



ENERGY FOR KNOWLEDGE TOWARDS 2020

Shaping research for a low carbon society

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World Energy Timeline





World energy timeline

- **400,000 BC Humans begin using wood for fuel**
- **1775 James Watt patents improvements on steam engine, initiating the 'Age of Steam'**
- **1830 First commercial coal powered steam locomotive**
- **1881 First hydropower station developed in England**
- **1882 Thomas Edison "throws the switch", lighting up part of Lower Manhattan and demonstrating commercial electric generation**
- **1905 Albert Einstein writes five papers while working in the Swiss patent office, including one on the "photovoltaic effect", the basis for solar energy**
- **1952 "Killer Fog" envelops London, killing thousands**



World energy timeline (cont)

- 1974 France embraces nuclear power generation
- 60's – 70's Combustion research to decrease SO_x
- 80's – 90's Combustion research to decrease NO_x
- 80's until now – CO₂ reduction
- 1997 Signing of Kyoto Protocol linked to United Nations Framework Convention on Climate Change
- 1998 First large scale coal over coal reburn succesful at ENEL Vado Ligure
- 2011 German government announces phase-out of nuclear power by 2022, accelerates renewables
- 2012 Shale gas reaches about 37% of total US gas production

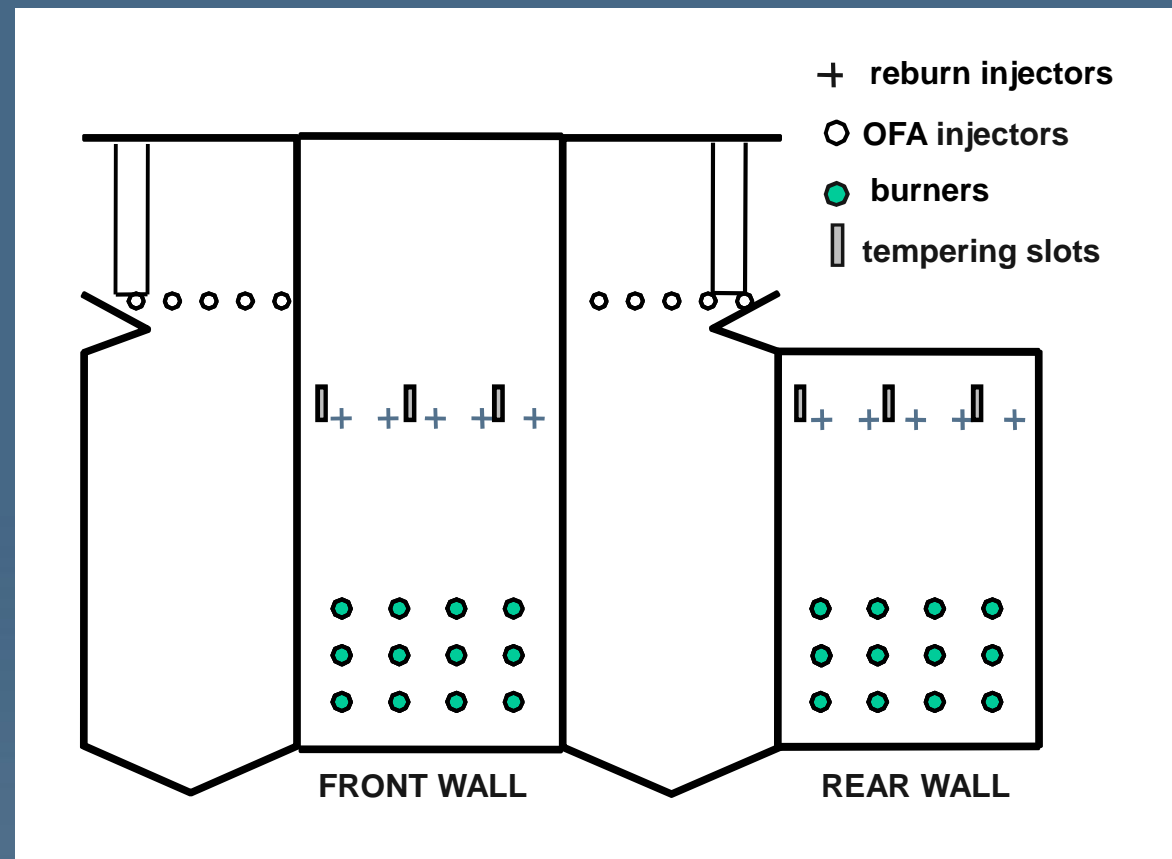
An example of energy research from the 90's



