Merituulivoiman ja P2X mahdollisuudet vihreän siirtymän välineenä

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Green NorthH_2 Energy

CLIMATE CHANGE IS A THREAT TO THE GLOBAL ECOSYSTEM

Reducing greenhouse gas (GHG) emissions is now the highest priority in majority of the world's countries

The European Union's target is to have cut 55% of GHG emissions by 2035 and be climate neutral by 2050

Objectives are set to stimulate the creation of green jobs and achieve a reduction in GHG emissions while simultaneously growing the economy

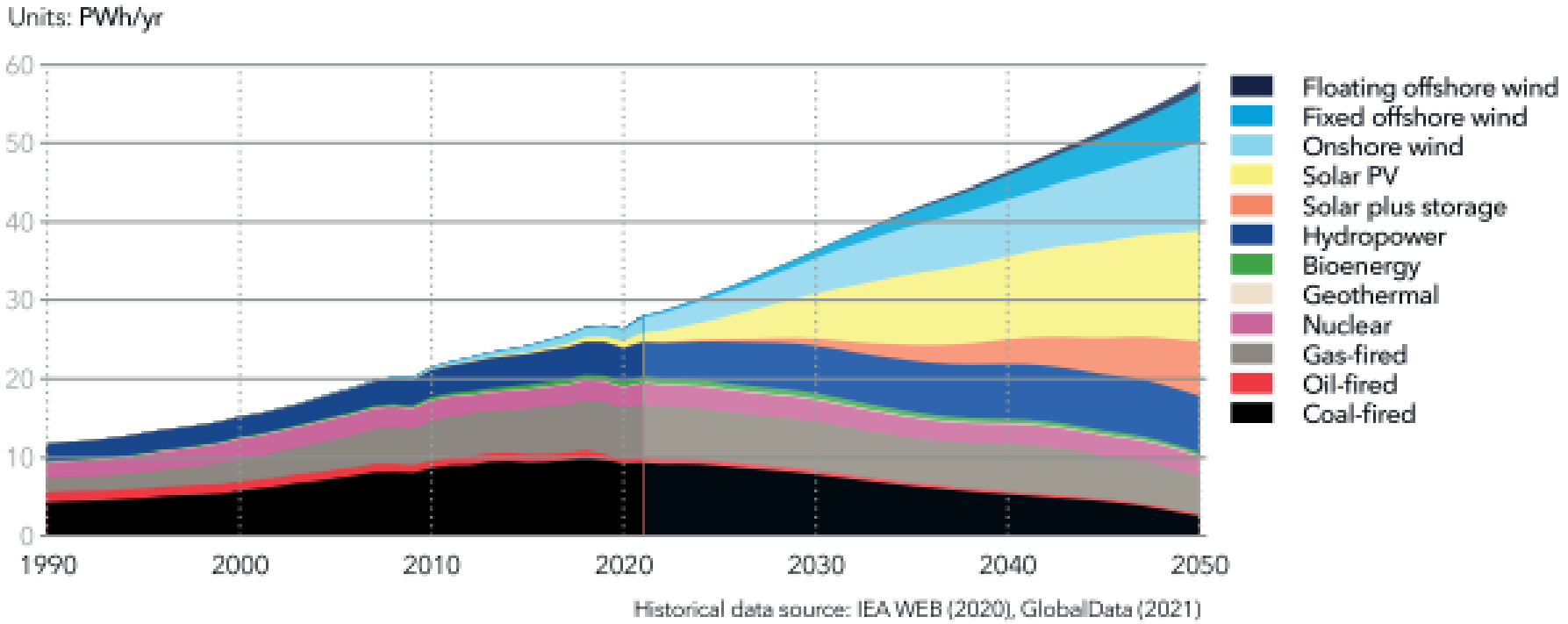
Worlds electrical production forecast

Renewables are growing rapidly on solar and wind

Offshore wind is in start of rapid growth

FIGURE 2.3

World grid-connected electricity generation by power station type

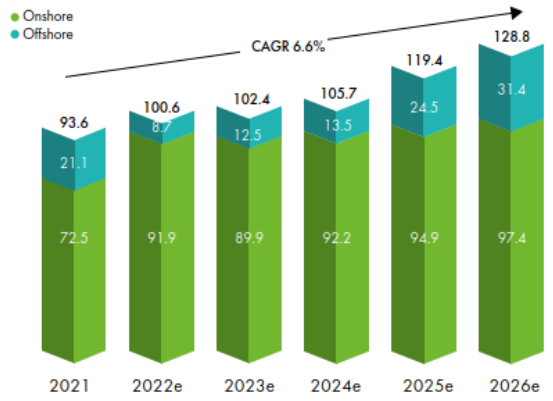


Historical data source: IEA WEB (2020), GlobalData (2021)

