



Electricity market design: lessons from the 'reforms of the reforms'

Session 2: WHOLESALE MARKET DESIGNS FOR FUTURE LOW-CARBON ENERGY SYSTEMS

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Agenda

- An institutional framework to analyse the “reforms of the reforms”
- The new ‘market modules’ that characterize hybrid electricity markets
- Case studies of hybrid markets around the globe
- Conclusions and policy recommendations

An institutional framework to analyse the “reforms of the reforms”

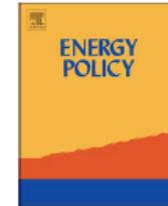
Thirty years of power sector liberalization: A continuous evolution process towards ‘hybrid markets’



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Adapting electricity markets to decarbonisation and security of supply objectives: Toward a hybrid regime?

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- We argue that the [policy objectives of decarbonisation](#) and [security of supply](#) have led to a [new wave of market reforms](#) towards a [new hybrid regime](#) in many jurisdictions.
- There is a [wide range of models](#) under this new hybrid regime which essentially [combine the energy market with coordination and planning mechanisms and long-term risk transfer arrangements](#).
- We review the issues with the standard historical market model which led to the introduction of additional long term “modules”, and study the [interactions between the existing and new “modules”](#).

A range of approaches for short-term dispatch and long term investment coordination

■ Power prices are a decentralised coordination mechanism

- **Short term** – Efficient dispatch of all generation units based on variable costs
- **Long term** – Signal retirement or new investment, trigger new entrants

■ Key categories of power systems:

■ Vertical integration

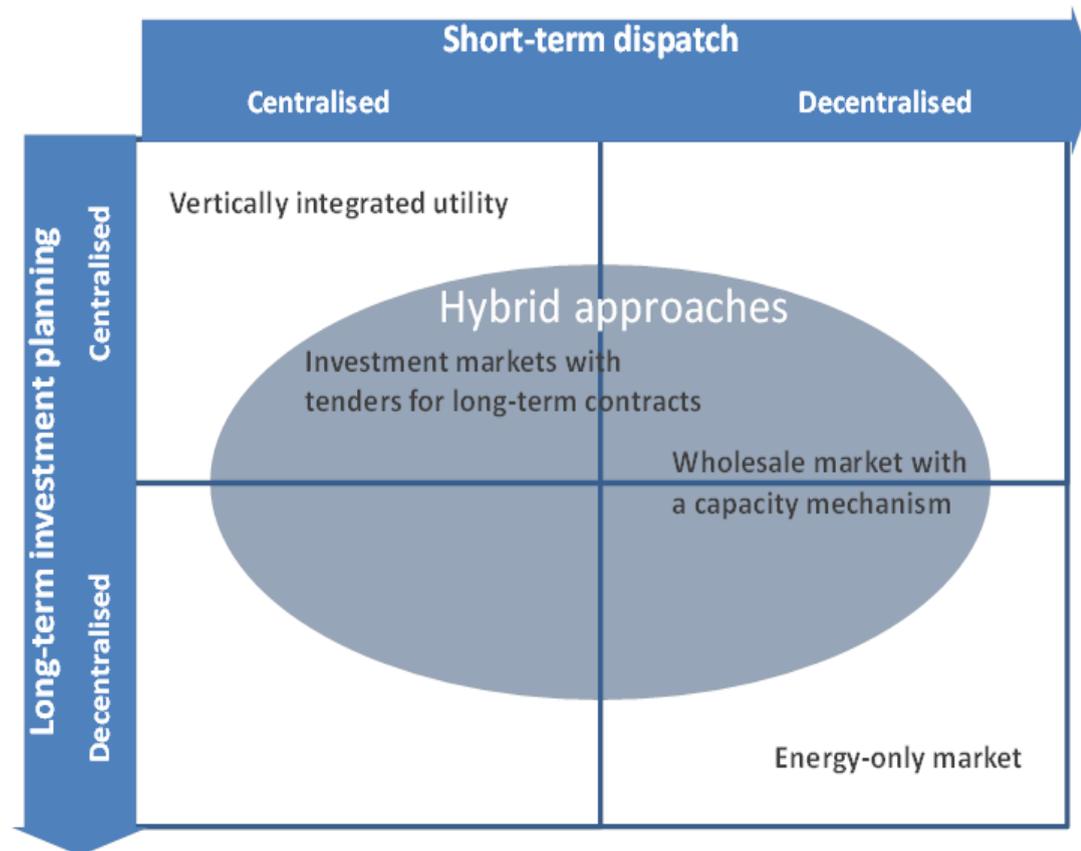
- Historical approach – coordination of short term dispatch and long term investment centralised

