RETHINKING ENERGY IN SOUTHEAST ASIA

NICOLAS LEONG | ENERGY BUSINESS DIRECTOR

THE ROLE OF FLEXIBILITY

SUPPORTING THE RENEWABLE ENERGY TRANSITION AND POWER SYSTEMS

ENABLING THE ENERGY TRANSITION

With a deep **understanding of the energy transition** and power systems, we can help our customers find their optimal and most efficient path towards 100% renewable energy, while **future-proofing** their power system.

Our portfolio consists of **flexible power plants** and **energy storage**, backed up by a strong world-wide **service** network. Our solutions enable our customer to increasingly add renewables to their power system in a **reliable** and secure way, while **reducing emissions**.

73 GW DELIVERED POWER PLANT CAPACITY IN 180 COUNTRIES

OVER 80 GLOBAL ENERGY STORAGE SYSTEMS INSTALLED

OUR EXPERTISE CENTRES SUPPORT NEARLY 250 POWER PLANTS GLOBALLY

INCREASING RENEWABLE ENERGY SYSTEM REQUIRES MULTIPLE FORMS OF FLEXIBILITY

DAILY

Daily variations in generation are handled mainly by energy storage

- Second and minute level balancing
- Daily shifting of energy

WEEKLY

Longer duration energy balance and system reliability is ensured by flexible thermal generation

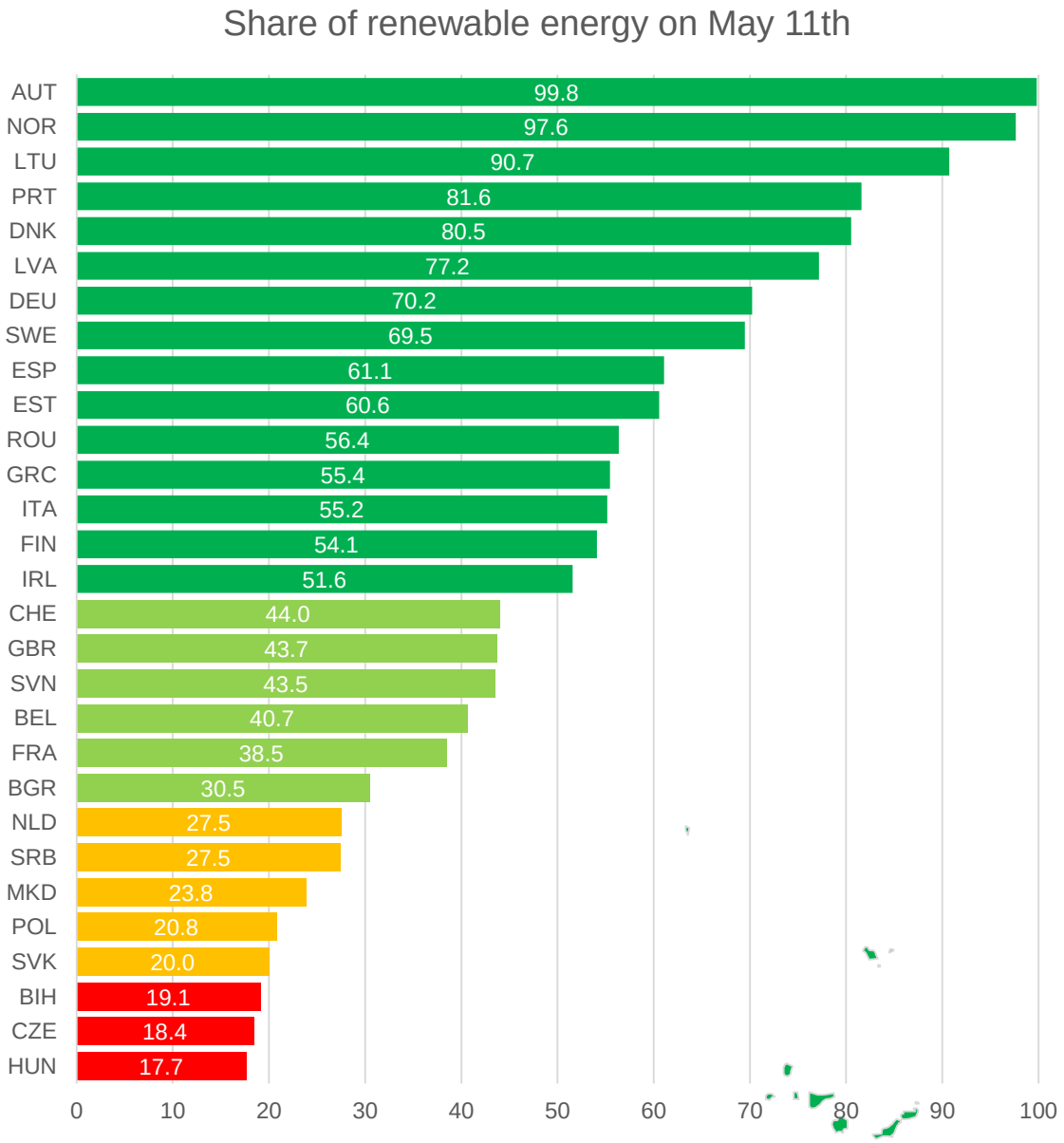
- Week-to-week
- Example: calm dark periods during winter, monsoon season, sand storm

