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Complementing electricity markets with long-term instruments

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Content

1. Key principles of an investment framework articulating long term contracts / hedging with short term markets

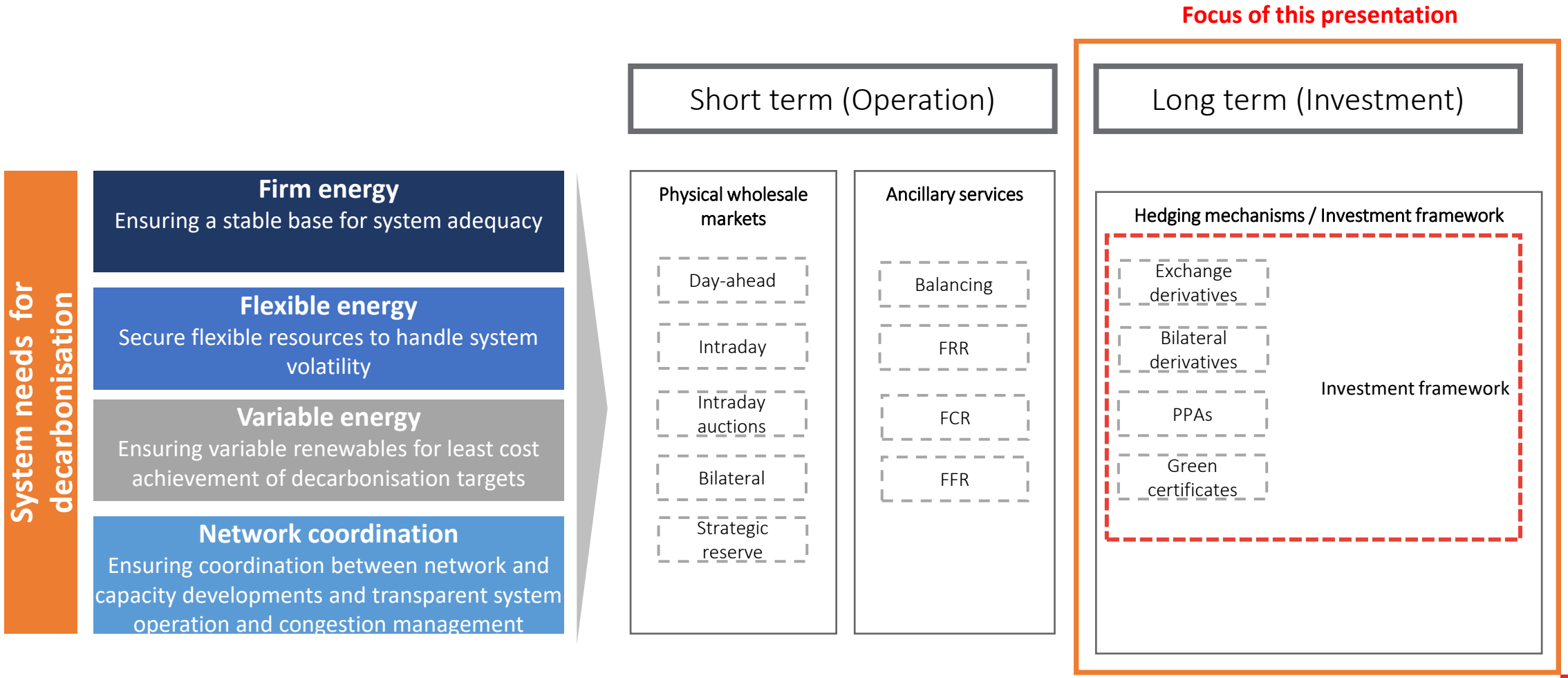
2. International case studies on investment frameworks

3. Main elements of the long-term contracting framework

4. Conclusion

Key principles of an investment framework articulating long term contracts with short term markets

This lecture focusses on the long-term contracting issues to complement market reforms focussing on short term operation

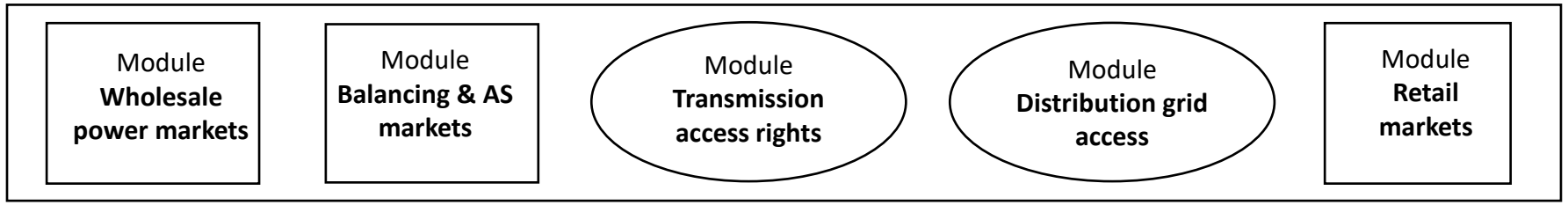


Content – introduction

- **There is a growing consensus that the canonical electricity market design (liberalised EOM) is not fit for purpose and that reform is needed to support investments required for decarbonisation.**
  - ✓ A number of countries with liberalised markets have taken steps to introduce some planning and contracting arrangements (e.g., CRMs / tenders of LT contracts for RES)
- **The literature on "hybrid markets" has mainly focussed on (e.g., Roques & Finon, 2013, 2017; Joskow, 2021; Keppler et al, 2021):**
  - ✓ The drivers of the introduction of such complementary planning and contracting mechanisms (e.g., theoretical issues with canonical model of liberalised markets, market and regulatory imperfections)
  - ✓ Possible alternative approaches to introducing contracting, de-risking or hedging schemes to protect consumers and foster investment
- **Yet, little focus on establishing a conceptual framework to explore the range of approaches for "hybrid markets" that have been used by policy markers and regulators to address the different issues with the EOM and support investment for decarbonisation.**
- **This paper addresses this gap in the literature and seeks to analyse the key common features of hybrid markets that are emerging across different countries and to provide a structured analysis and typology of "hybrid markets" [Work in progress].**

An institutional economics approach

- **This paper uses a conceptual framework inspired from the institutional economics literature to provide a common framework to analyse the various types of hybrid markets in different countries.**
  - ✓ The “rational choice” strand of the institutionalist literature initially developed by Williamson (1996) and by North (1990) emphasizes economic gains in terms of social efficiency (including transaction costs).
  - ✓ Baldwin & Clark (2000) introduced the “modularity framework” regarding the design of rules in an industrial organisation.
  - ✓ Glachant & Perez (2009) used this “modularity framework” to analyse the complexity and variety of initial power industry reforms and identified a series of distinct functional and institutional modules along the electricity value chain.
  - ✓ Roques & Finon (2017) built on this framework and identified a number of new “modules” that characterise the evolution of electricity markets given security of supply (capacity mechanism module) and decarbonisation (LT contracts and support for clean technologies)



Core/legacy modules of canonical energy only market model

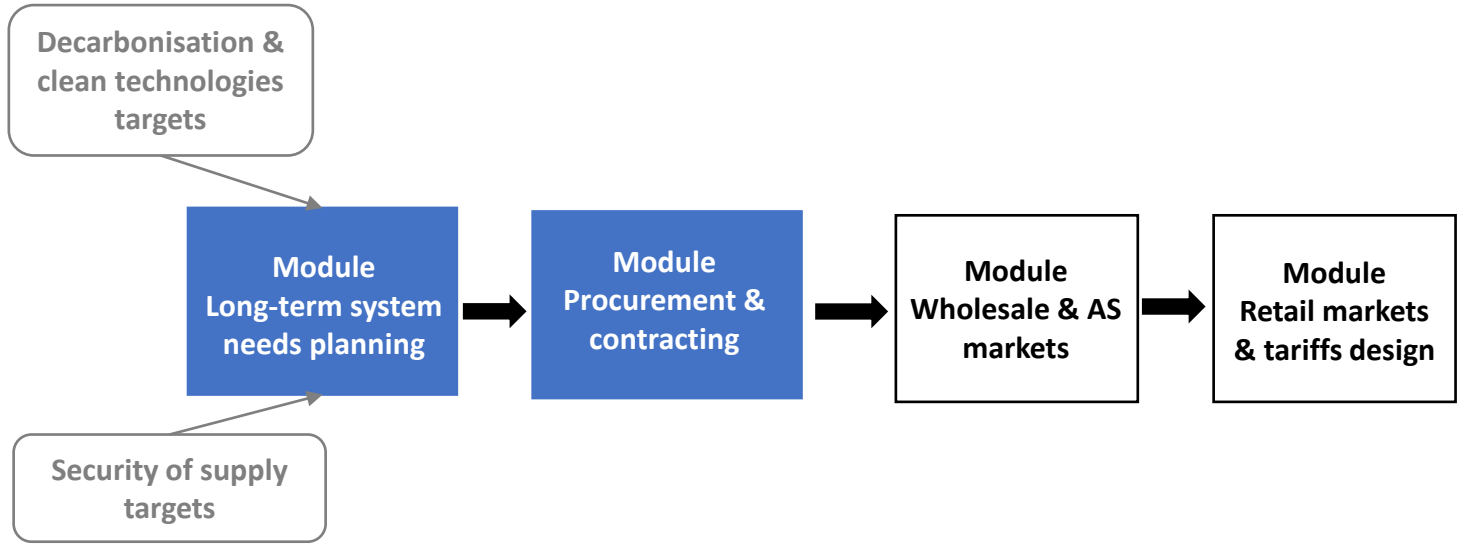
Introduction of two new modules in hybrid markets (1/2)

