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Sir John Armitt
Chairman

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The Rt. Hon Rishi Sunak MP, Chancellor of the Exchequer
HM Treasury
1 Horse Guards Road
London
SW1A 2HQ

The Rt. Hon Kwasi Kwarteng MP, Secretary of State
Department for Business, Energy and Industrial Strategy
1 Victoria Street
London
SW1H 0ET

24th September 2021

Dear Chancellor and Secretary of State,

National Infrastructure Commission advice on nuclear power plant deployment

You asked in your letter to me on the 28th of July 2021 for the National Infrastructure Commission's advice on whether an additional new nuclear plant, beyond the proposed Sizewell C project, is needed to deliver the sixth Carbon Budget. The Commission's view is that it is not.

Meeting the sixth Carbon Budget will require rapid deployment of new low carbon capacity over the next 15 years. The Commission agrees with the position government set out in the Energy White Paper that the vast majority of this new capacity should be wind and solar power.

These renewables will need to be complemented by firm low carbon generation that can provide additional power at times of high demand or low wind. The question is what technologies can be deployed in the next 15 years to do this.

It should not be more nuclear beyond what government has already committed to. Nuclear is a firm low carbon source of power and more nuclear may well have a role to play in a 2050 net zero emissions power system. By constructing two new projects, the UK will already be building four reactors over the next decade, twice as many as the United States is and four times as many as France. But over 70 years of experience building large scale nuclear power plants shows that they are incredibly difficult to deliver on short timescales. Since 1990 around half of all plants have faced at least a 50 per cent delay in construction, and 1 in 4 plants have faced at least a 90 per cent delay in construction. If a third new large scale nuclear project began next year and took as long as the Hinkley Point C project is expected to take to complete, it wouldn't come online until the mid 2040s. It is highly unlikely that a new large scale nuclear plant is deliverable in the next 15 years; trying and failing would jeopardise delivery of the sixth Carbon Budget.

New nuclear technologies, such as small and advanced nuclear reactors, may have a role to play in the long term. But relying on significant capacity being deployed before 2035 would be risky. They will face both the challenges of being first of a kind plants and being a nuclear technology.

Instead, alternative technologies should be pursued. The analysis from the Department for Business, Energy and Industrial Strategy sets out that a near zero carbon power system can be delivered by complementing renewables with a combination of gas power plants with carbon

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capture and storage, hydrogen fired gas plants and bioenergy with carbon capture and storage. This is supported by analysis previously conducted for the Commission and by other expert bodies such as National Grid ESO and the Climate Change Committee.

These alternatives are more likely to be deliverable at scale in the next 15 years. Whilst none of these technologies have been deployed at scale in the UK, there are pilot or commercial projects deployed elsewhere in the world. And the engineering of each is fundamentally sound. These technologies are smaller and more modular, exactly the type of technology the UK has experience delivering over short timescales. Deploying new technologies at scale will never be risk free. But the best way government can mitigate this risk is to act swiftly and finalise the policy frameworks under development that can facilitate the investment needed.

It is true that some of these technologies, in particular gas power plants with carbon capture and storage, rely on natural gas. However, these technologies would play a much smaller role in the power system in 2035 than unabated gas plants do today. And as the economy as a whole decarbonises, the county's overall dependence on natural gas will fall dramatically.

The Annex to this letter sets out the Commission's considerations in more detail. I would like to thank you for your officials' helpful and collaborative engagement with the Commission on this work.

I would welcome the opportunity to discuss this with you further.

Yours sincerely,

Sir John Armitt

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National Infrastructure Commission Nuclear Advice

Summary

1. Delivering a power system consistent with the sixth Carbon Budget will be challenging. It will involve building significant new electricity generation capacity faster than the UK has ever done before.

2. But there are a range of different technology options for delivering this system. Some of these include a third new nuclear plant, but many others do not. Analysis of the power system does not suggest that nuclear has any special properties that mean significant new capacity of nuclear is required in a near zero carbon power system by 2035.

3. Government should not make the challenge of delivering the sixth Carbon Budget harder by trying to deliver a third new nuclear project on historically short timescales. Nor should it rely on deploying significant volumes of novel nuclear technologies, such as small or advanced modular reactors, in less than 15 years. More than 70 years of evidence of building nuclear power plants demonstrates this would be a high risk strategy.

4. Instead, alongside rapid deployment of renewables, the focus should be on deploying other low carbon technologies such as, gas plants with carbon capture and storage, hydrogen powered gas plants, and bioenergy with carbon capture and storage plants. Whilst these technologies themselves are not risk free, evidence suggests it is more likely they can be deployed at the needed pace and without extended delays. But to do so will require swift action from government to finalise the policy frameworks under development that will incentivise the investment required.

5. Nuclear projects can still play a role in delivering a net zero power system in 2050. Government should continue to take a one by one approach to deploying large scale plants, as the Commission recommended in the National Infrastructure Assessment.[1] It may also be prudent to act now to develop the option to deploy small or advanced modular reactors as part of a 2050 net zero energy system, but this novel technology should not be relied upon to deliver the sixth Carbon Budget.

