

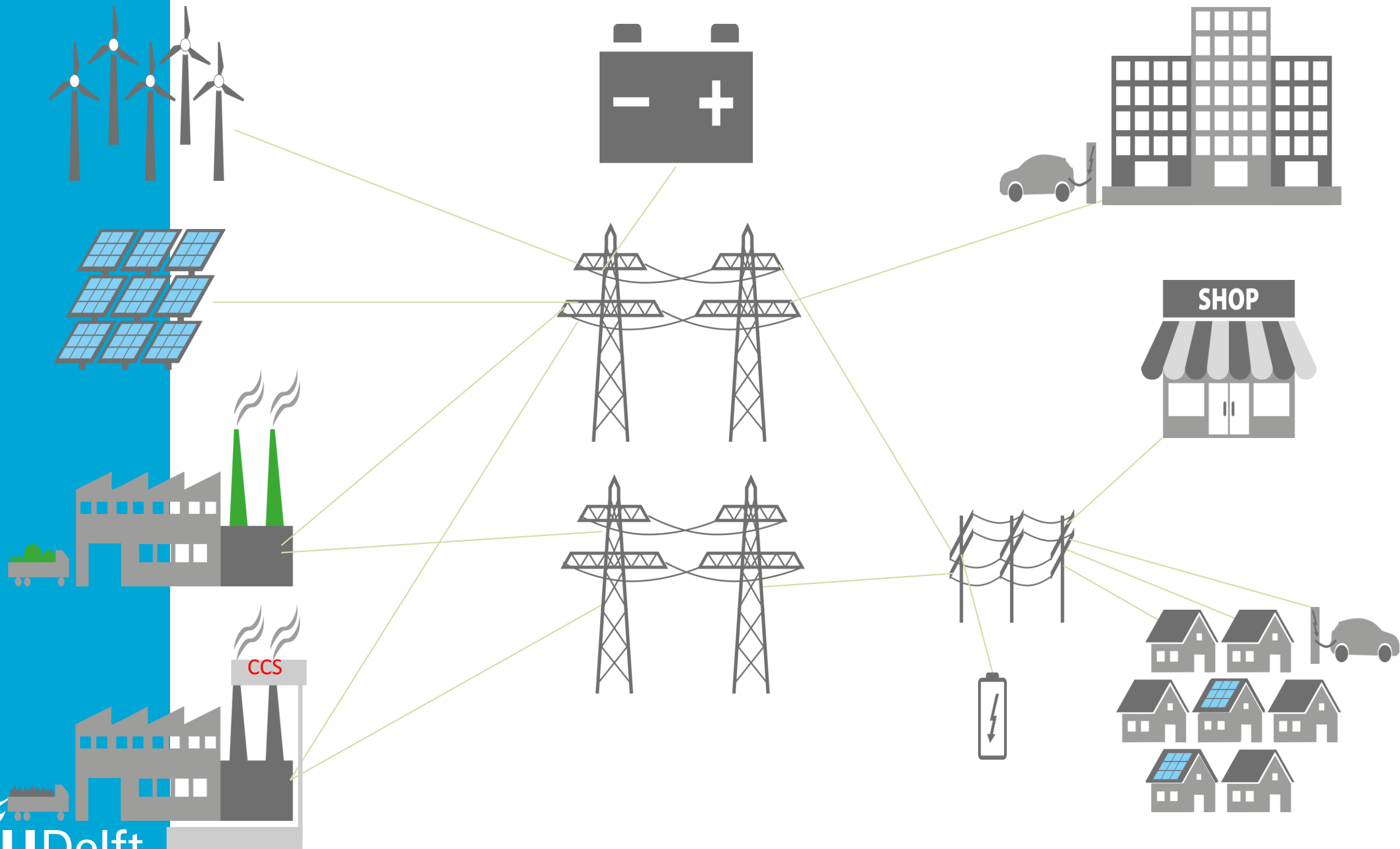
Electricity market design based on consumer demand for capacity

