Floating Offshore substations from the French TSO perspective

R&D Webinar - AFOSS-DC Project

Designing the electrical substations of the future

With the financial support of:

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2. Offshore wind development in France and challenges for the TSO

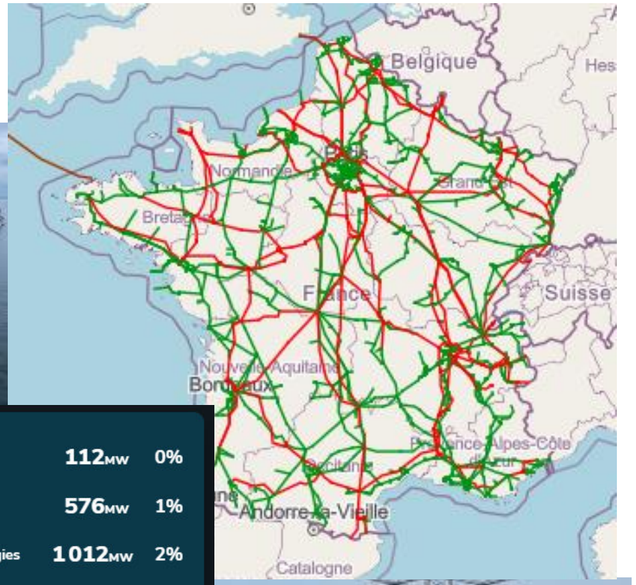
3. AFOSS-DC outcomes and remaining work

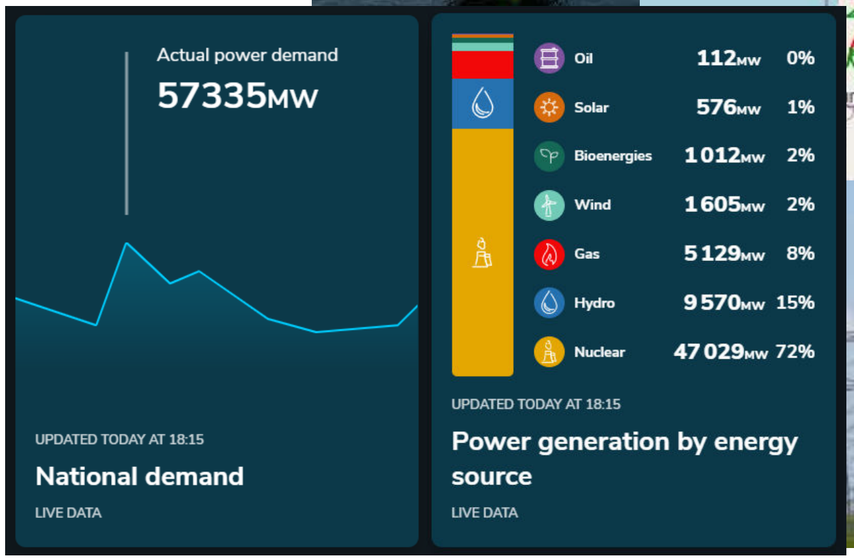
RTE’s missions

RTE - French Transmission System Operator (TSO)

Key accountabilities:

- Public utility who works every second to guarantee long-term access for all French people to decarbonized electricity through its network
- Provide the same quality of service across the country until the borders
- **Plan, Design and Operate the Electricity Transmission System**
- **Advise the French authorities on future** Electricity needs **and required investments**