Windpower

- Annual growth expected to continue
- Offshore wind annual growth is increasing

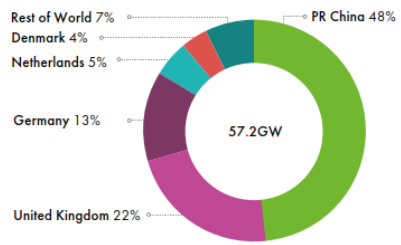
New wind power installations outlook 2022-2026 (GW)



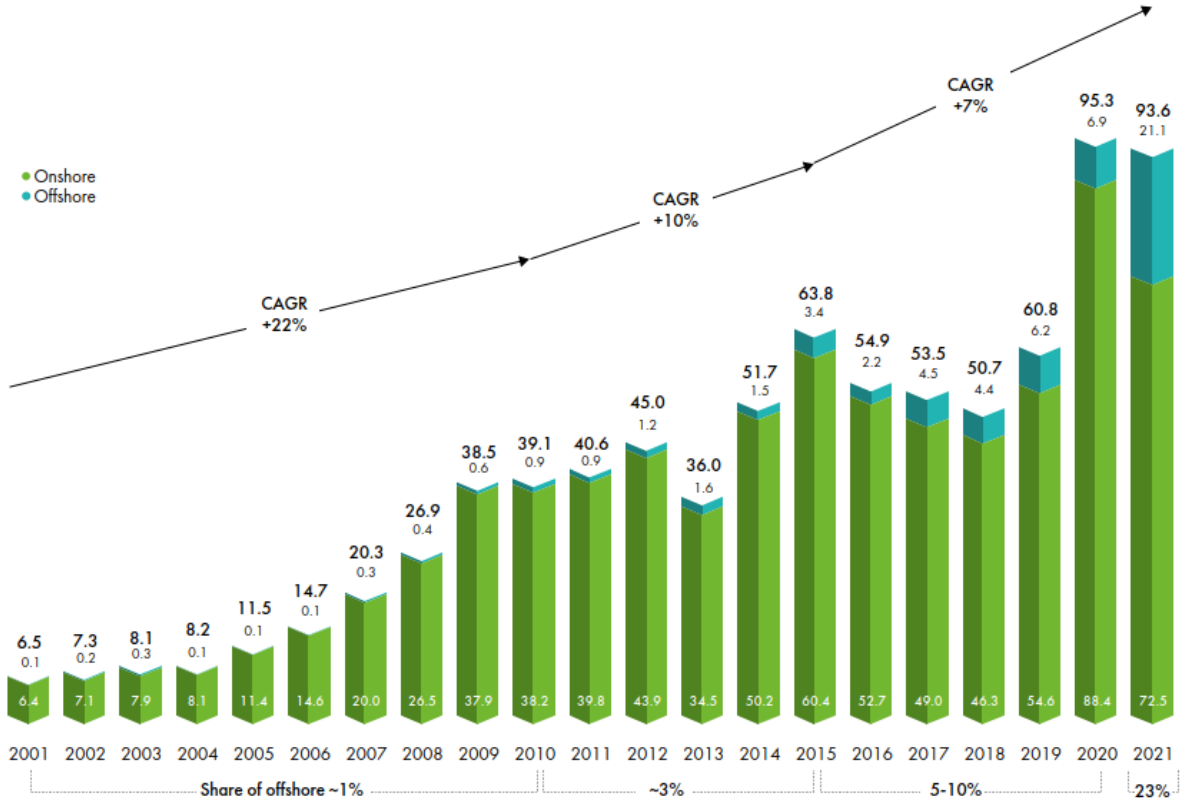
GWEC's Market Outlook represents the industry perspective for expected installations of new capacity for the next five years. The outlook is based on input from regional wind associations, government targets, available project information and input from industry experts and GWEC members. An update will be released in Q3 2022. A detailed data sheet is available in the member only area of the GWEC Intelligence website.

