelligent energy system, based on the interconnection of the households with the local power grid and power sources through an online network. Consumers can program their appliances in order that they only work during off-peak time frames.	70 homes and businesses	-Data privacy issues +Fruitful private partnership between a smart-grid technology provider and an internet-based platform provider
Ireland					
EV Network integration (2009-13) ESB Networks	District, City	Monitor the potential of electrical vehicle fast charging infrastructure and its impact on the electricity network through the use of smart meters	A €4,2 Million project between ESB networks and the Department for Regional Development of Northern Ireland (DRD NI) with the main aim of testing the potential of mass market adoption of electric vehicles in EU member states. The project uses 2 low voltage (220V) circuits to assess the impact of a EV fleet, both in urban and rural set ups.	46 new rapid charge-points in Ireland with the corresponding IT systems	Allow for longer intercity travel using EV and foster the use of EV in general

			Through the study of the impact the fleet would have on the network, the potential for an EV market was assessed and the required investments were estimated.		
Italy					
Energy@home (2009-13) - Enel Distribuzione SpA	Building	The association has released the JEMMA (Java-based Home Energy Management Application framework), open-source programme aiming at monitor energy consumption levels.	Energy@home is a non-profit association, which aims at developing and promoting technologies fostering energy efficiency in smart homes. The house is understood as an ecosystem of interacting appliances, realized through the collaboration of stakeholders from a diversity of industries: telecommunication, ICT, energy utility companies, home appliances, etc. The main idea is that the different smart applications adjust their power consumption and keep the consumer informed, in order to ensure the achievement of energy efficiency targets. A real-time bidirectional information exchange between utilities, telecom services, retailers, etc. allows for this exchange.	50 users in Italy and spread to the Netherlands involving 300 users	+Innovative and open-source technology. -data privacy issues.
Japan					
Eco-model City	City level	Accounting of the greenhouse gas emissions from city area	Japanese government has selected as Eco-Model Cities those cities that are working on high but achievable goals, making pioneering efforts to realize the low-carbon society. Greenhouse gas emission of each city is reviewed every year.	23 cities are selected	Only city-wide emission is estimated and estimation accuracy is not good.
Smart Community (CEMS)	Building and District level	Electricity consumption of each house/building is monitored by community energy management system	The Japanese government has demonstrated the smart community project in four cities in Japan (Kitakyushu, Keihanna, Toyota, Yokohama). Demand Response is proved.	Demonstration in four cities had ended.	They can monitor electricity consumption of each building, but it is not disclosed.
Netherlands					
Your Energie Moment – Breda (Easy Street&Meulenspie) and in Zwolle (Muziekwijk) (2012-15) Enexis	Household	Electricity and gas consumption through the application of smart meters	These are 2 pilot projects in which residents become *prosumers* using PV panels. They are equipped with a smart meter and smart washing machine which is additionally connected to the provided energy computer, equipped with a Central Energy Management System, which forecasts solar panel energy production for the next day. The aim of the project was to understand to what extent consumers are willing to use electricity more flexibly.	37 houses (Meulenspie) and 131 apartments (Easy Street) in Breda; 189 apartments in Zwolle	The project has shown that consumers adapt their consumption patterns, when they are adequately informed.

Link 2 Link 3			The main idea is that consumer are informed and given the possibility to manage their electricity consumption in an intelligent and rational way. The project has been partially commissioned by the Ministry for Economy.		
Transition approach, using ”Integral Spatial Realistic Scenario (ISRS)” .	District and City level	Energy neutrality in 2040, realised by 50% improvement of energy efficiency and 50% renewable energy.	Transition approach, using knowledge of innovative pilot projects to extrapolate the effects on the complete built environment of the City of Parkstad. These results are combined in an ”Integral Spatial Realistic Scenario (ISRS)” developed by the University of Wageningen. The results have been adopted by the City Council to apply transition management for achieving the long term goal to become zero-energy as a city in 2040. The necessary actions are analysed for each of the 8 districts in the City of Parkstad. The municipalities are now in the process of organising meetings with stakeholders, to make agreements of their role and contribution to achieve the ambition of the City. The progress in reaching this transition is monitored by each of the eight cities.	Until now, less than 5 cities, but more and More cities are using this approach.	Realistic scenario’s. Stakeholder involvement to contribute to the scenario’s. Needs a lot of expertise and negotiation to be able to reach the goals and monitoring is expensive and results are always late in time.
Norway					
Choosing indicators to monitor in future (Project PI-SEC: Planning Instruments for Smart Energy Communities) Link 2 Link 3	Neighbourhood-Community	To ensure that ambitious targets for the Smart Energy Communities are achieved, e.g: • No fossil fuels for heating • Energy efficiency in buildings • Infrastructure for district heating • Flexible energy infrastructure • Green Public Procurement • Infrastructure for green mobility • Involving citizens	The project PI-SEC (2016-2019) will deliver efficient planning instruments for integrated energy design at the neighbourhood scale, qualified for Norwegian planning context in co-operation with public stakeholders. The project will provide increased knowledge about what parameters are essential for moving towards smart and sustainable energy use in Norwegian cities and how these can be linked to the planning, operation and monitoring of new or renewed neighbourhoods.	2 pilot projects: New development Ådland in Bergen and suburb Furuset in Oslo	The project is still in an early phase, choosing indicators to monitor in the future
Switzerland					
Swiss2G in Mendrisio (2010-13)	Household and community	Smart meters will monitor the energy consumption using PV systems at household level.	The project´s purpose is to use a grid connected device in order to identify the status of the distribution grid, stabilize it and optimize its behaviour through the development of an	20 households	+No big upfront investments was required

Kraftwerke Oberhasli (KWO)		Energy flows at network level will be monitored by decentralised plants for the production of electricity	algorithm.		
Monitoring Standard for Buildings and areas –2000-Watt-Kompatibilität	Building and district	• Embodied energy: energy consumed in the construction and reconstruction of the 2000 Watt Standard buildings • Operating energy of buildings • Energy consumed by users in mobility	The aim of the monitoring standard is to develop a system to evaluate the energy consumption of buildings built or renovated under the 2000 Watt Standard.	All buildings holding a 2000 Watt Standard Certificate	+Can be easily replicated

A-6.4. Recommendations

After the acquired overview regarding the levels, targets, needs and challenges of monitoring the penetration rate of renewable energy and energy efficiency in communities, the key question comes to place: how can urban developers from cities worldwide make use of the available knowledge in order to develop and implement effective as well as consumer-accepting monitoring strategies? What know-how has been untapped so far, and where? What can be replicated not only in neighbouring cities, but in communities with significantly different social and cultural frameworks? What are the common denominators of a successful monitoring strategy?

The Monitoring Cluster has aimed to make use of the discovered experiences to provide a guideline for urban developers worldwide. The here presented set of recommendations are by far not exclusive.

- The most successful strategies have seen the active participation of a diversity of actors from different sectors: public utility companies, government, universities, ICT companies, etc.
- There is a high correlation between the digitalisation degree of the economy and the extent to which monitoring can be implemented at an affordable cost, effectively both in terms of time and money. Moreover, the higher the digitalisation degree of an economy is, the more a bottom-up approach will be preferred over a top-down method when it comes to monitoring the electricity consumption at all levels.
- A majority of the analysed Best-practice examples have shown that consumers tend to have a high price-elasticity demand when it comes to electricity consumption. In this case, the “education” of the consumer through the monitoring of electricity consumption levels and market behaviour is likely to have a high impact on the way enrooted consumption habits are modified. It is crucial to make the consumer understand that consuming less electricity does not necessarily imply less comfort, but consuming more intelligently.
- A major challenge to the widespread implementation and consumer acceptance of the monitoring practice relies naturally on data protection issues. There is an extent to which consumers are flexible about the share of personal data. Ensuring a solid institutional and legal framework should be a priority to all cities. However, consumers can also be incentivized to become pro-active and willing to share certain data, in exchange of a significant reduction of their electricity bills. A possible urban initiative would be the provision of the necessary equipment (such as smart meters) to households with the mere condition of access to their

electricity consumption levels. Information can be just as valuable as actual money, and a payment method by consumers for the received smart meters.

- An initiative that has provided highly positive results in terms of impact on consumer behaviour is the organization of “competitions” (e.g. the most user-friendly household within a district or neighbourhood), provided the involved buildings have similar architectural and refurbishment characteristics. This has been the case, for example, of the Dutch project “Your Energy Moment or the IEE “Energy Neighbourhoods” Project of B.&S.U. mbH as lead partner.

A-6.5. Summary

The presented analysis of the monitoring practice at theoretical as well as at practical level through the literature review and the provided Best-Practice Examples has proved the diversity of projects taking place worldwide and aiming at fostering the monitoring practice, whether it is at building, neighbourhood or city level.

We started the report by questioning the relevance of the monitoring practice and presenting what arguments speak in its favour. We aimed at answering the question: why do we need to monitor energy related sustainable urban development projects at all? We then identified in that sense a two-fold benefit of the monitoring of a specific project, i.e. the derived evaluation ability of the concerning initiative on the one hand, and the value of the untapped know-how for the implementation of future projects and initiatives on the other hand. We then concluded that the expenses incurred during the monitoring process ought to be understood not only as costs, but also and mainly as an investment.

The presentation of the different monitoring targets was discussed on the following stage. Monitoring is not to be reduced to environmental or economic parameters (by how much did the electricity consumption and the CO_2 emissions decrease?), but also to social and institutional ones: how prepared and how well equipped is the monitoring team of a specific project? How effectively has the project been implemented? How much did the behaviour of consumers change as a consequence of the project implementation?

The advantages and challenges of the monitoring practice were further analysed taking into consideration the constraints ranging from technical, economic, political and institutional nature. Moreover, a special emphasis was placed on the role that data protection and privacy issues play in order to widespread monitoring and make it a reality. Finally, in order to accompany the theoretical analysis of the monitoring field, we aimed at identifying a set of best-practice examples across Annex 63 partner countries to

provide a good overview of initiatives with potential of replication, given a set of parameters such as available technology, budget and partner participation.

The presented work underlines the potential as well as the need of an adequate monitoring strategy for urban development planners, while it highlights the pre-condition of optimising used financial and human resources in the most effective way. As significant advances take place regarding the available technology to undertake an accurate monitoring process and the level of digitalisation in our economies increases, monitoring will gradually move from being an additional possible parameter to consider to finding its place at the base of any project.

A-7. Stakeholder Engagement & Involvement

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A-7.1. Introduction

The transition to low-carbon urban development from current practice requires a change in approach. Integrated energy planning and urban planning advances the change in urban form and associated policies so as to create opportunities for increased energy savings. It demands the broad engagement of both stakeholders (external and internal to the organisation) and the general public.

History is full of examples of planned development that has been stalled or derailed by "public opinion." At the same time the benefits of positive stakeholder involvement are clear. Engaging diverse and interested parties to integrate an energy and urban planning process may present an organisational challenge but nevertheless provides benefits that are essential to successful implementation (Burby, 2003).

While municipal government is in the business of providing quality services to the public, it often struggles with the challenge of designing participation processes that will meaningfully engage stakeholders in decision making (Bryson et al., 2012). Engaging stakeholders early and throughout a project's development has been shown to accelerate the uptake of any change by allowing local issues to be mutually addressed and societal benefits to be achieved when implementation occurs. Developing a workable strategy to integrate stakeholders within a project's development should therefore be seen as a fundamental part of the overall planning process.

A-7.2. Barriers

Existing practices however highlight a lack of communication and engagement between those responsible for urban form and those responsible for the generation and delivery of energy. Identifying and integrating the energy form most appropriate for an urban development challenges the status quo and leads to the need for increased understanding, sometimes technical and sometimes political, of the benefits associated with that change.

Stakeholder Engagement, addressing the needs of those affected by such change must be seen as a central part of the project itself rather than an information dissemination task. To facilitate the smooth project advancement key inputs are required from individuals and organizations impacted by proposed plans and projects. This involvement provides critical insight and expertise to advance decisions on the future form of our energy and urban systems.

Furthermore, as we shift our focus towards a more integrated energy and urban plan; greater collaboration and consensus will become an even higher priority as a means to accommodate the multitude of interests..

A-7.3. Stakeholders

The term “stakeholder” reflects a party who has a personal or professional stake in the outcome of a process. More importantly, their opinion impacts the form and shape of the project and should be taken into account by leaders, managers, and others involved in advancing plans and projects (Bryson, 2004). In the context of any effort to integrate energy into urban planning, stakeholders may not be aware of the conceptual purpose of the change, only its impacts.

As has been identified through the questionnaire responses of Annex 63 case communities, energy and urban planners are often separated by not only their disciplines, but also their organisations, and a historical division of responsibility. Their bias toward the status quo and a reliance on established methods challenge the new breed of energy and urban planners to become familiar with new terminology and analysis techniques, as well as to explore ways to cooperate on their shared interests to achieve mutual gain.

Beyond the cadre of energy and urban planners, other stakeholders including departments of the municipality, other orders of government, public and business interest groups and residents all have expectations for a low carbon community that vary depending on a number of factors, including but not limited to economic, social, environmental, political, and technical. Pursuing change within a working environment impacts the status quo, requiring decisions to be made by and with those at new and possibly multiple levels. For some stakeholders, particularly those that have established power or authority related to a planning process or project, the level of engagement is related directly to the level of potential impact involved. Engagement can ensure that multiple perspectives are considered and that the range of potential impacts is accounted for. Other stakeholders however, may have a lower level of expectation of engagement and more passive efforts to elicit feedback and provide periodic updates will be sufficient. In general, both advocates and opponents will likely

be active in engagement processes. It is important to ensure that both are able to actively engage and that the process supports consensus-building whenever possible.

A-7.4. Content

This section highlights several challenges to achieve sustainable design solutions by addressing the concerns of stakeholders using examples from Annex 63 participants. Each country's context (political system, legislation, planning and construction approaches) can be seen as influencing the design of the solutions.

A-7.5. Stakeholder Involvement

Why involve stakeholders? From a municipal perspective the involvement of stakeholders in planning and project decision-making processes is a corporate decision: while it may increase complexity, resource needs, and the project timeline it represents a commitment to the community to communicate, gather their feedback and insights, and where possible align the needs of stakeholders with the broader public and community interest. The benefits of effective stakeholder engagement are self-evident: better plans and projects, more support for implementation, higher levels of trust, and increased capacity to address future issues.

Stakeholder engagement has traditionally been within the purview of the municipality. Even so, some communities have considered stakeholder engagement as a finishing touch, informing the public of a finished product, hoping to avoid any risk of controversy. Strong support from a broad range of stakeholders, including the general public, is essential.

Involvement of stakeholders can serve a variety of purposes and can offer a range of benefits. (Bryson et al., 2012) *Designing Public Participation Processes* article articulates multiple potential purposes, including:

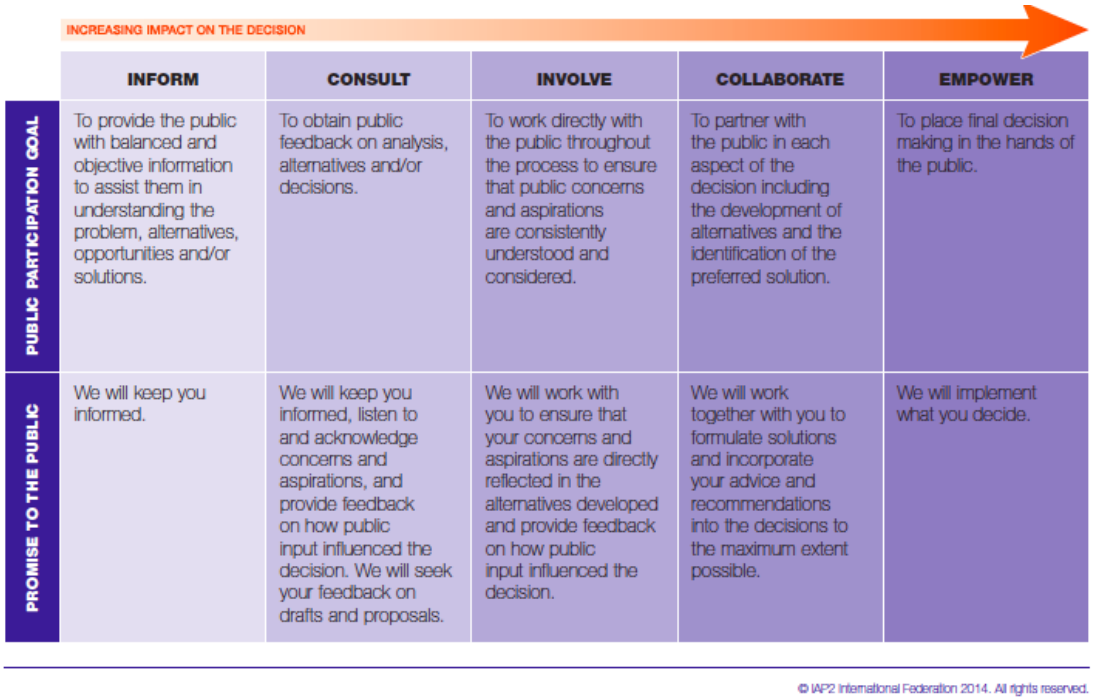
- Meeting legal requirements,
- Embodying the ideals of democratic participation and inclusion,
- Advancing social justice,
- Informing the public,
- Enhancing understanding of public problems, and exploring and generating potential solutions,
- Producing policies, plans, and projects of higher quality in terms of their content,
- Generating support for decisions and their implementation,

- Managing uncertainty, such as through building trust and improving the quality of information informing decisions, and
- Creating and sustaining adaptive capacity for ongoing problem solving and resilience.

With the exception of meeting legal requirements or compliance with existing municipal standards and established goals, private sector developers can often exempt themselves from the need to incorporate public or stakeholder consultation within their development process. Market response may be (a sometimes hard) substitute for stakeholder consultation. The avoidance of considering the needs and wants of the community may lead to great returns or to a less than stellar return on their investment and the potential for legal challenges. However, is this risk worth taking? Most would say no and making the development and implementation of stakeholder engagement strategies an appropriate requirement for any development that impacts the public's welfare.

A-7.5.1. Context

Stakeholder engagement can be employed to broaden input and alternatives to an otherwise, singular planning perspective. Stakeholder engagement is often characterized as being on a continuum, reflecting the need for different levels of engagement, higher and lower, that are associated with varied levels of impact on a decision. The International Association of Public Participation (IAP2) Public Participation Spectrum is among the best-known typologies of engagement, identifying a spectrum that specifies a continuum of participation goals and associated promises to the public ranging from *inform and consult* to higher levels of engagement including *involve, collaborate, and empower.*



INCREASING IMPACT ON THE DECISION

	INFORM	CONSULT	INVOLVE	COLLABORATE	EMPOWER
PUBLIC PARTICIPATION GOAL	To provide the public with balanced and objective information to assist them in understanding the problem, alternatives, opportunities and/or solutions.	To obtain public feedback on analysis, alternatives and/or decisions.	To work directly with the public throughout the process to ensure that public concerns and aspirations are consistently understood and considered.	To partner with the public in each aspect of the decision including the development of alternatives and the identification of the preferred solution.	To place final decision making in the hands of the public.
PROMISE TO THE PUBLIC	We will keep you informed.	We will keep you informed, listen to and acknowledge concerns and aspirations, and provide feedback on how public input influenced the decision. We will seek your feedback on drafts and proposals.	We will work with you to ensure that your concerns and aspirations are directly reflected in the alternatives developed and provide feedback on how public input influenced the decision.	We will work together with you to formulate solutions and incorporate your advice and recommendations into the decisions to the maximum extent possible.	We will implement what you decide.

Figure 29: Public Participation Spectrum (source: International Association for Public Participation Federation)

It is important to project developers to distinguish between participation and inclusion, especially at the higher levels of engagement on the spectrum. Participation is seen as increasing "public input oriented primarily to the content of programs and policies," while inclusion goes further in "continuously creating a community involved in coproducing process, policies, and programs for defining and addressing public issues." (Quick and Feldmann, 2011) Planners' capacity, stakeholder expectations, and resources available may be among the factors that determine the goal of public participation, as well as whether the engagement effort moves beyond participation toward inclusion and empowerment. Importantly, ascertaining who should be involved, when and what their input to the process might be, relates to their expectations. These expectations will vary widely yet are critical to the success of the planning or project decision-making effort.

An example of the need for process and structure in agreements has been demonstrated by the development of the Buiksloterham redevelopment project in Amsterdam. The initial request for public participation and input to the design continued beyond the scope and expectation of the City to include promotion and involvement. The expectation by public groups for compensation for their significant voluntary efforts led to some disappointment but demonstrated the need for structure and clear goal setting in future agreements between City Hall and public groups to clearly state what the expectations are of each player.

Stakeholder Engagement is a 2-way exchange of information with the aim of advancing knowledge. Effective engagement continues long after first discussions have been held and tacit agreement obtained. The engagement process is one that signifies a constant communication pathway between proponent and stakeholder to create an extended project team. The size and strength of this pathway constitutes the primary difference between success and compromised achievements. Stakeholder engagement typically involves a planned sequence of events and communications that creates a rapport between the proponent and the stakeholders.

For example, an initial one-on-one discussion with a senior management level leads to the support "in principle" for the concepts and a more broad-brush discussion at the working level. This would then be followed up with meetings or workshops to iron out any concerns and develop a longer term plan and a working consensus. Continued dialogue with the stakeholder would support the expectation that the stakeholder is a part of the process, providing input to the design and forming a link in the process

In this way, stakeholder engagement can be contrasted with public consultation, which amounts to a more arm's length interaction wherein input may be asked of the public to gauge their general interest and for monitoring purposes but not to a degree that will stop or alter the basic premise of the change.

Using stakeholder engagement for compliance with legislation or informing the public of a *fait accompli* is commonplace in municipal politics. It is straightforward and unilateral in nature and uses conventional media and factual wording to indicate what has changed. Most news media include sections for public announcements or through regular mailings. This is the level of consultation seen for many *Open Houses* associated with residential or other city owned projects: a series of posters and easels and a short narrative describing the proposed development. While the public are invited to comment on the proposed development it is clear that the concept has been finalised and limited change is possible.

A-7.5.2. Focus Groups

Expanding on this approach, engagement can also be used to take the public pulse on certain new issues. This may require a little more interaction and diplomacy than a traditional open house depending upon the proposed level of change. A heightened level of awareness must be created simply because of the intricacies and nuances of land-use planning or the legislative requirements of energy infrastructure assessment that may not be fully understood by those being asked to comment. Focus groups are useful therefore in determining the impact on certain stakeholder groups, generating feedback on the proposal, as well as building support for a public or private project. By including this additional information in the design they create a more informed discussion on the issue.