Laurens de Vries & Gerard Doorman

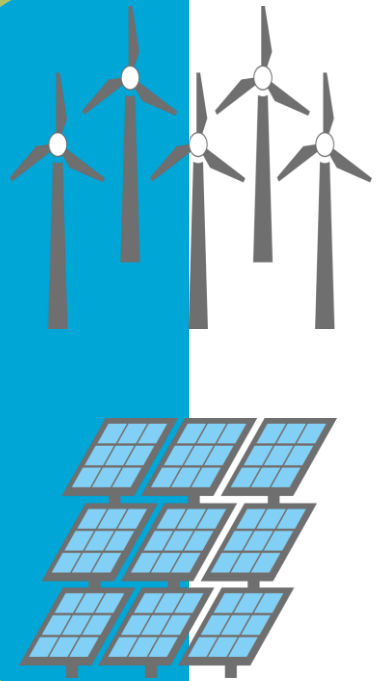
Eurelectric/FSR challenge:

‘Design the electricity market(s) of the future’ – What market design for a decarbonized electricity market?

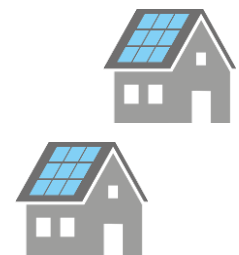
The changing power system



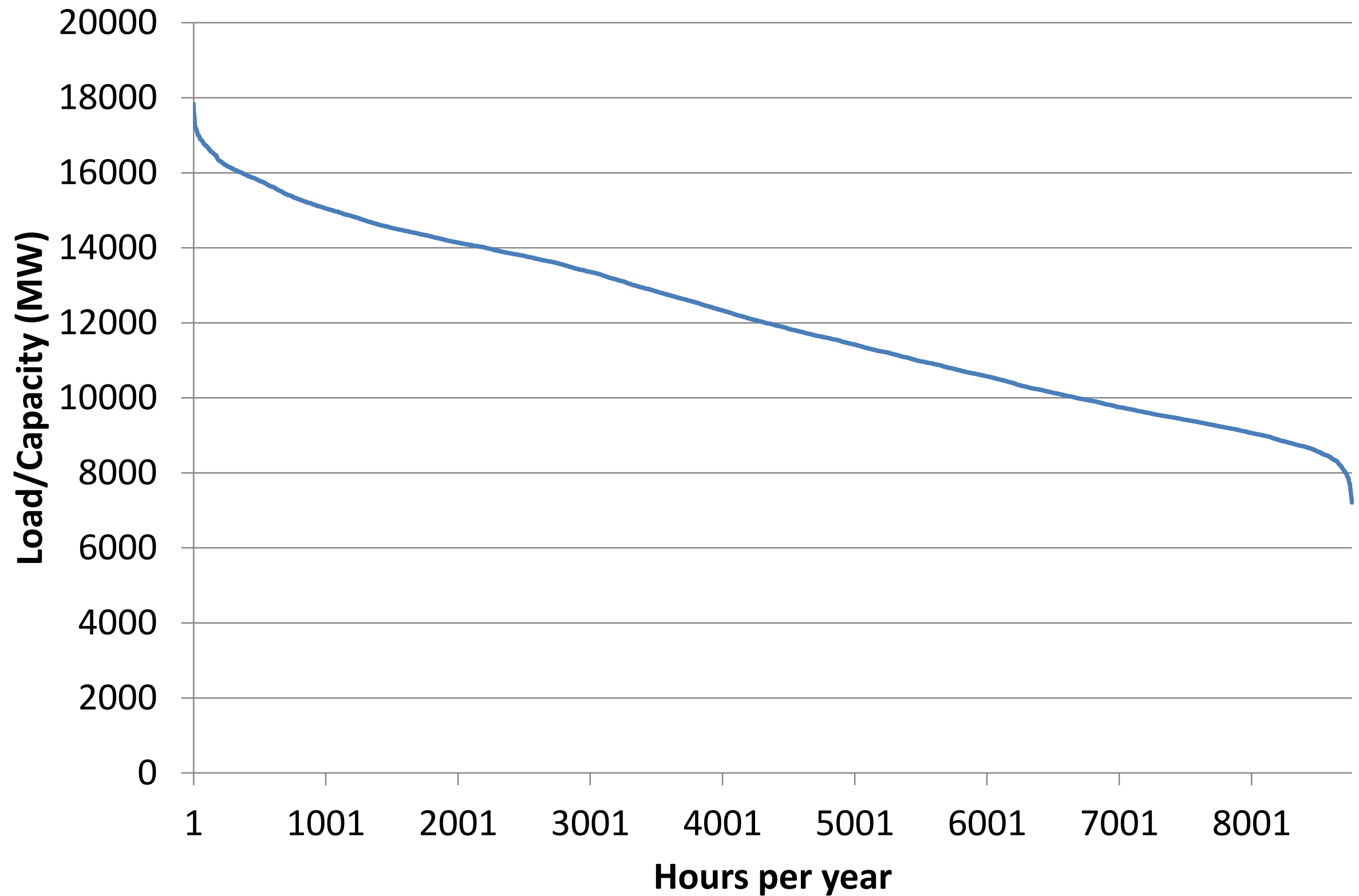
Challenges for low-carbon energy systems



