Consideration of Alternatives in the Rampion 2 Windfarm Examination:

A case-specific policy requirement under NPS (2011) EN-1: Section 4.4 Alternatives; paragraph 5.9.10 under "Development proposed within nationally designated landscapes", and; in paragraph 3.5.6 on national energy priorities.

Written Representation to the Rampion 2 Examination Authority (ExA)
On the Development Consent Order (DCO) Application

Submitted by Protect Coastal Sussex (PCS) in affiliation with community groups and civil society organisations on the Sussex Coast and project affected inland areas

PCS: IP Registration Number: 20044835
Submission Date: 28 Feb 2024

Submitted By:

The Secretary
Protect Coastal Sussex
Member of the Rampion 2 Community Project Liaison Group

On behalf of PCS Co-Chairs

Chris Lee, Aldwick
Melanie Jones, Middleton on Sea
Lawrence Haas, Littlehampton
Meera Smethurst, Cowfold

Preface

This Representation offers information and perspectives to help the Examination Authority (ExA) and Interested Parties (IPs) address the National Policy Statement (NPS) requirement for the consideration of alternatives in the Rampion 2 windfarm Examination.

That is a case-to-case specific requirement because the Rampion 2 infrastructure intrudes on designated landscapes, including the South Downs National Park and areas of Natural Beauty, and it interferes with statutory functions of those designations.

Here we argue for consideration of three viable alternatives for clean, low-emission generation systems that are consistent with the NPS energy policy and otherwise are essential in the drive to decarbonise power supply to the National Grid by 2035.

The purpose of this written representation is threefold.

1. To help respond to the NPS case-specific policy requirement to consider alternatives in the Rampion 2 Examination – in a meaningful way;

2. To help to break down transparently, and benchmark the national benefits and disbenefits of Rampion 2 aiming to inform key judgments the ExA will make on whether "adverse impacts of Rampion 2 outweigh its national benefits"; and

3. To highlight realistic opportunities for a better way forward, should Rampion 2 be refused consent on legal or other grounds, given the importance of decarbonisation of UK power supply in an affordable, realistic and common-sense manner in little over a decade.

This is one of three Written Representations that Protect Coastal Sussex (PCS) is offering to the Examination Authority (ExA) and all stakeholders to help weigh and balance the benefit-risk tradeoffs of the Rampion 2 project.

We sincerely hope the Examination Authority (ExA) can give weight to facts, information and evidence offered herein in its deliberations. And also, that the ExA is open to proactively call for relevant written, or oral expert testimony on Alternatives and for important system value modelling analysis prepared by competent power sector authorities that will add considerable value.

Summary

When weighing up what's more important, our health and physical and mental well-being and nature, or more wind turbines on display in the Sussex Bay inshore, the response many residents and local community organisations have is simple.   But of course, the question is far more complex.

For those who have engaged in the DCO process for Rampion 2, challenging as it was over a 3-year period since early 2021 and during Covid-19 lockdowns, and especially considering the inshore location proposed for up to 90 wind turbine generators (WTGs) up to 325 meters tall, as well as the physical and visual disruption of designated landscapes, our understanding of evidence is that:

1). Rampion 2 would likely breach UK international commitments on landscape /seascape protection and in aligned UK national advice, policy and law;

2). Consenting Rampion 2 means we accept comparatively inefficient infrastructure (or rather an inefficient location for WTGs in terms of wind energy density and output).

3). That has serious opportunity costs, including the requirement to import relatively more expensive and price volatile liquefied natural gas (LNG), which has high carbon emissions in processing and transport, together with more import of costly power from undersea cables from the Continent. That is limited help for UK energy-self reliance; and

4). At the same time, there are practical and viable alternatives for low emission generation to feed the National Grid, which can do more for less money than Rampion 2, among which alternatives the UK Government calls “game changers”.

The consideration of alternatives in the Rampion 2 Examination is a case-specific policy requirement in the NPS (2011), EN-1 Section 4.4 (Alternatives) that is carried forward to the NPS (Nov, 2023), which can be taken into account by the Secretary of State in the Rampion 2 decision.

Our analysis and conclusions offered in this Written Representation are the three alternatives we looked at by applying NPS Section 4.4 Alternatives criteria and offer equal, or more benefit to UK society across most, if not all metrics of national benefit stated in the NPS, including energy security, energy self-reliance and climate change objectives and low emission power.

Nor would consenting Rampion 2 be in the interest of the equitable sharing of benefits and costs in UK society. That is due to uniquely disproportionate effects it would have on coastal and inland communities required to “host” the infrastructure, and thereafter accept the industrial transformation of the character of the area. It impinges on areas of natural beauty, designated landscapes and conservation areas, including the South Downs National Park, that are a high status protected endowment for current and future generations to enjoy and derive intrinsic benefit.

Protect Coastal Sussex (PCS) submitted a written representation on what we see as the adverse local impacts of Rampion 2 in the form of a community-led Local Impact Assessment or (LIA).

In that LIA, we also set out how we believe the Rampion 2 design challenges the interpretation of the European Convention on Landscapes (ECL). We understand the ECL is already interpreted by the UK Government's own Offshore Energy SEA (OESEA) as the strategic environmental advice for the visual buffers it offers, and which we understand apply to Rampion 2.   The commercial Applicant has argued quite vigorously otherwise.

In this respect, the OESEA-4 clearly states that the UK's objectives and indicators for seascape / landscape protection include:

- *"Objective: To accord with and contribute to the delivery of the aims and articles of the European Landscape Convention and minimise significant adverse impact on seascape/landscape including designated and non-designated areas".*

This companion PCS written representation focuses on three alternatives for low emission generation that are fundamentally important to decarbonise UK power supply by 2035 as stated in the NPS. Otherwise, we believe it is reasonable to take a close look at alternatives when considering whether to grant consent for a £3-4 billion infrastructure investment, one that has such significant economic and environmental opportunity costs as Rampion 2.

Moreover, as the analysis of the former Business, Energy and Industrial Strategy (BEIS) group noted:

> ***"Clearly there are choices within the future electricity system pathway over which technologies to build, when to build them, and how to operate them."***
>
> Source: Electricity Networks Strategic Framework: Enabling a secure, net zero energy system, Department of Business, Energy and Industrial Strategy, August 2022

We thus offer a simple benchmarking and ranking exercise as a way to help break down and compare national benefits and disbenefits of Rampion 2. That is in summary form here and in more detail in the main representation.

As noted in relevant representations that were previously submitted in Nov 2023, we also believe it is important for the ExA to proactively invite expert testimony on the consideration of alternatives in this Examination, as is provided in Planning Act Guidance on calling expert witnesses.[1]

Moreover, given the UK is at a crossroads, and feeling its way forward given that changes in policy recently, and with £3-4 billion at stake, we feel this is a timely opportunity for PINs and DESNZ together with the relevant power authorities (e.g. Ofgem) to undertake power system modelling analysis expeditiously to support the ExA in this task and inform this Examination.

We identified three alternatives to consider based on conformance to NPS requirements (as in Annex 2 of this Representation). Additionally, the NPS guidance we assumed is:

i. NPS 2011, para 3.5.6, *"New nuclear power therefore forms one of the three key elements of the Government's strategy for moving towards a decarbonised, diverse electricity sector by 2050: (i)I renewables; (ii) fossil fuels with carbon capture and storage (CCS); and (iii) new nuclear".*

[1] Here we note the PA (2008) Procedure Rules allow," the Examining Authority to call expert witnesses to give evidence on specific points at hearings. They may also consider requests from the applicant and other interested parties to call expert witnesses in support of representations they make about the application."
Reference: Planning Act 2008: Guidance for the examination of applications for development consent", DCLG, 2015. Thus we remain hopeful the ExA may reconsider any decision not to invite, pursue or allow relevant expert witnesses in the Examination.
https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/418015/examinations_guidance-__final_for_publication.pdf

ii. NPS (Nov, 2023) which designates each of the three alternatives that we consider to be Critical National Priorities (CNP), namely: in addition to offshore wind, carbon abated gas-fired power stations that are NetZero ready, and new nuclear, where we emphasize small modular reactors (SMR) for obvious reasons explained in the main representation.

The Section 4.4 requirements state that the alternatives must be a realistic opportunity for the UK, and otherwise offer equal or greater national benefits as Rampion 2 over its economic life (roughly 2030 to 2050), and especially to support the ambition of decarbonisation of power supply to the National Grid by 2035 which among all the technology specific targets we see is most important and meaningful to focus on.

Consideration of Alternatives

These alternatives also conform to what Ofgem calls "least regret" choices, as they are wholly consistent with technology specific NPS. They include:

Alternative 1

Rather than extending the Rampion 1 installation, extend a recent licence award for an offshore windfarm in the North Sea area.

Specifically, facilitate incremental investment in an equivalent number of wind turbines (as proposed for Rampion 2) in southern Dogger Bank area where the Rampion 2 developer RWE has recently acquired two licences under the Crown Estate's fourth offshore wind bid round in Jan 2023. RWE only confirmed in Sept 2023 that it would proceed, when the UK increased the Contract for Differences (CfD subsidy) for offshore wind developers by up to 66%.

That reasonably re-directs £3-4nb of foreign capital investment to an area of higher wind power density, where the same Rampion 2 turbines would be more efficient; generating higher and more constant output. That affords the opportunity to take advantage of economies of scale with shared facilities like offshore substations, power evacuation cables and National Grid transmission connection to reduce costs. That reduces opportunity cost in the system (less costly LNG import) and can free up UK borrowing capacity for other strategic infrastructure. That also offers greater scope for 2-way power exchange with the continent and access to an offshore ring grid.

Those new North Sea projects are due to be completed around 2030 (about the same as Rampion 2). They are still in very preliminary stages of project preparation and design. It is a situation where good-faith negotiations can take place between the relevant parties (i.e., Crown Estates and RWE) with outcomes that are mutually beneficial for RWE and UK society.

Alternative 2:

Retrofit existing and new high efficiency combined cycle gas-fired turbines (CCGT) with carbon capture (CC) on the south coast near load centres in a sensible phased manner.

Putting carbon capture (CC) on existing and new gas-fired power stations to make them net-Zero ready as they will have no carbon emissions. New combustion turbines alongside existing turbines in power stations to extend their capacity, or a new gas power station fitted with carbon capture on the same site or new site can also be multi-fuel (i.e., and hydrogen ready).

This makes them NetZero as point source emitters for the 2035 decarbonisation drive. Locating that dependable and flexible abated gas generation capacity in the south of England minimises costs where grid connection and gas supply infrastructure are available. That reduces pressure on the need for infrastructure for north south power transfers. CO2 storage would initially be handled by barge transport to one of three offshore carbon storage “clusters” the UK is to have ready by 2030, and thereafter flexibly phasing in CCUS (carbon capture, use and storage) as appropriate.

The approach is based the Net Zero Teesside Power (NZT Power)) 850 MW abated gas-fired project consented by the Secretary of State in February 2024. It is all existing and proven technology. The final investment decision will be taken by the owners in Sept 2023. The project is expected to be online in the 2026-2028 timeframe.[2]

The south has many efficient combined cycle gas turbine (CCGT) power stations where it is likely additional CCGT capacity can be added to existing power stations with carbon abatement, or building a new power station on the same site with carbon capture that will provide essential firm power to help meet mandated load growth and back-up variable RE generation. It will take time pressure off the costly north-south transmission expansion, and improve system flexibility for load balancing to reduce the risks of societal disruption from costly power shortages and blackouts across the south. The point is all UK gas-fired power stations must have carbon capture by 2035.

Alternative 3:

Deployment of factory built, flexible Small Modular Reactors (SMRs) that use enriched uranium or thorium to raise steam to drive steam turbines. SMRs have a small footprint. They are to be co-located appropriately at decommissioned large nuclear sites, existing or under construction large nuclear power stations, or decommissioned coal or gas power stations.

While the new UK entity Great British Nuclear (GBN) opted for a competition between UK and international/ national supplies and expects to announce winning bids by April 2023, Rolls-Royce has a 470 MW modular, factory-built commercial power SMR that up-scales its military reactors that it has been manufacturing and maintaining for over 60 years.

In February 2024 Rolls Royce announced it aims to have its civilian SMR operational by 2029 in Eastern Europe based on memorandum of understanding with a number of Governments, after previously announcing it has provisional orders and financing.

[2] https://www.bp.com/en_gb/united-kingdom/home/news/press-releases/net-zero-teesside-power-and-northern-endurance-partnership-award.html

The UK Government' Great British Nuclear (GBN) was established in 2023 with the following mandate: [3]

> - Great British Nuclear to drive rapid expansion of nuclear power at an unprecedented scale and pace
> - government kickstarts competition for game-changing small modular reactor (SMR) technology, which could result in billions of pounds of public and private sector investment in SMR projects
> - plans will boost energy security, create cheaper power and grow the economy - creating better-paid jobs and opportunity right across the country

Comparison of National Benefits and Disbenefits

Table 1 at the end of this Summary is a check list and simple benchmarking and ranking exercise as a way to help break down and compare national benefits and disbenefits of Rampion 2 and weigh those against the three alternatives.

Table 1 shows the raw aggregate score for **12 NPS Policy-Relevant National Benefit Indicators** where the score shown is simply the sum of the scores for each criteria under each indicator. There are a different number of criteria under each indicator (criteria are scored 1 to 4).

This is elaborated and explained in the main representation in Section 4 Conclusions. In Table 6 on Section 4 all the detailed criteria and the scores are shown.

In the absence of systems value modelling (we argue this should be undertaken to inform the Examinations) this is a fall-back technique that uses Rampion 2 as a baseline to rank order the four options, thus qualitatively benchmarking Rampion 2 against the three alternatives.[4]

Obviously, there are limitations and complexities. These indicators aim to help make the determination of essential NPS policy interpretations less subjective, more transparent and clearer. In applying this technique people or groups may wish to chose different indicators and criteria and apply weights them. We simply assume using the same weight on each Indicator and criteria.

It informs the Section 4.4, EN-1 policy requirement as well as how national benefits may be weighed in the Examination "on adverse impacts of Rampion 2 outweighing its benefits".

Summary Conclusions:

Considering Alternatives under NPS EN-1 Section 4.4 is helpful to break down and benchmark the national benefits of Rampion 2 to inform Examination decisions about Rampion 2, for the three purposes set out in the Preface of this Representation.

Rampion 2 has national benefits.

Our simple benchmarking and rating analysis results shown in Table 1 indicates that all three alternatives offer a better way forward than Rampion 2, in respect to national benefits overall. It suggests they are in the local, national and wider public interest as compared to a £3-4 billion capital

[3] https://www.gov.uk/government/news/british-nuclear-revival-to-move-towards-energy-independence
[4] This weighting, rating and ranking technique is recommended in the World Commission on Dams for the consideration of Alternatives as a Strategic Priority which the UK government co-funded (WCD, 2000).

investment in Rampion 2. The alternatives do not have the same high economic and environmental opportunity costs and risk as Rampion 2.

Extending an existing offshore wind licence on Dogger Bank would for example lead to 1.3 times the national benefit than granting consent to a £3-4 billion Rampion 2. That would be at less cost. The economic opportunity cost of Rampion 2 could be quantified via power system value modelling. For these assumptions as set out in the main submission in Part 4 Alternative 3, and SMRs could lead to twice the national benefit.

The method and assumptions used for the benchmarking, the 12 national policy indicators used to break down National Benefits, and the detailed criteria and scoring is elaborated in Part 4 of the main representation. That includes the detail matrix presented as Table 6 of Part 4.

In summary

Rampion 2 and three NPS Section 4.4 Alternatives	**Benchmarking Indicator score (high being better)**	**Relative to Rampion 2**
Rampion 2 – the Baseline Extending the installation of turbines in the Sussex Bay with up to 90 WTGs up to 325m tall and transmission through designated landscapes	115	1.0
Alternative 1: Extending an existing Dogger Bank windfarm licence with equivalent capacity (up to 90 WTGs up to 325m tall) where they are more efficient, economies of scale and potentially link to an offshore ring grid to minimise onshore transmission and better facilitate connection to EU grids.	156	1.4
Alternative 2: Retrofitting an existing natural gas-fired power station with carbon capture (CCGT/CC) and adding a Rampion 2 equivalent new capacity at that site (or replacement power starting with CC, or a new power station with carbon capture in the south with multi-fuel capability to switch hydrogen when ready.	201	1.7
Alternative 3: A Small Modular Reactor (SMR) (located in decommissioned large nuclear site (or existing / under construction site) or decommissioned coal-fired or gas-fired power station sites)	236	2.1
For assumptions noted and policy relevant criteria indicated in Part 4 and Table 6 in Part 4		

It also raises a simple question: at least to 2035, when decarbonisation of the power sector is hopefully achieved and until energy storage systems are viable, affordable and deployed at scale some decades later: which is more environmental friendly and helpful for National Energy Security and UK energy-self reliance: (a) if the UK sources natural gas domestically from the North Sea fields, or (b) imports liquefied natural gas (LNG) transported over great distance from Qatar or the USA in the form of price vulnerable LNG.

That choice of (a) or (b) has real carbon emission implications, and whether those emissions appear in the UK's national carbon accounts or not.

An optimal "least regret" strategy can be highlighted when Alternatives are brought into Rampion 2 Examination. That may be for the UK to move in parallel with all three alternatives as complementary additions to the UK generation mix to achieve decarbonisation of the power sector by 2035 – rather than committing to an upfront £3-4 bn Rampion 2 capital investment at this time - is suggested by this analysis.[5]

[5] Ofgem 2021 strategic review of power system endorses a "least regrets" strategy.

Table 1: Benchmarking National Benefits of Rampion 2 against realistic Alternatives

		Baseline	Three NPS EN-1 Section 4.4 Alternatives		
	Criteria and National Benefit / Disbenefit Indicators	**Rampion 2 (Sussex Bay inshore & transmission via a SDNP route)**	**Wind Turbines extending Dogger Bank Licence**	**Abated Gas Turbines with carbon capture (CCGT/CC) In South UK**	**Small Modular Reactors (SMR) (in decommissioned Large nuclear sites or decommissioned coal or gas sites)**
	Date Ready to deliver power	~2030	Possible Before 2030	Possible Before 2030	Possible Before 2030 Policy Dependent
	Average annual plant factor	37-40%	60-65%	100% on demand	95% always on expected
		Both weather dependent			
	Estimate build time (years)	4-5 yrs	4-5 yrs	1-4 yrs for CCGT/CC	2-3 yrs is claimed
	Economic Life	20-25 yrs		Longer than Rampion 2	60+ yrs Expected
	Capital Cost (per project)	£3-4 bn	Depends on infrastructure sharing	Location specific CCGT has low capital costs	£2-2.5 bn claims
	12 NPS Policy-Relevant Indicators				
1	Likely contribution to decarbonisation of the UK Power Sector by 2035:	5	9	13	16
2	Likely contribution to UK Energy Security and Energy Self-reliance:	10	13	14	22
3	Effects on National Grid operation, quality and reliability of power supply:	**9**	**15**	**28**	**34**
4	Affordability Effects (National to Local):	**8**	**11**	**20**	**24**
5	Project Financability, Investability and Market Risk:	**16**	**16**	**16**	**17**
6	Job Creation Opportunity and Benefits (Local to National):	**7**	**7**	**16**	**22**
7	UK Industry Strategy, UK export and UK developing country assistance: Opportunity and Benefits	**4**	**4**	**12**	**16**
8	Adverse Environmental Footprint and Impacts:	**24**	**28**	**26**	**27**
9	Environmental Externalities:	**12**	**12**	**9**	**10**
10	Avoidance of compromising the achievement of sustainable development in coastal and inland areas	**8**	**19**	**20**	**20**
11	Distribution and Equity Effects (national to local)	**4**	**9**	**8**	**8**
12	Lowering Opportunity Costs: Economic, social and environment opportunities forgone	**8**	**13**	**19**	**20**
	Total Count (Un weighted)	**115**	**156**	**201**	**236**

Main Representation

Many people in our communities believe that Rampion 2 turbines are simply in the wrong place for infrastructure of this scale and nature. Stakeholders including elected MPs and community organisations constructively engaging with this DCO process in good faith stated so during the commercial developer's statutory pre-application consultations.

