

Options for flexibility

Energy system integration requires changes to market design

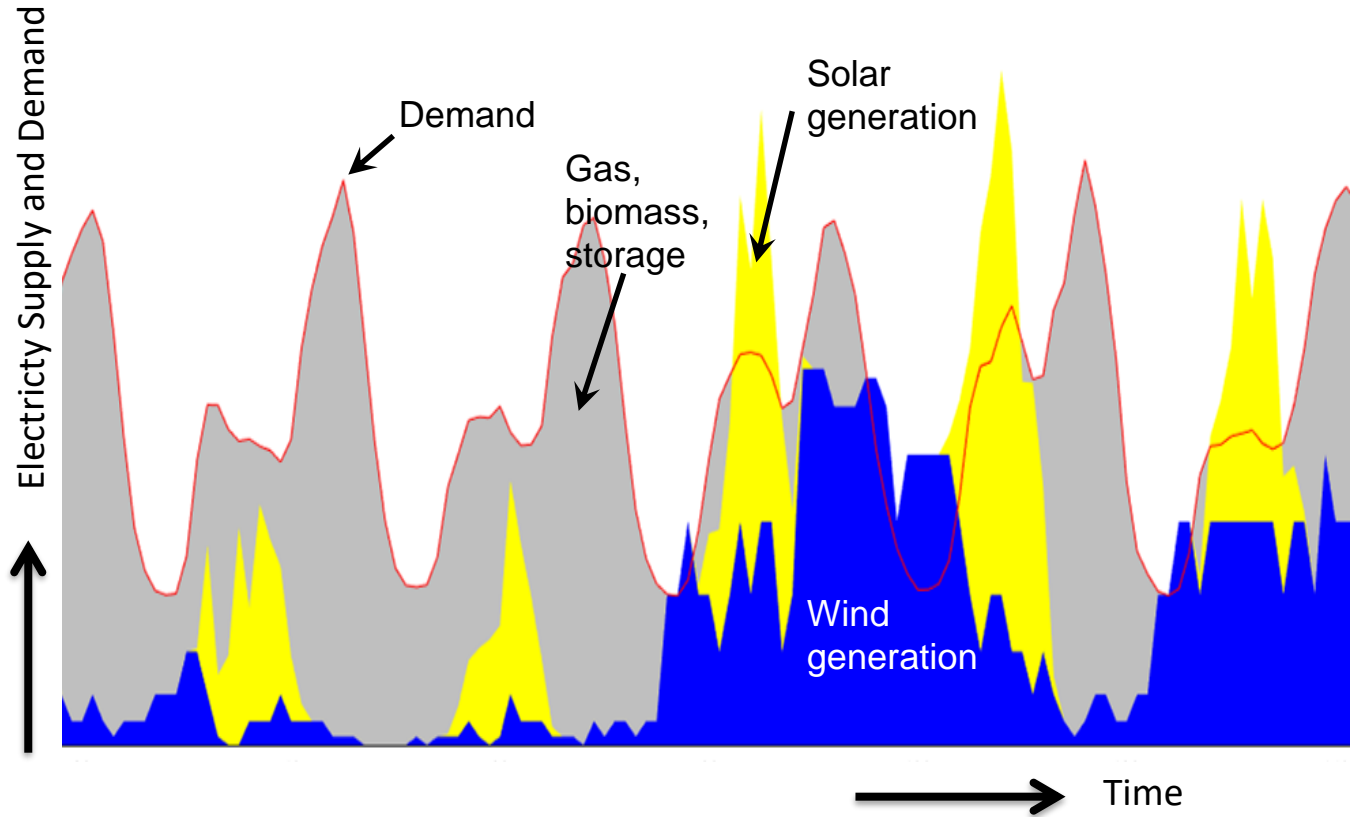
Laurens de Vries

