

Energy transition to a
global carbon-neutral
society

Gas Generation's role in it!

MONTEL



- News
- Market Price Data Platforms
- Market Fundamental Data Platform
- Long term curves
- Insight & Consultancy





Introduction

At a European level ...

- new activity ...
- capacity crunch...
- ageing nuclear/ closing nuclear
- and projected large increases in demand

giving positive news for Gas Turbine/
Gas generation Sector

Presentation will Look at how
CCG/OCGT Gas Generation is
operating in the market

Look beyond it as “bridge” from Coal
to renewables

Discuss "Stacked" revenue business
cases

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Germany plans to build 25 GW of new gas-fired capacity by 2030

10 MARCH 2023

The German government has announced plans to build 25 GW of new gas-fired capacity by 2030, as part of its strategy to diversify its energy sources and ensure security of supply.

The government is also planning to invest in necessary infrastructure, including gas pipelines and storage facilities.

The potential purchase of 2024, with a target of 2025.

Home / News / Energy & Environment / Energy / Germany to almost double gas firing capacity

Germany to almost double gas firing capacity

By Nikolaus J. Kurmayer | EURACTIV.com | Est. 3min | 5 Jan 2023

Language: EN | Light

Belgium plans 8 GW “energy island” by 2030s

03 Oct 21

AGRICULTURE | COAL | ELECTRIC POWER | ENERGY TRANSITION | NATURAL GAS — 21 Mar 2023 | 17:54 UTC

Europe undergoes modest revival in gas
plant construction as further coal
closures loom

HIGHLIGHTS

- Close to 10 GW gas plant in construction
- 15 GW of closures announced for 2023
- Dispatchable closures far outweigh adds

S&P Global
Commodity Insights

Gas & Oil Fired

Romanian coal plant to be repurposed as 1700MW combined-cycle flagship

Pamela Largue • Mar 08, 2023

Share

CCGT plant will run on Siemens Energy turbines and be one of the most efficient in Europe

Siemens Energy will supply independent power producer Mass Global Energy with HL-class gas turbine technology for the Mintia combined-cycle power plant in Romania.

The new 1700MW Mintia plant will replace a retired coal-fired power plant located near Deva in the Transylvania region which Mass Global Energy acquired for €91 million last year from Complexul Energetic Hunedoara.

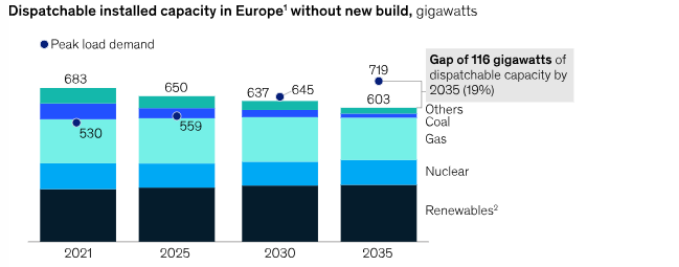
The contract will see Siemens Energy supply two SGT5-9000HL gas turbines with associated generators, an SST5-5000 steam turbine with SGen-3000W generator, and the SPPA-T3000 control system.

