CHAIRE EUROPEAN ELECTRICITY MARKETS
Fondation Paris-Dauphine

C.I.R.E.D.
Centre International de Recherche sur l'Environnement et le Développement

# The increasing role of Visible Hand in electricity markets:

## The dilemna between fixing market failures or adopting a new regime

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# Introduction

- Market failures
  - Adequacy
  - Sub-optimal technology mix (capital intensive)
  - Need of development of low carbon technologies (captial intensive) while carbon price signal is insuficient or dysfunctioning.

- To connect two strands of the literature
  - capacity adequacy
  - Market failure in capital intensive investment
  - Innovation economics and low carbon technologies

# Content

- 1. Increasing market failures in generation investment
- 2. Answers to market failures to invest in generation
- 3. Answers to market failures to invest in clean energy technolgoies
- 4. The convergence of carbon policy and generation adequacy policy

# 1. Increasing market failures in generation investment

# The double role of  market in coordination

Å The market have two functions:

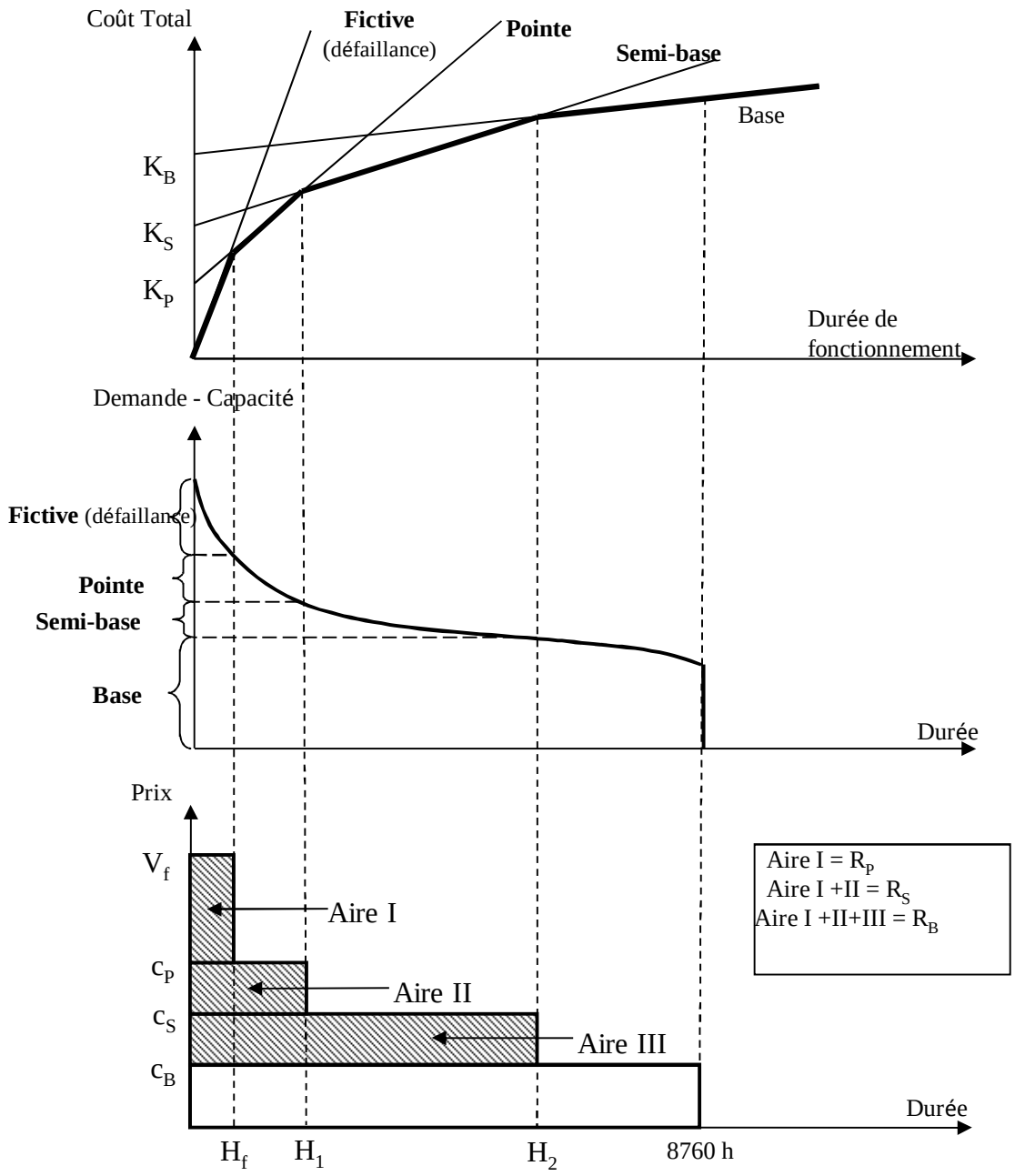
- ï Short term coordination for efficient operation of the set of competitors' equipment and for indicating scarcity