Background

6. The UK needs a near zero carbon power system by 2035 to support delivery of the sixth Carbon Budget. This will require almost all fossil fuel powered generation, largely unabated natural gas power plants, coming off the system. In addition, as

activities across the economy electrify, demand will increase from 310 TWh in 2020 to around 460 TWh by 2035.[2]

7. Government set out in the Energy White Paper that renewables will likely provide the majority of electricity in any future system.[3] The Commission agrees with this,[4] as do many others.[5] Delivering on this ambition for rapid renewable deployment must be the first priority.

8. To complement this highly renewable electricity system, firm and flexible low carbon power is needed. Part of this will be provided by deploying flexible technologies such as battery storage or interconnectors, as government has set out in the Smart Systems and Flexibility Plan.[6] But technologies such as gas power plants with carbon capture and storage and hydrogen powered gas turbines will also be needed. Deploying these firm and flexible technologies, alongside increasing system flexibility, must be the second priority.

9. However, the role of nuclear is less clear. One existing nuclear plant, Sizewell B, is likely to still be online by 2035 and the new nuclear plant Hinkley Point C (HPC) is expected to be online before 2035. Government is also aiming to take a second new nuclear plant to final investment decision by the end of this parliament, subject to clear value for money and all relevant approvals.[7]

10. The Commission has been asked to consider if there is a case that a third new nuclear plant, in addition to those set out above, should be delivered to support meeting the sixth Carbon Budget.

11. The rest of this paper sets out the Commission's judgement on whether this is the case, or whether alternative technologies should be deployed instead.

The Commission's approach

12. Given the time available the Commission has not undertaken any original analysis to answer these questions. Instead, it has interrogated the Department for Business, Energy & Industrial Strategy's (BEIS) existing extensive analysis on these questions and synthesised evidence from a range of other expert stakeholders and sources.

13. The analysis from BEIS comes from their Dynamic Dispatch Model (DDM), which is an electricity supply model of the GB power system out to 2050. This model has been used to analyse the deployment, cost and carbon intensity of a range of different power sector scenarios. These scenarios are created by combining tens of thousands of combinations of input capacities of technologies in the model. More detail on the methodology and approach can be found in *Modelling 2050: Electricity System Analysis*.[8] The analysis referenced in this paper is based on BEIS' power sector

optimisation modelling for 2035 and includes updated assumptions from the previous publication.

14. This advice is based on analysis from BEIS. The Commission has not scrutinised the key assumptions below and has taken the following as given:
    - The Sizewell B nuclear plant remains online, the Hinkley Point C plant comes online, as does one other new nuclear plant of the same size
    - To meet the sixth Carbon Budget, the GB power sector emissions are no more than 10 $MtCO_2e$[9]
    - Demand for electricity in 2035 is 496 TWh, this reflects the BEIS high demand scenario.

15. When considering the analysis, it is important to recognise the inherent uncertainty in such complex and long term modelling. It is critical that small differences in outputs are not over-interpreted to inform policy decisions. This is especially true for cost outputs. Previous forecasts for electricity technology costs over a ten year horizon have been highly inaccurate.[10]

16. Therefore, the Commission has not considered costs as a factor in this advice. Whilst nuclear power is likely more expensive on a per MWh basis, it also saves on costs in the system elsewhere, such as the cost of back-up capacity. However, as the cost difference between generation mixes in the BEIS, and other, analysis is well within a reasonable range of uncertainty, costs are not considered further here.

17. The Commission also wishes to stress that relying on just one set of analysis increases the risk of error or misinterpretation. Using more than one model, or comparing outputs across models, can significantly improve the robustness of decision making. Greater transparency over models and methodology will also help robustness. The Commission welcomes BEIS's commitment in the Energy White Paper to publish its models.[11] Publication of these models should not be delayed.

18. The Commission has structured its advice around four questions:

    1. Does the BEIS analysis make a robust case for an additional nuclear plant by 2035?
    2. What is the likelihood of successful delivery of an additional nuclear plant by 2035?
    3. Are the alternatives a lower delivery risk?
    4. Does nuclear have a role in a 2050 net zero electricity system?

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There are range of pathways for delivering a near zero carbon power system