McKinsey
& Company

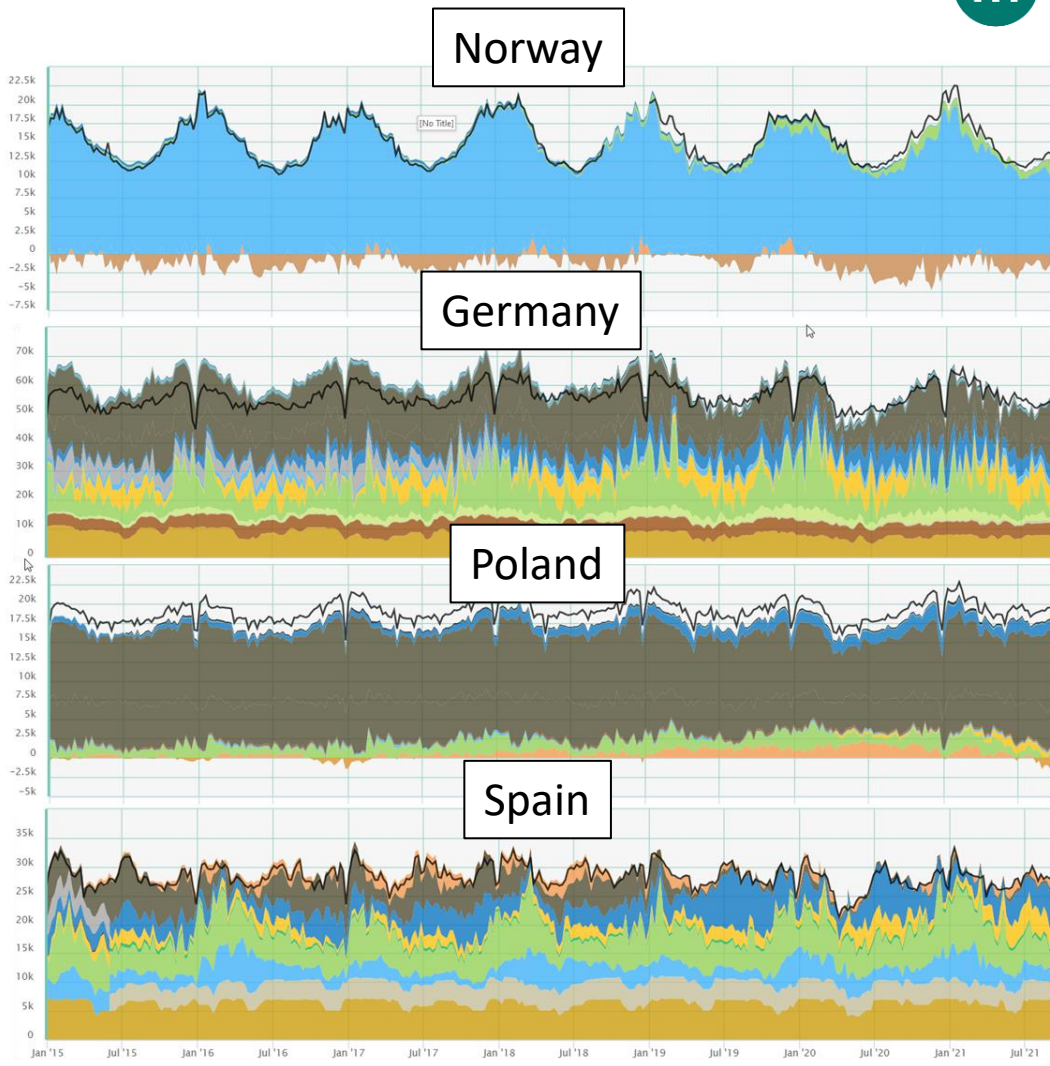
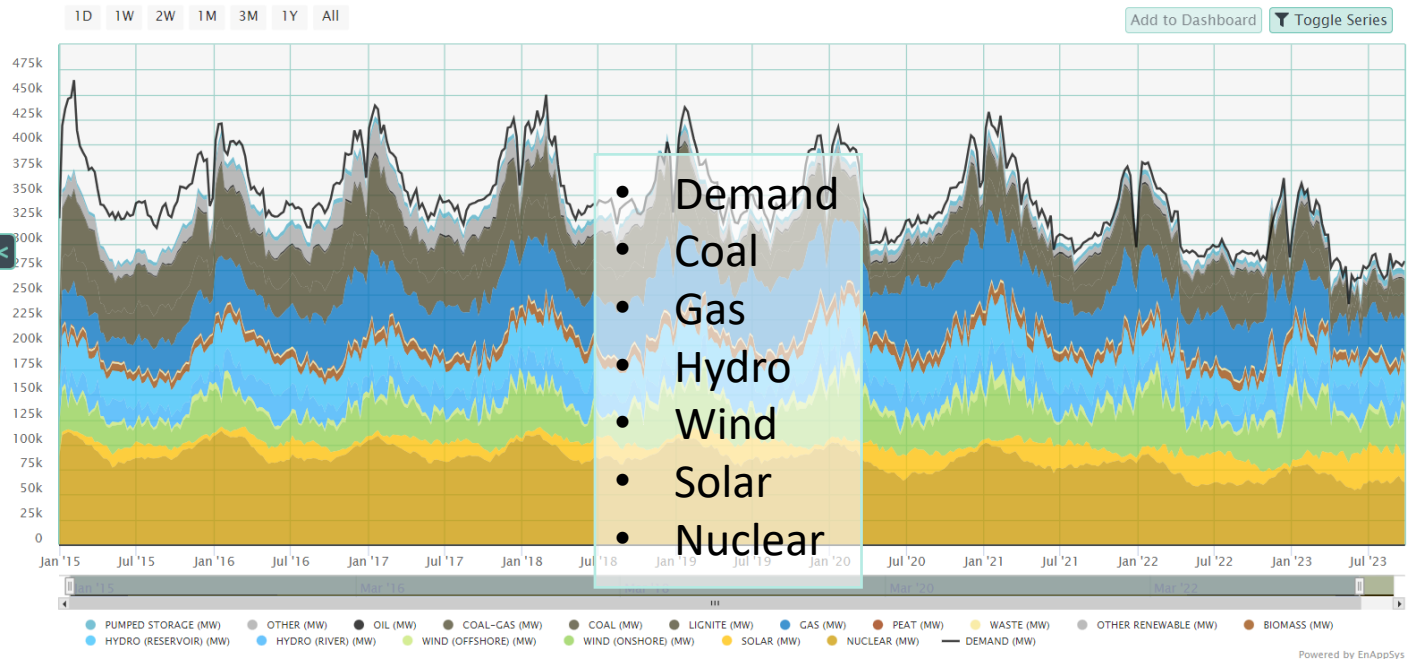
3. Not enough dispatchable power

Over the next several years, a gap will develop between peak electricity loads and the dispatchable power capacity that can be switched on to meet it. This shortage is expected to worsen as natural gas, nuclear, and hydro production continue to decline while peak loads increase. By 2035, Europe's gap will be equivalent to 19 percent of dispatchable capacity, or 116 GW (Exhibit 4). This, however, is a worst-case scenario and assumes no new capacity is built.

Assuming no new capacity is built, Europe could face a gap in dispatchable power by 2035.



¹Austria, Belgium, Bulgaria, Czech Republic, Denmark, Finland, France, Germany, Greece, Hungary, Italy, Netherlands, Norway, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden, Switzerland, and United Kingdom.
²Comprises hydro and biomass.
Source: McKinsey Power Solutions EU Power Model, November 2022; Platts PowerVision; McKinsey analysis