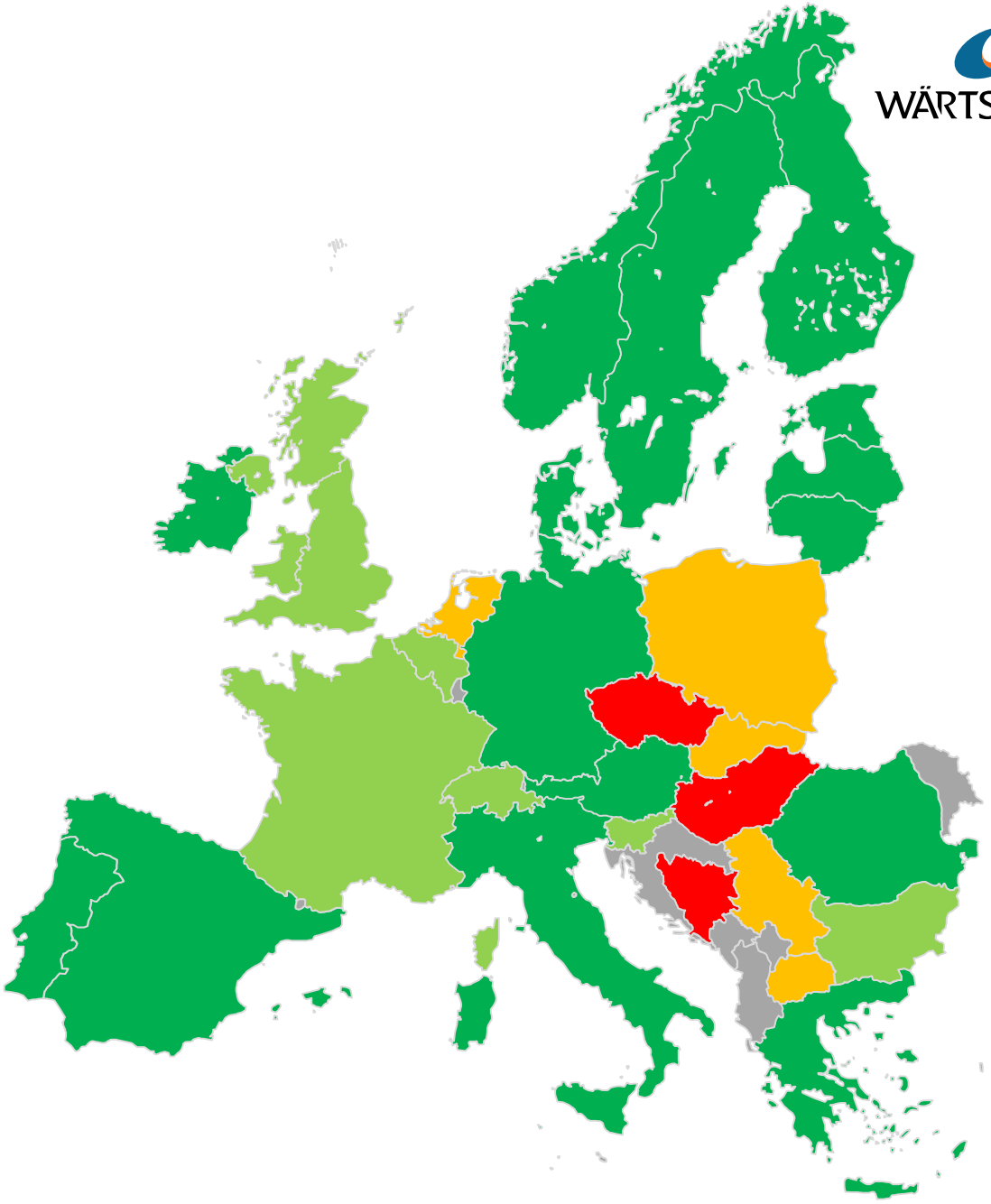
SEASONAL

Fuel as a form of energy storage to balance seasonal variation

- ”Shift” solar energy from summer to winter
- Power-to-gas and existing LNG infrastructure required

