

The cost of climate change

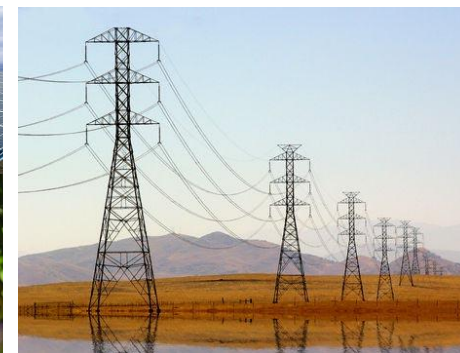
Impacts for power generation in Europe

Sytze Dijkstra, ECN Policy Studies



Electricity supply & climate change

- Climate change will affect the whole of society in the next 50+ years, including the power sector
- Existing energy infrastructure is vulnerable to these changes
- Investment for climate-proofing these systems is needed to maintain supply



Long-term threat – lack of understanding

- Climate change assessments

Sector	Percentage of CC effect assessments
Nuclear power	~100%
Fossil-fuelled power	~30%
Renewable electricity	<5%
Electricity transmission and distribution	~0%

- Long-term strategies

Sector	Percentage of long-term strategies including CC
Nuclear power	~50%
Fossil-fuelled power	~26%
Renewable electricity	<5%
Electricity transmission and distribution	~0%

Research steps

1. Identify climate scenarios at EU, national and local levels

2. Compile electricity demand/supply scenario

3. Identify and quantify climate impacts on operation of power systems

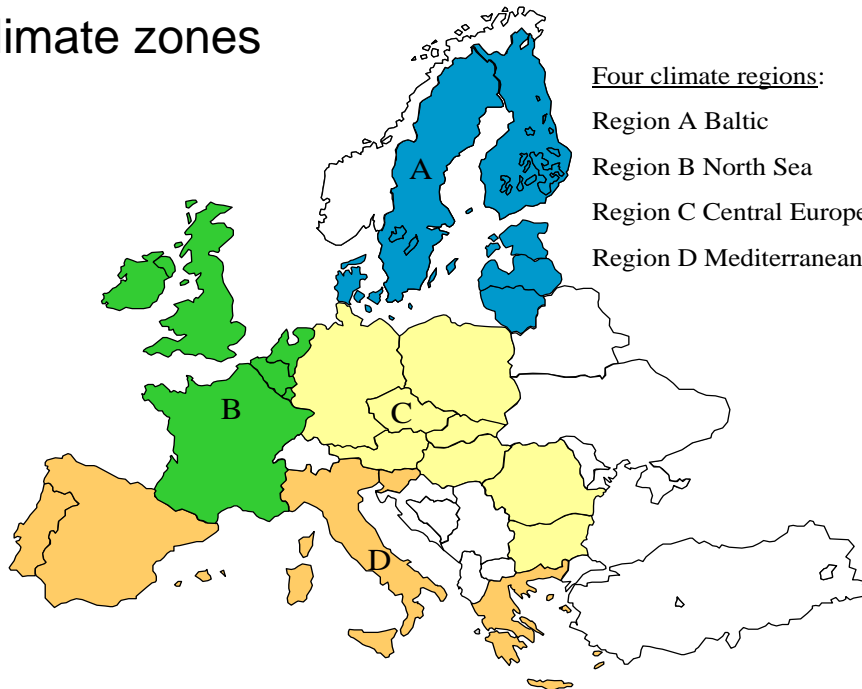
4. Assess potential impacts of climatic change on the power sector

5. Conclusions: implications for costs and security of supply

Climate change scenarios

- IPCC 4th Assessment Report (Working Group III)
- A1B scenario ('worst'-case scenario in climate change effects)

Climate zones



Climate indicators

- Temperature
 - Water & air temperatures
 - Sea level change
 - Occurrence of heat waves
- Precipitation
 - Precipitation change
 - Occurrence of floods
- Wind speeds
 - Wind speed change
 - Occurrence of storms

Electricity sector scenarios

Eurelectric Power Choices

- Baseline scenario (business-as-usual)
- Power Choices scenario (75% CO₂ emission reduction)

Baseline scenario

- Supply projections to 2050
- Follows assumptions of PRIMES DG Energy projections
- Announced EU climate and energy policies implemented by 2020

Main impacts on electricity sector (1)