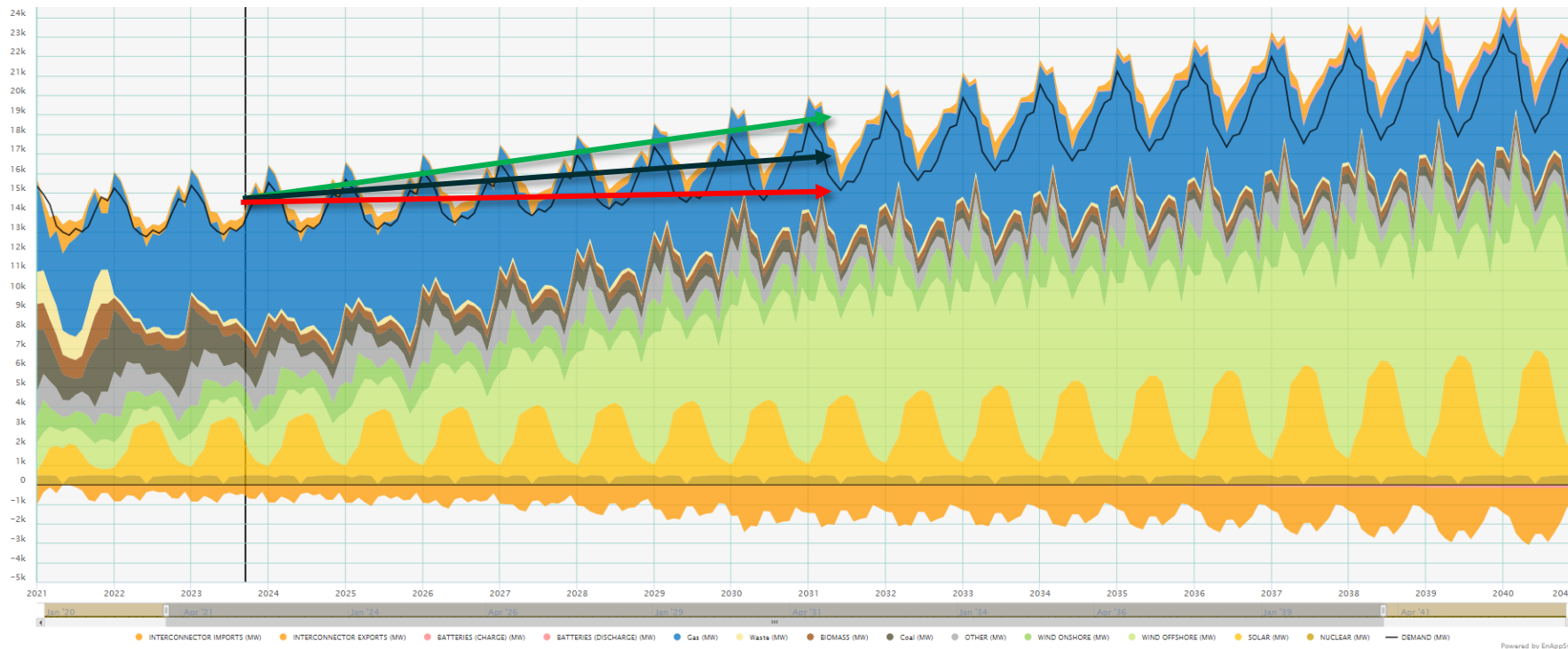
Gas in the EU Fuel Mix

- Still a key part of the fuel mix
- Sits in merit order behind 'must run' renewables (and Nuclear)
- EU Countries have differing fuel mixes
- Providing low carbon bridge from coal (Nuclear in Germany !) to net zero
- Prior to the "energy crisis" - traditional spark spread wholesale market business model was challenging

Example Forward Projection of Gas Generation in NL

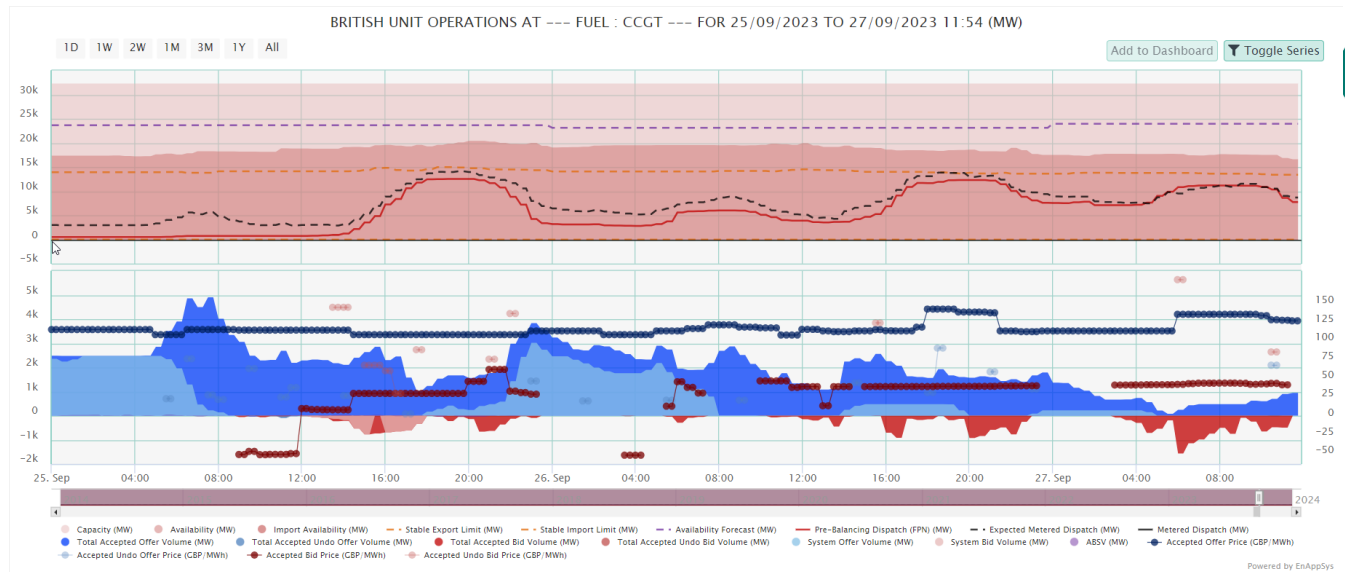


- Demand (black solid line) to increase, with larger difference between summer and winter due to electrification of heat
- Under net zero significant demand growth from electrification of heat and transport and industry
- Issues when growth of demand/ renewables / closure of coal is out of synch
- Asset types that offer flexible generation will be needed in the future



