Building Renovation in EU to achieve energy and CO_2 reduction targets

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Presentation based on:

EUROPE'S BUILDINGS UNDER THE MICROSCOPE

A country-by-country review of the energy performance of buildings

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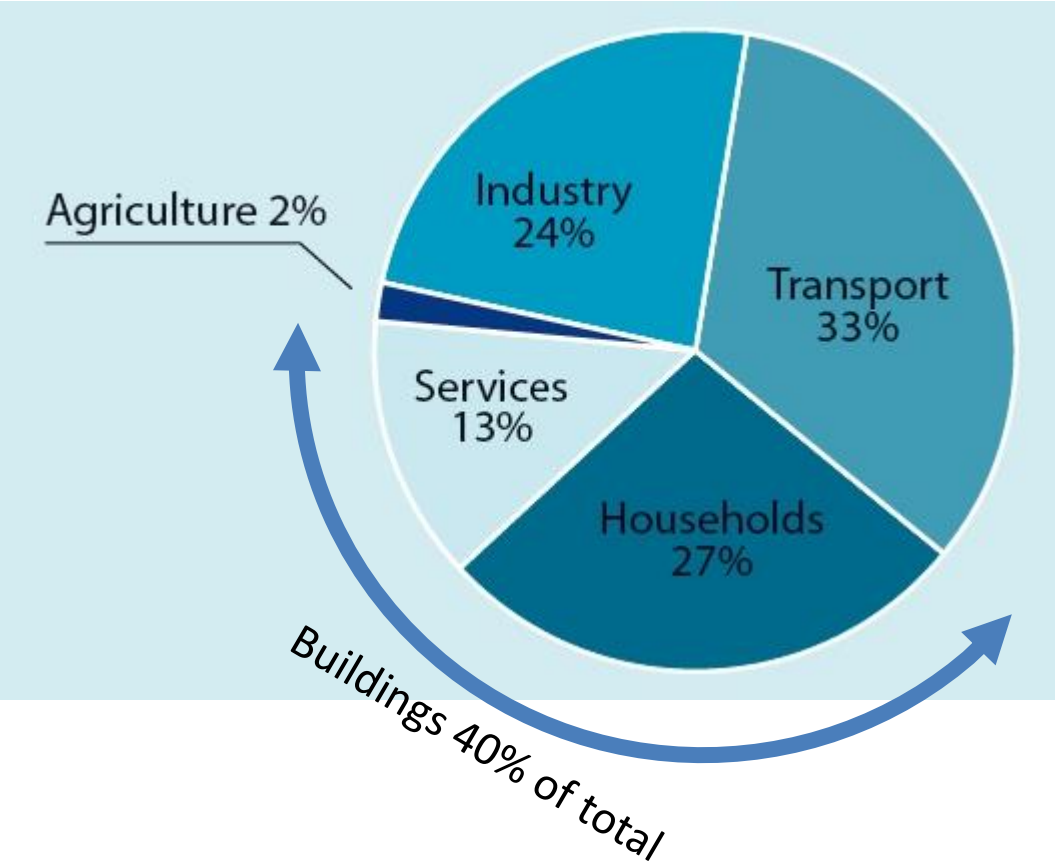
Final energy consumption by sector in the EU, 2009



Make up of building stock

Source: BPIE survey

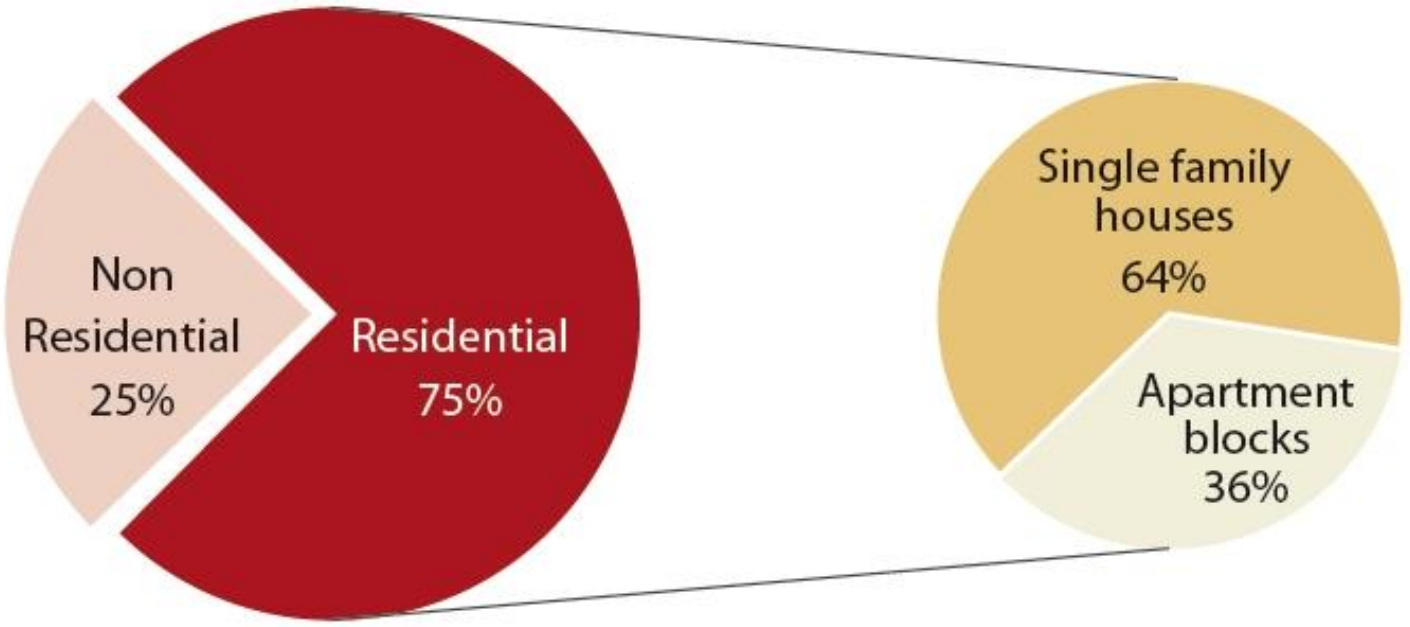


Figure 1C3 – Historical final energy use in the residential sector in EU27, Norway and Switzerland

