Title: 132kV array transmission license class exemption IA **IA No:** DESNZ038(C)-23-ESN **RPC Reference No:** N/A **Lead department or agency:** Energy Secruity & Net Zero **Other departments or agencies:** N/A	**Impact Assessment (IA)** **Date:** November 2023 **Stage:** Consultation **Source of intervention:** Domestic **Type of measure:** Secondary legislation **Contact for enquiries:** offshore.coordination@energysecurity.gov.uk

Summary: Intervention and Options

RPC Opinion: Not Applicable

Cost of Preferred (or more likely) Option (in 2019 prices)			
Total Net Present Social Value	**Business Net Present Value**	**Net cost to business per year**	**Business Impact Target Status**
£600m	£600m	−£23m	Qualifying provision

What is the problem under consideration? Why is government action or intervention necessary?

Electricity cable systems rated 132kV and above offshore are classed as offshore transmission under the Energy Act. Currently, the array cable systems which connect offshore wind farm turbines together typically operate at 33kV or 66kV and are owned and operated by the offshore wind generator as they are classed as generation assets. The next step up in voltage for array systems is 132kV. However, this voltage brings them under the offshore transmission regime which requires them to be divested to an independent operator. Without intervention, current regulations are expected to act as an unintended barrier to the uptake, and realisation, of benefits associated with the next generation of these systems.

What are the policy objectives of the action or intervention and the intended effects?

The objective of the policy is the enable offshore wind farms to use high voltage array systems where it is technically optimal to do so. Higher voltage array systems become more efficient as offshore wind farms increase in size and use larger turbines. Enabling the use of high voltage array systems is expected to lower the costs of meeting net zero through reducing the costs of offshore wind generation.

What policy options have been considered, including any alternatives to regulation? Please justify preferred option (further details in Evidence Base)

Option 0: Do nothing

High voltage array systems would not be built without intervention. Under do nothing, exemptions from the requirement to hold a transmission licence could be issued to enable the use of 132kV systems on individual projects. They would need to be issued on a case-by-case basis, with each individual exemption requiring a separate policy decision.

Option 1: Class exemption for 132kV+ array systems (preferred option)

A single broad exemption from the requirement to hold a transmission licence for operating 132kV+ array systems could be issued to apply all offshore wind farms meeting the relevant criteria.

Will the policy be reviewed? It will be reviewed. **If applicable, set review date:** 12/2028

Is this measure likely to impact on international trade and investment?		No		
Are any of these organisations in scope?	**Micro** Yes	**Small** Yes	**Medium** Yes	**Large** Yes
What is the CO_2 equivalent change in greenhouse gas emissions? (Million tonnes CO_2 equivalent)		**Traded:** N/A	**Non-traded:** N/A	

I have read the Impact Assessment and I am satisfied that, given the available evidence, it represents a reasonable view of the likely costs, benefits and impact of the leading options.

Signed by the responsible Minister: ..... Date: .....

Summary: Analysis & Evidence

Policy Option 1

Description: Class exemption for 132kV+ array systems

FULL ECONOMIC ASSESSMENT

Price Base Year 2022	PV Base Year 2024	Time Period Years 51	Net Benefit (Present Value (PV)) (£m)		
			Low: 300	**High:** 1,500	**Best Estimate:** 700

COSTS (£m)	Total Transition (Constant Price)	Years	Average Annual (excl. Transition) (Constant Price)	Total Cost (Present Value)
Low	N/A	1	N/A	**N/A**
High	N/A		N/A	**N/A**
Best Estimate	< 0.1		N/A	**< 0.1**

Description and scale of key monetised costs by 'main affected groups'

This is a deregulatory measure. The monetised cost are one-off familiarisation costs which are estimated to be minor at £25,000 in 2024. This is based on all 104 operational and in-development offshore wind projects and the 28 transmission licence holders reading and understanding the class exemption coming into force. The class exemption will not affect these projects and transmission licensees.

Other key non-monetised costs by 'main affected groups'

No non-monetised costs have been identified.