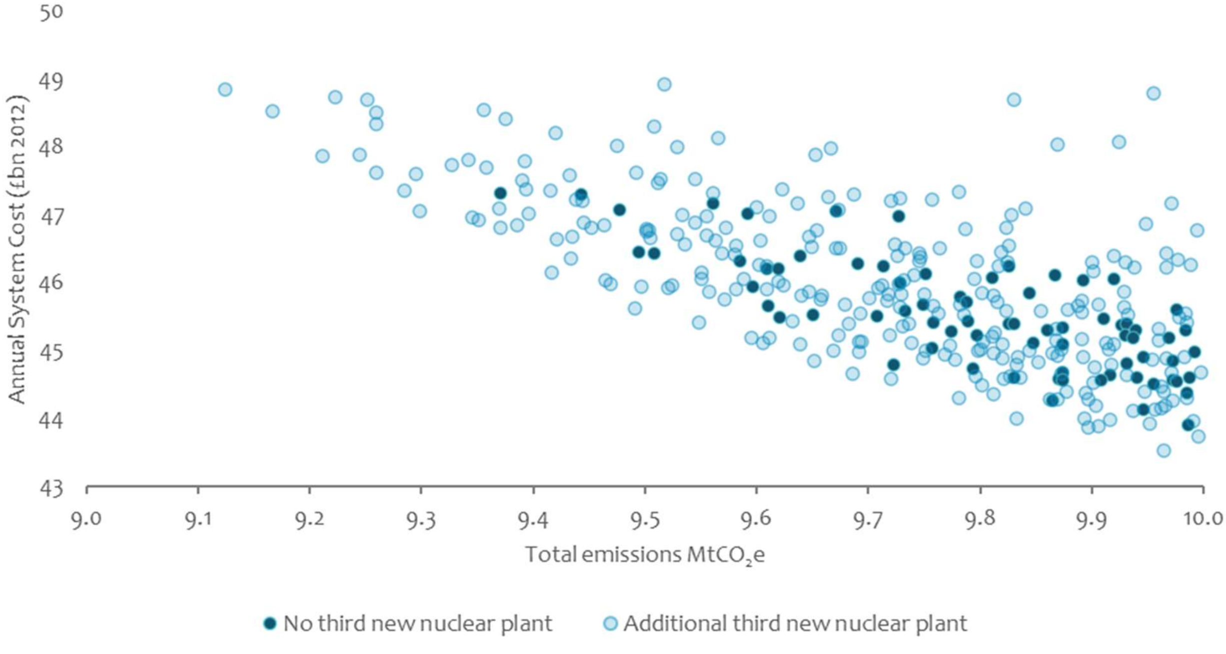
Overview of the analysis

19. The primary low carbon technologies that the analysis is considering are: renewables (onshore wind, offshore wind, and solar), gas plants with carbon capture and storage (gas CCS), hydrogen powered gas plants, and nuclear.

20. The BEIS analysis demonstrates that there are a range of different pathways to delivering a near zero carbon power system. Some of these rely on the maximum (an additional third new nuclear plant) level of nuclear deployment, but many others do not (Figure 1). This is supported by other external analyses which also demonstrate the feasibility of running a near zero carbon power system without the equivalent of a third new nuclear plant (Table 1).

Figure 1: A third new nuclear plant is not needed to deliver a near zero power system in 2035

Scenarios from BEIS' DDM that deliver less than 10 $MtCO_2e$ of emissions in 2035[12]



Note: Scenarios in BEIS' DDM vary the technology build rates to see how sensitive model findings are to these constraints, and therefore how critical any given parameter is to achieve a GB power system with emissions of less than 10 $MtCO_2e$ by 2035.

Table 1: Nuclear capacity in 2035 modelled in external analysis

Organisation	Minimum capacity of nuclear deployed (Plants, GW capacity)
Aurora Energy Research, Net Zero Power by 2035[13]	Hinkley Point C, Sizewell B, and one new additional nuclear plant (8 GW)
Climate Change Committee, Sixth Carbon Budget[14]	Hinkley Point C and Sizewell B (4.5 GW)
Imperial College, Net Zero GB Electricity[15]	Hinkley Point C and Sizewell B (4.5 GW)
National Grid, Future Energy Scenarios[16]	Hinkley Point C and Sizewell B (5.5 GW)
SSE, Net Zero Power[17]	Hinkley Point C and Sizewell B (4.4 GW)

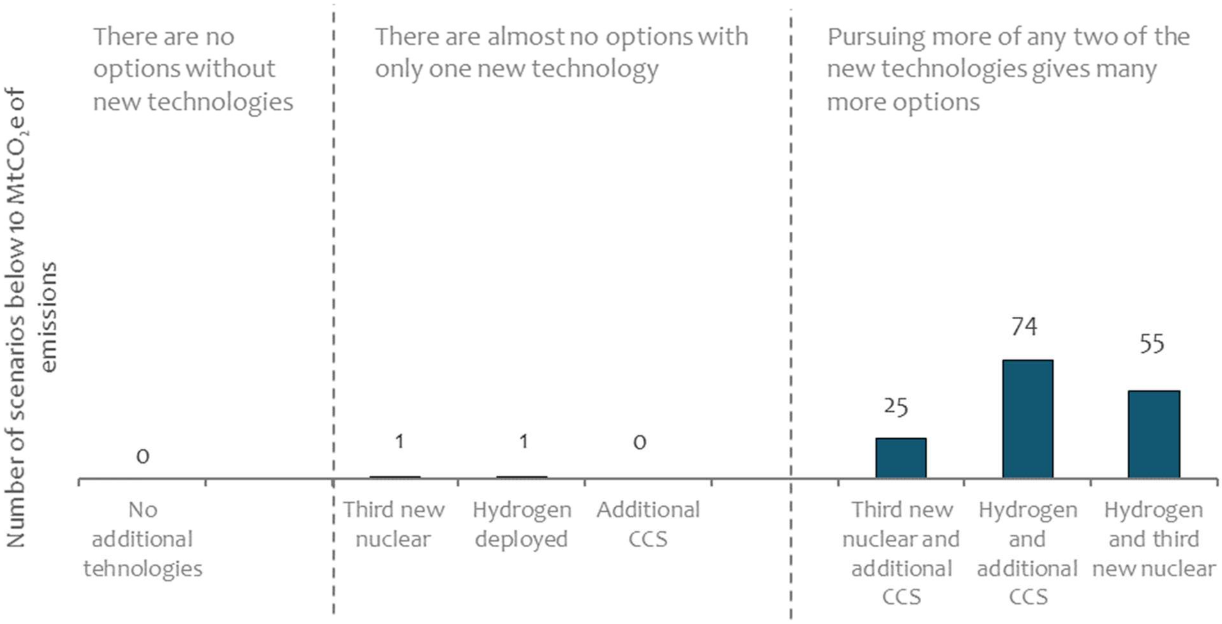
21. The analysis is clear that significant volumes of renewables are needed to deliver a low carbon power system by 2035. This is supported by previous analysis for the Commission[18] and others.[19] Rapid cost reductions and short and reliable build profiles mean that renewables will be the backbone of any future GB power system.