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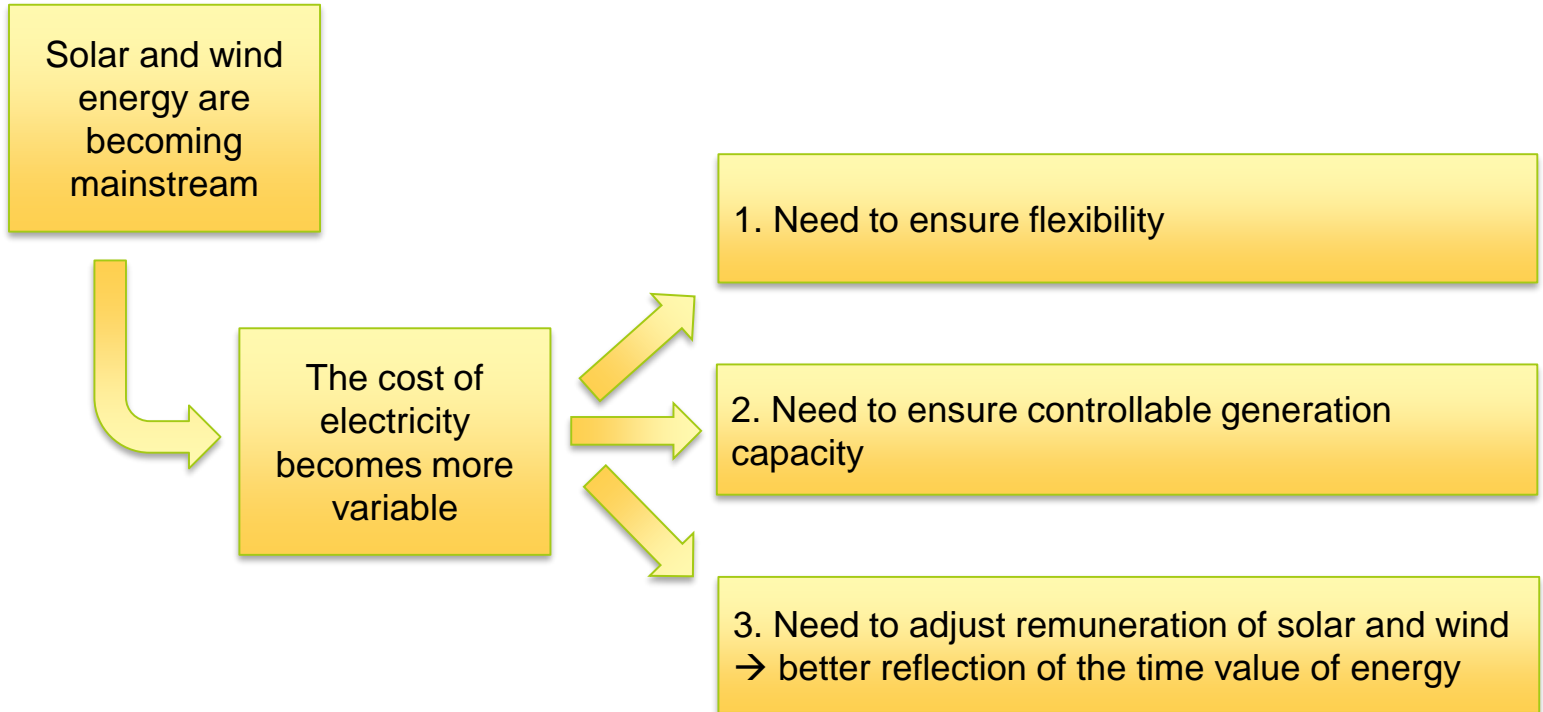
Coordinator, European Energy Research Alliance Joint Programme on

