Ocean Transformation:

Renewable Energy and Floating Offshore Wind

HD Hyundai Heavy Industries
Hyundai Maritime Research Institute

25th September 2024

Contents

#1 Reason for Renewable Energy

Why Renewable Energy?

Powering a safer future

United Nations | Climate Action

Global climate change;

Fossil fuels(coal, oil and gas)

75% of global greenhouse gas emissions

90% of all carbon dioxide emissions

IPCC (Intergovernmental Panel on Climate Change)

2023 March, 6th Assessment Report

Global surface temperature **+1.09 [0.95~1.20]°C**

in 2011–2020 than 1850–1900

The unprecedented scale of the challenge required

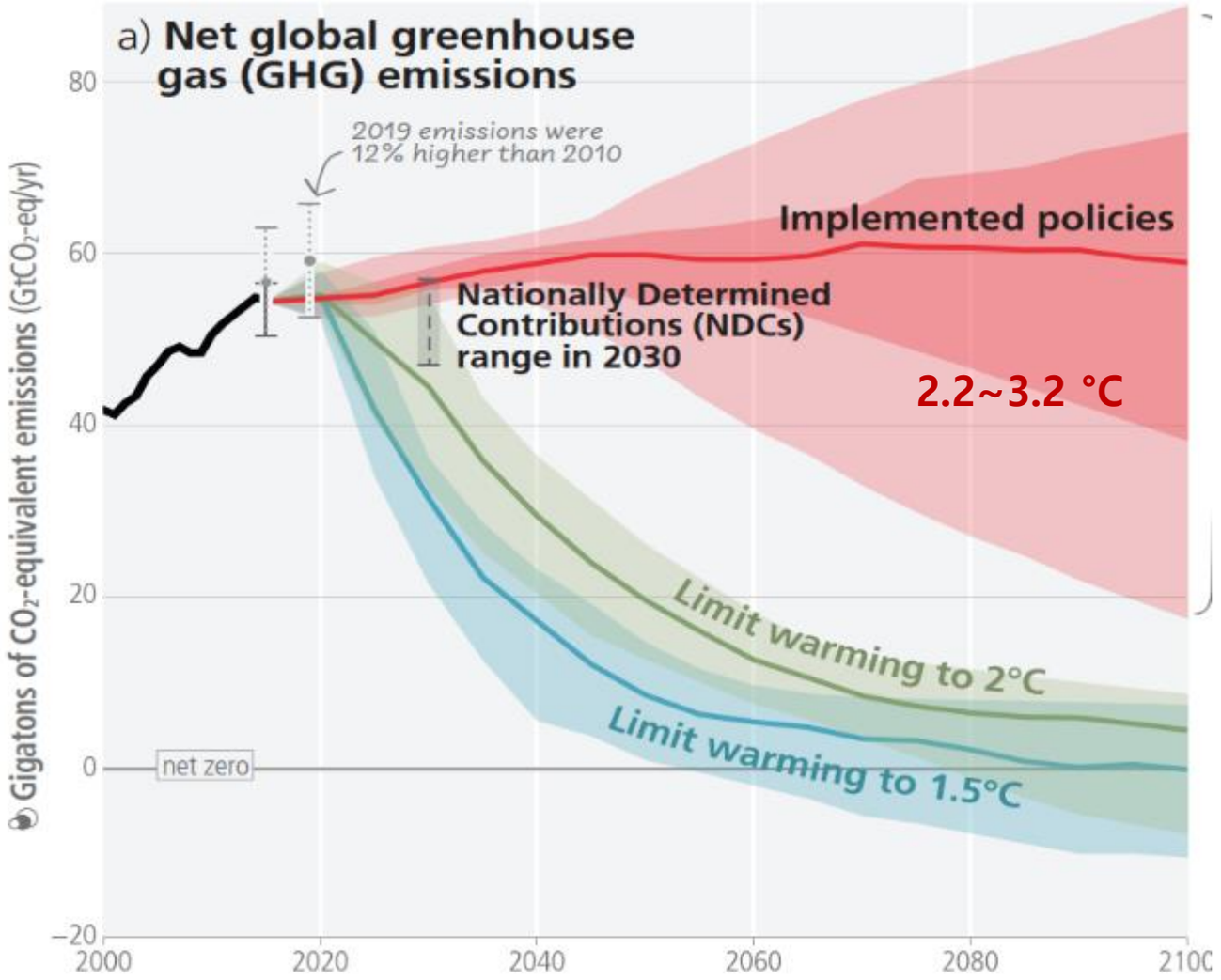
to keep warming to **1.5°C.**

IPCC (Intergovernmental Panel on Climate Change)

The science is clear

Global Greenhouse Gas (GHG)

- **half by 2030**
- **net-zero by 2050**



COP (Conference Of the Parties)

