Energy Demand and the Marine and Offshore Industry

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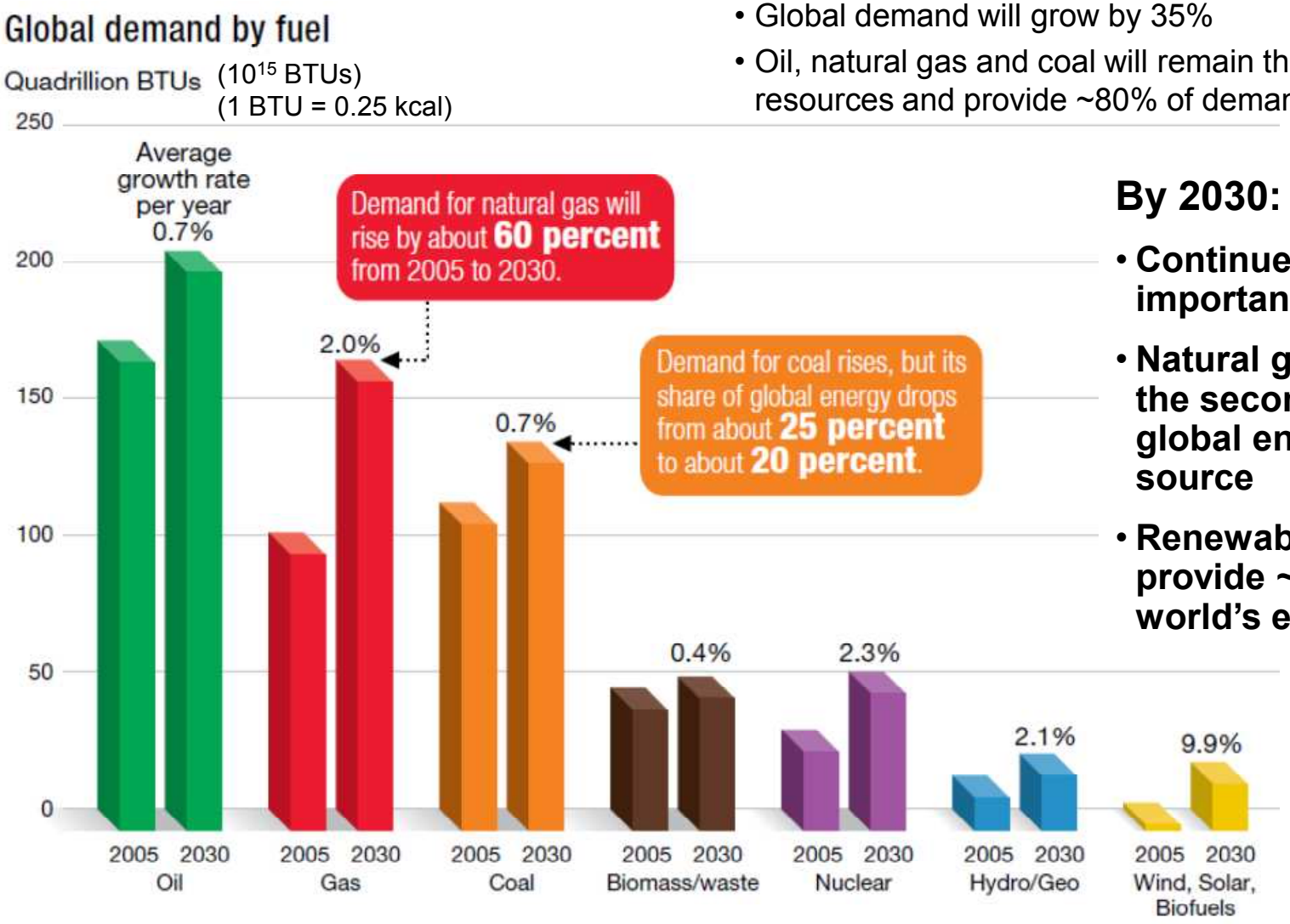
Energy demand – 2005 and 2030



- Global demand will grow by 35%
- Oil, natural gas and coal will remain the main resources and provide ~80% of demand

By 2030:

- **Continued importance of oil**
- **Natural gas will be the second-largest global energy source**
- **Renewables will provide ~3% of world's energy**

Source: ExxonMobil 2010 Outlook for Energy

Impacts on Offshore/Marine Industry

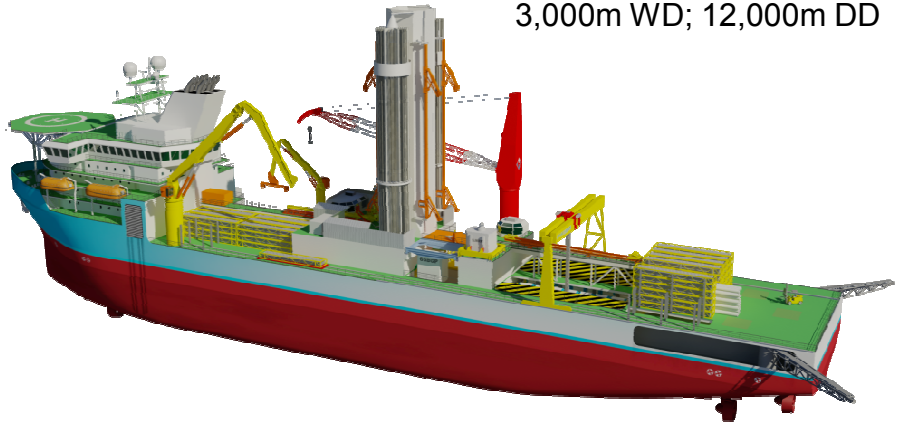
- Continued importance of oil
  - No more “cheap oil” – discoveries in hard-to-get-to places:
    - Offshore deepwater
    - Arctic
- Growth of natural gas
  - Increasing importance of LNG (production & distribution)
  - Increasing unconventional sources (shale gas, coal-bed methane)
- Growth of renewable energy
  - Offshore wind farm

Ultra deepwater drillships

- **Compact drillships**
  - Use of Huisman Multi-Purpose Tower, single or dual activity
  - Location engine room forward
  - Tubulars can be stowed in hold below main deck
  - Containerized tubular handling