Source: Eurostat database

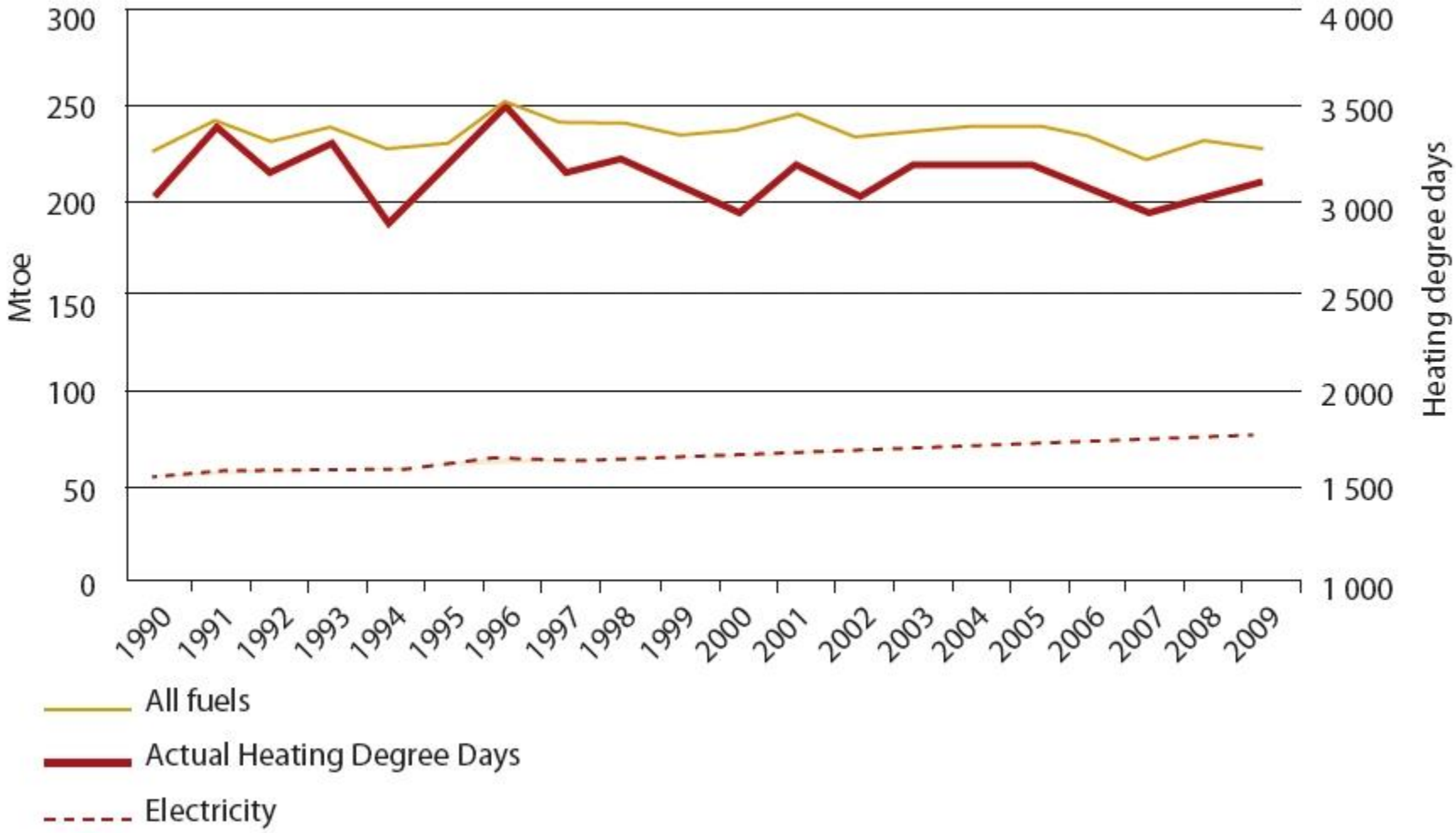
