

# Market Design for High Shares of Renewables: Is Radical Change Required?

*Presentation based on study for IEA RETD*

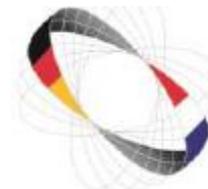
*Libéralisation du marché de l'électricité : cadre réglementaire et acteurs*

Fabien Roques, FTI-CL Energy

Dmitri Perekhodtsev, FTI-CL Energy

Lion Hirth, Neon

**BMWi, Berlin, 2 June 2016**



**Office franco-allemand pour  
la transition énergétique (OFATE)**



## Content

---

- Study context and objectives
- Criteria for an ideal power market design with high shares of VRE
- Diversity of power market design
- Findings from the case studies of market prototypes
  - Energy only market
  - Vertically integrated system
  - Hybrid market
  - Prosumer market

FTI Consulting is a multidisciplinary international consulting company. NEON is a specialised consulting boutique

## FTI Consulting activity



**INTERNATIONAL SCOPE**  
Over 4,200 professionals in 24 countries on 6 continents



**PROFESSIONAL EXPERTISE**  
Reputable consultants in a variety of domains with respect to international clients



**ENERGY EXPERTISE**  
FTI-CL Energy experts have advanced expertise in the issues of electricity market design

## NEON Consulting activity



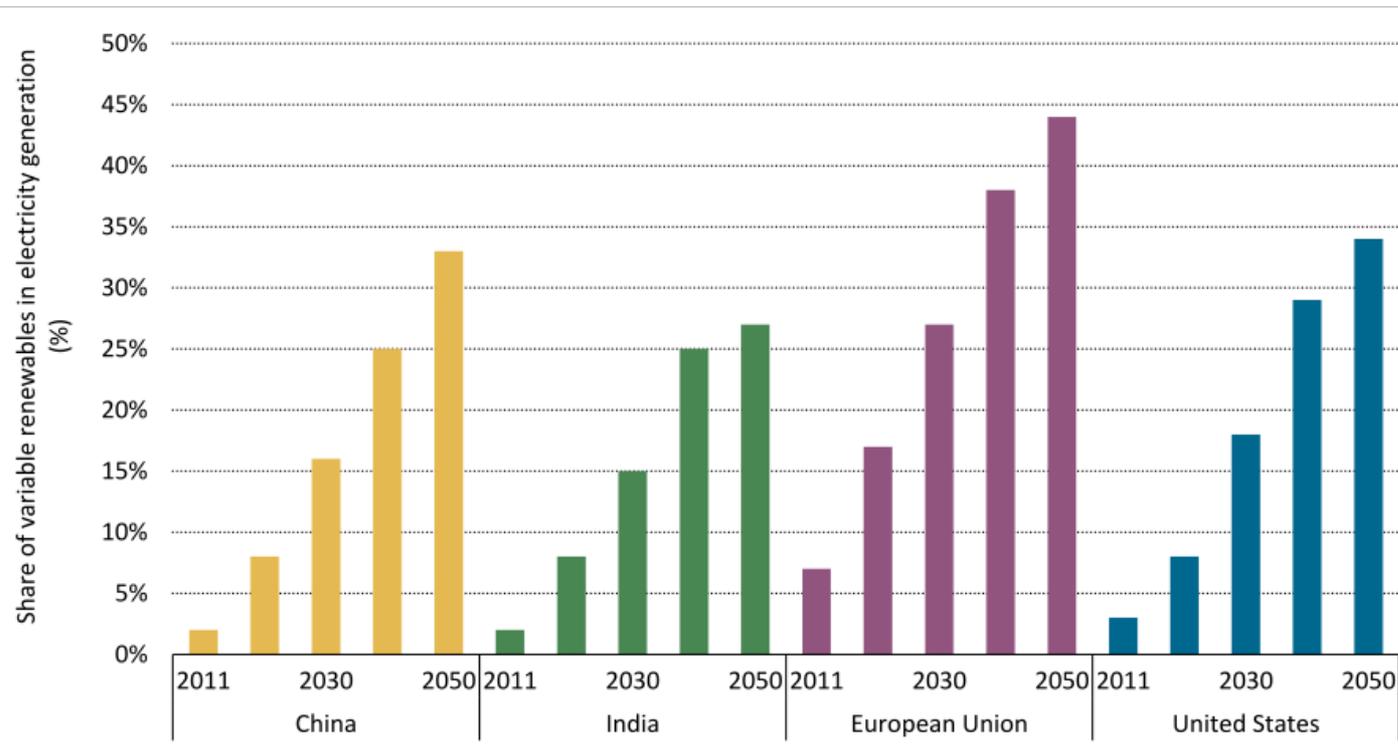
Neon is a Berlin-based boutique consulting firm for energy economics. We combine expertise on economic theory with advanced modelling capabilities and extensive industry experience. Neon specializes in four areas:

1. The economics of wind and solar power
2. Design of spot and balancing power markets
3. System costs / integration costs
4. Open-source power market modelling

[www.neon-energie.com](http://www.neon-energie.com)

# Study context: Toward high shares of renewables in the generation mix

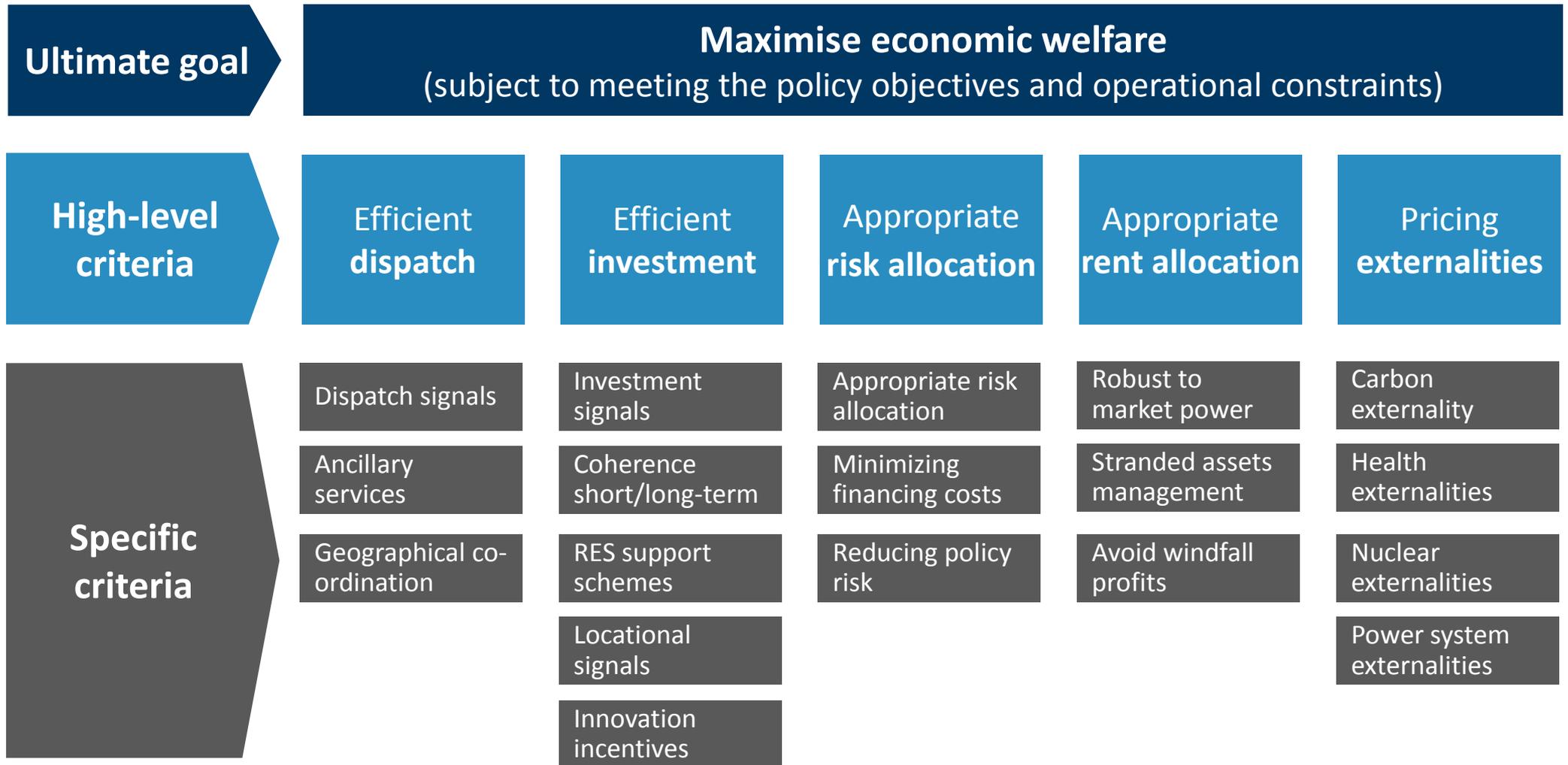
The share of variable renewables (VRE) in electricity generation in selected regions



IEA (2014): Energy technology perspectives, 2DS scenario.