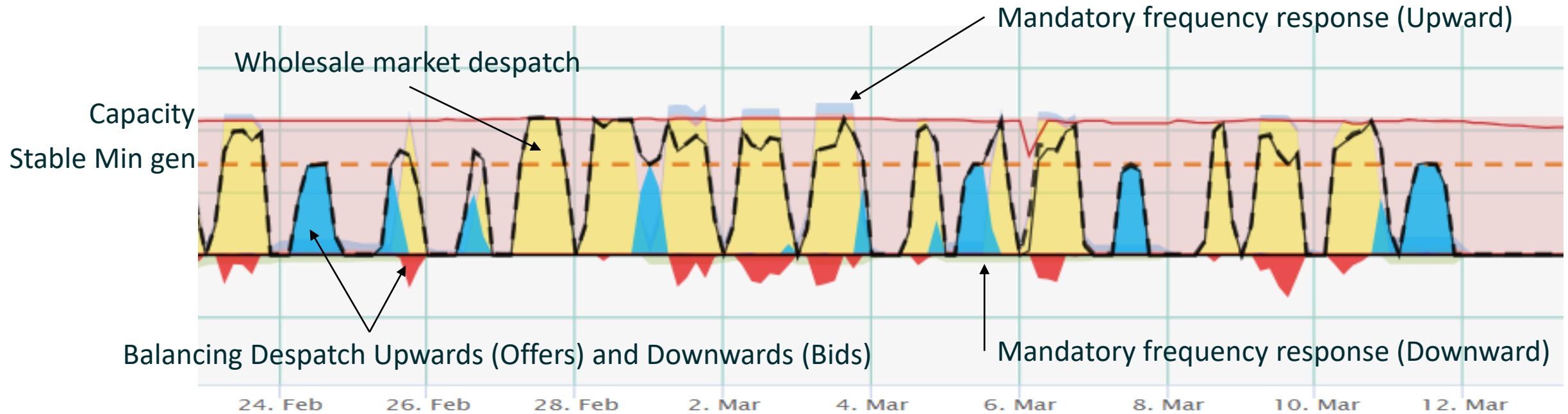
What role in the power market does gas generation currently occupy?

- Power into wholesale markets (to end users via suppliers and brokers)
- Grid Services
 - Supply/Demand/Renewable Balancing
 - Inertia / Frequency Stability Services
 - Voltage regulation – reactive Power
 - Blackstart
 - Capacity Reserve
- Constraint Mitigation
 - Current EU/GB transmission grids have problems managing renewable growth



Service	Lead Time	Min Availability Duration	Direction	Possible from Cold?	Possible if Online?	GB Equivalent
FCR	0-30s	15m	Symmetrical	No	Yes	Dynamic FFR
AFRR Availability Up	0-30s	15m	Up	No	Yes	MFR
AFRR Availability Down	0-30s	15m	Down	No	Yes	MFR
AFRR Free Bids Up	0-30s	15m	Up	No	Yes	Pumped Storage Spin Gen Low Freq. Response
AFRR Free Bids Down	0-30s	15m	Down	No	Yes	No clear equivalent
MFRRsa Up	15-30m	15m	Up	Yes	Yes	Fast Reserve (ended)
MFRRsa Down	15-30m	15m	Down	Yes	Yes	No equivalent
MFRRda Availability Up	10-15m	60m	Up	No	Yes	STOR
MFRRda Availability Down	10-15m	60m	Down	No	Yes	No equivalent
Redispatch (ROP)	>30m	60m	Up/Down	Yes	Yes	~ODFM (down)
Congestion Distr. Grid	>30m	15m	Up/Down	Yes	Yes	Balancing Mechanism (not a service)

What role in the power market does gas generation currently occupy?

