Integration of renewable energy in China – lessons learnt from Europe

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China National Renewable Energy Centre

- Assist China's energy authorities in RE policy research, industrial management and coordination
- Located in Energy Research Institute of NDRC

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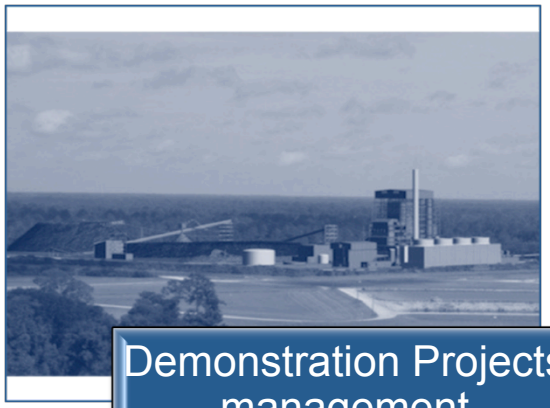
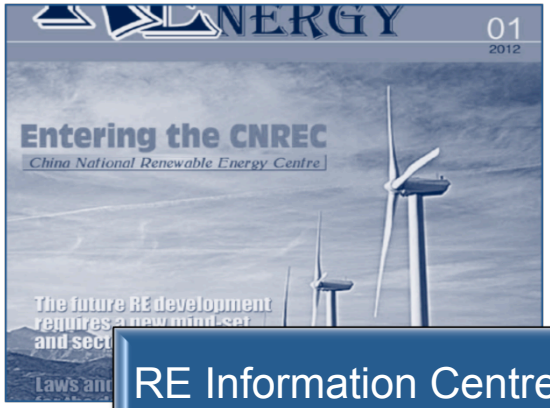
Policy Research

Industry Development



Demonstration Projects management

International cooperation



RE Information Centre

Testing centre

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Top 5 focus areas

1. Incentives for a flexible energy system
   - Flexible thermal power plants
   - Flexible use of district heating
   - Better use of interconnectors
2. Planning for new transmission grids
3. Good wind power forecasts integrated in the system dispatch
4. Reliable wind turbines
   - Grid code
   - Testing and certification
5. Smart grids

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FLEXIBLE POWER PLANTS

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Super flexibility

- Danish power coal fired CHP plant
- Able to produce power and heat at 10% of max. capacity

Technical key data

Commissioned	1992
Max power production (net)	378 MW
Max district heat production	460 MJ/s
Coal consumption at full load	120 t/h
Oil consumption at full load	73 t/h
Steam pressure	251 bar
Steam temperature	560 °C

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Flexible power plants

Denmark

- Grid code
  - 30% of max capacity
- Economic incentives
  - Marginal pricing
  - Negative prices if production > demand
- CHP
  - Heat accumulators
  - High heat prices

China

- Grid code
  - 50% of max capacity
- Economic incentives
  - None
- CHP
  - Low flexibility
  - Low heat prices

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Priority dispatch – in principle

1. Renewable energy – wind and solar should in general have first priority
   - Low marginal cost of power production
   - No fuel cost
   - No or low pollution
2. Hydro power should be used for balancing and for efficient use of the water resources
3. Thermal power plants with high investments, high efficiency and low operational cost should have second priority
4. Thermal power plants with low efficiency, high operational cost and/or high pollution should have third priority

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- NDRC Trial dispatch rules from 2007 have these principles embedded – but it has been difficult to use in practice because of the economic consequences for the thermal power plants

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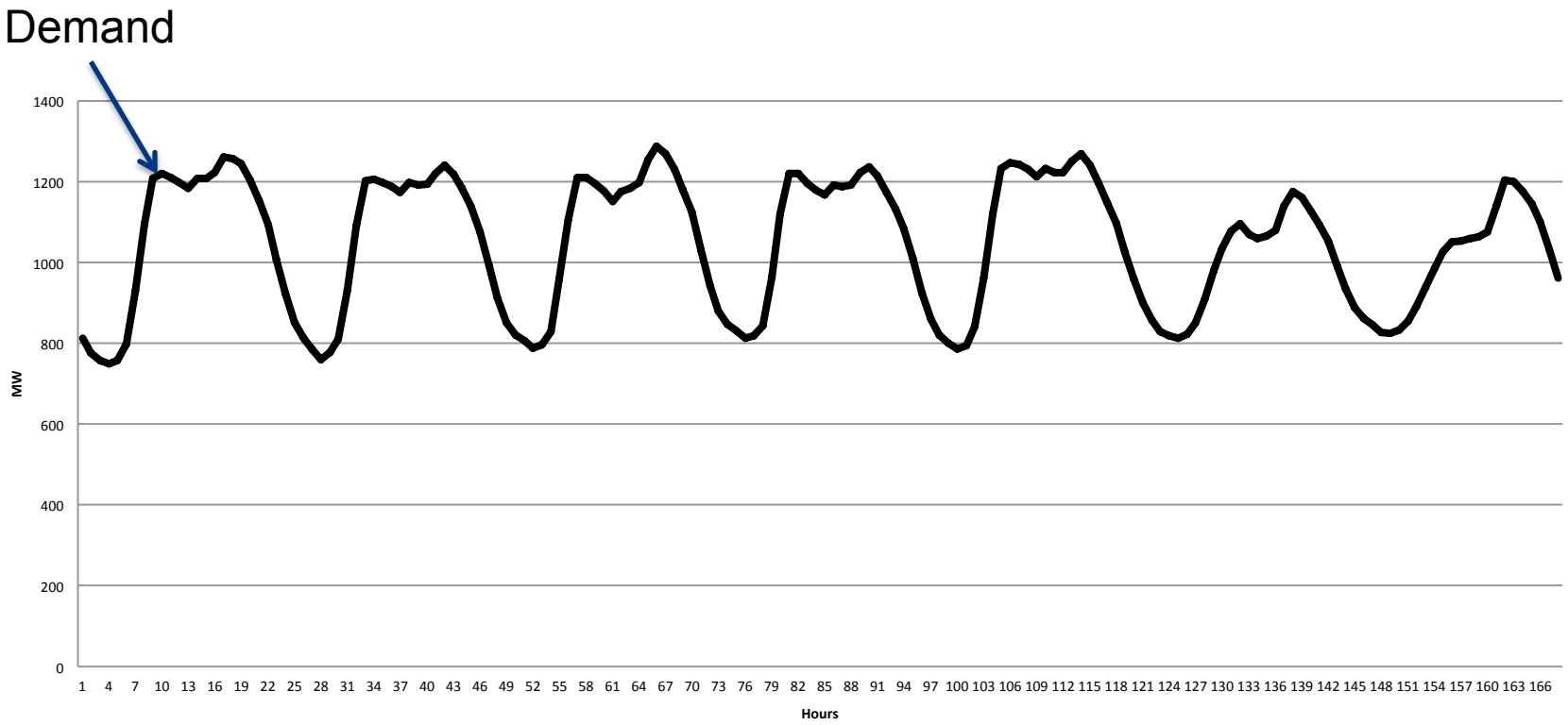
Example: One winter week



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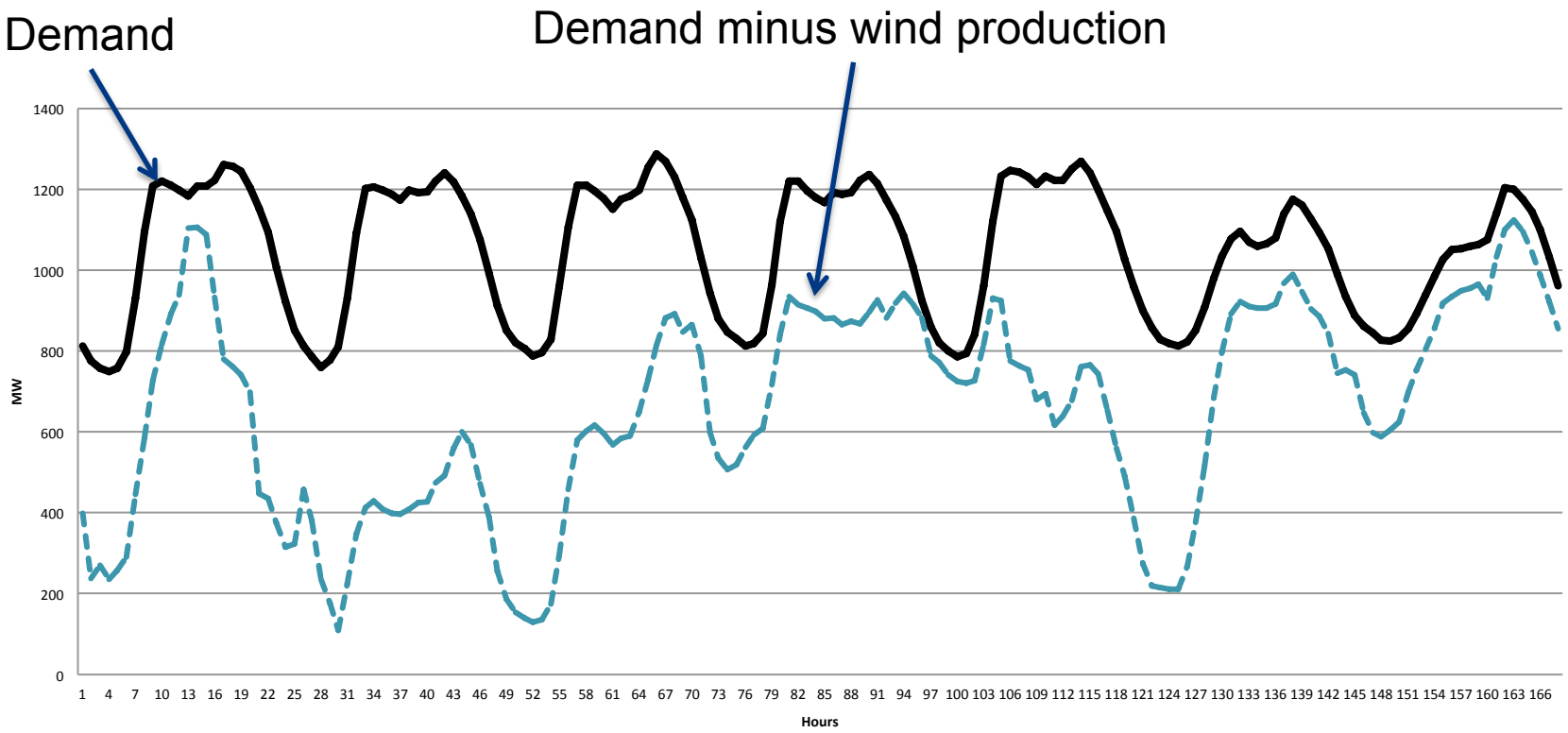

