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Review of the impact of the Carbon Price Floor on the GB electricity market

A report for CoalPro

Executive Summary

London, February 27, 2014

Insight in Economics™

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Study overview

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Question

CoalPro commissioned NERA Economic Consulting to conduct a rigorous and independent analysis of the effects on the GB electricity market of freezing the Carbon Price Support (CPS) rate at £9.55/tCO2 in real terms after 2016/17.

Approach

Two market and policy scenarios were designed to isolate and analyse the effect of freezing the CPS rate: a "Baseline" and a "Freeze" scenario.

The scenarios were run on NERA's GB electricity market model with a focus on output metrics relating to energy affordability, investment trends, supply security and emissions.

Insights

NERA analysed the results and gathered the key insights.

This document summarises the key findings of that analysis.

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Summary of Key Findings

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NERA's study found that freezing the Carbon Price Support (CPS) rate at £9.55/tCO2 in real terms from 2016/17 could:

1 Significantly improve energy affordability for British consumers and energy cost-competitiveness for industry	A reduction of up to £18/MWh (or 17%) in wholesale power prices relative to the Baseline scenario, and savings per household per year of £63(1) by 2025.
2 Provide an extended and more gradual phase-out of existing coal plants, enabling a "bridge" to CCS technology	13 GW of coal-fired generation plants opt in to the IED and extend their operating lives through to the period when CCS begins to ramp up.
3 Increase GB's supply security by deferring the need for investment in new generation capacity	Capital expenditure requirements for new generation capacity are £13 billion(2) lower than in the Baseline scenario by 2025.
4 Achieve long term emissions objectives while limiting leaked (offshore) emissions from increased electricity imports	Emissions would achieve long term objectives by 2030, relative to the Baseline scenario, when adjusted for carbon leakage.

Notes:
(1) Savings per household of £63 per year by 2025 refers to net savings associated with a reduction in wholesale electricity prices and an increase in RES support. Nominal (inflation-adjusted) prices.
(2) In today's prices (i.e. real 2014 £).

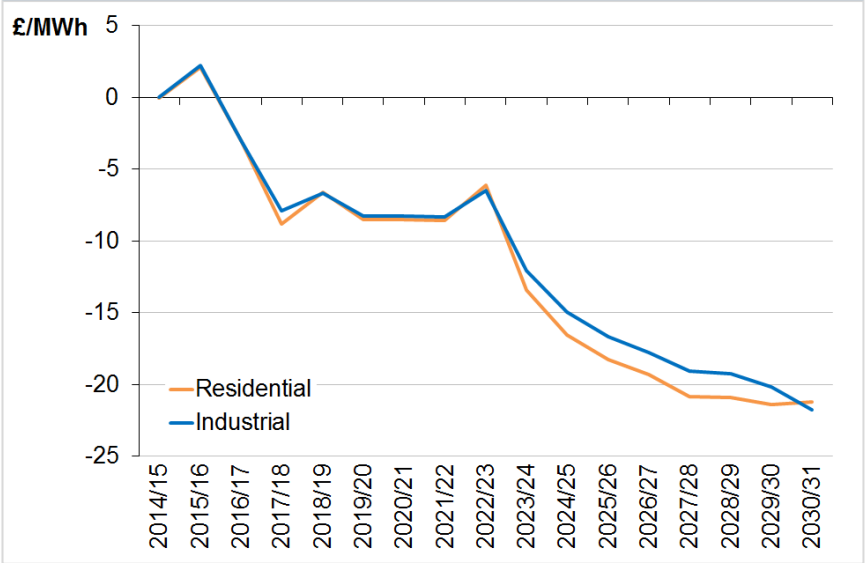
Summary of Key Findings

NERA's study found that freezing the CPS rate at £9.55/tCO2 in real terms from 2016/17 could:

1 Significantly improve energy affordability for British consumers and energy cost-competitiveness for industry

End-user electricity prices would be significantly lower than in the Baseline scenario by ~£9/MWh in 2020/21 and ~£17/MWh in 2024/25, and could deliver savings per household per year of up to £63 by 2024/25.

Difference in end-user electricity prices between the two scenarios (1)



Source: NERA analysis

Residential consumers

- End-user prices in the Freeze scenario change relative to the Baseline through a decrease in wholesale electricity prices (which pushes retail prices down) that more than offsets a slight increase in the amount of support for renewables that is added to consumer bills.
- End-user prices for residential consumers would be lower by £8.5/MWh (0.85 p/kWh) by 2020/21 and £16.5/MWh (1.65 p/kWh) by 2024/25.
- Such reductions in electricity prices would deliver savings per household per year of £32 by 2020/21 and up to £63 by 2024/25 (2).

