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# FORESEEN DEVELOPMENT OF MARKET RATIONALE INFLUENCING INVESTMENTS INTO LOW CARBON INNOVATIONS

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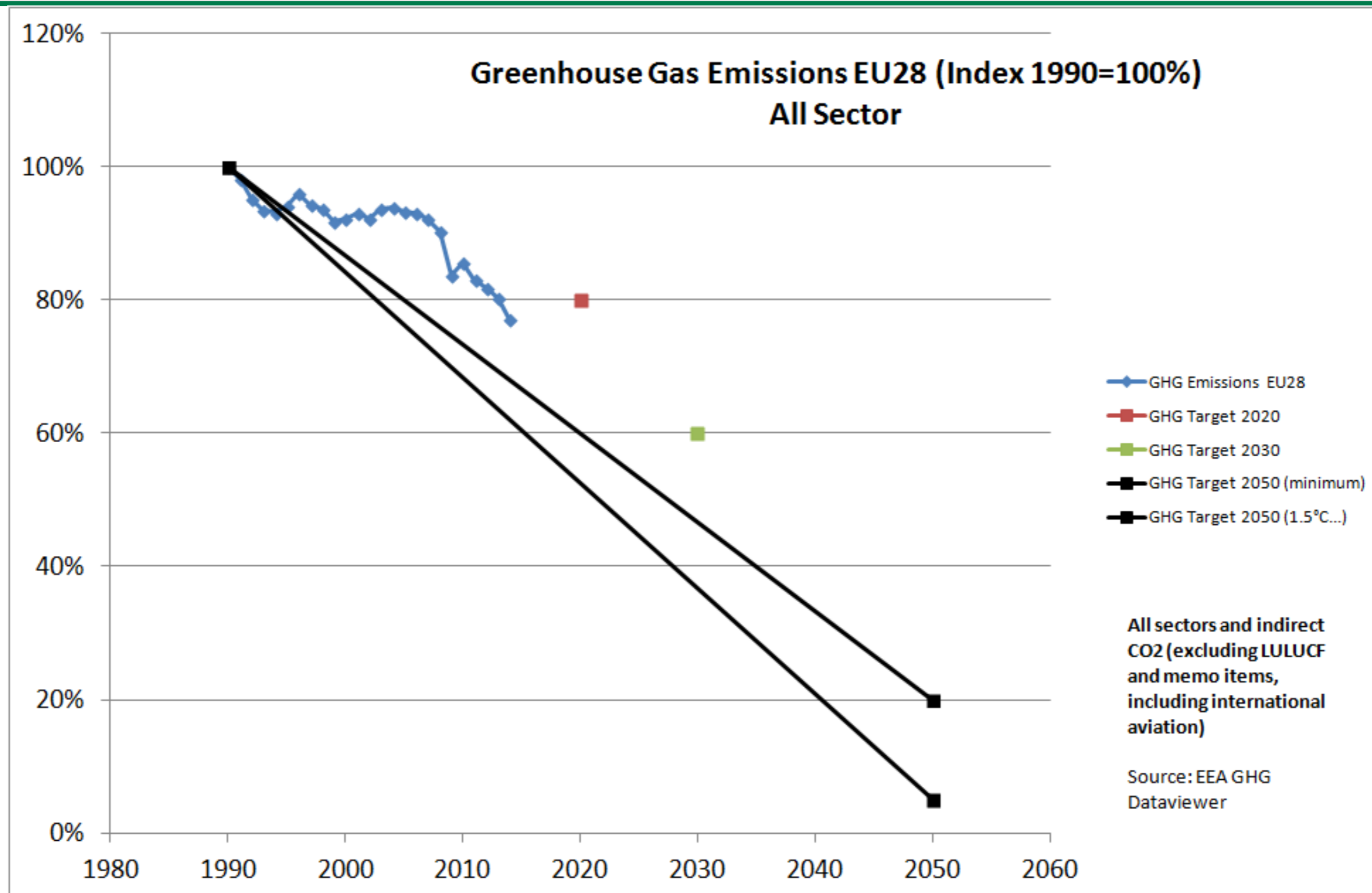
# Overview