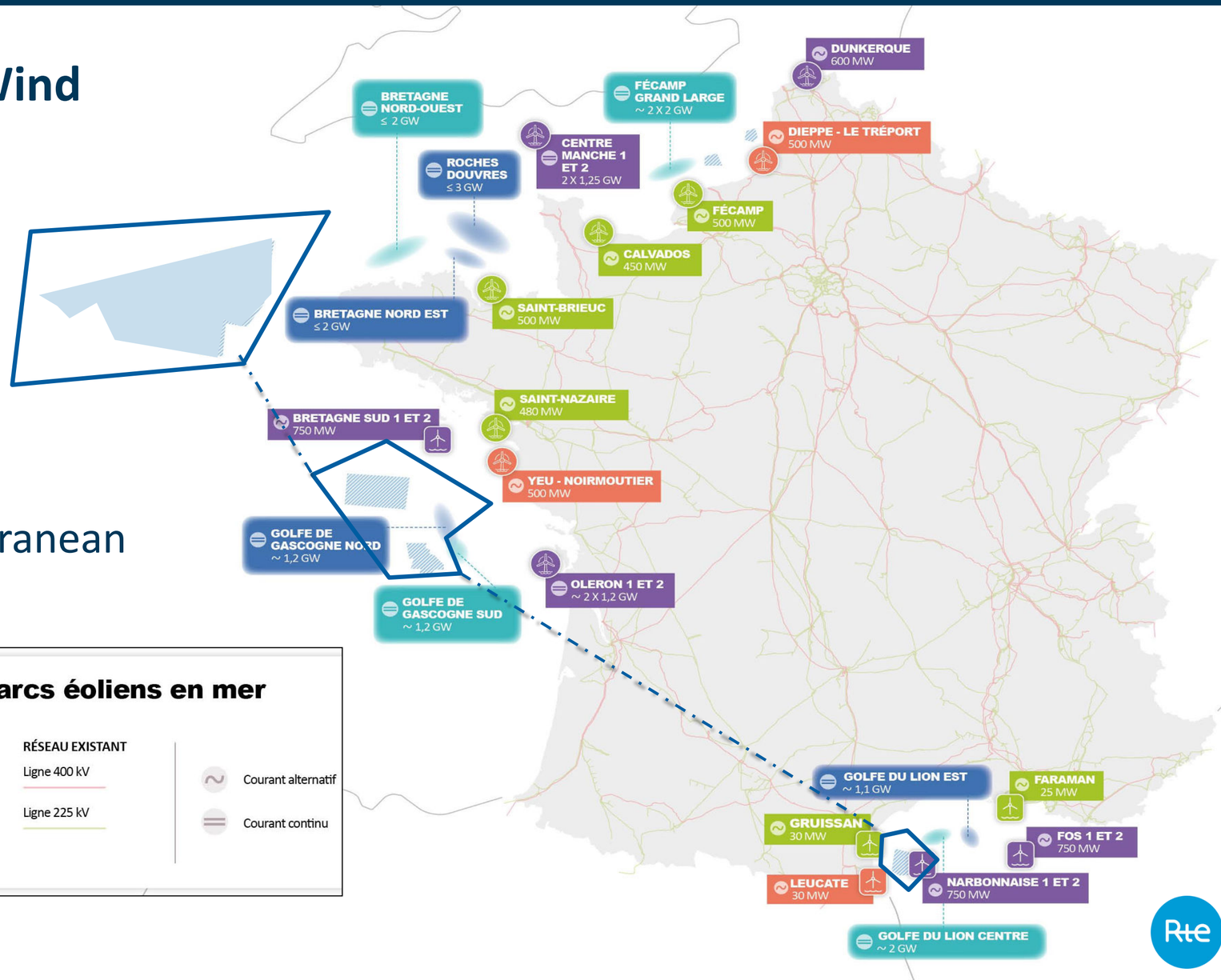


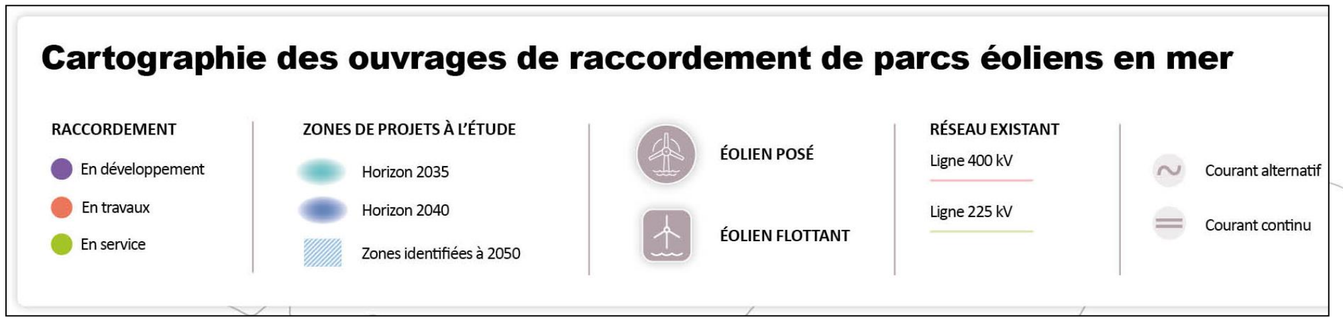
Offshore wind development in France and challenges for the TSO