22. The analysis is less certain on the role of other low carbon technologies and illustrates that there are trade-offs between them. Every scenario requires significant deployment of at least one or more of gas CCS, hydrogen, and nuclear (Figure 2). But maximum deployment of all three is not needed (Figure 2). Clearly increasing the availability of low carbon technologies will, by definition, increase the number of viable scenarios for delivering a near zero carbon power system. But it's important to note this is true for all low carbon technologies, not just nuclear power (Figure 2).

23. This illustrates that the main value each of these technologies is providing to the system is additional capacity. To reach a near zero carbon power system in 2035 very high deployment rates of low carbon technologies will be needed. However, this also illustrates that there is no special value that nuclear provides to the system that a combination of other technology cannot deliver.

Figure 2: Nuclear has no special properties compared to other firm low carbon generation for supporting delivery of a near zero power system

Number of scenarios from BEIS' DDM that meet emissions limit, split by type of technologies included



Note: All scenarios contain up to 67.5 GW of offshore wind, 45 GW of onshore wind, and 70 GW of solar. The 'no additional technologies' scenarios contain up to 7.8 GW of nuclear capacity, 5.1 GW of gas CCS capacity, and no hydrogen. The 'third new nuclear' scenario includes up to 11.1 GW of nuclear. The 'Hydrogen deployed' scenario includes up to 10.8 GW of hydrogen capacity running on up to 29 TWh of hydrogen. The 'Additional CCS' scenario includes up to 11.6 GW of gas CCS capacity. Whilst these are different on a capacity basis, they are comparable on a TWh basis. This chart shows the increase in viable scenarios as constraints across the model are lifted. It should be noted that releasing constraints will, by definition, increase the number of viable scenarios.

24. Finally, the inclusion of bioenergy with carbon capture and storage (BECCS) in the power system in 2035 would significantly increase the number of pathways to delivering a near zero carbon power system. However, this has not been explicitly considered in the BEIS modelling provided to the Commission and so is not included in the chart above. As BECCS would likely generate baseload power it can be considered a like for like alternative to nuclear. Its inclusion in the power sector therefore significantly decreases the need for additional new nuclear projects by 2035. For example, deploying around 3 GW of BECCS capacity onto a system where additional CCS is also deployed but neither hydrogen nor a third new nuclear plant is deployed, gives 25 viable scenarios with emissions below 10 $MtCO_2e$.[20]

Conclusions

25. For the purposes of informing a decision on a third nuclear plant, the analysis clearly sets out that this is not the only viable path to deliver a 10 $MtCO_2e$ power system. A third new nuclear plant would clearly support delivery of such a system, but there are

