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The Economics of off-shore Wind Power



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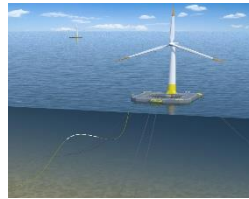
Economic benefits by stakeholder: Who captures the rent?

Where the benefits go?

The investor captures only a limited share of the Off-shore Wind power rent.

Society benefits of clean energy, locally generated, jobs, energy independency.

Wind power Operator



Feed-in Tariff
Or
Market spot price + Premium (Aid)

Local community



Local Taxes
Local jobs (direct + indirect)

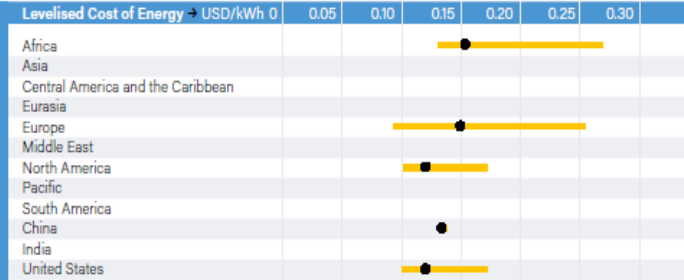
Society



Industry Exports
Jobs / Training / Education
Environment. Climate change. Less CO2
Energy Independency. Lower Energy Bill
GDP. **Higher Growth**

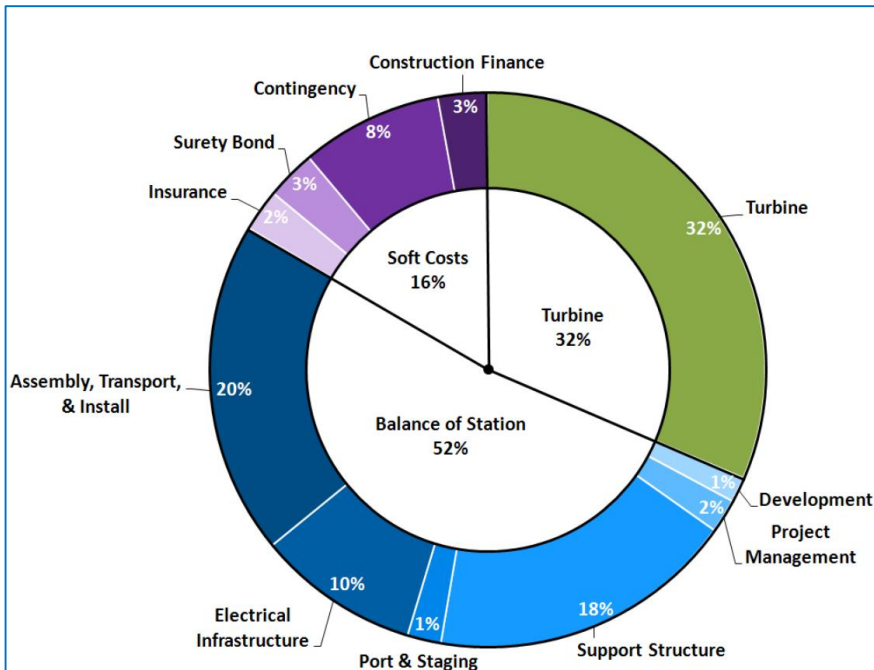
Learning rates: are costs expected to fall?

OFFSHORE WIND POWER



High investment costs: immature sector or permanent feature of the French context ?

Technology costs



Source: Tegen, S.; Hand, M.; Maples, B.; Lantz, E.; Schwabe, P.; Smith, A. (2012). 2010 Cost of Wind Energy Review. 111 pp.; NREL Report No. TP-5000-52920.

Administrative costs

- Long administrative procedures.
- Call for tenders cannot consider early technology innovation.
- Financing: capital cost + risk premium.
- Local taxation.
- Immature Supply chain: Transaction costs.
- Transaction costs could be higher than economies of scale gains. At early stage: small is beautiful.
- But sizing cables and economies of scale during construction and O&M could stand wind farm large size.