Offshore wind development

- **Areas of interest for Offshore Wind development**

- **Characteristics:**
  - **Areas:** Several hundred of km²
  - **Distance to the shore:** >150km
  - **Water depth:** 90 to 200m
  - **Metocean:** Atlantic and Mediterranean





What does it mean for the OSS ?

Wide marine areas

- Very large wind farms and/or
- Several wind farms to connect to the grid

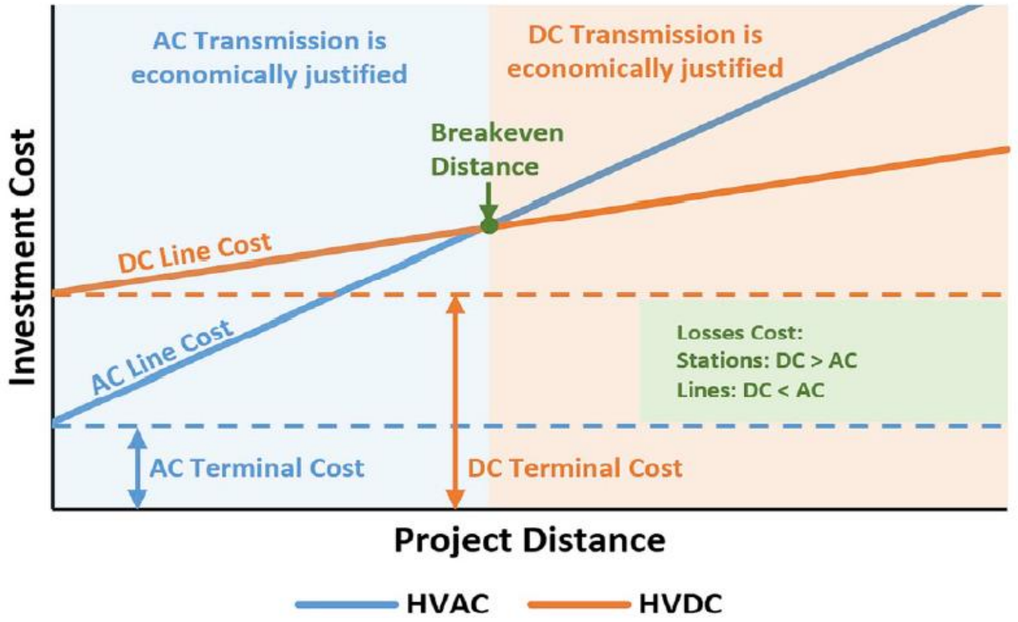
Distance to the shore

- Complex transport for AC electricity

Water depth

- Technical-economical equation of bottom fixed OSS challenged
- Determination of break even point for offshore substation solutions per sites, considering all project phases

