Power to the people –

Creating markets for supply security based on consumer choice

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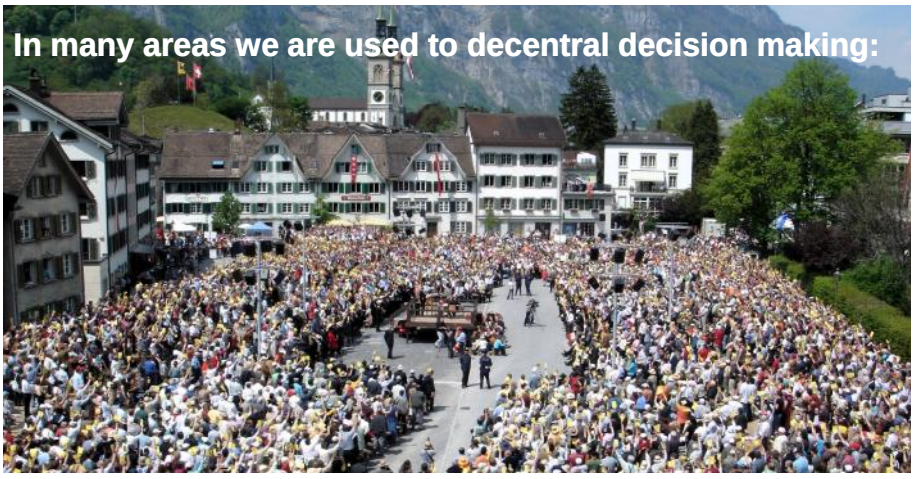
FSR/Eurelectric Conference: *"Design the electricity market(s) of the future"*
7th June 2017, Brussels

In many areas we are used to decentral decision making:



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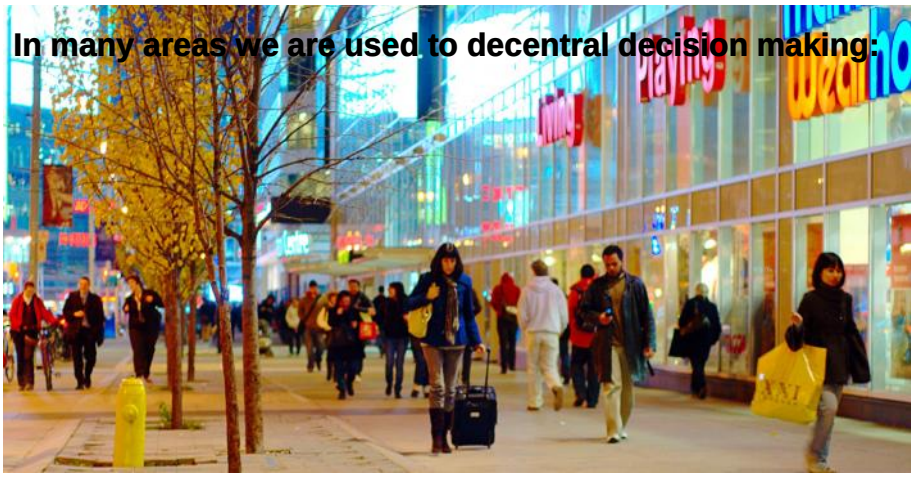
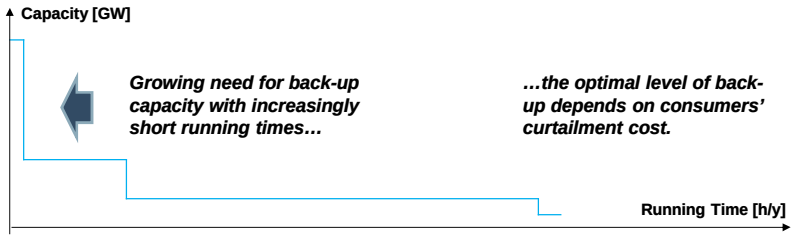


However, the preferred level of supply continuity is still determined administratively.

Why should the current arrangements be changed?

