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Ofgem TCR and Embedded Benefits Reforms

Wider system modelling results without a Capacity Market

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Overview and key assumptions

Wider system modelling without a Capacity Market

- To date, the TCR and embedded benefits wider system modelling has been based on scenarios with a Capacity Market (CM) operating throughout the modelling horizon in both the counterfactual and reform scenarios.
- However, given the current CM suspension, Ofgem asked Frontier and LCP to test the benefits case against an alternative (though unlikely) background of an energy-only market throughout the modelling horizon.
- The analysis assessed the impact of both the Full Reform TCR and the Full Reform TGR and BSUoS policy options, with implementation in 2021.
- The modelling has been carried out using assumptions that are very similar to the previous analysis. These include:
  - Low-carbon build, interconnector build and demand growth based on the 'Steady Progression' scenario from National Grid's 2018 "Future Energy Scenarios" (FES) report.
  - Commodity prices in line with the central projections from National Grid's 2018 FES report.
- A limited number of assumption updates have been made to incorporate recent market information:
  - announced plant closures (e.g. Cottam) and online dates
  - TGR projections updated with latest National Grid five-year view (2020/21 to 2024/25)

Overview and key assumptions

Modelling an energy-only market (1)

- A key feature of the previous analysis is that while the capacity mix changed, overall LOLE (and hence capacity) was held broadly constant by the CM (except for small changes as a result of the slope of the CM demand curve).
- This is not necessarily the case with an energy-only market (EOM). Under an EOM the equilibrium level of capacity will be a function of:
  - the reaction of wholesale energy prices to scarcity; and
  - the extent to which investors consider such wholesale prices to be “bankable”.
- Our modelling assumes a perfectly functioning EOM, in which investors consider the full value of revenue resulting from future wholesale prices (including price spikes) in making an investment decision (i.e. in which they consider modelled price spikes as “bankable”).
- In other words, investors have foresight over future prices when making investment decisions, and both future and outturn prices are consistent with the modelled outturn level of system security (LOLE).
- Even so, as the results show, the calibration of the response of modelled wholesale prices to scarcity is such that the reduction in capacity due to the reforms, and hence the increase in LOLE, is greater without a CM than with a CM in place.

Overview and key assumptions

Modelling an energy-only market (2)

- Given the original policy rationale for a capacity market which related to the bankability of wholesale price spikes, it might be reasonable to expect that the equilibrium level of capacity without a capacity market might be even lower (and hence the equilibrium level of LOLE higher) than with the intervention in place.
- The benefits can be sensitive to the assumed responsiveness of investors to prices. Were we to assume that investors considered higher wholesale price spikes less “bankable”, this could reduce the benefits observed, because the equilibrium level of capacity could be reduced further and wholesale prices remain higher for longer.
- However, while the results are very sensitive to this assumption, it seems unlikely that an energy only market in which investors did not consider price spikes to be bankable would endure without further intervention from government to improve the efficiency with which investment takes place. As noted above, this was the rationale for the introduction of the capacity market in the first place.
- Since these latest runs consider an enduring EOM, they are most likely to be consistent with a situation in which investors do consider price spikes bankable, where the original rationale for the capacity market had disappeared, and hence in which our underlying assumption as to investor behaviour is justified.

Results & comparison to prior TCR analysis

Consumer and system cost impacts

- The system and consumer cost impacts are summarised below. The results from the previous analysis are shown for comparison, though it should be noted that there have been updates to assumptions between the two sets of analysis so they are not directly comparable.
- Our results show the reforms reduce consumer costs by £4.8bn – a similar reduction to the previous analysis with the CM in place.
- System benefits are also reduced, but by a smaller magnitude. One reason for this is the increase in EEU (expected energy unserved) due to the reforms, which is valued at £17,000/MWh*.