HuisDrill 10000
HuisDrill 12000

189m x 32.2m x 18.9m
20,000mt VDL, 180 pax
3,000m WD; 12,000m DD

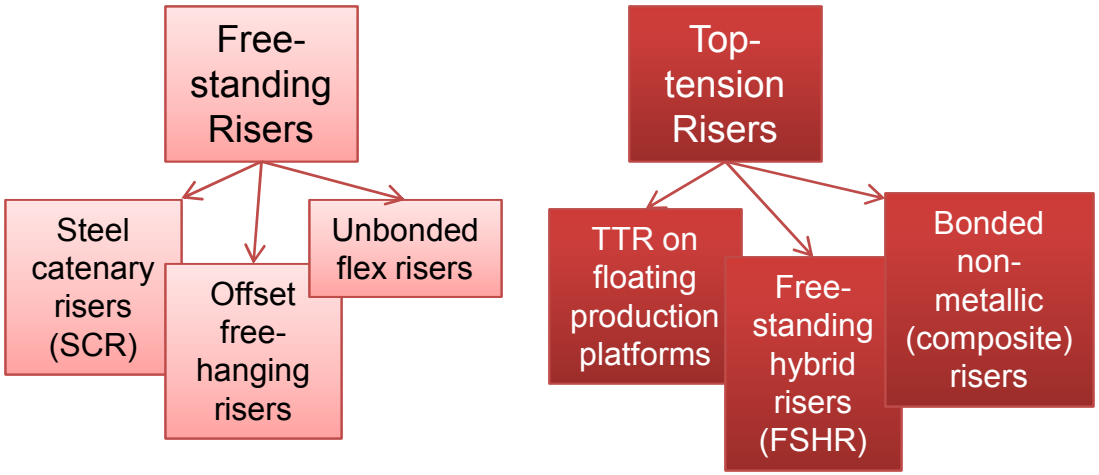


Deepwater spawns variety of MPVs

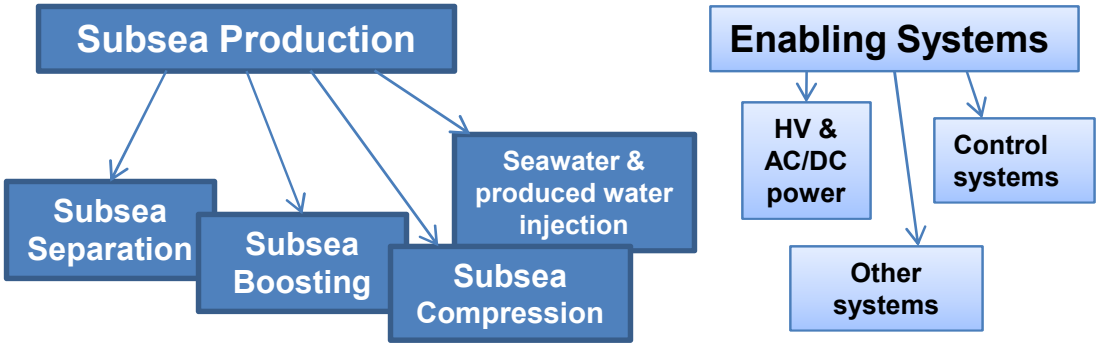
- Roles of offshore support vessels evolved into five major types:
  - Rigid & flexible pipelay, heavy lift, construction
  - Flexible pipelay, subsea construction
  - Saturation diving; subsea construction; inspection maintenance repair (IMR)
  - Well intervention