Industrial consumers

- End-user prices for industrial consumers in the Freeze scenario change relative to the Baseline in a similar fashion as to residential prices.
- End-user prices for industrial consumers would be lower by £8.3/MWh by 2020/21 and by £14.9/MWh in 2024/25.

Notes:

(1) All prices are nominal and change expressed is relative to the Baseline scenario (i.e. Freeze scenario prices – Baseline prices). Changes in wholesale component of residential prices calculated using demand weighted wholesale prices; for industrial price changes the baseload wholesale price is used instead.

(2) Based on household average annual consumption of electricity as per Ofgem Electricity and Gas Supply Market Indicators.

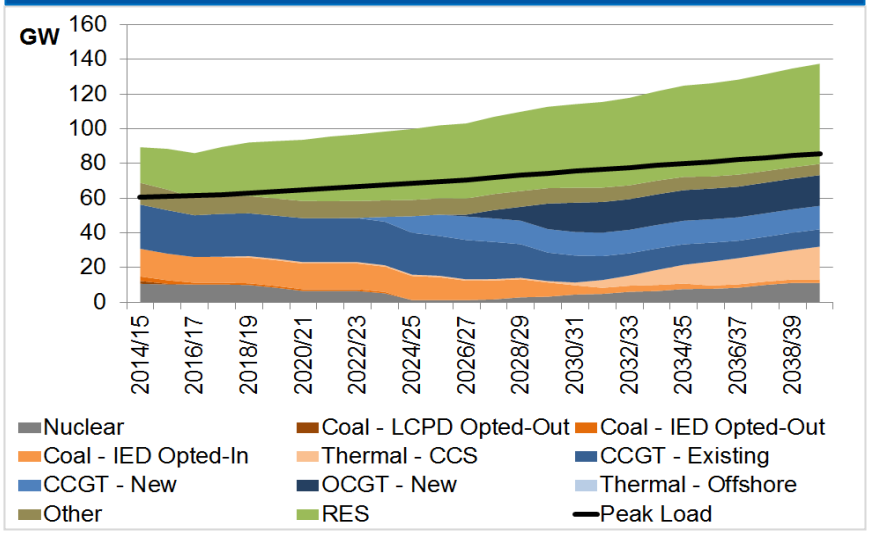
Summary of Key Findings

NERA's study found that freezing the CPS rate at £9.55/tCO2 in real terms from 2016/17 could:

2 Provide an extended and more gradual phase-out of existing coal plants, enabling a "bridge" to CCS technology

Up to 13GW of existing coal plants would remain in operation into the late 2020s as they opt-in to the IED and would be more gradually retired as CCS (including potential for new build coal with CCS) ramps up towards 2030. A significant increase in imports is avoided and CCS plays a much larger role in the GB mix.

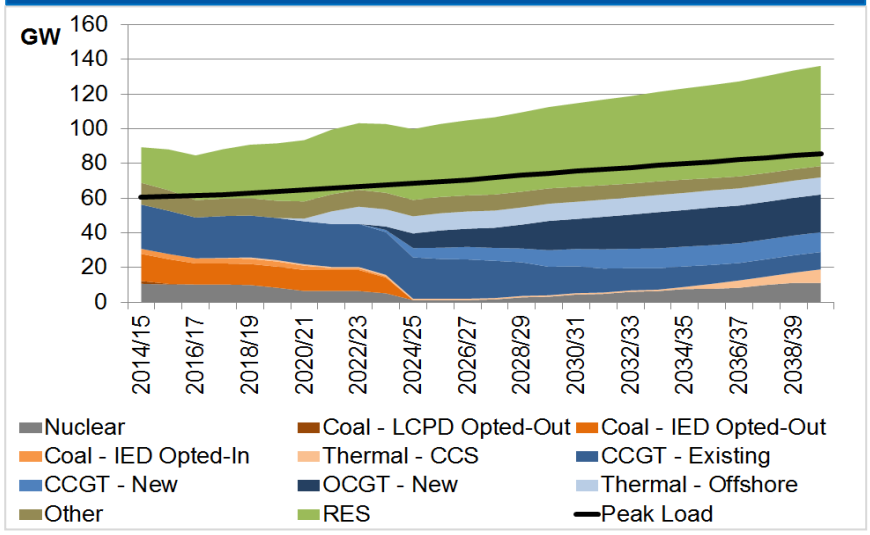
Freeze scenario



Source: NERA analysis

- Most existing coal plant opt in to the IED
- Limited additional imports relative to Baseline scenario
- Coal eases out as CCS is deployed post 2030

