Four market design scenarios

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Four market design scenarios

Energy-only

- the Nordic market model for Europe

Capacity market

- addition of a separate capacity market creating income for capacity even if not used

Locational Marginal Pricing

- a combination nodal pricing that incorporates the costs for network losses and network congestion into electricity prices and locational capacity markets

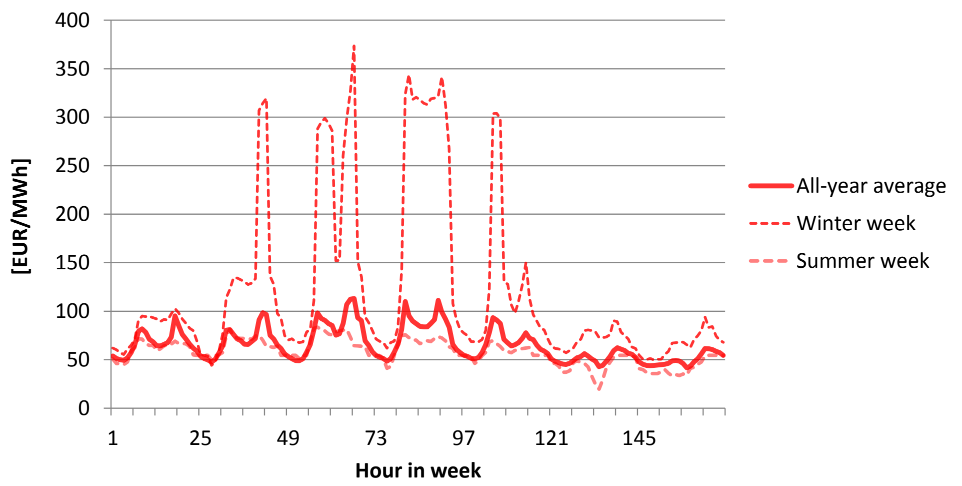
Detailed regulation

- increased central planning and consumer price based on average cost

Energy-only market requires price spikes

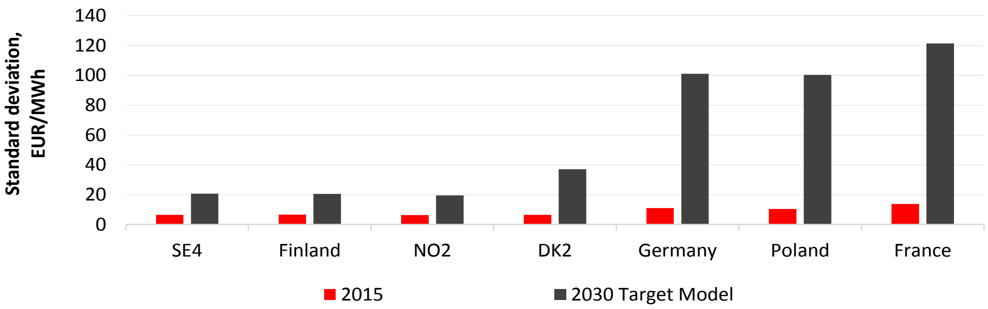
- **Investments in new generation only if profitable.**
  - Requires curtailment in some markets to reach profitability