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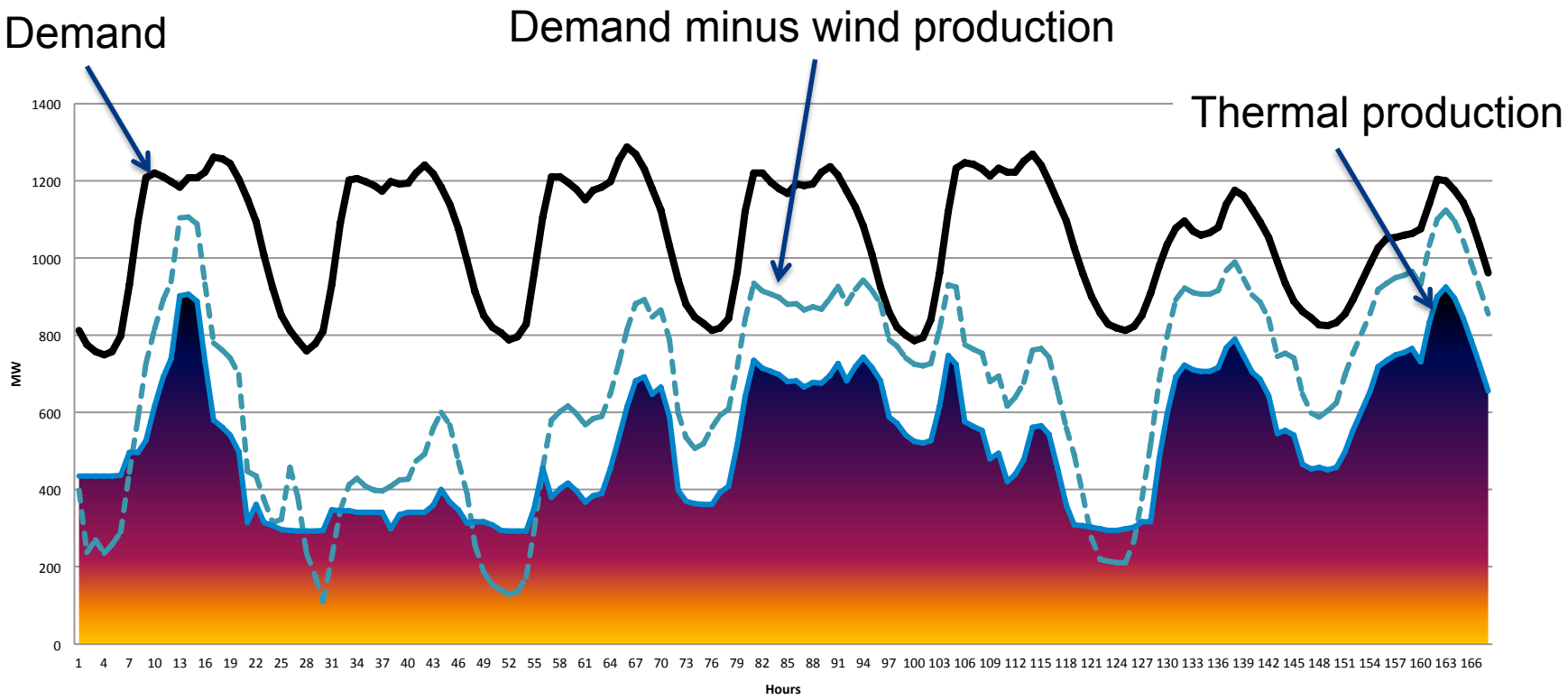

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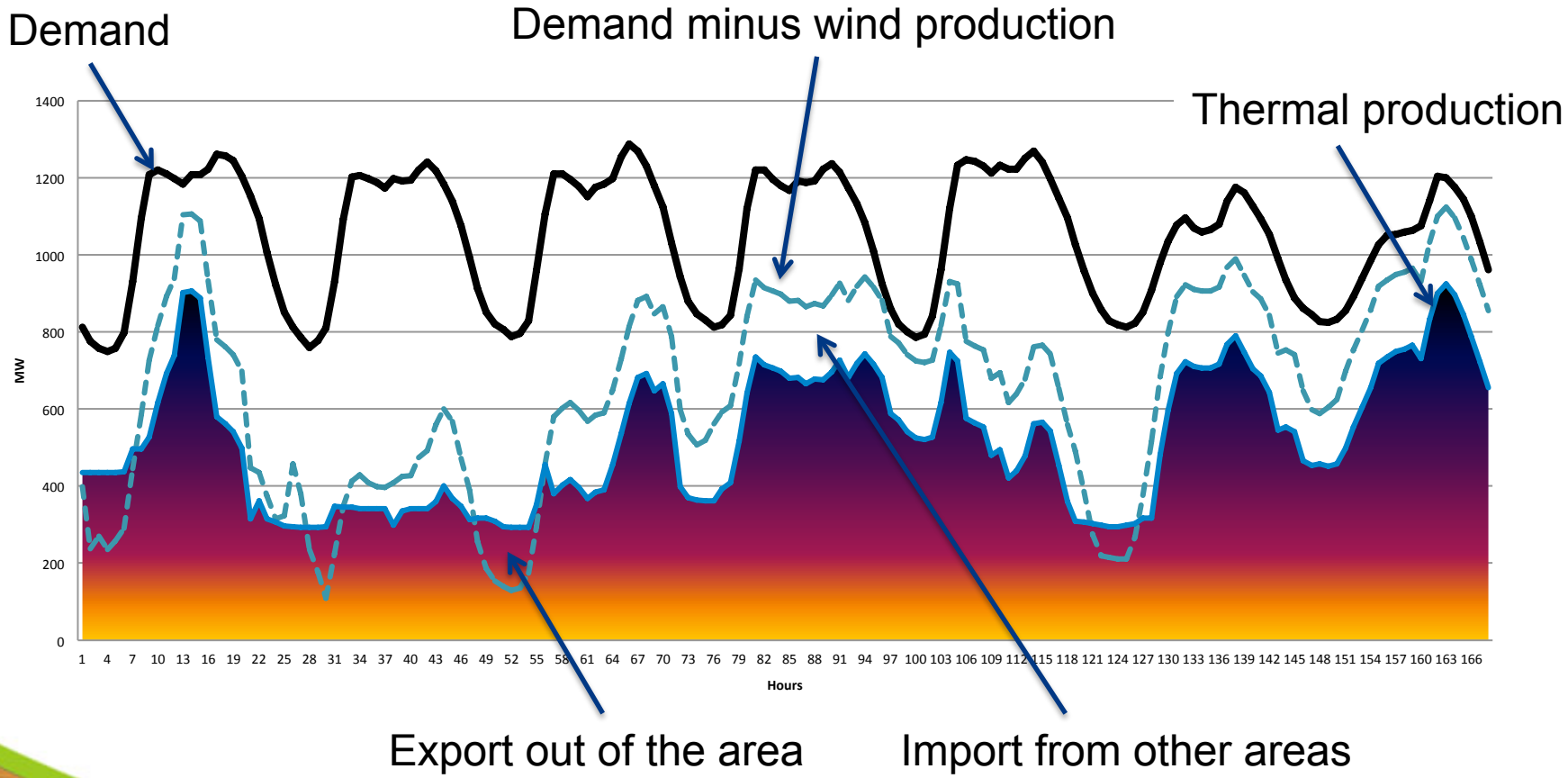

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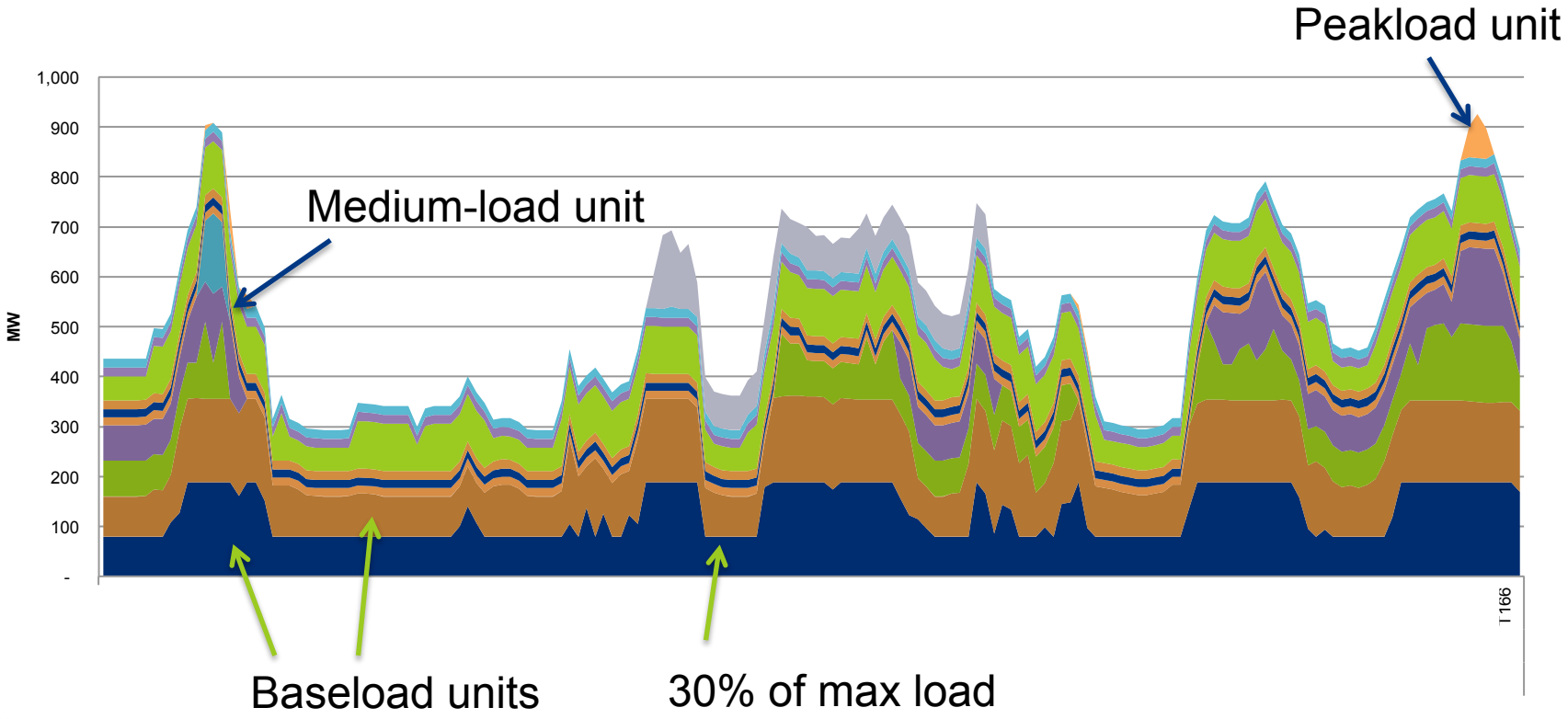
Production on each thermal power unit



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Consequences for thermal power plants

- Solutions:
  - One-time compensation
  - Payment for other services for the power system
  - More income from heat production
  - Others?