Baseline scenario



Source: NERA analysis

- By the early 2020s all coal capacity is decommissioned
- The carbon price differential provides strong incentives for imports of offshored fossil fuel capacity (through new interconnectors)
- Coal shuts down long before CCS is developed and the expanded import capacity reduces the role of CCS in the GB mix

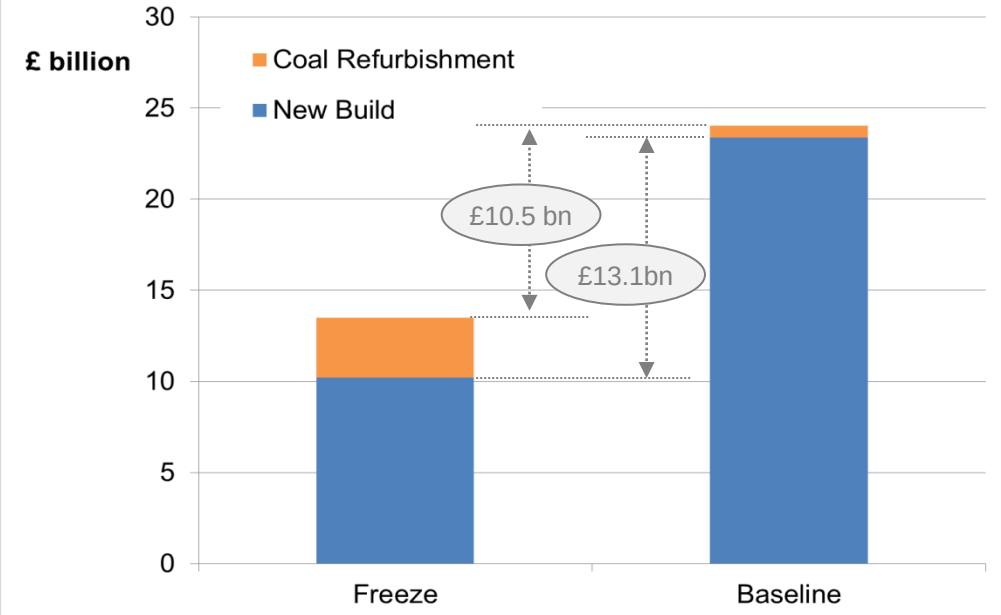
Summary of Key Findings

NERA's study found that freezing the CPS rate at £9.55/tCO2 in real terms from 2016/17 could:

3 Increase GB's supply security by deferring the need for investment in new generation capacity

The need for £13 billion by 2025 (1) of capital investment in new build generation capacity is avoided in the Freeze scenario. Not having to attract this large volume of capital is an important enhancement to the supply security of the GB electricity system.

Required capital expenditure in generation capacity by scenario by 2025/26



- Relative to the Baseline case, capital outlay in new generation capacity in the Freeze scenario changes as more coal plants choose to opt into the IED and extend their operating life to the 2030s, decreasing the need for new capital investments in generation capacity to ensure security of supply.

New build capacity

- Some 4GW less of new domestic generation capacity and 10GW less of electricity import capacity is required by 2025 under the Freeze scenario relative to the Baseline. This avoids the need to attract some £13.1billion of capital expenditure that would have otherwise been required to fill the capacity gap.

Coal Plant refurbishment

- In the Freeze scenario, up to 13GW of coal plants remain in operation from 2024, requiring an additional £2.6 billion of refurbishment investments, relative to the Baseline.
- Even accounting for the additional investment required to refurbish existing coal plant for the IED, the capital outlay required in the Freeze scenario is £10.5 billion lower than in the Baseline.

Source: NERA analysis

Notes: (1) All magnitudes in pounds are in real 2014 £ and change expressed is relative to the Baseline scenario.

