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The Impact of Changes in Access Charges on the Demand for Coal

Report for ORR

May 2012

Table 3.3
Change in Nuclear Plant Margins vs. Baseline (2014-18)

	Change in Nuclear Margins vs. Baseline
	% Change, Undiscounted Margins
£5 Increase	0.3%
£10 Increase	0.6%
£15 Increase	0.9%

Source: NERA analysis. Note, margins are defined as power market revenue, less variable costs of production, including fuel commodity and transport costs.

3.2.3. Impact of a change to biomass charges

3.2.3.1. The use of biomass in power generation

Biomass includes a range of fuels, including landfill gas, sewerage gas, waste combustion, animal and plant biomass products, liquid biofuels, and wood pellets.[37] Biomass is widely classified as a renewable energy source. As such, biomass plants do not pay for their emissions of CO_2. Even so, the costs of producing electricity using biomass is often substantially higher (on a £ per MWh basis) than the costs of using fossil fuels such as coal.

Because the UK has a legally binding target under the EU Renewable Energy Directive to increase the share of renewables in final energy consumption, the UK government subsidises power generators that use biomass through the Renewables Obligation (RO) scheme. For every MWh of output they produce using biomass, power generators are awarded Renewables Obligation Certificates (ROCs). Generators can sell ROCs to electricity suppliers, who buy them to comply with their obligation to present a certain number of ROCs to Ofgem each year.[38] Hence, the RO provides additional revenue to renewable generators, which is paid for initially by suppliers and ultimately by electricity users.

3.2.3.2. The impact on biomass demand

At present, biomass is largely used in power generation in coal-fired power stations through “co-firing”, whereby a small quantity of wood pellets or other forms of biomass are blended with coal in the combustion process. In this process, biomass usually makes up only a small proportion of fuel burned.[39] The change in demand for biomass for use in co-firing following an increase in track access charges is therefore determined largely by the impact on demand for coal, which we assess in Chapter 3.

However, the precise impact will depend on the way that the increase in track access charges is calculated. Biomass has a lower calorific value than coal, which means a larger amount of

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[37] Digest of UK Energy Statistics, Table 7.1.

[38] If electricity suppliers present too few ROCs as compared with their obligations, they must pay a “buy-out” on a £/ROC basis.

[39] Even Drax, which we understand co-fired more biomass than other coal plants on the GB system, is only capable of co-firing using 12.5% biomass and 87.5% coal. (Source: Drax website, visited on 28 March 2012, URL: http://www.draxpower.com/biomass/cofiring_plans/)

biomass (in tonnes) needs to be transported to power stations for every unit of energy produced than if the same unit of energy were produced using coal. And its different mass means that the relationship between net and gross tonne kms will be different from that for coal. As a result:

- if the increase in track access charges for biomass is calculated so that it has the same impact on generation costs (ie £ per MWh) as the increase in charges for coal traffic, then the impact on the ESI's demand for biomass for co-firing should be the same as the impact on its demand for coal; or
- if track access charges for biomass increase by the same amount per net or gross tonne km as track access charges for coal, then we would expect generators to reduce the proportion of biomass that they use and therefore the ESI's demand for biomass for co-firing might fall by more than our modelled reduction in demand for coal.

For dedicated biomass facilities, the impact on demand from increasing access charges depends on the change in plants' position in the merit order, and their marginal cost as compared to other competing technologies. Like nuclear plants, biomass generators are likely to be high in the merit order, so we would not expect an increase in track access charges to affect the output (and therefore the demand for biomass) of existing facilities. Indeed, the impact of the RO scheme means that dedicated biomass generators' marginal cost of production may be close to zero, or even negative, at present.[40] However, it is possible that an increase in track access charges could affect decisions about the future development of biomass plants.