Hourly prices in SE4 in representative weeks in 2030



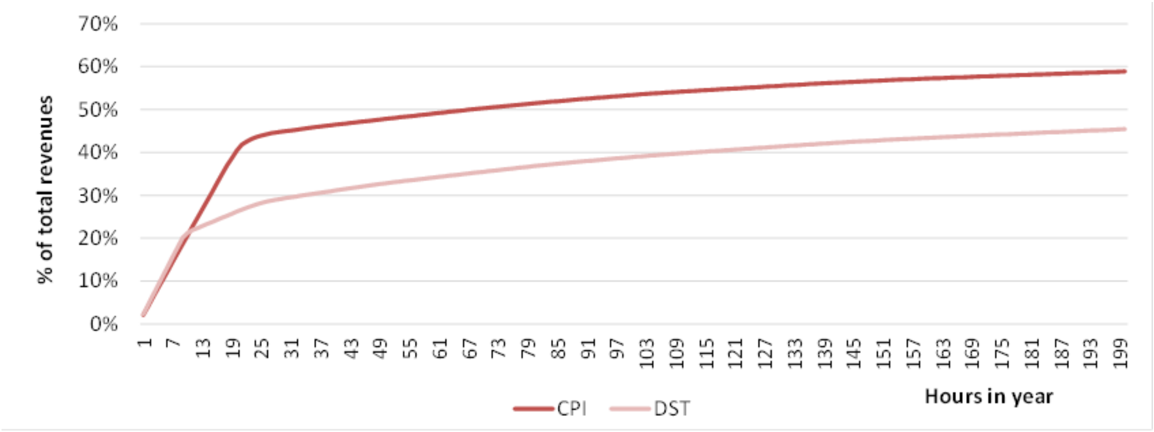
- **Price volatility increases**
  - Driven by increased amount of RES and tighter capacity margin

Price volatility in 2015 and 2030 in the Nordics and Continent



Conventional capacity relies on few hours with high prices

Cumulative share of net revenues for a CCGT plant in Germany in 2030



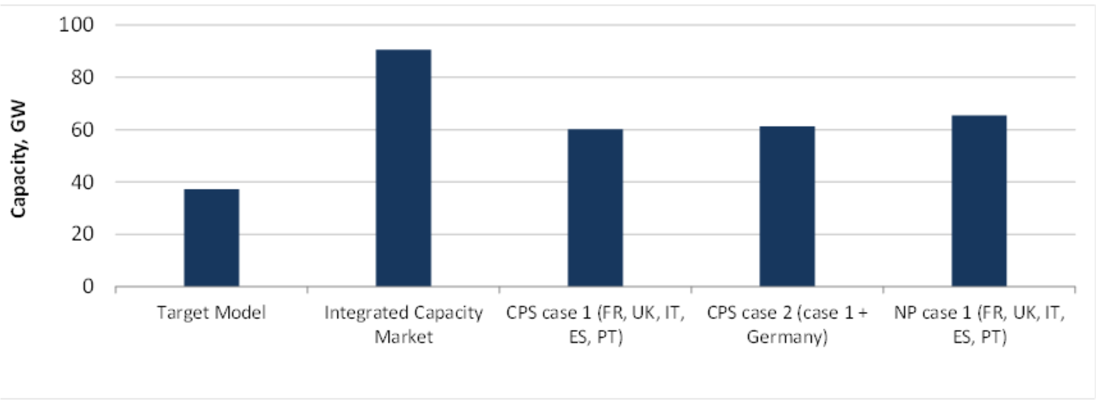
- **High risk to make investments based on few hours with high prices**
  - 40-60 % of the revenues from 200 hours with the highest prices

Capacity markets leads, as intended, to more investments

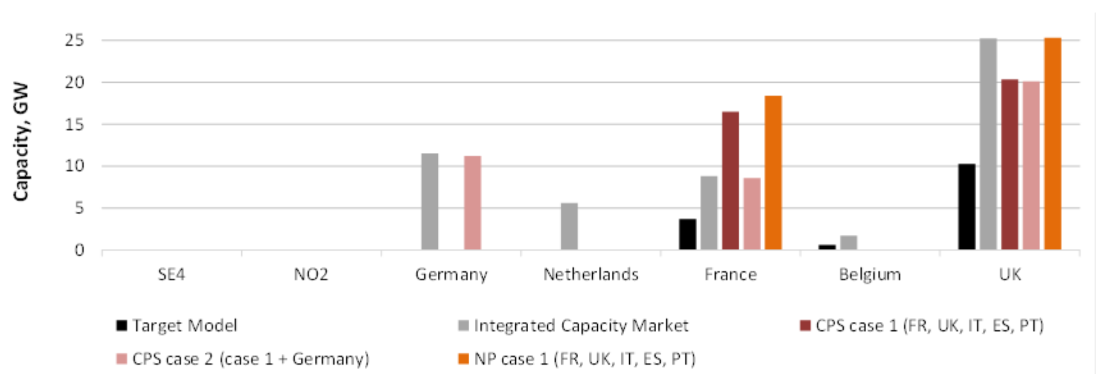
- **Capacity income reduces risk**
  - Should reduce cost of capital
  - Introduces regulatory risk
  - Over-investments likely in capacity markets
  - Under-investments likely in energy-only

