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Perspectives on energy efficiency and its importance towards sustainability

Target: 20% efficiency improvements

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Widened view of energy efficiency

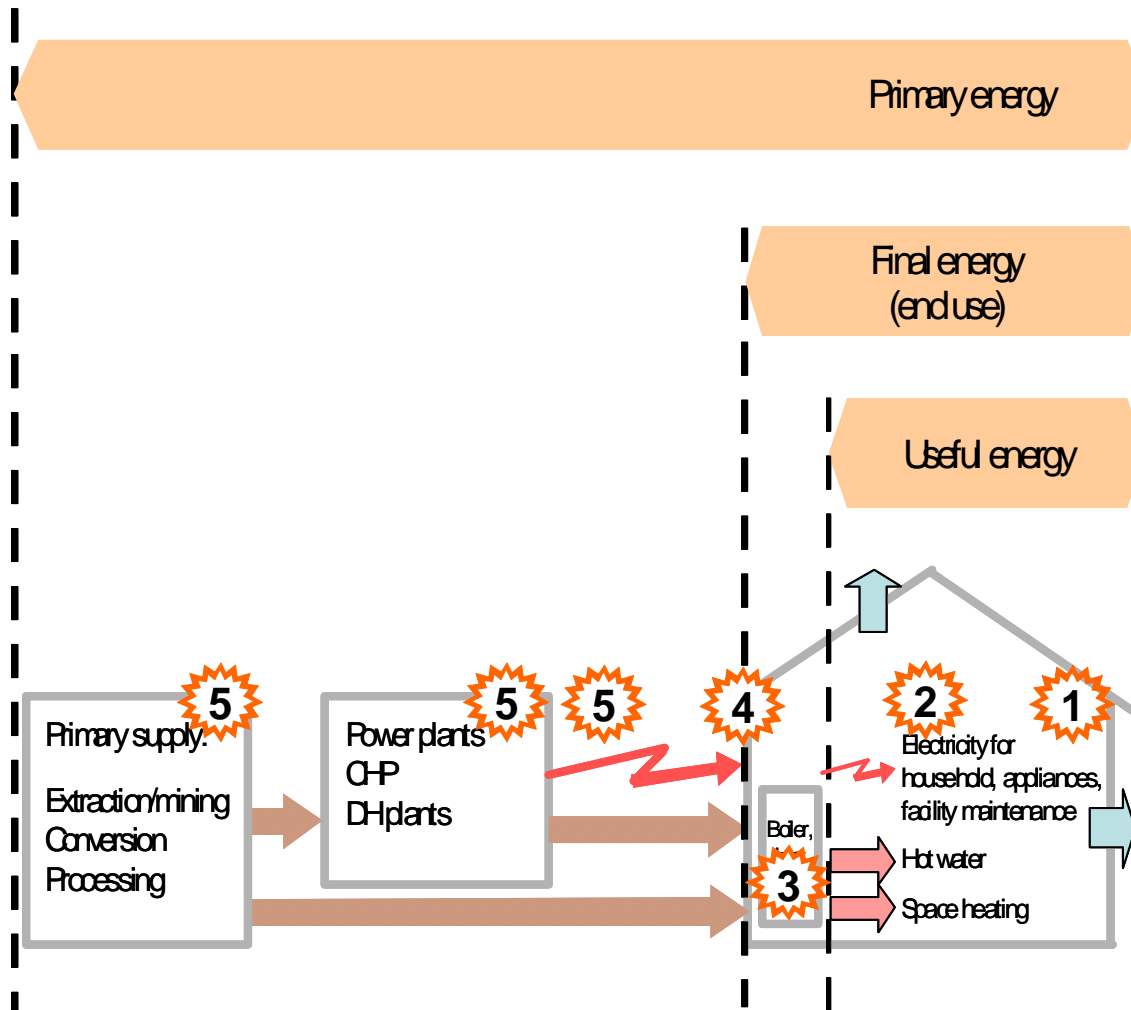
... in the Nordic energy system

The NEP approach:

- ❖ Definitions, system boundary, trading/non-trading etc.
- ❖ Evaluation of national policies and action plans (incl. ESD)
- ❖ Calculation of a (realistic) potential for end use efficiency
- ❖ Defining a "setup" for the EU 20% efficiency target
- ❖ Model calculations for the entire Nordic energy system, including all EU targets
- ❖ *Comparable analysis for the Nordic transport system*

System boundary

How much of efficiency improvements to be included?



Possible components when adding up energy efficiency results:

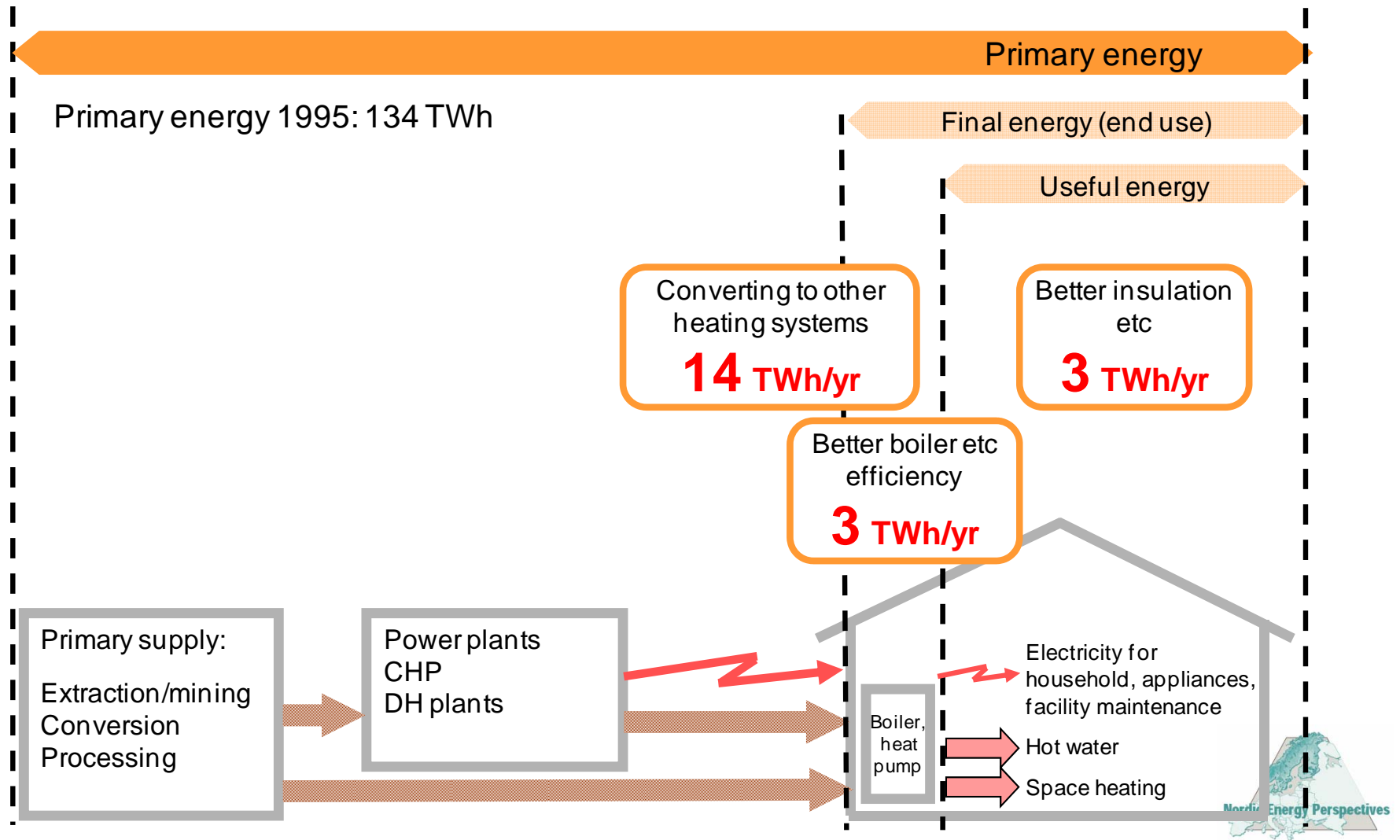
- 1 Better insulation, better control systems
- 2 Better appliances
- 3 Better boilers, better heatpump COP etc
- 4 Decreased primary energy due to converting to other heating systems in the houses
- 5 Better efficiency in energy transformation (new/better generation, more CHP, new/better distribution)

Sweden: Energy efficiency improvements 1995 – 2004 (as primary energy)

Heating of all residential, commercial and public buildings in Sweden.