Market status 2021

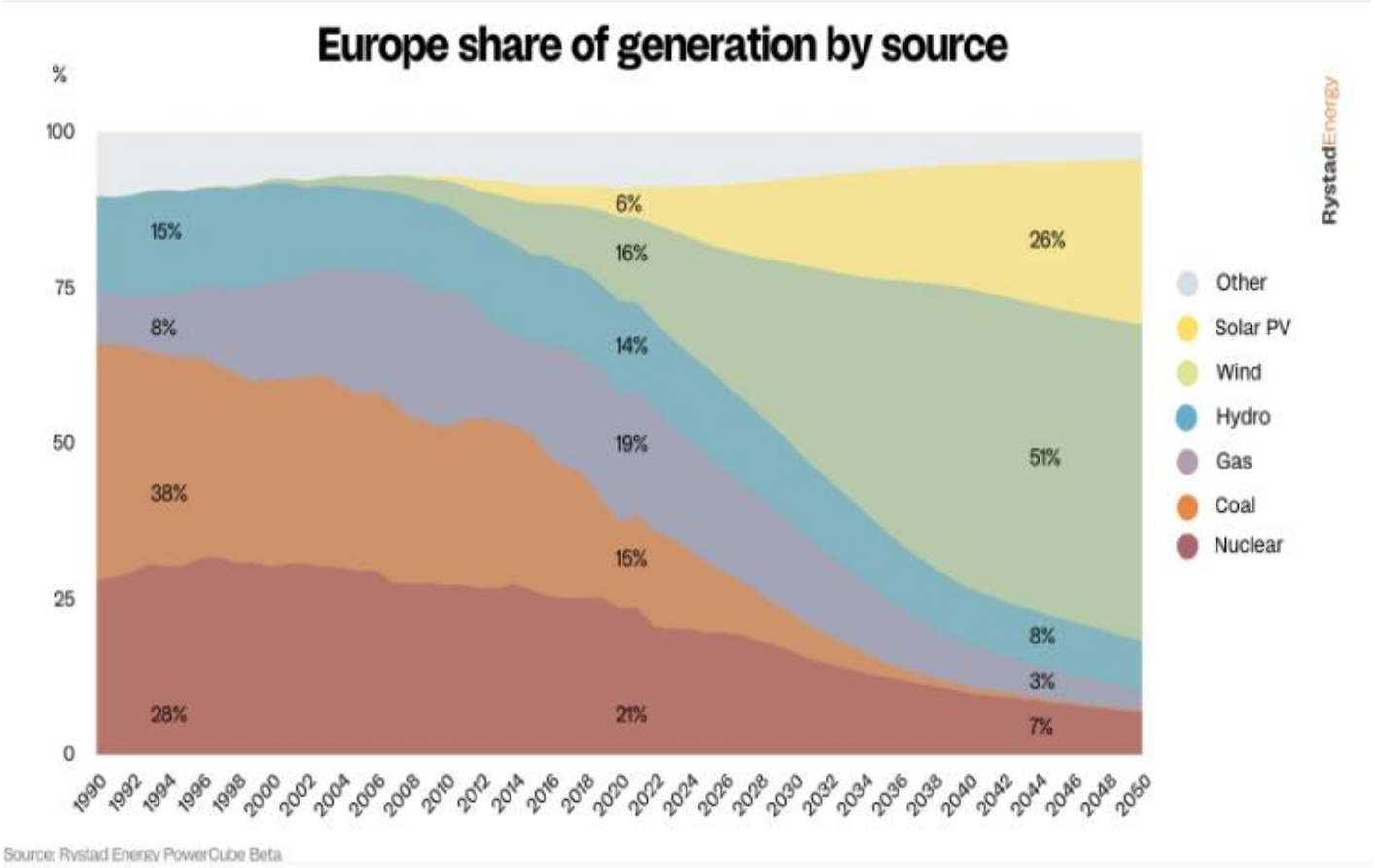
Total installations offshore (%)



Historic development of new installations (GW)