Vado Ligure Boiler

Boiler Characteristics:

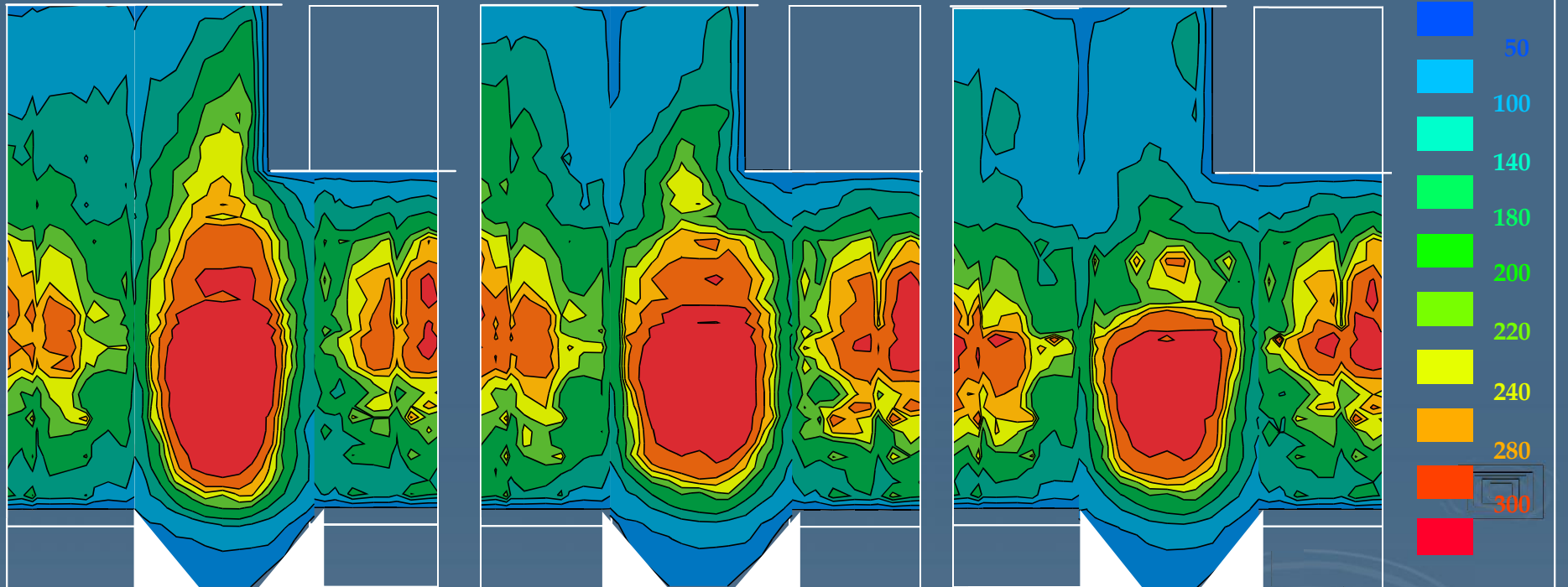
- Power: 320 MWe
- Opposite wall fired
- 24 burners (3*4*2)
- Low Nox burners
- OFA + Reburn injectors



L.M.R. Coelho, M.G. Carvalho, S. Pasini, A. Antifora, Numerical Modeling Applied to the Design of a Coal-Over-Coal Reburn Process at Vado Ligure Unit #4, 1999