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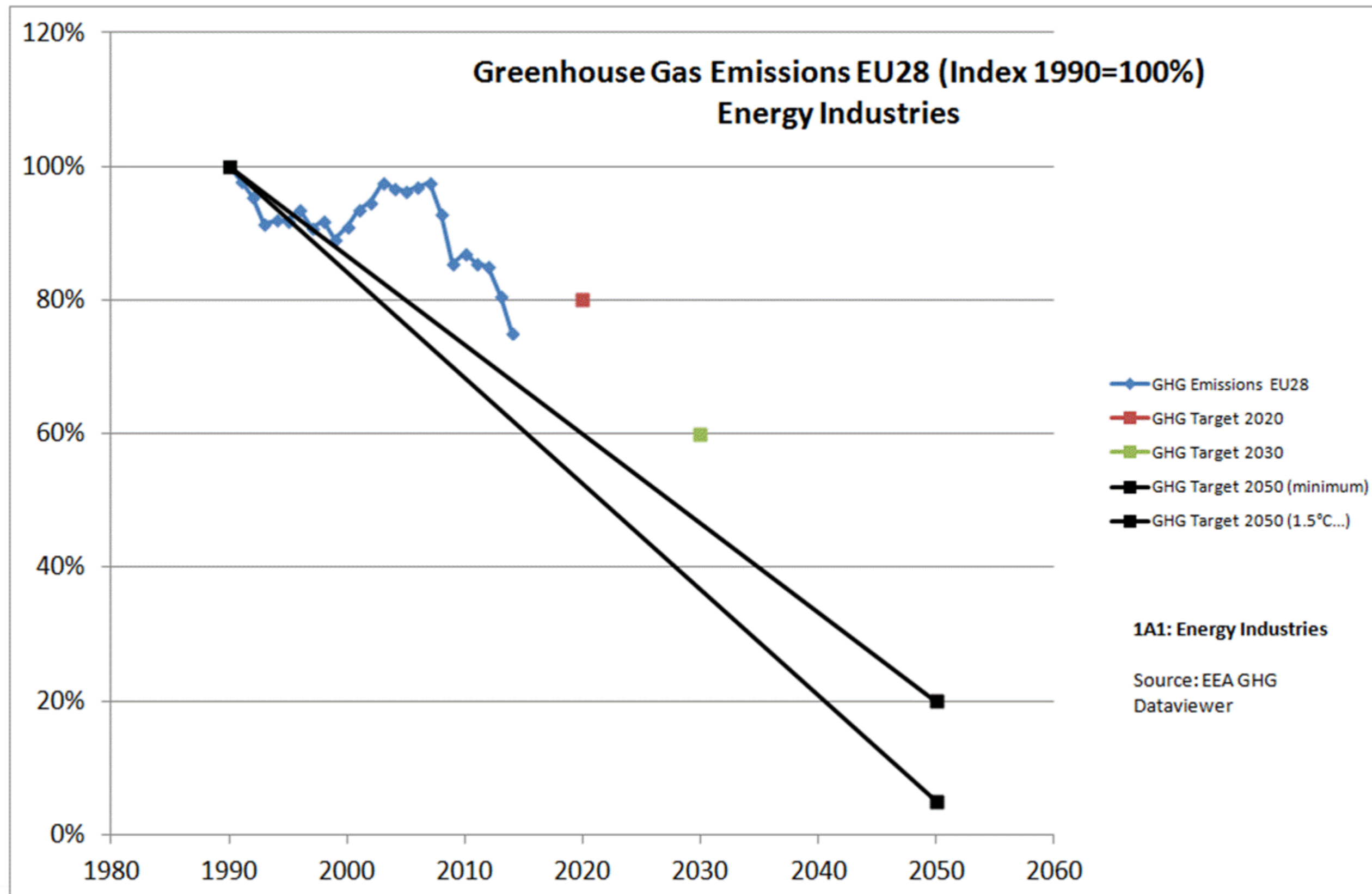
- State of play of de-carbonisation in Europe's energy system and sectors (energy supply, industries)
- Challenges to meet the 2030 and 2050 targets.
- Low carbon market fundamentals for the energy and manufacturing industries in Europe
- Example: Technology potential and innovation in cement production
- Potential financing needs and necessary market fundamentals evolution



