

# Development of CCS in Europe: The EU Technology Platform ZEP

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# Energy supply in the future will result in major challenges on the infrastructure

## Three global trends in the energy sector

### Demographic dynamics



- **Population growth:**  
7.5 bn in 2020 (+1.1 bn)
- **Power consumption:**  
+5.2% p.a. in emerging regions and 1.4% in developed world
- **Megacities:**  
23 megacities (>10 million inhabitants) in 2015

### Resource scarcity



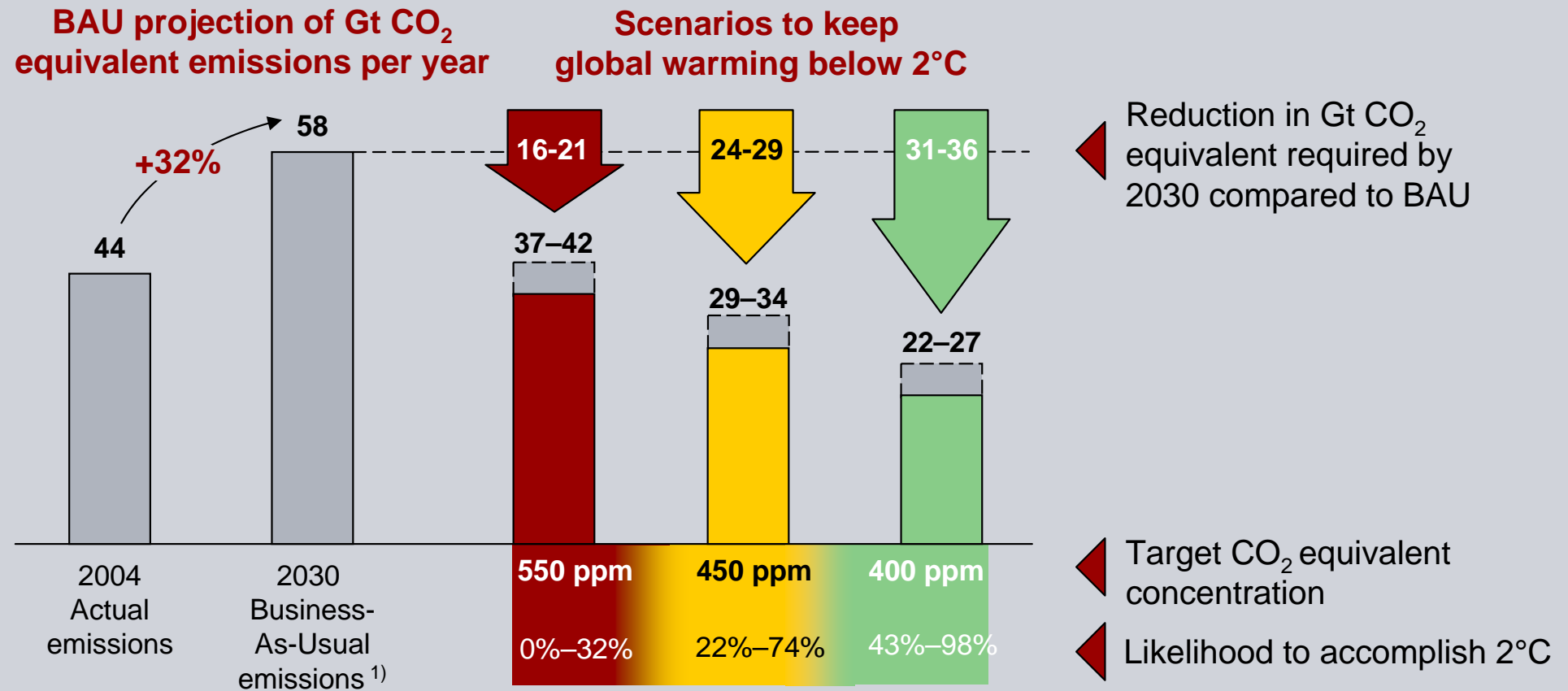
- **Geopolitics:**  
70% of world oil and gas supplies only in a few countries
- **Fuel diversity:**  
100% increase in oil prices over last 2 years accelerates shift to broader fuel mix

### Environmental focus



- **Global emissions:**  
40% increase in air pollution over past 20 years
- **Climate change:**  
Global warming limited to an average increase of 2 degrees Celsius