> *As an example, staff the focus groups for a redevelopment of a retail area one might create several separate groups: shop owners, consumers, bus travellers, etc. This would enable one to view the issue from different standpoints and hence position the opinions and ascertain possible points of contention and consensus. Larger, cross-sector meetings would follow with solutions at hand to address the issues raised during the focus groups. The information gathered benefits both the retail developer but also, through teaming with the municipality, for the development of a more effective transit system.*

Focus groups also offer excellent venues in which to identify, isolate and address contentious or uncertain issues that could later derail a project. Addressing these issues in a structured and more personalized environment amongst peers is by far more preferable than responding in a larger, less organised arena. A well run focus group can of-

ten reveal points of common interest among conflicting stakeholder perspectives, ultimately resolving concerns and building a base of support. The focus group approach allows concerns to be discussed proactively amongst peers in a transparent fashion, avoiding any perception of special solutions and secret deals being developed in private.

A-7.5.3. Timing

Further opportunity for stakeholder engagement is in securing stakeholder input to the design process itself. It is ironic that the need for public input is greatest when the availability of information is least. Compromise is required in the timing and sequencing of public engagement. Involving the public at the wrong time or the wrong people too early or too late can have a negative impact on any initiative. For example suggesting to the CEO of an energy company that City Hall is to amend the bylaws for energy delivery when no economic impact estimates have been made would likely produce a negative response (see Section A-7.6). It can be helpful to offer a basic, high level project outline is available (e.g. a promotional two-pager) that stakeholders may review and discuss before meeting to discuss further details (see Section A-7.7).

Just as timing of engagement is important and demands an understanding of the stakeholders' characteristics then so is the choice of who is asked and how. The selection can affect the overall outcome. This is especially so with the development of a champion for the initiative.

A-7.5.4. Stakeholder Selection

The question remains: who are these stakeholders who can help transform the community or project? Identifying and reaching out to the key stakeholders, including both individuals and organizations, is often a multi-level process. Besides their project-related involvement there are also non-project related activities aimed at bringing the groups together and increasing mutual trust so as to develop a common understanding of the different interests. For each level of activity it is necessary to identify and address key-persons in a focussed approach.

Conventional public participation techniques have involved a "request for public participation". Sometimes successful, this approach is better replaced by a more targeted approach.

1) First, define the impact that the change in energy delivery or technology is hoped to bring and hence describe the stakeholder group that will be affected

by that change. Sometimes no group or association is immediately evident and it becomes necessary to seek out individuals who are willing to participate on behalf of themselves or others.

2) Second, determine who in any group or association is most impacted by the change and/or has expertise or insight to offer a planning or project decision-making process. Without an intentional effort to identify and recruit stakeholders for participation, it is not uncommon to find engagement processes populated by those already comfortable and experienced with such processes – often termed “the usual suspects” and not the full range of those impacted by an issue or process. While it can be expeditious to engage just those who show up, doing so may not produce the best long-term results.
3) Third, in the case of industry associations, retail groups or similar organisation with a broad spectrum of membership. It is often difficult for those representing such a broad membership to directly address site specific issues and thus it may also be advisable to identify and include local representatives whose activities or locations are more directly related to the development project or technology and can provide the more specific input required of the group.

A-7.5.5. Socio-Economic selection

When the proposed change is one of a shift to a low carbon energy system and supply then the impact of that change might not be limited to a reduction in a carbon footprint. An evaluation of the socio-economic impact of key stakeholder interests might be required to assess the interactions between the many stakeholder activities and the community. Analysis of socio-economic and business impacts can help to highlight the benefits created through an energy upgrade of community housing, such as illustrated in Figure 30. In this case, while the residents received improved accommodations, the municipality received significantly greater benefit through the savings in associated community services.

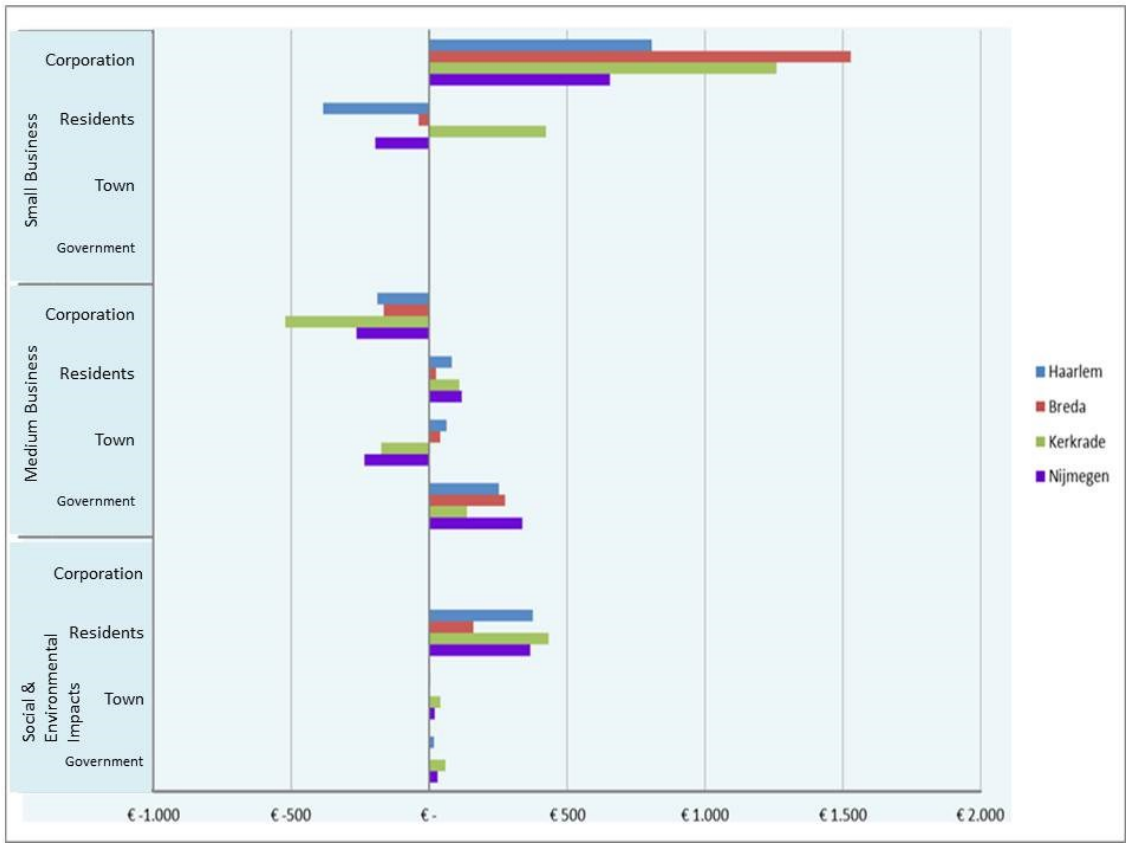


Figure 30: Comparison of socio-economic benefits for identification of stakeholders (Source: Kortman et al., 2016)

A-7.5.6. Power versus Interest

One general approach to stakeholder identification and analysis often promoted is the power versus interest grid shown in Figure 31. This stakeholder analysis tool accounts not only for stakeholders' level of interest, but also the power that they have to influence an issue, project, plan, etc.

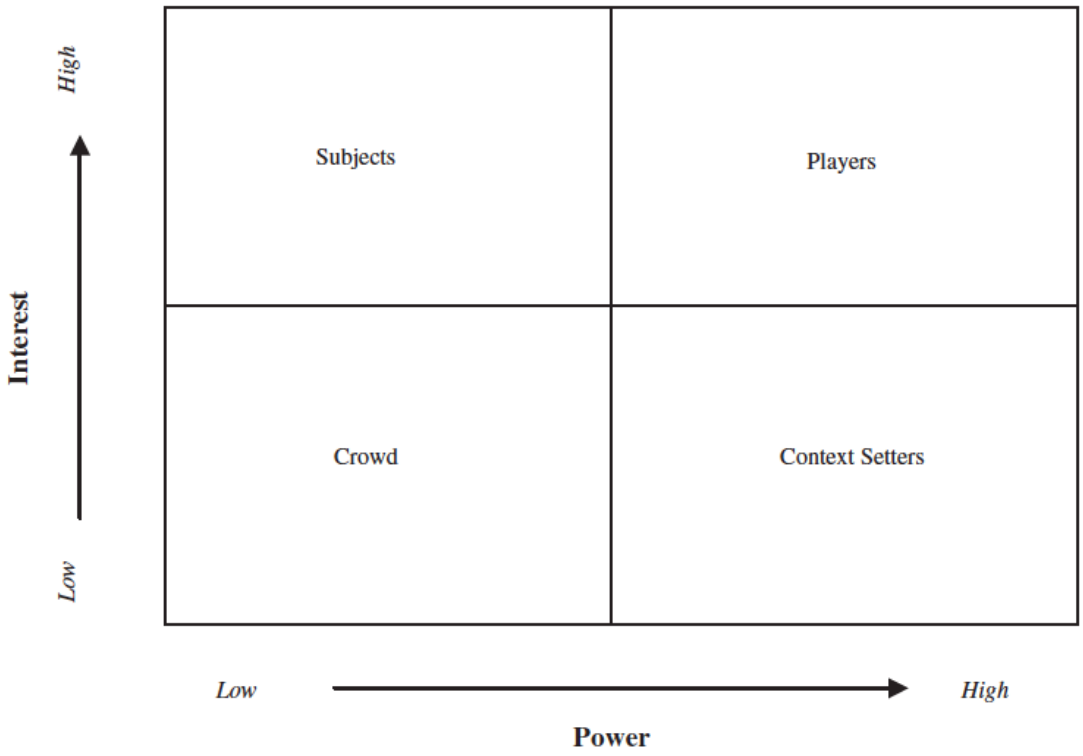


Figure 31: Power versus Interest Grid for Stakeholder Identification and Analysis (Source: Eden and Ackerman 1998)

Using this approach, organizers of an engagement process brainstorm names of stakeholders and then deliberate as to the quadrant of the power versus interest grid in which they are located. Lines can then be drawn among stakeholders to identify relationships among them. Based on the grid, it is then possible to understand lines of influence among stakeholders, with the intent of identifying the most influential and networked stakeholders. This kind of classification process can be helpful in targeting engagement efforts to particular types of stakeholders and understanding relationships among them.

A-7.5.7. Stakeholder Involvement

In other situations it is often difficult to persuade priority stakeholders to spend valuable time engaging in and providing input to a planning or project decision-making process. One approach, tailored to the intersection of energy and urban planning, is offered below and uses a tiered classification to rank stakeholders according to their involvement rather than availability.

A tiered approach, as illustrated in Figure 32, offers another way to identify and evaluate potential stakeholders. In this case, a brainstorming session was undertaken with

participants identifying the categories of stakeholders who would adopt specific roles in the project. For the case in question, the development of a city-wide community energy plan the roles were defined as: those directly affected or who would implement the change; those whose practices or activities are affected by the change and those who should be informed or who could learn from the plans implementation. Grouping them in sectors of the circle allows targeted communications and engagement strategies to be developed.

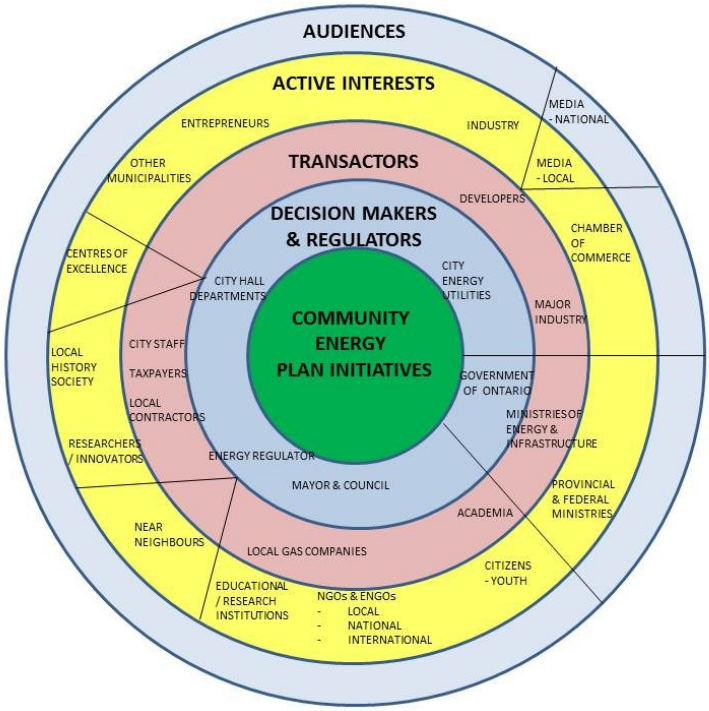


Figure 32: Stakeholder identification based on linkages (Source: City of Guelph Community Energy Plan: Strategic Plan and Critical Path, 2009)

A-7.5.8. Skill Set Selection

A third approach to stakeholder selection focuses on visualising key stakeholder groups, aligning their various skillsets pertinent to a project, rather than responsibilities. More of a bottom-up / people approach than the previous top-down / organisation approach, the technique allows the understanding of relevant tasks to guide the process organizer towards the appropriate organisations that should be invited for input. Figure 33 identifies such a list of potential skill sets.

All of the approaches discussed above are offered as structured methods to visualise the key stakeholders associated with a project. All three can be used in both public and private sector settings to help organize engagement processes.

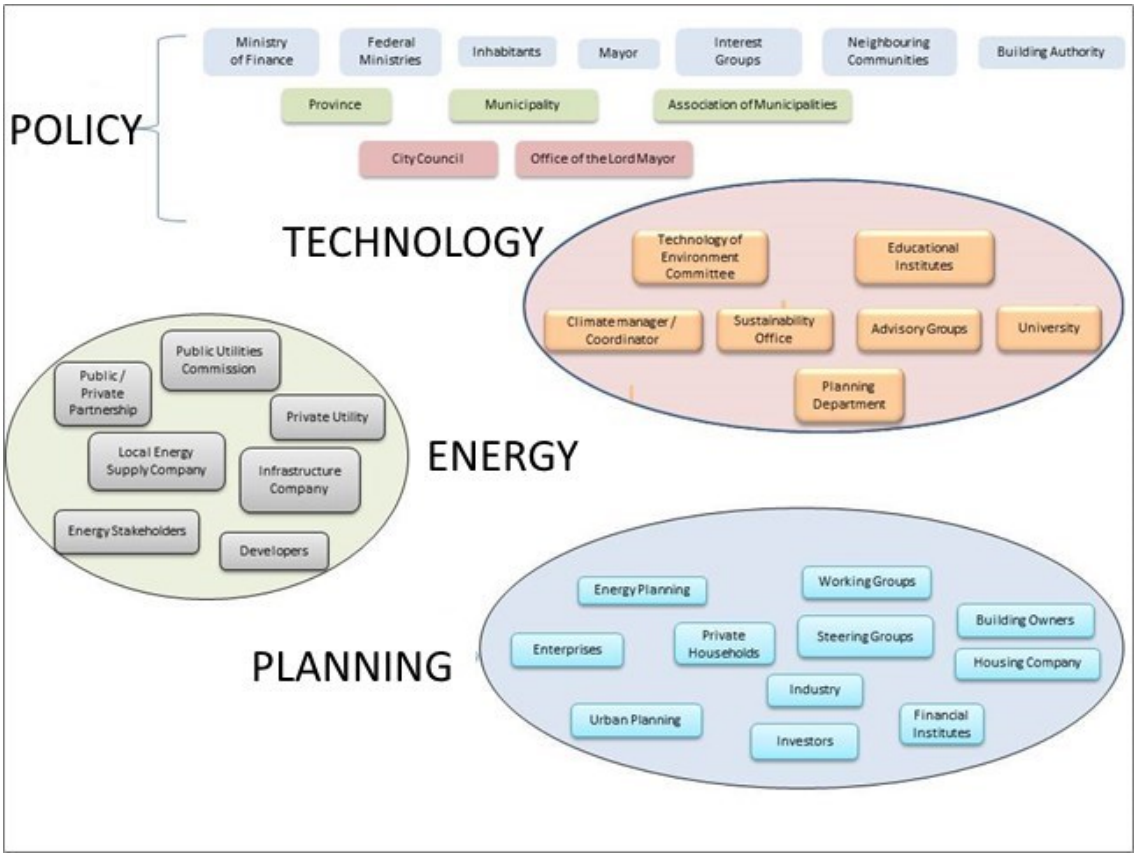


Figure 33: Stakeholder identification based on skill sets and roles. (Source: Personal Communications with Jacques Kimman, Lector Nieuwe Energie, Zuyd Hogeschool, Netherlands)

A-7.6. Champions

In addition to stakeholders, *Champions* play a central role in leading, convening, and contributing in multiple ways to planning and project decision making processes. Champions are traditionally thought of as public figures, but realistically they can be from the public or private sectors, as well as nongovernmental organisations. Typically, these leaders of change exist at several levels but chiefly at the technical and political levels. The technical champion understands the scientific or engineering implications and can address the change in terms of efficiency, speed, efficacy, cost, etc. The political champion on the other hand relates to someone who can facilitate change within the public arena; usually someone respected by his / her peers and who exhibits en-

thusiasm and belief in the task. Both technical and political champions can play central roles in determining what needs to be done, where and when, in order to get to a solution. Champions also play important roles in garnering stakeholder support, bringing expertise and important interests to the table.

A-7.6.1. Energy Manager

One approach to developing a technical champion at the municipal level is to employ or designate an energy manager. Typically, his or her role is to identify the opportunities for energy conservation within the community. Traditionally the energy provider or local utility would be responsible for developing and implementing energy efficiency programs such as for improved lighting, kitchen appliances, air conditioning units and possibly solar panels. In most cases, the scope of this work rarely extended to community initiatives. As connections between energy and urban planning are pursued, opportunities for more broadly integrated roles would be increased.

> *This approach was demonstrated in British Columbia, Canada where funding for the position of energy manager could be shared between the municipality and the provincial electricity utility. This allowed investigation to be made into larger, more dramatic initiatives at the community and neighbourhood-scales including the introduction of energy mapping, district energy, solar farms and others.*

A-7.6.2. Political Champions

Political Champions, as opposed to Technical Champions, are highly visible to stakeholders and the general public. The deployment of such a champion has been shown by many to represent a practical way to move a project forward since the role amounts to more than simply serving as a frontispiece; it also includes facilitating among stakeholders, encouraging potential participants to consider options and addressing alternative perspectives. Champions, who are not positioned to receive direct benefits from the initiative, are best positioned and are likely to be more successful.

Care should be taken however, in selecting champions from established or existing positions to prevent conflicts between the champion role and the current position's mandate. An example existed where the head of an electrical utility was requested to champion the implementation of a Community Energy Plan. His deep rooted in the electricity sector severely hampered the development of the plan and created significant public frustration.

With complex projects or initiatives that aim to bring together many different facets of a community it sometimes is more worthwhile to have several political / public / private / NGO sector champions, each one leading a specific area. In this case it is inevitably important to ensure that all champions share a similar or at least compatible understanding of what the end vision will be and how each will work together.

A-7.7. Stakeholder Triggers

Why would a stakeholder agree to participate? When asked, many will join if they see either a positive impact for themselves or the opportunity to avoid a negative one. The challenge therefore is to present to the stakeholder group the advantage, specific to them that the proposed change can bring. Highlighting the need for their particular expertise or perspective can also be helpful in some instances. However, a reluctance to become involved is not uncommon and may provide an additional challenge for the project champion to raise the level of interest to a point of involvement.

Looking back at Figure 29, as process organizers move from goals of informing and consulting to those of collaborating and empowering, tactics for encouraging stakeholders to participate and stay engaged, will vary. Different arguments will work with different stakeholders. Over the ages, inciting change (i.e. getting buy-in) has been possible through the use of age old triggers such as "cost savings" or "improved efficiency." Incentivise the required change and people would jump at the chance to participate. In today's environment that assumption is no longer true with direct incentives having only minimal effect. Similarly, social mores such as voluntary behaviour and public interest to gain or encourage engagement may work but not convince sufficient people to participate in a process. Understanding the range of "stakes" that stakeholders might have becomes increasingly important. For some, the motivation may be an organizational orientation to the issue that encourages staff to participate, for others there may be an opportunity for learning that advances an individual or organization's

work. In other cases, proximity to proposed project or a planning area may be motivation enough.

Somewhere central in the spectrum is the balance point, the combination of benefits that appeals to both better nature of the person or organisation yet provide the level of benefit needed, relative to effort expended.

Organizational structure can play a key role in creating a stake in a planning or project decision making process. Figure 33 was developed to identify the possible stakeholders according to their roles but it can also be used to identify the triggers of those organisations. Stakeholders such as those in the energy sector who are chiefly focused on effective technologies for energy delivery and customer satisfaction might include as their trigger points: equipment capital and operating cost savings, ease of maintenance and their corresponding costs, lifetime and depreciation, fuel availability and costs, access to customers, reliability, insurance, noise, etc. while stakeholders aligned more closely to the planning aspects might be triggers more by land-use / public issues such as: size, smell, noise & vibration, fuel supply routes and transportation, reliability & back-up, emissions and infrastructure. Other stakeholders whose interests might lie in policy might pay attention to issues of: public impact, taxation, billing structures, ownership, regulations and marketability. Identifying these issues would allow each party to be targeted for engagement with information tailored to their particular interests and in a language understandable to the particular sector.

As an example of the importance of a structured approach to stakeholder engagement is the new development under way in the centre of Ottawa, Canada. The Zibi project commands a premium position with "to die for" views of the Ottawa River and the cities of Ottawa and Gatineau. However, the property also lies on First Nations land that spans the Ottawa River which separates the provinces of Ontario and Quebec. Construction standards differ between provinces as are the energy delivery practices (the grids are not linked). Stakeholder discussions therefore involve, as a minimum: multiple departments of the Canadian federal government, the provincial governments of Ontario and Quebec, the National Capital Commission, the municipalities of Ottawa and Gatineau, electricity providers from Ontario and Quebec, Natural Gas providers from Ontario & Quebec, local industries, First Nations, building code and heritage experts from Ontario and Quebec and the general public. All discussions are bilingual and each party must be assured that their own issues will be met.

A-7.7.1. Stakeholder Engagement as Economic Development

The benefit of understanding stakeholder triggers can extend beyond simply seeking support for project development. A clearer understanding within the municipal government sector of the drivers within the industrial and commercial sectors within a community can be used to influence future growth patterns and plans of the community. By tailoring or emphasising, where appropriate, municipal plans to not only achieve community targets but also accommodate the needs and encourage partnerships with the various industry sectors can create economic development opportunities. In addition, closer partnership between the planning and the economic development arms of the municipality can increase a stakeholder's comfort level and effectively transition the investor from the role (Section A-7.5.1, Figure 29) of a bystander to that of an empowered partner in future activities.