This view is: locating the same wind turbine generators (WTGs) as proposed for the Sussex Bay inshore (up to 90 WTGs up to 325m) in higher and steadier wind regimes would be massively in the local and national interest.

Concerns extend to the adverse impacts of the whole development with the transmission route interrupting protected designated landscapes and local communities disproportionately.

As one of our area Members of Parliament stated clearly during statutory consultations in 2021: [6]

"…. This stretch of the West Sussex coastline is an inappropriate location for such a large wind farm. The English Channel is too narrow to enable the turbines to be positioned far enough out to sea to be acceptable. This proposal does not, therefore, comply with the Government's recommendations for offshore wind farms of this size."

Moving the turbines to a location where they are efficient is not only value for money, that step along with rapidly deploying complementary low-emission generation is essential to provide dependable, affordable and reliable power supply and decarbonise by 2035. [7]

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This Written Representation is in 4 Parts:

- Part 1. The NPS requirement to consider alternatives in the Rampion 2 Examination
- Part 2. Three reasonable and practical alternatives to Rampion 2
- Part 3. Comparison of alternatives and Rampion 2: in respect of national benefits/disbenefits
- Part 4. Conclusions

We include Annexes with additional information and evidence to support our views. Annex 2 is a NPS Tracking Note on relevant NPS (EN-1, 2011) requirements on assessing Alternatives.

Annex 2 indicates how we feel relevant NPS policy may be interpreted on this issue, on a case-specific basis. Other Annexes offer policy background information and context for the three alternatives considered and elaborate on the opportunities they offer UK society.

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[6] Statement by the Rt Hon Nick Gibb MP for Bognor Regis & Littlehampton at the 24 August 2021 public community led public consultation in Littlehampton that included, "… I support the Government's aim for the UK to be a world leader in renewable energy and the Government's ambitious programme to tackle climate change, but this stretch of the West Sussex coastline is an inappropriate location for such a large wind farm."
[7] There was no mention of alternatives to Rampion 2 that we proposed in the Applicant's Report on Consultations submitted with the Application in August 2023.

PART 1: THE NPS REQUIREMENT TO CONSIDER ALTERNATIVES

The case-specific policy requirement to consider alternatives in Rampion 2 Examination is triggered because Rampion 2 would interfere with the South Downs National Park (SDNP) and other designated landscapes.[8]

Specifically, under the NPS (2011) in the section on:

"**Developments Proposed within Designated Landscapes**":

- EN-1 (2011) paragraph 5.9.10, stats that government,"*… may grant development consent in these areas in exceptional circumstances. The development should be demonstrated to be in the public interest* ***<u>and</u>*** *consideration of such applications* ***<u>should include assessment</u>*** *of:*
  - *the cost of, and scope for, developing all or part of the development elsewhere outside the designated area,* ***<u>or meeting the need for it in some other way</u>****, taking account of the policy on Alternatives set out in Section 4.4;"* Our underlining.
- The South Downs National Park (SDNP) Authority objected to Rampion 2 on multiple grounds. In its Principal Areas of Disagreement (PAD) Statement, Nov 2023, the SDNP Authority states, *"… It is therefore the case that this 'test' of the National Policy Statement EN-1 paragraph 5.9.10 has not been met."*
- The revised NPS (Nov, 2023) maintain the same requirement to consider alternatives in Examination of DCO applications that encroach National Parks, and states further that the views of the Boards responsible for National Parks, (i.e., the views of the SDNP Authority on Rampion 2 in this case) *"… should be given substantial weight by the Secretary of State in deciding on applications for development consent in these areas".*

  NPS (2011) EN-1, in Part 4.4 Section on Alternatives state:
  - Para (4.4.3) *"The consideration of alternatives in order to comply with policy requirements should be carried out in a proportionate manner*" and "*only alternatives that can meet the objectives of the proposed development need to be considered*."
  - "*The Secretary of State should be guided in considering alternative proposals by whether there is a realistic prospect of the alternative delivering the same infrastructure capacity (including energy security, climate change, and other environmental benefits) in the same timescale as the proposed development*".
- Otherwise, we noted that the consideration of alternatives in the Rampion 2 Examination applies and complies with all stipulations in NPS (2011) under Part 4.4 Alternatives and similarly NPS (2023, proposed) namely policy conditions in EN-1 paras 4.2.21 through 4.2.29.
- For example, alternatives can be demonstrated as having been proposed in the statutory pre-Application consultations. [9]

In sum, there is a clear policy requirement for the Rampion 2 Examination to consider alternatives for low-emission bulk power supply and it is in the public interest to do so. [10]

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[8] Setting aside concerns that Rampion 2 is likely in breach of the European Convention on Landscapes and aligned UK policy and law, as we believe is interpreted by OESEA-4,

[9] Where there was no mention of that in the Applicant's Consultation Report filed along with the Application 10 August 2023. NPS (2011) EN-1 para 4.4.3 concludes, "Therefore where an alternative is first put forward by a third party after an application has been made, the IPC may place the onus on the person proposing the alternative to provide the evidence for its suitability as such and the IPC should not necessarily expect the applicant to have assessed it."

[10] The importance and relevance of this issue was reinforced by the High Court Decisions on NSIPs (Energy) in January 2023 to dismiss a DCO decision where alternatives were not properly taken into account.

PART 2: THREE REASONABLE AND PRACTICAL ALTERNATIVES

We highlight three alternatives that conform to NPS that offer equivalent, or greater national benefit over the expected economic life of Rampion 2, without being unlawful, or as we argue without having the same ecological, physical and social footprints as Rampion 2.

These are realistic alternatives that accord with NPS, which in addition re location of WTGs of the scale or Rampion 2, include small modular reactors (SMR) driving steam turbines, and the abatement of emissions from new and existing conventional gas-fired power stations (high efficiency combined cycle gas turbines (CCGT), which would be NetZero ready as well as hydrogen ready).

Presently about 32 gas-fired power stations (CCGT) form the bulk of the UK's flexible generation capacity and assets today. In conjunction with the phased, but urgent retrofit with carbon capture and storage, they are realistic alternatives along with extending the capacity of these power stations with additional turbines or new carbon abated gas power station.[11] The former may be preferred as it highly cost effective (subject to confirmation by routine power system value modelling analysis where this would all be routinely quantified).

And as the NPS indicate, eventually abated natural gas-fired power stations can be fed by green hydrogen in those same turbines (once hydrogen electrolysis technology and hydrogen storage is sorted); and to the extent that other utility-scale energy storage systems become viable and affordable as part of the UK power supply mix.

In this Representation we do not look at solar, either as a single "project" to install many small rooftop solar panels, or multiple utility-scale solar plants on land, nor at other potential renewable energy sources such as tidal, wave, ocean thermal and biomass combustion.

That is for one or more of three reasons relating to the NPS EN-1 Section 4.4 criteria, including: (i) there are not of the same quantum of electricity as Rampion 2 or the alternations that we do consider for bulk power supply, or sufficiently similar, (ii) the commercial development status is not ready, or (iii) the timeframe for deployment is well beyond 2035, such as tidal power.

National efforts are underway to advance other renewable and low-emission generation technologies along the research, development, demonstration and deployment path that will play an important role in the UK's future electricity generation mix. [12]

Additionally consideration may be give to the interconnect with France where a Judicial Review in January 2023 overturned a decision to refuse consent on the Aquind Ltd proposal to lay cables through Portsmouth, Hampshire, to Normandy. [13]

We elaborate on the three alternatives (each technology now designated as a critical national priority) as input to the NPS Section 4.4 requirement for the consideration of Alternatives in the Rampion 2 Examination, as follows.

[11] Nor have we looked at utility-scale storage for similar reasons as there are also unresolved supply chain issues and security of supply and environmental issues associated with for example the mining the rare earths and critical minerals needed for those options such a utility scale lithium battery "farms".
[12] There are also opportunities on the electricity end-use or demand-side to respond to intermittent renewable energy supply and improve end-use efficiency thus reducing the need and cost of electricity supply.
[13] https://www.bbc.co.uk/news/uk-politics-64388577

- ☐ **ALTERNATIVE 1**

  Instead of extending the existing Rampion 2 installation which poses significant challenges and opportunity costs, granting an extension to an existing developer's license in southern North Sea area, which has more efficient and favourable wind regimes.

  Specifically, one approach would be to facilitate investment in wind turbines in the North Sea where the same Rampion 2 developer (RWE) has recently acquired two licences under the Crown Estate's seabed leasing Round 4 that concluded in January 2023: Dogger Bank South (West) and Dogger Bank South (East) each to install turbines up to 1.5 GW for a total of 3 GW.

  As noted in the Summary, RWE only confirmed in Sept 2023 that it would proceed with these two projects, when the UK Government increased the Contract for Differences payments and subsidy (the CfD subsidy) for offshore wind developers by up to 66%.

  That would reasonably re-direct £3-4nb of foreign investment to an area of higher wind power density, where the same Rampion 2 turbines would be more efficient, generating higher and more constant output and be lawful. It would enjoy public support and be massively in the public interest – in our view and simple analysis.

- **Illustrative Features:**
  - Locates Rampion 2 turbines in higher wind regimes in the shallow offshore designated Renewable Energy Zone (REZ) on the southern North Sea, so the WTGs more efficient and there is better value for money;
  - For potentially the same £3-4 billion development cost - possibly lower through economies of scale;
  - Obviously this requires political will and constructive collaboration to achieve a negotiated outcome between Crown Estates, DESNZ and RWE and other relevant interests such as PINs.
  - In theory this may be can be linked to smaller Rampion 2 (within-Project Alternative where some turbines where feasible to integrate in the existing Rampion and the balance of WTGs installed in the new RWE concession areas on Dogger Bank and utilisation of the existing Rampion 1 transmission corridor or ROW. [14]

- **Comparative advantages over consenting a £3-4 bn spend on Rampion 2**
  - Higher efficiency, higher capacity factor, steadier and greater power output (see tables that follow in Part 3).
  - Greater scope for emission reductions to 2035, after which time the UK power system will be decarbonised (after 2035 Rampion 2 and all new windfarms would compete with compete with other low-emission generation on other attributes, until hydrogen storage is viable and scalable).

[14] Would have to overcome bottlenecks in the existing ROW where there may be bottlenecks in housing areas using horizontal drilling that RWE representatives were adamant about as not being feasible when that alternative was raised verbally in formal consultations at the pre-application stage at the Littlehampton Yacht club.

- Lower opportunity costs compared to Rampion 2 including in economic and environment terms: e.g.
    - Reduction in costly price-volatile imported LNG such as currently from Qatar and the USA each with threats to Energy Security.
    - Reduction in costly power imports via undersea power cables from the Continent, where the UK pays a heavy premium for imported power.
    - EU states trade power to cover UK supply imbalance at far lower rates.
- This Alternative eliminates the high risk of undermining sustainable development on the south coast of England and disproportionate impacts on coastal and inland communities that Rampion 2 poses.
- It respects the European Convention on Landscapes (ECL) and UK commitments as interpreted by OESEA visual buffers to conform to the ECL and aligned UK policy (OESEA-4 strategic advice).
- Would have greater community and public acceptance across the UK, especially if the alternative is linked to reduce UK power cable landings and transmission to connect to National Grid substations.

▪ Other Potential Synergies:

- Ties into the proposed offshore ring grid infrastructure opportunity in the North Sea to facilitate greater two-way power trading between the UK as inter-linked Continental power systems beneficial to UK interests.
- Potentially, exploits scope to reduce capital cost linking to RWE's Dogger Bank schemes with sharing facilities and incrementally increasing capacity (via economies of scale) plus reduced transmission.
- Capital savings may more than offset incremental costs of the north-south transmission to move power to the southern power loads.

Figure 1 below shows a preferred location alternative in the North Sea which is the Offshore Wind Leasing Round 4 Agreements for concluded in January 2023, where RWE has secured two licences and is yet to start the design work. The aspects can be confirmed in discussion with all the parties, recognising the Rampion 2 applicant would be reluctant initially. Part of a win-win negotiated outcome may be that the Applicant recovers development cost of the Rampion 2 Application to date as incentive.

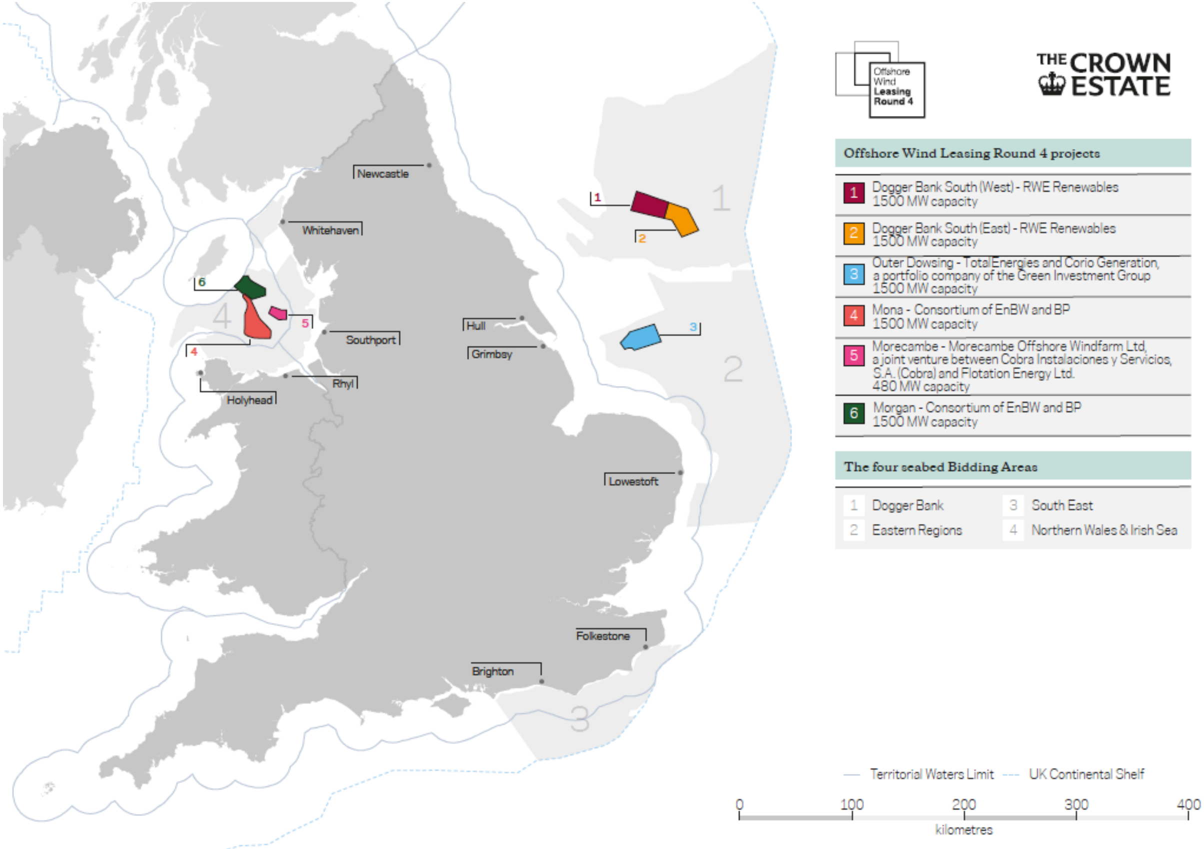

Figure 1: The Offshore Wind Leasing Round 4 Agreements for Lease signing concluded in January 2023, (Source: The Crown Estates)

The alternative of moving Rampion 2 turbines to the North Sea was recommended to the Rampion 2 developer RWE during its formal pre-application consultations in a Community-Led Public meeting in Littlehampton Town Council Millennium Chamber 24 August 2021, as a Resolution 3 endorsed by the participants:

Resolution 3: Participants feel the Rampion 2 EIA should assess moving turbines 25 miles offshore as a "reasonable alternative". A non-project alternative assessed in the EIA should be the extension of a wind farm application in Dogger Bank. [15]

The meeting report was also submitted as a formal consultation response agreed with stakeholders.

The recommendation was submitted as a formal consultation response which is relevant to NPS EN-1, Section 4.4 provisions.

[15] The full resolution is available in the Report submitted to RWE as a formal consultation input. As mentioned it is not indicated in the Applicant's Consultation Report submitted with the Application in August 2023.

□ Alternative 2:

Retrofit existing and new high efficiency combined cycle gas-fired turbines (CCGT) with carbon capture (CC) systems at gas-fired power stations on the south coast near load centres to make them NetZero immediately in a sensible phased manner.

Putting carbon capture (CC) on existing and new gas-fired power stations to immediately make them NetZero and have no carbon emissions. This includes either adding new combustion turbines alongside existing gas turbines to extend the existing power station capacity, or new gas power stations fitted with carbon capture that also can be multi-fuel (i.e., hydrogen ready) – ether where and exist power station is replaced or at a new site. This makes them NetZero for the 2035 decarbonisation drive.

Locating that dependable and flexible abated gas-fired generation capacity in the south of England minimises costs at sites where grid connection and gas supply infrastructure are already available. It reduces pressure on the need for transmission infrastructure for north south power transfers and gives more time.

CO2 storage would initially be handled by barge transport to one of three offshore carbon storage facilities "clusters" the UK is to have ready by 2030, and thereafter flexibly phasing in CCUS (carbon capture use and storage). Then eventually reverting to hydrogen or leaving the option to do so as a "least regrets" choice.