Most existing biomass power stations have been developed on a small scale,[41] and so are likely to purchase biomass from their local areas, and making little use of the rail network. In the coming years biomass demand is expected to grow to meet government targets, which may result in the development of large-scale dedicated biomass facilities that consume biomass products more suitable for transport by rail, such as imported wood chips. However, at present there is considerable uncertainty over where any new biomass generators will be located, or the extent to which they will rely on the rail network. For instance, a number of new biomass generation projects have been proposed near to ports, whereas others are inland, and so some of these would rely on rail transport to a greater extent than others. An increase in track access charges, therefore, might make inland locations relatively less attractive compared with locations near to ports.

[40] For example, a recent study by Mott MacDonald for DECC estimates that the variable cost of biomass generation is between £22/MWh and £41/MWh. Under recent DECC proposals, new dedicated biomass generators will receive 1 ROC/MWh. At the current market price for ROCs of £42/ROC, the net cost of generating a unit of electricity is negative, between -£1/MWh and -£20/MWh.

Sources: (1) UK Electricity Generation Costs Update, Mott MacDonald, June 2010, Table C.2; (2) Consultation on the Renewables Obligation Banding Review, Department for Energy and Climate Change, October 2011, page 26; (3) ROC market price based on results of the "e-roc" auction from 24 February 2012 – see http://www.e-roc.co.uk/trackrecord.htm.

[41] For example, the "Platts Powervision" database, which contains data on GB power plants. lists only 7 operating dedicated biomass plants, all of which have capacity below 50MW. In contrast, most coal-fired generators in GB have capacities of 1,000MW or more.

The impact on demand for biomass, by both dedicated biomass plants and coal plants that use biomass for co-firing, is further complicated because the total effect will depend on the response of government to changes in the cost of generation using biomass. When setting biomass subsidy levels, the government aims to provide sufficient payment to generators to enable its targets to be met, while also minimising the additional costs placed on electricity consumers from providing subsidy revenues to renewable generators in excess of their costs. The government therefore accounts for the costs of generating electricity using biomass when setting subsidy levels.[42] Hence, if biomass generators' fuel costs increase, they may benefit from an offsetting increase in subsidy payments that the government would need to offer in order to achieve its targets, albeit possibly with a lag as the government only reviews subsidy levels periodically.[43] If higher subsidies compensate biomass generators for an increase in access charges, demand for ESI biomass would be unchanged. However, any delay in adjustment means increasing access charges could still affect demand for a period.

Ultimately, therefore, the future demand for biomass from the ESI will depend on government policy regarding renewables subsidies, which it sets taking account of the costs of competing renewables technologies, as well as other factors such as its desire to meet renewable energy targets using a range of generation technologies.

3.2.3.3. The impact on subsidies

Although the uncertainties surrounding the location of new biomass stations means it is difficult to predict the precise effect of an increase in track access charges, we have conducted some simple calculations to illustrate the magnitude of the impact.

Assuming that biomass is transported, on average, 100 kms by rail, we estimate that an increase in access charges of £10 per thousand net tonne kms would increase the variable cost of biomass generation by around £0.6/MWh.[44] While this will not affect biomass generators' output, for the reasons set out above, our modelling suggests they will earn higher revenues from the power market due to the impact on prices from coal generators' increased variable costs. We estimate that they would earn an extra £0.3/MWh of revenue on average between 2014 and 2018.

The difference between the change in costs and revenues (£0.6/MWh - £0.3/MWh = £0.3/MWh) will manifest itself as either lower margins for biomass generators, or as a requirement for additional subsidies to maintain the profitability of new biomass plants. Assuming 3,900MW of new biomass capacity comes online by 2020,[45] an increased subsidy

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42 Energy Act 2008, Section 32D, paragraph 4(a).

43 The government is in the process of fixing subsidies for existing biomass plants through the "Renewables Obligation Banding Review" for the period from 2013-2017. However, new biomass generators may have the option of receiving subsidies under a new mechanism, proposed as part of the government's Electricity Market Reform process, that will replace the Renewables Obligation around the period 2014/15.

