



EU Energy Roadmap 2050

Feuilles de route Energie à
l'horizon 2050
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Context: European Energy Policy

1951/57: European Coal and Steel Community + EURATOM

Since 2005/6: Integrated EU energy & climate policy

Objectives (2007):

- Increase energy efficiency by 20% by 2020
- Reduce CO₂ emissions by 20% by 2020
- Increase share of renewables to 20% by 2020

2nd Strategic Energy Review (2008) includes, i.a.:

- Low-carbon electricity share of ~66% by 2020 (2007: 44%)
- Low-carbon electricity share of close to 100% by 2050

Since 2008/9: SET-Plan for technology development

Since 1.12.2009: TFEU (Lisbon Treaty) - Competences of the European Union according to Art. 194 ("Energy"):

- *Objectives:* Internal energy market, Supply Security, Efficiency, New & RES technologies, Network interconnections.
- *Measures* to achieve objectives shall not affect a MS's right to exploiting its energy resources, choice between sources and supply

Energy Strategy 2020 (2010) [COM/2010/639]



Energy Roadmap 2050

- **10/2009 European Council:**
 - Commitment to reducing GHG emissions to 80-95% below 1990 levels by 2050 in the context of necessary reductions by developed countries as a group
- **8 March 2011 Communication "Roadmap for moving to a competitive low-carbon economy in 2050":**
 - Analysis of implications on different sectors (e.g. power sector, industry, transport, agriculture, ...)
 - e.g. GHG reductions required in the **power sector** (compared to 1990):
 - -54 – -68% by 2030
 - -93 – -99% by 2050



European
Commission

11 March 2011



Die Explosion im japanischen
Atomkraftwerk Fukushima 1



Energy Roadmap 2050

- Communication adopted by the Commission on **13 December 2011**
- A basis for developing a long-term EU energy policy framework, supported by scenario analysis
- **To help in seeing what policy action is needed in the next years for an energy system transformation delivering energy security, competitiveness and decarbonisation**
- Represents the EC's post-2020 agenda (beyond "20/20/20"), focused mainly on 2030 and consistent with 2050
- To consolidate long-term investment concerns and diminish policy uncertainty for 2020-2030
- To facilitate coherence of action by EU and MS

● Outline of presentation

1 Scenario design

2 Results and policy conclusions

● Rationale for scenario design

- **Four main routes** to cut energy related CO₂ emissions:
 - Reducing energy consumption through **Efficiency**
 - Making energy supply less carbon intensive – **RES, Nuclear and CCS**
- Market driven approach complemented in some cases by targeted support policies where very broad support (energy efficiency and RES)
- Technology specific assumptions (e.g. nuclear, CCS)

● 7 Scenarios to explore decarbonisation

Current trends Scenarios

(→ 40% GHG reduction by 2050)

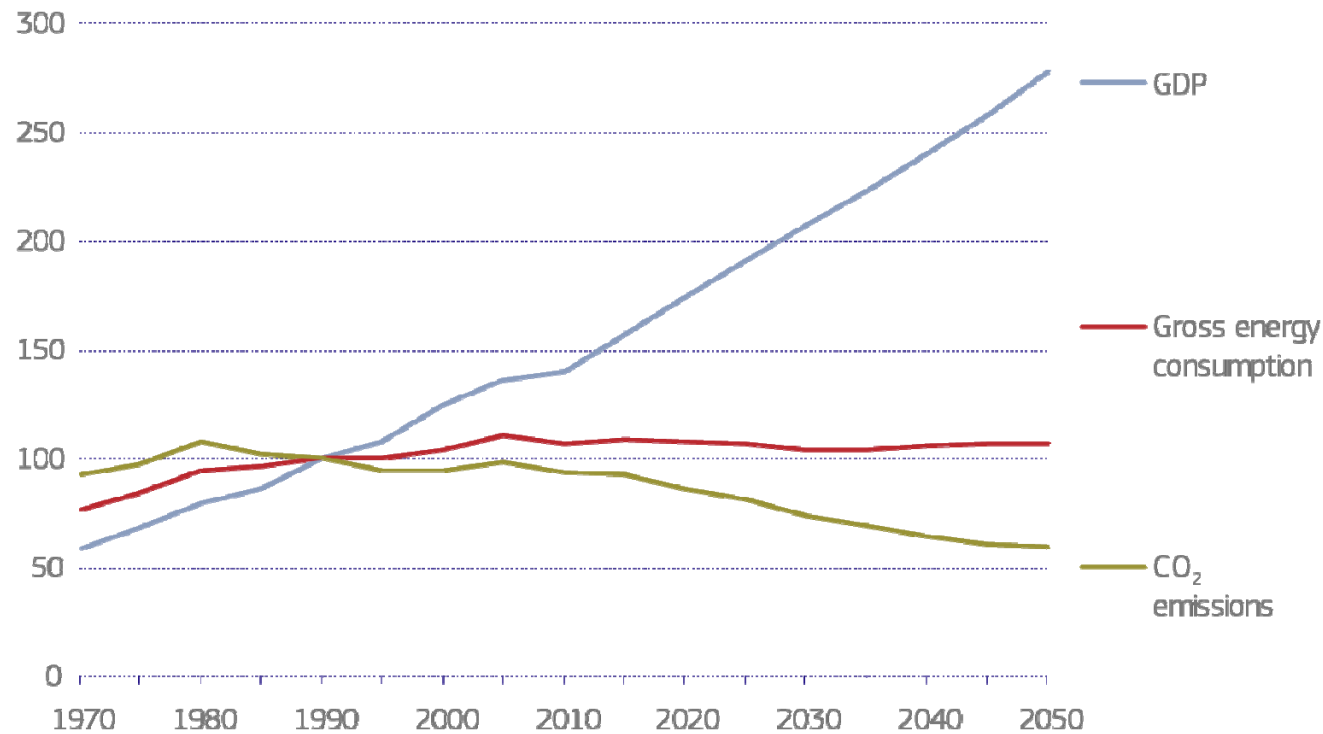
- *Reference scenario* (as of March 2010)
- *Current policy initiatives* (as of April 2011 (**post-Fukushima**))

