Offshore Floating Wind Turbines - Green Electricity for O&G Platforms

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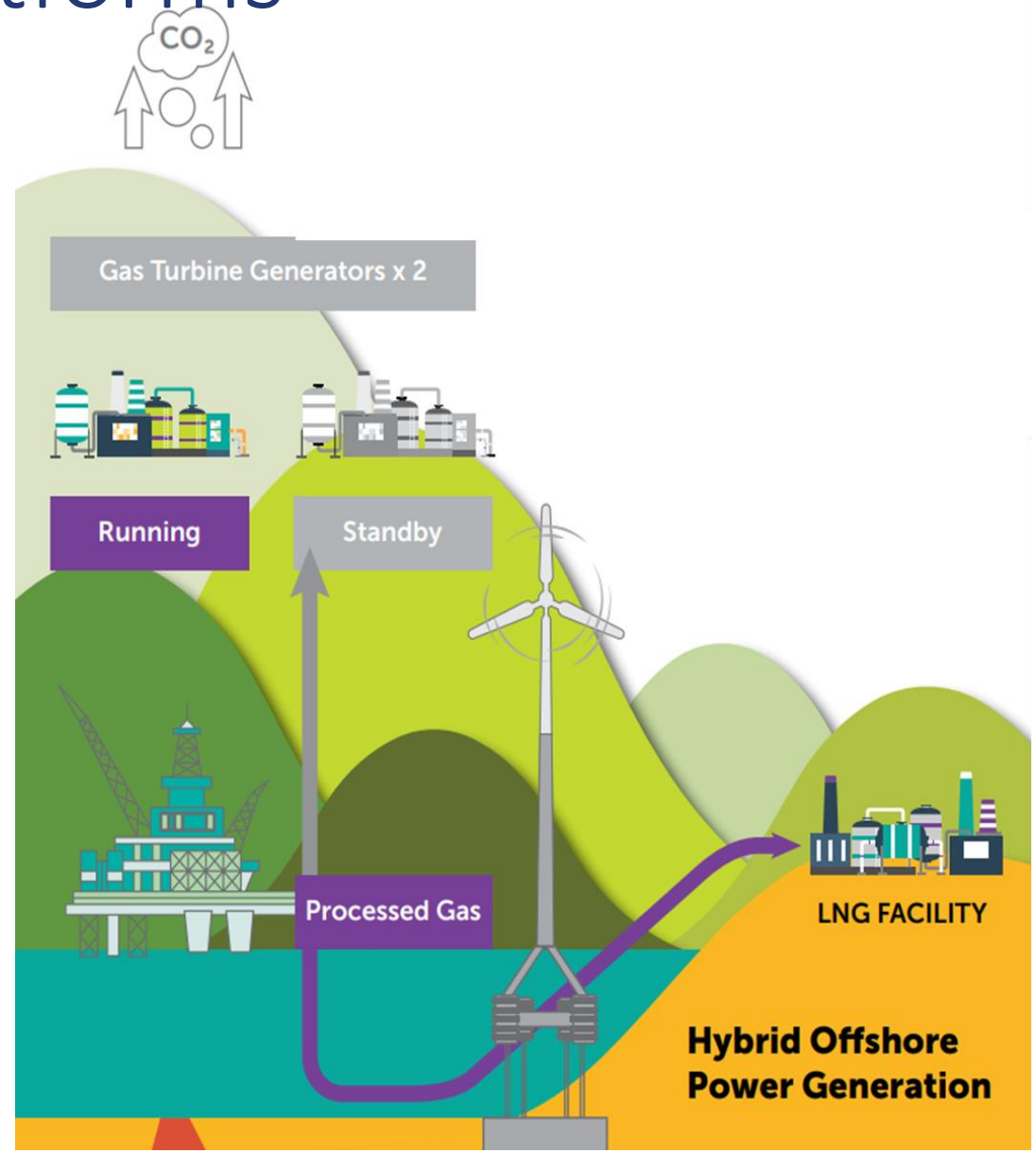
Organized by FWE Quest Offshore