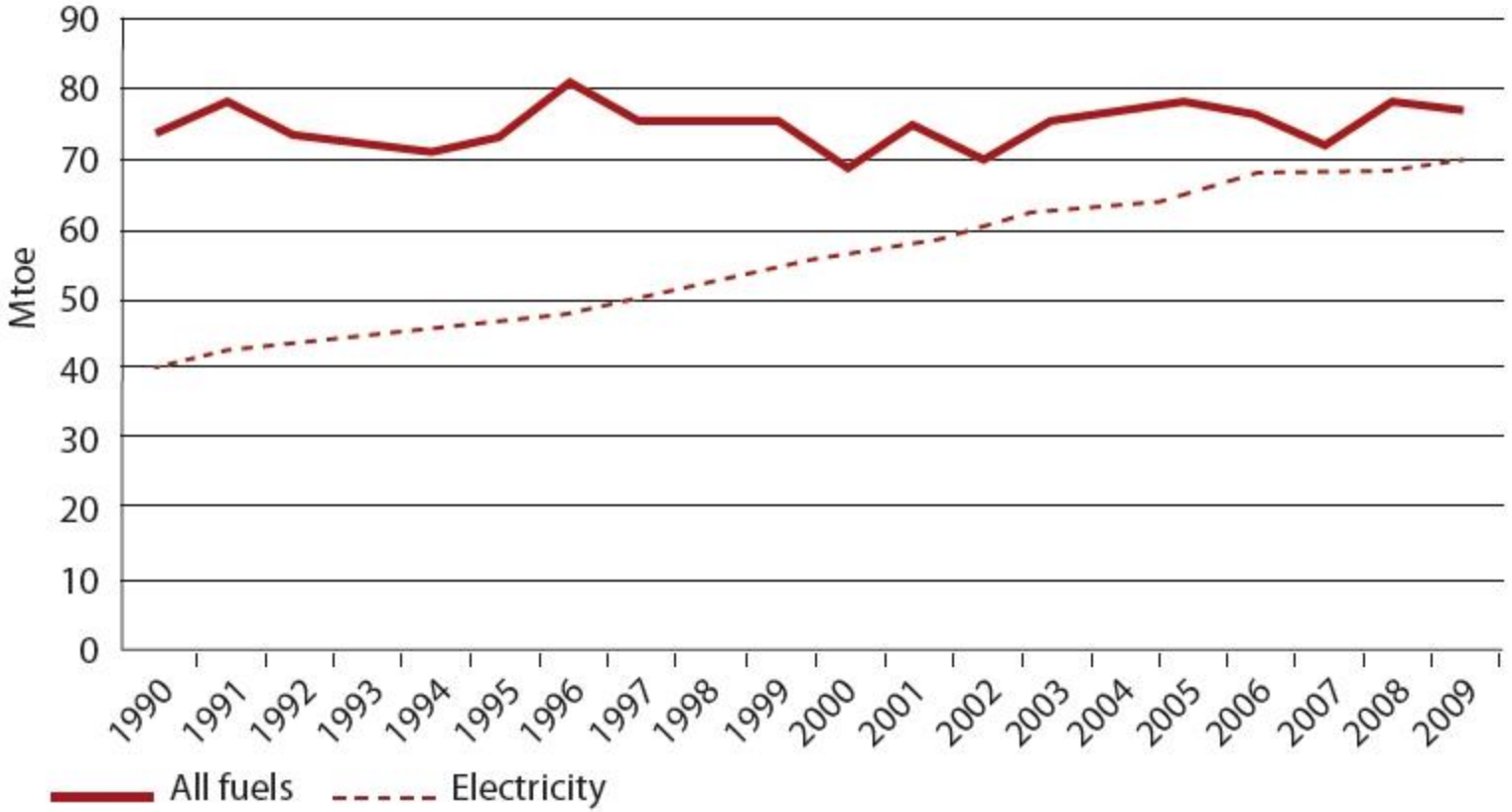