- **National CRM can distort investment signals**
  - Investments in CRM regions can crowd out investments in neighboring non-CRM regions

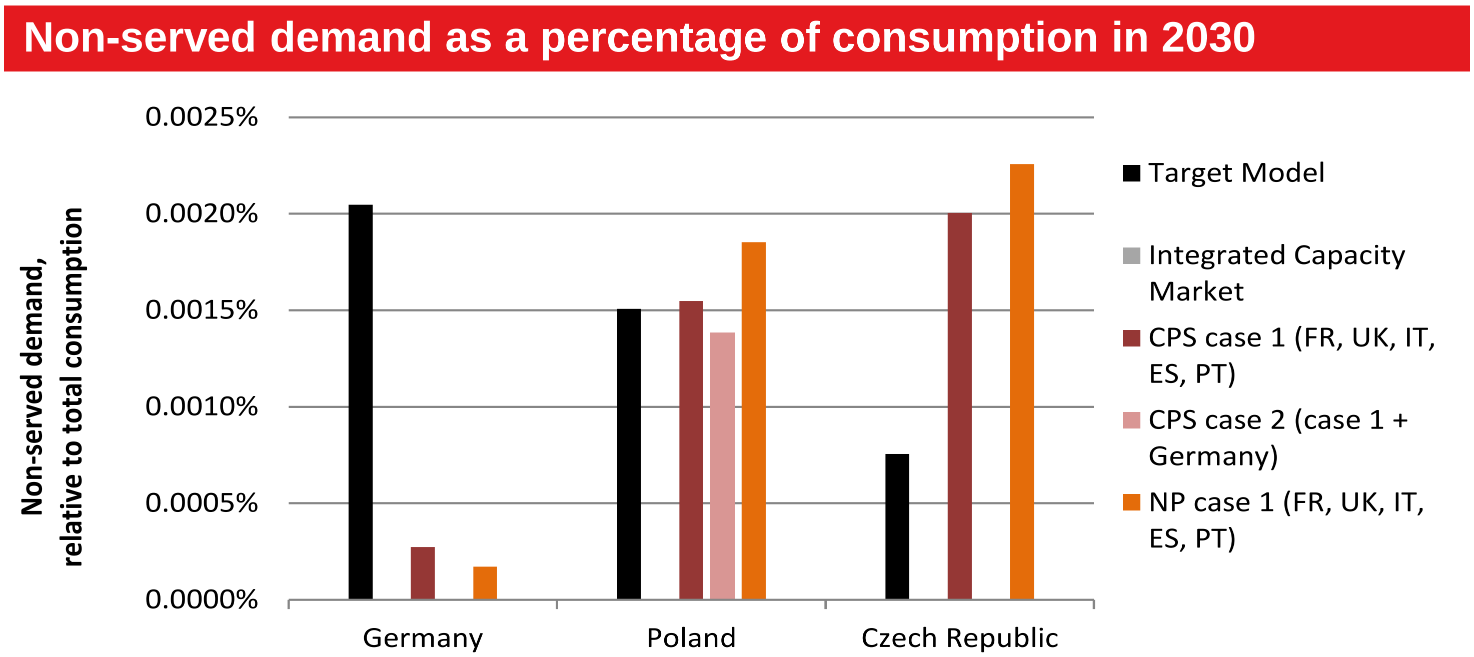
Total new capacity installed in Sweco scenarios by 2030