■ Liberalised markets

- Wholesale market prices coordinate market players' actions – short and long term

■ Hybrids

- Most markets are hybrids with some form of regulatory intervention
- Public intervention differs depending on objective, type of intervention and risk allocation



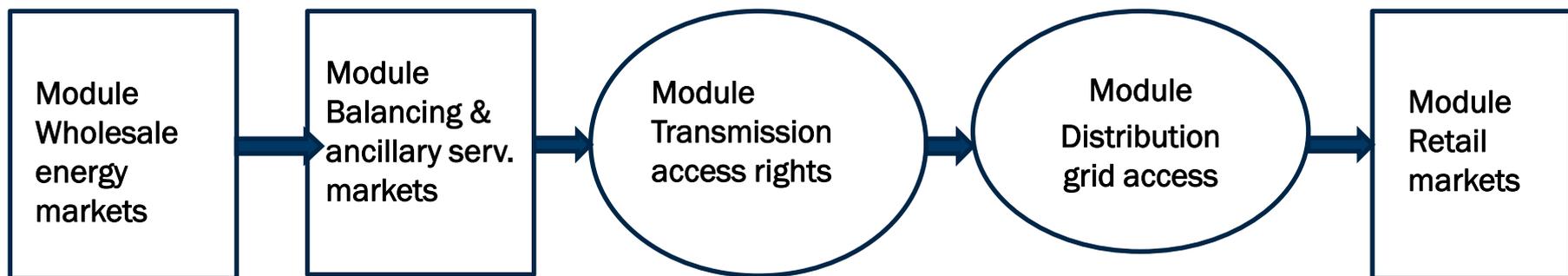
An institutional framework to analyse the “reform of the reforms” of the electricity industry

- **Several strands in the neo-institutionalism literature focus on explaining the drivers and dynamics of this evolution:**
 - The “rational choice” institutionalism emphasizes economic gains in terms of social efficiency (including the transaction costs) initially developed by Williamson (1996) and by North (1990);
 - The “historical institutionalism” focuses on power asymmetries and the general features of the prevailing political and economic system in the concerned sectors and countries; and
 - The “sociological or organisational institutionalism” highlights the importance of culture.
- **Last two strands focus on explaining the variety of liberalisation reforms and trial and error processes**
 - Due to differences of institutions and development policies, as well as the governance and regulatory approach
 - See for instance: Newbery, 2002; Glachant, 2001; Jamasb, Pollitt 2005; Joskow, 2008a Pollitt, 2008; Correlje, De Vries, 2008; Borenstein, Bushnell, 2015
- **Another area of study is the “reforms of the reforms” – both in developed and developing countries**
 - Highlight importance of the credibility of public governance and show how the roles of interest groups, public opinion, and common beliefs interfere with more objective drivers of market reform.
 - See e.g. Holburn and Spiller (2002), Correlje and De Vries (2008), Spiller (2009), and Henizs and Zellner (2010)
- **Our paper belongs to the “rational choice” strand of the institutionalist literature**
 - However, the variety of hybrid models, and the differences in the speed of evolutions towards the new hybrid regime related to institutional, legal and political issues would find relevant explanations in the historical and sociological strands.

A “modularity framework” to characterize the key elements of electricity markets

- Our approach builds on the “modularity framework” introduced by Baldwin and Clark (2000)

- Glachant and Perez (2009) use this “modularity” framework to analyse the complexity and variety of initial power industry reforms
- They identify a set of distinct functional and institutional modules along the electricity value chain



- In theory, the electricity market has two coordination functions:

- In the short-term, ensures the efficient operation of the different generation resources
- In the long term, signals a scarcity of capacity for different technologies
- In theory, complete consistency btw. ST and LT signals with perfect competition and information, and no risk aversion.