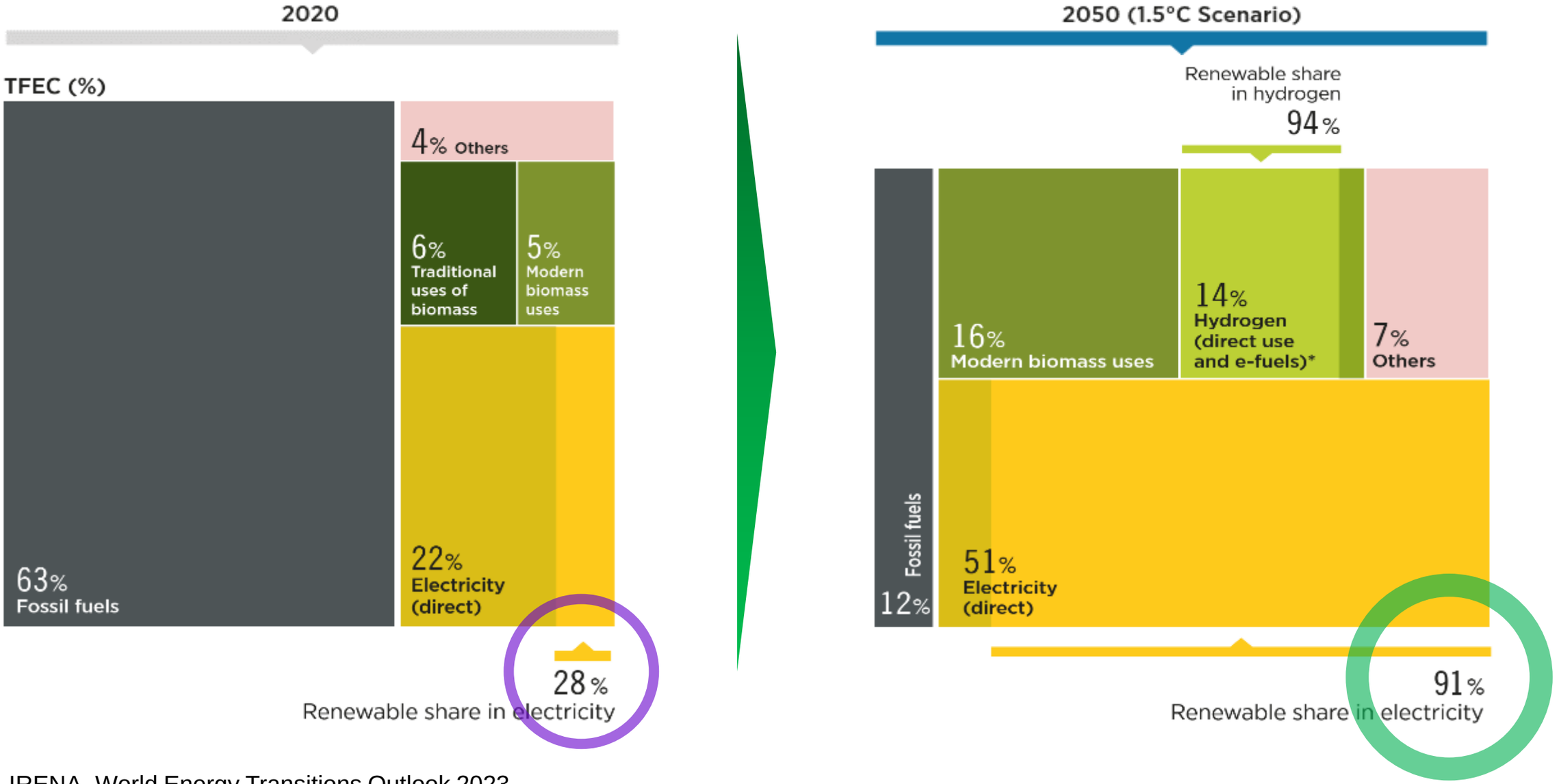
2023 December, 28th

Transition away from the **Fossil Fuel fuels**

- **Triple renewables capacity**
- double energy efficiency by 2030

#2 Outlook for Offshore Wind Energy

Global, Energy consumption



IRENA, World Energy Transitions Outlook 2023

Global, Capacity Expansion

Wind
(Offshore)