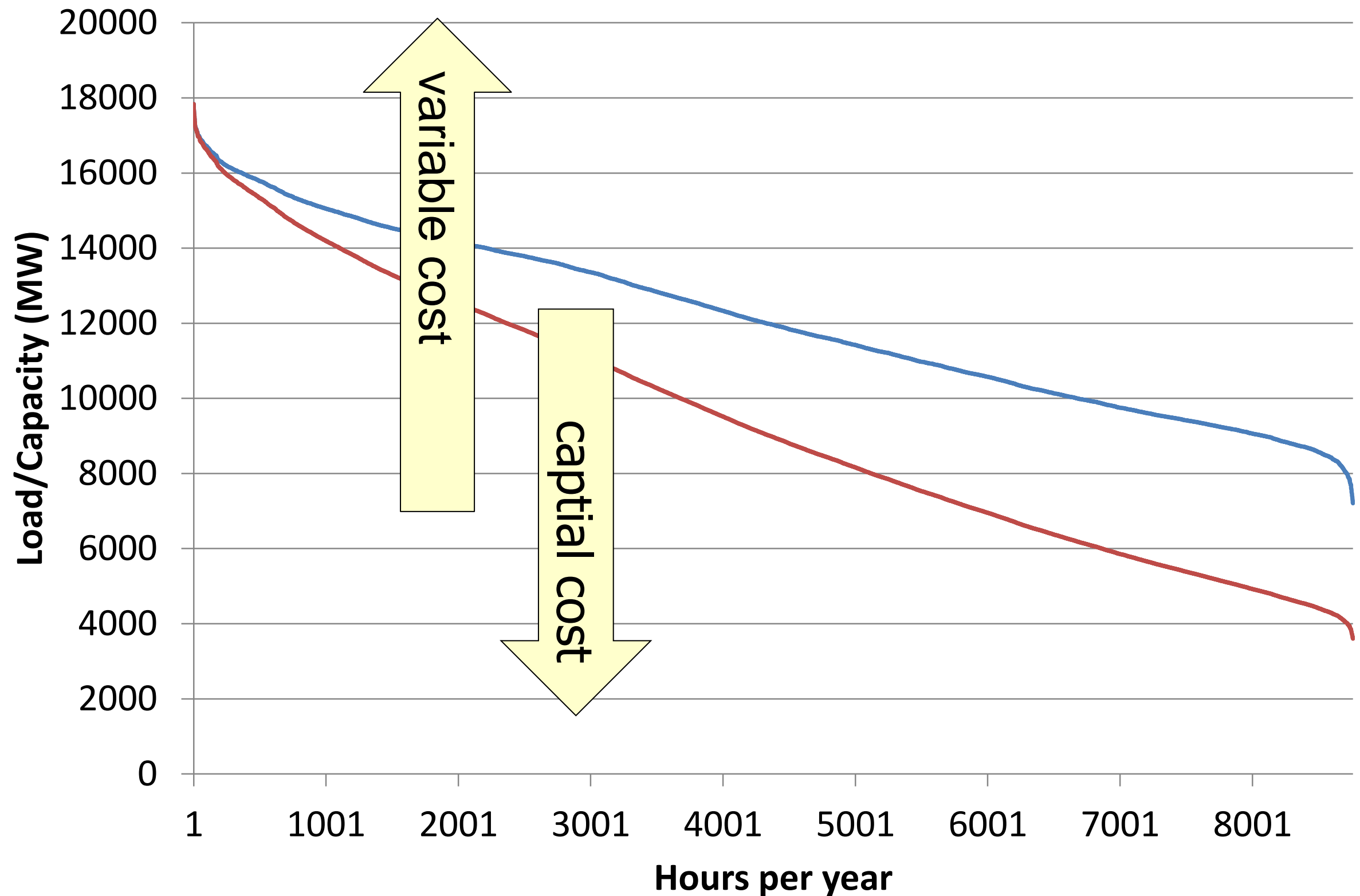
- Starting point of this exercise: (almost) no carbon emissions...
- Main sources of energy are solar and wind - Fluctuating supply
- Design challenge: large wind drought → large energy deficit
- Need large volume of controllable generation capacity with low utilization rates.