BENEFITS (£m)	Total Transition (Constant Price)	Years	Average Annual (excl. Transition) (Constant Price)	Total Benefit (Present Value)
Low	N/A	N/A	9	**300**
High	N/A		49	**1,500**
Best Estimate	N/A		24	**700**

Description and scale of key monetised benefits by 'main affected groups'

The monetised benefits are lifetime cost savings for offshore wind farms. Total costs savings are estimated to range between £300m and £1,500m, with a best estimate of £700m. This depends on the scale of future offshore wind deployment and speed at which 132kV array systems can become the norm. About two thirds of this comes from upfront capital cost savings and one third comes from loss and unavailability savings over a project's lifetime.

Other key non-monetised benefits by 'main affected groups'

Regulatory clarity is a key non-monetised benefit of a class exemption compared to potential individual exemptions under the do-nothing option. Considering each exemption application on a case-by-case basis under do-nothing means developers experience greater uncertainty because there is a chance an exemption would not be issued. Increased regulatory clarity from a class exemption is expected to provide greater early support for the deployment of high voltage array systems.

Key assumptions/sensitivities/risks	**Discount rate (%)**	3.5

A key assumption is each gigawatt of future offshore wind deployment using 132kV array systems instead of 66kV benefits from £27m to £42m of lifetime costs savings. This was calculated using estimates from The Carbon Trust. Total savings are also sensitive to the extent to which high voltage array technology is adopted, driven by the scale of future offshore wind deployment and speed at which 132kV array systems can become the norm.

BUSINESS ASSESSMENT (Option 1)

Direct impact on business (Equivalent Annual) £m:			Score for Business Impact Target (qualifying provisions only) £m:
Costs:	**Benefits:**	**Net:**	
< 0.1	30	−30	−30

Evidence Base

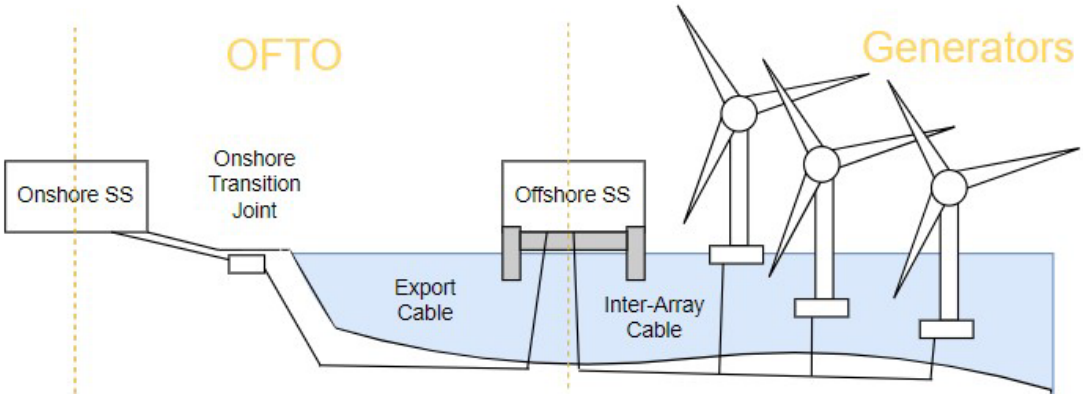
Problem under consideration and rationale for intervention

1. Offshore wind projects use different voltage systems to carry electricity for different purposes. Array cables which connect wind turbines to offshore platforms currently typically operate at 33kV or 66kV, while export cables which carry the power produced by the wind farm to the onshore grid operate at 132kV and above.

2. Electricity conveyed in offshore systems rated 132kV, and above, are classed as offshore transmission under the Energy Act. A transmission licence is required to operate the assets and transmitting electricity without a licence is an offence under the Act. The Act also requires a licence to generate electricity, and it prohibits persons from holding both a transmission licence and a generation licence.