‘30

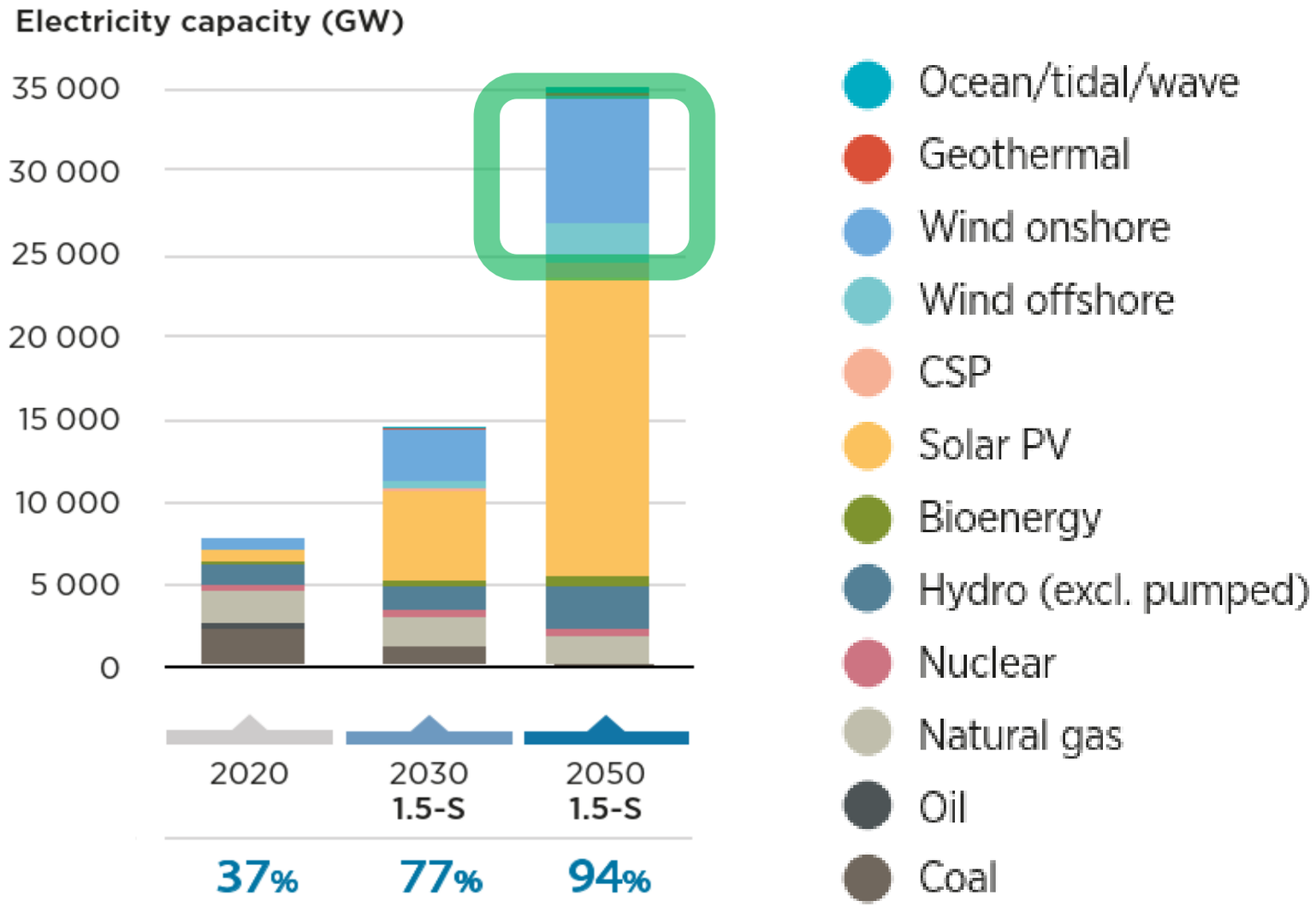
3,500 GW

(500 GW)

‘50

10,300 GW

(2,500 GW)



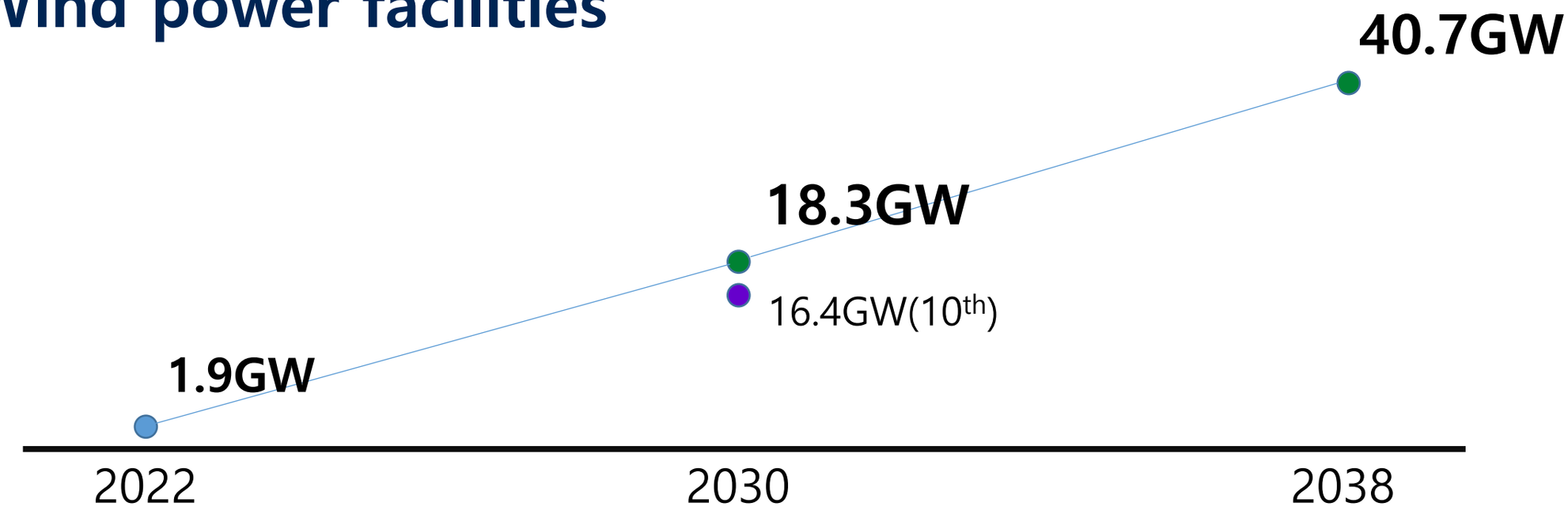
IRENA, World Energy Transitions Outlook 2023

Korea, 11th Basic plan for supply and demand of power('24.5, working draft)

Year	Nuclear	Coal	LNG	**Renewable**	Hydrogen Ammonia	Others	Total [TWh] [%]
2030	204.2 (31.8%)	111.9 (17.4%)	160.8 (25.1%)	**138.4 (21.6%)**	15.5 (2.4%)	10.6 (1.7%)	641.4 (100%)
2038	249.7 (35.6%)	72.0 (10.3%)	78.1 (11.1%)	**230.8 (32.9%)**	38.5 (5.5%)	32.5 (4.6%)	701.7 (100%)

Korea, 11th Basic plan for supply and demand of power('24.5, working draft)

Wind power facilities



▣ Offshore Wind Power Generation Business Permission
: 27.8GW / 86 Projects in 2024

