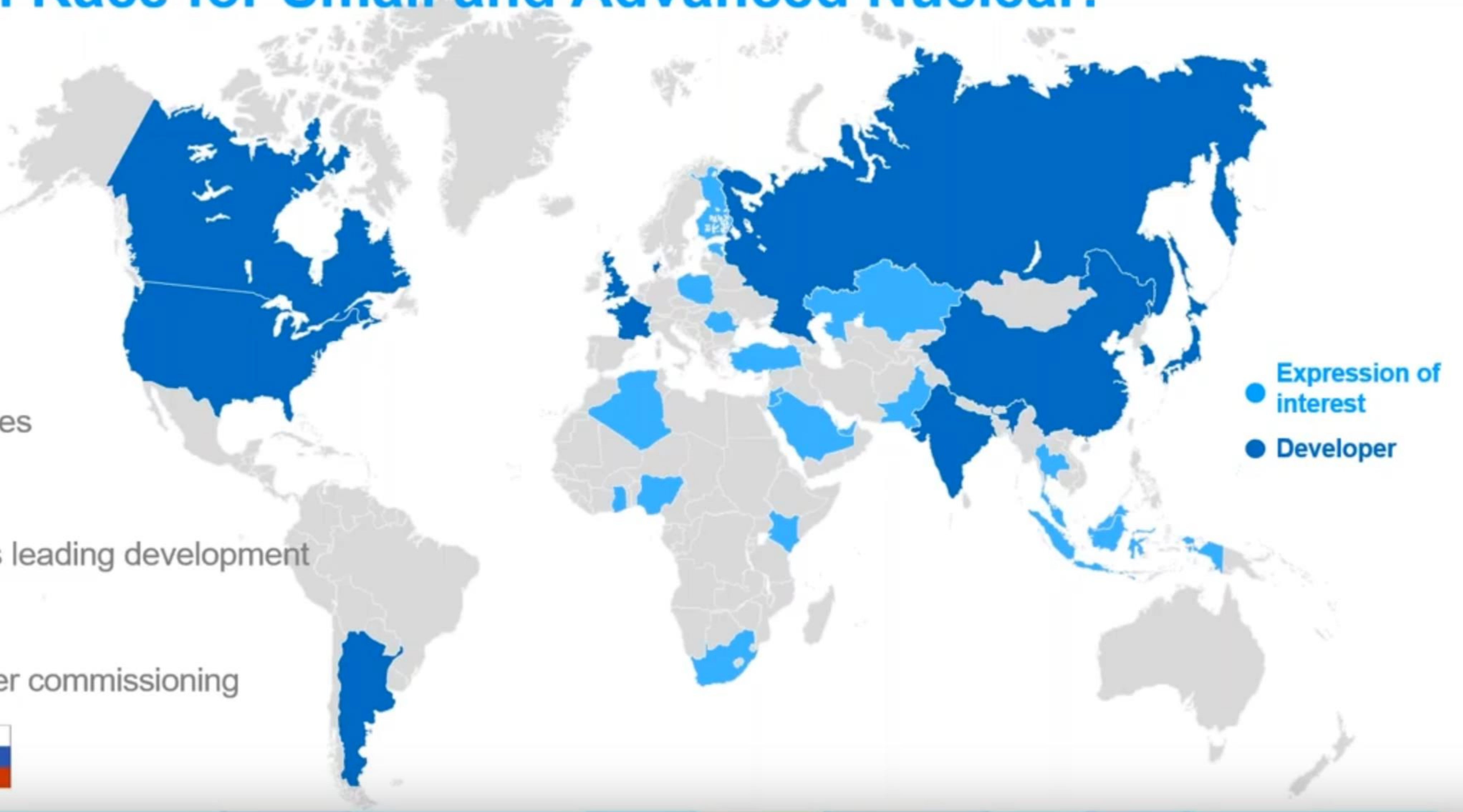
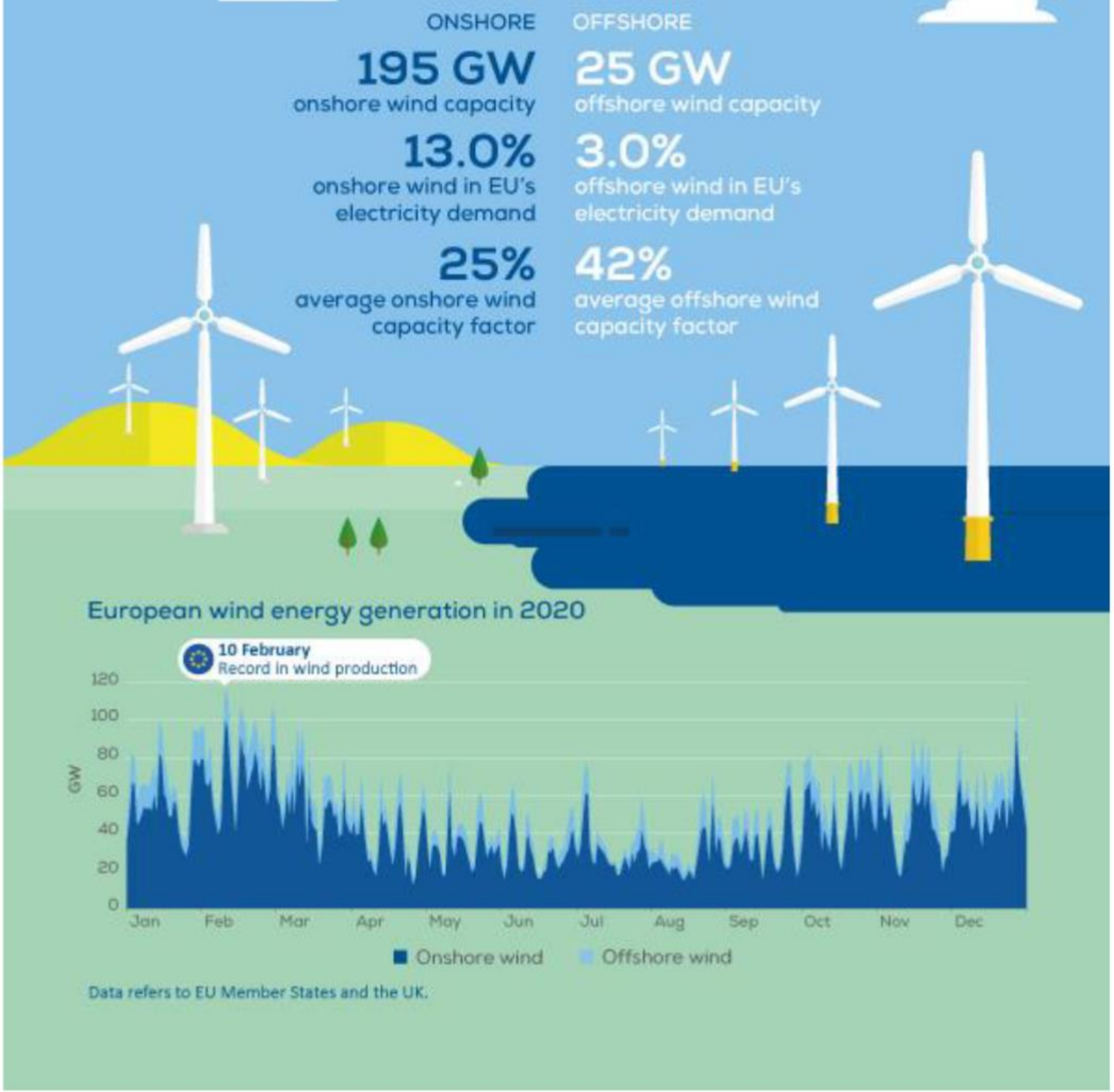
SMALL MODULAR REACTORS

The Global Race for Small and Advanced Nuclear!