Summary of Key Findings

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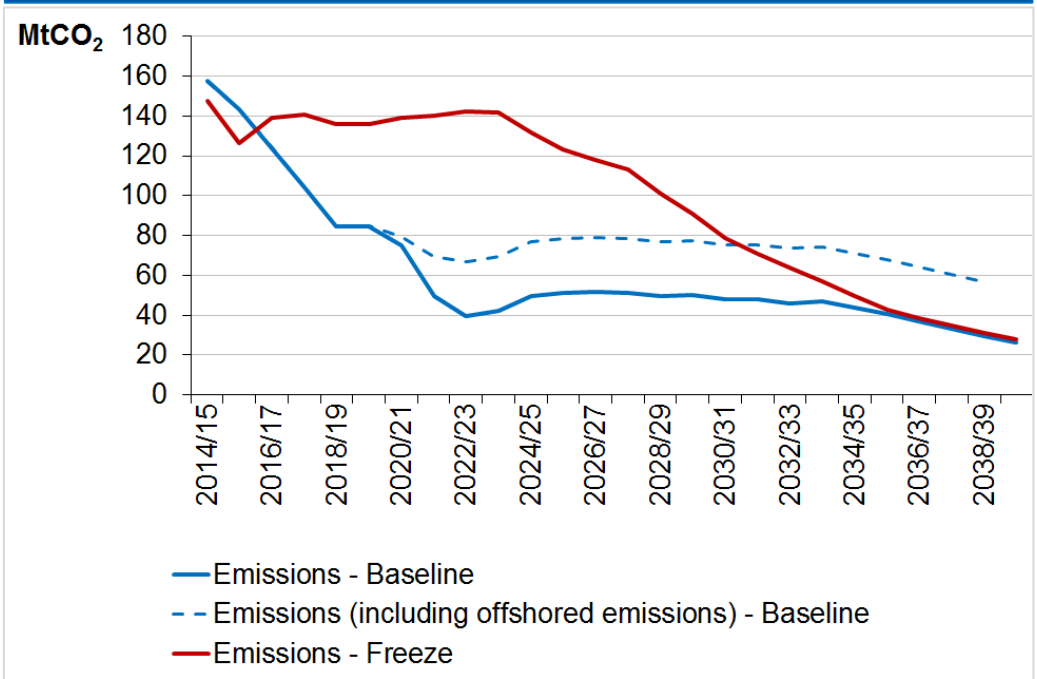
NERA's study found that freezing the CPS rate at £9.55/tCO2 in real terms from 2016/17 could:

4 Achieve long term emissions objectives while avoiding leaked (offshore) emissions from increased electricity imports

Although emissions in the Freeze scenario exceed that of the Baseline across most years, both scenarios arrive at similar levels by 2040. Moreover, when adjusted for leaked (offshore) emissions occurring in the Baseline scenario, emissions in the Freeze scenario are lower than the Baseline from 2030/31 onwards.