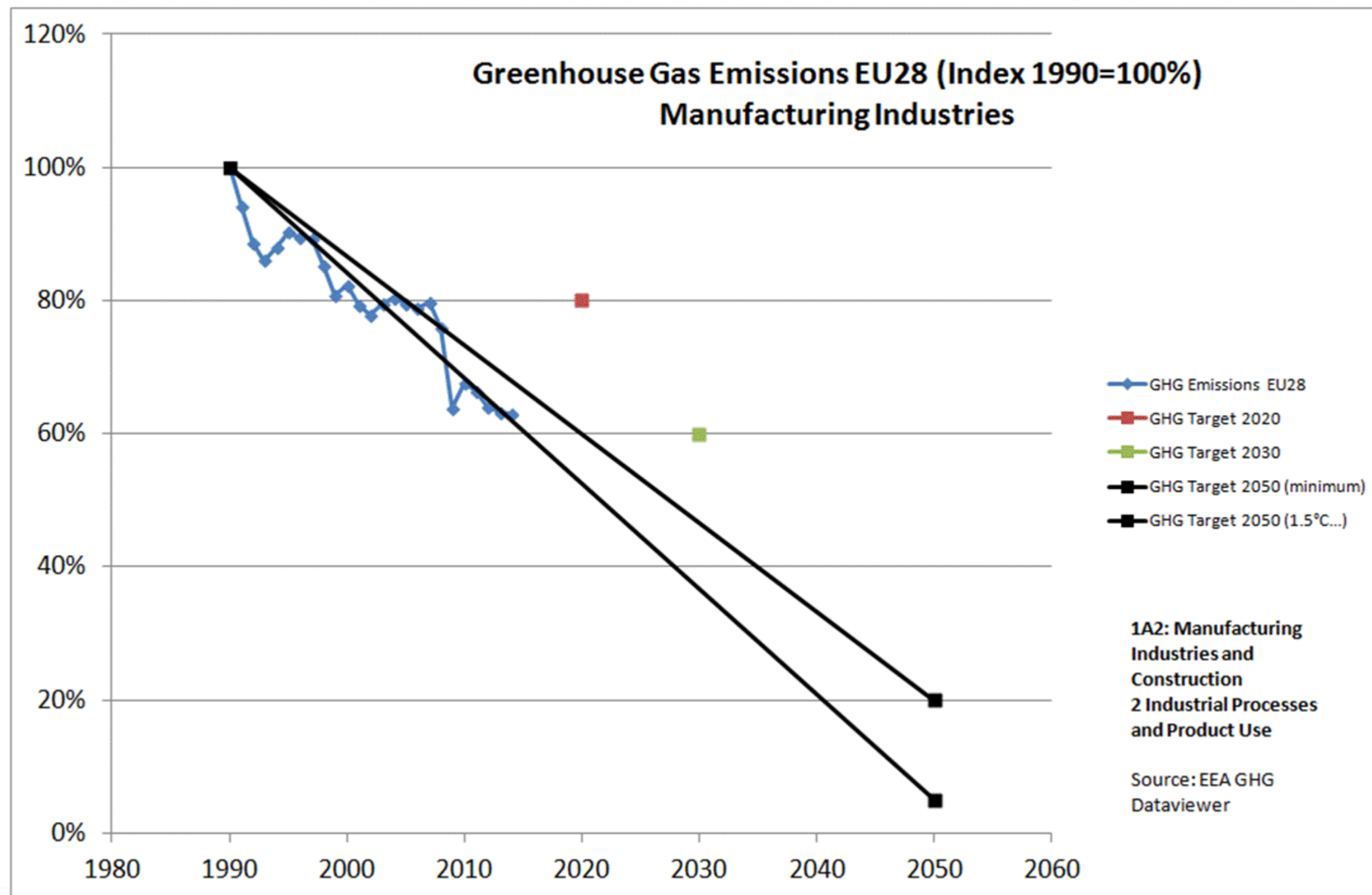
# Greenhouse Gas Emissions EU28 and targets up to 2050 (all sectors)