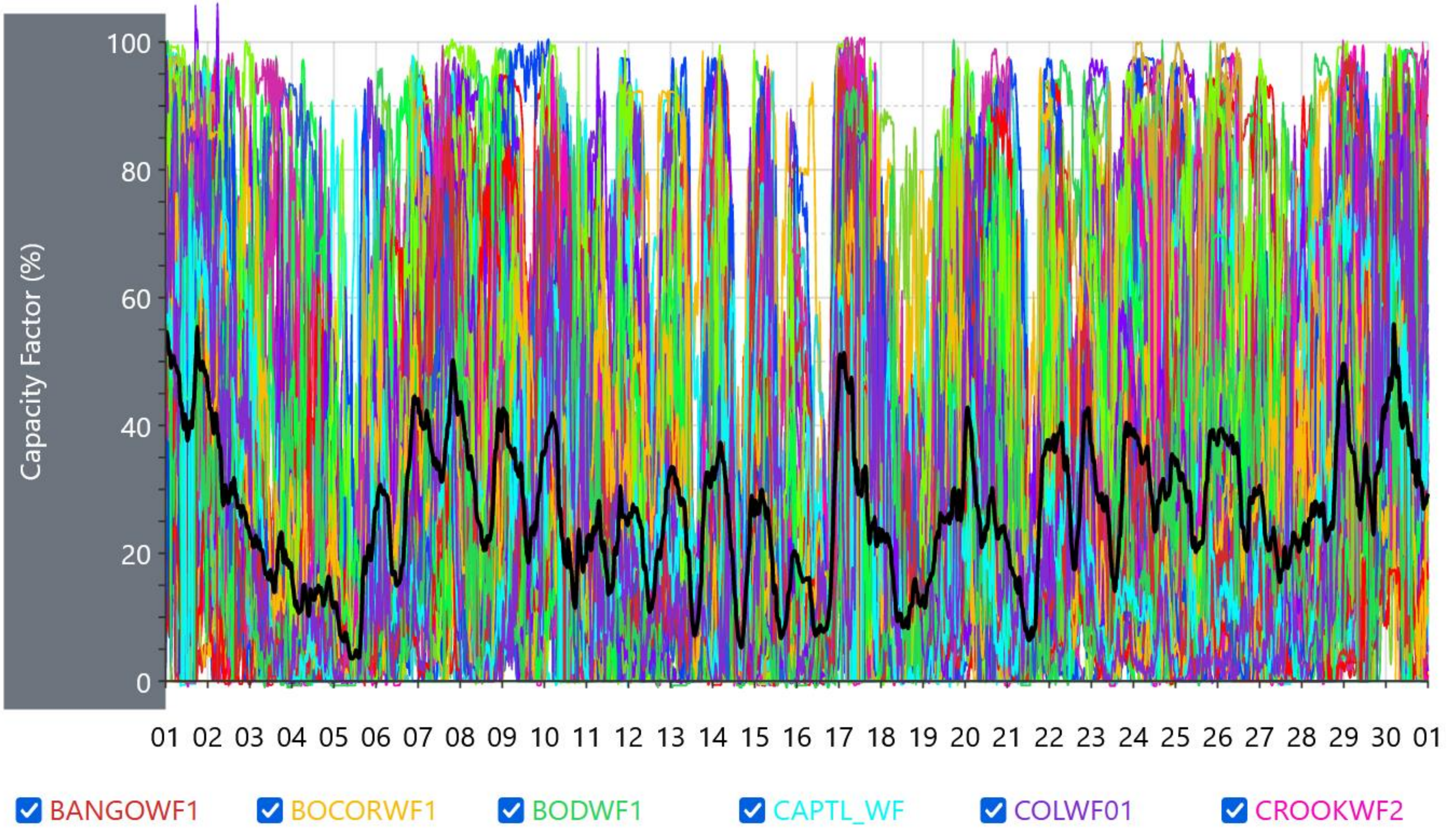
Key figures

- **50+** Products
- **6+** Technologies
- **10+** countries leading development
- **2** designs under commissioning


ONSHORE
195 GW
onshore wind capacity
13.0%
onshore wind in EU's electricity demand
25%
average onshore wind capacity factor
OFFSHORE
25 GW
offshore wind capacity
3.0%
offshore wind in EU's electricity demand
42%
average offshore wind capacity factor
European wind energy generation in 2020
10 February
Record in wind production
120
100
80
60
40
20
0
GW
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec
Onshore wind
Offshore wind
Data refers to EU Member States and the UK.