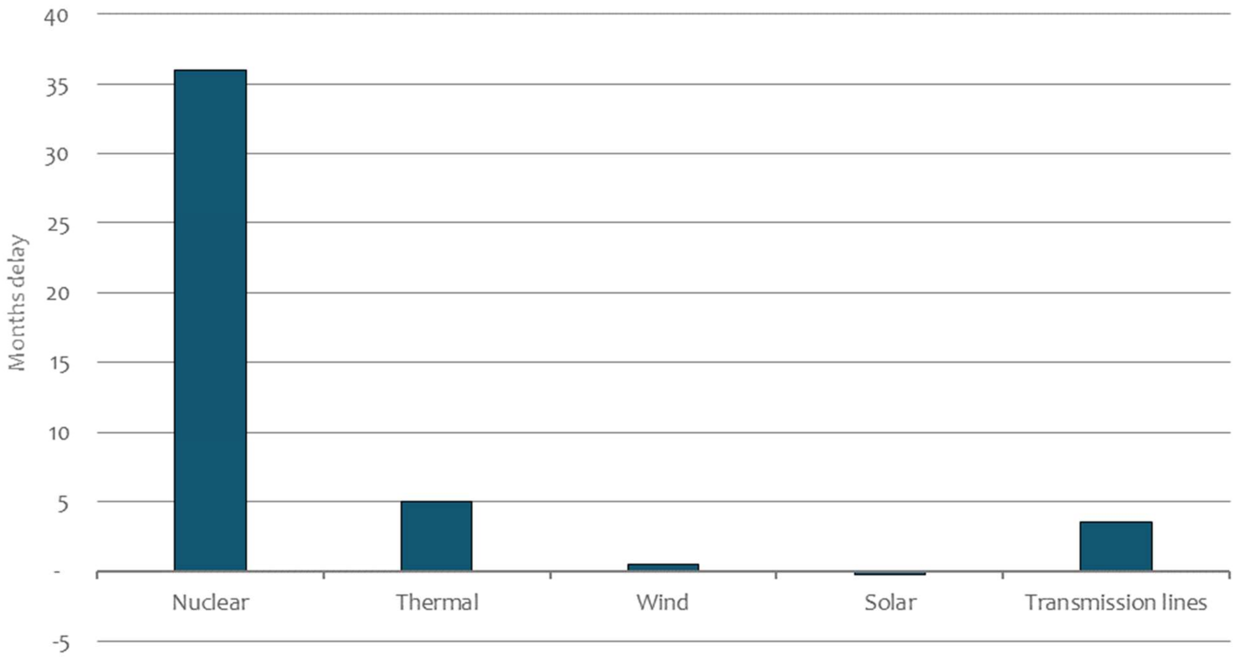
many options for delivering a near zero carbon power system without it. This is supported by many other external analyses.[21]

There are significant delivery risks associated with nuclear plants

Large scale nuclear projects

26. Nuclear projects are large megaprojects: they take a long time to build and are highly complex. Moreover, because of the correlation between size of project and cost and delivery overruns nuclear projects often face the greatest challenges of all megaprojects.[22] The median overrun for a Pressurised Water Reactor is 40 per cent.[23] Nuclear projects also face longer delays than other power projects globally (Figure 3). Having highly technical project needs, stringent regulatory requirements[24] and public opposition are key contributors to nuclear time and cost overruns.[25]

Figure 3: Most electricity projects deliver more reliably than nuclear
Average delay in months for electricity generation projects by technology[26]

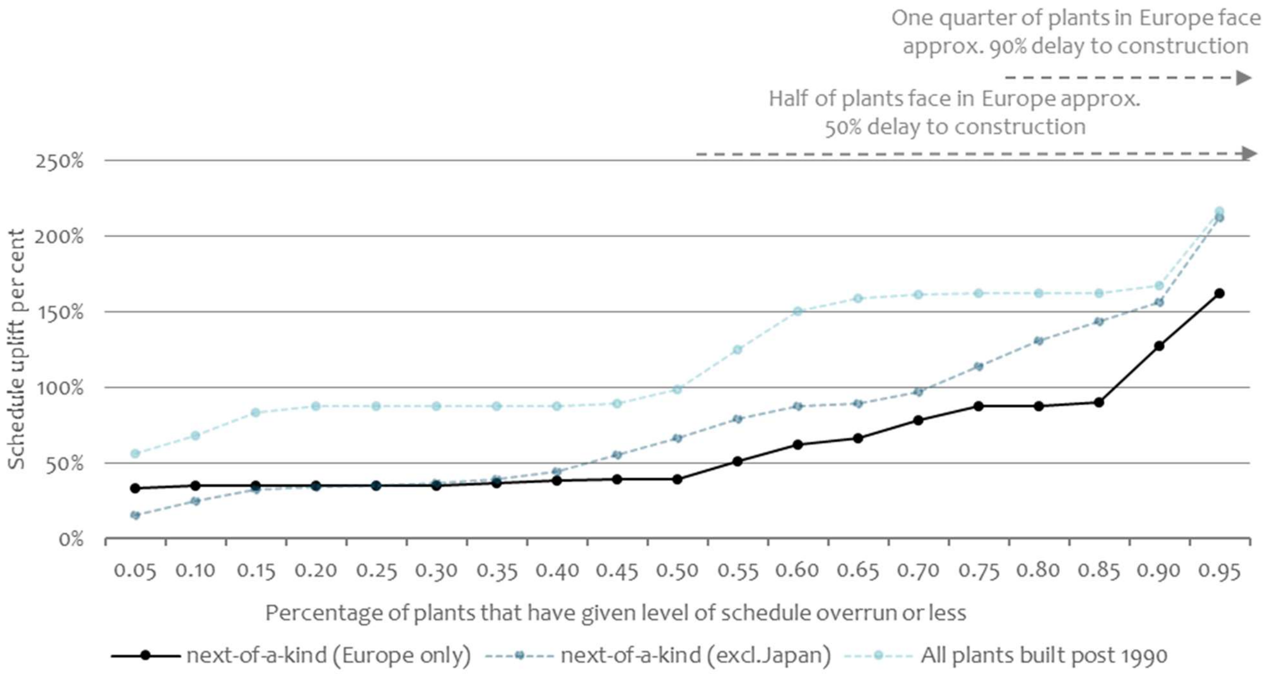


Note: Data for the chart is based on 401 electricity projects from around the world installed between 1936 and 2014.