Cost of back-up capacity will increase



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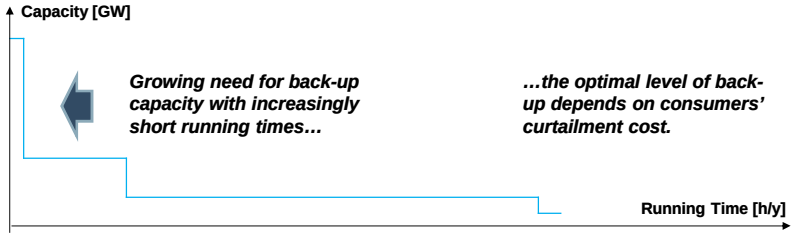

Impacts and usage of curtailments:

- Curtailment costs will vary strongly between consumers, and across time (e.g. battery full / empty?).
- The network code on emergency and restoration foresees manual curtailments as well as (unpaid), automatic under-frequency load shedding of up to ~50% of demand as last resort measures.

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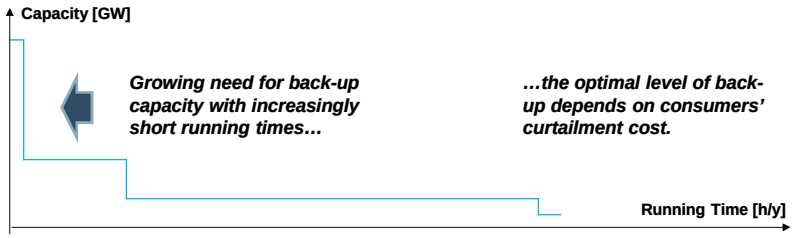

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Problems of current arrangements:

True curtailment cost is unknown because emergency curtailments are not market-based:

- Inefficient, administrative dispatch during emergencies, e.g. simultaneous scarcities
- Administrative investment incentives, e.g. capacity markets required to make up missing money

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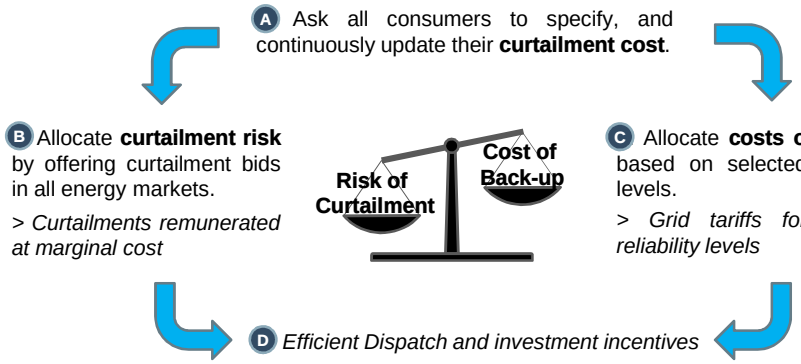
How could market arrangements be changed?

Markets for emergency curtailments should enable each consumer to trade-off curtailment risk against the cost of back-ups.



A Each consumer should specify the curtailment cost for (different tranches of) their consumption

Consumers select:

- **Supply price**: the maximum price they want to pay for the delivered energy
  (> determines level of price risk)
- **Curtailment Price**: maximum willingness to pay for a continued supply (in case of contract with real-time price) or compensation which they would require in order to accept a curtailment (in case of contracts with fixed supply price)
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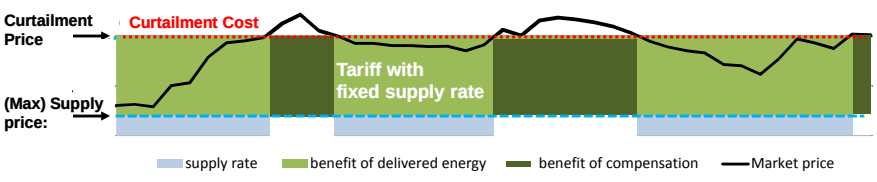