Energy Systems Integration

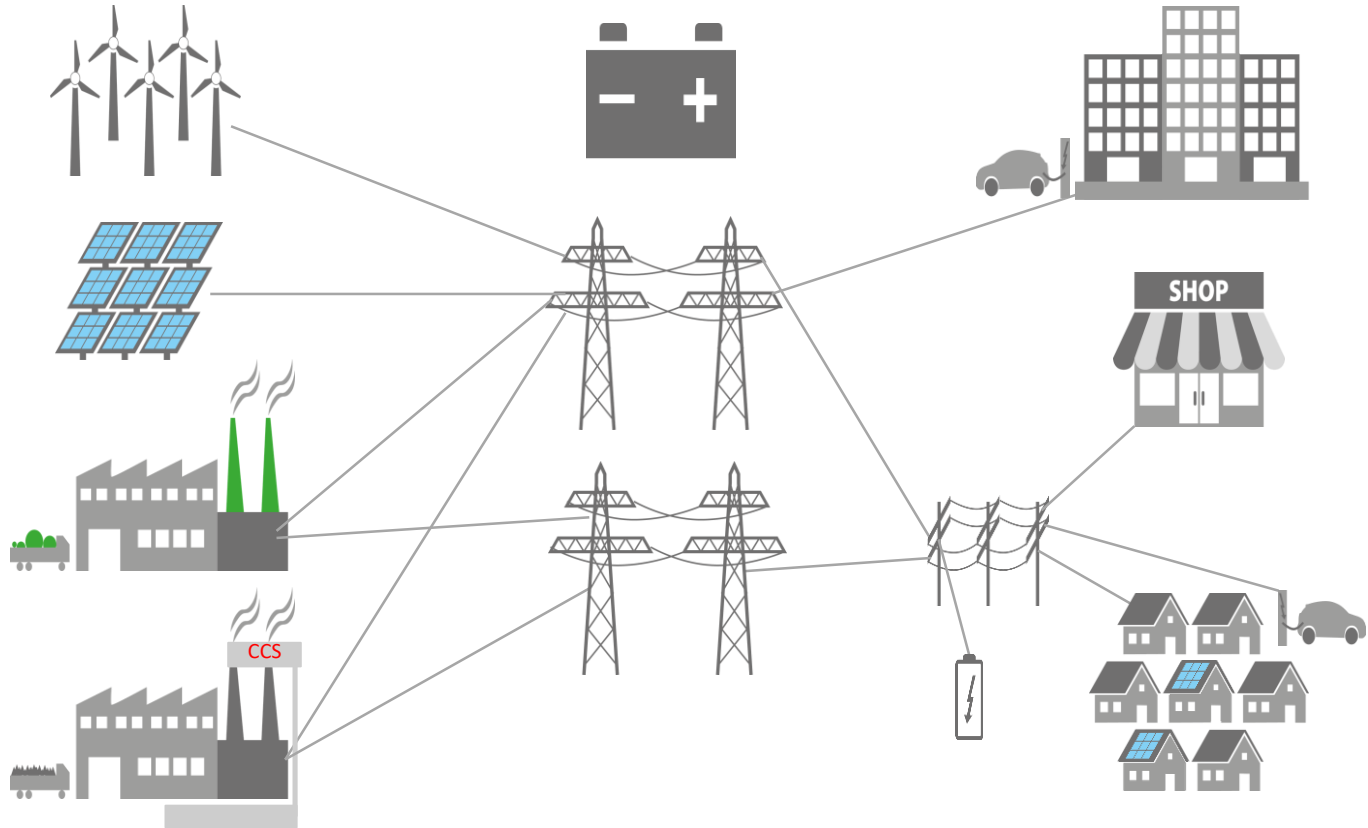
The impact of variable renewable energy



Changing requirements for the design of the electricity market



1. Flexibility options



Flexibility challenges

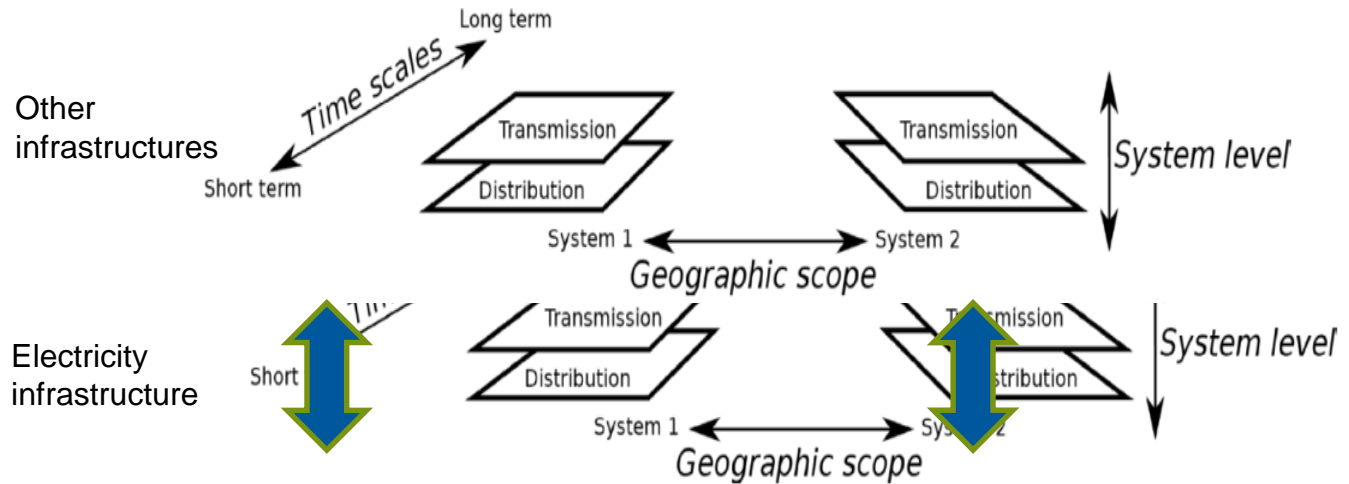
- Level playing field for:
 - All renewable energy sources
 - Wholesale / retail
 - Between energy carriers
- For example, consumer market design:
 - Need to manage flexible demand, such as EV charging, batteries, electric heating and cooling
 - They should respond to wholesale prices, but not overload the grid.
 - Investment incentives should be aligned across electricity, gas, district heating and transport infrastructures

Flexibility challenges (2)

Example: investment in home batteries:

- Consumer market design should stimulate their flexibility services to the grid, but:
 - The same incentives should be given to flexible EV charging and other demand response.
- Large-scale storage and controllable generation should receive the same incentives.
- If batteries create network congestion, they should change their operational mode: lower cost than network investment.
- Network investment can be cheaper than other flexibility options.