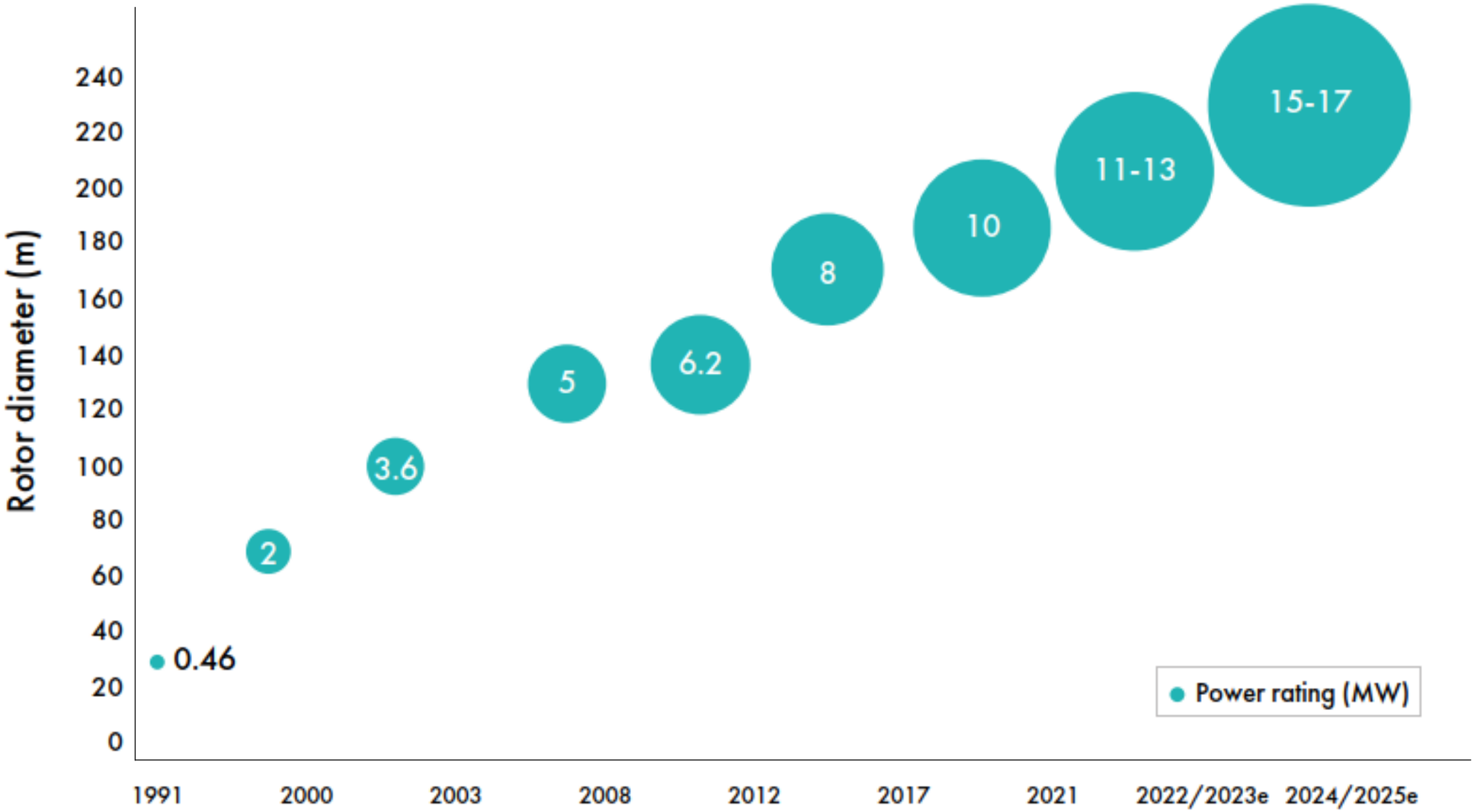
#3 Value Chains and Technology for Floating Offshore Wind Platform

Value Chain by Tasks

Development Phase	Construction Phase	Operation Phase	Deconstruction Phase
Managed by wind farm developer • Feasibility studies, Licensing, planning, Radar • Environmental surveys • Coastal process • Met station surveys • Seabed surveys • Human impact studies	**Wind turbine** • Nacelle • Rotor • Tower **Balance of plant** • Foundation • Substation • Cables **Installation and commissioning**	**Operation Maintenance** • O&M Port • Technical and equipment transfer • Offshore accommodation • Large component refurbishment, replacement and repair	**Deconstruction** **Removal** **Recycling**

