

Long term scenarios for strategic energy policy in the EU



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Towards a common EU energy strategy?

- Formally, no legal obligation, but
- A coordinated EU energy strategy is accepted as imperative, at least in order to address:
 - The Internal Energy Market
 - The Climate Change Challenge
- Both issues are better addressed at the broad EU scale (see Green Paper on Security of Supply)
- Seemingly conflicting objectives?
 - Environmental sustainability vs. Competitiveness!
 - Dash for gas vs. long term security of supply!

Relevant DGTREN publications





Scenarios with the PRIMES model for the EU energy market

- **Baseline scenario:** current trends in demand, investment and technologies, policies in place and in the pipeline, no major climate change constraint
- **Alternative scenarios and variants:**
 - Energy policy options (renewables, efficiency, nuclear)
 - Extended policy options (renewables, efficiency, transport sector restructuring, emission trading)
 - Full policy options (all above and new power technologies)
 - Kyoto forever (EU emissions at 95% of their 1990 level)
 - Gothenburg with domestic actions (EU emissions must drop in 2030 at less than 80% of their 1990 level)



The Baseline Scenario

**As in the “Scenarios on Key Drivers”
publication, 2005, DG TREN**



Energy Demand in Baseline

- Energy Demand grows but Energy Intensity improves at an annual rate of 1.7%
 - Energy demand <1% pa, despite GDP growth >2%
 - Policies and measures need to ensure this progress
 - Energy demand becomes less sensitive to prices
- In the long run, 40% of energy in buildings, 35% in transportation and only 25% in industry
 - Industry is efficient in energy use, low potential
 - Considerable potential for efficiency in transportation
 - Similarly, focus on efficiency and quality related to the use of energy and especially electricity in buildings
 - Policies in these two sectors concern numerous users!



Energy Forms in Baseline

- Use of **electricity** grows twice faster than average
 - Electricity is essential for technology progress in industry and services, competitiveness and comfort in buildings
 - Sustainability and efficiency in power generation is key..
- **Petroleum** becomes a product only for specific use in two sectors: transport and chemicals;
 - nevertheless in 2030 oil use is higher by 8% than in 2000 and oil imports will be in 2030 higher by 25% than today!
- **Gas** becomes the strategic fuel: in 2030 the EU needs 50% more gas per year than today
 - Incremental use of gas: 60% for power generation, 40% for final use
- **Renewables** grow fast but do not exceed 9% of primary energy needs of the EU-25 (today 6.5%)
- Use of **solid** fuels is stable, but doubles after 2020 as a result of nuclear decommissioning



Power sector under Baseline

- Over the next 30 years, 500-600 GW of new power plants need to be built, to reach a capacity almost double than today
- Under current trends and under market competition, gas fuelled plants are likely to dominate investment:
 - More than 40% of power generation capacity shall depend on gas, against 11% today (380,000 MW of new gas plants, mostly CCGT)
 - This increases power generation efficiency, curbs emissions and keep electricity prices at low levels – but threatens security of supply
- Renewable energy is fast growing, but its share remains small: 150,000 MW of new renewables up to 2030
- Nuclear energy declines in the long term (in 2030, 22% less than today) – too much capital intensive for the market?
- Coal comes back in the long term, through clean coal technologies (a market for 150,000 MW); despite efficiency, this leads to higher emissions after 2020.

Import dependency under Baseline

67% in 2030, from 48% in 2005

- Dependency on gas imports jumps to 82% from 50%!
- Additional imports will be needed annually for all fossil fuels