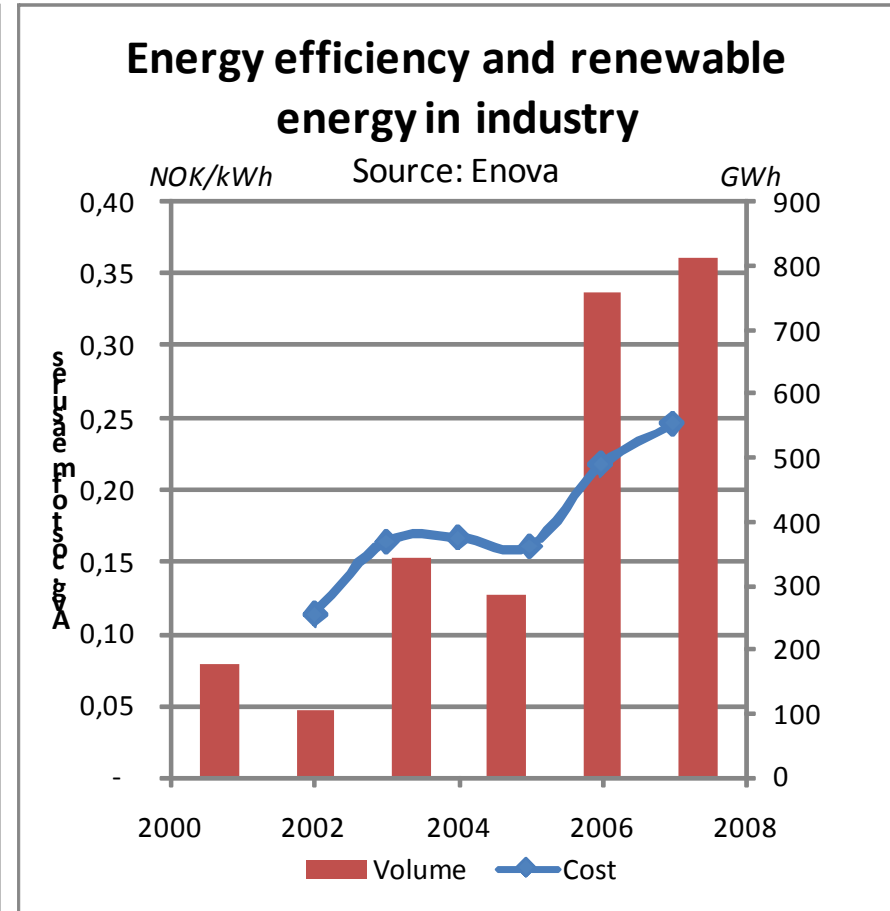
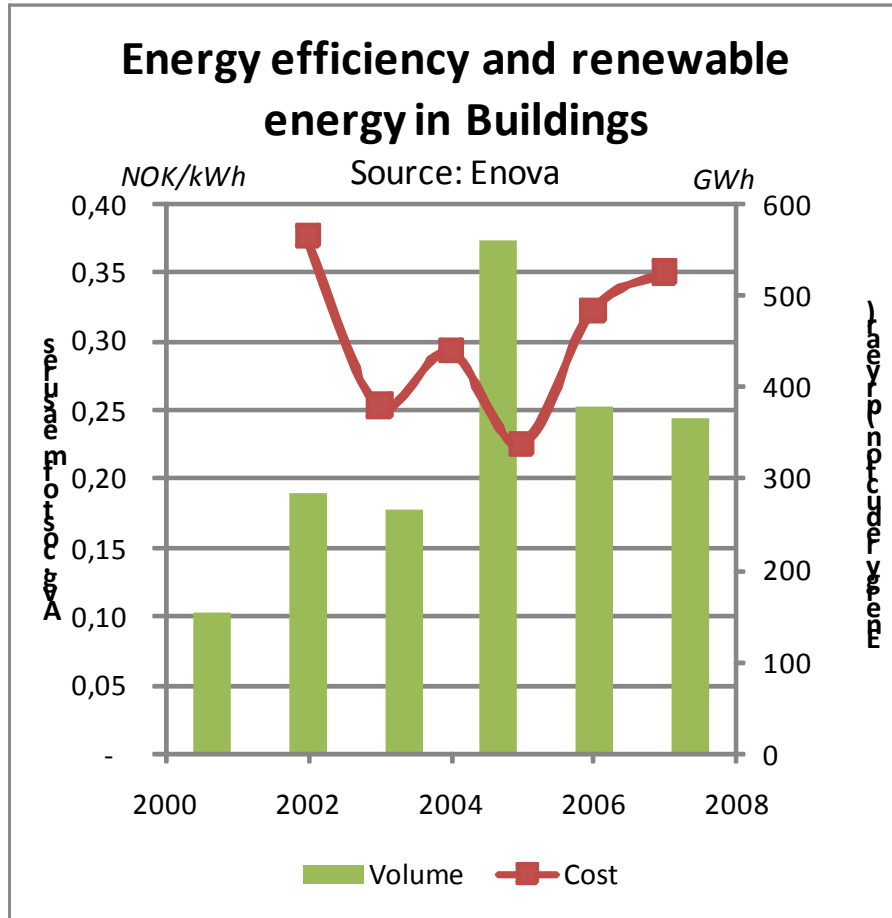
Same stock both years (remaining buildings, same area) adjusted to same indoor climate

Study for Energimyndigheten, with detailed primary energy factors for each year



Energy efficiency improvements & renewable activities in Norway

- Source: Enova



Widened view of energy efficiency

... in the Nordic energy system

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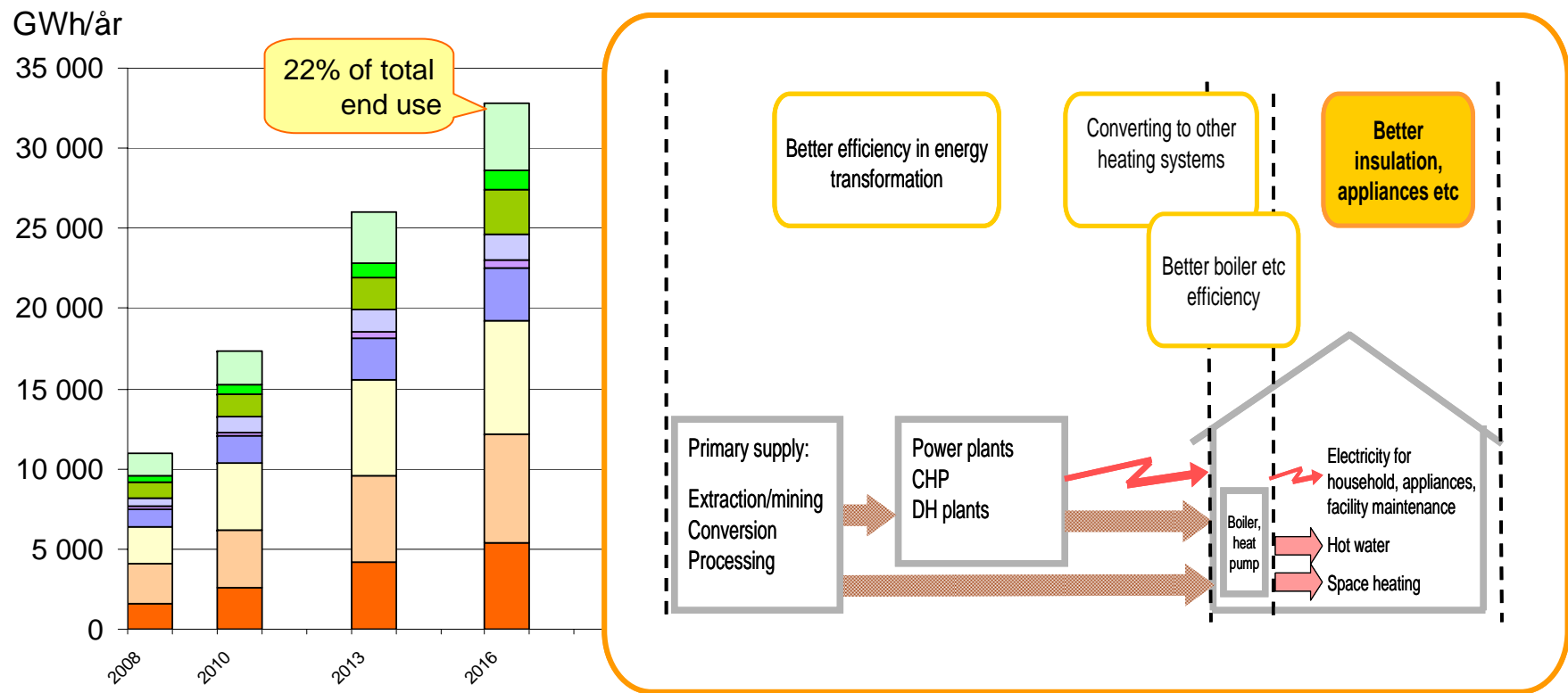
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Calculation of potentials for efficiency improvement