MAY 11TH – RENEWABLE RECORD IN EU



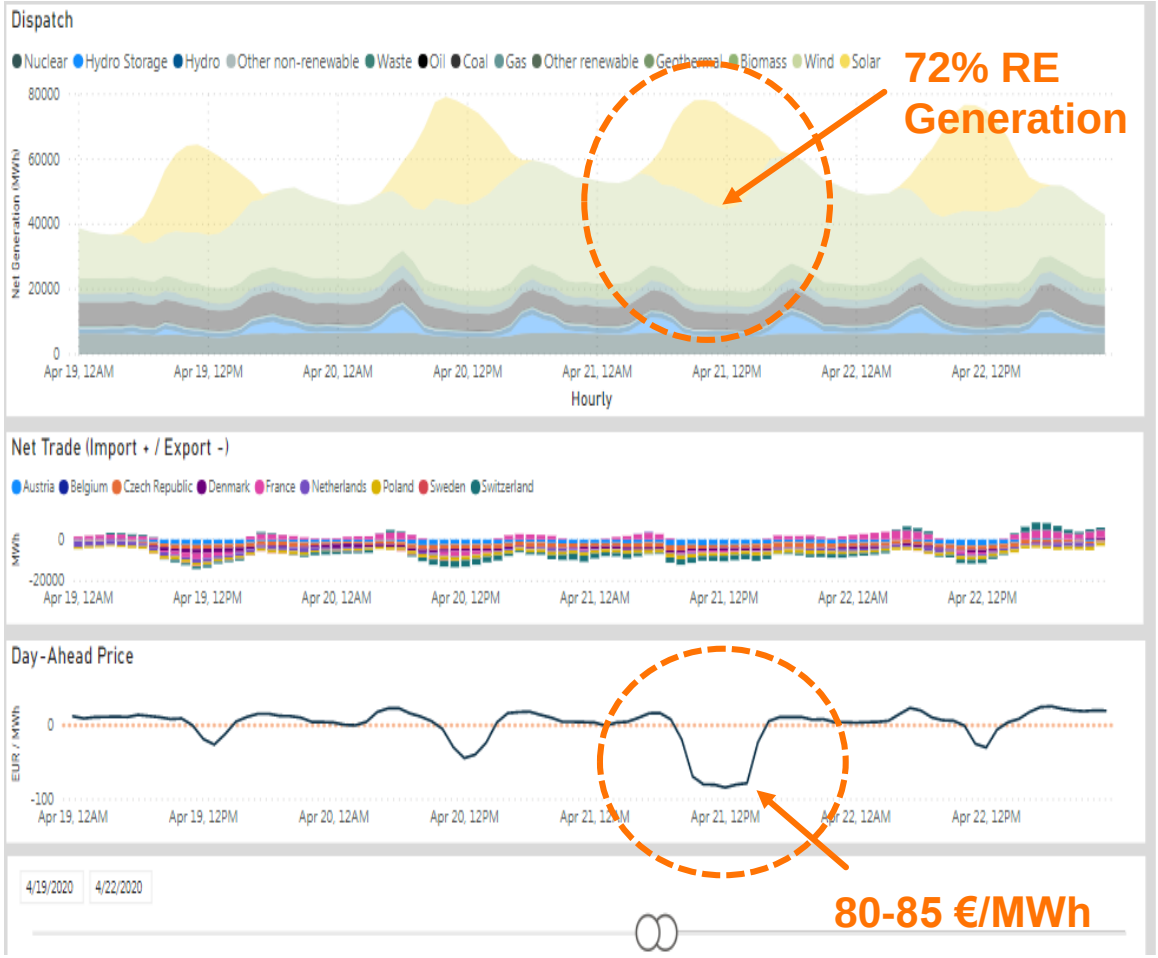


GERMANY PAID 1 MILLION € PER HOUR TO NEIGHBORS TO TAKE THE ENERGY AWAY

Germany had to pay up to €80/MWh to export excess electricity as it was unable to shut down the baseload plants on days of strong renewable generation.

Visit the **Wärtsilä Energy Transition Lab** to access the tool:

wartsila.com/energy/transition-lab



COAL-BASED ELECTRICITY GENERATION IN THE UK
HALTED COMPLETELY FOR ALMOST TWO MONTHS (APRIL-JUNE 2020)

Day prices for electricity halved, affecting the country's baseload from coal & nuclear.

On some days, the UK regulator paid utility EDF to ramp down production at the Sizewell B nuclear power plant, idling reactor no. 2.

Britain goes two months without burning coal amid lockdown

By Katie Pavid

First published 15 June 2020

COMMODITIES MAY 6, 2020 / 4:03 PM / 2 MONTHS AGO

EDF asked to lower Sizewell nuclear plant output to help balance UK grid

36.94 Actual Total Load (TWh)		-12.2%
40% Share of Renewable Generation		9.4%
162 CO2 Intensity (gCO2/kWh)		-24.6%
30.32 Total Generation (TWh)		-12.6%
10.70 Gas Generation (TWh)		-34.4%
0.00 Coal Generation (TWh)		-100.0%
12.08 Renewable Generation (TWh)		14.0%
7.15 Nuclear Generation (TWh)		-3.8%
26.19 Average Day-Ahead Price (EUR/MWh)		-43.1%