Emissions in the Freeze and Baseline scenarios



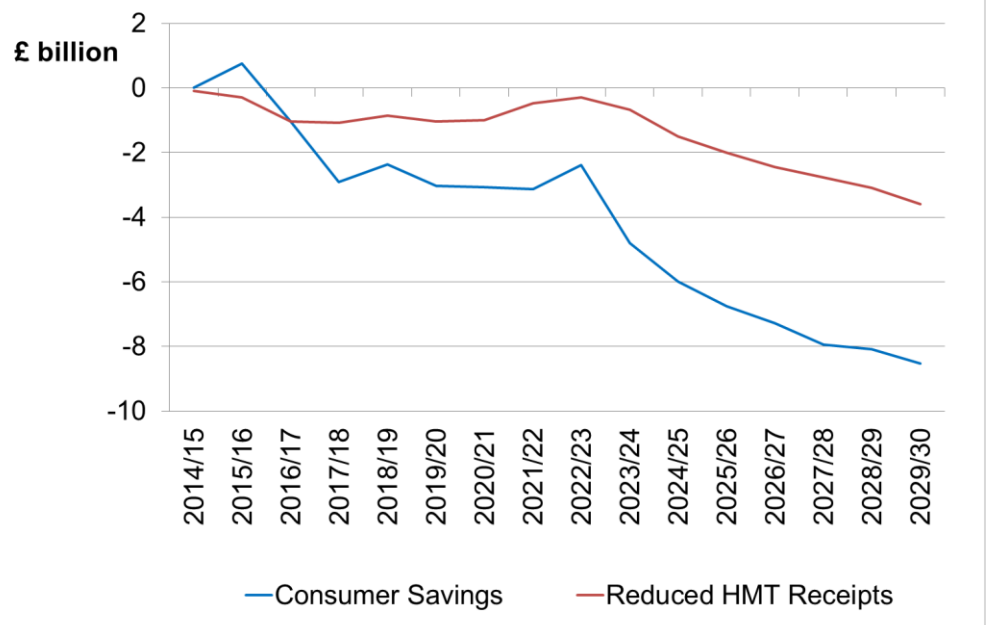
Source: NERA analysis

- UK domestic emissions under the Freeze scenario are higher than under the Baseline, but converge to the same levels by 2040.
- Under the Baseline scenario, a significant amount of electricity is imported from overseas into the GB market. This means that a large proportion of the reduced domestic emissions under the Baseline scenario are actually offset by higher emissions from offshore plants serving the UK market and thereby deliver zero environmental impact.
- When Baseline emissions are adjusted for these offshored emissions, the gap between the Freeze and Baseline scenarios narrows considerably.
- Moreover, total emissions in 2040 are lower under the Freeze scenario than under the Baseline.
- Freezing the CPS eliminates incentives to invest in offshore fossil capacity to serve the UK market.
- The figures shown in the analysis assume that imported electricity is generated by advanced CCGT plants. Offshored emissions could be even higher if the imported electricity is generated by coal-fired plants.

Commentary on CPS receipts by HM Treasury

- **NERA's study found that freezing the CPS rate at £9.55/tCO2 in real terms from 2016/17 could reduce HM Treasury's receipts from CPS payments by ~£1 billion per year by 2020/21 and by some £2 billion per year by 2025/26, relative to the Baseline scenario.**
- **This change in tax receipts should be seen in the context of the significantly larger reduction in end-user expenditure on electricity (£3 billion in 2020/21 and £6 billion in 2024/25), product of the lower electricity prices of the Freeze scenario.**
- **In turn, it is expected that higher economic activity due to lower energy prices and expenditures will produce economy-wide compensatory effects on HMT's revenues. Such effects have <u>not</u> been quantified in this study and are being assessed as a subject of potential subsequent analysis.**

Reductions in HMT revenues versus Savings for consumers (1)



- Freezing the CPS rate would reduce HM Treasury's receipts by a maximum of £1 billion per year by 2020/21 and by nearly £2 billion per year by 2024/25.