# Drastic actions are required to limit global warming to 2°C

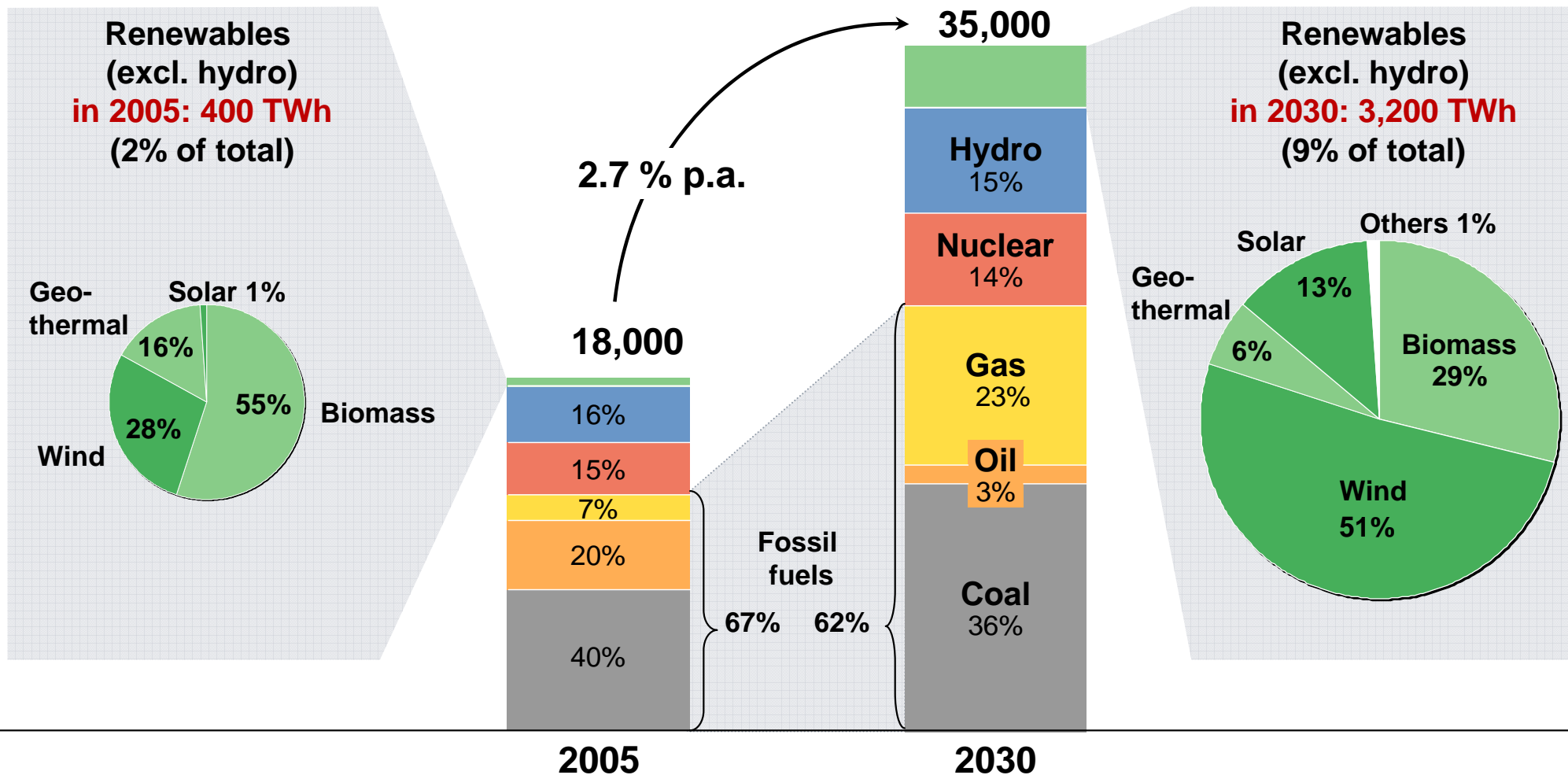


1) According to IEA, EPA

Source: IEA WEO 2006 and 2007, Vattenfall

# Renewables are gaining in importance – but fossil fuels will continue to be the mainstay

## Power generation (in TWh<sup>1</sup>)



Source: Siemens Energy Sector, GS4 base case

1) Terrawatt-hours

# Requirements of the energy and power industry

**Society's requirements**

## Economic Efficiency



## Security of Supply



## Environmental Protection



**Customers' requirements**

### Low life-cycle costs

- High efficiency
- High quality
- High availability
- High reliability
- Low O&M and service costs
- Short delivery time
- Low investment costs

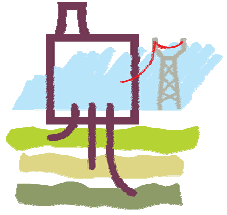
### Reliability and flexibility

- Good load tracking and cycling capability
- Dispatchability
- Fuel flexibility and availability
- Low start-up times
- Gasification
- Secure grid operation

### Compliance with environmental standards

- Reduction of air pollution
- Avoid the use of hazardous substances
- CO<sub>2</sub> emission reduction
- CO<sub>2</sub> capture and renewables