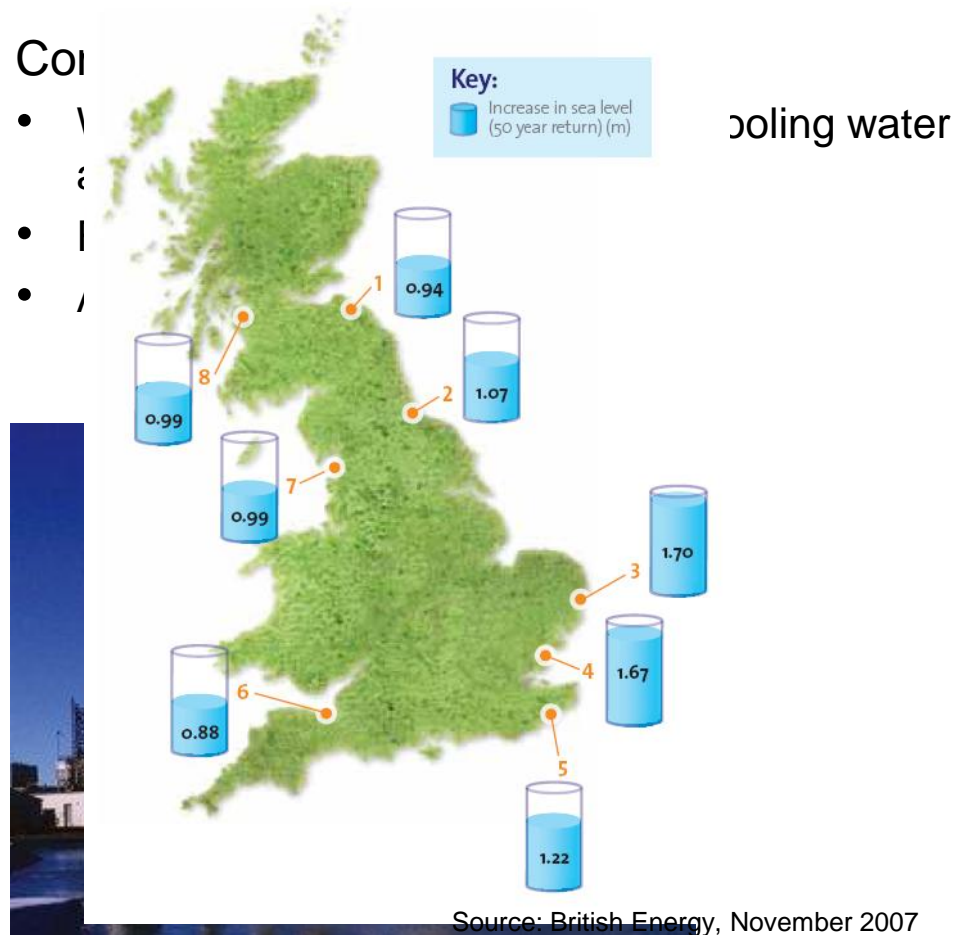


Nuclear power

- Flooding
- Water temperature increase and cooling water availability decrease
- Ambient air temperature increase

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Main impacts on electricity sector (2)