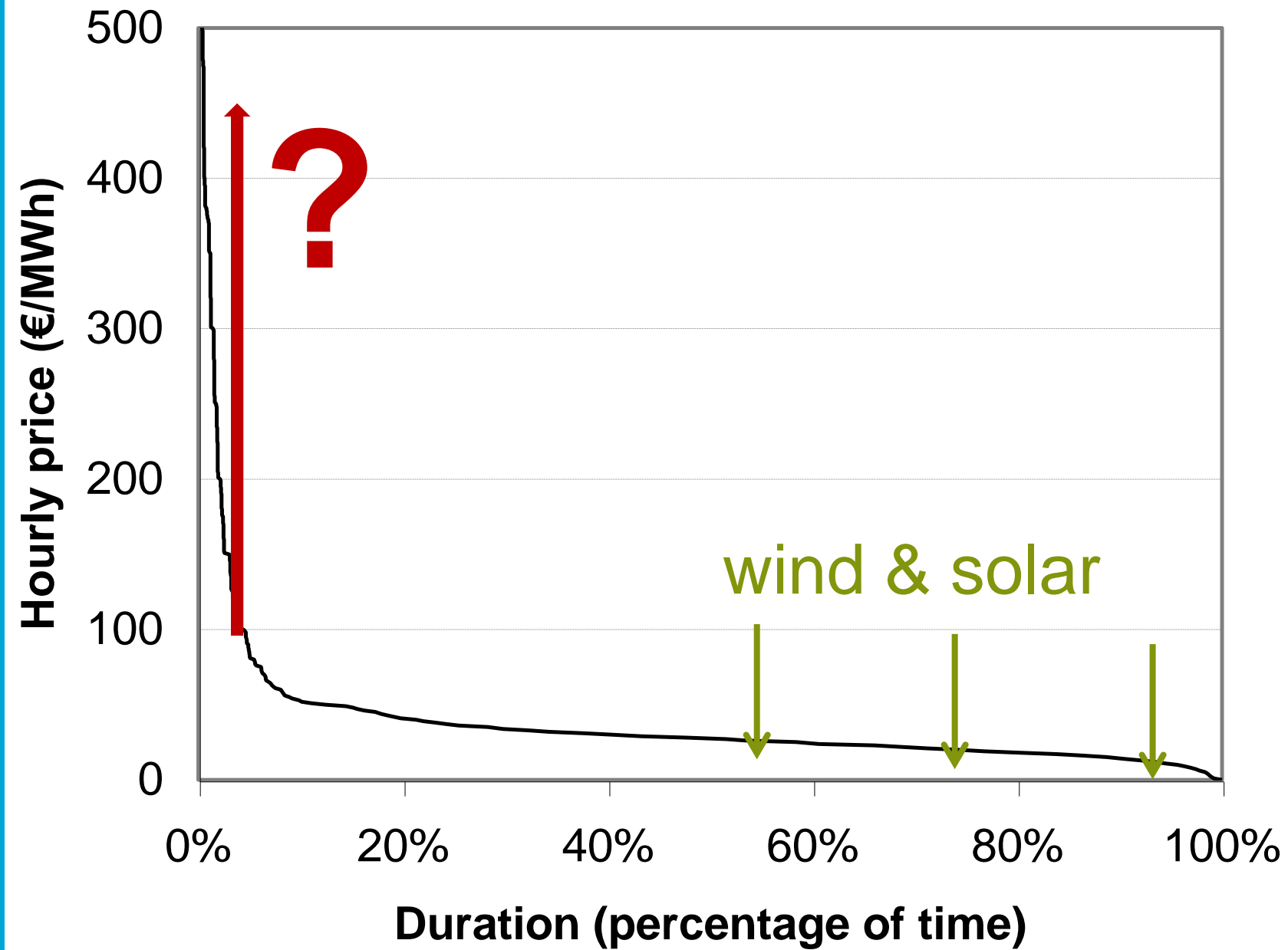
The generation mix



The generation mix



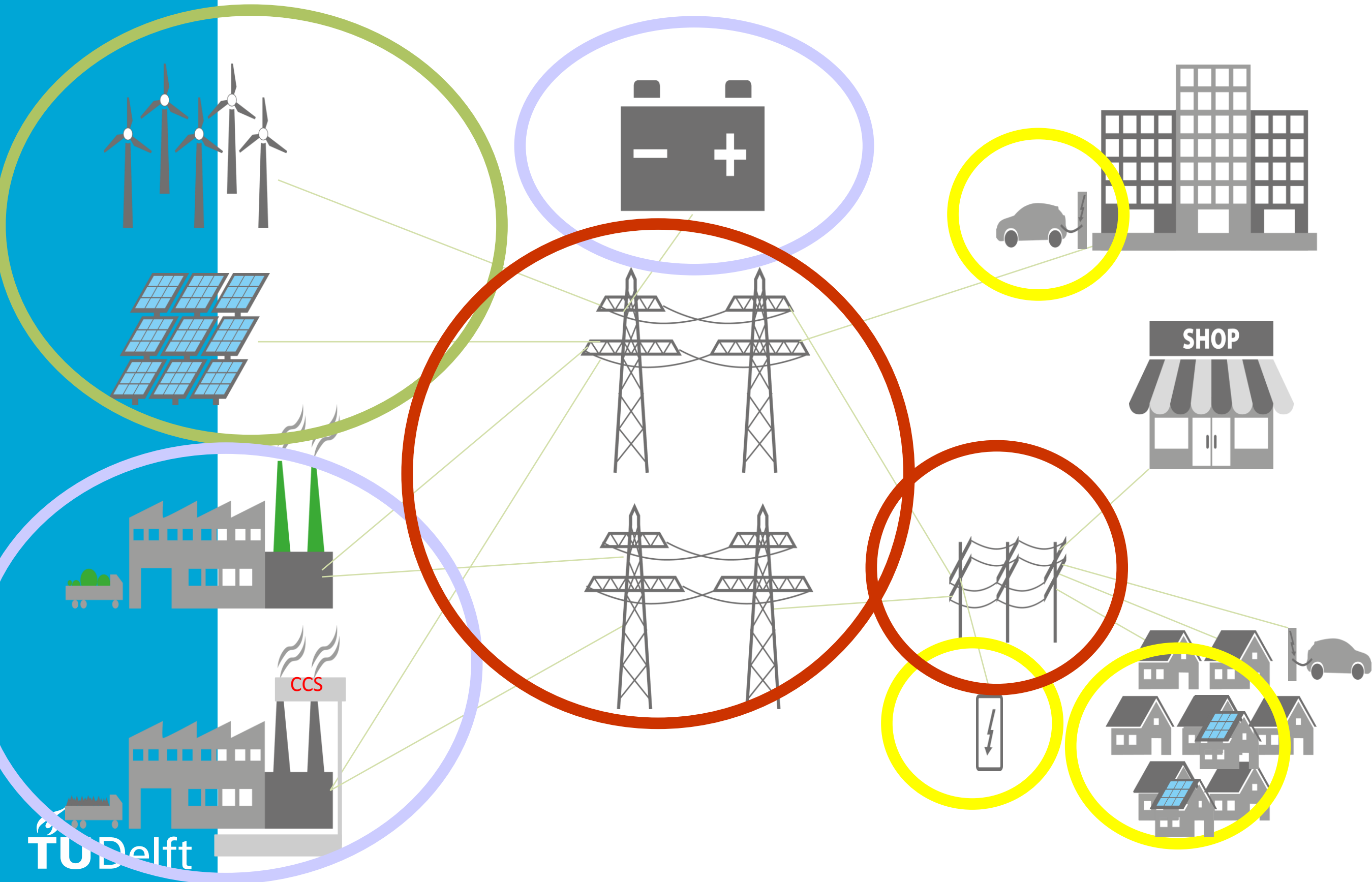
Changing price profile



Four main challenges for market design

- vRES cause low prices
 - How will they recover costs?
- Coordination between large-scale and small-scale vRES
 - Large off-shore windpark \neq Private PV
- Investment in flexibility
 - Needed to maintain reliable power system
- Network regulation and cost recovery

Market design challenges



Our approach

1. Large-scale vRES: tenders
2. Small-scale vRES: create level playing field with large vRES
3. Networks: follow *Utilities of the Future* recommendations
4. Controllable generation & storage: capacity subscription

1. Wholesale vRES investment

- Dutch/Danish tenders: seem to work well.