**Key product features**



## European Technology Platform for Zero Emission Fossil Fuel Power Plants (ETP ZEP)

**SIEMENS**

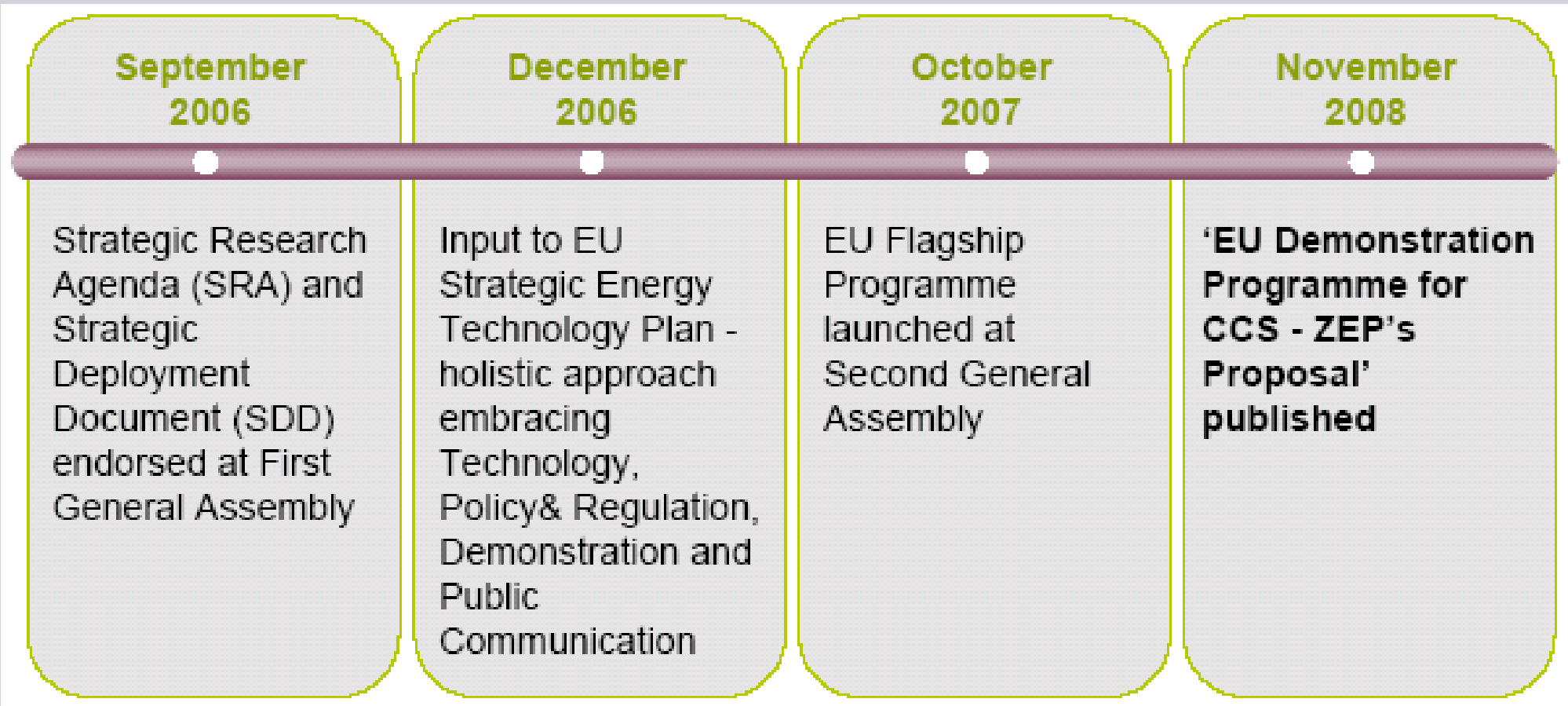
### **ETP Role:**

**Define a strategic agenda for the development and deployment of technologies involving major economic or societal challenges.**