Deepwater production

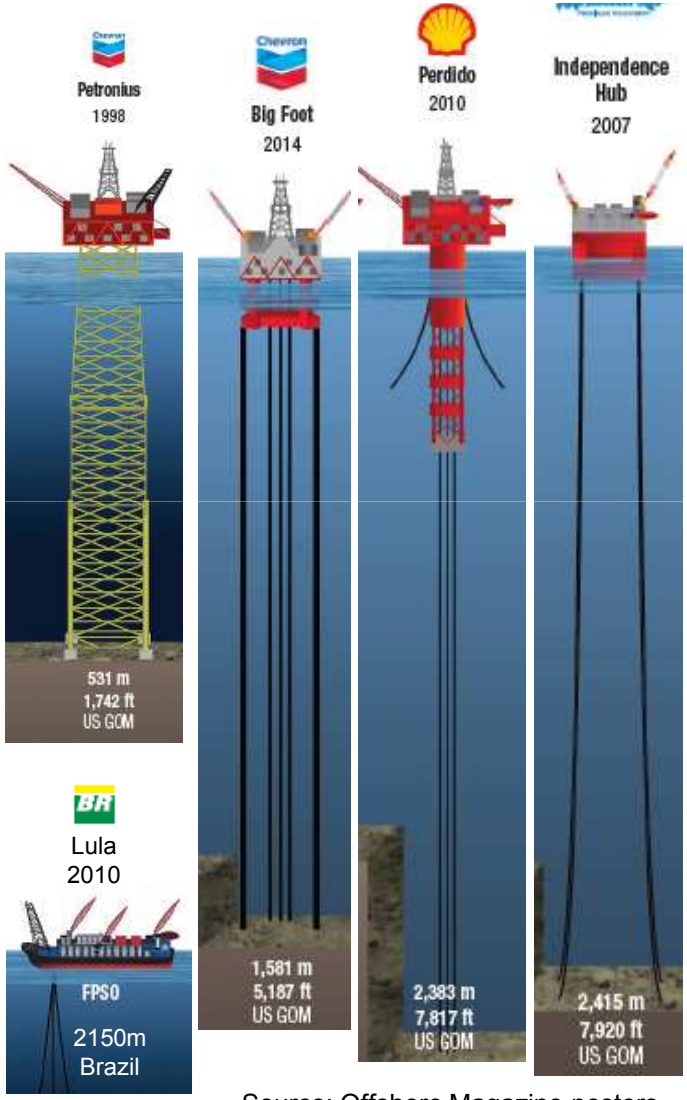
Deepwater Production Riser Systems



Subsea Processing Systems



Deepwater Records



Source: Offshore Magazine posters

The Arctic

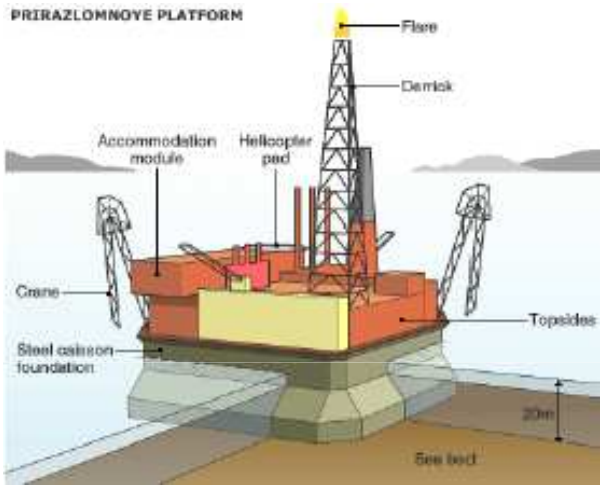
- 5 coastal states
  - Canada,
  - USA (Alaska),
  - Denmark (Greenland)
  - Norway
  - Russia

- USGS estimates of oil and gas resources
  - **Oil**: 44~157 Bbbl (Saudi Arabia proved reserve: 264 Bbbl)
  - **Gas**: 770~ 2,990 TCF (Qatar proved reserve: 899 TCF)
  - >80% offshore
- Today, over 400 field discovered with 240 BBOE (Douglas Westwood)

Some Arctic Units in the 1980s

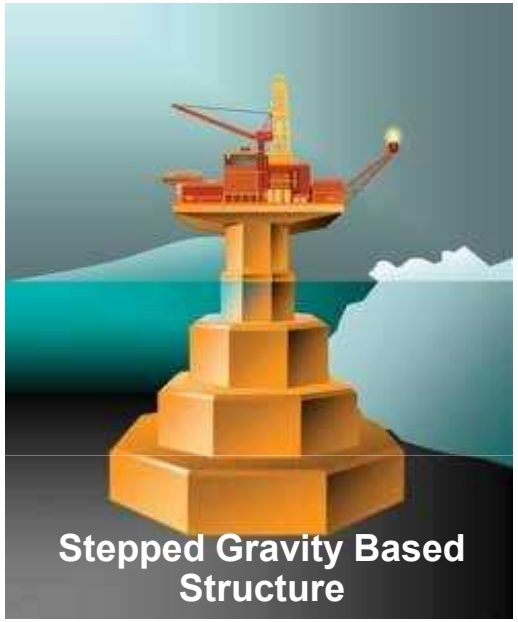
Arctic offshore concepts

Shallow water Gravity Based Structure



Source: MMS report, Jan 08

Deepwater concepts



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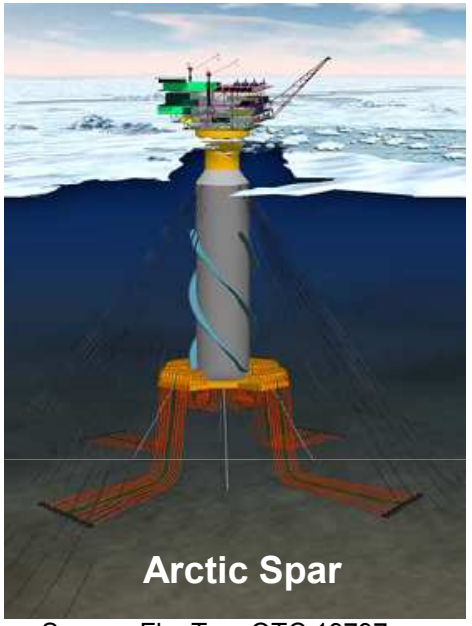
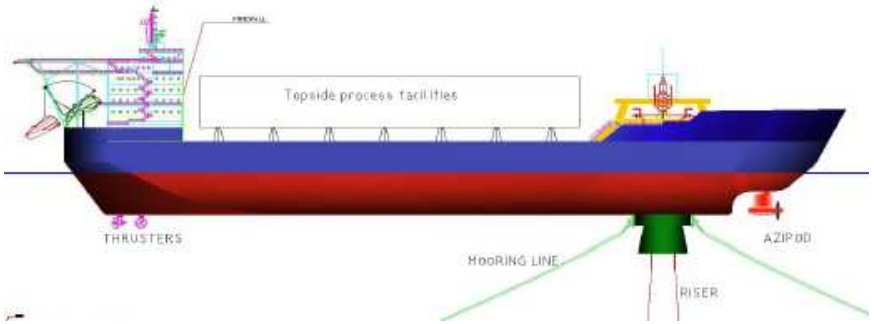