Two main long-term issues with EOM framework	Hybrid market modules to address these two issues
Need for coordination (short-term price coordination in EOM is not sufficient to drive investments/closures given exogenous policy objectives for decarbonization)	**Quantity-based coordination and planning of long-term system needs** (e.g., some form of planning, decentralized quantity obligations)
Need for long-term contracts or hedging arrangements (that do not spontaneously emerge, or not at the adequate level, in an EOM)	**Long-term contractual / hedging arrangements** (e.g., obligations to contract, LT centralized auctioning, public long-term counterparty)

Depending on the intensity of these issues, different types of hybrid markets can be considered

Introduction of two new modules in hybrid markets (2/2)

- **Typology of emerging hybrid market models based on two new key modules:**
  - ✓ i) planning module defining the long-term system needs (quantity-based coordination tool);
  - ✓ ii) contracting/procurement module, which ensures the adequacy of investment to meet system needs, allocates risks efficiently, and leverages competition to bring down costs.



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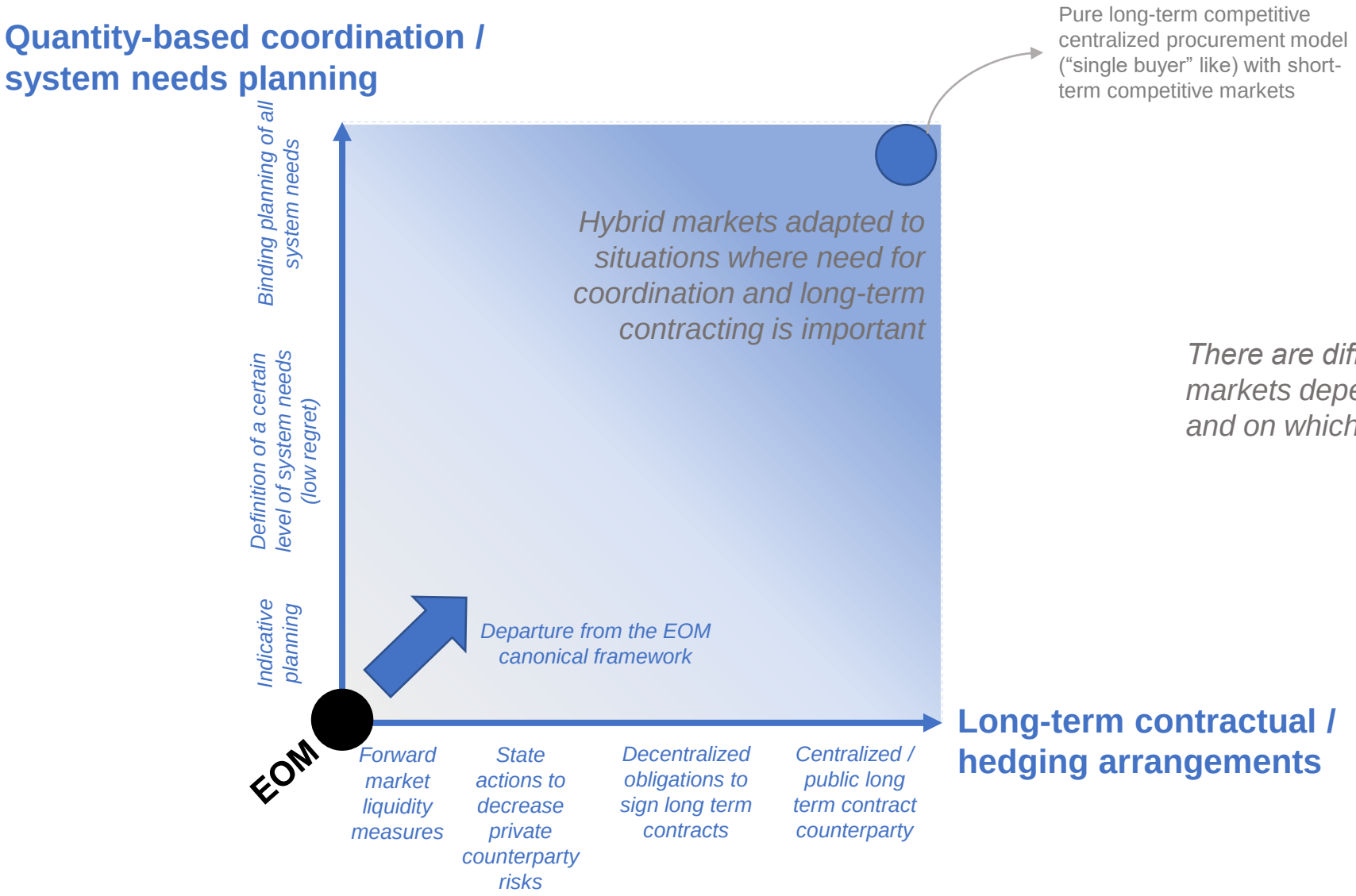
First tentative typology of hybrid markets (1/2)



There are different "shades" of hybrid markets depending on local context and on which issues predominate

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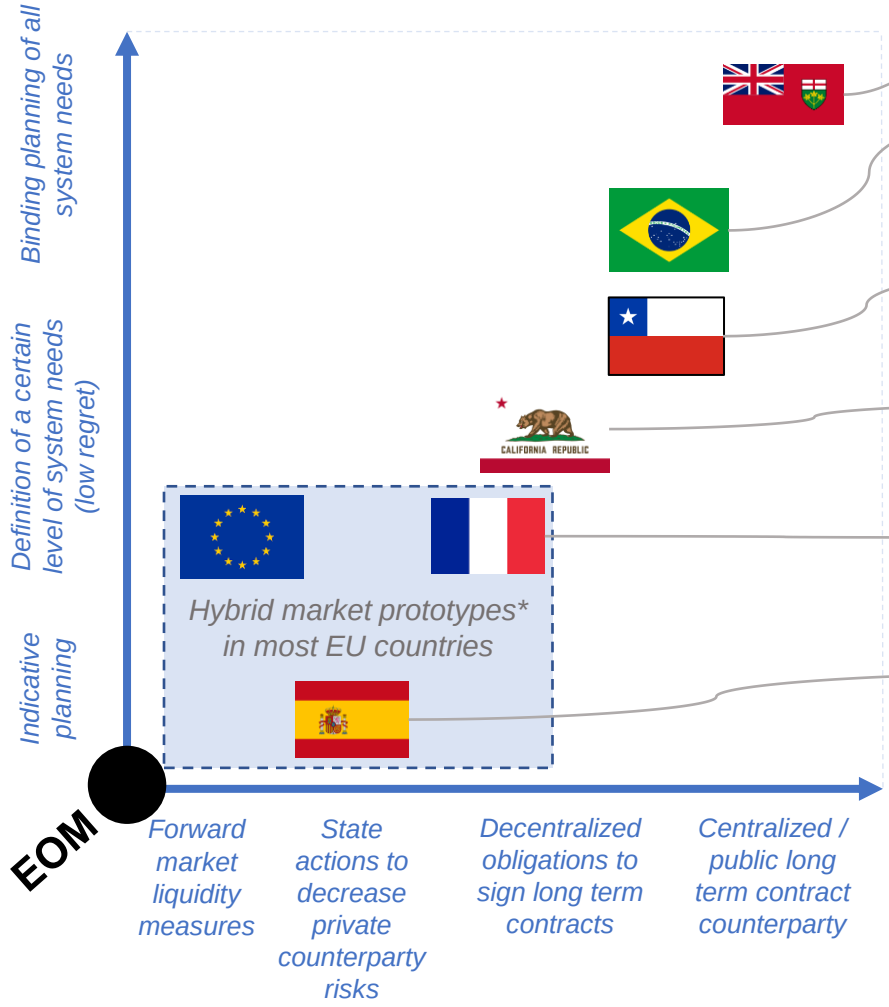
First tentative typology of hybrid markets (2/2)

Quantity-based coordination / system needs planning



Ontario/Canada:
Centralised procurement & centralised LT counterparty combined with short-term competitive markets

Brazil:
Obligations for retailers and big industrial consumers to contract long term with centralised procurement

Chile:
Obligations for retailers and big industrial consumers to contract long term (joint/centralised long-term procurement for retailers, decentralized procurement for big industrials)

Proposal for California/USA (Wolak 2021):
Obligations for retailers to contract long term

France:
Short-term mandatory planning of system needs (PPE) + LT contract RES tenders + decentralised capacity obligations (CRM) + distributional schemes (e.g., ARENH)

Spain:
State-backed solvency guarantees for RES PPAs with electro-intensive consumers

**Prototypes: comprise hybrid design elements but added on top of one another without sufficient coordination or holistic approach from the start*

