@psmonks

New Nuclear and the UK Energy Strategy

Professor Paul Monks

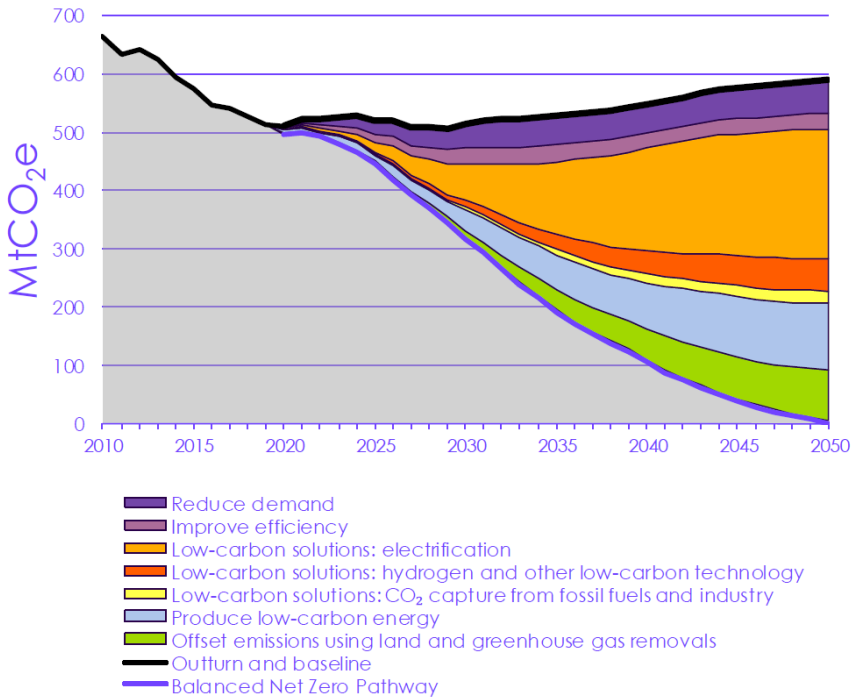
Chief Scientific Adviser,

Department of Business, Energy and Industrial Strategy

How do we achieve Net Zero?

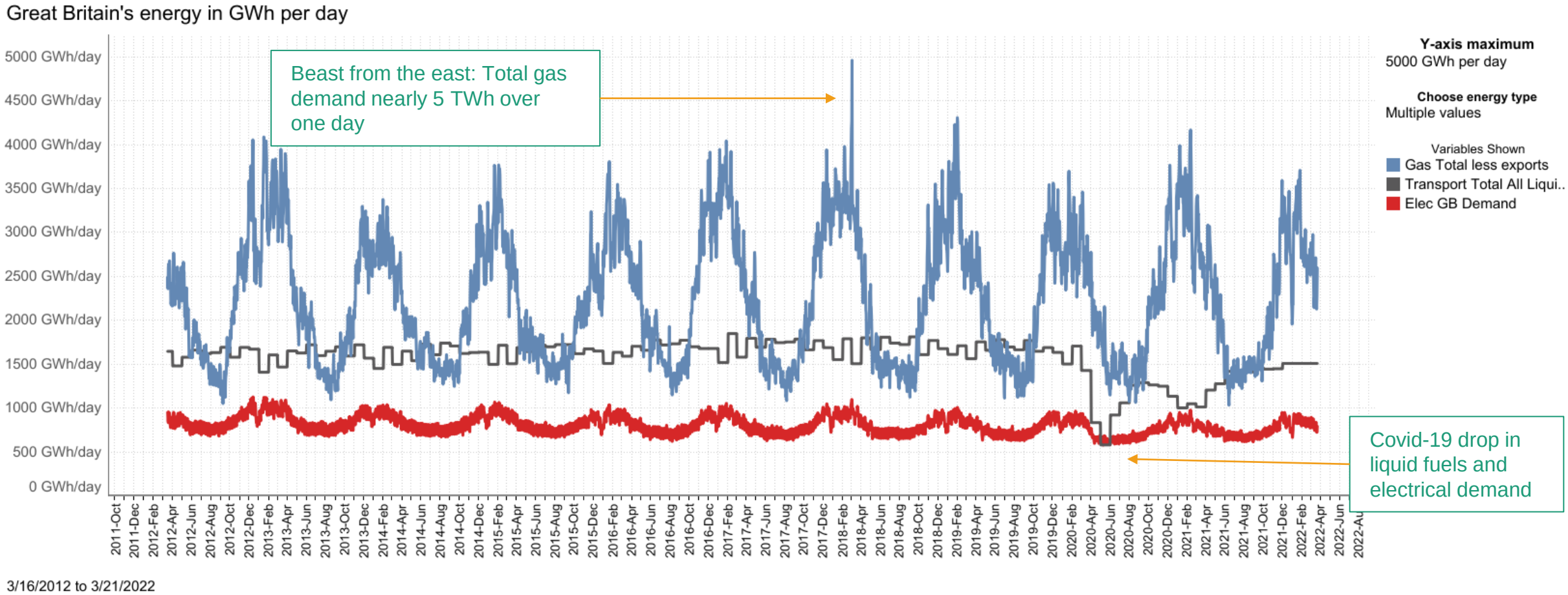
- Reduce Demand
- Improve efficiency
- Low-carbon solutions
  - Electrification
  - H_2
  - CCUS
- Low-carbon energy
- Land-use and GGR