- In a carbon-constrained world, variable renewables will supply a large share of electricity
- IEA ETP 2014 2 degrees scenario: VRE represent 30-45% in most world regions by 2050 (other studies provide similar estimates)
- What are the challenges for market design depending on the power system organisation?
  - Liberalised power sector
  - Vertically integrated utilities
  - Hybrid systems
  - Active prosumer participation

# Criteria for ideal market design with high level of VRE



## Three main challenges of VRE to market design

### Capital intensity

- **Cost recovery: investment incentives**
  - Adequate investment signals
  - Implications for the design of energy markets, capacity markets, support schemes
- **Cost of capital: optimal risk allocation**
  - Exposure to risk, including policy risk, is a fundamental factor determining total system costs if the system is capital-intensive
  - Trade-off between policy flexibility and regulatory risk

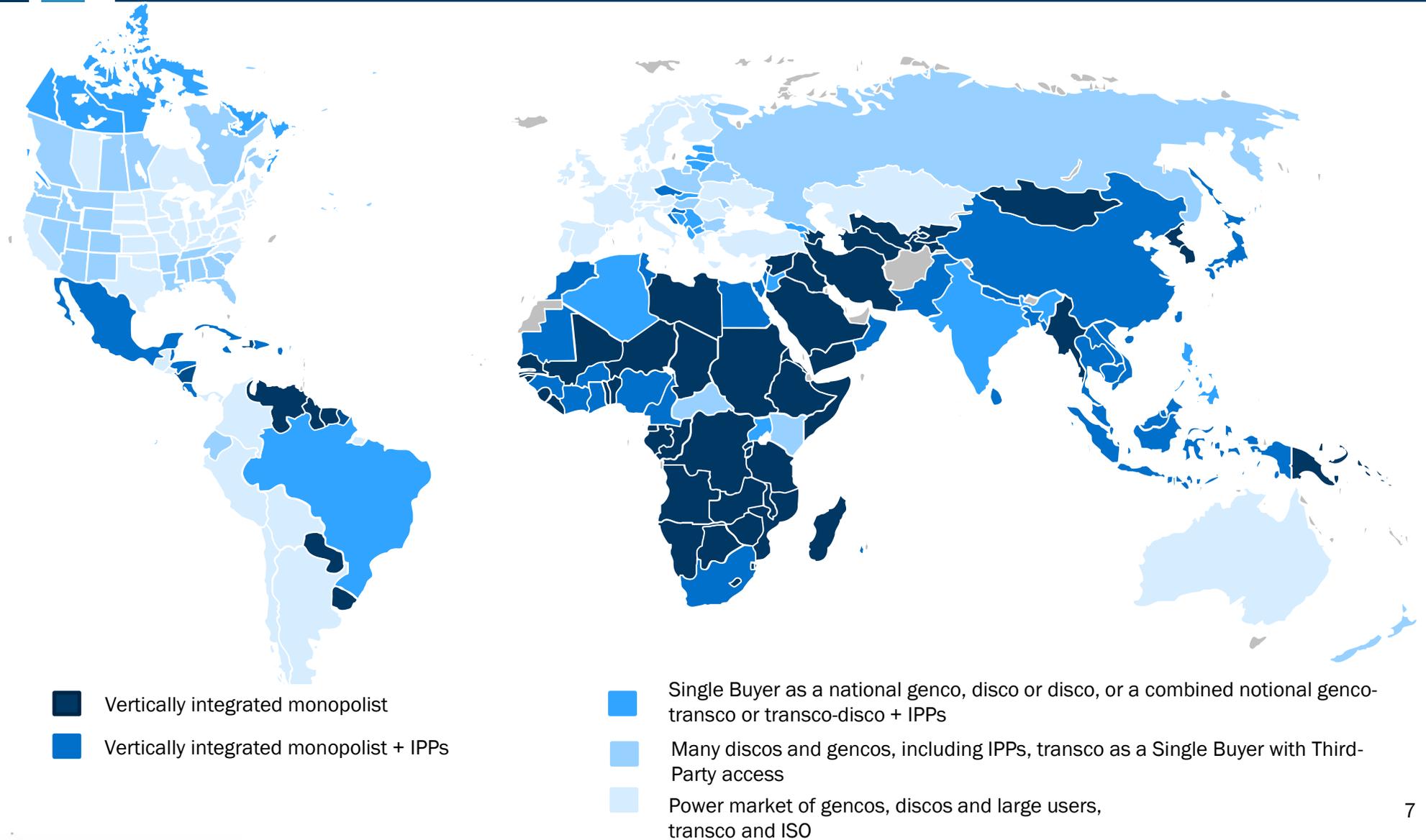
### Limited predictability and variability