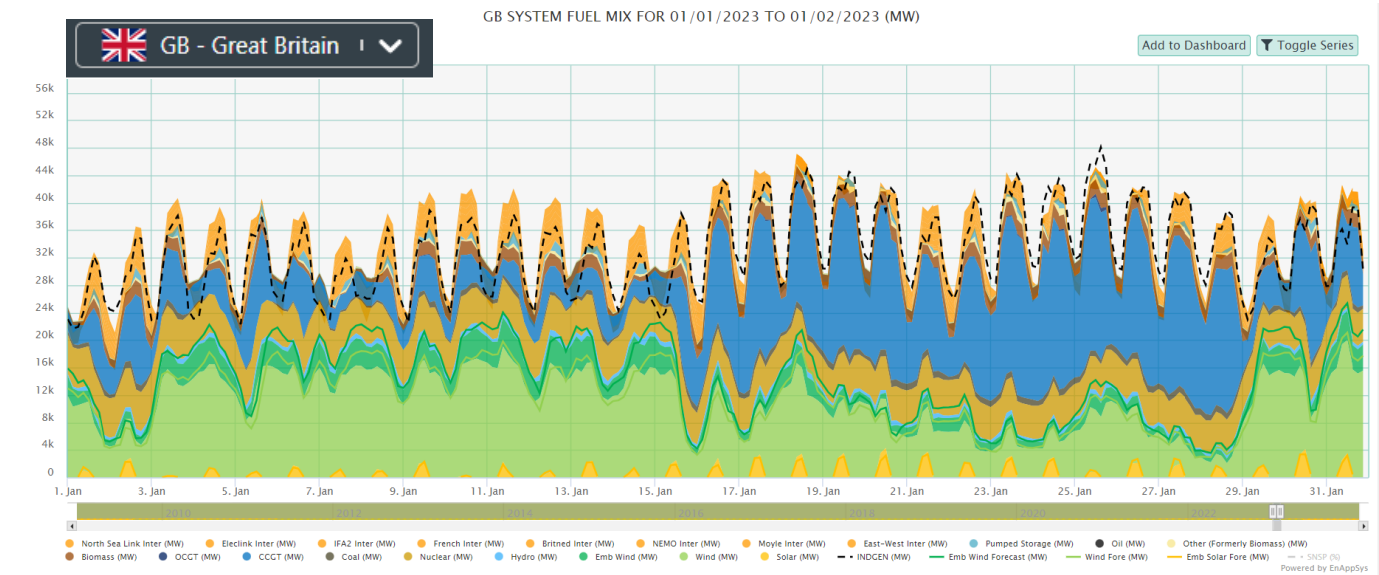
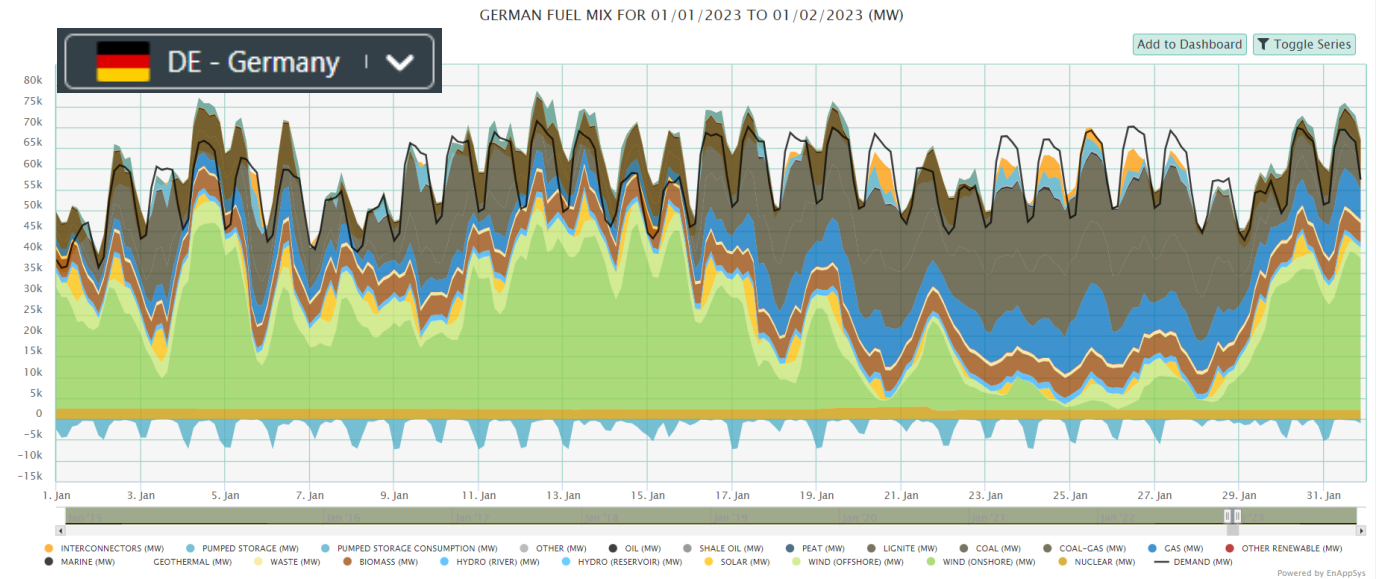


Connahs Quay 2 – 330MW GB CCGT Unit (Single shaft GE9FA)

- Shows operation in multiple areas of the market
- “Stacked Services/ Revenue”
 - Wholesale
 - Balancing
 - Frequency
 - + Reserve Capacity via the Capacity Mechanism

What issues in energy transition does gas generation fill?

- Gas (flexible) generation often presented in net zero as essential to fill the gap
 - Replacement of high carbon emitting power stations (predominantly coal) with gas fired
 - Flexes with renewable output to match supply and demand
 - Provides dispatchable standby capacity
- For larger Combined Cycle Gas Turbines it does the above at scale and provides grid services to stabilise the grid.



Is it the best fit, What are alternatives and why GT's?



Coal Carbon Capture and Storage

- High Capex / high perceived project risk, awaiting government support at scale
- Geography/location for Carbon sequestration
- CCS kit may add inflexibility

Power to Gas – Hydrogen

- Storage and transportation solution (for power case)
- Storage-Conversion technology to power still needed

Large Scale Nuclear

- Long construction cycle
- Lifecycle costs (decommissioning)
- Requires government (and popular) support

Modular Small Scale Reactors

- Technology risk/ No significant build yet

Batteries – Solid State

- High capex v MWh stored - Degradation/ Life

Pumped Hydro

- Geographic limitations
- High capex – long construction cycle
- No significant private sector build to date

Conventional Hydro

- Only works with certain geography
- Cannot 'store' energy can just hold it back

Novel Storage - Flow batteries/ gravity/ CAES

- Similar to Pumped Hydro risk but also technology risk

Gas Turbine generation benefits:

- Proven/ mature technology that exists at scale
- Can burn multi-fuels for energy security
- Fits into existing grid design - lots of sites already!