Figure 4 Types of abatement in the Balanced Net Zero Pathway



Source: BEIS (2020) Provisional UK greenhouse gas emissions national statistics 2019; CCC analysis.
Notes: 'Other low-carbon technology' includes use of bioenergy and waste treatment measures.
'Producing low- carbon electricity' requires the use of CCS in electricity generation.

Daily total energy demand



3/16/2012 to 3/21/2022

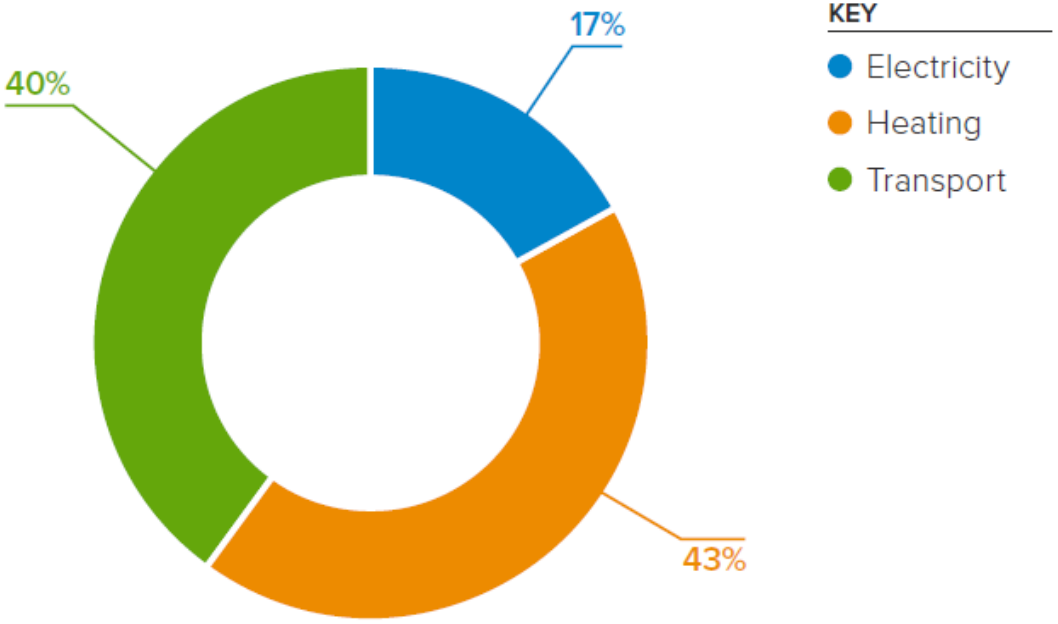
UNIVERSITY OF BIRMINGHAM | BIRMINGHAM ENERGY INSTITUTE

Underlying data are from National Grid, Elexon and BEIS
Figure created by Dr Grant Wilson: i.a.g.wilson@bham.ac.uk
Energy Informatics Group, University of Birmingham