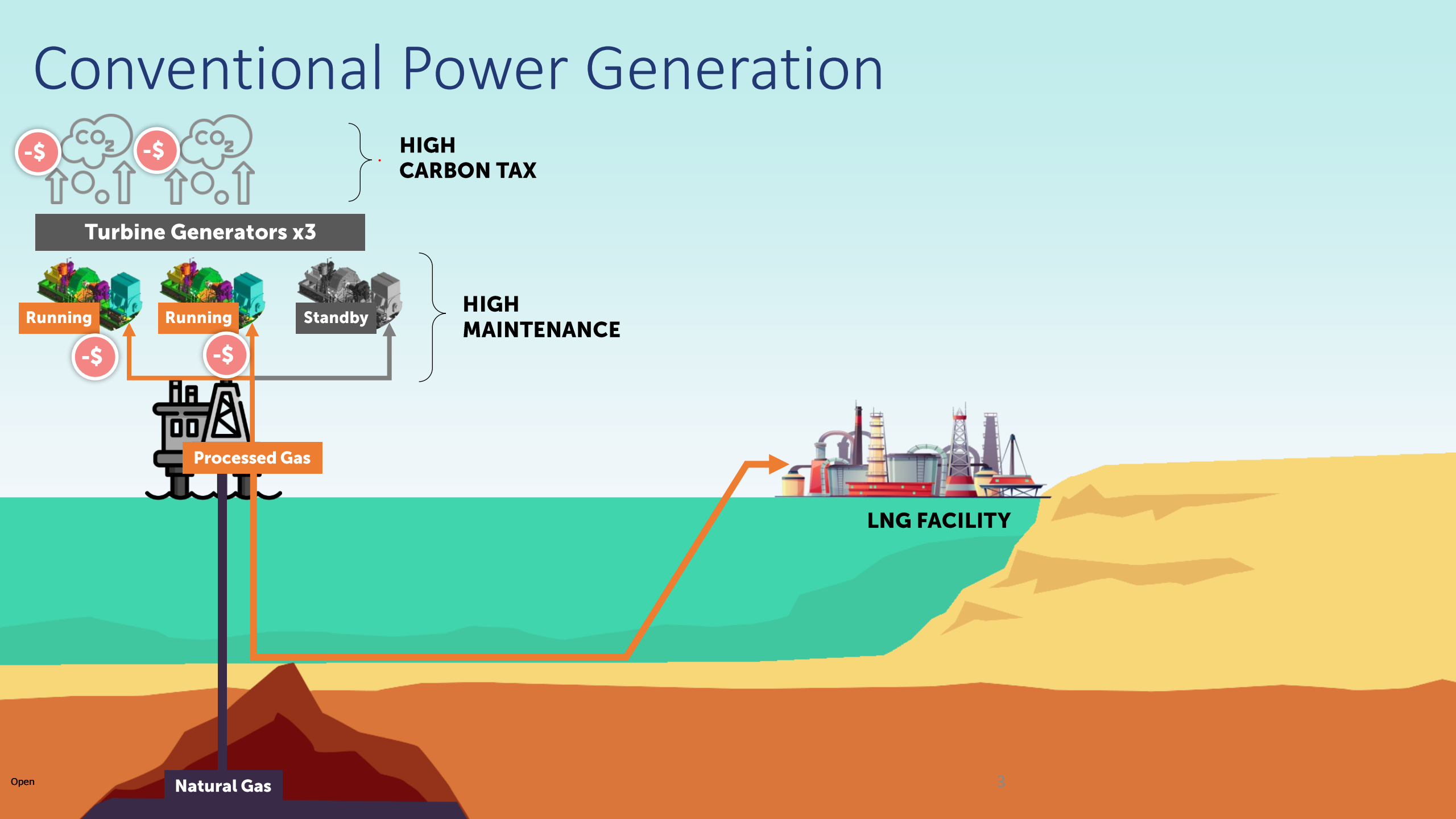
Green Electricity for O&G Platforms

- PETRONAS has declared its' aspiration to achieve net zero carbon emissions by 2050.
- Challenges in Malaysia O&G operations:
  - low wind region
  - offshore ~ up to 250km from shore
  - water depths > 60m