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FLEXIBLE HEAT- AND POWER PRODUCTION

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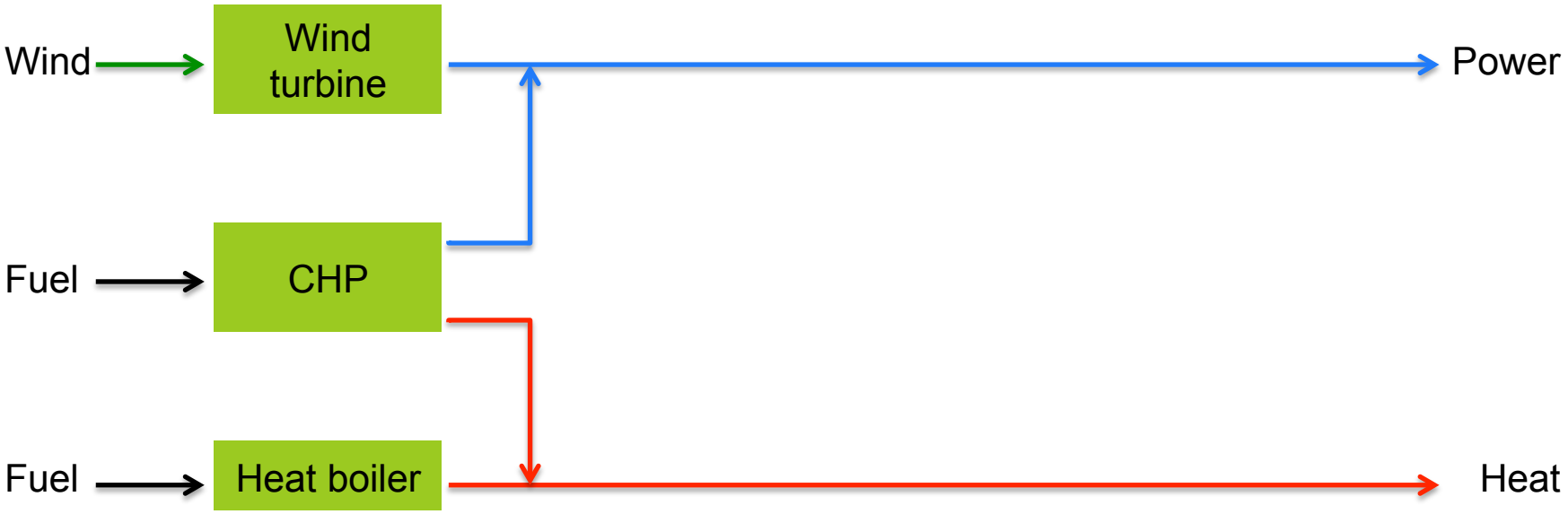
Current system



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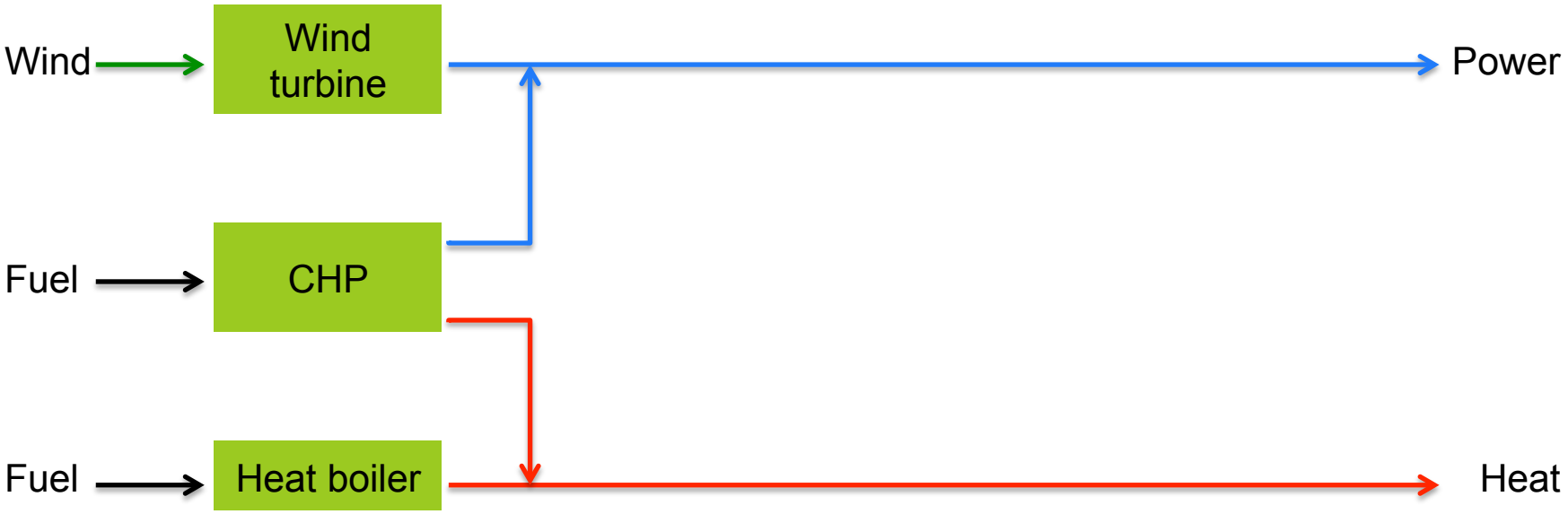
Much wind and need for heat



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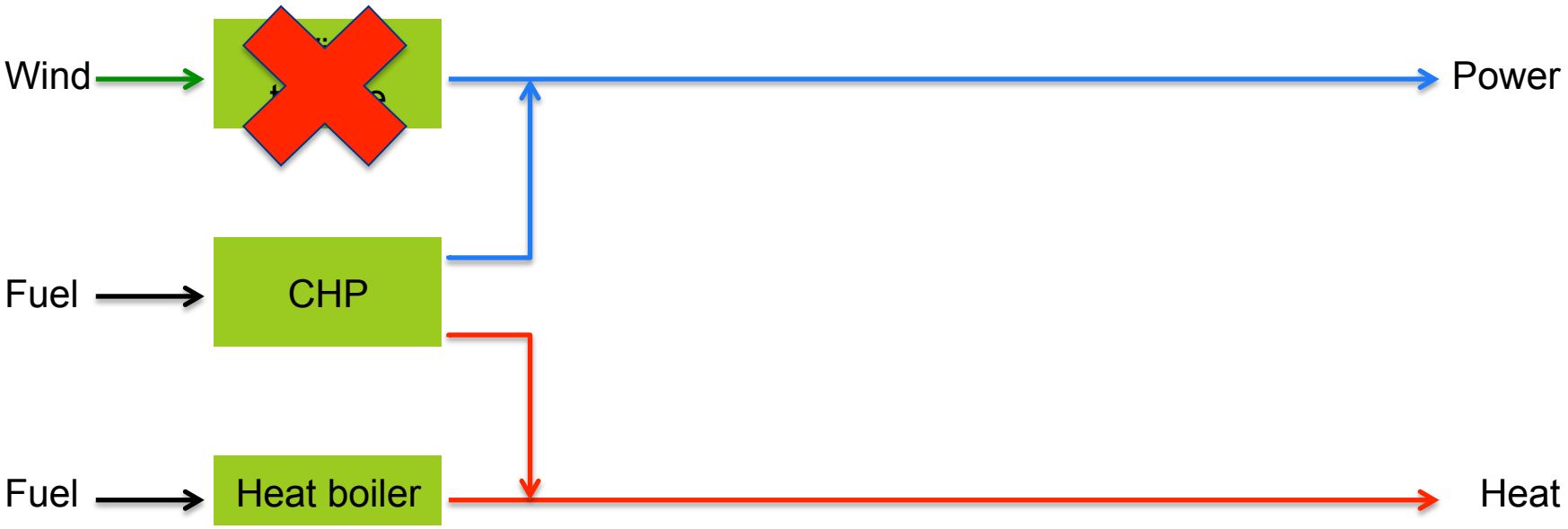
Much wind and need for heat