- However, in practice, electricity markets are incomplete and suffer from a number of imperfections.

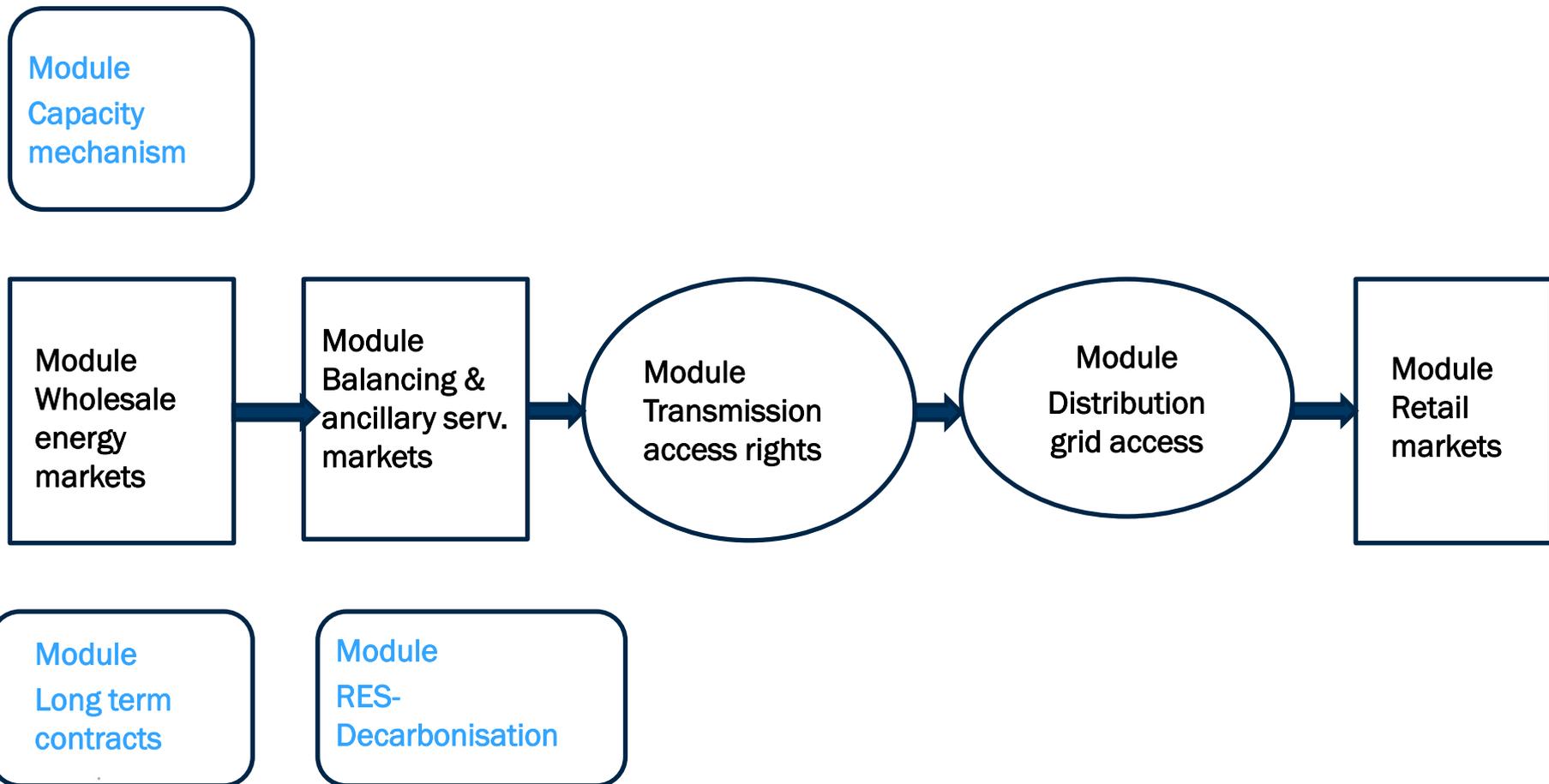
- Ability to deliver investment signals that guarantee resource adequacy and lead to a socially optimal generation mix remains uncertain.
- In addition, policies supporting the use of renewables have significant effects and amplify the market failures.