Wind Energy Production During April 2022

% MW



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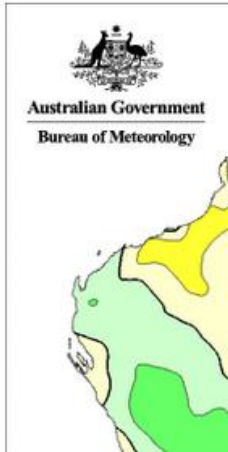
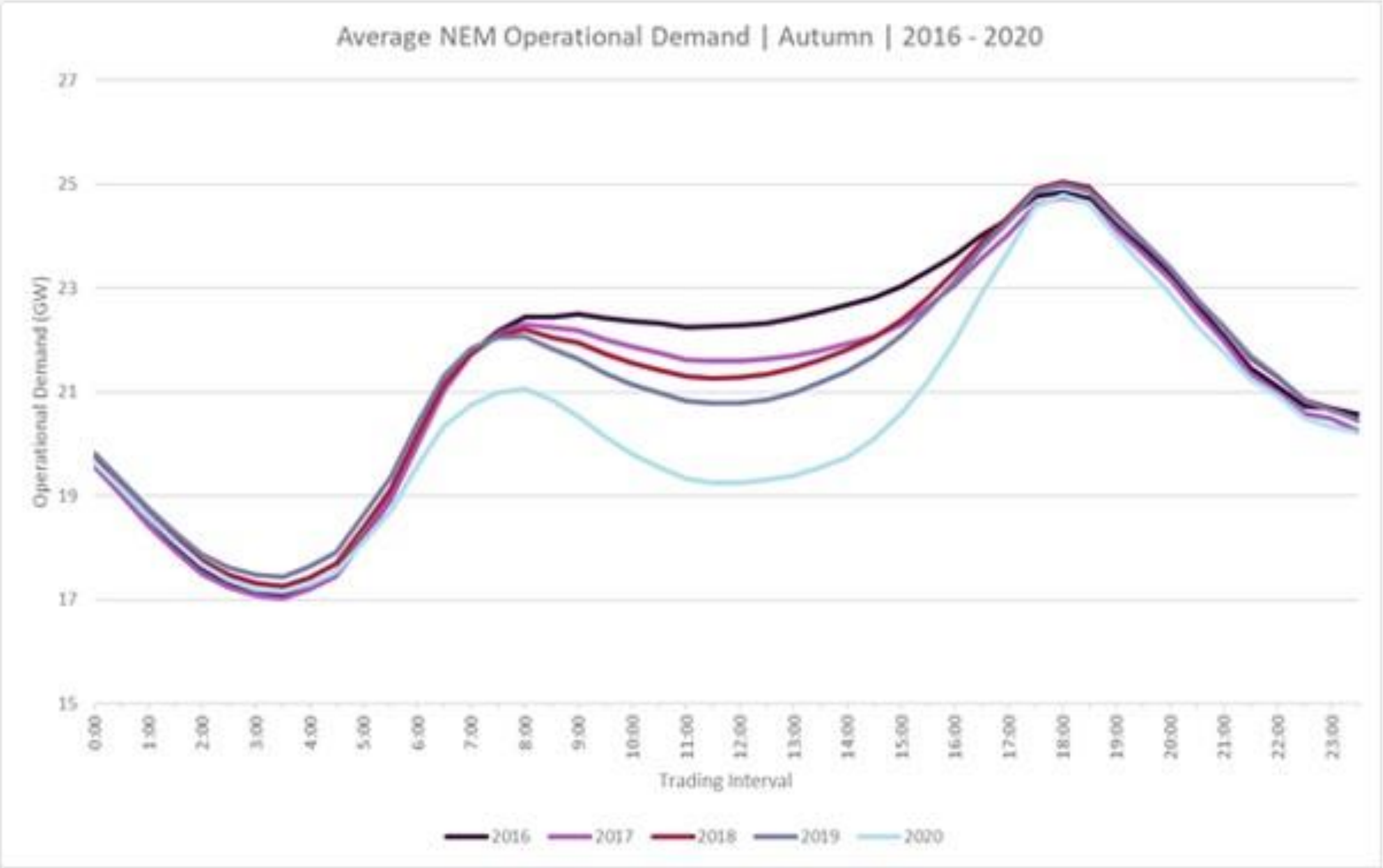
April 2022





Operational demand for the NEM between 2015 and 2020. This shows a reflection of the downward trend in demand over a whole season.

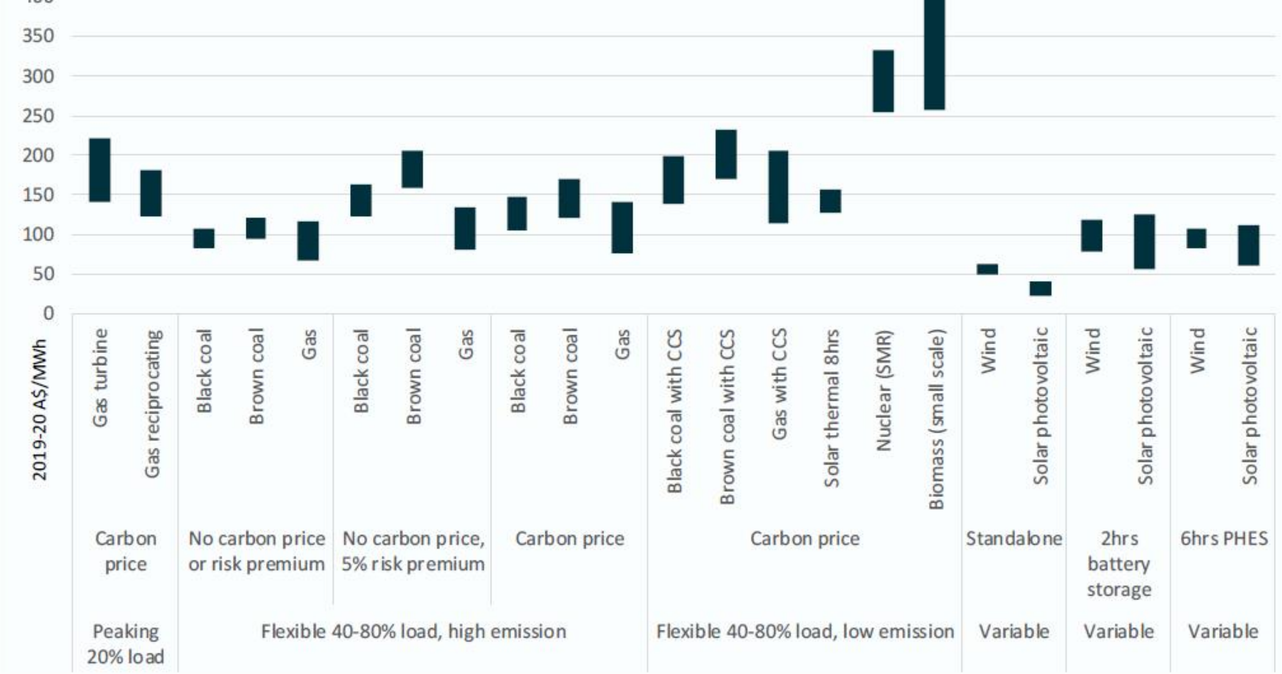
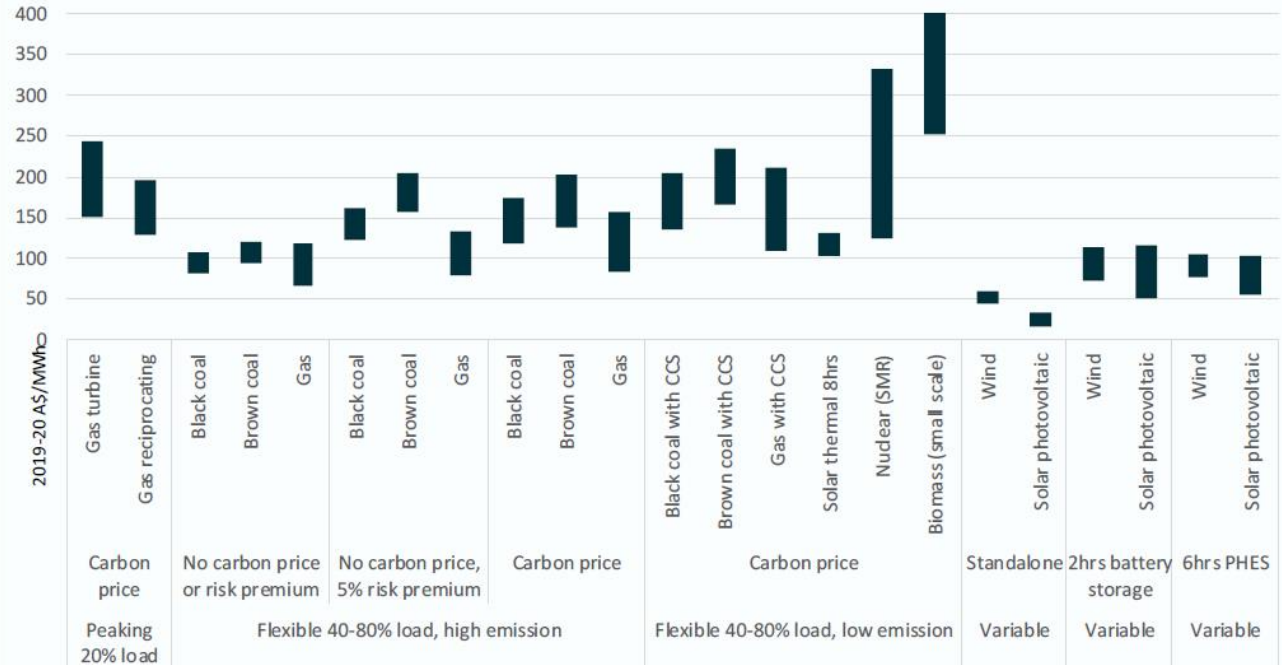