The move towards a lower carbon community implies the use of many alternative and local energy supplies, a possible challenge for the traditional energy provider. The additional infrastructure and costs involved with a multi-energy sourced system, the additional monitoring, metering and management can increase the cost of the development, but at the same time provide opportunities for partnering with technology suppliers (e.g. fibre optics, internet based solutions). These opportunities are leading many developers to collaborate with technology partners, rather than undertaking the entire project in-house.

A-7.7.2. Stakeholder Inter-relationships

Not only do stakeholders respond to triggers from the proposed initiative or project, they also respond to the behaviour and response of other stakeholders and groups. These inter-relationships may be difficult to recognise but should nevertheless be assessed. Inter-relationships between stakeholders reflect the integrated nature of municipal issues and the wide range of interests involved. Sometimes legislation precludes shared activities, such joint ownership of certain technologies or shared ownership of property, especially where liability is not clearly defined.

Figure 34 (Canadian Urban Institute, 2010) illustrates the interconnections between development projects proposed for the City of Hamilton, Canada. Developed through a brain-storming approach with local expertise, it can be seen that the interconnections range from the transfer of information (1-way), a discussion (2-way) through to a group debate (4-way). Awareness as to these patterns may lessen or increase the range of stakeholders that may be needed within the engagement process.

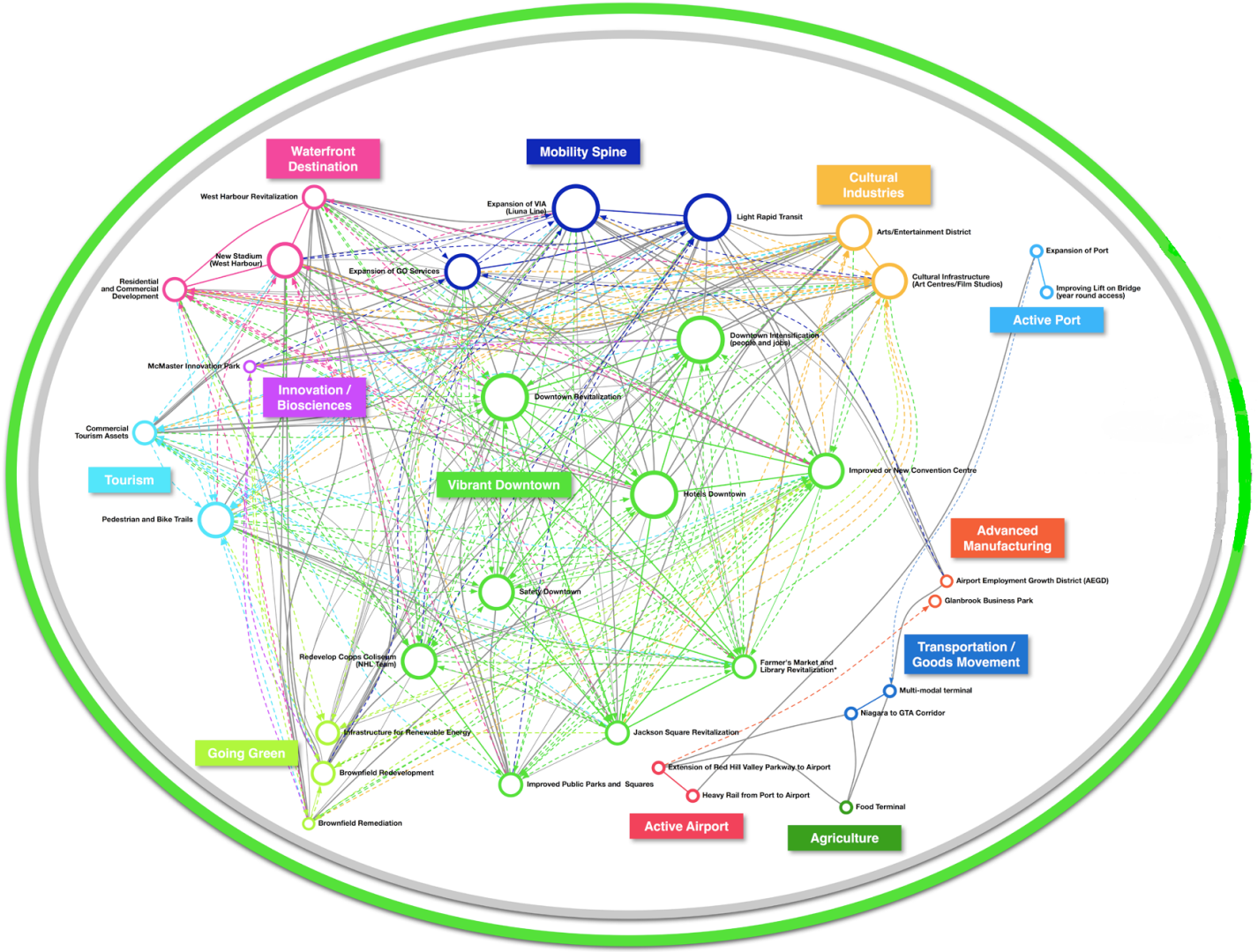


Figure 34: The typical interconnection pathways for multiple infrastructure projects. (Source: Building Momentum – Made in Hamilton Infrastructure Solutions. Canadian Urban Institute, 2010)

Consensus building, especially when accounting for stakeholders' interests and interrelationships, is an art in itself in that it requires the balancing of priorities and the sharing of information. Identifying the stakeholders and their individual triggers must be examined against the potential for competing interests between stakeholder groups. Through deliberation among stakeholders, potentially facilitated by a convener representing the planning or project decision making process, it is possible to move toward consensus – accounting for individual expectations, but working toward shared power, shared interests, and toward a commonly shared vision (Innes and Booher, 1999).

Understanding the linkages between stakeholder groups will likely increase the cooperation between similar or compatible groups simply through a better understanding of their interests and needs. This understanding of stakeholder linkages also has associated benefits for the planning organization or other discussion convener, especially when the development of cost sharing or voluntary initiatives is a priority. Examples range from the local development of community energy from organic waste through to the national plans for eco-industrial parks.

A relevant example comes from the Minneapolis, Minnesota, in the U.S., from the development of its Building Disclosure Policy. The policy requires annual reporting of energy use for medium – large multifamily residential, office, and commercial buildings. Support for the policy emerged through discussions conducted as part of a broader collaborative planning effort around green jobs conducted with a wide range of public sector, industry, manufacturing, real estate, and other stakeholders. A Green Building Subcommittee of this group played a role in identifying the Building Disclosure Policy as a relevant strategy to address building energy use, identifying this strategy as important in moving toward broader goals established by the group. Minneapolis ultimately drafted a policy that would apply to certain buildings in the City. Anticipating concerns about cost, privacy, and other impacts of collecting and reporting this data among affected building owners and managers, City staff conducted significant one-to-one outreach to business and office properties, as well as coordinated with the local chapter of the building owners and managers association.

A-7.8. Approaches, Considerations & Timing

It is generally accepted that getting stakeholders on board early in a process offers the greatest opportunities for success: people have more time to understand the issues, feel part of the decision-making process and are more likely to contribute fully to the activity. This early engagement can also eliminate confusion that typically arises when joining later in the process. As summarized by Bryson et al. (2014), engagement pro-

cesses that aspire to move beyond just meeting legal mandate toward participatory democracy and participant learning, must have the following features:

- Greater inclusivity that engages diversity, addresses conflict, and accounts for power differences,
- Concerted efforts to engaged those typically excluded from participatory processes due to institutional inequities, and
- Participants that go beyond the “usual suspects” who can be easily recruited and are comfortable in public processes.

Stakeholder identification can help to identify relevant interests and proactive attention to barriers to engagement can help in working toward more comprehensive involvement.

A-7.8.1. Format

Stakeholders may be physically uncomfortable in a public discussion due to a variety of reasons: unequal power such as when a shop floor worker is uncomfortable discussing work related issues in the presence of his CEO, or with public speaking nerves due to a lack of confidence, etc. but they still have valuable understanding of the local issues pertaining to either the planning or energy infrastructure fields. Several opportunities exist to access this information.

- Facilitating meetings using measures that provide equal opportunity for input and eliminate the marginalisation of less powerful interests.
- Creating subgroups of similar stakeholder interests (e.g. subgroups of retail associations or realty developers to provide specialised input) removes status inequalities and allows participants to speak more openly and focus specifically on their areas of expertise.
- Allowing written submissions or one-on-one sessions, before or after the discussions to provide more detailed or technical input.

Conflicting opinions may (or should) arise when procedural changes are under discussion, such as in cases of alternative energy delivery and building access. Facilitation, offering moderation and support of the discussion, can help reveal these differing perspectives earlier in the process and build trust through open discussion rather than creating the possible appearance of special arrangements between individual stakeholders.

A-7.8.2. Timing

Stakeholder involvement in the discussion arena can result in significantly varied impacts depending on the timing of outreach and engagement efforts. In general, the

mantra of engaging “early and often” applies. Early and often ensures some clarity about the purpose and goals of a planning or project decision-making process has been developed. Continuous vetting of the purpose and goals with stakeholders can enhance the buy-in and public support. Examples abound of projects that have failed because key stakeholders were introduced late into the process, felt insulted that their status and input was ignored and proceeded to undermine the project.

A Canadian electricity supply company had progressed as far as completing a feasibility study for a district energy system before consulting with the city planning department. As it happens the planning department also had plans for redeveloping the vicinity which did not include a district energy system. The energy supplier had wasted significant money simply because they did not feel the planners needed to know.

A similar issue emerged in a climate action planning process in Minneapolis, Minnesota, in the U.S. At the outset of the process, three technical committees were organized around buildings, transportation, and waste and recycling. An over-arching steering committee was also convened. A few months into the planning process, it became clear that environmental justice interests were very interested in the planning effort and that they felt excluded because of the issue-oriented structure of the workgroups. Proactive engagement of these groups and elevation of this issue to working group status may have avoided these concerns. In lieu of this early engagement, the creation of an environmental justice working group midway through the planning process provided a platform for engaging a variety of environmental justice interests and groups and ensured that this issue was well-represented in the final plan.

Stakeholder analysis processes, such as those discussed earlier, are helpful in identifying potential technical and political implications of integrated urban and energy plans and projects on stakeholders. Political champions, also discussed earlier, can also be critical in assessing potential political implications for stakeholder, thus creating and potentially smoothing pathways for engagement. The development and introduction of the political champion must therefore be considered at an early stage of the initiative. The champion should an integral part of the project team so as to understand the implications of the project and the involvement of the potential stakeholders. His, or her, role is to use this information to generate the confidence that the stakeholders seek, to facilitate meetings and to provide direction at the political level.

A-7.9. Stakeholder Input

Within the structure of the Public Engagement Spectrum described earlier, the involvement of stakeholders in planning and project decision making processes can be seen to vary significantly. Stakeholders offer critical expertise, both technical and based on their knowledge of the community, as well as a broad range of skills and experience. Process organizers must balance the demand for their time in their interaction with the stakeholders, with the limitations of stakeholders' own schedules. Too frequent meetings may prove too onerous, drive away supporters and result in a substandard attendance profile.

The creation of stakeholder committees, such as an advisory, technical or steering committees, is of great advantage when developing complex integrated urban and energy plans, such as community energy plans and climate action plans, as well as community scale projects. While they do require the engagement of more stakeholders (rather than the "usual group of suspects") committees nevertheless serve as critical sounding-boards for planning and project decision making processes, providing direct and current input that will reduce the review process at a later date. Committees often benefit from multiple interests and a range of expertise represented among stakeholders, all of which can result in higher quality outcomes.

In Ontario, Canada the stakeholder review process is used in communities to assist in developing emission targets through its knowledge of the local design and construction industry and the capacity of the community to absorb the change. In Ottawa the development of a 100% Renewable Energy Transition Plan utilised a series of 7 different resource committees to examine: Vision, Municipal Energy Plan Funding Application, Communication and Engagement, Buildings, Transportation, Energy Supply, Research and Funding

In Minneapolis, Minnesota, a steering committee was used during the preparation of the City's first climate action plan. In addition to issue-specific technical committees described earlier, an over-arching steering committee was convened. It included representatives from each of the technical committees, as well key stakeholders such as state energy agency staff and local elected officials. The steering committee provided technical knowledge, but also critical political support and buy-in. The steering committee was tasked with reviewing technical committee work, reviewing plan drafts, and offering a final recommendation for approval prior to review by the elected City Council.

Partnership, which yielded a unique city – utility partnership that facilitates joint goal setting around energy and climate impacts, along with implementation of actions by the utility and the city around energy production and consumption. In this case, the Partnership was facilitated primarily via direct negotiation between the city and the private utility. However, a standing advisory committee – the Community Environmental Advisory Commission, played an important role in supporting the negotiations and the final partnership agreement. As an existing convened group of environmental interests, the membership of which is approved by the City Council, the group was a key source of support that could be tapped to move the Partnership forward.

The process of gaining support and input from the local community and the key stakeholders is seen to parallel the engineering development. The stakeholders can provide input to influence the progression of the design. As such there exist milestones for public input just as there are milestones for engineering decisions. Figure 35 illustrates the stages and possible responsibilities of the engagement process.

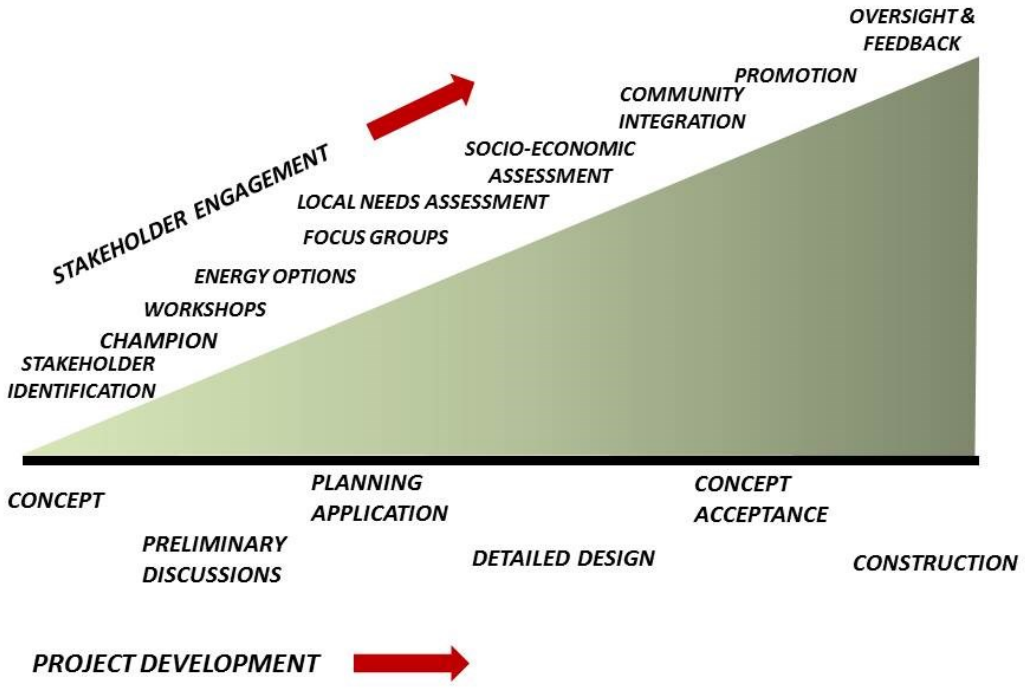


Figure 35: Temporal Stakeholder Engagement (Source: Ken Church, Natural Resources Canada)

A-7.10. Transferability / Recommendations

It is inevitable that planning styles and approaches will vary across the world. This in some measure demonstrates the need for this Annex. As the inherently diverse interests in energy and urban planning converge, dialogue and communication is essential. Research, as well as evidence from a variety of planning processes in various countries, demonstrates that seeking and sustaining stakeholder engagement ensures higher levels of support for planning outcomes and better plans and projects. This report offers a basic set of principles for stakeholder engagement. At the same time, by highlighting cases from numerous country specific processes for planning and project development, the report emphasizes the need for a context-informed approach. A basic set of recommendations for engaging stakeholders is provided.

However, the need for communication among the many players remains fundamental to each approach and has demonstrated itself as key to a smoother transition. From the research completed here it is possible to spell out an engagement pathway that planners of all stripes could apply to their projects.

1 Identify the lead person / organisation for the plan or project initiative – who is responsible and under what authority does that lead person operate? Is there a similar role in the energy delivery sector? Is there a critical technical or political champion that should be engaged?
2 What are the driving principles and goals of the plan or project in terms of energy / emission related benefits for the community?
3 What stakeholders share the project territory, have related expertise, have interests, and/or have power that can influence the outcomes of the project or plan?
4 What impact could the project bring to each of the stakeholder groups and where are the contact points?
5 In what ways can stakeholders and the public contribute expertise, knowledge of the local context, and resources that can help to enhance the plan or project?
6 What role will the stakeholders play in your project; what are the possible ways to interact with them and when should that interaction begin?
7 How and when should ongoing interactions and results be documented and shared?

These basic steps are generalized to apply across multiple country, governmental, and planning authority contexts. The steps help to identify to critical questions than can help planners design and facilitate stakeholder engagement processes that maximize the potential for positive outcomes for all involved.

A-8. Include Socio Economic Criteria

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A-8.1. Introduction

The need to transition to low-carbon urban development stems from an increasing desire to reduce a community's carbon footprint and the impact that fossil fuel has on the environment. After millennia of society that has been organised and constructed around the use and combustion of carbon, the transition will undoubtedly present significant challenges.

From the consumer's perspective, the transition challenge represents a change in value systems from one which priced development at its lowest cost to one that is more holistic and identifies a product's value by its impact on the environment. Holism in economics is a complex issue that allows comparisons to be made between options based upon the true value of each.

Investments in energy efficiency can provide many different benefits to many different stakeholders which are often overlooked. The challenge is to build knowledge and understanding of the nature and scope of these benefits of energy efficiency, and to provide practical guidance on how to apply policy development, business and assessment tools to account for these impacts. Since multiple stakeholders have the potential to experience multiple benefits, a stronger business case that engages public and private interests can be created. The combination of theory and practice will help policy makers and other stakeholders integrate multiple benefits into strategic planning in order to maximise the potential for positive outcomes.

Determining the true value of an activity necessitates an understanding its interaction with its external environment, but once that impact or externality is understood, it can be presented for comparison to the decision maker.

A-8.2. Barriers

Existing Energy efficiency is recognised as a key resource for combatting climate change. The reduction of energy demand and the use of renewable energy is expected to provide significant opportunities for public and private industries alike to move towards a low carbon environment. While the opportunities for being energy efficient with one's personal space are well known there is often difficulty in justifying the price

premium that represents the external costs and benefits of making those changes based solely upon the cost of the energy saved. There is a need to understand the real value of energy and not simply the cost of production so as to allow comparison and justification for change.

The International Energy Agency, in its report *Capturing the Multiple Benefits of Energy Efficiency (IEA, 2014)* used the term “multiple benefits” to describe the externalities and conditions where investment of time and resources related to energy efficiency actions can create improvements for the community. Figure 36 below illustrates many of the multiple benefits and monetising these multiple benefits allow the use of terminology familiar to economic analyses to describe these benefits:

- Direct benefits- as the name implies, the impact measured as a direct result of the change – e.g. switching from oil to natural gas will yield a direct reduction in greenhouse gas emissions.
- Indirect benefits - those that result from the change in process – e.g. in the above example indirect benefits would result from the need for new equipment.
- Induced benefits - those related to the recirculation of indirect impacts – e.g. the additional benefits in the retail sector brought about through the spending of employee wages.

The inclusion of these benefits creates the true impact or value of an action and can significantly affect any comparison process. However, the techniques for monetisation of these benefits; from Direct to Induced, is progressively more complex and therefore increasing in uncertainty. An evaluation of the cost of carbon dioxide emissions for example revealed a range of values from $5 per tonne to several thousand dollars per tonne (Church, 2017). Creating consistency in the use of monetisation approaches is the subject of ongoing research.

This report, as part of the IEA-EBC-Annex 63 *Implementation of Energy Strategies in Communities* will attempt to provide insight into the benefits, some of the techniques and the impact on a decision making process.

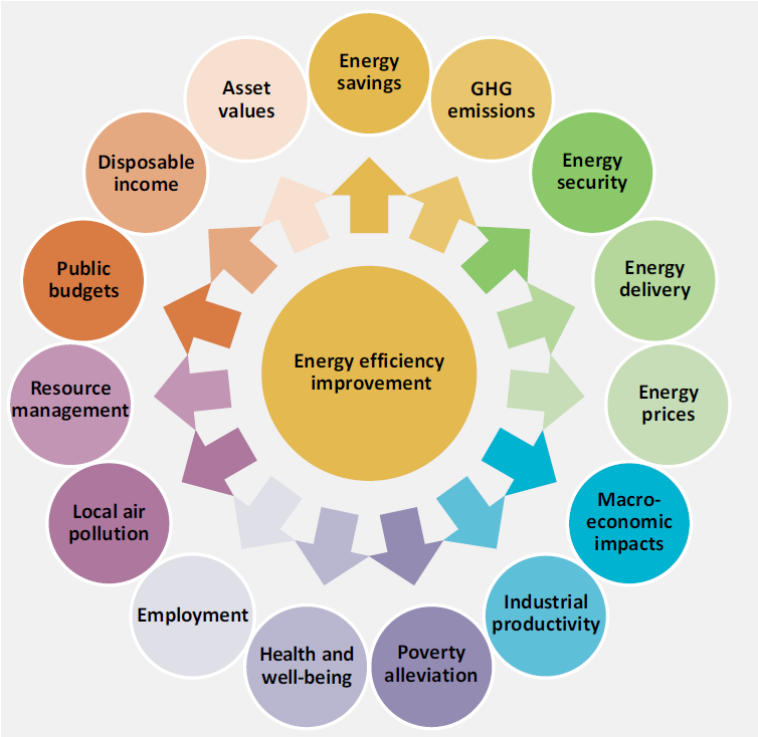


Figure 36: Typical benefits accruing from energy efficiency (Source: IEA, 2014)

A-8.3. Stakeholders

The Stern Review on the Economics of Climate Change highlighted the cost of transitioning to a low carbon future (Stern, 2006). It also highlighted the cost of not making this change. These two types of social costs are often included within discussions of change: the cost to change and the cost not to change. It is often thought that there is always a cost to change but not to maintain the status quo. This reflects the lack of inclusiveness consistent with current financial thinking. What is forgotten (or ignored) is that the additional cost to change may be offset by the value of the benefits created by that change (avoided costs).