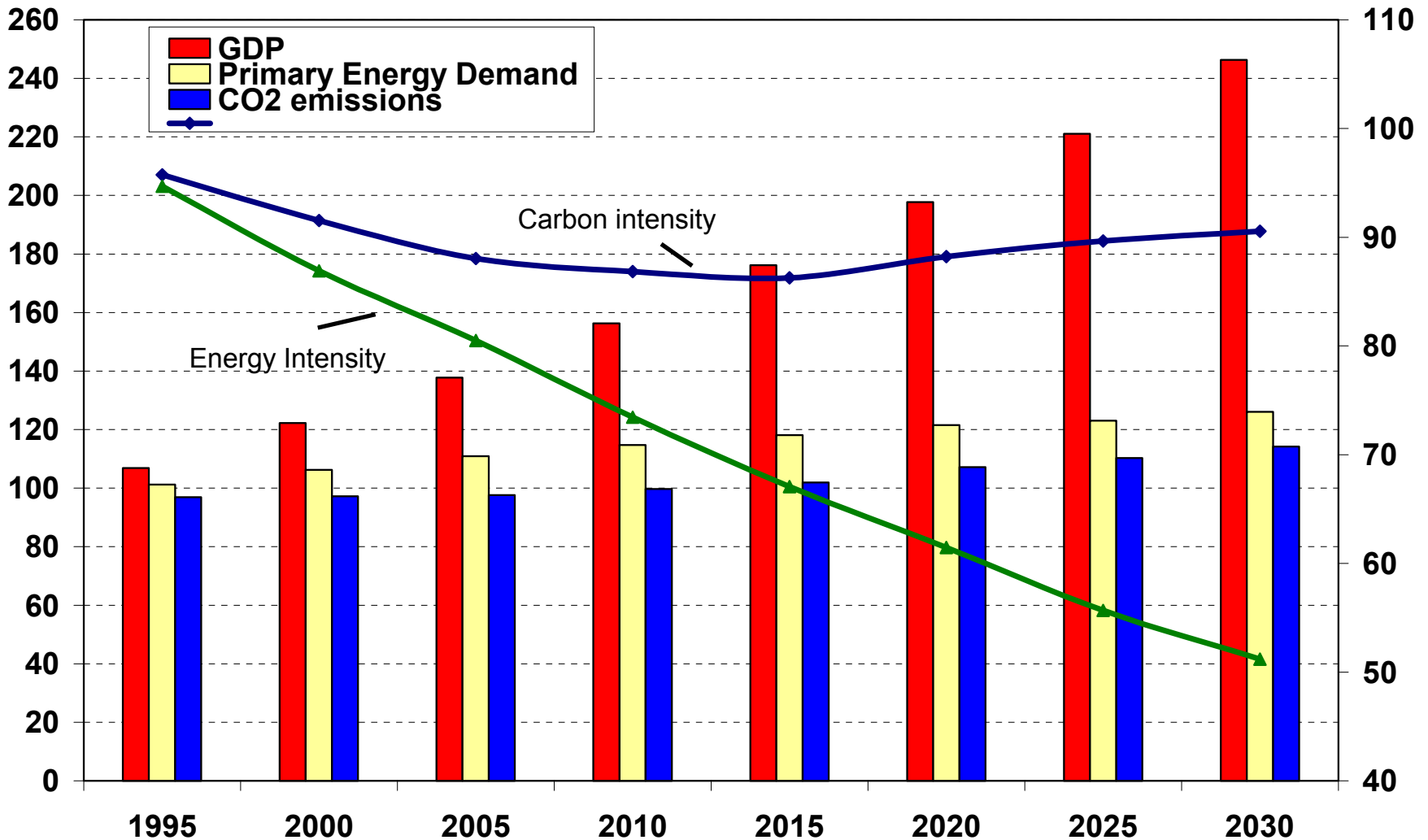
EU-25	2000	2010	2020	2030
In Mtoe per year	level	Incremental change in a year compared to 2000		
<i>Indigenous</i>	897	-37	-156	-236
Solids	203	-50	-77	-101
Oil	164	-32	-61	-77
Natural Gas	197	0	-49	-80
Nuclear	238	8	-24	-52
Renewables	96	37	55	73
<i>Imported</i>	797	175	405	562
Solids	91	-2	35	106
Oil	520	53	106	131
Natural Gas	186	124	264	325



Carbon emissions in Baseline

- Carbon emissions (EU-25) stabilise until 2010, at level lower than 1990, but then increase again (in 2030, 15% higher than 1990), far away from climate (IPCC) targets
- Two sectors are responsible for higher emissions:
 - Power generation (30% more in 2030 than today), due to the come-back of solids beyond 2020 and the nuclear decommissioning, and despite the use of gas and renewables)
 - Transport (>25% more in 2030 than today and despite efficiency gains by more than 1% per year)
 - The other sectors avoid direct carbon emissions by using more electricity, this explains the key role of power generation
- Post Kyoto policy for CO₂ emissions shows as a major issue!
- *Note: All other environmental impacts improve over time*