# Greenhouse Gas Emissions EU28 and targets up to 2050 (energy industries)



# Greenhouse Gas Emissions EU28 and targets up to 2050 (manufacturing sector)



# Low Carbon Market Fundamentals for Energy Industries in Europe

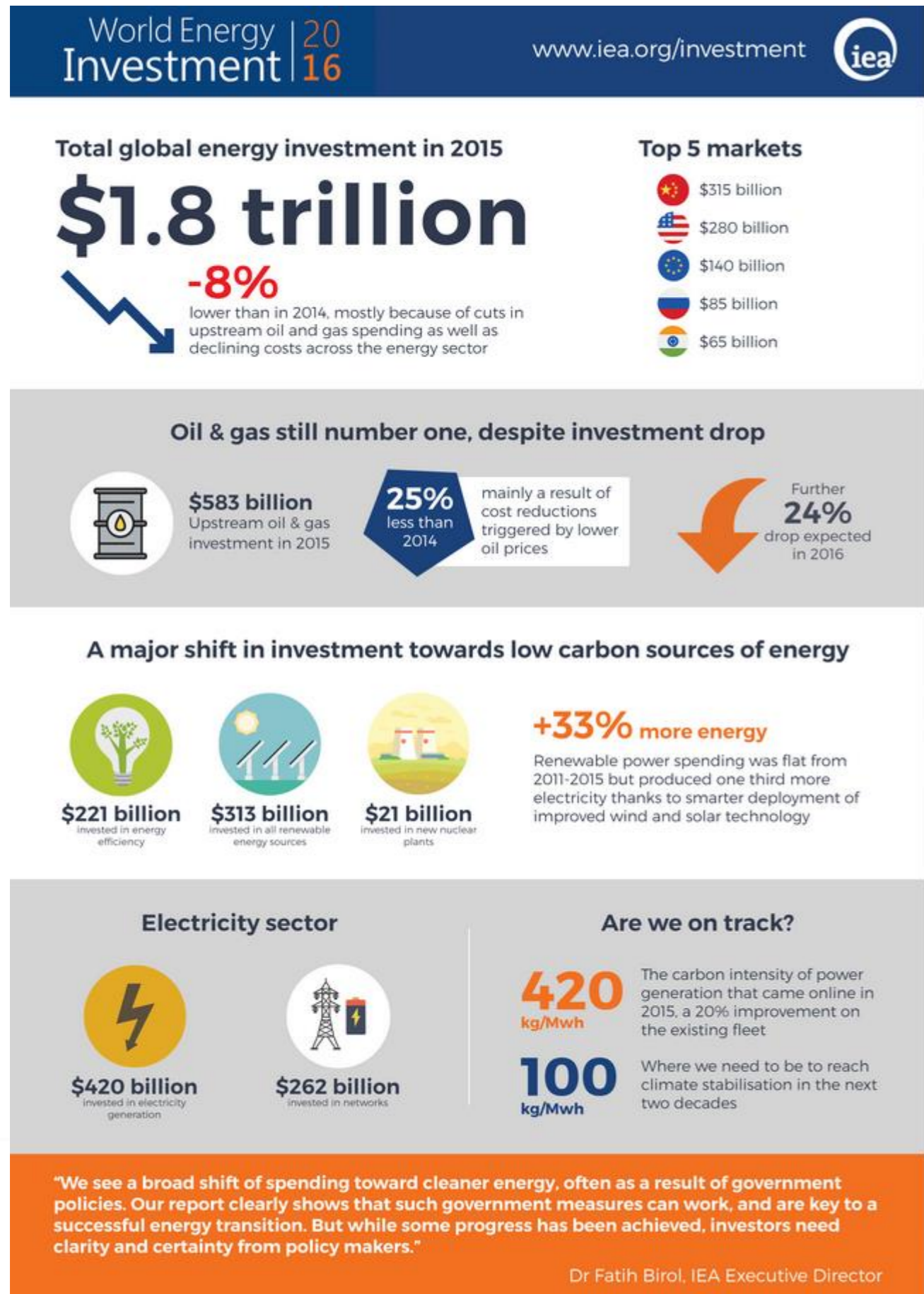
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- Strong growth in renewable energy shares and industries world-wide (market integration of RES)
- Policies to support RES and to reduce energy demand in Europe (Energy Efficiency Directive EED)
- Sector coupling: e-mobility, heat pumps
- Pressure on traditional supply companies (electricity, oil, coal), new actors
- Technology acceptance
- Carbon pricing EU ETS, KETS (Korea), CETS (China)
- Investment criteria of the Finance Sector in Energy