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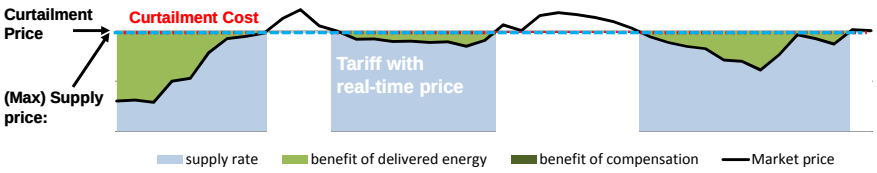

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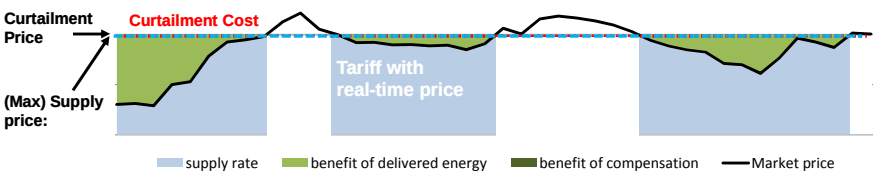
…based on information about resulting:

- **Expected monthly bill**: expected monthly bill resulting from the selected tariff, (and consumers' demand profile).
- **Expected curtailment frequency**: average, minimum and maximum number and duration of curtailments (for their demand profile)
- **Expected curtailment compensation**: expected compensation they would receive during curtailments (for their demand profile)



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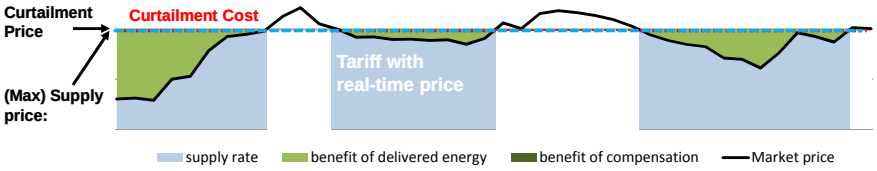
e.g. enabled through Load-Limiting-Devices

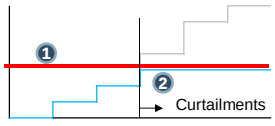
e.g. provided through Central Data-Hub



B Offer curtailment bids in all energy markets and remunerate them at marginal cost

Administrative approach → **Market based approach**

Today



1. Price cap set below curtailment cost
2. Forced curtailments are not priced into the market

- *Curtailment bids are suppressed*
- *Administrative risk preparedness plans for emergency dispatch*
- *Administrative investment signals for back-up capacity*

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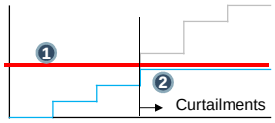

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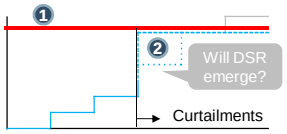
Clean Energy Package



1 Price cap set at average estimated curtailment cost

2 Forced curtailments are not priced into the market

- + *Curtailment bids **may** emerge*
- - *Administrative risk preparedness plans for emergency dispatch*
- - *Administrative investment signals for back-up capacity*

Curtailment cost — Price cap — Market price

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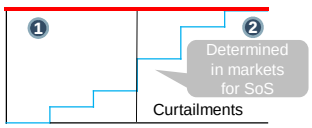
By 2050



1 Price cap set at average curtailment cost or higher

2 All curtailments are priced at marginal cost

- + *Curtailment bids **guaranteed***
- + *Market based emergency dispatch based on consumer preferences*
- + *Market based investment signals for back-up capacity*