 - Government provides location, site studies and permits.
 - TSO provides grid connection.
 - RES investors bid for needed subsidy.
-
- Tenders will phase themselves out if the technology begins to recover its cost in the wholesale market..
 - E.g. if sufficient flexibility options develop.

2. Small-scale consumers: beyond net metering

Problems with net metering:

- It ignores the time value of electricity.
- Allows evasion of taxes and levies.
- In most countries, allows avoidance of network tariffs.
- Equity issues: subsidy for those who can afford self-generation.

Decentral RES generation

- Current tariffs have little to do with cost.
- Is subsidy needed? Not if:
 - the wholesale energy price is efficient! and:
 - the cost of CO₂ is internalized
 - decentral generators receive the momentary wholesale price.

Proposal:

- Self-generation can be netted with consumption *in real time only*.
- Small consumers pay real-time prices for their momentary consumption or injections.

Efficient end-user tariffs

- How to allocate the cost of large-scale RES tenders?
- If the costs of the vRES tenders are added to the consumer price of electricity...
- ... 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.

3. Network tariffs

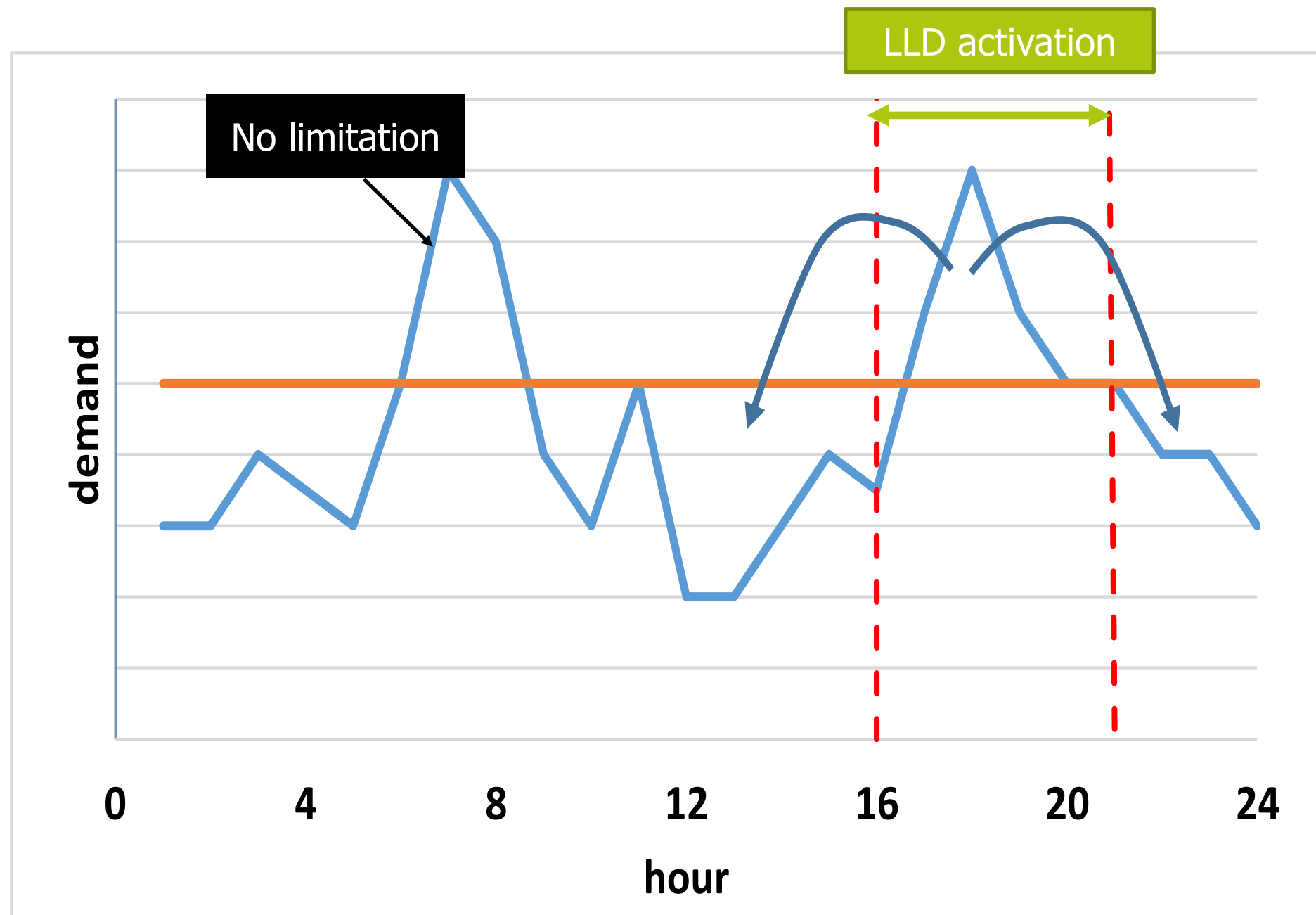
- Should be capacity based (not included in electricity bill).
 - Because the network costs are capital costs
 - And to avoid wholesale price distortion.
-
- *Utility of the Future* project recommendations
 - Capacity-based tariff has similar properties to capacity subscription.

