

Title: The Future of Coal Generation in Great Britain	Impact Assessment (IA)
IA No: DECC0212	Date: 09/11/2016
RPC Reference No: RPC16-DECC-3350(1)	Stage: Development/Options
Lead department or agency: Department for Business, Energy and Industrial Strategy	Source of intervention: Domestic
Other departments or agencies:	Type of measure: Primary legislation
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Summary: Intervention and Options	RPC Opinion: GREEN
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Cost of Preferred (or more likely) Option				
Total Net Present Value <sup>1</sup>	Business Net Present Value	Net cost to business per year <sup>2</sup> (EANDCB in 2014 prices)	One-In, Three-Out	Business Impact Target Status
Net positive	N/A	£0m - £65m	In scope	Qualifying provision

#### What is the problem under consideration? Why is government intervention necessary?

Two key market failures mean that coal-fired power generation is overvalued relative to other forms of power generation: (i) the externality arising from emissions of carbon dioxide and other harmful pollutants; and (ii) imperfect information leading to investor uncertainty for new build plant. Without Government intervention there could be an excessive delay in the switch from coal-fired power generation to less carbon-intensive forms of generation such as gas.

#### What are the policy objectives and the intended effects?

The policy objectives are to: (i) reduce emissions of carbon dioxide and other harmful pollutants from the UK power sector; (ii) increase revenue certainty for investment in new lower carbon plant, such as gas; (iii) maintain security of electricity supply.

The policy intends to lead to the retirement of unabated coal-fired power plants by the end of 2025, to be replaced by less emission-intensive forms of generation such as gas without risking security of electricity supply.

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

Options considered are: (0) do nothing; (1) regulation mandating unabated coal plant closure by 2025; (2) option 1 plus a restriction on unabated coal operation at or roughly equivalent to a maximum coal load factor of 40% from 2023.

#### Will the policy be reviewed? It will not be reviewed. If applicable, set review date: Month/Year N/A

Does implementation go beyond minimum EU requirements?	N/A		
Are any of these organisations in scope?	Micro No	Small No	Medium Yes
What is the CO <sub>2</sub> equivalent change in greenhouse gas emissions? (Million tonnes CO <sub>2</sub> equivalent)	Traded: 0		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:

8 / 11 / 16

<sup>1</sup> We consider that this policy would have a net positive impact but cannot provide an NPV figure for this consultation stage IA, as important non-monetised benefits cannot be quantified.

<sup>2</sup> EANDCB is presented as a range between the central and the high coal scenarios – please see Section 12 for discussion.

# Summary: Analysis & Evidence

# Policy Option 1

**Description:** Regulation mandating unabated coal plant closure by 2025.

## FULL ECONOMIC ASSESSMENT

Price Base Year 2016	PV Base Year 2016	Time Period Years 15	Net Benefit (Present Value (PV)) (£m)		
			Low: N/A	High N/A	Best Estimate: Net positive

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

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

Key monetised costs are those which result from the exit of coal stations from the electricity market and their replacement with alternative new capacity and existing generation, as well as the associated impact on the energy system and the environment. The following impacts have been monetised: change in carbon, capital, generation costs, changes in network and balancing costs (system costs), changes in air quality, changes in costs of unserved energy and electricity delivered through interconnectors. These costs are expected to be zero in the central scenario.

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

It has not been possible to fully estimate the costs of implementation and monitoring of this regulation to government, regulators and businesses, since they will depend on the precise design of the policy but they are expected to be low compared to other components. It may also be possible that an increased demand for new plants, including gas plants, will lead to higher construction costs in the short term if physical build constraints are approached.

BENEFITS (£m)	Total Transition (Constant Price) Years	Average Annual (excl. Transition) (Constant Price)	Total Benefit (Present Value)
Low	N/A	N/A	N/A
High	N/A		N/A
Best Estimate	N/A		N/A

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

Key monetised benefits are assessed across the same categories as monetised costs above. The benefits will result when there is an improvement in these impacts. These benefits are expected to be zero in the central scenario. In the low NPV scenario, the benefits are a reduction in total carbon costs (£3,190m), a reduction in balancing costs (£140m) and an improvement in air quality (£340m).

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

Benefits that have not been monetised include: lower financing costs for new plants, such as gas plants, resulting from an increased certainty that coal will come off the system and provide more opportunities for new generation, such as gas, and, consequently, higher revenues; and the positive impact on the international climate change arena by the UK being one of the first developed countries to close unabated coal generation. This is potentially a very large, but clearly unquantifiable, benefit if it crystallises faster global emissions reductions. The threshold analysis in section 5 shows how the non-monetised benefits can offset the relatively small negative NPVs from monetised costs in the high coal scenario and impacts on business summarised below, supporting the overall judgement that the NPV for the policy is net positive.