3. Current array systems are owned and operated by offshore wind generators because they are not classed as transmission voltage so can be treated as generation assets. Typically, the wind farm will have also built the transmission system connecting the project to the onshore grid, but they are required to divest those assets under the offshore transmission regime. Ofgem manages the competitive tender process which sells the assets to an independent offshore transmission owner ('OFTO').

Figure 1: Diagram of offshore transmission and generator asset ownership



Source: Marine Energy Wales

4. High voltage array systems become more efficient as offshore wind farms increase in size and use larger turbines. The next step-up in array system voltage is expected to be 132kV following the offshore wind sector transitioning from 33kV to 66kV systems being the norm over the past decade. The Carbon Trust conducted research in collaboration with industry which identified 132kV as the next cost-optimal voltage to adopt and could bring significant savings for future wind farms compared to 66kV systems.[1]

5. Without intervention, current regulations are expected to act as an unintended barrier to the uptake and realisation of benefits associated with the next generation of array systems. Primary legislation classifying, what could be reasonably defined as generator assets, as transmission network would disincentivise the use of the technology as it would bring them under the offshore transmission regime. This would create significant uncertainty for projects and could still require policy intervention because the offshore transmission regime was not designed to process array systems.

[1] Unlocking the next generation of offshore wind: step change to 132kV array systems (Carbon Trust, 2023)

Description of options considered

6. The regulatory barrier to uptake of high voltage array systems can be resolved by exempting offshore wind farms from the requirement to hold a transmission licence. At present, these would need to be issued individually on case-by-case basis for each project. Alternatively, a single class exemption could be issued to cover all instances the situation arises. The options considered in this impact assessment are therefore:

   Option 0: Do nothing
   Wind farms without transmission licence exemptions would not adopt 132kV+ array systems. They could potentially engage with government and regulators individually to try and obtain an exemption, but these petitions would then be assessed on a case-by-case basis. There is currently no formal process for assessing these applications.

   Option 1: Class exemption for 132kV+ array systems (preferred option)
   Issue an exemption for all offshore wind farms using from the requirement to hold a transmission licence for operating 132kV+ array systems.

7. The requirement to hold a transmission licence for export cables carry electricity from offshore wind farms to the electricity grid remain unchanged. An exemption effectively means the offshore transmission regime would not apply to array systems which happen to use voltages which are defined as transmission level in the primary legislation. When the primary legislation was designed it was not foreseen that, through the passage of time and technological progress, voltages of 132kV and above offshore could have non-transmission uses.

8. This impact assessment analyses the impact of enabling the use of high voltage array systems with a class exemption against a counterfactual where they are not installed. Exemptions are issued through secondary legislation. While individual exemptions could be issued under do-nothing, each exemption would be a separate policy decision. A class exemption combines these individual policies together. However, this assessment also covers some differential impacts between issuing a single class exemption versus multiple individual exemptions.

Policy objective

9. The objective of the policy is the enable offshore wind farms to use high voltage array systems where it is technically optimal to do so. It is expected to lower the costs of meeting net zero through reducing the costs of offshore wind generation. However, the uptake of the technology is uncertain, and the development timeline of offshore wind means the first projects to benefit from the exemption are not expected to be realised until around 2030.