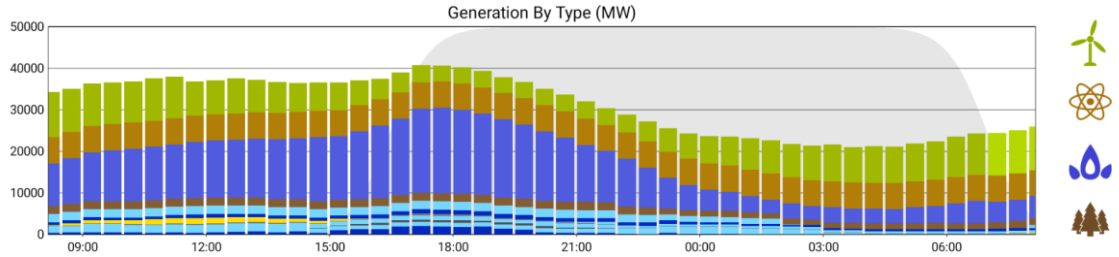
Department for Business, Energy & Industrial Strategy

We need to double electricity generation to meet Net Zero. It needs to be decarbonized, and able to turn on and off quickly.

Current UK energy consumption:

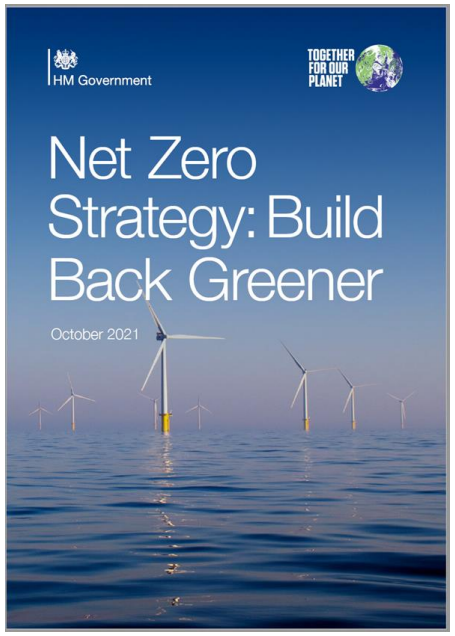


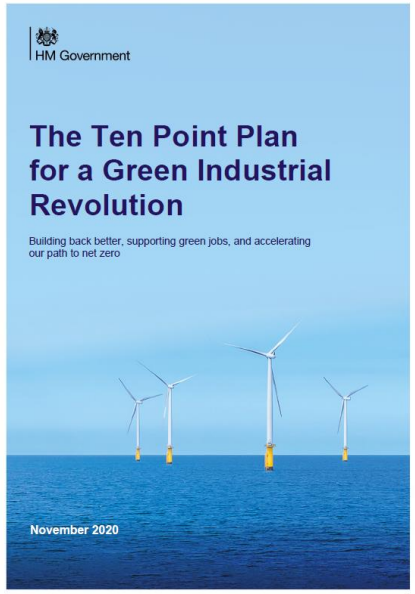
Renewables are intermittent. Today, we manage these fluctuations with gas:

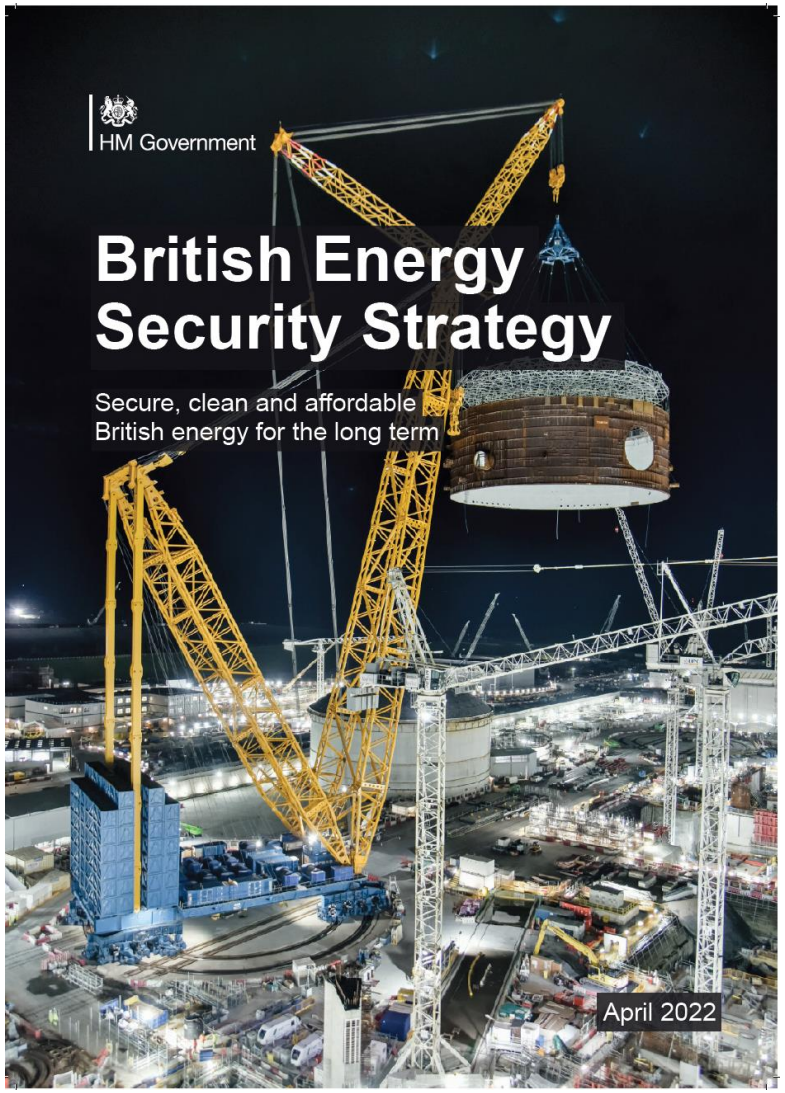


- The cheapest way to ensure we can meet electricity demand in future is to also build a small amount of reliable low carbon power.
- “Gigawatt build” nuclear plants provide baseload contribution (brown above), but do not manage fluctuations well, and cannot be the solution to manage intermittency.
- Gas (blue above) currently manages intermittent fluctuations in electricity demand.

BESS - Builds on both the Prime Minister's
Ten Point plan for a Green Industrial Revolution and the Net Zero Strategy.







Key commitments 1/2

Nuclear

- The strategy will see a significant acceleration of nuclear, **increasing our plans for deployment of civil nuclear to up to 24GW by 2050** – approximately three times more than today and representing **up to 25% of our projected energy demand**.
- A **new government body, Great British Nuclear, will be set up** to bring forward new projects, backed by funding, and we will launch the £120m Future Nuclear Enabling Fund this month.

Offshore wind

- **Increasing the pace of offshore wind deployment by 25%,** delivering up to **50GW by 2030** of which we would like to see **up to 5GW from floating offshore wind** in deeper seas.
- Underpinned by new planning reforms to **cut the approval times for new offshore wind farms from 4 years to 1 year** and an overall streamlining which will radically reduce the time it takes for new projects to reach construction stages

Onshore wind

- Accelerating the deployment of onshore wind
- **Consulting on developing partnerships with a limited number of supportive communities who wish to host new onshore** wind infrastructure in return for guaranteed lower energy bills.

Solar

- We will look to increase the UK's current 14GW of solar capacity **which could grow up to 5 times by 2035, consulting on the rules for solar projects**, particularly on domestic and commercial rooftops.
- Accelerating the deployment of solar technology, while **supporting communities to enjoy the benefits** of hosting them

Key commitments 2/2

Oil and gas

- A **licensing round for new North Sea oil and gas projects** planned to launch in Autumn, with a **new taskforce providing bespoke support to new developments –** recognising the importance of these fuels to the transition and to our energy security, and that producing gas in the UK has a lower carbon footprint than imported from abroad.