27. The likelihood of a nuclear project being delivered on time is not increasing. Since 1990, nuclear projects have faced significant delays all around the world. Even just in Europe around half of all plants have faced at least a 50 per cent delay in construction, and 1 in 4 plants have faced at least a 90 per cent delay in construction (Figure 4).

Figure 4: Half of all nuclear projects face at least a 50 per cent delay in construction

Schedule overruns for previous nuclear projects by proportion of overrun experienced[27]



28. The UK is currently planning to build more nuclear reactors than comparable countries and committing to a third new large scale plant would make the UK a notable outlier. Construction of Hinkley Point C, another plant that is expected to be brought to final investment decision this parliament, and an additional plant is equivalent to six reactors,[28] many more than any comparable country is currently building (Table 2). In those countries the existing projects are already delayed.

Table 2: Nuclear projects under construction in Europe and the US[29]

Project	Reactor	Country	Status
Flamanville 3	EPR – 1 reactor	France	Under construction, 12 year delay[30]
Olkiluoto 3	EPR – 1 reactor	Finland	Under construction, 13 year delay[31]
VC Summer	AP1000 – 2 reactors	USA	Recently cancelled after nine years[32]
Vogtle 3&4	AP1000 – 2 reactors	USA	Under construction, 3 year delay[33]

29. Evidence on deploying nuclear projects underlines that it is important that government does not attempt a 'forced scale up'.[34] Trying to build out nuclear projects rapidly is unlikely to be successful. The UK has tried to rapidly deploy nuclear projects before, when it commissioned the fleet of Advanced Gas Cooled Reactors in 1964. The programme was fraught with cost and time overruns and only the final two reactor stations were completed on budget and schedule.[35]

30. In judging the likelihood of delivering a third nuclear plant by 2035, schedule estimates should be adjusted to reflect historical experience. Any nuclear project schedule estimate should be expected to take at least 50 per cent longer than planned. If a new project began development next year and took the same amount of time as the Hinkley Point C project is expected to take to complete, it would not come online until at least the mid 2040s.[36]

Small Modular Reactors

31. Small modular reactors (SMRs) may mitigate the financial risk of large scale plants but they will face additional first of a kind plant risk.[37] Energy generation technologies have some of the longest commercialisation periods following invention.[38]

32. As yet, no SMR has gone through the Generic Design Assessment process[39] and some developer proposals are conditional on government support to progress project development.[40] There are no SMRs in operation in countries similar to the UK.[41]

33. To fill the same capacity gap illustrated in the BEIS modelling, at least six SMRs would be needed by 2035, if not more.[42]

34. This would require compressing the normal delivery timeline and doing things in parallel rather than in sequence, significantly increasing the risk of delays. Delivery success will also be dependent on the capability of the developer.

Conclusions

35. The historic delivery challenges of nuclear plants and limited project development for a new plant at this stage mean the likelihood of being able to deliver a third large scale plant by 2035 is highly unlikely.

36. Planning on delivering significant new nuclear capacity for 2035 and failing to deliver on time would jeopardise the UK meeting the sixth Carbon Budget. If a 3 GW nuclear project was delayed, the missing generation would be replaced by electricity generated from natural gas. For each year of delay, power sector emissions would be higher by 8 $MtCO_2e$, almost double the modelled emissions constraint.[43]

37. Acting now to develop the option to deploy small and or advanced modular reactors may be a prudent action. But relying on many plants coming online by 2035 would not be. These reactors will face the complexities of delivering nuclear projects and the challenges of deploying a first of a kind technology at scale. The risk of delays or unanticipated obstacles is therefore very high.

The alternatives to additional nuclear build are a lower delivery risk

38. The analysis set out above demonstrates that a third new nuclear plant is not necessary to reach the 2035 emissions target and that more gas CCS, hydrogen powered gas plants, and BECCS could be deployed instead. Whilst these technologies are yet to be deployed at scale, the Commission considers them to be a lower delivery risk than nuclear. Government has already set out ambition to bring forward gas CCS plants and hydrogen generation at scale in the 2020s.[44]

Natural gas plants with carbon capture and storage (gas CCS)

39. Attaching carbon capture technology to gas plants mitigates most of their emissions. Gas CCS plants could produce baseload power or operate more flexibly to fill gaps between supply and demand.

40. Whilst gas CCS plants have yet to be deployed at scale in the UK, evidence suggest the main components of the technology are deliverable:

    - Gas power plant: the UK has demonstrated that gas plants can be deployed quickly. Around 40 gas plants, equivalent to 20 GW of capacity, were built in the UK between 1991 – 2001.[45]
    - Carbon capture technology: the fundamental capture technology is proven at scale and there are now over 26 projects operating globally.[46] Whilst it is critical that high capture rates are achieved, evidence suggests that this is possible.[47]
    - Carbon transport and storage network: these networks have been deployed at a range of projects globally — for example, the Sleipner project in Norway has been safely storing CO_2 underground for over 20 years[48] — and is not dissimilar to the infrastructure used to extract and transport oil and gas. The UK has extensive experience deploying such infrastructure in the North Sea.