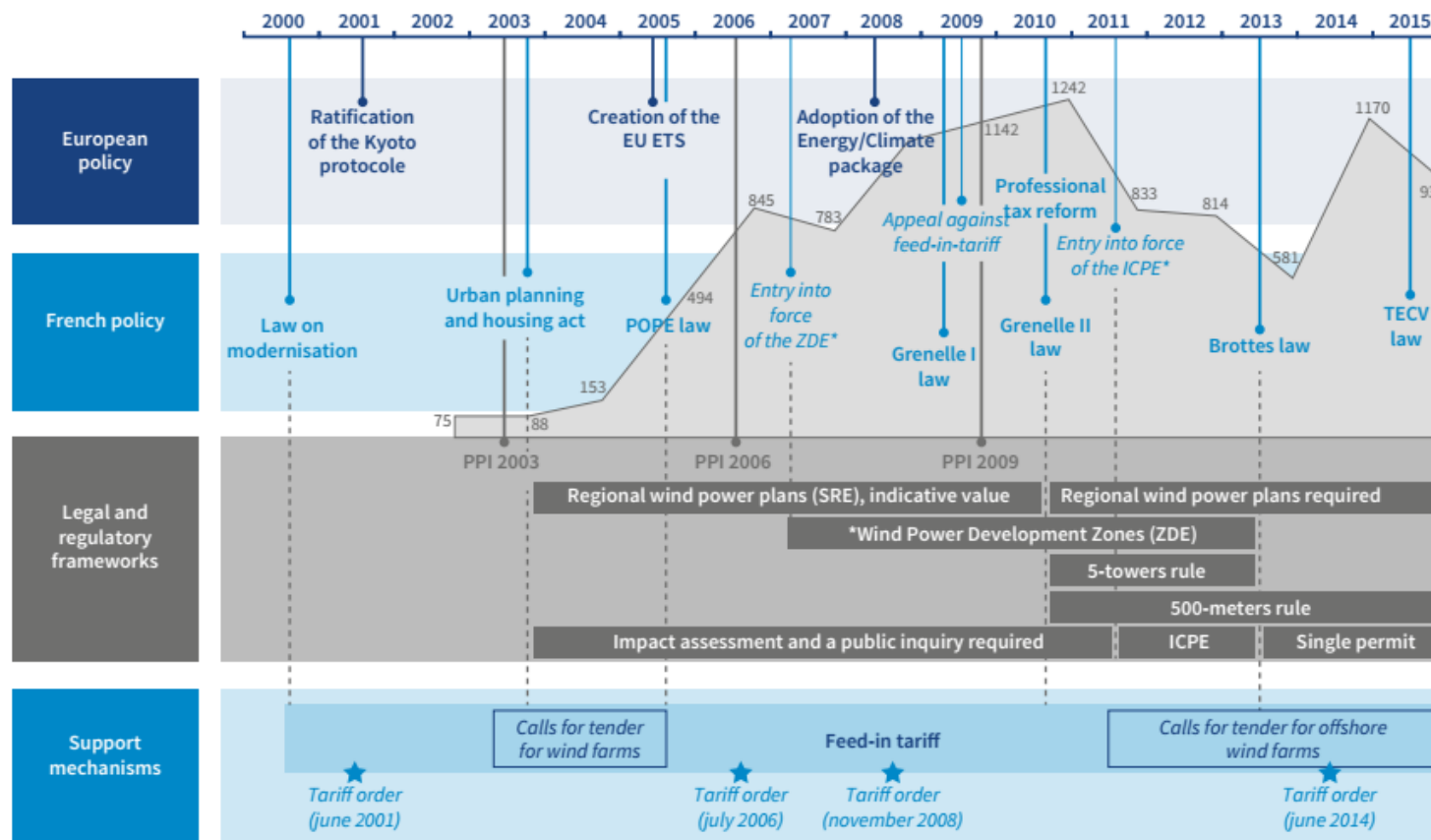
Few incremental investment possibilities.

Cash-flows: Policy Support in France

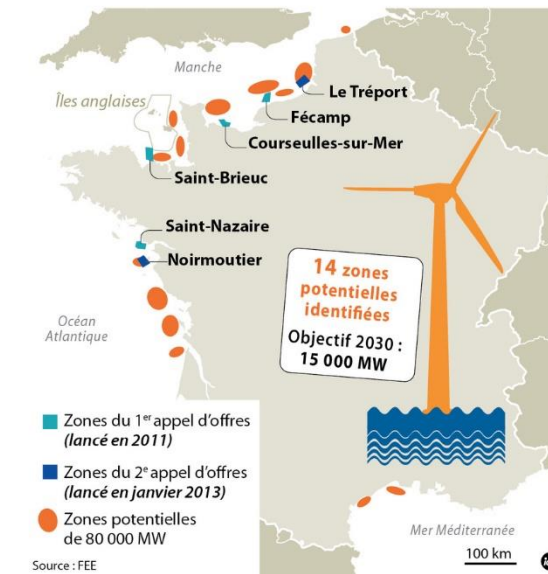


France in the
United States

Consulate of France in Boston



L'éolien marin en France



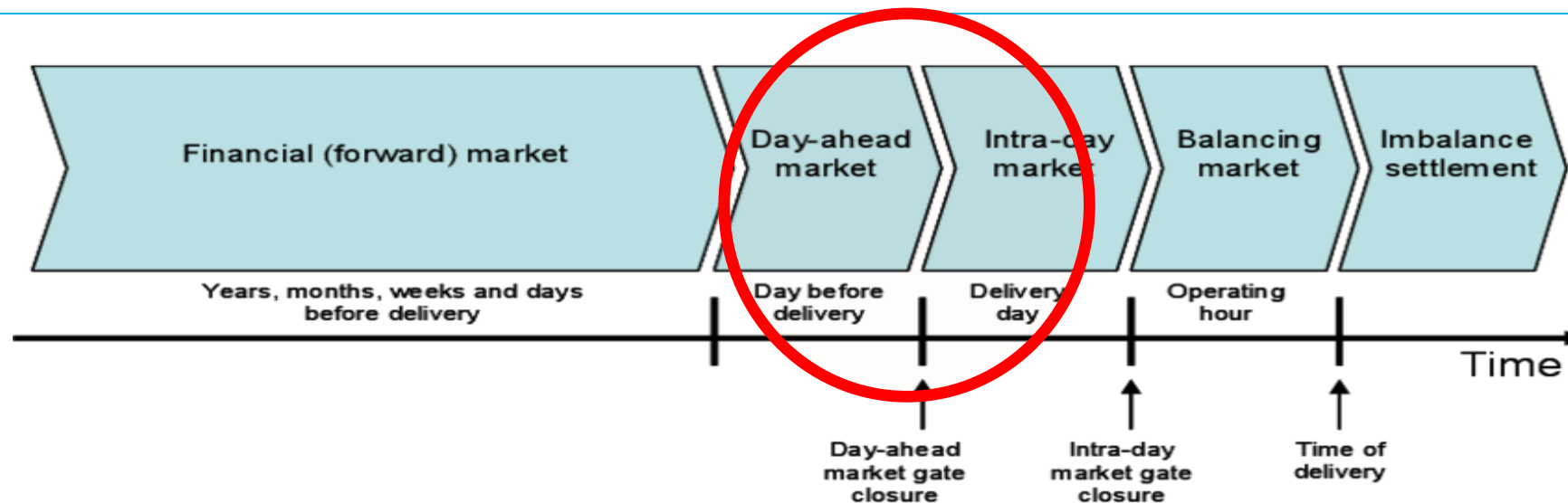
Power Market perspectives for an energy operator

