



CÁTEDRA BP DE ENERGÍA Y  
SOSTENIBILIDAD

**Ignacio Pérez-Arriaga**

LONG-TERM ENERGY AND REGULATORY PROSPECTIVE  
Strengths and weaknesses of low-carbon policy  
strategies after 2020

***Workshop: Economic Challenges for Energy***

***Economics for Energy, Madrid, January 30-31, 2012***

# Outline

- Highlights of the 2050 Energy Roadmap
- Major challenges for the transition
- How to get there (2050)?
  - Carbon policy strategies after 2020: The debate on intermediate targets



# **Highlights of the 2050 Energy Roadmap**

**The long term perspective**

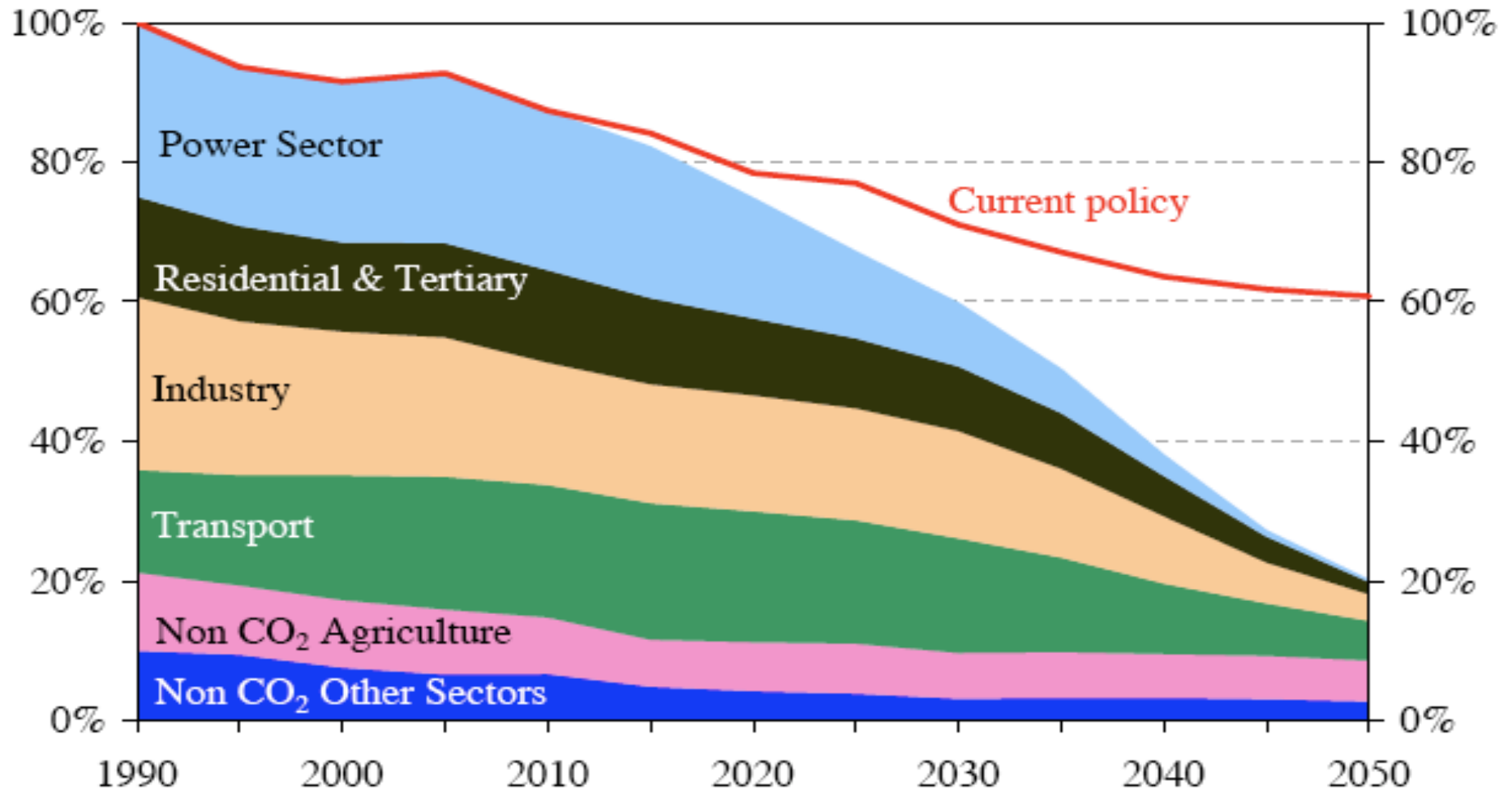
# The boundary conditions

- 2050 EU Roadmap for a low-carbon economy
  - 80-95% reduction target in GHG emissions
  - Why bother (*the EU contributes so little...*)?
- Need to establish the energy policy after 2020  
(*with the current policies the GHG reduction would be 40%*)
- Much uncertainty on 2050... but we are only one investment cycle from that date
- No U-turn in the EU energy market liberalization strategy



# The EU 2050 Climate Change Roadmap

**Figure 1: EU GHG emissions towards an 80% domestic reduction (100% =1990)**



**Source: “A Roadmap for moving to a competitive low carbon economy in 2050”, EU Commission (DG Climate), COM(2011) 112 final, March-8-2011**

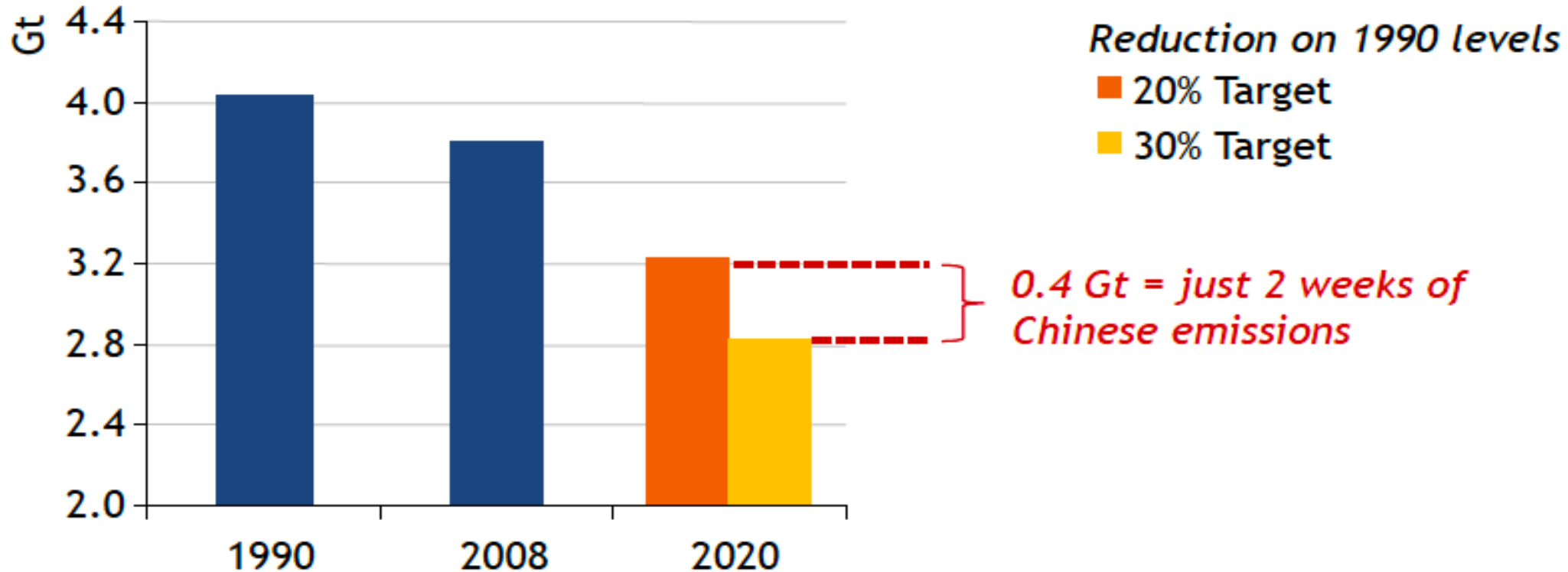
# Why bother?