Key assumptions/sensitivities/risks	Discount rate (%)	3.5
The key assumptions are those that significantly affect the economics of coal, as this determines the profile of coal generation and retirements without intervention. These assumptions include future fossil fuel and carbon prices, decisions on compliance with Industrial Emissions Directive, and future low carbon deployment.		

## BUSINESS ASSESSMENT (Option 1)

Direct impact on business (Equivalent Annual) £m:			Score for Business Impact Target (qualifying provisions only) £m:
Costs: N/A	Benefits: N/A	Net: £0-65	£0 - £324

# Summary: Analysis & Evidence

# Policy Option 2

**Description:** Unabated Coal plant closure by 2025 plus an emissions limit to restrict unabated coal load factor to 40% from 2023.

## FULL ECONOMIC ASSESSMENT

Price Base Year 2016	PV Base Year 2016	Time Period Years 15	Net Benefit (Present Value (PV)) (£m)		
			Low: N/A	High: N/A	Best Estimate: Net positive

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

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

Key monetised costs are those which result from the exit of coal stations from the electricity market and their replacement with alternative new capacity and existing generation, as well as the associated impact on the energy system and the environment. The following impacts have been monetised: change in carbon, capital, generation costs, changes in network and balancing costs (system costs), changes in air quality, changes in costs of unserved energy and electricity delivered through interconnectors.

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

It has not been possible to fully estimate the costs of implementation and monitoring of this regulation to government, regulators and businesses, since they will depend on the precise design of the policy but they are expected to be low compared to other components. It may also be possible that an increased demand for new plants, including gas plants, will lead to higher construction costs in the short term if physical build constraints are approached.

BENEFITS (£m)	Total Transition (Constant Price)	Average Annual (excl. Transition) (Constant Price)	Total Benefit (Present Value)
Low	N/A	N/A	N/A
High	N/A		N/A
Best Estimate	N/A		N/A

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

Key monetised benefits are assessed across the same categories as monetised costs above. The benefits will result when there is an improvement in these impacts.

These benefits are expected to be zero in the central scenario. In the low NPV scenario, the benefits are a reduction in total carbon costs (£3,700m), a reduction in balancing costs (£210m), and an improvement in air quality (£400m).

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

Benefits that have not been monetised include: lower financing costs for new plants, including gas plants, resulting from an increased certainty that coal will come off the system and provide more opportunities for new generation, such as gas, and, consequently, higher revenues; and the positive impact on the international climate change arena by the UK being one of the first developed countries to close unabated coal generation. This is potentially a very large, but clearly unquantifiable, benefit if it crystallises faster global emissions reductions. As there is earlier restriction on coal plant than in option 1, we would expect these unquantified benefits to be larger under this option. The threshold analysis in section 5 shows how the non-monetised benefits can offset the relatively small negative NPVs from monetised costs in the high coal scenario and impacts on business summarised below, supporting the overall judgement that the NPV for the policy is net positive.

Key assumptions/sensitivities/risks	Discount rate (%)	3.5
The key assumptions are those that significantly affect the economics of coal, as this determines the profile of coal generation and retirements without intervention. These assumptions include future fossil fuel and carbon prices, decisions on compliance with Industrial Emissions Directive, and future low carbon deployment.		

## BUSINESS ASSESSMENT (Option 2)

Direct impact on business (Equivalent Annual) £m:			Score for Business Impact Target (qualifying provisions only) £m:
Costs: N/A	Benefits: N/A	Net: £0-82	£0 - £411

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# Evidence Base

## Section 1: Introduction

### Rationale for intervention

1. Intervention to facilitate a transition from unabated coal-fired plant to lower carbon alternatives is justified by two key market failures:
  - i. carbon dioxide, and other harmful pollutants, are not fully priced by the market. Without intervention, this leads to an excessive level of coal-fired power generation, which emits around twice the level of carbon per unit of electricity generated than gas power plants; and
  - ii. imperfect information about the future role of coal in the energy mix creates significant uncertainty for lower-carbon new build plant, increasing hurdle rates and discouraging investment.
2. Furthermore, the policy options considered would all provide a strong signal on the UK's commitment to reducing its carbon emissions in the UK and the international community. This policy would be a clear signal of Government's intent to reduce emissions in the power sector.