FLEXIBILITY IS THE FASTEST GROWING SECTOR IN THE ENERGY TRANSITION

RES

BASELOAD

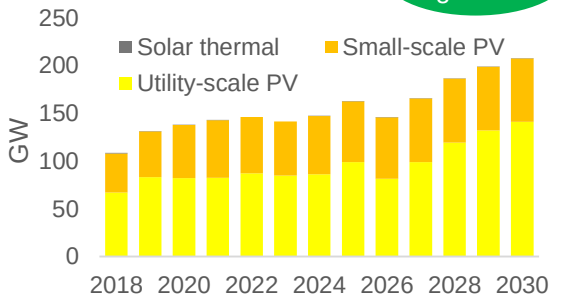
FLEXIBILITY

Wind

3x growth

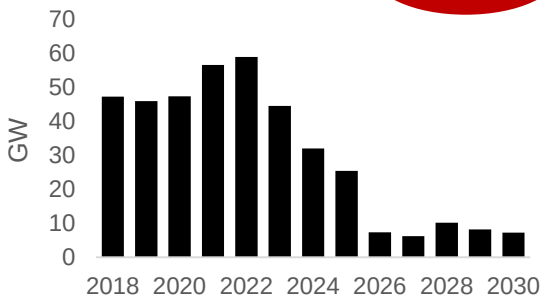
Solar

2x growth



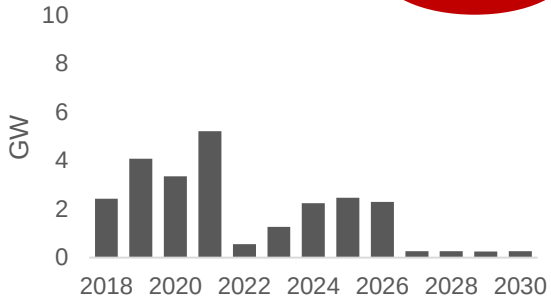
Coal

Decline



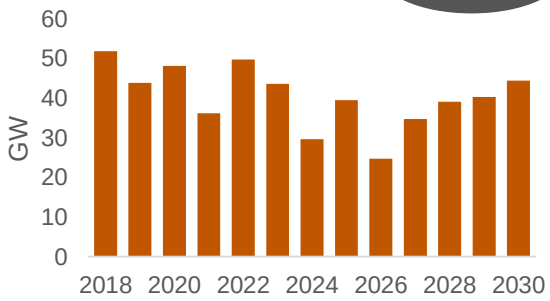
Oil

Decline



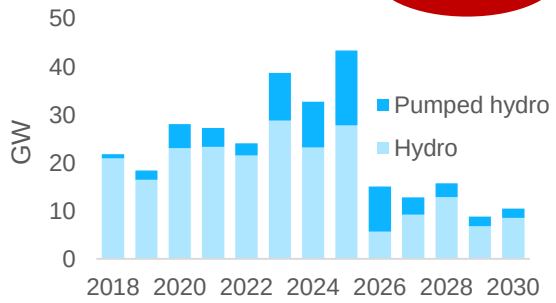