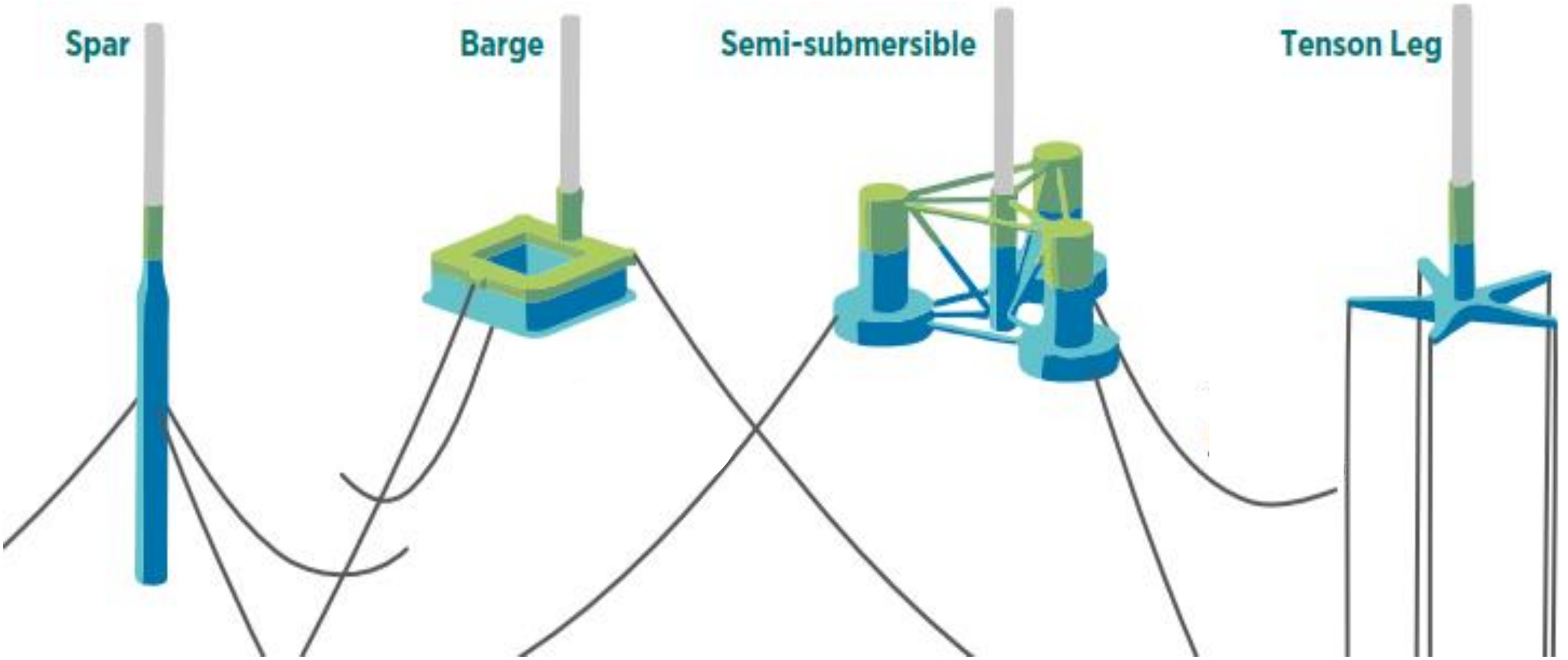
Baltspace project, Spatial economic benefit analysis, 2017

Turbine



GWEC, Global Offshore WIND Report 2022

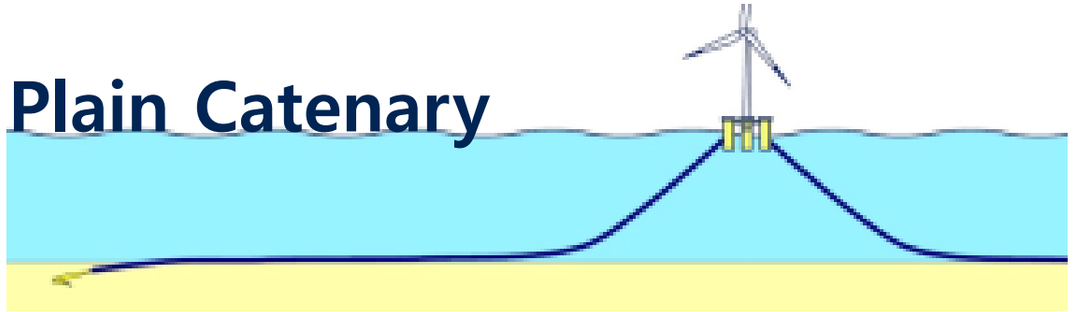
Floater



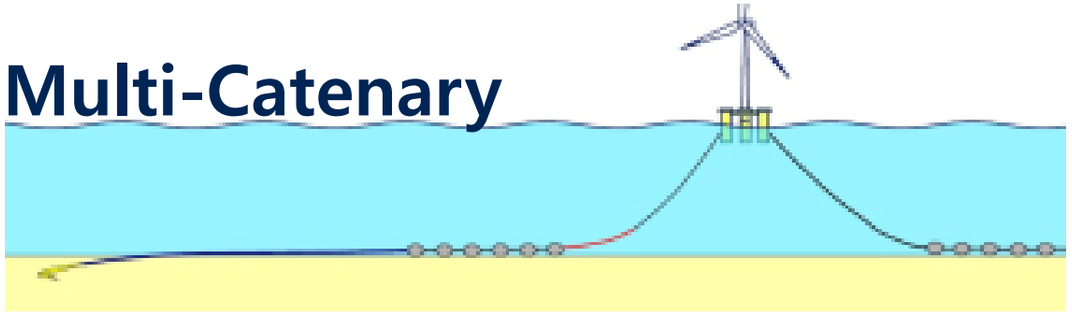
IRENA, Floating Offshore Wind Outlook 2024