Gas Generation/ Gas Turbines Role as part of “Storage” and Energy Security Solution



EnAppSys (now Montel) future scenario modelling identified ... a combination of green Power to H₂ and H₂ to Power **essential** to make the market work, at a reasonable cost and meet demand in a fuel mix with high renewable wind

Why

Low wind periods

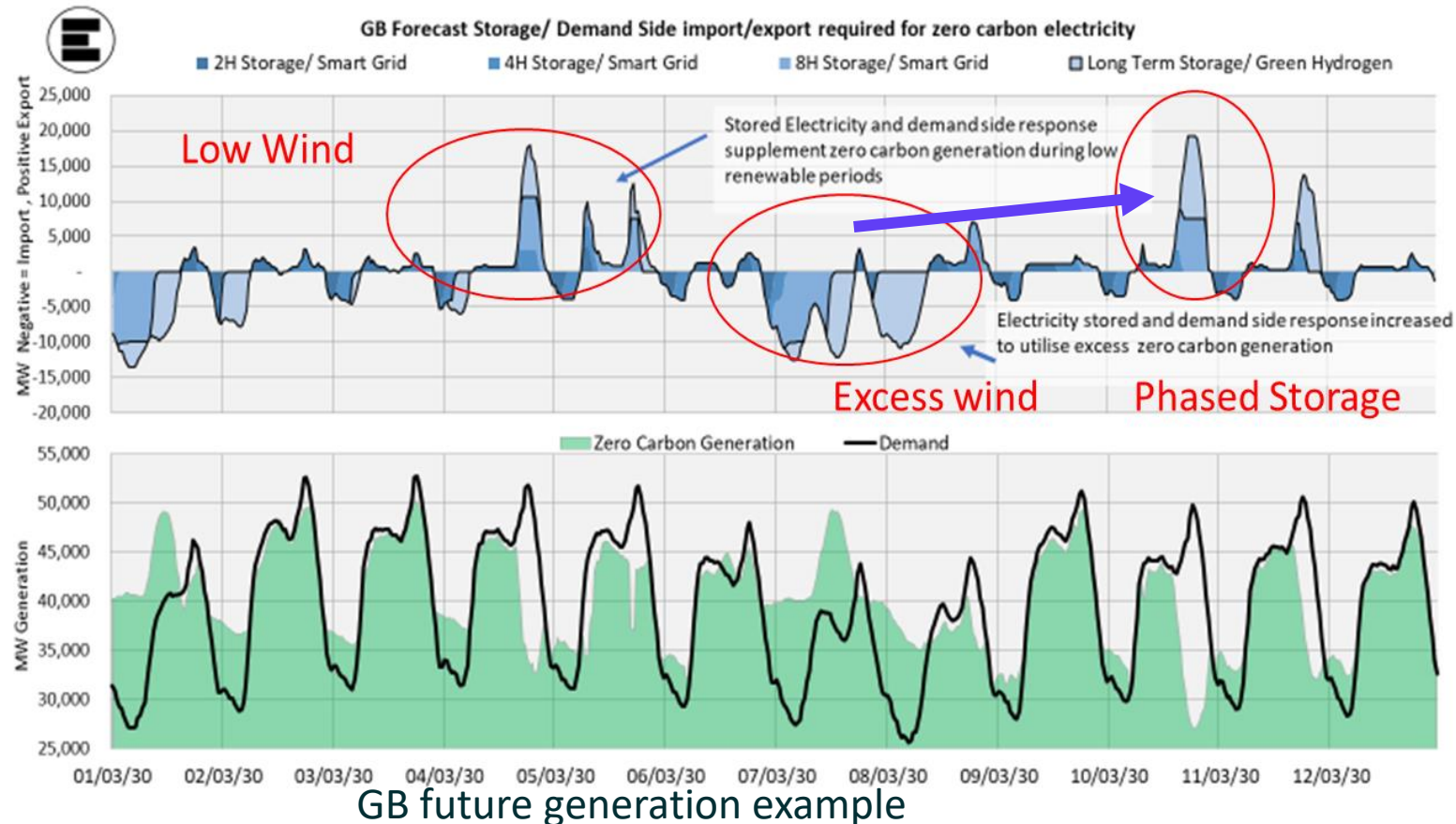
- short and medium term storage becomes depleted
- Even Hydrogen stores may be depleted

A multifuel proven technology can be an integral part of a net zero (and beyond) fuel mix

Renewable developers embracing co-location ... batteries/ solar ..share grid resources