Gas

Flat/ Decline



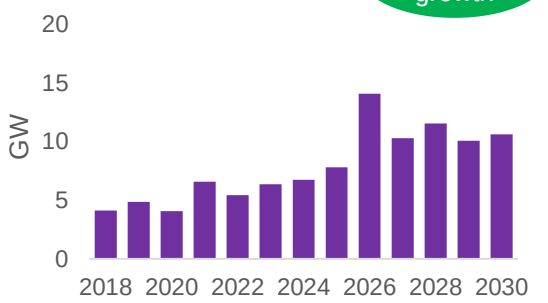
Hydro

Decline



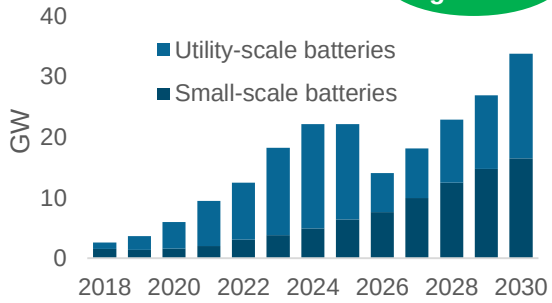
Demand response

3x growth



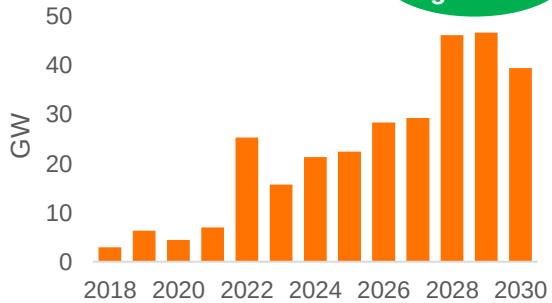
Battery Storage

13x growth



Peaker gas

14x growth



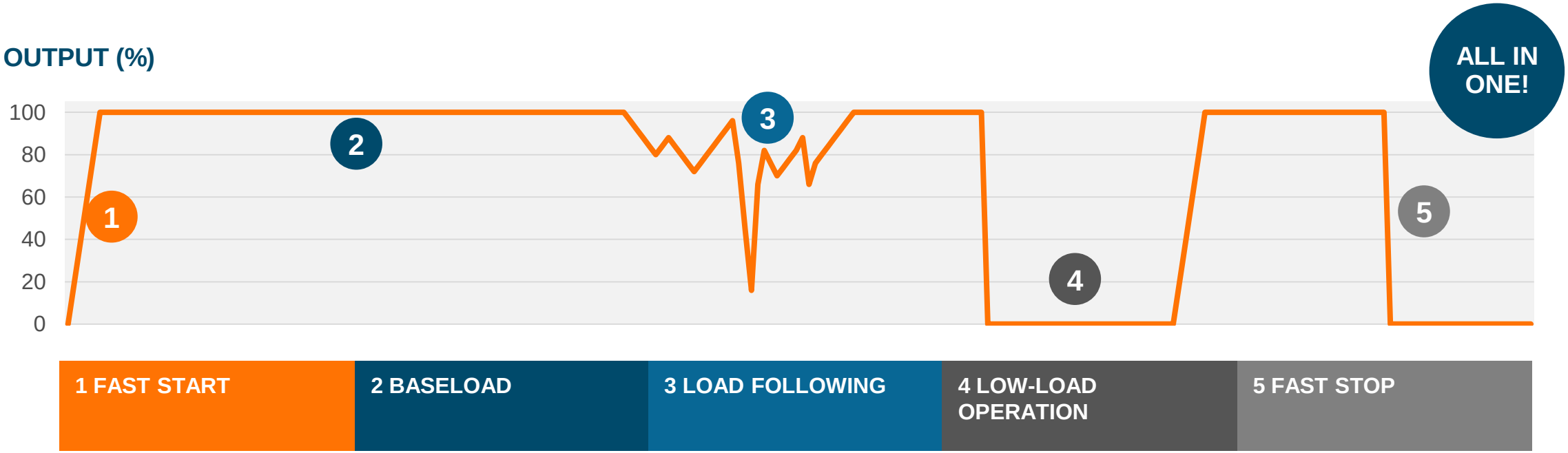
Source: Bloomberg NEF 2019

CHANGING POWER MIX