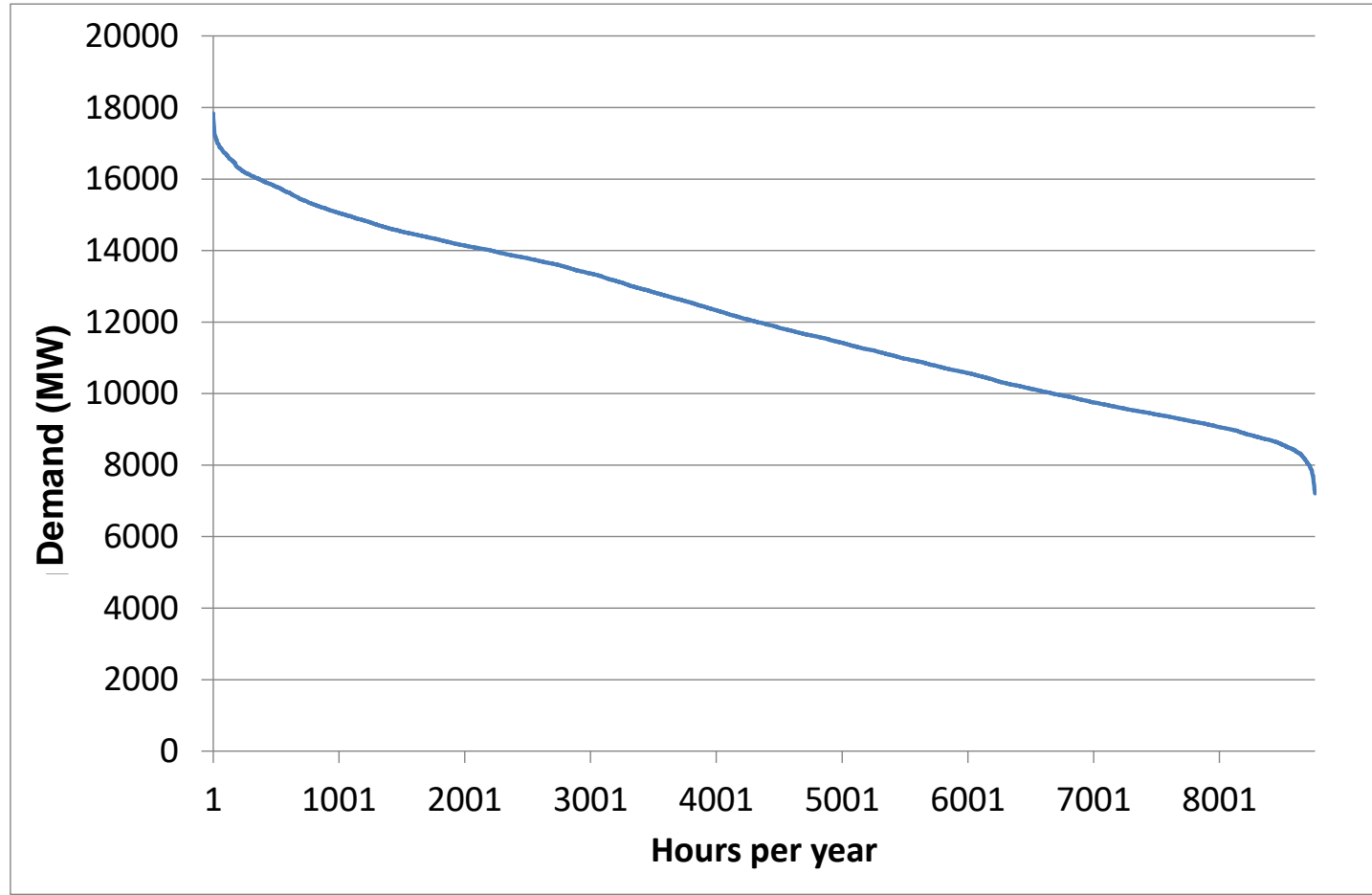
Challenges to system integration



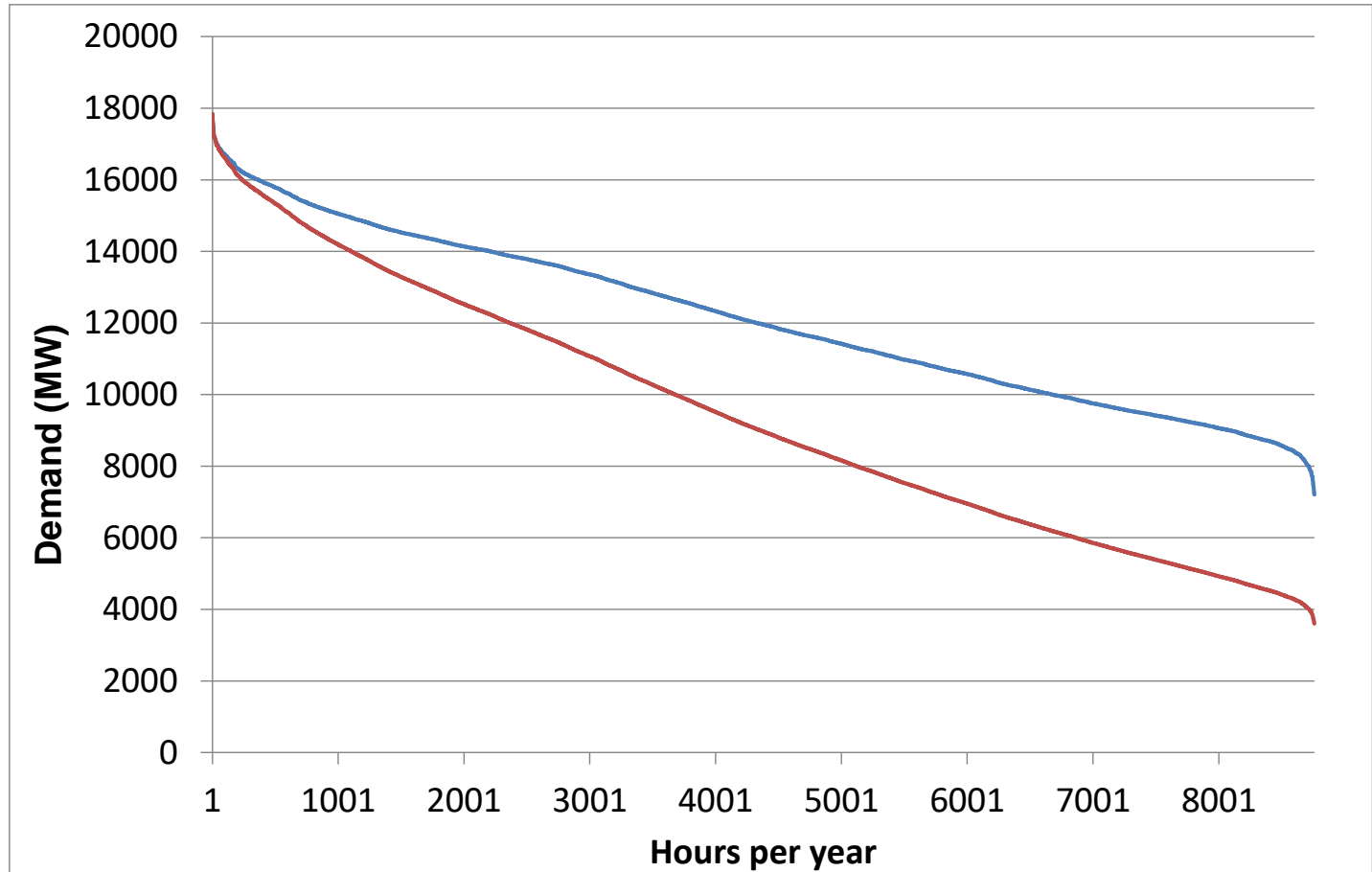
System integration... (conclusion)

- Operations
 - Investment choices
 - Network development