Curtailment of wind - or



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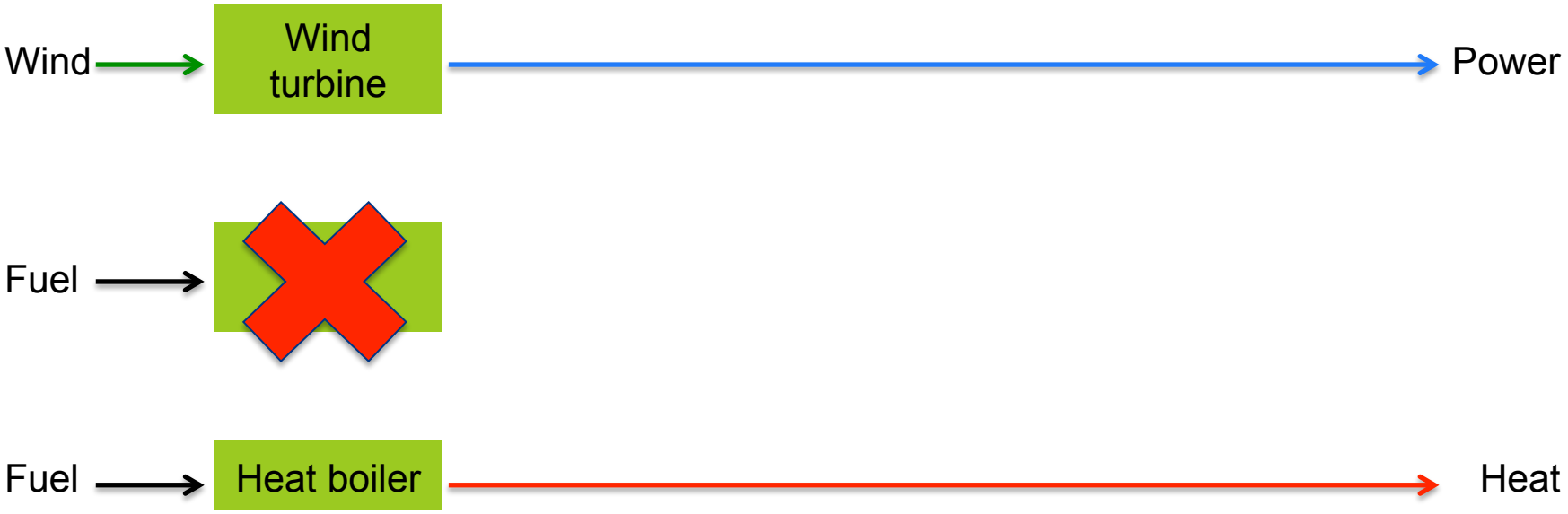
Much wind and need for heat

Curtailment of CHP-plant



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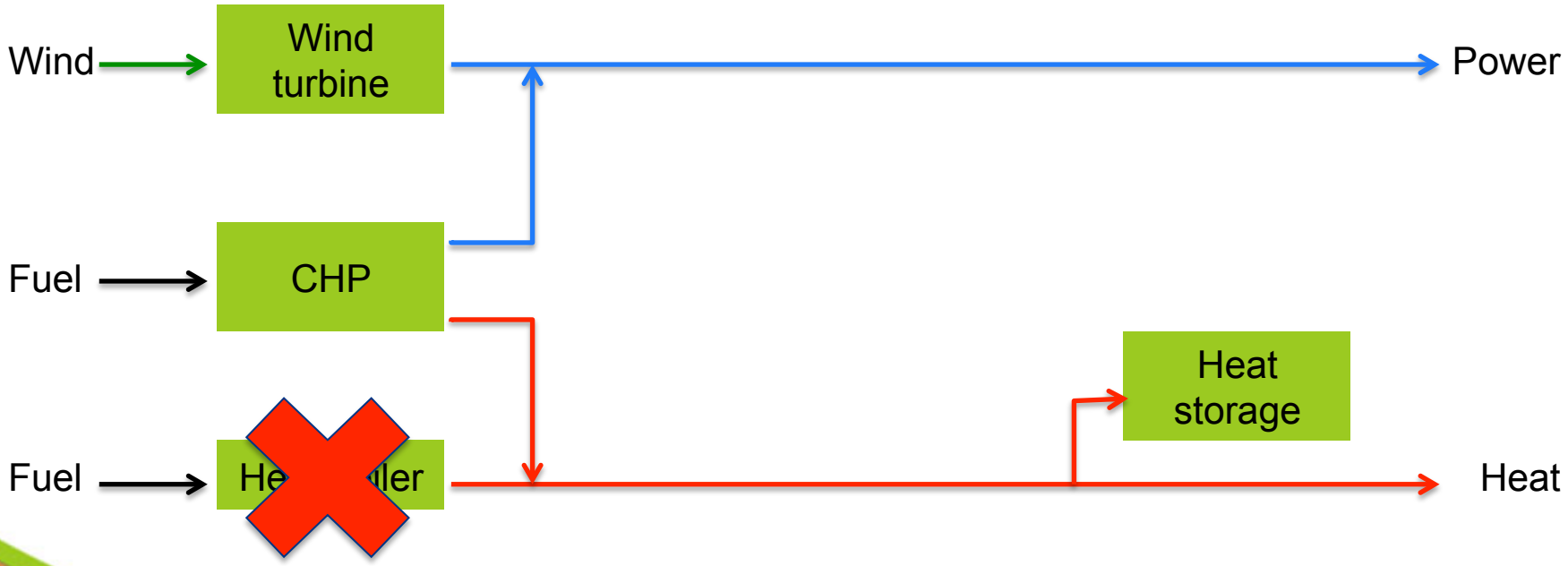
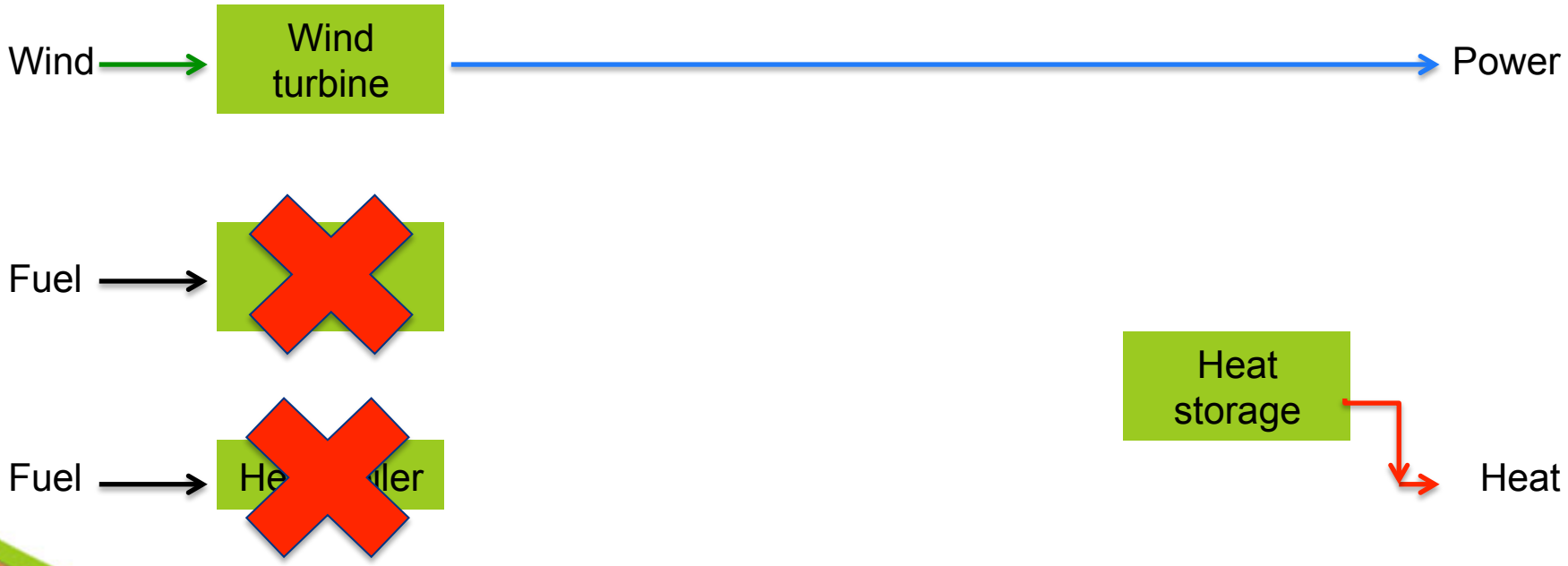
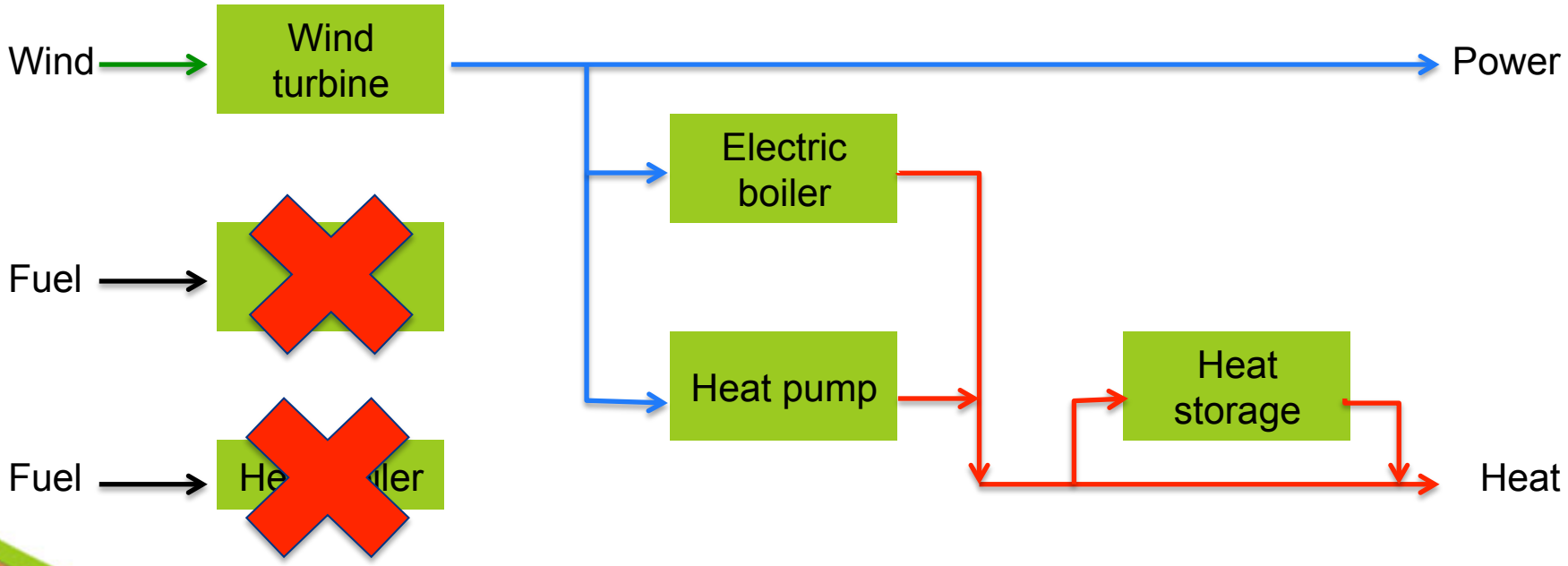
Need for power – less need for heat