Decoupling economic growth from energy needs and emissions under the baseline

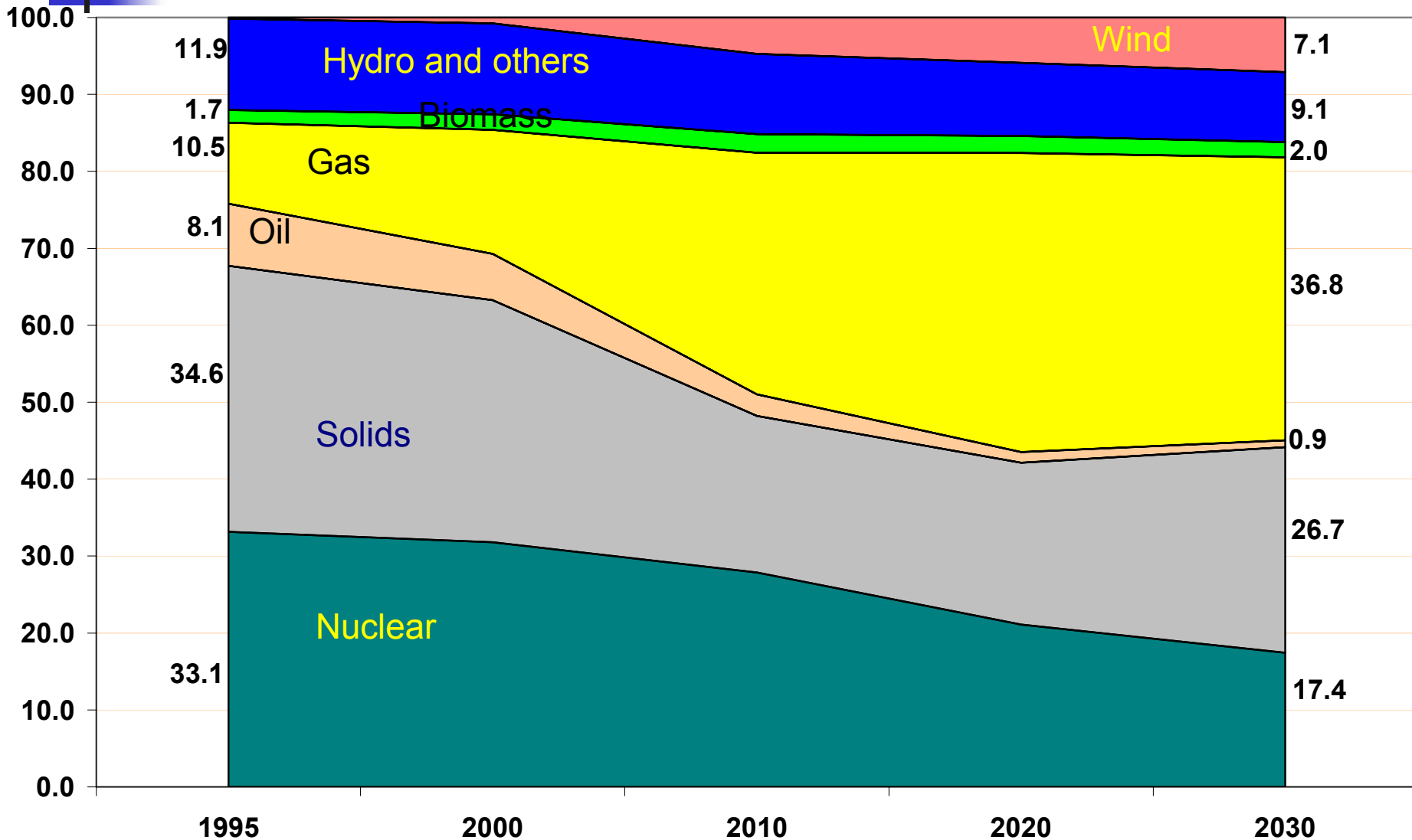




Summary of baseline trends

Current Trends (baseline)					Annual growth rate	
	2000	2010	2020	2030	Short term	Long term
EU - 25 MS						
Primary Energy Needs (Mtoe)	1,651	1,784	1,889	1,960	0.8%	0.6%
Energy Intensity (to GDP)	185	156	131	109	-1.7%	-1.7%
Energy per capita (toe)	3.6	3.9	4.1	4.3	0.8%	0.6%
Share of renewables	5.8%	7.4%	8.0%	8.6%	5.1%	1.9%
Industry (Mtoe)	309	339	367	389	0.9%	0.8%
Buildings (Mtoe)	433	484	523	557	1.1%	0.8%
Transport (Mtoe)	332	387	427	449	1.5%	1.0%
Electricity use (TWh)	2,457	2,640	3,455	3,887	0.7%	1.5%
Gas in Power Gener. (bcm)	125	206	273	284	5.1%	2.8%
CO2 Index (1990=100)	97.2	99.7	107.2	114.2	0.3%	0.5%

Power generation in baseline





EU Policy Challenges

1. Security of Energy Supply, in relation to:
 - dependence on imports of natural gas and oil (high volumes of imports from unstable regions)
 - Investment to ensure adequacy of electricity supply
2. Increasing carbon emissions, in contrast with climate change objectives
3. Poor performance of policies supporting penetration of renewable energies; Energy efficiency issues in sectors of transport and buildings;
4. High uncertainty about the future of nuclear after 2020 – lack of strategic choice about sustainable base-load generation
5. Continuous growth of road and air transport, source of congestion and air quality problems.



The Alternative Scenarios

- Energy policy options (renewables, efficiency, nuclear)
- Extended policy options (renewables, efficiency, transport sector restructuring, emission trading)
- Full policy options (all as above, nuclear and new power technologies)
- Kyoto forever (EU emissions at 95% of their 1990 level)
- Gothenburg with domestic actions (EU emissions must drop in 2030 at less than 80% of their 1990 level)

- And other cases (see “Scenarios on Key Drivers”, 2005, DG TREN)