Figure 1C9 – Historical final energy use in the non-residential sector in the EU27, Norway and Switzerland

Source: Eurostat database



[18] n_{50} represents the total air change rate in a building caused by pressure difference of 50 Pa.

[19] Source: *ASIEPI - Assessment and Improvement of the EPBD Impact*. Retrieved June, 2011 from www.asiepi.eu

Figure 1C1– Historical final energy consumption in the building sector since 1990s for the EU27, Switzerland and Norway

Source: Eurostat database

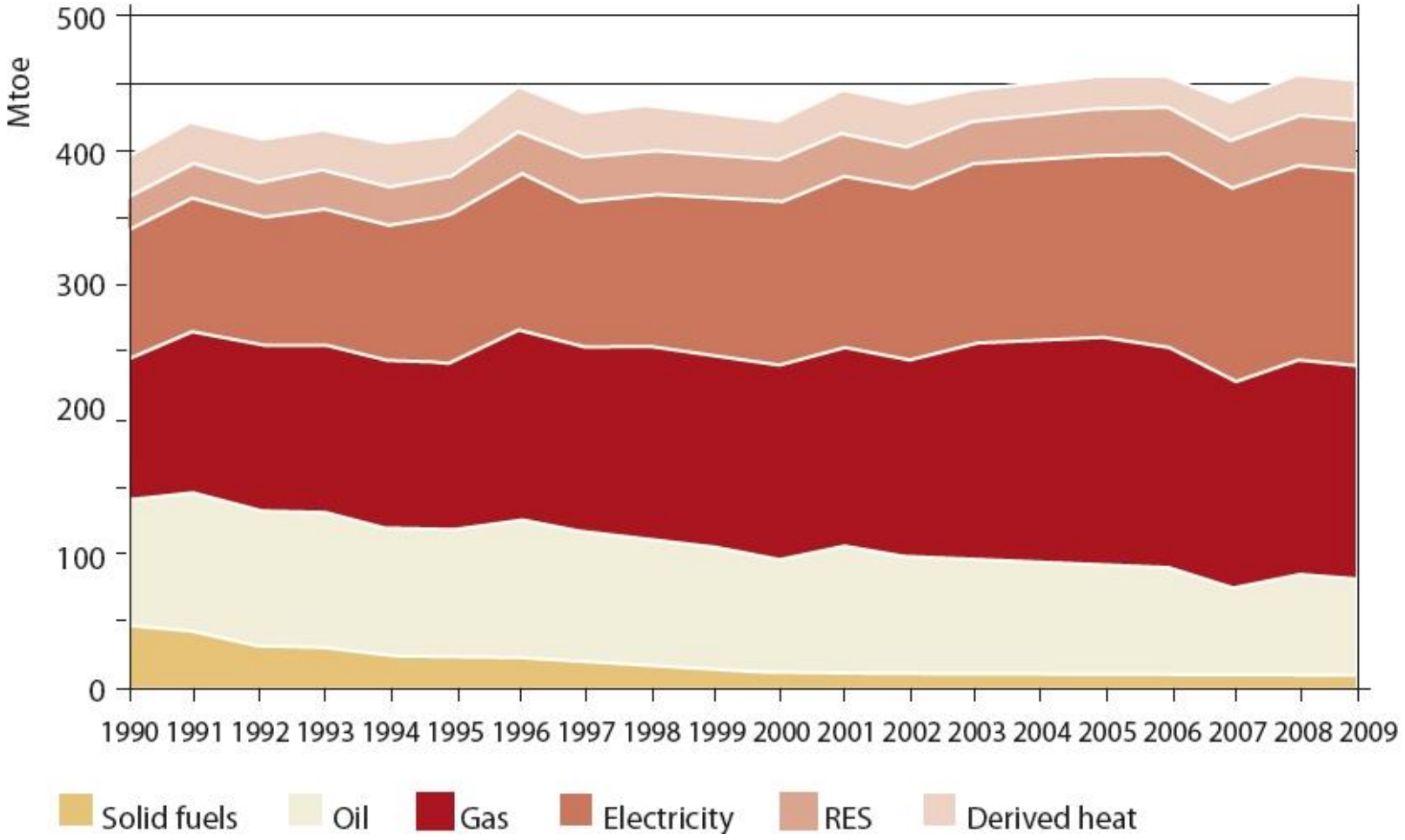
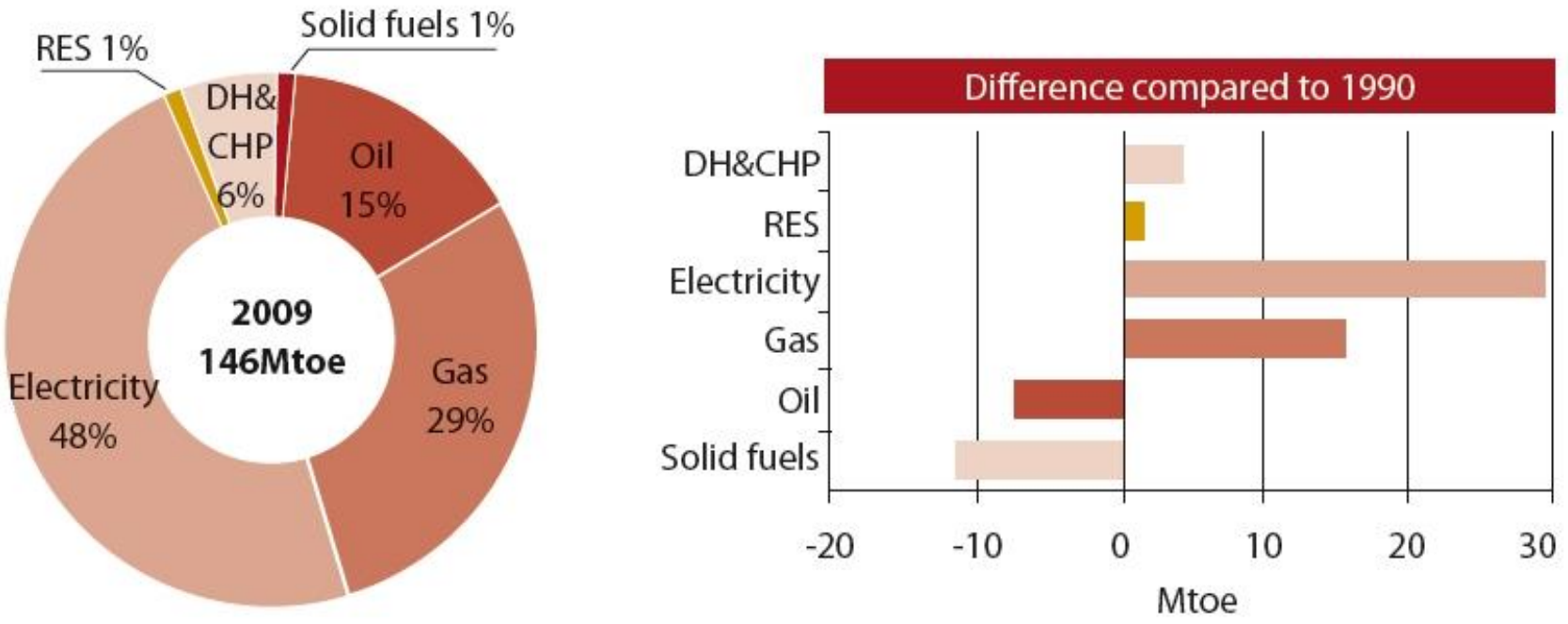


