



POWER CHOICES

Pathways to carbon-neutral electricity in Europe by 2050

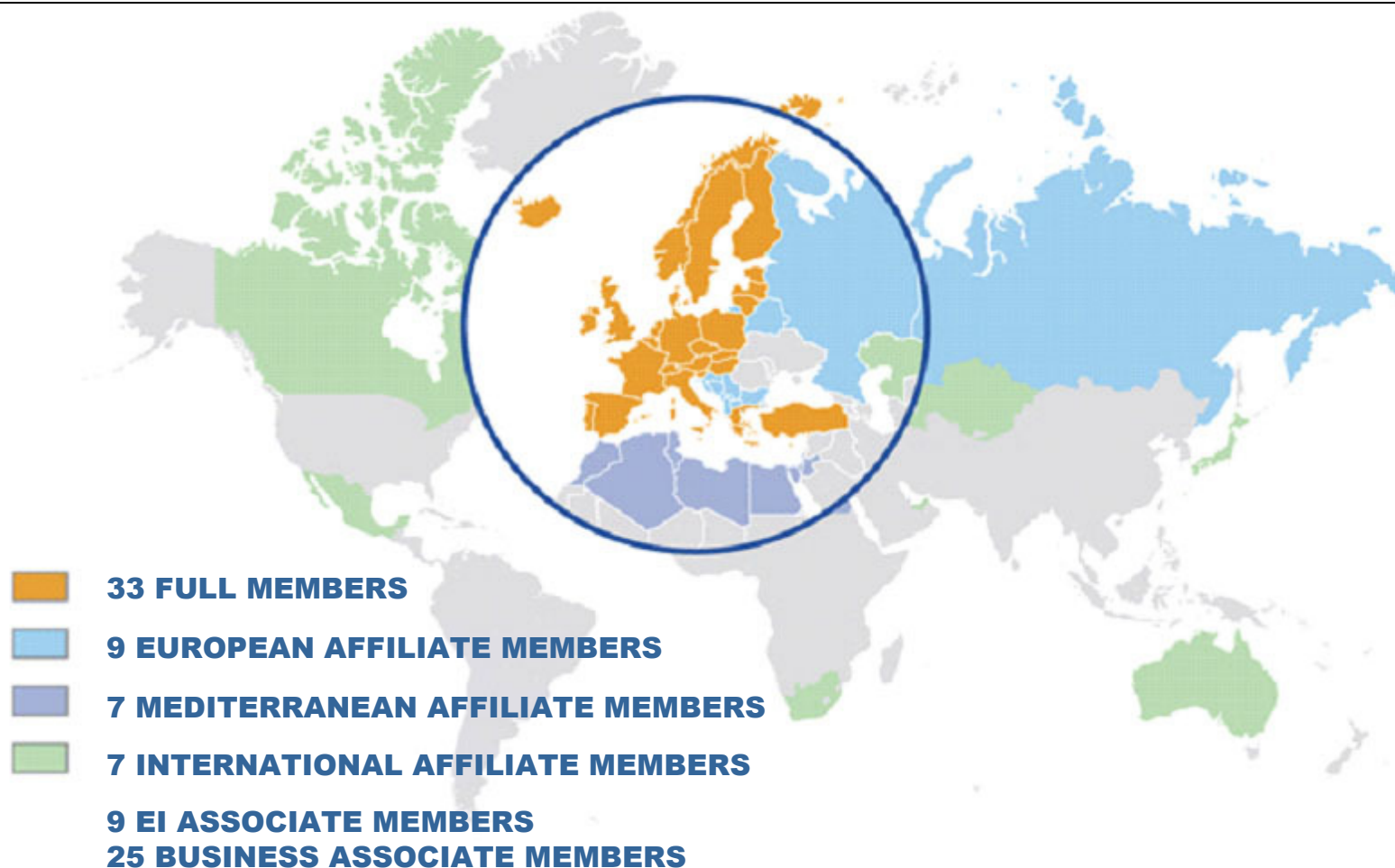
Nicola Rega

Advisor – Environment and Sustainable Development Policy

Bruges, 18 March 2010

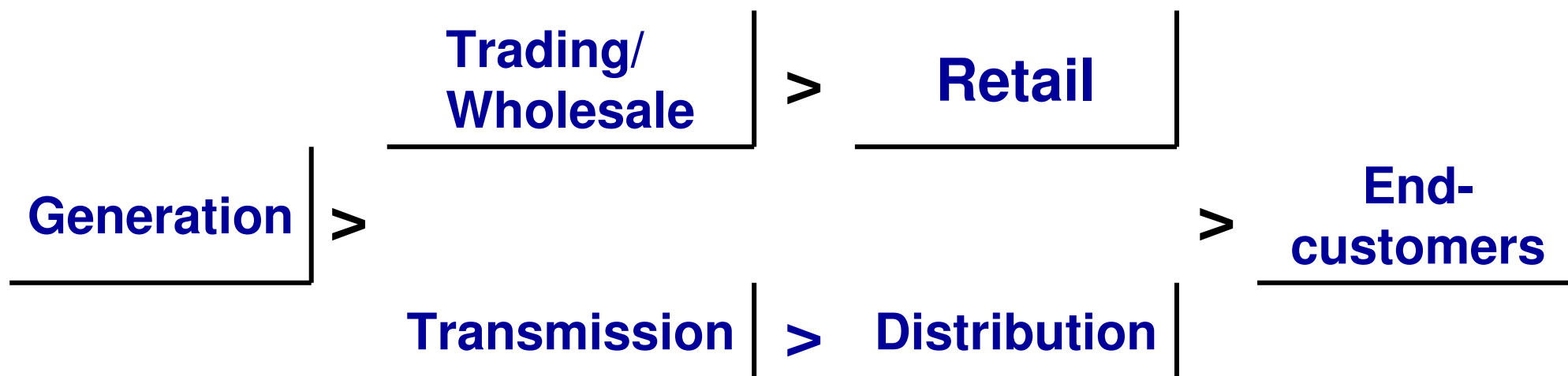


**Representing the electricity industry at expert,
strategic and policymaking levels.**





EURELECTRIC represents the whole value chain of the European electricity industry





EURELECTRIC CEO Declaration

18 March 2009

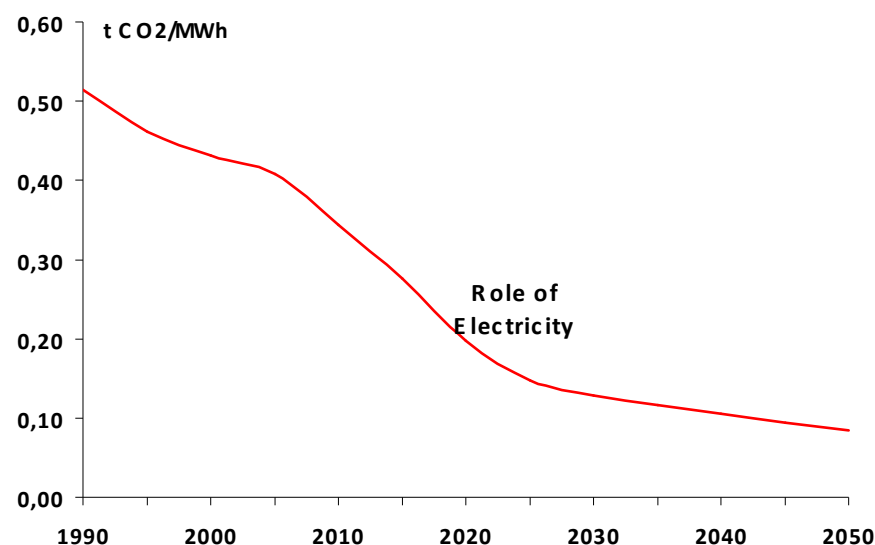


- 1. Carbon-neutral power in Europe by 2050**