Decarbonisation Scenarios

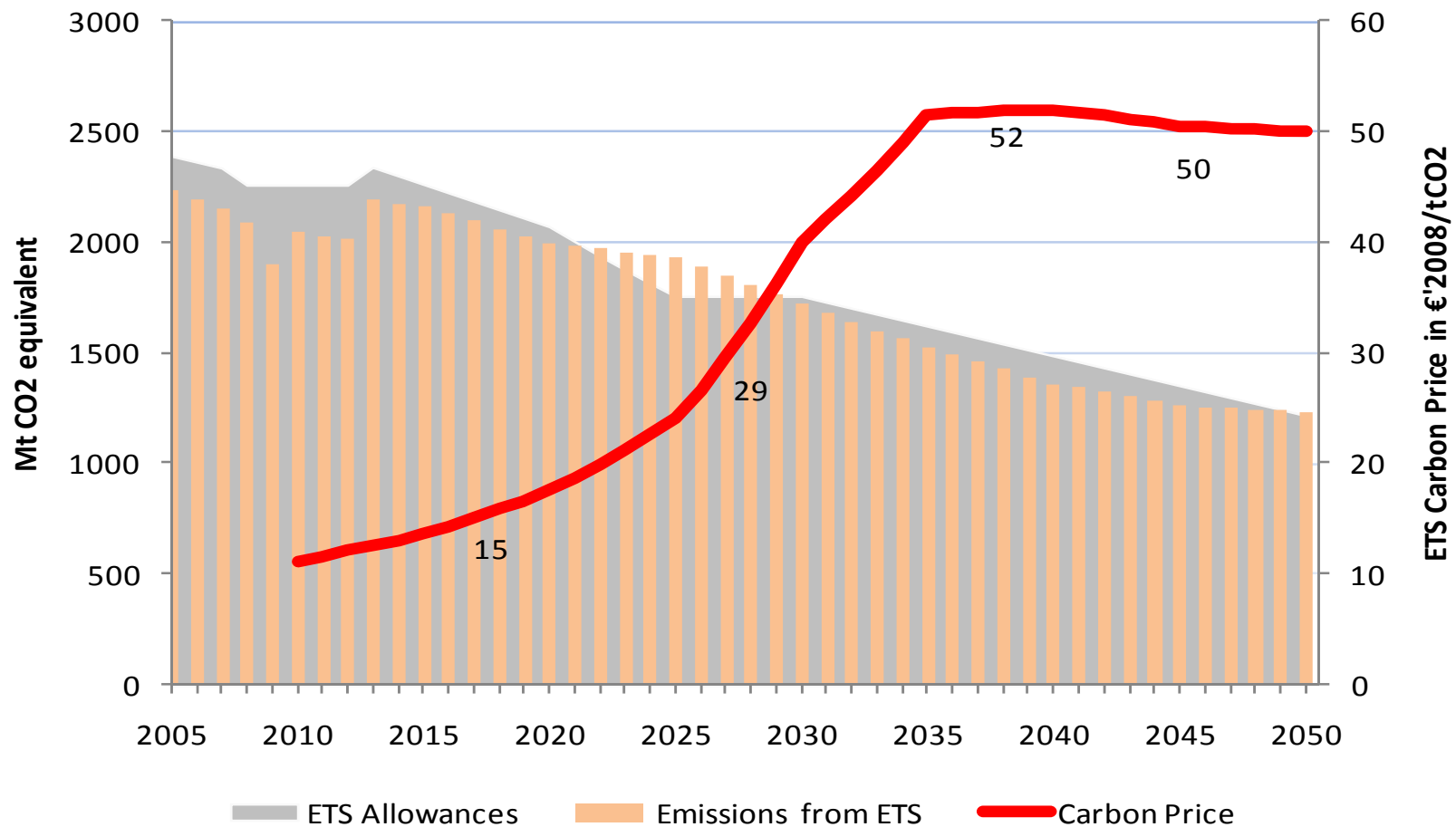
(→ 80% GHG reduction by 2050)

- *High energy efficiency*
- *Diversified supply technologies* (all energy sources compete on market basis with no specific support measures)
- *High RES* (Strong support measures for RES)
- *Delayed CCS* (Else, similar to Diversified supply technologies)
- *Low nuclear* (Else, similar to Diversified supply technologies (**post-Fukushima**))

- Reference scenario: GDP, energy consumption and CO₂ emissions 40 years back and ahead (1990 = 100)