EU share of global energy demand & energy-related CO<sub>2</sub> emissions



# Why bother?

CO<sub>2</sub> emissions from fossil-fuel combustion in the European Union



# The starting point

- EU Directives, Regulations & “Framework guidelines” on gas, electricity, renewables & efficiency
- The Strategic Energy Technology (SET) Plan
- The energy strategy 2020
- Individual “roadmaps” of several Member States
- The EU 2050 roadmaps
  - 2050 Roadmap for a low-carbon economy
  - 2050 transportation Roadmap





# Some EU 2050 Energy Roadmaps

- **European Climate Foundation:** Roadmap 2050 - A Practical Guide to a Prosperous, Low-carbon Europe. Technical, economic and policy analysis (2010)
- **PWC:** 100% Renewable Electricity – A Roadmap to 2050 for Europe and North Africa
- **Energy Research Centre of The Netherlands:** A zero-carbon European power system in 2050: Proposals for a policy package (2010)
- Energy Research Centre of The Netherlands: Climate, Energy Security and Innovation (2008)
- Energy Research Centre of The Netherlands: A sustainable energy system in 2050: Promise or possibility? (2007)
- **European Climate Forum:** The Supersmart Grid (2007)
- **European Commission:** Strategic Research Agenda for Europe's Electricity Networks of the Future (2007)
- **International Energy Agency:** Prospects for Large-Scale Energy Storage in Decarbonised Power Grids (2007)
- **Shell** energy scenarios to 2050 (2008)
- "Scenarios for electricity supply in the future" – "Cost-optimal variation for the electricity supply in Europe and its neighbors from renewable energy sources"; **Czisch**
- Market based analysis of Interconnections between Nordic, Baltic and Poland Areas in 2025 (2010)
- **Tradewinds;** KEMA Contributor
- **Dena study** - Planning of the grid integration of wind energy in Germany onshore and offshore up to the year 2020
- **UK Energy Networks Strategy Group:** A Vision for 2020 (2009)
- Re-thinking 2050 – A 100% Renewable Energy Vision for the European Union; European Renewable Energy Council (**EREC**)
- **National Grid:** Fundamental Review of National Electricity Transmission System Security and Quality of Supply Standards (2010)
- **European Wind Integration Study** (2010)
- **UK Energy Networks Strategy Group:** A Smart Grid Vision (2009)
- **ERMinE:** Electricity Research Road Map in Europe (also called Coordinated Action within the 6th Framework Program of the European Commission)
- **Airtricity:** European Offshore Supergrid Proposal - Vision and Executive Summary
- **UK Energy Networks Strategy Group:** A Smart Grid Routemap (2009) DESERTEC

# The 2050 Energy Roadmap

## Purpose

- Balance between a “European framework” (*to facilitate & enhance the effectiveness of national policies*) & the “national policies” (*adapted to the specific characteristics of the Member States*)
- Draw conclusions from the analysis of a set of scenarios (*they are not forecasts*) with 85% reduction of GHG from the energy sector
  - “Current trend scenarios” (*Reference, Current policy*)
  - “Decarbonization scenarios” (*High energy efficiency, Diversified supply technologies, High renewables, Delayed CCS, Low nuclear*)



## Scenarios for development of EU energy system

### Current trends scenarios

- Reference scenario (as of March 2010)
  - Current Policy Initiatives (as of April 2011)
- ➔ 40% GHG reduction by 2050

### Decarbonisation scenarios

- High Energy Efficiency
  - Diversified Supply Technologies
  - High RES
  - Delayed CCS
  - Low Nuclear
- ➔ 80% GHG reduction

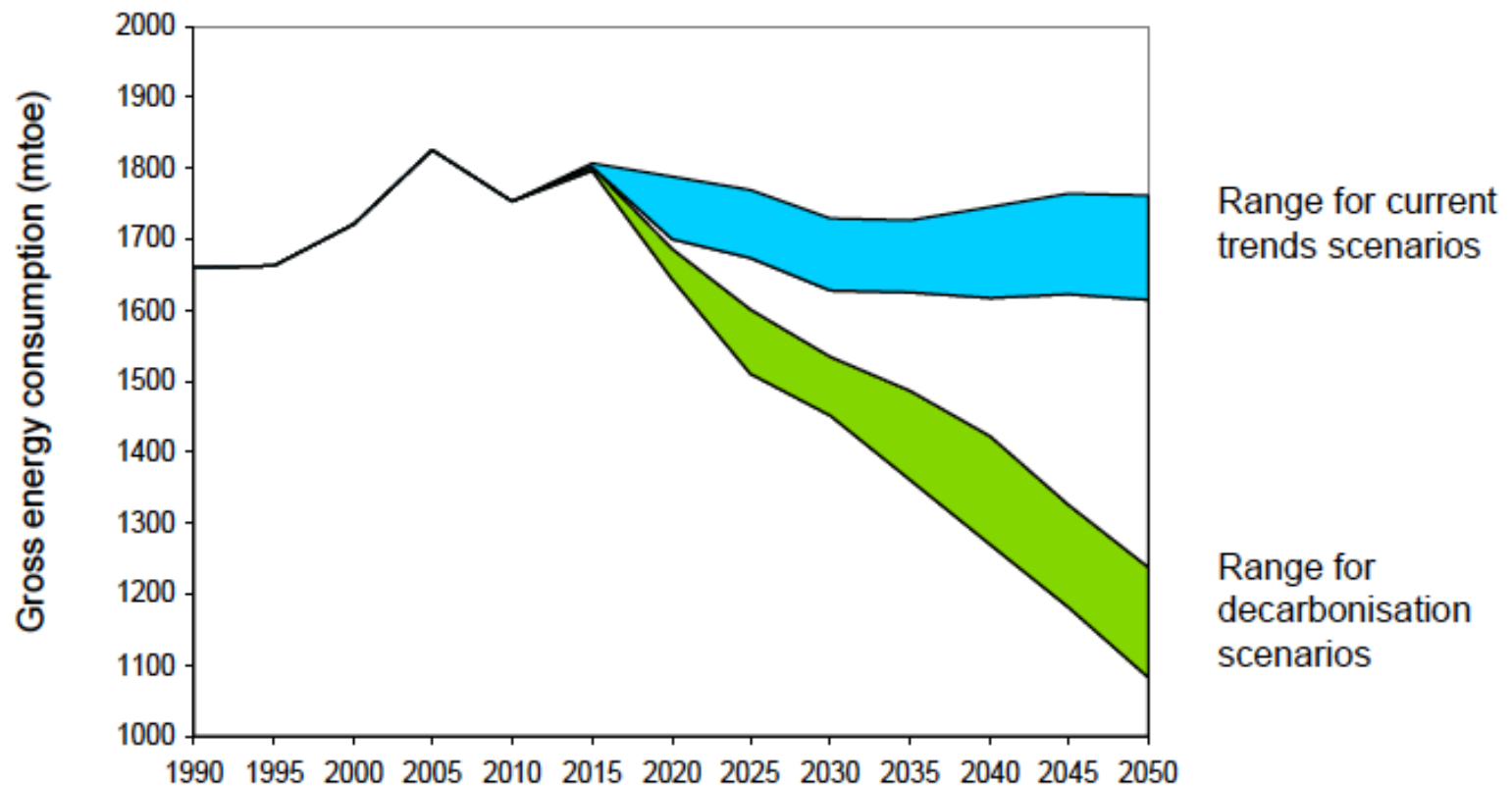
## Highlights from 2050 decarbonisation scenarios:

- System transformation relies on energy efficiency, savings
- Growing importance of electricity
- Renewables move centre stage - *at least 55% of gross final energy consumption in 2050, at least 60% of electricity generation*
- but all decarbonisation options contribute
- Investment expenditure up
- but energy purchase costs (fuels, electricity, steam) fall in long run
- Decarbonisation can be less costly than current policies
- Timing matters - power sector decarbonisation needed early

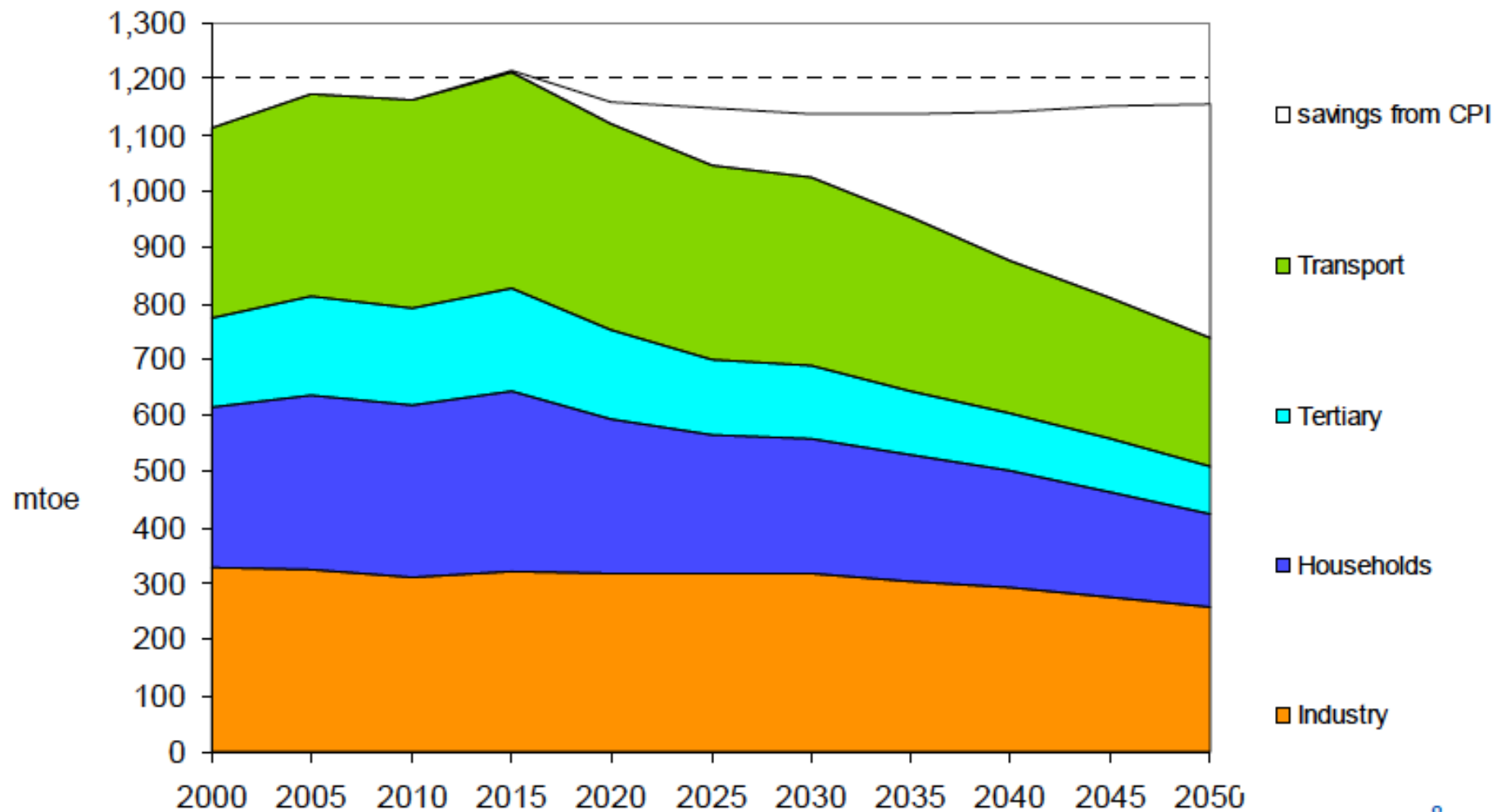
## Way forward:

- Energy/climate strategy continues to make sense - common EU approach can keep costs down
- Energy efficiency
- RES – impact in market -modernisation of policy framework
- IEM – well-designed market structure instruments, new ways of cooperation needed, as energy mix changes
- Cost-reflective prices
- Infrastructure – urgency and collective responsibility
- Safety and security
- Broader approach to international energy relations, including climate action
- 2030 policy framework, milestones, consistent with 2050
- Communications in 2012 – RES, IEM, nuclear safety, CCS

## Energy efficiency, savings - essential



## Energy efficiency scenario: Final energy demand



Source: Helen Donoghue, DG Energy, EU Commission.



## **Investment expenditure** in decarbonisation scenarios, compared to current policies scenarios

+ €270 bn p.a.

€30 bn in power (electricity generation, grid):

€75 bn in built environment (buildings, appliances)

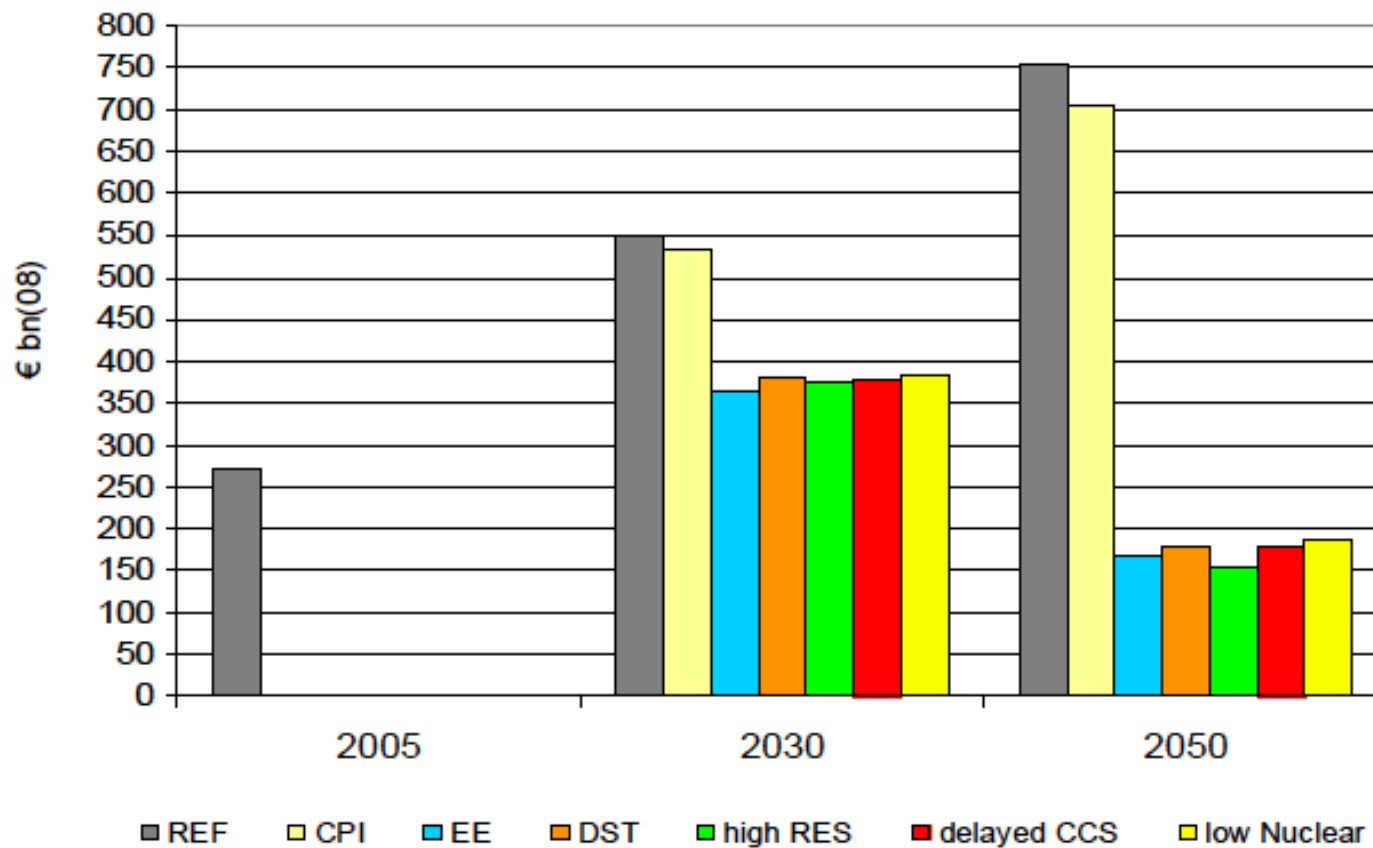
€150 bn transport (vehicles and infrastructure)