PETRONAS Technology Activity Outlook 2021-2023

Conventional Power Generation



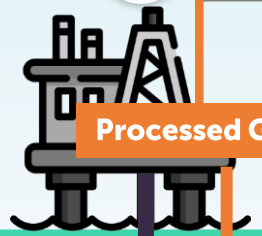
Hybrid Power Generation

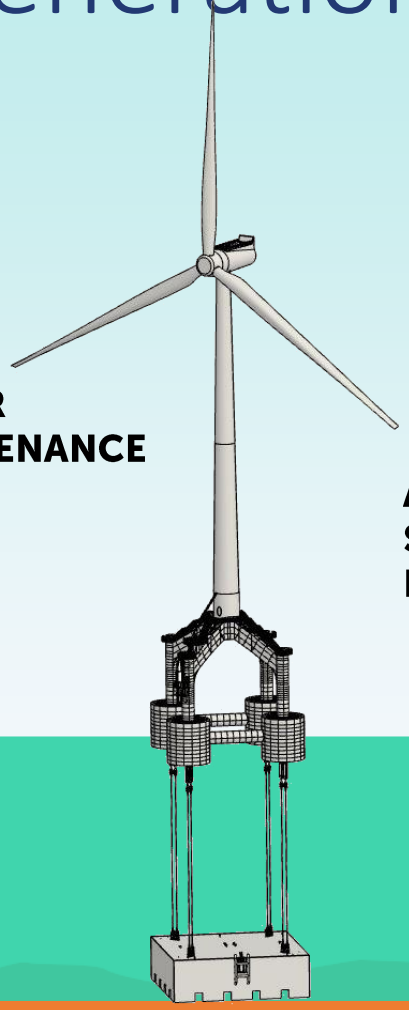
LOWER CARBON TAX

Turbine Generators x2

LOWER MAINTENANCE

-$





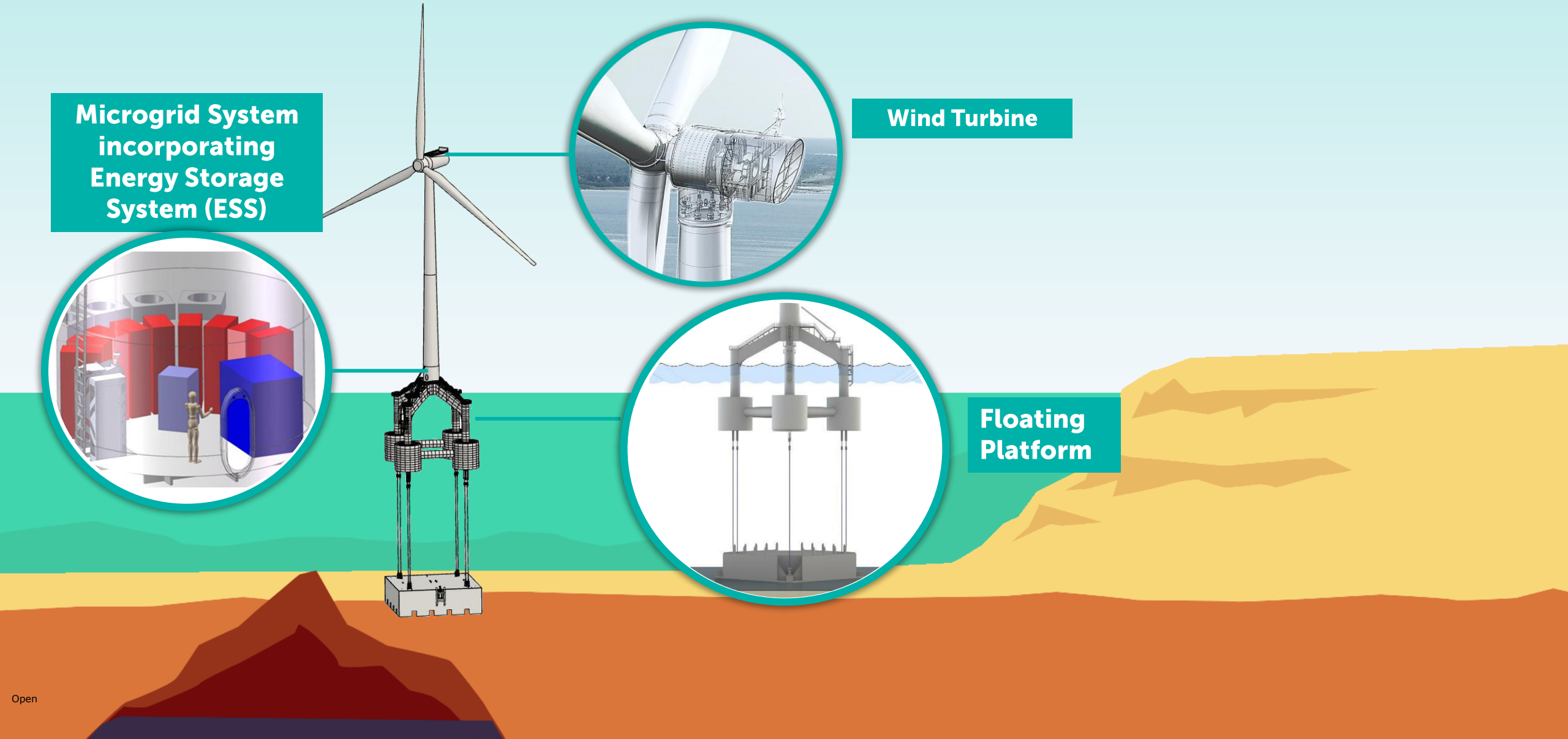
ADDITIONAL SALES GAS REVENUE

LNG FACILITY

Natural Gas

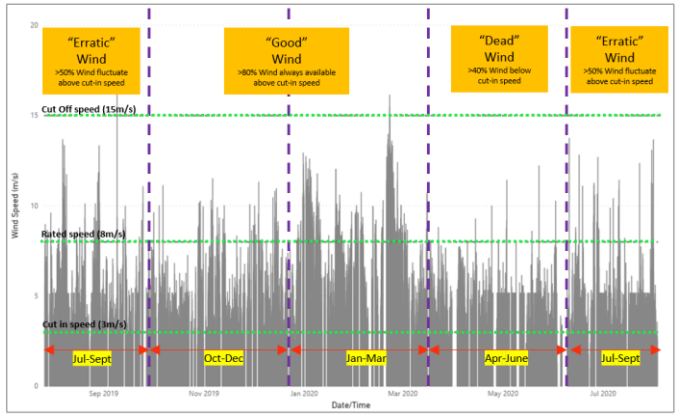
Open

Wind Turbine Components



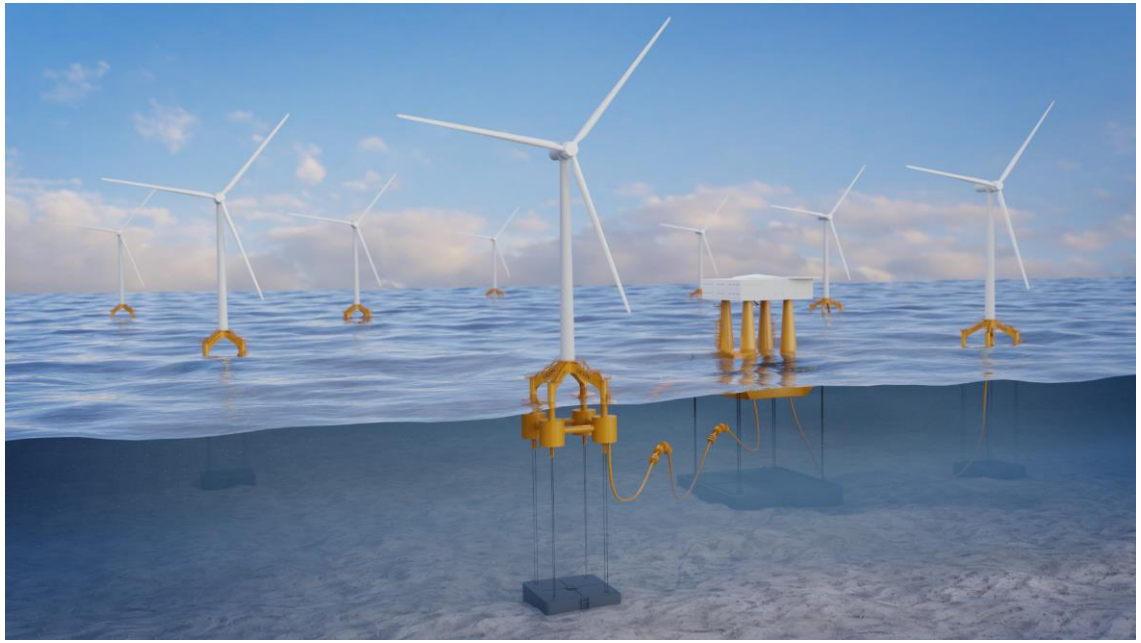
Advance algorithm implementation for microgrid

- State of the art WT Micrologic application – control voltage and frequency of wind turbine, ESS & conventional generator.
- Enables seamless transfer between wind turbine, ESS and conventional generator according to load demand during low or erratic wind speed condition.
- WT and GTG act as main power generation and ESS as backup power during low wind speed.



GICON®TLP

- Small footprint
- Gravity anchor
- Composite mooring lines
- Simple design



DNV·GL