Heat pump manufacturing

- We will run a **Heat Pump Investment Accelerator Competition in 2022 worth up to £30 million** to make British heat pumps, which reduce demand for gas.

Hydrogen

- We will aim to double our ambition to **up to 10GW of low carbon hydrogen production capacity by 2030**, with at least **half coming from green hydrogen** and utilising excess offshore wind power to bring down costs.
- **Designing, by 2025, new business models for hydrogen transport and storage infrastructure**, which will be essential to grow the hydrogen economy

Networks, storage and flexibility

- **Establishing the Future System Operator** as soon as practicable.
- Publishing **a strategic framework** this year with Ofgem for how networks will deliver net zero.
- **Appointing an Electricity Networks Commissioner** to advise Government on policies and regulatory changes to accelerate progress on network infrastructure.
- **• Setting out a blueprint for the whole system by the end of 2022** in the Holistic Network Design (HND) and Centralised Strategic Network Plan (CSNP).
- Undertaking a comprehensive **Review of Electricity Market Arrangements in Great Britain**, with high-level options for reform set out this summer.

What are the options for future nuclear generation?

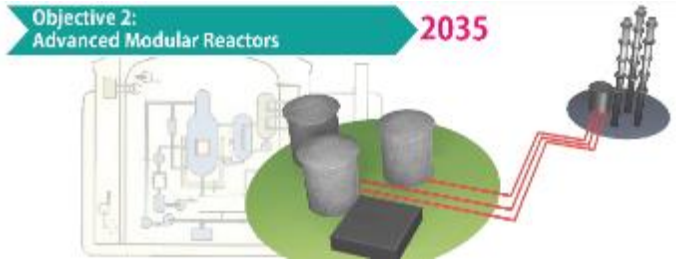
GW production

+

Continues to provide the “stable baseload” electricity requirement

Manages intermittency + some co-generation

+



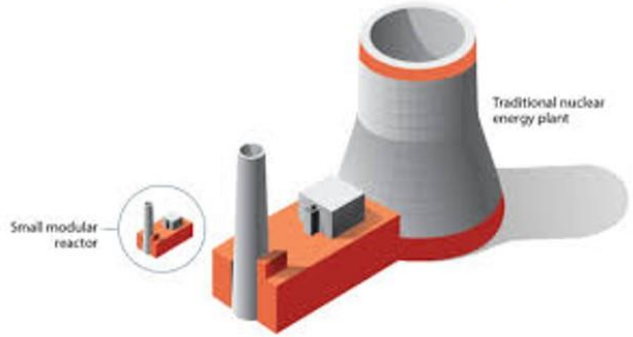
Significant co-generation

SMRs and AMRs – what are they?

Small Modular Reactors (SMRs):

The next generation of current nuclear plants

Smaller than current nuclear plants



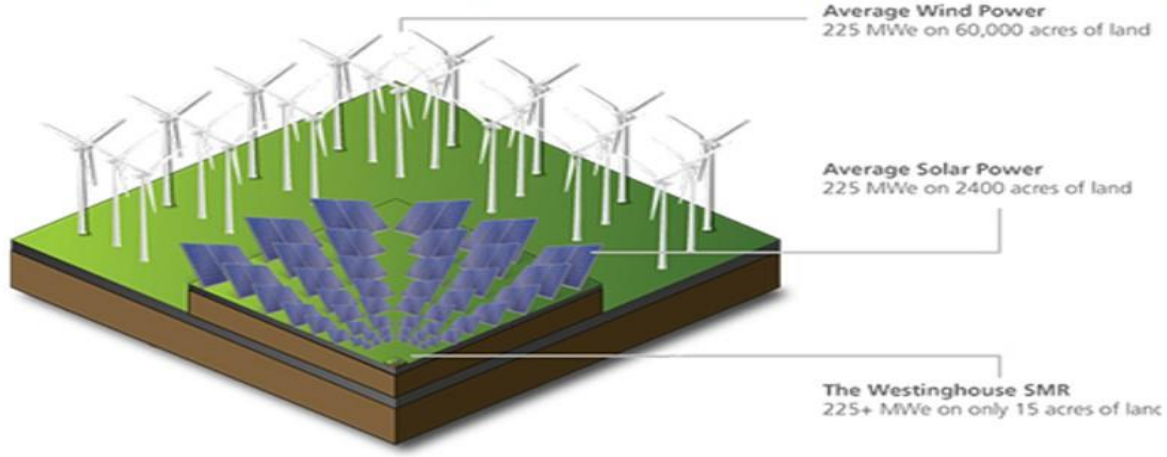
Already being built and there is high confidence they can produce electricity at competitive prices.