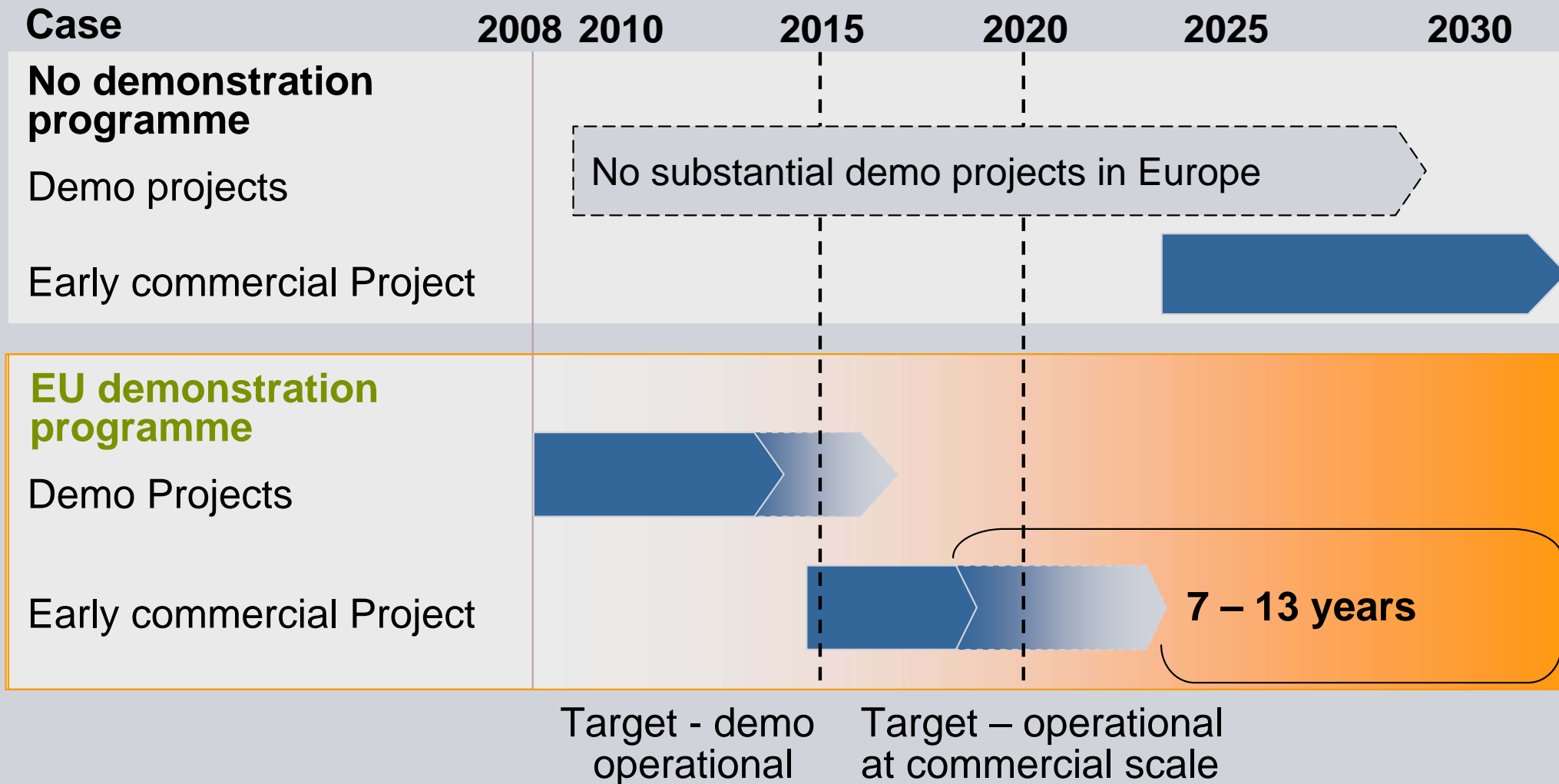
- Founded in 2005
- Unique and broad coalition of stakeholders:  
European utilities, petroleum companies, equipment suppliers, scientists, geologists and environmental NGOs.
- 200 people in 19 different countries contribute
- 35 different companies and organizations represented on ZEP's board