Figure 4-2 Calculated LCOE by technology and category for 2030

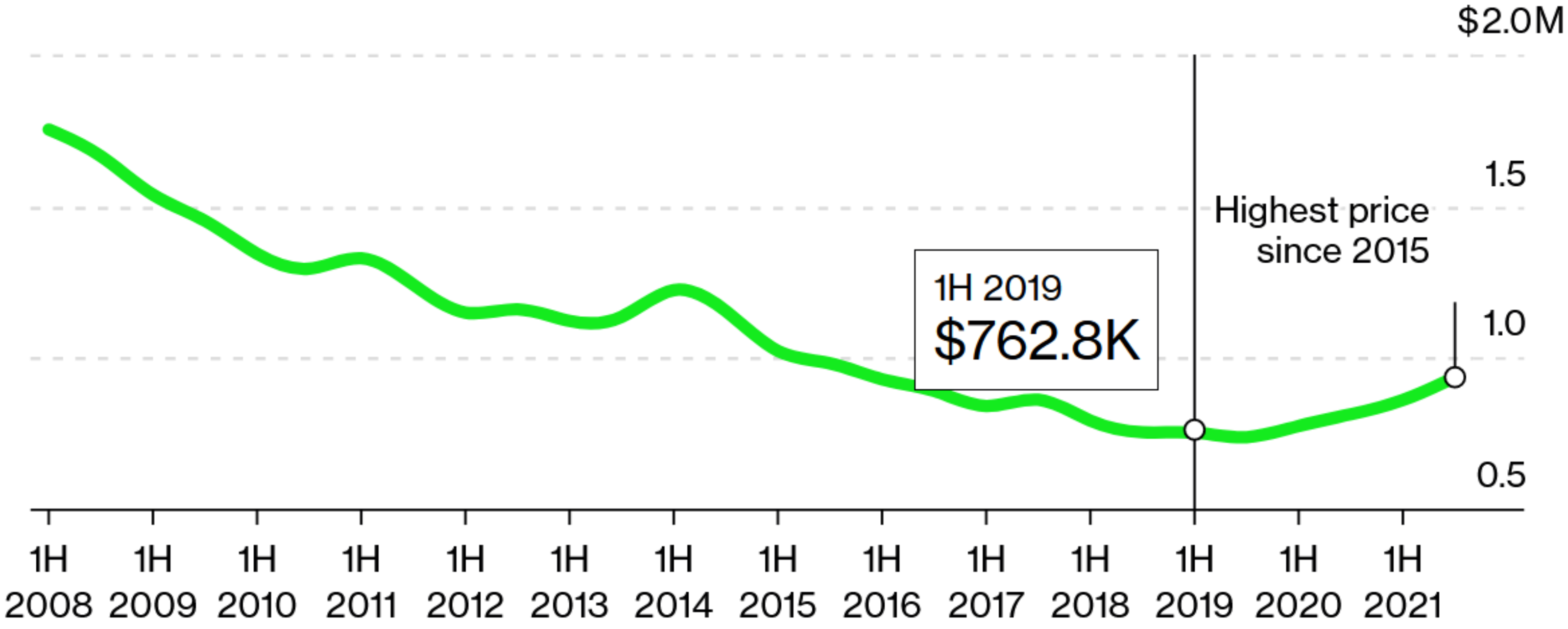


projects in fewer markets, raise prices, streamline their product lineups and cut manufacturing costs. That comes just as surging fossil fuel prices should be making renewables more competitive.