# Investment figures



- Fossil fuels (including supply and power generation) 55% of 2015 global energy investment (down from 61% in 2014 (IEA).
- RES share in investment 17%, Networks 14% , Efficiency investments 12% (IEA).
- New investment in clean energy \$349/288bn (2015/16) (BNEF)
- Electricity : renewables about 70% of investments (IEA)

# Low Carbon Market Fundamentals for Manufacturing Industries in Europe

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- World-wide competition ; opportunities from low-carbon processes
- Carbon pricing EU ETS, KETS (Korea), CETS (China)
- Carbon leakage
- Energy / CO2 taxation + exemptions
- Lowering of the carbon cap versus speed of technological innovation
- Electricity-intensive processes benefit from decarbonisation of electricity system. Further shift towards electric processes?
- Technology acceptance
- Market integration of RES:





# Main measures to reduce CO<sub>2</sub> emissions in cement making

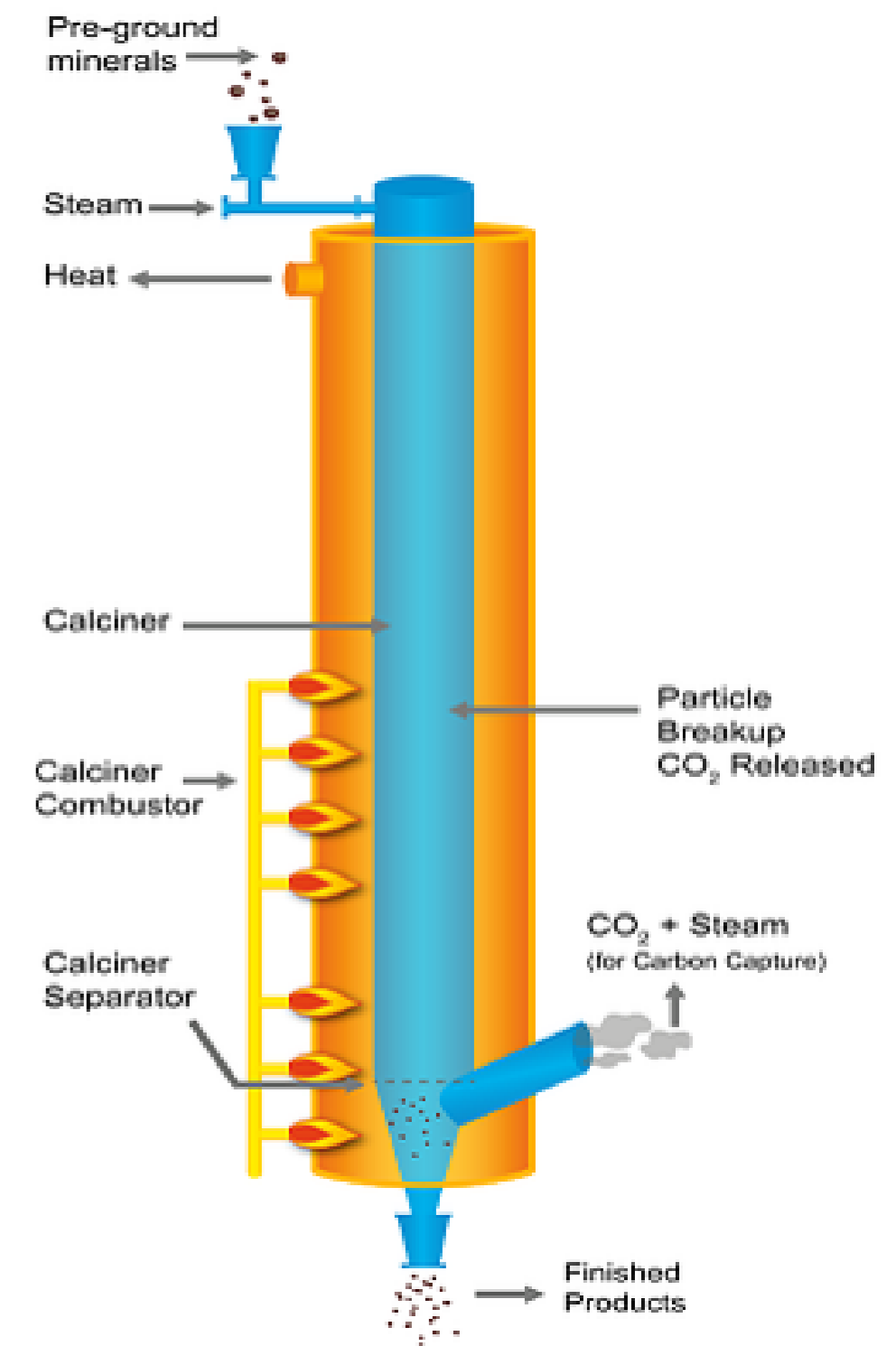
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- Energy-efficient technologies/ production processes,
- Promotion of composite cements (clinker content now 75%)
- Alternative fuels including biomass (up to 70% of fuels)
- Shift in raw materials (from wet to dry processes)
  