4. Capacity subscription for controllable generation capacity

- Consumers buy (subscribe to) capacity they need during scarcity events
- Demand is restricted to subscribed level when a scarcity event occurs
- Producers sell their firm capacity
- Price and cleared volume are determined by supply and demand
 - Year-long contracts, reselling possible.
- Generation adequacy is ensured.
 - For the contracted levels of capacity.
 - Generators have clear demand signal and more stable income.



Stay below the limit – when *necessary*!



Consumer perspective

- Passive consumers don't want to be restricted --> buy large capacity.
 - same as in current system
- Consumers can choose to become active.
 - High reward for reducing load when the system is short.

Implementation options:

- LLD – physical limitation
- Smart meter: financial incentives. (Capacity subscription plus high penalty for overshooting peak consumption.)
- *Ex post* determination of capacity payment based on previous year's contribution to peak (for passive consumers)
 - Combined with opt-in possibility.



LLD activation

- By TSO
 - Clear and transparent rules
- In real time when scarcity event occurs
- Pre-warnings normally given hours ahead
 - But could be short notice e.g. in case of outage



Regulation

- In principle, consumers choose their level of reliability
 - But households may need protection in the form of a minimum requirement
- The market sets the price of reliability
 - In case of energy poverty concerns, a block tariff may be implemented, with a subsidized minimum capacity volume
- Consumption is not coincident, so 1 kW of demand does not need to be covered by 1 kW of supply. Regulator needs to create an adjustment factor.