Insulation, appliances etc in the Swedish building sector

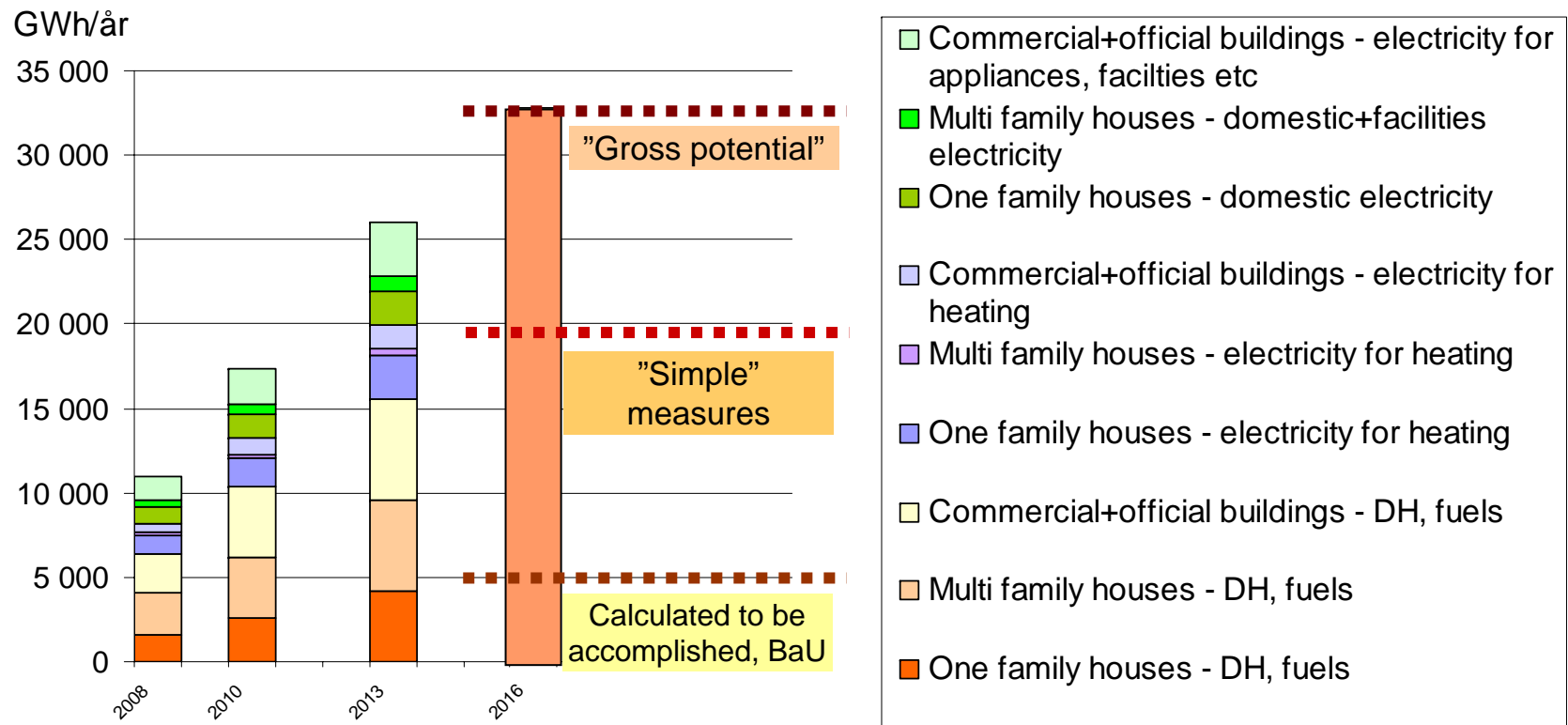
Final energy (end use). From the Swedish ESD action plan



Calculation of potentials for efficiency improvement

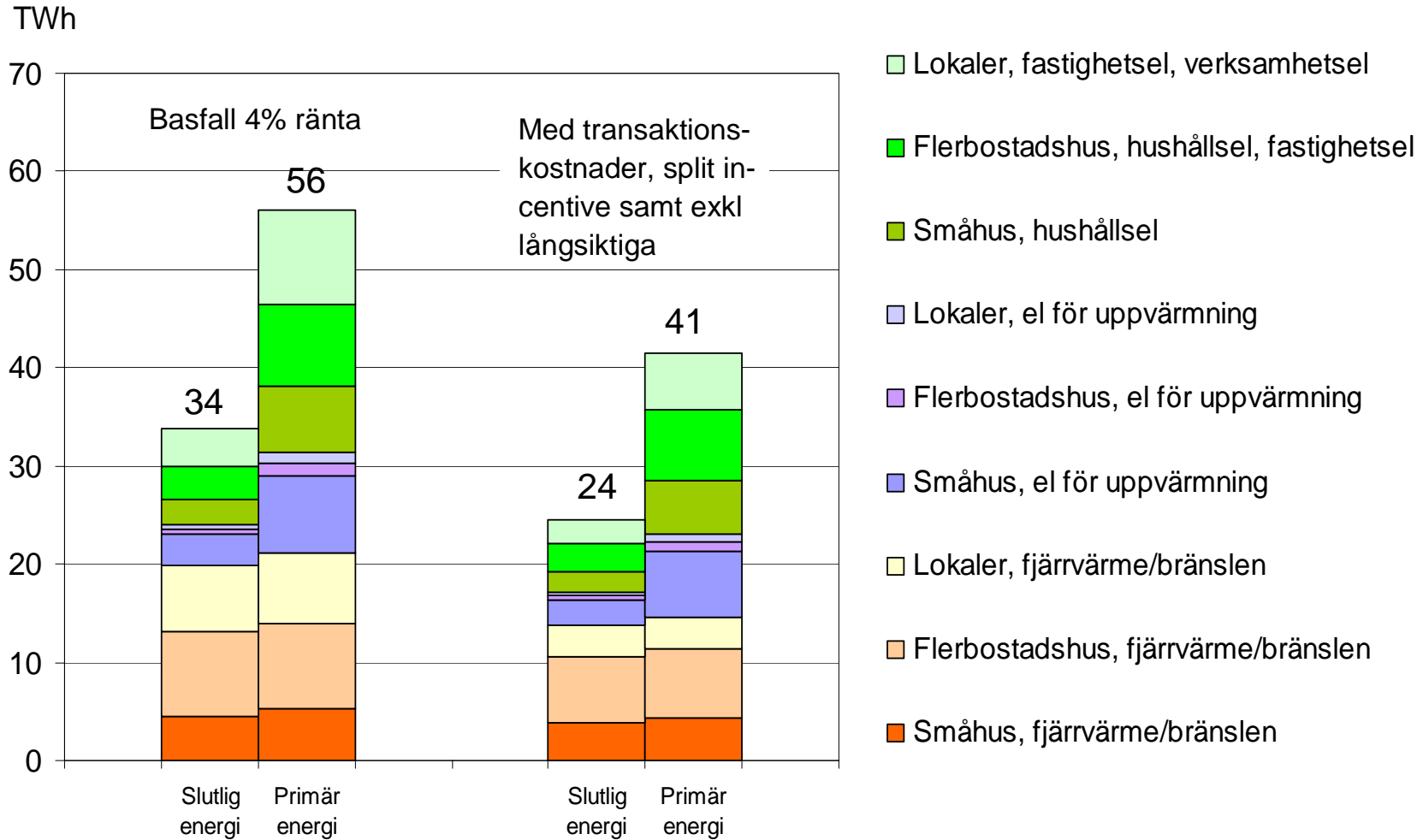
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A "realistic" potential for energy efficiency improvements