High Efficiency, Renewables and accepted new Nuclear

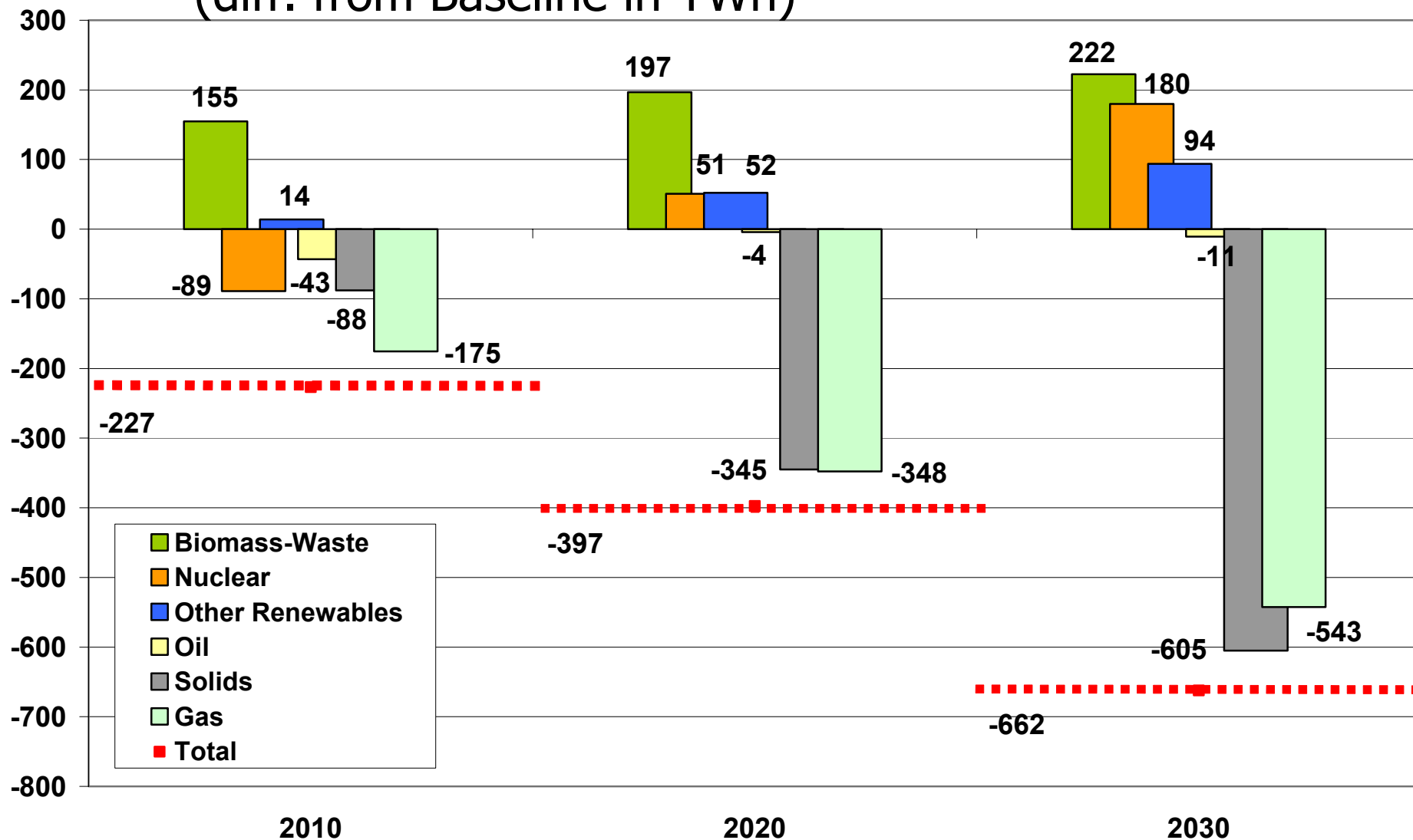
- The EU primary energy needs can stabilize over the next 25 years (more than 10% less from baseline)
- The share of renewables can grow up to 12% in 2010 and 15% in the long term: Higher share of renewables: wind power (ten times more), CHP, biomass and biofuels
- Nuclear remains in 2030 at present levels, avoiding the increase of coal in power generation
- Gas needs remain high, but 20% less than in baseline
- Carbon emissions evolve in compliance with climate change targets, 25% less than in baseline, 88% of their 1990 level
- Import dependence grows only up to 57% (50% today)
- Policy issues:
 - Considerable additional policies and measures, that are difficult to implement because of high dispersion
 - With policy focus on the sectors of buildings and transport, efficiency of electricity use can be improved

Comparison to baseline

Current Trends					Annual growth rate	
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Electricity use (TWh)	2,457	2,640	3,455	3,887	0.7%	1.5%
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High Efficiency and Renewables					Annual growth rate	
EU - 25 MS	2000	2010	2020	2030	Short term	Long term
Primary Energy Needs (Mtoe)	1,651	1,680	1,698	1,684	0.2%	0.1%
Energy Intensity (to GDP)	185	147	117	94	-2.3%	-2.2%
Energy per capita (toe)	3.6	3.6	3.7	3.7	0.0%	0.1%
Share of renewables	5.8%	12.1%	13.4%	14.4%	5.1%	1.9%
Industry (Mtoe)	309	330	351	376	0.6%	0.7%
Buildings (Mtoe)	433	448	467	477	0.3%	0.3%
Transport (Mtoe)	332	369	383	389	1.1%	0.5%
Electricity use (TWh)	2,457	2,461	3,079	3,273	0.0%	1.0%
Gas in Power Gener. (bcm)	125	167	213	199	2.9%	1.6%
CO2 Index (1990=100)	97.2	87.8	88.1	88.5	-1.0%	-0.3%

Changes in electricity generation

(diff. from Baseline in TWh)