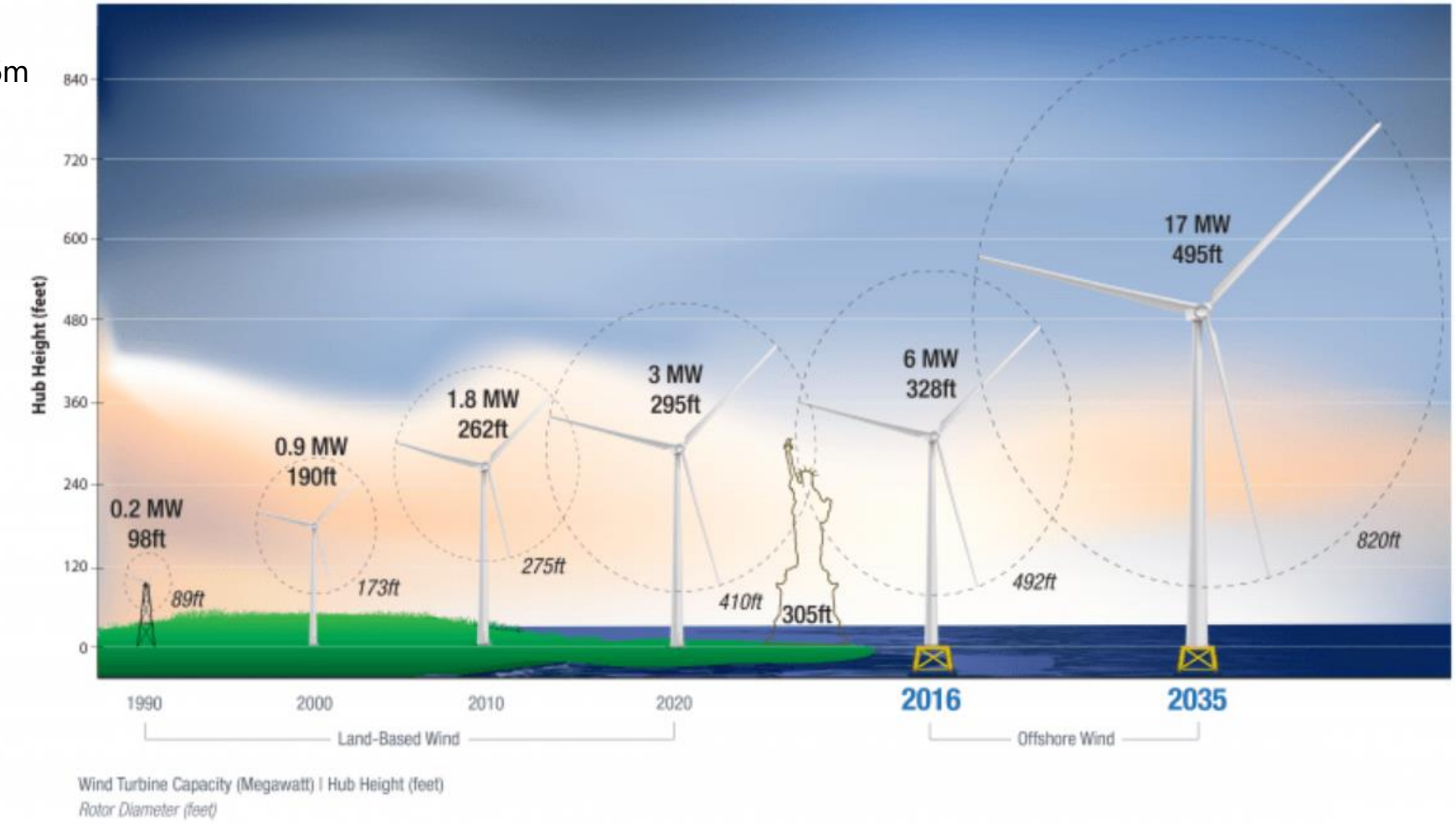
Europe transition / Rystad Energy



Offshore wind, unit sizes increases beyond onshore wind - scale of windfarms increasing

256m

146m



Power-to-X

From Wikipedia, the free encyclopedia

Transformation in joining up sectors

Power-to-X (also P2X and P2Y) is a number of electricity conversion, energy storage, and reconversion pathways that use surplus electric power, typically during periods where fluctuating renewable energy generation exceeds load.

Power-to-X conversion technologies allow for the decoupling of power from the electricity sector for use in other sectors (such as transport or chemicals), possibly using power that has been provided by additional investments in generation.

The X in the terminology can refer to one of the following:

- power-to-ammonia
- power-to-chemicals
- power-to-fuel
- power-to-gas
- power-to-hydrogen
- power-to-liquid
- power-to-methane
- power to food
- power-to-power
- power-to-syngas