- ï Long term coordination : price signal supposed to orient the investor decision

Market failures in long term coordination

## Classic representation of long term optimal mix by screening curves

- Shortage cost as a linear function for optimal arbitrage withthe annualized cost of peaking units
- Area 1 = scarcity rent for every technology
- Area II as infra-marginal rents for mid load and base load
- Area III for base load equipment



# 1.2. Two market failures: Capacity adequacy and optimal technology mix

## 1.2.1Capacity adequacy

Difficulty of attaining long term efficiency through markets because absence of price elastic demand and storage

Risk of disequilibrium supply and demand

- 3 difficulties

Risk aversion of investors in peaking units

- ✓ Capital intensive by MWh
- ✓ A few number of peak load periods with uncertain price spikes)

Regulatory failure : quite low price-caps

- ï Peak price up to Value of Lost of Load socially inacceptable:
- ï Implicit market power exercise for reaching scarcity price

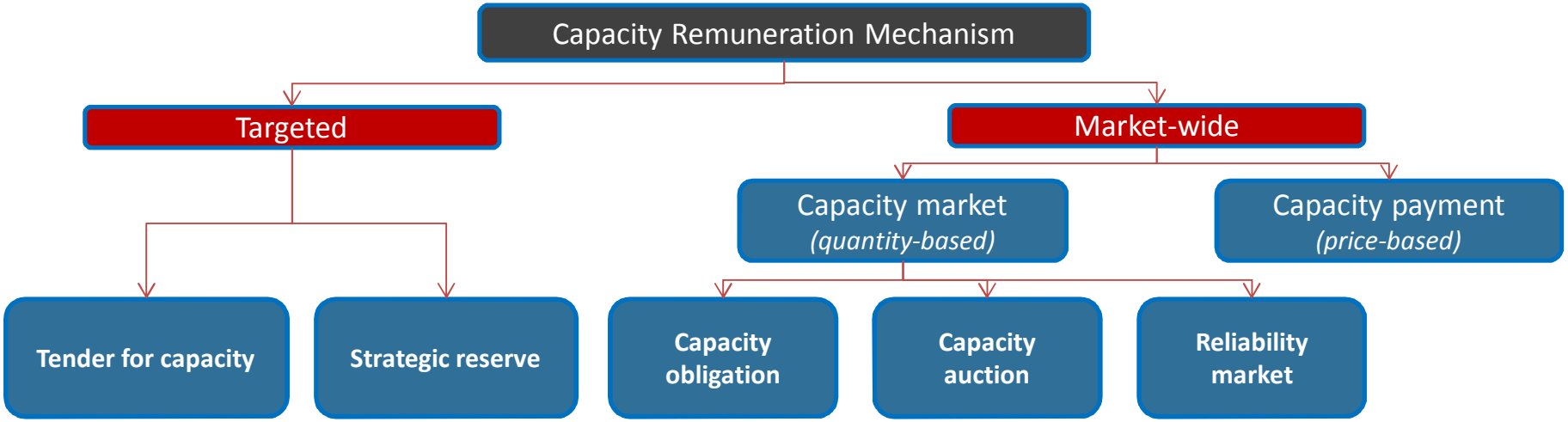
Å low price cap in many jurisdictions = lower scarcity rent

ï Premature intervention of System operator

The market signal is not sufficient to incite to invest in peaking units

Missing money

# Need of capacity adequacy policies



## 1.2.2 Market failure in the technology mix development

- Risk management with no complete markets, and imperfect information
- Numerous risks: technology risk, regulatory risk, besides fuel cost risk, price risk, and volume risk
- **They are borne by the investors**, but neither by consumers, nor by government as they did before in the public service monopoly regime