- Illustrative Features
  - By far the lowest capital costs among Rampion 2 and other alternatives.
  - Conventional high efficiency combined cycle gas turbines that today provide the majority of UK flexible and dependable power supply, can be retrofitted with CC and with additional capacity with combustion turbines at power stations in the south.
  - The carbon capture unit (CC) based on Amine-based post-combustion capture (PCC) is commercially-available technology used in the petroleum sector since 1996 and in the coal-fired power industry since 2014.
  - This alternative is deployable before 2030 and can be based on the NetZero Teesside Power station consented in Feb 2024 due be on line by 2027-28, awaiting financial closure this September.
  - Provides Net Zero increment for essential dispatchable generation to both support the build out of variable renewables as well as growing load imbalances and demand growth from mandated electrification.
  - That is an energy penalty as CC will draw up to 10% of the plant output so turbines need to be that amount larger, to the incremental cost is small

relative to the build cost and opportunity cost of Rampion 2

- Comparative advantages over consenting a £3+ bn spend on Rampion 2
    - No requirement for parallel investment in a back up generation systems with associate transmission.
    - Essential flexibility for power system operation to prevent outages, interruptions and grid collapse as the share of variable renewable capacity is grown on the National Grid to levels no country has seen before based on wind and solar (intermittency, variability and grid instability) . Cannot be compared to hydropower storage.
    - High load factor of any gas-fired power station and scalable
    - Potential capital cost advantage (depends on use in the system either for flexible backup or dependable power or both (it offers both)
    - Eliminates undermining sustainable development of the south coast
    - Reduces reliance on imported RE / wind technology and support expansion of solar and windpower (as a flexible backup)
    - Local Community and public acceptance
- Other Potential Synergies
    - The Crown Estate initiative for storage on south coast and the system and mapping Flexible staging of the CCT and CCUS elements.
    - Supports Increased amount of variable renewable installed capacity the power system can take.
    - Preferably utilising domestic natural gas supplied from the North Sea that has far lower supply-chain Co2 emissions (3 to 10 times) than imported LNG.
    - Use of hydrogen-ready turbines can be fitted into new and existing gas-fired power plants.
    - Co-located with other industries and advances in carbon capture utilisation and storage (CCUS) on the south coast as a catalyst.
    - Genuine industrial strategy and export of systems CCGT / CC power stations where much of the developing world is reliant on coal and natural gas-fired power stations
    - Potential synergies in co-locating gas turbines with CC plant and SMRs in Industrial Power parks.

This is illustrated by the power component of the NetZero Teesside Power (NZT). Net Zero Teesside itself is a collection of industrial, power and hydrogen businesses which aim to decarbonise their operations through the deployment of carbon capture utilization and storage (CCUS) and noted on its website.

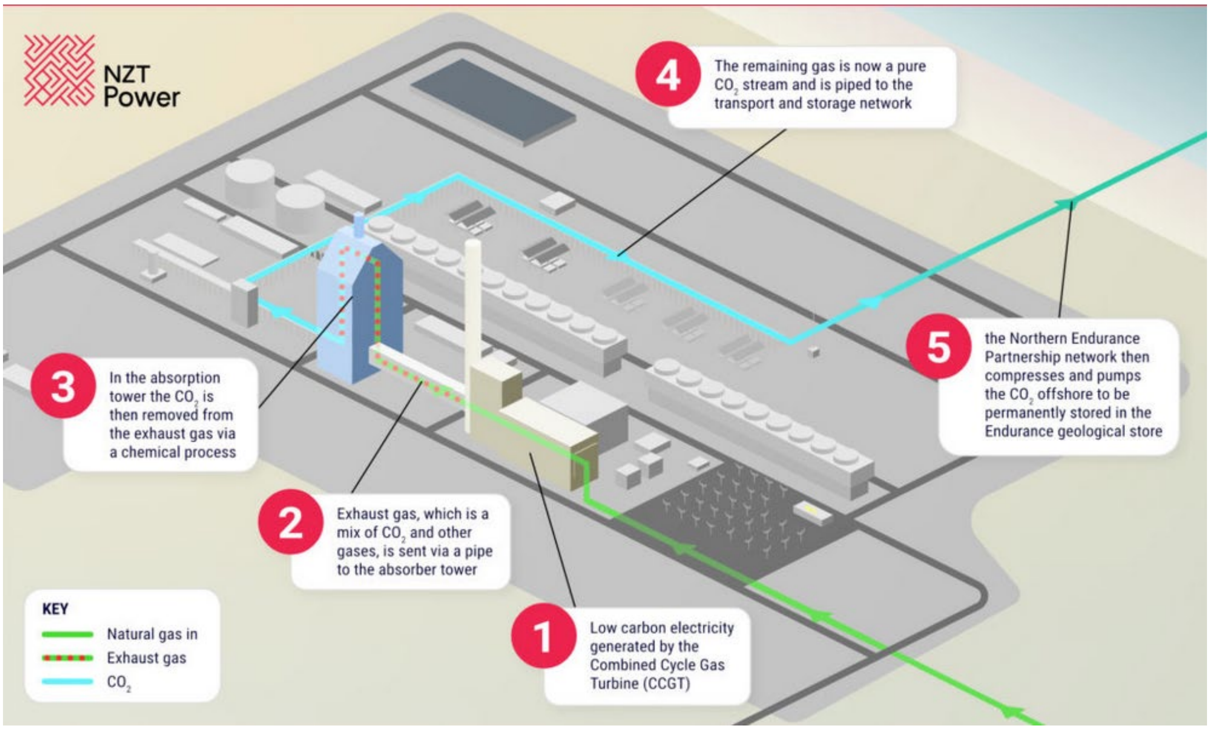

Figure 2: [16] The Net Zero Teesside Project Consented in Feb 2024

Figure 3: Alternative view of The Net Zero Teesside Project

The Secretary of State for Energy Security and Net Zero (DESNZ) granted a development consent order (DCO) for the Net Zero Teesside (NZT) Power scheme on 16 Feb 2024.[17] Financial closure is anticipated in Sept 2024. Policy Relevance NPS-1 3.3.17 "*However, new unabated natural gas generating capacity will also be needed as it currently plays a critical role in keeping the electricity system secure and stable. It will continue to be needed during the transition to net zero while we develop and deploy the low carbon alternatives that can replicate its role in the electricity system*.

[16] https://www.netzeroteesside.co.uk/project/ and https://infrastructure.planninginspectorate.gov.uk/projects/north-east/the-net-zero-teesside-project/
[17] https://infrastructure.planninginspectorate.gov.uk/projects/north-east/the-net-zero-teesside-project/

□ **Alternative 3:**

Deployment of factory built, flexible Small Modular Reactors (SMRs) that raise steam to drive steam turbines. SMRs have a small footprint and are to be co-located appropriately at decommissioned large nuclear sites, existing or under construction large nuclear power, or decommissioned coal or gas power stations.

While the new UK entity Great British Nuclear (GBN) opted for a competition between UK and potential international national supplies and GBP expects to announce the winning bids by April 2023 dir a next stage design, Rolls-Royce has a 470 MW modular, factory-built commercial power SMR that up-scales its military power reactors which it has been manufacturing and maintaining for over 60 years.

In February 2024 Rolls Royce announced it aims to have its civilian SMR operational by 2029 in Eastern Europe reportedly based on Memorandum of Understanding with a number of Governments, after previously announcing it has provisional orders and financing.

This focuses the re-emergent UK nuclear industry on rapid deployment of home-grown Small Nuclear Reactors with a small footprint and 95% capacity factor. Up to 7 existing large nuclear plants are expected to be decommissioned by 2030. That offers multiple synergies and value for money. The UK has a target of 25 GW of new nuclear capacity by 2050.

- Illustrative Features
  - Proven technology in military applications for a half century scaled up for civilian commercial power adapted and scaled up to deliver fully integrated, factory built uranium fuelled power stations.
  - Modular, factory assembled components that are transported to and installed on site.
  - Uses existing transmission connections when co-located on decommissioned or already operating and licensed nuclear sites, or decommissioned coal or gas-fired power stations.
  - Reportable deployable well before 2030 (Rolls Royce (RR) claims) and multiple other supplies contend (Canada expecting first SMRs by 2027 and site work has stated, RR is aims to have firs units in Eastern Europe operating by 2029 .
  - One tenth the footprint of conventional large nuclear power stations.
  - Key feature is low cost, factory and a 2-3 year manufacture and installation schedule, according to proponents.
  - Safe country fuel sources (E.g. uranium from Canada)
- Comparative advantages over consenting a £3-4 bn spend on Rampion 2

- Capacity factor in the range of 95% thus producing more energy reliably than Rampion 2 (as a always on, base load)
- No requirement for parallel investment in back up generation
- Eliminates risk of undermining sustainable development of the south coast that Rampion 2 presents.
- UK home grow technology options with high local content

- Other Potential Synergies
  - Potentially avoids foreign ownership and operation of the entire UK nuclear fleet and sending profits offshore and foreign control. (Energy self reliance)
  - Growing UK and European public support for nuclear and synergy with the Continental (EU) policy classifying nuclear as a green energy source in 2022 to access funding ESG and conventional funding.
  - Co-locate on large nuclear sites that are decommissioned, existing or proposed reducing public acceptance challenges on specific sites and approval time.
  - Plans underway to include SMR in Wales at decommissioned sites.
  - Potential to fundamentally create a domestic industry with high skilled jobs and technology advancement and help UK nuclear industry get back on its feet
  - Genuine industrial strategy and export of systems as demonstrated in global interest including Eastern Europe to place orders.
  - Potential to build on maintains UK technology reputation and leadership in small nuclear development and offers technology that genuinely helps other countries on their low-emission journeys impacting the global climate.

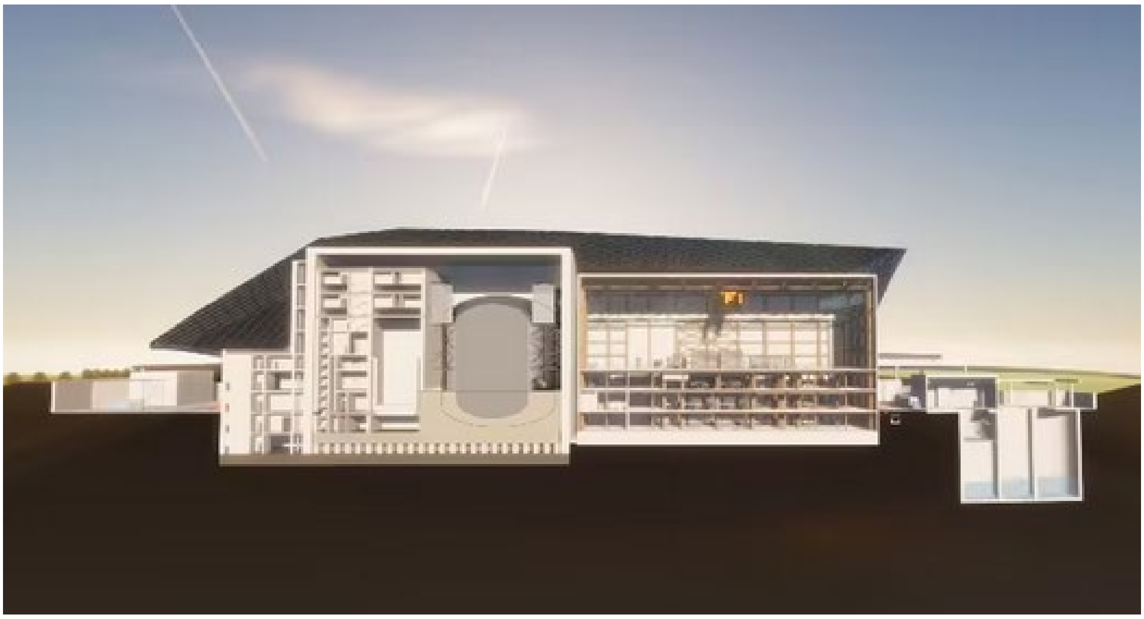

Figure 4: 470 MW Small Modular Reactor (SMR) Source: Rolls Royce[18]

[18] https://www.rolls-royce.com/innovation/small-modular-reactors.aspx#section-why-rolls-royce-smr

General government support via the UK Government' Great British Nuclear (GBN) established in 2023 that sets the trend: [19]

- Great British Nuclear to drive rapid expansion of nuclear power at an unprecedented scale and pace
- government kickstarts competition for game-changing small modular reactor (SMR) technology, which could result in billions of pounds of public and private sector investment in SMR projects
- plans will boost energy security, create cheaper power and grow the economy - creating better-paid jobs and opportunity right across the country

GBN is to announce its bid award for final development and deployment of SMRs in the UK in April 2024. [20] France is aiming to have its whole large nuclear replaced by 2035 by SMRs

In February 2024 the Chairman of UK based Rolls Royce announced it aims to build its first SMRs in Europe as export projects by 2029, well ahead of the pace in the UK. [21]

A fundamental question with SMRs as to other Alternatives is whether the UK Government is to seek any ownership or stake in the ownership of nationally strategic energy infrastructure in future, give that today most of the UK's energy infrastructure and generation assets are foreign owned and operated, mainly by European State owned companies or European State backed multi-energy consortium under the providence and regulation of the EU Commission.

[19] https://www.gov.uk/government/news/british-nuclear-revival-to-move-towards-energy-independence
[20] https://www.gov.uk/government/news/six-companies-through-to-next-stage-of-nuclear-technology-competition Rival bidders to RR the UK has invited include EDF (100% ownership of UK large nuclear assets and 100% French state owned), GE-Hitachi, Holtec Britain, NuScale, and Westinghouse.
[21] https://www.telegraph.co.uk/business/2024/02/22/rolls-royce-boosted-post-pandemic-jump-demand-jet-engines/

Part 3: COMPARISON OF ALTERNATIVES WITH RAMPION 2 IN RESPECT TO NATIONAL BENEFITS AND DISBENEFITES

At the end of this section we offer a spreadsheet table (Table 5) that expands and illustrates the breakdown of national benefits and disbenefits that we see as policy relevant to the NPS We offer a scoring and ranking exercise that benchmarks Rampion 2 against these Alternatives.

To inform the spreadsheet (in Part 4 Tables 5 and 6) we first offer this comparison of:

1) Co2 emission reduction
2) Energy generation and power output
3) Capital investment
4) Contribution to Power System flexibility and operation
5) Energy Security and Import Dependency
6) boosting UK Business and its Industrial Strategy
7) the achievement of Sustainable Development

Additionally Part 4 tables 5 and 6 are informed by the PCS Local impact Assessment (LIA) that is submitted in parallel as a Written Representation.

1. On Co2 emission reduction

Emission reductions may take into consideration: (1) life cycle or "cradle to grave" emissions, or (2) only CO2 emissions during the multi-year operation stage.

Ideally the metric is life cycle emissions. But it is a complex calculation that requires looking at the technology supply chain (i.e., from mineral mining and transport, to smelting, to manufacturing, construction and installation, then through multi-year operation and maintenance (O&M), and finally decommissioning work.

It also requires looking at the supply chain emissions for the energy resource, where that applies (e.g. for pipeline natural gas versus imported liquefied natural gas (LNG), and reactor fuel for SMRs such as enriched uranium or uranium or thorium fuel).

Rampion 2 has no direct energy resource cost but the trade-off is turbines in the location are comparatively inefficient (Annex 7) intermittent, variable and weather dependent. Rampion 2 thus requires more investment in complementary dependable back-up either via power imports from the Continent or abated gas-fired generation and adds to emissions for LNG imports (emission in the supply chain) and requirement for investment in other system infrastructure to provide ancillary power serves such as indicated in Annex 6 – adding to the opportunity cost of Rampion 2.

Observations are:

- Life Cycle emissions apart from operation of Rampion 2 WTGs on the south coast and similar WTGs on southern Dogger Bank and we assume are roughly similar.
- Operating the same WTGs on Dogger Bank where they generate more and steadier output (as seen in load duration curves, Annex 7), means incrementally less backup generation, reducing imported LNG requirements, hence resulting in less point-source emissions from backup gas-fired generation and LNG supply chain emissions.
- Far less life-cycle emissions would be expected for the small modular nuclear (SMR) given its high capacity factor (more than double that for wind alternatives) and lower requirement for materials and infrastructure, and not requiring backup.
- For similar reasons, far less life-cycle emissions result from operating the CCGT / CCS as a fully integrated "NetZero ready" alternative, compared to Rampion 2, though there would be LNG versus pipeline gas supply chain emissions to trade-off.

These are summaries in Table 2 below.

Alternatives for Low emission generation	**Relative Life Cycle Emission Reduction (Excluding Operation)**	**Relative Emission Reduction in Operation**
Rampion 2 Extension[1] (up to 90 WTG up to 325m) inshore visibly starting 13 km (6 NM) from the coast	Base line	Baseline: RWE indicates Co2 offset with the present UK generation mix of 1.8 million tonnes co2 per year. However from 2035 when the UK power system is fully decarbonised Rampion 2 competes with other low emission alternatives mainly on other factors. It does induce more LNG imports post 2035 for back up.
Extension to existing South Dogger Bank License Award [2] (up to 90 WTG up to 325m) Well offshore over 100 km from the coast	Similar to Rampion 2 baseline for mining, manufacturing and a little less in construction de to economies of scale as an extension	Greater than Rampion 2 offsetting more gas-fired plant emissions at least 25% and possibly double with LNG supply chain emissions LNG is imported. [2]
Small Modular Reactor (SMR), Based on Rolls Royce model[3]	Far Less than Rampion 2 baseline	Similar to Rampion 2 from when commissioned to 2035. Low emission but also offsets more imported LNG and LNG supply chain emissions pre and post 2035
Abated gas-fired generation Net Zero Ready and Hydrogen ready) Net Zero Teesside Power (NZT Power) Equivalence as a CCGT / CC Power Station	Far Less than Rampion 2 baseline	Similar to Rampion 2 Net Zero as a power station when commissioned, but also has ongoing LNG or North Sea gas supply chain emissions
Notes: 2. Based on using ratios of life capacity factors hence energy generation / yr assuming the same installed capacity of 1,200 MW of WTGs		

Table 2: Relative Carbon Emissions of Rampion 2 - Life-Cycle and Operation

Assuming that abated gas-fired generation that is dispatchable would back up Rampion 2 over most of its economic life (~2030 to 2050), [22] moving turbines to the North Sea and SMRs offers UK society a better carbon emission reduction outcome.

Between Rampion 2 and abated gas-fired generation there are question about relative amount of carbon embedded in the supply chains for each technology (mining through construction and commissioning) and whether the natural gas supply (in each case) is domestic or imported LNG (as back up dependable supply for Rampion 2 and for operation of the abated gas-fired power station beyond a RE backup role for supply-demand balancing).

The other important consideration is that once the power sector is decarbonised in 2035 Rampion 2 and the Alternatives would only compete against other low emission generation sources inn terms of cost, performance, system fit, system reliability, opportunity cost and energy security and self reliance. Thus the carbon reduction benefit of any alternative is only till then 2025, in the Rampion 2 case 2030 to 2035, for 5 years.

2. On energy generation and power output

Table 3 below indicates the average annual generation and variability of electricity supply from Rampion 2 and the three alternatives. This is illustrative. The same WTGs on Dogger Bank offer the highest average annual generation, while the others at the assumed scale are roughly similar. The differences being (1) the observed variability in wind resources (seen in the load duration curve in Annex 7), and (2) the CCGT option with or without abatement can be scalable to and power and energy output and depends how it is used in the system.

[22] As suggested in EN-1 (2021) page 25 para 3.3.5 on delivering affordable decarbonisation.

Alternatives for Low emission generation	**Average Energy Generation Potential**			**Variability & Reliability of Power Output**	
	Installed capacity MW	Life Capacity Factor %	Average Generation GWH/yr	Load duration (Annex 7)	General
Rampion 2 - Extension [1] (up to 90 WTG up to 325m	1,200	38.0	3,995	15% of time no output; 50% of time less than 60% output	Varies daily, seasonally and year -to-year
South Dogger Bank New Licence Extension [2] (up to 90 WTG up to 325m)	1,200	47.6	4,972	7% of time no output; 50% of time less than 60% of full capacity output	Varies daily, seasonally and year -to-year. At a higher capacity (more efficient than Rampion 2
Small Modular Reactor (SMR) based on the Royals Royce model[3]	470	95%	3,911	Always on	subject to O&M
Net Zero Teesside Power (NZT Power) Equivalence as a CCGT / CC Power Station.[4]	860	95%	3,828	On demand to continuous operation	Scalable

Notes:
1. Life capacity factors are used as capacity factors (or load factors) vary year-to-year. https://energynumbers.info/uk-offshore-wind-capacity-factors. Rampion 2 would be expected to perform in the 37-40% being far larger than Rampion 1, but in the same win regime.
2.Capacity factor is assumed based on Honsea One, as in the source above
3. Capacity factors for SMR are based on USA small reactor experience. The same 95% is assumed for the CCGT/CCUS simply for comparison as there will be some schedule maintenance. That is maximum generation.
4.The CCGT/CC is scalable and can be any size and can be phased e.g. Install and operate CCGT now and add the CC capacity later plus can make turbines hydrogen ready.