Total new generation investments in individual countries by 2030

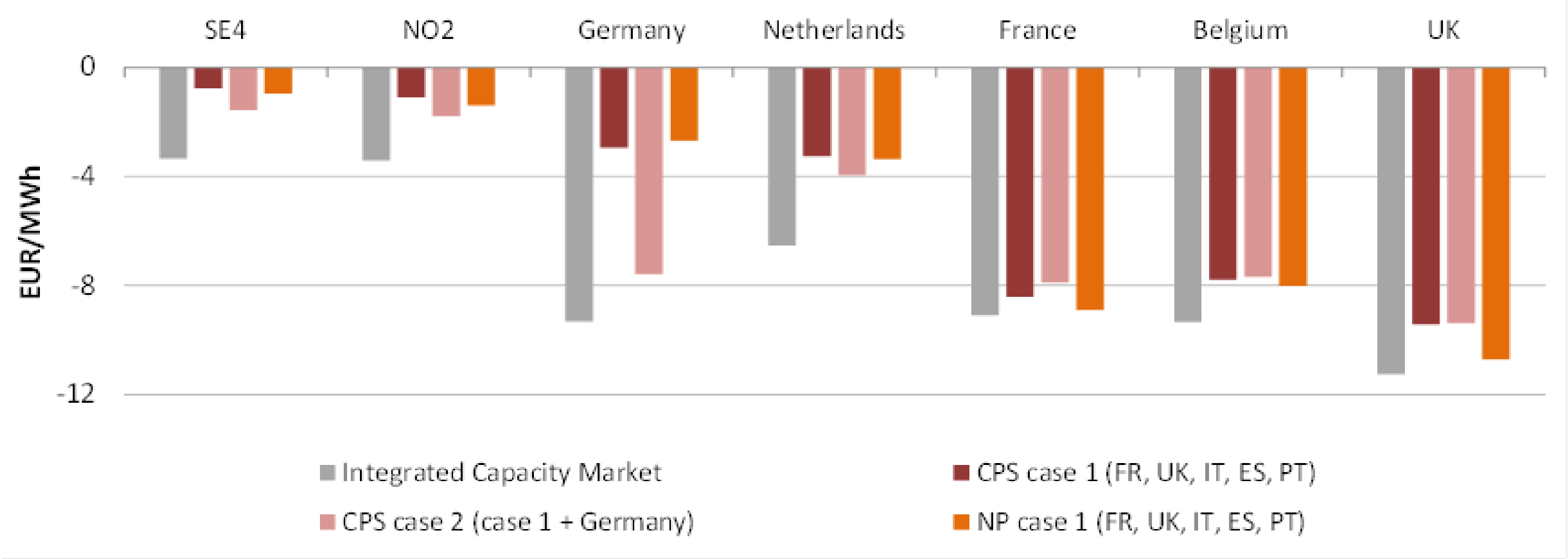


Distorted investment signals can lead to decreased security of supply



Increased capacity will result in lower wholesale prices

Change in wholesale price relative to the Target Model in 2030

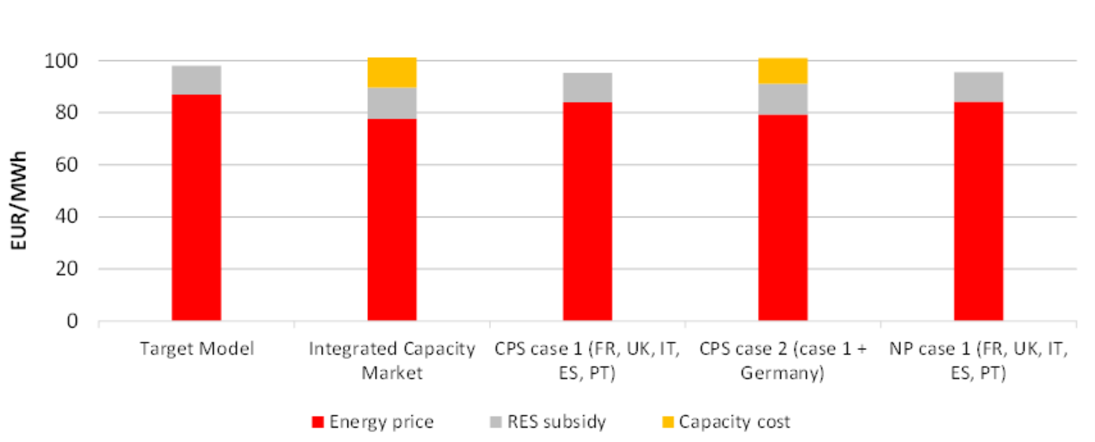


- **Capacity markets encourage more investments in new capacity**
  - Results in lower wholesale prices from lower peak prices
  - Spillover effects to neighboring countries, sometimes substantial