- **Domination of the criteria of risk management on the criteria of NPV**

- Power generation technologies have different risk and returns characteristics
  - Different exposure to market risks (electricity price, fuel price, CO2 price)
  - Different degrees of capital intensity (ratio of investment to operating costs)

- **The present value of total hourly infra marginal rents is supposed to cover fixed costs technologies**

- Risks and price-making on electricity markets
  - Large upfront cost technologies are in the bottom of merit order
  - Dependence on this price setting is highly risky for these « infra-marginal » technologies
  - Carbon price uncertainty add to price risks

- So the “marginal cost setting technology” (the CCGT) is facing the least market risks in liberalised markets

- “***Self hedged***” CCGTs (correlation between. elec. & gas/CO2 prices) + much less capital intensive than coal , nuke and RES-E

- **CCGTs have been almost the unique new entrants’ generation** choice in liberalised markets

# Two ways of corrections of market failure in generation mix

**To change risk allocation between investors and consumers/suppliers**

1. **Fixed price /fixed quantity contracts generators-suppliers/large consumers**
   - BUT opportunism risk about the suppliersô commitments:
     - problem of risk of price squeeze and customers switch
   - How to make credible the consumersô commitment ?
     - ✓ Vertical agreement industrialist/producers with common equipments
     - ✓ Cooperative of customers:
     - ✓LT contracts with suppliers with a large core business oré .with remaining supply monopoly

2. **Vertical integration**

Only some exceptions with large-sized vertical and diversified companies

**Model of deep pocket firms (or joint ventures of deep pockets)**

When equity investment in an generation project goes beyond 15%-20% of market capitalisation, worry about the effect on the shareholder value.

## But ambitious climate policies introduce new dimensions in market failures in long term coordination

Decarbonation = need of capital intensive equipment (small sized and large sized renewables, CCS, new nuclear) to be developed

In theory increasing and predictable carbon price is supposed to be sufficient to give an advantage to low carbon technologies

But imperfections of carbon price (exemple of ETS ) and no low carbon investment triggered by carbon price

# Part 2
# Public coordination and long term arrangements in support of clean energy technologies

Confirmation of the development of a hybrid regime mixing planning and markets

# Pressures from new carbon policies focused on RES-E and LCT technologies

- Need for large scale deployment of capital intensive “green technologies” (nuclear, renewables, CCS) to be taken into account when considering industrial structure and contractual arrangements in liberalised markets
- Not only decentralized RES-E are concerned above a certain %
  - **Three factors**
    - Technologies are not only capital intensive with long lead time, but they are in a costly and long lasting learning (or re-learning) process under political uncertainties
    - Risks are amplified by market environment
    - CO2 price is not at all an efficient price signal to orient investment (at the top of the hourly marginal electricity price to increase infra marginal rent)
      - Quantity instrument (quotas) and not price instrument (tax) = uncertainty on CO2 price
      - ETS not sufficiently long term foreseeable

- Parallelism of instruments with capacity adequacy approaches
  - But no need of consistency between them because different collective goods (adequacy, clean environment)
- Possibility to define a package of instruments covering centralized and decentralized technologies
- Two functions:
  - To add a support for non-mature technologies
  - To transfer the overcost and the main part of the risks onto the consumers

How to maintain incentive to control project and technology risks on the operators

# Instruments based on costs payment by the consumers

- **Decentralized coordination by price instrument**
  - **Fixed Feed in tariff (FIT)** with purchase obligation by SO or historical operator
    - Variant of tax credit: dependence of public budget/ less credibility
  - **Fixed « feed in premium »** : exposure to market price
- **Decentralized coordination by quantity instrument:**
  - **Renewable Certificate obligation**
  - Renewable portfolio standards (non exchange of certificates)
  - Clean energy obligation (extended to CCS, nuclear, etc)
- **Centralized coordination:**
  - Auction for long term contracts with neutral agency
  - Negotiation of long term contracts