Advanced Modular Reactors (AMRs):

A further generation again, using novel fuel types and specifically designed for co-generation

Have been built, but further demonstrators are required to show they can produce electricity at competitive prices.

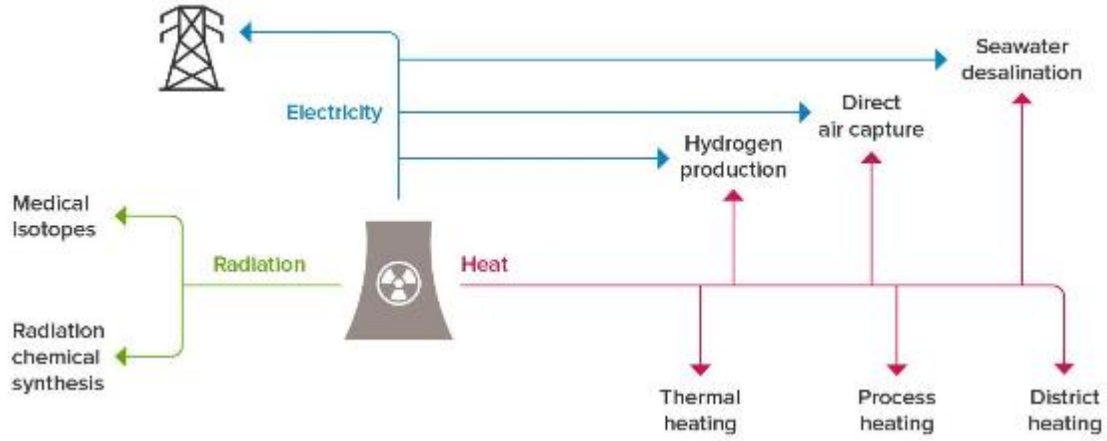
SMRs and AMRs are space-efficient per unit of energy



One advantage of new nuclear is the potential for co-generation to contribute to Net Zero

65% of energy generated by nuclear is lost as "waste heat".

That wasted energy can be utilised: to heat buildings, to support industrial processes, and to create low-carbon fuels, including hydrogen and ammonia.



Current nuclear generation is not designed to utilise waste heat. While current nuclear generation could be used to create low-carbon fuels, this would be inefficient and expensive.

The next generations of nuclear power – Small Modular Reactors ("Generation III") and Advanced Modular Reactors ("Generation IV") – have been designed in part with co-generation in mind.

To meet Net Zero, we require a range of solutions to decarbonising hard-to-reach sectors, including surface transport, aviation and industrial processes.

SMR: The road to AMRs and future production

Why build SMRs?

- Cheaper per unit of energy than GW builds
- Better generation flexibility to meet fluctuating demand than GW builds – important as we increase % renewables in the Grid (Load-following)
- More suited to co-generation (e.g. Hydrogen) than GW
- “Production line” benefits – cost per build, increased engineering expertise
- UK production (potential for export industry)
- Accrues expertise and confidence in UK supply chains ahead of future choices (e.g. AMR scale-up; fusion)
- Exercising UK supply chain so it is fit for AMR build

Why build AMRs?