With the varied range of benefits then so too there is a varied range of stakeholders. Each has a specific interest and specific priorities that defines their value system. For example, the benefit of cleaner air has little financial value to the energy supply sector but may be of high value to the health sector. Each benefit is therefore monetised from the perspective of the recipient. Since multiple stakeholders will benefit from the multiple benefits, we are effectively creating a public-private business case and accordingly, a different approach to the project.

Identifying the stakeholders could utilise any of the techniques described in section A-7. Once identified, an understanding of the task that the stakeholder performs is required in order to determine the scale of the stakeholders' activities that might be impacted by the proposed change. This discussion could likely be through a series of focus groups or one-on-one discussions with the individual stakeholders to allow them to contribute their understanding of the impact and benefits.

A research project in Alberta, Canada focused on the thermal energy rejected from industries within the oil producing sector near to Edmonton. This sector is highly competitive and traditionally unwilling to share corporate information. A protocol was arranged between the companies to allow them to provide information regarding energy use within the production facilities. The results of the survey of 17 major petro-chemical industries surprised the companies and allowed some of them to enter into discussions on reciprocal energy arrangements.

The advantages for municipalities of including some degree of environmental impact in their valuation of energy efficiency measures extend further than direct benefits alone. While most industries have interest in their own local environment, municipalities employ a more integrative and holistic approach to managing entire communities. They need to address important issues of the future such as sustainable energy supply and mobility or quality of life have an interest in the benefits of the future (e.g. in times of higher energy prices). The communities with energy supply costs that are independent from market conditions will be more competitive. The value of and the ability to rent or sell energy-efficient real estate objects will increase in times of high energy prices. In addition to conventional energy efficiency measures, many organisations are already seeing advantages in accessibility, advanced and affordable mobility infrastructure and are starting to use energy efficiency as a lever to attract skilled employees to the area. Energy efficiency and personal mobility options are seen as benefits that will support preparations for a green future. Urban authorities that use the co-benefits of energy efficiency to liberate their communities from the constraints of relying on fossil fuels will label their community as progressive and smart, thereby creating a valuable advantage over other cities.

Usually such extensive transitions need long lead times as new governance models are created to support a radical change from non-continuous, project-oriented and short-term solutions. Thus fundamental changes in the structure, culture and practices of a system are needed. Starting early means that municipalities will be well-prepared for future challenges. Nevertheless municipalities must remain aware of the lengthy time delay between the implementation of measures and their financial pay-off.

From the different frontrunner projects around the world we can learn that achieving energy efficiency will be more successful if it can be linked to other key-issues. Realizing this, energy efficient cities have a positive impact on three subjects:

- Economics
- Social issues
- Environment

For example, improving the insulation of existing building stock will provide jobs for contractors, in industry, in transportation etc. Also the property will increase in value, which is a benefit to the end-user, and tax-income will increase in the end, which will be beneficial to the government (municipalities). By making new products locally, a more stable economic situation in a region might be realized. These are all “spin off” effects

which are usually not taken into account when making a business case for an energy efficient urban development.

A-8.4. Methodology

We analysed the approaches in several IEA-countries and provided an inventory of cases where co-benefits were included in the business case.

The benefits are identified in the fields of economic impact, social impact and environmental impact. With respect to the implementation process, we recognised four steps:

1. Inventory possible co-benefits
2. Value and monetise the co-benefits and broaden the business-case
3. Involve stakeholders, including the inhabitants, in the selection of the co-benefits for a specific district
4. Ensure commitment of relevant stakeholders and investors to the broad business-case, including the added values of the co-benefits.

A-8.5. Economic Benefits

A-8.5.1. Stability in energy costs

The structure of the business model employed by most energy suppliers fails to include many of the externalities of energy production exposing the customer directly to the volatility of the energy marketplace. As noted earlier, a homeowner's attempt to address this issue through energy efficient measures (e.g. energy efficient building stock and production of local renewable energy) faces the law of diminishing returns. Only through recognition of the complete production – delivery – consumption process will it be possible to recognise the value of energy efficiency and the positive impact of a transition to renewable energy supply.

> *The City of Revelstoke in British Columbia, Canada suffered from poor air quality due to particulate emissions from the uncontrolled combustion of wood waste from the sawmill located in the downtown core. The development of a district energy system that used the sawdust as a fuel provided employment, heating and a cleaner environment for the area.*

Macroeconomic analyses of energy efficiency to identify Gross Domestic Product (GDP), employment levels, trade balances and energy prices invariably restrict themselves to direct and indirect benefits with the indirect benefits being developed based upon statistical data on industry sectors for the area. The International Energy Agency (IEA, 2014) suggests that GDP improvements following large scale energy efficiency policies could achieve a GDP increase between 0.25% and 1.1% per year.

Similar research in Canada (Natural Sources Canada, 2015) identified for the application of district heating suggested that the capital premium for installing an alternative energy network was recouped throughout the 25 year analysis period. This is equivalent to suggesting that a transition to a lower carbon thermal energy network would be self-funding from the perspective of the benefits to the community.

A key factor highlighted in the Canadian research was the power of local procurement. The ability to broaden the business case either at a national level using financial instruments such as Cap & Trade or where an attempt is made to encourage local industry can have a direct impact on the economic benefits. Using pollution as an economic stimulus within the marketplace as a means of generating investment improves the general situation. This has been tried in Europe and is now being considered within North America communities.

For society to operate in a sustainable condition then economic stability must also exist for the energy supplier. A transition from a fossil environment to a low carbon or low energy situation will impact significantly the ability for the energy supplier to function. A reduction in energy consumption, while financially beneficial to the consumer can provide additional costs to the supplier in the form of part load operation and stranded assets. Likewise for the case of user installed renewable energy sources. If not included within a local Renewable Energy Strategy or other coordinating plan then these installations can force the energy provider to invest in energy storage or expensive stand-by generation to compensate of the intermittent nature of the energy source.

In these situations and when the ability of an energy provider to operate is related directly to the sale of energy to the customer then the introduction of unplanned renewable energy systems, deep energy retrofits policies, passive housing or the development of net zero communities will be seen as a threat to the energy providers. A new approach to the energy supply industry is required, one that does not rely upon direct sales but rather includes the provision of services and other revenue generating mechanisms such as equity partnership in alternative generation and distribution techniques. It is becoming more common for energy supplier to provide packages of services: power, heating, cooling, water and telecommunications. All require access to the public rights of way and all require access to the house or building.

> *In response to rising energy prices for industries in Toronto, Canada it became more common for industries to install small Combined Heat and Power (CHP) units as a demand side response unit. Toronto Hydro realised an increasing reduction in power demand and in an attempt to recoup their costs reassessed the rate structure so to reduce the price of electricity to the customer but increase the capacity charge.*

The use of taxation instruments to address socio-economic benefits in the general accounting process took the form of a carbon tax. Setting a price on carbon emissions provided an additional criterion for decision making and has gone some way to

influencing public behaviour. However, the division between state tax and regional taxes is also important. As shown in Canadian research (Natural Sources Canada, 2015) one third of the tax generated on a DSM based combined heat and power was derived from local efforts (salaries, local procurement) yet this tax would be collected at the provincial level. This is not unique to Canada where the tax benefits of regional initiatives flow to senior government, while the policy is to decentralise the responsibilities. The tax instruments are often not in step with the policies and municipalities must evaluate their ability to generate their own revenue streams through local means such as Local Improvement Taxes.

A-8.5.2. Green jobs

The shift to a green economy through the transition to a low carbon community will generate an increase in the environmental services sector. The IEA (IEA, 2014) suggests that this increase in jobs could be as much as 27 full time jobs per year for each million Euro invested. This is already supported by the Architects' Council of Europe (ACE) who concluded that in a recent research: “Refurbishment (of buildings) is therefore part of the solution and, according to the report released by Renovate Europe, a deep renovation in two stages of all types of European buildings would result in 71% energy savings across Europe by 2050 and create 800,000 clean energy jobs”. This shift to greater energy efficiency will also create new industry sectors that cross traditional boundaries.

> *In response to energy efficiency legislation in the Province of British Columbia, Canada the provincial electricity supplier and a department of the provincial government funded Energy Managers in municipalities across the province. These new positions were embedded within the municipal government and liaised with the public and local energy suppliers to facilitate the introduction of energy efficiency projects at the community level.*
>
> *In the City of Parkstad (250.000 inhabitants), in the Netherlands an 'ambition document' PALET (Parkstad Limburg Energy Transition (Parkstad, 2014)) has been developed by the University of Wageningen and the South University. The ambition paper shows that it is spatially realistic for the region to achieve energy neutrality in 2040. In Parkstad about 500 to 550 million euros per annum is spent on energy, currently 98% of this amount flows out of the region. Of this amount, 200 million euros are spent by households alone. A considerable portion could be kept in the region if one focusses on energy reduction and renewable energy generation. Above all, the ambition paper shows that the transition towards a renewable energy system benefits the regional economy, businesses, and the wallets of the inhabitants Palet provides a scientific basis for all technical and spatial aspects that facilitate the transition to a renewable energy-neutral region by the year 2040. It began as an exploratory study and has developed into a vision document with a translation of local execution plans into the*

implementation of the PALET 3.0 roadmap. As a co-benefit it was calculated that for the production of 20 PJ of renewable energy 2200 fte of jobs are involved, based on figures by the Dutch Central Office of Statistics (CBS).

A-8.6. Social benefits

When a district in a city is made more energy efficient by a large-scale renovation, the benefits can extend to address social problems that exist within that neighborhood.

A sustainable renovation can restyle the neighborhood, increasing the value of the houses and creating a more secure atmosphere. The Regent Park social housing complex in Toronto, Canada was constructed in the mid-20th century in the era of concrete high rise development. The development became a low income ghetto, rife with drugs and illegal activities. Neglected for many years, it created many social problems and was unattractive for the city. A major redevelopment involving the community in its design undertook a deep green energy renovation. The finished product has created stability in that part of the city.

The cost of energy for households is still increasing on the averaged and will increase even more on the long run (lower stocks and increasing demands). As a result of energy efficient measures (e.g. energy efficient building stock and production of local renewable energy) people have a smaller energy bills, and recognize that their energy costs are not determined entirely by the fluctuating oil prices worldwide; they are more stable for a longer period. There will also be fewer problems with people who cannot afford to pay their rent or mortgage because of these volatile energy costs. Especially housing companies show large interest in including those benefits in energy efficient renovation schemes because otherwise they will lose customers on the long term.

By improving the indoor air quality and other factors, people will be subject to fewer health problems; medical visits and need less medication. This has a positive reflection on the health care system and saves money in the end. Also the residents don't have to call in sick for work that often, which saves money for their employer and the insurance companies. This is substantiated by the World Green Building Council who evaluated the impact of "green construction". The advanced construction techniques improved indoor air quality and consequently workplace productivity. This increase in staff productivity far outweighed the additional premium paid for the "green" building.

Monetising health and climate benefits is possible through a variety of methods although a definitive value for change is often difficult to obtain. Three key approaches exist to monetise the impact of pollutants:

- Cost to correct the problem (post-pollution) – determining the cost to correct the impact of the pollution in the environment and population. This approach is site and environment specific and requires an understanding of the starting and

finishing points to define complete elimination of the problems. It is a detailed analysis and depending on the scope of the analysis can result in extremely high apparent costs.

- Cost to correct the technology (pre-pollution) – a case by case approach that identifies end-of-pipe technologies that will eliminate the referenced pollutants from specific producer technologies. Depending on the producer technology the cost of elimination will differ from region to region. With this approach however, the cost is directly attributable to the technology and can be added directly to the delivery cost.

- Willingness to pay – the simplest and least useful approach. Unfortunately, it is the most common approach and involves focus meetings and public input to define a cost premium that is most acceptable to the public. The cost premium contains little or no reference to the pollutants or the impact but simply the willingness for the consumer to help pay for the clean-up.

Legislation at the national and local level can also be used to encourage the inclusion of social and public issues within decision making. Examples of this might be the requirement for Environmental Assessments on publicly funded projects or for those with significant impact on public spaces.

A-8.6.1. Environmental benefits

By improving the energy efficiency of a city also other aspects can simultaneously be addressed, possibly saving costs by taking all measures at once. Examples of these aspects are land use, nature conservation, treating waste water etc. Also climate adaptation is an important issue. Energy efficiency itself obviously helps the environment. Taking this a step further it will for example help reducing the air pollution from transportation. Renewable energy can help the environment also in unexpected ways. Research turned out that, on the contrary to what was expected, off-shore wind farms are a safe harbor to fish and other marine life.

A-8.7. Tools and Approaches

A-8.7.1. Canada

Research work undertaken by Natural Resources Canada (Natural Resources Canada, 2012) in 2012 as part of the project addressed the relationship between stakeholders and externalities and the use of graphical indicators to express the social and economic change created. Many municipalities use indicators on a periodic basis to allow change to be recognised and compared against a predetermine target. An example of this might be the use of annual reviews of infrastructure investments to better understand their value in relation to their impact on the community. The

appraisal process identifies the changes in community value and links them directly to the incremental (annual) infrastructure investment.

To quantify the indicators identified within the report highlighted the work undertaken by the United Nations, specifically *The Economics of Ecosystems and Biodiversity* (TEEB). TEEB is a global initiative focused on "making nature's values visible". Its principal objective is to mainstream the values of biodiversity and ecosystem services into decision-making at all levels. It aims to achieve this goal by following a structured approach to valuation that helps decision-makers recognize the wide range of benefits provided by ecosystems and biodiversity, demonstrate their values in economic terms and, where appropriate, capture those values in decision-making.

A more conventional method for monetising change has been adopted by Natural Resources Canada specifically for district energy systems. The *District Energy Economic Model* (DEEM) is an economic assessment model that allows proponents to translate investment dollars into a community's social impacts, namely jobs, Gross Domestic Product and the impact on tax base.

To date (in North America), despite interest being shown in some quarters, the wide-scale inclusion of monetised socio-economic impacts have not been accepted as part of the accounting process. Ironically, corporate goodwill has been an accepted part of business valuation for many years, providing a much sought after addition to the value of a service industry. Campaigns to include socio-economic benefits as part of the annual budgeting process have been active in both Europe and North America, often paralleling the conventional budgetary process. It is not known what if any of the more comprehensive process has been incorporated in federal budgets.

An opportunity to demonstrate the power of externalities and their monetised values might be through the use of socio-economic-/ energy- mapping. The conventional mapping process overlays the energy consumption profile of a community upon its spatial layout. Understanding what stakeholder interconnections exist as regards energy reduction technologies and their associated activities, it may be possible to develop a third layer that maps the combined impact of the change and hence provides guidance for site selection for alternative energy delivery systems.

A-8.7.2. The Netherlands

In the Netherlands the Netherlands Enterprise Agency of the Ministry of Economic Affairs is setting up the conditions to support the public-private business case for the sustainable renovation of a district of 10,000 houses. The challenge is to coordinate the necessary knowledge, to manage the risks, to finance the design and process costs and to convince investors (such as National and European Funding Agencies) of the broad and profitable business case on the longer term.

In order to quantify the public-private business, three forms of business partnerships were considered.

Table 5: Business Partnerships (Kortman and Vis, 2016)

	Stakeholder	Costs	Benefits
1.Small business case	Housing Company	Investment in renovation	Rents
		Maintenance after renovation	Increase of rents
		General costs after renovation	
		Organisational costs renovation	
	Tenant	Increase of the rent	Lower Energy Bills
2.Broader business case	Housing Company	Consumption tax	Subsidies
		House tax	
	Tenants		Rent subsidy
	Municipality	Subsidy houses and yards	House tax
		Organisational costs	Less unemployment
	Government	Less energy tax	Consumption tax
		More rent subsidy	Income tax
		Subsidies	
3.Social and environment effects	Tenants	Disturbance during renovation	Comfort improvement
			Health improvement
	Municipality		Improvement of air quality
			Improvement lifestyle
	Government		Less CO2 emittance

Researchers from the University of Amsterdam applied these three business options to four renovation projects in the Netherlands: Haarlem, Breda, Kerkrade and Nijmegen, to evaluate their profitability. Conclusions were that long term options were profitable for all stakeholders, even the Small Business Case (this case looks only at the single

house level). In two projects the broader business case is negative for the Municipality and in all the projects for the Housing Company. To explain the negative outcomes, one must consider the innovative nature of the pilot projects which required strong support from the Municipality and the Housing Company.

When social and environmental effects were included, the business case for all stakeholders became all positive. This demonstrates that the broader the business case the healthier it gets. It is proposed to broaden the business case even more to examine the business cases including the local economic effects and the effects of avoided costs.

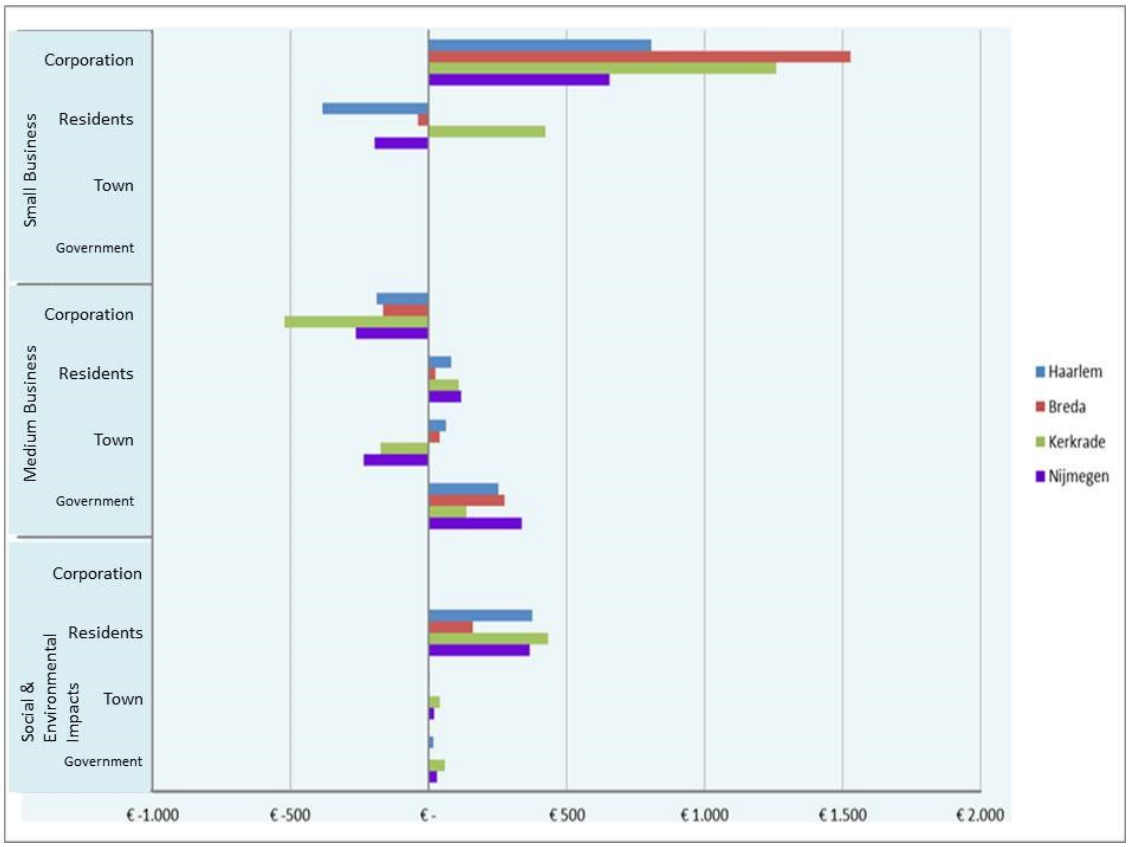


Figure 37: Evaluation of Broader Business Case Options (Source: Kortman et al., 2016)

The challenge is to organise the stakeholders on bases of the broader business case in such a way that they feel a common responsibility, that they trust each other and the risks are managed.

One of the recent findings is that if the wishlist of inhabitants are inventorised, many wishes for the transformation of their neigbourhood only cost money and do not financially benefit (e.g. getting rid of a high tension cable). What comes out of this experiment is the broader the business case is chosen and the more collective the energy system is designed, the more wishes can be included in the total business case. This approach generates more public support and the choice of more energy efficient energy systems.

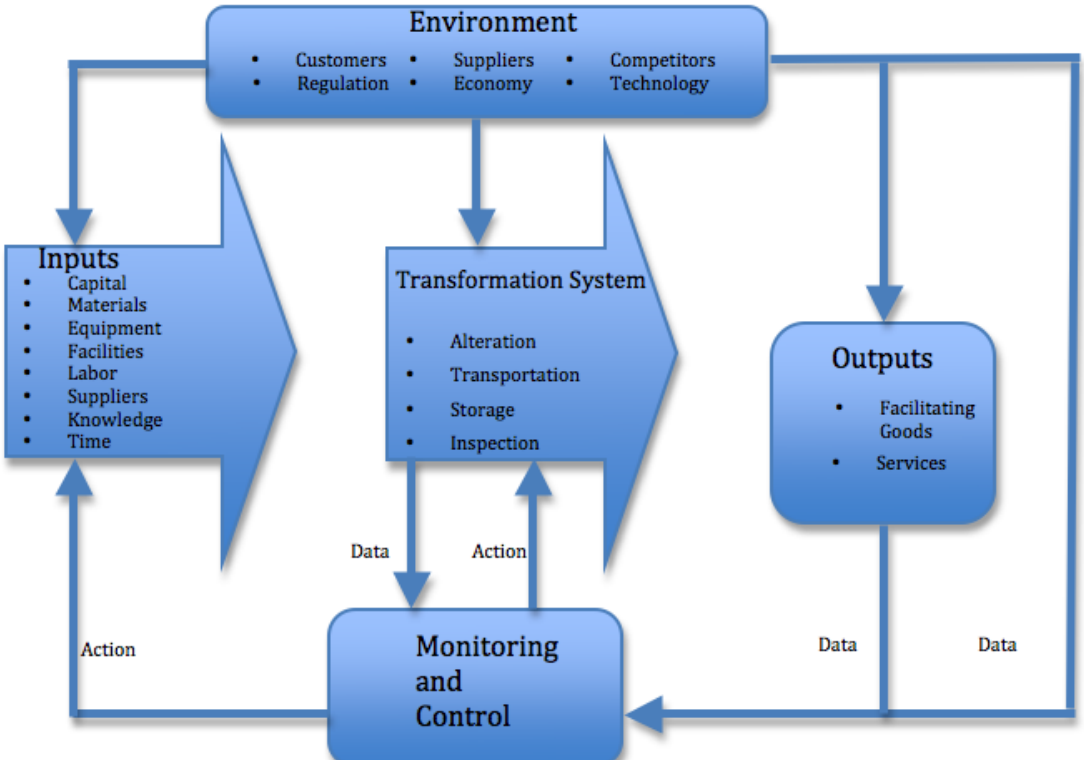
In the Netherlands also a new approach is introduced which already includes the co-benefits during the design of the product or project. It is called the “power of multi-functionality (RVO, 2016)”. Nice examples are roads which produce and store renewable energy for districts or sound barriers integrated with solar panels.