| Type of arrangement | Autonomy left to generators in investment | |
|---|---|---|
| **Fixed FIT(with purchase obligation)** | .Freedom of timing<br>Orientation of choice by technology FITs | |
| **Premium FIT** | Freedom of timing<br>.Orientation of choices by technology FITs | |
| **Renewables obligation** | Freedom of timing<br>***Technology neutrality*** *???*<br>*Need of technology bands* | |
| **Auction for Fixed price contracts or for CfD** | **No autonomy**<br>No **technology neutrality** (issue of learning investment)<br>**Perhaps in future** | |

| **Type of arrangement** | **Autonomy left to generators in investment** | **Role of the current market** |
|---|---|---|
| **Fixed FIT(with purchase obligation)** | | *No responsibility of RES producers on markets* (priority access) |
| **Premium FIT** | | Increasing responsibility of intermittent producers on balancing and energy market |
| **Renewables obligation** | | Responsibility of intermittent producers on balancing and energy markets |
| **Auction for Fixed price contracts or for CfD** | | Responsibility of producers on markets |

# Model of accumulation of FIT contracts and tendered contracts (German model or US extended RPS model in regional markets)

**FIT** : they trigger decentralised decisions for small RES-E units

Increasing role of **LT Contracts** (tender system)

Priority access for RES-E

**Government** monitors development of RES-E by FIT (with tuning of tariffs)

It **directly coordinates and assumes call for tender** and selection for large sized technologies (mainly wind offshore, bioelectricity, large remote PV projects with AC transmission , etc.

**Markets**

- Bilateral contracts and trade on organised markets remain, but exchanges are retracting

# The Model of Single Risk Manager of low carbon electricity (UK model)

- Allocation of contracts for low carbon technologies by negotiation, tender or auction for large sized technology

- Financial contracts (CfD)
  - technology in the first step
  - (different formulas for operation : priority access,
  - CfD (efficient operational decisions)
- Overlapping of instruments (standards on new fossil fuel equipment, etc)
- FIT focused on small sized technologies
- Remaining role of market for short term coordination; but is it able to help triggering semi base load and peak load investment

# Short normative insights

- Design of instruments should be relevant to the maturity of technology

  (examples of PV feed-in tariffs)

- Design of instruments to be preferred:
  - those who do not add risks to current market risks as does the renewables certificate obligation
- How to control the planner when auctioning? (open decision making process )

# Part 4
# The convergence of carbon policy and generation adequacy policy

# Ambitious climate policies introduce a new dimension in market failures in long term coordination (I)

Distortive effects by « out of market » entries of RES-E and Low carbon technologies (LCT)