Hydrogen powered gas plants

41. Gas power plants could be modified to run on hydrogen rather than natural gas, making them a zero carbon generator. These plants would be able to operate baseload or flexibly just like a natural gas plant and provide balancing through hydrogen storage.

42. Large scale gas plants that run on hydrogen are still a novel technology, but work is underway to commercialise them over the 2020s. Evidence suggests the two main new components are deliverable and scalable:

    - Hydrogen power plants: whilst these are a novel technology, they will only require minor modifications from traditional gas power plants. Pilot projects are underway, and a number of organisations have committed to commercialising hydrogen plants by the mid to late 2020s.[49] Once developed it is highly likely these could be deployed at scale quickly, given the UK's previous experience deploying natural gas power plants.

- Producing low carbon hydrogen: this can be done either by electrolysing water or through reforming natural gas. Electrolysis is a mature technology, although not yet at scale and there is uncertainty concerning how rapidly costs will fall. To be low carbon, gas reforming would have to be used in combination with carbon capture and storage technology and may require novel approaches such as autothermal reforming. Supply chain emissions will also have to be kept low. Whilst hydrogen may be a constrained resource over the coming years as production technologies scale up, only a small amount of hydrogen is needed in the power sector for back-up and generation at peak times. The BEIS analysis discussed above assumes around 30 TWh of hydrogen is available in 2035 for the power sector, in line with the ambition set out in the Hydrogen Strategy.[50]

Bioenergy with carbon capture and storage (BECCS)

43. BECCS power plants process biomass to generate electricity, while also capturing the carbon stored in the biomass, thereby also producing a negative emission. BECCS plants would likely provide baseload generation, similar to nuclear.

44. There are some uncertainties on the scalability of BECCS plants, but the main components are well understood:
    - Biomass plant: the UK has around 4 GW of dedicated biomass plants, including the 2.5 GW that have been converted from a coal plant by Drax in the last ten years.[51]
    - The capture technology: BECCS plants would likely use similar capture technology as discussed above. There are already a small number of large scale BECCS plants operational in other countries.[52] Most recently the 50 MW Mikawa BECCS plant came online in Japan, which aims to capture 180,000 tonnes of CO_2 annually.[53] A pilot project is also underway at the Drax plant in the UK.[54]
    - The biomass supply: there is some uncertainty around the amount of sustainable biomass that will be available to the UK. However, analysis from the Climate Change Committee suggests it is likely there will be enough available to supply the 3 GW of BECCS plants discussed above.[55]

Energy from waste

45. Finally, the Commission wishes to highlight that further action on reducing emissions from energy from waste plants would be valuable. In the BEIS analysis around 75 per cent of the residual emissions in 2035 are from energy from waste plants. However, no option for reducing these emissions appears to have been explored to date. Even a small reduction in the level of emissions from energy from waste plants would

significantly increase the number of viable pathways to a near zero carbon power system.

46. Attaching carbon capture and storage technology onto energy from waste plants can reduce their emissions by over 90 per cent.[56] Whilst this could be challenging for small and dispersed plants, there are some plants that are part of the UK's industrial clusters where project proposals are already coming forward.[57] Moreover, it would be feasible to move to using fewer larger energy from waste plants, so that carbon capture and storage technology can be deployed. Equally, increasing recycling rates, as the Commission has previously recommended,[58] would reduce the amount of waste these plants need to process and therefore their emissions. These technologies will be required by 2050 to reach net zero. Taking action now will not only support delivery of the sixth Carbon Budget but also start on a pathway to 2050.

Conclusions

47. None of these technologies are risk free. But they all involve incremental changes to technologies that the UK has experience in deploying. Deployment timelines for each are much shorter than nuclear, so even if there are delays these will be less consequential. Moreover, the maximum level of deployment is not required across all three, so the risk of delay or failure is spread across multiple options.

48. The primary risk is that the first plants are harder to deploy than expected. This is a real risk. The best way to mitigate this risk is early action to deploy first of a kind plants across the range of technologies. Urgent action is needed from government to finalise the policy frameworks that will deliver these technologies.

49. But once each of these technologies has been successfully deployed it is highly likely they can be rapidly scaled and delivered on much shorter timelines, with much lower construction risk, than large scale nuclear projects. Most of the components of these technologies are modular and are similar to technologies that the UK, and others, have scaled up many times before.

50. Finally, unlike nuclear, the UK will not be an outlier in pursuing these technologies at the needed scale. For example, carbon capture and storage is included in 15 country's long term low greenhouse gas emissions development strategies submitted under the United Nations Framework Convention on Climate Change, including the European Union, Japan, and the United States.[59] Similarly carbon capture and storage is included in 11 countries Nationally Determined Contributions, including Norway and China.[60]

New nuclear can still play a role in a 2050 net zero power system

51. Electricity demand will continue to increase beyond 2035 as high carbon activities across the economy continue to electrify, such as heating and some industrial processes. The Climate Change Committee estimate electricity demand will increase by 128 – 200 TWh between 2035 – 2050.[61]

52. New nuclear plants could be used to meet some of this increase in demand and contribute to the UK's security of supply. Therefore, even though a third new nuclear plant is highly unlikely to have a role to play in a 2035 power system, it can still play a role in a 2050 power system.