(public+private, in EU, averaged over 2011-2050)

**External fossil fuel costs** are some € 175-320 bn p.a  
lower

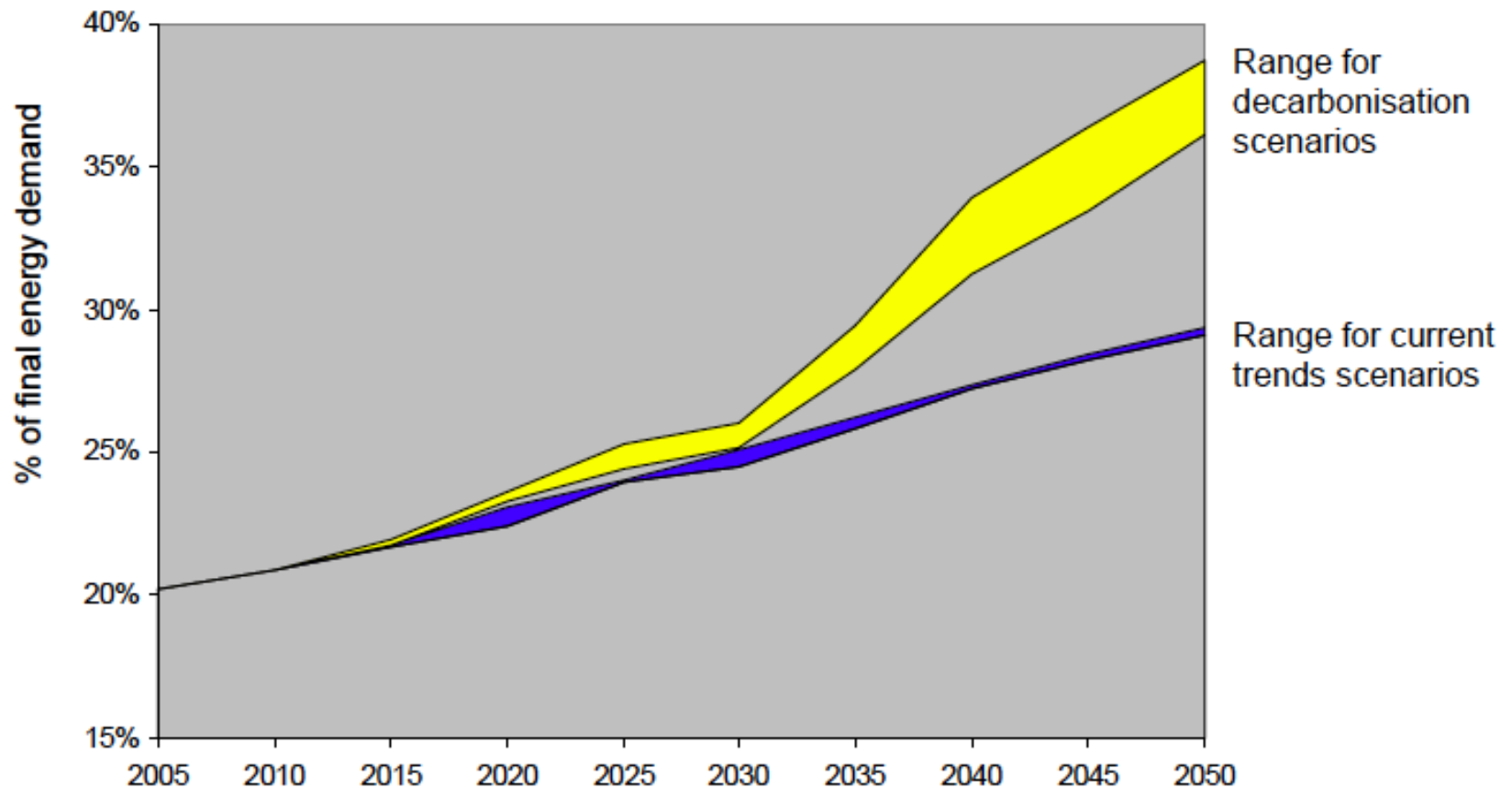


## EU external fossil fuel bill



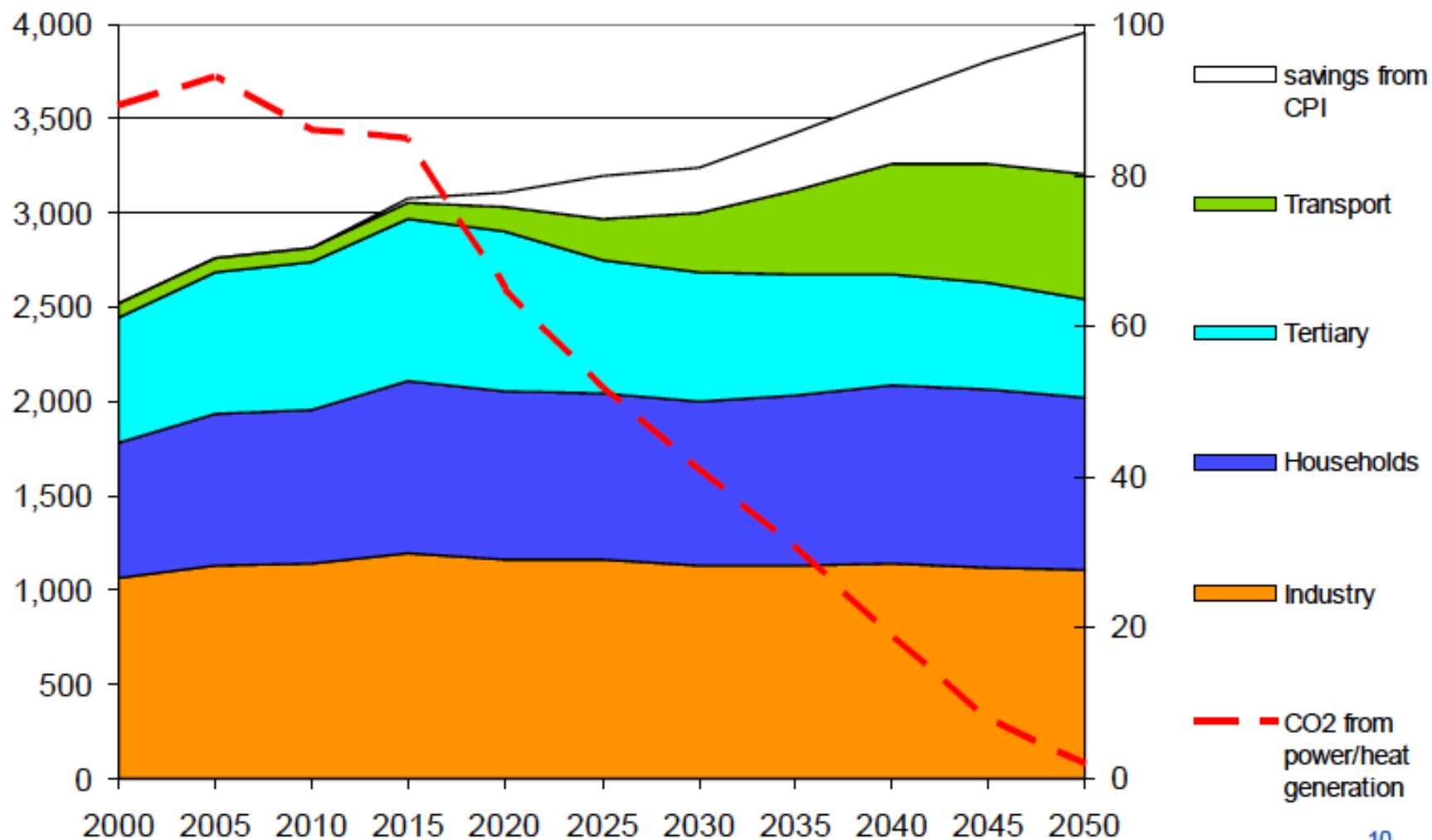
Source: Helen Donoghue, DG Energy, EU Commission.