Mooring

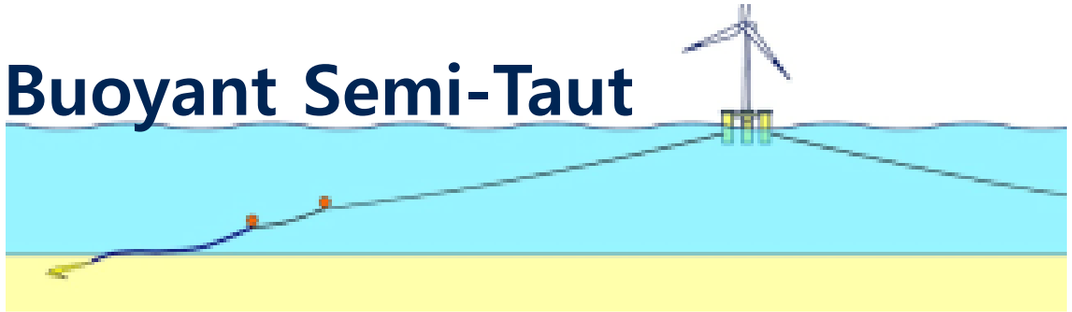
Plain Catenary



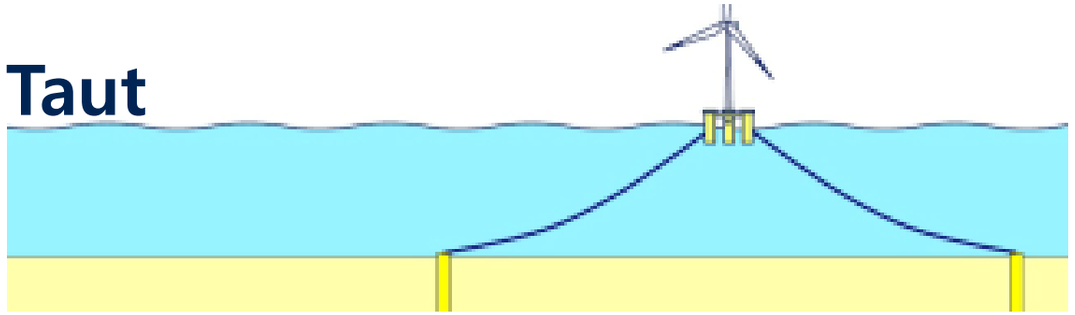
Multi-Catenary

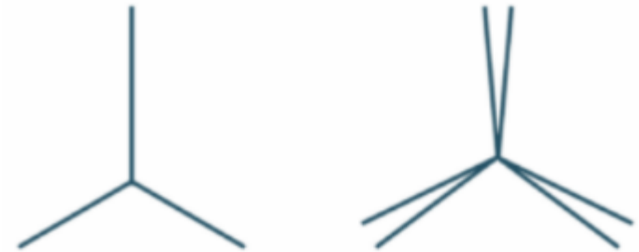


Buoyant Semi-Taut

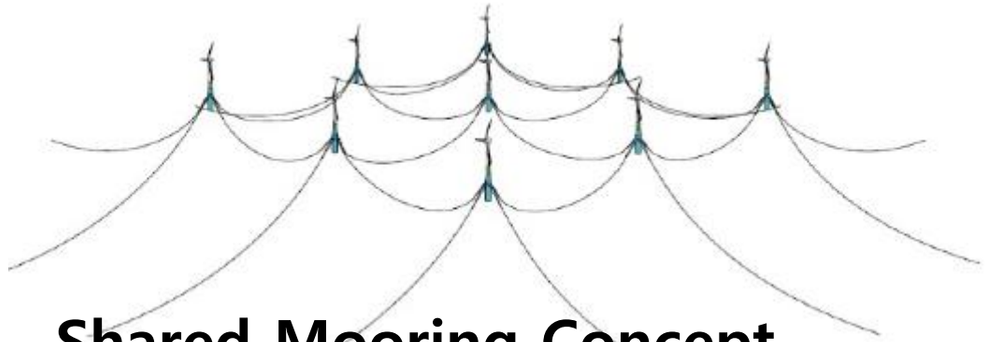


Taut