CHANGING POWER MIX

- Part load efficiency
- Minimum stable load
- Start cost
- Start-up time
- Minimum up & down time
- Fuel consumption at start-up
- Cycling cost

FLEXIBILITY IS THE KEY FEATURE OF HIGH-RENEWABLE POWER SYSTEMS



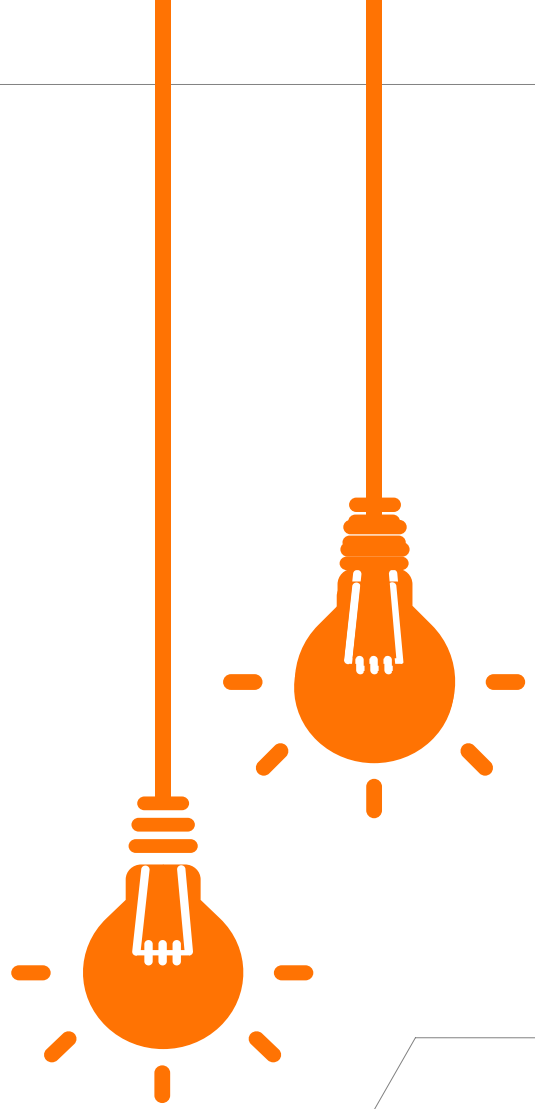
- Power to grid in 30 s
- 2 min to full power
- Start up efficiency