Going Up

Wind turbine manufacturers are raising prices after years of declines

Global average price per megawatt



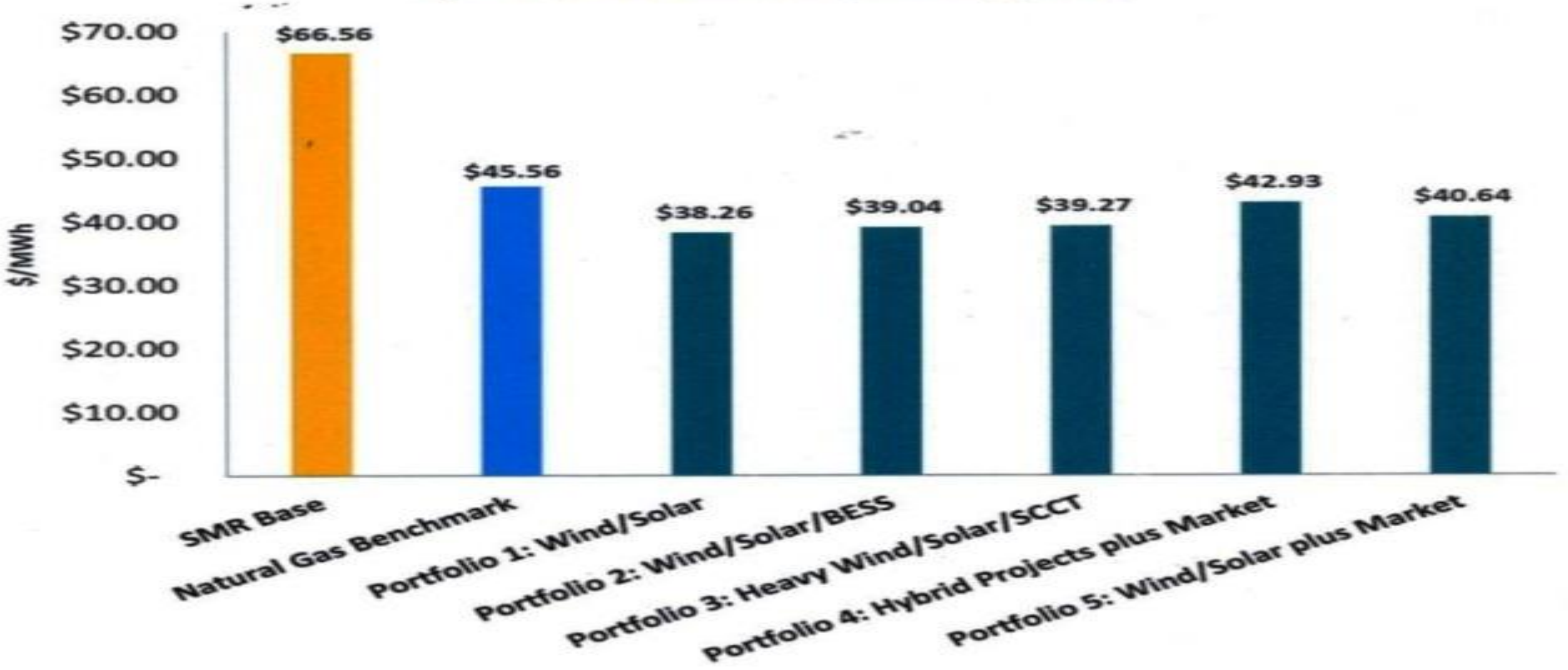
Source: BloombergNEF

“You absolutely need to see some of these profit pictures turn around for the decarbonization goals to be achievable,” said Aaron

3.2 Portfolio Cost Analysis

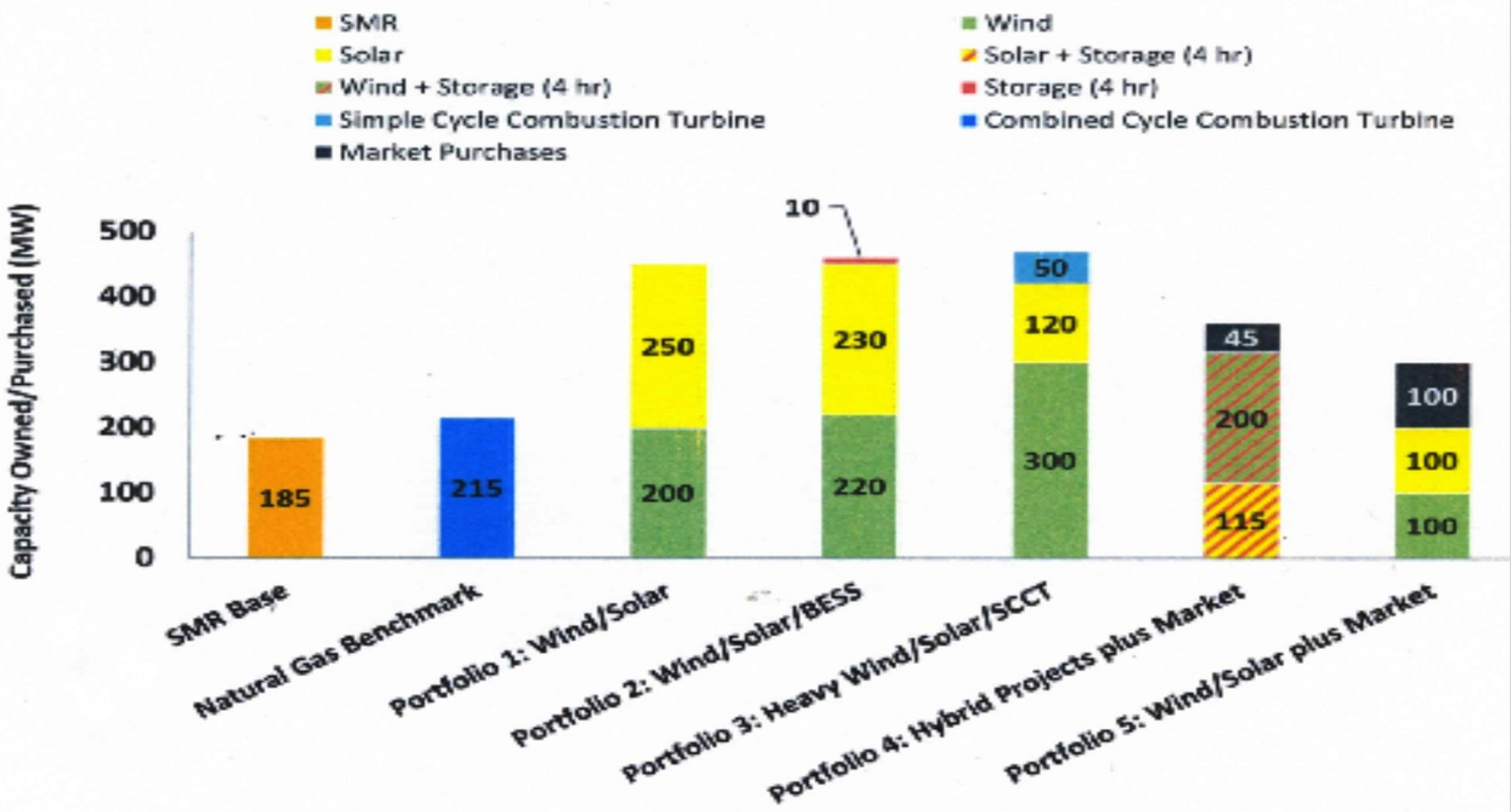
The total portfolio costs on an LCOE basis, excluding the cost of interconnection or transmission, are summarized in **Figure 4**. The SMR Base Case portfolio cost is $67/MWh, while the alternative portfolios range from $38-$43/MWh. The analysis found that the SMR Base Case portfolio's levelized cost per megawatt-hour is $24-$28 higher than each alternative portfolio analyzed. The natural gas benchmark portfolio is $46/MWh, which is slightly higher than the alternative portfolios, but roughly 30% less expensive than the SMR portfolio.

Figure 4: Total Levelized Portfolio Cost ($/MWh)



The present value of each portfolio LCOE represents the total cost of that portfolio. Differences in this present value cost between portfolios represent estimated savings (or costs) between portfolio choices. The present value analysis was performed for 20 years, capturing total costs from 2026-2045. The differences in costs between the SMR Base Case and each portfolio were

Figure 2: Portfolio Content by Nameplate Capacity (MW)