53. The Commission has previously recommended that government take a one by one approach to deploying nuclear plants. This is still the Commission's view. Taking a one by one approach allows government to mitigate some of the risk of shortfalls in capacity if nuclear projects fail to deliver by pursuing a range of technologies, whilst keeping the option for future nuclear firmly on the table. It maintains optionality for additional nuclear plants to be deployed in the future and avoids a 'stop start' approach which risks disrupting supply chains.

54. Aiming to bring a new large scale nuclear project to final investment decision this parliament, as set out in the Energy White Paper,[62] aligns with the Commission's recommended approach. But committing to a third new nuclear plant now does not.

55. Instead, a final investment decision on a third new large scale nuclear plant should be considered in the mid to late 2020s. This would be aligned to when the Hinkley Point C project is coming online and construction is expected to have started on the second new nuclear plant. Doing so would allow government to take as much learning as possible from completed projects and maintain supply chains, whilst ensuring delivery is not stretched over three projects at once. Assuming a similar build timeline to Hinkley Point C, this project could then come online in the 2040s and support delivery of the net zero target and security of supply.

56. Whilst the Commission has not previously explicitly considered the role of small or advanced modular reactors, if developed, these may have some value to the energy system. However, as the technology has not yet been commercialised there is limited information to make decisions on. Acting now to develop the option to deploy these reactors to support net zero by 2050 could be prudent. However, they will face the challenge of being both a first of a kind project and a nuclear project. Delivery should therefore not be rushed.

NATIONAL INFRASTRUCTURE COMMISSION

Endnotes

[1] National Infrastructure Commission (2018), National Infrastructure Assessment

[2] Climate Change Committee (2020), Sixth Carbon Budget

[3] HM Government (2020), Energy white paper: Powering our net zero future

[4] National Infrastructure Commission (2020), Net zero: opportunities for the power sector; and National Infrastructure Commission (2020), Renewables, recovery and reaching net zero

[5] Climate Change Committee (2020), Sixth Carbon Budget: Electricity Generation; National Grid ESO (2021), Future Energy Scenarios 2021

[6] Department for Business, Energy & Industrial Strategy and Ofgem (2021), Transitioning to a net zero energy system: smart systems and flexibility plan 2021

[7] HM Government (2020), Energy white paper: Powering our net zero future

[8] Department for Business, Energy & Industrial Strategy (2020), Modelling 2050: Electricity System Analysis

[9] The UK power sector emissions assumption for 2035 provided by BEIS to the Commission for the purposes of this analysis is 11 $MtCO_2e$, which BEIS has equated to 10 $MtCO_2e$ for the GB power sector.

[10] Comparison explanation of previous forecast inaccuracy: Department for Business, Energy & Industrial Strategy (2020), Electricity Generation Costs; Department for Business, Energy & Industrial Strategy (2019), Contracts for Difference Allocation Round 3: Results

[11] HM Government (2020), Energy white paper: Powering our net zero future

[12] All scenarios from BEIS' DDM power sector optimisation analysis under the 'high demand' scenarios (496 TWh) and 10.8 GW of hydrogen deployed. "No third nuclear plant" refers to scenarios with nuclear capacities of 4.5 GW and 7.8 GW. "Additional third nuclear plant" is all scenarios with nuclear capacity of 11.1 GW.

[13] Aurora Energy Research (2020), Net Zero power by 2035: could the UK accelerate decarbonisation of its power system?

[14] Climate Change Committee (2020), Sixth Carbon Budget

[15] Imperial College (2021), Net zero GB electricity

[16] National Grid (2021), Future energy Scenarios 2021

[17] SSE (2021), Net zero power without breaking the bank

[18] National Infrastructure Commission (2020), Net zero: opportunities for the power sector; and National Infrastructure Commission (2020), Renewables, recovery and reaching net zero

[19] Climate Change Committee (2020), Sixth Carbon Budget; Imperial College (2021), Net zero GB electricity; National Grid (2021), Future energy Scenarios 2021; SSE (2021), Net zero power without breaking the bank

[20] This assumes runs across all available CCS capacities, 4.5 GW and 7.8 GW nuclear capacities deployed, and 3.2 GW BECCS, with no hydrogen.

[21] Climate Change Committee (2020), Sixth Carbon Budget; Imperial College (2021), Net zero GB electricity; National Grid (2021), Future energy Scenarios 2021; SSE (2021), Net zero power without breaking the bank

[22] G. Locatelli (2018) Why are Megaprojects, Including Nuclear Power Plants, Delivered Overbudget and Late? Reasons and Remedies, Report MIT-ANP-TR-172, Center for Advanced Nuclear Energy Systems (CANES), Massachusetts Institute of Technology; Brookes N and Locatelli G (2015), Power plants as megaprojects: Using empirics to shape policy, planning, and construction management

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