- Those reduced revenues can be contrasted with the savings to consumers from lower electricity prices: up to £3 billion per year by 2020/21 and up to £6 billion per year by 2024/25.
- The CPS freeze and its resulting expected improvement in energy affordability could have a series of positive impacts across the UK economy, with the potential to compensate for the losses in CPS tax receipts. Estimation of these compensating effects was outside the scope of this study, but some examples include:
  - Higher tax intake due to improved economic growth .
  - Higher VAT revenues due to consumers' higher disposable incomes from lower electricity costs to residential customers.
  - Higher corporation tax revenues from improved profitability through lower electricity costs to industry and businesses.
  - Higher revenues from higher carbon prices at EUA auctions.

Source: NERA analysis

Notes: (1) All magnitudes in pounds are nominal and change expressed is relative to the Baseline scenario. Does NOT include compensating effects.

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We isolate the effect of freezing the CPS rate against the background of a realistic mix of other policies and fundamentals

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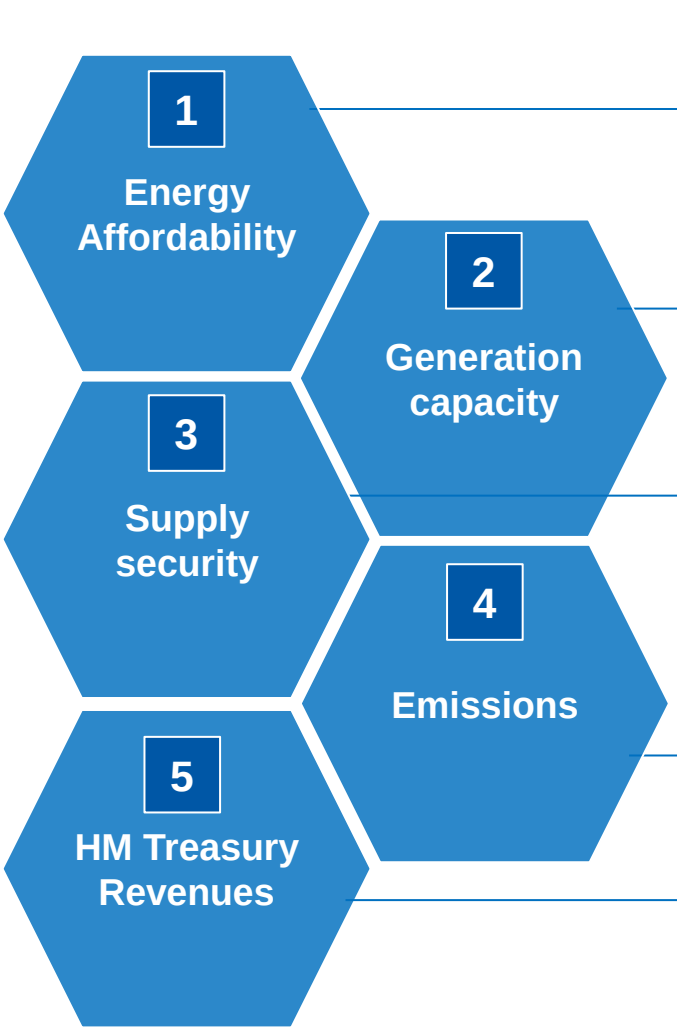
Scenario drivers	Baseline Scenario	Freeze Scenario
Investment in New Renewables	25% of generation from renewables by 2020 and 28% by 2030.	Idem
Investment in New Nuclear	First new build online in 2028, total installed capacity of 4.5GW by 2030.	Idem
EUA Price Carbon Price Floor & CPS	EUA reference prices + CPS to achieve CPF: £32/tCO2 in 2020, £74/tCO2 in 2030 in line with policy (2011 real prices).	EUA reference prices + CPS fixed at 2014/15 rate (£9.55/tCO2) from 2016 onwards and adjusted for inflation thereafter.
The Industrial Emissions Directive	Implemented according to current directive.	Idem
Demand Growth from Heat and Transport	Total demand growth CAGR 1.1% over forecast period. Demand growth in electric vehicles and heat pumps (20% and 14% CAGR, respectively).	Idem
Generation carbon intensity	100g/KWh by 2035 and 50g/kWh - 2040.	Idem
Capacity market and cash-out regime	Capacity payments start in 2019; cash-out reform assumed to result in a cap on power prices at £3,000/MWh	Idem
Fuel Prices	Bloomberg forward curves + IEA prices.	Idem