> *An embankment that serves as flood defence, road and tidal energy plant at the same time. These three goals are combined, and together share the means of the embankment. They link the interests of water safety, transport and renewable energy.*
>
> *The Netherlands nowadays try to perform as a ‘Sustainable Urban Delta’. The cooperation between the government, private sector, and knowledge institutes to commonly tackle challenges has been pivotal in safeguarding the sustainable development of the Dutch delta. Nowadays, this type of cooperation still provides the stable base for the multifunctional solutions that keep the Dutch sustainable urban delta a wealthy and lively place to live. At a time when space and money have never been so scarce, individuals, authorities and businesses are faced with new challenges. Professionals and users who are involved in area development, production chains and social services are looking for new earning models and cooperation. One begins with what is already there: people’s qualities, areas, products and services. Through multifunctionality we can reinforce the developmental power that already exists. More and more people are opening the treasure chest and discovering that a new combination of functions is achievable socially. There are still many more possibilities. In fact if we fail to combine, it means missed opportunities. It is important to escape from compartmentalised structures, because one cannot feel the loss of an opportunity from within its own compartment.*

A-8.7.3. Switzerland

In Switzerland often economic impact models such as Rütter+Partner Input-Output-Modell IMPACT_CH (Figure 38) are used to calculate the potential impact of renewable energy on the local and federal economy. Such models produce an input-output table that outlines the effect of activities within 52 economic sectors as well as the effect on national imports and exports (McCubbrey, 2016).

In economics, an input–output model is a quantitative economic technique that represents the interdependencies between different branches of a national economy or different regional economies. It includes direct and indirect effects having in economic or a qualitative manner for a range of sectors that are concerned with a transition to a low carbon environment. Using this model it was concluded in 2012 that the gross national product increases by 4% due to the implementation of renewable energy sources.



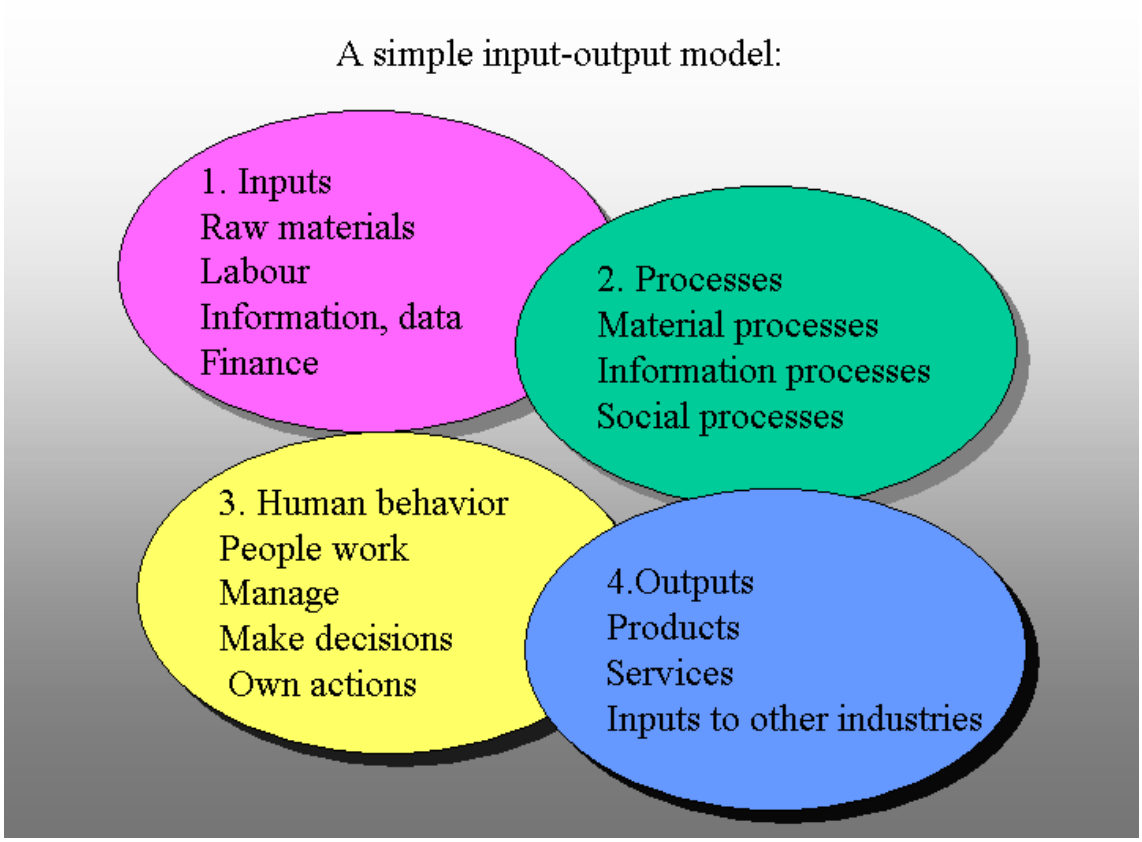


Figure 38: Depiction of an Input-Output model (McCubbrey, 2016) and the Input-output model of Nokia (Source: http://hzyebusiness.tripod.com/id19.html, 2017)

The model depicts inter-industry relationships within an economy, showing how output from one industrial sector may become an input to another industrial sector. In the inter-industry matrix, column entries typically represent inputs to an industrial sector,

while row entries represent outputs from a given sector. This format therefore shows how dependent each sector is on every other sector, both as a customer of outputs from other sectors and as a supplier of inputs. Each column of the input–output matrix shows the monetary value of inputs to each sector and each row represents the value of each sector's outputs. Wassily Leontief (1906–1999) is credited with developing this type of analysis and earned the Nobel Prize in Economics for his development of this model.

A-8.7.4. Denmark

Sixty-four percent of the houses in Denmark receive heating from a district heating system. District heating system is most cost efficient when building density is high, resulting in the policy that district heating in all households is not a national goal. Instead, district heating companies are run on a Not-for-Profit basis: they do not earn profit on their business but rather make investments to raise the energy price over a specified level. However, due to various local conditions, there can be a variation in energy price between towns.

Currently over 55 % of the energy produced in the district heating system comes from green energy and the national goal is to make the whole system 100% based on RES. The green energy production comes from a combination of biomass, solar collectors, photovoltaics, geothermal, wind, etc. using different strategies to make the system 100 % RES. The long term vision is to invest in heat pumps for each power plant which will make it possible to use excess electricity from the electricity system in the district heating network thereby making the overall energy system more stable, solid and sustainable for least cost.

The layout of the energy system in Denmark already includes a significant level of decentralized energy systems with the potential for adding more. This opens the opportunity for purchasing waste heat from commercial properties such as supermarkets. In 2013 the supermarket “Superbrugsen” in Skjern in Denmark received an award for his onetime investment on € 6.800, connecting to the district heating network. The connection hardware came from Danfoss and was a “standard” product. With this small investment it was possible for the supermarket to produce enough heat for heating five single family homes a year. Another supermarket, this time in Høruphav, made a similar investment and reduced their CO_2 emissions by 34% and saved 27.000€ on their yearly energy bill (danfoss, 2017).

To date approximately 20 supermarkets have installed this hardware. A primary barrier for many potential suppliers is the legislation and demands that it places on the supermarket owner. The owner not only makes the investment but must become an energy producer in a field where he has no experience. To counter this issue a national funded project has been initiated with the goal of removing the barriers by raising awareness and the knowledge level of supermarket managers so that they can feel confident in making the investment.

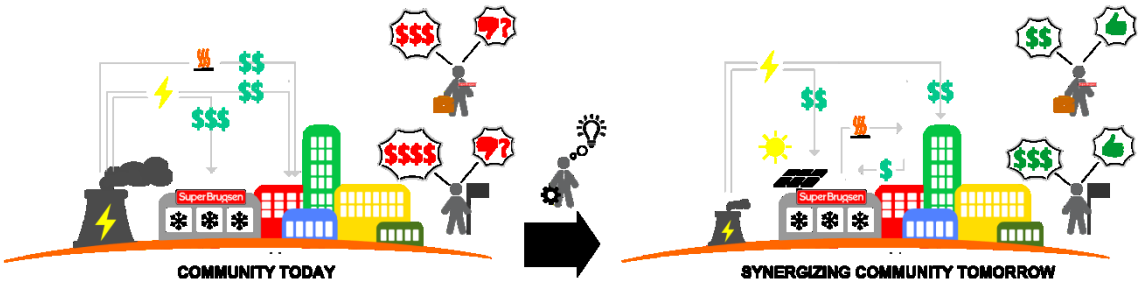


Figure 39: Local community today and synergizing community tomorrow (Source: Aalborg University, Denmark, 2017)

A-8.7.5. Germany

The energy-related refurbishment of buildings is actively promoted under 37 promotional schemes in Germany making it the most widespread promotional mechanism for demand-side energy efficiency management in the country. The main funding body behind the programmes is the "KfW Development Bank" although the programmes are implemented through state-level banks that, in some cases include additional incentives. Participants in these programmes to receive low interest loans and grants, include corporate clients, municipalities, public entities, private individuals and also associations.

The Energy Efficient Refurbishment Programme is the principal EE refurbishment programmes that offers low-interest, long-term loans combined with repayment subsidies for renovation measures in existing residential buildings. The loans are available for either single projects or for comprehensive refurbishment to reach the certified KfW Efficiency House Standard. Depending on the level of the Standard achieved, a repayment subsidy is provided of up to 17.5% of the loan amount. Whilst the main programme focuses on residential buildings, it can be applied to public buildings and historic landmarks.

In 2012 savings of 2,623 GWh were achieved through program investments of € 1,420 million. This represented a cost effectiveness ratio for the investment of 1.85 kWh per Euro fund invested. The continuity of energy savings is recognised as a long-term process because EE measures in buildings are assumed to last for more than 30 years.

Technologies or materials needed for energy-related refurbishment (insulation material, windows, etc.) are generally available, lowering the dependency on advanced or innovative technologies. The scheme is however, labour intensive as architects, engineers, building developers and craftsmen are required for the modernisation of the buildings. Capacity building takes place for several stakeholder groups, including the building occupants, investors, the engineers and those involved in implementing the rehabilitation. Currently, 242,000 residential units have been refurbished through this scheme (Diefenbach, 2013) and nearly 50% of all refurbished buildings in 2012 in Germany have made use of the programme.

Multi-criteria analysis (MCA) is a common approach used also in Germany for structured and transparent decision making using highly complex information and multiple objectives (Monteiro and Guedes, 2010). MCA has been widely used in the field of energy planning, climate change impact evaluation and even in classifying energy efficiency alternatives. Whilst a traditional cost-benefit analysis is limited to economic factors, the MCA approach includes other aspects such as social and ecological factors in the process. The UNFCCC (UNFCCC, 2017) defines the multi-criteria analysis as "a type of decision analysis tool that is particularly applicable in cases where a single-criterion approach such as cost-benefit analysis, especially where significant environmental and social impacts cannot be assigned monetary values".

A-8.7.6. Ireland

In Ireland every district requires a LECP Local Economic community Plan. These plans integrate all targets with respect to economy, employment, poverty, environment, energy etc.

A-8.7.7. Japan

In Japan in order to estimate the monetary value of Non Energy Benefits (NEB) for a particular energy retrofit project a classification process was proposed employing 5 major categories (a - e). These were additionally divided into fourteen sub-categories (a1 – e2). Figure 40 represents the cost-benefit ratio (B/C) evaluation for the carbon reduction measures in the target community considering the monetary value of the NEBs. The B/C is calculated using the total annual benefit (B), which is the sum of the monetised value of the EB and NEBs, and the total annual cost of the measures (C = MAC+EB).

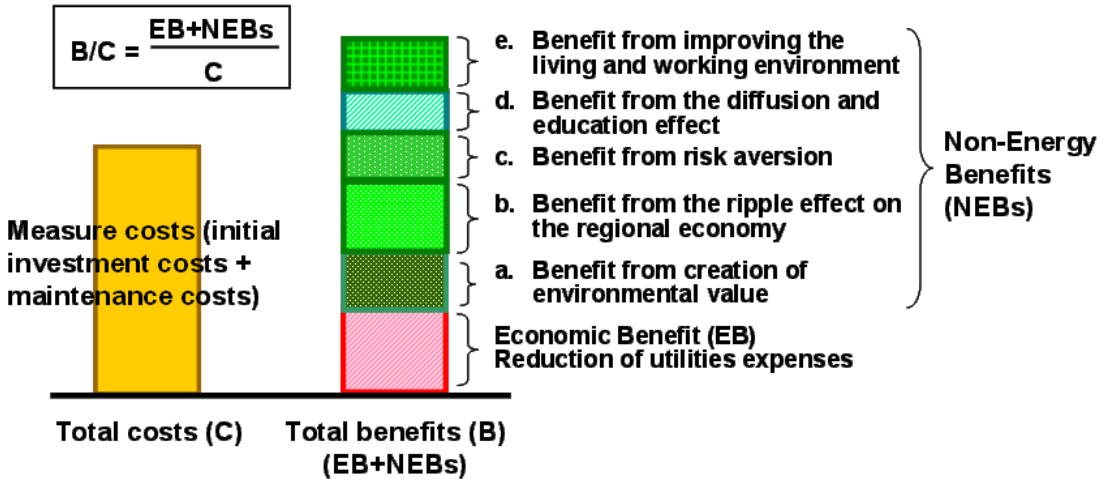


Figure 40: Image of the Cost-Benefit Ratio (B/C) Evaluation in the Subject Region (Kuzuki et al., 2011). NEB means NON-energy-benefits

The non-energy benefits (NEB) are described in Table 6

A sensitivity analysis was then conducted by calculating the range of fluctuation in B/C corresponding to the uncertainty of each factor. Figure 41 shows the B/C fluctuations for a project as a whole and suggests a value of 1.22. It also suggests that in this particular case, the following factors are more sensitive to B/C: magnification ratio for ripple effects in economy, yield from solar collectors, green heat unit price, and construction costs.

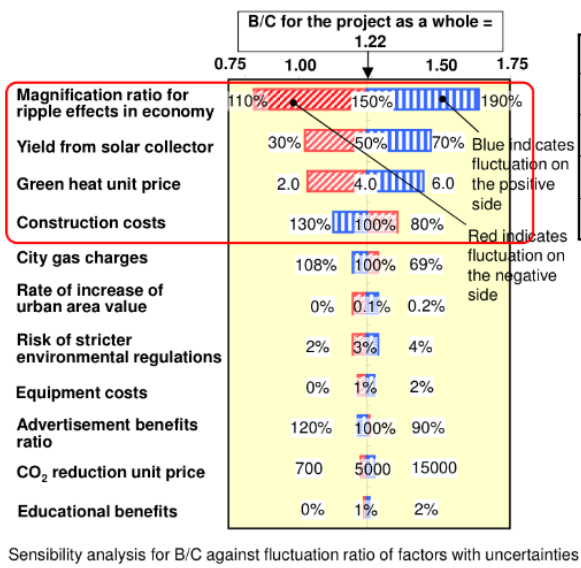
Based on these observations, a probability distribution was undertaken using a Monte Carlo simulation of which Figure 41 also shows the results. It illustrates fluctuation ranges equivalent from 10% to 90% of the B/C cumulative probability distribution by stakeholders as risk. The expected B/C value for each stakeholder almost reached that of the project as a whole (1.22). However, stakeholders' perceptions of opportunity costs related to their own risk tolerance are different so that they are not always able to reach agreement due to differences in expected B/C and risk tolerance created by restrictions in their own financial situations.

Given this reality, the feasibility of adjustment was considered by reviewing the allocation of C, EB, and NEBs. Using the actual process of project formulation as a reference, this case was assumed to satisfy the following policy conditions among stakeholders.

1) The neighboring building desires to have its B/C higher than 2.0 at 90% probability
2) The local government desires to have its B/C higher than 1.2 at 90% probability
3) Stakeholders incur a part of running costs and in return, they get NEB (a. creating environmental value) at a certain ratio, while central and local governments will incur a part of running costs.

Table 6: Non-Energy Benefits (Calculation of monetary value of EB and NEBs by category)
(Source: Kuzuki et al., 2011)

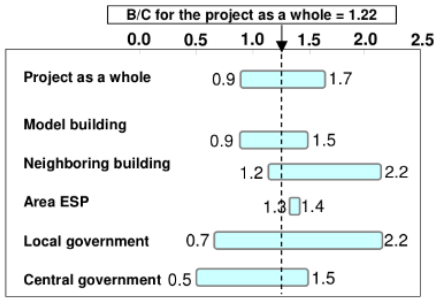
Benefit	Calculation of Monetary Value Outline	References
＜Energy Benefit (EB)＞		
Reduction in utilities expenses	Reduction in utilities expenses (yen/year) = energy reduction volume (MJ/year) x energy unit cost (yen/MJ)	**Energy unit cost** set based on supply agreements and supplementary supply agreements from city gas and electric power utilities
＜Non-Energy Benefit (NEB)＞		
a. Benefit from creation of environmental value		
a1. CO_2 reduction value	CO_2 reduction value (yen/year) = CO_2 reduction amount (t-CO_2/year) x CO_2 price (yen/ t-CO_2)	**CO_2 price** set (e.g., 4,000yen/t-CO2) "Point Carbon "Carbon 2009" (March 2009)"
a2. Green energy creation value	Green energy creation value (yen/year) = green energy use volume (MJ/year) x green energy unit price (yen/MJ)	**Green energy unit price** set (e.g., 15yen/kWh) "Examination Committee on VER Japanese Certification Standards Used in Carbon Offsets" (for photovoltaic power generation)
b. Benefit from the ripple effect on the regional economy		
b1. Economic ripple effect from infrastructure construction investment	Economic ripple effect from infrastructure construction investment (yen/year) = initial infrastructure construction investment (yen) x gross value added ratio ÷ ripple effect period (years)	**Gross value added ratio** set (e.g., 0.5) with reference to public investment gross value added estimates from various industry-related analyses by local governments **Ripple effect period** set at 70% of the lifetime of business facilities lifetime (e.g., 10.5 years ~ 31.5 years)
b2. Economic ripple effect on business operations	Economic ripple effect on business operations (yen/year) = business operating expenses (yen/year) x (ripple effect multiplier – 1)	**Ripple effect multiplier** set (e.g. 1.3) with reference to public works ripple effect multiplier, estimates from various industry-related analyses by local governments
b3. Increased real estate value effect (residential property) b4. Increased real estate value effect (commercial property)	Area real estate value increase effect (yen/year) = standard land price (yen/m^2) x subject land area (m^2) x (real-estate-value increase rate (%)/100) ÷ increase effect period (years)	**Standard land price** uses the figures from Ministry of Internal Affairs and Communications, Statistics Bureau, "2009 Statistics on Cities, Wards, Towns and Villages" **Real estate value increase rate** set (e.g., 0.5%) with reference to the rent increase rate (0-5% for model case rent) in the "CASBEE Real Estate Use Manual (provisional version) (July 2009)" **Increase effect period** set at 70% of the lifetime of business facilities lifetime (e.g., 10.5 years ~ 31.5 years)
c. Benefit from risk aversion		
c1. Contribution to the business and living continuity plan (BLCP); energy supply interruption aversion effect	Energy supply interruption aversion effect (yen/year) = energy supply interruption unit damage (yen/kW-hour) x decentralized power source capacity (kW) x supply interruption period (hours/interruption) x damage occurrence probability (times/year)	**Supply interruption damage** (yen/kW-hour), **Supply interruption period** (hours/interruption) **Damage occurrence probability** (times/year) set considering prior study[4]
c2. Risk aversion effect from stronger regulatory system, higher standards, etc.	Risk aversion effect from stronger regulatory system (yen/year) = utilities expenses (yen/year) x risk aversion expense ratio ÷ 100	**Risk aversion expense ratio** set with reference to "Sumitomo Trust & Banking Co. Ltd. "Outline of Business Awareness Survey Regarding Environmental Buildings" (July 2009)
c3. Health damage risk aversion effect (residential sector)	Health damage risk aversion effect (yen/year) = insurance benefits (yen/person) x subject population (persons) x occurrence ratio	**Insurance benefits** set using the figures from Japan Institute of Life Insurance "Nationwide Life Insurance Fact Survey" (e.g., 20.33 million yen/person for death benefits) **Occurrence ratio** set (e.g., 0.01%) Tokyo Medical Examiner's Office)
c4. Health damage risk aversion effect (commercial sector)	Health damage risk aversion effect (yen/year) = work absence ratio (days/person-year) x salary income (yen/year-person) / work days (days/year) x affected persons (persons) x occurrence probability	**Salary income** uses figures from National Tax Agency "Fiscal 2005 Salary Income Survey" (e.g., nationwide average of ¥4.37 million/person [including bonuses, etc.])
d. Benefit from the diffusion and education effect		
d1. Leading model project public awareness and education effect	Public awareness and education effect (yen/year) = subject population (persons) x cost required for public awareness and education (yen/person-year) x effective period coefficient	**Subject population** is the population residing in the subject community **Cost required for public awareness and education** set (e.g. 3,000yen/person) referring to the costs for attending seminars implemented by non-profit organizations **Effective period coefficient** set (e.g., 3 years, 10 years) as the ratio of the periods in which projects are still leading projects
d2. Leading model project advertising and publicity effect	Advertising and publicity effect (yen/year) = costs required for the measure (yen/year) x advertising and publicity effect coefficient x effective period coefficient	**Advertising and publicity effect coefficient** set (e.g., 2%) referring to the cases (e.g., an effect equivalent to 2% of total environment-related costs) for company case studies "FY2005 Environmental Accounting Guidelines Reference Materials" **Effective Period Coefficient** set the same as in d1
e. Benefit from improving the working and living environment		
e1. Higher worker intellectual productivity effect	Higher worker intellectual productivity effect (yen/year) = affected persons (persons) x personnel expenses (yen/person-year) x productivity improvement coefficient x effective period coefficient	Productivity Improvement Coefficient set (e.g., average of 0.5%) referring to the case study analysis (16 environmental buildings in the U.K. with an intellectual productivity change ranging from -10% to +11%) in Diana Urge-Vorsatz, et al., "Mitigating CO_2 Emissions from Energy Use in the World's Buildings," Building Research & Information (2007) 35(4), pp. 379-398
e2. Resident health promotion effect	Residents' health promotion effect (yen/year) = subject persons (persons) x amount intended to spend (yen/person-year) x effective period coefficient	**Subject persons** are the number of residents in the subject community **Amount intended to spend** is set based on a questionnaire survey of the residents