### Policy objectives

3. The objectives of intervening to ensure the closure of unabated coal by 2025, and of constraining its use in the preceding years, are to:
  - i. reduce emissions of carbon dioxide and other harmful pollutants from the UK power sector;
  - ii. increase revenue certainty for investment in new flexible plants, such as gas; and
  - iii. maintain security of electricity supply.

### Options considered

4. Three policy options are considered:
  - i. **Option 0: Do nothing.** The impact of the policy options below are compared to this do nothing option in the cost benefit analysis.
  - ii. **Option 1: Mandated closure of unabated coal plant in 2025.** For the purposes of the modelling, the closure date is set to 31 December 2025; however there may be value in setting the closure date to 30 September 2025, to align with Capacity Market delivery years. **The consultation seeks views on this.**
  - iii. **Option 2: mandated 2025 closure and a constraint of 40% on unabated coal plant load factors in 2023 - 2025.<sup>3</sup>** This would limit emissions from existing coal plants to around the level of those permitted for newly constructed unabated stations by the Emissions Performance Standard, and could help to smooth the retirement of coal plants, reducing the cost of ensuring security of supply.

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<sup>3</sup> The precise vehicle through which a constraint on coal plant operation could be imposed forms part of the consultation that accompanies this impact assessment. For the purposes of this analysis, it has been assumed that a constraint will be placed on coal plant operation equivalent to a load factor restriction as set out below.

## Section 2: Analytical approach

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5. This section explains how different scenarios were constructed to reflect underlying uncertainty over the impact of policy intervention, and the assumptions used in each of these scenarios.

6. The analysis of the monetised impacts of policy options was carried out using BEIS's Dynamic Dispatch Model (DDM)<sup>4,5</sup>. DDM analysis does not necessarily reflect the full range of uncertainty around the impact of intervention; nor does it monetise all relevant costs and benefits. For this policy, key elements of the benefits – increased forward certainty on the generating mix, and international leadership – are not monetised. We describe how we have taken account of un-monetised costs and benefits in section 5.

### Modelling assumptions and counterfactual scenarios

7. This IA compares the impact of policy intervention using two scenarios:

- i. a 'central' scenario, which reflects our current view of how the UK electricity market is mostly likely to evolve;
- ii. a 'high coal scenario', where assumptions are flexed to create a more favourable market outlook for coal plant. Part of the rationale for the policy is to mitigate against such a scenario, whereby coal plants could continue operating into the early 2030s. We consider this is a feasible but unlikely scenario.

8. Table 1 compares the assumptions used in these scenarios. It is important to note that the high coal scenario is not one that reflects established Government policy or expectation.

**Table 1: comparison of assumptions in the central and high coal scenarios**

Assumption	Central Scenario	High Scenario
Fossil Fuel Prices <sup>6</sup>	DECC 2016 Central Interim Gas and Coal Price Assumptions	DECC 2015 Low Coal and Central Gas Price Assumption.
IED decisions	Two coal plants opt-in to the IED, investing in plant technology to meet emissions limits	Without policy intervention, five coal plants opt-in to the IED in the counterfactual; policy intervention is assumed to disincentivise two of these five plants from IED investment, meaning that only three opt in to the IED.
Deployment of low carbon capacity	Consistent with the strategy set out in the Secretary of State's speech of 18 <sup>th</sup> November 2015.	The level of offshore wind delivered in the 2020s is halved and pipeline nuclear projects delayed by three years.
Carbon costs <sup>7</sup>	Central EU ETS trajectory and CPF rising to £70/t by 2030	Central EU ETS trajectory and real £18/tCO2 CPS to 2030

## Section 3: Monetised costs and benefits

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9. Figure 1 shows the level of coal capacity under the central and high coal scenarios in the counterfactual. In the central scenario, poor profitability in the wholesale electricity market means that all coal plants retire by the end of 2021. In the high coal scenario, coal-fired generation continues until 2031.