Need for heat – less need for power



Much wind – less need for power



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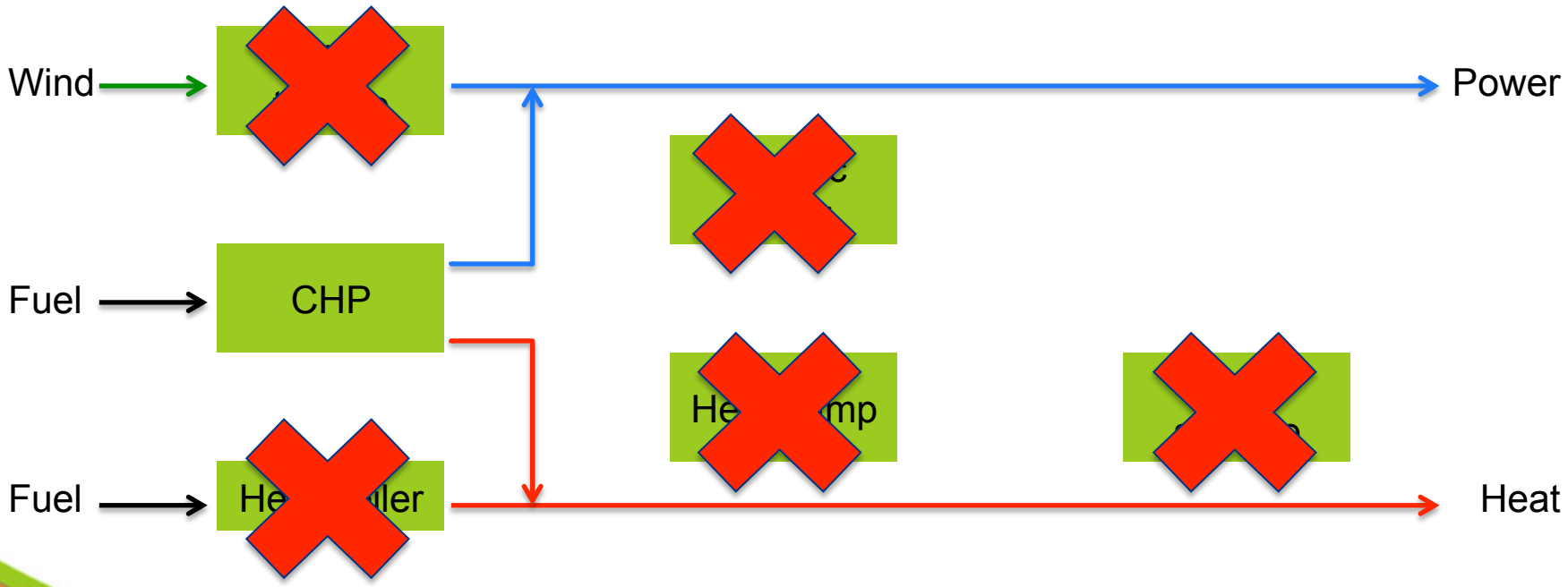
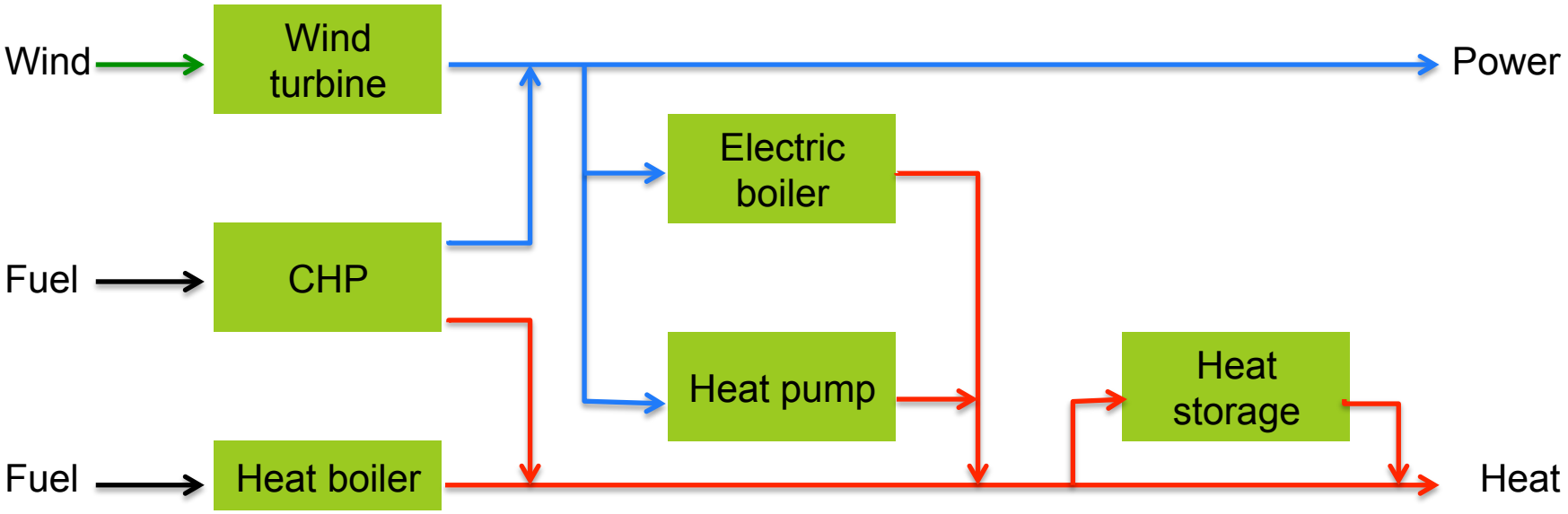
No wind



A flexible power and heat system



BUT -

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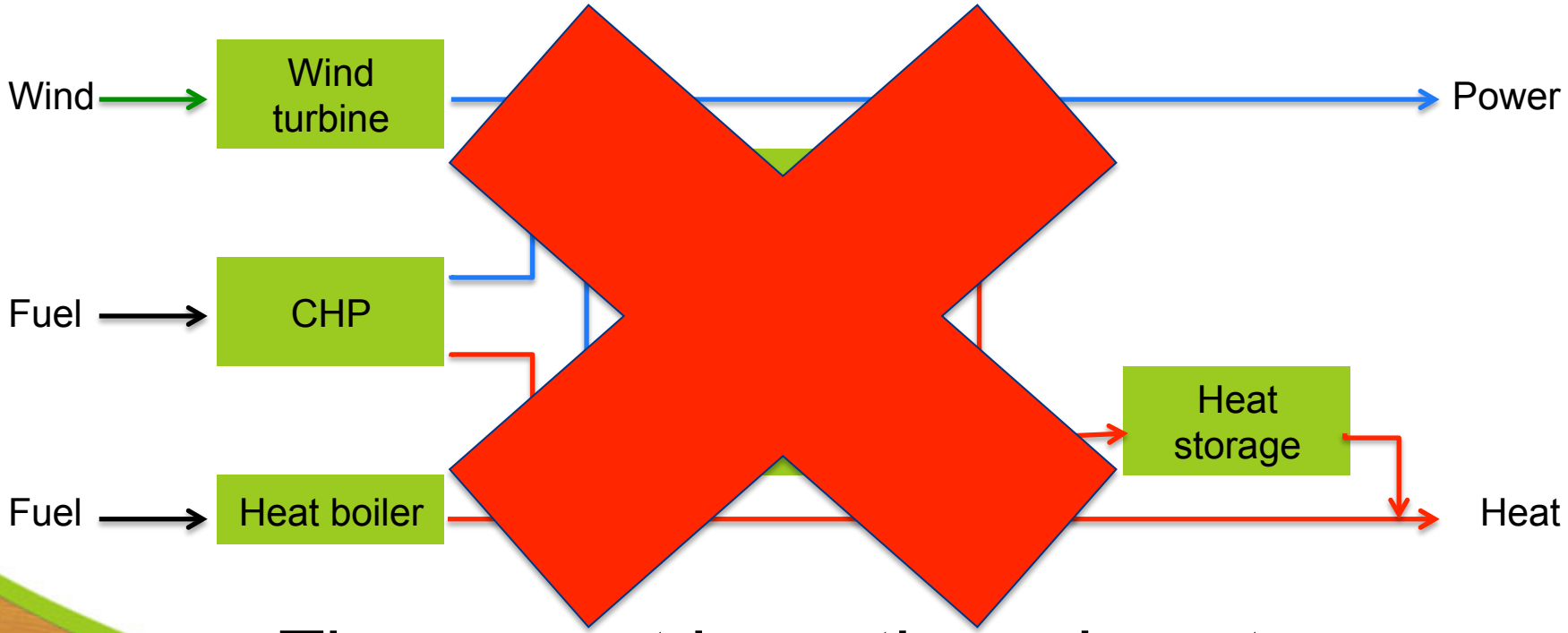
A flexible power and heat system



The current incentives do not support such flexibility

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CNREC – project under preparation

- Analysis of the impact of more flexible power system
- Economic optimisation of the whole system involved
- Who will benefit and who will lose with a more flexible system?
- Which policy measures could ensure a viable solution for all?
- Area: One province – with interconnectors to other provinces

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GRID PLANNING

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10-Year Network Development Plan 2012