Source: FloaTec, OTC 19797

Aker Yard FPSO concept



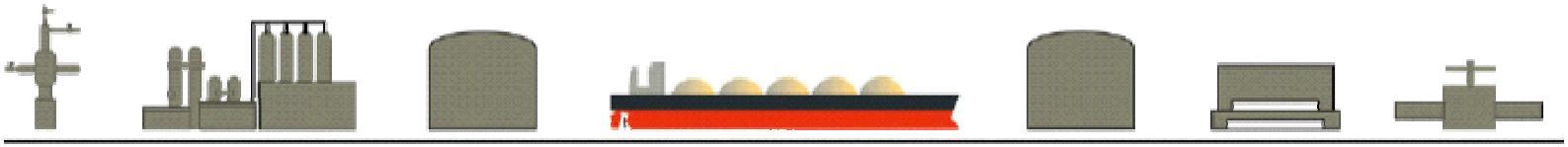
Moss/Krylov FPSO concept

Arctic Double Acting Tanker

Evolution/Revolution in LNG Value Chain

UPSTREAM

DOWNSTREAM



Offshore LNG production

- LNG FPSO

Evolution of LNG ships

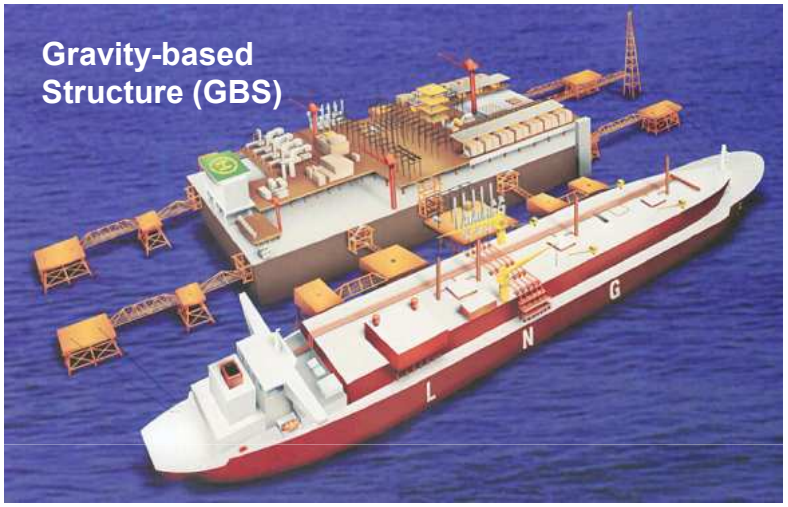
- Size: >220,000m3
- Propulsion systems
- Containment systems