- 2. Cost-efficient, reliable supply through an integrated market**
- 3. Energy efficiency & electricity use as solutions to mitigate climate change**



Background: EURELECTRIC studies

2007 - Role of Electricity:
EU 50% reduction target.
CO₂ from power reduces
from 0.45 to 0.10t CO₂/MWh

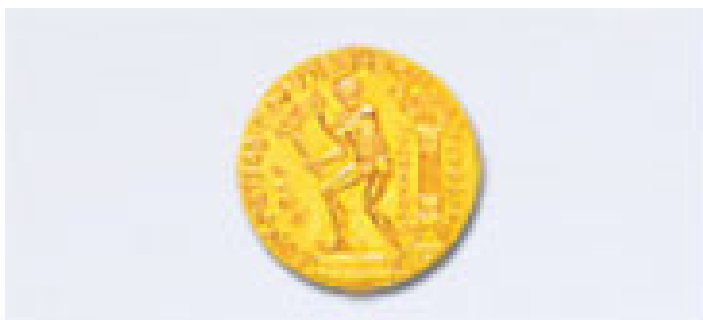


2009 - Power Choices:

- Review the 2007 study, aiming at *carbon-neutral power by 2050* under an EU target of -75% CO₂
- Investigate needed technology development, costs & regulatory framework



EURELECTRIC's partner organisations in Power Choices study:



National Technical University
of Athens



Verband der
Großkraftwerks-Betreiber



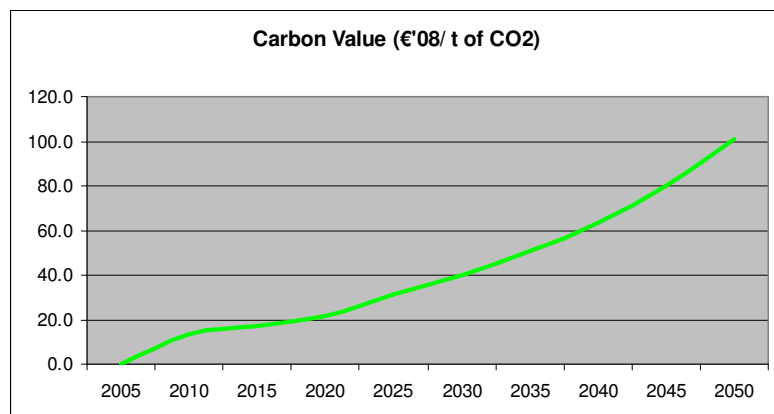
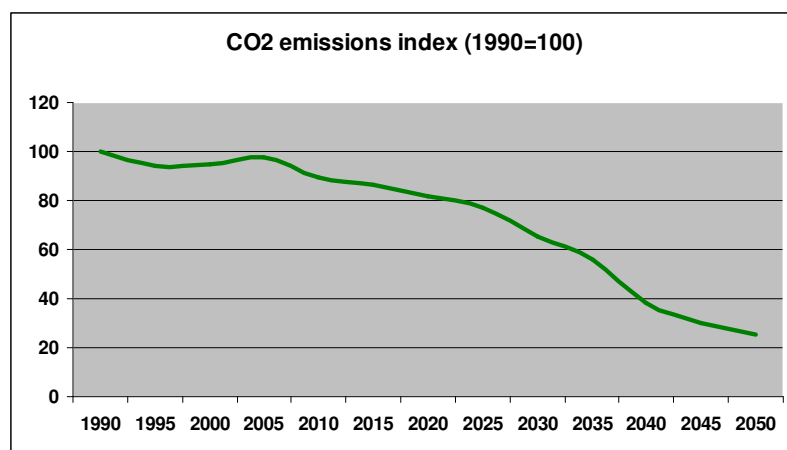
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Policy Analysis



Main assumptions for Power Choices scenario



POWER CHOICES SCENARIO

- 75% CO₂ cut across whole EU economy
- CO₂ price applied uniformly to all sectors
- Power becomes major transport fuel
- All power generation options available (with CCS commercially available as of 2025)
- Major policy push in energy efficiency
- No binding RES target post-2020
- CO₂ price is the only driver for low-carbon generation post 2030

Need for all low-carbon generation options

In 2050

RES:

- **38% of total mix (1800TWh)**
- **Wind: 56% of RES**

Nuclear:

- **27% of total mix (1300TWh)**

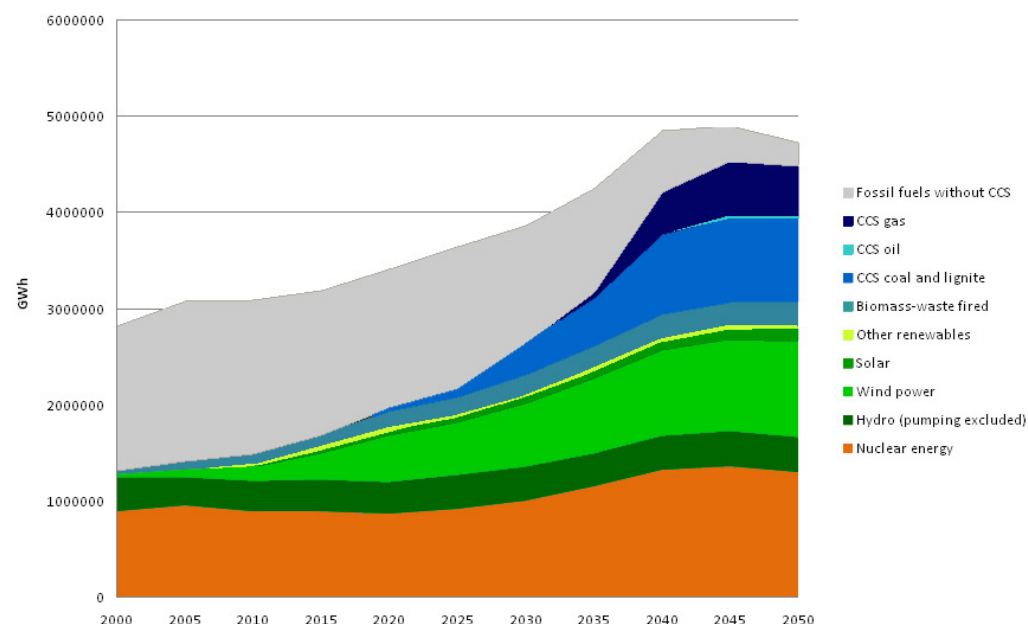
CCS:

- **30% of total mix (1414TWh)**

Other fossils:

- **5% of total mix (231TWh)**

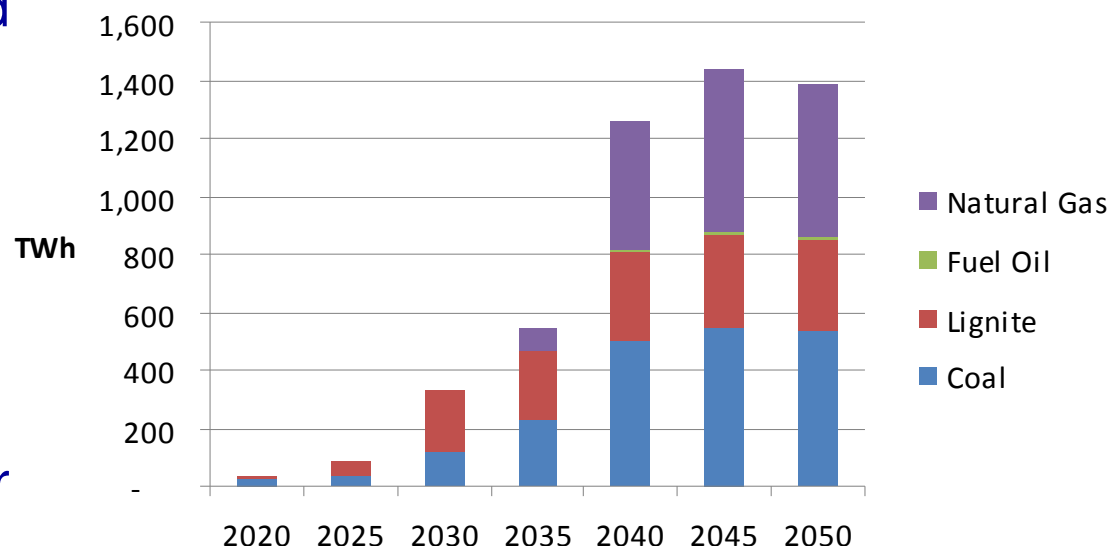
Net power generation in EU-27



CCS production in Power Choices

- CCS power production: 90 TWh in 2025, but increases to 330 TWh in 2030 (all coal and lignite)
- Gas-CCS develops after 2030, reaching 450 TWh by 2040
- Total CCS production peaks in 2045 at 1440 TWh : coal and lignite 870 TWh, gas over 560 TWh
- Share of CCS-power in 2050 is 30%