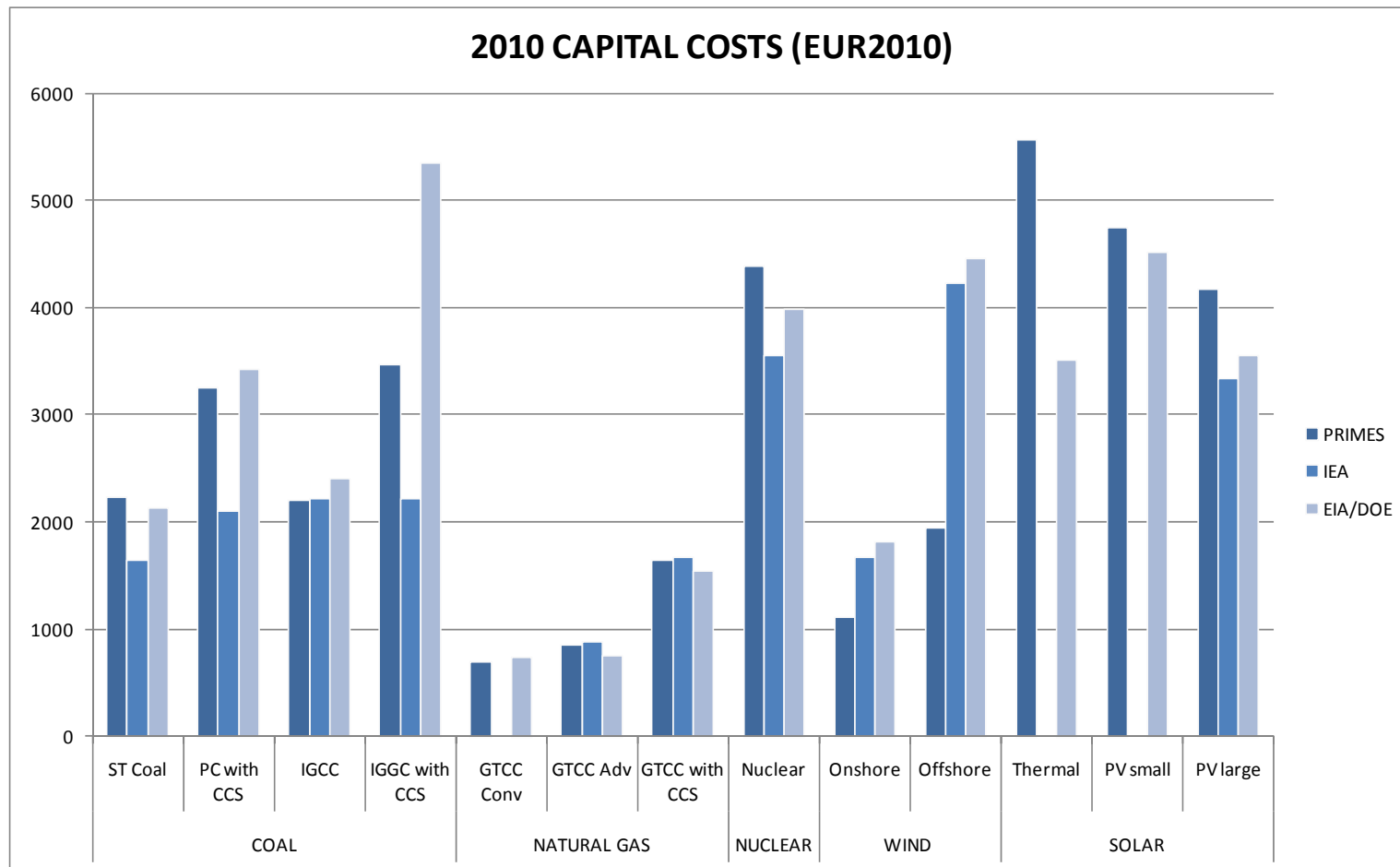


● Reference scenario: Example of Policy-related Input Data: ETS carbon price, emissions and allowances



Source: European Commission

- *All scenarios: Example of Technology-related Input Data: Capital costs 2010 (EUR(2010) / kWh)*



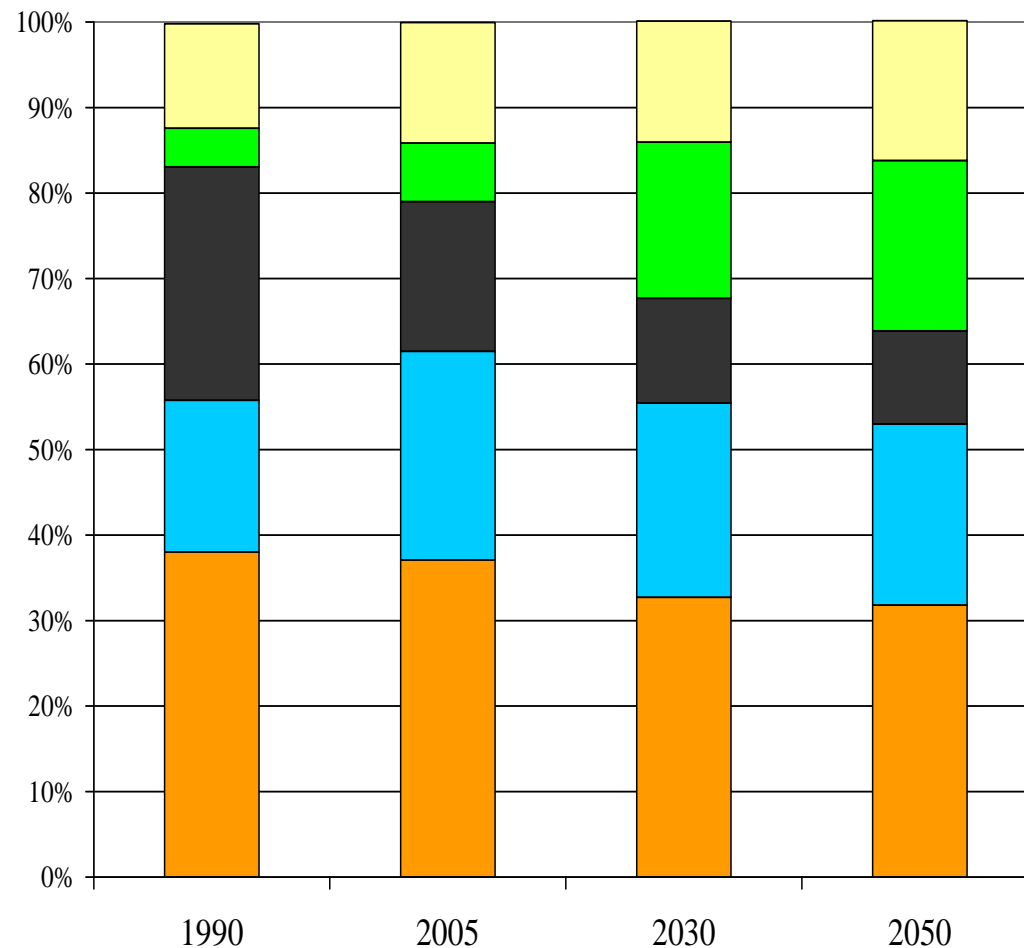
Source: European Commission

● Outline of presentation

① Scenario design

② Results and policy conclusions

Reference Scenario: Fuel shares in primary energy



■ Nuclear

- Fossil fuel share down from 83% in 1990 to 64% in 2050;

■ RES

- Gas more important than in 1990;

■ Solids

- CCS penetration reaching 18% of electricity generation in 2050;

