CEEM INTERNATIONAL CONFERENCE

Market design to facilitate cost recovery and hedging of generation power investments: hybrid markets to deal with long/short-term interactions

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Rationale for the market in the long run - Ideal

- $max \quad -\sum_i ic_i \; g_i^{max} + \sum_{t,i}(\pi_t - c_{t,i})g_{t,i}$

  $s.t. \qquad u_{t,i}g_i^{min} \leq g_{t,i} \leq u_{t,i}g_i^{max} \qquad : \lambda_{t,i}^{min}, \lambda_{t,i}^{max}$

- $ic_i = \sum_t \lambda_{t,i}^{max}$
- $\pi_t = c_{t,i} + (\lambda_{t,i}^{max} - \lambda_{t,i}^{min})$

Investment ok if inframarginal rents enough to pay for investment costs

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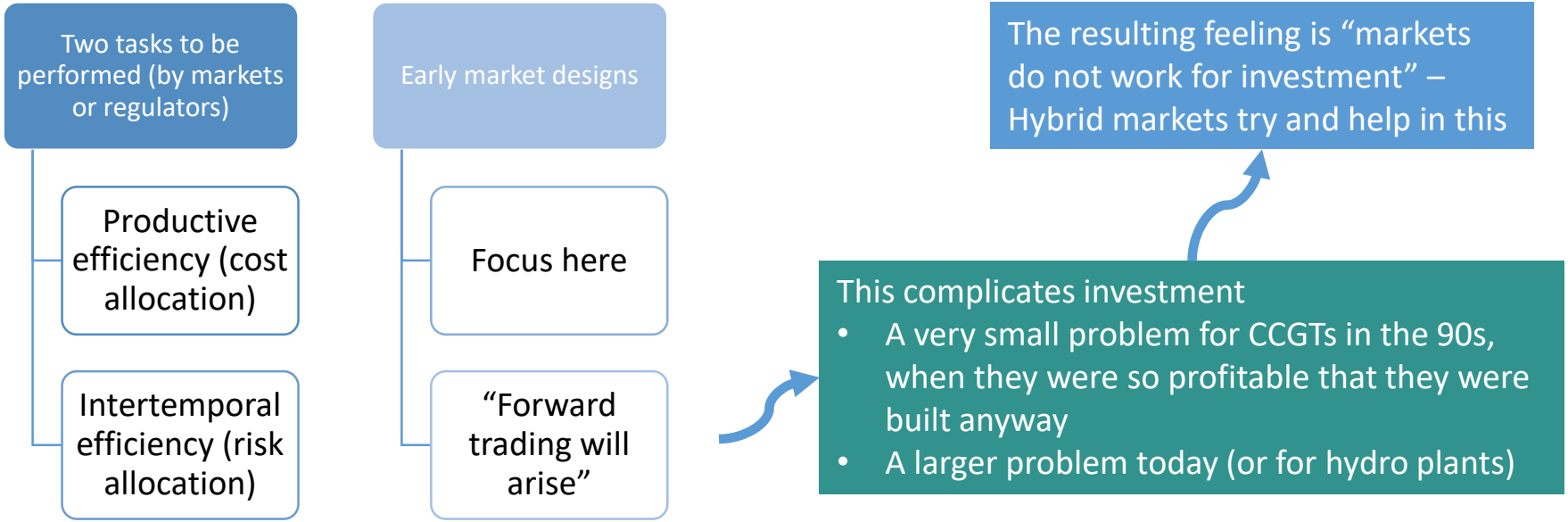
- $\boldsymbol{ic_i = E_{risk-neutral}\left[\sum_t \lambda_{t,i}^{max}\right]}$
- $\pi_t = c_{t,i} + \left(\lambda_{t,i}^{max} - \lambda_{t,i}^{min}\right)$

Risk in this valuation might be significant, making investment challenging

Investment ok if inframarginal rents enough to pay for investment costs + risk premium

Problem statement – How did we get here?



Options

- Power generators need long-term commitments (including long-term issues into markets)
- Several options with certain amount of regulation

Capacity mechanisms (payments or markets)

- The basic idea is to hedge for the main risk identified
  - Paying for the investment cost of the "last generator"
  - … which in an energy-only market would be based on price spikes
- But with minimum interference: the spot market would be the main driver for most investment decisions
  - The capacity price would be typically equal to the fixed cost of the peaker
  - Any other (hydro, coal, CCGT) would have to collect the difference from spot prices

Capacity mechanisms

Capacity payments

- $ic_i = E_{risk-neutral}\left[\sum_t \lambda_{t,i}^{max}\right] + Payment$

- This was the dominant mechanism at the beginning of markets in LatAm: Chile, Argentina, Colombia, afterwards in Spain, Italy...
- Difficulties in setting the capacity price, led to excess entry
- Who defines the volumes