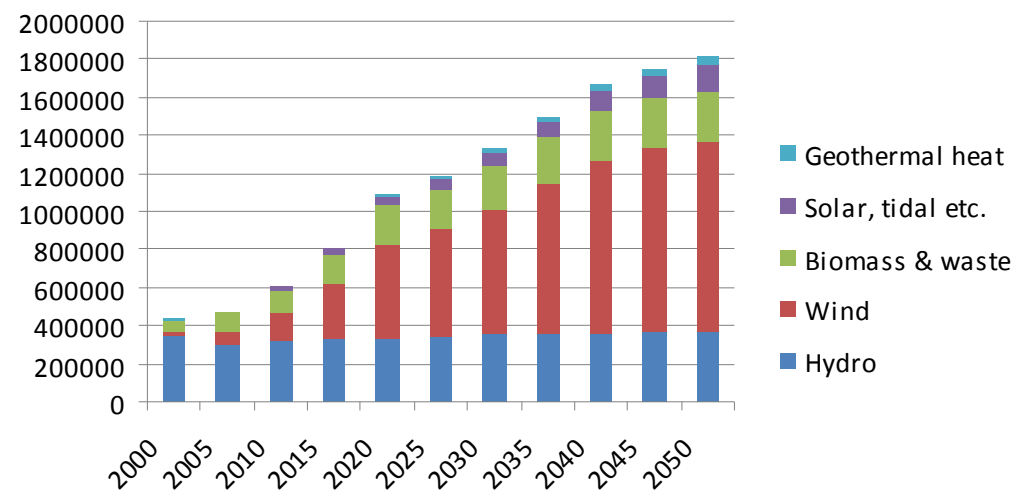
Power Generation from CCS

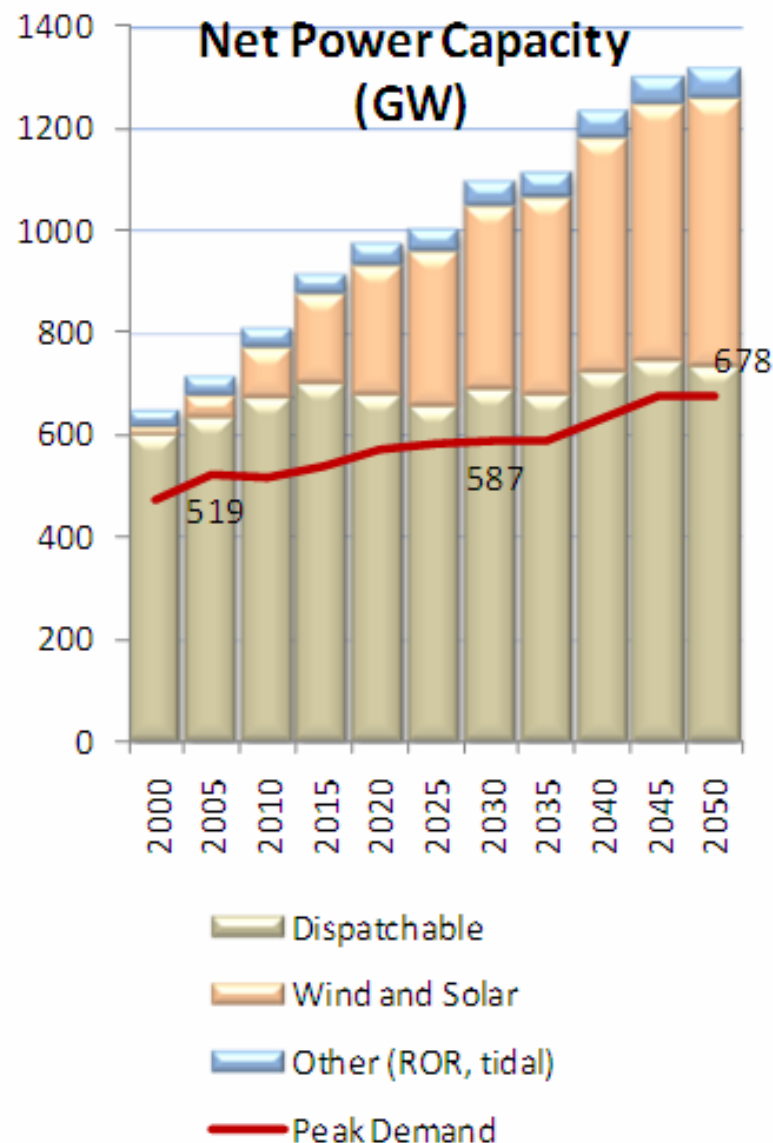


RES production: 1800TWh in 2050

- RES production already reaches 1090TWh in 2020, or 32% of total electricity generation
- Renewable production continues to rise steeply, reaching 1812TWh in 2050. The proportion of renewables rises to 38% in 2050.
- RES production in 2050:
 - Wind 1004 TWh
 - Hydro 370 TWh
 - Biomass 289 TWh
 - Solar 113 TWh

RES electricity EU-27, GWh



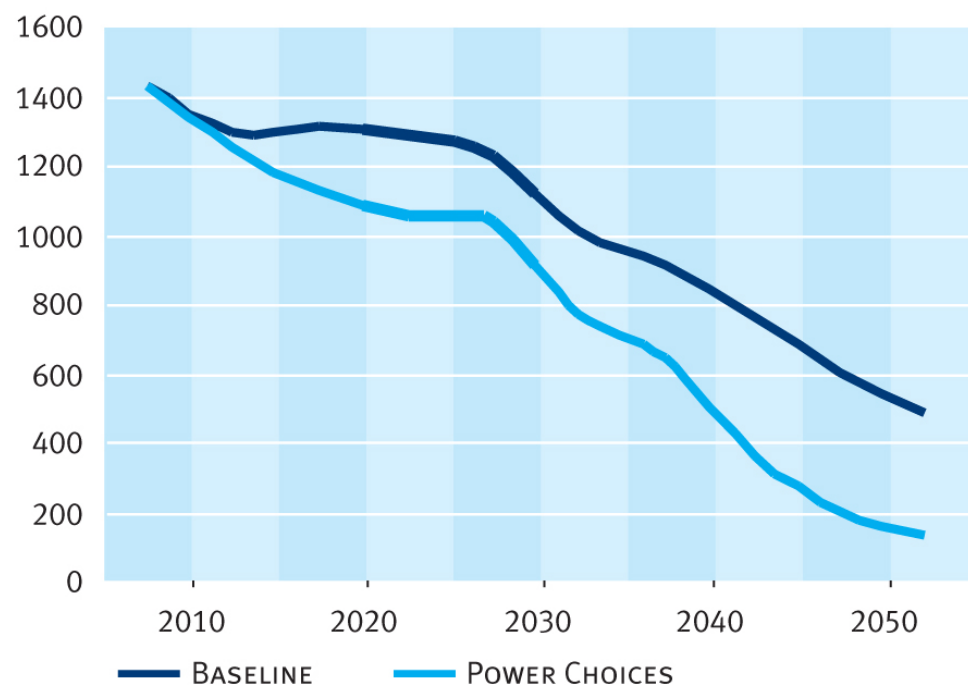


- Dispatchable capacity would be needed to guarantee the meeting of peak demand
- Higher share of intermittent renewables would require back-up capacity to meet peak demand
- Renewables will impact the way dispatchable electricity is generated, but substantial investments in dispatchable electricity would still be needed.