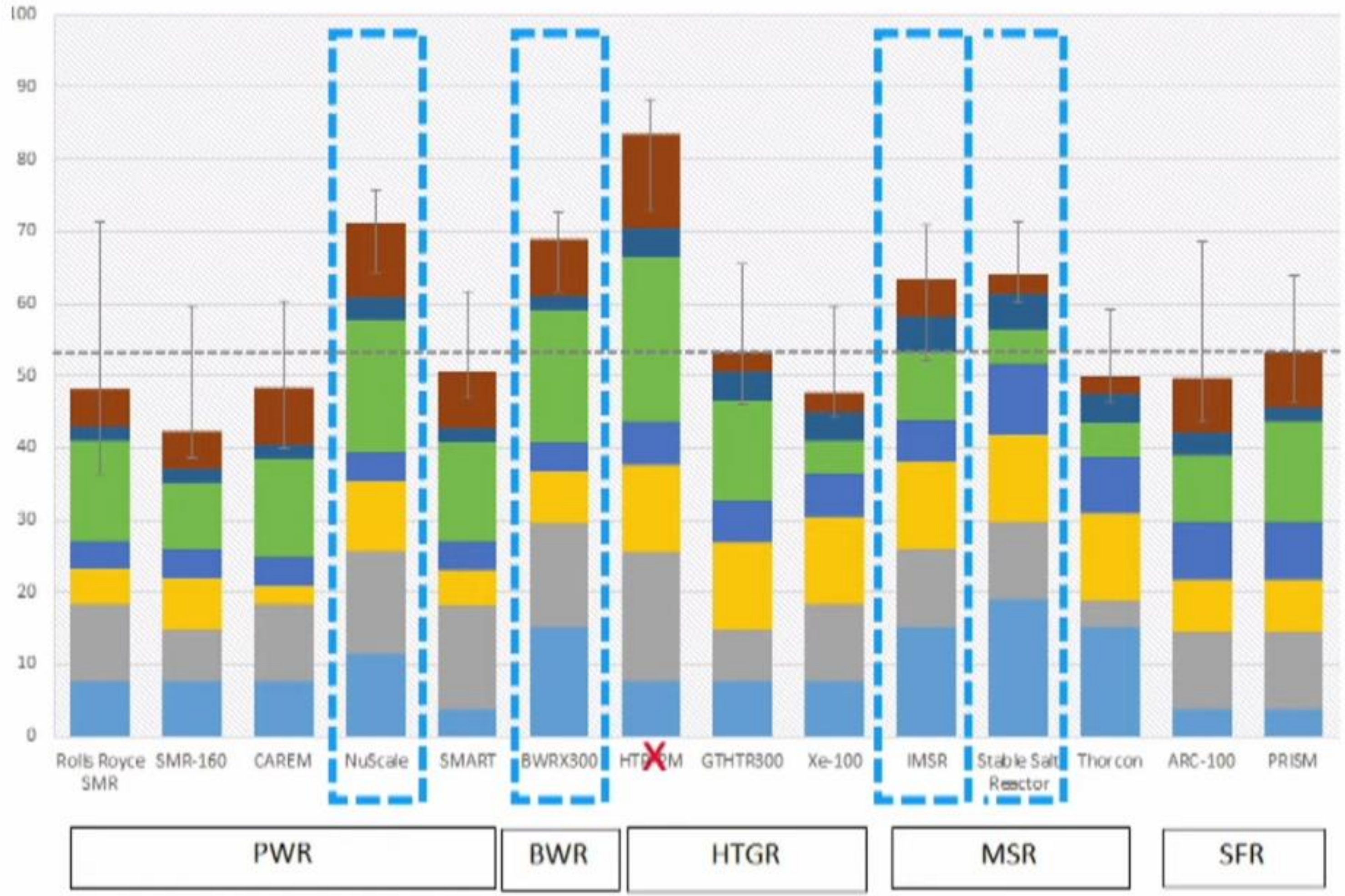


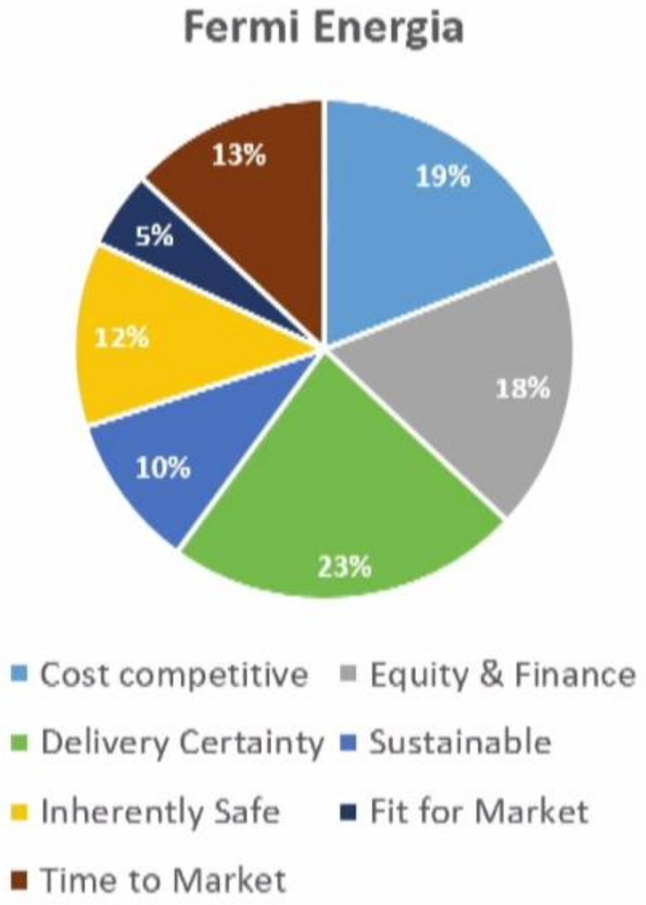
The comparable nature of each portfolio on an energy and capacity value basis and the resource composition of portfolios studied is shown in **Figure 3.** The diagram shows how the capacity value (black line) is held constant across the portfolios, while the energy content (bars) are all roughly equal to the energy content of the SMR Base Case portfolio.

Overview of SMR technologies

	Light Water Reactor	Molten Salt Reactor	High Temperature Gas-cooled Reactor	Sodium Fast Reactor
	Mid-2020s	Early 2030s (low TRL)	Under commissioning	Late-2020s
	Excellent passive safety No backup power	Inherent passive safety High simplicity systems	Excellent passive safety Elimination of core melt	Excellent passive safety But sodium reactivity & void coefficient
	Possible load-following & desalination	Load-following & heat applications	Load-following & high T° applications	Medium T° applications
	Not a long-term waste solution	Prospects for waste solution	Higher burn-up Not a long-term solution	Closed fuel cycle and transmutation
	Good cost-competitiveness: 40 – 90$/MWh	Excellent expected competitiveness: 30 – 65 $/MWh	Lower competitiveness: 80 – 120$/MWh	Operational complexity

Assessment results
Fermi Energia weighting profile





Short-term deployment options
Top-ranked designs

Short-term options: Promising and mature LWRs

	NUSCALE (Power for all humankind)	GE HITACHI BWRX300
TECHNOLOGY	Integral Pressurized Water Reactor	Boiling Water Reactor
REFERENCE POWER	12x 60 MWe	300MWe
CAPEX	**4000 - 5000$/kW**	**3000 - 4000$/kW**
FIT FOR MARKET	Enhanced load-following & low T° process heat	Daily cycle load-following & low T° process heat
DISTINGUISHING FEATURES	**Triple Crown Safety**: extended grace period > 30days 1mile EPZ	Safety: extended grace period > 7days **Proven technology** – Evolved from ESBWR **Cost**
LICENSING	**2020 , US NRC**	**Pre-licensing US and Canada**
FOAK	**2026, Idaho - US**	Not yet announced