NPV (£bn), 2019-2040

Counterfactual	Factual	System Cost (£bn)	Consumer Cost (£bn)
Previous analysis (with CM)			
Baseline (TCR)	TCR Residual Reform	-1.01	-0.54
TCR Residual Reform	TGR & Full BSUoS Reform	-0.03	-4.52
	Total, with CM	***-1.04***	***-5.06***
New analysis (no CM)			
Baseline (No CM)	TCR Residual Reform, TGR & Full BSUoS Reform (No CM)	-0.23	-4.81

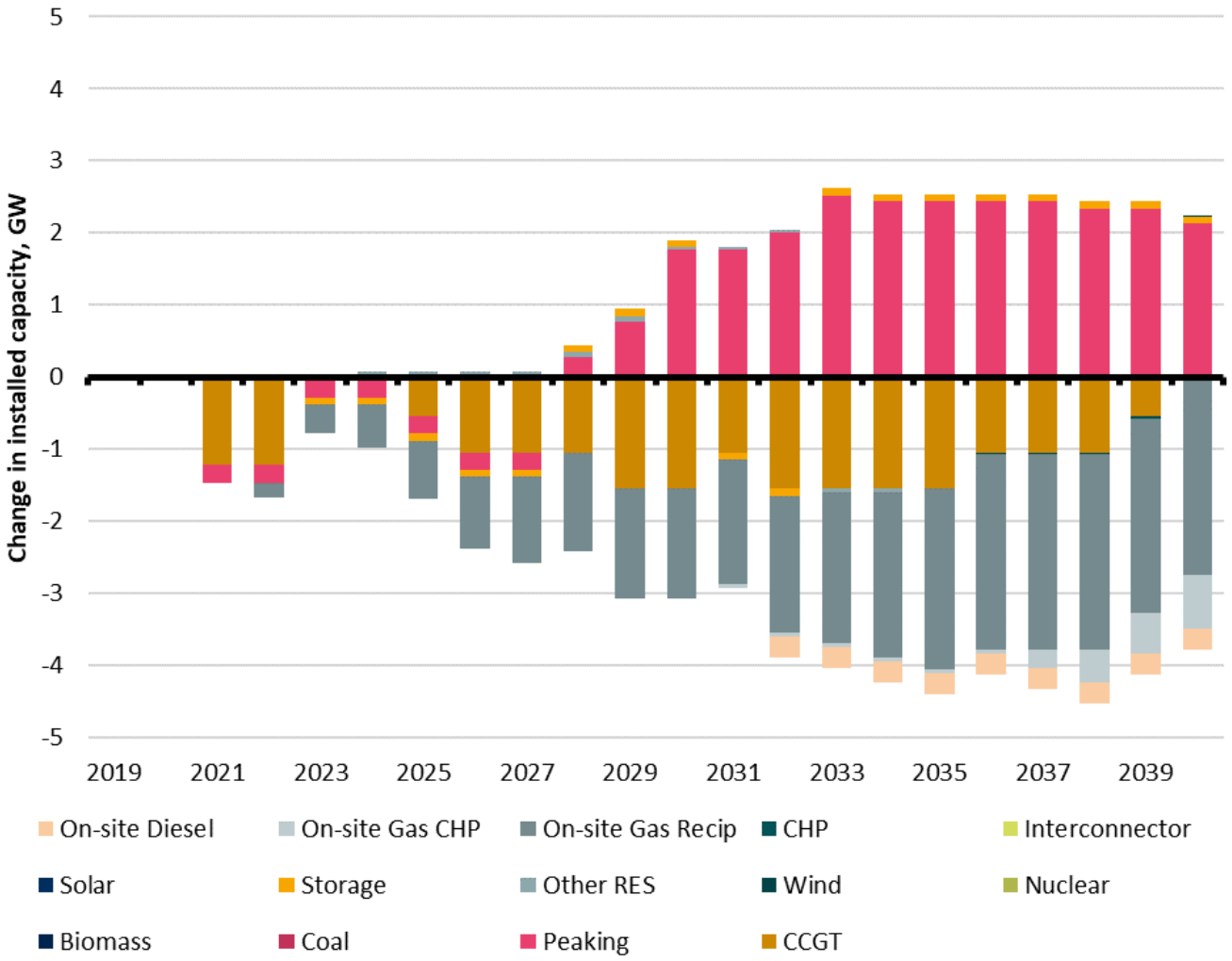
* Appraisal value for VoLL used by BEIS in capacity market impact assessments, based on: https://www.ofgem.gov.uk/ofgem-publications/82293/london-economics-value-lost-load-electricity-gbpdf

Wider system modelling results:

Counterfactual:	*No CM, Baseline with no reforms*
Factual:	*No CM, TCR residual, TGR & Full BSUoS reforms*
Background:	*Steady Progression*

Capacity (GW)