Carbon emissions from power fall by 90%

CO₂ EMISSIONS (IN Mt CO₂)



**Deep emission cuts
take place between
2025-2040.**

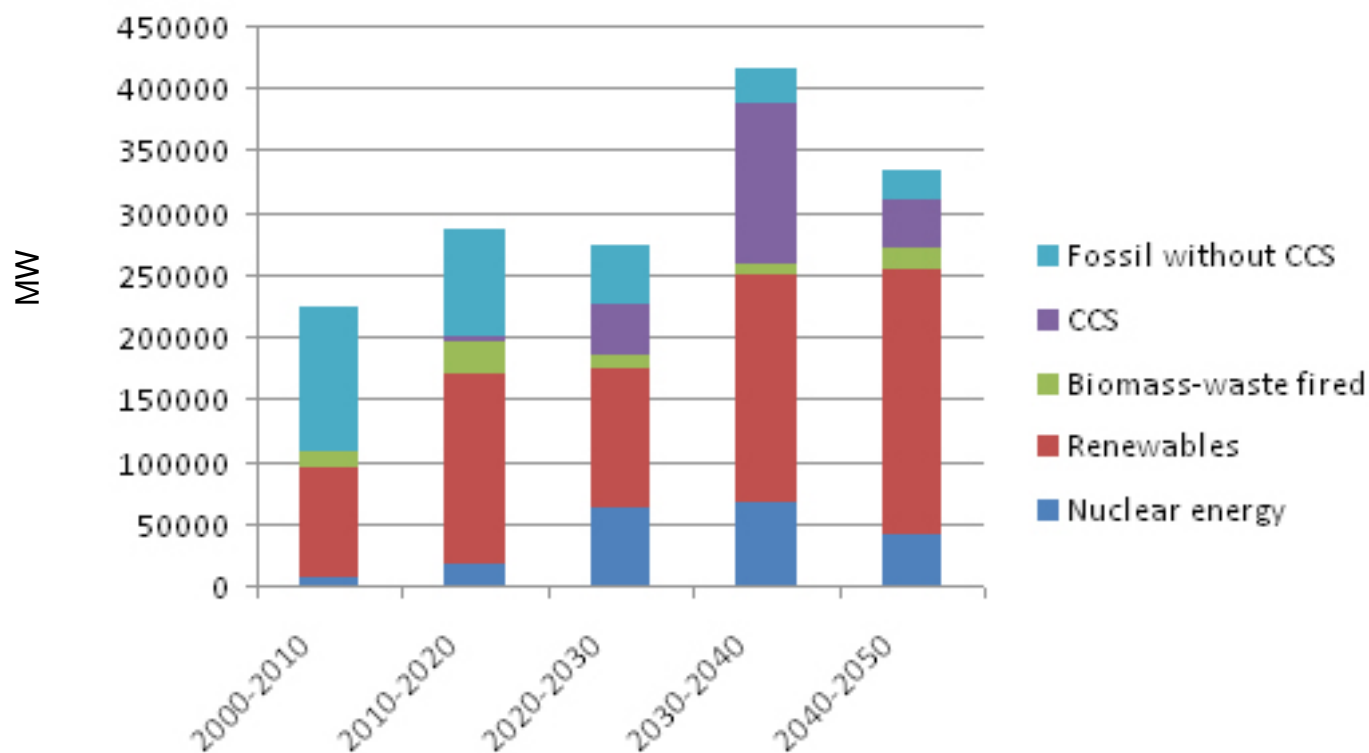
**But investments are
needed NOW!**

**NOW: 1423 MtCO₂
2050: 128 MtCO₂**



Investment needed across the period

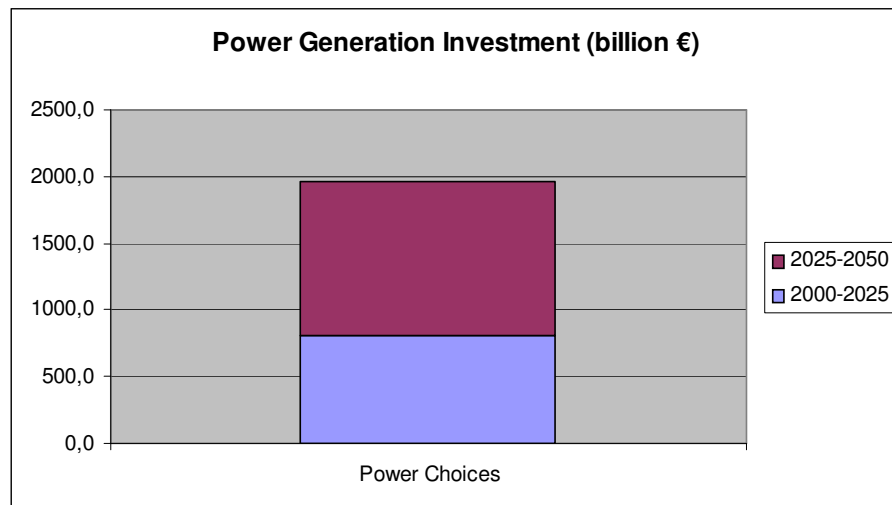
Gross investment in generation capacity