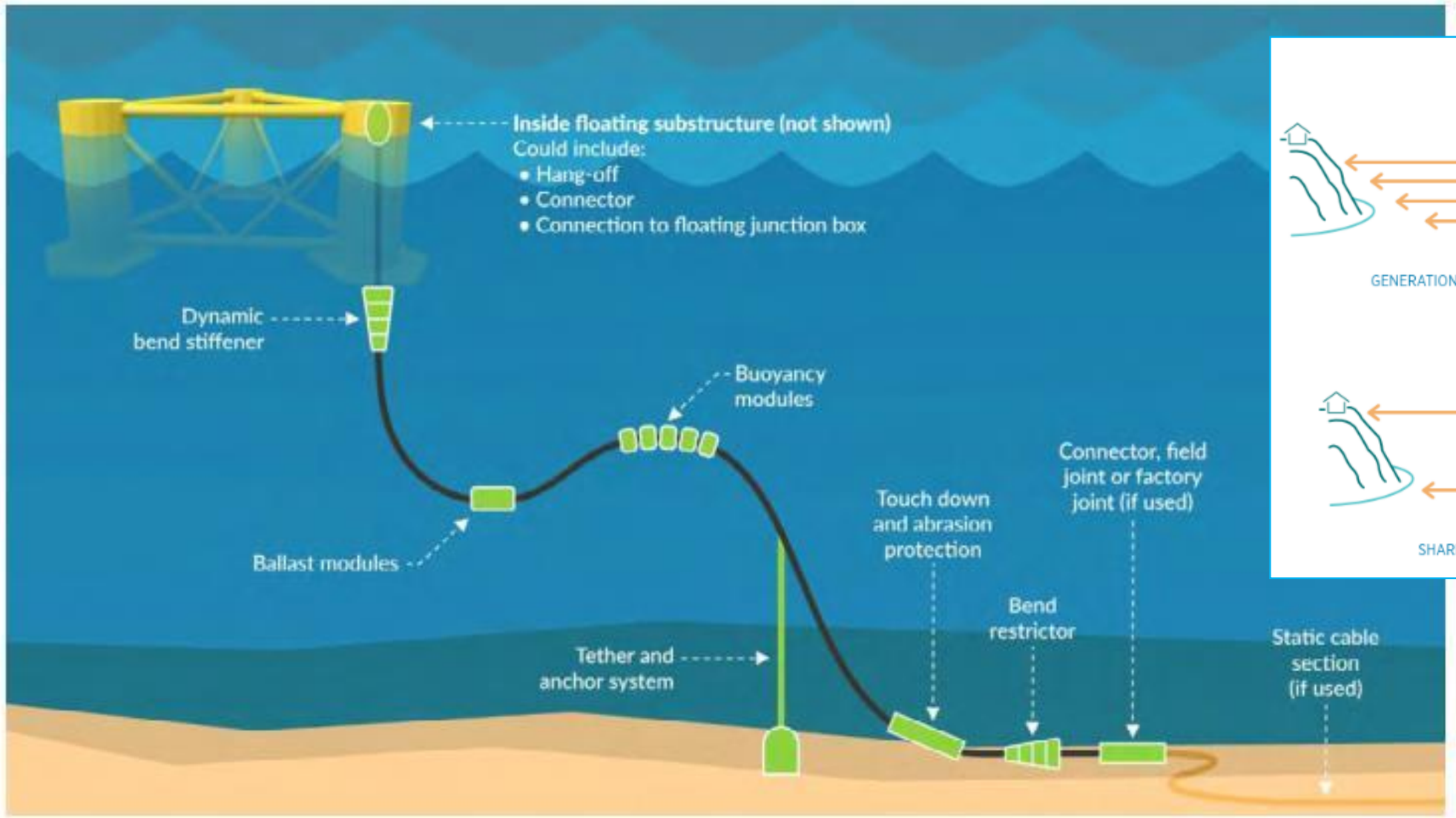
3×1-Line and 3×2-line

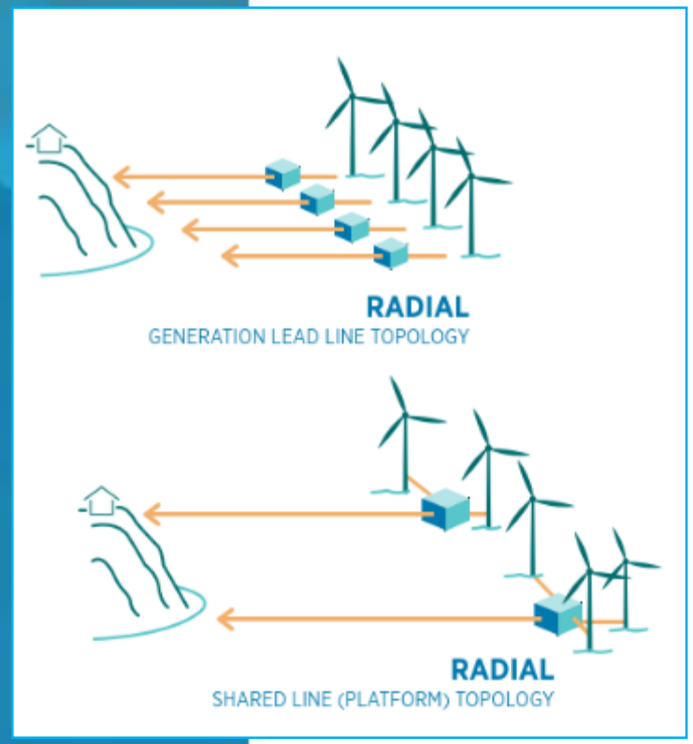


Shared Mooring Concept

WFO (2022), Mooring systems for floating offshore wind: integrity management concepts, risks and mitigation,