- Swedish building sector



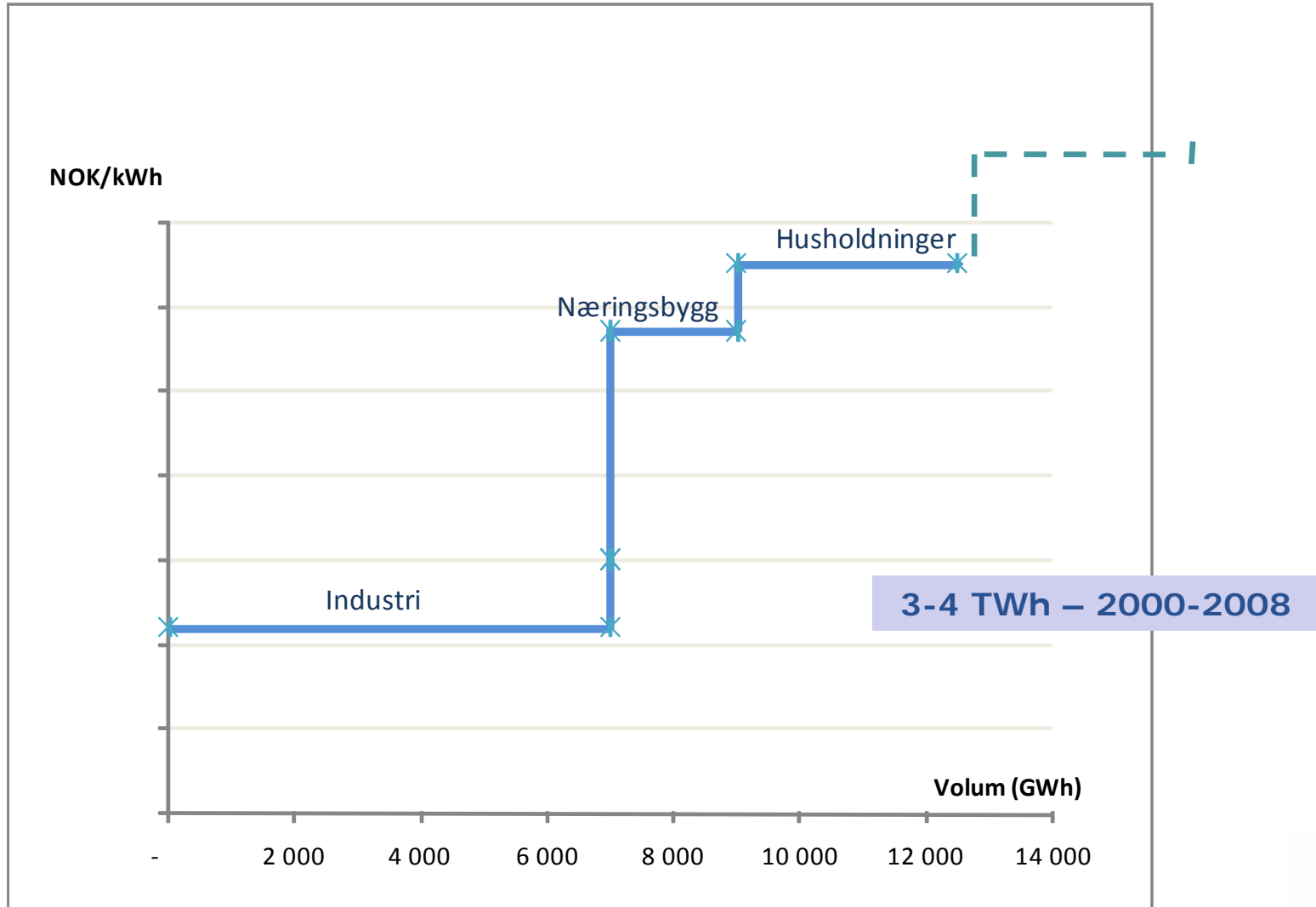
A “realistic” efficiency potential in the Nordic energy system

- End use measures (at “final energy” level in the stationary non-trading sectors)

Alla sektorer - Norden	Norden		Sverige		Danmark		Finland		Norge	
	Läge 2020 Final energy	Läge 2020 Final energy	2020 TWh	2020 %	2020 TWh	2020 %	2020 TWh	2020 %	2020 TWh	2020 %
Relativt BaU-2020										
Energianvändning basår	765		294		130		165		177	
Effektiviseringsåtgärder - el	23,1	3,0%	9,3	3,2%	3,3	2,6%	2,6	1,6%	7,8	4,4%
Effektiviseringsåtgärder - värme	37,9	5,0%	13,8	4,7%	9,0	7,0%	9,2	5,6%	5,9	3,4%
Summa (inkl. MARKAL-åtg)	61,0	8,0%	23,1	7,9%	12,4	9,5%	11,8	7,2%	13,8	7,8%
Bostäder och servicelokaler										
	Läge 2020 Final energy	Läge 2020 Final energy	2020 TWh	2020 %	2020 TWh	2020 %	2020 TWh	2020 %	2020 TWh	2020 %
Energianvändning basår	429		156		84		93		97	
Effektiviseringsåtgärder - el	16,0	3,7%	6,9	4,4%	2,3	2,7%	2,0	2,2%	4,8	5,0%
Effektiviseringsåtgärder - värme	24,8	5,8%	8,2	5,3%	6,6	7,9%	6,0	6,5%	3,9	4,1%
- ökn/minskn av åtg. jmf. med NEEAP										
Summa	40,8	9,5%	15,1	9,7%	8,9	10,6%	8,0	8,6%	8,8	9,1%
Industri										
	Läge 2020 Final energy	Läge 2020 Final energy	2020 TWh	2020 %	2020 TWh	2020 %	2020 TWh	2020 %	2020 TWh	2020 %
Energianvändning basår	336		138		46		72		80	
Effektiviseringsåtgärder - el	7,1	2,1%	2,4	1,7%	1,1	2,3%	0,6	0,9%	3,0	3,8%
Effektiviseringsåtgärder - värme	13,2	3,9%	5,6	4,0%	2,4	5,3%	3,2	4,4%	2,0	2,5%
- ökn/minskn av åtg. jmf. med NEEAP										
Summa	20,2	6,0%	7,9	5,8%	3,5	7,6%	3,8	5,3%	5,0	6,3%

Potential for energy efficiency improvements in Norway

- Calculated from the year 2000 (approx.) – until 2020

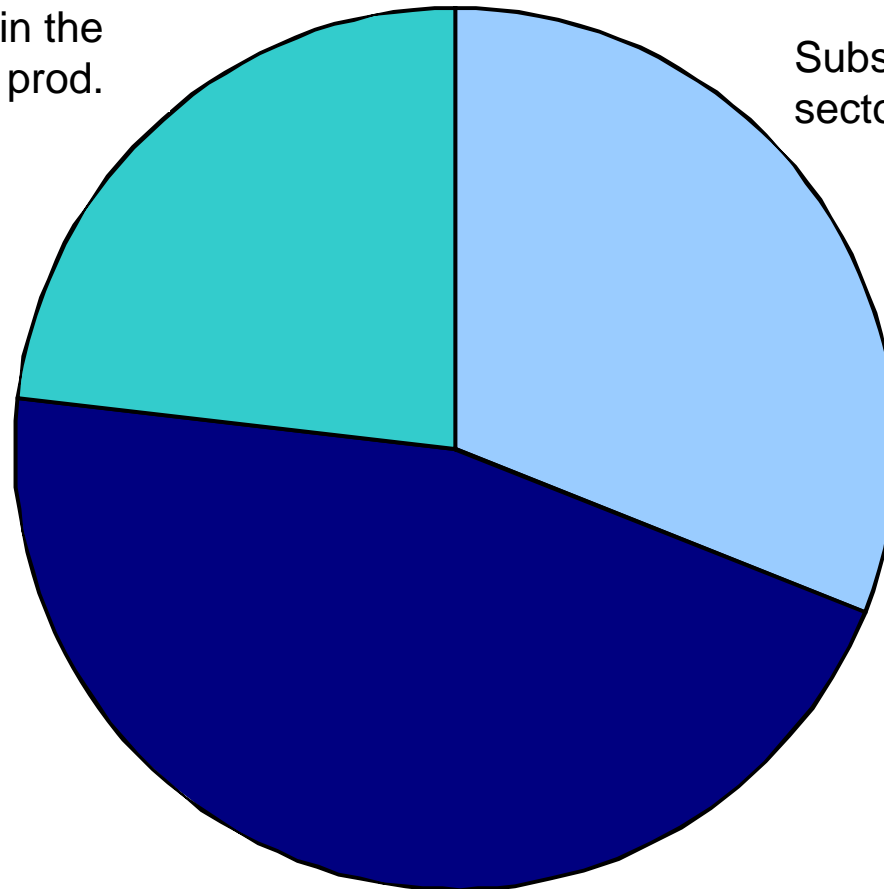


How is 20% energy efficiency achieved?