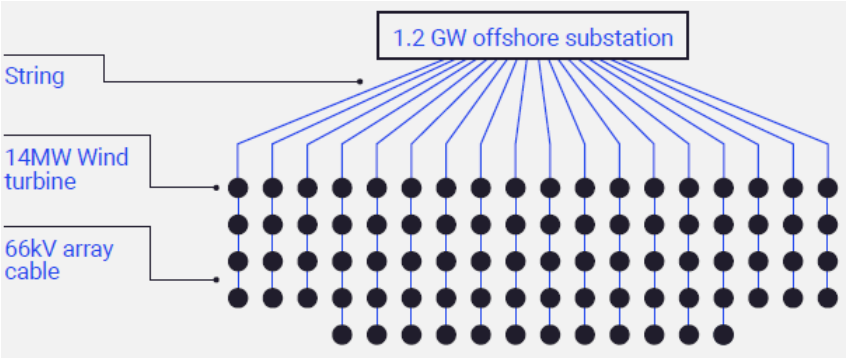
Monetised costs and benefits

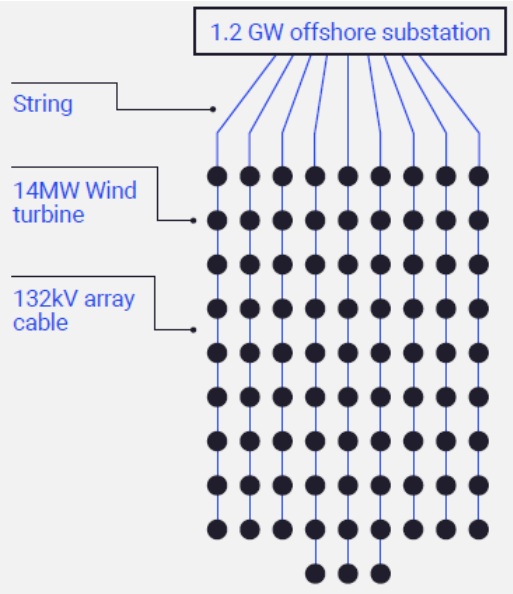
Offshore wind project lifetime cost savings

10. Offshore wind farms using 132kV array systems are estimated to benefit from lifetime cost savings of £32m to £50m per farm, relative to the current standard of 66kV array systems. This estimate from The Carbon Trust is based on a typical 1.2GW project.[2] Engagement with The Carbon Trust indicated around two thirds of these savings are due to upfront capital cost savings. The diagrams in Figure 2 illustrate higher voltage cables enable a reduction in the number of cable strings and total cable length required to connect turbines to the offshore platform.

[2] Unlocking the next generation of offshore wind: step change to 132kV array systems (Carbon Trust, 2023) p.5

Figure 2: Illustrative cabling configurations for different array system voltages





Illustrations show a 132kV array system can have fewer cable strings than the 66kV system to join the same number of wind turbines to the offshore substation. Each individual string is longer, but total length is shorter because there are fewer sections of cable running to the substation without turbines.

Source: The Carbon Trust

11. The lifetime cost saving estimates include loss and unavailability savings over an assumed 25-year asset lifetime. [3] Higher voltage systems incur lower electrical losses so more of the power generated can be supplied to grid. While the impact of cable failures is higher with 132kV systems compared to 66kV systems, this is offset by a reduction in the probability of failure due to less cable. The Carbon Trust indicated these operational savings have been discounted at a private discount rate and represent around one third of the lifetime savings.

12. We estimate the total offshore wind project cost savings from Option 1 range between £300m and £1,500m (2022 prices, 2024 present values), with a best estimate of £700m. This was obtained by multiplying project level savings estimates with assumptions on annual offshore wind deployment and the proportion of projects using 132kV array systems. Total savings are sensitive to the size of savings for single wind farms using 132kV technology, as well as the rate of uptake which is directly affected by the rate of offshore wind deployment and speed at which projects adopt 132kV arrays. The range was estimated by combining the most pessimistic and optimistic assumptions and scenarios together. Figure 3 shows the impacts of these sensitivities individually. These savings may be passed on to electricity consumers by enabling projects to submit more competitive bids into the Contracts for Difference scheme.[4]

13. Each gigawatt of future offshore wind deployment using 132kV array systems instead of 66kV is assumed to benefit from £28m to £44m of lifetime savings. This was scaled from The Carbon Trust's research and represents the private net present value in the year of deployment. These are discounted at the social discount rate from the year of deployment to the policy's present value base year. The best estimate is the midpoint of the range.

14. Three offshore wind deployment scenarios were created (see Table 1) to capture the significant uncertainty around how much offshore wind will deploy in future. These use linear interpolations between current deployment of 14GW and 2050 with 'anchor' years of 2030 (a key date for offshore wind policies) and 2035 (targeted power sector decarbonisation date).