Table 3: Average Annual Generation Capacity Comparison

3. On capital investment

Rampion 2 requires a capital outlay of £3-4 bn that REW will arrange (as equity and debt finance typically in a 20:80 ratio with international lenders such a venture capital, ESG and conventional funds providing loans or 80% debt financing).

There will be an additional capital outlays on offshore wind as mentioned, as the UK society must invest in the backup or parallel dispatchable power system to turn on when the wind drops, whether that is carbon abated gas-fired generation or costly power imports, or energy storage systems when they are eventually available.[23]

[23] There is no endless pot of money for infrastructure investment either from UK government or UK financial institutions sources and or foreign sources; and there are obvious limits to increasing tariffs that must repay investors at commercial rates of return and even higher compensation rates (windfall profits) as we have seen lately with the Renewable Energy Contribution and CfD subsidy contracts discussed in media. (cite)

Observations are:

- Installing the same capacity of WTGs on Dogger Bank as Rampion 2 would deliver more energy and power at a higher capacity factor for the roughly same capital outlay.
- In addition, there may be savings or reductions in capital requirements for the Dogger Bank license extension due economies of scale involved with co-locating infrastructure (i.e. combing the 1,200 MW with either of RWE's the new 1,500 MW licences, plus addition cost reduction synergy in connecting to the offshore ring grid that is anticipated to be available by 2030).
- The potential would need to be investigated.
- Evidence is the 1,400 MW Sonia windfarm now under construction by RWE at the similar cost as proposed for the 1,200 MW of Rampion (about £3 bn in 2019 money).
- It is stated that the 270MW SMR can be built in a factor and installed on site in a 2-3 year period in the order of £2bn, once regulatory approval is secured and a UK Government order is confirmed. [24] This of course needs to be verified in invited testimony at an Examination Hearing.

- Similarly for the CCGT / CCUS alternative the natural gas turbine CCGT is known conventional technology with low capital cost and is deployed around the UK and the world. The capital cost of the CCUS would have to be verified in testimony and may also be available in submissions to the Net Zero Teesside Power (NZT Power) Examination completed in 2022.

- It is not as bad as it sounds, as in the short- to medium- term the UK has ample high efficiency gas-fired power stations that run without Co2 abatement now. Retrofit with CC in a flexible approach. NPS EN-1 states abated gas-fired power station generations is needed to move on an affordable path to NetZero as a flexible power supply option. [25]

Evidence in this analysis thus suggest UK society would likely be better off pursuing Alternatives, in terms of capital outlay and freeing up money for higher quality investments.

4. On contribution to Power System flexibility and operation

The three reasonable alternatives have considerable advantages. That is important and relevant if the policy and practical aim is to increase dependable power supply in the south of England (power on demand) and prioritize investment in the most efficient use of wind energy resources.

[24] Cite source UK energy. Get a statement from RR.

[25] Separately it may be argued and verified with Ofgem testimony, there would benefit from a closer look a supply chain investment requirements and emissions of pipeline gas from the North Sea versus imported LNG. It is NPS policy relevant for the consideration of Alternatives.

Apart from load balancing and preventing blackout and in the worst case Grid collapse these include a range of what are called ancillary power system services that are needed to ensure grid stability (such as spinning reserve and reactive power generation, for system power factor correction). CCGT with or without Co2 abatement offers these services whereas wind generators typically do not at all or not very well. Thus additional equipment such as utility-scale expensive capacitor banks are then required.

As recommended by World Bank (ESMAP, 2016) system value analysis (to quantify the value associated with any proposed capacity addition for low carbon energy, including flexibility to meet power sector needs and wider energy and climate policy) is crucially important once past a 30% share of variable RE on the power system, which the UK is well past.

As noted, the value of system modelling analysis was undertaken for the Net Zero Teesside Project now awaiting a DCO decision in 2023 and serves as a good model. It could also be part of the "no-project" analysis, as in the EIA Regulations 2017 for Rampion 2.

5. On Energy Security and Import Dependency:

This Representation argues that investing in comparatively low efficiency wind farms on the inshore of the south coast, like Rampion 2 (with lower capacity factors), requires incrementally more imported LNG (or pipeline gas) to back it up, and similarly incrementally increases dependency on undersea power imports.

While power interconnections are hugely desirable and important for 2-way power exchange now and especially in future as offshore wind and solar (strategically sequenced) is built out, over-reliance also has security of supply and dependency risks.

The inherent geopolitical risk of over dependence on imported gas was clearly demonstrated to the world in 2022. The aftershocks are ongoing and long-term. The risk does extent to physical risk to infrastructure in the water.

In terms of interconnection with EU States, for example, it still leaves the UK dependent on the variable power demand-supply situation in France. Plus it cumulatively adds to UK political vulnerability and security of energy supply threats, as recently witnessed when France threatening to cut Jersey power supply via undersea cable amid demands on fishing in UK waters.

The recent UK High Court decision in January 2023 to overturn the former BEIS Secretary of State decision in 2021 to reject the £1.35bn AQUIND interconnect or proposal for an additional high voltage transmission link between the UK and France we suggest is relevant in two respects. Firstly, if the connector is built it will afford additional power system operation flexibility in the south assuming France can send power on demand. Secondly, it is important because the basis for the High Court Decisions as reported was the failure to consider alternatives adequately in the DCO process.

The other dependence noted previously the ongoing and deepening UK dependence on imported RE technology, where value added is with international suppliers.

For wind power that is mainly Continental interests, where the UK now effectively off-shores jobs, profits and innovation along with the opportunity to create a domestic Green energy industrial capacity.

Finally the geopolitical risk to Energy Security plains strategic infrastructure in offshore waters when they can be attacked by hostile states as noted in Annex 4.

6. On boosting UK Business and its Industrial Strategy

In terms of overall UK business confidence, reducing uncertainty, improving the productivity and competitiveness the benefits of ensuring, secure affordable and reliable power are profound. That spills over to trade and investment hence UK prosperity.

As Ofgem (2021) states the UK must take a holistic view to business, energy and industrial strategy. There is an urgent need for a credible industrial strategy to help the country back on its feet and one obvious place to start would be its hugely promising but fledgling small modular nuclear reactor (SMR) operation, which offers huge export potential.

SMR technology is exportable and has the potential to genuinely impact the global climate. Similarly carbon capture (CC) know how and technology for power generation applications is important. Whether the big winner in respect to value added in terms of leadership, innovation and UK industrial stage rests with modular nuclear is yet to be seen.
A lot depends on policy and what the Rolls Royce Chairman on the steps of Parliament recently describes essentially as "regulatory capture and delay" where the first Rolls-Royce mini nuclear reactor will now be built in Europe instead of Britain aiming for 2029. [26]

And the issue again is RE technology (wind) is mainly supplied by continental interests which again essentially means the UK is off-shoring the high value RE jobs and profits and opportunities to the highest international bidders, as Table 4 illustrates.

Local content for Rampion 2 from construction through operation and decommissioning is not readily exportable, or even a basis for a home-grown green energy industry renaissance. It is mainly relegated to some civil engineering and local construction aspects and support services marketing and public relations. Most countries in the world have their own local construction capacities. The EU has also challenged UK attempts to set minimum local content standards for RE projects in the WTO and in international courts.[27] So the present situation of dependency on imported RE technology will not reduce any time soon.

To many it makes the Press Releases on the announcement of the Crown Estate's Offshore Wind Leasing Round 4 bid ring somewhat hollow to many energy policy observers, "*Britain's position as the European leader in offshore wind shows no signs of letting up.*"

[26] https://www.telegraph.co.uk/business/2024/02/22/rolls-royce-boosted-post-pandemic-jump-demand-jet-engines/

[27] https://www.telegraph.co.uk/business/2022/01/28/brussels-sets-sights-british-wind-power/ and https://www.windpowermonthly.com/article/1751177/eu-takes-uk-offshore-wind-local-content-fight-wto

Propose windfarm Development	Home Country of Developer / Ownership	Expected source of wind turbines and high value components	UK Ownership Stake
Dogger Bank South (West) RWE Renewables 1500 MW	Germany	EU / Continent	Nil ?
Dogger Bank South (East) RWE Renewables 1500 MW	Germany	EU / Continent	Nil ?
Outer Dowsing – Total Energies and Corio Generation, 1500 MW capacity	France / Denmark	EU / Continent	Nil ?
Mona - Consortium of EnBW and BP 1500 MW capacity	German (EnBW)	EU / Continent	Nil ?
Morecambe Offshore Windfarm Ltd a joint venture between Cobra Instalaciones y Servicios, S.A. (Cobra) and Flotation Energy Ltd. 480 MW	Spanish Multinational	EU / Continent	Nil ?
Morgan Consortium EnBW and BP 1500 MW	German (EnBW)	EU / Continent	Nil ?

Table 4: Selected Projects Offshore Wind Leasing Round 4 - Ownership and Technology

7. On the achievement of Sustainable Development

The achievement of sustainable development is an overarching objective of the planning system. I.e.: "*The government's wider objectives for energy infrastructure include contributing to sustainable development and ensuring that our energy infrastructure is safe. Sustainable development is relevant not just in terms of addressing climate change, but because the way energy infrastructure is deployed affects the well-being of society and the economy, for both current and future generations. (NPS, EN-1 page 21 2.5.1)*

In our collective view, the proposed Rampion 2 windfarm development would clearly compromise the achievement of sustainable development on the Sussex coast of England, affecting present and future generations of residents and visitors alike. The proposal specifically does not respect strategic environment advice and safeguards put in place to protect coastal communities and the environment, as embodied in the rolling Offshore Energy Strategic Environment Assessment programme (OESEA) to reinforce commitments under the European Convention on Landscapes.

All three low-emission alternatives indicated in this Representation avoid risk of undermining the achievement of sustainable development to the extent Rampion 2 does with its large footprint.

That is simply incontestable. Pursuing those alternatives otherwise avoid the risk of degrade "natural capital" that makes our treasured wildlife and ecosystem functions and services even more susceptible and vulnerable to longer-term climate change and flies in the face of local environment stewardship. [28]

[28] Natural Capital: in general being the collection of natural resources of a region, land area or a coast together with its ecosystem services viewed broadly, including its overall economic value (for example, from the value

PART 4: CONCLUSIONS

Evidence shows that each alternative would likely do more for the UK's national climate, energy supply, energy security, sustainable development, environment and industrial policy objectives than Rampion 2, while offering better value for money and less upward pressure on electricity prices.

NATIONAL POLICY (NPS) - RELEVANT INDICATORS

In the absence of systems value modelling this is a fall-back technique that uses Rampion 2 as a baseline to rank order the four options to thus qualitatively benchmark Rampion 2 against the three alternatives.[29] To do this we identified 12 indicators that helped break down the national benefits.

These indicators and the scoring of each, aim to make the determination of essential NPS policy interpretations on Rampion 2 less subjective, more transparent and clear.

The steps were:

i. 12 NPS relevant indicators were identified to breakdown national benefits in a reasonable and understandable way;

ii. Under each indicator a set of underlying criteria relevant to the indicator are identified;

iii. Alternatives are scored for each criteria on a scale of 1 to 4. using Rampion 2 as a baseline;

iv. The scores for criteria under each indicator are then summed to give an raw unweighted score for each of the 12 indicators;

v. All the indicators scores are then summed to give one simple aggregate raw score for Rampion 2 and each of the alternative;

vi. The higher the raw score for the four options (Rampion 2 as the baseline) the better for the assumptions implied in the scoring of criteria, all things considered.

In this scoring system if Rampion 2 is seen as the best of the four, it gets a "4" score – i.e., the highest for that criteria or metric. Conversely, if it is seen as the worst in relative terms it is given a "1". If an alternative has the same national benefit (or national disbenefit) for a particular criteria it gets the same score and Rampion 2.

Obviously there are limitations and complexities. Different groups may wish to apply different criteria and indicators to break down the National benefits and may also want to apply weights to the various criteria and indicators. We simply assume the same weight for each criteria and indicator to give unweighted raw scores.

Rampion 2 has national benefits. Our simple benchmarking and rating analysis results in Table 5 indicates that all three alternatives offer a better way forward than Rampion 2, in respect to national benefits overall, and suggests they are in the local, national and wider public interest as compared to a £3-4 billion investment in Rampion 2.

Table 6 elaborates the criteria and scoring applied in detail.

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derived from pollination services provided by migrating birds and insects lost to windfarm turbines, to the visual impacts of transforming the natural seascape that affects the visitor and coastal tourism economy and jobs to intrinsic values of natural seascapes the are part of our culture, heritage and promote well-being).

[29] This weighting, rating and ranking technique is recommended in the World Commission on Dams for the consideration of Alternatives as a Strategic Priority which the UK government co-funded (WCD, 2000).

Table 5: Relative Ranking and Scoring of National Benefits of Alternatives (Rampion 2 Baseline)

Rampion 2 and three NPS Section 4.4 Alternatives	**Benchmarking Indicator score (high being better)**	**Relative to Rampion 2**
Rampion 2 – the Baseline Extending the installation of turbines in the Sussex Bay with up to 90 WTGs up to 325m tall and transmission through designated landscapes	115	1.0
Alternative 1: Extending an existing Dogger Bank windfarm licence with equivalent capacity (up to 90 WTGs up to 325m tall) where they are more efficient, economies of scale and potentially link to an offshore ring grid to minimise on-shore transmission and better facilitate connection to EU grids.	156	1.4
Alternative 2: Retrofitting an existing natural gas-fired power station with carbon capture (CCGT/CC) and adding a Rampion 2 equivalent new capacity at that site (or replacement power starting with CC, or a new power station with carbon capture in the south with multi-fuel capability to switch hydrogen when ready.	201	1.7
Alternative 3: A Small Modular Reactor (SMR) (located in decommissioned large nuclear site (or existing / under construction site) or decommissioned coal-fired or gas-fired power station sites)	236	2.1
For assumptions noted and policy relevant criteria indicated in Part 4 and Table 6 in Part 4		

As Table 5 shows, for the assumptions applied, extending a recently awarded offshore wind farm licence on Dogger Bank would, for example, lead to 1.3 times the national benefit than granting consent to the Rampion 2 extension.

Extending an existing gas-fired power station in the south, or a replacement on the same site (or at a new site) incorporating a carbon capture system (also with multi-fuel capability to run on green hydrogen in future) - offers 1.7 times the national benefit as Rampion 2. And small modular reactors (SMRs) that are factory built and rapidly installed on site could lead to twice the national benefit as Rampion 2.

It also raises a simple question, at least to 2035, when decarbonisation of the power sector is hopefully achieved and until utility energy storage systems are viable, affordable and deployed at scale some decades later: which is more environmental friendly and helpful for National Energy Security and UK energy-self reliance: (a) if the UK sources natural gas domestically from the North Sea fields, or (b) imports liquefied natural gas (LNG) transported over great distance from Qatar or the USA in the form of price vulnerable LNG.

That choice of (a) or (b) has real carbon emission implications, and whether those emissions appear in the UK's national carbon accounts or not.

And here we recognise what the NPS say about a realistic timeframe for phasing out natural gas in the power sector; when by 2035 all gas-fired power stations in the UK must have full carbon-capture, and be available to back-up intermittent renewables when called upon. High efficiency gas-turbines can be multi-fuel and switched to burn hydrogen, once hydrogen storage is available at scale, however hydrogen that hydrogen is produced (e.g., as green hydrogen).

An optimal "least regret" strategy that can be highlighted as Alternatives are brought into Rampion 2 Examination (as the NPS policy requirement), as is suggested in this alternative analysis and benchmarking[30], is it's best in national benefit terms for the UK to move in parallel with all three as complementary additions to the UK generation mix rather than committing the upfront £3-4 bn Rampion 2 capital investment at this time, also give Rampion 2's comparatively high opportunity cost and risk.[31]

These three alternatives are all designated as critical national priorities in NPS (Nov, 2023).

But again we do highly recommend the ExA calls for a full power system value modelling analysis to inform the Rampion 2 Examination, as was made available to inform the Examination of the Teesside NetZero Project and the Secretary of State decision to consent that Application in February 2024.

[30] Ofgem 2021 strategic review of power system endorses a "least regrets" strategy.
[31] Ofgem 2021 strategic review of power system endorses a "least regrets" strategy.