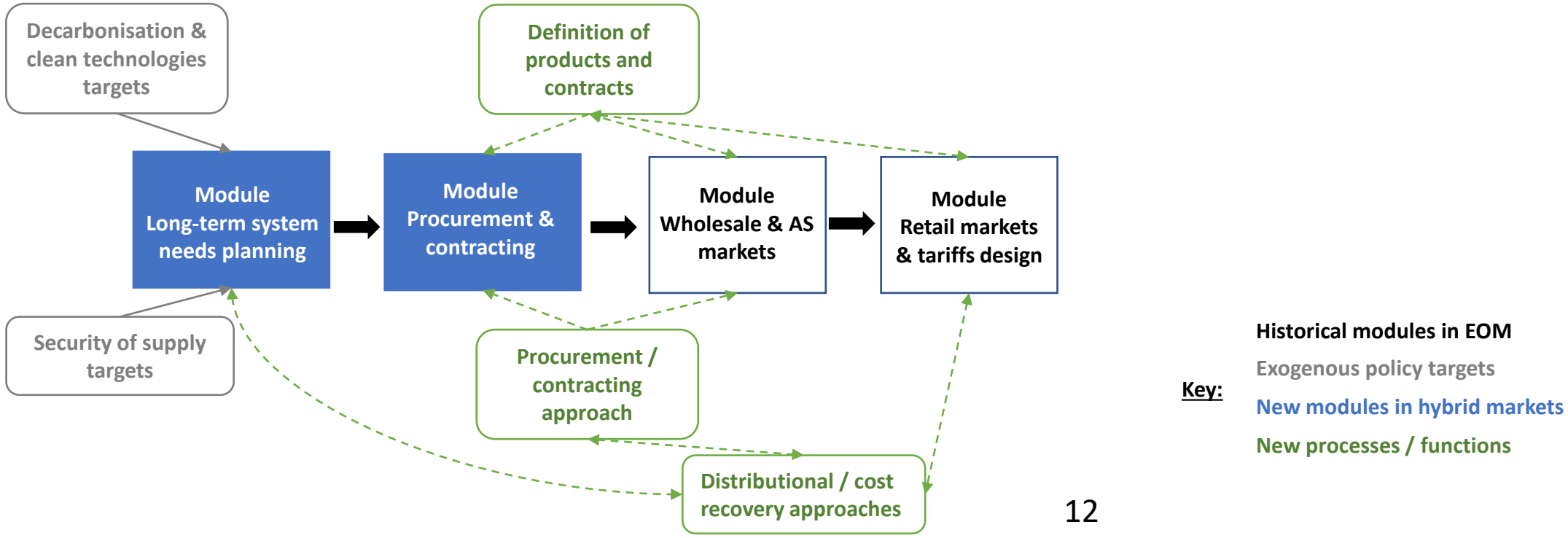
Key issues with the two new modules – Design trade-offs

- **The planning and definition of system needs to meet policy targets and maintain security of supply requires:**
  - ✓ A holistic approach for system planning including electrification of end uses and associated infrastructures
  - ✓ New approaches for planning under (deep) uncertainty to identify low-regret pathways
  - ✓ A rethink of the governance of the organisation / entity in charge of the planning
- **Procurement and contracting: the forward contracting of some or all of system needs requires the definition of:**
  - ✓ The objectives and timing of procurement
  - ✓ The nature of the contracting process, either centralised or decentralised via the imposition of obligations on suppliers
  - ✓ The type of products and contracts used for forward contracting, their degree of standardisation (e.g., to support a secondary market), how they are auctioned / traded, whether there are state guarantees involved, the type of market clearing, whether there are specific market power mitigation approaches, etc.

→ **Rich variety of design choices with important trade-offs to put in relation with policy objectives and contexts**

Key issues with the two new modules – Cross-module interactions

- **The functions performed by new modules and how they interplay with legacy modules must be assessed carefully, for instance:**
  - ✓ i) the ways in which short-term remuneration of the different resources in wholesale and ancillary services markets interplays with the contracting of different products;
  - ✓ ii) the articulation with retail competition, in particular the issues of allocating the costs associated with forward contracting to different categories of users, or ensuring efficient retail competition through the pass though of the contracting obligations.



International case studies on investment frameworks

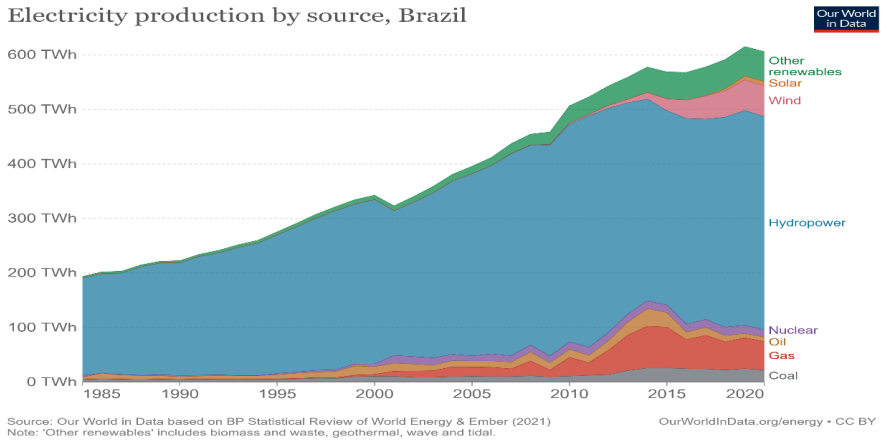
International investment frameworks – overview of main design elements

	Brazil	Chile	Ontario
Planning	Independent planning agency EPE	Regulator and ministry	Transmission System Operator IESO
Procurement	Procurement by distributor companies through a centralized market-place	Regulator CNE procures on behalf of distributors who remain off-takers and counterparties.	IESO procures capacity through competitive tenders passing the cost of contracts to consumers
Auction process	Separate procurement of new and existing capacity as well as RES and reserves	Centralised auction with standardized products	Long-term PPAs for the existing generation, competitive tenders and negotiations for new generation
Auction product	Energy quantity products for hydro, PV and wind and energy availability contracts for thermal	Long-term contracts setting maximum amount of committed energy	CfD-like PPAs

Case study Brazil: Key context and system needs

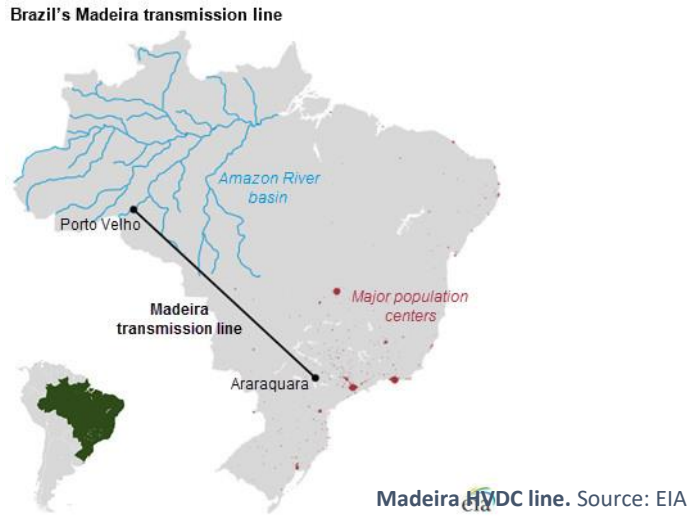
Electricity mix and policy

- The **largest** power system in South America.
- Dominated by a single technology, **hydroelectricity** (see upper right chart)
- Brazil intends to diversify its generation mix in the coming years: The **2024 Brazilian Energy Plan** calls for expanding development of non-hydro renewable generation technologies
- Most of Brazil's generation capacity is located in the **Amazon basin**, north of most urban load centres, in the southeast (see lower right chart)



Overview of the regulatory framework

- Until the late 1990s, Brazil's electricity sector consisted of a series of vertically integrated utilities.
- In the late 1990s, unbundling and introduction of a Spot Market
- Fast demand growth and lack of incentives for investment resulted large scale shortages of electricity in 2001-2002
- A major reform led to the implementation of a hybrid system in 2004:
  - **Regulated consumers (~70% of consumption, under 3 MW)**: supplied by the local distribution companies in monopoly, which procure energy on their behalf through LTCs auctions.
  - **Free consumers (~30%, over 3 MW):** can procure their energy as they please (bilateral contracts, auction, etc.).