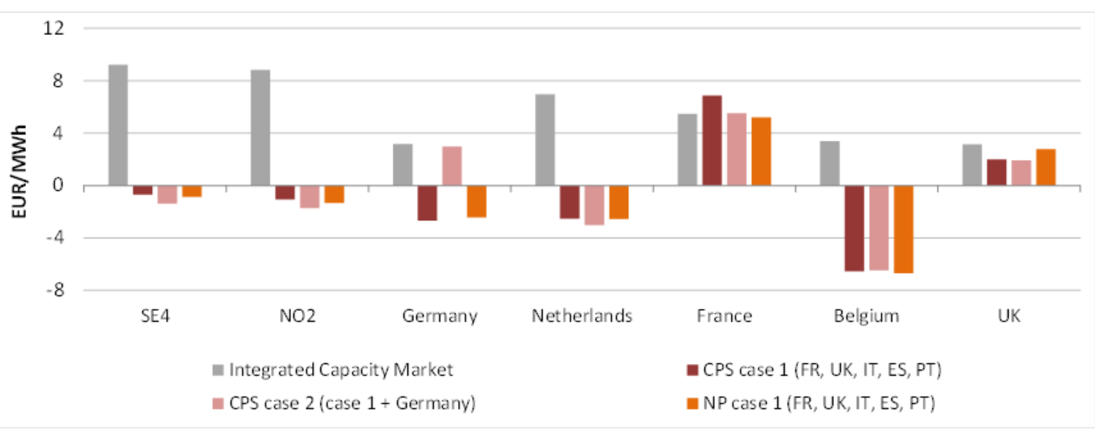
End consumer prices may however not decrease

- **Decrease in wholesale price is compensated by capacity cost**
  - Also cost for RES subsidies may increase
- **Spillover effects to consumers in neighboring countries**