The new 'market modules' that characterize hybrid electricity markets

Applying the “modularity framework” to investigate the recent electricity market reforms

In our institutional framework, three different types of new modules are typically implemented to resolve these issues.

- The Long-Term Contracts module to support risk transfers and facilitate investment in different technologies
- The RES-Decarbonisation module to drive the decarbonisation of the energy mix , and;
- The Capacity Mechanism module to guarantee security of supply



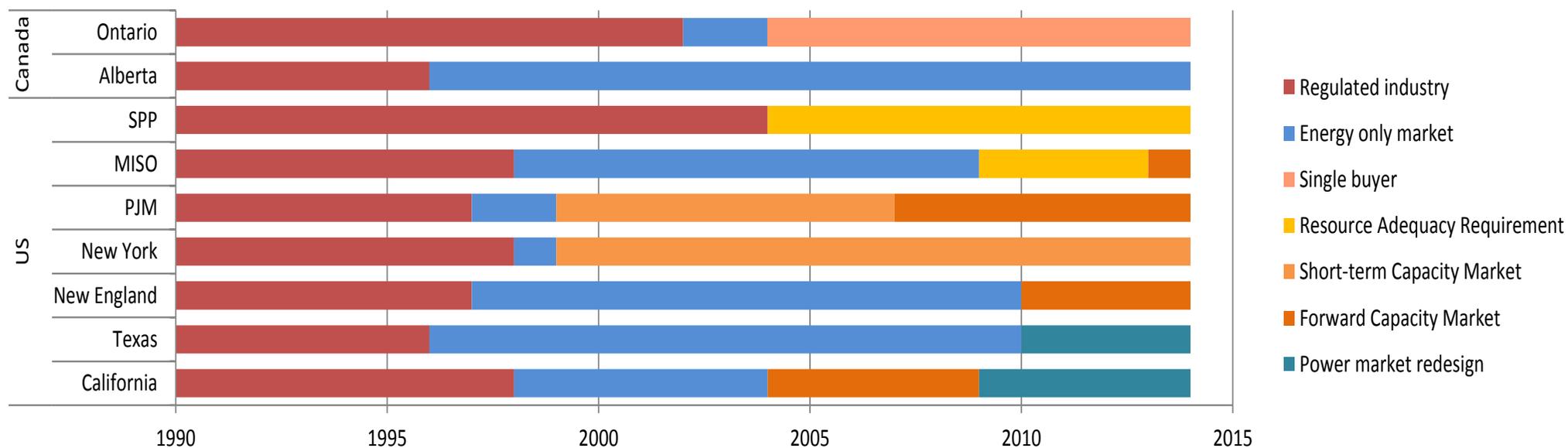
Case studies of hybrid markets around the globe

North America: Evolution toward hybrid markets

■ After the initial wave of deregulation and the start of the power markets in mid-90s, a number of **major revisions of the market design** have been implemented with different approaches across the states:

- Some of the revisions were pro-market (e.g. nodal prices in California and Texas)
- Others were administrative interventions to support capacity (short-term and long-term capacity markets and resource adequacy requirements) or short term scarcity pricing (Texas)

Timeline of regulatory reforms in North America



- Many states of the US and Canada have converted into a range of hybrid markets arrangements with some state intervention, often to support investment and/or influence the generation mix
- There is no standardised approach and a range of approaches exist since the failure of the 'Standard Market Design' initiative from the FERC