- Highest simple cycle efficiency
- Multi unit → high firm capacity

- High part load efficiency
- Very fast loading and unloading
- Run only as many units needed

- Very fast unloading
- In multi-unit configuration less engines running needed for low load

- 1 min shutdown
- No minimum up time
- No minimum down time



CASE STUDY FROM SOUTH AUSTRALIA

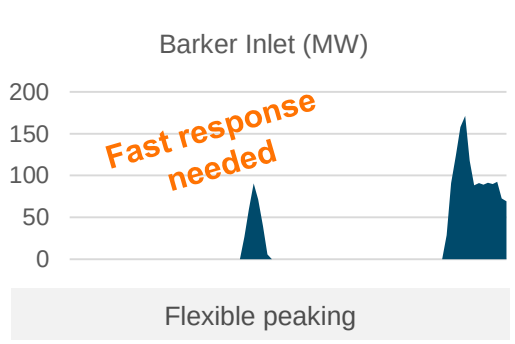
211 MW BARKER INLET POWER STATION

BALANCING INTERMITTENCY OF RENEWABLES – WHY FLEXIBILITY MATTERS
HIGH RENEWABLE DAYS

South Australia generation: 14-15.3.2020

Gas generation split by power plant: 14-15.3.2020

Baseload generation at minimum or close to minimum load – inefficient



Flexible peaking

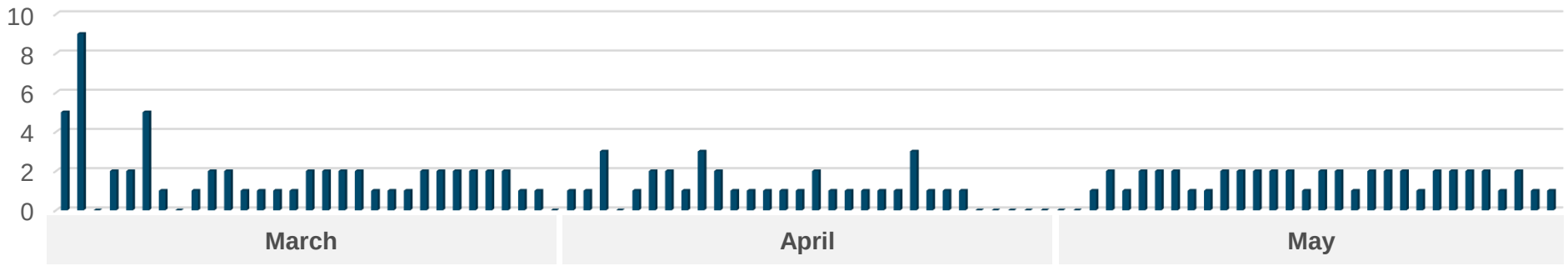
On days with very high renewable generation the ability to respond quickly with flexible gas generation is important – state interconnection may not always be optimal