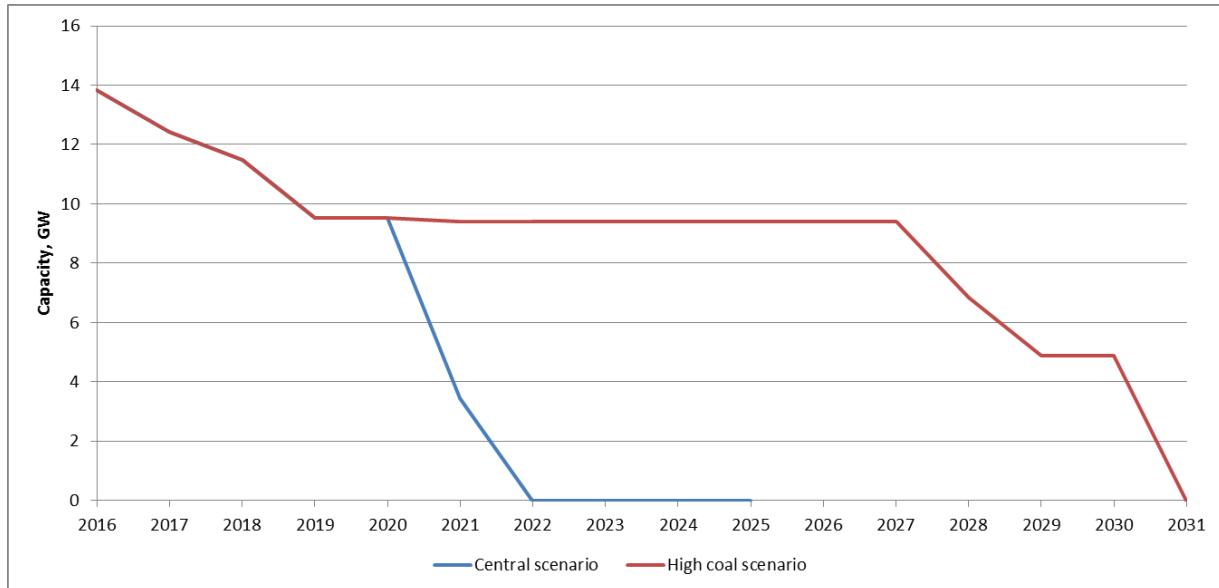
<sup>4</sup> On 14 July 2016, the Prime Minister announced that the Department for Energy and Climate Change (DECC) and the Department for Business, Innovation and Skills (BIS) would be merged to form a new Department for Business, Energy and Industrial Strategy (BEIS). In this document we refer to the department as BEIS, except to refer any departmental activity prior to 14 July 2016, in which case DECC is used.

<sup>5</sup> See <https://www.gov.uk/government/publications/dynamic-dispatch-model-ddm> for more information on the DDM

<sup>6</sup> We will update fossil fuel price assumptions for the final-stage Impact Assessment

<sup>7</sup> Please note that the stated level of CPS is used for modelling purposes only and is not an indication of the policy direction.

**Figure 1: coal plant capacity in the central and high coal scenarios under policy option 0, the counterfactual.**



10. There is no monetised change to welfare resulting from policy intervention in **the central scenario**. This is because all coal power stations close before any of these options take effect. However, we consider non-monetised benefits and costs are still likely to accrue.
11. Table 2 shows the impact of policy intervention in the high coal scenario where the conditions for coal plant improve, based on DDM modelling, along with air quality analysis based on Green Book supplementary guidance (2013).<sup>8</sup> The increased generation, capital and network costs from an earlier switch from coal and gas-fired generation are not fully offset by the monetised reduction in carbon emissions and other pollutants. This does not capture the important non-monetised benefits around investor certainty and international leadership.

**Table 2: Monetised impact of Policy Options on Net Total Welfare relative to the baseline, high coal scenario £m discounted to 2016, rounded to two significant figures**

NPV of changes in societal welfare, cumulative to 2035		Option 1- 2025 stop	Option 2- 2023 cap
<b>Net Welfare</b>	Carbon costs	2,700	3,200
	Generation costs	-3,200	-3,900
	Capital costs	-320	-240
	Network costs	-190	-260
	Balancing costs	140	210
	Unserved energy	65	-4
	Interconnectors	-110	-270
	Unpriced carbon (appraisal value)	490	500
	Improvements in Air Quality	340	400
<b>Change in Net Welfare, excluding non-monetised benefits</b>		<b>-40<sup>9</sup></b>	<b>-320</b>

<sup>8</sup> <https://www.gov.uk/government/publications/green-book-supplementary-guidance-air-quality>

<sup>9</sup> As noted elsewhere, this only reflects elements of policy which can be partially monetised. Other non-monetised benefits offset these effects, supporting the overall judgement that the NPV for the policy is net positive.

## **Section 4: Security Of Supply Assessment**

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12. One question about the proposed policy is whether it could make it more costly to ensure security of electricity supply. This section provides more detail on how policy intervention could impact the retirement profile of coal plants.
13. In the central scenario, policy intervention has no impact on security of supply.
14. In the high coal scenario, around 6GW of coal plant is projected to retire in 2025 under both policy options 1 and 2. This is replaced by around 6GW of new lower carbon fossil fuel plant (CCGTs, OCGTs and reciprocating engines).