[3] Unlocking the next generation of offshore wind: step change to 132kV array systems (Carbon Trust, 2023) p.10

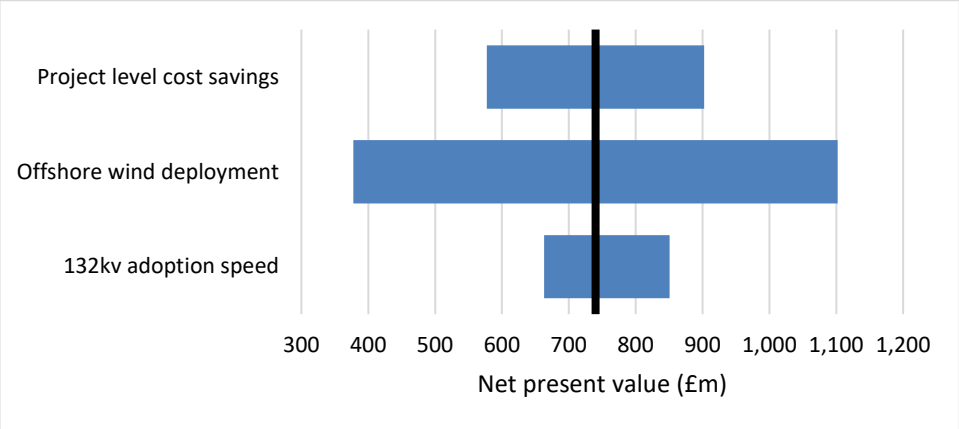
[4] The Contracts for Difference (CfD) scheme is the government's main mechanism for supporting low-carbon electricity generation. The cost of the scheme is paid for through consumers' energy bills.

Table 1: Offshore wind deployment scenarios

Deployment scenario	2022	2030	2035	2050
Low	14GW – Outturn cumulative installed capacity[5]	40GW – Government deployment target from Ten Point Plan[6]	51GW – apportionment deployment to 2050 anchor using DESNZ Net Zero power sector scenario renewables growth[7]	65GW – CCC Carbon Budget 6 Net Zero headwinds electricity generation scenario[8]
High		50GW – Government deployment ambition from British Energy Security Strategy[9]	84GW – apportionment deployment to 2050 anchor using DESNZ Net Zero power sector scenario renewables growth	125GW – CCC Carbon Budget 6 Net Zero tailwinds electricity generation scenario
Central		45GW – Midpoint of low and high anchors	68GW – apportionment deployment to 2050 anchor using DESNZ Net Zero power sector scenario renewables growth	95GW – CCC Carbon Budget 6 Net Zero balanced pathway electricity generation scenario

15. It is uncertain how quickly 132kV array cables could penetrate the market but the earliest projects to use 132kV array cables are not expected until the late 2020s. We assume 20% of capacity deploying in 2030 across scenarios would use 132kV cables, increasing to a maximum 80% market penetration in 2036. Six to seven years is the typical length of time it takes for projects to submit planning applications, receive consenting and complete construction.[10] The modelling therefore assumes 132kV becomes the technology of choice for new projects being designed soon after the first adopters demonstrate it as workable. This means approximately 28, 1.2GW offshore, wind farms with 132kV array systems are assumed to build over 2030 to 2050 in the modelling. Given the uncertainty around the speed of adoption, slow (low) and fast (high) sensitivities where 80% usage is reached in 2033 and 2039 are also tested.