- CO<sub>2</sub> Capture and Storage (CCS), CCU
  - Oxy-fuel process (enrichment of exhaust gas)
  - CO<sub>2</sub>-Recycling
  - Use of CO<sub>2</sub> as a raw material
  - Production of biofuels from CO<sub>2</sub> emissions
  - CO<sub>2</sub> storage technologies
- New cement chemistry



# LEILAC (Low Emissions Intensity Lime And Cement)

- European Union Horizon 2020 research and innovation project (€21m project, €12m of funding from the EU)
- Core technology - Direct Separation: indirectly heating of limestone via a special steel vessel. Pure CO<sub>2</sub> is captured as released from the limestone; furnace exhaust gases are kept separate.



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Utrecht University



The Direct Separation Reactor

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# Technological / Commercialization

## “Valley of Death”

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- “Technological Valley of Death”: occurs early in the development of a technology, as breakthrough research and technological concepts aim to achieve commercial proof-of-concept.
- “Commercialization Valley of Death”: exists between the pilot/demonstration and commercialization phases of the technological development cycle
  - *“Even in 2008, as stocks touched all-time highs and interest rates dipped to all-time lows, virtually no truly private project finance capital was available for projects that sought to deploy unproven technologies. ..the Commercialization Valley of Death challenge is one that the private sector will not address on its own”. (BNEF)*

# Potential financing needs and necessary market fundamentals evolution

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- Innovation Fund: financing volume reserved from auctioning volume: from 3Bn € (450 mill. allowances at 6€) to 12 Bn € (600 mill. allowances at 20€). Split on 4 sectors (RES, CCS, industry, CCU)
- Investment needs for industry-size low carbon plants/processes may be in the range of 0.5-1 Bn € for one single large process.
- Leverage of investments from the private sector (technology suppliers and finance): how to share reasonably the risk of large unproven processes?
- Trade-offs between competing ideas in same sector? Between sectors when Funds are limited?





Many thanks for listening!

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