Flexible peaking capacity is crucial for integrating high amounts of RE

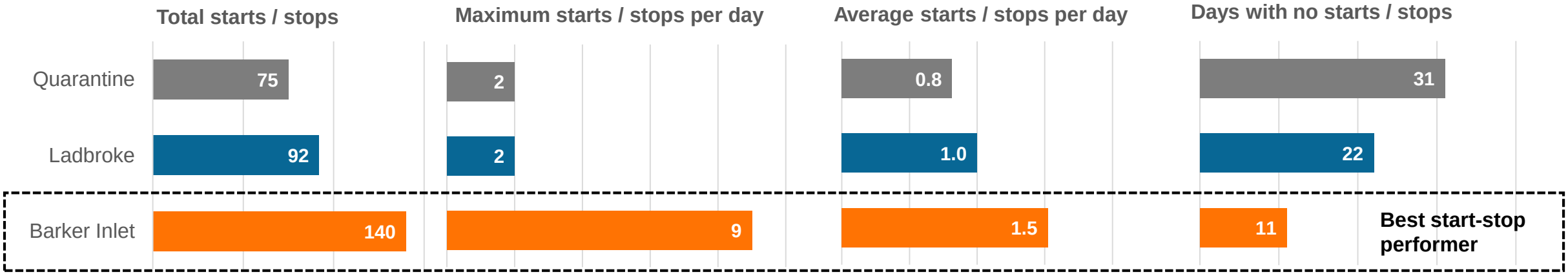
Source: NEM Station All data

FREQUENT STARTING AND STOPPING IS NECESSARY WHEN SHARE OF RENEWABLES INCREASES

Barker Inlet daily starts and stops during March-May 2020 period



Comparison of Start – Stop statistics of Peaker gas plants in South Australia (during March-May 2020)



FLEXIBLE SOLUTIONS PROVIDE BASELOAD FOR ENERGY DEMAND AND BALANCING CAPACITY TO INTEGRATE RENEWABLE ENERGY

Wärtsilä's fast track delivery of a 200 MW engine power plant will help meet Cambodia's rapidly growing electricity demand

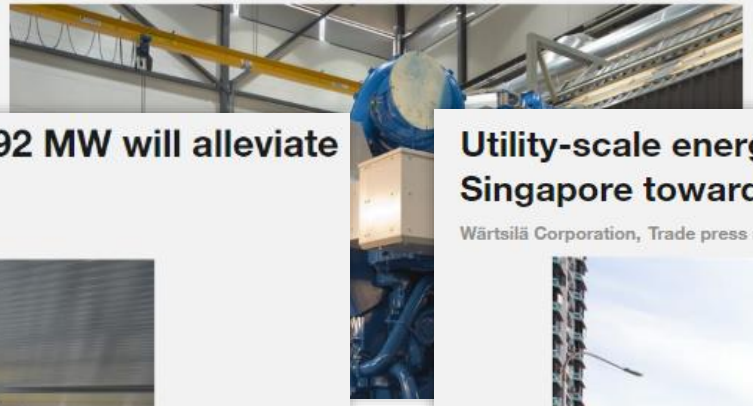
Wärtsilä Corporation, Press release, 1 July 2019 at 5:00 AM E. Europe Standard Time

Wärtsilä awarded energy storage system order totalling 90 MW / 90MWh from South East Asia

Wärtsilä Corporation, Press release, 19 October 2020 at 10:00 AM E. Europe Standard Time

Wärtsilä delivers 40 MW engineered equipment for MCM Power to meet Myanmar's increasing energy demand

Wärtsilä Corporation, Press release, 25 November 2019 at 11:30 AM E. Europe Standard Time



Two projects with Wärtsilä engines delivering 292 MW will alleviate Myanmar's power shortages

Wärtsilä Corporation, Press release, 6 February 2020 at 9:00 AM E. Europe Standard Time

Utility-scale energy storage system supplied by Wärtsilä helps move Singapore towards a low-carbon energy future

Wärtsilä Corporation, Trade press release, 27 October 2020 at 10:00 AM E. Europe Standard Time


WÄRTSILÄ