Figure 3 Offshore wind project lifetime cost savings under different scenarios and sensitivities



Familiarisation costs

16. We estimate one-off familiarisation costs for Option 1 will be minor at £25,000 in 2024. This is based on all 104 operational and in-development offshore wind projects and the 28

[5] Energy Trends Table 6.1

[6] The Ten Point Plan for a Green Industrial Revolution, BEIS (2020)

[7] Energy and Emissions Projects 2021 to 2040 Annex O

[8] The Sixth Carbon Budget Electricity generation sector summary, CCC (2020)

[9] British Energy Security Strategy, BEIS (2022)

[10] Internal DESNZ analysis of Renewable Energy Planning Data

transmission licence holders reading and understanding the class exemption coming into force.[11] [12] While existing operations would not be affected by the exemption, it is assumed one corporate manager or director from each organisation takes 3 hours to consider the class exemption and disseminate (the lack of) implications back to the organisation. The relevant explanatory notes are expected to total around 3,000 words and are assumed to be read three times by individuals to understand the content. A reading speed of 50 words per minute is used to account for the higher level of language complexity in these documents.[13] Estimated labour costs are £62 per hour, including both wage and non-wage costs.[14]

Non-monetised costs and benefits

Regulatory clarity

17. While exemptions could be assessed and issued individually under the do-nothing option, a class exemption is the preferred option because of the regulatory clarity it provides. Under individual exemptions, developers would need to proactively apply to for an exemption for each project which project uses 132kV+ array systems. This could increase perceived project risks from a developer's perspective because of uncertainty around whether an exemption would be provided. Considering each exemption application on a case-by-case basis means there is a chance the exemption would not be issued.

18. The greater regulatory clarity from a class exemption is expected to provide greater early support for the deployment of high voltage array systems. Once several individual exemptions have been issued, developers' perceived risks around obtaining exemptions for further projects using 132kV+ array systems are expected to fall. However, the first projects do not benefit from this precedent so may be more uncertain over whether an exemption would be issued. It has not been possible to quantity the extent of the support greater clarity provides.

Administrative burden

19. A class exemption reduces administrative burden on businesses compared to individual exemptions in the do-nothing counterfactual. Projects hoping to use high voltage array cables would incur costs in applying for an exemption. These costs would be incurred regardless of whether an exemption is issued. However, a class exemption avoids these costs because the exemption already being in place means there would be no need to apply. These administrative burden savings would be one-off for each project using high voltage array systems and is expected to be negligible relative to the project's lifetime cost savings.

20. In addition to lower administrative burdens on business, a class exemption also creates significantly lower administrative burdens for government and regulators. The issuance of each exemption requires the completion of a separate impact assessment, drafting of documents such as exemption order text and explanatory memoranda, as well as the running of a consultation exercise. For previous transmission licence exemptions this process has taken up to 6 months to facilitate. A class exemption means this process only needs to be completed once instead of individually for each system exempted.

Direct costs and benefits to business

21. The offshore wind project lifetime cost savings outlined above represent a direct benefit to business. Each developer of future projects using high voltage array systems is estimated to

[11] Offshore Wind Report 2022, The Crown Estate (2022)

[12] List of all electricity licensees including suppliers, Ofgem (retrieved 16/8/23)

[13] Low end of the range for technical texts from Business Impact Target: appraisal of guidance, BEIS (2017)

[14] Hourly gross wages from ONS Annual survey for Hours and Earning (ASHE) Table 14: 2020 (11: Corporate managers and directors, at the 90th percentile) and private sector non-wage costs from ONS Index of labour costs per hour (Non-seasonally adjusted) Q1 2020

benefit from savings of £32m to £50m per farm over the assumed 25 lifetime of the project. Total industry cost savings for Option 1 range from £300m and £1,500m (2022 prices, 2024 present values), with a best estimate of £700m.

22. The familiarisation costs outlined above represent a potential direct cost to current businesses. Each offshore wind project and transmission licence holder is assumed to incur around £180 in labour costs familiarising with the class exemption. These costs on industry are negligible compared to the project lifetime cost savings afforded by exemptions enabling the use of array systems of 132kV and above.

23. This policy is deregulatory in nature. The equivalent annual net direct cost to business (EANDCB) is a saving of between £10m and £60m, with a best estimate of £28m. This was calculated based on an appraisal period of 51 years. The time covers the period immediately following commencement where legal clarity supports the development of high voltage array projects (2024) to the end of operational life of projects deploying in 2050 (2074).