- Measures in the entire energy system

Energy efficiency in the
electricity and DH prod.
< 5%

Substitutions in R&C
sector and industry
6-7%



Energy efficiency measures in
R&C sector and industry
8-9%

*We assume that the
transportation sector
take responsibility for its
share of the energy
efficiency*

The NEP "setup" for the 20% target

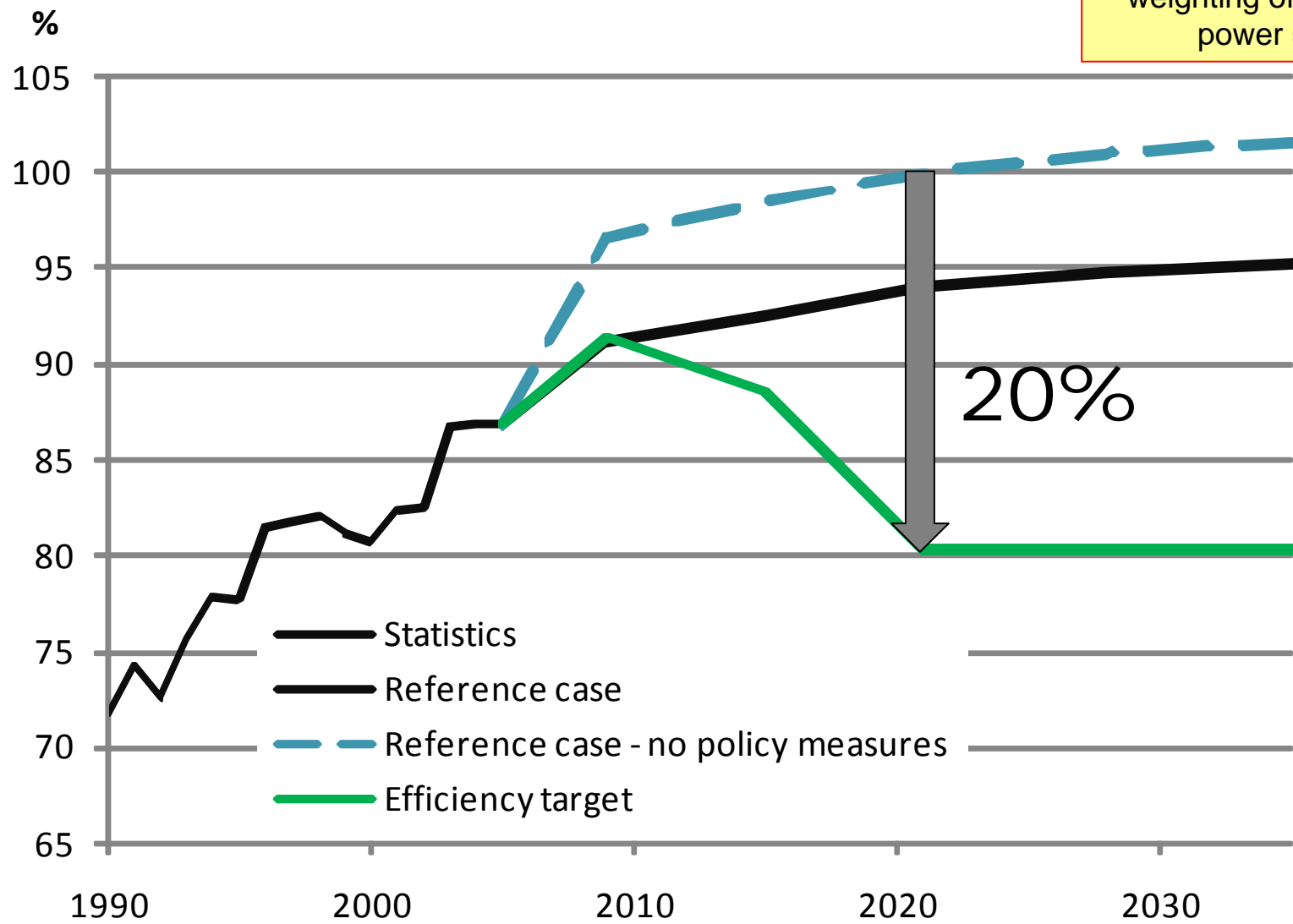
... in the MARKAL Nordic model scenarios

1. Estimate the baseline level of primary energy use in 2020
 - re-run of the reference case – Nordic energy system
2. Include a 20% efficiency target in the model
 - and also include the CO2 and renewable targets
3. Explicitly reduce the final energy demand by 8-9%
 - in line with the NEP calculations of a "realistic" potential for efficiency improvement
4. Let MARKAL "identify" the substitution measures
 - nuclear energy is primary energy weighted by one (1) in these scenarios
5. Evaluate the mix of efficiency measures
 - by comparing the marginal cost in the different groups of measures

Primary energy use in the Nordic energy system

- How is 20% energy efficiency achieved?