Table 6: Benchmarking National Benefits / Disbenefits of Rampion 2 against realistic Alternatives (with criteria and scores)				
Parameters and National Benefit / Disbenefit Indicators	**Baseline**	**Bulk Power Supply Alternatives (EN-1 Section 4.4)**		
	Rampion 2 (Sussex Bay inshore & transmission via a SDNP route)	**Wind Turbines extending an existing Dogger Bank Licence**	**Abated Gas Turbines (CCGT/CC) In South UK**	**Small Modular Reactors (SMR) in decommissioned power sites**
Selected Parameters				
Date Ready to deliver power	~2030	Possible Before 2030	Possible Before 2030	Possible Before 2030 Policy Dependent
Average annual plant factor	37-40%	60-65%	100% on demand	95% always on expected
Estimate build time (years)	4-5 yrs	4-5 yrs	1-4 yrs for CCGT/CC	2-3 yrs is claimed
Economic Life	20-25 yrs		Longer than Rampion 2	60+ yrs Expected
Capital Cost (per project)	£3-4 bn	Depends on extent of cost sharing with new project	Location specific CCGT has low capital costs	£2-2.5 bn claims
NATIONAL POLICY (NPS) - RELEVANT INDICATORS				
1 Likely Contribution to decarbonisation of the UK Power Sector by 2035 and to 2050	**4**	**8**	**14**	**16**
- Carbon Emissions Reduction: reduction in CO2 emissions in absolute terms.	1	2	3	4
- Relative Emission Reduction: reduction in CO2 emissions per project alternative (as source emissions).	1	2	4	4
- Contribution to 2035 Ambition: contribution to the aim of	1	2	3	4

Table 6: Benchmarking National Benefits / Disbenefits of Rampion 2 against realistic Alternatives (with criteria and scores)				
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decarbonising the UK power sector by 2035.				
- Contribution Post 2035: investment contributes to the overall target of net zero by 2050.	1	2	4	4
2. Likely contribution to UK Energy Security and Energy Self-reliance	**10**	**13**	**14**	**22**
- Reduction Energy Import Dependence: Assess the reduction in reliance on imported LNG and electricity via undersea interconnection during periods of low wind.	1	2	1	4
- Reduction in Technology Import Dependence: Measure the degree of reliance on proprietary technology from foreign sources.	1	1	3	4
- Interconnection Benefits with the Continent: Assess the decrease in dependence on imported electricity through interconnections with European grids.	2	4	2	2
- Energy Resource Availability and Quality: Evaluate the variability of energy resources, considering the intermittency of wind.	2	3	2	3
- Reduction in Foreign State Leverage over UK Policy: extent to which other states leverage control of UK policy via technology or energy supply dependence.	2	2	2	4
- Risk and Strategic vulnerability to attach by hostile States: risk of physical attack on infrastructure by hostile states, considering geopolitical risks to 2050 economic life of Ramp2.	2	1	3	4

Table 6: Benchmarking National Benefits / Disbenefits of Rampion 2 against realistic Alternatives (with criteria and scores)					
		Baseline	Bulk Power Supply Alternatives (EN-1 Section 4.4)		
	Parameters and National Benefit / Disbenefit Indicators	Rampion 2 (Sussex Bay inshore & transmission via a SDNP route)	Wind Turbines extending an existing Dogger Bank Licence	Abated Gas Turbines (CCGT/CC) In South UK	Small Modular Reactors (SMR) in decommissioned power sites
3	**Effects on the National Grid operation, quality and reliability of power supply and preventing interruptions**	**9**	**15**	**28**	**34**
	- Energy resource variability and predictability: degree of variability and predictability impacting on operations and power infrastructure	1	2	3	4
	- Project capacity factor: (or load factor) as an indicator of infrastructure and location efficiency, all things considered.	1	2	3	4
	- Grid integration complexity challenges: ability to integrate with the National Grid and provide consistent quality supply to customers 2030-2050.	1	2	4	4
	- Flexibility to help balance supply-demand and minimise power supply interruptions: Especially as the amount and proportions of variable RE supply in the generation mix increases, the dispatch ability to match fluctuating demand and back up variable supply sources and balance generation supply with grid demand that varies hourly, seasonally and yearly.	1	1	4	2
	- Contribution to meet growing power demand with dependable power: Especially as the amount and proportions of variable RE supply in the generation mix increase and grid demand is expected to double that today sometime between 2035-2050 due to mandated electrification of heating and transport.	1	2	2	4
	- Impacts on grid stability and reliability impacting consumers and the economy. Frequency regulation, reactive power support, voltage control, load following, reserve capacity	1	1	4	4

Table 6: Benchmarking National Benefits / Disbenefits of Rampion 2 against realistic Alternatives (with criteria and scores)				
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- Meeting mandated increases in demand: Especially suitability to provide transport and home and commercial heating required to match cold weather and routine economic activity patterns (e.g. charging EVs for going to work and day-to-day business activities)	1	2	2	4
- Pressures on average power system costs: Degree of upward pressure on average power system costs to additional infrastructure i.e. back up and ancillary services and grid balancing to match supply and demand.	1	2	3	4
- Project Longevity: lifespan and durability of infrastructure.	1	1	3	4
4. **Affordability Effects (National to Local):**	**8**	**11**	**20**	**24**
- Capital Intensity: Offshore wind projects and SMRs require substantial upfront investment for construction, licensing, and regulatory compliance.	1	2	4	3
- Value for Money: the cost-effectiveness of project related to efficiency and tradeoffs of benefits and adverse impacts.	1	2	4	3
- Degree of Government Subsidy: level of direct and indirect subsidies, risk guarantees required to incentivise commercial developers and private investment (domestic and foreign)	1	1	4	4
- Affordability of additional power infrastructure: The need for additional power system infrastructure for ancillary services, load balancing etc.	1	1	4	3
- Vulnerability to international price shocks: The impact of international factors on construction and operation costs.	1	1	1	4

Table 6: Benchmarking National Benefits / Disbenefits of Rampion 2 against realistic Alternatives (with criteria and scores)				
Parameters and National Benefit / Disbenefit Indicators	**Baseline**	**Bulk Power Supply Alternatives (EN-1 Section 4.4)**		
	Rampion 2 (Sussex Bay inshore & transmission via a SDNP route)	**Wind Turbines extending an existing Dogger Bank Licence**	**Abated Gas Turbines (CCGT/CC) In South UK**	**Small Modular Reactors (SMR) in decommissioned power sites**
- <u>Consumer electricity Costs</u>: impact pm energy bills at national and local levels and competitiveness	1	2	2	3
- Balance of payments effects – of Importing LNG and need for electricity impacts on the UK's national balance of payments, affecting the current account and the overall trade balance (exchange rate effects). Do to the relative efficiency of the infrastructure.	2	2	1	4
5. **Project Financeability, Investability and Market Risk:**	**16**	**16**	**16**	**17**
- <u>Project Financeability</u>: Financing large-scale projects can be challenging due to high capital costs the requirements to organise many investors to spread the risk and/or long construction timelines. While financial closure had not been reached money is on the table. Regulatory stability is the issuer	4	4	4	4
- <u>Cost and Investability:</u> Relative cost and ability to attract traditional forms of capital as well as green energy financing (ESR). Largely due to smaller capital outlays.	2	2	3	3
- <u>Regulatory stability</u>: To the extent it impacts stability and predictability of regulatory policies, including subsidies, grid connection agreements, and planning permissions, financeaibility and market attractiveness. NPS (March, 2023), NPS (Nov, 2023) and 66% increase in the CfD subsidy for offshore wind in Sept 2023 are examples of volatility.	2	2	2	2
- <u>Technological readiness</u>: Established offshore wind technology	4	4	3	3

Table 6: Benchmarking National Benefits / Disbenefits of Rampion 2 against realistic Alternatives (with criteria and scores)				
	Baseline	**Bulk Power Supply Alternatives (EN-1 Section 4.4)**		
Parameters and National Benefit / Disbenefit Indicators	**Rampion 2 (Sussex Bay inshore & transmission via a SDNP route)**	**Wind Turbines extending an existing Dogger Bank Licence**	**Abated Gas Turbines (CCGT/CC) In South UK**	**Small Modular Reactors (SMR) in decommissioned power sites**
and supply chains can reduce technology-related risks, though ongoing innovation may influence project economics and competitiveness.				
- <u>Fuel supply and waste management Issues:</u> Access to nuclear fuel and long-term waste disposal solutions are. Uncertainty surrounding fuel availability, uranium prices, and waste storage can pose market risks. Whether domestic natural gas from the North Seas is available till when or reliance on LNG imports will be forced is a factor.	3	3	1	1
- <u>Export Market for the UK for Companies involved directly or indirectly in the project:</u> Largely on the degree of meaningful project participation and where the technology is UK home grown and sourced or proprietary technology of another and cant be exported by UK interests unless licensed to do so.	1	1	3	4
6. **Job Creation Opportunity and Benefits (Local to National):**	**7**	**7**	**16**	**22**
- <u>Likely Direct Employment Opportunity on projects</u>: the number of jobs created in construction, operation, and maintenance.	1	1	2	3
- <u>Likely Indirect Employment opportunity:</u> job creation in related industries such as manufacturing and services locally, regionally and nationally feeding the project supply chain.	1	1	3	4
- <u>Skills Development Contribution</u>: development of a skilled workforce in renewable energy technologies.	1	1	2	4
- <u>Proportion of high skilled to low skilled jobs</u>: meaningful	1	1	3	4

Table 6: Benchmarking National Benefits / Disbenefits of Rampion 2 against realistic Alternatives (with criteria and scores)				
	Baseline	**Bulk Power Supply Alternatives (EN-1 Section 4.4)**		
Parameters and National Benefit / Disbenefit Indicators	**Rampion 2 (Sussex Bay inshore & transmission via a SDNP route)**	**Wind Turbines extending an existing Dogger Bank Licence**	**Abated Gas Turbines (CCGT/CC) In South UK**	**Small Modular Reactors (SMR) in decommissioned power sites**
creation of high-value, well-compensated jobs.				
- Likely Sustainable Local Jobs: Likely scope for long-term sustainable local job creation and opportunities due to the project	1	1	1	1
- Likely Sustainable Regional jobs: Likely scope for long-term sustainable local job creation and opportunities due to the project	1	1	2	2
- Likely Sustainable National Jobs: Likely scope for long-term sustainable local job creation and opportunities due to the project	1	1	3	4
7. **UK Industry Strategy, UK export and UK developing country assistance: Opportunity and Benefits**	**4**	**4**	**12**	**16**
- UK Industry strategy boost: potential to support a UK domestic technology base, sustainable manufacturing industry and supply chain opportunity.	1	1	2	4
- Degree of foreign control of technology: Extent to which technology is controlled by foreign entities and UK government can influence.	1	1	3	4
- Export opportunity for UK companies: Extent to which the technology creates export opportunities and further job growth for UK companies and interest to benefit jobs the economy and government revenue.	1	1	3	4
- UK Developing Country Assistance opportunity; for the UK to incorporate the project or aspects of the project / technology	1	1	4	4

Table 6: Benchmarking National Benefits / Disbenefits of Rampion 2 against realistic Alternatives (with criteria and scores)					
		Baseline	**Bulk Power Supply Alternatives (EN-1 Section 4.4)**		
	Parameters and National Benefit / Disbenefit Indicators	**Rampion 2 (Sussex Bay inshore & transmission via a SDNP route)**	**Wind Turbines extending an existing Dogger Bank Licence**	**Abated Gas Turbines (CCGT/CC) In South UK**	**Small Modular Reactors (SMR) in decommissioned power sites**
	to assist developing countries on their low emission journeys and such partnerships for Global NetZero				
8.	**Adverse Environmental Footprint and Impacts:**	**24**	**28**	**26**	**27**
-	Visual and Aesthetic Impact: Consideration of the relative visual landscape changes.	1	3	3	3
-	Size of the Ecological Footprint: Assessment of marine and land-based environmental impacts.	1	2	3	4
-	Extent of wildlife and ecosystem impacts that can not be mitigated. And the nature of these impacts undermining achievement of sustainable development	1	2	4	4
-	Waste Management: challenges in managing waste responsibly and disposal of materials and infrastructure post-decommissionining.	3	3	2	1
9.	**Environmental Externalities:**	**12**	**12**	**9**	**10**
-	Absence of potential Technology Supply Chain Environmental Damage in Developing Countries: Environmental harm in third countries along the supply chain of technologies that involving resource extraction for materials or components (i.e. rare earths and critical minerals)).	**2**	**2**	**3**	**3**
-	Absence of potential Energy resource extraction environmental effects in Developing or Third Countries: Environmental harm for technologies involving energy	4	4	2	2

Table 6: Benchmarking National Benefits / Disbenefits of Rampion 2 against realistic Alternatives (with criteria and scores)					
		Baseline	**Bulk Power Supply Alternatives (EN-1 Section 4.4)**		
	Parameters and National Benefit / Disbenefit Indicators	**Rampion 2 (Sussex Bay inshore & transmission via a SDNP route)**	**Wind Turbines extending an existing Dogger Bank Licence**	**Abated Gas Turbines (CCGT/CC) In South UK**	**Small Modular Reactors (SMR) in decommissioned power sites**
	resource extraction to operate (i.e. LNG, pipeline natural gas or uranium).				
	- Absence of CO2 Emissions in Technology Supply and Delivery Chain: Accounting for carbon emissions during resource extraction (mining), smelting and processing raw material processing, manufacturing, and construction. (e.g.) rare earths, cement and steel)	2	2	3	3
	- Absence of CO2 emissions in energy / fuel supply chain for project operation and maintenance: Accounting for carbon emissions in a LNG or uranium imports and operation stage including maintenance activities).	4	4	1	2
10	**Avoidance of compromising the achievement of sustainable development**	**8**	**19**	**20**	**20**
	- Environment Dimension	1	2	3	3
	- Social Dimension	1	2	3	3
	- Economic Dimension	1	3	3	3
11.	**Distribution and Equity Effects (national to local)**				
	- Fair and Equitable Distribution of Benefits and costs: Extent economic benefits and adverse impacts equitably shared national-to-local and within host communities.	**4**	**9**	**8**	**8**
	- Local benefit relative to investment: Community benefits relative to the investment costs that are ultimately recovered through taxes and energy bills (national to local).	1	3	3	3

Table 6: Benchmarking National Benefits / Disbenefits of Rampion 2 against realistic Alternatives (with criteria and scores)				
	Baseline	**Bulk Power Supply Alternatives (EN-1 Section 4.4)**		
Parameters and National Benefit / Disbenefit Indicators	**Rampion 2 (Sussex Bay inshore & transmission via a SDNP route)**	**Wind Turbines extending an existing Dogger Bank Licence**	**Abated Gas Turbines (CCGT/CC) In South UK**	**Small Modular Reactors (SMR) in decommissioned power sites**
- Local Impact Tradeoffs: Tradeoffs and drawbacks experienced by local communities.	1	1	1	1
- Public Perception and Opposition: Extent the public are aware of the likely range and scope of impacts and accepting of impacts local communities.	1	2	2	2
12. Opportunity Costs: Economic, social and environment opportunities forgone (for improvement)	**8**	**13**	**19**	**20**
- For greater reduction in costly LNG imports: cost of additional LNG to backstop periods of low RE output in order to fuel abated gas-fired generation	1	2	1	4
- For greater reduction in costly power imports: via cross-channel undersea interconnections to backstop low RE output periods via imports from France and other interconnections with the continent, accepting that a two-way flow on interconnections is mutually-beneficial but the UK needs to maximise exports of surplus, not imports with efficient investment.	1	2	4	3
- For a reduction in investment in additional National Grid infrastructure: relating to the forgone opportunity to reduce requirement for additional ancillary services to grid stability and associated investment costs.	1	2	4	3
- To reduce adverse National balance payments: Either related to paying for import of technology from commercial entities or	2	2	2	4

Table 6: Benchmarking National Benefits / Disbenefits of Rampion 2 against realistic Alternatives (with criteria and scores)				
Parameters and National Benefit / Disbenefit Indicators	**Baseline**	**Bulk Power Supply Alternatives (EN-1 Section 4.4)**		
	Rampion 2 (Sussex Bay inshore & transmission via a SDNP route)	**Wind Turbines extending an existing Dogger Bank Licence**	**Abated Gas Turbines (CCGT/CC) In South UK**	**Small Modular Reactors (SMR) in decommissioned power sites**
for LNG and electricity imports:				
- Environmental opportunity costs: Impacts on the value of ecosystem services and tradeoffs versus project benefits.	1	2	4	3
- Social and socio-economic opportunity costs: National health, physical and mental well-being benefits forgone for many via additional costs for all UK citizens (and reduced opportunity) due to degradation/ loss of coastal assets with intrinsic value. As one consequence many travel out of the UK to seek the same benefits; or have lower benefit visiting and the south coast	2	3	4	3
Total Count (Unweighted)	**115**	**156**	**201**	**236**
The higher the score 1 to 4 the more benefit.				
This is relative to Rampion 2 as an assumed baseline				

List of Annexes

Annex#	Title	Relevance
1	Selected Acronyms and Definitions	Selected terminology that some members community organisations asked about
2	Tracking of Relevant case specific NPS Policy Requirements for the consideration of Alternatives in the Rampion 2 Examination	To help indicate the interpretation of the relevant policy provision in Section 4.4. Alternatives in the Rampion 2 case.
3	The Scope for inviting Expert testimony in the Rampion 2 Examination on Section 4.4 Alternatives	Other national policy considerations embodied in UK policy and laws and as seen by international organisations the UK is party to.
4	Relevant Amendments to the Critical National (Energy) Priorities	This is how we interpret and apply NPS EN-1 Section 4.4 in the WR.
5	Wider Policy Context for Interpretation of NPS on Alternatives	Provides background for the consideration of alternatives and how that is relevant
6	Policy Outlook: Economic Life of Rampion 2 (2030-2050)	As above
7	Offshore wind farm efficiency: is Rampion 2 inefficient infrastructure	Important is as evidence of the relative efficiency of turbines in the Sussex Bay inshore versus the Dogger Bank offshore.
8	Ancillary services where efficiency of the windfarm output matters to reduce system costs	Part of the opportunity costs of Rampion 2 and how and why it puts upward pressure on average system costs and hence household electricity bills. The issue is Rampion 2 will require more ancillary services than other Alternative hence higher opportunity costs.
9	Offshore Wind Development Pipeline	While there are may policy targets this shows the room in the offshore project pipeline. However we also feel that the target to decarbonise the power sector by 2035 is the overriding target. Rampion 2 would be ready for decommissioning in 2050. Installed capacity targets for offshore wind have less meaning and value if they do not account for location or efficiency.
10	List of Gas-fired power stations in the UK	To indicate what the more than 30 gas-fired power stations are around the UK what Alternative 2 may be feasible
11	Retired, operating and proposed nuclear sites collocation opportunity for SMRs	Similar to the above for SMRs (Alternative 3)
12	Small Modular reactors: the example of Rolls Royce 470 MW units	Details of Alternative 3 as provided by an SMR Proponent where we believe expert testimony would help the ExA satisfy the Section 4.4 requirements.
13	Gas-fired turbine (CCGT) extension or new plant with carbon capture, use and storage (CCUS)	Similar to the above or Alternative 2

Annex 1:

Selected Acronyms and Definitions

Selected Acronyms

BEIS	Business, Energy and Industrial Strategy
DESNZ	Department of Energy Security and Net Zero
SoS	Secretary Of State
Ofgem	Office of Gas and Electricity Markets
ESO	National Grid Electricity System Operator
TSO	Transmission System Operator
UKAEA	The UK Atomic Energy Authority (UKAEA)
GBN	Great British Nuclear
NDA	The Nuclear Decommissioning Authority
PINs	Planning Inspectorate
CE	The Crown Estates
CCSA	The Carbon Capture and Storage Association (CCSA)
WEA	The Wind Energy Association (WEA)
RWE	The Applicant
CCGT	Combined cycle gas turbine
SMR	Small Modular Reactor
WTG	Wind turbine generator
NZT	The Net-Zero Teesside (NZT)
CC	Carbon Capture
CCS	Carbon Capture and Storage

Selected Definitions

Opportunity Cost	Opportunity cost refers to the potential benefits that are forgone when one alternative is chosen over another. In this context it refers to the economic and environment cost associated with choosing Rampion 2 over an Alternative such as additional LNG or power imports or savings on upfront capital costs
Variable renewable energy generation	Electricity generated from renewable sources supplied to the grid. In this case wind which exhibit fluctuations in output due to natural variability in weather conditions on an hourly, daily, seasonal basis and year-to-year.
Intermittent generation	Electricity generation that occurs sporadically or irregularly in this case offshore wind, which are subject to changes in weather patterns and location specific factors.
Dispatchable power	Electricity generation that can be controlled and dispatched according to demand, allowing grid operators to adjust output levels as needed. In this context it mainly means gas-fired turbines with carbon capture fitted. In the longer term it includes utility-scale energy storage.
Dependable Power	Electricity generation that can be relied upon to provide a consistent and predictable supply of energy, in this case mainly meaning SMRs but include natural gas with carbon capture used for peaking and backing up variable offshore wind when the wind drops
Power system reliability:	The ability of a power system to deliver electricity to UK consumers consistently and without interruptions, while meeting certain performance standards for voltage and frequency.
Ancillary services in a power system	Additional services provided by power system operators to maintain the stability, reliability, and efficiency of the grid. These services may include frequency regulation, voltage control, and reserves for managing sudden changes in supply or demand.: See Annex
Abated Gas-fired Power Stations	Gas-fired power stations that are fitted with carbon capture system so that they have no carbon emissions or little. All UK gas-fired power stations will have to be fitted with carbon capture by 2035
Grid Collapse	A catastrophic failure of the electrical grid resulting in widespread blackouts and loss of power to large areas or regions. Grid collapses can be caused by various factors such as equipment failures, extreme weather events, operator errors or insufficient dependable and dispatchable power to balance demand and supply. At present the most risk is in coldest weather in high pressure which are typically low wind periods, cost and electricity demand is highest.
Unserviced energy cost	The economic and social cost associated with energy that is not delivered to consumers due to transmission or distribution losses, equipment failures, or other factors that prevent electricity from reaching its intended destination and use.
Carbon Capture on gas-fired power stations	The process of capturing carbon dioxide emissions produced by gas-fired power stations and storing them in the UK's offshore carbon storage depots initially in the North Sea to be read by 2030. In this context, initially transport from the southern power stations to storage would be by barge. Reference the Net Zero Teesside Power (NZT Power) project consented in Feb 2024 to be the UK's first fully integrated gas-fired power and carbon capture project with an 860 MW combined cycle gas turbine which, in that case will use a dedicated CO2 pipeline to offshore storage depot.