Sensibility analysis for B/C against fluctuation ratio of factors with uncertainties

Probability distribution set by fluctuating factors

Factors with uncertainty	Probability distribution	Predicted fluctuation range
Magnification ratio for ripple effects in economy	Normal	Mean value μ = 150%, standard deviation σ = 20%
Yield from solar collector	Normal	Mean value μ = 50%, standard deviation σ = 10%
Green heat unit price	Triangular	2-8 yen/MJ Setting maximum-likelihood at 4 yen/MJ
construction costs	Triangular	90-120% setting initial predicted value to 1

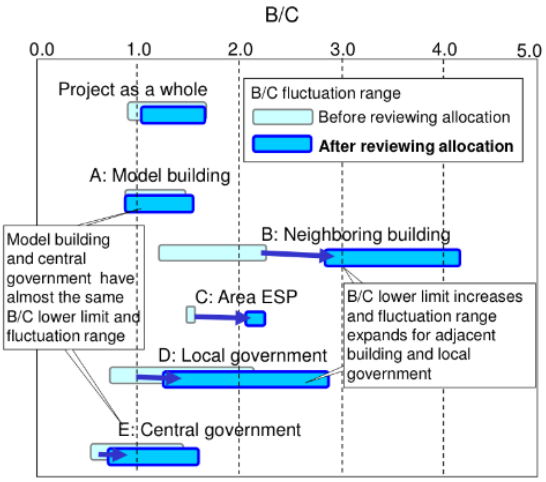


10%-90% of the B/C cumulative probability distribution by stakeholders

Figure 41: Sensitivity Analysis (Output Influential factors' sensitivity to B/C= benefits-costs ratio and probability distribution of B/C by stakeholders) (Source: Kuzuki et al., 2014)

	Project as a whole	by Stakeholders A	B	C	D	E
Cost allocation						
Initial cost						
Solar collectors, heat source renovation	1	1/2				1/2
Thermal exchange conduit	1			1/3	1/3	1/3
Running cost						
Amount of area ESP to be paid	1	2/5	1/10			1/2
Co-benefit allocation						
Energy benefit (EB)						
Reduced power and gas expenses	1	2/3	1/3			
Non-energy benefit (NEB)						
a. Creating environmental value	1	3/5			1/10	3/10
b. Ripple effects in economy	1				1/5	4/5
c. Risk avoidance	1	2/3	1/3			
d. Effect of education and promotion	1	1/5	1/5	1/5	1/5	1/5
Calculation results for B/C	1.2	1.0	2.8	2.1	2.0	1.1

Notes :
Dotted boxes areas are proposed re-allocation based on stakeholders' risk tolerance



10%-90% of the B/C cumulative probability distribution by stakeholders

Figure 42: Distribution of non-energy-benefits (Reallocation of cost and co-benefits and expected fluctuation of B/C= benefits-cost ratio by stakeholders) (Source: Kuzuki et al., 2014)

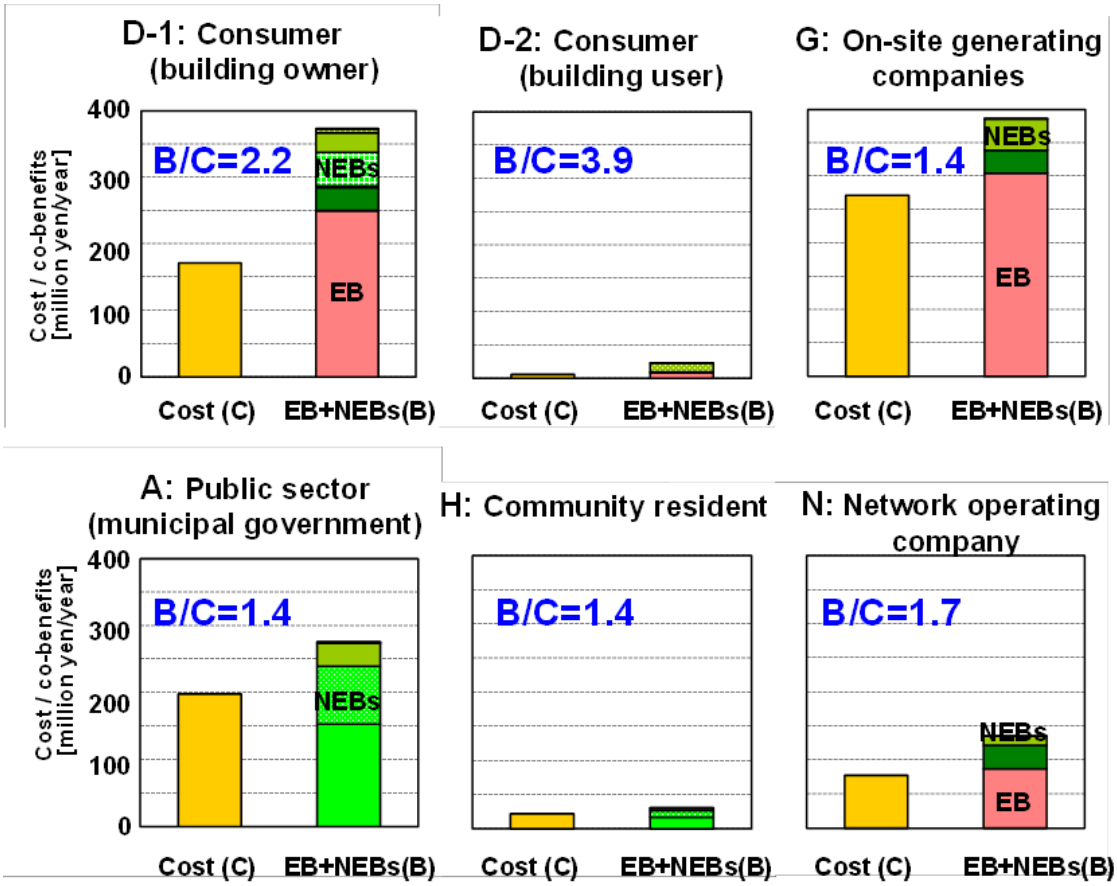


Figure 43: Example allocation of cost and co-benefits in terms of the benefits-costs ratio among stakeholders (Japan Sustainable Building Consortium, 2014). EB= energy benefits, NEB= Non-energy-benefits

The outcome is therefore that the local government gets an NEB (a. creating environmental value) at a certain ratio in return for subsidizing the initial cost of the district energy system. Figure 42 shows a preliminary review of the C, EB, NEBs allocation and the results of the B/C calculations based on the above policy. The neighboring building and local government are expected to be satisfied with their risk tolerance range (i.e. lower limit: 2.0 and 1.2 respectively). On the other hand, the B/C fluctuation range for these two grew, while the ranges for other stakeholders remained almost same.

From the results described in Figure 43, the process suggests clearly that risks can be adjusted by modifying the allocation of C, EB, and NEBs for each stakeholder. Hereby, one should be aware of the phenomena of “the wrong wallet””, which means that the benefit for each stakeholder is not always directly connected to their own investments.

A-8.7.8. USA

In the United States, an environmental impact assessment is obliged by the National Environmental Policy Act (NEPA). It is required only for projects and plans on federal land and/or receiving federal funding. Thus, environmental impact assessment applies to some energy-related projects such as large solar installations, wind farms, and

power plants. However, it does not apply to local urban development projects. When NEPA is applicable, it addresses a range of environmental, economic, and social impacts. The NEPA process occurs in two primary phases, beginning with an Environmental Assessment (EA) to assess the significance of impacts and then if deemed necessary, a more detailed Environmental Impact Statement (EIS) is completed. Specific to climate change impacts, the U.S. Council on Environmental Quality, which is responsible for administering the NEPA law, recently released final guidance on how to address climate change in EA and EIS documents. It requires that agencies assessing environmental impacts under NEPA account for estimate greenhouse house gas emissions and the impacts of climate change on the proposed action (e.g. project, policy, plan). Agencies are encouraged to use the best available science and information to inform proposed actions and must also consider alternatives to the action that would make it and affected communities more resilient to the effects of climate change.

A-8.8. Transferability / Recommendations

The nature of socio-economic benefits derived from energy efficiency measures means that municipalities should be aware of the lengthy time delay between the implementation of measures and the social and economic pay-back. Research in California (Wei, 2011) suggests that social change can take as much as 40 years to appear in public although this could reduce with legislation.

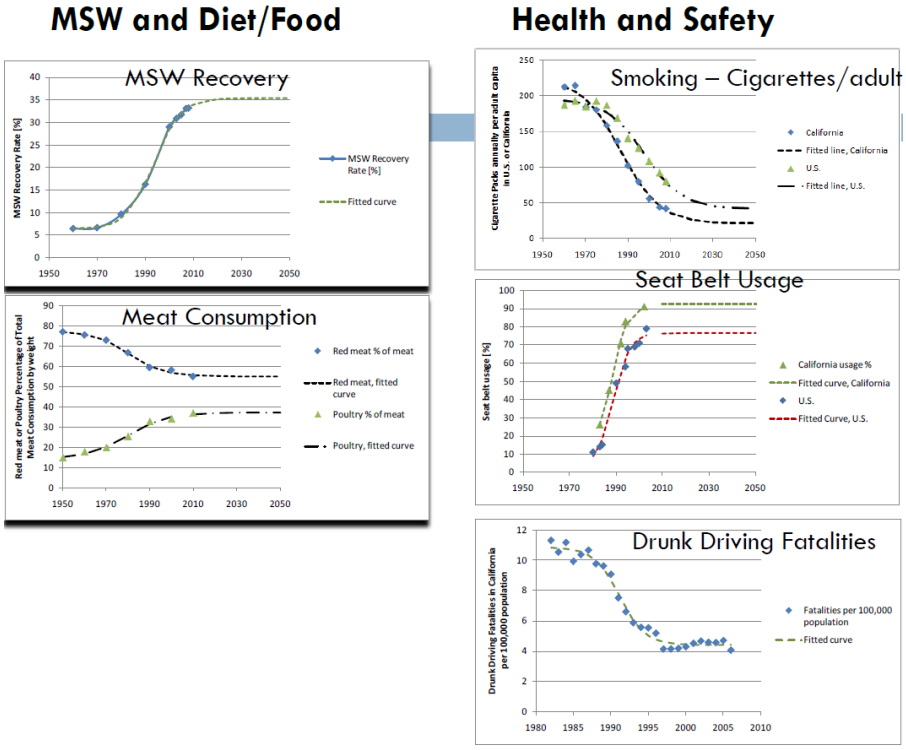


Figure 44: Time duration of change (Source: Wei, 2011). MSW= Municipal Solid Waste

From an analysis of the countries participating in Annex 63 the importance can be seen of the coordination in organizing the case for public-private business partnership. The coordinator of this effort must have a broad overview of both (or all) partners' aims and positions and present a more or less independent position. This role is most of the time played by governmental organisations and/or municipalities.

The success of the venture will very much depend on the trust that the stakeholders have in each other and how solid the business case is defined. It is likely a matter of the culture in each country that determines the willingness of companies to cooperate with each other, as well as with governmental agencies and municipalities. In Japan for example, large companies feel strongly committed to social challenges, like sustainability and climate change. In North America however, companies sharing the commodities marketplace (oil, natural gas, petrochemicals) are notoriously secretive regarding their business and performance.

The introduction of new legislation on a local and national governmental level will improve the boundary conditions for consideration of public issues in the decision making process. For example the audit of municipal organisation and the legal requirement for an Environmental Assessment or public reviews.

Of course, setting a higher price on carbon emissions provides an additional value for energy efficiency and an additional criterion for decision making. However, decisions should preferably be taken on a global level in order to avoid losing level playing fields for companies. But also the division between state tax and regional taxes is important. Often the tax benefits of regional initiatives flow to the federal government, while in many countries the policy is to decentralise the responsibilities. In fact, the tax schemes often change too slowly and are not in pace with the policies with respect to regional development.

The benefits of change are generally more measurable at the larger scale. However it does not imply that projects on a smaller scale are not relevant and advances in price management techniques can also be learned from projects at a smaller scale; for example, learning from a renovation project for a small district that lowers the high maintenance costs of the house owners.

For projects at a large scale, large investments are involved and therefore large risks. Risk management is an important issue. If the project is less successful than expected, who is going to carry the losses of lower pay-back rates? Perhaps this risk can be lowered by working with different scenarios for sensitive parameters from the beginning. This approach was described in section A-8.7as applied to a retrofit project in Japan.

Communicating the value of socio-economic benefits to the public or stakeholders to date has really been anecdotal (locally) or through the scaling down of results from larger economic models. Public acceptance of these benefits is often only for those that can actually be measured or seen: a cleaner atmosphere, increased employment, faster internet, etc. It is unfortunate that less tangible benefits such as reduced wait

times in hospitals may well exist but personal experiences often outweigh the benefits. Non-factual evidence often fails to explain what the direct or indirect impact will be for a given community. While direct benefits can be determined in a reasonably accurate and immediate fashion – cost savings of new equipment, revised fuel orders, etc., the indirect and induced benefits are more difficult to determine, not only to calculate but also to comprehend.

A-8.8.1. Recommendations

There is a strong case for municipalities to examine and consider the multiple benefits of a transition to renewable energy in their business model and financing decisions:

- Identify which stakeholders benefit from the Broader Business Model. Use *Stakeholder Engagement* and *Planning Support and Decision Making Tools* to identify those politicians, agencies working for the government, decision makers, municipal elected officials, planners of urban and energy plans, policies and infrastructure, energy companies, ESCO's, tenants/house owners, building industry, investors etc. who could be involved with the project.
- The more time is spent in the pre-phase / planning phase, committing stakeholders and bringing them together, the more profitable the business case gets on the long term.
- Identify a localised set of benefits that inter-relate the stakeholders.
- Identify those stakeholders who will profit from the Broader Business Model
- Employ impact assessment models to assess the impact of transition options on the community.
- Address and include localised socio-economic benefits in the broader business decision making case.
- Involve long and short-term investors (e.g. pension funds).
- Develop the organisational process, with respect to the development and operation of the initiative, the financing of the broader business-case and the governance of risks and commitments.
- Develop financing based on added value, avoided costs by revolving funds, insurance funds, pension funds, European funds like the Junker fund, private investors, etc.

A-8.8.2. Summary

The inclusion of socio-economic impact in the business cases for the implementation of energy efficient measures is a quite new, but very promising topic. Financial models in which the co-benefits are monetised are under development in several countries. It seems one of the key success factors for the large scale implementation of energy efficiency on a large scale in communities and the only way for municipalities to reach their ambitious long term goals. The reason for this that the one dimensional business case which includes only energy pays itself back on a rather long term and is not yet of direct interest for the conventional business partners and investors.

- Communities should try to define and organize a broader business-case for the implementation of energy efficiency measures and renewable energy sources. This is necessary to combine goals of society and business and to make the implementation more feasible and more competitive to conventional methods and business.
- The Energy transition needs sustainable urban development and vice versa.
- The municipality or government should (at least in the initial phase) realise that they play an important role in the facilitation of this process, since they are the most independent stakeholder covering the public values.
- More research is necessary on the inclusion of avoided costs (like costs for healthcare).
- The knowledge of the existing models in the different countries should be combined and further extended toward effects on the local economy, employment, environmental, quality of life and health issues.

A-9. Implement Effective and Efficient Organisational Processes

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A-9.1. Introduction

Since there are many actors on the local level involved in the field of urban development and energy planning, an effective and efficient organisation and process design (e.g. definition of roles/responsibilities) is of great importance. As formal planning processes are given in each country, the description of additional, new governance instruments, organisational frameworks and methods to formally integrate energy planning issues and subsequently apply them on the community level are the core of this work. Through new frameworks, the local administration will be enabled to develop and implement urban and energy planning concepts in collaboration with the relevant stakeholders.

Cities face the pressure to transform their energy system but are challenged by a lack of authority, because energy has just recently become a field of duties for municipalities. Hence, in most countries there are no defined formal planning procedures for urban energy planning. Another challenge arises from earlier liberalization and privatization of public energy utilities resulting into a great need for collaborative planning approaches combining public and private interests. Cities did respond to these pressures in formulating energy visions (e.g. being climate-neutral in 2050 etc.) to build networks around these visions and gain commitments from other important stakeholders. These visions are in the best-case backed-up with renewable energy strategies to show the path for technological development within the municipality that require an active participation of all relevant stakeholders – not only to increase effectiveness of strategy development and implementation through more tangible interim targets – but also to enhance and improve governance of the process.

The complexity of local urban communities, as endemic setting for development projects is accompanied by a range of implementation challenges. Actor networks with conflicting objectives, values or divergent tactics block a successful implementation of energy strategies equally as deviant temporal and spatial scales for operation of public administrations. In connection with the mentioned lack of authority and technology knowledge in city administrations, these mostly non-technical barriers lead to incoherent implementation processes for energy strategies. As a result, an implementation gap between national policy and local practice accrues. This has led to a nonattainment of national energy-efficiency targets, which jeopardizes the overall success of the energy transition.

In practice lacking political support and funding, persuasion of local stakeholders, opposing interests of project partners and resource-craving planning processes are “only” symptoms of the complexity of the construct community and a limited understanding of the interconnection of local actors and spatial issues. Existing community energy strategies tend to be single focused on technical measures because of the misconception that communities are only based on physical parameters.

Additionally administrative, technical and particularly social parameters shape communities, which have to be considered and understood to derive successful energy strategies. Consequently, the complexity of communities can be grouped in four interwoven problem areas:

1. Missing linkage between different spatial & institutional planning scales
2. Missing linkage of disciplines and their knowledge sets
3. Missing linkage of disciplines working procedures
4. Missing linkage of actors with deviating values and targets

The complexity of communities and interrelated hurdles are different for each urban development project. Hence, guidebooks, checklists or one-dimensional decision trees can only give an advice on what to look out for, but they can rarely be used as a manual for a successful urban energy planning process. These “wicked problems” occurring from interrelated entities require solutions of the same kind that are not based on a rational understanding of the planner, but an understanding of the planner as mediator. Municipalities as potential facilitators and drivers of energy transitions need to understand this complexity and the correlation of each entity within the community on one another. An integral step towards the implementation on community level is the formal integration and representation of energy planning issues within the administrative structures and frameworks.

This report aims to show - despite all the difficulties - ways to integrate the issues of energy efficiency and sustainability into urban planning processes and the respective administrative structures. The core is a summary of a survey that was conducted amongst successful examples of Annex63 partners which proves in how many different ways municipalities set up their organisation to manage the challenges and issues stated above (e.g. creation of new departments or new organizational bodies outside the administration). Common features and success factor are summarized and contextualized in a way that they can serve as examples for other municipalities, which aim to integrate energy efficiency planning in their set of municipal responsibilities. The focus is on the set up and management of these bodies rather than how they connect with the very different communities.

While the mayor part presents thoughts on the general structure and set up of new ‚management’-bodies the last section introduces their tasks and different operational modes. It includes thoughts on process management and is followed by a section on stakeholder identification and inclusion.

A-9.1.1. Compelling condition

- Legal regulations, facilitating stakeholder participation in urban and energy planning
- Identification planning conditions and boundaries

A-9.1.2. Content

- Answers to the question of how to ensure the anchoring of a new organisational body beyond a project lifetime
- Comparison of best practice examples and subtraction of common features
- Methods for the organisation of processes in the local administration
- Methods to identify the relevant local/regional (key) Stakeholders (energy consultants, homeowners, energy provider, real estate developer, council, administration, etc.) that are either part of a new formalized institution or an informal network that ensures their integration and participation

A-9.2. Barriers

Energy planning and organisation is an issue that concerns multiple actors and stakeholders from the private and public sector as well as various fields of already existing municipal tasks such as infrastructure, energy provision, building or housing. At the same time, as a cross cutting issue that touches many thematic fiends it is not a separated subject but needs to be approached in an integrated way. Subsequently, all political and administrative persons in charge who aim to integrate energy planning and sustainably in their field of responsibility are faced with the same question of how to set up a body that can fulfil this task. How can multiple sources of knowledge be integrated in an exchange and communication process, how can the issues be treated in an integrated way and how can they be disseminate in a way that the findings, goals and targets reach all respective institutions and actors?

This is challenging in multiple ways. Firstly, because up until very recently energy reduction was seen as a technical issue with few concerned actors and it has now become immanent that the greater challenges lie in the coordination and networking that is required to connect all stakeholders to actually create an impact on the local level. Secondly, the current model of municipal agencies that are occupied with all kinds of tasks tend to treat issues and theme fields in an isolated way, in separated departments or offices and as such are not suitable to implement measure that need to include a multitude of partners. There are no general concepts of how municipalities should integrate the task of climate protection and energy planning into their administrative (urban planning) structure as they do not only depend on the challenges stated above but also on financial restrictions and the different stakeholder situation in each local context. However, only an interdisciplinary approach can lead to success as it creates synergies and avoids thematic overlaps within the development of separated concepts.

An important aspect of the integration of urban planning and energy planning in terms of organisation is its vertical and horizontal integration. Vertical means the integration and involvement of various stakeholders of the administration as well as non-governmental stakeholders relevant to urban and energy planning. Horizontal means integrating and coordinating the various sectoral policies and actions of the public and private sector within the city or the selected area. Therefore, an adequate organisation structure has to be installed to facilitate this process.

There is a range of formality across the governance in cross-sectoral cooperations. Many operate without documenting formal governance processes, relying instead on a strong culture of trust and mutual accountability. Others put in place detailed memorandums of understanding and bylaws.

The organisation structure has to consider several demands: The structures, responsibilities and procedures for the development and implementation of urban and energy planning must be clear and transparent. The organisation of the process has to ensure

- to reduce conflicts between the different sectoral stakeholders,
- to coordinate sectoral policies and concepts towards a common goal and
- to make use of synergies of urban and energy planning.

Thus, it is important to agree on an institution or organizational framework that will deal with all of the administrative procedures and will act as reliable and competent partner in the target area for private and public actors. A political mandate for the organisational scheme is highly recommended.