Spot power market price = 40-45 €/MWh (2015-19)



Wind power operator has two market options:

- **Independent sale on the market:**
 - Day-ahead and intraday segments are the most suitable to the intermittent output;
 - Market + Premium in case of missing money.
- **Sale to an aggregator** who further sells on the wholesale market.



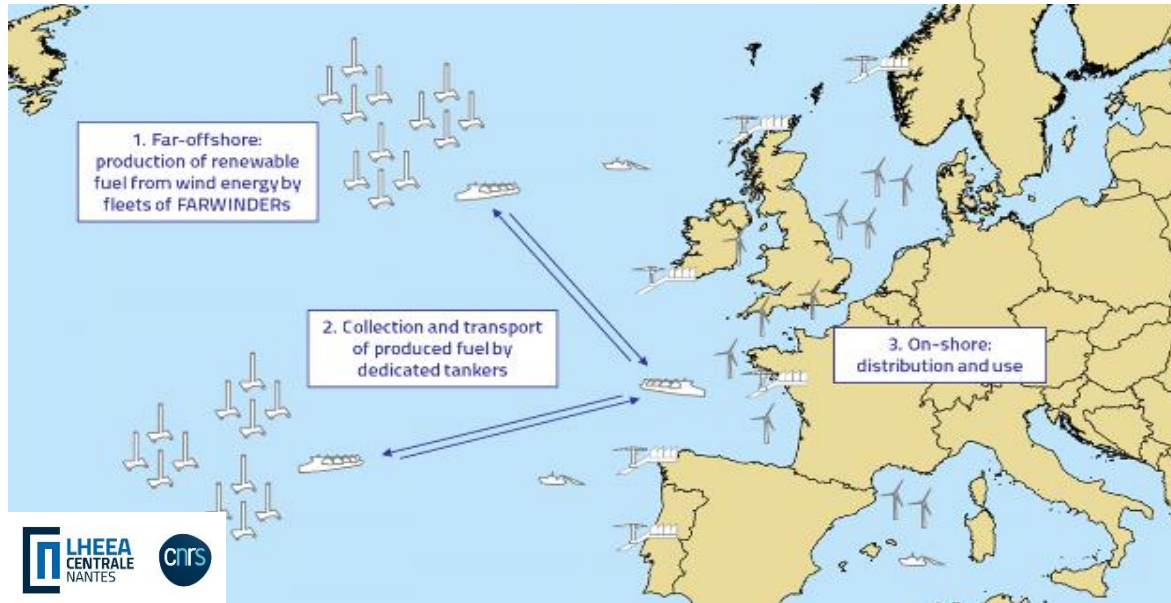
Multi-use: multi-entities.

A viable business plan
requires pluridisciplinarity

➤ Energy storage – H2 for mobility

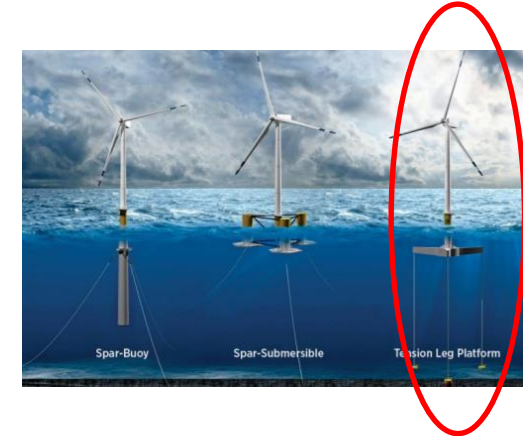
Viable model if

- optimal sizing H2 Supply-Demand;
- optimal sharing of the sea/ harbor among operators;
- mature H2 production-storage technology.