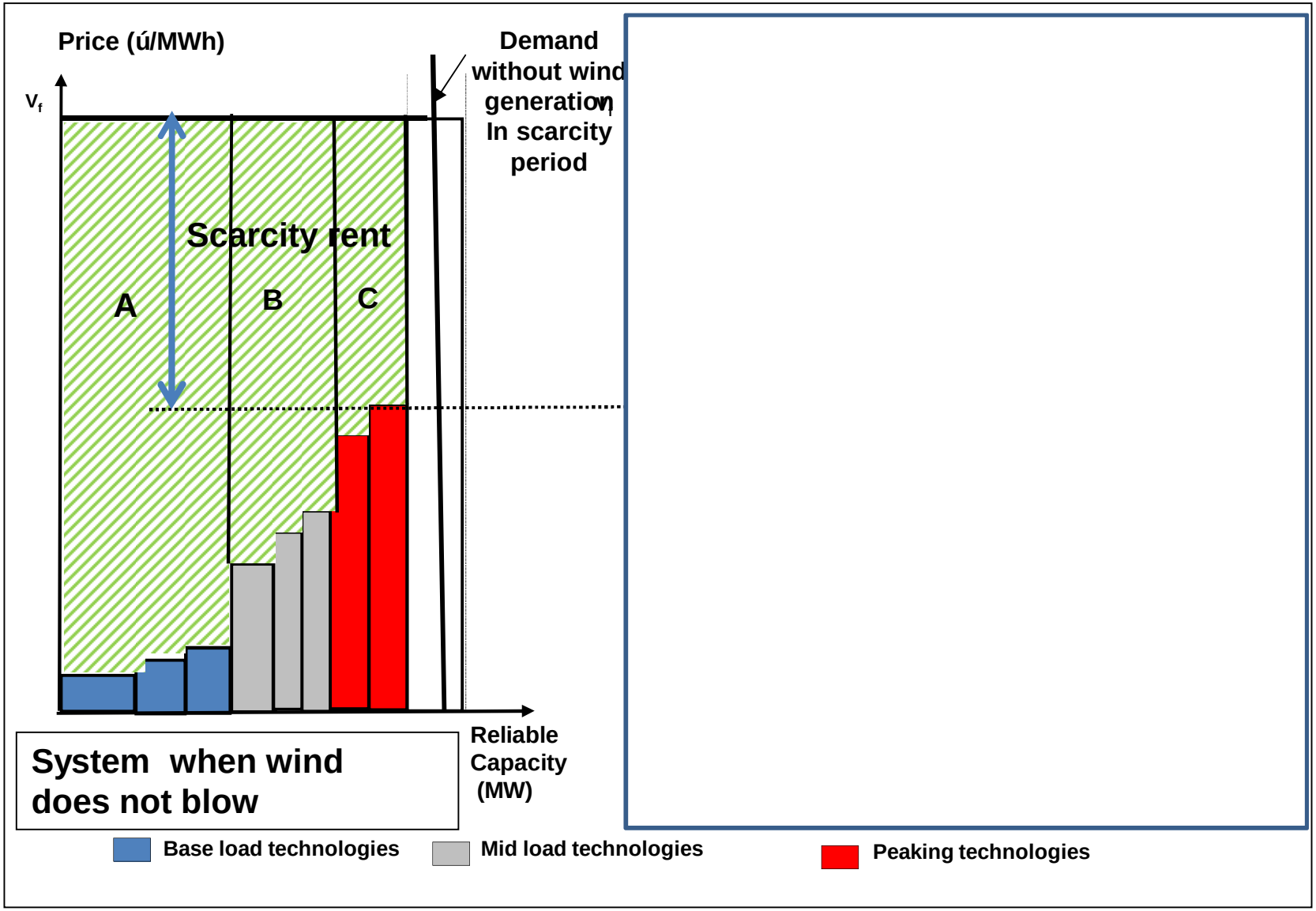
Because RES generation **is intermittent** (variable, not completely predictable**): greater price volatility in particular during peak period; so higher risk premium for peaking units.**

Because **good correlation of windpower production and peak load demand** (with a non-normal proba distribution), new **limitation on scarcity rents** (cf figure)

Increasing need to invest in flexible units for back up and in peaking units for capacity adequacy:

- Need of new flexibility products valuation on different market (infraday, balancing, auxiliary services, operating reserves)
- need of capacity mechanism