■ Natural gas

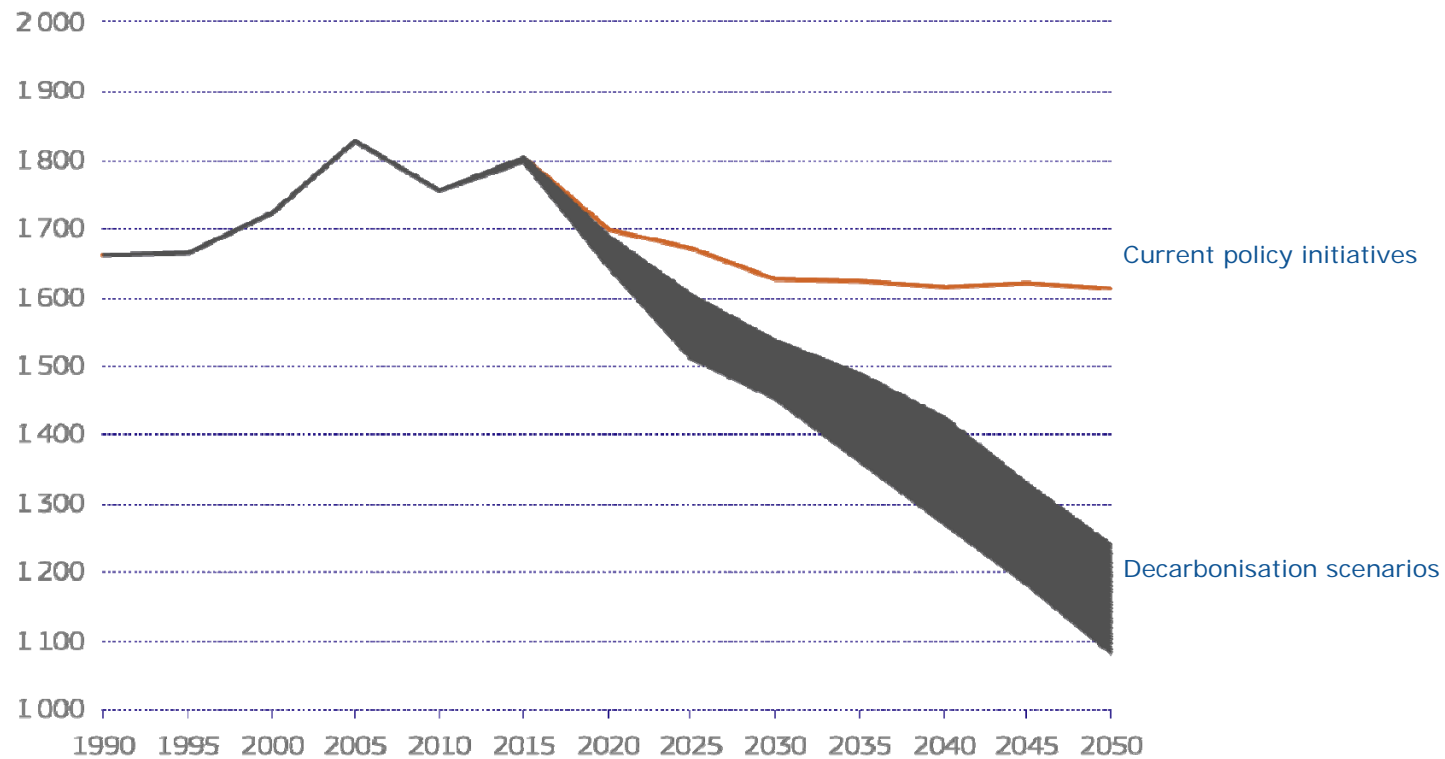
- ETS price rising to 50€(08)/t CO₂ in 2050;

■ Oil

- **CO₂ from energy falls 40% in 1990 - 2050**

Decarbonisation scenarios: Energy savings throughout the system are crucial

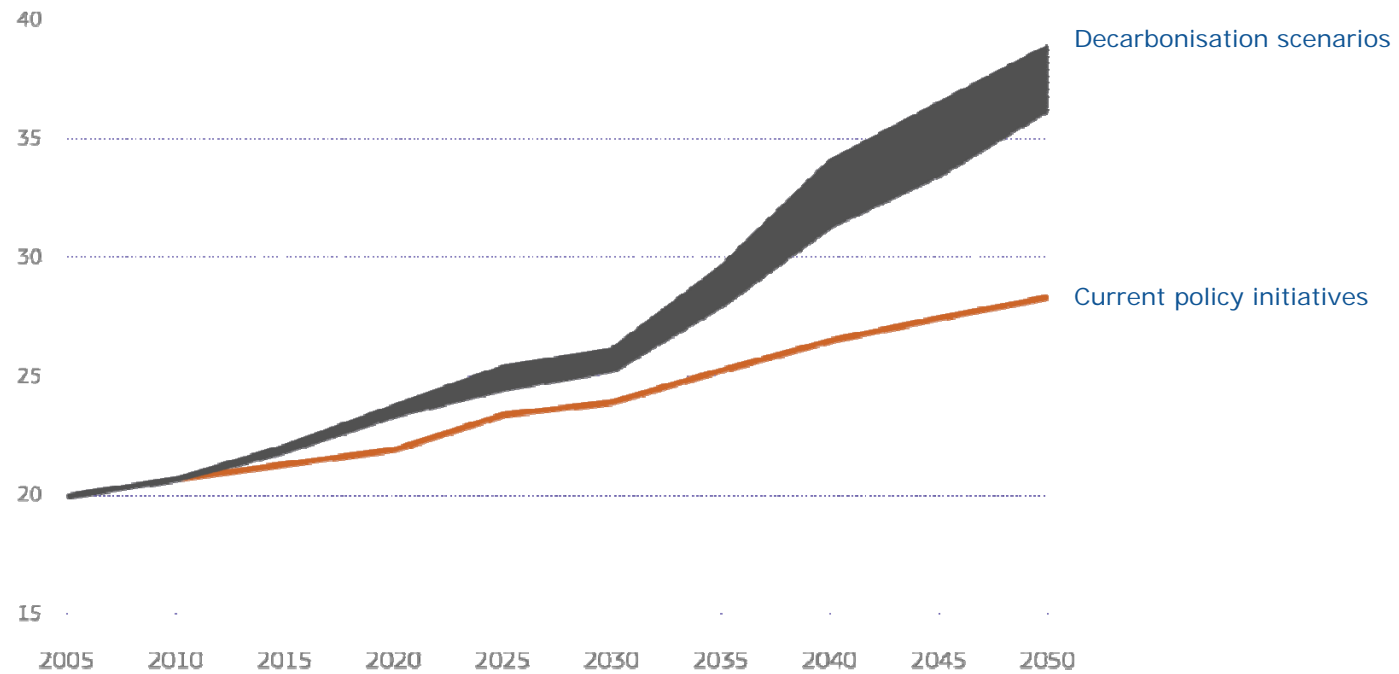
Gross energy consumption (in Mtoe)