Heat Fluxes

ABSORBED RADIATIVE HEAT FLUXES ON THE BOILER WALLS

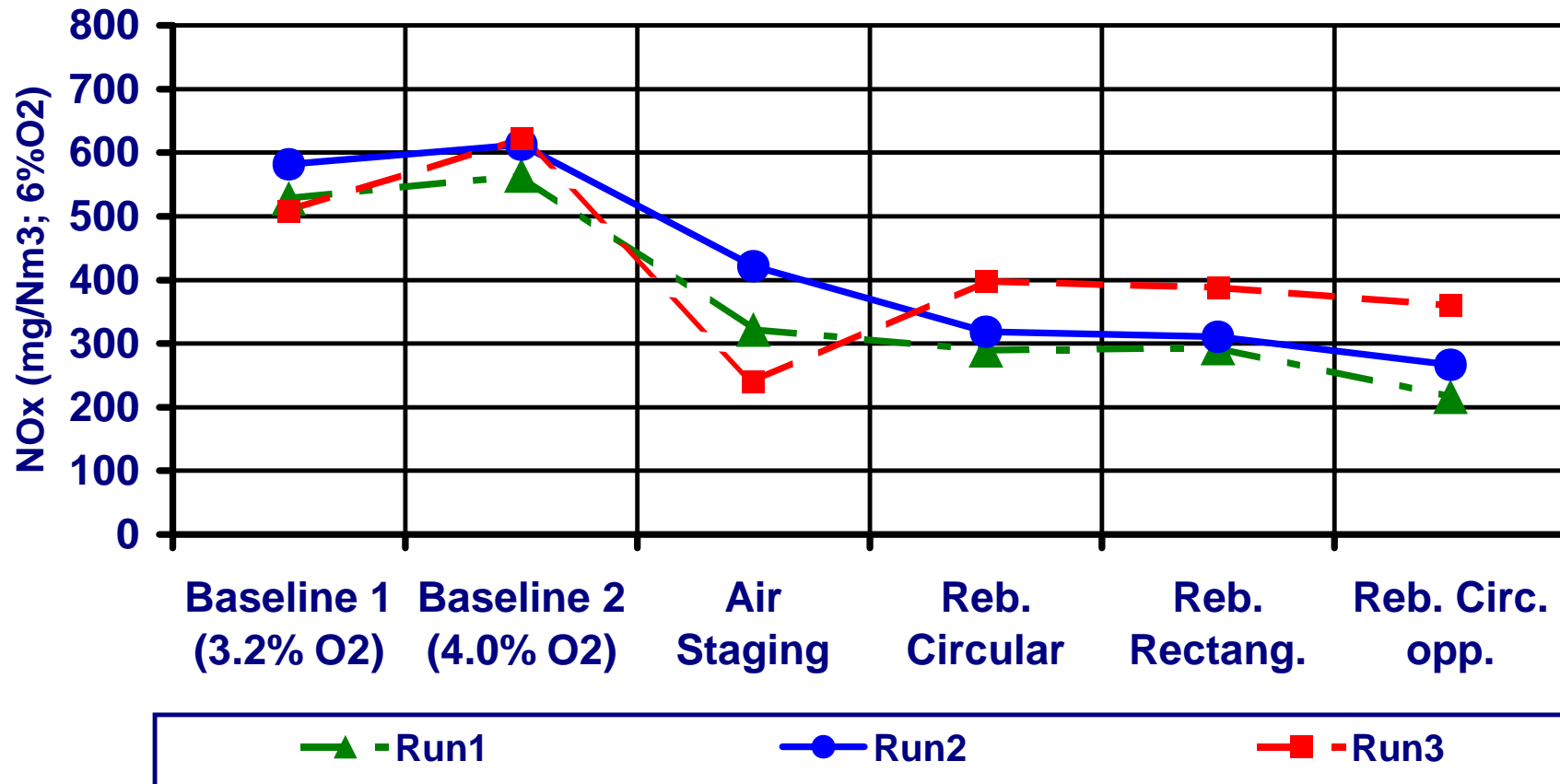


Baseline

Air Staging

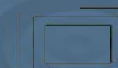
Reburning