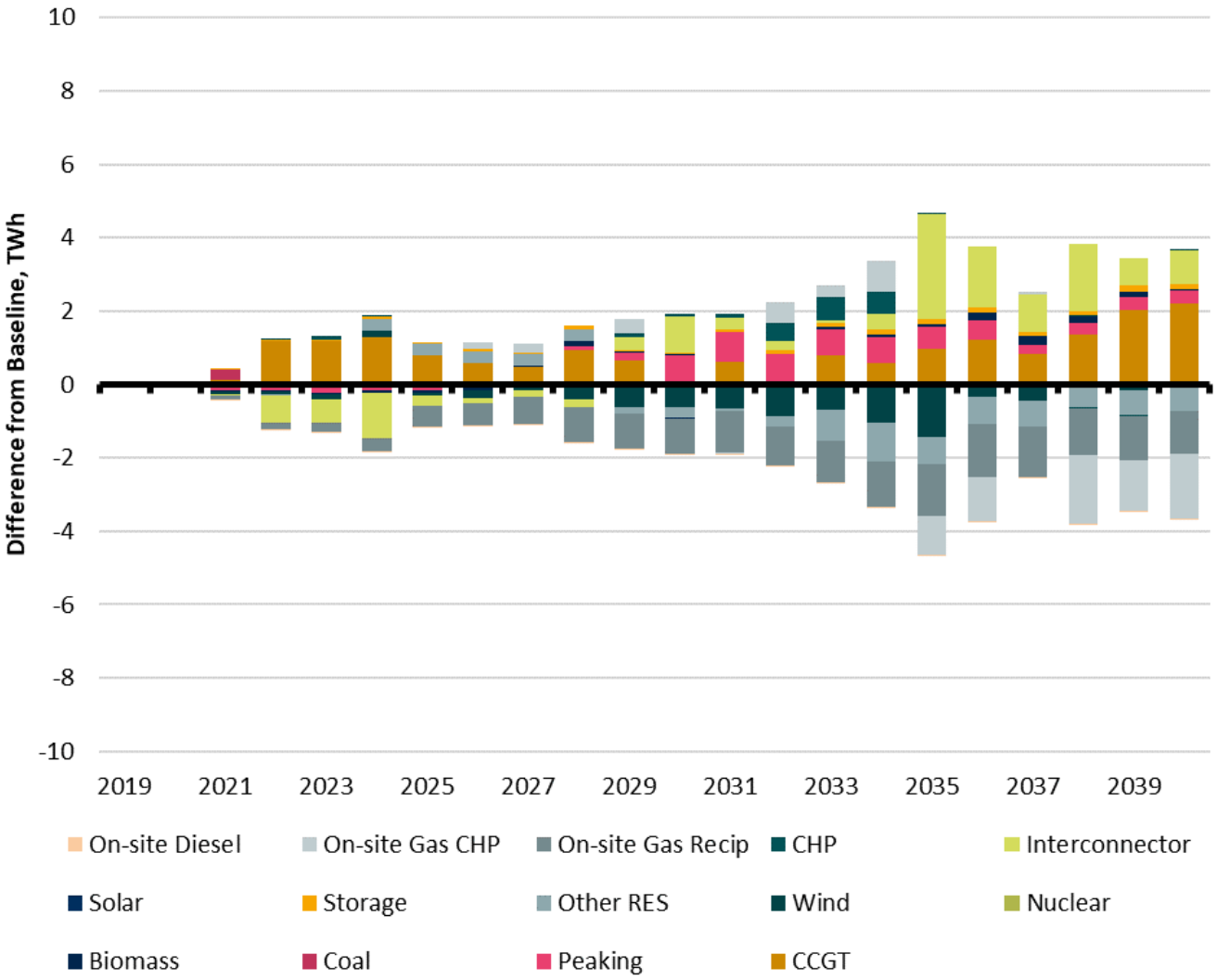
Difference between Baseline and Residual, TGR & Full BSUoS reforms (no Capacity Market)



- The total amount of capacity is reduced as a result of the reforms.
- Under the reforms, plant lose revenue streams (charge avoidance, TGR) which do not vary significantly with the total amount of capacity, and become more dependent on a stream of revenue that does (energy prices). As a result, the same marginal plant investment will require higher energy prices. The calibration of the response of modelled wholesale prices to scarcity is such that the reduction in capacity, and hence increase in LOLE, is greater without a CM than with a CM in place.
- Capacity of on-site generators (gas recips & gas CHP) is reduced, due to the TCR residual reforms.
- CCGT capacity is also reduced, primarily due to the increase in TGR (which they are now unable to recoup through higher CM prices and only partially able to recover through higher wholesale prices).
- Small (sub-100MW) distribution-connected gas peaking plant, which aren't affected by TGR or residual reforms, make up the majority of new build.