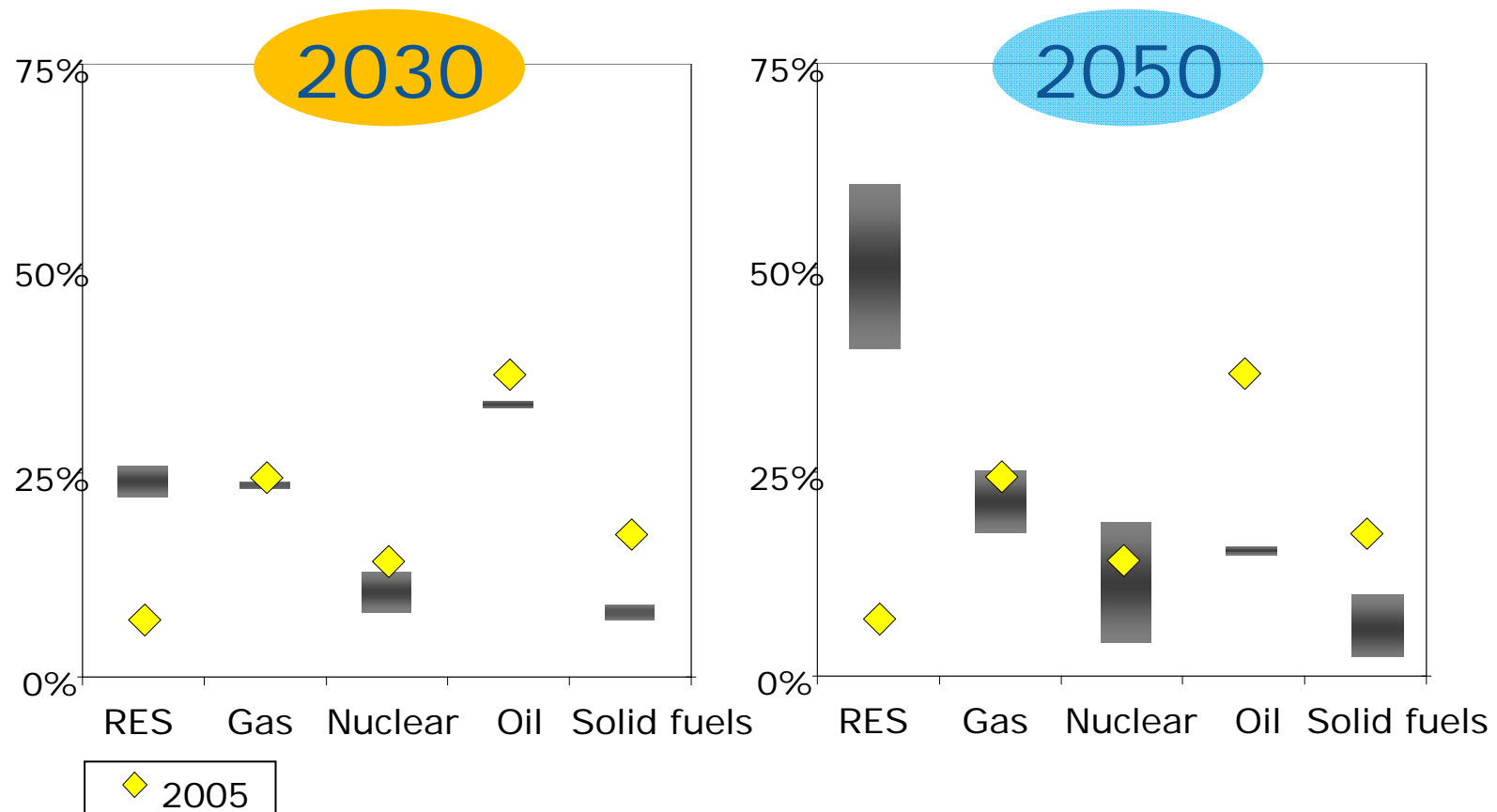
Source: European Commission

Decarbonisation scenarios: Electricity plays a drastically increasing role

Share of electricity in current trend and decarbonisation scenarios
(in % of final energy demand)

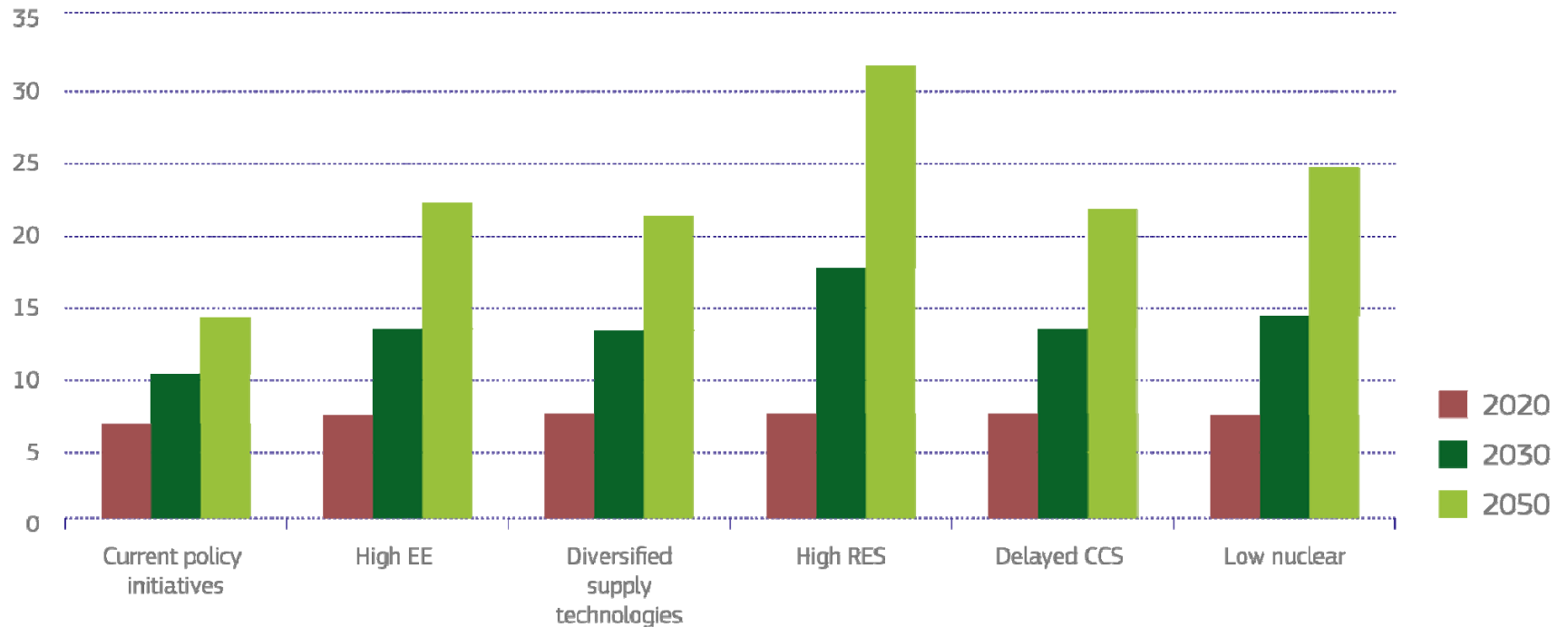


Decarbonisation scenarios: Primary energy consumption in [%]





Share of decentralised electricity in power generation [%]