44 This calculation assumes an HHV (net) calorific value for biomass of 16.5 GJ/tonne (based on the PIX Pellet Nordic Industrial Index Specification, see www.foex.fi), and that biomass generators have a sent-out HHV efficiency of 35%.

45 Our calculations using data from the Government's 2011 "Renewable Energy Roadmap" suggest that, in a central case, the Government's projections imply around 3,900MW of new dedicated biomass generation capacity by 2020. Source: UK Renewable Energy Roadmap, Department for Energy and Climate Change, July 2011, page 67. This calculation assumes biomass generators run at an 80 per cent load factor.

requirement of £0.3/MWh would increase costs to customers by around £8 million per year which we estimate would increase residential electricity bills by around 0.02 per cent.

The increase in biomass generation costs (and therefore subsidy requirements) would be lower, however, if the increase in track access charges was less than £10 per thousand net tonne miles. One reason for a lower increase would be to ensure that the impact on generation costs (per MWh) is the same for biomass as for coal.

3.3. Sensitivity Tests

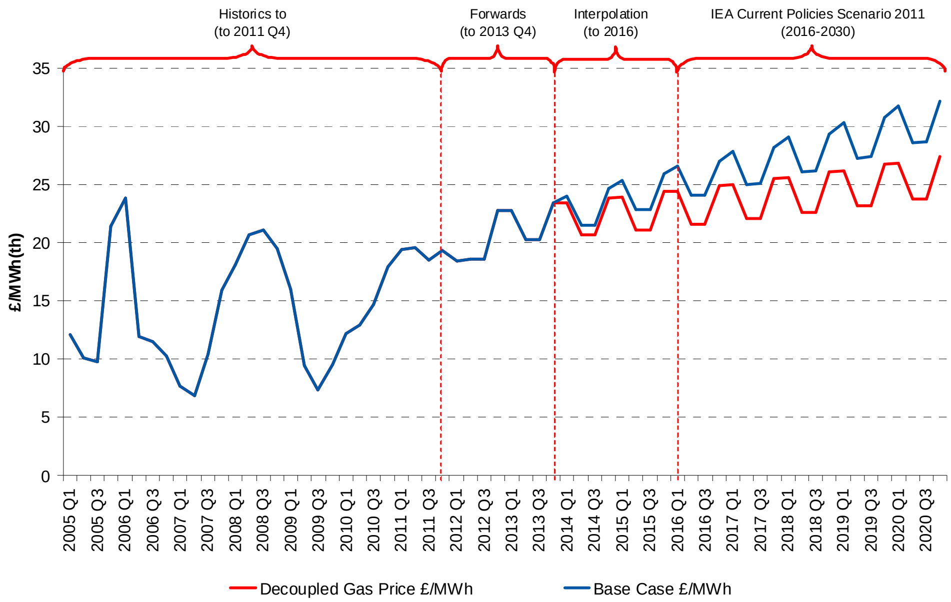
3.3.1. Low gas price scenario

The IEA's 2011 WEO gas price forecast, which underlies our baseline long-term gas price forecast, assumes that EU gas prices will remain at a constant ratio to the oil price over the period to 2030. This reflects an assumption that oil indexation will continue to dominate gas pricing in Europe for the coming years.

However, this assumption is subject to some uncertainty. For instance, in 2009/10 a surplus of upstream gas and LNG capacity caused a "decoupling" of gas and oil prices in Europe due to a surplus of upstream supplies. This "decoupling" may be repeated in future due, for example, to the further development of competition in downstream gas markets, expansion of global LNG trade, or the gradual discovery of shale gas supplies in Europe.

To reflect this uncertainty, we considered a low gas price scenario in which European gas prices remain constant in real terms from the end of the liquid forward curve, as shown in Figure 3.9.