**Enable commercial availability of CCS by 2020**

# Milestones



# An EU demonstration program gives CCS a ~10 year head-start



# The focus and benefits of an EU CCS demonstration program

## Objective:

Enable commercial availability of CCS by 2020

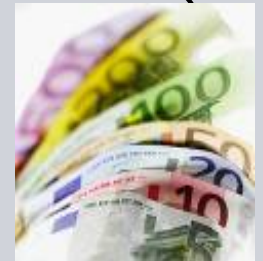
1

Validate technology



2

Bring down costs

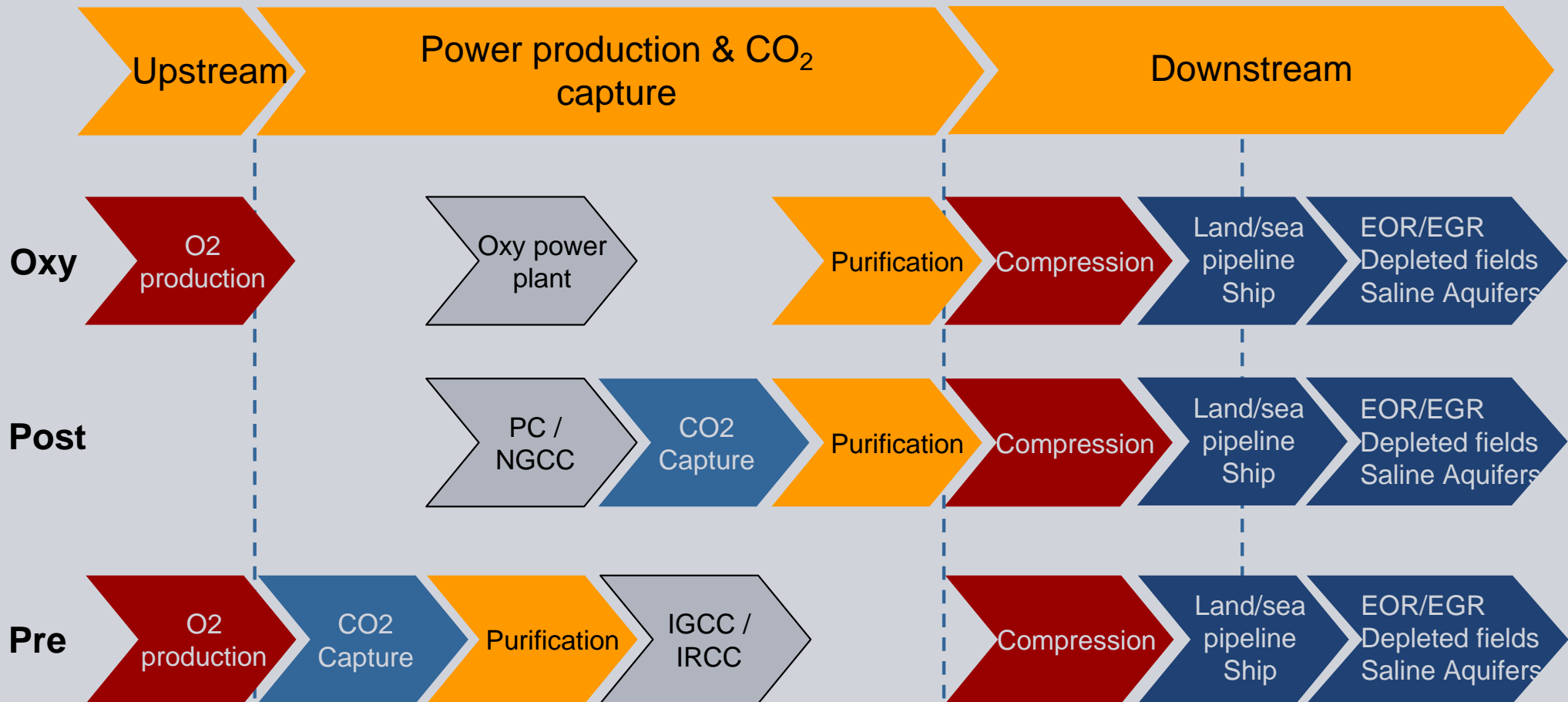


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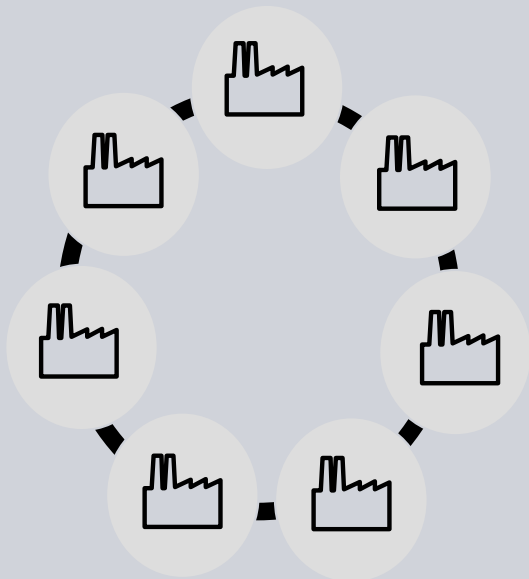
Contribute to public acceptance of CCS



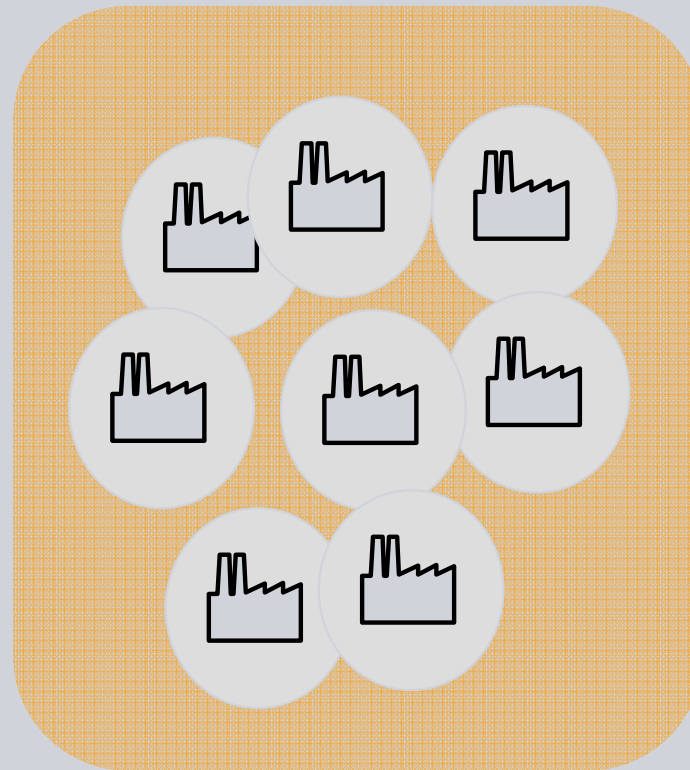
# Overview of the Technology Blocks along the CO<sub>2</sub> capture, transport and storage value chains