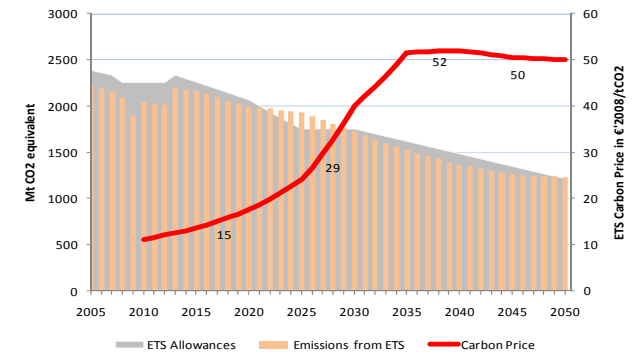
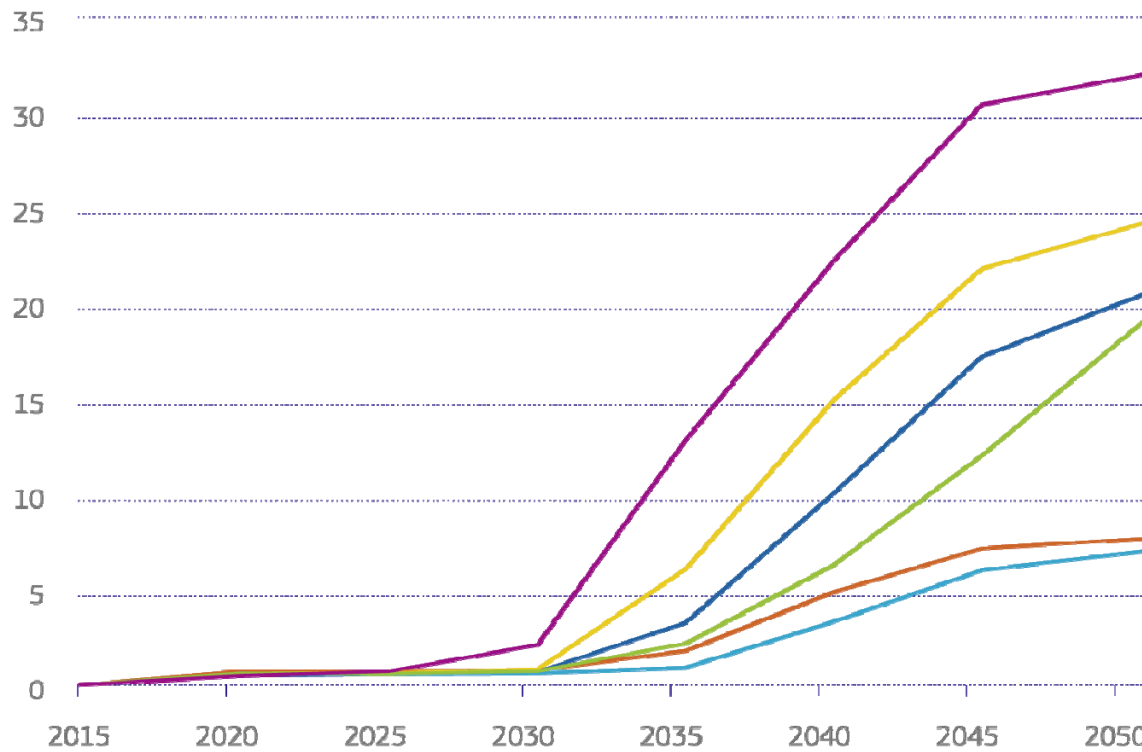


Source: European Commission

Networks and markets must adapt to the coexistence of centralised and increasing decentralised power generation and new possibilities for demand response, demand management.

Carbon capture and storage could play a pivotal role in system transformation

Share of CCS in power generation (in %)



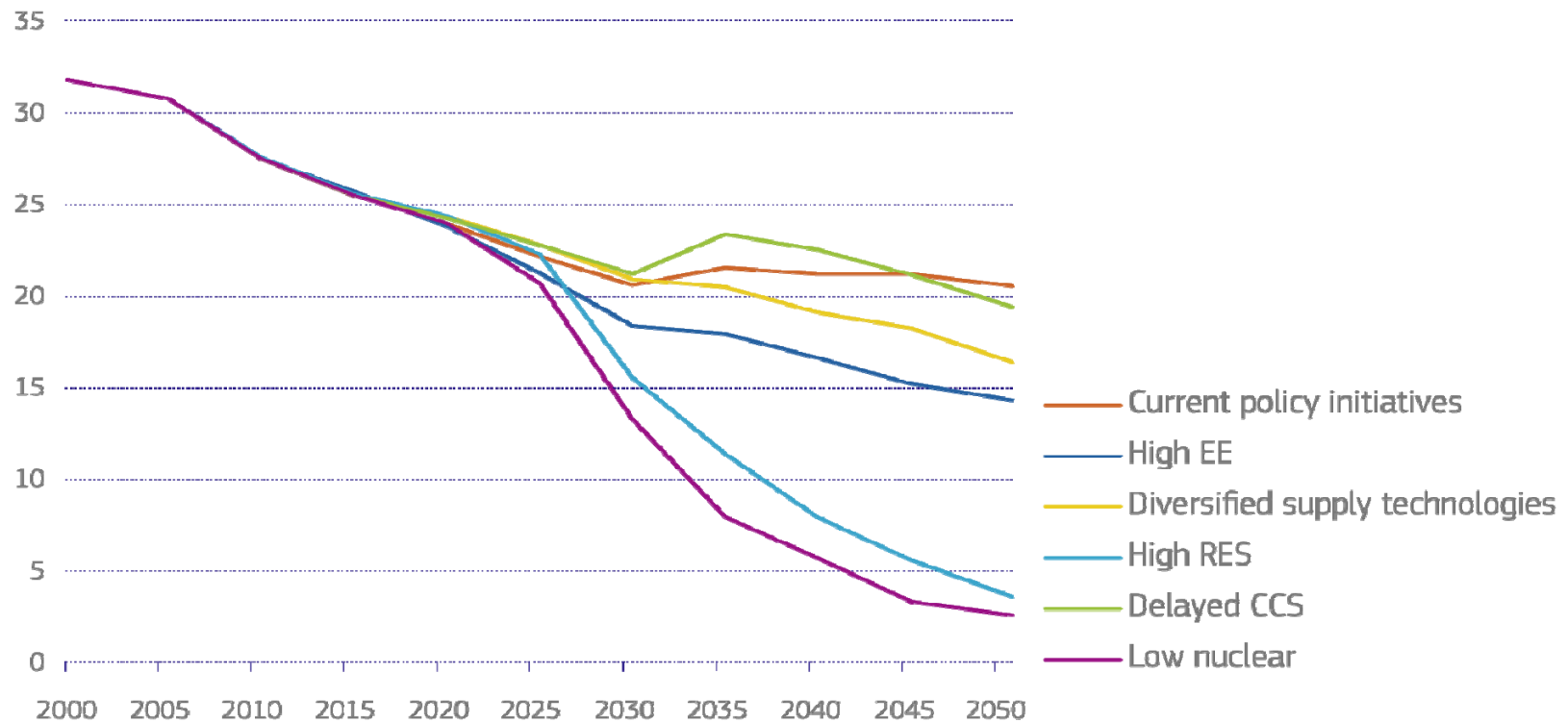
- Current policy initiatives
- High EE
- Diversified supply technologies
- High RES
- Delayed CCS
- Low nuclear