**Table 3: coal plant retirements and new build fossil fuel plant under policy intervention in the high coal scenario**

	2018	2019	2020	2021	2022	2023	2024	2025
Coal plant retirements	-2.0	0.0	-2.2	-1.4	0.0	0.0	0.0	-5.9
New build FF plant - option 1	0.8	2.9	2.4	0.0	0.0	2.8	1.2	6.1
New build FF plant - option 2	0.0	0.8	2.9	2.4	0.0	0.0	2.4	2.0

15. The Capacity Market is designed to provide the economic incentives required to ensure there is sufficient capacity to meet peak electricity demand.<sup>10</sup> Auctions are held four years ahead of the delivery year to allow competition from large-scale new build technologies such as CCGTs, which need the lead time for construction, with further auctions held 1 year ahead of the delivery year.
16. Evidence suggests that this rate of new build is feasible: a 2014 study commissioned by DECC suggests that between 4-6GW of new build CCGT and OCGT can be brought online per year, with the key constraint being obtaining sufficient skilled labour for the construction and commissioning phase.<sup>11</sup> In addition, BEIS considers around 2GW of reciprocating engines could be brought online per year. Additional technologies such as interconnection, DSR and energy storage also have the potential to safeguard security of supply.
17. There is inevitably some uncertainty around the feasible level of new build rates; BEIS welcomes further evidence on this during the consultation. BEIS will also continue to analyse the potential that a pre-2025 constraint on coal plants could have on smoothing the profile of coal plant retirements and reducing the costs of ensuring security of supply.

## **Section 5: Unmonetised costs and benefits**

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18. The figures presented in section 3 exclude key benefits of policy intervention due to modelling restrictions; the security of supply section above explains how some costs and benefits relating to safeguarding security of supply are not fully monetised. This section sets out 6 additional costs and benefits that could arise from policy intervention.
19. Four are direct costs and benefits of policy intervention, and are directly related to policy objectives:

<sup>10</sup> Further information on the Capacity Market can be found at <https://www.gov.uk/government/collections/capacity-market-2016>

<sup>11</sup> [https://www.gov.uk/government/uploads/system/uploads/attachment\\_data/file/315717/coal\\_and\\_gas\\_assumptions.PDF](https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/315717/coal_and_gas_assumptions.PDF)

- reduced hurdle rates for new build plant, arising from increased revenue certainty;
- international Climate Change leadership, which could encourage other countries to increase action on Climate Change;
- implementation and monitoring costs of mandated closure and constraints; and
- increased capital costs due to bringing forward new capacity.

20. In addition two indirect non-monetised impacts of the policy have been identified:

- impacts on the rail freight sector and UK mining sector; and
- impacts on competition in the wholesale market.

### **Reduced hurdle rates for new build capacity**

21. The proposed intervention should increase the level of certainty that investors have in the revenues for new build plant, such as gas plant. Coal and gas plant compete closely with each other for wholesale market revenue, and there is a significant degree of uncertainty around which of the two technologies will be the most competitive in the future because of the dependency on factors such as fossil fuel prices.
22. Mandating the closure of unabated coal plant by 2025 therefore helps to reduce the market failure arising from imperfect information, thus helping to reduce the hurdle rate that investors require to invest in new build plant, such as gas. Pre-2025 load factor constraints would also improve certainty for new build plant such as gas plant, but to a lesser extent.
23. Attempting to monetise the reduction in uncertainty for investors in new build plant is difficult for a number of reasons. For example, uncertainty in new build plant cashflows is driven by a number of market risks. Where new build plants are financed through corporate debt, these financing costs will depend more on overall company investment profiles, of which new build plant will be just one issue. The policy would increase certainty for new build plant even in the central scenario, although the timeframe over which the impact will occur will be reduced.
24. Financing costs for new fossil fuel plant built between 2018 and 2030 are forecast to be around £1.5bn in NPV terms over this period.<sup>12</sup> These costs would need to reduce by 2.7% to offset the negative NPV of £40m from policy option 1 in the high coal scenario. So if, for example, investors in new gas plant have a hurdle rate of 10%, this equates to a 0.3 percentage point reduction, down to 9.7%.
25. In the central scenario, policy intervention would increase certainty for new build capacity and reduce financing costs until 2021, where all coal plant retires in the counterfactual. We consider that this reduction in finance costs would therefore lead to a positive NPV in the central scenario.