 - Policy making and market design
 - Research and analysis
- } industry
- TSOs and DSOs
- government
- knowledge institutes

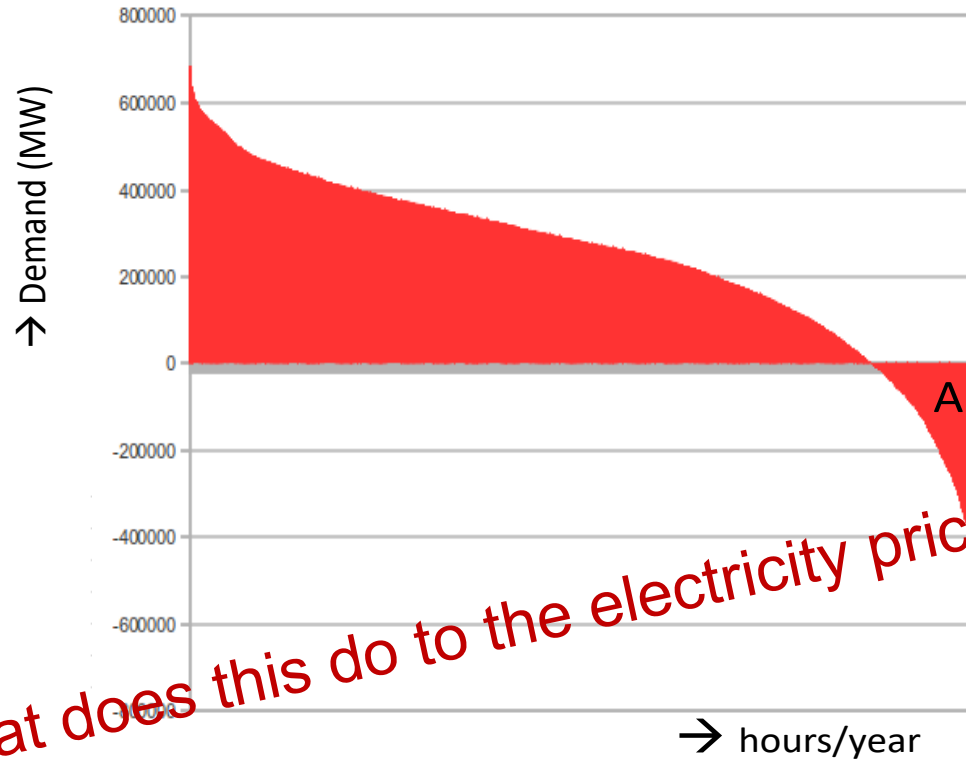
2. Controllable generation: the load-duration curve...