Cable





IRENA, Floating Offshore Wind Outlook 2024

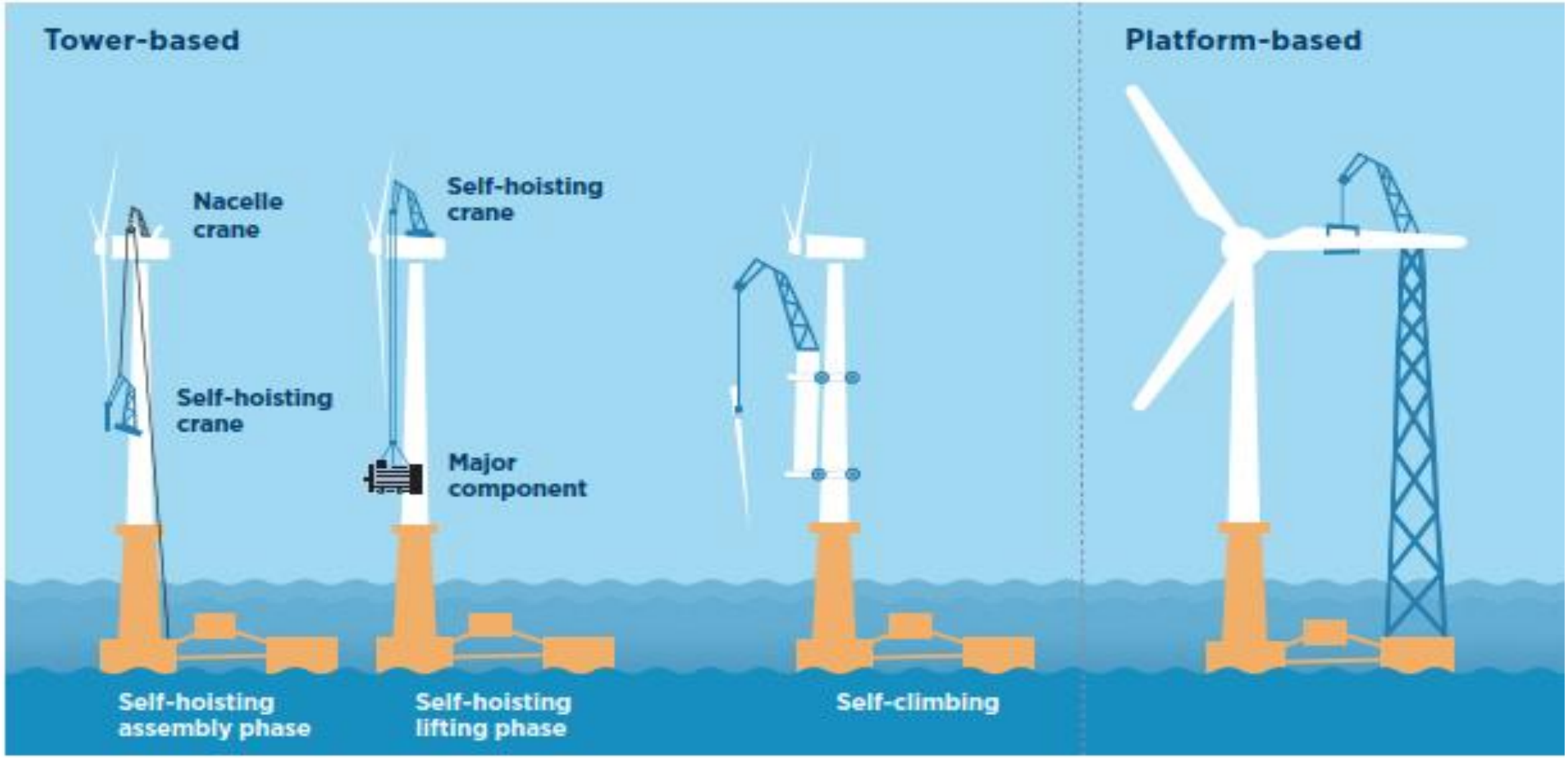
Port

Parameters

- Shipyard and fabrication facilities
- Storage space
- Water depth
- Cranage
- Weight-carrying capacity
- Interface between fabrication facility and water load-out
- Distance to project site
- Port availability

IRENA, Floating Offshore Wind Outlook 2024

O&M



IRENA, Floating Offshore Wind Outlook 2024

#4 Ocean Transformation for Sustainable Future Growth

Ocean Transformation

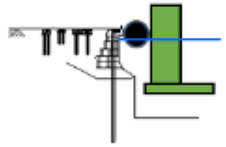
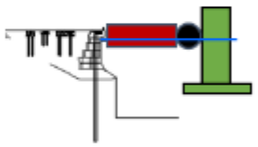
HD Hyundai Group

For sustainable future growth,
it is necessary to realize the infinite potential of the ocean,
a valuable resource of mankind

- **Ocean Mobility**
- **Ocean Wise**
- **Ocean Life**
- **Ocean Energy**

Hi-Float

Hi-Float

	Hi-Float	Other
Safe quayside arrangement		
Easy berthing to quayside		
Stable turbine integration		

HHI's FOWT Projects

8MW
JEJU Pilot Project
'21 ~

15MW
GW3 FEED Project
'22~'24

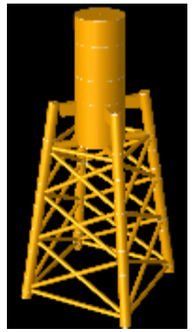
15MW
HAEWOORI3 Pre-FEED Project
'23

+

FireFly Floating OSS FEED Project
'24

HHI's Development Experience

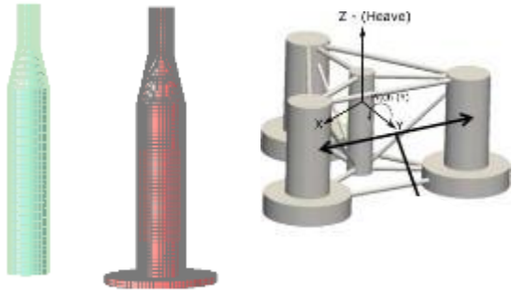
2010 → Phase 1 Technology



Fixed OWP Study
Floating OWP Study

- Model Study
- Wave Basin Model Test
- Performance Estimation

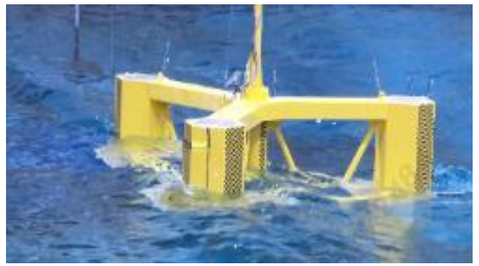
2018 → Phase II Product



5MW Spar Develop.
8MW Semi Develop.

- Floater Design
- Performance Estimation
- Wave Basin Model Test
- DNV Review

2020 → Phase III HHI's Model



10MW Semi HHI's Model:
Hi-Float

- AIP from ABS, BV, LR & KR in 2021
- Wave Basin Model Test

Extension to
8MW, 15MW, 18MW

2021 **Hi-Float**

2010 **Development for OWT Technology & Product**

Since 1976 **HHI's Offshore Projects**





Type	Floaters	Platforms	Drilling Facilities	Onshore Facilities	Subsea Pipelines
Project Units	22	93	5	18	35
Weight(M/Ton)	1,131,837	1,426,729	118,586	528,230	5,821km

#5 Closing

Hope

IPCC (Intergovernmental Panel on Climate Change)

We can turn things around if we act fast and collectively

Enablers for effective climate action

Definition and Strategic Direction of our Slogan

"**Beyond Blue**" stands for the innovation in our core businesses and
"**Forward to Green**" represents our determination
to move forward as an eco-friendly company with advanced technologies

BLUE

Represents the identity of our core business as well as the marine ecosystem we ought to preserve

GREEN

Represents the direction of our future business as well as the clean future we will create

BEYOND BLUE

Pursues technological innovation in shipbuilding, energy, and machinery sectors along with future paradigm change

FORWARD TO GREEN

Pursues transition to eco-friendly business with advanced technologies and our strategy to lead sustainability