European Network of Transmission System Operators for Electricity

entsoe

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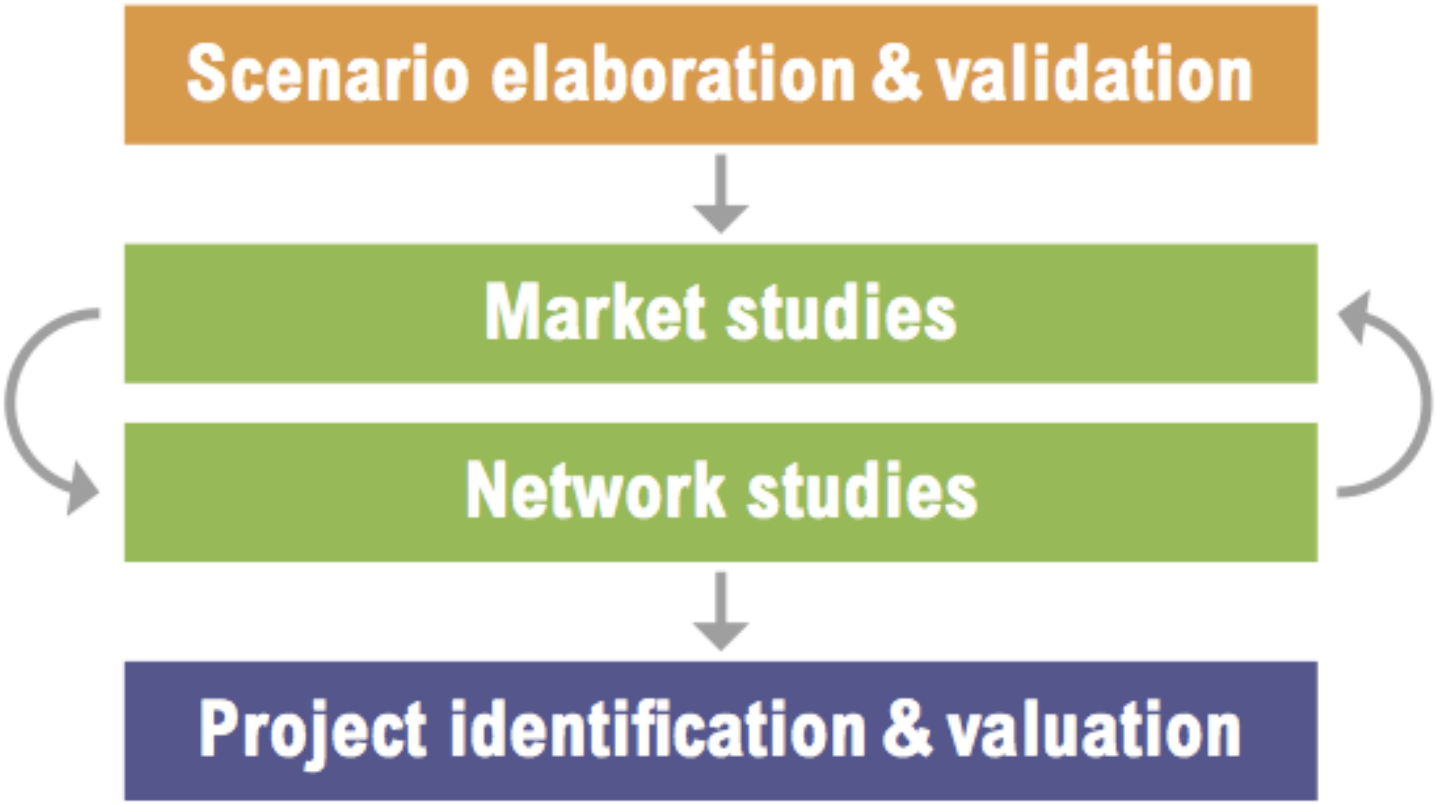
Methodology



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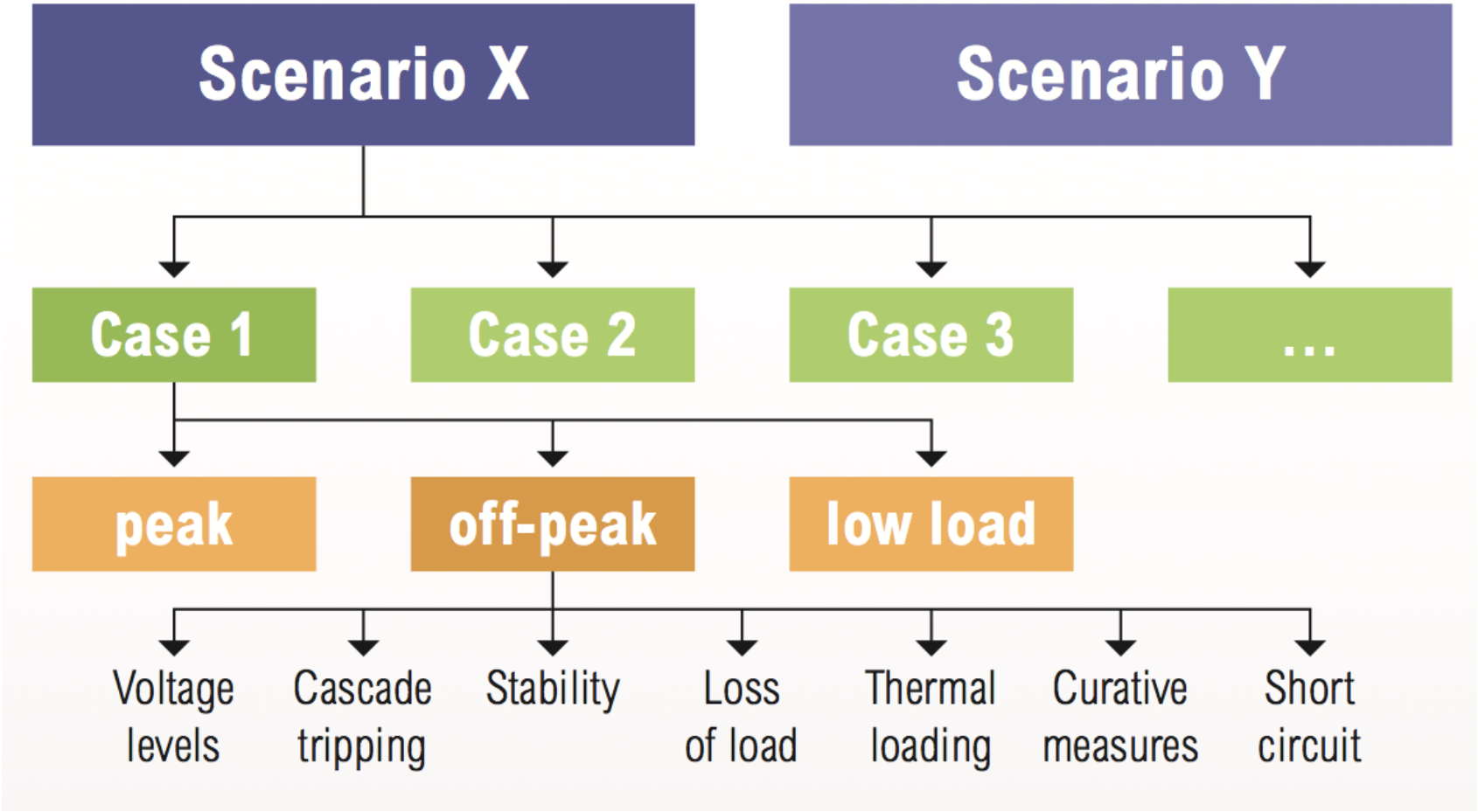

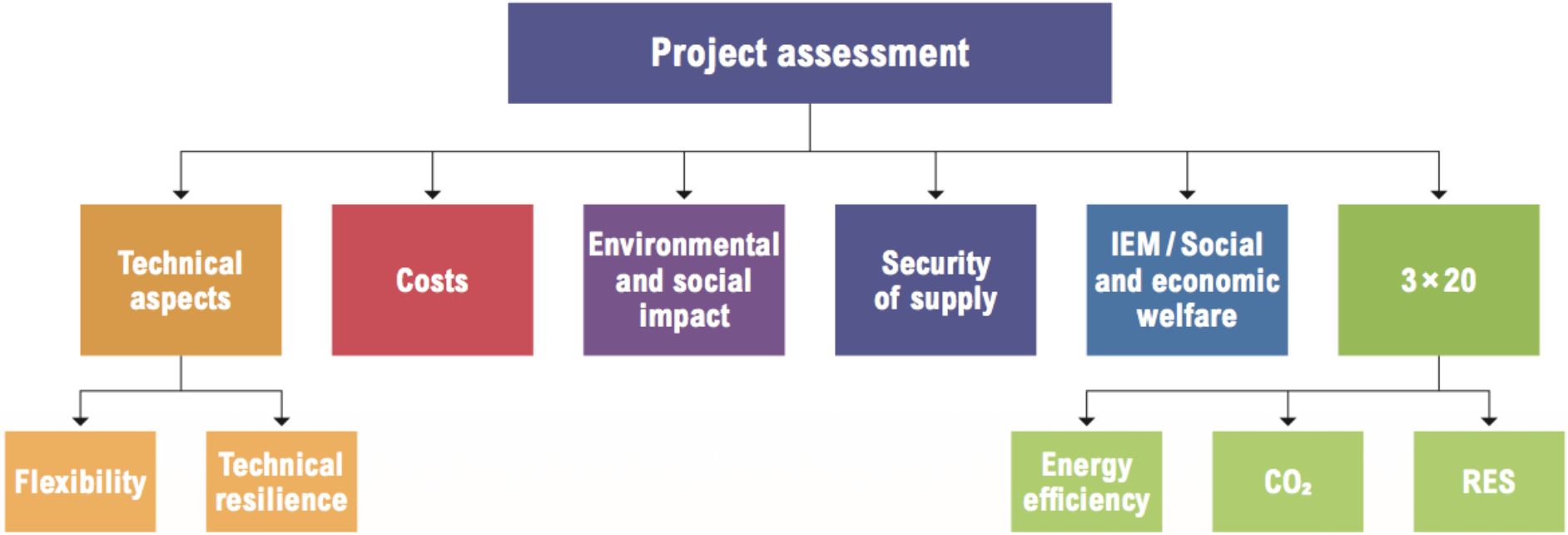

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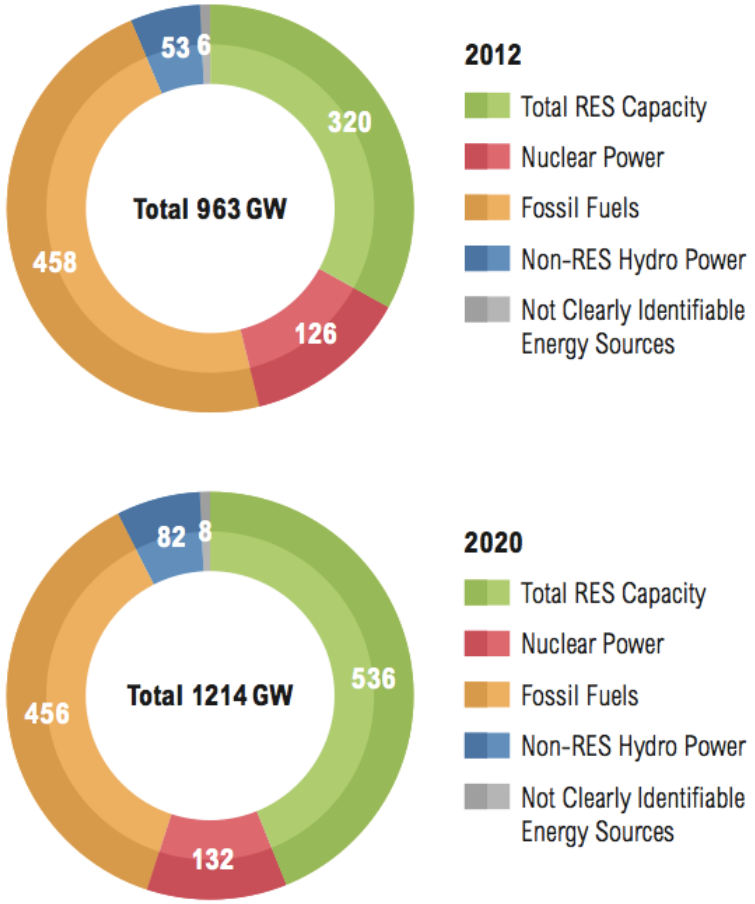
Europe power development to 2020