Curtailment cost — Price cap — Market price

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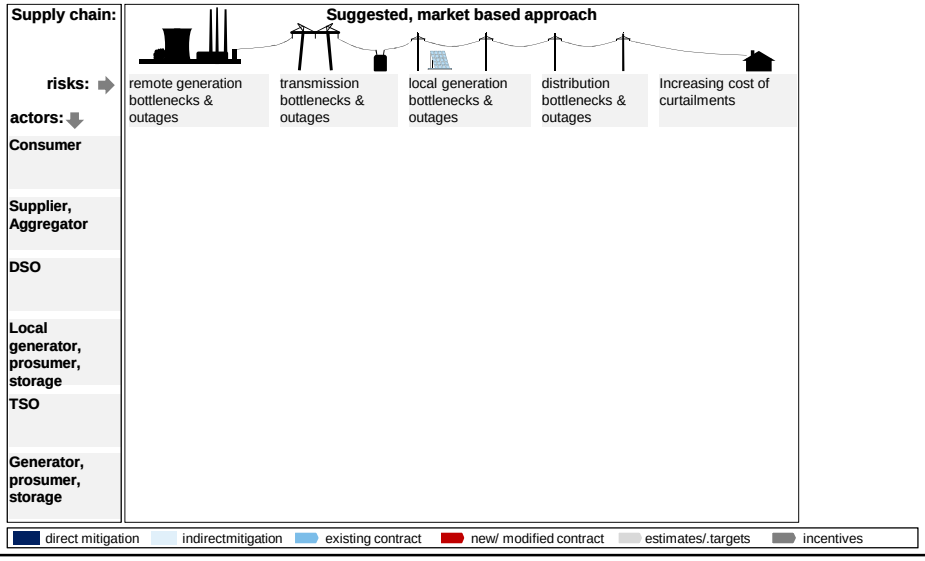
Contracts should allocate risks to the party, which is best placed to mitigate the risk.
Costs of mitigation should be allocated to consumers based on their selected reliability levels.



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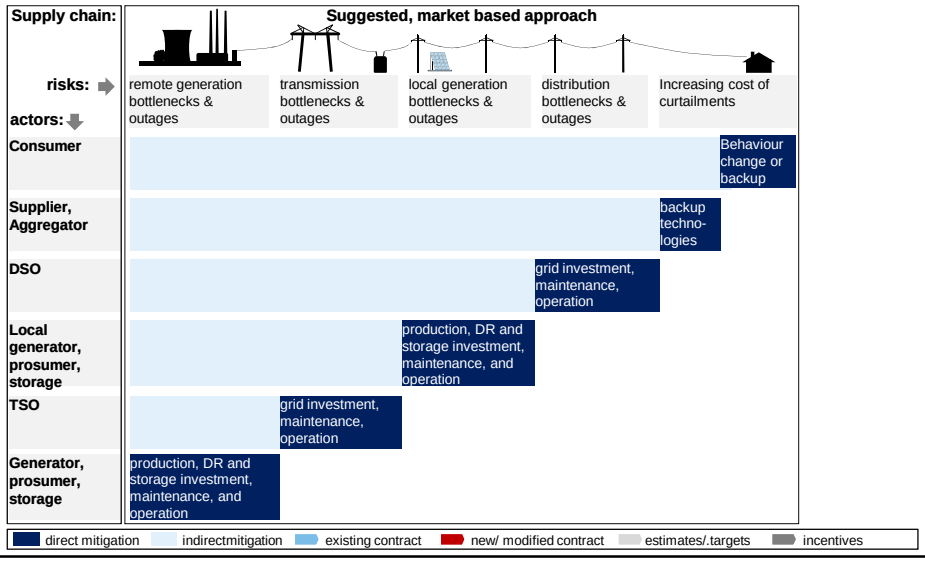

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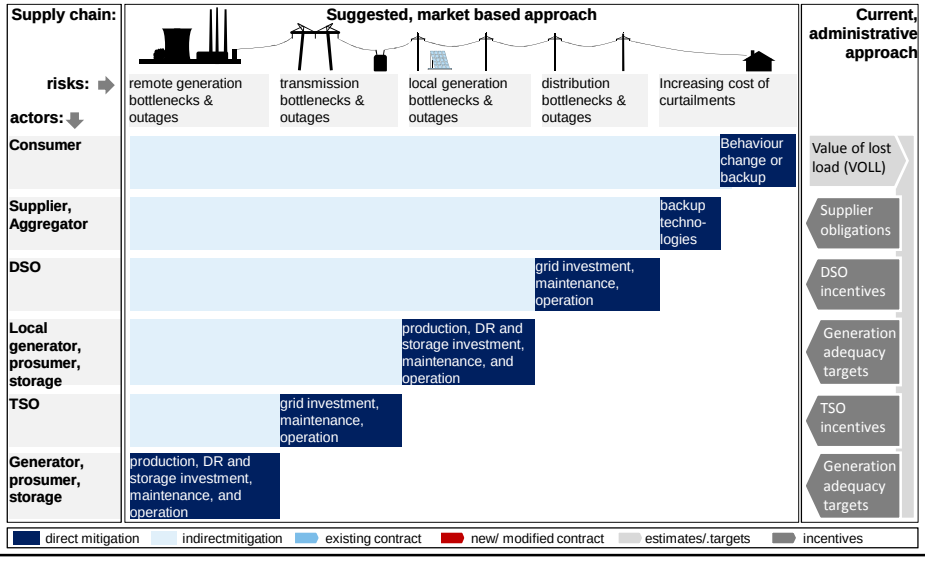