NOx Predictions



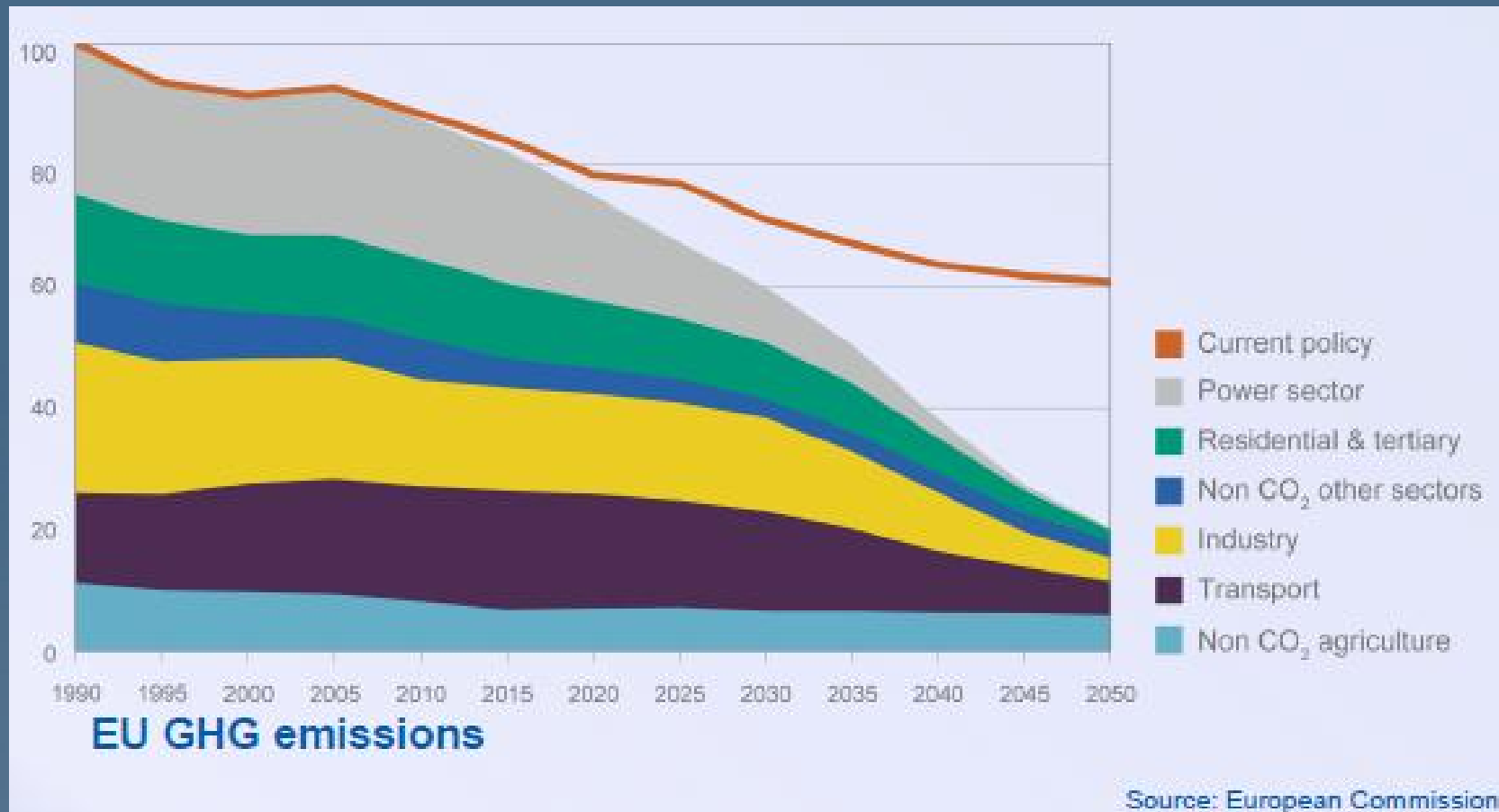
NOx REDUCTION (run 2): AIR STAGING - 28 %; REBURN - 45 %
 Old configuration, without low Ox burner: 900 mg/Nm3, 6%O2
 -> 65% reduction