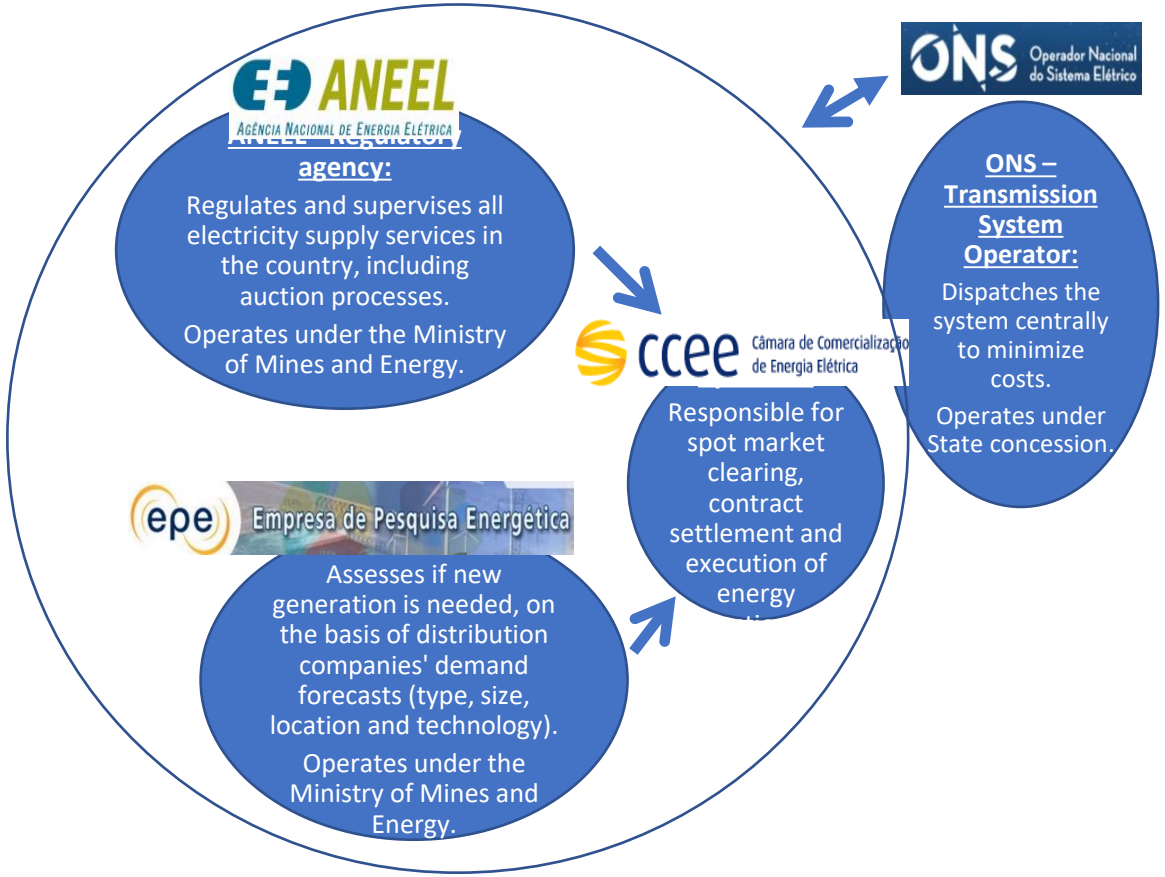
Madeira HVDC line. Source: EIA

The 2004 reform introduced a hybrid market framework overlaid with auctions of long-term contracts to support least-cost electricity expansion

Case study Brazil: Planning and procurement governance

- **Planning governance**
  - Roles for planning are differentiated
  - **Distribution companies produce load forecasts for their local monopoly** and must contract energy through Long Term Contracts to meet their forecasts.
  - Separately, for long term adequacy, a **planning agency (EPE) determines whether new generation is needed** based on the aggregation of distributors' demand forecasts.

- **Procurement governance**
  - **Auctions are organised for the regulated market** by CCEE under the delegation of ANEEL:
  - CCEE acts as a **broker: it coordinates a central auction** process for procurement of energy on behalf of distributors – it does not buy and sell electricity.
  - **Distributors individually contract with each generator** in proportion to their share of the pool.
  - This allows to **mutualise and mitigate the counterparty risk** for the distributors on one side, and for generators on the other side



Organisation and role allocation in the Brazilian power sector. Source: *CL intelligence*

Case study Brazil: Auction process and auction products

- **New and existing capacity have been procured in separate auctions**
  - First, existing capacity is procured, then, if needed, new capacity via specific auctions
  - Terms and delivery differ by auction (right table).
- **Other types of auctions conducted to target specific purposes**
  - Alternative energy sources (LFA), Short-term adjustment needs (LA), and procurement of Reserve Energy (LER)
  - For each auction, the government defines how much of the electricity being procured is to be supplied **by different fuel sources and the type of contracts (quantity versus availability) per fuel source**
- **Common auctions for thermal and RES ensure a level playing field**
  - The de-rated firm energy or physical guarantee represents the amount of energy that can be delivered under a **pre-defined degree of reliability**
  - Hence it is the **maximum monthly amount of energy that can be sold via contracts,** determining the power plants **competitiveness in the auctions.**
  - The derating methodology used to determine the firm energy amount is **complex and depends on the energy source and technology**

Key auction characteristics

	Existing capacity	New Capacity
Desired basis for price	Short-run marginal cost	Long-run marginal cost
Contract term	1 to 15 years	Thermal: 15 years RES-E: 20 years Hydro: 30 years
Delivery date	Few months to 2 year	3-6 years ahead

Source: CCEE auctions' statistics.

Case study Brazil: Auctions results: RES take over conventional for new capacity

Contracted capacity

- The sequence of long-term auctions allows covering a large part of the system need over a long term (up to 2045)
- Contracted wind energy volumes reach and exceed the contacted gas volumes

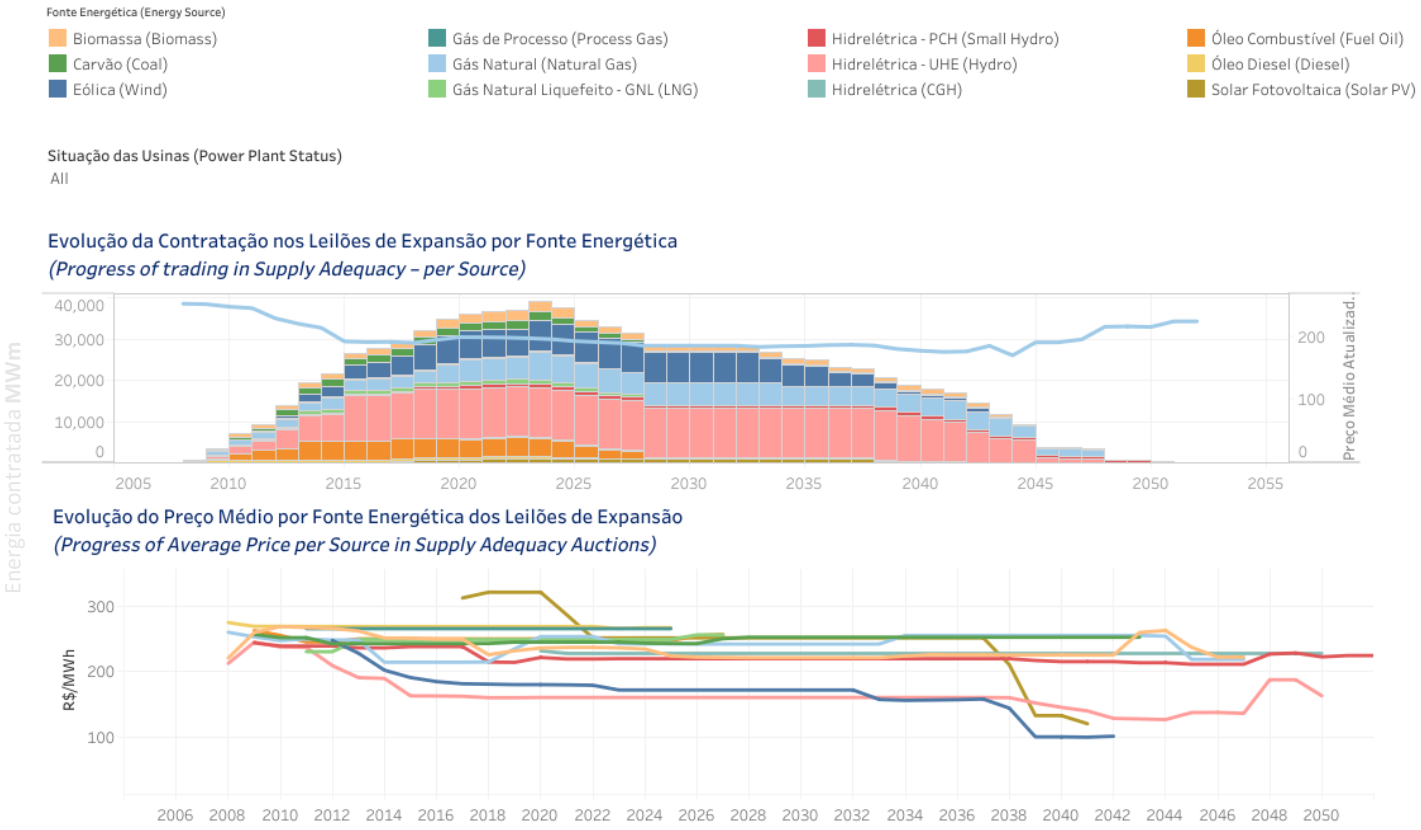
Auction prices

- Wind energy contracts become more competitive as compared to hydro, biomass and natural gas.

Notes:

- For the same auction, prices per technology are different because the auction is Pay-as-bid and there are specific price caps and share floors per technology
- Each technology can have a different contract duration
- 1R$=0.17€

Median prices achieved and forecasted by energy source in auctions



Source : Monthly newsletter referring to the consolidated result of the auctions carried out by the CCEE – Info Auction Dynamic 16-July-2018

Some RES are already able to compete with conventional energy sources in general new energy auctions. Today, wind represents the cheapest energy source.