HVAC vs. HVDC cost comparison -Qualitative breakeven distance assessment



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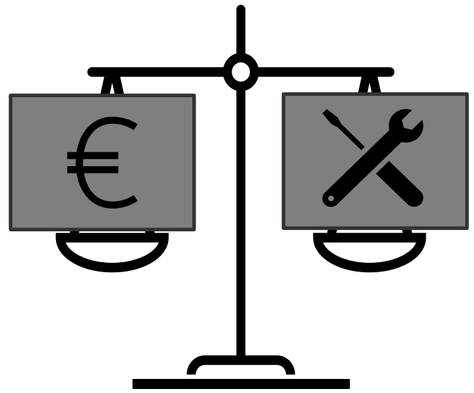
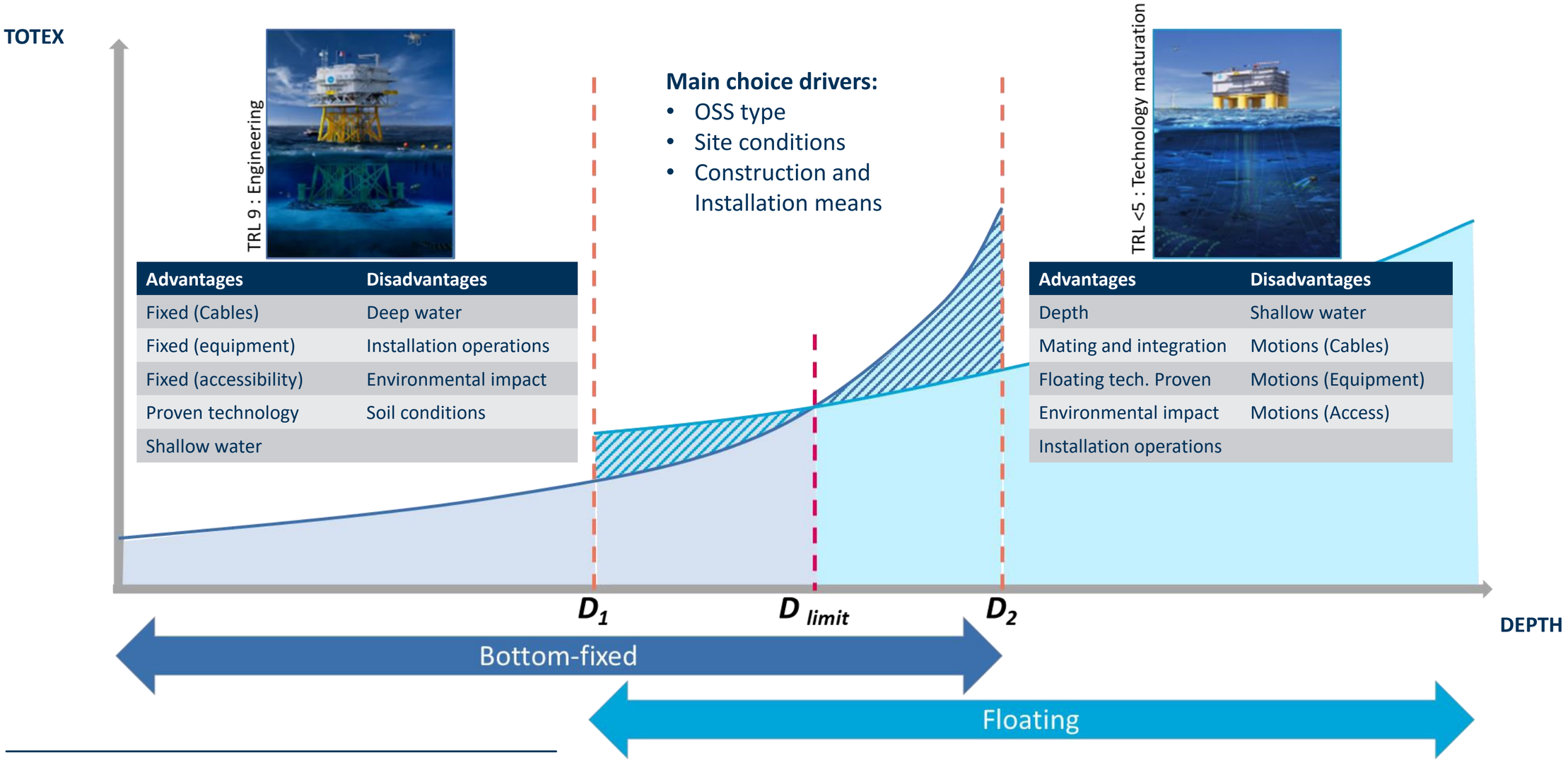
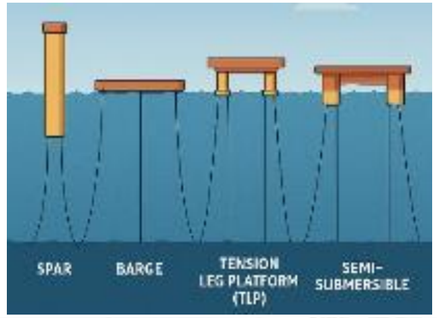
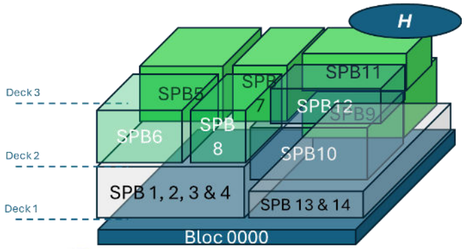