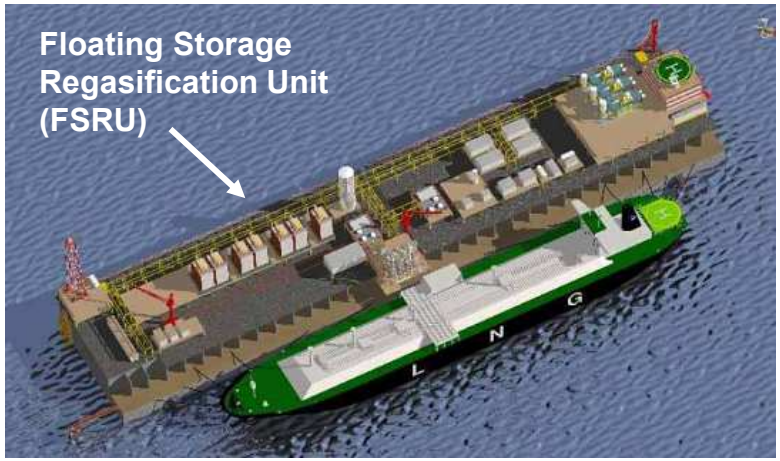
Offshore LNG storage and gas send-out

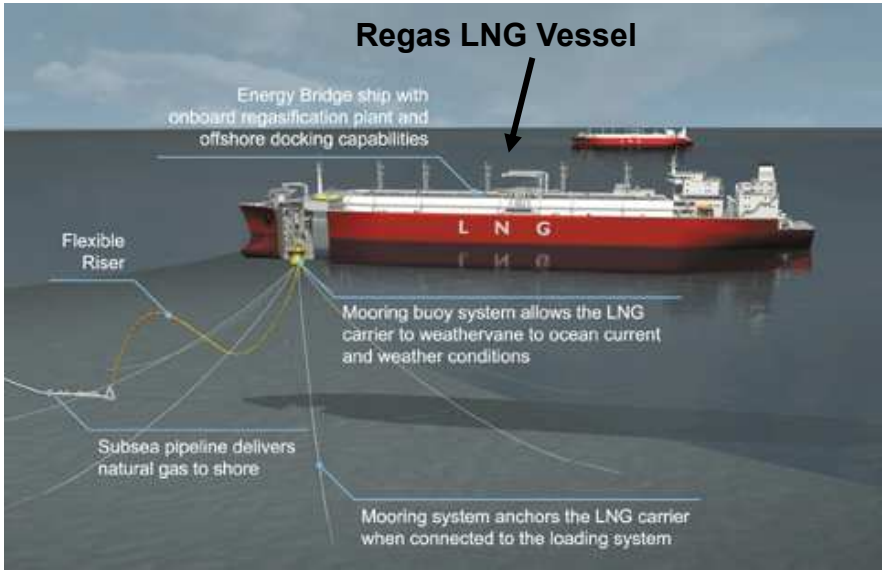
- RV (Regas vessel)
- Storage RV + STS
- FSRU
- Gravity based structure (GBS)