The development and implementation of measures needs to be clearly appointed to an administrative body with sufficient capacity in terms of staff and experience. It is advisable to establish an interdisciplinary working group within the administration, in particular the urban planning department and the department responsible for energy issues (i.e. environment, economy). It can be an appointed team within the administration or an external institution such as a local energy or urban development agency. When the management of the process organisation is dedicated to an external institution, a close contact with that administrative body has to be ensured.

It might be helpful, at least in the beginning of the process, to integrate additional public and private key stakeholders in the organisation. In addition, the establishment of an independent advisory board that includes interested parties and stakeholders has proven its worth in practice. Regular meetings of the involved stakeholders are a basic instrument to coordinate subjects and interests.

A-9.3. Common success features – practical relevance

To find out how different partners and their governmental or municipal bodies react to these demands and the new “voluntary” task to integrate energy issues into their administrative structure and planning processes, a survey among Annex63 partners was conducted. The analyzed examples are from Altbauplus - Aachen (Germany),

CanmetENERGY (Canada), Clean Energy Partnership - Minneapolis (USA), ProjectZero - Sønderborg (Denmark), SmartCitySalzburg Initiative - Salzburg (Austria) and the Urban Planning Agency of Strasbourg (ADEUS) - Strasbourg (France). At the time of the survey, all partners were involved in a structure that dealt with energy planning and linking the administrative in one or the other way.

Within the survey, partners were asked about their respective organizational set up of bodies or new departments (legal framework, financing etc.), that deal with the issue of energy planning as well as their relation or integration into existing administrative structures. Other requested information concerned the competences and responsibilities of the stakeholders within as well as the integration and participation of stakeholders outside the organization. Another focus was on the degree of formality regarding the relations and networks between all actors as well as the involvement and support from the political side. Finally, partners were asked about obstacles or management problems that emerged or are yet to be solved.

It has become evident, that the tasks stated in the paragraphs above were applied very differently to the local settings in all municipalities. Within the last five to ten years all questioned partners were part of a process, in which municipalities or higher administrative levels engaged in setting up permanent bodies or organizations that were then assigned the tasks of local energy planning with regard to higher sustainability and increased efficiency goals. Despite their different contexts, they also share common features that should be closely looked at and can act as example for other municipalities.

The most important success features, derived from the answers of all questioned Annex-Partners are:

1. Strong ties to existing municipal structures/political support
2. Strong local involvement and impulse
3. Secured financing
4. Monitoring process and cyclical thinking
5. Involvement of energy suppliers and network providers
6. Governmental requirements
7. Create exchange of knowledge

This list provides insight in common features and factors that successful cases within the Annex63 team share and that may serve as good practice examples for other municipalities who aim to integrate energy efficiency planning in their set of municipal responsibilities. This List is neither exhaustive nor hierarchical but presents a cross section of all experiences, gathered from partners in the survey. Each feature is explained below.

A-9.3.1. Strong ties to existing municipal structures/political support

There are multiple ways to set up an organisational framework that deals with the issues of sustainability and energy consumption and allow municipalities to choose from

a variety of structures. The least binding framework would be a project with limited duration that aims to raise awareness and create networks under the impression of various limitations - time, staff, finances. The strongest commitment would be the creation of a new municipal structure that can rely on permanent funding and secured staff. A general positive attitude of politicians towards the issue is crucial in any case. The stronger the political support, the easier it gets to reshape the administrative setup or organisational framework and the higher will be the impact, that can be achieved through a new structure or institution.

Accordingly, all five Annex63 members that took part in the survey share a strong commitment from their respective institutions. Two cases are prevalent: a public private partnership or the creation of a new municipal body that is more openly structured in order to integrate other - internal or external - stakeholders. In both cases, the municipalities are permanently involved in the new organisational structure. This proves a long-term commitment from the municipalities' side and provides security for all stakeholders to engage in a long-term process. It also proves that the municipalities are interested in creating real impact and show an interest in influencing the processes of networking, knowledge exchange and coordination over a long period rather than outsourcing the handling of energy and sustainability issues to external bodies.

A-9.3.2. Strong local involvement and impulse

In some cases, the impulse to create a new management structure to deal with the issues of energy efficiency has come directly from interested single persons or milieus, such as local businesses. The case of ProjectZero in Sønderborg can serve as a positive example, where a local business cooperation and its Think-Tank were the main driver behind a development, aiming for municipal reorganization. They encouraged the municipality to invest time, effort and resources into creating a new organisational body (Public Private Partnership) which is now promoting energy efficiency measures and at the same time testing new solutions in cooperation with private businesses. Therefore, already existing local initiatives need to be taken into consideration as they prove to be a strong driver in creating new and innovative structures (that will subsequently suitably approach their target groups, in the Sønderborg case possible clients). If the impulse is not bottom-up but top-down with initiatives coming from the municipalities themselves, the integration of affected local groups in crucial to secure the long-term success of energy planning strategies in communities.

A-9.3.3. Secured financing

This point is directly linked with the first one. A stable financing basis is crucial to provide secure positions for staff and a permanent structure for counterparts that can facilitate the networking and exchanging process over a long period of time. As the networking and management processes takes up a lot of time, only a stable and permanent structure can capitalise on the exchanged knowledge and built up networks in order to ensure an impact on the application level. As findings from all five Annex63 partners show, the municipalities have a strong interest to back up these structures with fi-

nancial support. In some cases, the municipal or governmental funding is topped up by financial commitments from the local businesses, the local energy providers or network operators.

This also proves a strong interest by the energy and private sector to initiate processes and fund networking and development as well as the implementation of new solutions.

A-9.3.4. Monitoring process and cyclical thinking

It has become clear, that a regular evaluation and review of the development processes has to be a part of new governance instruments and management structures. This is even taken to a further extend by some experts, who suggest to structure every municipal energy and sustainability management as a cyclical process, that focuses not only on awareness-raising and implementing one-time measures but rather a permanent monitoring and reviewing process, that is aiming for continuous improvements. Long-term strategies create the best results whereas short term measure who merely focus on economical interventions with short term amortization are not sufficient in the long run. (Lynar, Cabanero et al. 2016).

These findings on monitoring processes have been applied or are about to be applied in all of the questioned cases of Annex63 partners. In some cases there are steering committees doing the monitoring, others are in a constant reporting and reviewing process with committees of higher administrative authorities. In some cases where the effectiveness of implemented plans was below expectations, partners started an additional reviewing and evaluation cycle to identify shortcomings on the implementation level and to improve future policies and planning processes.

All that is based on the assumption, that clear goals and targets have been identified and agreed upon in an earlier process by all involved partners. This is even more important, as partners often discuss plans and targets based on different realities and approaches (such as municipalities and energy suppliers/ network providers – see point 5). A more detailed description of the challenges and processes of target setting can be derived from section 2.1 (Set Vision and Targets) as well as in section 2.6 (Implement Monitoring of Energy Consumption and GHG Emissions).

A-9.3.5. Involvement of energy suppliers and network providers

All cases from the questioned Annex63 partners show, that energy suppliers and network providers are not only part of the exchange and participation process but take an active role in constituting the respective work groups and steering committees. On one hand, this proves their commitment as well as their interest in influencing the management and policy setting processes. On the other hand, it shows that a successful structure needs to include energy supplier and network providers as it ultimately relies on their cooperation at some point in the further process in of implementing new solutions and measures.

This involvement becomes crucial, as conflicting interest occur between municipalities and the utilities who operate as private companies (even though municipalities or governments often own them) and seek higher profitability instead of committing to a costly and unsteady transition towards renewable energy. As a result, conflicting values often block implementation in daily work. Additionally to the involvement of energy suppliers and network providers, municipalities should therefore assure that the utility strategy is aligned to the municipal strategy and its targets. Further information can be found in the Cluster Report B “Renewable energy strategies”.

A-9.3.6. Governmental requirements

It has to be admitted that new governmental requirements and frameworks also created the incentives or the legal basis for municipalities to either increase their attention on energy efficiency issues or ‚push‘ them towards a more proactive approach. In some cases, municipalities were assigned more responsibilities, in other causes municipalities were give the legal right to take over more liability in working on energy efficiency on the local and community level. These legal changes however often met with the municipalities existing willingness and/or bottom up movements from the local communities and quickly created synergies.

A-9.3.7. Create exchange of knowledge

All questioned partners share this one point - the exchange of knowledge is crucial. Cross - cutting issues can only be approached by collecting knowledge from various stakeholders and redistributing expertise amongst all of them. Networking and frequent exchange processes within the organisations, steering committees, work groups or the broader public are an integral part. Because of that, informal networks with externals as well as participatory processes have become increasingly important.

This list provides insight in common features and factors. More details about the specific cases are available in the attachments to this report, where each case is presented with a short summary and an overview on its internal and external structure.

Guiding questions to set up an organization structure can be found in appendix and in Cluster reports that focus specifically on Stakeholder involvements, such as the Cluster Reports A and G “Political and stakeholder inclusion / approach”.

Aside from that, all partners share similar obstacles. Unsurprisingly, the question of distribution and assignment of responsibility remains a difficult one in a field of complex and always changing stakeholder constellations.

Another difficulty is the monitoring and evaluation of impact on the action level. There are similar or at least comparable ways of how municipalities oversee the exchange and management process (steering committees etc.) but the tools on the ‚ground‘, the action level where concrete measures are implemented differ widely from community

plans, new technical solutions, pilot plants or specific research. Monitoring and reviewing the impacts of each measure remains a challenging task. However, as stated above, all partners have set up or are about to set up a (cyclical) monitoring process.

A-9.4. Process management in general

While the previous section focused on the set up and structure of new organisational bodies, this section deals specifically with the tasks of those bodies, their challenges and ways of process management and the identification and inclusion of relevant stakeholders. Both tackle the core challenges of administering urban energy planning - managing the process of planning with multiple stakeholders while it is no core issue for any of them. Furthermore, the identification of relevant stakeholders that have to be part of the process is substantial for a successful integration of energy issues into (urban) planning processes.

The model of *public* planning and *private* implementation has only limited validity for an integrated urban development. Moreover, a cooperative planning approach, which is implementation oriented and involves public and private stakeholders, is needed. Regulatory planning and formal tools of urban and energy planning have to be supplemented by active process management. Only through an additional process management, goals and concepts will not only be formulated but also implemented in cooperation with private stakeholders.

The design of the methodology provides an important basis for the planning process of energy-efficient urban development. Integrated approaches are considered as an essential part of the design process towards an effective energy-efficiency policy at local and regional levels. They can only be realized in a cross-sectoral, interdisciplinary and participative process. The basis of the development process is the joint elaboration of integrated concepts for energy related urban regeneration, building on a thorough analysis of the physical and socio-economic situation.

Integrated and strategic urban energy planning includes a series of repetitive tasks. These are in practice usually not connected in linear succession, but are the building blocks of a networked system with numerous feedback loops used in an iterative way. Communication, cooperation and management require greater and differently qualified resources to administer planning than classical technical/design planning and formal procedures. Within the working process of urban energy planning, the following elements are of importance:

1. Coordinating and networking,
2. Participation,
3. Monitoring,
4. Planning Fundamentals,
5. Evaluation,
6. Top-down and bottom-up approaches.

and will be described in detail as follows.

A-9.4.1. Coordinating and networking

The process management has to be provided by an administrative body with sufficient capacity in terms of staff and experience. It has to be aware of the needs of the stakeholders and of all conflicts that might arise during the process of the urban and energy improvement. This body can be an appointed team in the administration or a public institution (i.e. local energy agency). It is of great importance to agree on an institution that will deal with all of the administrative procedures and will act as trustworthy and competent partner in the target area for private and public actors ("building trust"). Initiating of cooperation is the beginning of the process. In many cases there are already some networks and cooperations established on the local level, which can be integrated. Coordinating and networking between different public and private actors is an important task to elaborate and implement urban and energy planning. When steering the process, project management for key projects is necessary to make efforts and results visible to decision-makers, the cooperating stakeholders and the general public. In addition, the coordination of strategically relevant sectoral planning (i.e. infrastructure projects) can be an issue within the process.

A-9.4.2. Participation

The participation within the process tends to go beyond the formal participation procedure, as there are more direct and extensive participation approaches applied. To achieve objectives and actions that local stakeholders can agree on, it is of utmost importance to include the relevant stakeholders as well as the citizens in the development process. Involving different stakeholders is important as they have manifold needs and demands, which have to be coordinated and balanced.

The involvement in the elaboration of a local process will also lead to a stronger identification with the objectives and actions for the area and stronger support for their implementation. To a certain extent, this can help to tap further private resources, knowledge and finances for the implementation of actions. A further opportunity that participation offers is to make use of the local knowledge of stakeholders. For the analysis of the current situation as an example relevant information and expertise can be drawn from local energy agencies or public utility companies (like district heating or electricity or water suppliers). Further information can be taken from the Cluster Report A and G "Political and stakeholder inclusion / approach".

A-9.4.3. Monitoring

A further task of a managing institution would be to monitor the development process of the addressed area by appropriate indicators. It is necessary to recognize upcoming problems and reporting them to decision makers (i.e. local council, head of administration, property owners etc.). The monitoring would allow to check whether the implementation of the jointly defined actions is advancing as planned and if objectives are reached and actions are realized as scheduled. Such monitoring will be helpful to keep the process up-to-date and to revise and adapt it if necessary. Communicating the monitoring results to stakeholders and target groups can also raise the awareness about the situation of the area as well as bear on decisions affecting the area. Further information can be taken from the Cluster Report D “Monitoring”.

A-9.4.4. Planning Fundamentals

The inventory and analysis of the current situation helps to precisely determine the needs and fields of action to be addressed in the process of urban and energy planning. It is also the basis to design target-oriented actions for energy efficient measures in the addressed area. Relevant fields of action might be energy and heating requirements, the design of buildings, green spaces, transportation, infrastructure, social welfare and the use of renewable energy. There should be a political and expert-based agreement about which criteria lead to set-up an urban and energy planning process. These criteria should consider urban structure, energy efficiency, functional aspects and a balance between economic, social and ecological development. For energy efficiency, the relevant criteria include the energy demand and the potential for energy reduction as well as the state of the supply network and the available options to improve the situation.

A-9.4.5. Evaluation

Evaluation and controlling are an indispensable element of the process. Urban energy planning is a systematic way of success or impact testing strategies, policies, programs and measures. Due to the process-oriented nature of energy planning, it has to be regularly evaluated and reviewed (cyclical thinking). For this, a monitoring and controlling system has to be established as one of the priority measures (see point 3 as well as Cluster Report D “Monitoring”).

A-9.4.6. Top-down and bottom-up approaches

From various municipalities there are experiences of different approaches when it comes to process management, especially in urban planning processes. Typically, there are top-down approaches and bottom-up approaches. The top-down approach is a public authority activity characterized by political given objectives and implementation by technical experts. It is a deductive approach based on a valid or legal concept or strategy, which will be applied on specific measures. Bottom-up processes are intro-

duced by NGOs, local stakeholders, interest groups or non-profit organisations in a specific local context and initial projects. Experiences gained on the specific project are the basis for the transfer of the results into a new common concept or strategy (inductive approach). Both approaches are suitable for local urban and energy planning processes.

Different approaches for local urban energy planning

Table 7: Jens Freudenberg, DV, 2016, based on own experience

***Concept* oriented top-down approach from district concept to pilot project**	***Project* oriented bottom-up approach from pilot project to district concept**
1. Set up of a local project team	1. Set up of a local project team
2. Clarification of the local institutional framework	2. Definition of energy objectives of the local pilot project
3. Physical analysis and potentials	3. Feasibility study for the pilot project:
4. Involvement of local key actors	technical, financial criteria to assure implementation
5. Development of a local common vision of the long-term energy goals	4. Detailed definition of the pilot project
6. Derivation of specific objectives and sub goals	5. Public tender / competition
7. Definition of indicators to measure success	6. Involvement of local key actors (stakeholder analysis)
8. Definition of an action plan: ranking and a time frame for the implementation of projects/measures	7. Implementation of the local pilot project
9. Discussion and resolution of the energy concept by the local government	8. Documentation, discussion, evaluation and dissemination of results
	9. Conceptual design for the development of a district concept

The integration of stakeholders is another central challenge to overcome innovative barriers. Therefore, the knowledge of relevant stakeholders is essential. More knowledge on stakeholders in particular can be found in section A-7 (Stakeholder Engagement & Involvement)

A-9.5. Overview on Annex63 questionnaires - Summary

On the next pages, each of the six cases of interviewed partners is presented with a short summary in the form of an A4 profile. Those profiles are based on in depth interviews and were the basis for the summary of common success factors (see section “Challenges”).

The order is as follows:

- Altbauplus, Aachen (Germany)
- CanmetENERGY (Canada)
- Clean Energy Partnership, Minneapolis (USA)
- ProjectZero, Sønderborg (Denmark)
- SmartCitySalzburg Initiative, Salzburg (Austria)
- Urban Planning Agency of Strasbourg (ADEUS), Strasbourg (France)

Altbauplus association

Country	GERMANY
status	PUBLIC – PRIVATE – PARTNERSHIP
sector	NON-PROFIT
admin. level	MUNICIPAL
reach	GENERAL PUBLIC, PRIVATE PROPERTY OWNERS
partners	27 INSTITUTIONS I.E.: MUNICIPALITY, UTILITIES, LOCAL ENERGY TECHNOLOGY COMPANIES, HOUSING COMPANIES, ASSOCIATIONS OF CRAFTSMEN, HOME OWNERS, CONSUMERS ETC.
Foundation	2004
Further information	HTTP://WWW.AACHEN.DE/DE/STADT_BUERGER/PLANEN_BAUEN/THEMEN/ALTBAUPLUS/INDEX.HTML

SUMMARY

The altbauplus association is an important actor with free initial consultations, events and projects in the **topic of energy retrofitting**. The Aachen c**ity council commissioned the administration to initiate an organisation** to take care of the below-mentioned issues. It was intended to involve all organisations working on the energy subject as well as users, proprietors, scientists, craftsmen, universities, energy-suppliers, etc. Many of the members are interested in the issue itself, as it represents one main focus of their daily work.

The idea is to create a **good cooperation between the different actors and to bundle the knowledge** in one network. Therefore, the consumers have one partner to deal with and can be sure to get **independent information. Thus, Altbauplus has a high credibility**.

Eight members of the association form the **executive board, which takes strategic decisions**. Responsible for the daily operation of the association is an executive director. The staff of Altbauplus is provided by the city of Aachen, but also from the local energy provider STAWAG and the regional consumer association.

Altbauplus is based in the so-called Aachener “energy-mile”, where also other consulting offers are located for energy efficiency and energy-saving renovation. The **presence in the town** and the **personal contact with the customers and the stakeholders are seen as important factors**.

ACTIVITIES

Altbauplus offers the provision of multiple services aiming to promote energy efficiency to private owners:

- **Networking of relevant stakeholders in the field of energy efficient refurbishment of old buildings**
- **Offering independent advice to citizens about energy refurbishment, renewable energies, funding possibilities, cost effectiveness**
- **Initiate and organize education for crafts men**
- **Promote, implement and publish best-practice examples**

Natural Resources Canada (NRCan)

Country	**CANADA**
status	**PUBLIC**
sector	**FEDERAL GOV. DEPARTMENT, INNOVATION AND ENERGY TECHNOLOGY (IETS)**
admin. level	**GOVERNMENTAL**
reach	**NATIONWIDE**
partners	**INFORMAL NETWORK: FED. OF CANADIAN MUNICIPALITIES (FCM), QUALITY URBAN ENERGY SYSTEMS OF TOMORROW (QUEST CANADA), COMMUNITY ENERGY ASSOCIATION, VARIOUS IDUSTRY LED CLEAN ENERGY ASSOCIATIONS**

SUMMARY

The organisation is Natural Resources Canada (NRCan) and in particular, CanmetENERGY-Ottawa, its research laboratories that focuses on energy conversion technologies. Before 2005 and the involvement in community energy planning, the concept of linking energy consumption with the urban form was primarily to feasibility studies. **NRCan is subordinate to the federal gov. department IETS**.

The role of the federal government in Canada is to advance the concept of energy efficiency at the technological level. Whereas application and implementation on the local and regional level is left to provinces and municipalities. Through CanmetENERGY research into energy efficiency is undertaken at the level of the community and applied to Canadian communities through **specific projects**, sometimes **in cooperation with other partners through direct funding**.

An additional department within NRCan – the Office of Energy Efficiency is responsible for program delivery related to energy efficiency issues. Its **potential is to deliver community level initiatives**.

The interest on communities side is steered through the initiatives such as the **Green Municipal Funds** – a $550 million revolving fund and the **Green Communities Act in British Columbia** that required communities to conduct GHG inventories, produce and implement plans to mitigate their emissions.

ACTIVITIES

The following activities are conducted through NRCan or its subordinate institutions:

- **Research on community level in cooperation with external partners**
- **Development of tools and instruments that aim at the urban planner / development process**
- **Development and implementation of community plans**
- **Steering the development of community energy engineer as a skill set**

Clean Energy Partnership (CEP) in the City of Minneapolis, Minnesota

Country	**UNITED STATES OF AMERICA**
status	**PUBLIC – PRIVATE - PARTNERSHIP**
sector	**UNDER PARTICIPATION OF SUSTAINABILITY OFFICE, CITY OF MINNEAPOLIS (ENERGY AND CLIMATE POLICIES) AND TWO PRIVATE COMPANIES (ENERGY/HEAT SUPPLY NETWORKS)**
admin. level	**MUNICIPAL**
reach	**MUNICIPALITY**
partners	**FORMAL NETWORK: CITY OF MINNEAPOLIS, XCEL ENERGY & CENTERPOINT ENERGY (GAS AND ELECTRICTY PROVIDERS)**
foundation	**2014**

SUMMARY

Energy initiatives are led primarily out of the **City of Minneapolis Sustainability Office**. The office is situated with the city coordinator's office, which administers a variety of cross cutting issues. The sustainability office **coordinates cross-sectoral city departments** and works to integrate sustainability principles into city decision making. It advances policies and programs focused on energy and climate change. Electricity, gas and supply networks in the city are provided by two private utilities (Xcel, Centerpoint). To facilitate coordination with the electricity and gas utilities, the city of Minneapolis has entered into the **Clean Energy Partnership**, which **brings together the city, Xcel Energy, and Centerpoint Energy**. The Partnership has been set-up following on significant discussion in Minneapolis regarding **establishing a local energy utility to have greater influence on energy sources and the use of renewables**.

Implementation of the partnership is administrated by the Clean Energy Partnership Board, which includes representatives from the three partner organizations. The **City of Minneapolis Energy Vision Advisory Committee advises the board**. The committee plays a role in reviewing the partnership board's work plans, measurement and performance reports, offering feedback on special initiatives, and communicating to members' constituencies regarding activities of the committee and board.