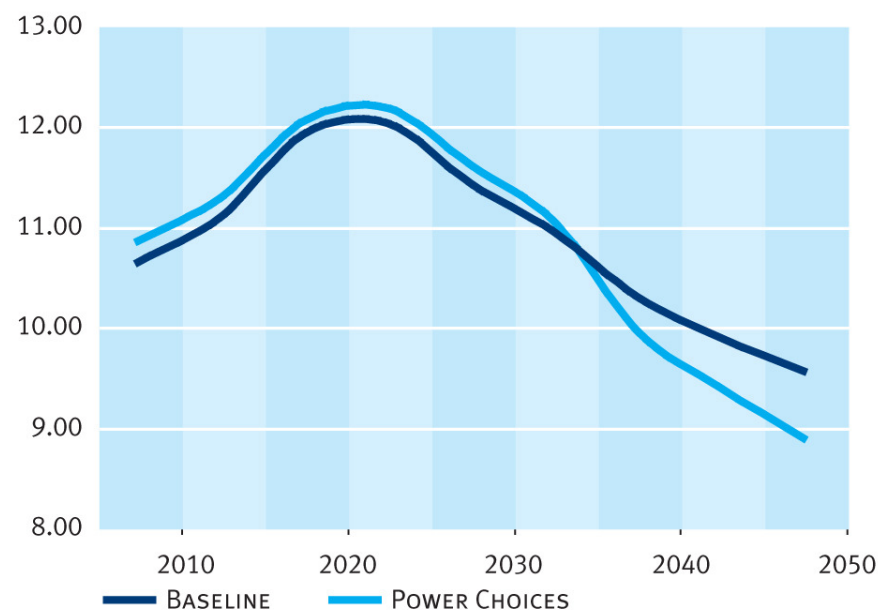


Significant investments... ... but a reasonable cost for society

Investment needed in power generation by 2050: €2 trillion

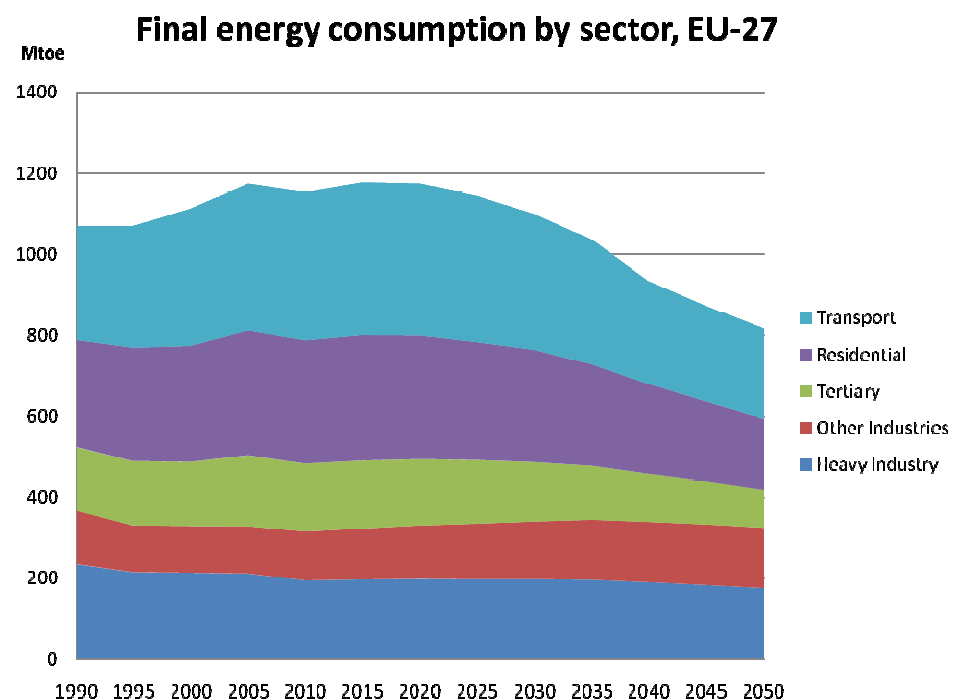


TOTAL COST OF ENERGY AS % OF GDP





Decrease in energy demand



➔ **Paradigm shift to efficient electric technologies**

➔ **More electricity = less energy**



What if...