# Peak rent in an hourly electrical market in two different blowing wind situations



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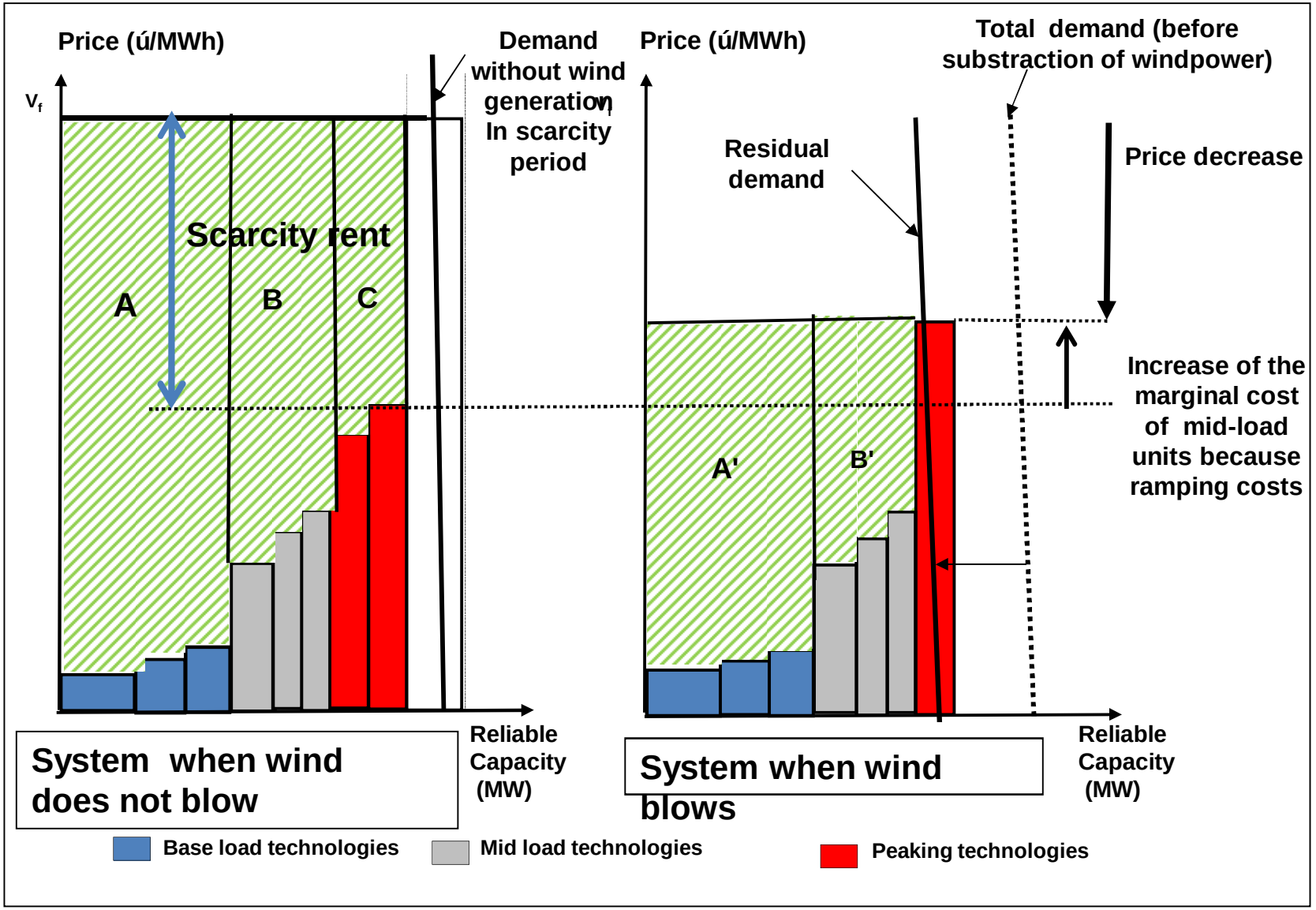

# Ambitious climate policies introduce a new dimension in market failures in long term coordination (III)

**Uncertainty on the results of RES and LCT policy : negative externality on investment in mid load (and flexible) units**

- important risk of dispatchability: when to generate and which revenue?
- risk on the load factor (operating hours of 2000h instead of 5000h)

- **The recovery of fixed cost for mid load units becomes challenging**
  - Closure of CCGTs in the next years
  - Risk aversion to invest in CCGT while new needs of flexibility

# Two necessary changes (I)

**First ideal way : Combining support for low carbon technologies and capacity mechanisms**

Going towards a general auctioning for long term contracts on capacity and energy for every new and existing equipement (Exemple of Brazil)

- Fossil fuel capacity will be remunerated
- Difference with the present cap. meca. : long term commitment and not one year forward
- Is it possible to be technology neutral from the beginning?
- Covering energy sales by CfDs in order to let energy market keeping its short term coordination role

If not possible;, need to install a market wide capacity mechanism

# Two necessary changes (II)

Improvement of the valuation of the flexibility products on the successive markets by two ways :

- Responsibilisation of intermittent producers
- Better definition of products for the balancing, auxiliary services and operating reserves and better designs of successive markets

- Investment in fossil fuel by NPV coming from day ahead, infraday, balancing, reserve markets and from capacity markets
- One does not exclude the other
- Better scarcity and flexibility price signals would make the capacity market less important
- Would reduce possible unintended consequences of the capacity markets

# 5. Conclusion

## Dramatic adaptations of market regime?

- **From the present FIT or tender for renewables capacity**

  **to Tender for all capacity**

  – Type (and perhaps location) specified

  – Capacity continues to compete day-to-day

- **Working assumptions :**
  - **investment can be “de-risked” through greater public sector intervention**
  - **Overcost of techno. learning and risks are shifted to the consumers…**
- **Technology neutral orthodoxy is de facto broken down**
- **Market only for operational coordination: technology continues to compete day-to-day**
- **New problem: the control of the planner**