The **partnership board reports annually on its activities**, as well as on metrics such as green greenhouse gas emissions, commercial and residential building energy use, local or directly purchased renewable energy, energy efficiency activities, and multi-family energy program participation.

ACTIVITIES

The Partnership positions Minneapolis and the two utilities in working together in:

- **Planning, implementing, marketing, and tracking new approaches around energy efficiency, energy choices, and renewable energy for business and residential customers**
- **Review of work plans & implementation, giving feedback through Committee representatives**

PojectZero, Sønderborg

Country	DENMARK
status	PUBLIC – PRIVATE - PARTNERSHIP
sector	MUNICIPAL GOV. OFFICE ("PROJECTZERO SECRETARY")
admin. level	MUNICIPAL ASSOCIATED
reach	REGIONAL
partners	FORMAL NETWORK: SONDERBORG MUNICIPALITY, LOCAL BUSINESS COOPERATION, UNIVERSITY OF SOUTHERN DENMARK AND OTHER LOCAL PARTNERS
foundation	2007

SUMMARY

ProjectZero Company started in June 2007 to foster local economy and reach the energy target of the Sønderborg municipality to be climate neutral in 2029. The **local business cooperation and its Think-Tank were the main driver** behind this development. Within the PPP, the companies´ products and solutions can be tested and showcased. Hence, the **municipal target on reducing GHG emission** (2008 the Sonderborg Municipality elaborated as one of the first municipalities an Energy Policy and Strategy) was **combined with the business development plan**. Another advantageous aspect is the fact, that it is neither the municipality nor the industry, which contacts people and encourages them to do energy renovation. So far, the hybrid construction seems to be the best solution to motivate people.
The ties between the PPP and the municipality are strong with the municipality strongly supporting the partnership. A "**ProjectZero secretary" exists in the municipal administration** and the management of ProjectZero is partly assembled by elected officials of the municipality. The financial support is ensured through a fund, which it **financed by local businesses, the municipality and other funds** like Nordea (a Danish Bank) and the formerly fully state-owned electricity & gas grid operator (Dong Energy).
In 2008, the city Council adopted an energy policy with associated energy strategy. Every second year, this **energy policy is followed regularly up by a new energy strategy** which describes the current status of former initiatives and lists a number of new ones. **The energy strategy is anchored in all departments of the municipality**, as they must contribute to the implementation of the initiatives in the energy strategy. The climate **secretariat of the municipality is responsible for coordinating the effort**.

ACTIVITIES

The following activities are conducted through the ProjectZero PPP:

- **Communication and citizen involvement strategy**
- **Constant review, monitoring and creation of initiatives within the existing integrated energy strategy**
- **Development and testing of new solutions to reach the neutrality goal in 2029**

SmartCitySalzburg initiative

Country	**AUSTRIA**
status	**PUBLIC**
sector	**MUNICIPAL DEPARTMENT (CONSTRUCTION & BUILDING DEPARTMENT)**
admin. level	**MUNICIPAL**
reach	**CITY**
partners	**FORMAL NETWORK: MUNICIPALITY ON ADMINISTRATIVE AND POLITICAL LEVEL, MUNICIPAL COMPANY** **INFORMAL NETWORK: WITH EXTERNALS (PEOPLE, ECONOMY, BUILDING SECTOR ETC.)**
foundation	**2012**

SUMMARY

The Initiative was part of the approval of the Smart City Masterplan 2025 by the City council in 2012.
The organisational structure is **integrated in the municipal department of construction and building** but has also strong connection to the department of spatial planning and the municipal agency for construction, urban planning and transportation. Members of both departments are part of the coordination office which is the operational body of the Initiative.
The coordination office subordinates to the municipal coordinator for energy and smart city and receive additional support by experts from the Salzburg institute for regional planning and housing. Together they form the coordination group and aims at the implementation of the masterplan 2025.

Through their work they connect with externals such as the city´s population, science institutions, banks, transport representatives and others by exchanging information and more regular meetings in working groups.
It is monitored and advised by a **steering committee** which is assembled by political representatives and the local energy supplier. The steering committee aims to create political acceptance and is responsible for the strategical orientation of the Initiative.
The **coordination group meets on a regular basis every month**. The steering group meetings depend on the currency of topics.

ACTIVITIES

The following activities are conducted through the SmartCitySalzburg initiative:

- **Operational implementation of the SmartCity masterplan 2025**
- **Constant reviewing and monitoring of progress**

Urban Planning Agency of Strasbourg (ADEUS)

Country	**FRANCE**
status	**PUBLIC**
sector	**RESP. DEPARTMENTS IN MUNICIPALITIES AND HIGHER ADM.**
admin. level	**METROPOLE (GROUP OF MUNICIPALITIES)**
reach	**REGIONAL**
partners	**INFORMAL NETWORK: PROFESSIONS FROM THE SECTOR OF ENERGY PRODUCTION AND DISTRIBUTION, PLANNING AND ENVORONMENT, ECONOMY, HOUSING, TRANSPORT, DATA PROVIDERS, ADMINISTRATION (REGION & DEPARTEMENT)**
foundation	**2014**

SUMMARY

The organisation is the **Urban and development agency of Strasbourg** - (ADEUS) which is a **platform, composited by representatives from the sector of planning and transportation**, mainly from the metropole level. All **administrative levels** from the region and below (department, metropole) **secure its funding**. With a new law implemented in 2015, **competencies on energy have been transferred to local authorities**. As a result, ADEUS was founded and since then works on integrating energy issues into planning processes.

Connecting stakeholders and experts within and outside the organization through different formats of meetings is one of the core tasks of ADEUS. Technical committees and meetings with representatives of administrations are organized to **share expertise knowledge** and help all partners to create and develop a global vision. On top of that, **meetings with external actors and partners** (economical chamber, harbor, companies, architects) are set up mirror the goals and fill knowledge gaps. Through this process, difficulties on local levels are discussed and integrated into the macro level.

Joint targets and proposals are developed which need further validation from the administrative responsible (metropole) before they are translate into municipal plans and sent into action.

ACTIVITIES

The following activities are conducted through ADEUS and its communication formats in platform project:

- **Exchange, mutualize and capitalize information**
- **Integrate the issues of energy in planning processes**
- **Help local energy transition and proposal of targets and actions**

A-9.6. Template to set urban energy planning processes

These tables can be used as template to set the basis for an urban energy planning process.

Relevant stakeholders:

Social promoter	**Expert promoter**	**Authority promoter**
□ Mister x, company x, external consultant □ Misses y, company y, president of the local network	□ Mister x, company x, professional planner □ Misses y, company y, professor in university	□ Mayor and director of the local energy supplier, members of the steering group □ Mister x, company x, land owner

Communication concept:

Who will be informed	Mister x
From whom	Misses y
Topic	Project start
When	July 2017
How	Personal Meeting

Organization structure:

Type of group	Project group	Working group	Steering group
Group members	Mister x, Misses y, Mister a, Misses b	Mister a, Misses b	Mister c, Misses d
Tasks	Common discussion about interim results	Elaboration of specific results	Meet of decisions
Responsible person	Mister x	Misses b	Misses d

Decision making structure:

What decision	Should we use solution A or B?
Who must meet the decision	Steering group
When	Steering group meeting in August 2016
How	Working group must prepare a management summary

Appendix B – Inventory of measures

Inventory of measures from Volume 1 (sorted to strategic measures):

- Appendix B: Entry points, motivation to using and distribution/benefit
- Chapter 2: Description, intent of measure and related themes

B-1. Set Vision and Targets

No	Entry point Urban Planning	Entry point Energy Planning	Motivation to using	Distribution/Benefit
1	/	/	Contribution to meet the global goal	/
10	Official Plan	Energy supply selection	Consistent division of responsibility.	Include within zoning bylaws
20	Initial scoping / design	Energy efficiency action plan development	Opportunities for Certificate / Label for construction Creates Competition between designers.	High public visibility of results
30	General framework/guideline for future plans	General framework/guideline for future plans	Reach pre-established targets by 2020.	Will be published in spring 2016.
31	General framework/guideline for future plans	General framework/guideline for future plans	Foster economic use of energy across all sectors	All possible media channels.
32	General framework/guideline for future plans	General framework/guideline for future plans	Reach climate-neutral building stock by 2050.	All possible media channels.
40	Parallel	Parallel	Create awareness and promote use of RE and EE	Online Portal.
70	Making the business case more healthy, by including energy benifits	Energy Transition needs an brader approach	Making both the energy transition and sustainable regional	Exchange bottlenecks and solutions between regions. Optimising

No	Entry point Urban Planning	Entry point Energy Planning	Motivation to using	Distribution/Benefit
			development more feasible	the national instruments.
79	Any planning stage	Basis of energy planning process Can be entered at any point in the planning process	Global goal High publicity Covers more than the planning and construction process	Through legislation (e.g. Zürich) Through Special Use plan Through Energy plan creates a common vision
86	Target setting for planning	Energy planning strategy	Foundation for local decisions related to urban planning and energy planning (if local), basis for negotiation with utility (if private)	Transparency in vision and progress
59	Project Initiation	Project Scoping	Enables ambitious target setting for entire project	Provides examples to future projects

B-2. Develop Renewable Energy Strategies

No	Entry point Urban Planning	Entry point Energy Planning	Motivation to using	Distribution/Benefit
18	Originates from the Municipal Plan	Energy supply selection	Creates a foundation for municipal energy decisions.	Basis for future Local Development Plans Becomes binding for the energy utility
19	Initial scoping of development scenarios	Energy strategy scenario planning with stakeholders	Definitive / holistic results Covers more than just one energy sector, which leads to synergies Combination with business growth strategies	Provides support for solutions that are the common goal of stakeholders
24	Local Climate Action Plan	Local Climate Action Plan	Target Setting / Monitoring	National Law
49	Executive planning in relation to Development Plan reviews	Renewable energy strategies	Consistency of approach to RE across all local authority areas	Contact with Local Authorities through public consultation
50	Executive function in drafting the development plan	Energy planning not a direct function of the development plan	Opportunity for the public to engage in local area planning.	Opportunity for input and future repeat projects
54	Internal DECLG senior advisors	Internal DECNR energy analysts	Overarching framework – strategic guidance	National support for change
68	Scenario building	Project outset	Encourages stakeholder involvement based on all available and realistic data	Open source information and transferable
74	Project concept	Project Concept	A plan that involves the greatest portion of the population	Has the buy-in from both the public and the authorities

No	Entry point Urban Planning	Entry point Energy Planning	Motivation to using	Distribution/Benefit
77	Project concept	Project concept	Facilitates the inclusion of alternate transportation means.	Removes responsibility from developer.
80	Special Use Planning & Regular zonal planning	During Zone Planning process or Special Use Plan Can be entered at any point in the planning process	High publicity Facilitates the sustainable and efficient heat use	Efficient heat supply on local level Holisitic information
65	Project outset	Energy planning scenarios & strategy	Creates realistic scenarios for the overall strategy Energy neutral approach to growth	Applies across the board; from cities to individual institutions

B-3. Make Full Use of Legal Frameworks

No	Entry point Urban Planning	Entry point Energy Planning	Motivation to using	Distribution/Benefit
2	Revision of Regional Development Concept	/	Contribution to meet National Climate Goals	By Legislation
5	Development of Local Development Plan of the concerned area	Binding act / Making all planned measures legally binding.	To get higher acceptance plus commitment	By Local Development Plan By legislation
14	Economic analysis	Infrastructure planning & upgrade	Improved economics	Clear definitions of bylaw requirements
33	Legal precondition for development of any urban projects	Legal precondition.	General allocation of municipal area.	Legislation
34	Legal precondition for development of any building projects. Developed from the Zoning Plan.	Legal Precondition.	Regulate specific allocation of land use in smaller areas.	Legislation
35	Legal framework for future plans, Building permission	Legal framework for future plans	Expansion of RE and EE across all sectors Financial incentives (EEG)	Legislation
36	General framework/guideline for future plans	General framework/guideline for future plans	Informal base for future urban and energy plans at city level	Local Development Plans (conventional communication channels)
47	Parallel	Parallel	Expansion of DH grid, cost-effectiveness of operation	Increasing number of connection to the grid, campaign, user information
60	Project Initiation and target setting	Project Initiation	Low Carbon City Development Plan	Provides transparency for public review
82	Zone planning (basis) Project design (concrete application)	When designing the project incl. energy concept	Possible Win-win situation for municipality (better energy concept) and developer (higher floor area ratio)	In zone planning

B-4. Design of Urban Competition Processes

No	Entry point Urban Planning	Entry point Energy Planning	Motivation to using	Distribution/Benefit
4	As early as possible / as a first step when developing a building project	As early as possible / as a first step when developing a building project	Achieve innovative approaches; achieve best economic solution	Tendering procedure
27	Guidelines for sustainable construction at district scale		Provide Management Process to reduce environmental impact of urban development projects	HQE
28	District Planning	Local Energy Concept	Showcase lighthouse projects	National competition and documentation Club national EcoQuartier
46	Parallel	Parallel	Proof of high quality and a sustainable district (or building)	Recognition, image
63	Design scoping & selection	Design scoping & selection of renewable energies	Across the board use of comprehensive assessment tool for Building, Residential building, Community, City.	Consistent approach to energy improvements
78	Design approval	Information from Energy Structure Plan (if existing)	Higher value of the energy efficient buildings Freedom to optimize Private: Setting themselves off from the crowd Less tenant turnover High publicity Assurance that site is in line with energy strategy	Through Special Use Plans through high publicity Supports implementation of long term targets of Energy Cities Cooperation tool for planning authorities and investors (creates a common language) Holistic approach

B-5. Make Use of Tools Supporting the Decision-Making Process

No	Entry point Urban Planning	Entry point Energy Planning	Motivation to using	Distribution/Benefit
25	National comparison of measures	National comparison of targets	Monitoring	ADEME
42	Parallel	Parallel	Public awareness and engagement	Conventional communication channels (web portal, city journal, etc).
43	Parallel	Parallel	Foster awareness across private households Promote investments	Online Portal
44	Parallel	Parallel	Foster EE across all sectors	Online Portal
56	LARES (voluntary)	Identification of suitable sites for wind development	Guidance only.	Clearly identifies areas of greatest opportunity. Enables consideration of areas for further analysis and testing. Also supported by Biomass and Geothermal Maps as well.
66	Scenario building	Infrastructure assessment & strategy scenarios	Makes effective use of all energy and land-use resources in the area	Holistic information transferable to future projects
67	Project initiation	Project scoping	Integral approach to planning. Evaluates and includes all local resources and material flows	Maximises local benefits
72	Preliminary Design	Preliminary Design	Proven concept, known to attract industrial partners	Reduced use of fossil fuels and increased renewable energy integration

No	Entry point Urban Planning	Entry point Energy Planning	Motivation to using	Distribution/Benefit
84	Data planning	Data planning	Supports design and efficiency programs	Improved collaborative design
88	Data collection and planning	Data collection and planning	Targets incentive programs	Ongoing technical support
73	Final Design	Final Design	Facilitates the involvement of multiple stakeholders in the operation of the energy grid	Transparency of operation

B-6. Implement Monitoring of Energy Consumption and GHG Emissions

No	Entry point Urban Planning	Entry point Energy Planning	Motivation to using	Distribution/Benefit
6	Ongoing	Ongoing	Create awareness and promote use of RE and EE	Evaluation plus documentation of activities on a municipality level
15	Compliance with emission caps	Compliance with emission caps	Reduced marketing Justification of decisions	Publicly available disaggregated results
21	Post project – compliance with emission targets	Post project – compliance with emission targets	Allows justification of decisions Enables corrective measures for errors	Improves future action plans
23	PCET	Emission Targets	Analysis	ADEME
41	Parallel	Parallel	Monitoring and progress evaluation.	Online Portal.
45	Parallel	Parallel	Monitoring actions and progress concerning CO2 emissions	Recognition, image
57	Not applicable (to the best of my knowledge)	Informs Public sector renovation and retrofit strategies and priorities.	Required to use this process. Scorecard is sent to each Local Authority Chief Executive on a regular basis to inform of progress against established target.	Nationally applied, consistent model that is comparable across different Local Authority Regions.
75	Project approval	Ongoing	Provides detailed monitoring approach to verify the actions	The collected data creates a sound basis for future planning and decision making
85	Data tools for planning	Data tools for planning	Consistent assumptions in decision making	Limited ambiguity between partners

No	Entry point Urban Planning	Entry point Energy Planning	Motivation to using	Distribution/Benefit
81	Any planning stage, accompanying the whole process	When organising, designing, implementing and monitoring the energy concept	Holistic approach for considering the inclusion of energy related topic in each of the planning phases	Audit and certification as prove of action and for political buy-in Integration of all departments (horizontal involvement)

B-7. Stakeholder Engagement & Involvement

No	Entry point Urban Planning	Entry point Energy Planning	Motivation to using	Distribution/Benefit
3	Precondition for development of any building projects	Basis of energy planning process	Contribution to meet National Climate Goals; respect and publicity of the public	Urban planning process (voluntary)
7	As early as possible	/	To get higher acceptance plus commitment	Urban planning process (voluntary)
8	Project Initiation.	Project scoping	Consistent Point of View	Maximising awareness / opportunities for exposure
9	Project Initiation	Project initiation	Single point of contact. Unbiased access to all stakeholders	Report directly to senior management
11	Information sharing / trust building	Information sharing / trust building	Multiple perspectives and experience. Access to customer base	Publicly available database
26	Early design phase	Assessment of local energy concept	Control, Monitoring, Communication	EIFER
29	1. Vision development 2. Target setting 3. Spatial application	Ibid	Providing an integrated approach	Process to support sustainable urban development

No	Entry point Urban Planning	Entry point Energy Planning	Motivation to using	Distribution/Benefit
	4. Implementation			
38	Precondition for development of urban projects	Early stage to receive as much public feedback as possible	Ensure well reception and effective urban/energy plans	Conventional communication channels (web portal, city journal, etc).
53	Provide evidence based inputs to energy transition plans	Provides evidence based inputs on energy transition challenges	Meets periodically, to stimulate national debate	Will include community, business, and researchers.
55	Encourages local renewable energy strategy development. Participation in development of national community energy generation models and supporting policies.	All stages of energy infrastructure planning, may also be the Local Authority acting as an SEC and undertaking Local Authority Renewable Energy Strategy (LARES)	Funding available, support to develop energy master plan for community, training and networking opportunities made available, local and regional representation. Technical advisors available to support plans.	80 communities across Ireland involved. Community led energy projects delivering 100M of energy upgrades each year. Developing the ‚Energy Citizen' and encouraging wider participation in local and national energy projects.
62	Project Initiation Allows target setting through wide-scale discussion	Project Initiation	Accepted standards for Building Energy Efficiency, DHC, etc.	Transparency in approach by both land-use and energy planners
69	Stakeholder engagement	Stakeholders engagement	Quantifies stakeholder responsibility	Open source / transparent agreements
87	Community support for planning	Community support for energy planning	Clear levels of public support with multiple perspectives	Long term vision support
22	/	/	/	/
76	Preliminary Design	Preliminary Design	Provides a resource for the simulation of possible action options	Transparency in decision making

B-8. Include Socio Economic Criteria

No	Entry point Urban Planning	Entry point Energy Planning	Motivation to using	Distribution/Benefit
12	Official Plan Information database	Energy efficiency program development	Cross-cutting thinking (social / technical) What-if scenario builder	Coordinate databases within the community
13	Initial scoping / design	Infrastructure planning & upgrade	Rapid scoping of technology options	Publicly available information on available methods
16	Investment reporting	Investment reporting	Development of policy support	Publicly available disaggregated results
17	Development of the Municipal Plan	Basis of energy planning strategy	Lower end-user energy costs Societal benefit included in decision making	Creates a comprehensive planning process
39	Parallel	Parallel	Promote RE and EE investments	Online Portal.
48	Parallel	Parallel	To get a higher rate of renovation	Implementation of renovation measure is perhaps cheaper and faster
89	In some U.S. states (e.g. California, Massachusetts, Minnesota), environmental impact assessment (EIA) is required for some (typically larger) public and private urban development projects. EIA analyses document a range of environmetnal imapcts and in some cases are required to account for social and	EIA, when required, can provide a means of identifying environmental impacts associated with energy production, consumption, and conservation. Only California has well-developed standards for assessing GHG emissions and associated impacts from urban devleopment projects.	At the scale of urban development projects, EIA is typically only conducted when it is required. In some cases, urban development project developers may conduct a voluntary or more extensive analysis in ordert o respond to public concerns related the project.	Data and analysis provided in EIA documents related to environmental impacts, including econonomic and social impacts, is provided with the intent of informing the project decision making. The EIA must be completed before a final decision (e.g. permit approval) is made related tot he project. The public and decision makers can review the information in the EIA

No	Entry point Urban Planning	Entry point Energy Planning	Motivation to using	Distribution/Benefit
	environmental impacts such as environmental justice and economic development.			in order to infom their comments and decisions.
58	Policy is led by planning department.	Energy can be considered as part of this plan.	Each Local Authority is required to prepare an LECP in consultation with the community and update on a fixed schedule. Includes substantial consultations phases and engagement. (still in 1st cycle)	Sets out community development objectives and can depend on local priorities that may not include energy.

B-9. Implement Effective and Efficient Organizational Processes

No	Entry point Urban Planning	Entry point Energy Planning	Motivation to using	Distribution/Benefit
37	Early stage.	Early stage.	Provide extensive information and support to overall community.	Online and “on the field” presence (direct contact with citizens).
51	Project outset: embed position in the Local Authority	Liaise with embedded position in the Local Authorities	Environmental issues are more mainstream in local authority decision making processes	Facilitates the integration of energy in future planning
52	No clear entry point as no local authority representation	Cross sectoral: will advise government on actions required to decarbonise the economy	Development of a national mitigation plan and policies to bring about a low-carbon economy	Includes the EPA and SEAI in addition to research institutes and economists

No	Entry point Urban Planning	Entry point Energy Planning	Motivation to using	Distribution/Benefit
61	Project Initiation	Design strategies / scoping.	Allows renewable energy options and Energy management to be included	Immediate acceptance of renewable options
64	Planning scenarios	Energy planning strategy & future scenarios	Proven concept on a system level	Within the scope of housing company, locally and on a national scale
71	Energy Atlas	Energy Atlas	Shared responsibility urban and energy planners	Within the municipality and meeting national goals
83	Project initiation	Local goal and private utility target setting	Collaboration of diverse parties	Visible support for project

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