The load-duration curve...

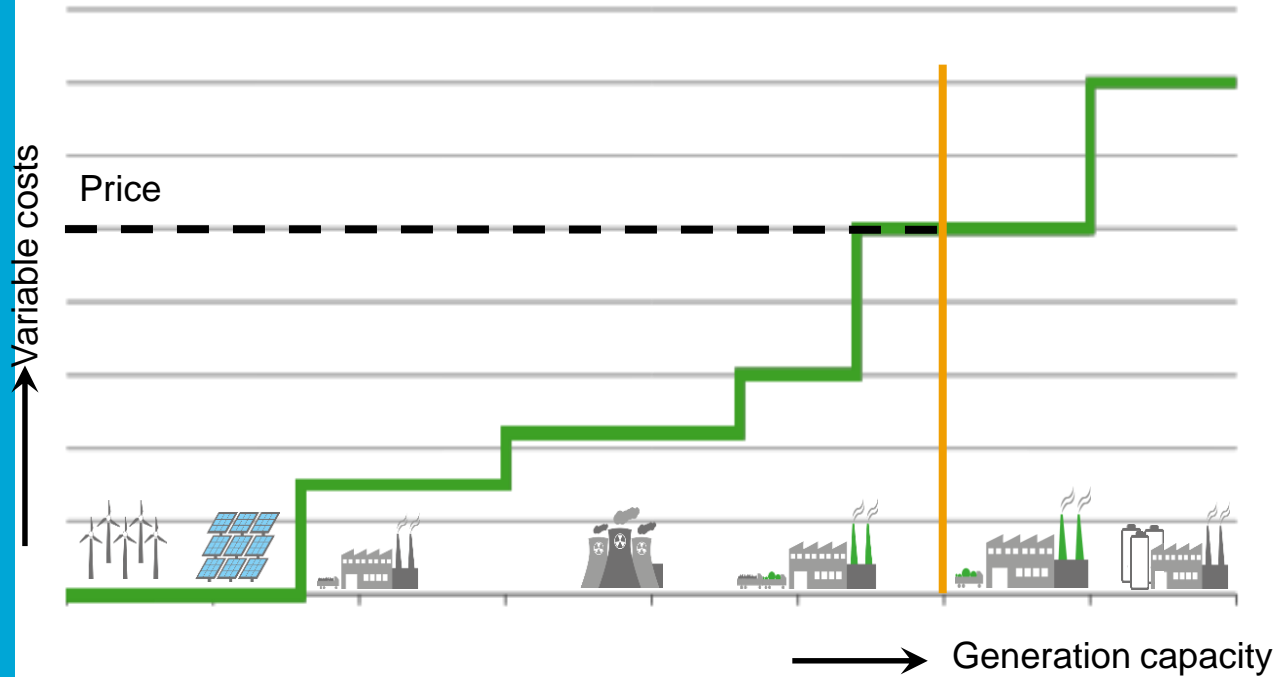


The impact of solar and wind...



What does this do to the electricity price?

The impact of solar and wind on prices...