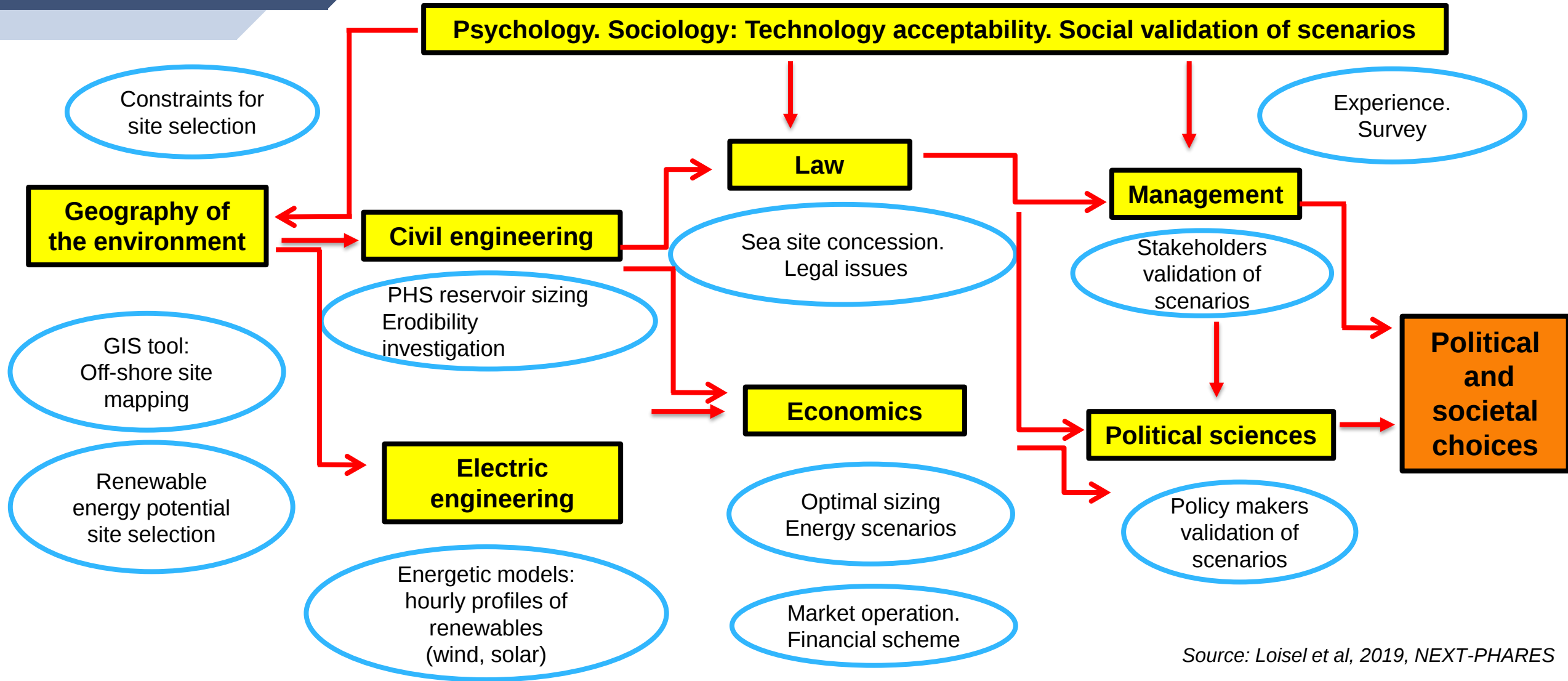


➤ Aqua-culture

Viable model as long as
the input is man-
independent and free of
costs.



Pluridisciplinarity



Ultimate key criteria: wind farm total cost and social acceptability.