- Further extend benefits of SMRs.
  - Help with with intermittency
  - UK supply chain (building on SMR)
- Much higher temperature output and therefore:
  - High potential for co-generation of synthetic fuels.
  - More efficient co-generation of hydrogen.
- Link to eventual fusion energy and international partnerships

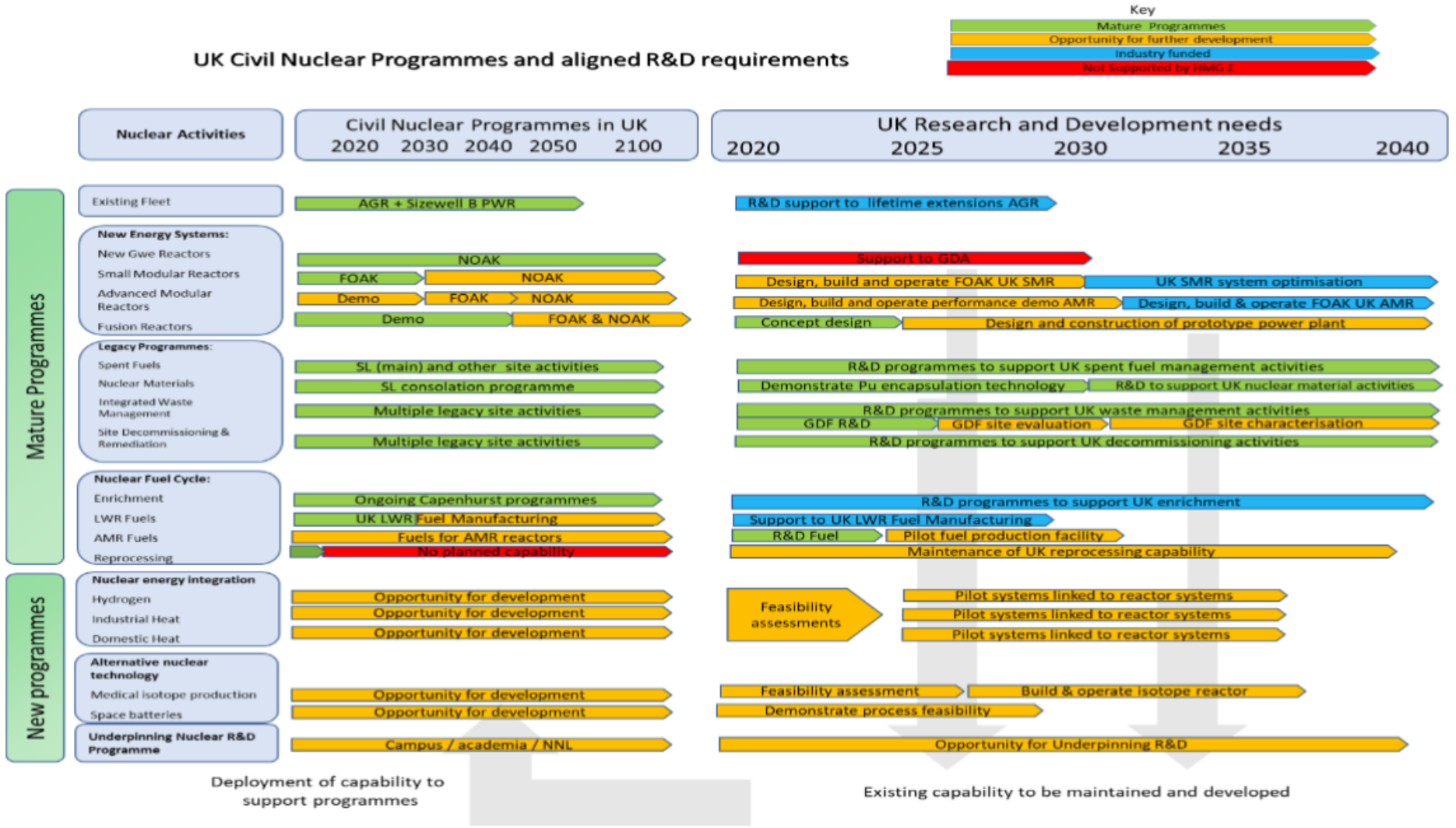


Figure 1-UK Civil Nuclear Programmes and aligned R&D Requirements

Department for Business, Energy & Industrial Strategy

2050 – “A view”

- In 2050 most of our electricity will come from renewables.
- These are by their nature intermittent.
- The cheapest way to ensure we can meet demand is to also build a small amount of reliable low carbon power.
- Nuclear offers a trade-off between capacity (small) and generation (significant).

@psmonks