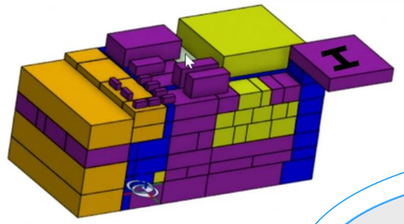
Bottom fixed vs Floating: a technical-economical frontier

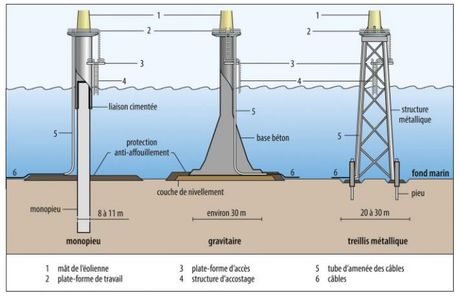


Problematic









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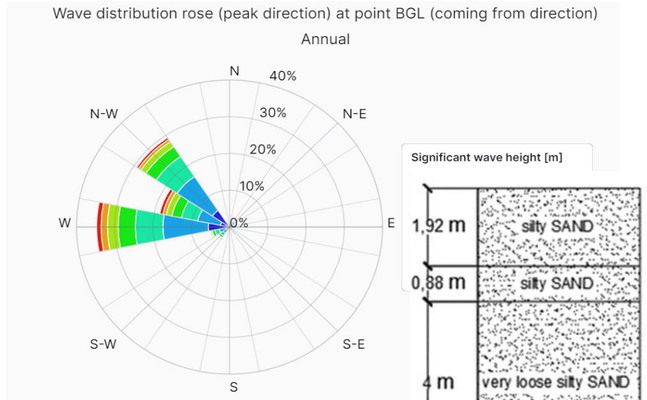