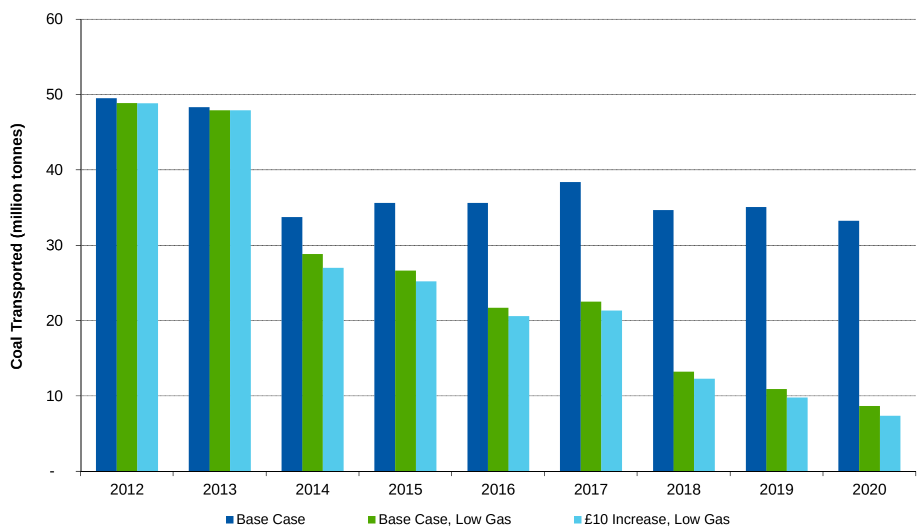
Figure 3.9
Low Gas Price Sensitivity Scenario



Source: NERA Analysis

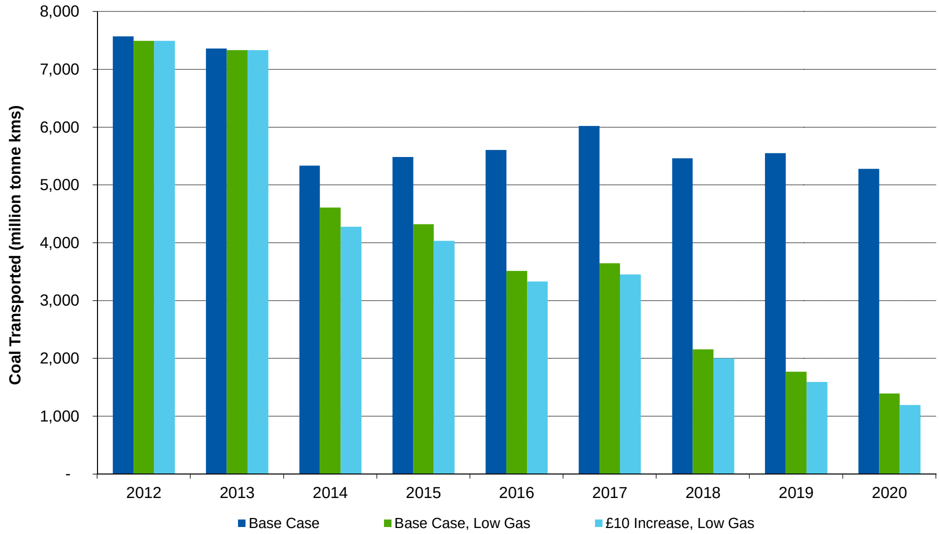
As the figures below illustrate, the low gas price sensitivity significantly reduces coal demand by more than 50 per cent relative to the base case. The figures also show that the central case increase in track access charges (£10 per thousand net tonne km) reduces coal lifted and moved by around 6 per cent, which is only a slightly larger proportional reduction than in the central case runs with the higher gas price.

Figure 3.10
Coal Lifted - Central Case, Low Gas Price Sensitivity



Source: NERA Analysis

Figure 3.11
Coal Moved – Central Case, Low Gas Price Sensitivity



Source: NERA Analysis

Table 3.4
Overall Impact on Coal Transportation (2014-18)

	Coal Lifted		Coal Moved	
	million tonnes	*% Change*	*million tonne kms*	*% Change*
Base Case	178		27,889	
Base Case, Low Gas	113		18,231	
£10 Increase, Low Gas	106	-5.8%	17,083	-6.3%

Source: NERA Analysis

3.3.2. A higher increase

ORR also asked us to examine the impact of an increase in track access charges of £25 per thousand net tonne kms (equivalent to £20 per thousand gross tonne miles). Rather than being a realistic policy option, this is simply designed to test the sensitivity of demand and the presence of tipping points.