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Long-term sustainability options
Top ranked designs

Long-term options: Advanced reactors

Closing the fuel cycle

moltex energy — safer, cheaper, cleaner

TERRESTRIAL ENERGY

	moltex energy	TERRESTRIAL ENERGY
TECHNOLOGY	Molten Salt Reactor (fast spectrum)	Molten Salt Reactor (thermal spectrum)
REFERENCE POWER	300 MWe	200MWe
CAPEX	**~3000$/kW**	**<3500$/kW**
FIT FOR MARKET	Load-balancing with heat storage & high T° process heat	Load-balancing with heat storage & high T° process heat
DISTINGUISHING FEATURES	**Waste burner** **Walk-away safety** & site-boundary EPZ Load-balancing with **heat storage**	**Walk-away safety** & site-boundary EPZ **> 500°C process heat** (H2, petro-chemical, …)
LICENSING	**Pre-licensing CNSC**	**Pre-licensing CNSC**
FOAK	**~2030**, New Brunswick - **Canada**	**~2030, Canada** (site not announced)

Fast reactors are nuclear reactors that are designed to maintain their neutrons at high energies. Fast neutrons can unlock the energy in the dominant isotope of uranium (U238) and thus extend known fuel resources by many orders of magnitude, enabling nuclear power to achieve long term sustainability.

Whereas traditional reactors contain moderators to slow down neutrons after they're emitted, fast reactors keep their neutrons moving quickly. An average slow neutron moves around at about 2200 m/s while a fast neutron might be cruising well above 9 million m/s, which is about 3% of the speed of light.