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Merci de votre attention!

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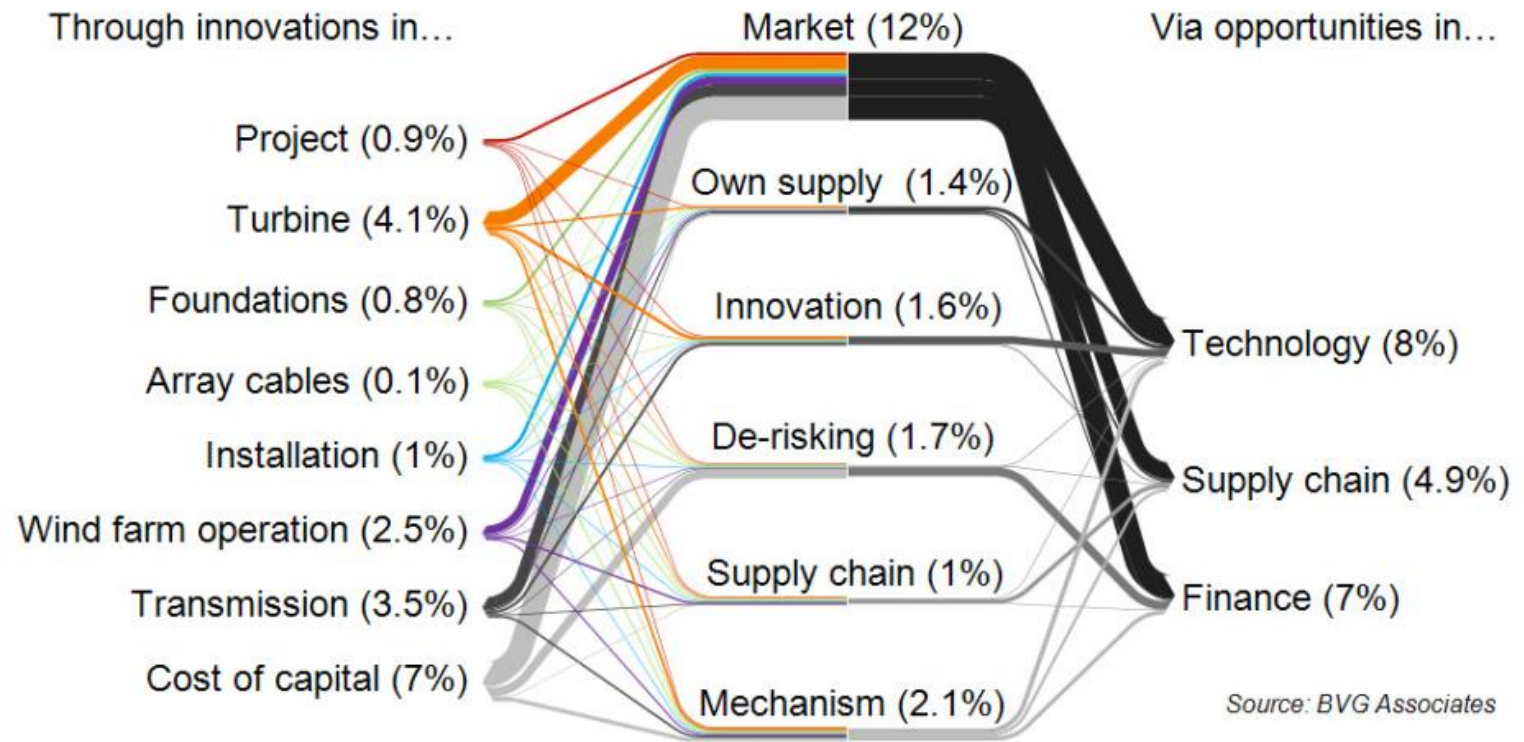
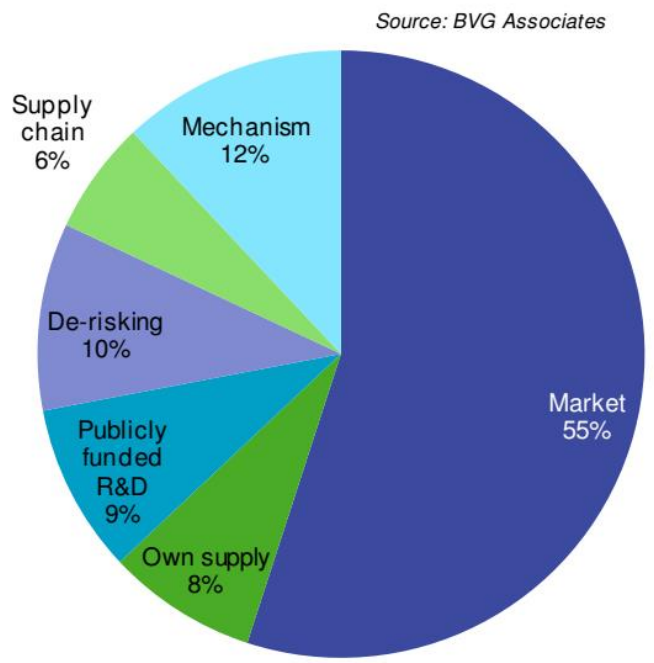
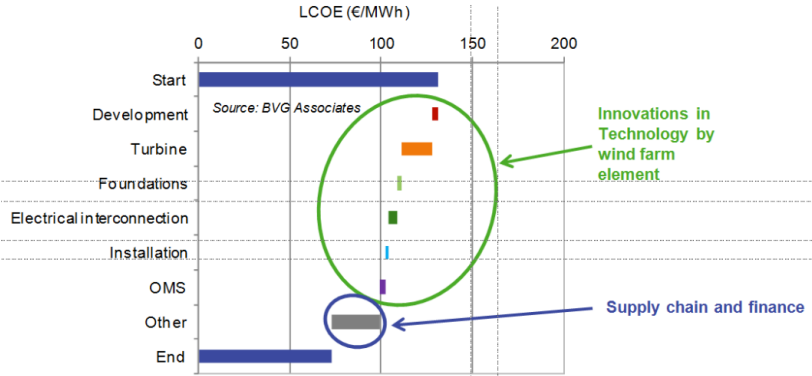
Take-away issues:

- Who captures the rent?
- Temporarily or permanently expensive?
- Large size: no incremental investment.
- Multi-use = multi-legal entities.



ANNEX

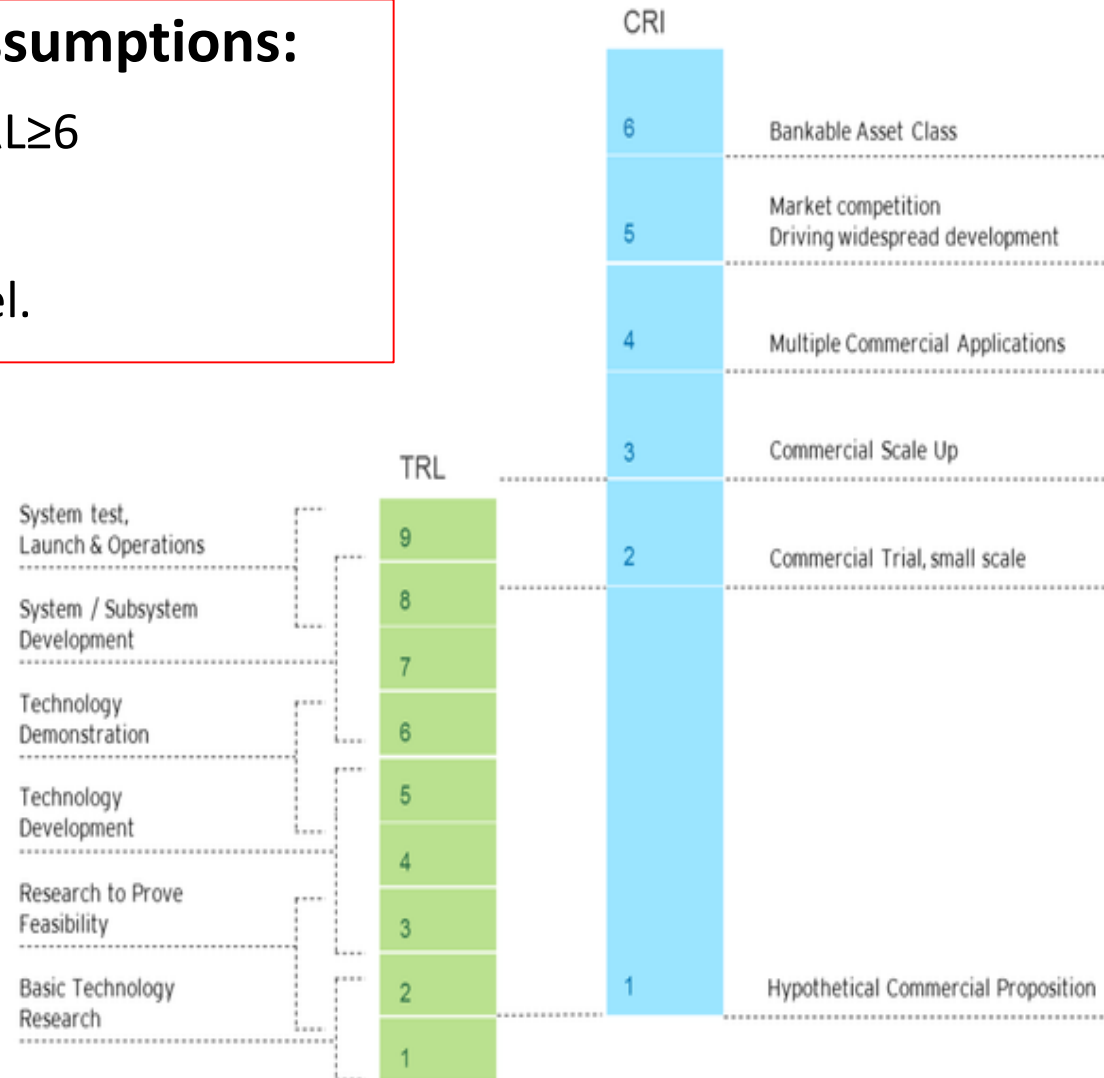
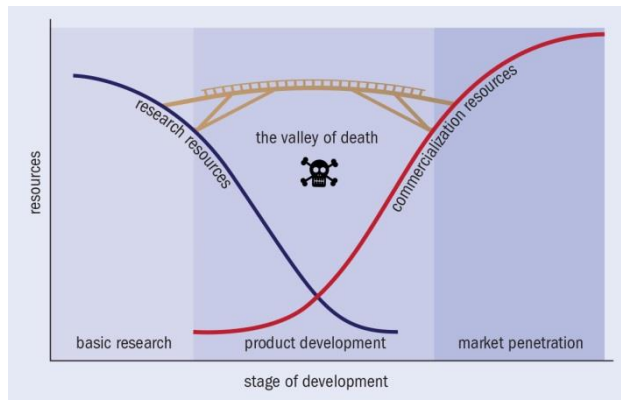
Relative impact of policy drivers on cost of energy reduction, comparing UK offshore wind farms with first generation in 2020 and 2030



When does it make sense to build a *Business Plan*?

Scenario/ Business plan assumptions:

- Technology proved feasible $TRL \geq 6$
- Risk = known, evaluated €
- Social acceptability = high level.