Not surprisingly, as Table 3.5 shows, the £25 increase has a larger impact on coal demand than a £10 increase. The proportionate difference between the impacts on both coal lifted and coal moved is slightly larger than the proportionate difference between the £10 and £25 increases, but not by very much. Consistent with Table 3.1 above, this is suggestive of an impact on traffic volumes that gets gradually larger, rather than there being any specific tipping point, at least for increases of up to £25 per thousand net tonne kms.

Table 3.5
Overall Impact on Coal Transportation (2014-18)

	Coal Lifted		Coal Moved	
	million tonnes	*% Change*	*million tonne kms*	*% Change*
Base Case	178	0.0%	27,889	0.0%
£10 Increase	170	-4.6%	26,501	-5.0%
£25 Increase	155	-12.6%	23,383	-16.2%

Source: NERA Analysis

3.3.3. Partial pass through of cost increases

In all the scenarios described above, we assume that the increase in track access charges is passed on in full to generators, and that generators do not change their coal sourcing and transport decisions in response to the increase (even though it will affect some flows to a greater extent than others). Section 2.6.5 lists some of the changes that could occur in practice and might insulate generators from some of the impact of higher track access charges. It also identifies the risk that changes to coal sourcing and transport decisions could lead to a larger impact on freight tonne kms.

In order to illustrate the potential size of such impacts, we carried out a sensitivity test based on the central increase of £10 per thousand net tonne kms, but also assuming that:

- Scottish coal producers absorb some of the increase in order to maintain their competitive position relative to imported coal.[46] As a result, the cost increase faced by generators consuming Scottish coal is the same as that applying to imported coal (routed through a near port);
- generators that currently import coal through distant ports switch this traffic to closer ports in response to higher track access charges.[47]

The combined impact of these changes is to reduce the increase in delivered coal costs by around 30 per cent. However, the change in ports used for coal imports also reduces the average distance that coal travels by more than 10 per cent.

It is difficult to judge the likelihood that these or other changes might occur in practice. As noted in Section 2.6.5, some further rationalisation of transport routes might occur before 2014, in which case the risk of further rationalisation (and therefore a reduction in tonne kms moved, even if tonnes lifted remains the same) would be reduced. If the only change were that Scottish coal producers absorbed some of the increase (ie no change in use of ports), then we would expect both coal moved and coal lifted to fall by around 4 per cent.

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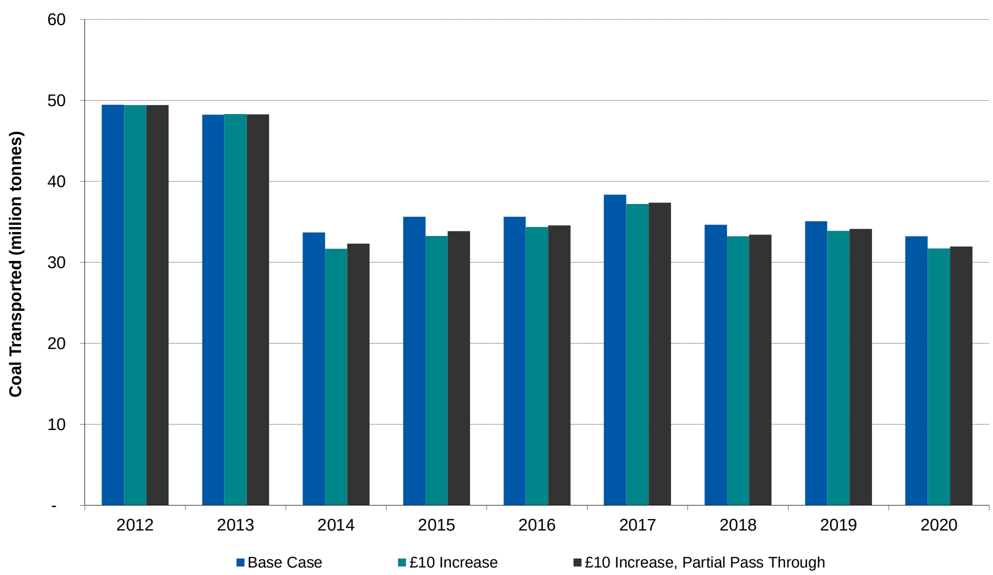
[46] As discussed in Section 4.3, recent history shows that the use of Scottish coal has remained relatively constant, despite large changes in international coal prices.