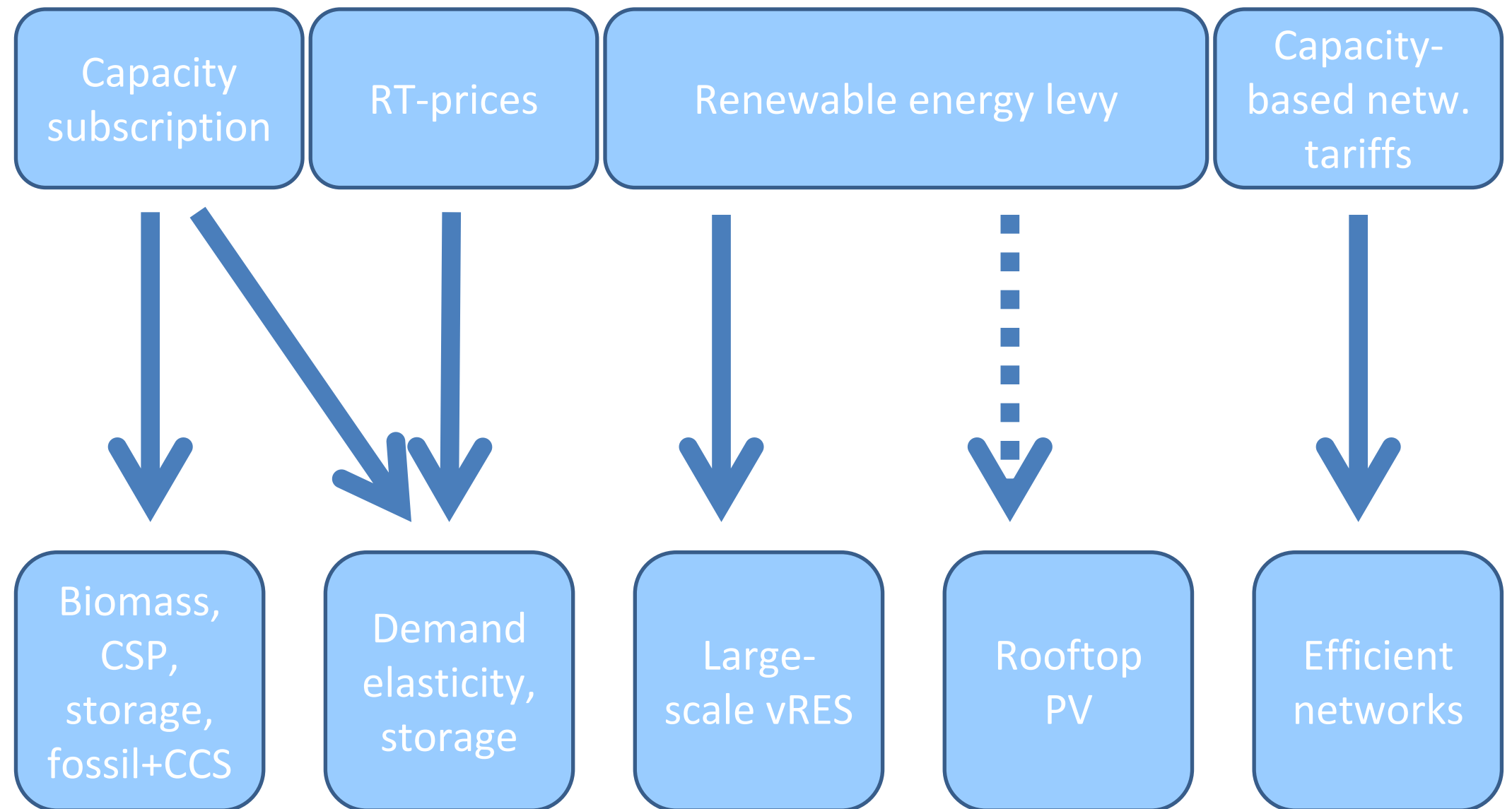
Regulation (2)

- The availability of generators needs to be verified
 - If generators also commit to a maximum price, they are selling option contracts similar to *reliability options*.
- The contribution of storage needs to be determined
 - E.g. the smaller of:
 - maximum stored energy volume / expected sequential peak hours.
 - generation capacity.

Security of supply becomes private good

- Present: SoS is common good:
 - All consumers assumed to require same (very high) SoS level
 - Costs are socialized
 - Not possible to choose lower (or higher) level
- With Capacity Subscription, consumer SoS is determined by:
 - Ability/willingness to accept demand limitations
 - Price of capacity
 - Availability and price of demand control options
 - Strong market pull for demand control.
- Strong private good characteristics
- Consumer is really put at the center
 - As demanded by the EU Clean Energy Package.
- Reduction of risk for controllable generation capacity.

Overview





LOTO TABAC L'ENERGIE LOT

ERIE LOTO L'ENERGIE