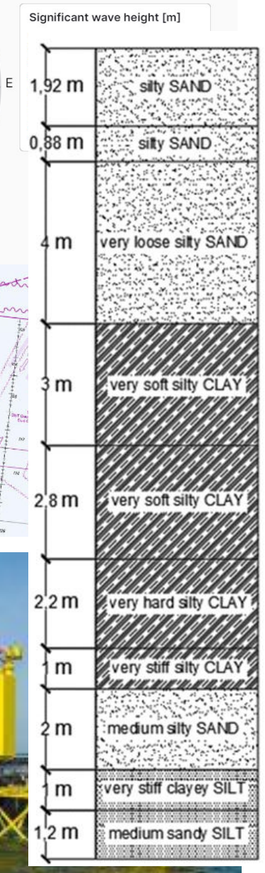

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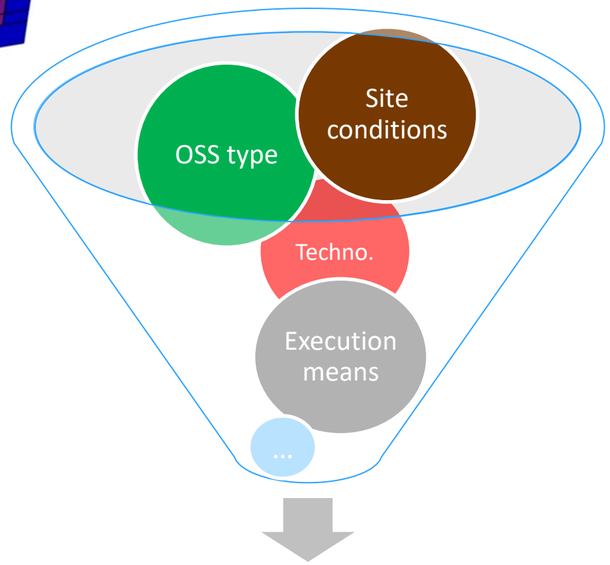

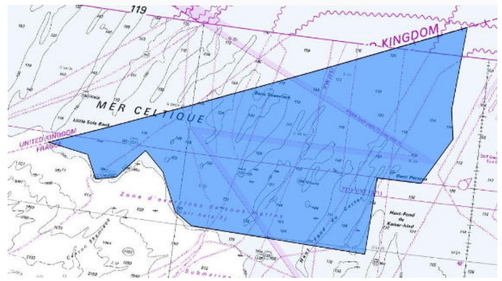

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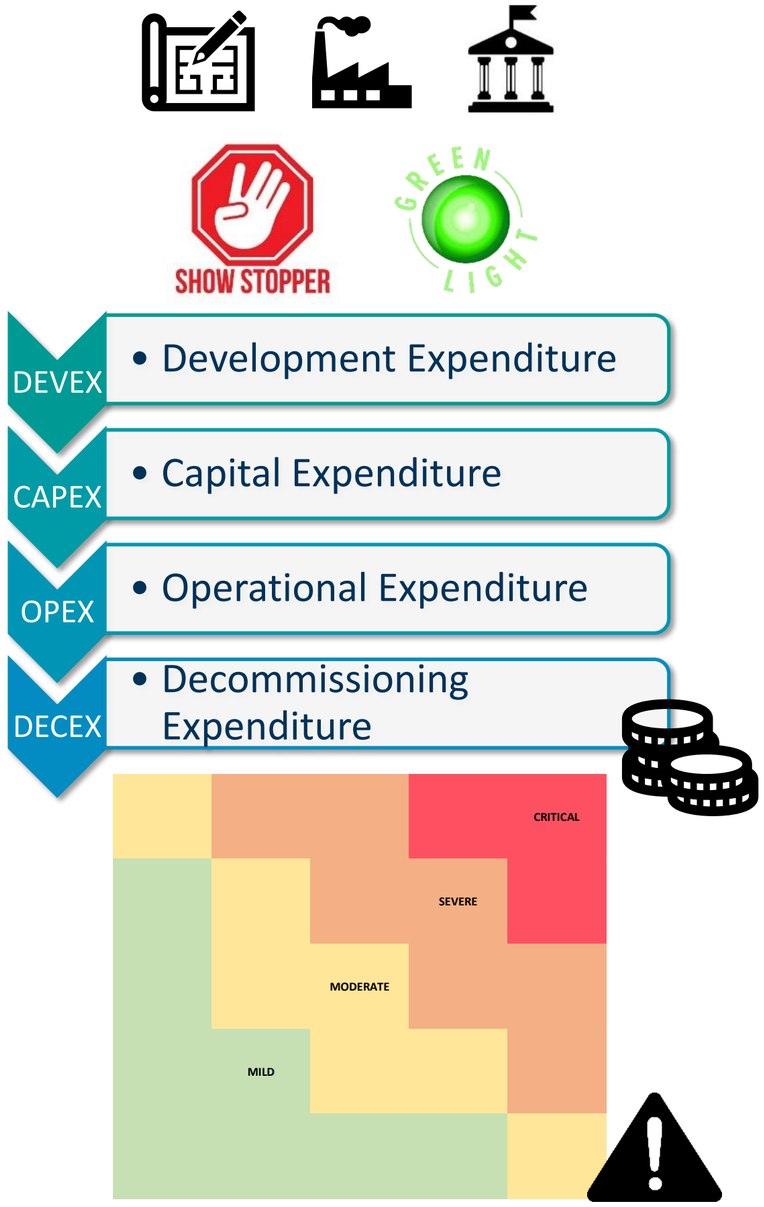
Several relevant solutions for moderate depth

How to choose ?