## Electricity plays a growing role



## Energy efficiency scenario: final electricity demand

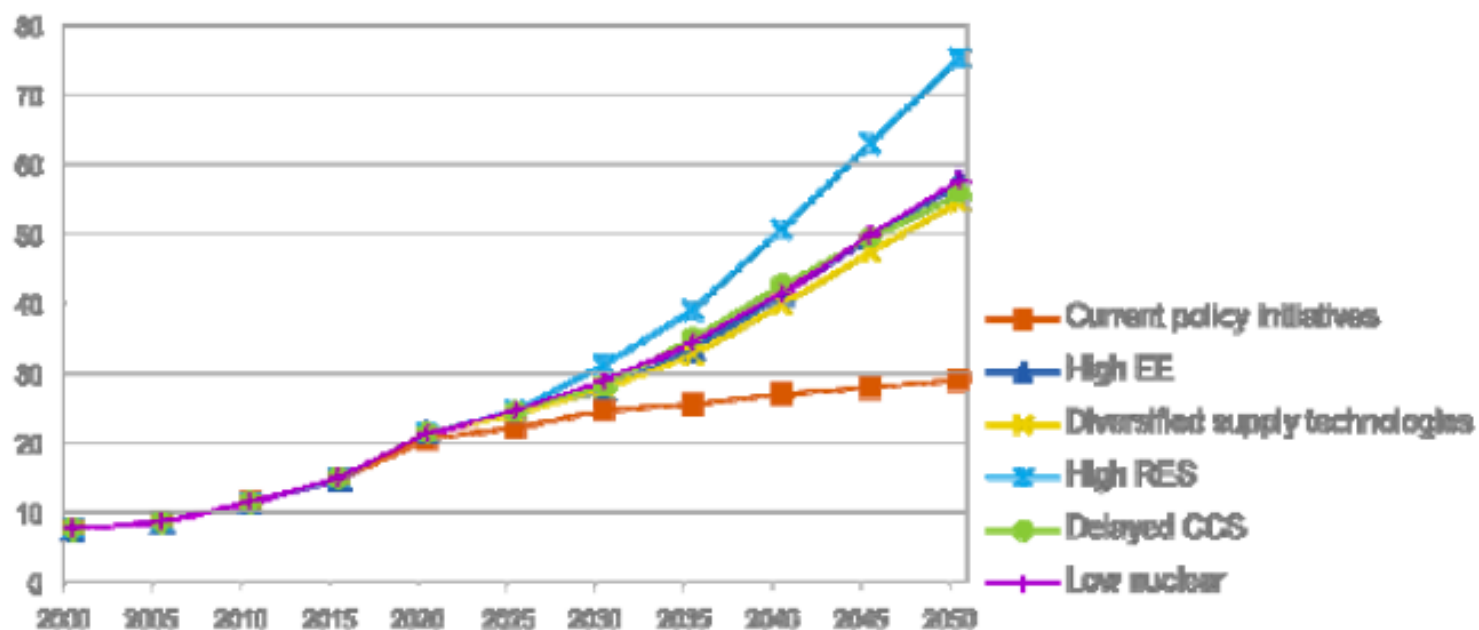
CO<sub>2</sub>: 1990=100



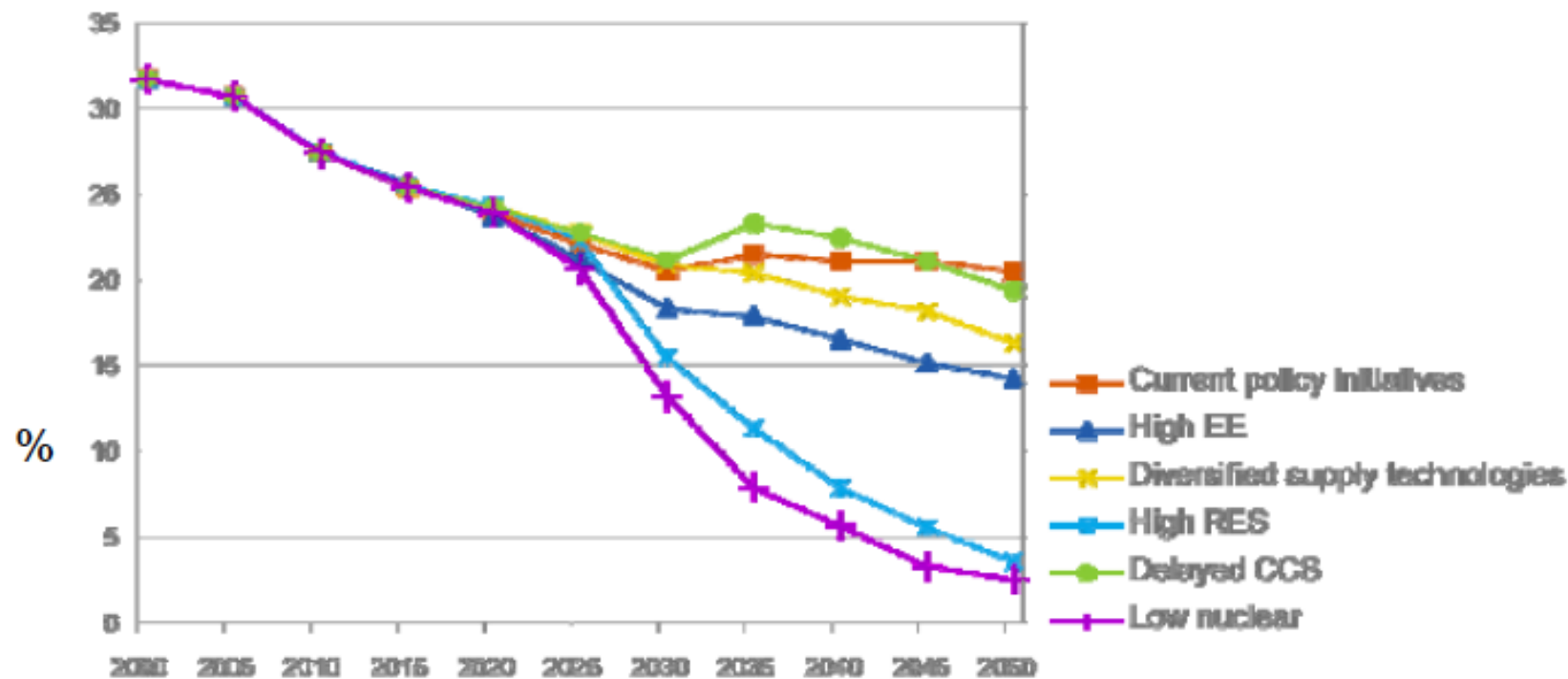
Source: Helen Donoghue, DG Energy, EU Commission.