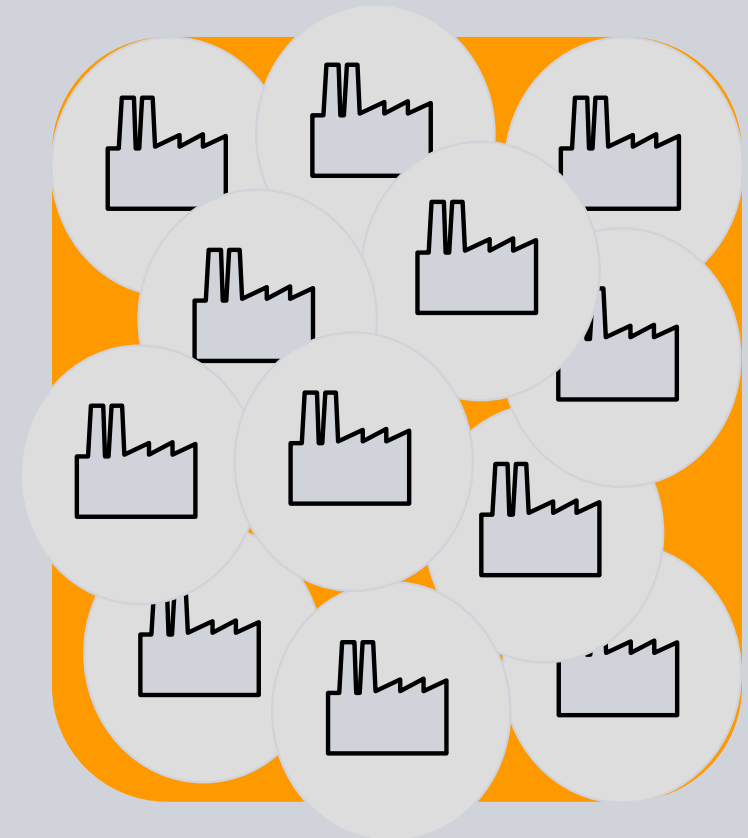
# EU CCS demonstration programme means: 10-12 projects required



In an ideal world,  
a theoretical minimum  
of 7 projects is needed  
to test all criteria



In reality, 8 projects are  
required to test the vast  
majority of the criteria



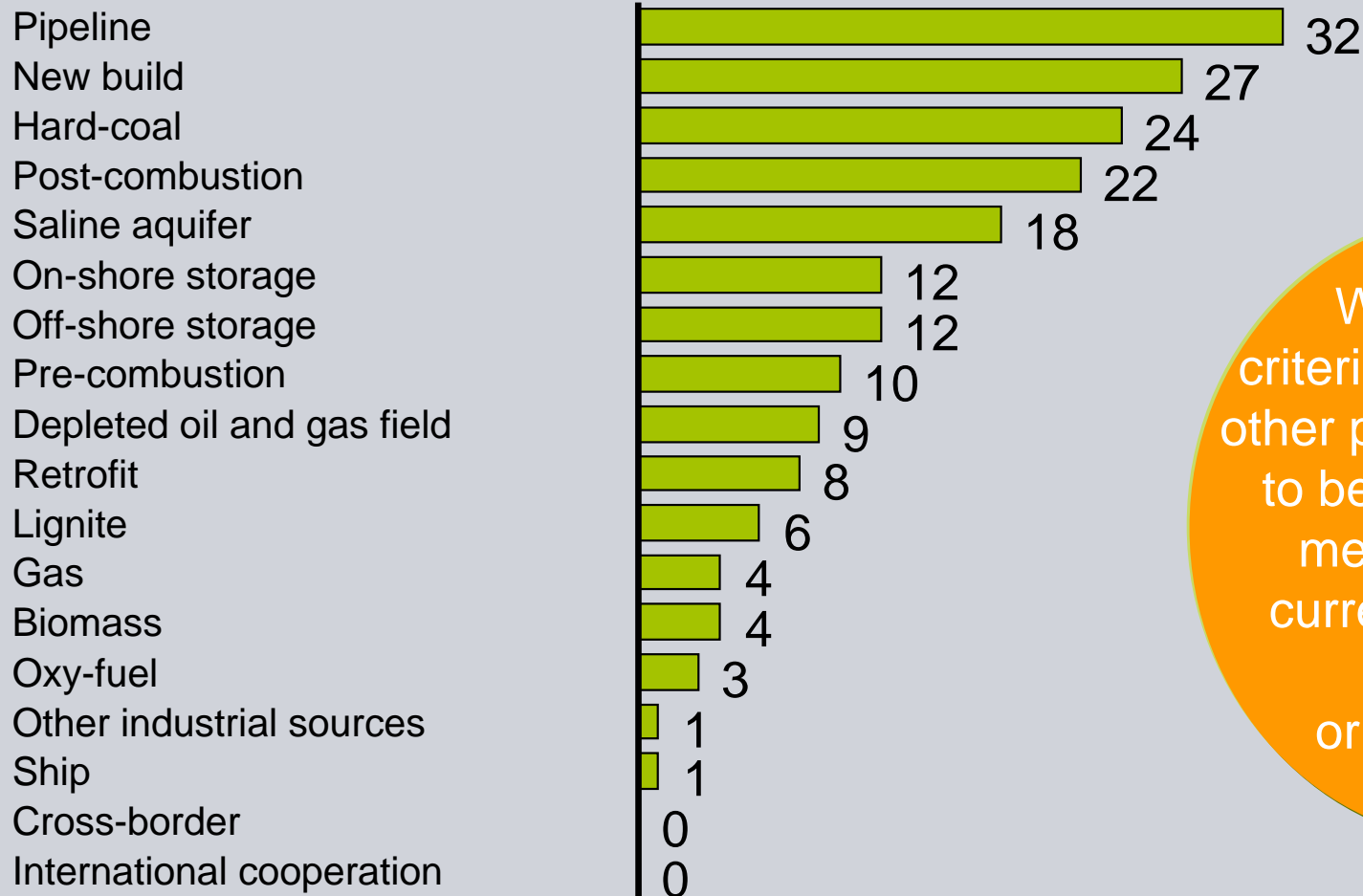
**To test all criteria in  
reality, an estimated  
2-4 additional projects  
are required, bringing  
the total to 10-12**