North America – Lessons from the various experiences with liberalisation

- The liberalisation process is stalled across North America, and a wide **variety of industry structures** coexist
 - FERC's attempt in 2002 to introduce a 'Standard Market Design' failed
 - Some states have gone through a number of pro-market reforms (e.g. nodal prices in California and Texas)
 - Others have seen administrative interventions to support capacity (short-term and long-term capacity markets and resource adequacy requirements such as PJM)
 - or even re-regulation (such as the reintroduction of a single buyer in Ontario)
- A **range of frameworks exists for generation investment** and resource adequacy, examples being:
 - Ontario: Administrative contracts for capacity procured a single buyer
 - PJM: Capacity markets clearing the capacity and setting capacity price based on the capacity requirement
 - Texas: Energy Only, relying primarily on the price signals from the energy and ancillary services markets
- **No optimal solution** seems yet to have been found among other North American regulatory frameworks to stimulate efficient investment
 - Some regulatory intervention seems necessary to induce efficient investment in Energy-Only market (e.g. scarcity pricing mechanism as in Texas)
 - Single buyer approach ensures capacity in the ground, but may create excessive risk for customers, especially in face of considerable need for investment and planning uncertainties (e.g. Ontario)
 - Provided that capacity markets are well designed, they induce material capacity. However, capacity markets are most efficient in inducing "low-cost" resources rather than new plant capacity (e.g. PJM)

Latin America – The two waves of market reforms

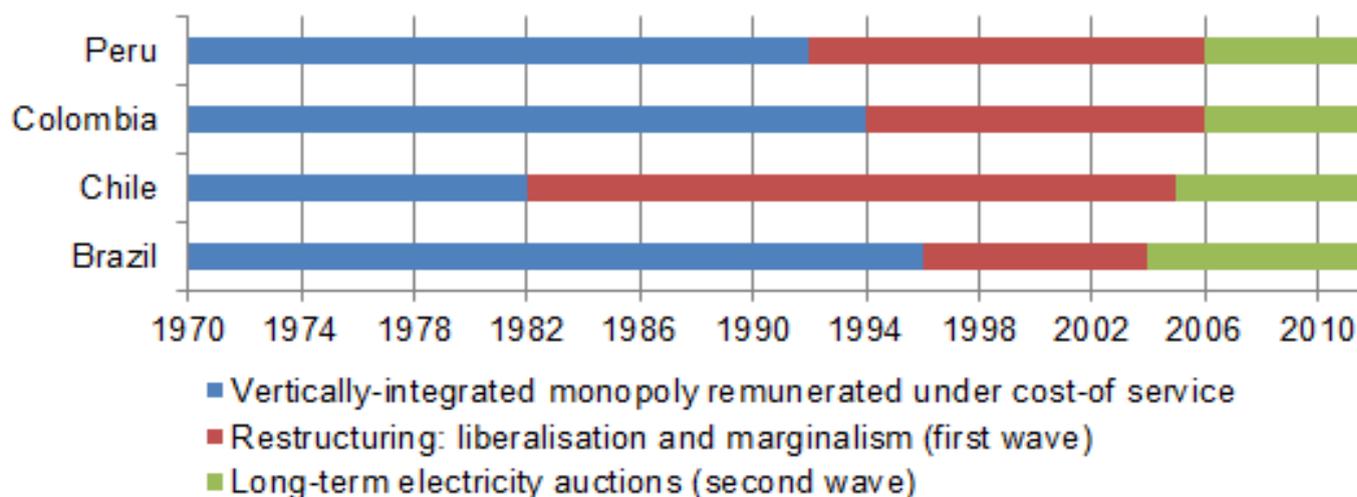
1st wave of market restructuring

- Early 1980s: vertically integrated monopolies.
- From 1982 onward: **partial liberalization with centralized cost-based dispatch**; prices for small consumers remain regulated.
- Policy discontent in the early 2000s:
 - Dissatisfaction with price regulation;
 - Volatile spot prices failed to stimulate timely investment; rotating blackouts in some countries;
 - No stable long-term generation revenues for project-finance of new capacity.

2nd wave of market restructuring

- Early 2000s: introduction of **hybrid markets with long term contracts (LTCs)** to support and coordinate investment. Rationale included:
 - Coordinating investment through a competitive process (auctions);
 - De-linking of investment from volatile spot prices;
 - Reducing risks for new comers and facilitating project financing through LTCs;
 - Allowing enough time to develop capacity through forward auctions reflecting anticipated need.