Floating LNG – offshore import terminal

Gravity structure or floater; new build or converted from LNG carrier



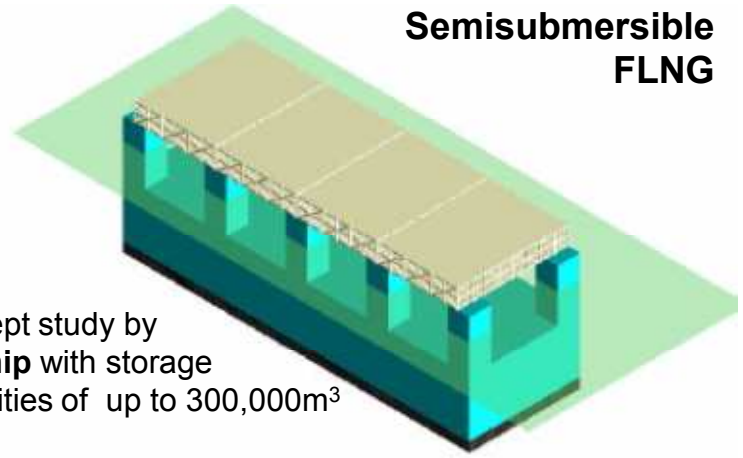




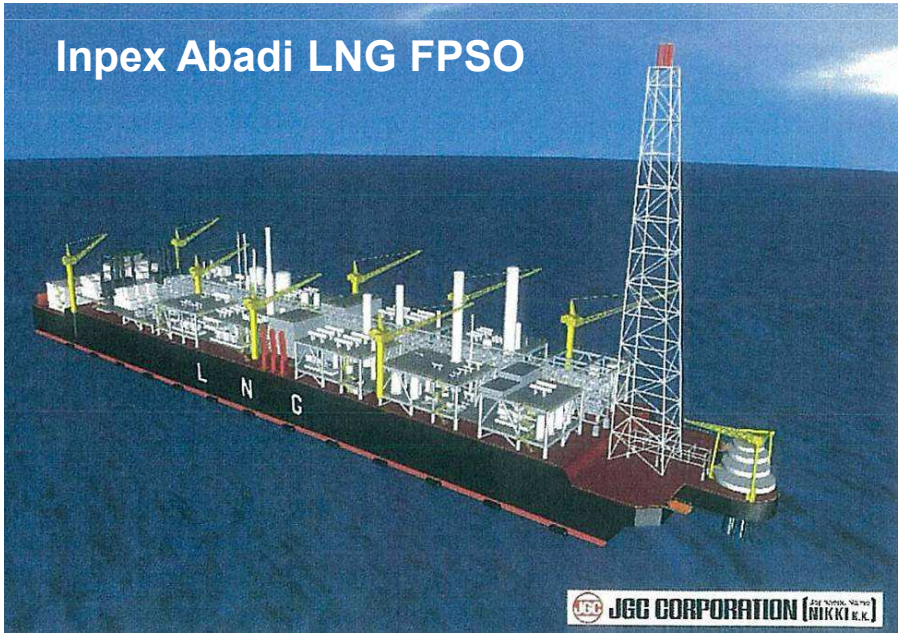
Floating LNG – LNG FPSO

SBM / Linde
2.5 mtpa

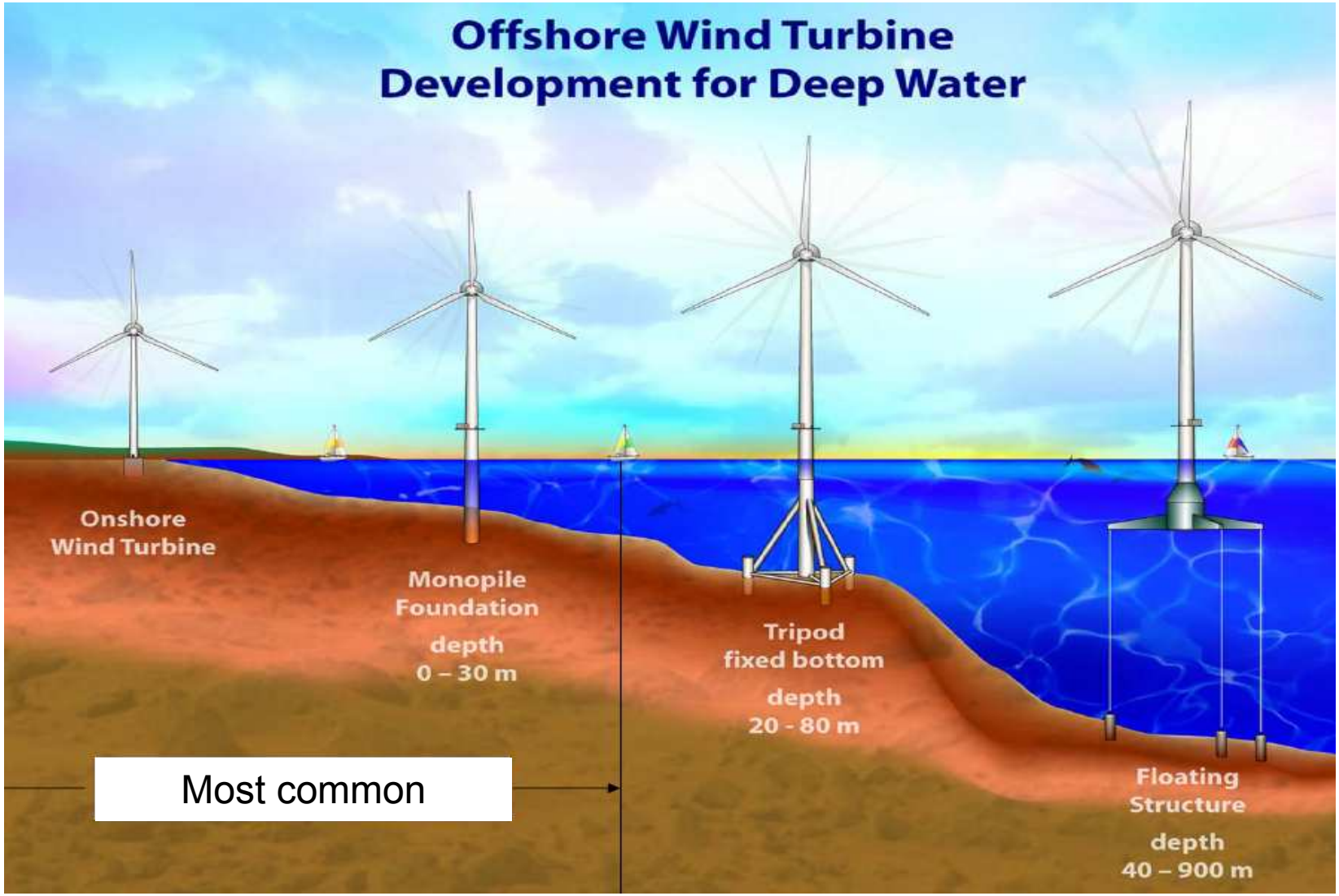
Semisubmersible FLNG



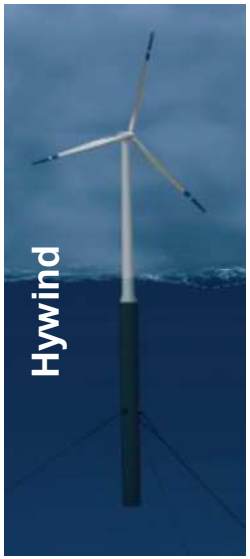
Concept study by **Technip** with storage capacities of up to 300,000m^3

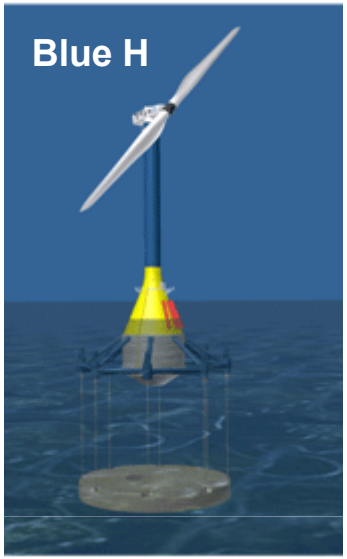


Offshore Wind

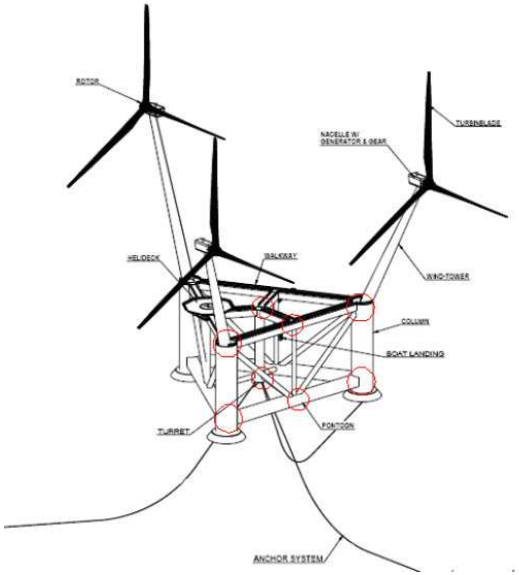


Floating Wind Turbine





Hywind installed in water depth 200m; blade dia 82m; tower dia 8.2m - 6m: draft 100m: concrete ballast 600t



WindSea

Concept study at present for 3x 3.6MW

3-tower design, one higher than other two to avoid wind shadow

Mooring by central turret, through which power can be transmitted

Windmill installation vessels

MPI Offshore - *Resolution*
130m x 38m x 8m; Speed 11 kts
300t crane; 25-30m water depth

Seajacks Kraken

76m x 36m x 6m; Speed 8 kts; DP2
300t crane; 41-48m water depth

A2 SEA – *Sea Power*
91.76m x 21.6m x 4.25m;
Speed 8.5 kts
400t crane
24m water depth

Summary

- Energy demand, particularly offshore oil and gas, and wind present tremendous opportunities for the offshore and marine industry
- An area of not just of design & engineering evolution, but conceptual and technological innovations
- For SMI – a fertile ground for the picking

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