- Capacity grows from 963 GW to 1214 GW
- Fossil fuels and nuclear same level
- High growth in RE



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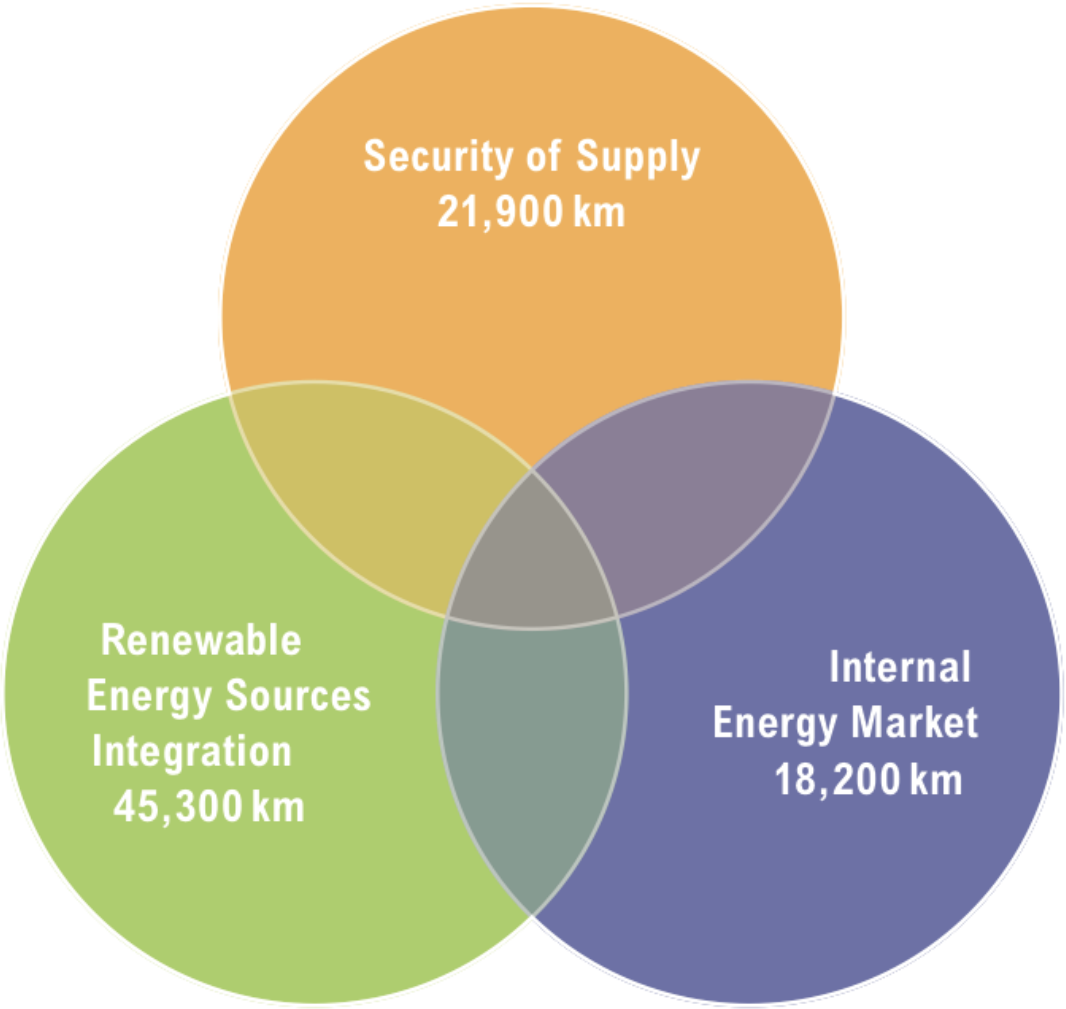
Reasons for grid expansion



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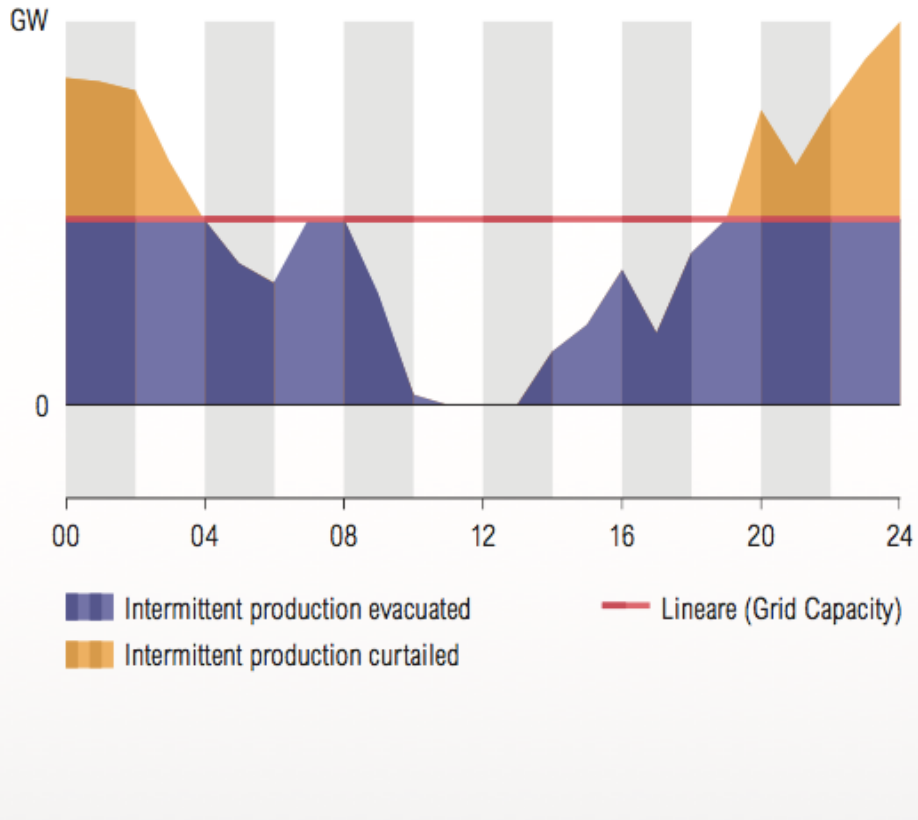
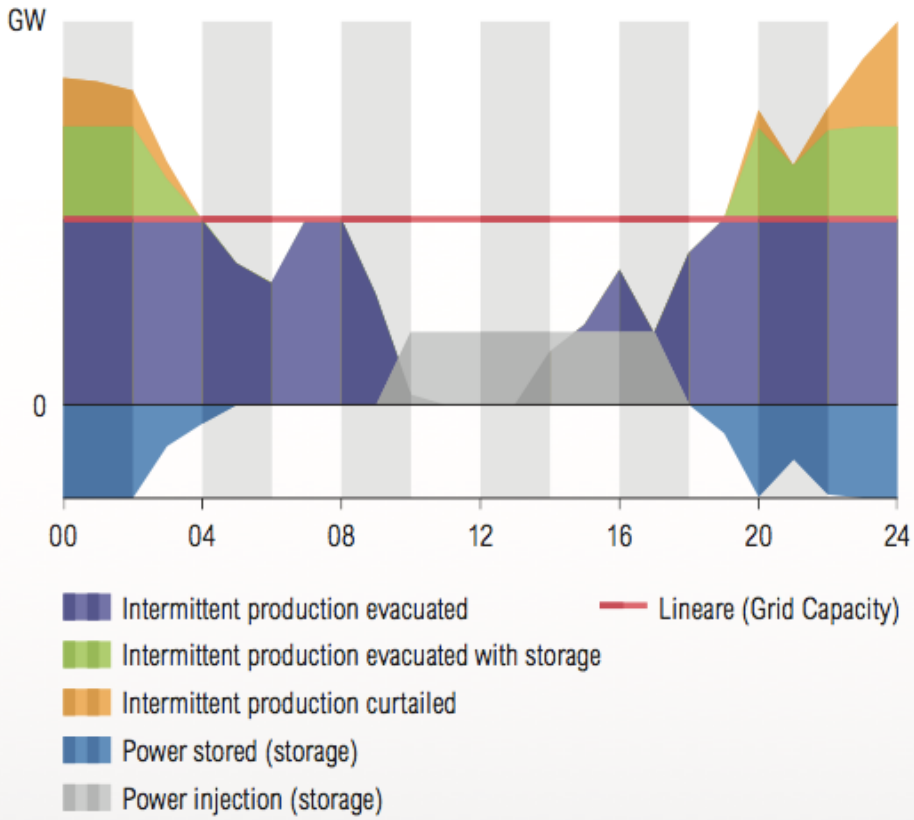
Storage?