## Renewables move centre stage

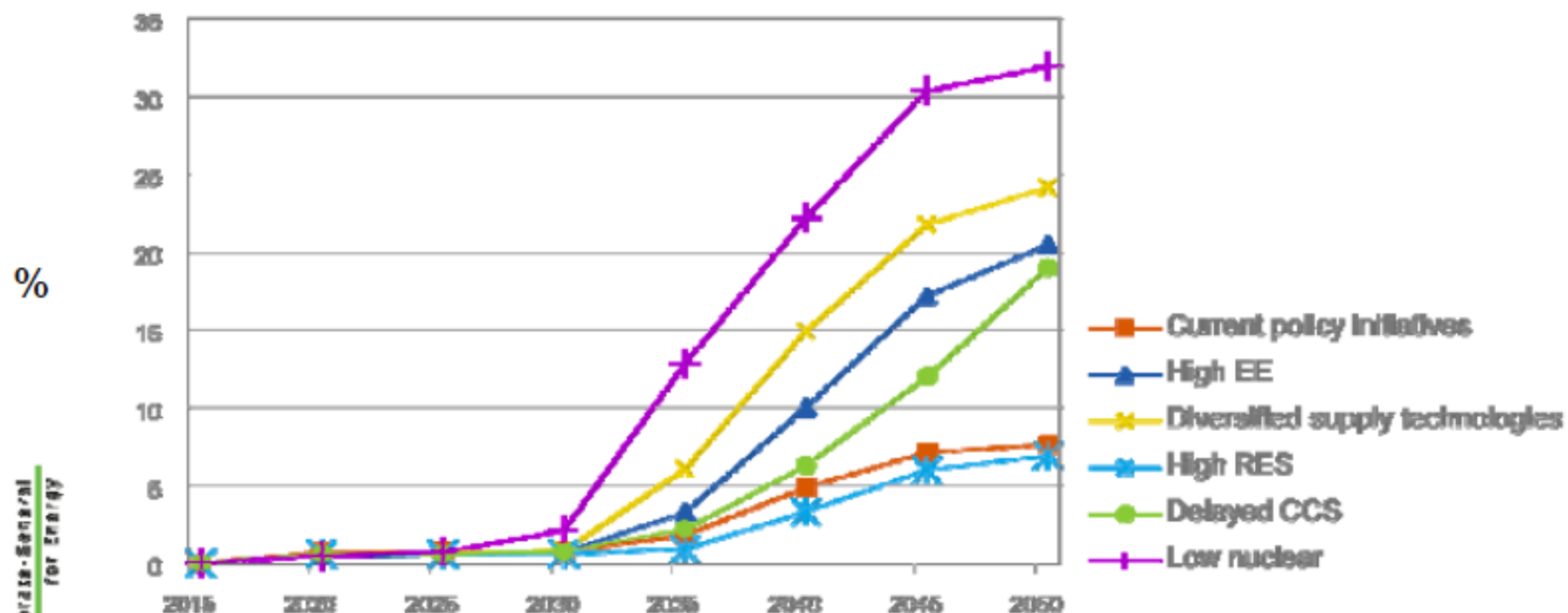
Share of renewables in  
gross final energy consumption (%)