### **International Climate Change leadership**

26. Internationally, UK policy is able to encourage other countries to end or at least minimise their use of coal on climate change grounds. We do this through encouraging the take up of lower-carbon energy alternatives and by limiting the export credit finance available for unabated coal projects through the OECD. Domestically, our proposal to close all unabated coal-fired power stations by 2025 marks the UK out as one of the first

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<sup>12</sup> This is based on modelling using the rates of new build CCGTs OCGTs and reciprocating engines and upfront capital cost and hurdle rate estimates used in DDM. Developers are assumed to draw down the entire finance required to construct the project in year 0, and pay back this principal at a constant rate over 10 years.

developed countries to signal such a commitment which should encourage other countries to follow this lead.

27. The extent to which the proposed policy could encourage other countries to make similar commitments is uncertain. Rather than attempting to monetise these benefits at this stage, we therefore consider the cost of global carbon emissions in relation to the costs of this policy intervention.

28. Global carbon emissions from the power sector are forecast to be around 10GtCO<sub>2</sub> per year between 2020 and 2030<sup>13</sup>. Monetising the cost of these emissions using BEIS's social cost of carbon estimates results in an NPV of £4,100bn over this time period. Even a small proportionate reduction in global carbon emissions as a result of the proposed policy would therefore have significant benefits. We consider that these benefits will outweigh the net costs to the electricity system calculated in section 3, however these benefits will accrue outside the UK's boundaries so cannot be included in headline NPV figures for this Impact Assessment.

### **Implementation and monitoring costs**

29. Implementing and monitoring regulations would involve costs for government, regulators and businesses in terms of labour and IT systems. An assessment of these costs is difficult now, given the variety of options for the design of the backstop and any constraint.

30. An assessment of these costs will be published in the final stage Impact Assessment, once there is more certainty over policy design.

### **Increased capital costs**

31. If the electricity market evolved in line with our 'high coal' scenario, the high demand for new gas build in the mid-2020s may temporarily lead to higher construction costs for new build plant. This could occur, for example, if skilled labour is required to be diverted from other industries, pushing up labour costs. The PB report referenced in section 6 provides estimates of the supply curve for CCGT and OCGT plants.

### **Macroeconomic impacts**

32. The DDM analysis in section 3 presents estimated change in net present value of the economic activity that goes ahead. Whilst this provides comprehensive quantification of the costs and benefits from changing electricity sector activity, it does not take in to account:

- frictions involved in moving resources from one sector to another, which can reduce economic activity in the short term and create distributional impacts; and
- whether the value is added in the UK or abroad.

33. Two sectors that may be impacted are the transport and coal mining sectors.

#### Transport

34. Coal accounts for a significant proportion of rail freight activity. It accounted for 29% of rail freight demand (on a net-tonne-km basis) in 2014/15, although this percentage has been

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<sup>13</sup> IEA World Energy Outlook (2015)

falling and is likely to have fallen further<sup>14</sup>. Whilst these figures include coal transport for all end uses, the power sector accounted for 79% of UK coal demand in 2014<sup>15</sup>.

35. The reduction in demand for coal transport within the UK is likely to be offset by an increase in investment in gas transport capacity in the UK, for example in pipelines, gas storage facilities and LNG infrastructure.

### UK coal mining

36. The power sector is the major consumer of coal mined in the UK: around 87% of the coal mined in the UK was steam coal, and the power sector accounts for 93% of steam coal consumption in the UK.<sup>16</sup>
37. UK production fell by 52% between 2011 and 2015. If these trends continue, UK coal production would be unlikely to provide a material proportion of the coal demand of between 24Mt and 7Mt in the 2020s under the high coal scenario baseline. Therefore even in a high coal scenario, evidence suggests the proposed policy options are unlikely to have a significant impact on the UK coal mining sector.

## **Section 6: Distributional Impacts**

38. As before, **in the central scenarios** policy intervention does not result in any changes in distributional impacts.
39. In the **high coal scenario**, the policy has a distributional impact on market participants. The impact is varied across options but to a large extent reflects the profile of new gas build and generation that replaces coal plants.
40. Modelling suggests the policy will lead to a transfer from producers to consumers. This indicates that the additional generation and capital costs that occur from the restriction on coal plant are not passed on to consumers. The intuition behind this is that the model assumes the marginal plant sets prices in the wholesale and capacity market, so cost increases to infra-marginal plants will not be passed on to consumers. This suggests that the policy has the effect of flattening the capacity and generation supply curves; infra-marginal costs are increased, whilst marginal costs decrease. However it should be noted that this result is highly sensitive to assumptions and modelling approach.