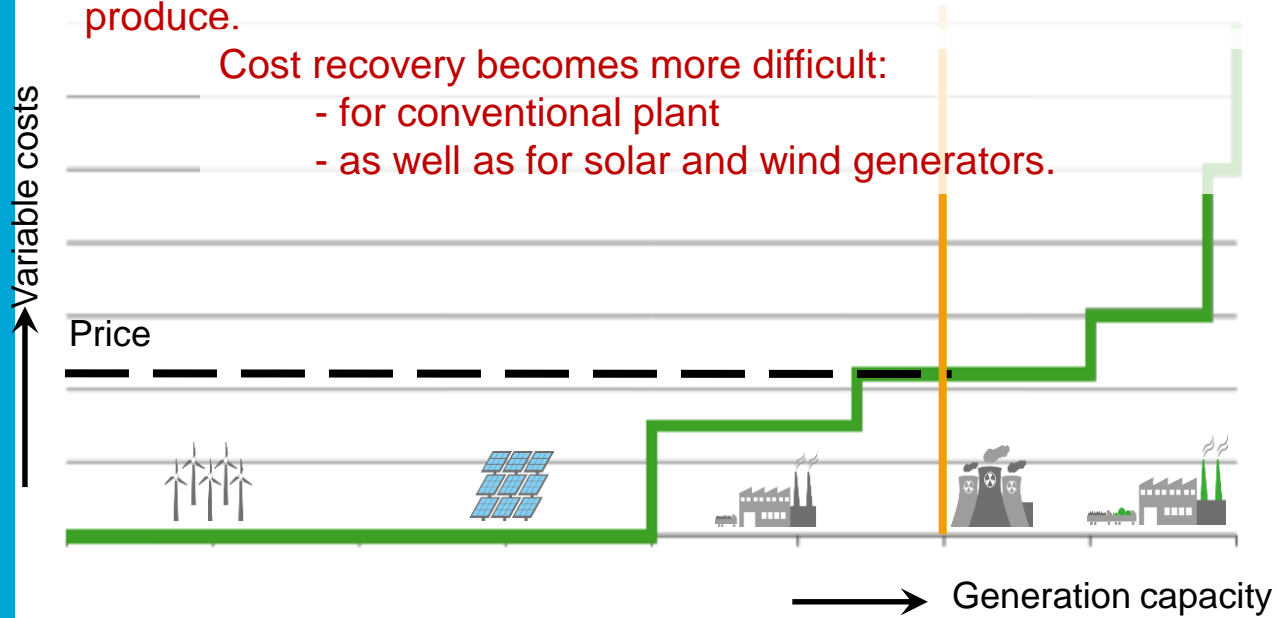


The impact of solar and wind on prices...

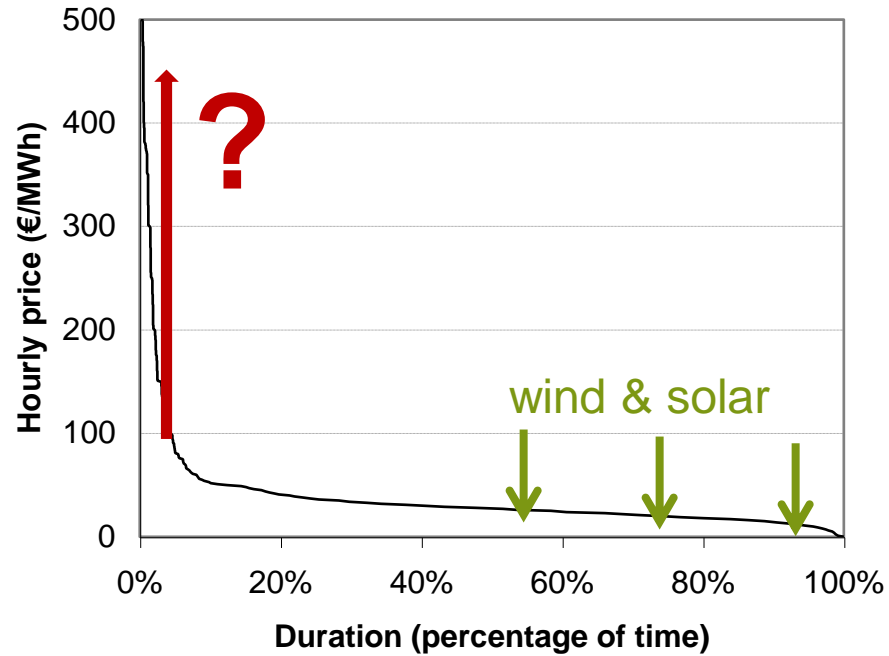
Solar and wind generators push the market price down when they produce.

Cost recovery becomes more difficult:

- for conventional plant
- as well as for solar and wind generators.