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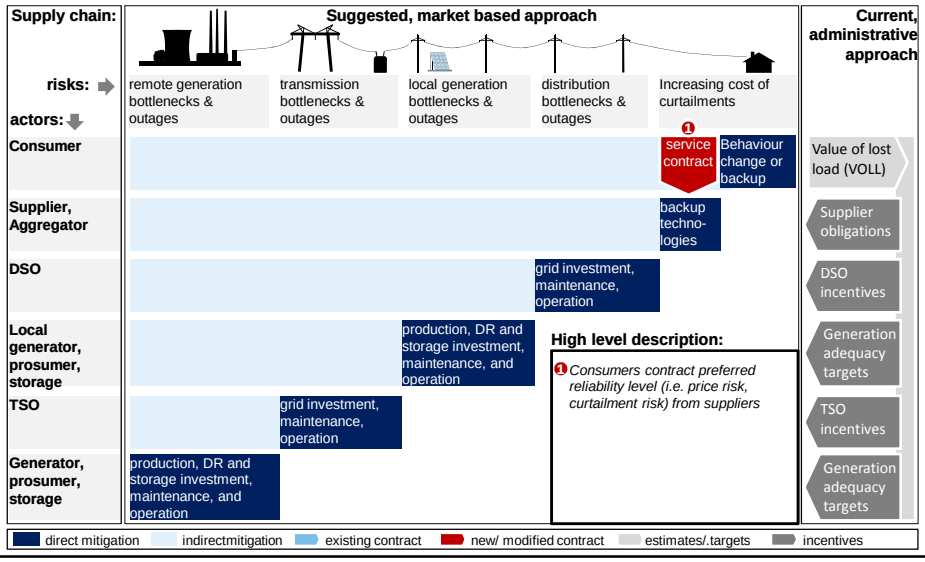

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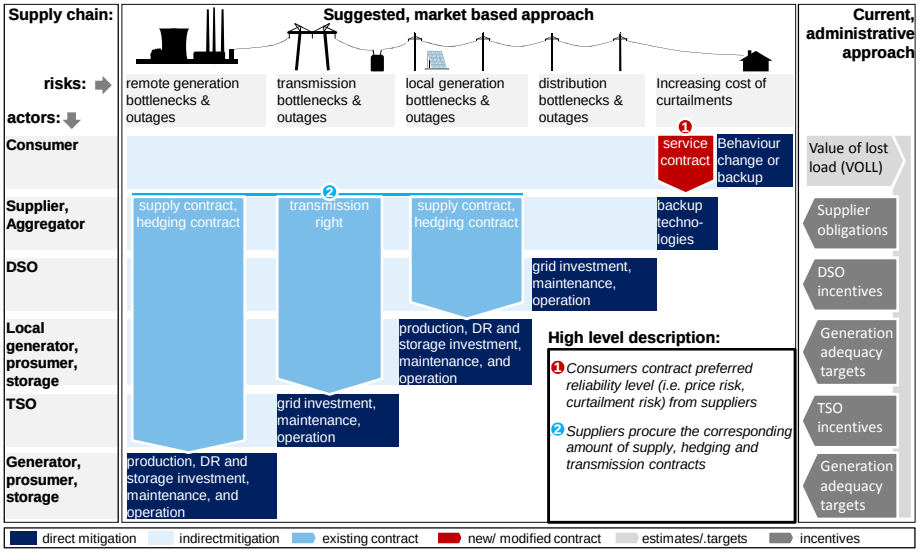