**Table 4: Distributional impacts across options, change on the high coal counterfactual, 2016 £m<sup>17</sup>**

NPV of monetised changes to consumer and producer surplus, cumulative to 2035		Option 1- 2025 stop	Option 2- 2023 cap
<b>Consumer Surplus</b>			
Wholesale price		330	-450
Low carbon payments		-96	-190
Capacity payments		360	1,100
Network costs (demand)		-130	-180
Balancing costs (demand)		260	340
Unserved energy		65	-4

<sup>14</sup> Office of Rail Regulation (ORR), Rail Freight Statistics <http://orr.gov.uk/statistics/published-stats/statistical-releases>

<sup>15</sup> DUKES 2015 Table 2.4 <https://www.gov.uk/government/statistics/solid-fuels-and-derived-gases-chapter-2-digest-of-united-kingdom-energy-statistics-dukes>

<sup>16</sup> ibid

<sup>17</sup> Figures in the table have been rounded to 2 significant values and therefore sums may not add up.

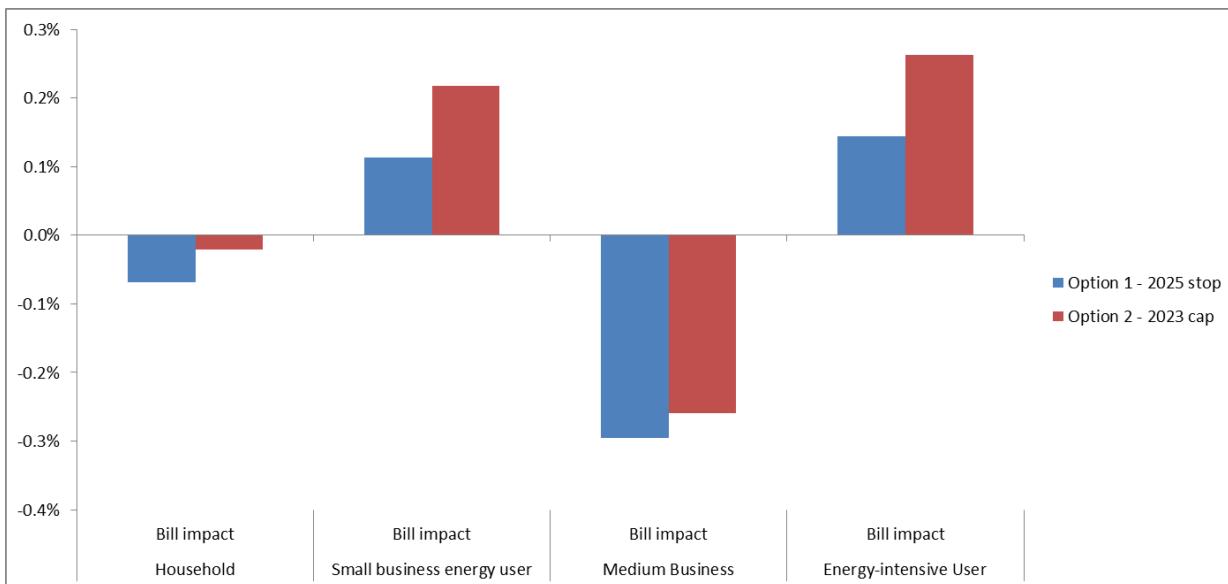
	<b>Change in Consumer Surplus</b>	<b>780</b>	<b>630</b>
<b>Producer Surplus</b>	Wholesale price Low carbon support Capacity payments Producer costs <b>Change in Producer Surplus</b>	-440 96 -360 -710 <b>-1,400</b>	170 190 -1,100 -860 <b>-1,600</b>
<b>Environmental Tax</b>	<b>Change in Environmental Tax Revenue</b>	<b>-230</b>	<b>-240</b>
<b>Societal benefit</b>	<b>Change in Unpriced Carbon Externality Improvements in Air Quality</b>	<b>490</b> <b>340</b>	<b>500</b> <b>400</b>
<b>Total change in monetised Net Welfare</b>		<b>-40<sup>18</sup></b>	<b>-320</b>

### **Impacts on consumer bills**

41. Impacts of policy options on consumer electricity bills have been estimated using BEIS's Prices & Bills model, that takes into account the changes in wholesale and retail prices and policy pass-through costs that result from implementing the regulation. The analysis covers the period between 2016 and 2030.
42. There are no consumer bill impacts from the monetised elements of policy intervention in the central scenario, although a reduction in capital costs of new build could reduce capacity market costs and so in turn reduce bills.
43. In the event of a **high coal scenario**, modelling suggests the monetised elements of policy intervention will result in a small decrease in bills for households and some business consumers, but increases for other business users. However the impact is expected to be very small, neither increasing nor decreasing bills by more than 0.3% between 2020 and 2030 and may also be affected by the non-monetised elements as above.