Key metrics derived from the analysis

By contrasting the model output from the Freeze and Baseline scenarios, metrics around the following areas were analysed:



	Metric
1 Energy Affordability	▪ Change in **wholesale and end-user prices**
2 Generation capacity	▪ Change in **GB installed capacity and generation by technology** ▪ Change in **CCS deployment**
3 Supply security	▪ Change in **investments in thermal plant** ▪ Change in **electricity imports**
4 Emissions	▪ Change in the annual **emissions from GB generation** ▪ Change in **emissions from electricity imports**
5 HM Treasury Revenues	▪ Change in **HM Treasury receipts from CPS**

Methodology: Impact on affordability

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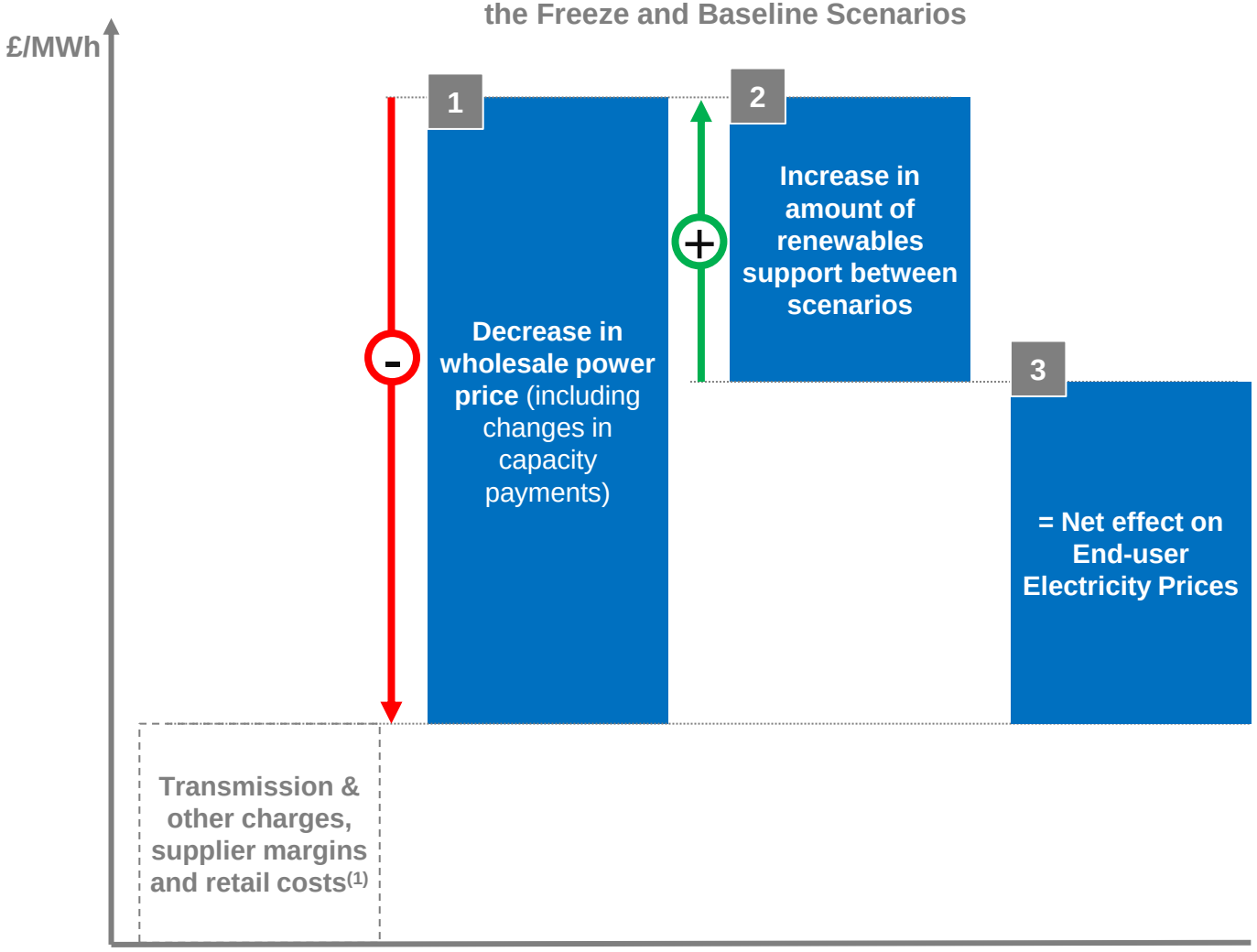
Decomposition of changes in the retail electricity price between the Freeze and Baseline Scenarios