Components of cost to customers in Germany in 2030 in different scenarios

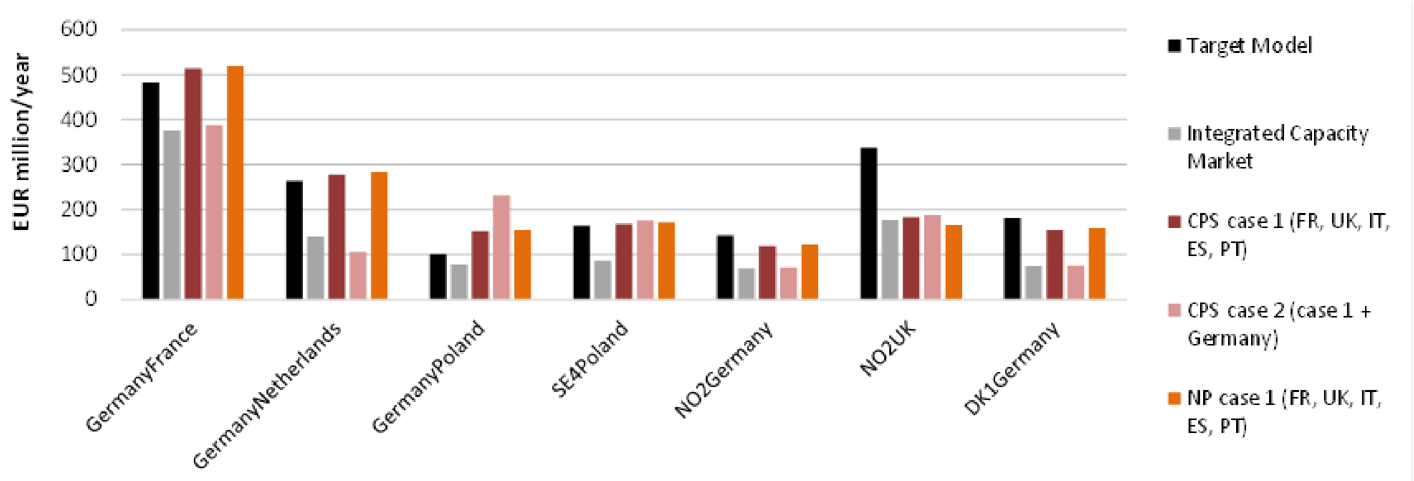


Change in customer cost relative to the Target Model in 2030



Capacity markets will have an impact on the profitability of interconnectors

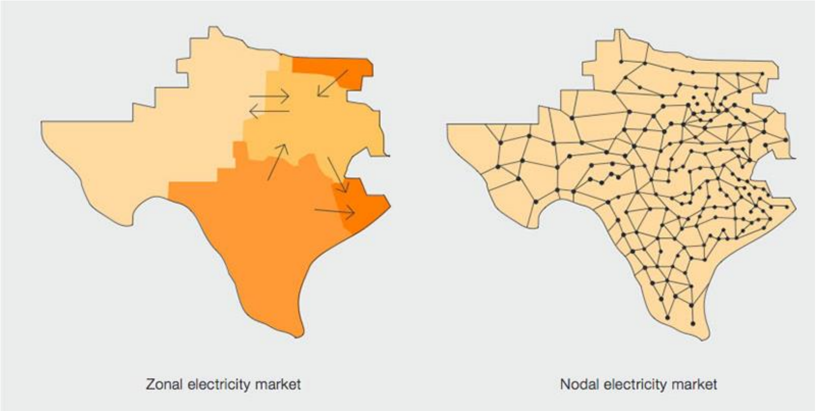
Congestion revenues for selected interconnectors in 2030



- **Decreased volatility reduces the congestion rent for interconnectors**
  - National capacity markets replace the need for interconnectors
  - Can be compensated by inclusion of interconnectors in CRM

Locational Marginal pricing (Nodal pricing)

- **Uses a full network model**
  - Simultaneously establishes dispatch volumes and prices at each node, taking into account market participant's bids and also the effect of the resulting power flows.
- **LMP has been adopted in liberalized markets in the United States and New Zealand.**
  - Normally only generation is exposed to nodal prices while demand faces zonal prices



Benefits with LMP

Short term

(support efficient operations and dispatch)

+ Nodal prices reflect the both the temporal and the locational value of electricity. Therefore uses the transmission grid more efficient.
- Demand is however often priced in larger zones.