Timeline of regulatory reforms in selcted countries of Latin America



Latin America – Comparison of market and auction arrangements across countries

Country	Brazil	Chile	Peru	Colombia
Degree of centralisation	Joint auctions by distribution companies centrally organised.	Disco(s) organise and manage their auctions, possibility of joint auctions.	Disco(s) organise and manage their auctions, possibility of joint auctions.	Joint auction to ensure reliability, closing gap between supply and demand organised by the Regulator
Buyers	Regulated users.	Regulated users.	Regulated users, but free consumers can be included.	All consumers.
Sellers	Separate auctions for existing and new capacity	Existing and new capacity in the same auction.	Existing and new capacity in the same auction	Existing and new capacity in the same auction.
Load forecast responsibility	Disco(s) inform on load forecasts in each centralised auction to supply regulated market.	Disco(s) are responsible.	Disco(s) are responsible.	Regulator and planner provide demand, auction bridges the total system gap.
Delivery date	Existing: few months - 1 year New: 2-5 years	2-5 years	3 years	3 to 7 years.
Auction process	2-phase hybrid auction.	Sealed-bid combinatorial auction with pay-as-bid rule.		Descending clock auction.
Energy policy decisions	Specific auctions for technologies and special projects.	All technologies compete together.	Separate auctions for renewables.	All technologies compete together.
How often are auctions organised	Regular auctions to contract new capacity, government can organise additional auctions whenever needed.	Disco(s) decide.	Disco(s) decide.	At planner's discretion, whenever there is a foreseen gap between future demand and supply.



Latin America – Lessons from ‘hybrid’ markets

- Latin American power sectors have evolved in the past decade toward **various forms of ‘hybrid models’** combining a role for the **spot market and for long term contracts (LTCs)** in order to separate :
 - Short term system optimization (dispatch) based on spot market prices
 - Long term investment decision largely driven by auctioning of LTCs
- In practice, there are **significant differences in implementation** across countries:
 - Brazil: centralized scheme with a single auction to contract distribution company’s needs
 - Chile / Peru: decentralised scheme where distribution company auctions their demand
 - Colombia: auctions whenever demand not covered by capacity
- Whilst auctions for LTCs attracted significant interest of investors, much debate remains on the **effectiveness of the auction mechanisms** to attract investment in an efficient resource mix; key issues include:
 - The type product to be auctioned – energy, capacity or some hybrid product and implications for technology neutrality
 - How far in advance of delivery to run the auction, how much volume to auction and how frequently
 - The auction design: how to efficiently allocate and clear prices
- Of particular importance is the **definition of roles and responsibilities for planning** (load forecast), **contracting and running the auctions**:
 - Whether the procurement process needs to be centralised
 - Who should be the counterparty
 - Incentives to minimize costs, risk of policy interference and regulatory capture

Europe: The come back of long term contracts in recent European electricity market reforms

- Recent reforms suggest that some form of long term contracts / risk hedging instruments make a come back both for clean technologies and for thermal plants

Renewables /
clean technologies

Reforms of RES
support schemes -
auctioning of CFDs



Thermal plants

Capacity markets with
long term contracts
for new build



- Spot power market prices remain key for operational/dispatch incentives
- Fixed cost recovery and long term investment decisions increasingly decoupled from spot market dynamics and based on auctions / capacity remuneration schemes

Conclusions: Debunking myths about “hybrid” power markets

Towards a convergence of the new long term modules?