Nuclear phase-out is reversed in Germany and Belgium?



Commercial deployment of CCS is delayed to 2035?



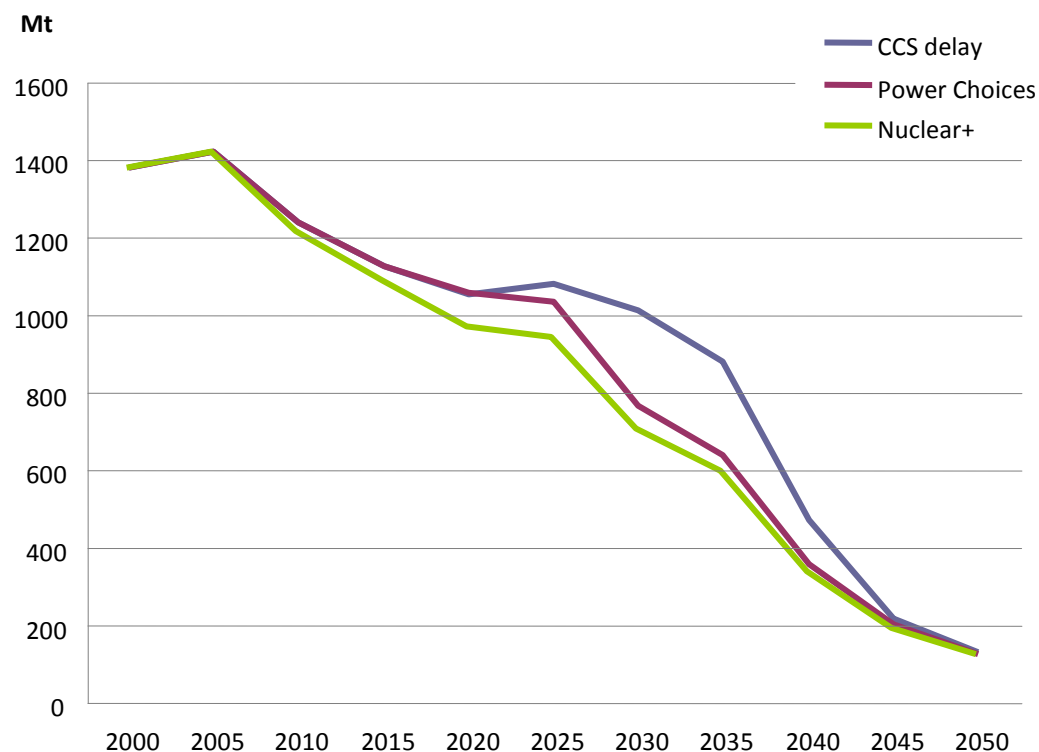
One-third of onshore wind power is not built due to planning problems?





All technologies are *really* needed

CO2 emissions from power, EU-27



- 10-year delay of CCS = delayed CO₂ emission reductions from power & whole economy!
- More nuclear = more rapid reduction curve
- 1/3 onshore wind not built = more CCS & nuclear, off-shore wind not likely to fill gap.



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Final Remarks



Key outcomes

- **EU carbon-neutral power by 2050 is realistic**
 - ➔ **-75% CO₂ on whole economy can be reached**
- **All power generation options needed**
- **Electrification of the demand side essential**
- **Significant investment but at acceptable cost to society**
- **The major CO₂ reductions in power are achieved from 2025 onwards**
- **CCS delayed &/or nuclear phase-out = slower CO₂ reduction**



Policy recommendations

CO2 reductions

- Support CO₂ market to deliver cap at least cost
- All sectors to internalise cost of CO₂
- Promote an international agreement on climate

Technology choices

- Enable the use of all low-carbon options for power generation
- Encourage public support for modern energy infrastructure: onshore wind, CCS, smart grids...

Cost

- Significant investment cost but reduction in share of GDP
- Recognise that cost of technology deployment differs substantially across the EU

Demand-side

- Facilitate electrification of road transport and spatial heating & cooling
- Major policy push in energy efficiency



Thank you for your attention!

More info on:

www.eurelectric.org/powerchoices2050