STATEMENT OF FEASIBILITY

Statement No.:	Issued	Valid until:
C-DNVGL-SE-0422-07382-0	2021-06-04	2024-06-03

Issued for:

Concept

of

GICON tension leg platform (TLP) design
Baram field

Comprising:

Substructure and foundation

Specified in Annex 1

Issued to:

PETRONAS Research SDN BHD

Lot 3288 & 3289, Off Jalan Ayer Itam Kawasan Institusi Bangi
43000 Kajang , Selangor
Malaysia

According to:

DNVGL-SE-0422:2018-07
Certification of floating wind turbines

Based on the document:
CR-C-DNVGL-SE-0422-07382-0 Certification Report, dated 2021-06-03

Changes of the concept are to be approved by DNV GL.

Hamburg, 2021-06-04
For DNV GL Renewables Certification

Fabio Pollicino
Director and Service Line Leader
Project Certification

By DAkkS according DIN EN ISO/IEC 17065 accredited Certification Body for products. The accreditation is valid for the fields of certification listed in the certificate.

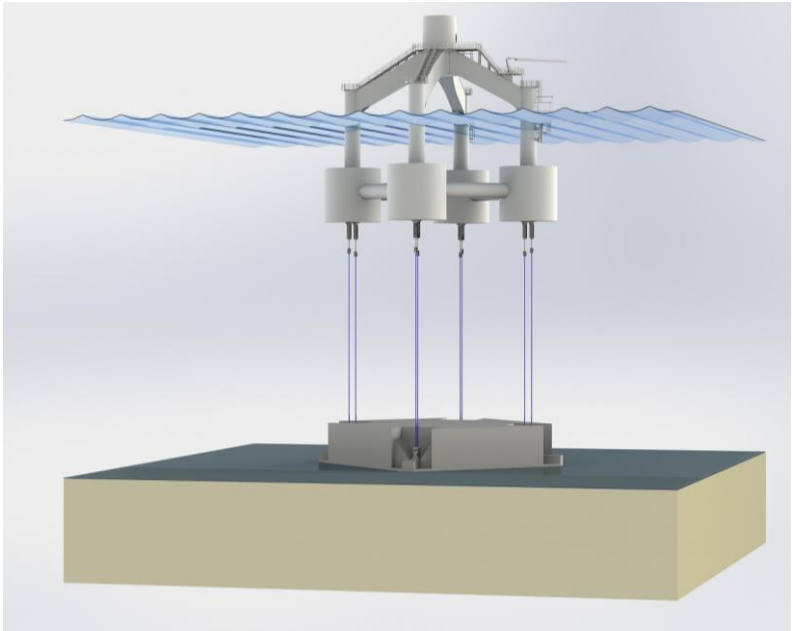
Hamburg, 2021-06-04
For DNV GL Renewables Certification