[47] It is possible that capacity constraints at some ports are one factor that helps to explain the continued use of distant ports for coal imports. However, the total demand for coal is forecast to fall by 2014, thus reducing the risk that capacity constraints will prevent generators from routing all of their coal imports through the most conveniently located ports.

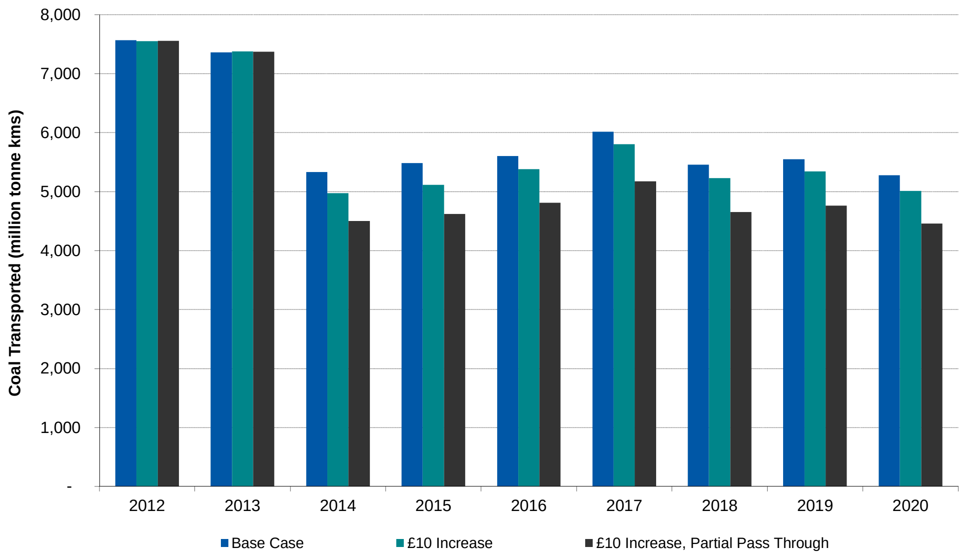
The purpose of this sensitivity test is simply to illustrate how much difference such changes could make to the estimated impact of higher track access charges on rail freight volumes, rather than necessarily describing a specific outcome that we think is likely to occur. As the figures below illustrate, the assumption that increased track access charges are only partially passed through to coal-fired generators reduces the impact on coal lifted due to a £10 per thousand net tonne km increase in freight access charges from 4.6 per cent (see Table 3.1) to 3.6 per cent. However, because coal generators source their fuel from closer ports or mines, we estimate a larger impact on coal transported of 14.8 per cent, relative to 5 per cent in the case where we assume a £10 per thousand tonne km increase in access charges.