## 34 EU Projects announced, ensuring competition

Though announced, these projects are awaiting further decisions on funding and legislation

### Element requiring testing

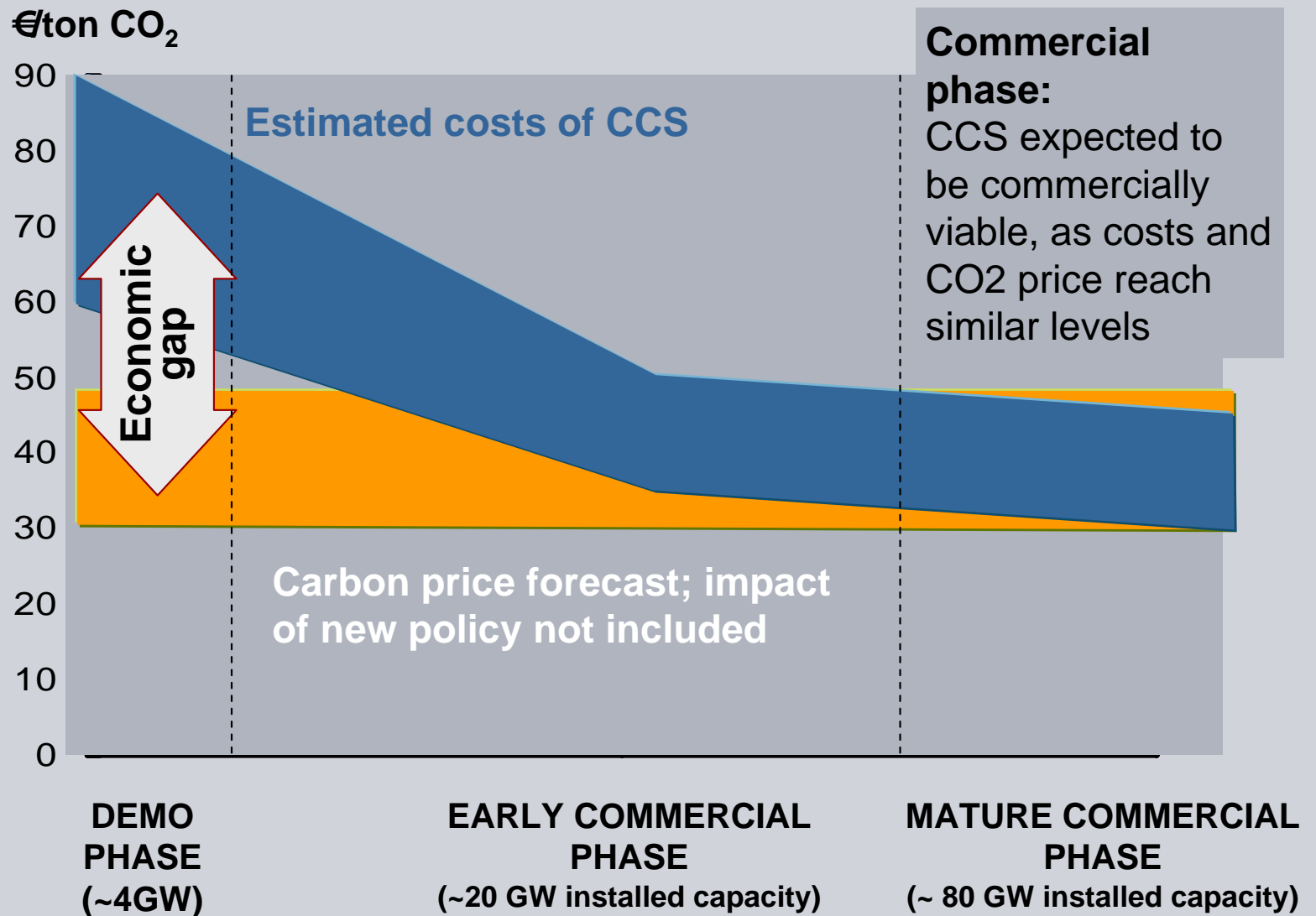
### Number of projects that tests this element



When tender criteria are published, other projects are likely to be proposed that meet the criteria currently difficult to satisfy, or not satisfied at all