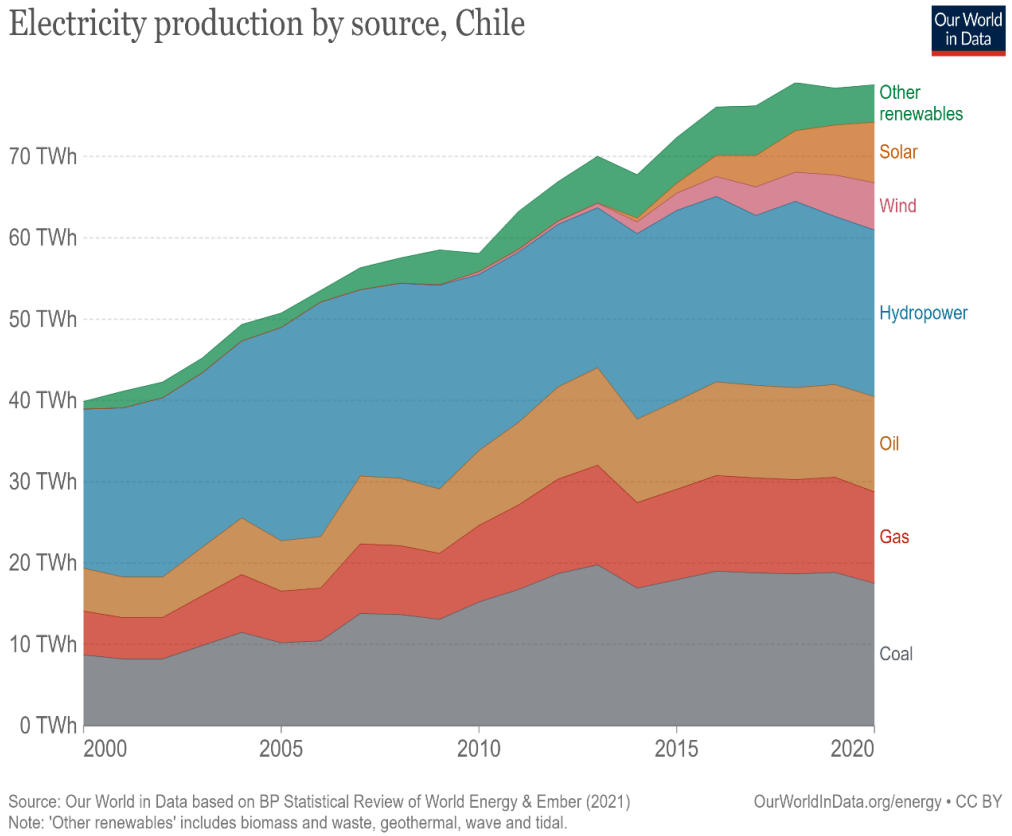
Case study Chile: Key context and system needs

Electricity mix and policy

- Chile's power mix is still **dominated by fossil-fuel sources, but RES are growing fast** (PV in particular – see right chart)
- Due to the country geography, the power system is divided into **several zones**
- Objective to **phase out coal generation by 2040** with a fully decarbonized energy matrix.

Overview of the regulatory framework

- **First electricity market in the world to be liberalized (1982),** supply of captive consumers remained regulated.
- In the **early 2000s difficulties for financing of new projects**: volatile spot price and 2004 gas curtailment from Argentina.
- In **2004/2005 the Government introduced auctions of long term contracts** in order to stimulate investment. 2 types of consumers:
  - **Regulated consumers (44% of consumption in 2018)**: Mainly residential. Supplied through distributors.
  - **Free consumers (56% of consumption in 2018):** Mainly industrial. Expected to procure their own supply requirements independently, through their preferred mechanism (auctions, bilateral contracts, etc.).



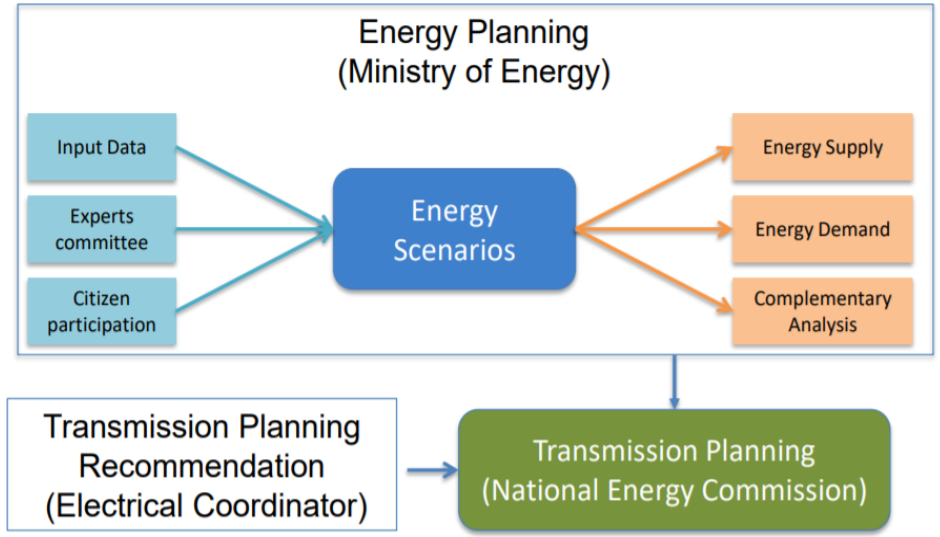
The 2004/2005 reform introduced auctions of long-term contracts to support investment.

Case study Chile: Planning and procurement governance

- **Planning governance**
  - Before the 2015 reform, distribution companies were responsible of planning capacity based on their demand forecasts and to manage their own procurement auctions.
  - Since the 2015 reform, the regulator CNE forecasts electricity demand and outlines a **10-year plan** to expand the electric system, based on the TSO recommendations and the Ministry scenarios
  - The plan prescribes the amount and the timing of necessary new capacity.

- **Procurement governance**
  - After the 2015 reform, auction management is transferred from the distributors to CNE, with **homogeneous products and rules** that reduce barriers to entry.
  - The 2015 Reform introduced **centralisation and product standardisation** with the objective of increasing competition and liquidity, decreasing price, and allowing RES to be more competitive in the auctions:
  - However, **the distributors are still the off-takers and counterparties**.

Planning process since the 2015 reform



Case study Chile: Auction process and auction products

- **Auction process**
  - Distributors have to always be **100% contracted in advance**
  - Auctions are **technology-neutral, open to new and existing** generators.
- **Auction products**
  - Long-term contracts (LTC) for delivery 5 years after the auction with duration up to 20 years.
  - LTCs are **not "take-or-pay"** contracts
    - Set a **maximum annual amount of energy committed** by the awarded bidder (~forward option)
    - This introduces **demand uncertainty** to potential bidders if auctioned demand is not in line with the real or effective demand.
  - Auctioned products are adapted to RES generation profiles (time-blocks)
    - In 2015, the bidding conditions changed from the standard "flat" 24-hour block to various time-blocks (hourly and quarterly).
    - This favours certain technologies, e.g. solar (in the hourly-segmented 24-hour block) as well as hydro and wind (in the seasonally-adjusted quarterly blocks).
    - This allows intermittent technologies to maximize their potential without having to incorporate a storage component
  - LTC expose generators to **congestion price risk** in case they are not located in the same zone as their counterparty

In Chile, the LTCs are forward options which leave generators exposed to demand uncertainty and congestion price risks

North-South congestions and transmission grid development

The Atacama Desert in the north receives some of the strongest, most consistent sunshine on Earth and has seen substantial solar and wind project development.
The North Power system (SING) is home to a quarter of the country's total generating capacity, largely serving mining operations in the region. For decades, the SIC and SING operated independent of one another.
That changed in November 2017 when a new, $700-million interconnection was completed. Among its goals was to ease delivery of low cost clean energy from the remote desert to population centers further south. The interconnection was reinforced with the commissioning of the 753km Polpaico-Cardones line in mid-2019. This has further alleviated grid congestion.