Figure 3.12
Coal Lifted - Central Case, Partial Pass Through



Source: NERA Analysis

Figure 3.13
Coal Moved - Central Case, Partial Pass Through



Source: NERA Analysis

Table 3.6
Overall Impact on Coal Transportation (2014-18)

	Coal Lifted		Coal Moved	
	million tonnes	*% Change*	*million tonne kms*	*% Change*
Base Case	178		27,889	
£10 Increase, Partial Pass Through	172	-3.6%	23,760	-14.8%

Source: NERA Analysis

4. Wider Impacts

In this section we consider several wider impacts that ORR asked us to address, including the change in electricity bills, the implications for Scottish open cast coal mining, and any impact on current or planned investments. First, however, we briefly report the increase in Network Rail revenues that would result from the main options we have examined

4.1. Impact on Network Rail Revenues

An increase in track access charges could lead to a greater share of Network Rail's total freight avoidable costs being recovered from train operators and ultimately from end users. This would reduce the amount of subsidy that Network Rail requires from the Department for Transport and Transport Scotland.

To assess the additional contributions that would be generated, we have calculated the net impact of:

- additional payments of £5, £10 or £15 per thousand net tonne kms for the coal traffic that continues running despite the higher level of charges;
- reduced revenues from the freight-only line charge as a result of the estimated reduction in total ESI coal traffic.

We have not taken account of the reduction in Network Rail's income from variable track access charges, as Network Rail would also be expected to benefit from a similar sized reduction in its variable costs.

Table 4.1 shows the net increase in Network Rail's revenues from coal traffic in each year. In addition, there would be a small increase in net revenues from nuclear traffic – with a £10 increase this is less than £300,000 per year.

Table 4.1
Net Increase in Network Rail Revenues

£ million, 2010-11 prices	2014	2015	2016	2017	2018	Total
Increase of £10 per 1000 net tonne kms	49.5	50.9	53.7	57.9	52.1	264.1
Increase of £5 per 1000 net tonne kms	25.7	26.2	27.5	29.6	26.7	135.7
Increase of £15 per 1000 net tonne kms	70.4	72.7	77.8	84.4	75.1	380.4

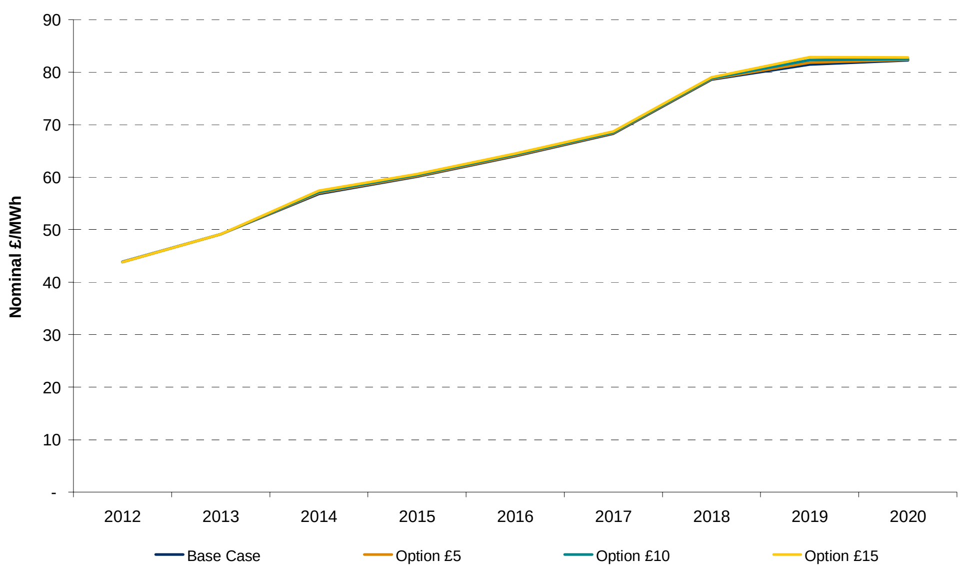
Source: NERA Analysis

4.2. Impact on Electricity Bills

An increase in track access charges can increase electricity bills, because when coal plants are on the margin, power prices will reflect their increased short run marginal cost of production. This increases the price that electricity retailers pay to procure power to serve end users, which raises customer bills.