- **Price volatility**
  - More volatile prices
  - Product definition (e.g., peak/off-peak) loses relevance
- **Spot market design**
  - Reduced gate closure
  - Higher frequency
  - Both day-ahead and intra-day
- **Assurance of system stability**
  - Need for new ancillary services products, e.g. providing system inertia
  - Redesign ancillary services to allow VRE participation

### Decentralized and scattered generation

- **Coordination between generation and grids**
  - Increased investment demand requires new approach to TSO and DSO regulation
  - Locational price signals for centralised & decentralised generators needed
- **Prosumers**
  - Retail prices becomes investment signal
  - Base for taxes and grid fee erodes
  - Many small producers need access to wholesale markets

# The diversity of power systems and implications for market design

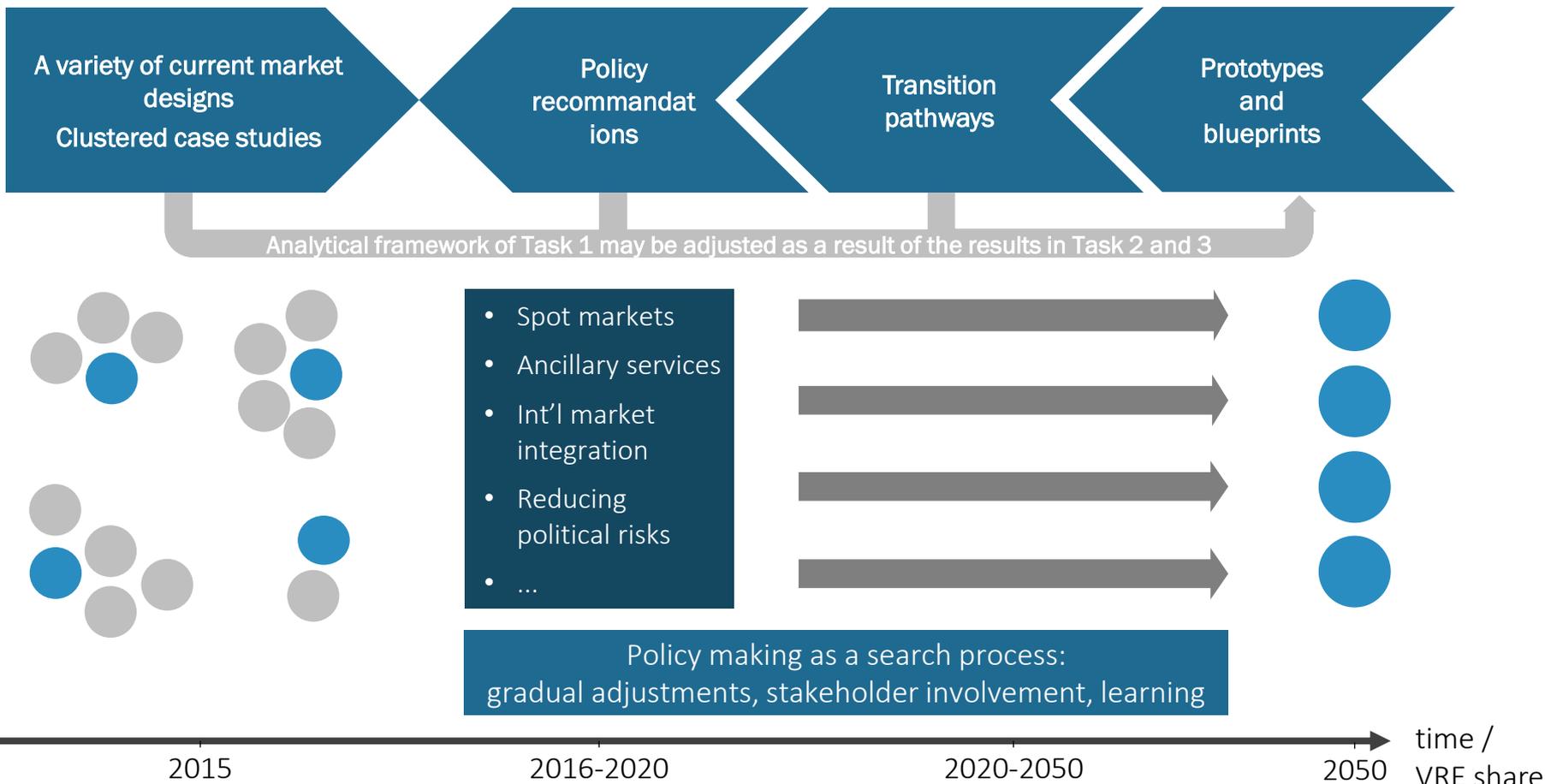


# Stylized models of power system organization: 4 different prototypes used as case studies

- Real-world market and policy design is diverse, complex, multi-level and path-dependent.
- To address this diversity in a transparent way, we propose to study a small number of **power system prototypes**
- Each real-world market represents a combination of these prototypes
- Each prototype allows to focus on a *specific aspect* of market design

	<b>1 Energy-only</b>	<b>2 Vertically integrated</b>	<b>3 Hybrid</b>	<b>4 Prosumer</b>
Dispatch decisions	Decentralised through wholesale market prices	Centralised based on costs and other drivers	Decentralised through wholesale market prices	Decentralised through retail market prices
Investment generation	Decentralised through wholesale market prices	Centralised based on planning	Centralised based on planning and/or risk sharing mechanism	Decentralised through retail market prices
Examples	Texas , Australia, Europe	South Africa, US	Brazil, UK	Germany, Australia, California

# Our approach starts from the view on the ideal market design in the high-VRE future and works backward in the chronological order



# Energy Only market

## Policy recommendations

### Design of spot and ancillary services markets

- Harmonise market designs across time frames