## Power generation - share of nuclear



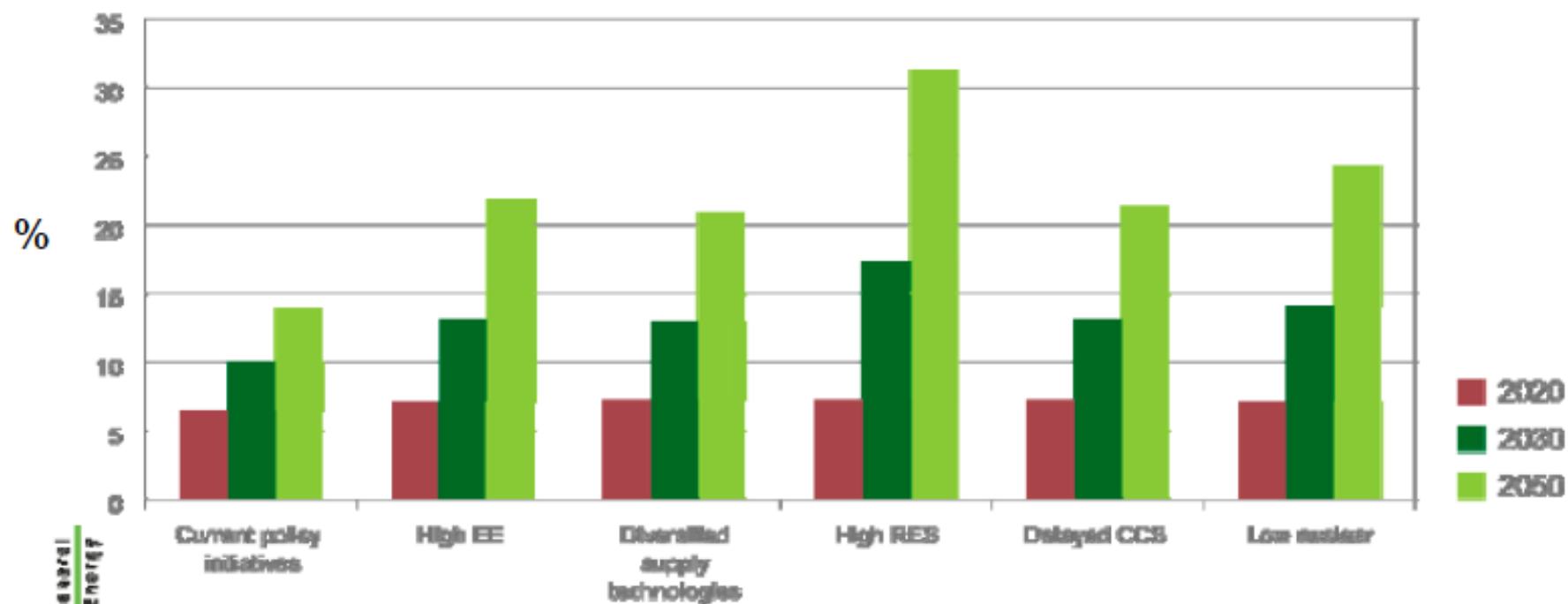
## Power generation - share of CCS





European  
Commission

## Power generation - decentralised generation



Decentralised-Generation  
for Energy

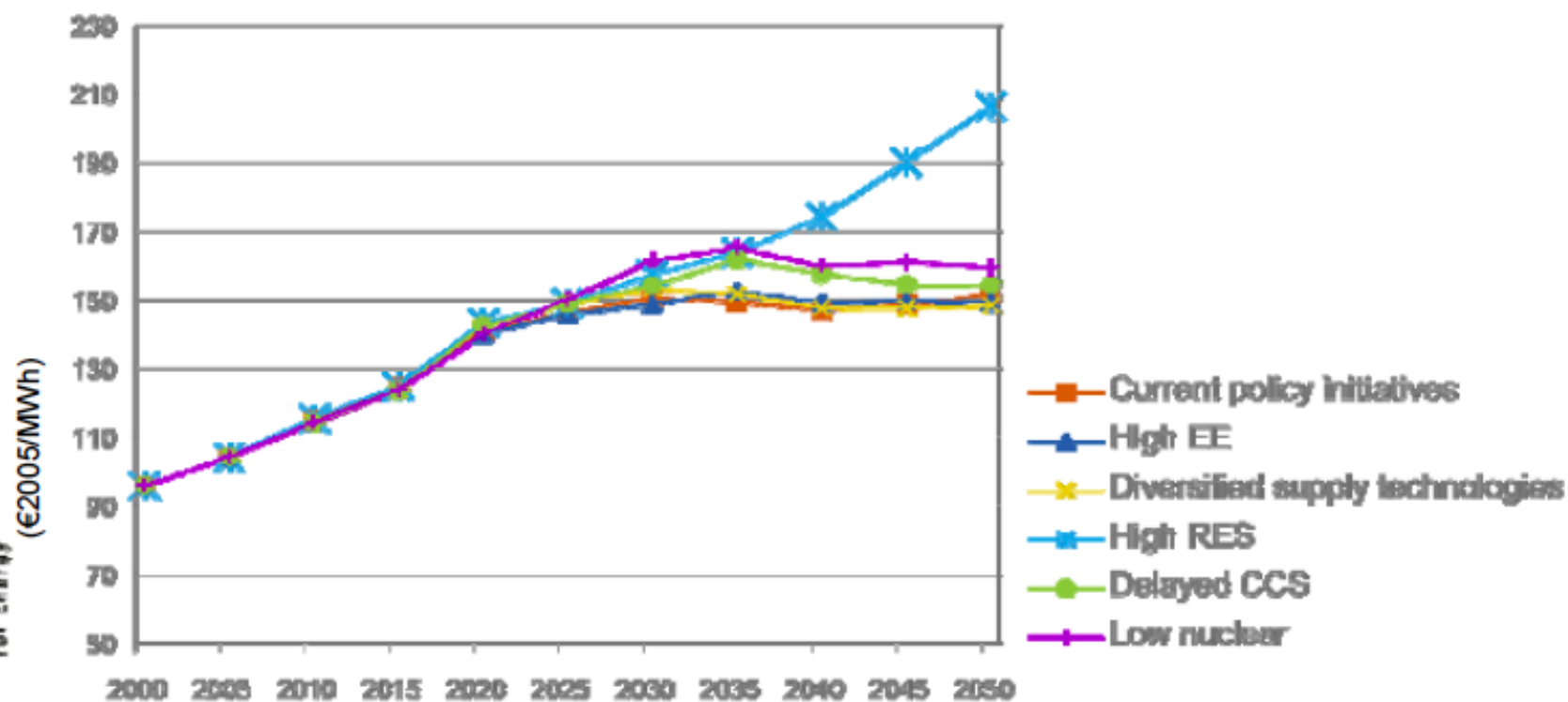


## Implications for electricity market:

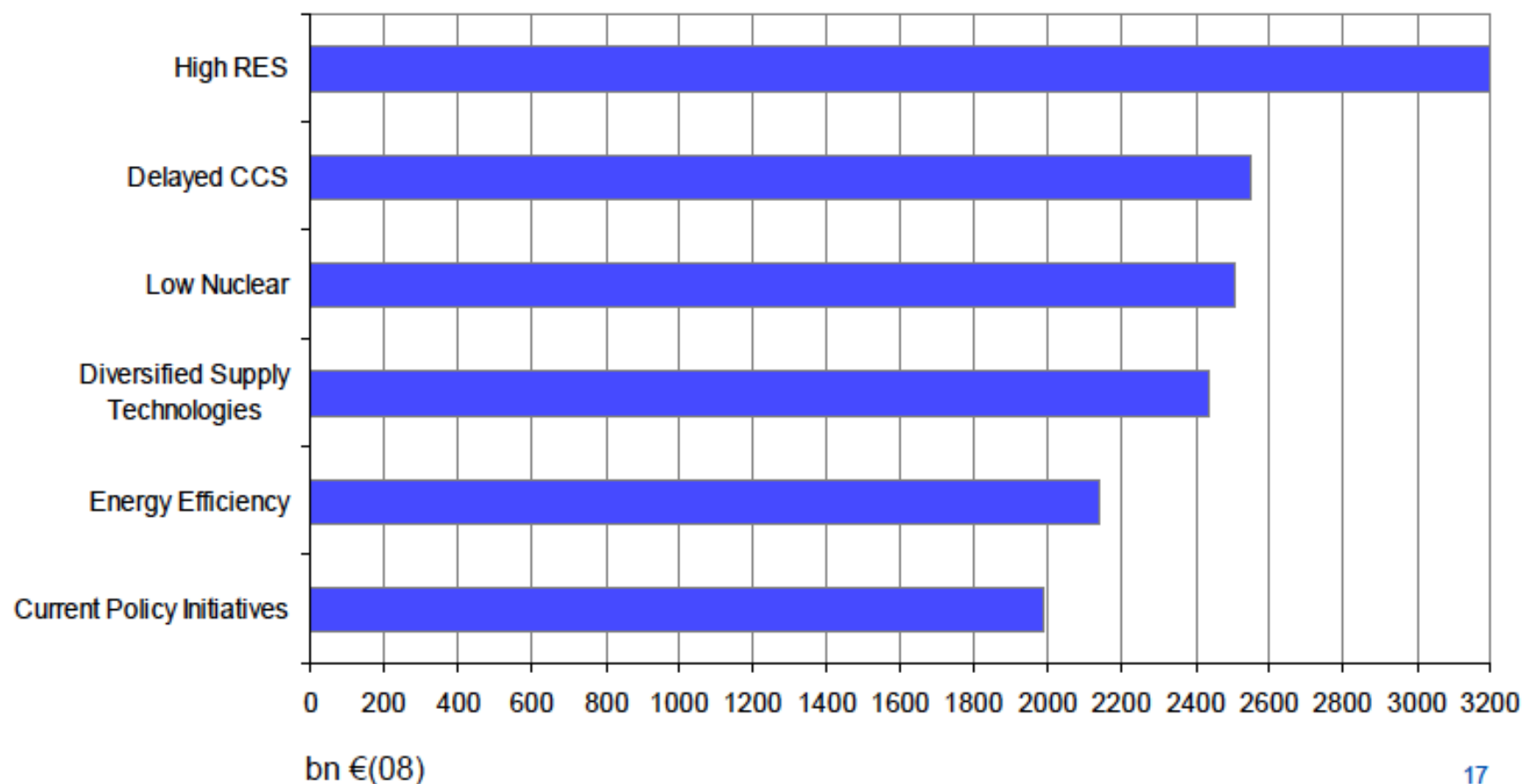
- **Low-carbon and energy efficiency options** emerging on supply and demand sides across Europe
- Carbon pricing will have to play an increased role
- Cost-effectiveness calls for integrated markets, open to these varied resources
- RES – incentives must lead to more market integration
- More **flexibility** needed in system, options emerging
- New prospects for retail market developments
- **Market arrangements** must offer cost-effective solutions
- **Interventions** – greater need now for coordination
- 2030 milestones – options will be considered