Note: Primary energy weighting of nuclear power = 1

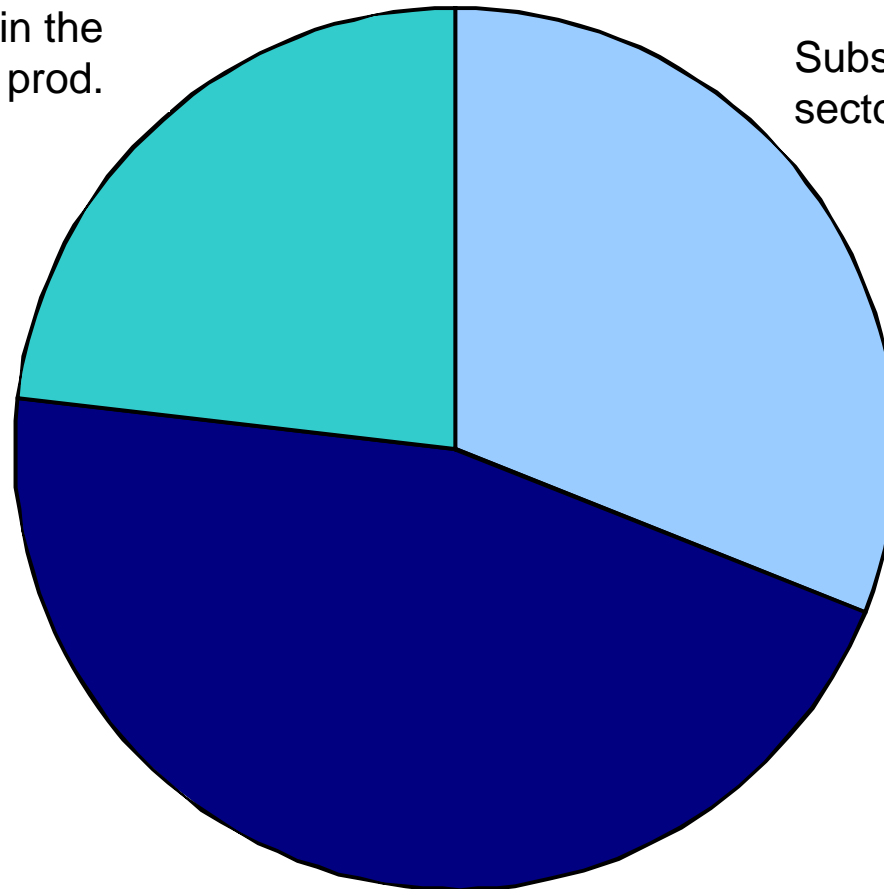


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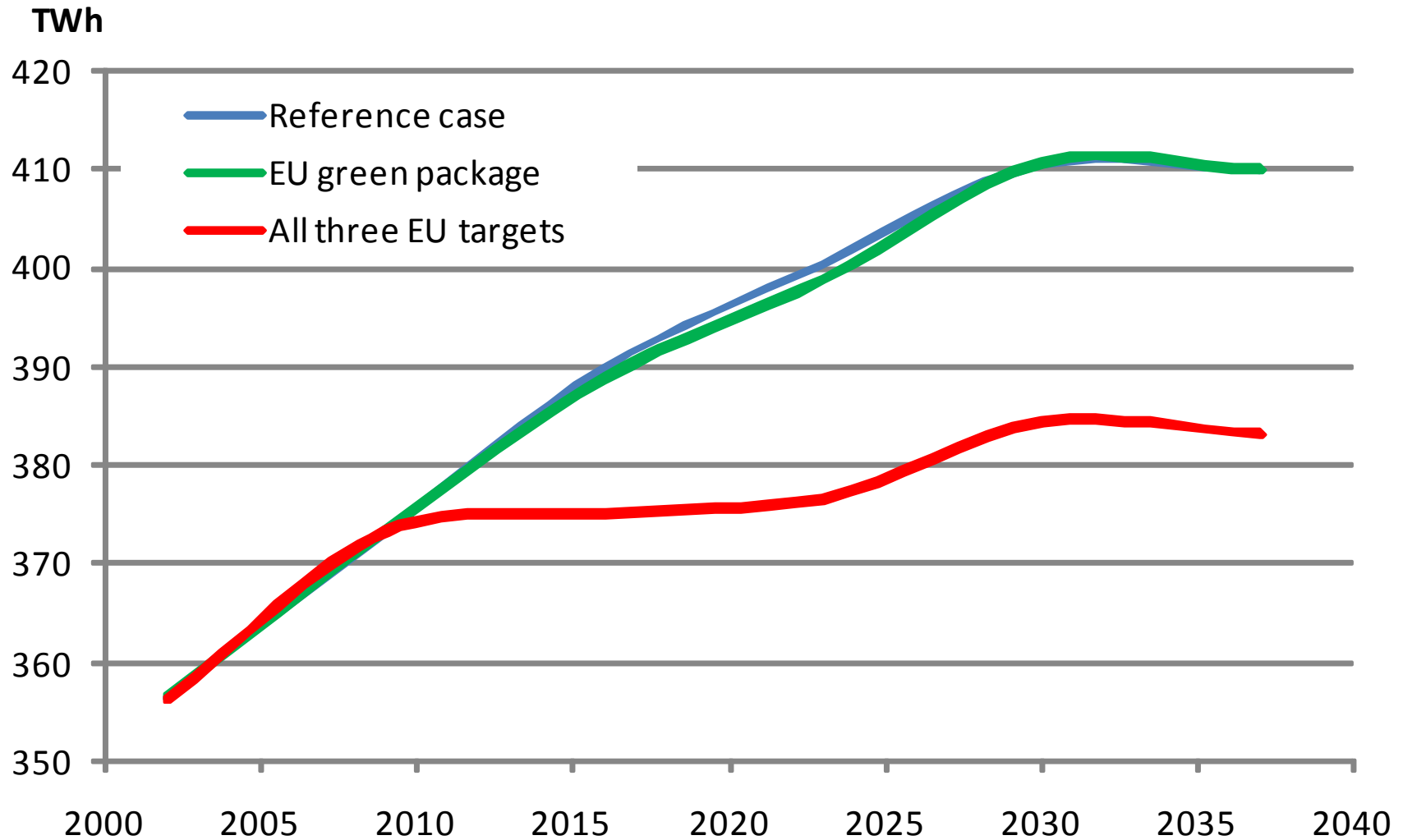


Energy efficiency measures in
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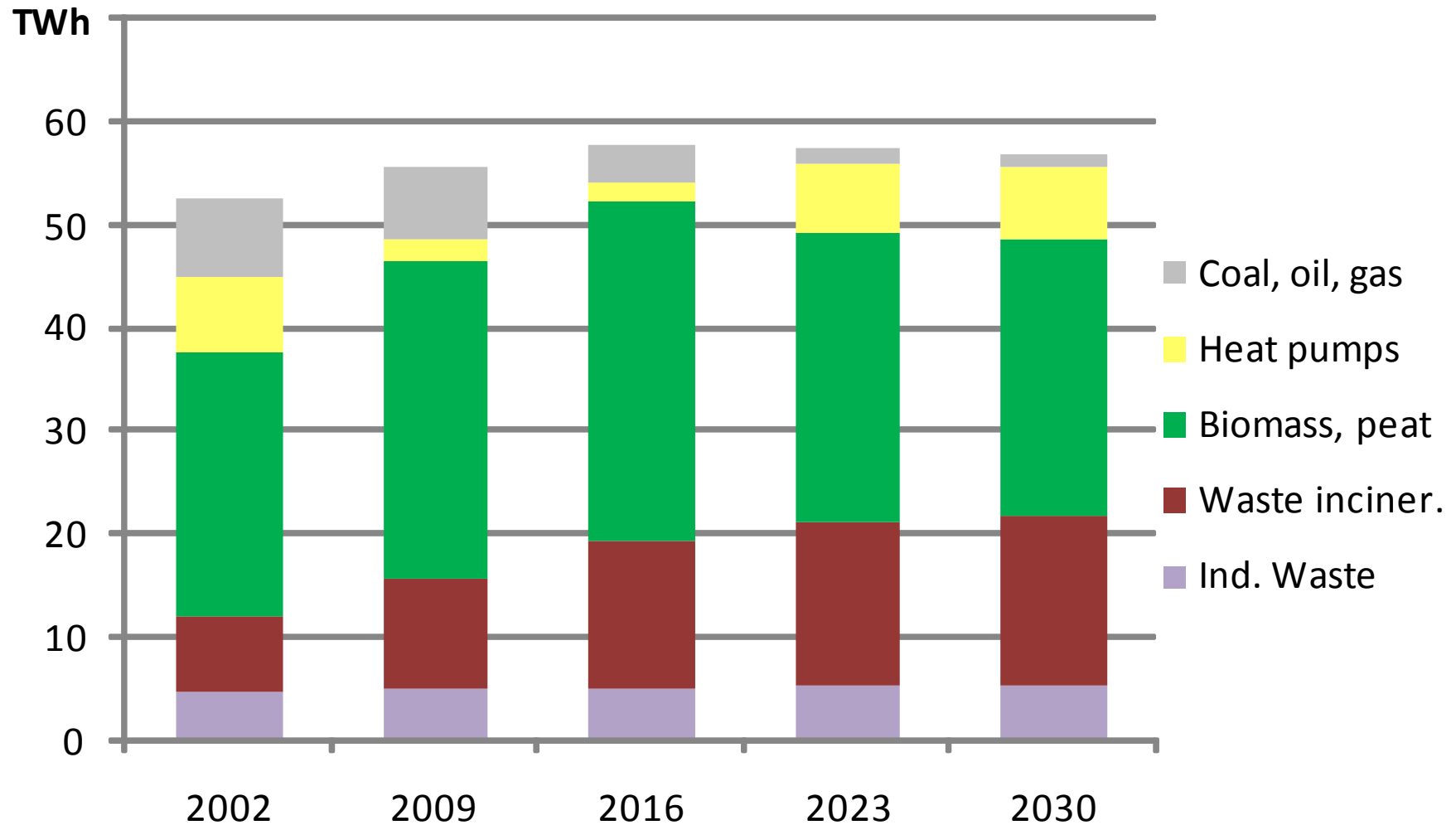
Electricity demand