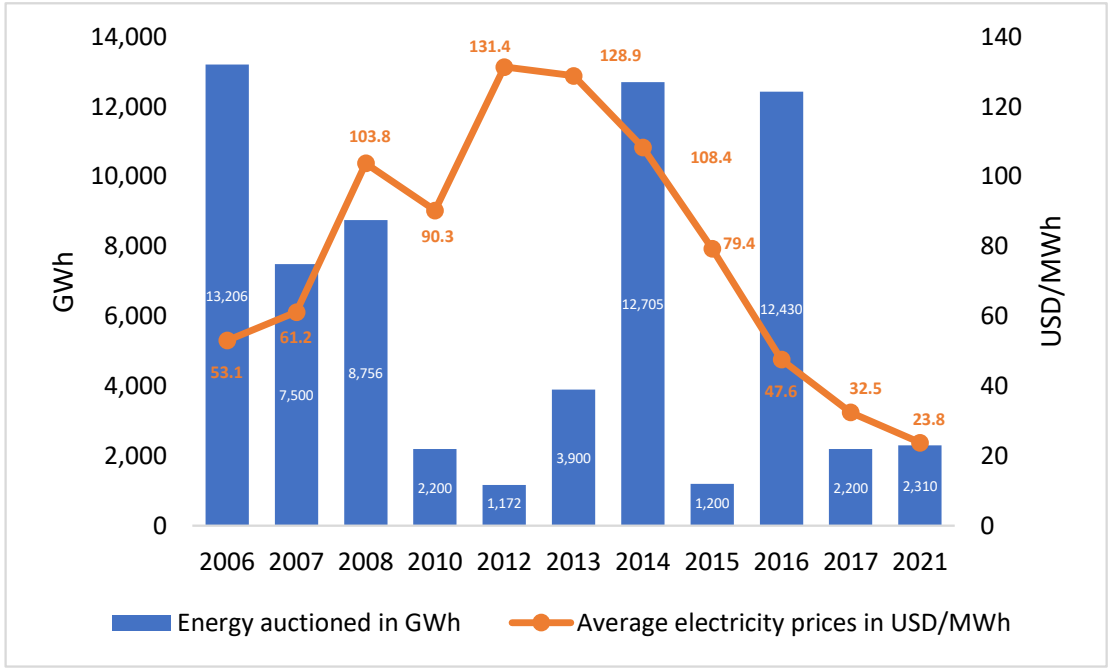
Figure 4: Chile's power systems

Source: CNE

Case study Chile: Procurement Outcomes

- The 2015 reform of the procurement and the introduction of the time-blocks has led to an increase in approved RES projects and a sharp decrease in auction prices since 2014.

Energy auctioned and average prices in Chile from 2006 to 2021



Source : Ministry of energy, Chile

New time-blocks products introduced by the 2015 reform favoured the development of solar.
As RES share increases, Chile may have to consider additional products given the rising need for flexibility.

Case study Ontario: Key context and system needs

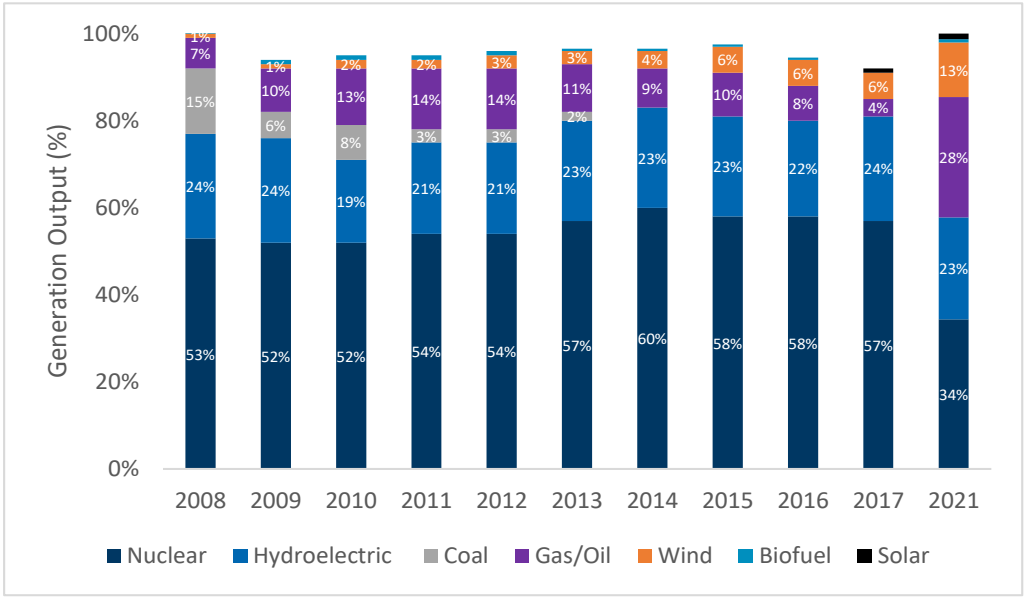
Electricity mix and policy

- Ontario electricity mix is **largely carbon-free**, with nuclear power (60% in 2017) and hydroelectricity (26% in 2017) making up almost all generation
- Through its Long-Term Energy Plan, Ontario has transformed its power mix in the past decade (Coal phase-out by 2014 – see right figure)

Overview of the regulatory framework

- In 2002, the **vertically integrated utility was split** into Generator, Transmission, and Distribution, and a system operator. Ontario Power Generation (OPG) owned around 90 percent of the total generation capacity. A **Spot market** was introduced.
- **Wholesale prices rose sharply** after the reforms due to market fundamentals (high demand driven by the hottest summer in 50 years, reduced generating capacity, and limited import capacity).
- Residential consumers who were directly **exposed to the wholesale price volatility** urged politicians to intervene.
- The wholesale market was **closed after only six months**, retail price were frozen and the **Single Buyer** model was implemented in 2004.

Ontario Power generation evolution

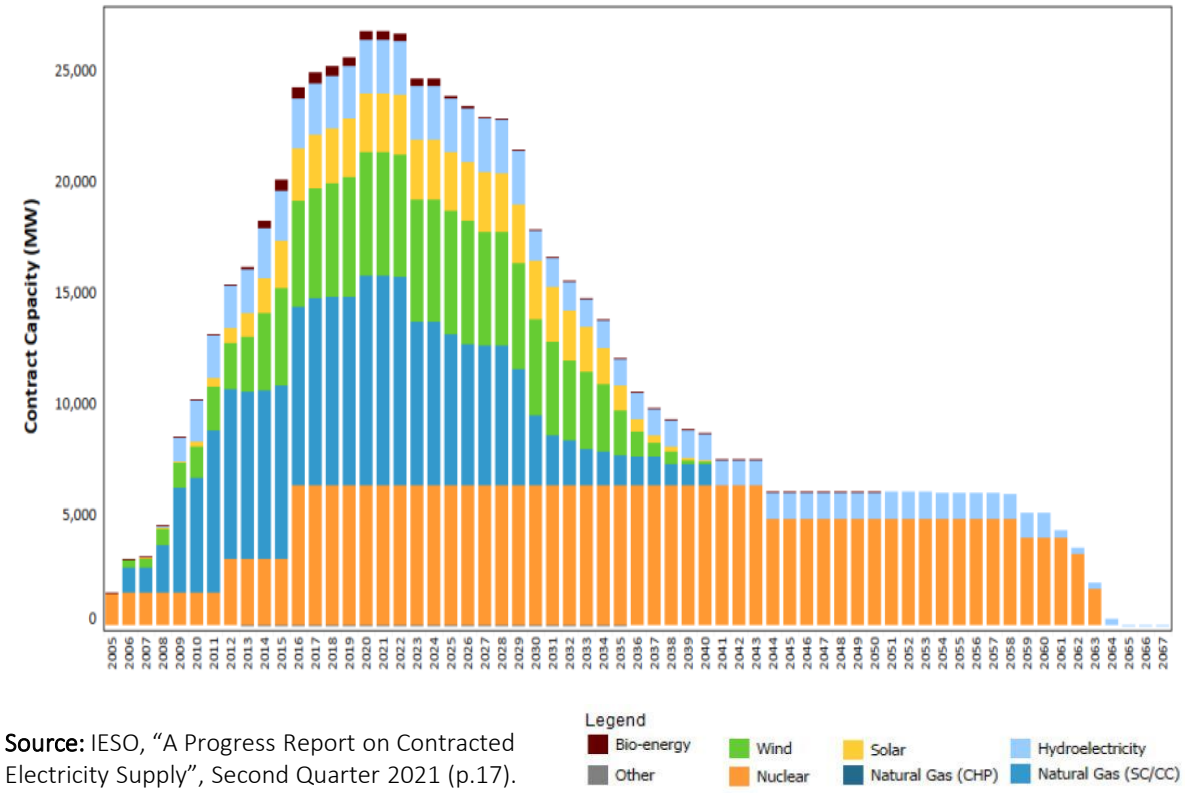


Note: Biomass generation from 2008-2013 reported with solar.
Note: Labels for capacity percentage <1 are not shown.
Source: IESO Media Center, Year-End Data. IESO reliability outlook 2021 data (page 14).

Case study Ontario: Planning and procurement governance

- **Planning governance**
  - Under the Ontario **Single Buyer Model**, forecasting and planning is **centrally controlled by** Ontario TSO (IESO):
  - IESO prepares **20 year plans** for generation and transmission to meet forecasts, and ensures that adequate generation is contracted through the procurement process.
  - IESO provides **advice to government on policy priorities**, including phasing out the use of coal and increasing renewable energy sources.
- **Procurement governance**
  - Procurement in Ontario is the responsibility of the **Single Buyer IESO**
  - IESO responsibility to ensure **adequate, reliable and secure electricity supply and grid** came before cost minimisation.
  - These obligations were likely to create incentives for **over capacity**.
  - It resulted in a **too high capacity margin and customer prices** higher than in neighbouring areas.