# To conclude (2)

- Need of intellectual and legal shift at the European level
- Recognizion of the problem in order to have relative harmonization of arrangements decided by national policies besides an energy market apparently integrated (issue capacity mechanism)
- Strong amendement of electricity markets directives on articles which limit exemptions to LT contracts and public contracting (for instance the art 3 )
- To adapt the principles of competion policy in the name of economic and social efficiency

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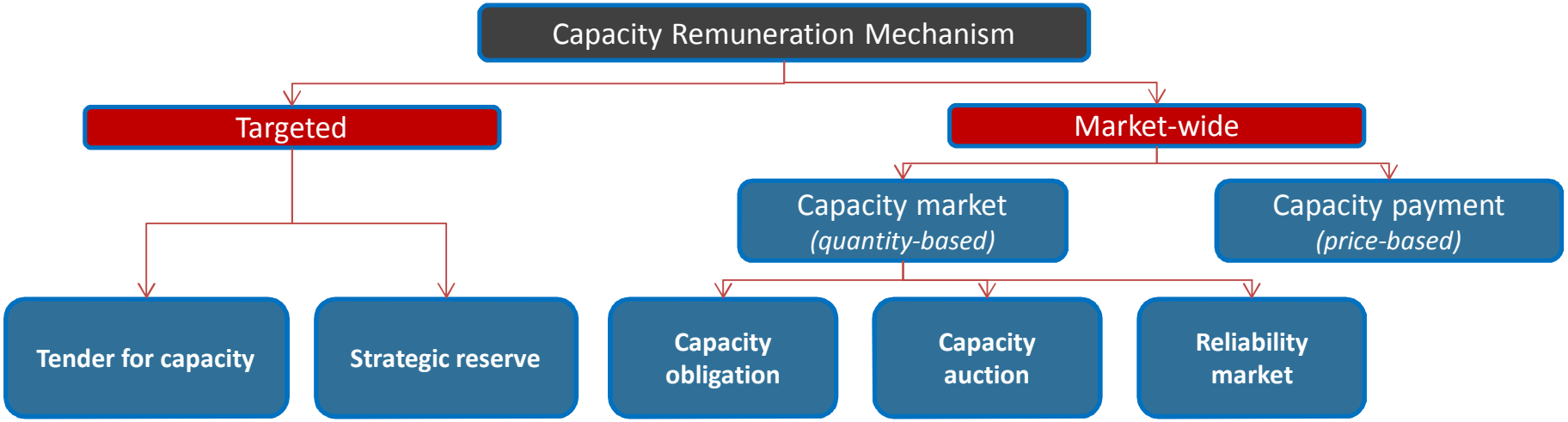
# Back up

## Need of capacity adequacy policies

- The real time price-inelasticity makes reliability of the system as a public good (legal role of the system operator)
- Necessity of **a long term insurance** in order to be reliable in every situation (**criteria of loss of load probability and reserve margin)**
- Which answer to the missing money problem?



# Different principles and difference in social efficiency (I)

- "Targeted contracting" can provide a temporary fix, (well adapted to hydro systems)
  - could introduce distortions if strategic reserves are called before all the other resoures

- Price instrument: Capacity payment: experience shows that they are adapted to market pool architecture
  - Energy bid aligned on marginal costs on the energy market with generally Low price cap
  - Capacity adder should depend on the scarcity situation and related to reliability commitment
  - Low performance in terms of effectiveness

- **Quantity instruments**
  - **Decentralised/bilateral obligation on retailers defined in a forward way**
  - **Auctioning on forward capacity contracts**
  - **Auctioning on forward reliability options**
    - **They can be effective to create a safety net,**
    - **They are complex and can introduce other forms of distortions. (exemple of double payment by the energy price spike and by the capacity payment)**

- **Degree of autonomy in investment**
  - Capacity payment the more free
  - Bilateral obligation: each retailer free to find the most convenient arrangment
  - Auctioning: decisions driven by the SO/regulator
- **Public governance:**
  - Strong commitment of the The SO and regulator with the central auctioning : planning , auctioning and contracitng
  - The least commitment with the capacity payment ( but exposure to capture,)
- **The role of /and interaction with/ energy markets**
  - Reduction of prioce spikes and price volatility
  - No direct interference except if strategic treserves is badly designed
  - Problme if cross border trade