- Several cases: sum of demand in the Nordic countries



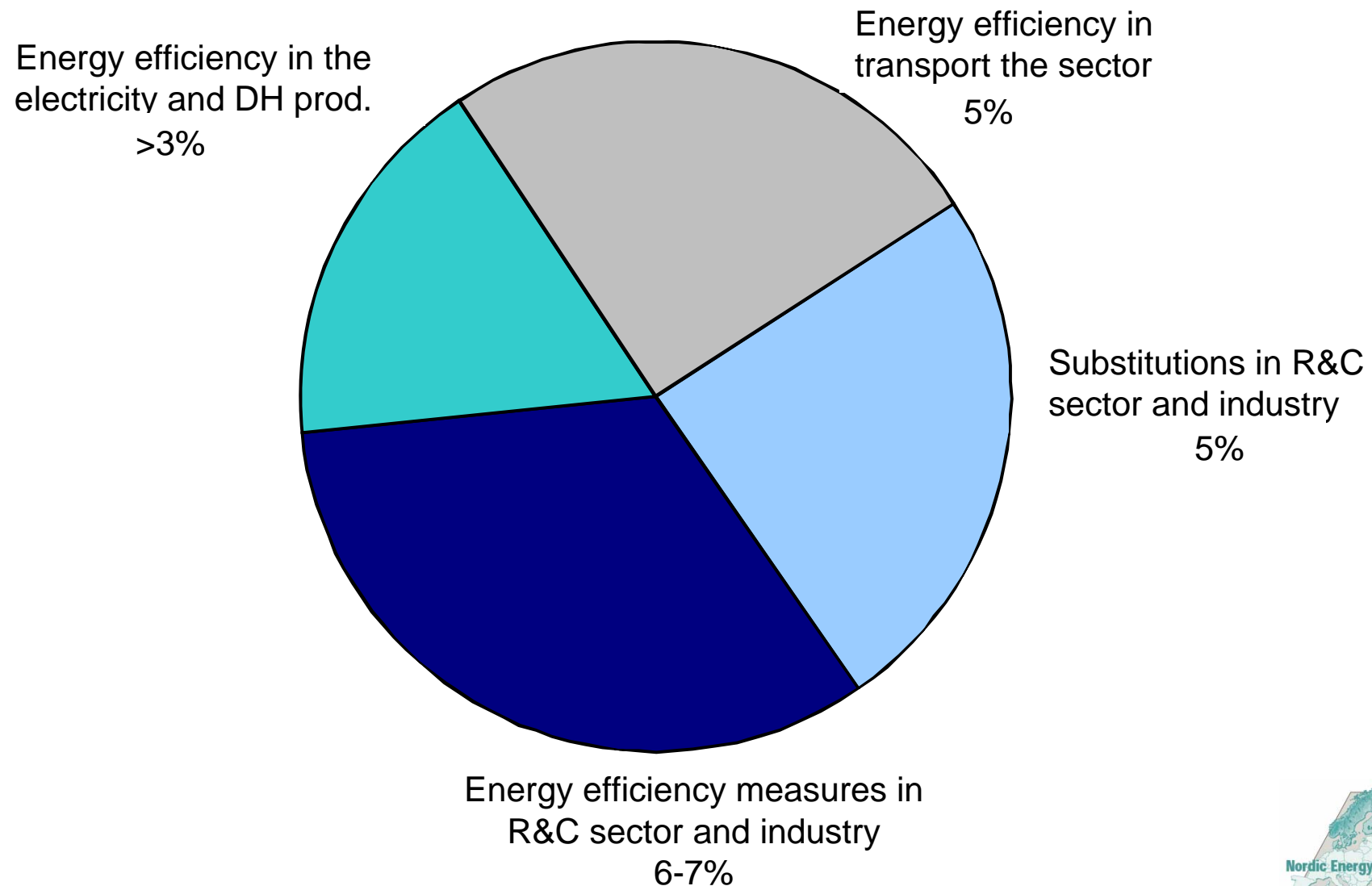
District heating production in Sweden

- Scenario: All three EU targets



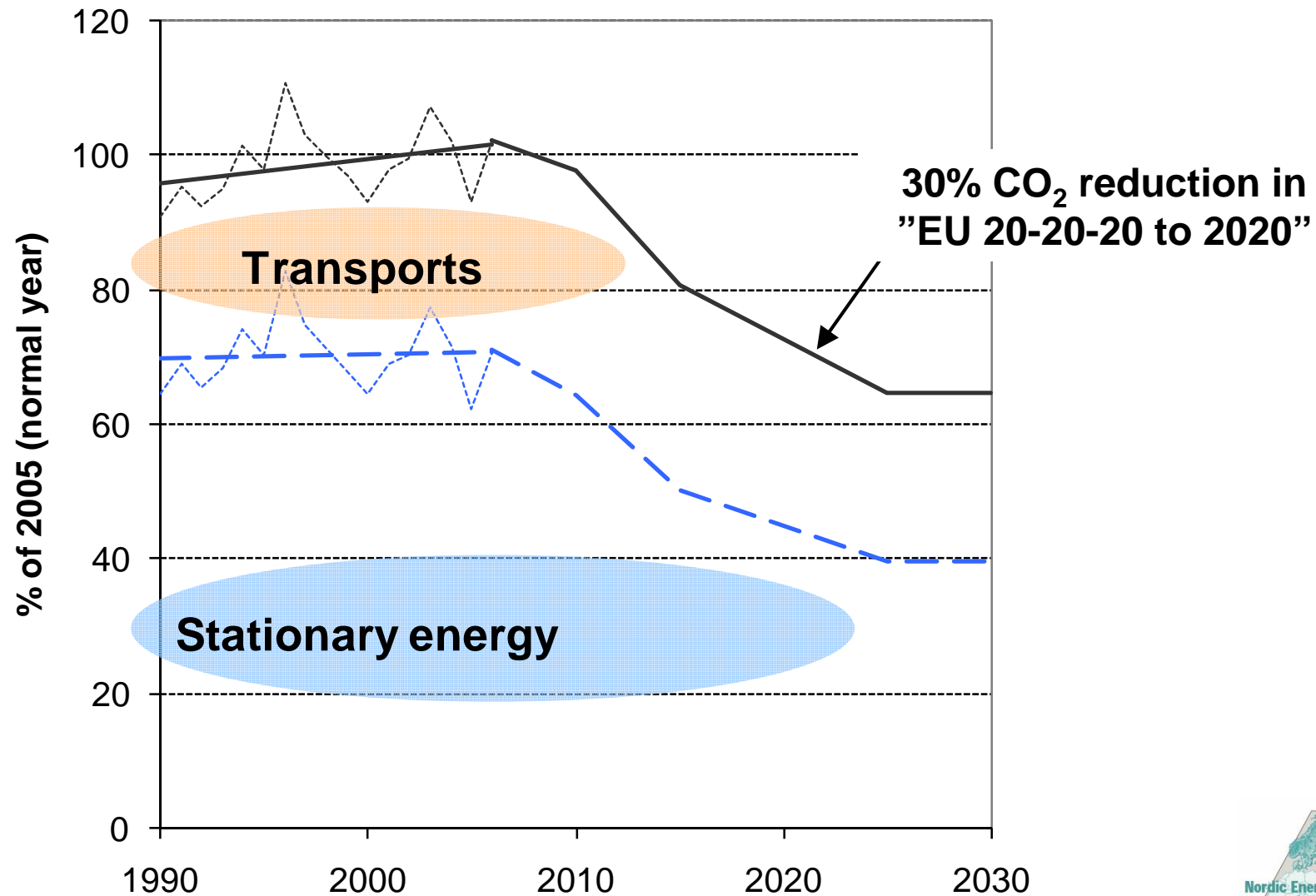
How is 20% energy efficiency achieved?

- Measures in the energy system and transport sector



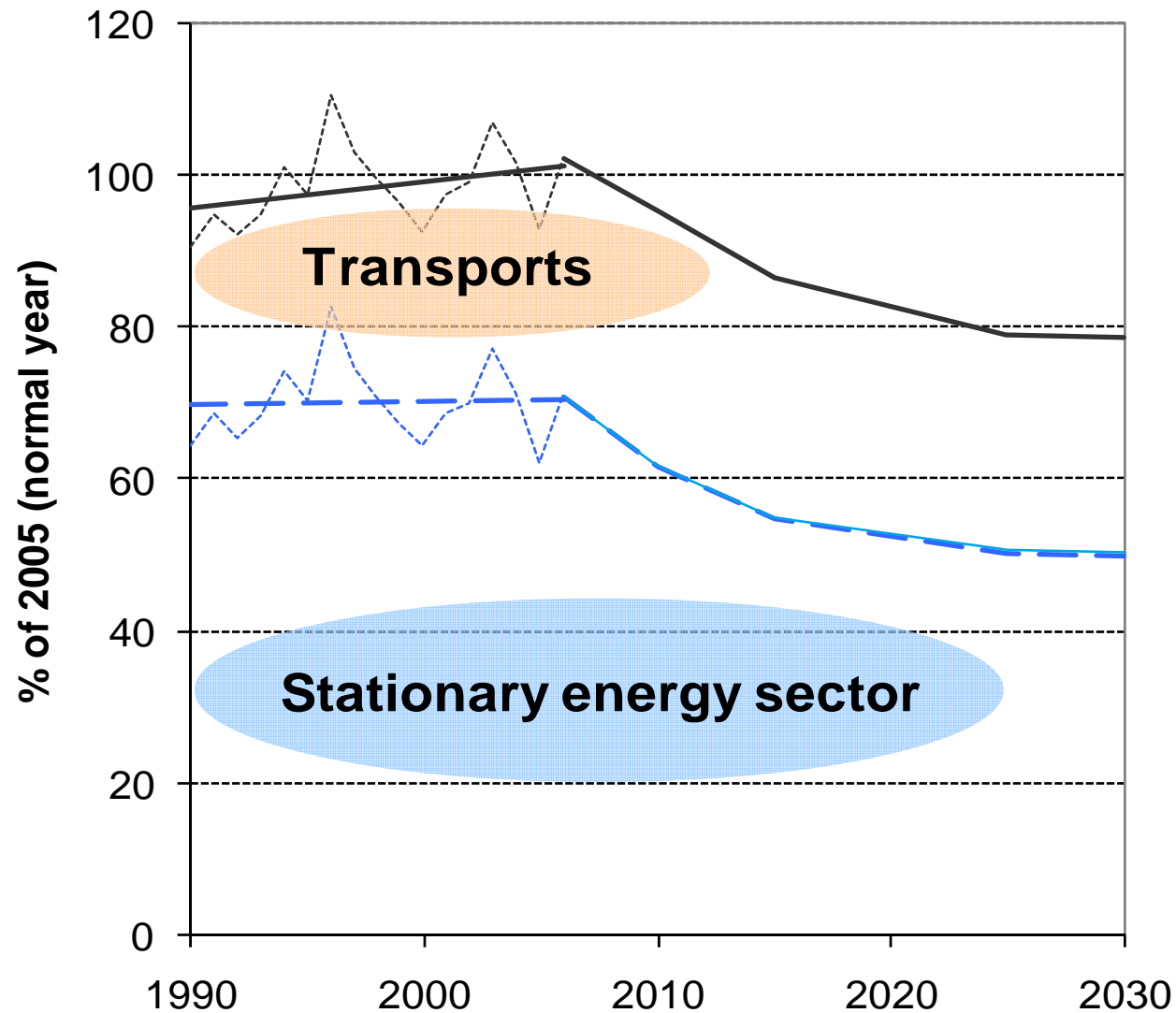
CO₂ emissions in the Nordic energy system