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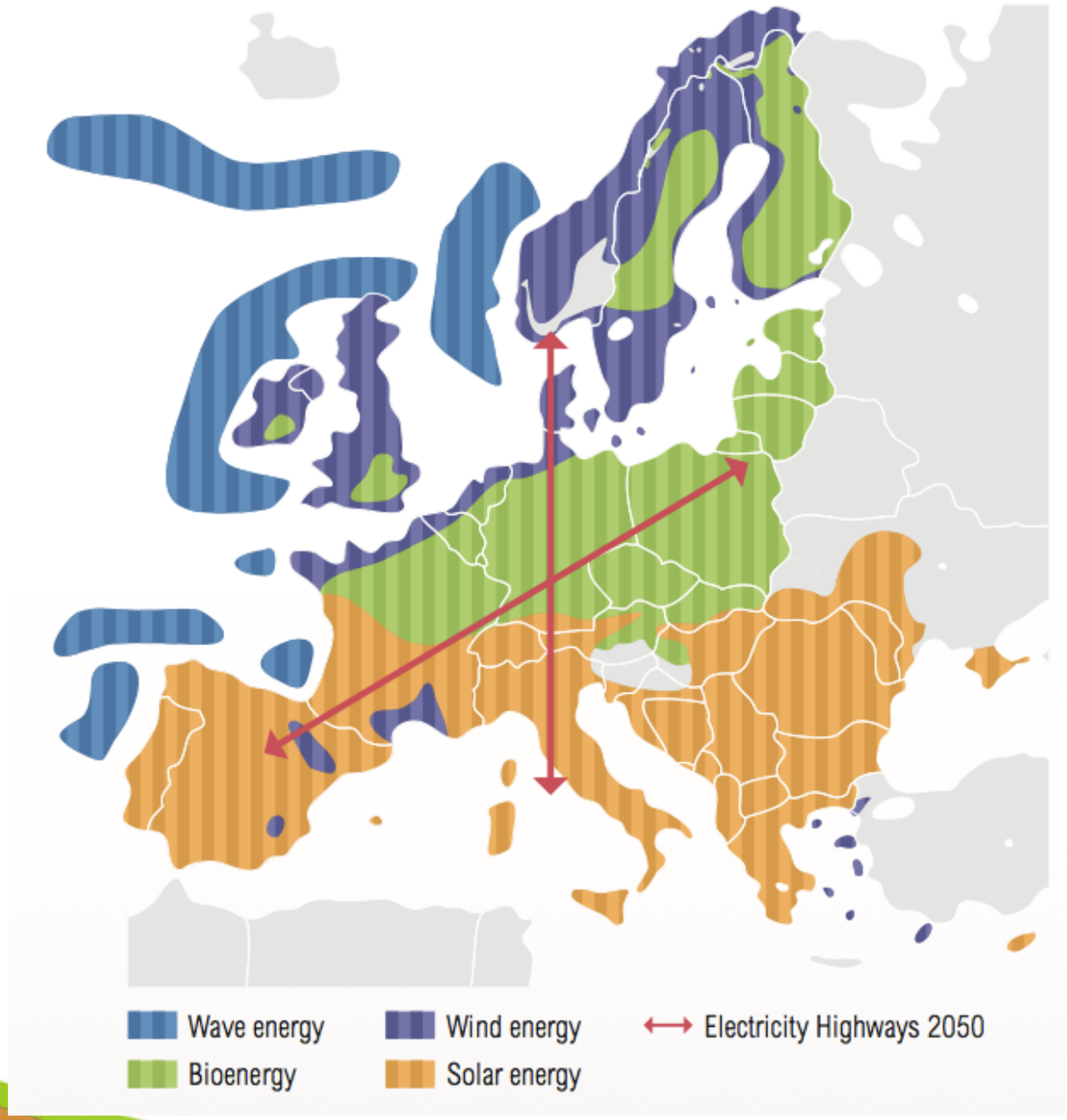

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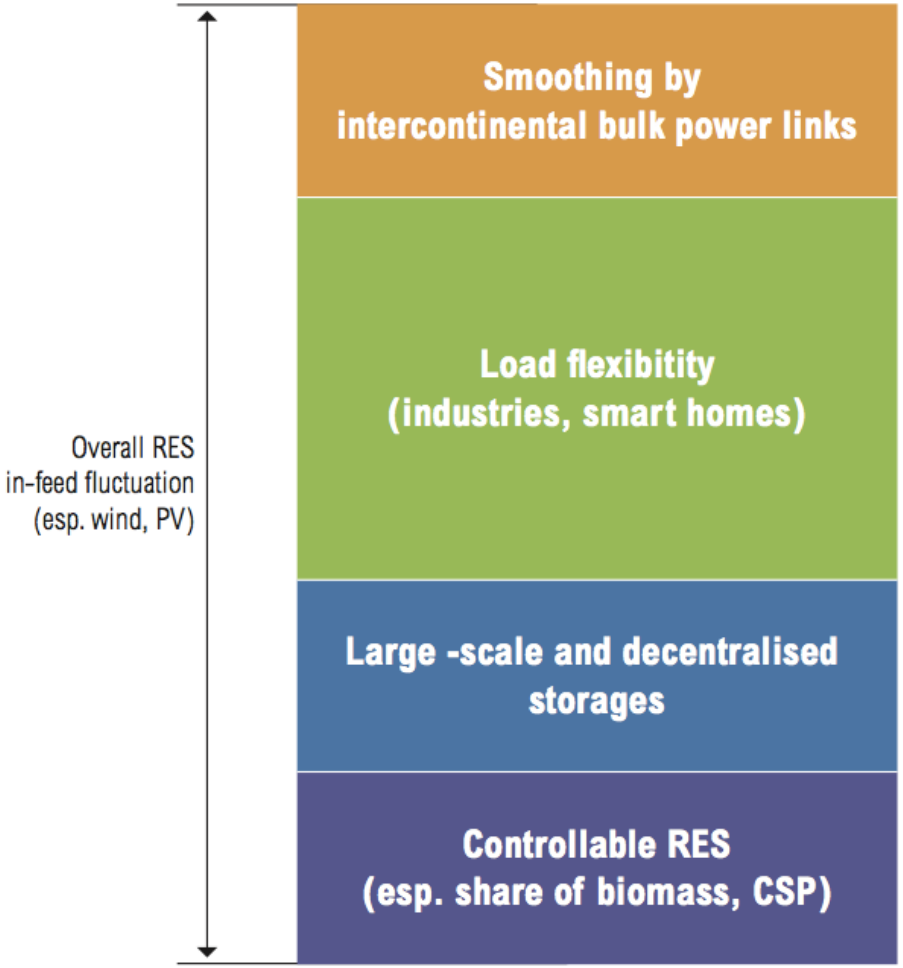
2050 fluctuation control



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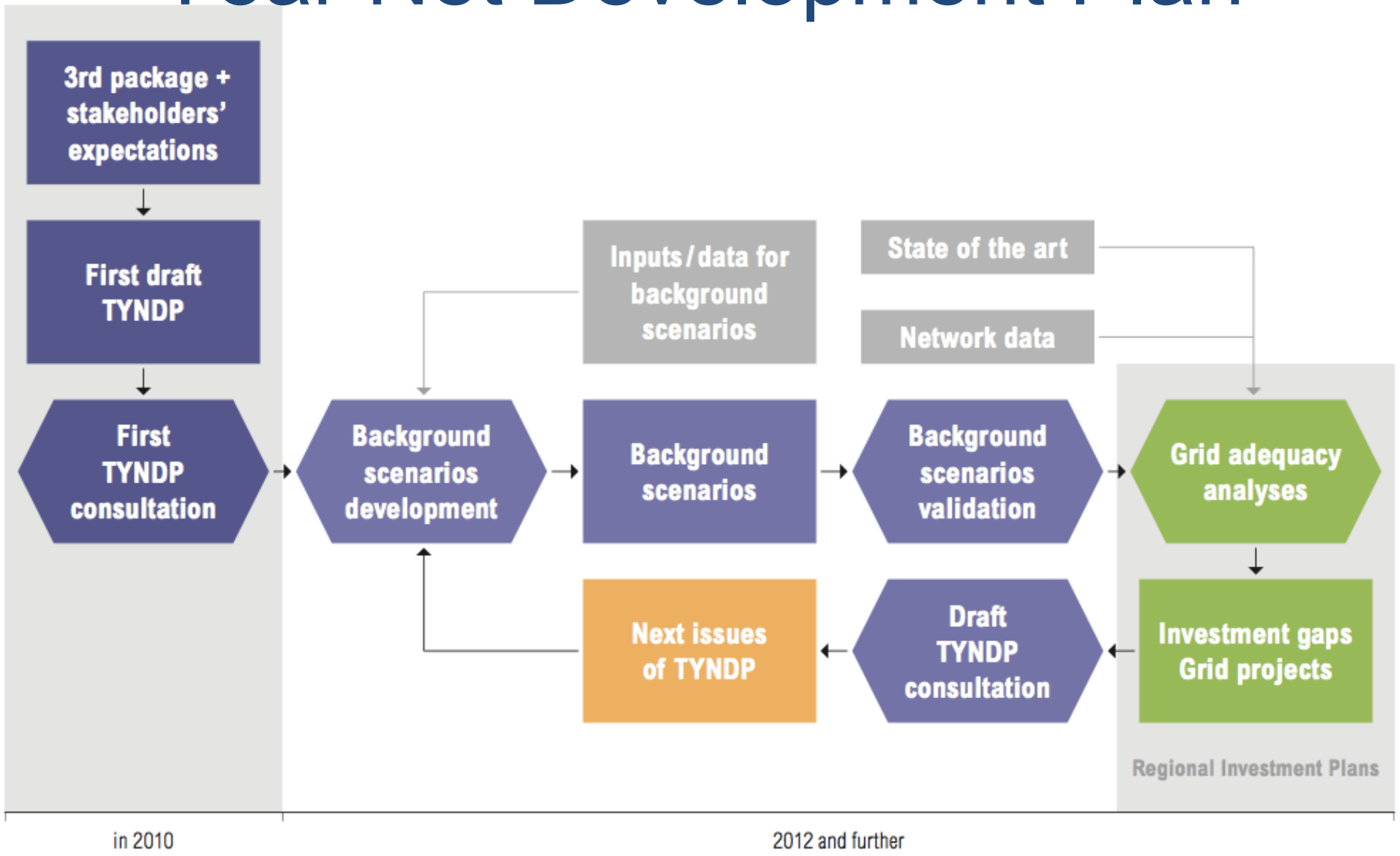
Stakeholder involved in the Ten Year Net Development Plan



Conclusions on grid planning

- Cooperation between TSO necessary – and has developed quickly based on EU legal requirements
- Grid planning is based on scenarios for development of load and production
- All stakeholders involved in the planning process through hearings etc.
- Location of RE crucial for the need for grid expansion

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Challenges

- Difficult to predict the development of the future generation mix
- Long time from planning to decision and implementation
- Financing and public acceptance the most difficult issues to deal with
- How to make robust grid plans in time

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CNREC activities

- Catalogue of generation technologies with future development trends - easy to compare
- Cost-of-Energy analyses for RE technologies compared with conventional technologies
- Scenario analyses to 2050 – Large RE share in the Chinese energy system
- A large number of stakeholders involved

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THANK YOU FOR YOUR ATTENTION

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