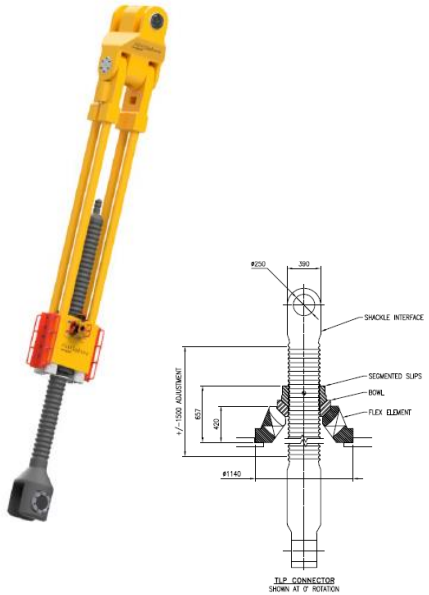
Andreas Manjock
Project Manager

The accredited certification body is Germanischer Lloyd Industrial Services GmbH, Brooktorkai 18, 20457 Hamburg.
DNV GL Renewables Certification is the trading name of DNV GL's certification business in the renewable energy industry.

Simple TLP design (concept development)

- Combining buoyancy and tension-based stabilization which gives favorable motion characteristics compared to other floating substructure types.
- Stiff platform – activating suitable pre-tensions in the moorings. Working with high safety level and redundancy for e.g. critical components like connectors and cables.
- Smaller and lighter structure compared to others.