Extended policy scenario

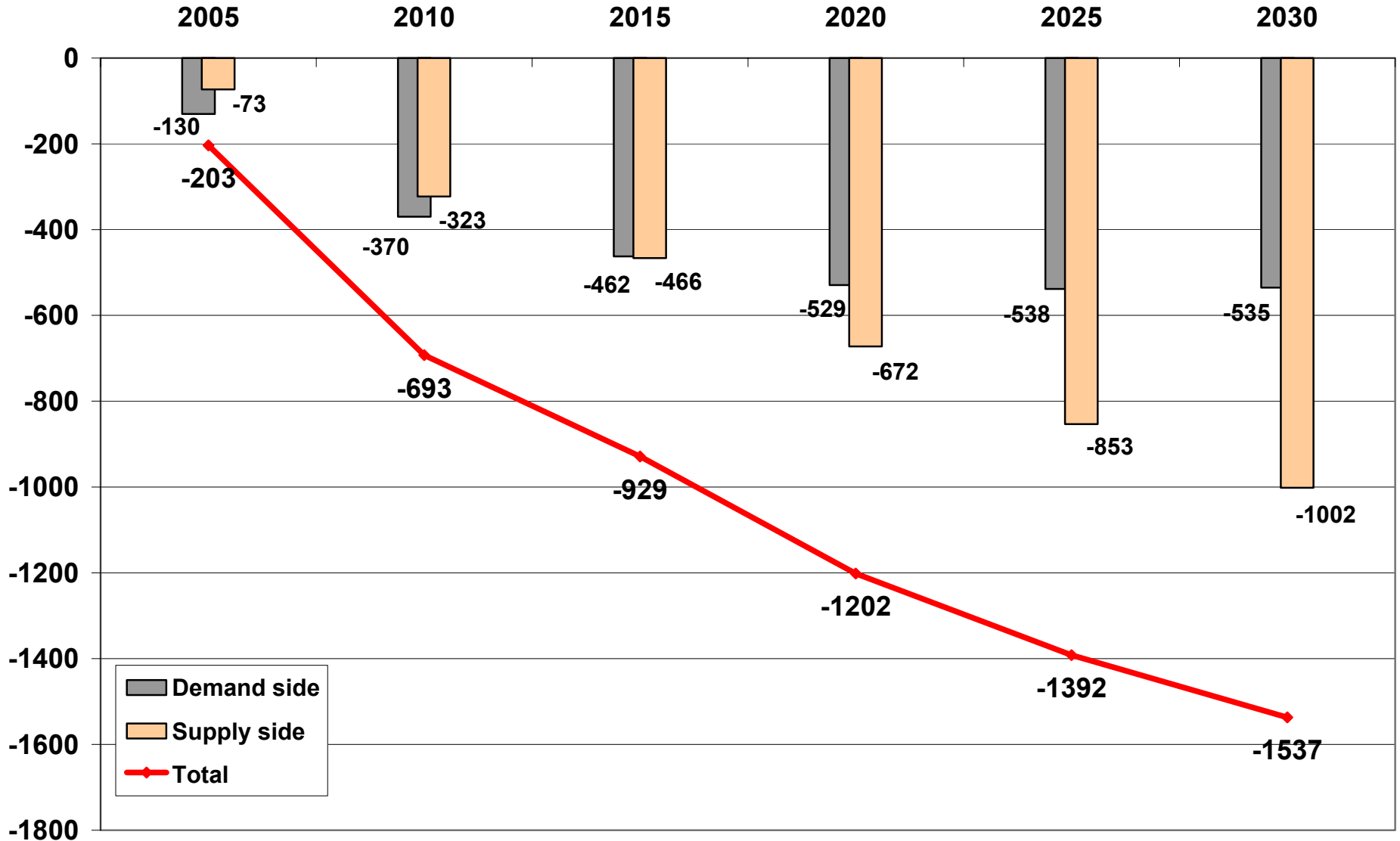
- It focuses on efficiency and renewables, but also on transport restructuring; contrary to other scenarios, it does not assume success of new nuclear
- High benefits are still obtained:
 - Primary energy needs stabilise, spectacular progress in the sector of transport
 - Import dependence grows only up to 59%
 - Carbon emissions even better: 81.5% of their 1990 level
- Increase of biomass and renewables in power sector
- Increase of use of solids in power sector is avoided
- However, dependence on gas is high but lower than in the baseline (-5% only): *gas supply is key!*



A Full Policy Options Case

- A policy package that combines
 - Extensive support for acceleration of renewables
 - Standards and measures for high energy efficiency
 - Accepted advanced nuclear technology
 - New standards and fuels for transports
- It delivers high performance in all objectives, except the need for higher investment expenditures, significant stranded costs and higher energy prices
- It curbs carbon emissions at -25% in 2030 from 1990 level
- One third of energy comes from carbon free sources in 2030
- It restores import dependency to 55% in 2030, instead of 70% and more in the baseline
- Considerably improves impact indicators from transports
- Still it needs abundant gas: 2.5 times more than in 2000