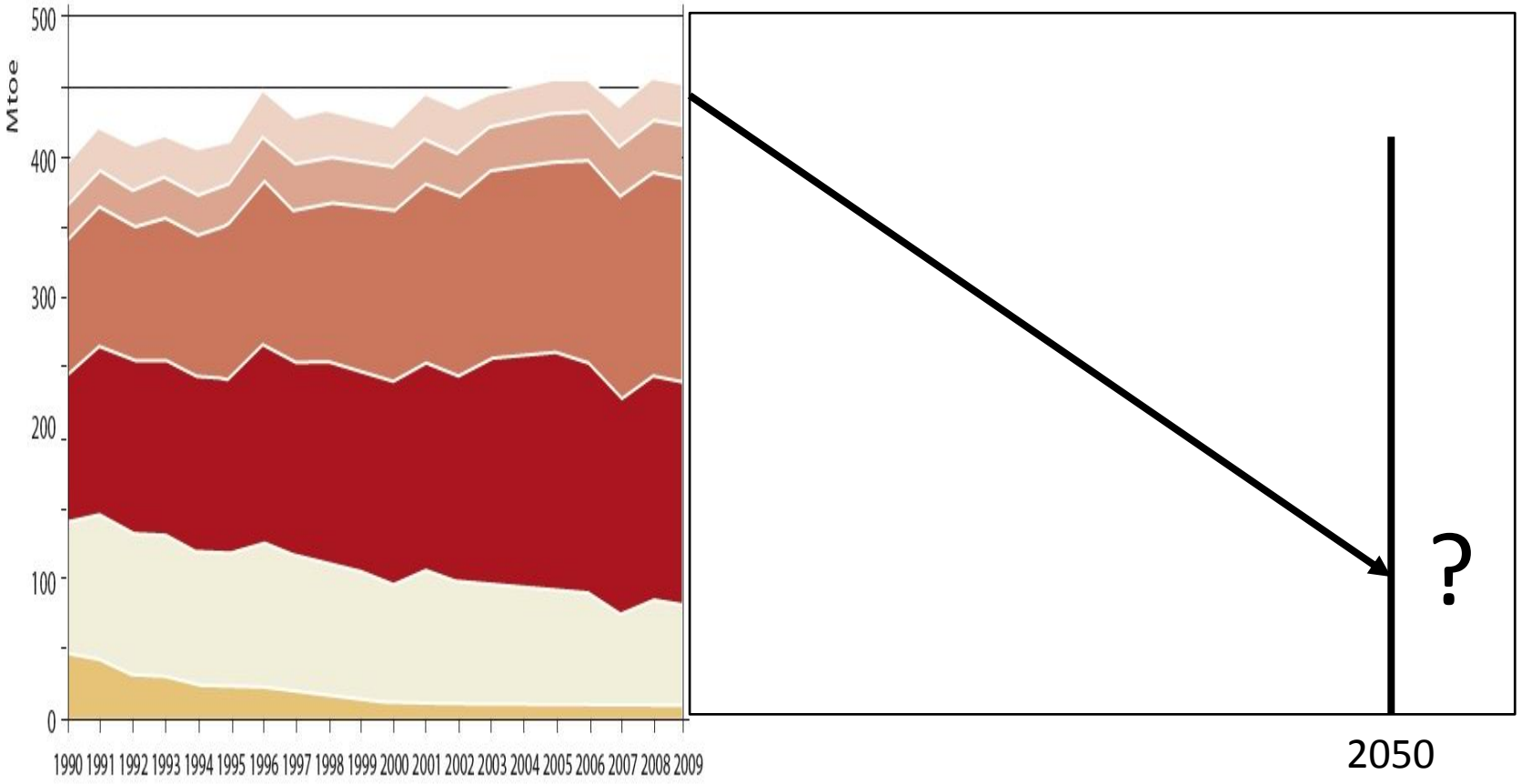
Figure 1C10 – Energy mix in the non-residential sector in the EU 27 together with Switzerland and Norway and corresponding difference compared to 1990 profile

(DH denotes district heating and CHP denotes Combined Heat and Power)

Source: Eurostat database



Target reduction?



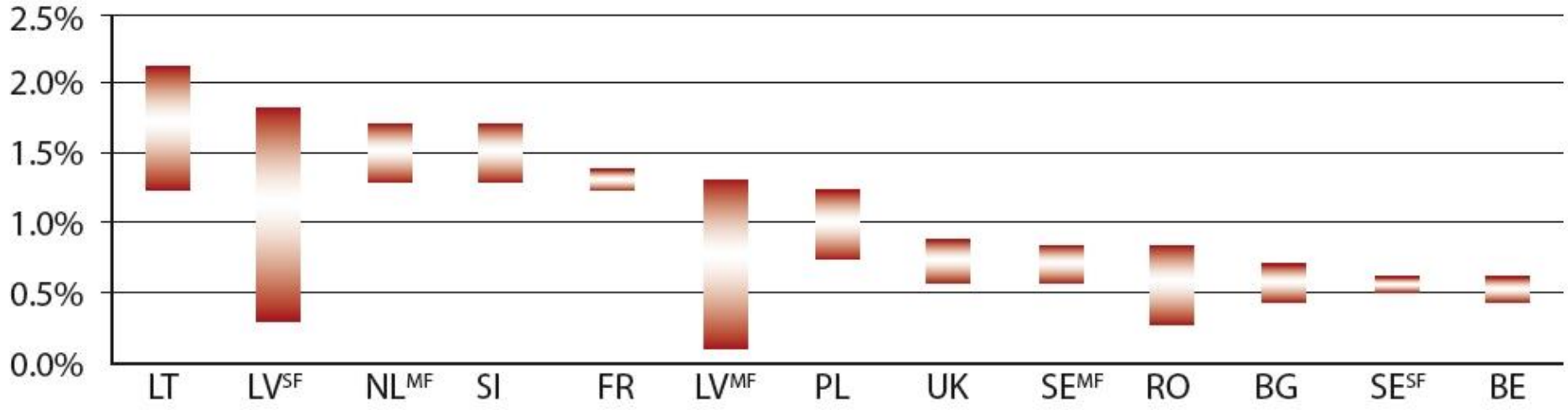
Targets & issues

- 80% cut in CO_2 by 2050 (ref 1990 levels)
- 40-50% cut by 2030?
- Renovation target for buildings depends on:
  - New building: construction rate, replacement vs additions and performance in use (nZEB?)
  - How much do buildings need to compensate for other sectors (eg: transport & manufacturing)
  - To what extent will the energy and fuel supplies to buildings be decarbonised?

Example new building rates

Figure 1A7 – Range of new build rates in the residential sector (2005-2010) where SF and MF denote single family and multi-family houses, respectively.

Source: BPIE survey



Most likely scenario?

- Most new buildings will be additional and will not achieve near zero energy use in practice.
- Buildings will need to compensate for other sectors like transport where energy use is increasing and manufacturing where it has already been largely outsourced.
- Despite good progress on renewables in many EU countries, discontinuous policies and reliance on gas will limit decarbonisation.
- Result: final energy use in the existing building stock will need to be cut in the order of 50% to 80% by 2050.

How is this to be achieved?