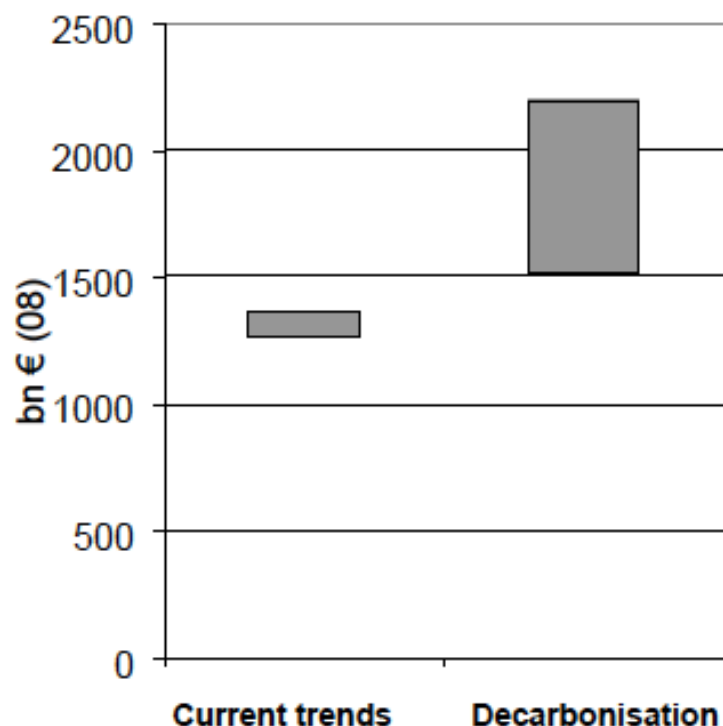
## Electricity prices



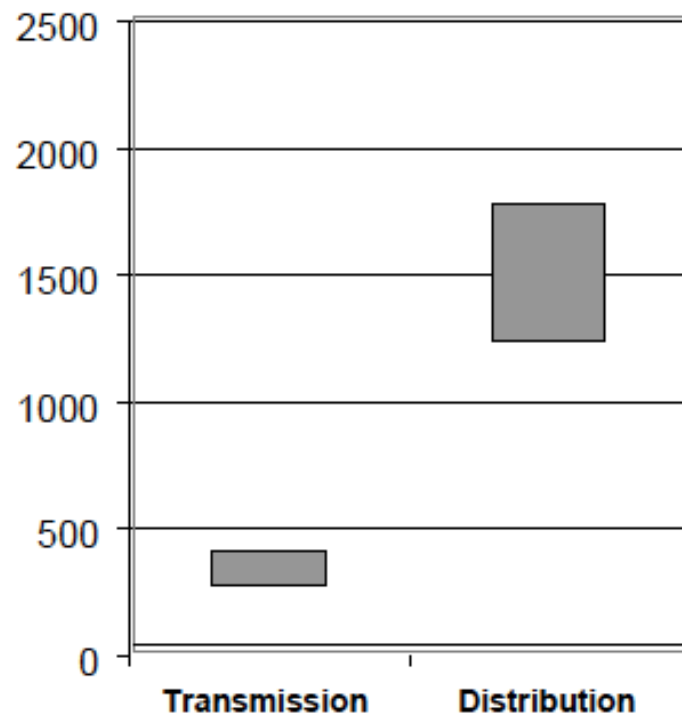
## Cumulative investments in power generation 2011-2050



## Cumulative investments in grids 2011-2050



### Transmission and distribution - decarbonisation scenarios



# **Major challenges for the transition**

# The “stress test” for energy markets

- Practically complete decarbonization of power sector by 2050 (*let's focus on the electricity market*)
  - Subsidized technologies / volatile electricity prices / unusual operating conditions/ strong regulatory risk
  - One investment cycle away from 2050 (*a “time tunnel”*)

**Q1:** *Can our current markets do the job?*

**Q2:** *How to adapt / redesign market regulation to facilitate that these policies reach their objectives efficiently?*



# Electricity markets

## Present & future concerns

- Implementation of **EU-wide market integration** should **not** be a **problem** in the medium & long-term (*current target: completion by 2014*)
- The potential problem is **adequate investment**
  - In **generation** (*sufficiently clean technologies that are compatible with intermittent generation*)
  - In **networks** (*to allow EU-wide market integration & to accommodate intermittent generation*)
- Plus **demand response** at a level far beyond anything experienced so far



# An adequate regulatory context for investment in clean energy

- For the most part the market for clean energy is policy-driven (*for a good reason*)
- In a policy-driven market regulation itself is a risk
- Therefore, to unlock finance for clean energy there is a need for “investment grade” policy

# Regulation needs to be “loud, long & legal”

## • Loud

- Policy instruments make a difference, so that investments in clean energy become commercially attractive

## • Long

- Policy instruments are sustained for a period that is consistent with the financial characteristics of the project

## • Legal

- Policy instruments are based on a clear, stable & well-established regulatory framework

Based on “Unlocking finance for clean energy”, [www.chathamhouse.org.uk](http://www.chathamhouse.org.uk), 2009





# Why is generation investment a potential problem?

- **Poor quality of regulation** in many EU countries (*sound regulation is loud, long & legal*)
  - **Insufficient economic signals** (*market prices, adequate ancillary services, CO2 prices*)
  - Too much **uncertain interference** from regulatory support to diverse technologies
  - All sorts of **tricks by NRAs** to support local (*typically industrial*) consumers & spurious interests
  - Growing **irrelevance of the spot market** (*the preferred option for an investor is to get some regulatory support rather than competing in the market*)



# Why is transmission investment a potential problem?

- We still do not know how to **plan** transmission expansion at EU-wide level
- We resist accepting the **simple paradigm**: “TSOs plan, RAs authorize, beneficiaries pay”
  - ➔ inadequate business models for investors
- We do not know how to **allocate network costs** fairly & efficiently
  - ➔ beneficiary pays // hierarchical allocation // ex ante charges to generators // independence on commercial transactions



# Why is lack of demand response a potential problem?

- The “**worst scenario**” of intermittent generation (*widespread lack of generation for a few days*) will require **full demand support**
    - Creative & well-coordinated use of all available technologies (*advanced metering, real-time tariffs, behind-the-meter load management, innovative aggregators, new formats of interruptibility, distributed generation response including V2G, multiple storage forms*)
- ➔ Much pending technical & regulatory work



# Why is distribution investment a potential problem?

- Design, operation & control of distribution networks have to be adapted & costs will increase  
➔
  - Refine the **models of remuneration** of distribution networks, so that the extra costs & benefits of accommodating DG & efficiency measures are recognized & negative incentives are minimized
  - Find regulatory instruments to incent deployment of efficient **innovative** technologies



# **How to get there *(2050)*?**

**Carbon policy strategies after 2020:  
The debate on intermediate targets**

# Should technology targets be set for 2030?

## Of course, NOT

- Deployment (*energy*) targets for renewables:
  - make it more expensive to meet the carbon targets
  - waste resources that could be better used to stimulate low-carbon innovation
  - disrupt markets discovery processes
  - undermine the European Trading Scheme (ETS)

Source: Dr. Simon Less, Policy Exchange, London. Eurelectric Conference, January 2011.



# Should technology targets be set for 2030?

## Of course, **NOT** (*continuation*)

- Instead, energy policy after 2020 should:
  - keep it simple
  - focus on carbon price as “the” instrument & avoid technology-specific deployment targets
  - focus (*politically*) on achieving a long-term, credible carbon pricing framework
  - focus any subsidies on stimulating most valuable innovation, while balancing R&D & learning-by-doing
  - & overcome behavioural barriers to energy efficiency

Source: Dr. Simon Less, Policy Exchange, London. Eurelectric Conference, January 2011.



# Should technology targets be set for 2030?

## YES, of course

- Carbon price, for the time being, is not loud (*too low to make an impact*), long (*no agreement after 2012*) or legal (*credible*) enough
  - Any progress in this direction is very welcome
- Investment in subsidized technologies needs an adequate & credible regulatory framework
  - Clear targets & strong enough economic signals by 2030 for renewables & efficiency
  - Adequate support instruments for R&D & deployment for each technology
  - Avoid picking winners as much as possible

Source: Dr. Simon Less, Policy Exchange, London. Eurelectric Conference, January 2011.





**Thank you for your  
attention**