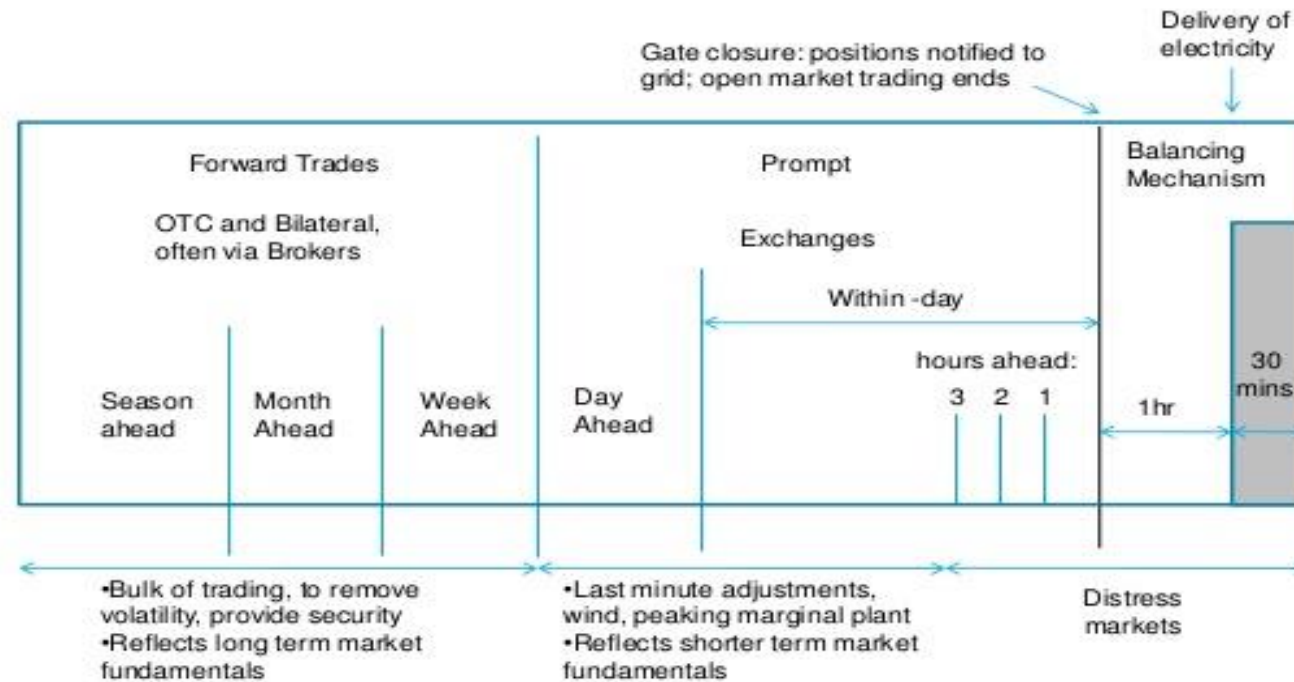
Overview



UK Trade & Investment



Electricity Trading

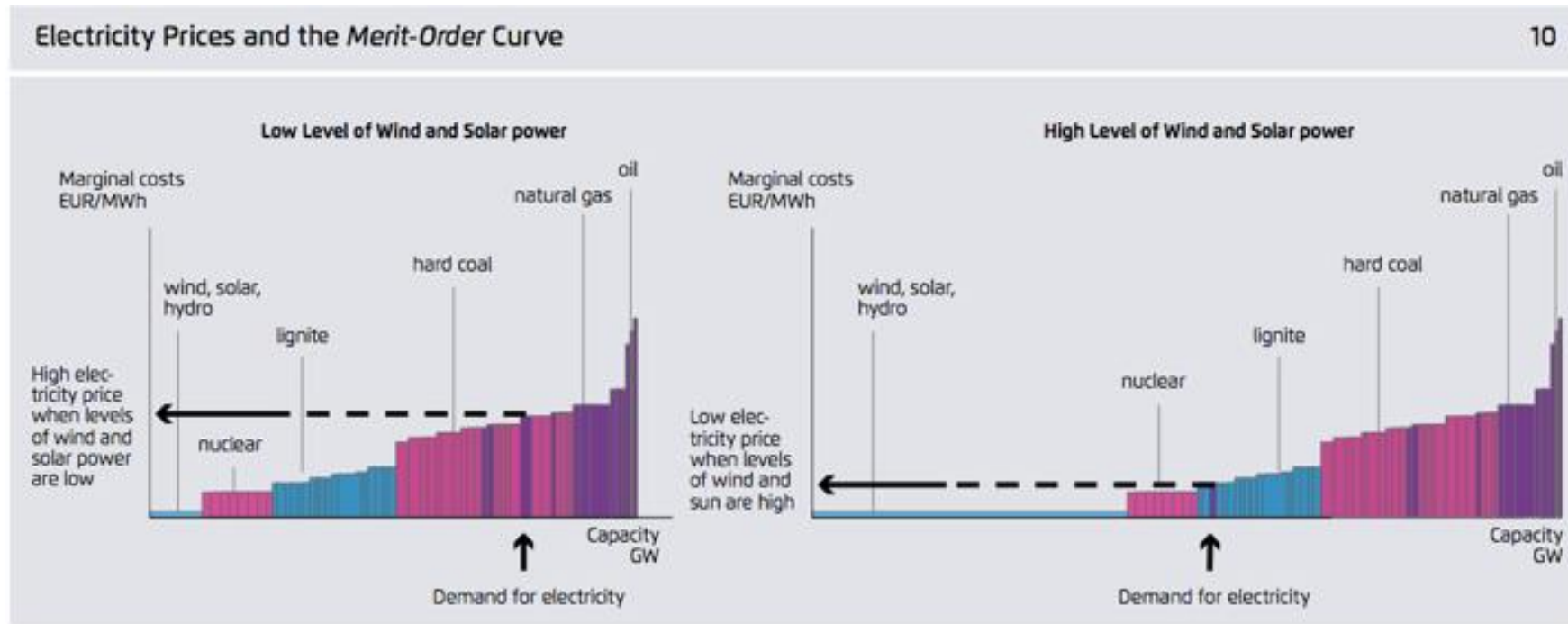


Electricity Market Reform

Slide 11

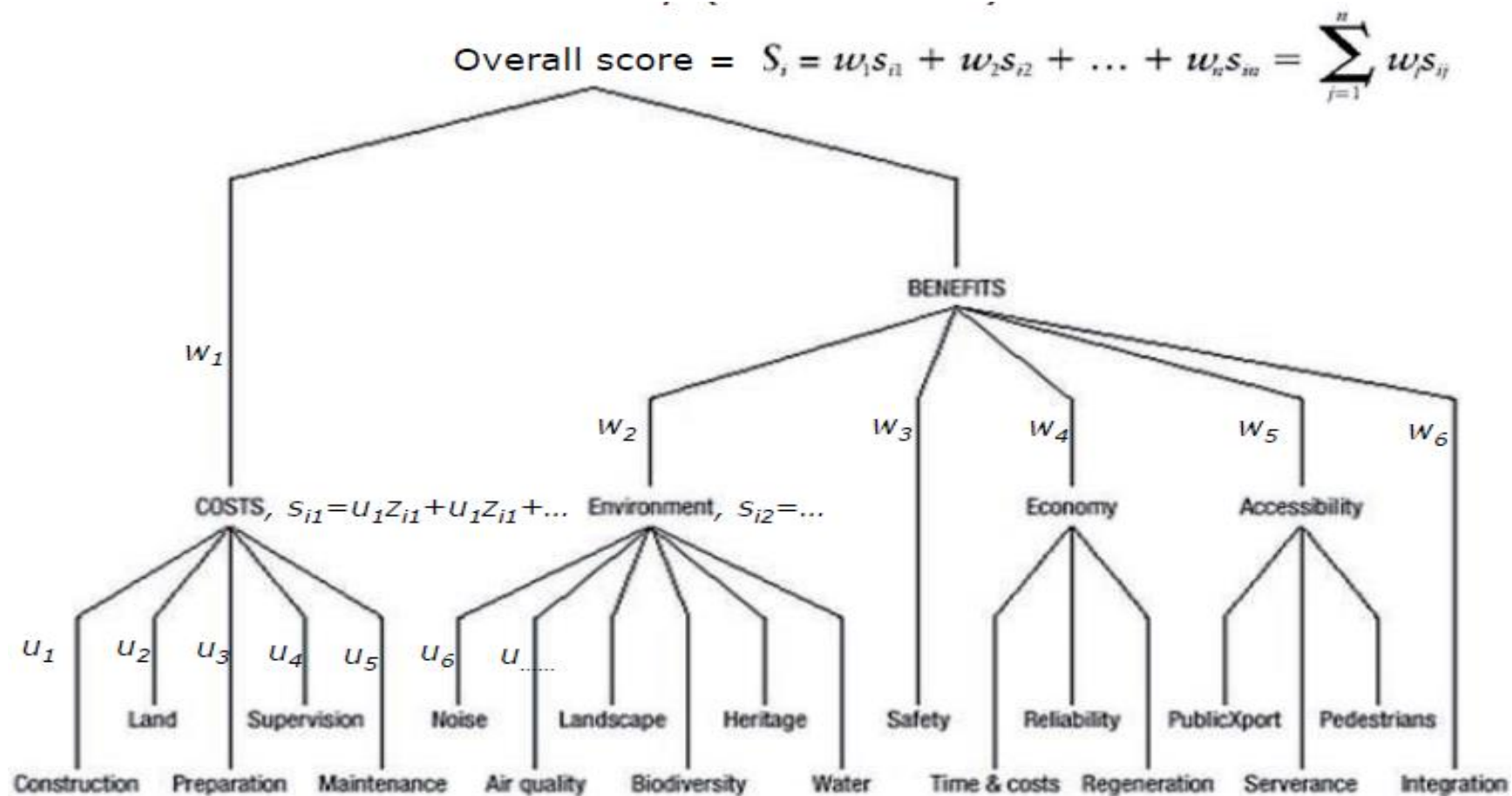
Effects of RES on price setting

A court terme: Les ENR poussent vers la droite (vers la sortie du marché) les centrales aux inputs chers.
A long terme: risque d'éviction du marché des technologies peu utilisées (manque à gagner, arrêts / démarrages fréquents).



ACB: construction des arbres décisionnels

Les options décisionnelles seront **classées par ordre d'importance** économique et d'acceptabilité sociale, sous contrainte locale d'urbanisme, de planification industrielle et d'aménagement des espaces naturels.