Carbon emissions drop in full policy case

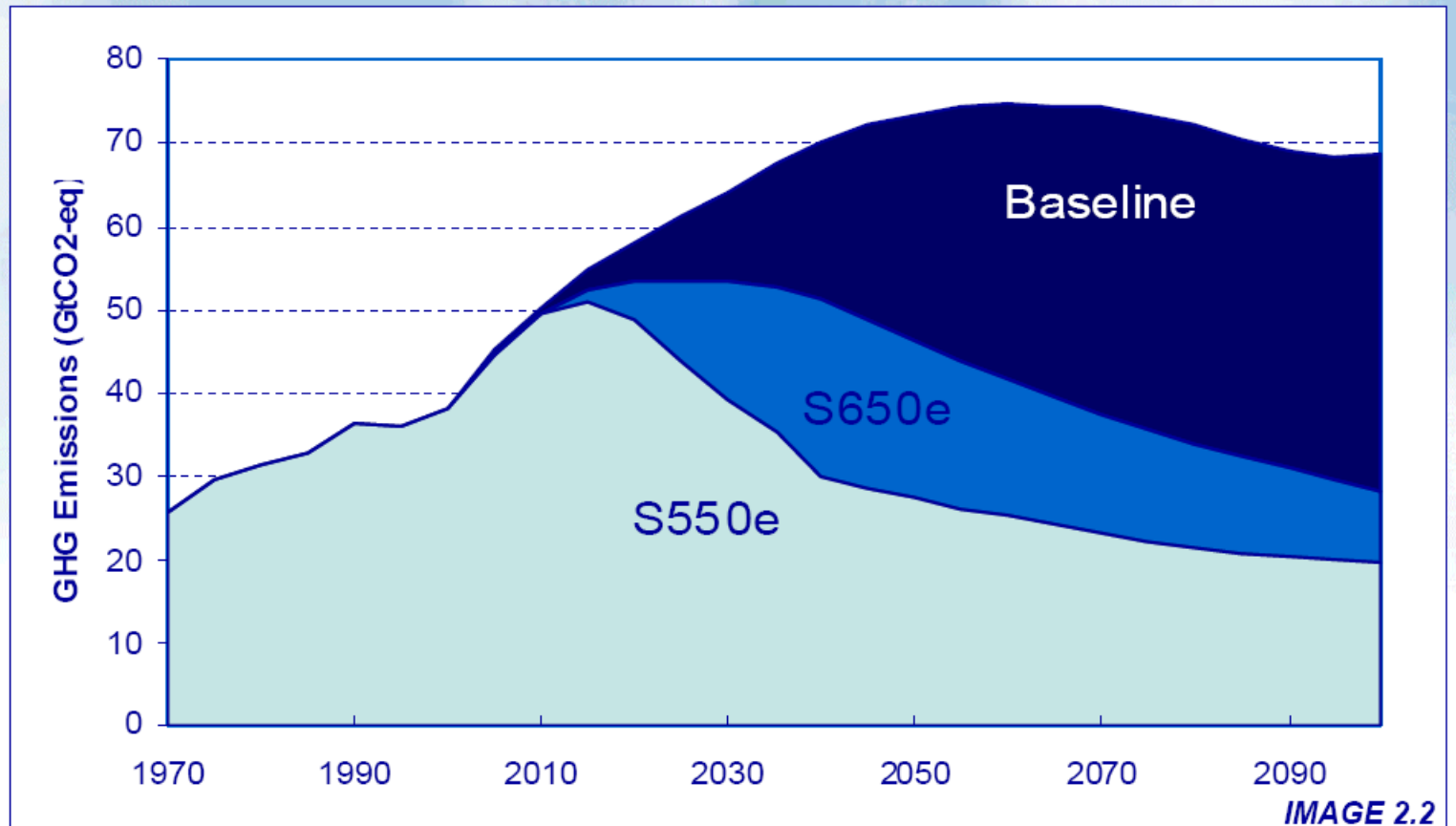




Climate Change Targets

- **Big gap and uncertainty in the post-Kyoto period**
- **Mitigation costs do not compare with those under the current Kyoto commitments**