- **The hybrid regime has seen some convergence between these different modules in the past decade:**
 - The second wave of Latin-American electricity market reforms in the early 2000s introduced long-term contracts to support and coordinate investment in answer to investment market failures (Battle et al. 2010; Moreno et al., 2010, 2011; Rudnik et al., 2002, 2006).
 - In OECD countries, the dynamic over the past decades has focussed first on the RES-Decarbonisation module and more recently on the Capacity Mechanism module
 - But these new market modules increasingly borrow the key features of the Long-Term Contracts module: e.g. auctions of CFDs for RES, and long term capacity contracts for new entrants (up to 15 years in the UK, 7 years in France).
- **It is therefore possible that eventually the three different new modules will be merged into one single mechanism**
 - In Brazil and Chile, the auctioning of long-term contracts fosters a technology-neutral approach.
 - Ongoing discussions in the UK on simplifying the EMR multiple tools (auctions for CFD, for capacity, etc.)
- **Finally, an important driver of the future evolution of the long-term modules that characterize the new hybrid electricity regime is competition policy rules at the supranational or federal level.**
 - EU the State Aid regulations have recently refined their approach toward both RES and LCTs support and capacity mechanisms.
 - The principle of getting long-term contracts to help to trigger investment decisions with revenue guarantees is henceforth recognized, provided that long-term competition exists to allocate them.
 - Moreover the principle of regular open tenders for an certain amount of capacity relies implicitly on a planning approach.

The fundamental underlying principle of hybrid markets: Toward ‘competition in two steps’

Investment planning (years ahead)

Operations planning (days /hours ahead)

Competition “for” the market

- Tendering of long term capacity contracts
- Can be technology neutral or specific
- Puts competitive pressure where it matters: CAPEX
- Can be used to stimulate new entrants and development of competitive market
- Ensures coordinated system development

Competition “in” the market

- Well integrated and liquid forward, day ahead and intraday markets
- Optimizes short term dispatch and minimizes costs for consumers
- Level playing field with balancing obligation
- No distortions as subsidies not based on production

■ Key alternatives / trade offs to implement two step competition based on long term contracts :

- Use a technology neutral (single auction) or a technology specific approach
- Mandate an independent organization to define the type of contracts and to procure them through a centralized auction (e.g. capacity auction, CFDs, etc.), or implement a decentralized process with contracting obligations on suppliers (e.g. capacity obligation, renewables obligation, etc.)



Conclusion and policy implications

- A variety of 'out-of-market' mechanisms have been introduced to support RES development, ensure security of supply, and provide some form of long-term risk sharing arrangements to support investment.
- These interventions affect the pre-existing market, and adjustments are therefore required to overcome the resulting inconsistencies and overlaps to define a consistent hybrid market model.
- Our review of some of the international experiences with hybrid markets suggests a dynamic process of gradual evolution and learning to address some of the issues associated with the interfaces between the modules.
- Despite the variety of rules and arrangements adopted in the different countries, some common features can be identified: investment is structured by the combined principles of planning, competitive tenders for long term risk sharing arrangements, and expected revenues in short term markets.
- The move towards a hybrid market model appears to be unavoidable as long as governments want to be involved in determining the generation mix and to guarantee security of supply at an administrative level.
- While more research is required to identify the best practices, the recognition that government involvement is here to stay, given the policy objective of decarbonisation, would help to cast a new light on existing legislative and regulatory practices (e.g. for competition and state aid rules)
- More fundamentally, our institutionalist perspective on the evolution of electricity market design highlights the importance of a sound governance process that allows for a dynamic approach to market design.

Annex: Our recent work on electricity market design as well as the ETS and RES policies

Our recent work on electricity market design

Toward the Target Model 2.0 – Policy Recommendations for a sustainable market design

[Web link](#)



Publications on capacity mechanisms

- Market design for generation adequacy: healing causes rather than symptoms [Web link](#)
- Coordinating capacity mechanisms – which way forward? [Web link](#)
- European electricity market reforms: the “visible hand” of public coordination [Web link](#)

Publications on European electricity markets

- The new European Energy Union - Toward a consistent EU energy and climate policy? [Web link](#)
- European electricity markets in crisis: diagnostic and way forward [Web link](#)

Our recent work on the ETS and RES policies

Wake Up! Reforming the EU ETS: Comparative Evaluation of the Different Options

[Web link](#)



The new European Energy Union - Toward a consistent EU energy and climate policy?

[Web link](#)



Electricity Market Design and RE Deployment

[Web link](#)