Changing price profile



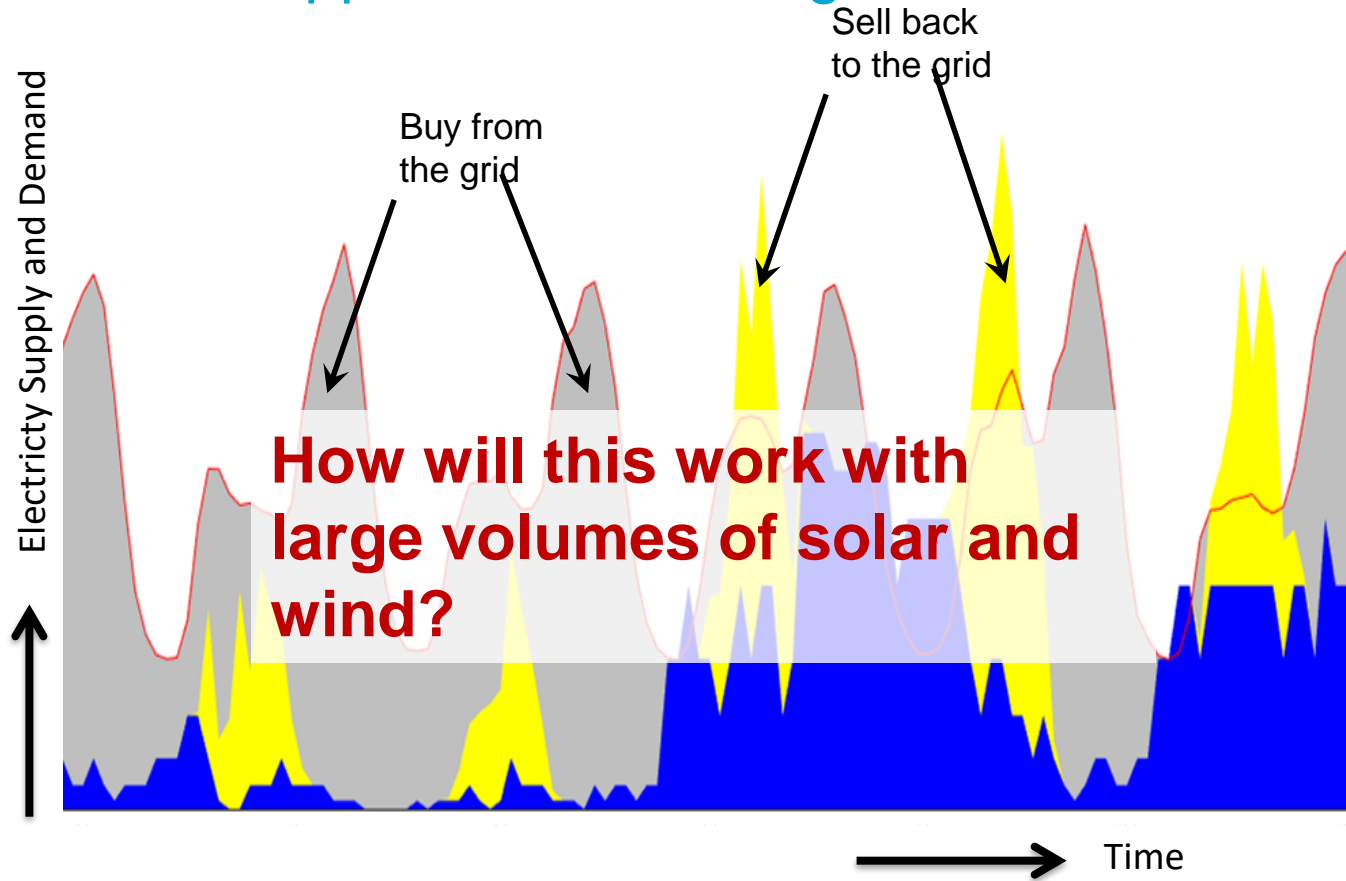
Problems with short-term markets

- Prices are volatile, will become more so with solar and wind.
 - Unpredictable
 - Increasing year-on-year changes to price profile!
 - High investment risk for solar and wind as well as for controllable generation
- Prices are dropping when solar and wind produce
 - Cost recovery remains a challenge, despite falling costs of generation

Need additional incentives for investment security

- Additional challenges:
 - Policy uncertainty
 - Renewable energy policy
 - CO₂ policy and price
 - Network development
 - Fuel price risk, demand development (electrification?)
- Solution (?):
 - Capacity market
 - Or: capacity subscription
 - More advanced, consumer-oriented, but not proven

3. RES support: net metering is not sustainable



Wholesale investment in renewables

- Dutch/Danish tenders for renewable energy: seem to work well.
 - Government provides location, site studies and permits.
 - TSO provides grid connection.
 - Investors bid for needed subsidy.

 - Tenders will phase themselves out if the technology begins to recover its cost in the wholesale market..
- Problem: still no reflection of the time value of electricity
 - Option: pay for generation *capacity*, not *energy* output.
 - Or stop paying subsidy when the electricity price ≤ 0 .

Small-scale consumers: beyond net metering

- Let self-generation be netted with consumption *in real time only*.
- And small consumers should pay and receive *real-time prices*.
- How to ensure enough household investment in renewable energy?

Coordinating renewable energy generation – wholesale and retail

- Add the costs of the renewable energy tenders to the consumer price of electricity...
- ... Then there is a level playing field for self-generation
→ no need for subsidies.
- This should also provide an efficient incentive for storage behind the meter!

- Drawback: consumer price not exactly the same as marginal cost
 - Because of RES levy.
 - And due to VAT.

- Option 2: If renewable generation *capacity* is subsidized
 - The tender amount is also paid to small-scale generators.

Conclusions

- More RES → more flexibility
 - More flexibility → energy systems integration
 - Energy systems integration → improvement of market design
- Controllable generation (including biomass, large-scale storage) probably requires a capacity market or capacity subscription
 - Need to optimize demand response!
- Renewable energy markets need to be redesigned
 - Coordination of local and wholesale
 - Balance between short-term incentives and investment security.