Methodology brief

1

- Baseline and Freeze assumption sets are run on NERA's GB power market model which optimally dispatches existing plant and builds new thermal capacity in response to economic, policy and technical constraints and exogenous assumptions
- Model produces wholesale power prices (WPP) for residential and non-residential customers.
- Difference in WPP between the 2 scenarios is calculated

2

- Modelled RES deployment to 2040 based on NERA analysis of industry data
- Large scale RES costs based on both RO and CfD FIT support schemes; small scale RES costs based on existing FIT scheme
- Support levels are limited by the Levy Control Framework
- Change in support levels between the 2 scenarios is calculated

3

- Other components of the retail price such as transmission charges and supplier margins are assumed not to change between the 2 scenarios and therefore not estimated.
- The effect from the two sources of positive and negative change above are added to determine the net effect on retail prices.

Notes:
(1) Retail costs excluding renewable energy support costs.

Methodology: Impact on tax receipts

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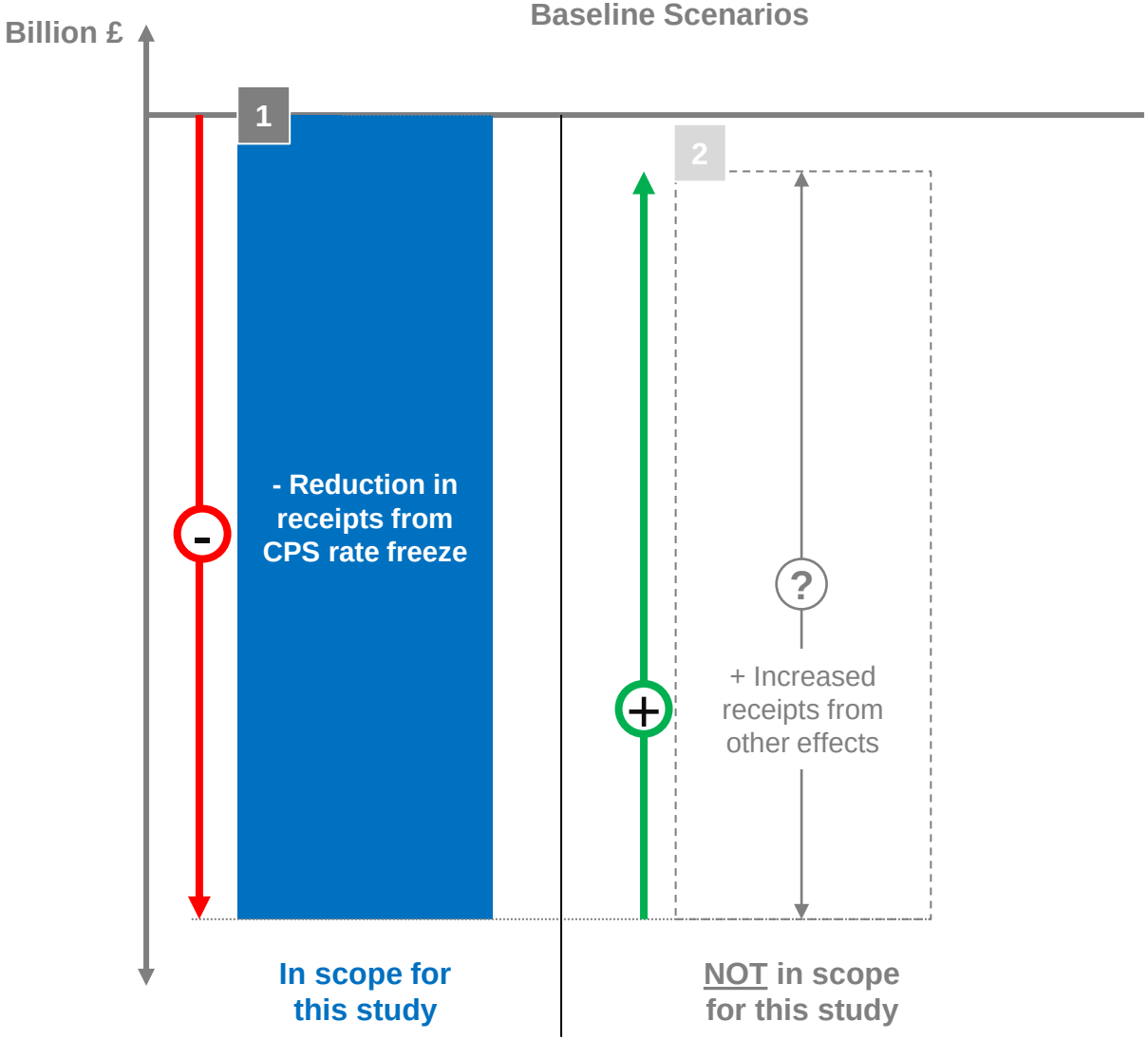
Change in tax receipts between the Freeze and Baseline Scenarios



Methodology brief

1

- Both fuel consumption and emissions from NERA's GB power market model are combined with the Baseline and Freeze scenario CPS rate assumptions to calculate CPS tax receipts.
- Relevant CPS rate discounts are applied to CCS plants and other eligible plants

2

- The freeze of the price floor could have wide ranging impacts across the economy with the potential to compensate for the reduction in CPS receipts. Estimation of these effects was outside the scope of this study. Some examples include:
- Higher tax intake due to improved economic growth .
- Higher tax intake (e.g. VAT) due to consumers' higher disposable incomes from lower electricity costs to residential customers.
- Higher tax intake (e.g. corporation tax) from improved profitability through lower electricity costs to industry and businesses.
- Higher revenues from higher carbon prices at EUA auctions.

Methodology: notes on scope

This initial analysis has been conducted with a focus on direct impacts to the GB electricity market and policy and tax instruments that are specific to it. Feedback effects and cross industry and macroeconomic impacts are not included, but may be analysed at a later stage.

- The analysis is focussed solely on direct impacts to the GB electricity industry actors, electricity prices and sector specific tax yields. i.e.
  - We calculate impacts on net tax receipts from CPS rates.
  - We do not include in that estimate changes in receipts from economy-wide levies such as VAT or corporation tax.
  - We do not include in our analysis any estimates of "compensation" for the indirect costs of the CPS to relevant Energy Intensive Industries.
- Spill over/indirect impacts and feedback effects are excluded at this stage of the analysis. E.g.:
  - Impact of changes in power prices to electricity demand.
  - Impact of changes in power prices to industry competitiveness, capex and/or relocation decisions and the ensuing impact to electricity demand and prices.
  - Feedback effects of changes in capacity and/or emissions levels to carbon (EUA) or fuel prices.

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About NERA

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NERA Economic Consulting is a global firm of experts dedicated to applying economic, finance, and quantitative principles to complex business and legal challenges

For over 50 years, NERA's economists have been creating strategies, studies, reports, expert testimony, and policy recommendations for government authorities and the world's leading corporations and law firms

We bring academic rigor, objectivity, and real world industry experience to bear on issues arising from competition, regulation, public policy, strategy, finance, and litigation

Clients value our ability to apply and communicate state-of-the-art approaches clearly and convincingly, our commitment to deliver unbiased findings, and our reputation for quality and independence

Our clients rely on the integrity and skills of our unparalleled team of economists and other experts backed by the resources and reliability of one of the world's largest economic consultancies