Generation (TWh)

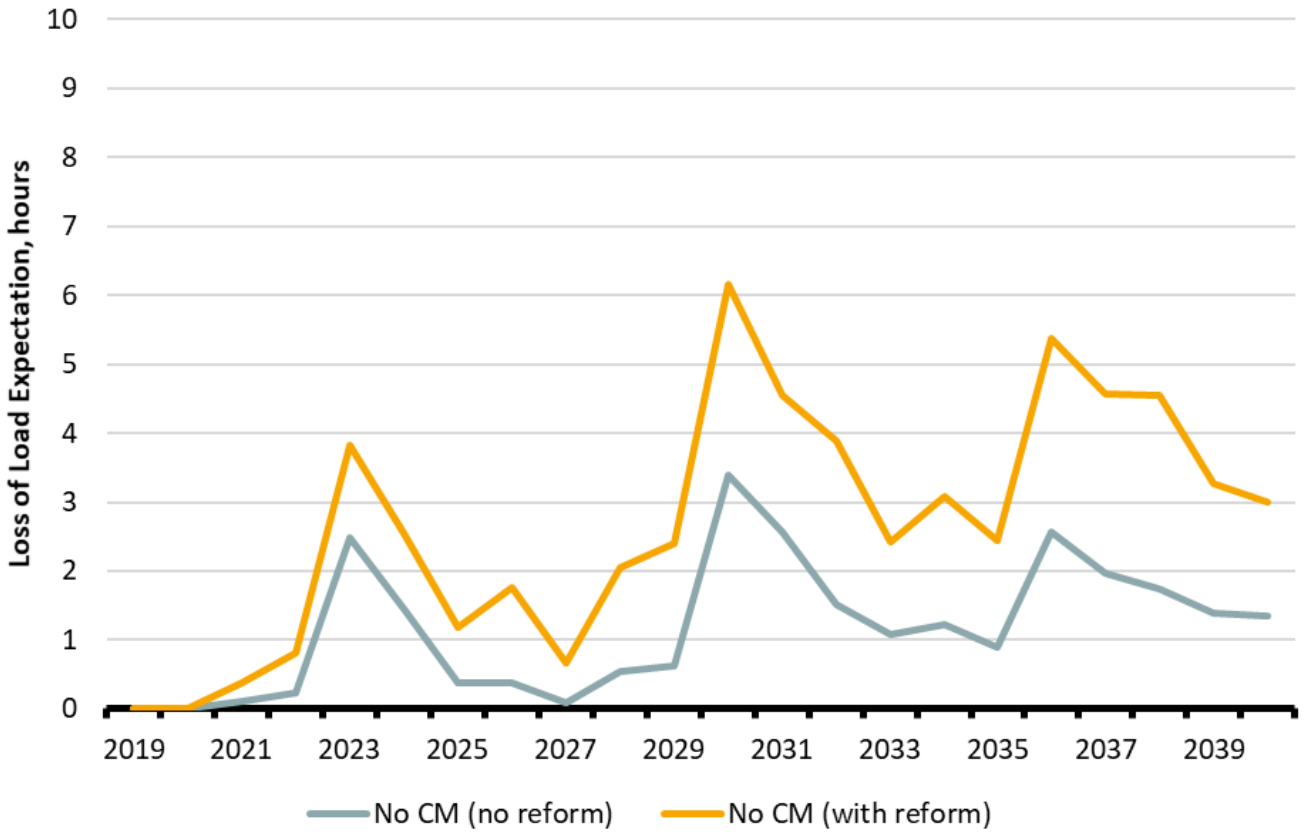
Difference between Baseline and Residual, TGR & Full BSUoS reforms (no Capacity Market)



- The results show an increase in generation from CCGT, which (despite lower levels of capacity) benefit from lower BSUoS charges as a result of the reforms, and reduced generation from distribution-connected and onsite generators.
- Interconnection imports increase in later years due to higher wholesale prices in GB.
- On-site generation is reduced due to the TCR residual reforms.
- Generation of distribution-connected renewables reduces, partly due to the direct impact of the full BSUoS reforms, and also partly due to the impact of BSUoS reforms on storage, which reduced its activity, resulting in increased curtailment of renewable generation at times of low demand.