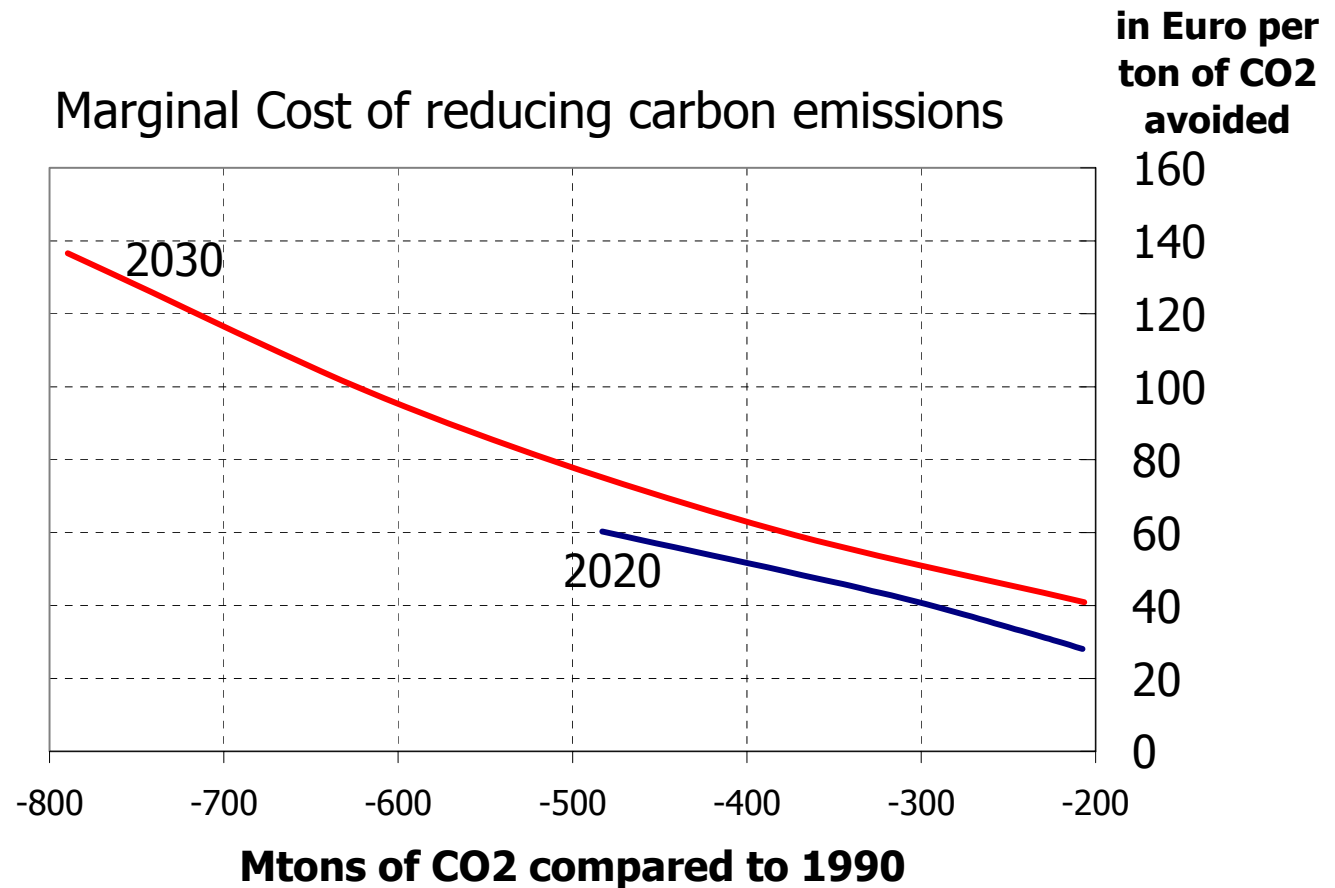
Climate Policy Targets



- ◆ By 2025, global reductions of 15 to 30 % from baseline are required, respectively in S650e and S550e
- ◆ By 2050, these reductions reach 35 to 65 %

Carbon emission reduction costs

- To avoid carbon concentration as IPCC suggested, targets reach more than -20% emissions in 2030 (from 1990) at a marginal carbon cost of more than 130 Euro per ton of CO₂ avoided, per year
- This implies 50% higher electricity tariffs than today, in real terms
- Needs a strong full policy package asap !!