Annex 2:
Tracking of Relevant case-specific NPS Policy Requirements on the consideration of Alternatives in the Rampion 2 Examination

Highlighted National Policy Statement Paragraphs on Alternatives EN-1 Overarching (NPS 2011)		
EN-1 Policy #	**Text of Policy** (truncated when reasonable due to length)	**Our view on Interpretation / Application in the Rampion 2 Examination**
3.5.6	New nuclear power therefore forms one of the three key elements of the Government's strategy for moving towards a decarbonised, diverse electricity sector by 2050: (i)I renewables; (ii) fossil fuels with carbon capture and storage (CCS); and (iii) new nuclear.	Directional guidance on which Alternatives to consider in the Section 4.4 as realistic and NPS policy-relevant alternatives to Rampion 2 for bulk low-emission supply.
5.9.10	*… Nevertheless, the IPC may grant development consent in these areas in exceptional circumstances. The development should be demonstrated an assessment of:* *- the need for the development, including in terms of national considerations, and the impact of consenting or not consenting it upon the local economy.* *- the cost of, and scope for, developing elsewhere outside the designated area or meeting the need for it in some other way, taking account of the policy on alternatives set out in Section 4.4; and* *- any detrimental effect on the environment, the landscape and recreational opportunities, and the extent to which that could be moderated.*	*The NPS policy pertinent to the consideration of alternatives for low emission generation in the Rampion 2 Examination.* *This analysis will better inform judgments on the national benefits of Rampion 2 in Policy 1.1.2 (adverse impacts outweigh benefits)*
4.4.1	*Under 4.4 Alternatives* *…. From a policy perspective this NPS does not contain any general requirement to consider alternatives or to establish whether the proposed project represents the best option.*	*4.4.2 applies and overrides this to create the requirement in the Examination*
4.4.2	*However:* *…. in some circumstances, the relevant energy NPSs may impose a policy requirement to consider alternatives (as this NPS does in Sections 5.3, 5.7 and 5.9).*	*This is met by paragraph 5.9.10 under Development proposed within nationally designated landscapes*
4.4.3	*Where there is a policy or legal requirement to consider alternatives the applicant should describe the alternatives considered in compliance with these requirements ….* *- the consideration of alternatives in order to comply with policy requirements should be carried out in a proportionate manner;* *- …. the IPC should not reject an application for development on one site simply because fewer adverse impacts would result from developing similar infrastructure on another suitable site,*	Considering alternatives is proportional in a £3-4 billion infrastructure proposal, as well as the context and the three overriding policy considerations noted in the Chapter 2 Summary related to NPS EN-1 paragraphs 1.1.2, 1.2.4 and 1.2.7. It would not be simply due to fewer adverse impacts. It is due to multiple factors including far fewer adverse impacts.

Highlighted National Policy Statement Paragraphs on Alternatives EN-1 Overarching (NPS 2011)		
EN-1 Policy #	**Text of Policy** (truncated when reasonable due to length)	**Our view on Interpretation / Application in the Rampion 2 Examination**
	- alternatives not among the main alternatives studied by the applicant (as reflected in the ES) should only be considered to the extent that the IPC thinks they are both important and relevant to its decision;	The alternatives are important and relevant as they are all critical national priorities. The alternatives are important are relevant to the actual decision-making on Rampion 2 in a number of respects including (1) genuine alternatives to Rampion 2 in the public interest (2) to benchmark and better inform judgement on the overriding considerations noted in the summary of this chapter related to NPS EN-1 paragraphs 1.1.2, 1.2.4 and 1.2.7., and (3) the convergence of the above considerations that add substantial weight to the decision on whether to consent Rampion 2. We argue both important and relevant to the decision and directly inform the consideration of national benefits.
	- it is intended that potential alternatives to a proposed development should, wherever possible, be identified before an application is made to the IPC in respect of it (so as to allow appropriate consultation and the development of a suitable evidence base in relation to any alternatives which are particularly relevant). Therefore where an alternative is first put forward by a third party after an application has been made, the IPC may place the onus on the person proposing the alternative to provide the evidence for its suitability as such and the IPC should not necessarily expect the applicant to have assessed it.	Section 4.4 Alternatives were raised with the Applicant in written statutory consultation responses and verbally in consultation meetings. The Applicant's Consultation Report is silent on the matters of these Alternatives being raise. PCS and IPs have proposed in Relevant Representations in the fall of 2023 how this consideration of alternatives can be conducted efficiently engaging with competent power authorities. Here we note the PA (2008) Procedure Rules allow that,*" the Examining Authority to call expert witnesses to give evidence on specific points at hearings. They may also consider requests from the applicant and other interested parties to call expert witnesses in support of representations they make about the application."* Thus we remain hopeful the ExA may reconsider its decision not to invite, pursue or allow relevant expert witnesses.

Annex 3:

The Scope for inviting Expert testimony in the Rampion 2 Examination on Section 4.4 Alternatives

As Noted:

PA (2008) Procedure Rules allow that," the Examining Authority to call expert witnesses to give evidence on specific points at hearings. They may also consider requests from the applicant and other interested parties to call expert witnesses in support of representations they make about the application."

Reference: Planning Act 2008: Guidance for the examination of applications for development consent" (DCLG, 2015 .
https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/418015/examinations_guidance-__final_for_publication.pdf

Thus in this Representation we again ask, would it not be in the public interest if the ExA to encourage and invites expert testimony on Alternatives from relevant public, private or academic organisations with expertise and resources, such as:

- Great British Nuclear responsible for the planned roll out of home grown Small Modular Reactors (SMRs) on the timeframe and feasibility by 2030 or earlier, as well as industrial strategy benefits, relative to investing £3-4 bn today on Rampion 2, to genuinely position the UK help not only itself but other countries along their low-emission journey.
- Rolls-Royce, and the UK Nuclear Industry Association on plans to co-locate SMRs on existing and proposed large nuclear sites (feasible due to small footprints one tenth that of large nuclear) and the Nuclear Decommissioning Authority (NDA) on plans to coordinate decommissioning of lager nuclear with conversion to one or more Small Modular Reactors (SMRs) including possibly gas-fired turbines at the two planned new large nuclear generation sites both to be EdF built, owned an operated experiencing delays (Hinkley Point C in Somerset set open June 2027, though with media concerns it may delay to 2035 and EDF talks with on funding Sizewell C, in Suffolk.
- Net Zero Teesside Power (NZT Power)[32] on advancing combined cycle gas turbine (CCGT) with carbon capture and storage (CCS) before 2030 including feasibility of abating existing on the south coast (e.g., with post combustion capture, shipping of captured Co2 for on-use or storage way established under the UK Government's Carbon Capture, Usage and Storage (CCUS) cluster sequencing process. Others may include the Carbon Capture and Storage Association (CCSA).
- Ofgem and National Grid on the congruence of these reasonable alternatives to Rampion 2 in the context of re-prioritised energy policy in 2023, and on enhancing flexibility to operate power grid such as with load balancing and impact on reliability and transmission investment. In particular, it would be helpful to engage those with

[32] Facilitated by the oil and gas industry's CEO -led Oil and Gas Climate Initiative. https://www.ogci.com/ and https://www.netzeroteesside.co.uk/project/

expertise to prepare system value modelling analysis with / without Rampion 2 comparing selected reasonable alternatives illustrated in this Representation.

- Crown Estates (CE) in respect to the North Sea option of adding turbines (proposed for Rampion 2) where RWE has just acquired two additional licences on the southern Dogger Bank to develop 3GW of turbines. Project preparation essentially has yet to start. It would be an extension to those licences instead of the existing Rampion installation.
- Here we also note the Rampion 2 was tendered in the 2017 windfarm bid where extension could be no larger than the existing windfarm (in this case 400MW), post-bid increased to 1200 MW - which suggests there is flexibility in the seabed licensing system. Additionally the existing DCO for Rampion 1 that was signed in 2014 states additional adjacent turbines could only be 15% taller than the Rampion 1 turbines (140m).

  The Crown Estates also plays a key role in the development and licensing of carbon storage such as in south coast geological formations offshore, that would be critical to support CCGT/CCUS deployment in the south of England, and open up the possibility and early timing of adding CCUS to existing gas turbine power facilities.

The system value analysis (to quantify the value associated with any proposed infrastructure additions to the generation mix such as Rampion 2, including assessment of flexibility to meet power sector needs and wider energy and climate policy) was undertaken for the Net Zero Teesside Project now awaiting a DCO decision in 2023.

The system value analysis could also be routinely incorporated as an integral and highly important part of the "no-project" analysis, as in the EIA Regulations 2017.

If the Rampion 2 ExA elects not to encourage, facilitate or invite such testimony during the Examination, we urge the ExA to consider a recommendation along those lines that the (now former) Department for Business, Energy and Industrial Strategy (BEIS) may take up during the Rampion 2 Examination period. The ExA may also consider formal recommendations along these lines in their report to the Department of Net Zero then take into account in the latter DCO decision stage.

We do accept that advancing reasonable alternatives to Rampion 2 while essential, requires good-faith collaboration.

Again to reflect Ofgem's call for a more holistic approach to business, energy and industrial strategy, we believe that entails looking at reasonable alternatives and ways to move beyond the relentless focus on building out RE generation even, when the infrastructure is sub-optimal and adds to unwarranted dependency on imported RE technology and imported LNG with higher emissions in the supply chain.

We see this Rampion 2 DCO as being uniquely pivotal and timely as an opportunity to highlight a corrective reasonable alternative pathway for the UK, one that in the words of the former BEIS in its 2021 NPS Review - is "fit for purpose".

Annex 4:

Relevant Amendments to the Critical National (Energy) Priorities

These are

Recommended Amendments to the Government's proposed Critical National Energy Priority (CNP)

Consultation Audiences: *"The government wants to hear from members of the public, industry, non-governmental organisations and any other organisation or public body."*
https://www.gov.uk/government/consultations/planning-for-new-energy-infrastructure-revisions-to-national-policy-statements

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Summary Note

Evidence suggests that limiting the UK's critical national energy priority (or CNP) to offshore wind <u>alone</u> is counterproductive and requires amendment. Any CNP must also ensure that in parallel, complementary low-emission generation and other essential system components are in place to back-up the intrinsically intermittent offshore wind. That is essential to deliver secure, reliable and affordable electricity supply, as well as foster the achievement of sustainable development in affected coastal and inland areas all around these islands – not undermine it.

This CNP approach actually increases UK dependency on imported energy <u>**and**</u> imported RE technology - at least for decades. For the foreseeable future the lion's share of the UK's offshore wind technology will be supplied by European commercial consortiums where the high-value green jobs, renewable subsidy and profits flow. It does little to advance home-grown green energy technology and industry capacity to provide self-reliance, or access export markets or advance UK global leadership to help other countries on their low emission journeys.

- As formulated the CNP spectacularly fails to take account of policy and regulatory failures over past decades that have placed "too many energy eggs" in one basket and has made UK electricity unaffordable for many households and small businesses today.
- Ironically, the UK is now saddled with the highest electricity bills in Europe, despite having the largest share of wind and solar of any major economy in the world, now approaching 50 percent on an average annual basis, ignoring the variability and intermittency.
- Military threats to all energy infrastructure fixed offshore, including wind installations, have not receded after 2022-2023 events and given geopolitical realignments now underway. In terms of promoting National Security CNP claims may be seen as wishful thinking, even reckless.
- It may also be argued this single technology focus is London-centric as directly harmful impacts are "out of sight, out of mind". It assumes that all offshore wind projects have the same benefit-risk tradeoffs, thus can be imposed on coastal and inland communities simply by restricting time and local voice in the consenting processes, regardless of location and "residual impacts".
- <u>**Most concerning**</u> is this CNP formulation ignores key recommendations of national and international bodies who have deeply considered the UK's energy priorities and ways to effectively deliver decarbonisation of the power sector by 2035, and eventually NetZero, notably:
    - The Parliamentary Committee on Climate Change in their recent report of March 2023 calling for an *"<u>equal focus to low-carbon flexible solutions</u> as to the delivery of its existing renewable and nuclear commitments*";

- Ofgem and ESO statements on priorities to maintain reliable and affordable electricity supply as the share of variable RE is grown while the national grid comes under pressure from electrification mandates for transport and heating, at least doubling demand by 2035-2050;
- The World Bank Energy Sector Management Assistance Programme (ESMAP) and IEA, both advising on ways to responsibly integrate variable RE into electric power grids;
- The CBI urging Government to prioritise new nuclear power and scale-up carbon capture technology for flexible generation to power a competitive economy and reach NetZero; and
- The European Commission in 2022 which urgently classified natural gas and nuclear as green energy sources essential for the multi-decade transition (to unblock ESG financing).

It may be reasonably argued that this CNP reflects the same "wilfully blind" thinking and narrative that landed the UK in the present-day mess: lots of variable RE generation (sometimes, and more to come) yet among the highest electricity bills in the world; leaving these islands more vulnerable to volatile international markets and supply chains for both imported RE technology and raw energy (i.e. LNG imports and gas pipelines and power interconnects with the continent).

A more balanced and responsible way forward is to amend this CNP, namely by:

i. Including clean, low-emission generation systems under the CNP umbrella to complement weather-dependent variable wind and electrification mandates, specifically flexible generation from abated gas-fired power (adding carbon capture to existing power stations to make them NetZero) and deploying small modular reactors (SMRs) in locations where existing large nuclear plant are decommissioned, as already provided in technology-specific NPS, but with no real sense urgency or priority;
ii. Focusing offshore wind development in the designated Renewable Energy Zone (REZ) wisely identified as such in the UK Energy Act (i.e. from 12 to 200 nautical miles seaward);
iii. Giving legal status to the Government's own existing Offshore Energy Strategic Environmental Assessment (OESEA) advice on ensuring visual buffers for large wind turbines (distance from significant receptors, or from shore) to ensure consistency, fairness to coastal communities and thereby reduce controversy;
iv. Ensuring system value analysis / modelling of all NSIP offshore windfarm proposals are routinely undertaken by relevant authorities (such as Ofgem or ESO) to inform each DCO application and to optimally time and sequence low-emission generation additions with the essential transmission and ancillary services; and
v. Rank and prioritise locations to systematically license investment in offshore wind by appropriate criteria such as efficiency, energy performance, system fit and value for money.

Further it will massively help to introduce a **fast track category of offshore wind developments** that satisfy simple location and policy criteria, as suggested herein.

These proposed amendments are common sense and reflect considered advice of the bodies noted above. They are prudent and measured given the Government's ambition is to collapse the consenting process for offshore wind from the present average of 4 years to 1 year, in effect by removing safeguards, close scrutiny and local voice - contrary to the wisdom of the Localism Act.

Annex 5:

Wider Policy Context for Interpretation of NPS on Alternatives

BEIS, 2022 a; UK ENERGY IN BRIEF, https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/1130451/UK_Energy_in_Brief_2022.pdf

CCC, 2023a Delivering a reliable decarbonised power system, Climate Change Committee March 2023, https://www.theccc.org.uk/

The UK is at a critical crossroads re-calibrating its national energy policy, strategic infrastructure planning priorities and regulation after international events in 2022 changed the world; and revealed massive UK energy risk exposures including for offshore infrastructure.

Despite attaining the highest renewable energy (RE) share of any major OECD economy, now near 45-50% of total UK electricity generation (on an average annual basis ignoring the RE intermittence), the UK now has one of the highest electricity tariffs in the world. Moreover, the national grid risks being overwhelmed as demand will at least double by Ofgem estimates between 2035 and 2050.

The near- to medium-term outlook to 2035 is for ever higher dependence on target-driven imported RE technology, as well as LNG from abroad and other imported energy via cross-channel pipelines and cables. Current trajectory guarantees vulnerability with mostly offshore energy supply and infrastructure, while off-shoring high value jobs, profits and industrial opportunity to economic competitors - impoverishing UK households and small businesses in the process.

Critical thinking is needed on a sensible transition to a low-carbon economy and to meet mandated increases in power demand with the electrification of the transport and heating sectors, in ways that respect the overarching planning objective of sustainable development and strategic environmental advice in that regard. A system value approach is fundamentally important to examine and optimally sequence power sector investments at the right time, in the right place and to do so affordably - rather than relying on simple, symbolic targets to drive important strategic decisions.

It also recognises the dynamic and ongoing recalibration of the suite of National (Energy) Policy Statements that are the foundation for reaching decisions on NSIPs like Rampion 2 and viable alternatives.

Plus it reflects a common sense wider debate, not only in the UK but across the western world now on how rapidly the energy transition can take place and the urgency to better sequence generation investments to avoid severe economic disruption and social consequences now a reality (IMF, 2022 a).

As noted by the Government Office for Gas and Electricity Markets recently," ***there are choices within the future electricity system pathway",*** which the DCO Examination and decision stages can take into account (Ofgem, 2021a).

The 2023 parliamentary Climate Change Committee report (CCC, 2023a) highlighted related concerns including:

- *"… Government has not yet provided a coherent strategy to achieve its goal (decarbonisation of the power system by 2035, subject to reliability) nor provided essential details on how it will encourage the necessary investment and infrastructure to be deployed over the next 12 years",*
- *"This will open the path to major new investment in renewable generation and infrastructure. It can also support essential flexible low-carbon technologies – these must remain a critical priority for Government alongside the delivery of renewables and nuclear,"*
- *"a number of processes – including planning, consenting and connections – must be urgently reformed to deploy infrastructure at sufficient speed to deliver the required range of system components by 2035.*
- *"The Government must give equal focus to low-carbon flexible solutions as to the full delivery of its existing renewables and nuclear commitments."*

In this respect the call by the Parliamentary Committee on Climate Change for low-carbon flexible solutions as a critical priority alongside Renewables also aligns with **the European Commission's reclassification of nuclear power and natural gas as "green energy" sources in 2022.**

That unlocked European and international financing to enable nuclear and gas-fired generation (preferably abated) to form part of a more flexible, low-emission less ideological sustainable energy transition, not seemingly blind to the inherent variability of RE resources otherwise forming an important part of the generation mix.

Annex 6:

Policy Outlook: Economic Life of Rampion 2 (2030-2050)

From and energy security perspective in practical terms, the UK will continue to grow its dependency on imported RE technology and imported energy resources in the near- to medium-term, despite the rhetoric and claims in Government press releases that the UK is now “leading the world in the renewable energy revolution: i.e.