Source: European Commission

CCS needs to be sufficiently demonstrated on a large scale and investment in the technology ensured in this decade, and then deployed from 2020, in order to be feasible for widespread use by 2030

● Role of nuclear energy depends on scenario

Share of nuclear in power generation (in %)

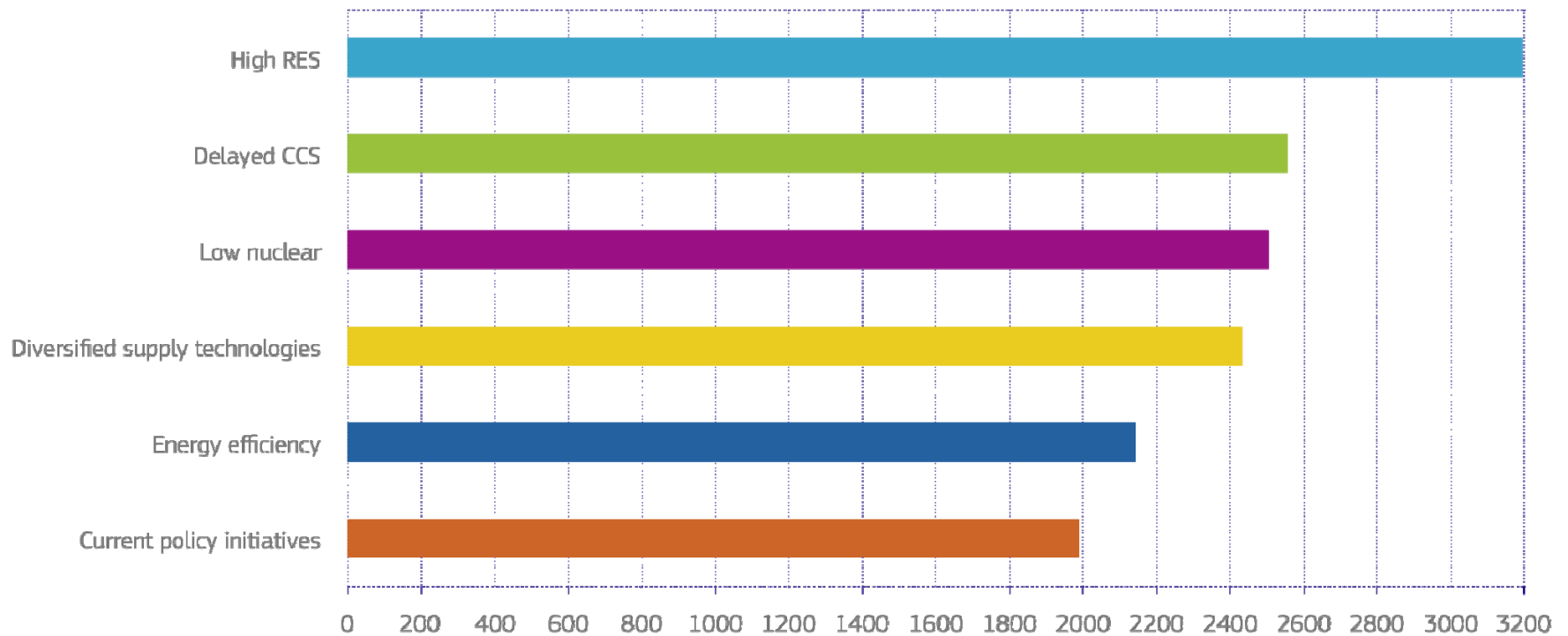


Source: European Commission

Nuclear production will contribute more or less, depending on the scenario.
80% GHG reduction can also be achieved with a very low nuclear contribution.

How much does it cost?

Cumulative investment expenditure for power generation from 2011 to 2050 (in billion €2008)

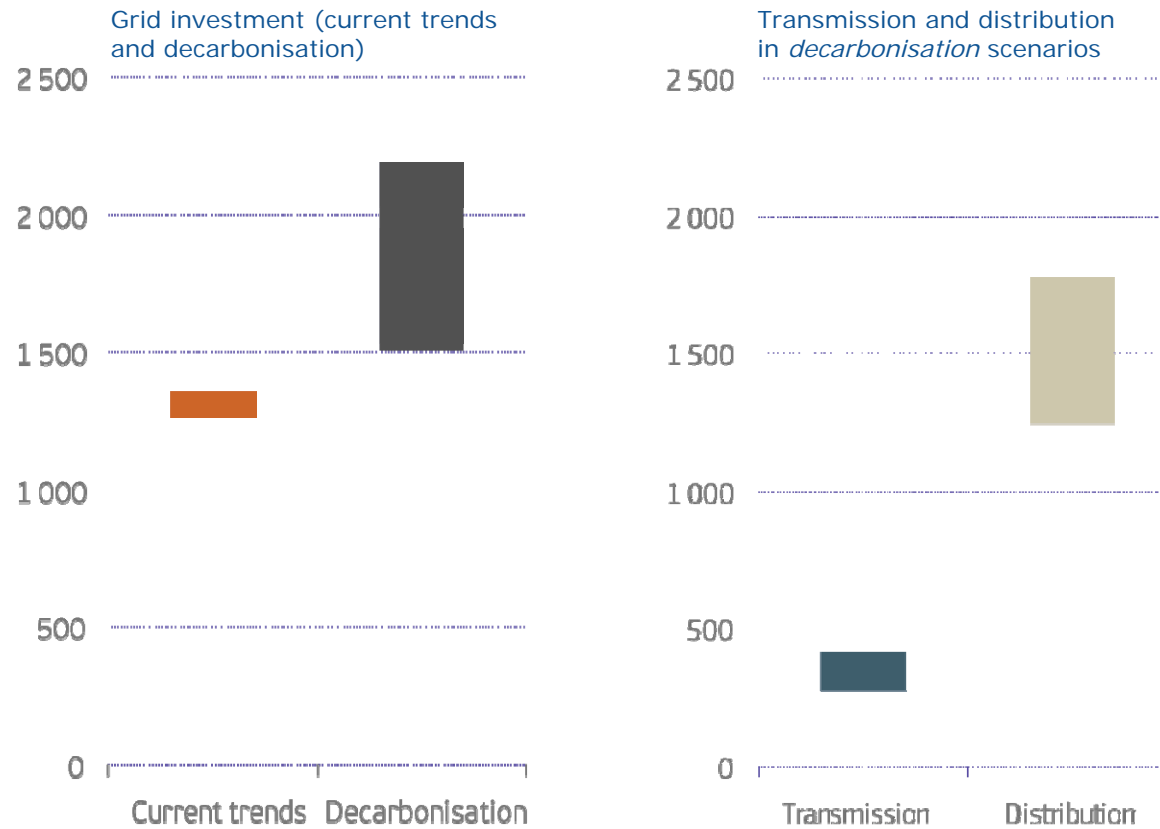


Source: European Commission

More investments are needed in power generation, grid infrastructure and storage.