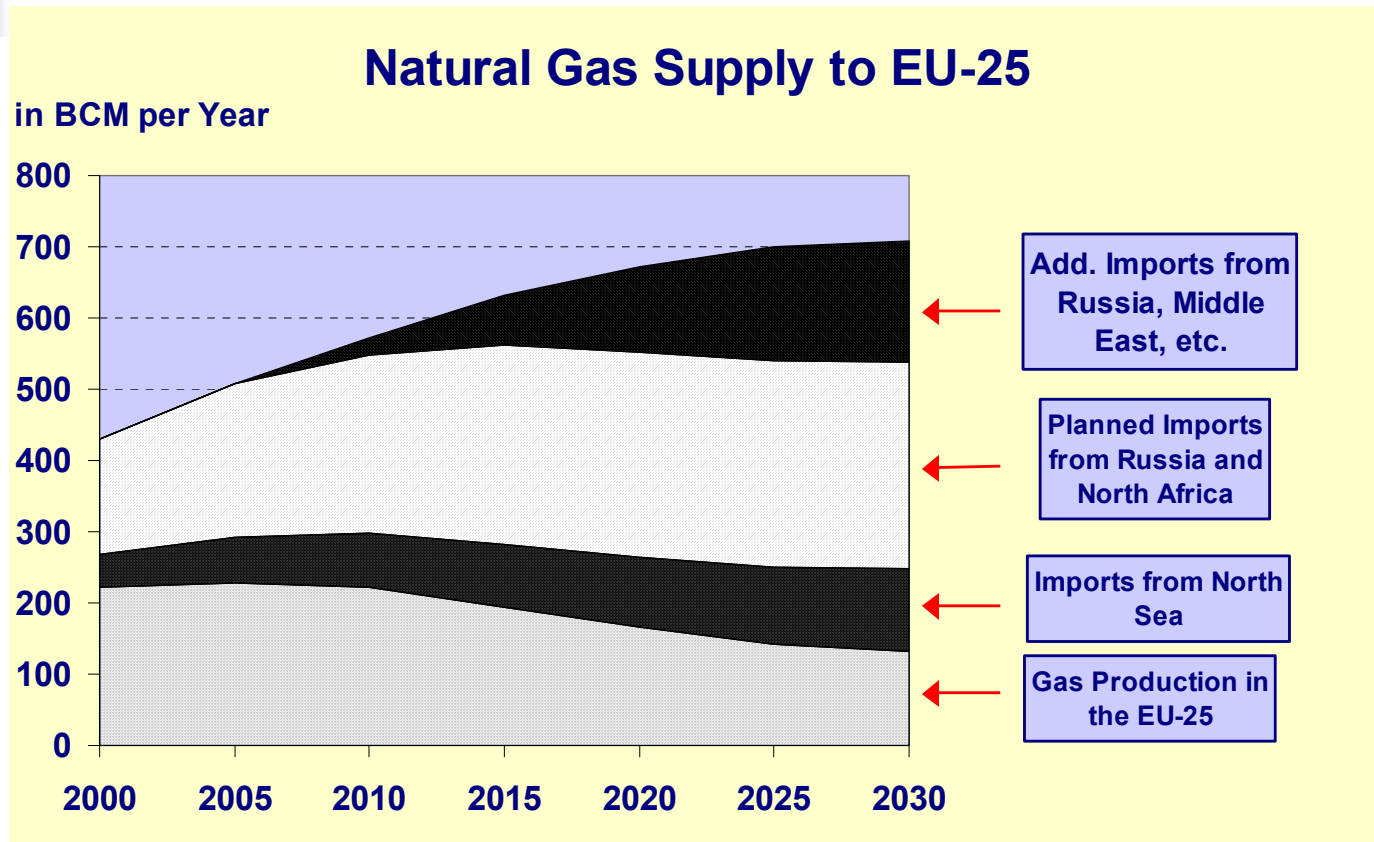


Inelastic Dependency on Gas

- In 2030, gas imports become between 2 and 3 times higher than in 2000
- Irrespectively of policy pattern, gas needs remain inelastic
- Securing non expensive gas imports is a critical policy objective

EU-25 Natural gas imports for each Scenario					
in bcm per year	2000	2010	2020	2030	Index
Scenarios					
Baseline	207	344	500	568	2.75
Low economic growth	207	324	467	511	2.47
High prices of oil and gas	207	313	444	467	2.26
Efficiency and renewables	207	283	400	444	2.15
Accelerated Nuclear	207	294	491	544	2.63
Strong Energy Policy	207	283	389	417	2.02
Extended Energy Policy	207	289	466	537	2.60
Full Energy Policy	207	289	448	510	2.47
Kyoto forever	207	339	521	602	2.91
Gothenburg climate targets	207	339	503	521	2.52
Average	207	310	463	512	2.48
Standard Deviation	0	25	44	56	0.27

Gas Supply to the EU



- Plan for infrastructure and supply to obtain the considerable additional imports needed beyond 2010, as North Sea and EU gas production will not expand
- Supply must deliver 18,000 BCM in 30 years of which 10,000 imported from Russia, North Africa and Middle-East, 2,500 imported from North Sea and 5,500 produced in the EU



Nuclear Uncertainty

- Nuclear capacity, from 140 GW in 2000, could go down to 100 GW in 2030 in the absence of new nuclear policy. Under most favourable conditions it could reach 175 GW in 2030. Under moderate nuclear policy, keeping the level of 140 GW combines well with other policy options, like renewables and energy efficiency improvement.
- A nuclear phase out would have considerable adverse effects on carbon emissions and import dependency
- Extending nuclear lifetimes does not address the key strategic issue that arise beyond 2020. Absence of strategic choice influences all investment decisions before that period
- It is unlikely that, up to 2030, accelerated renewables and/or hydrogen could equally perform in terms of costs, carbon emissions and import dependency
- Nuclear combined with accelerated renewables and energy efficiency deliver highest performance. What to do then?



Energy-environment driving growth?

- EU is comparatively strong in Equipment Goods Industry and the Services sector
- EU internal market area is large and expanding
- A unilateral stringent policy in terms of energy-environment can drive accelerated technical progress and investment in the Equipment Industry and Services, resulting into economies of scale, hence in comparative advantage at world level
- The EU-internal demand sustains employment and activity
- In the long run, the new exporting potential drives additional accelerated growth of the EU area
- Such a strategy, with removal of uncertainties, may push the EU to enter into a new investment cycle..



Gap: current market trends versus long term public policy aspiration

- The EU energy markets under liberalization:
 - Invest under market competition uncertainty and adopt technologies with minimum capital cost and high efficiency
 - Have not internalized the long term public policy objectives, e.g. climate change, import dependency, etc.
 - Consider public policy aspiration as a source of high uncertainty, so prefer postponing actions and investment
- Public policy attempt to pursue objectives mainly through state-driven support:
 - Emission trading depending on NAP defined by the state
 - Accelerated support of renewables, exempted from market competition
 - Various forms of state-aid envisaged for the development of nuclear energy (cases of France and Finland)
 - Threat for sales from high energy and carbon taxes or similar.
- Reconciliation involves: clear strategic choices, removal of uncertainties, use of market mechanisms, ...



Thank you for your attention

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