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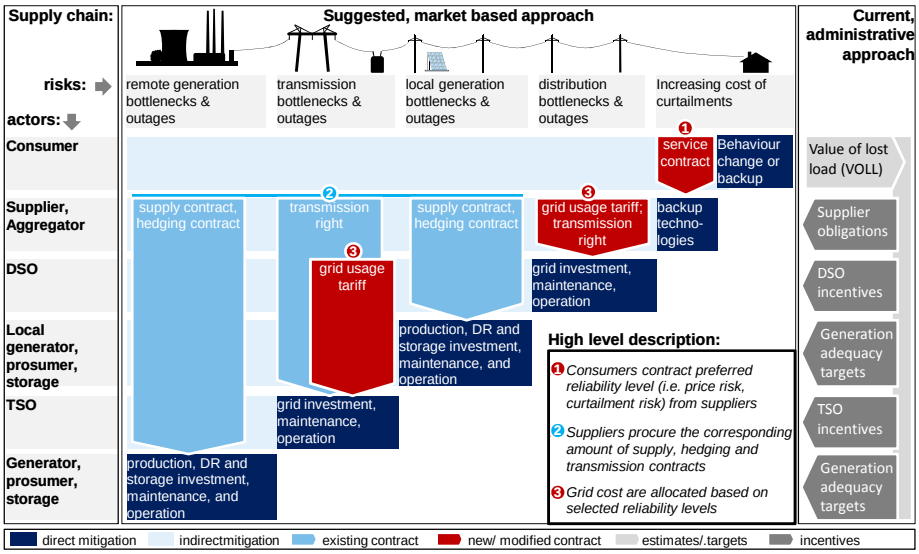

D By tackling the problem at its root, emergency curtailment markets would remove a number of distortions

Area:	Clean Energy Package:	Emergency curtailment markets:	Benefits:
Customer Involvement:	• Administrative estimate of curtailment cost	• Consumer choice of curtailment cost	⊕ Allow consumer choice ⊕ Increase consumer awareness, trigger innovation

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Dispatch signals, link between retail & wholesale:	• Administrative risk preparedness plans & curtailment schemes • Automated rotating outages • Socialized cost	• Market based curtailment merit order • Allocation of cost& risks based on consumer demand for reliability	⊕ Efficient dispatch during emergencies, within and across countries ⊕ Quick adaptation to changing consumer preferences

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Investment signals, system adequacy:	• Administrative procurement targets for capacity mechanisms • Administrative grid reliability targets	• Market based demand for hedging contracts and back-up capacity • Market based investment decisions	⊕ Undistorted investment signals ⊕ Quick adaptation to technological changes and high potential for innovation

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-> Further details & transitional arrangements see forthcoming paper.

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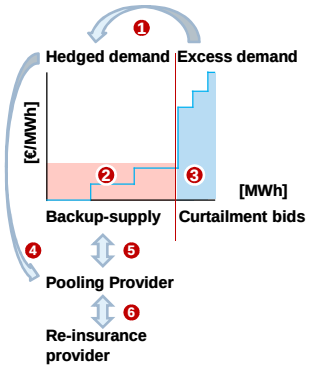
Thank you for your attention!

Would curtailment prices create excessive risks?

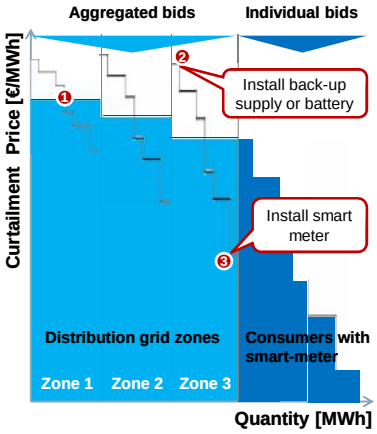
Markets for hedging contracts could protect consumers against imbalance price spikes and create investment incentives.