Capacity under LTC in Ontario

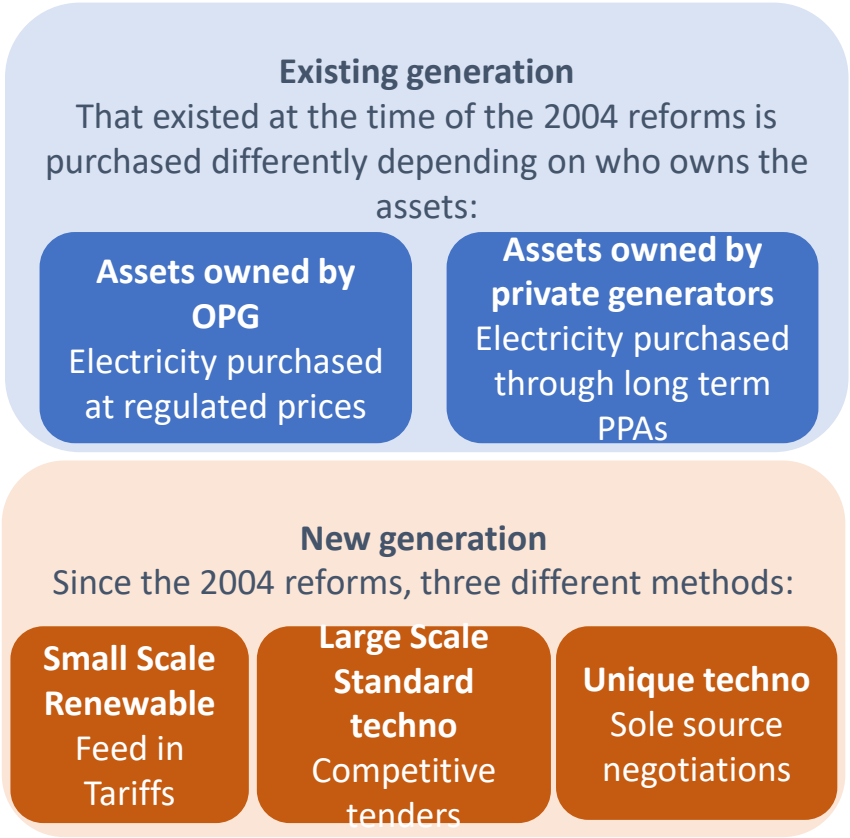


Source: IESO, "A Progress Report on Contracted Electricity Supply", Second Quarter 2021 (p.17).

Centralisation of both system forecasting and procurement by the TSO (without sufficient incentives to minimise costs) has led to limited checks on the planning and procurement process, unnecessary contracting and excessive capacity margin.

Case study Ontario: Auction process and auction products

- **Auction process**
  - Capacity is procured through **competitive tenders on an as-needed basis**
  - **Contracts costs are passed on to consumers**
  - Capacity existing at the time of the 2004 reforms is treated **differently from new capacity**. However, **both can benefit from long term PPAs**:
  - The duration of PPA contracts with Ontario's Single Buyer varies being on average **20 years,** but reaching **40 years or more for** hydropower and nuclear**.**
  - **Single Buyer contestability:** direct **bilateral contracts** are allowed between producers and retailers or large customers, but the share of the Single Buyer in LTC is predominant, e.g. 91% in 2014
- **Auction products**
  - The awarded products are the PPA contracts (CfD-like) with payments settled monthly based on the difference between the eligible fixed and variable cost, and the Spot market revenues
  - Generators have an incentive for efficient operation: If the generator's net revenues in the spot market exceed the fixed costs, they are only allowed to keep 5 % of this excess (with the remaining 95 % surplus kept by IESO).



Ontario Procurement process. Source: *CL intelligence*

The procurement process in Ontario was favourable for developers: With a lengthy duration and government-backed purchase guarantee, financing risks were lower than in other settings with private or investor-owned utilities, implying a lower cost of debt or equity capital.

International investment frameworks – overview of main design elements

	Brazil	Chile	Ontario
Planning	Independent planning agency EPE	Regulator and ministry	Transmission System Operator IESO
Procurement	Procurement by distributor companies through a centralized market-place	Regulator CNE procures on behalf of distributors who remain off-takers and counterparties.	IESO procures capacity through competitive tenders passing the cost of contracts to consumers
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Auction product	Energy quantity products for hydro, PV and wind and energy availability contracts for thermal	Long-term contracts setting maximum amount of committed energy	CfD-like PPAs

Conclusion of case studies and key issues (1/2): Centralisation of procurement and governance

- **Degree of (de)centralisation of procurement**
- The considered case studies have applied different approaches for (de)centralisation for planning and procurement.
- The challenge is to strike a balance between liquidity, efficiency and economy of scale of the centralised approaches and better quality of the revealed information of the de-centralised approaches.
- Asymmetry of information of the centralisation approach to forecasting and procurement creates a risk of over-procurement (e.g. Ontario)
- Chile and Brazil are searching for an equilibrium between the centralised and decentralised approaches trying to limit the information asymmetry by decentralising the process whenever possible.
  - Chile has started from a decentralised approach but has introduced a centralised approach in 2015, while maintaining distributors as counterparties of contracts
  - Brazilian approach keeps distributors responsible to procure for their load and for load forecasting, but centralises the auctions and forecasting through independent entities

- **Organisation of governance between centralised and decentralised authorities**
- Different entities have different objectives that may not be perfectly aligned:
  - TSO may favour reliability and grid development (remuneration based on RAB) over costs
  - Ministry: may favour policy decisions, e.g. decarbonisation at the expense of market certainty and economic efficiency
- An independent authority is necessary with a clear vision and mandate to drive forecasting and procurement
- In Brazil, such entity is EPE for planning purposes. In Chile, the regulator CNE has an independent role of demand forecasting and identifying the need for new capacity

Conclusion of case studies and key issues (2/2): Product design and interactions with spot and retail markets

- **Products**
- Evolution of the system requires introduction of new products: policy goals on RES procurement and integration require flexibility, while specificities of the mix may require energy from hydro resources and capacity from thermal resources
- Chile and Brazil have started from relatively simple (mainly energy) products, but are diversifying the product range to meet the evolving needs.
- Brazilian approach is to introduce specific auctions to cover needs for different resources, combine energy and capacity products, however, creating level playing field through de-rating factors remains challenging
- Chilean approach is to maintain energy products addressing the technology diversity through time blocks of the energy contracts (e.g. hourly-segmented 24-hour block for solar and seasonally-adjusted quarterly blocks for hydro and wind). Further product differentiation is discussed.

- **Articulation of long term contracts (LTC) with retail competition**
- The considered case studies currently have regulated distribution franchises with stable customer base, but planning retail competition in near future
- In a liberalised retail market, retailers do not have long-term certainty on their customer portfolio. This may create additional risk for competitive retailers under the long-term procurement schemes, such as the one in Chile or Brazil.
- Evolution of the procurement processes will be necessary to address this issue of retail liberalisation, e.g. revision of decentralised obligation on retailers, specific contracts following customers transferred at the moment of customer switching, etc.

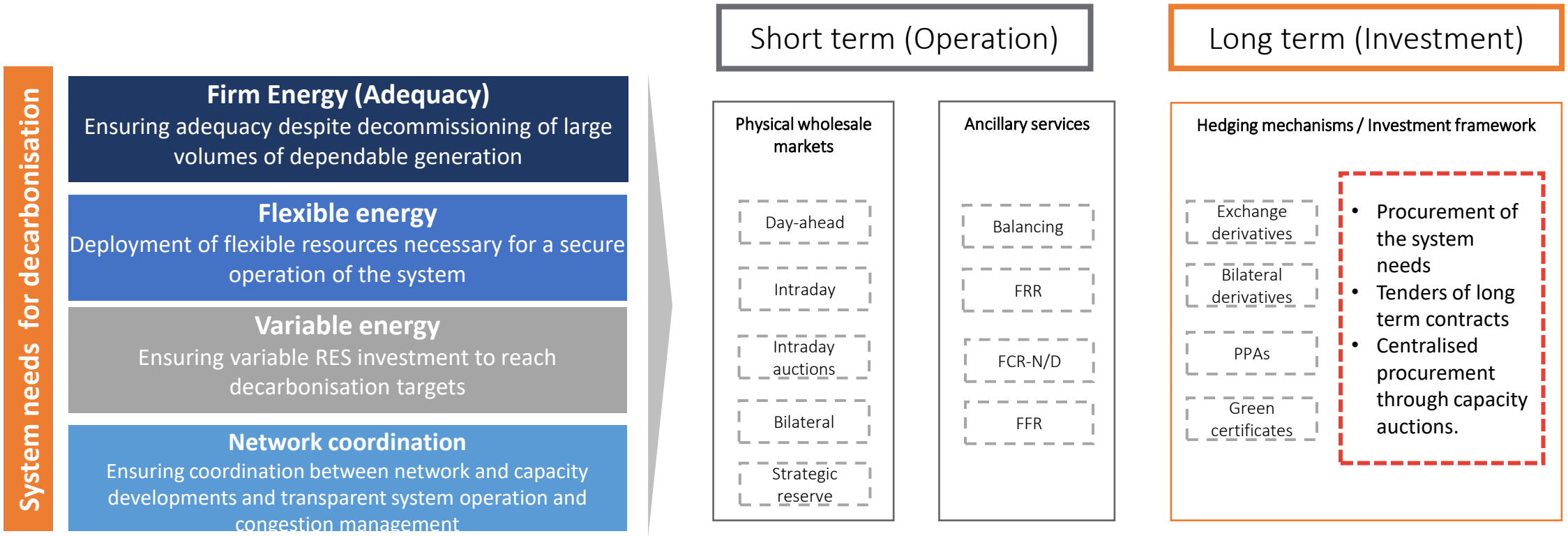
- **Interaction between spot and long-term**
- LTC should be linked to short-term products, so that design LTC and its interface with spot market do not damage and even reinforce spot signals
- Conversely, the design of short-term markets need to improve incentives provided by LTC.
- In Chile the spot markets are organised to provide incentives for both dispatch and generation and LTC mainly serve as a hedging instrument
- Ontario example suggests a possible approach of coordination of LTC with spot market through a CFD approach

Main elements of the long-term contracting framework

Key elements of the framework: a long-term contracting framework to address system needs

Approach for defining the system needs for adequacy, flexibility, sustainability, and networks in a consistent manner

- Detailed methodology for the holistic system needs study and for setting the minimum % shares for contracting need to be developed
- This section outlines the key principles and elements of the long-term contracting framework, including multiple deep dives on the key market design issues, such as market sequence, interaction with retail markets, and simultaneous procurement of multiple system needs.