The BPIE model

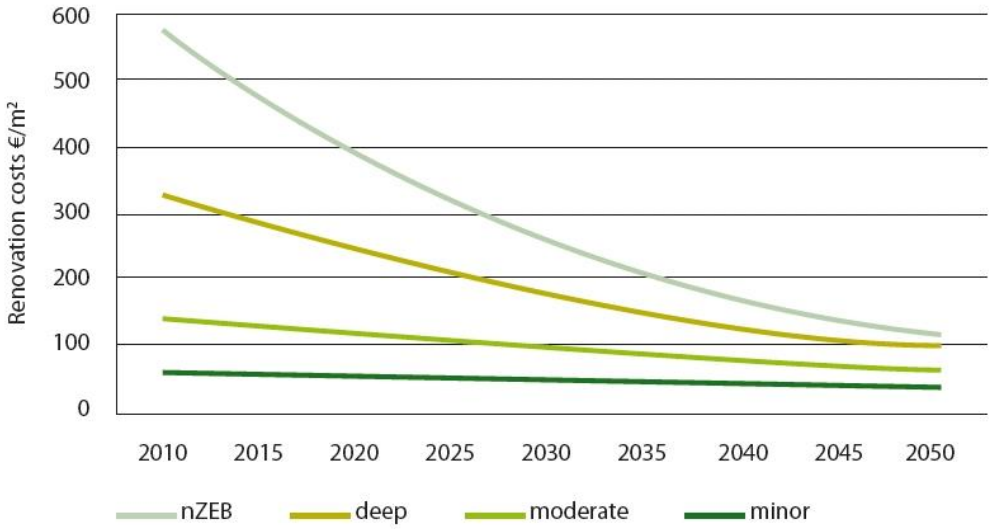
Renovation types, savings and costs

(now and in the future)

Description (renovation type)	Final energy saving (% reduction)	Indicative saving (for modelling purposes)	Average total project cost (€/m²)
Minor	0-30%	15%	60
Moderate	30-60%	45%	140
Deep	60-90%	75%	330
nZEB	90% +	95%	580

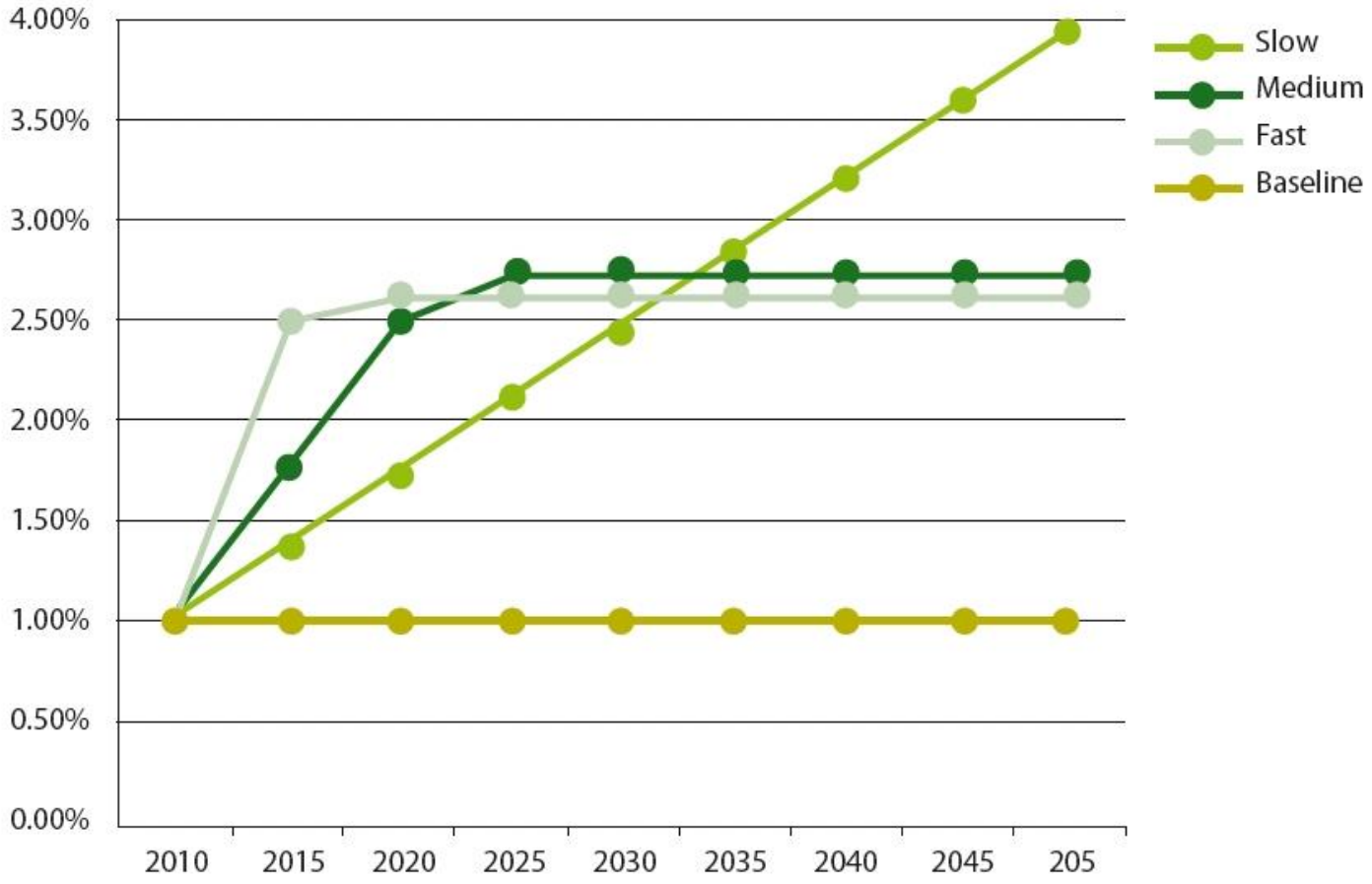
Figure 3B1 – Cost reductions for different levels of renovation over time