WHEN USED AS A MARITIME E-FUEL, GREEN AMMONIA WILL ENABLE DECARBONIZATION

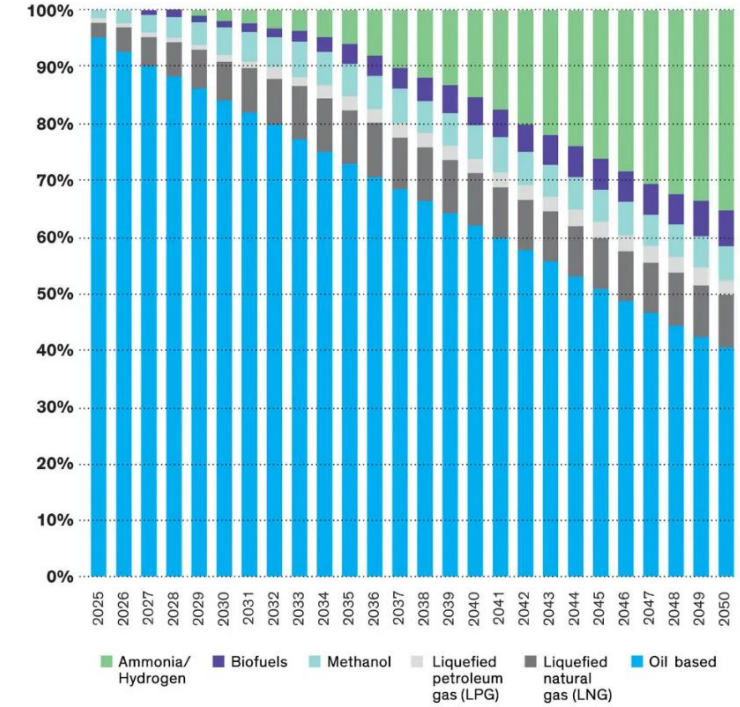
Ammonia is expected to take a major role especially in deep-sea shipping

Hydrogen will be a viable solution for short-route ferries

GNE, Meriaura and Wärtsilä are developing a new ammonia-fueled vessel

NYK and Elomatic have developed several concept designs for an ammonia-fueled vessel

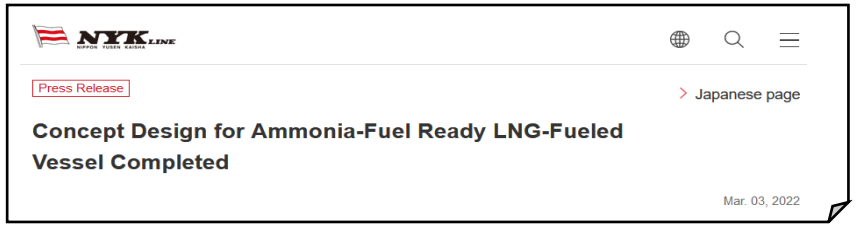
Estimates show the possibility to gain a market share as large as the current one




MARINE RENEWABLES

Green NorthH2 Energy, Meriaura and Wärtsilä to collaborate on green ammonia cargo vessel

By CALLUM BROOK-JONES — September 22, 2022 No Comments


NYK LINE

Press Release

Japanese page

Concept Design for Ammonia-Fuel Ready LNG-Fueled Vessel Completed

Mar. 03, 2022

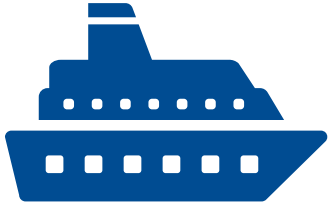
Which fuel to select?

ELECTRICITY

HYDROGEN

AMMONIA

TUGS,
ROAD FERRIES,
LOCAL TRANSPORT



FERRIES,
SHORT VOYAGES,
SHEDULED TRAFFIC

DEEP SEA
SHIPPING

	Volumetric density [MJ/L]		**LHV** [MJ/kg]	
	w. storage	net	w. storage	net
BATTERY	*2*		*0,3*	
CH_2 (700 bar) **LH_2** (-253 °C)	est. 4 est. 6	4,8 8,5	est. 7 est. 14	120
AMMONIA	10	11,4	11	18,6
MGO	36	41	41	43

Longer contracts?

- Offshore wind may not get grid connections for full power – increase size with P2X production
- P2X production have high investments – derisking with longer contracts
- Consumers will for some time not get freedom where to buy (ex. in any harbour as with oil)
- Bunkering at sea?
- The selection of technologies might not be possible alone as before
    - whole chain costs (wind, p2x production, ship design etc.) to be considered
        - Ex. Liquefied hydrogen in Norway was strongly selected from ship design perspective (storage size, efficiency). However it seems to be that no one is interested in investing in liqufaction plant (high cost).
        - Ammonia production can start from other demands as chemical and then have capacity to also marine segment
        - CCU may have limitations on availability of suistainable CO2

SUMMARY Potential to go Green with Wind + P2X is high, but do likely need longer commitments in order to take place in scale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