- Increase price caps and remove barriers to scarcity pricing
- Market power monitoring
- Improve balancing markets
- Improve the operating reserve markets
- Allow DSR participation in all market segments

### Locational price signals

- Introduce geographical price differentiation through
  - Zonal splitting
  - Nodal prices
  - Other location signals, e.g. locational connection charges, locational loss charges, etc.
- Geographical differentiation of balancing prices

### Development of hedging products

- Introduce measures to improve opportunities for voluntary forward hedging
- Let the market demand for hedging develop as the intensity of price spikes increases

# Vertically integrated system

## Policy recommendations

### Regulatory framework

- Implement incentive regulation to foster deployment of low carbon technologies and support the development of the enabling infrastructure,
- Possibly delegate the planning role to a neutral third party.

### Rules for third-party access

- Apply transparent and non-discriminatory rules for third-party access.
- Possibly, delegate third-party connection and dispatch roles to a neutral agency.

### Cross-border trading arrangements

- Implement regulation and legal frameworks allowing bilateral cooperation on trading.
- Develop regional cooperation to ensure secure operation through a regional coordination agency

# Hybrid market

## Policy recommendations

### Integrated resource planning

- Efficient resource planning and procurement process.
- Transparent process for determination of investment needs.
- Efficient governance and incentives of the planning agency.

### Interface between centralised and decentralised processes

- Design products to allow and encourage participation of renewables
- Ensure product definition and procurement process remunerates capacity irrespectively of the plant's output and short-term operations.
- Account for specificities of RES cost structure to design mandatory hedging contracts that allow an efficient risk allocation and support capital intensive investments.