Figure 4.1 shows that the increase in the demand-weighted wholesale electricity price[48] under the £5-£15 charging options is extremely small.[49] The average increase following a £10 per thousand net tonne km in access charges is about 0.5 per cent over the period 2015-2020, although the impact varies slightly from year-to-year. This percentage change in the costs of purchasing electricity on the wholesale market will tend to overstate the proportional impact on end-users' bills because customers also pay for other costs, such as network charges and supply costs, which are not included in wholesale prices. Hence, we would expect most end-users' bills to increase by less than 0.5 per cent on average under the central case increase in access charges.[50]

Figure 4.1
Wholesale Power Prices (£/MWh)



Source: NERA Analysis

4.2.1. Impact on domestic customers' bills

As shown in Table 4.2, we estimate that an increase of 0.5 per cent in the demand weighted wholesale electricity price implies an increase in a typical domestic customers' annual bill of around 0.2 per cent, or less than £1 per year.[51]

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48 This is defined as the annual average of hourly prices over the course of the year, weighted according to the level of demand in each hour.

49 The alternative charging options have a similar impact on prices so are not shown.

50 Additionally, as described above, customer bills may also increase following an increase in track access charges because of the additional cost of subsidising biomass power stations.

51 In this calculation, we have assumed the increase in wholesale market costs to serve domestic users is determined by the increase in the demand weighted electricity price. This is consistent with domestic customers' tendency to consume more electricity during the peak hours than off-peak hours.

Table 4.2
Illustrative Impact on Domestic Electricity Bills of 0. 5 per cent increase (Domestic Direct Debit customer)

Item	Units	Pre Price Rise	Post Price Rise	Increase
Variable Cost	pence/kWh	10.98	11.01	0.23%
...Of which Energy	pence/kWh	5.00	5.03	0.50%
Fixed Cost	£/Year	35.98	35.98	0.00%
Total Bill	£/Year	398.36	399.18	0.21%

Source: NERA Analysis on data from DECC, Average variable unit costs and fixed costs for electricity in 2010 for selected towns and cities in the UK (QEP 2.2.4).[52] Assuming annual consumption of 3,300 kWh per year.

4.2.2. Impact on other customers' bills

Due to the variety of large electricity consumers it is difficult to assess the impact on a typical large customer. While the impact on a typical small retail unit might be similar to the impact on a household, large industrial or commercial facilities may have quite different power purchasing arrangements, related to their different consumption patterns and the voltage level at which they connect to the electricity network. The impact of the increase in track access charges on these other types of customers (commercial, industrial) therefore depends on a range of factors specific to each company, and in particular at what time of year the customer consumes electricity (i.e. peak or off-peak).

Small business and residential electricity customers typically consume most power during "peak" periods, so as described above we can examine changes in the demand-weighted power price to assess the likely impact on these customers. In contrast, industrial customers often have flatter consumption profiles than average, i.e. they consume a similar quantity of electricity at all times of the year, and at all times of day. In principle, large industrial customers who use electricity in off-peak periods, when prices are more likely to be set by the marginal cost of coal-fired generation, may be hit harder by the increase than the average customer in some years.

To assess the impact on industrial customers, we examined changes in the "baseload" power price, which assumes a flat profile of consumption over the year. As shown in Table 4.3, we find no strong evidence to suggest that the impact of increased track access charges is larger for customers with a flat consumption profile (as measured by the baseload price) than for customers who consume more power in peak periods (as measured by the demand weighted price). Therefore, we would expect the increase in energy costs for industrial customers to be very similar to that shown above for residential customers.

Table 4.3
Energy Cost Increase (Baseload vs. Weighted customer), £10 option

	Average	2014	2015	2016	2017	2018	2019	2020
Demand Weighted Price	0.5%	0.7%	0.5%	0.4%	0.4%	0.3%	1.0%	0.4%
Baseload	0.5%	0.7%	0.6%	0.5%	0.4%	0.4%	0.9%	0.4%

Source: NERA Analysis

52 http://www.decc.gov.uk/en/content/cms/statistics/energy_stats/prices/prices.aspx#domestic

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