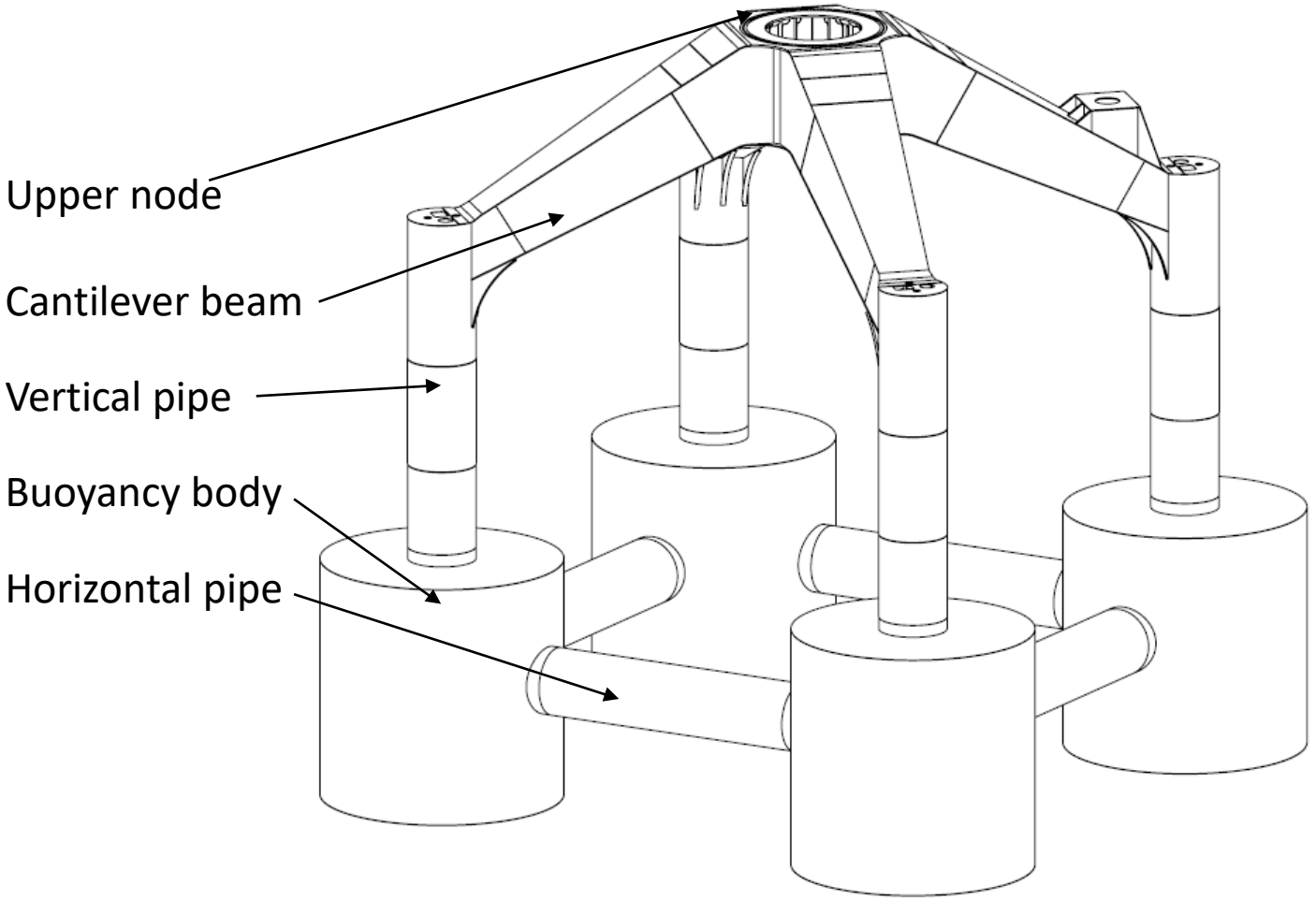




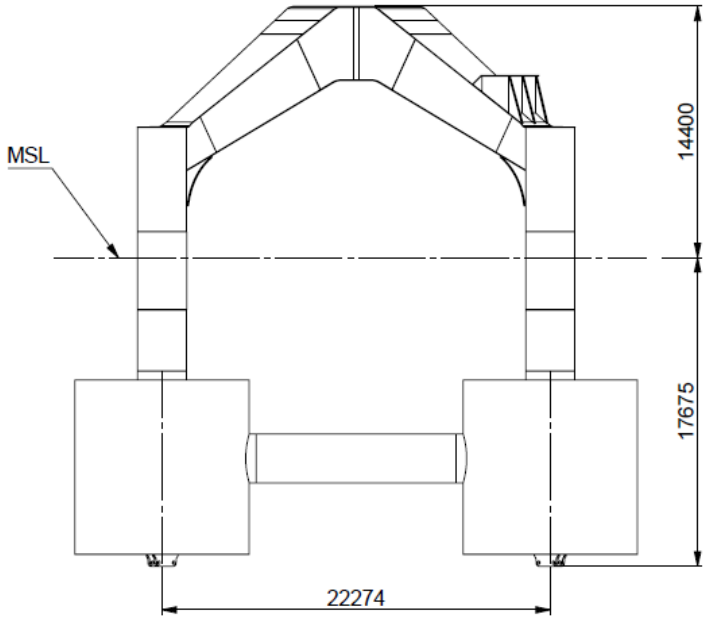
Adjustable connectors

Current design of TLP

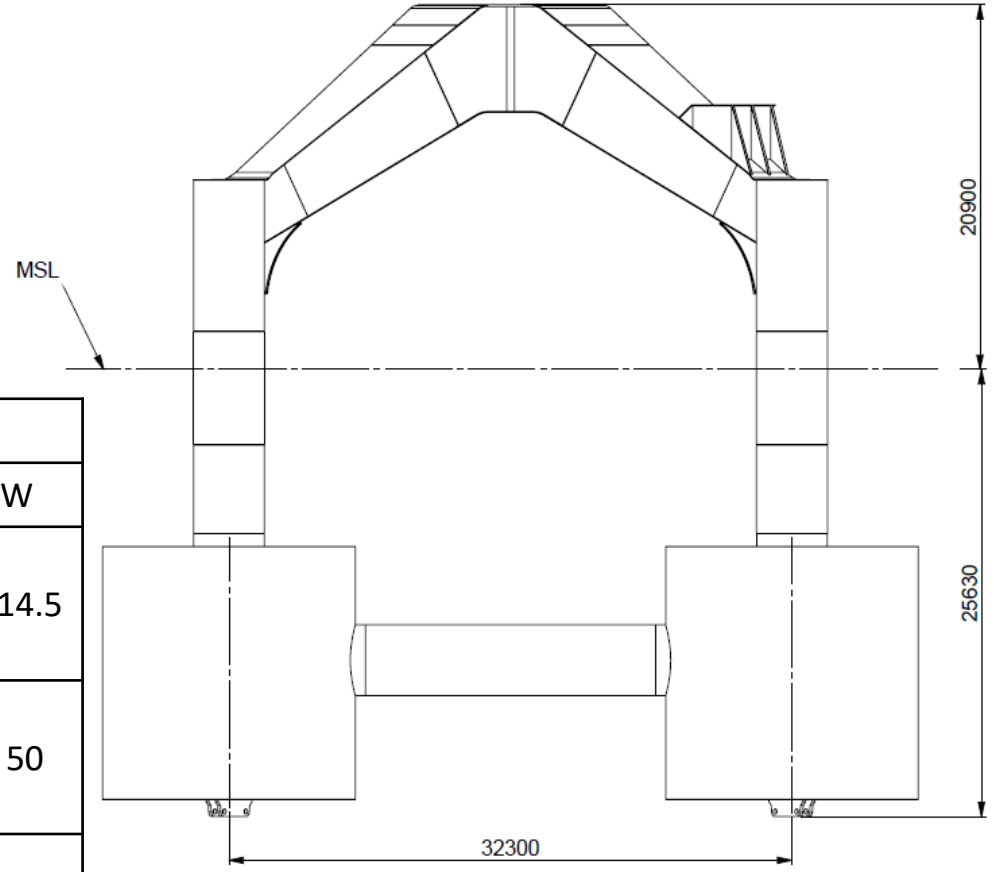
- manufacturing of components using existing fabrication structures of a shipyard.