Option-based capacity markets

- Auction for regulated options
- $ic_i = E_{risk-neutral}\left[\sum_t \lambda_{t,i}^{max}\Big|_{s.t.\ p \le s}\right] + OptionPremium$

- Newer: Colombia, New England...
- Stabilization of income from price spikes. However, capacity price is generally set by new entrants, based on their investment costs
- Includes a lag period to favor new entrants
- Who defines the volumes

Capacity mechanisms

Capacity payments

- $ic_i = E_{risk-neutral}\left[\sum_t \lambda_{t,i}^{max}\right] + Payment$

Regulated

Option-based capacity markets

- Auction for regulated options
- $ic_i = E_{risk-neutral}\left[\sum_t \lambda_{t,i}^{max}\Big|_{s.t.\ \pi_t \leq s}\right] + OptionPremium$

Resulted from an auction

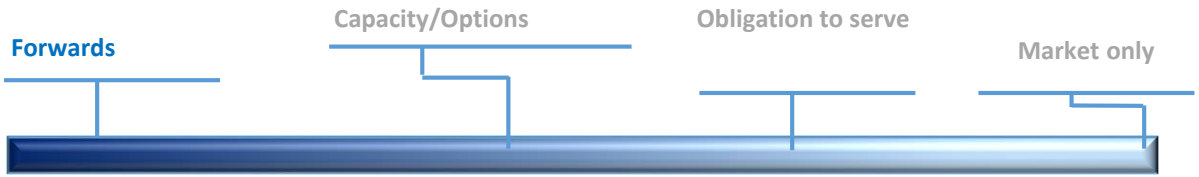
Regulated strike

Capacity mechanisms

- The idea of capacity fits very well with peakers
  - Investment cost similar to capacity price
- But does not fit so well “base-load technologies” (hydro, renewables)

Forward contracting

- Auctions to sell energy in the long term



Forwards and "traditional" PPAs

Long-term forward contracts

- Auctions by distributors to buy energy for the regulated customers for 10-20 years
- $ic_i = ForwardPrice - E_{RN}[\sum_t c_{t,i}]$

- Perú, Chile
- Includes a lag period, after the auction and before obligation is binding, to favor new entrants
- Different indexations for each technology
  - Eliminates the asymmetry. Maybe too much?
  - Leaves some risk on the end-user
  - Comparing bids is contentious

"Traditional PPAs"

- Essentially, generators do little more than O&M

- Brazil. Also, traditional PPAs (Mexico, India, etc.)
- Eliminates risks for generators with high variable costs
- Different indexations for each technology
  - Eliminates the asymmetry. Maybe too much?
  - Leaves some risk on the end-user
  - Comparing bids is contentious

Forwards and "traditional" PPAs

Long-term forward contracts

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"Traditional PPAs"

- Essentially, generators do little more than O&M

- Price risk mostly transferred to consumers
- And hedging of the forward contract still needed (open to spot transactions)

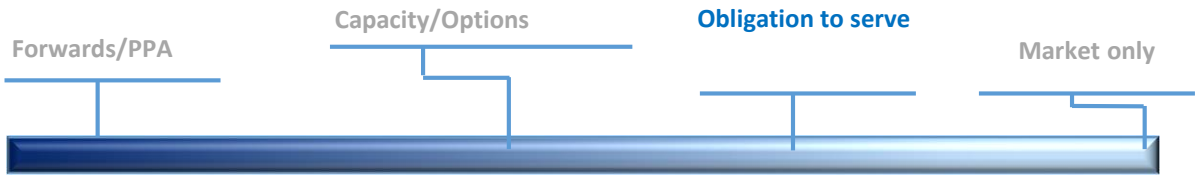
Forward contracting

- Very easy for the regulator to insert any kind of additional considerations
  - Different conditions for new/existing generators
  - Special auctions for renewable energy
  - Different conditions for thermal / hydro generators
- Back to centralized planning?

Obligation to serve

As similar as possible to the ideal market

But with prudential regulation



Final discussion

- There are two extreme basic cases when dealing with the coordination of short- and long-term transactions in power systems:
  - Short run and long run are perfectly linked, so short-term prices are efficient long-term signals – We only need to worry about the short run. This is the rationale behind the designs originally implemented in the EU and the US: Competition in the market
  - Short run is centrally coordinated, we have only a long-term market – perfectly NOT linked, so we need only to worry about the long run, because the TSO optimizes the short run. This is the typical rationale implemented in Latin America: Competition for the market.
- The key question (not yet solved) is how to find a market design combining elements of these two extreme cases while maximizing advantages and minimizing drawbacks

Which is better? For what?

Capacity payments

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Long-term forward contracts

- Auctions by distributors to buy energy for the regulated customers for 10-20 years

$ic_i = ForwardPrice - E_{RN}\left[\sum_t c_{t,i}\right]$

Just prudential regulation

GRACIAS

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