<sup>18</sup> As noted elsewhere, this only reflects elements of policy which can be partially monetised. Other non-monetised benefits offset these effects, supporting the overall judgement that the NPV for the policy is net positive.

**Table 5: : Impact of monetised elements of policy options on consumer bills, % change relative to the high coal counterfactual, average over 2020-2030**



## **Section 7: Overall assessment**

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44. The impact of this policy depends on the balance between two sets of factors:
- the monetised costs and benefits on the electricity system; and
  - the non-monetised benefits, particularly the reduced uncertainty to new build plant.
45. In the central scenario, the policy has no impact on the electricity generation mix. We consider that the increased certainty for new build plant such as gas will reduce financing costs and result in the policy having a net positive impact on society, without taking account of any positive impact on international action to tackle climate change.
46. In the high coal scenario, which we consider unlikely to materialise, analysis suggests that the additional generation and capital costs from an increased rate of switching from coal and gas fired power generation will marginally outweigh the benefits of reduced carbon emissions and other pollutants. However, we consider that the impact of increased certainty for new build plant may reduce financing costs by more than the monetised net cost on the electricity system.
- 47. The consultation welcomes views on monetised and non-monetised impacts described above.**

## **Section 8: Small and micro business assessment**

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48. These are not analysed within this Impact Assessment as no coal plants operators qualify as a small or micro business, which under the Better Regulation framework are businesses that employ fewer than 50 FTE employees<sup>19</sup>.

## **Section 9: One-in, three-out**

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49. This section assesses the direct impacts on business as a result of implementing the policy. There is no net impact on businesses in our central scenario. However, given the uncertainty around fossil fuel prices and their historic volatility, we present a range of costs that businesses may experience as a result of the policy by including direct impacts of the high coal scenario. While a more accurate approach would be to estimate a single EANDCB by weighting EADNCB in each scenario by the probability of that scenario occurring, estimating these probabilities is not practical due to the complexity and unpredictability of the factors involved. The discussion on the relationship between coal and gas prices in Section 2 identified that the likelihood of the high coal scenario, whilst feasible, is very low, suggesting the actual impacts on the market are likely to be much smaller and closer to the EANDCB values estimated for the central scenario. If possible we will refine this methodology for the final stage of the Impact Assessment.

50. It is important to note that the reduced financing costs for new build plant are not accounted for below, as our current view is that they are not classified as a **direct** impact of the policy according to the one-in, three out methodology. However we consider that these benefits would outweigh the net cost to business calculated below.

## Coal plants

51. Table 6 summarises the EANDCB values for policy options and two economic scenarios. A positive value means an increase in business costs relative to the counterfactual and a negative value means a saving. As discussed in the Impacts sections above, the policy does not impact coal power stations in the **central scenario**. Analysis showed that there is a minor increase in coal generation (discussed in more detail in p.38) but the resulting impact on estimated plant profits is negligible and when annualised, shows a net **zero EANDCB**.

52. In the **high coal scenario**, restrictions on running hours mean that coal plants lose opportunity for profits they would otherwise have in the counterfactual. In EANDCB terms this is equivalent to **£64.8m – £82.2m net cost**, as shown in columns 2 and 3 of the table below

53. The reduction in profits for coal plant will lead to an increase in profits for other forms of generation, which in some cases will be owned by the same companies that own coal plants. The resulting change in profitability could be classed as a transfer between businesses; in this case any transfer in profits should be netted off the cost to business figure, and thus the EANDCB figure would show the impact on profitability all generators as a result of the policy. Columns 3 and 4 of the table below show the impact on the profits of other generators.

54. Whilst it may be appropriate to include all the impact on all generators as a direct cost, for the purposes of this consultation-stage IA we have only included impacts on coal plant in the headline EANDCB figures.

**Table 6: Net direct cost to plants of policy options 1and 2 for the central and high coal scenarios, EANDCB, £m**

	Coal plants		Other existing and pipeline plants	
	Option 1 - 2025 stop	Option 2 - 2023 cap	Option 1 - 2025 stop	Option 2 - 2023 cap
Central scenario	0	0	0	0
High coal scenario	64.8	82.2	-73.4	-124.9

## **Summary**

55. Overall, policies result in **no net impact** in costs to coal plants **in the central scenario**, and **£64.8m - £82.2m** per year **in the high coal scenario**, although it should be noted that there is considerable uncertainty with regards to these values, in particular in the high coal scenario, which we consider less likely to occur than the central.
56. Moreover, these figures do not account for the reduced financing costs for new build plant that would result from policy intervention