Comparison TLP design 4 MW/ 10 MW wind turbine



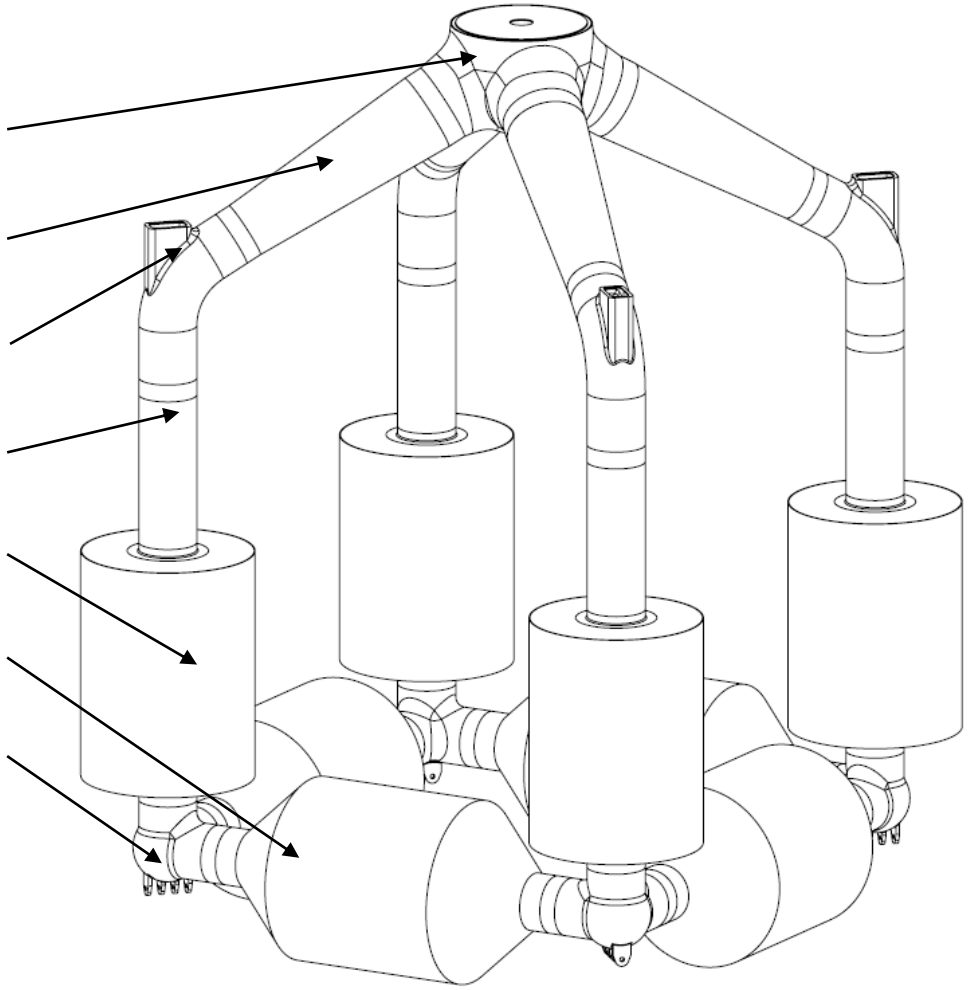
Comparison		
	4MW	10MW
Pipe diameter in m	2.5 to 10	3.6 to 14.5
Pipe thickness in mm	20 to 35	30 to 50
Plate thickness in mm	14 to 95	14 to 110



MSL- depending on site condition

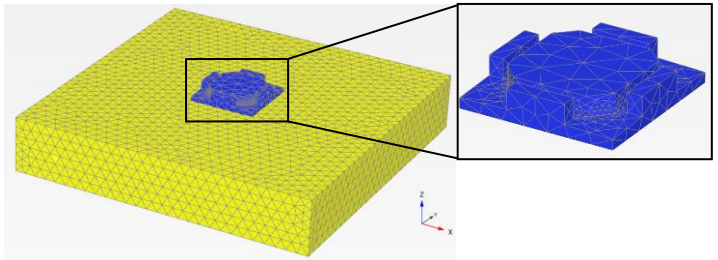
Future design of TLP (advanced simplified solution)

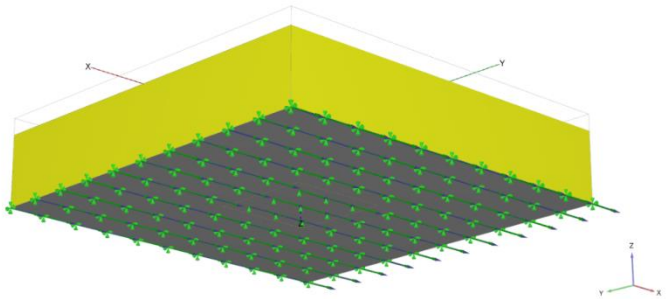
- Simple manufacturing of components by using existing fabrication structures:
  - Pipes made by monopile technology
  - Nodes made by casting technology
- Simple assembling of components by using plug and play connection between nodes and pipes.