How to make a decision ?

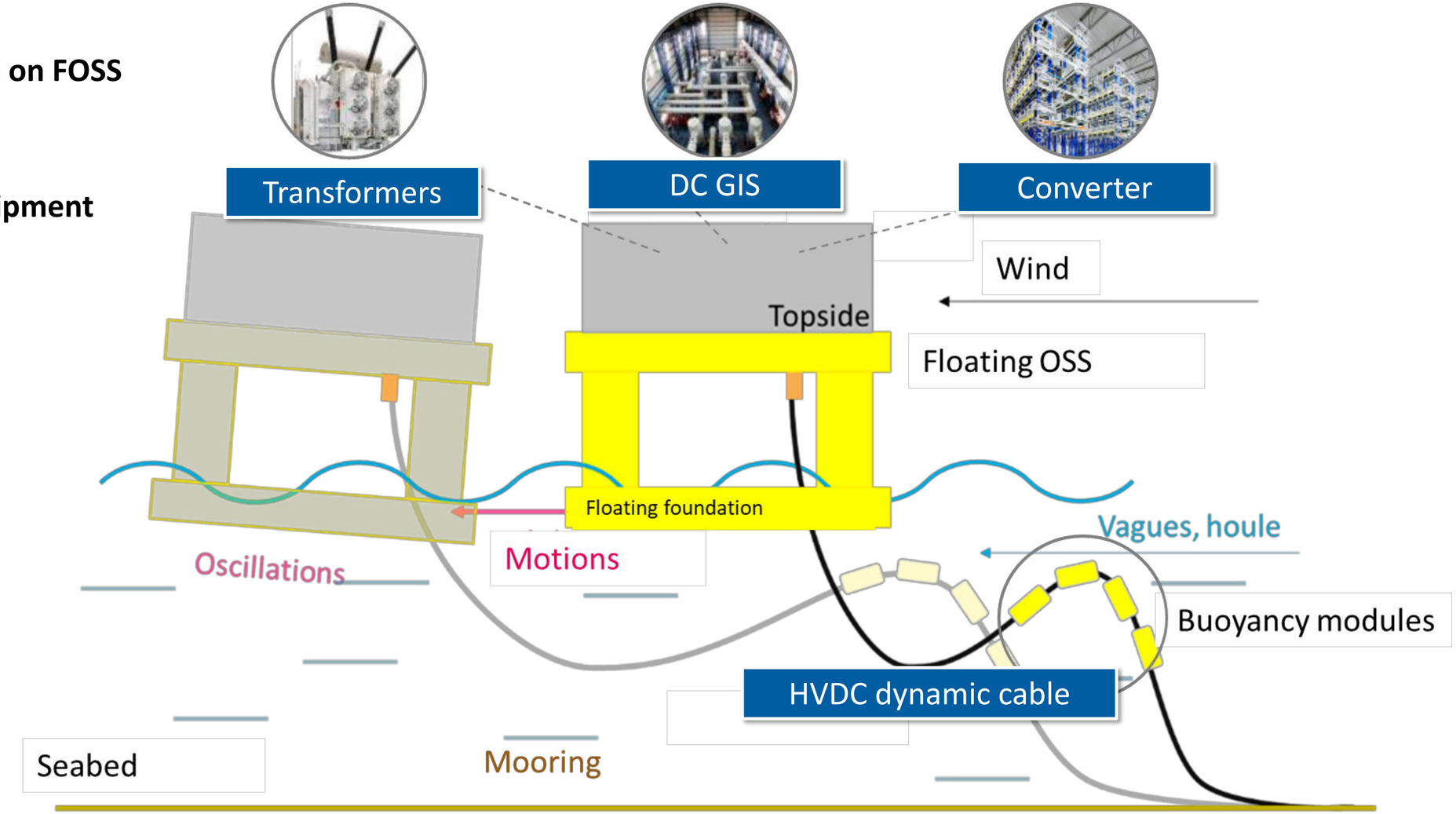
Assess the drivers which enhance decision quality and make a choice:

1. Feasibility: **technical**, **industrial**, political, **regulatory and normative**…
2. Costs and penalties: DEVEX, **CAPEX**, **OPEX**, **DECEX**
3. Risk profile and then **contingences** just as **ensurability** of the projet



Focus on main technical challenges of a FOSS

1. **Converter station on FOSS**
2. **Dynamic cable**
3. **HV Electrical equipment**



Floating offshore substations challenges for a TSO

Strategic

Estimate the technical, economic and environmental applicability of floating offshore connections (compared with bottom fixed offshore connections).
These estimates will enable RTE to build future offshore connection strategy plan.

Technical

Specify the different requirements for this type of connection (substation and cable).
The specifications will enable RTE to issue invitations to tender and evaluate suppliers' bids.

Industrial

Check that the infrastructure and skills of European (or even French) industry are compatible with the manufacture and maintenance of these new types of connection.
And then build industrial strategies

Environmental

Assess environmental impacts and propose follow-up protocols
The specifications will enable RTE to issue invitations to tender and evaluate suppliers' bids.

AFOSS-DC outcomes and remaining work

Work streams in RTE's roadmap

Industrial

- Supply chain
- Infrastructures
- Skills

OSS

- HVDC of several power rates
- Floater concept selection
- Design, prototyping and tests

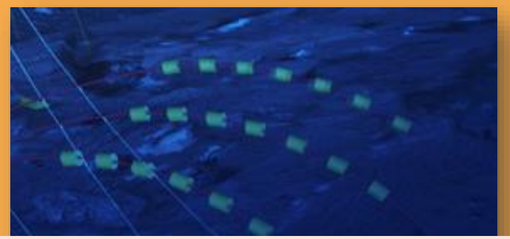
O&M

- Failure modes
- Reliability
- O&M strategy

Environment

- Impact on the environment
- Climate change impact
- Life-cycle analysis

Cable



- Export dynamic cable
- Design, prototyping and tests

Work streams in RTE's roadmap

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- HVDC of several power rates
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O&M

- Failure modes
- Reliability
- O&M strategy

Environment

- Impact on the environment
- Climate change impact
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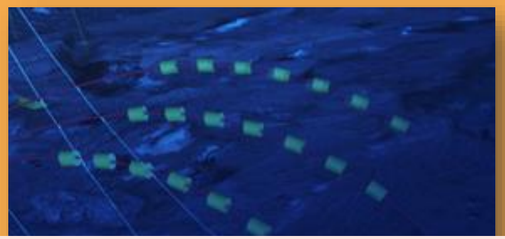
With AFOSS-DC:

- Achieved
- Partially achieved
- **Not studied yet**

Cable



- Export dynamic cable
- Design, prototyping and tests

Summary and next steps

- **AFOSS-DC allowed to pave the way** on several aspects of the RTE's roadmap:
  - Substation functional **specifications**
  - Floater concept **selection** and preliminary **design**
  - Preliminary dynamic cable **design**
  - FMECA and RAM **analysis**
  - **Regulatory and normative**

- **Develop the technological blocks needed to** realize high power floating offshore substation solutions capitalizing on AFOSS-DC
- **Validate** them with dedicated qualification campaigns and tests through numerical validation, basin tests or the deployment of a demonstrator including the key technological blocks to derisk (floating platform, electrical equipment, dynamic export cable…)…
- …with an **adequate experimental protocol** (enhancing the efficience of the test campaign able to support the adequate maturation plan).
- … representative of RTE's cases for site conditions

- **Engage and involve** supply chain
- **Propose industrial solutions to the sector** for building high power floating offshore substation solutions for French and export market.
- Favor the emergence and the consolidation of an **European and French industrial supply-chain** able to deliver such floating offshore substation.

Thank you for your attention!