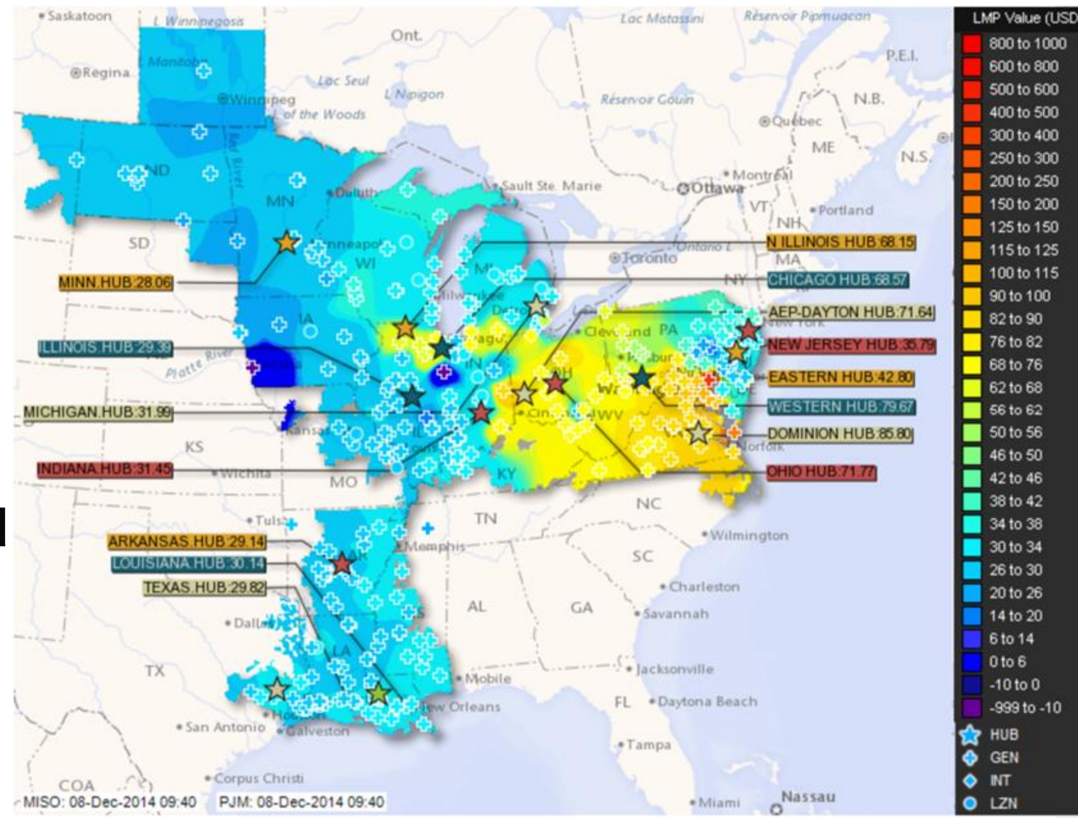
Long term

(facilitate long term contracting and investment in new generation)

+ Can deliver locational signals and timing for generation investments
- Congestions can be temporary and relieved by investments in transmission
- Location is rather driven by other factors such as permits, renewable subsidies, capital costs, expected operating costs and fuel availability (many nodal markets have resorted to special arrangements to encourage investment in peak generation).

Managing congestion risk

- **Congestion-related price risk is a primary concern in both zonal and nodal markets.**
- **Liquidity risk in a main concern in nodal markets**
- **Hedging can be simplified by aggregating nodes into trading hubs**



Source: http://www.jointandcommon.com

LMP raises concerns about market power

- **LMP has been criticized for being vulnerable to market power.**
  - The counter-argument is that market power is not an effect of LMP per se, but a consequence of real grid constraints. LMP only serves to bring this market power out into the open.

- **Market power is a concern in existing LMP markets**
  - The mere possibility of market power has led to the introduction of price caps in highly constrained areas in some LMP markets, notably in the US.

Why zonal and not nodal in EU?

- **ERGEG described the nodal approach to capacity allocation and congestion management as "*the ultimate goal and (technically and economically) optimal solution*".**
  - A zonal approach is more in line with the decentralised market design in EU.
    In the United States, trading goes via the system operator that has a more central role.
  - Political unwillingness in some countries to let consumers and/or generators face different electricity prices.
  - Concerns in Europe about the potentially very large number of nodes that can make up a market and the impact on market liquidity.

Increased central planning to ensure security of supply and a decarbonisation

- **The overall goal is to create an environment where the investment risks are reduced.**
  - Centrally planned investment plan to ensure security of supply and a decarbonized electricity sector.
- **Governments are not likely to undo the privatization of the electricity industry**
  - Create a low risk investment environment.
- **Investment is driven by central planning and subsidies**.
  - Conditions needs to be in force for a long period. Changes to regulation will always be accompanied by grandfathering clauses to protect existing investments.

Possible design of a single byer market

- **The single buyer contracts generation capacity through long-term contracts.**
  - Based on long term forecast of demand
  - 3-5 years for existing capacity
  - 15-40 years for new capacity
- **Capacity is contracted through an auctioning process.**
  - Capacity charges: cover the fixed costs of the plant,
  - Energy charges: cover the variable costs of the plant including fuel costs
- **Dispatch will be centrally controlled**.
  - Generation will usually be dispatched in merit order according to the contracted energy price.
  - Other considerations could however be taken such as environmental concerns or grid stability issues.
  - Hydro power will be optimized separately to minimize the cost of thermal generation.
- **Consumer price based on average cost**
  - No room for retail competition
  - DSO charges a regulated tariff

Most of the risk is handed over to the single byer (i.e. consumer/tax payer).