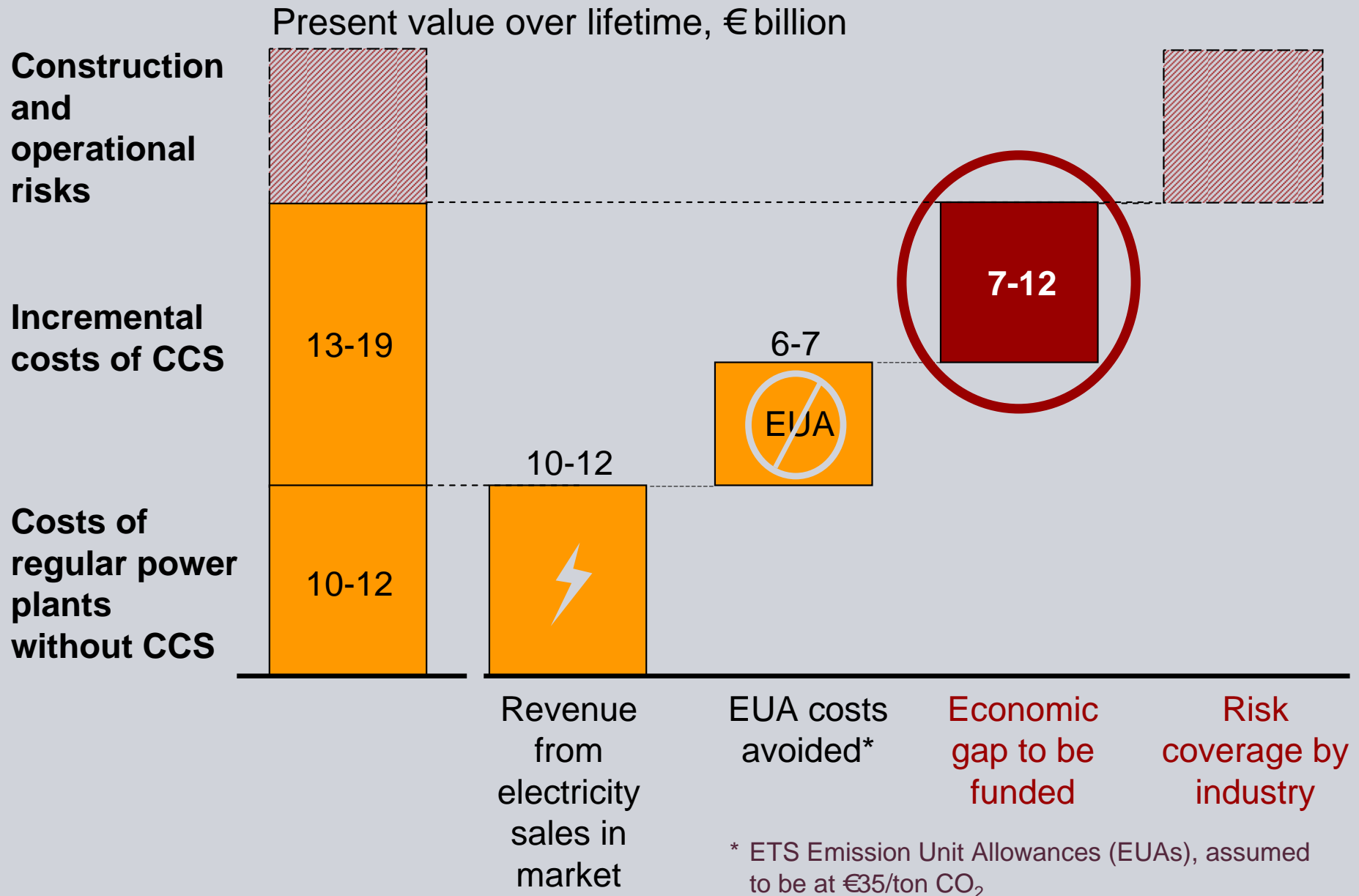
# Demonstration phase requires funding to fill the economic gap

**Demonstration phase:**  
CCS not economically viable. Public contribution necessary for some portion



**Commercial phase:**  
CCS expected to be commercially viable, as costs and CO<sub>2</sub> price reach similar levels

# 10-12 Demonstration projects means €7 to €12 bn in public funding



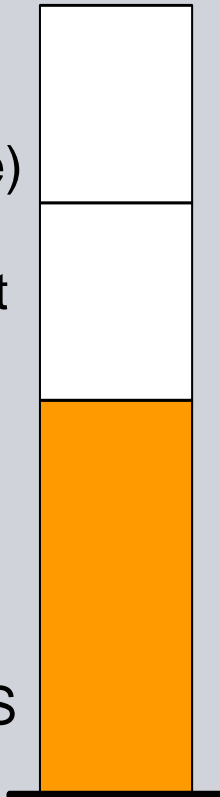
# Industry and public to jointly share CCS costs, construction & operational risks

## Proposed approach to covering costs and risks

Other risks  
(e.g. non-  
performance)

Risks of cost  
increase

Expected  
incremental  
costs of CCS



1

Industry is prepared to cover the majority of the risks

- Given the innovative nature, risks are significantly higher than in normal projects
- Risks have a large potential downside and little upside (as gains from higher carbon price will be returned to the public)
- “No performance, no pay”
- Risks size is similar to total expected costs

2

With industry bearing risks and the base costs of the power plant, public is asked to cover expected incremental costs of CCS

## Summary

1

Energy is on the top of the agenda worldwide. Electricity production based on fossil fuel will still play a major role.

2

CCS will play a key role in combating climate change, as the single biggest abatement lever.

3

An EU CCS Demonstration Program is required to make CCS commercially viable by 2020.

4

10-12 demo plants required. Industry is ready to bear risks & base plant costs and requests €7 to €12 bn in public funding.

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