Renewable electricity

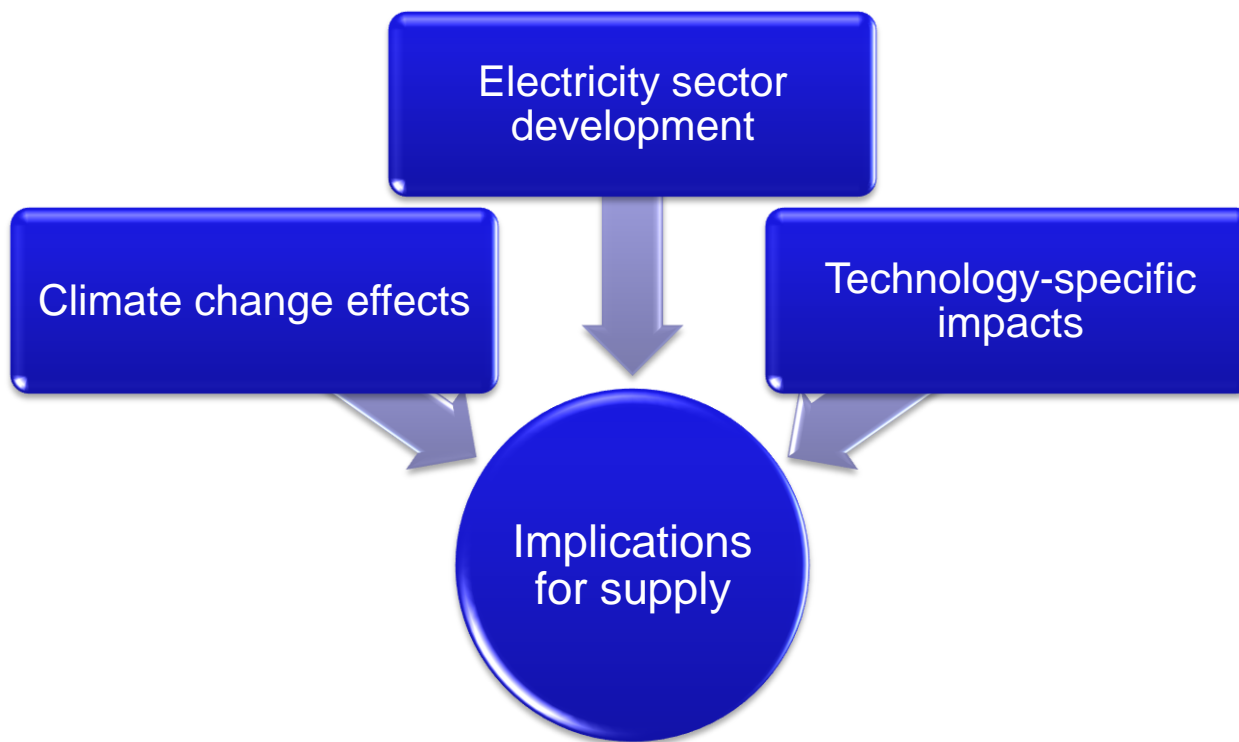
- Extreme storm events
- Heat waves
- Flooding



Transmission and Distribution

- Extreme storm events
- Ambient air temperature increase
- Flooding

Estimating costs for power sector

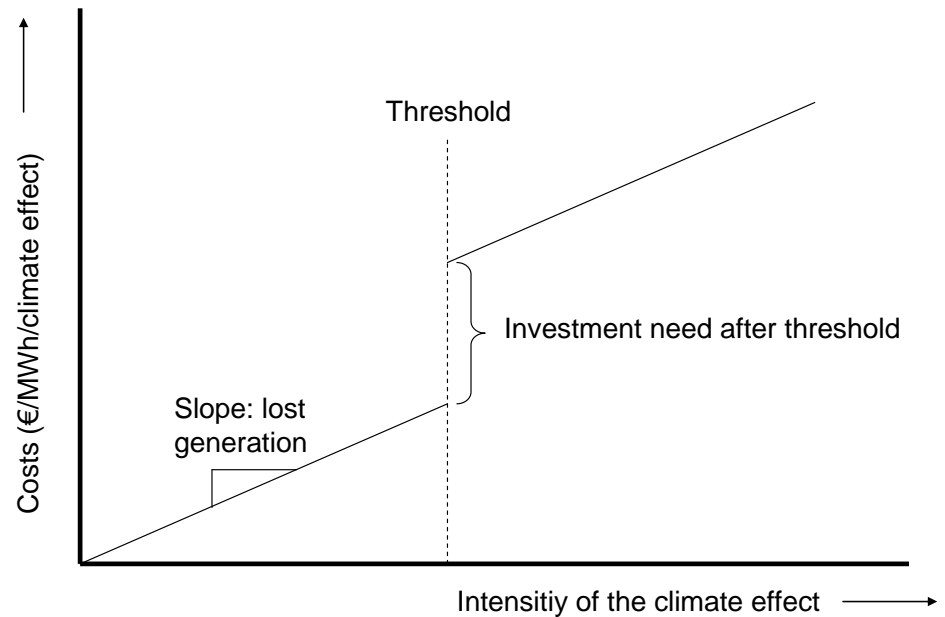


Quantifying risks to supply

Cost estimates (€/MWh) per technology:

- Lost power generation
 - Gradual effect
 - Average wholesale power price

- Investment need
 - Threshold
 - Capacity factor per technology



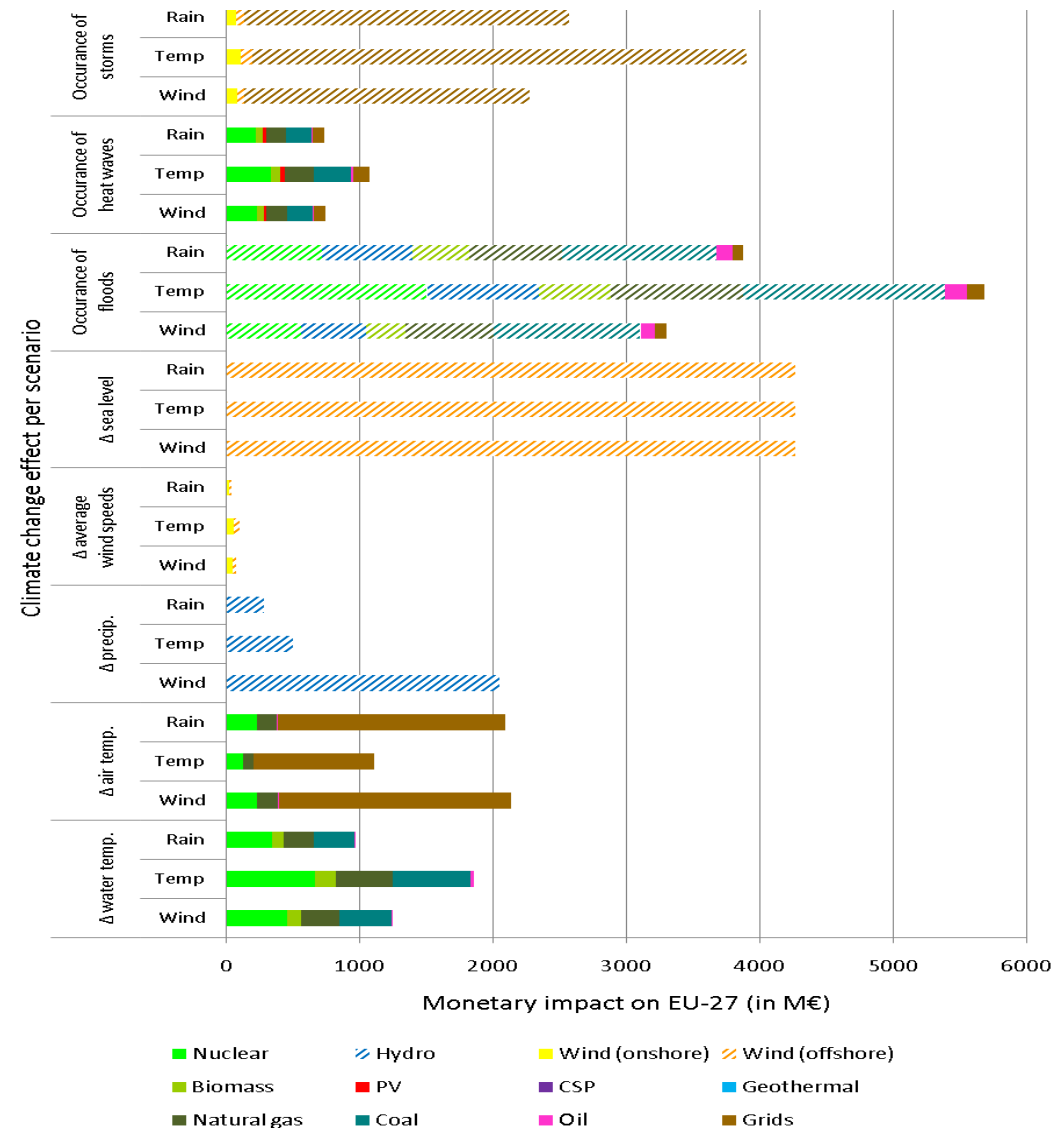
Impact on supply

Extreme events pose largest threat:

- Storms
- Flooding
- Sea-level rise

Grids and renewables most affected:

- Electricity networks
- Offshore wind
- Hydropower



Conclusions: main results

- Temperature increase: wide but gradual impact
 - Affects nuclear and fossil-fuel power plants
 - Smaller effect on electricity networks
- Extreme events: local impacts, but high costs
 - Costs highest in Southern regions
 - Lower investment needed in the North Sea region
- Impacts unequally distributed
 - E.g. precipitation

Conclusions: Implications

- Long-term but potentially major threat
 - Especially risk for technologies with long lifetime (nuclear, networks)
- Awareness of risks and planning for prevention varies widely
 - Integrated into nuclear safety assessments
 - Increasingly assessed for fossil power generation
 - General understanding of impacts on grids, but few concrete risk-assessments
 - Knowledge on impacts on renewables patchy
 - Exception for hydro-power
- Warrants long-term strategic approach

Thank you for your attention

Questions

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