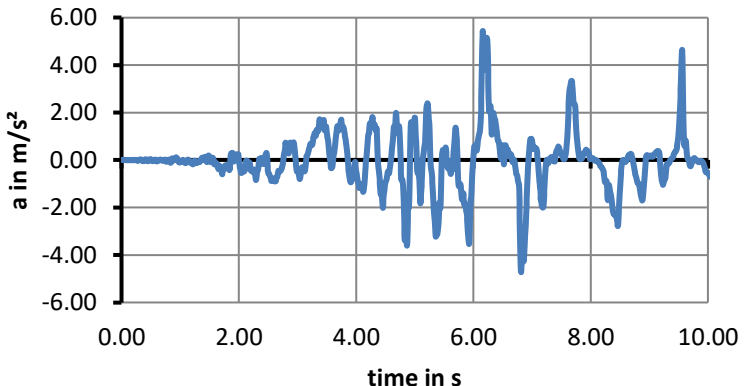
Earthquake Resilient

- No major inhomogeneous liquefaction expected.
- If additional anchor settlement – adjustment of ropes feasible.
- In place stability is given.





	1	2	3	4
F_x	-4300	-4400	-6820	-6870
F_y	-2	-1	-1	-1
F_z	550	570	890	860



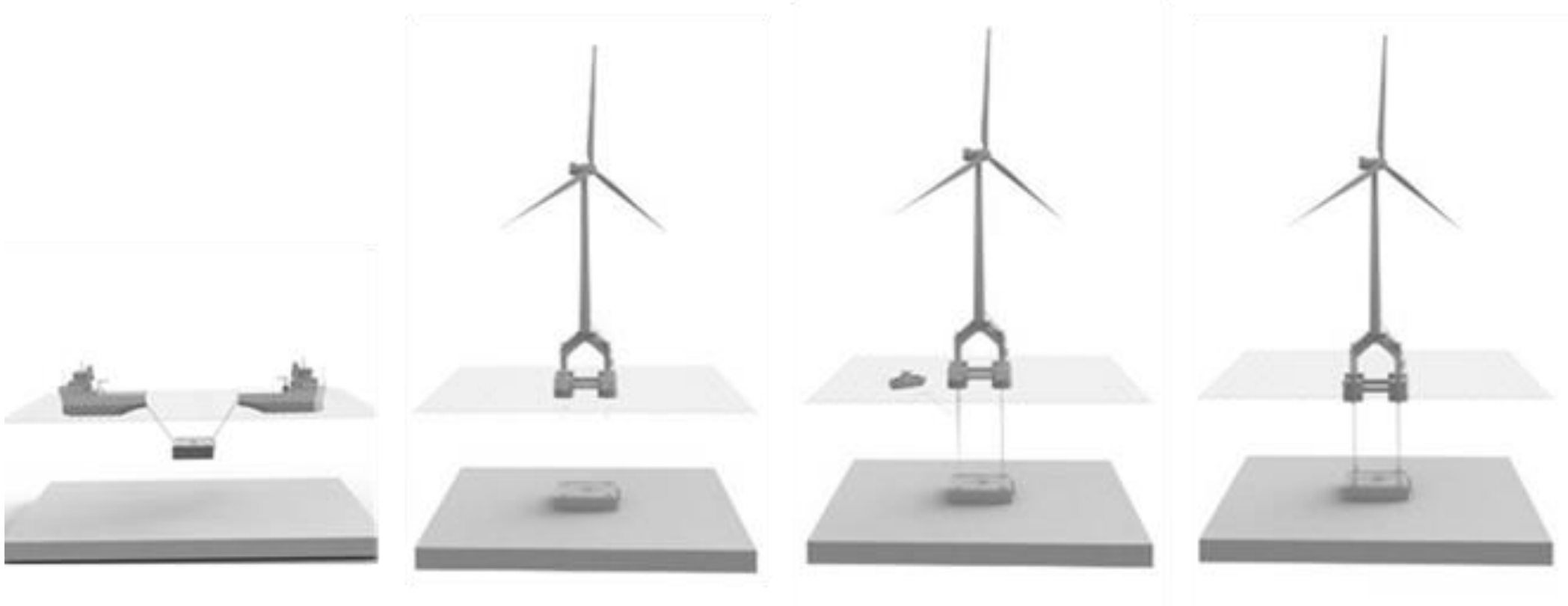
Open

PCIC leveraging on local supply chain

- Fabrication Yards
  - TLP
    - Experience in platform building
    - Drafts >5m
  - GA
    - Experience in pre-cast concrete
    - Space for GA at least post pan max. width
    - Drafts > 10m
- T&I
  - At least 2 Tugboats of 2200 HP with winch and winch capacity of 20 ton.
  - 1 construction vessel with ROV.
  - At least 1 ROV with lifting capacity of 1 ton and different tools.

T&I with towing tugs and ROV

- 2 step installation using towing tugs only.
- Installation by ROV, no diver intervention required.



Conclusion

- PETRONAS Floating TLP has obtained DNV AIP and ready for commercialisation.
- The applications are:
  - Reliable O&G microgrid – integration among O&G existing conventional turbine generators, wind turbine system and large energy storage system.
  - Power to grid.
- Our solution will be leveraging on local supply chain.