Demand risk

- Is borne by the buyer. The buyer contracts to purchase a certain amount of electricity, independent of whether demand actually exists for this electricity.

Fuel price risk

- Is borne by the buyer. Changes in fuel costs are passed through to the buyer under the contract.

Inflation and foreign exchange risk.

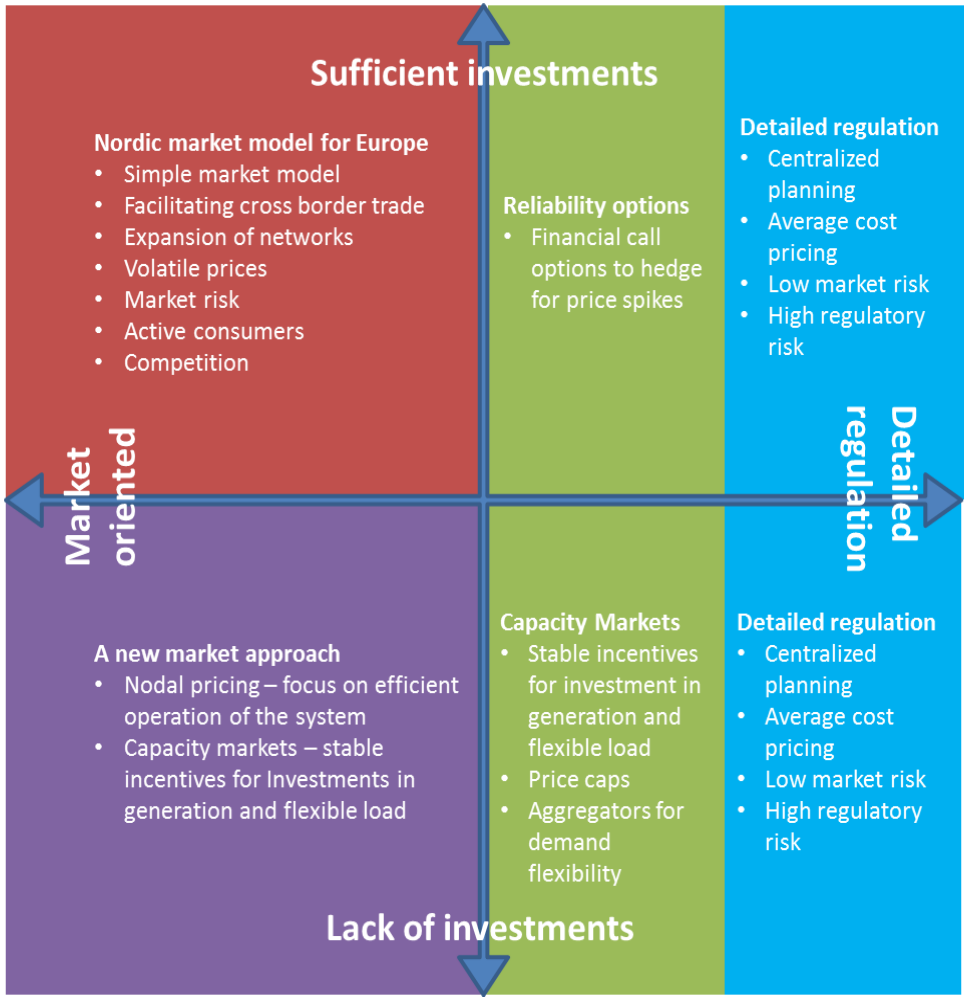
- Is borne by the buyer through escalation provisions in the contract

Technical generation risks

- Is borne by the seller, who is best able to control whether the plant is appropriately designed and functioning properly.

Where are we heading?

- **Energy-only**
  - Market oriented approach with uncertain investment climate, especially in combination with subsidized RES.
- **Capacity market**
  - Lower risk for investment, but can distort investment signals if implemented without coordination
- **Locational Marginal Pricing**
  - Could lead to more efficient use of the transmission grid. Probably to be combined with locational CRM to give incentives for investments
- **Detailed regulation**
  - Low risk for investors as risk is moved to consumers/tax payers. Risk of overinvestment.



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