- Wind turbines and associated high-value proprietary RE technology are largely from European suppliers.
- solar technology is mainly imported from China, produced in energy intensive processes with a significant fossil fuel mix impacting on global emissions (with some solar array and balance of systems assembled in the UK);
- imported north sea gas from Norway under pressure to expand natural gas production and also to make that same gas available to the Continent to replace Russian gas imports;
- Imported LNG mainly from Qatar and the USA, or in essence “off shoring” the UK’s natural gas fracking to the USA, and
- Imported power from interconnection with EU power grids (yes a positive also facilitating 2-way exchange) but also increasing import dependence.

The various ways to expand low-emission energy technology systems both for grid-connected and distributed uses are noted in the initiatives in the National (Energy) Policy Statements NPS that guide DCO Examinations for energy NSIP. Former BEIS staff updated these in 2021 and conducted an open consultation in order to “… identify whether the revised NPS presented were “fit for purpose” and “whether they provide a suitable framework to support decision making for nationally significant energy infrastructure)”. [33]

Reality check on key challenges to 2035:
Setting the international context in 2022 the IMF indicated that in addition to the uncertain pace of technological development and deployment of different energy technologies, four issues in particular stand out in energy policy across the globe, namely:

1. ***“The return of energy security as a prime requirement for countries***
2. ***Lack of consensus on how fast the transition should and can take place, in part because of its potential economic disruptions***
3. ***A sharpening divide between advanced and developing countries on priorities in the transition***
4. ***Obstacles to expanding mining and building supply chains for the minerals needed for the net-zero objectives.”***

[33] https://www.gov.uk/government/consultations/planning-for-new-energy-infrastructure-review-of-energy-national-policy-statements

Annex 7:

Offshore wind farm efficiency: is Rampion 2 inefficient infrastructure

One immediate challenge of course is to both appreciate and deal with the RE resource variability issue, as wind and solar resources will form a large share of renewable supply, and to thus optimally sequence complementary NSIP investments.

The intrinsic variability of UK wind resources is illustrated by the rolling 30-day graphs on the Crown Estates website of total offshore wind output, as in Figure ES-X for Jan-Feb 2023 and ES-Y Y for Aug 2022 recognizing it varies daily, seasonally and year-to-year. [34]

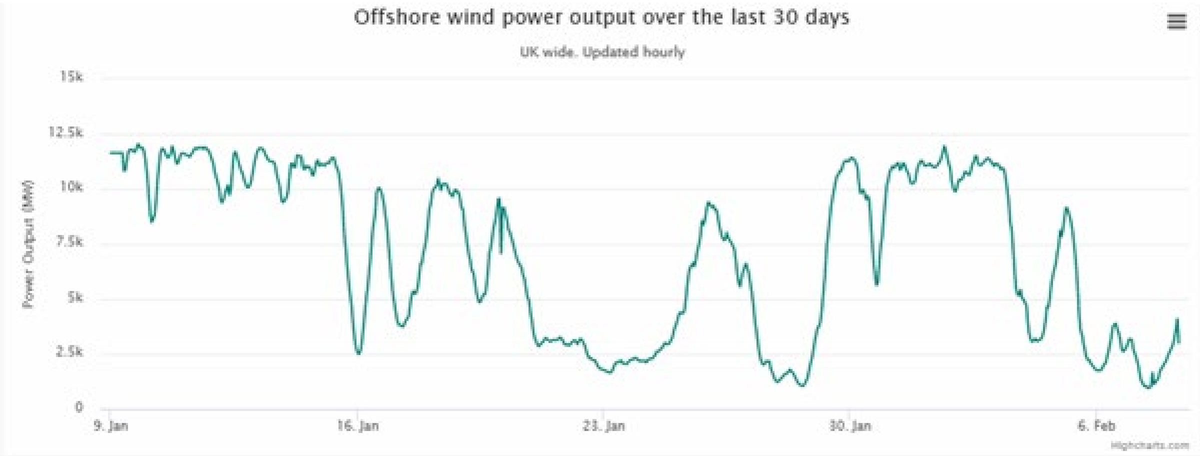

Figure ES-#: Total UK offshore wind rolling Output 30-day Jan-Feb 2023 (Crown Estate website 08 Feb 2023)

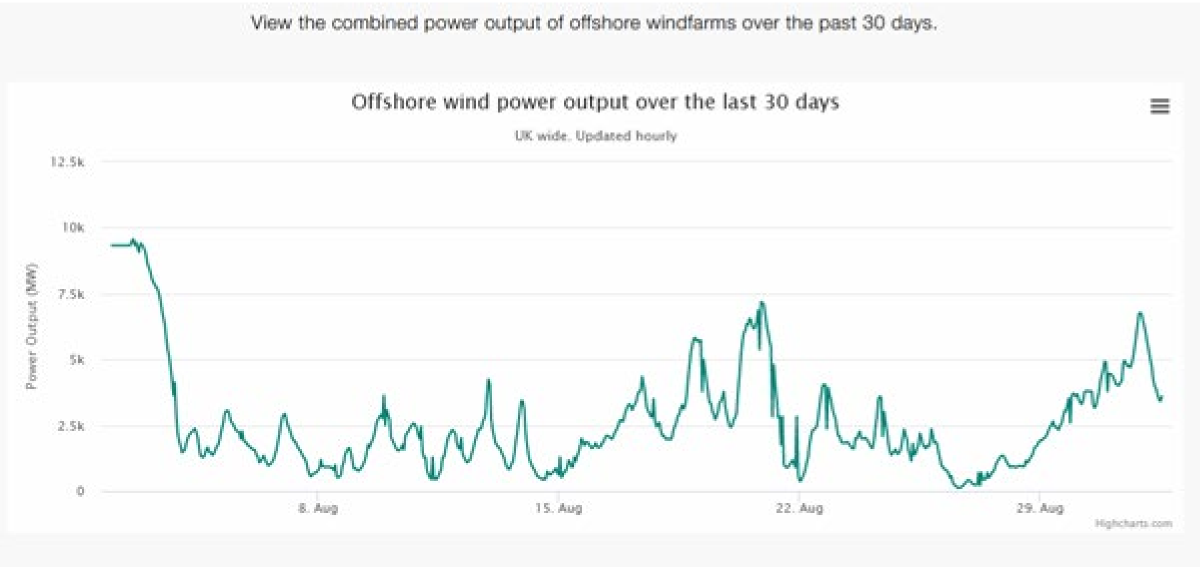

Figure ES-#: Total UK offshore wind rolling Output 30-day August 2022

[34] At night we get no solar generation either from large grid-scale solar installations in fields, or on house roofs. At UK latitudes we receive far less solar in winter months due to short daylight hours (8 hours daylight in January versus over 16 hours of daylight in July) and far lower solar intensity in winter, by a factor of almost 7.

Inherently all wind farms are an intermittent source of energy, however some are more intermittent than others. When the wind blows at a reasonably high speed then they will generate their full output. At lower wind speeds the output will be low. When the output is low there is no wind-generated electricity to feed into the National Grid.

Locating wind turbines in areas of high wind power density make them more efficient and value for money, all things considered.

An illustration of concern over the relative performance of Rampion 2, as compared to moving the same turbines offshore to the North Sea is seen in the data in Figure . It is a semi-technical graph of load duration curves for offshore windfarms showing the percent of time (horizontal axis) they produce at different power outputs (capacity factor or load factor, on the vertical axis) as a percent of installed capacity.

That graphical data tells us:

- 15% of the time the existing Rampion windfarm turbines produce no output at all. [35]
- That compares with 7% of the time the Hornsea One windfarm in the North Sea produces no output. Rampion thus has no output twice as often.
- 60 % of the time Rampion 1 output is 40% or less of its installed capacity; or conversely, Rampion only produces above 40% of installed capacity 40% of the time.
- In contrast, the Hornsea One windfarm spends 55% of time generating above 40% of its installed capacity (compared to 40% for Rampion).
- Honsea One produces above the UK average capacity factor 65% of the time.

The point being that Rampion 2 turbines would have the same relative lower performance noted above (being adjacent to Rampion 1 in the same wind regime) as compared to investing the same £3-4 billion to install those turbines in the North Sea area.

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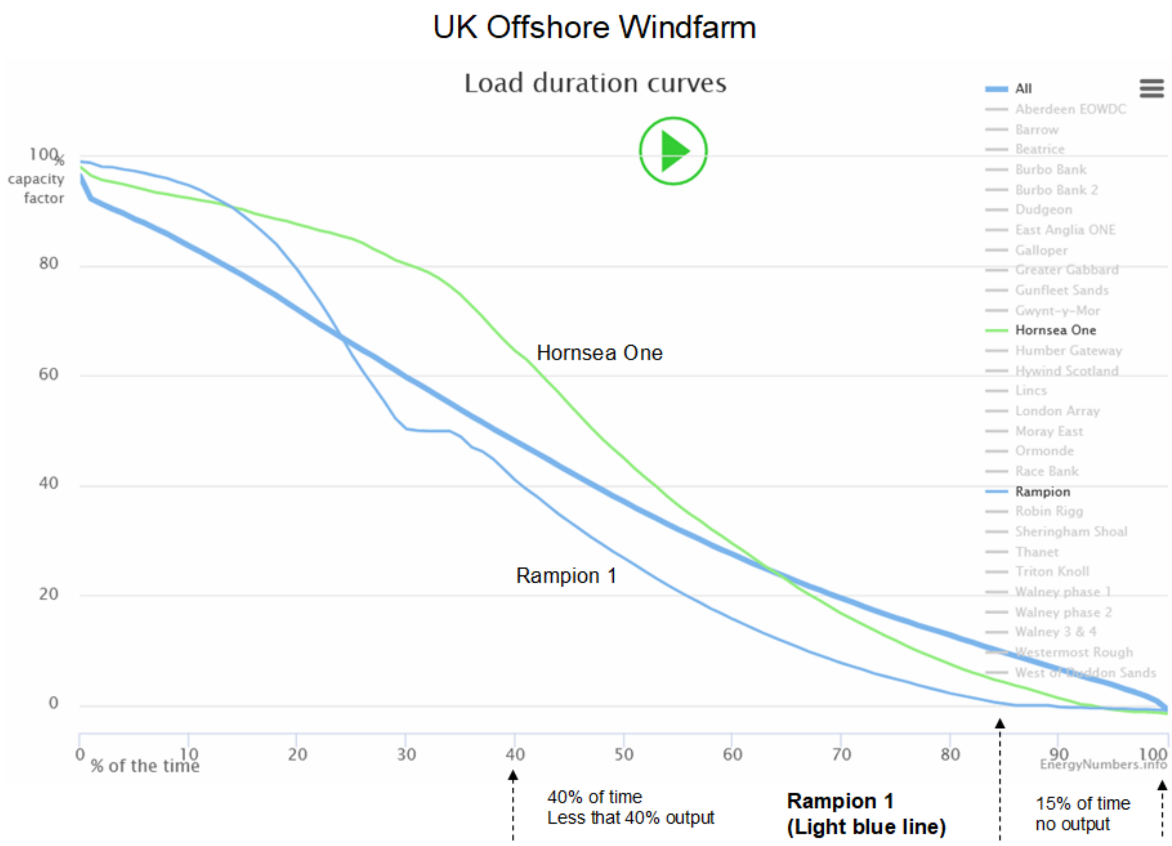
[35] 15% of the time is equivalent on average to 1 day a week with no power. 40% is equivalent to nearly 5 months (4.86 months) that Rampion 1 output is less than 40% its installed capacity. Figures 1 and 2 with the rolling 30-day output this year, show that periods of low output actually vary up to several days at a time.



Source: https://energynumbers.info/uk-offshore-wind-capacity-factors

Figure 3: Comparison of Loads Duration Curves (capacity factor versus % of time) for Rampion 1 on the South Coast (light blue line), Hornsea One in the North Sea (green line) and, the average for all UK Offshore windfarms (thicker blue line).

Annex 8:

Ancillary services where efficiency of the windfarm output matters to reduce system costs

Ancillary services are a range of support functions and capabilities within a power system where infrastructure may necessary to ensure reliable operation, particularly in systems with a significant presence of intermittent and variable renewable generation like wind and solar as planned in the UK. These services help to maintain grid stability, balance supply and demand, and manage variability and uncertainty inherent in renewable energy sources.

Additional infrastructure investment is required. The functions include:

Frequency Regulation: Fluctuations in electricity demand and supply can affect the frequency of the power system. Frequency regulation services involve investment in adjusting generation or load in real-time to maintain grid frequency within acceptable limits.

Voltage Control: Variations in renewable energy output can impact voltage levels in the grid. Voltage control services and related investments involve regulating voltage at various points in the system to ensure it remains within acceptable ranges for the safe and efficient operation of equipment.

Reactive Power Support: Reactive power is necessary for maintaining voltage levels and ensuring efficient transmission of electricity. Renewable generation may not inherently provide sufficient reactive power support, so ancillary services are needed to supply or absorb reactive power as needed to maintain system stability.

Ramp Rate Control: Intermittent renewable sources like wind and solar have rapid changes in generation output. Ramp rate control services and investments manage these rapid changes and smooth the transition between different levels of generation to avoid grid instability.

Black Start Capability: In the event of a system-wide blackout, black start services involve the ability to restart and re-energize the grid from a completely de-energized state. Abated gas generation and energy storage resources can provide this critical service.

Load Following: Renewable generation can vary throughout the day based on weather conditions, leading to mismatches between supply and demand. Load following services involve adjusting generation or dispatching flexible resources such as abated gas generation to match changes in demand in real-time. In the longer term well beyond 2035 other storage systems may be affordable and scalable.

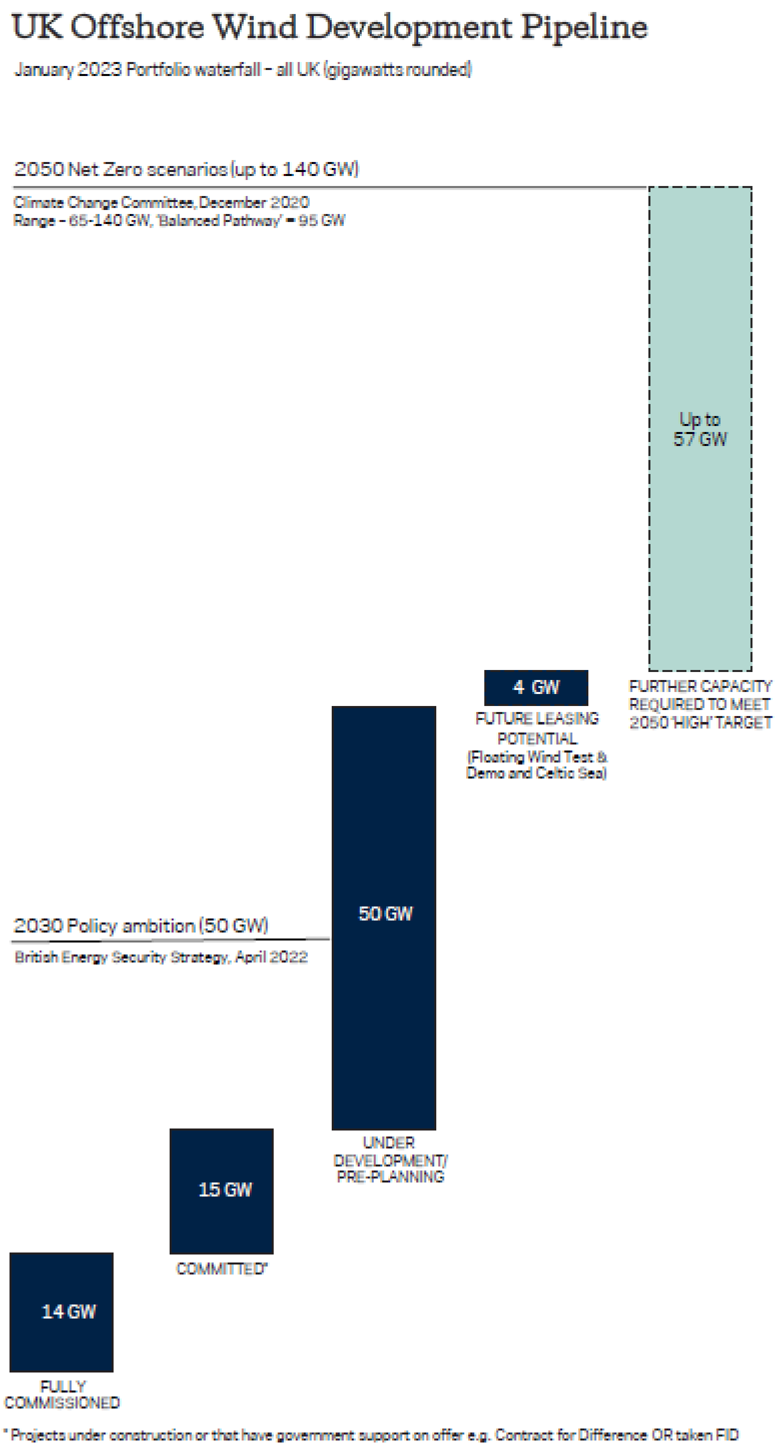
Reserve Capacity: Reserve services ensure that additional generation capacity is available on short notice to respond to unexpected changes in demand or generation, helping to maintain grid reliability and prevent disruptions.

Grid Balancing Services: These services encompass a range of actions to balance supply and demand on the grid, including energy storage, demand response, and flexible generation resources that can respond quickly to fluctuations in renewable generation.

The issue is Rampion 2 will require more Ancillary services than the other Alternative hence have higher opportunity costs.