The way ahead on energy research



Roadmap to a Low-Carbon Economy by 2050

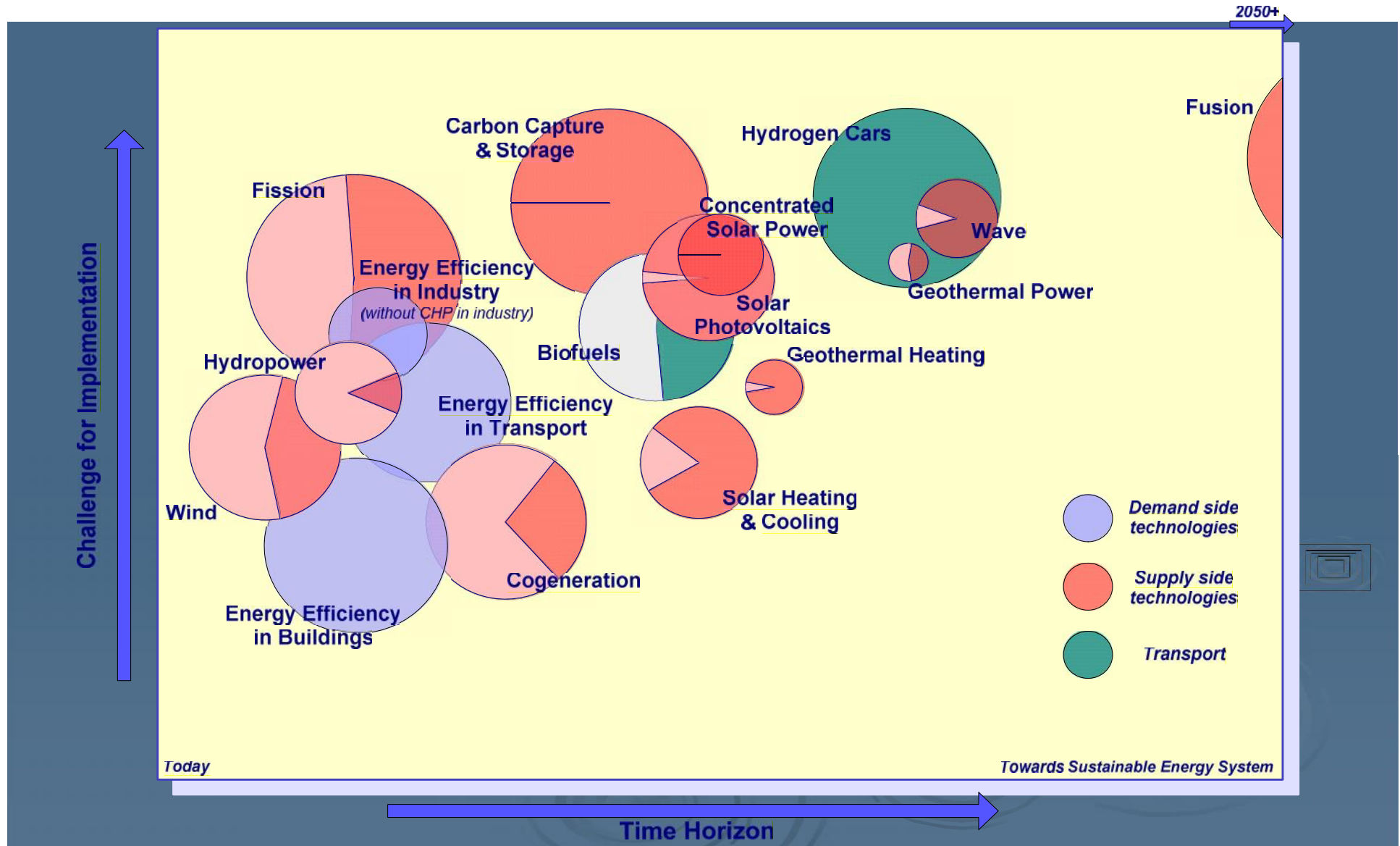
Objective – reduce EU GHG emissions to 80-95% below 1990 levels (in context of necessary reductions by industrialised countries as a group)



Sectoral milestones towards a low-carbon economy

GHG reductions compared to 1990	2005	2030	2050
Power (CO ₂)	-7%	-54 to -68%	-93 to -99%
Industry (CO ₂)	-20%	-34 to -40%	-83 to -87%
Transport (incl. CO ₂ aviation, excl. maritime)	+30%	+20 to -9%	-54 to -67%
Residential and services (CO ₂)	-12%	-37 to -53%	-88 to -91%
Agriculture (non-CO ₂)	-20%	-36 to -37%	-42 to -49%
Other non-CO ₂ emissions	-30%	-72 to -73%	-70 to -78%

Potential of Technologies SET-PLAN



The role of Horizon 2020 in the future of energy research





Energy R&I in Horizon 2020

- ***‘Secure, clean and efficient energy’*** one of the 7 Societal Challenges
- **Separate but complementary to Euratom**
- **European Parliament suggests a budget increase of 16,5% for Energy Societal Challenge (7.370 M€)**
- **Objective: make the transition to a reliable, sustainable and competitive energy system, in the face of increasingly scarce resources, increasing energy needs and climate change**



Societal Challenge 3

Secure, Clean and Efficient Energy

- 3.1. **Increasing energy efficiency** and reducing energy consumption and carbon footprint through smart and sustainable usage
- 3.2. **Sustainable**, low-carbon, low-cost electricity supply
- 3.3. Alternative fuels and mobile energy sources
- 3.4. A single, smart *flexible* European *energy* grid
 - 3.4.1. **Energy storage**
 - 3.4.2. **Back-up and balancing technologies**
- 3.5. New knowledge and technologies
- 3.6. Robust decision making and public engagement
- 3.7. Market uptake of energy innovation, empowering markets and consumers **through Intelligent Energy Europe III**

CONCLUSIONS



Conclusions

Challenges for 2020 and Beyond

- Ensuring continuity of supply
- Reducing the cost of the transition to a low carbon energy market
- Enabling consumers to save, produce and store energy
- Make technology and market uptake work together
- Horizon2020 will contribute to achieving the EU energy policy targets

Thank you

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