The emissions compared to the 2005 level – all EU 20% targets



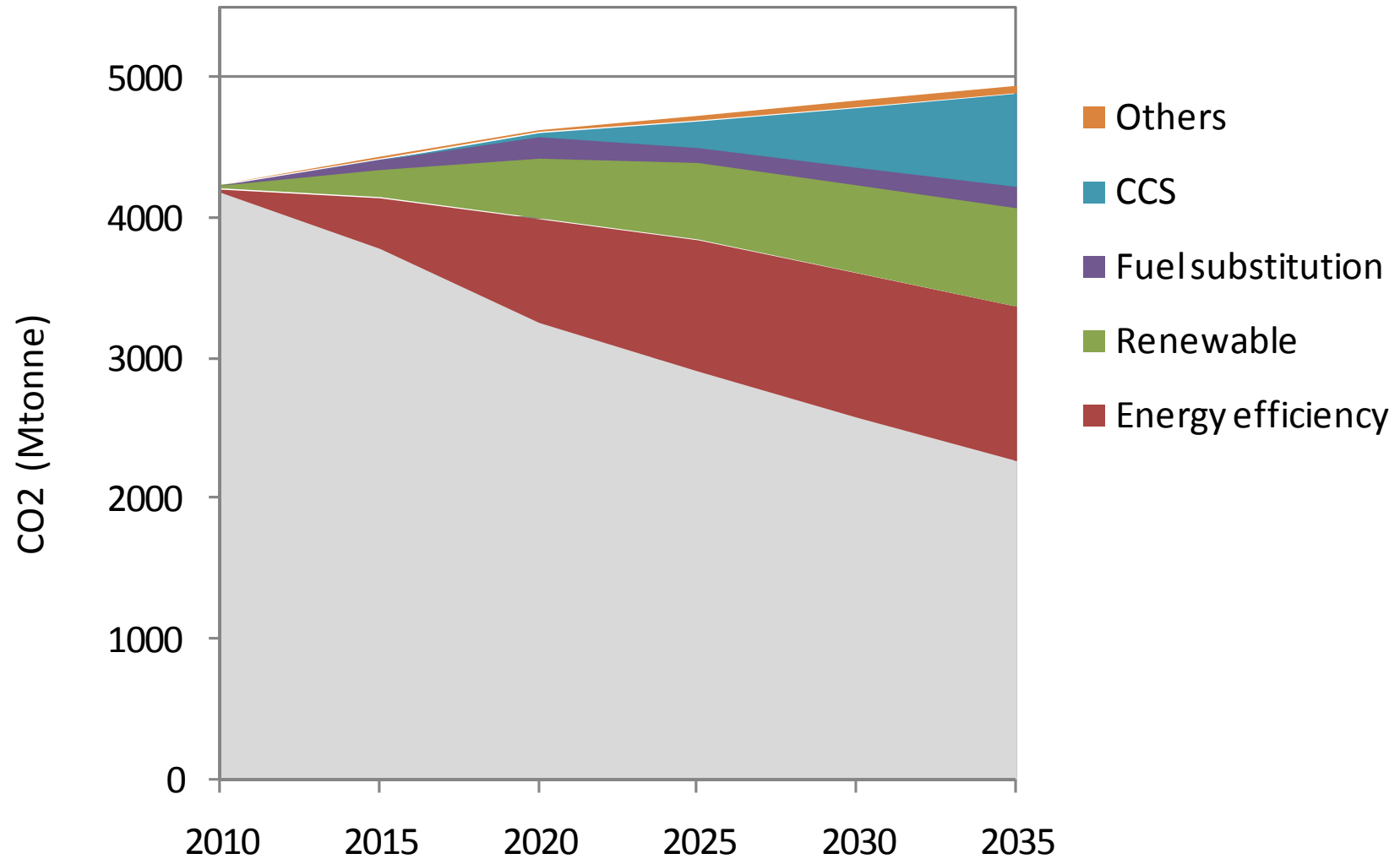
CO₂ emissions in the Nordic energy system

The emissions compared to the 2005 level – excl. efficiency target

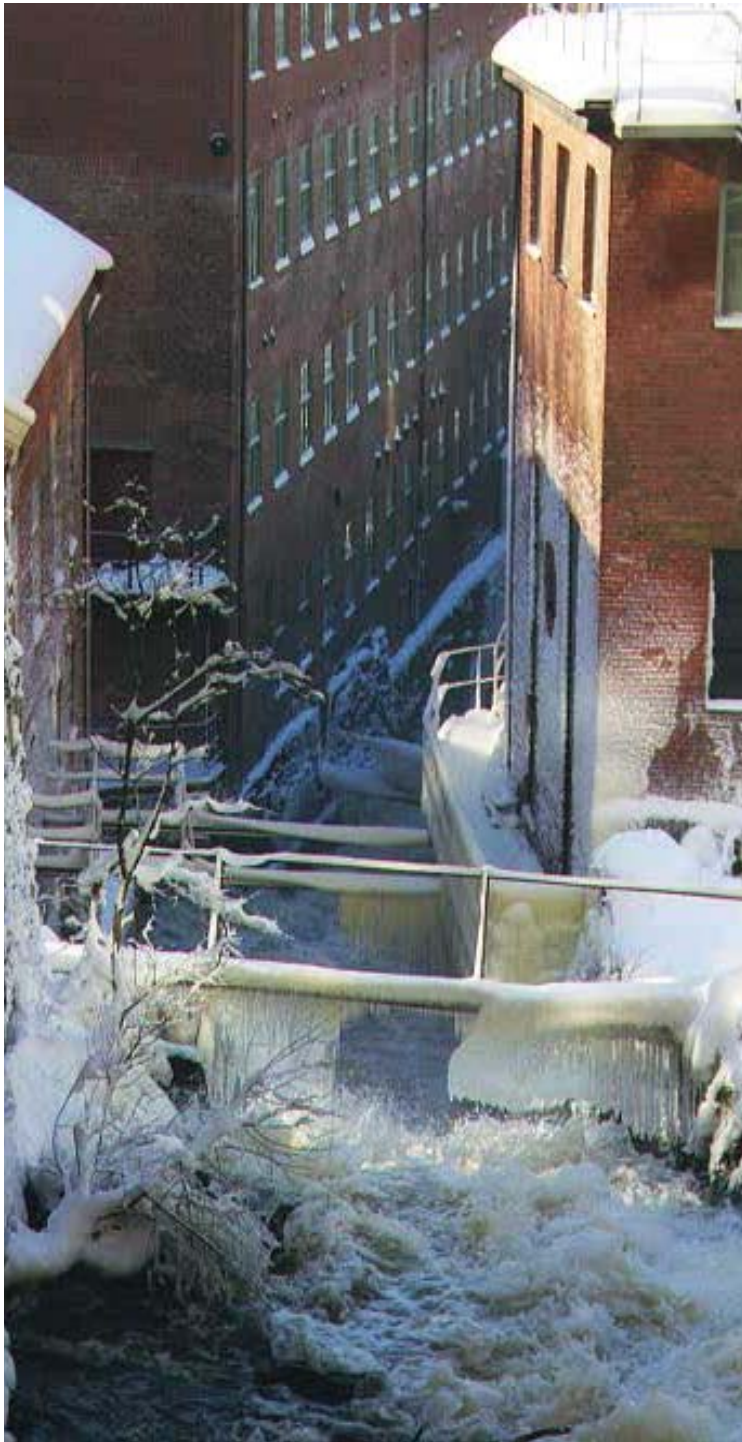


CO2 emission reduction measures – a "low CO2 scenario"

- From the project: Pathways to Sustainable European Energy Systems



Preliminary results



Thank you!

www.NordicEnergyPerspectives.org