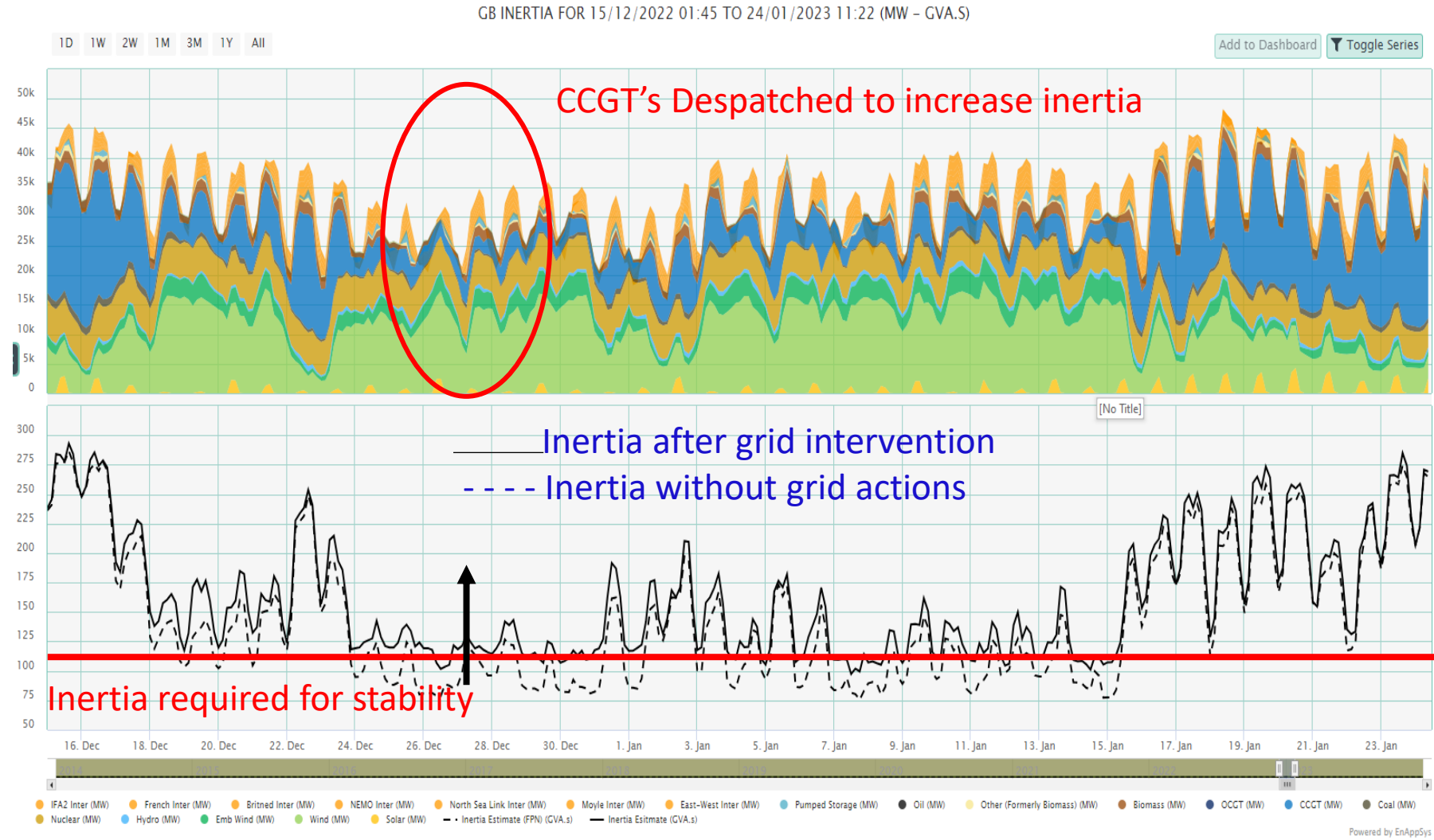
Gas turbine plant...Hybrid ?

Moving Excess power 3 day forward



Gas/Gas Turbines Role in grid stability

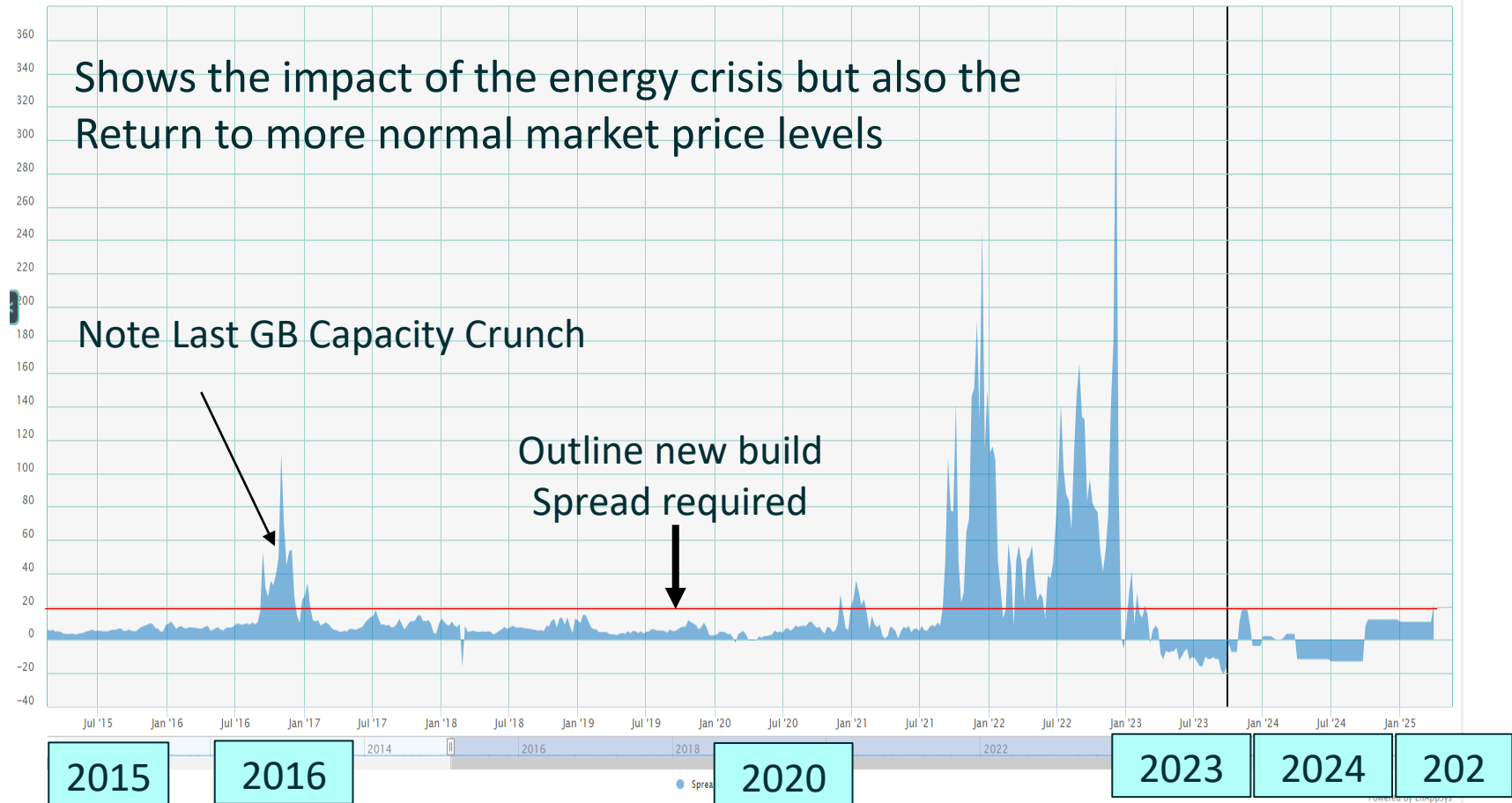
- CCGT/GT's provide significant inertia (and therefore stability) into the system
- TSO's intervene in periods where inertia is low
- TSO's looking to MW less inertia – eg synch condensers / synthetic inertia
- Can new Gas turbine designs / installations provide 'close to ' MW less inertia ????