How much does it cost?

Cumulative costs 2011-2050 (in bn €) (in ranges)



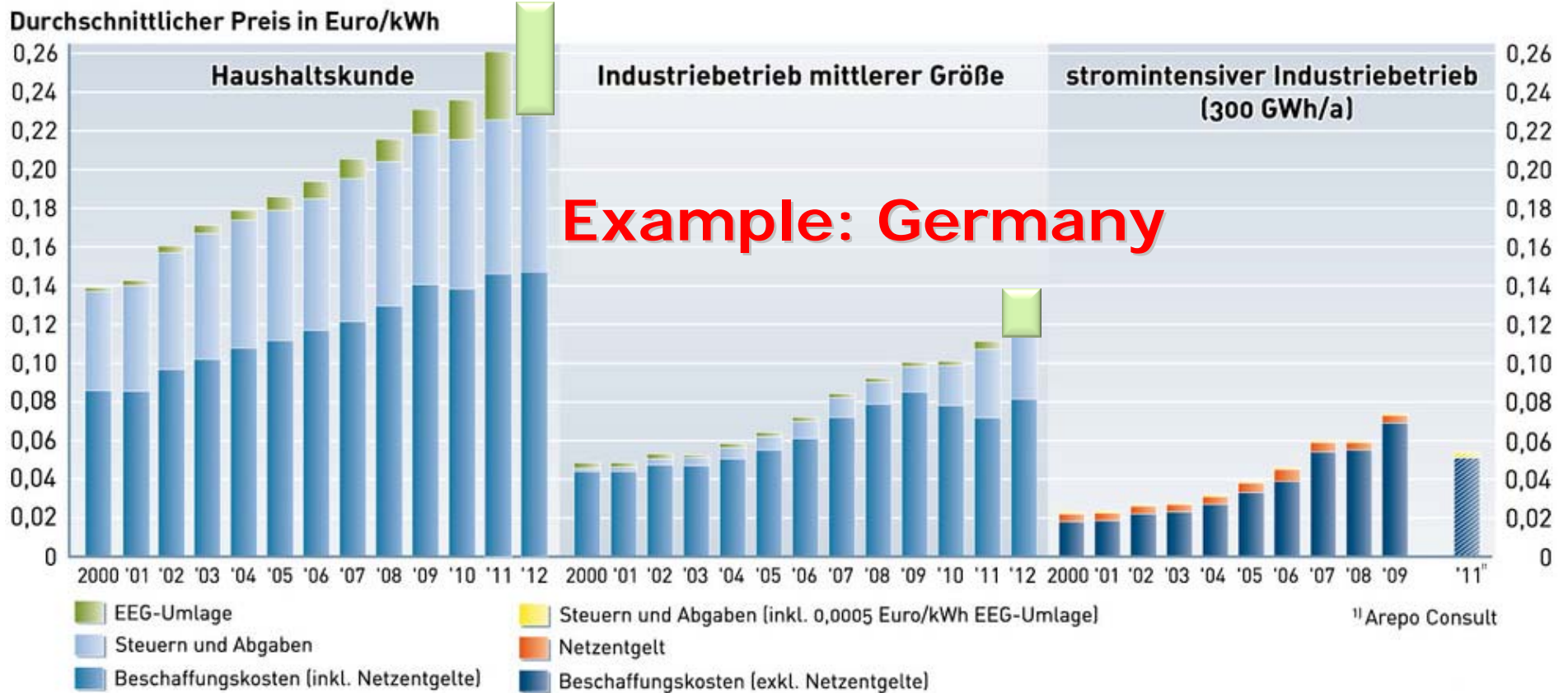
Source: European Commission

● How much does it cost?

- Assumption:
 - Fossil fuel import dependency & bill decrease
 - Thus, overall, in all decarbonisation scenarios, total costs are similar to current policies
 - **However, electricity prices rise until 2030 and then decline**
- **Social dimension?**

Strompreise in Deutschland im Vergleich

Die EEG-Umlage macht nur einen geringen Anteil am Industriestrompreis aus.





● Rethinking energy markets in Europe

- Growing reliance on electricity, more intermittent RES, more interdependence, more trade (IEM)
- **Ensure that market arrangements offer cost-effective solutions, allowing all resources to be used**
- Recent initiatives in different MS to facilitate investment in low-carbon generation (incl. nuclear):
 - Feed-in tariffs, carbon tax, ETS certificates' price floor, ...
- For investments with public good character, some support measures for early movers may be warranted:
 - MS can define "services of general economic interest" (SGEI)
 - Need to demonstrate current market failure (IEM):
 - i.e. that current arrangements do not provide sufficient low-carbon or flexible generation
 - Measures proportional, temporary, keep original objective



● The Way Forward

- Precondition is adopted 2020 strategy (20-20-20 targets)!
- «No regrets» options (those indicated by all decarbonisation scenarios): *energy efficiency, renewable energy, more and smarter infrastructure*
- Need for fully integrated, well-designed markets for gas and electricity
- Innovation for low-carbon solutions
- Nuclear safety
- Broader and coordinated approach
- **Next steps:**
 - Develop milestones for 2030 in an iterative process with MS, EP, stakeholders
 - 2012/13 Communications on IEM, RES, CCS, NS-initiative
 - **Process leading to policy framework for 2030 by ~2014**



Summary – Energy Roadmap

- **Technically:**

- No single optimum,
- But many optima depending on physical / temporal circumstances
- **Implication: No EU-MS alone can provide sustainable energy to its citizens**

- **Politically:**

- Ongoing discussion process with stakeholders (Council, EP, public),
 - expected to lead to 2030 policy framework by 2014
- Rethinking of IEM ?
 - ↔ Review of ETS auctioning regulation (DG CLIMA) ... economic recession + over-supply of ETS-credits