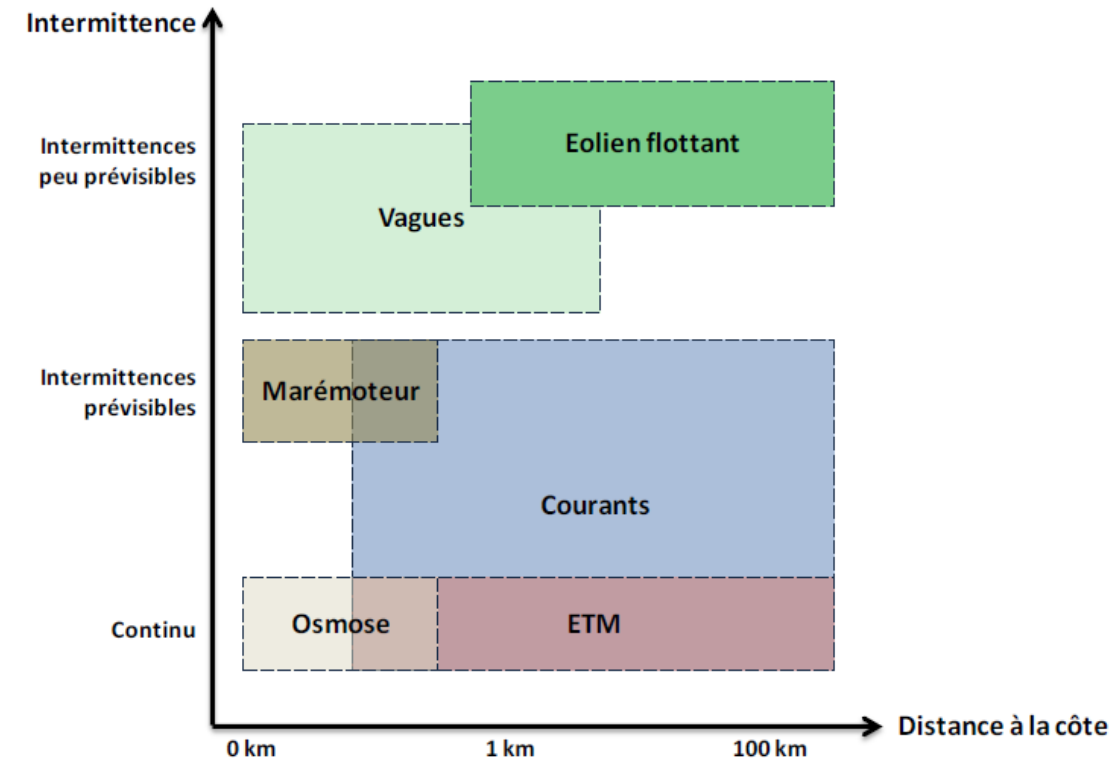


Intermittence: quel type de contrat de fourniture?

Quel segment du marché d'électricité fournir?

Choix en fonction de la prévisibilité du volume et de la capacité (ferme ou non) à souscrire.

Cartographie des EMR (intermittence / distance à la côte)



Source: ENEA (2012)

Marché + prime (complément de rémunération) remplacent l'obligation d'achat et le tarif garanti

A moyen terme, une partie des ENR ne pourra plus bénéficier d'obligations d'achat à un prix et à une durée déterminée, et devra être vendue sur le marché de gros de l'électricité (Décret n° 2016-68, loi sur la TECV).