New Investment / Continued Investment Case Challenge

- Traditionally CCGT/CHP/Gas Generation business cases built on forward base load spark spread curves
- The Chart (peak running spread) shows that a simple business model based on wholesale energy sales won't meet new investment criteria alone
- Investment in existing plant similarly will need different business cases

Example Spark Spread Chart (peak running NOT baseload)



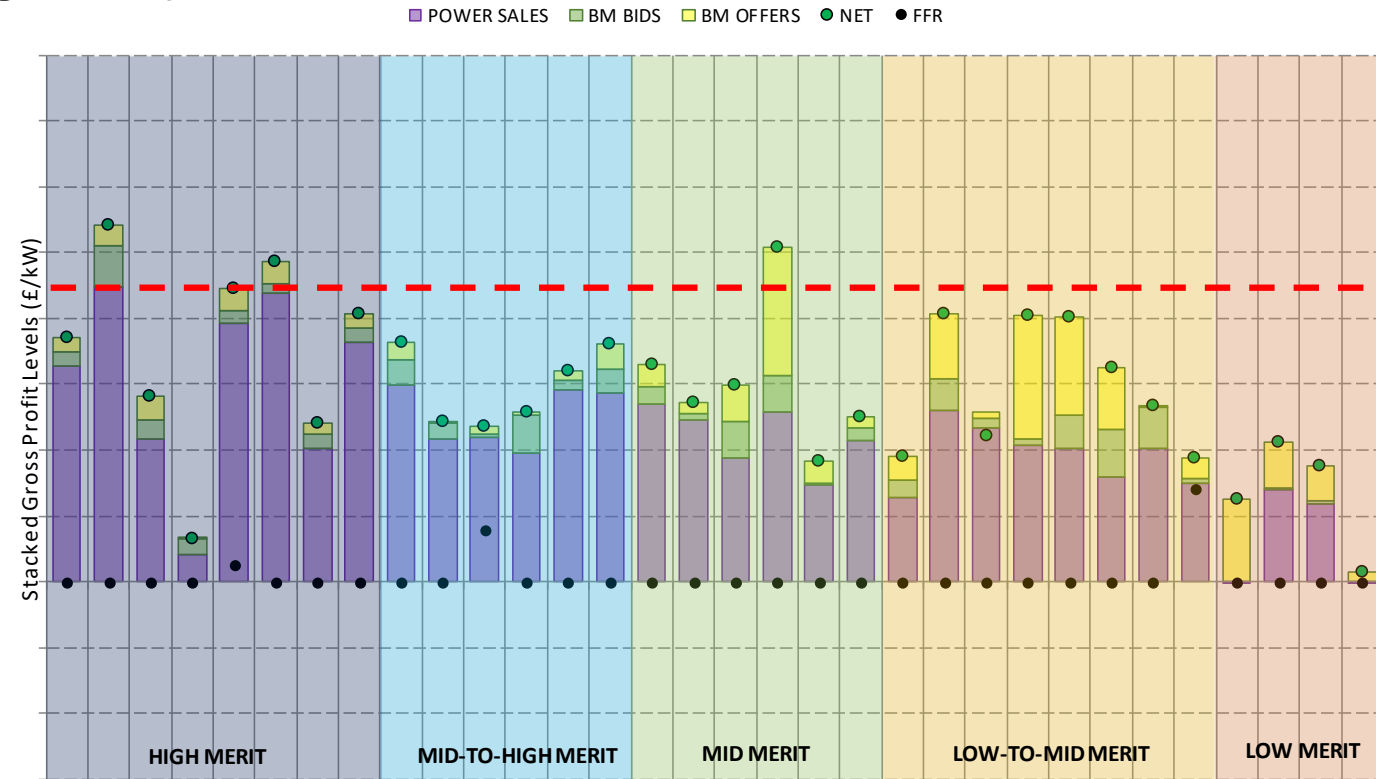
Stacking Revenue

- Wholesale market revenue +
- Balancing +
- Grid Services (ancillary services) +
- Fuel optionality +
- PPA support +
- Capacity mechanisms
(Availability payments by governments for security of supply) + grid services contracts are key

Generation flexibility required to manage asset despatch around negative price periods (and turn into revenue)

EnAppSys

2016/17 CCGT GROSS PROFIT BY SOURCE (£/kW)



Closing

- a. CCGT/OCGT/ Gas Generation is a key part in the energy transition
- b. Building new plants in rapidly decarbonising markets is challenging without some level of government support and a stacked revenue approach
- c. Need to think differently about revenue and operation (build in flexibility, grid services, multifuel)
- d. Consider co-location/ hybrid with “new technologies”
- e. Key advantages of the industry in being part of the long term solution
 - i. Large base built
 - ii. Flexibility for future green gas
 - iii. Adaptable to carbon capture
 - iv. track record of innovation and pushing the boundaries of what is achievable
- f. Industry on all sides to embrace and work with new technologies and new fuels.
- g. Lobby and input into regulatory discussions

Thank You

Need to know more ... please contact us

www.montelgroup.com

www.enappsys.com