### Organisation of mandatory risk hedging instruments

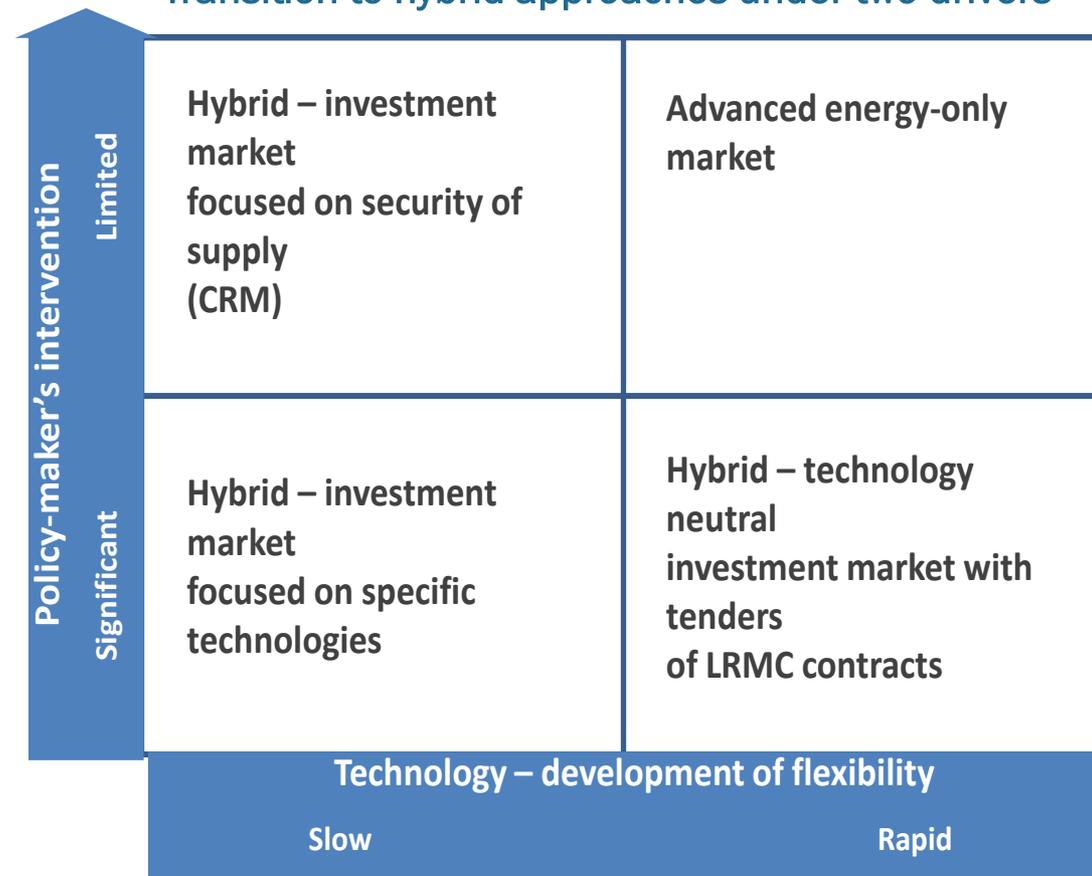
- Award the risk-hedging contracts through a transparent auction-based procurement process.
- Design auctions' procurement processes so that they encourage participation of renewables and demand response providers.
- Favour a decentralised procurement to allow contracts to be tailored to meet the specific needs of suppliers and capacity providers.

# Retail market design

## Engineering the transition to hybrid approaches

- Challenges presented by high-VRE on market designs will likely require the **introduction or redesign of hybrid system elements** (i.e. combination of price signals and other coordination/ risk sharing mechanisms)
- **Two key uncertainties will determine the type of hybrid market:**
  1. **Policy maker's degree of intervention**
    - The degree of a policy-maker's intervention and the resulting tendency for centralised solutions.
    - This is determined by policy-maker's attitude to risk and information asymmetry
  2. **Technology / regulation impact on development of flexibility**
    - The development of the generation mix along the decarbonisation path leading to high shares of VRE, especially the flexibility of the mix
    - A mix with higher flexibility reduces the urgency of market design challenges presented by VRE and smooths the transition of the market design.

### Transition to hybrid approaches under two drivers



# Prosumer market

## Policy recommendations

### Retail pricing and (net) metering

- Make sure the prices that prosumers and non-prosumers face are aligned.
- Apply taxes and charges to self-consumed electricity or clean up the electricity bill from taxes/ charges

### Regulation of distribution system operators

- Provide incentives for efficient large-scale investments.
- Stimulate innovative solutions such as demand response, or storage

### Geographic coordination between grid and generation investments

- Introduce retail price geographical differentiation at the level of the distribution grid.
- Differentiated retail price signals should give prosumers investment signals to coordinate with grid constraints and grid upgrade requirements.

### Wholesale market access and balancing responsibilities of prosumers

- Ensure low-cost access to wholesale and ancillary service markets for prosumers.
- Foster aggregator competition while keeping a “market access of last resort” to avoid excessive risks.

Thank you for your attention

---

**Fabien Roques**  
Senior Vice President  
COMPASS LEXECON

[froques@compasslexecon.com](mailto:froques@compasslexecon.com)

+33 1 53 05 36 29

**Dmitri Perekhodtsev**  
Vice President  
COMPASS LEXECON

[dperekhodtsev@compasslexecon.com](mailto:dperekhodtsev@compasslexecon.com)

+33 1 53 05 36 29

**Lion Hirth**  
Neon neue  
energieökonomik GmbH

[hirth@neon-energie.de](mailto:hirth@neon-energie.de)

+49 157 55199715