1. Possibility of extreme price spikes and appropriate liquidity requirements for unhedged demand will create incentive to hedge against high imbalance prices
2. Imbalance price risk for hedged consumption will be limited (e.g. to the strike price of option contract).
3. Only the unhedged excess demand will be exposed to the full imbalance price risk
4. Hedging contracts will be sold by pooling providers, and will pay back the difference between the hedged price and the marginal imbalance price.
5. To recover the price difference, pooling providers will contract sufficient back-up supply (creating investment incentives) and offer it in the imbalance market.
6. To cover against risk of extreme events, pooling providers could sign re-insurance contracts .

In absence of smart meters, consumers could vote on the preferred reliability level for their distribution grid zone.

Votes on the preferred reliability level could be used for efficient roll-out of smart technologies.



0 Already today, consumers in different sections of the transmission and distribution grid can be (and are!) assigned different reliability levels. However the curtailment sequence is determined administratively.
-> *See example*

1 This could be improved by allowing consumers in each zone could to vote on their preferred curtailment priority. Each zone would be assigned the average curtailment price and pay for the corresponding share of costs for grid and back-up supplies.

2 Consumers with a curtailment cost above the average value of their zone could install back-up supplies to avoid frequent curtailments.

3 Consumers with a curtailment below the average value of their zone, could install smart meters to avoid paying a high share of the costs for grid and back-up supplies.

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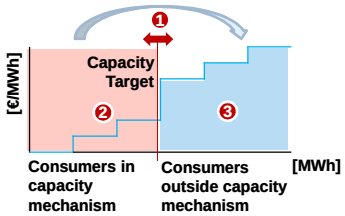
To start the transition, consumers could be allowed to opt out of capacity mechanisms.



1 Consumers could be allowed to opt out of capacity mechanisms (for part of their consumption), and procurement targets should be adjusted accordingly

2 Consumers that chose to remain in the capacity mechanism, should pay the cost of the capacity mechanism, as well as the grid cost associated with the maximum curtailment price. In return, they should only be curtailed as last resort.

3 Consumers that chose to opt out, should not pay for the capacity mechanism. They would be asked to specify their preferred curtailment price and pay the associated share of grid costs. In case of a scarcity that exceeds the capacity target, they would be curtailed in the order of ascending curtailment costs.

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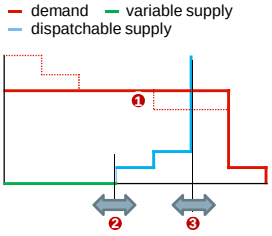
The market designs that have been suggested in the FSR call differ along a number of key criteria.



Criteria:

❶ Dispatch price and priority during (simultaneous) scarcities which require curtailment
❷ Side-payments vs. completely separate markets for variable renewable generators.
❸ Types of contracts (i.e. products) used to achieve capacity target (in each of the markets)

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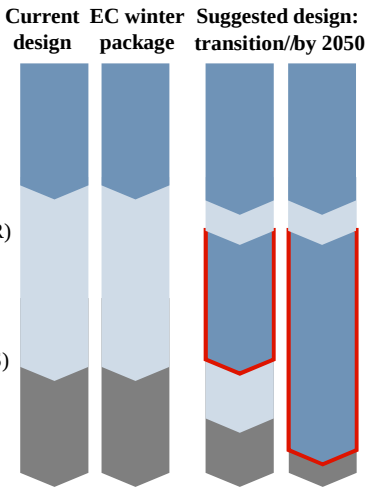
We propose new consumer centred market mechanism for security of supply during emergency operations.

Current System Operation

D-1 12:00	**Day ahead market**
D-1 15:00	**Intraday market**
H-1 Realtime +5Min +15Min	**Balancing markets:** >Frequency containment reserve (FCR) >Frequency restoration reserve (FRR) >Replacement reserve (RR)
Varying Lead-times	**System defence plan:** >Multilateral remedial actions (MEAS) >Voltage reductions >Manual curtailments >Automatic curtailments >System restoration



Market based elements include: demand &supply | supply | none

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