Stable Salt Reactor – Moltex Energy: GridReserve

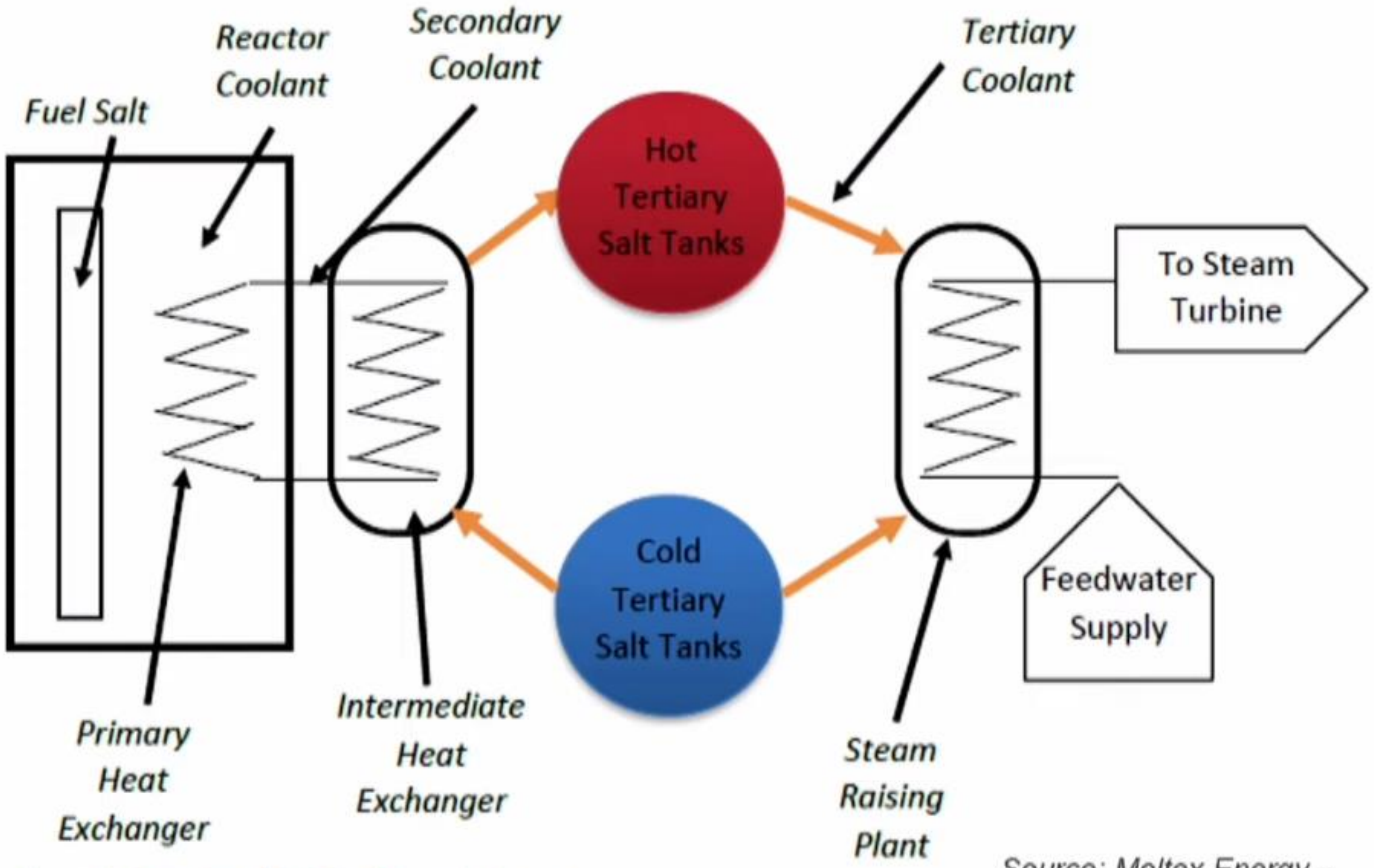


Figure 9: Overview of SSR Heat Transfer Loops

Source: Moltex Energy – Introduction Portofolio 2018

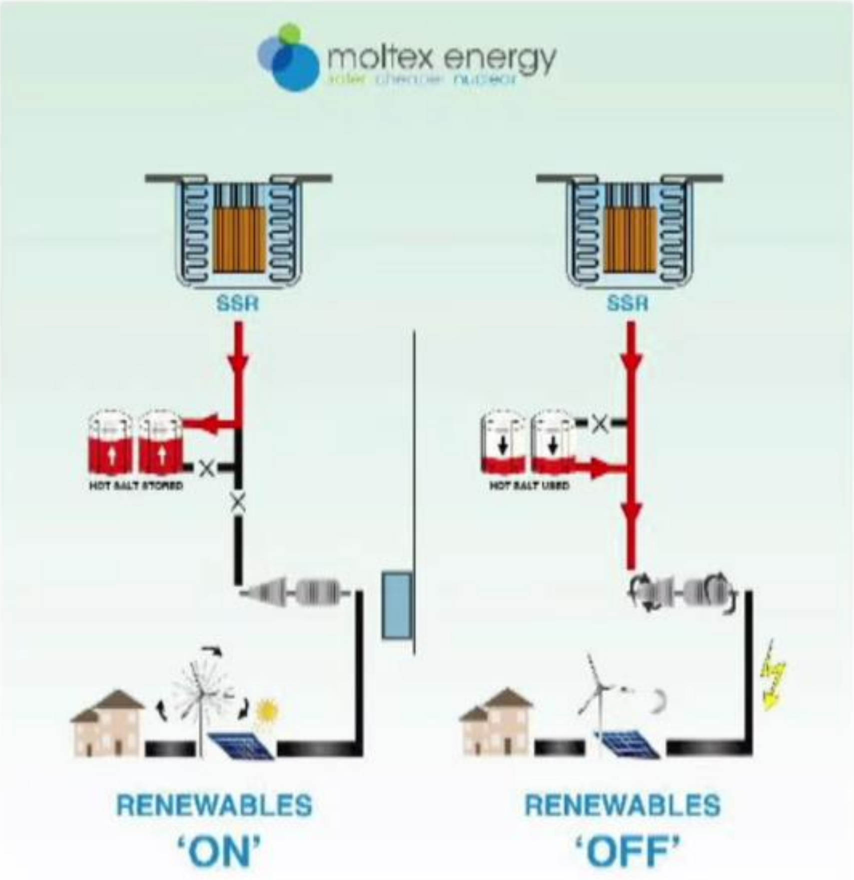
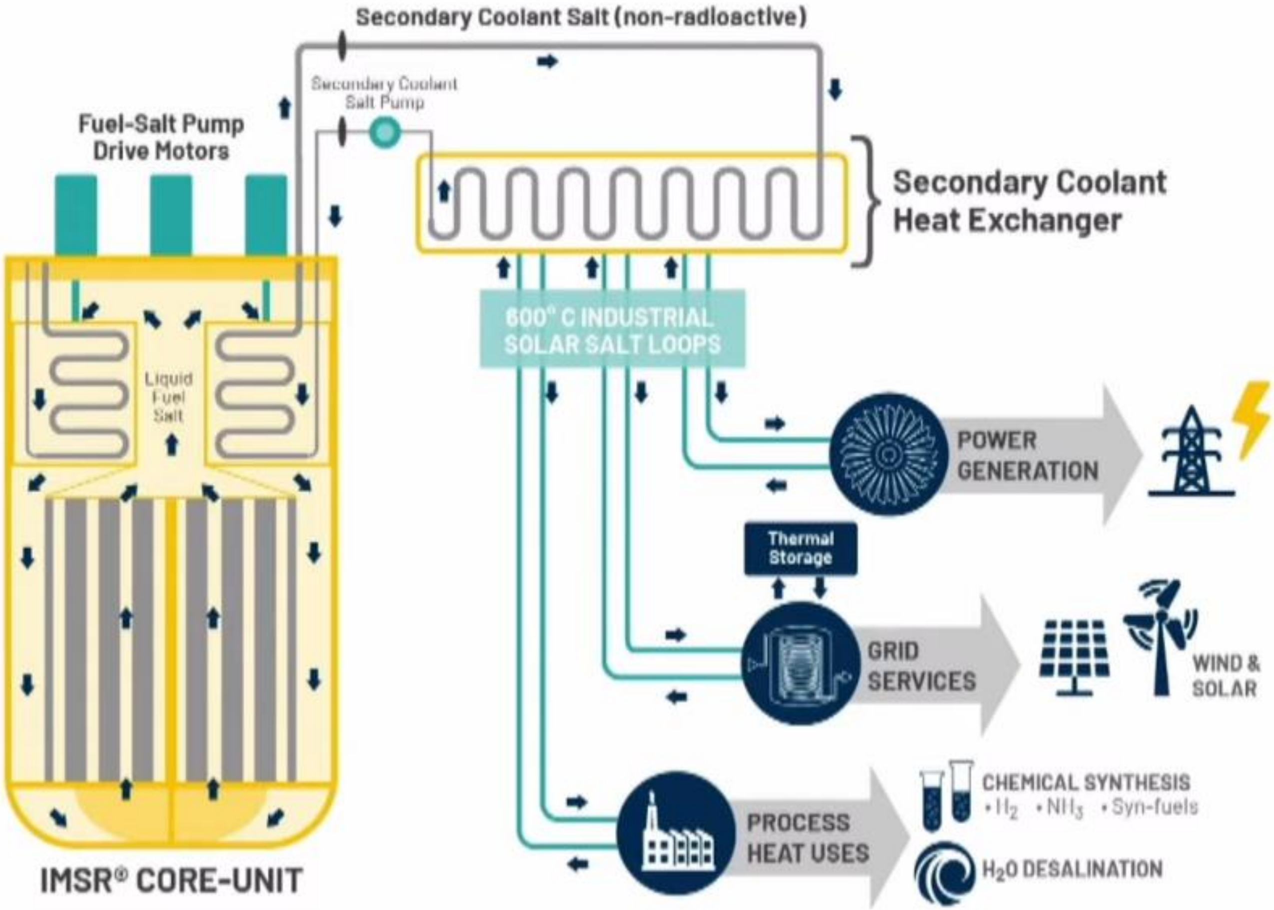


Figure 14: GridReserve to support intermittent renewables.

Integral Molten Salt Reactor (IMSR)

TERRESTRIAL ENERGY



Source: www.terrestrialenergy.com/

Status

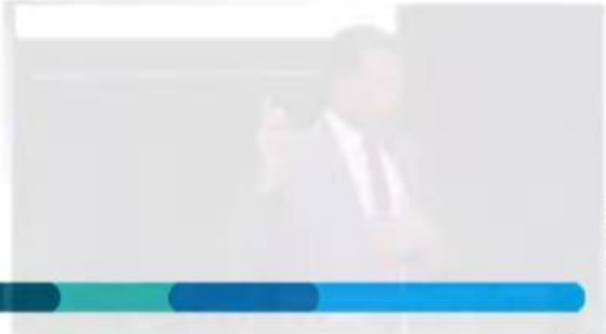
Vendor Design Review **Phase 2**

CNSC CCSN

Canada

Canadian Nuclear Laboratories

Laboratoires Nucléaires Canadiens



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Integral Molten Salt Reactor (IMSR)

Source:
www.terrestrialenergy.com/

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Conclusions

Strong international momentum

Nuclear industry is on the verge of launching SMRs demonstration projects in several parts of the world

Deployment of LWR within the decade

Chosen light-water SMR technologies rely on mature technology and would allow deployment within the decade

Long-term sustainability

Full potential of 'new nuclear' can be anticipated for the early to mid 2030s (deep decarbonization, H2, industrial use, waste reduction)

Synergy with renewables

SMRs should be promoted together with renewable energy, as synergetic means of achieving zero-carbon target by 2050

Fermi Energia leadership

Fermi Energia's ambitious goals and dynamic approach has drawn attention on the international scene and may become a trendsetter in the European nuclear industry