Source: BPIE model



Modelled rates of renovation

Source: BPIE model



Renovation paths modelled

Figure 3B3 – Shallow renovation path

Source: BPIE model

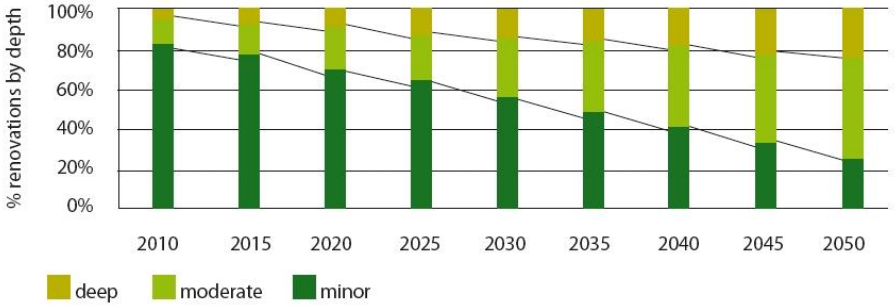


Figure 3B4 – Intermediate renovation path

Source: BPIE model

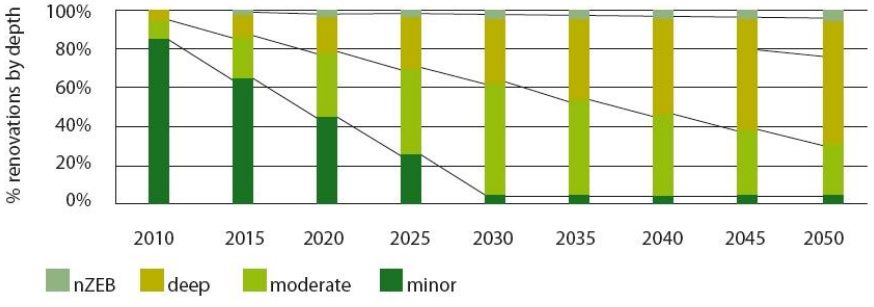


Figure 3B5 – Deep renovation path

Source: BPIE model

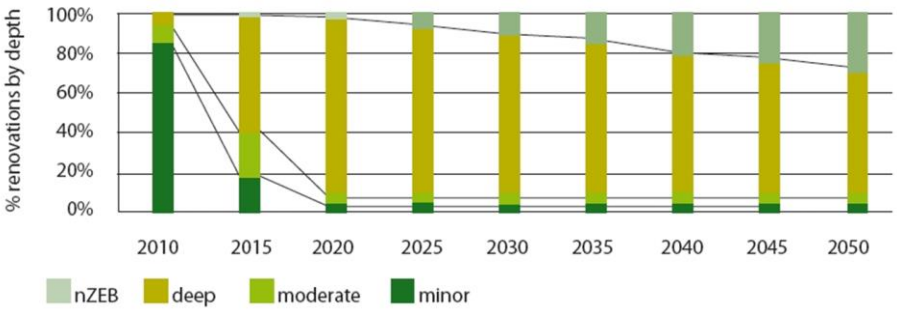
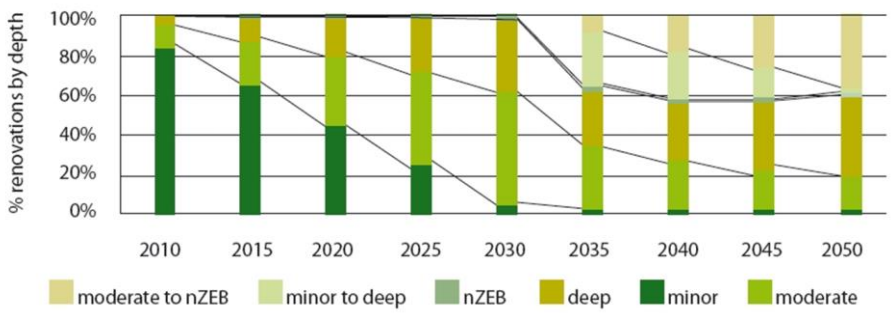


Figure 3B6 – Two-stage renovation path

Source: BPIE model



Scenarios modelled

Scenario 0 – Baseline (Business As Usual)

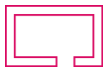
For the baseline scenario, it is assumed that the prevailing renovation rates (which are predominantly minor) continue until 2050. Unlike the other scenarios, this does not result in a full renovation of the building stock. In fact, at the prevailing renovation rate of just 1% p.a., only 40% of the stock is renovated by 2050.

Scenarios 1a (Slow & shallow) and 1b (Fast & shallow)

These two scenarios both take the shallow renovation path. They compare the impact of a rapid acceleration in the rate of renovation ("Fast & shallow") with a slow but steady ramping up ("Slow & shallow"). These scenarios are shown in order to illustrate the consequences of focusing mainly on shallow renovation measures which may be perceived as the "cheaper and more pragmatic solution".

Scenario 2 - Medium

The Medium scenario combines the intermediate renovation path with the medium rate of growth.



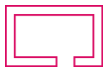
Scenarios modelled

Scenario 3 - Deep

The Deep scenario combines the deep renovation path with the medium rate of renovation growth. By virtue of the rapid shift towards deep renovations, and the growing share of nearly Zero Energy Buildings towards the middle of the century, this scenario achieves energy savings as high as 68%, with corresponding CO_2 emissions reductions of 90% (under the fast decarbonisation option) - the target for buildings set out in the EU 2050 Roadmap.

Scenario 4 – Two-stage renovation

The fourth scenario deviates from the assumption in the previous scenarios that buildings will be renovated once between 2010 and 2050. In this scenario, from 2031 onwards the "second stage" renovations commence, occurring in addition to the first time renovations.