Key design features for an efficient and comprehensive investment framework

- An investment framework features three main elements to complement the existing set of markets and infrastructures in Europe :
  - Need for a coordination and planning mechanism
  - Need for long term contractual commitments to hedge some policy, regulatory and market risks
  - Need to ensure efficient interface with wholesale and retail markets
- Different market design archetypes can be identified depending on some fundamental premises and trade offs summarised by the questions below.

Planning and definition of system needs

Need for coordination and planning (given uncertainty on technology evolution and costs)

Questions

- Is the planning done for **indicative purposes** or aims to **inform procurement of resources**?
- Does the planning focus on the **entire need** for investment or the **minimum (backstop) need** for investment?
- Does the planning imply a **centralised or a decentralised definition of the need** for investment?

Entities concerned

- TSO/DSO, government, regulator and/or dedicated planning entity

Procurement and contracting

Need for long term contractual commitments to hedge some policy, regulatory and market risks

Questions

- Does procurement cover the **entire need** or the **minimum need**?
- Is the procurement based on **centralised auctions** or a **decentralised obligations**?
- How are the long-term contracts/arrangements defined?

Entities concerned

- TSO/DSO, regulator and/or dedicated procurement/contracting entity

Interaction with wholesale and retail markets

Need to ensure efficient interface with wholesale and retail markets

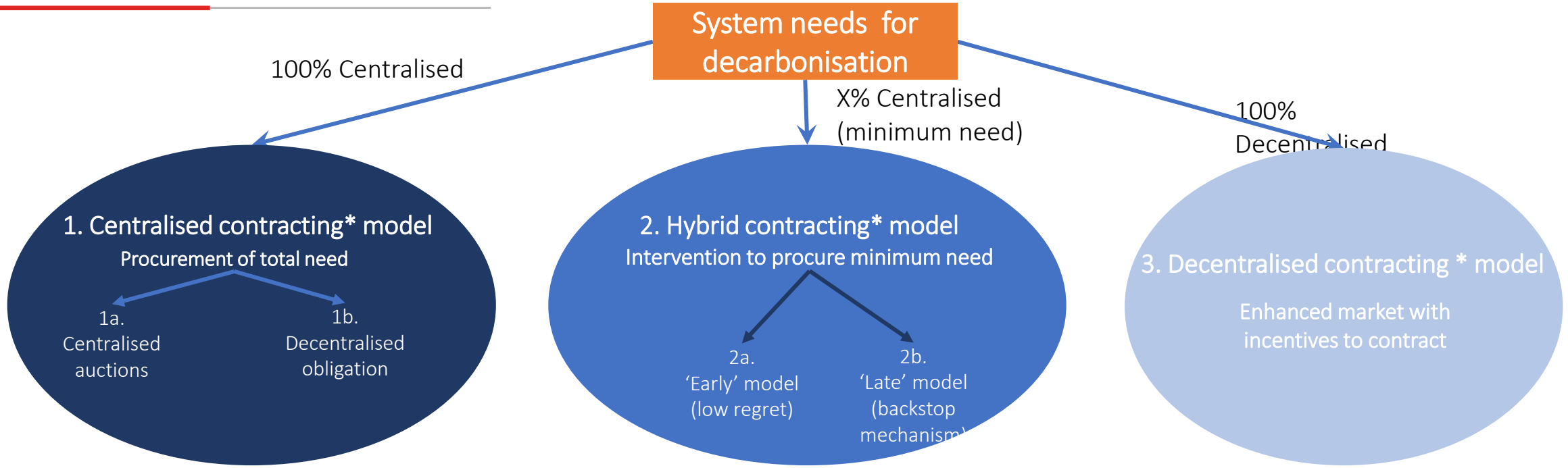
Questions

- How does the mechanism **define the product(s)** procured?
- How does the mechanism define the **interaction of the investment product with the spot market**?
- How does the mechanism articulate with **retail market and does it foster competition**?

Entities concerned

- TSO/DSO, government, regulator and/or market operator?

The three market archetypes differ on the degree of centralisation of the definition of the system needs



*Long-term contracting model covers new and existing assets.

The choice of the market archetype and model depends on a number of key questions

- **Degree of certainty.** Are policy markers willing to **rely on market signals** alone for investment? **How much guarantee / insurance** is needed in reaching the target? **When to activate** it (early or late intervention)?
- **Degree of centralisation of procurement.** How much **certainty / visibility** for the authorities vs how much **liberty to innovate** in contracting?
- **Role of the market.** Can suppliers and consumers efficiently **reveal their preferences** for meeting system needs? Do policy makers accept to **limit their responsibilities** as public goods (e.g. security of supply) evolve towards private goods (individual differentiation)?

Deep dive on products: Various products are possible for the different system needs

		Firm energy	Flexible energy	Variable energy
Capacity	Physical	• Firm/de-rated capacity at peak • Physical availability obligation (e.g. UK or French capacity market)	• Forward Ancillary Services (AS) contracts	
Capacity	Financial	• Reliability Options (e.g. Italy, Ireland or Belgium CRM)	• A forward hedge against the spot Ancillary Services capacity price	• Support scheme based on installed capacity rather than generated power (e.g. Capacity part of the Spanish renewable support scheme)
Energy	Physical	• Firm energy certificates (e.g. in Brazil to address an energy issue) • Physical PPA (Renewable or conventional)	• Hourly energy time blocks adapted to the demand profile • Physical PPA (Renewable or conventional)	• Green certificates • Guarantees of origin (physical)
Energy	Financial	• Virtual PPA (Renewable or conventional)		• Contract for difference (CfD) • Guarantees of origin (financial)

LTC remunerating energy may distort the bidding incentives and therefore energy markets. LTC remunerating capacity have in general less distortive effect on the energy markets.

Conclusions and recommendations

A market design to support investment: competition in two steps anchored in the planning of system needs

Key framing principles for a market framework to support investment

- **Build on existing markets** to deliver short term operation efficiency and **overlay a structured framework** to meet long term policy objectives
- **Identify the evolving system needs** and ensure that the c**ontribution of all resources is adequately rewarded**
- **Revise governance** to ensure **holistic planning** and unbiased / transparent definition of system needs
- Implement **contracting arrangements for the long term system needs** to provide credible commitment towards policy objectives

Holistic planning of system needs

- Comprehensive and transparent approach to identify the evolving system needs
- Three main dimensions: firm, flexible, variable energy
- Ensure that the contribution of all resources is adequately rewarded

Competition "for" the market

- Tendering of long-term 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 developments

Competition "in" the market

- Well integrated and liquid forward, day ahead and intraday markets
- Optimises short term dispatch and minimises costs for consumers
- Level playing field with balancing obligation for all
- Supports retail competition and development of demand response

Investment (years ahead) → Operations (days /hours ahead)

Key principles for an efficient long-term contracting framework: planning, contracting and efficient market interaction

Investment framework components	Stakes
1 Planning & definition of system needs	• **Need for efficient coordination & holistic planning of the different system needs** (firm, flexible and variable capacity), **across sectors** (power/gas/heat/mobility) **and Member States** • Need for **neutrality of the planning agenc(ies), supported by sound regulatory framework**
2 Contracting & hedging mechanisms	• **Need for long term contractual commitments** to hedge some of the policy, regulatory and market risks and to facilitate investment • **Need for increased coordination & consistency of the procurement mechanism with the planning process,** to make it more efficient and predictable (e.g. RES tenders schedule consistent with long term policy targets)
3 Market Interaction	• **Need for efficient interface** with wholesale and retail markets, to avoid distortions • **Need for an assessment framework and mitigation of the impact** of some of the current schemes on short term market signals (e.g. negative prices triggered by feed-in-tariffs)

In this lecture, the objective is to find a pragmatic market design with planning processes, procurement of long term contracts and markets to work hand-in-hand to deliver the needed investment in an efficient way.

THANK YOU FOR YOUR ATTENTION!

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