Impact on small and micro businesses

24. Businesses affected by the proposed exemption are in the offshore wind and electricity transmission sectors. While the operations of projects in the early stages of development could be small, they are generally owned by consortia of large businesses, including parent companies and institutional investors. Operational wind farms projects would no longer be small businesses due to the value of their assets. Significant investment is required for projects to be realised, with a 1GW farm costing around £2.5bn to £3bn to construct.[15]

25. It would not be appropriate to omit small or micro businesses from a class exemption because the policy is deregulatory in nature. Such a carve-out could also create regulatory uncertainty and reduce the willingness of developers to consider using high voltage array systems even when it is the optimal technology choice. This prevents the objective of enabling high voltage array systems where it is optimal to do so from being achieved.

Wider impacts

Innovation

26. Exemptions enabling the use of high voltage array systems will have a positive impact on innovation. The technologies required for 132kV array systems was generally assessed by The Carbon Trust to have a high Technology Readiness Level, but Commercial Readiness Level was lower.[16] Removing the barriers to their use is expected to support the technological and commercial development of the technology by providing more certainty to the supply chain of potential future demand from offshore wind projects.

Environmental benefits

27. The reduction in total offshore wind farm array cable length from using high voltage systems are also expected to have a small positive environmental benefit. Though generally temporary, the laying of cables disturbs seabed habitats can damage or displace marine flora and fauna.[17] Enabling the use of high voltage array systems therefore reduces the impact cumulative impact of offshore wind on habitats and ecosystems.

[15] Offshore Wind Investment Roadmap (DESNZ, 2023)

[16] Unlocking the next generation of offshore wind: step change to 132kV array systems (Carbon Trust, 2023) p.17

[17] Guidelines on Best Environmental Practice (BEP) in Cable Laying and Operation, NOAA (2009)

Equalities

28. Transmission licence exemptions do not have equalities impacts. Array cables are located offshore, away from where individuals reside. Furthermore, offshore wind developers conduct extensive stakeholder when developing their projects. Any disproportionate impacts from individual projects would be expected to be mitigated through local planning and consenting processes.

Risks and assumptions

29. A key assumption in this impact assessment is the lifetime savings available to wind farms from installing 132kV arrays systems instead of the current norm of 66kV. Research from The Carbon Trust has been used to estimate policy savings. The Carbon Trust estimates on potential savings are robust and are the result of a research project in collaboration with ten international offshore wind farm developers and operators. Many different illustrate wind farm configurations were tested and the full range of estimated savings has been used here. The consultation for this policy is asking for further views on the estimated savings.

30. The savings from the class exemption are sensitive to the extent to which 132kV array technology is adopted. The sensitivity analysis above shows the level of offshore wind deployment has a significant impact on policy savings by directly affecting the number of projects which adopt the technology. However, the net present value of Option 1 will be positive if at least one offshore wind farm benefits from class exemption. The analysis also shows the speed at which 132kV array cables can penetrate the offshore wind market has a smaller impact on total savings.

31. There is a risk of unintended consequences from issuing a class exemption. For example, wind farms may change their designs by more than expected when incorporating high voltage array systems to exploit interactions with the offshore transmission charging regime for which export cables will continue fall under. A post implementation review (PIR) is expected to identify any unintended consequences at an early stage given the long development timeline of offshore wind projects. It would use wind farm designs submitted as part of the planning permission and consenting process. The consultation for this policy is expected to identify further potential unintended consequences.

Monitoring and Evaluation

32. A PIR will be completed within five years of the class exemption coming into effect, primarily to identify at an early stage any unintended consequences of the policy. As mentioned above, the development timeline of offshore wind means unintended consequences around the changes to the design of projects can be identified at an early stage. An initial view of whether the policy has achieved its objectives can also be formed based on uptake of high voltage arrays in projects going through planning. However, the actual monetised benefits of the policy will not be reviewed because it is unlikely that there will be projects which will be operational to verify the assumed cost savings.