Results – energy savings

Scenario		0	1A	1B	2	3	4
Description		Baseline	Slow & Shallow	Fast & Shallow	Medium	Deep	Two- stage
Annual energy saving in 2050	TWh/a	365	1 373	1 286	1 975	2 795	2 896
2050 saving as % of today	%	9%	34%	32%	48%	68%	71%

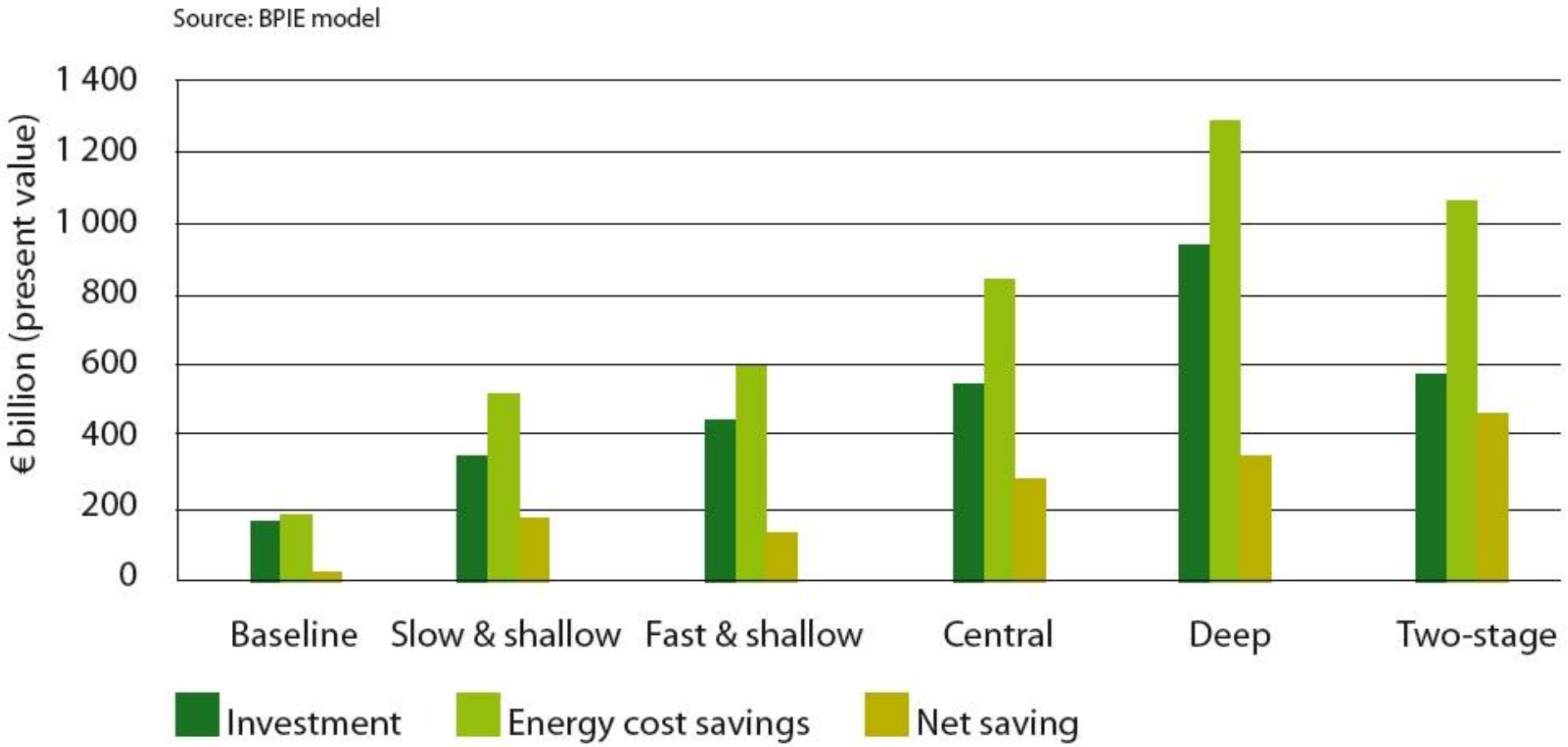
Results – costs and benefits

Scenario		0	1A	1B	2	3	4
Description		Baseline	Slow & Shallow	Fast & Shallow	Medium	Deep	Two- stage
Investment costs (present value)	(€ billion)	164	343	451	551	937	584
Savings (present value)	(€ billion)	187	530	611	851	1 318	1 058
Net saving (cost) to consumers	(€ billion)	23	187	160	300	381	474
Net saving (cost) to society - without externality	(€ billion)	1 116	4 512	4 081	6 451	8 939	9 908
Net saving (cost) to society - including externality	(€ billion)	1 226	4 884	4 461	7 015	9 767	10 680
Internal Rate of Return	IRR	10.1%	12.4%	11.5%	12.5%	11.8%	13.4%

Results – CO_2 reductions and jobs

Scenario		0	1A	1B	2	3	4
Description		Baseline	Slow & Shallow	Fast & Shallow	Medium	Deep	Two- stage
Fast decarbonisation							
Annual CO_2 saving in 2050	$MtCO_2/a$	742	821	814	868	932	939
2050 CO_2 saved (% of 2010)	%	71.7%	79.3%	78.6%	83.8%	89.9%	90.7%
CO_2 abatement cost	€/tCO_2	-20	-74	-68	-103	-136	-151
Slow decarbonisation							
Annual CO_2 saving in 2050	$MtCO_2/a$	182	410	391	547	732	755
2050 CO_2 saved (% of 2010)	%	18%	40%	38%	53%	71%	73%
CO_2 abatement cost	€/tCO_2	-89	-196	-185	-221	-238	-255
Average annual net jobs generated	Million	0.2	0.5	0.5	0.7	1.1	0.8

Lifetime financial impact for consumers



Conclusions

- Targets for energy reductions in buildings dependent upon other factors:
  - Compensating for other sectors (transport, etc.)
  - Extent and rate of fuel/energy supply decarbonisation
- Going for deep renovation from the outset is expensive (unaffordable?)
- BAU and shallow won't achieve the targets
- Minor and moderate renovations first (whilst they are lowest cost) and deeper renovations later (when they are cheaper) may be best!

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