Annex 9:

Offshore Wind Development Pipeline



https://www.thecrownestate.co.uk/media/4213/overview-of-uk-offshore-wind-portfolio.pdf

Annex 10:

Gas-fired power stations in the UK

There are about 32 active gas fired combined cycle power plants the United Kingdom, which have a total generating capacity of 28.0 GW.[1]

Name	Location	Owner	Date Commissioned	Total capacity (GW)
Baglan Bay	Wales		2002	0.52
Ballylumford C	Northern Ireland	AES	2003	0.62
Carrington	North West	ESB	2016	0.91
Connahs Quay	Wales	Uniper	1996	1.38
Coolkeeragh	Northern Ireland	ESB	2004	0.41
Corby	East Midlands	ESB	1994	0.41
Coryton	East England	Intergen	2002	0.8
Cottam Development Centre	East Midlands	Uniper	1998	0.45
Damhead Creek	South East	Vitol	2000	0.81
Didcot B	South East	RWE npower	1998	1.45
Enfield	London	Uniper	1999	0.41
Grain CHP	South East	Uniper	2011	1.52
Great Yarmouth	East England	RWE npower	2001	0.42
Keadby	Yorkshire and Humber	SSE plc	1994	0.74
Langage	South West	EPUKi	2010	0.91
Little Barford	East England	RWE npower	1995	0.72
Marchwood	South East	Marchwood Power	2009	0.9
Medway	South East	SSE plc	1995	0.76
Pembroke B	Wales	RWE npower	2012	2.2
Peterhead	Scotland	SSE plc	2000	1.18
Rocksavage	North West	Intergen	1998	0.81
Rye House	East England	Vitol	1993	0.72
Saltend	Yorkshire and Humber	Energy Capital Partners	2000	1.2
Seabank	South West	Seabank Power	2000	1.23
Shoreham	South East	Vitol	2000	0.42
South Humber Bank	Yorkshire and Humber	EPUKi	1997	1.37
Spalding	East Midlands	Intergen	2004	0.95
Staythorpe C	East Midlands	RWE npower	2010	1.77
West Burton B	Yorkshire and Humber	Vitol	2004	1.25
	East Midlands	EDF Energy	2013	1.33

30.24

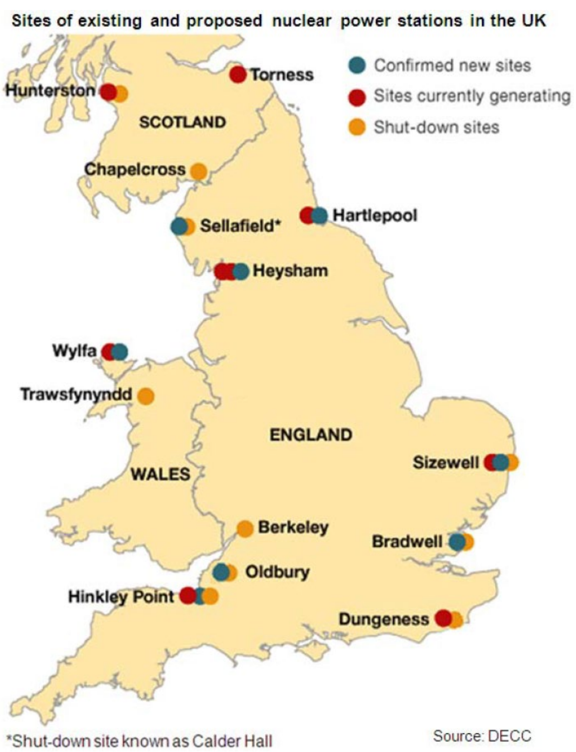
Annex 11:

Retired, operating and proposed nuclear sites collocation opportunity for SMRs

As noted on Government's BEIS website: [36]

> *"(The UK) will see a significant acceleration of nuclear, with an ambition of up to 24GW by 2050 to come from this safe, clean, and reliable source of power. This would represent up to around 25% of our projected electricity demand. Subject to technology readiness from industry, Small Modular Reactors will form a key part of the nuclear project pipeline.*
>
> *A new government body, Great British Nuclear, will be set up immediately to bring forward new projects, backed by substantial funding, and we will launch the £120 million Future Nuclear Enabling Fund this month. We will work to progress a series of projects as soon as possible this decade, including Wylfa site in Anglesey. This could mean delivering up to 8 reactors, equivalent to one reactor a year instead of one a decade, accelerating nuclear in Britain." 6 April 2022*

The UK's current nuclear fleet is now down to five power stations that currently supply about 16pc of Britain's power annually. All but one plan is expected to close before 2030. Another three sites are being defuelled as they are closed down, the latest being Hinkley Point B in Somerset, which closed in 2022.



36 https://www.gov.uk/government/news/nuclear-energy-what-you-need-to-know 6 April 2022

Recently retired Large Nuclear Plant in the UK

The three recently retired nuclear plant which are all Advanced Gas-cooled Reactors (ARGs) that have been operating for 40 or more years include:

1. Hinkely Point B
2. Dungeness B
3. Hunterston B,

A key aspect in relation to locating SMR as reasonable alternatives as BEIS sates is "In terms of future use for these sites, after the final defueling phase and then decommissioning they will be freed up land for future uses."

Currently operating nuclear plant in 2022:

1. Sizewell B
2. Hartlepool station, on the River Tees
3. Heysham 1 station, near Lancaster (2GW)
4. Heysham 2
5. Torness

There are currently 5 remaining generating stations all operated by EDF Energy. Sizewell B, the UK's only Pressurised Water Reactor (PWR) is expected to continue generation past 2028 though EDF is said to be looking at plans to extend the life of Sizewell B by 20 years to 2055. [37] AGR stations at Torness, Heysham 1, Heysham 2 and Hartlepool will end generation between 2022 and 2028. [38] EDF is reportedly reviewing current plans to close Hartlepool and Heysham 1 in March 2024 "with an ambition to generate longer if possible" [39]

Extending large nuclear plants will not help the UK in the immediate crisis, but could secure supplies in the longer term.

Proposed new large nuclear:

- EDF is building Hinkley Point C in Somerset, set open June 2027, though concerns are it may be facing an 11 year delay to 2035[40]
- EDF was in talks with the Government on co-funding funding Sizewell C, in Suffolk.

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[37] EDF exploring keeping UK nuclear power plants open for longer to boost energy supplies (telegraph.co.uk)

[38] The closures will unfold just as demand for clean electricity rises due to a boom in electric cars, while stable sources of power are needed to balance out intermittent renewables. Extending large nuclear plants will not help the UK in the immediate crisis, but could secure supplies in the longer term.

[39] EDF exploring keeping UK nuclear power plants open for longer to boost energy supplies (telegraph.co.uk)

[40] Hinkley Point nuclear plant faces risk of 11-year delay (msn.com)

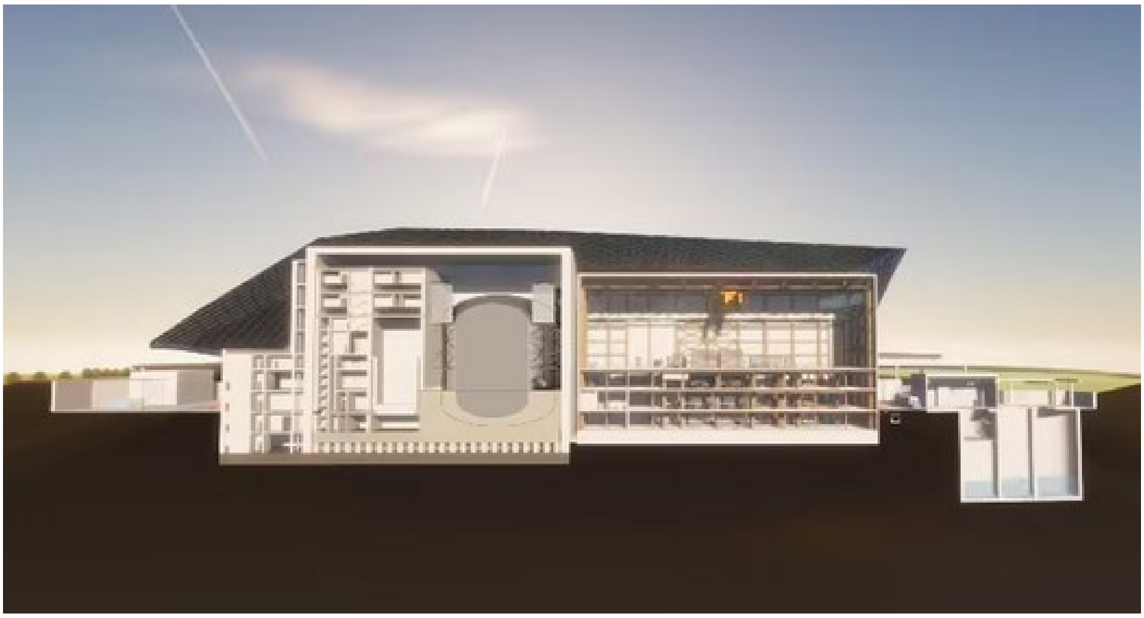
Annex 12:
Small Modular reactors: the example of Rolls Royce 470 MW units

At present Rolls-Royce is the only UK Company with over 60 years experience with small nuclear plane for military applications. It now has a civilian power model. In 2022 Rolls-Royce shortlist of six potential sites for its first dedicated small modular reactor (SMR) factory. It is expecting to receive UK regulatory approval for its SMR by mid-2024 with a view to powering up by 2029. [41]

Relevant points that Rolls-Royce SMR in its promotional material on the website extracted as follows for reference, evidence and illustration purposes:

Extracts from https://www.rolls-royce.com/innovation/small-modular-reactors.aspx#section-overview

"Our SMR value proposition has 4 key elements for SMR success – we are bringing to market a low cost, deliverable, global and scalable and investable solution:



Low cost

- always on' clean energy
- low-cost clean energy solution, using proven and commercially available technology to deliver a fully integrated, factory built nuclear power plant.

- focus on modularisation, and maximising the amount of work conducted under factory conditions.

Deliverable

[41] https://www.newcivilengineer.com/latest/rolls-royce-shortlists-six-sites-for-modular-nuclear-reactor-factory-05-07-2022/

- uses the breadth of the UK supply chain, able to contribute more than 80% of each SMR by value – focusing on standardised, commercially available and off-the-shelf components.
- moves away from the high cost and high-risk complex construction programme principles into predictable factory-built commodities.

- Approximately 90% of manufacturing and assembly activities are carried out in factory conditions, helping to maintain an extremely high-quality product - reducing on-site disruption and supporting international roll out.

Global & scalable

- Making a meaningful impact across multiple countries, meeting unprecedented demand for clean energy.
- direct response to that enormous global challenge and our ambitions are set to match that global market as we look to build a world class global product.

- factory-built model is entirely scalable. As demand increases, we invest in further factories using the same design and management systems used for all our SMRs.

- Memorandums of Understanding are already in place with Estonia, Turkey and the Czech Republic.

- The Rolls-Royce SMR programme is forecast to create 40,000 regional UK jobs by 2050 and generate £52bn in economic benefit.

The compact footprint increases site flexibility and maximises potential plant locations, including replacement for existing coal or gas-fired plants.

Investable

- Designed to attract traditional forms of capital through a low-risk factory-based solution.
- By design, our SMR is focused on attracting all forms of private capital to support the build out of global SMR demand.

- With a proven factory built commoditised approach, our SMR will offer investors and lenders a degree of confidence that will enable future customers to access a range of capital options to finance their SMR purchase.

- A Rolls-Royce SMR power station will have the capacity to generate 470MW of low carbon energy, equivalent to more than 150 onshore wind turbines.

- It will provide consistent base load generation for at least 60 years, helping to support the roll-out of renewable generation.

- The compact footprint increases site flexibility and maximises potential plant locations, including replacement for existing coal or gas-fired plants.

- In addition to stable base load power, Rolls-Royce SMRs will be able to provide energy for the net zero manufacture of green hydrogen and synthetic fuels to support the decarbonisation of transport.

It will occupy approximately one tenth of the size of a conventional nuclear generation site, helping to reduce local environmental impacts. Rolls-Royce SMR will be factory built, enabling completed modules to be transported by truck, train or barge, reducing vehicle movements and completion risk and increasing build time certainty.

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As far as sites for UK SME rollout:

Wylfa in Anglesey and Oldbury in South Gloucestershire have also been named as candidates to host either large-scale plants, smaller modular nuclear reactors, or possibly both. To date as MoU enables the Nuclear Decommissioning Authority (NDA) to share information and expertise around the characteristics of its land at Trawsfynydd, to align the decommissioning plans and site activities with the new nuclear project, and to support Cwmni Egino with stakeholder engagement and developing socio-economic plans. [42]

The newly created (in 2022) Great British Nuclear (GBN) as well as BEIS and NDA) is to identify other appropriate sites. We would ague that with appropriate expert advice serious consideration (if not already done and subject to Great British Nuclear (GBN) as well as BEIS and NDA be given to:

- Wylfa in Anglesey and Oldbury in South Gloucestershire already named
- The existing Sizewell B site
- Hinkley Point C in Somerset (11 year delay gas turbines as construction power?

Rolls Royce Reveals 440 MW Commercial Reactor Design | Neutron Bytes: November 9, 2019
https://neutronbytes.com/2019/11/09/rolls-royce-reveals-440-mw-commecial-reactor-design/

(61) Rolls Royce Nuclear "Small" Modular Reactors are coming! - YouTube

UK Government kick-starts approval process for Rolls Royce's small nuclear reactors Published, March 2022
https://www.edie.net/uk-government-kick-starts-approval-process-for-rolls-royces-small-nuclear-reactors/

Rolls-Royce hopes for UK SMR online by 2029 : New Nuclear - World Nuclear News: *April 2022*

42 https://www.gov.uk/government/news/agreement-to-progress-development-of-new-uk-small-modular-reactors

https://www.world-nuclear-news.org/Articles/Rolls-Royce-hopes-for-UK-SMR-online-by-2029
The chairman of Rolls-Royce SMR, Paul Stein, has told the *Reuters* news agency he hopes to get regulatory approval for its small modular reactor (SMR) design by mid-2024, with grid power able to be produced by 2029.

Rolls-Royce expecting UK approval for mini nuclear reactor by mid-2024 – EURACTIV.com: April 2022
https://www.euractiv.com/section/energy/news/rolls-royce-expecting-uk-approval-for-mini-nuclear-reactor-by-mid-2024/

UK launches funding to encourage nuclear new build: Nuclear Policies : World Nuclear News: *May 2022* https://www.world-nuclear-news.org/Articles/UK-launches-funding-to-encourage-nuclear-new-build
Annex 8:

Annex 13:

Gas-fired turbine (CCGT) extension or new plant with carbon capture, use and storage (CCUS)

Crown Estates notes:
https://www.thecrownestate.co.uk/en-gb/what-we-do/on-the-seabed/energy/carbon-capture-usage-and-storage/

"With carbon capture widely recognised as integral to the UK meeting its climate change target of net zero emissions by 2050, the UK Government has recently expanded on its ambition with a renewed target to capture and store 20 to 30 million tonnes of CO2 emissions per year by 2030, and over 50 million tonnes by 2035.

Three aspects circumscribe the consideration:

Firstly, the EU re-classification in early 2022 of natural gas as "green energy" mends increased competitiveness for EU sourced natural gas from pipelines (e.g., Norwegian North sea gas and Algerian supply to southern Europe) and LNG on international markets for which the EU are building LNG import facilities.

Secondly, as the National Grid points out and to paraphrase, as the UK continues the journey towards a decarbonised energy future, gas-fired power stations alongside other balancing mechanisms will be increasingly expected to meet the variability associated with renewables.

"This change in requirement creates operational uncertainty that we need to quantify, to understand the risk it poses. As electricity generation becomes more weather dependent, we anticipate that gas-fired generation demand will become more variable within-day, and day-to-day. National Grid"

https://www.nationalgrid.com/gas-transmission/insight-and-innovation/gas-future-operability-planning-gfop/future-gas-fired-generation

Thirdly:

"Most natural gas-fired generation technologies can provide flexibility. Natural gas can be utilized for a number of centralized or distributed flexible generation technologies in a wide variety of capacity ranges that can contribute to VRE integration. Natural gas-fuelled assets can run in different operating modes, from peak to base-load, in stand-alone or standby applications, or even combined with VRE systems in hybrid power plants." P36. WB

https://www.iea.org/reports/the-role-of-ccus-in-low-carbon-power-systems/how-carbon-capture-technologies-support-the-power-transition https://www.ge.com/gas-power/future-of-energy/carbon-capture-storage

Context:

Crown Estates:
https://www.thecrownestate.co.uk/en-gb/what-we-do/on-the-seabed/energy/carbon-capture-usage-and-storage/

"With carbon capture widely recognised as integral to the UK meeting its climate change target of net zero emissions by 2050, the UK Government has recently expanded on its ambition with a renewed target to capture and store 20 to 30 million tonnes of CO2 emissions per year by 2030, and over 50 million tonnes by 2035.

Carbon Capture and storage component.

https://www.ogci.com/about-us/ The Oil and Gas Climate Initiative is a CEO-led organization bringing together 12 of the largest oil and gas companies worldwide to lead the industry's response to climate change. It aims to accelerate action towards a net zero emissions future consistent with the Paris Agreement. OGCI members are Aramco, BP, Chevron, CNPC, Eni, Equinor, ExxonMobil, Occidental, Petrobras, Repsol, Shell and TotalEnergies.

OGCI members set up OGCI Climate Investments to create a US$1 billion-plus fund that invests in companies, technologies and projects that accelerate decarbonisation within energy, industry, built environments and transportation.

The system value analysis (to quantify the value associated with any proposed infrastructure addition to the generation mix for low carbon energy, including flexibility to meet power sector needs and wider energy and climate policy) was undertaken for the Net Zero Teesside Project now awaiting a DCO decision in 2023. That features a gas-fired 850 MW gas-fired power station with carbon capture, utilisation and storage (CCUS) to be operational by 2029. It could also be part of the "no-project" analysis as in the EIA Regulations 2017.

Pins Description - About this project

A full chain carbon capture, utilisation and storage ('CCUS') project, comprising a CO2 gathering network, including CO2 pipeline connections from industrial facilities on Teesside to transport the captured CO2 (including the connections under the tidal River Tees); a combined cycle gas turbine ('CCGT') electricity generating station with an abated capacity circa 850 MW output (gross), cooling water, gas and electricity grid connections and CO2 capture; a CO2 gathering/booster station to receive the captured CO2 from the gathering network and CCGT generating station; and the onshore section of a CO2 transport pipeline for the onward transport of the captured CO2 to a suitable offshore geological storage site in the North .

Net Zero Teesside Power's proposed combined cycle gas turbine electricity generating station will have an electrical output of up to 860 megawatts (MW) of low carbon electricity, enough to power up to 1.3m homes per year. From the power plant alone, the proposed carbon transportation and storage infrastructure will capture and store up to two million tonnes of CO2 a year.[1],[2]

The integrated facility consists of a H-class gas turbine combined cycle gas turbine (CCGT) with amine-based post-combustion capture designed for rapid start-up, whilst capturing over 95% of emissions. CO2 is dried and compressed to safely enter the transportation and storage system. Low-carbon power will be exported to the nearby National Grid Tod Point facility.[43]

References

BEIS, 2022 a; UK ENERGY IN BRIEF, https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/1130451/UK_Energy_in_Brief_2022.pdf

CCC, 2023a Delivering a reliable decarbonised power system, Climate Change Committee March 2023, https://www.theccc.org.uk/

[43] https://gccassociation.org/cement-and-concrete-innovation/carbon-capture-and-utilisation/amine-based-post-combustion-capture/ Amine-based post-combustion capture (PCC) is a well-proven and commercially-available technology, having been used in the petroleum sector since 1996 and in the coal-fired power industry since 2014. In the cement industry, it was successfully used to capture carbon dioxide (CO_2) during a small-scale trial at Norcem's Brevik plant in Norway, a project that is now being scaled up to capture up to 400,000 tonnes per year of CO_2. The technology uses an amine solvent to scrub CO_2 from the flue gas. The flue gas is initially fed into an absorption column, where the solvent selectively removes the CO_2. The CO_2-rich solvent is then fed into a desorber column, where it is heated to release the CO_2, which is captured before being sent for geological storage or onward use. This regeneration process is highly energy intensive, however, posing an economic and environmental challenge. The regenerated solvent is cooled and returned to the absorption column. Commercially-available amine solvents can be grouped into first and second generations. First-generation solvents include mixtures of water and monoethalolamine (MEA), diethalolamine (DEA), triethanol amine (TEA) or potash. Of these, MEA is most widely used for CO_2 absorbtion, due to its high selectivity, quick reaction and low cost. However, it is also sensitive to impurities and requires desulfurization and denitrification of the flue gas to work effectively. Second-generation solvents include improved blends of sterically-hindered alkaloamines and amino acids that require lower regeneration temperatures and are more resistant to degradation. However, they cost more than and do not perform as well as MEA. Despite the challenges, amine-based PCC is the most advanced carbon capture technology available to the cement industry with several suppliers on the market. Its planned commercial-scale deployment at Brevik – where waste heat from the cement manufacturing process will be used to optimise the process – is set to provide valuable operating experience to the industry, easing its future adoption by other cement plants.