Loss of Load Expectation (hours)

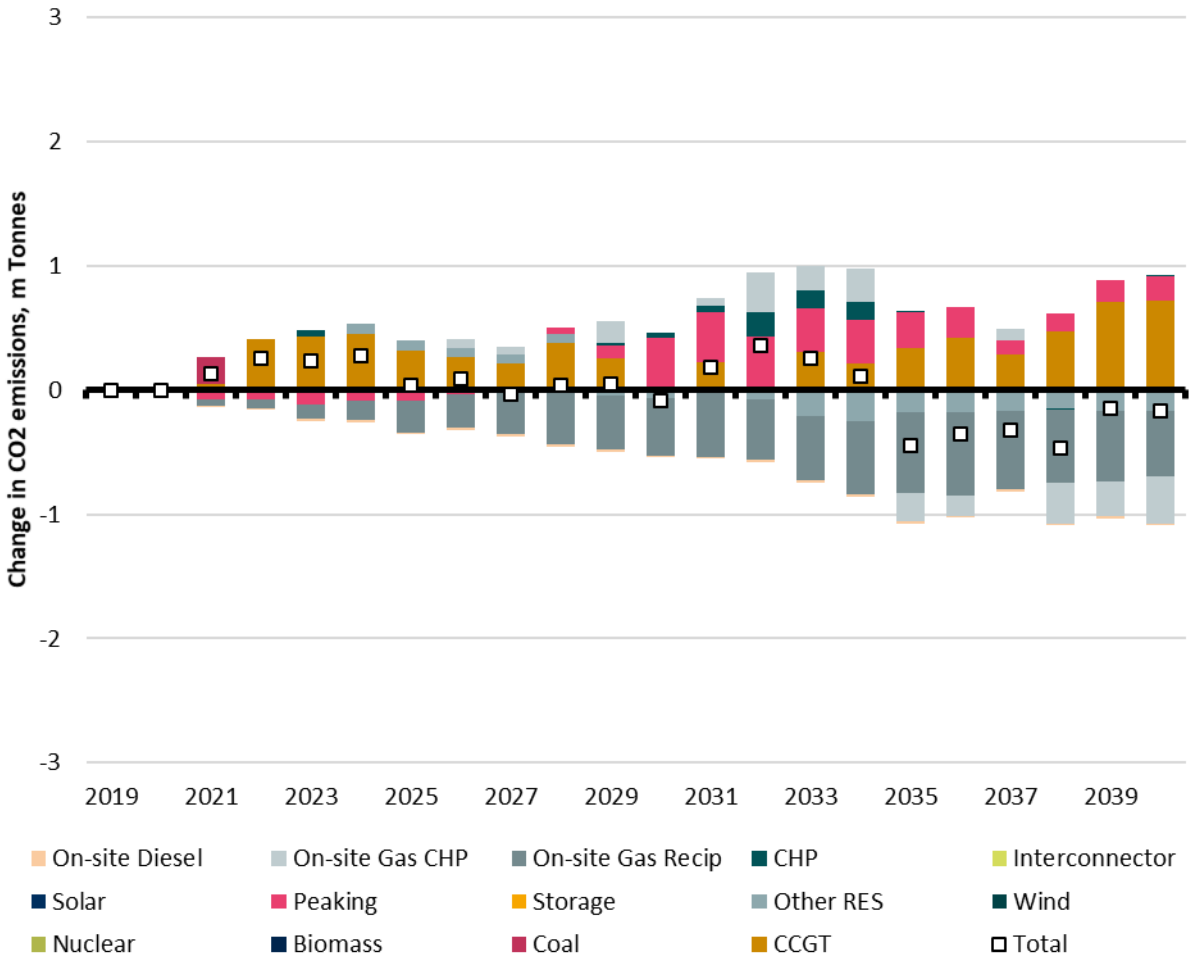
Comparison of Baseline and Residual, TGR & Full BSUoS reforms (no Capacity Market)



- As expected, LOLE values are higher in this analysis (in both the counterfactual and reform scenarios) compared to the previous analysis with the CM in place
- In addition, the results show increases in LOLE as a result of the reforms, of approximately 2 hours per year.
- As noted earlier, the equilibrium level of capacity is lower, and hence LOLE is higher, due to the greater reliance on energy revenues with the reforms.

CO_2 emissions (m Tonnes)

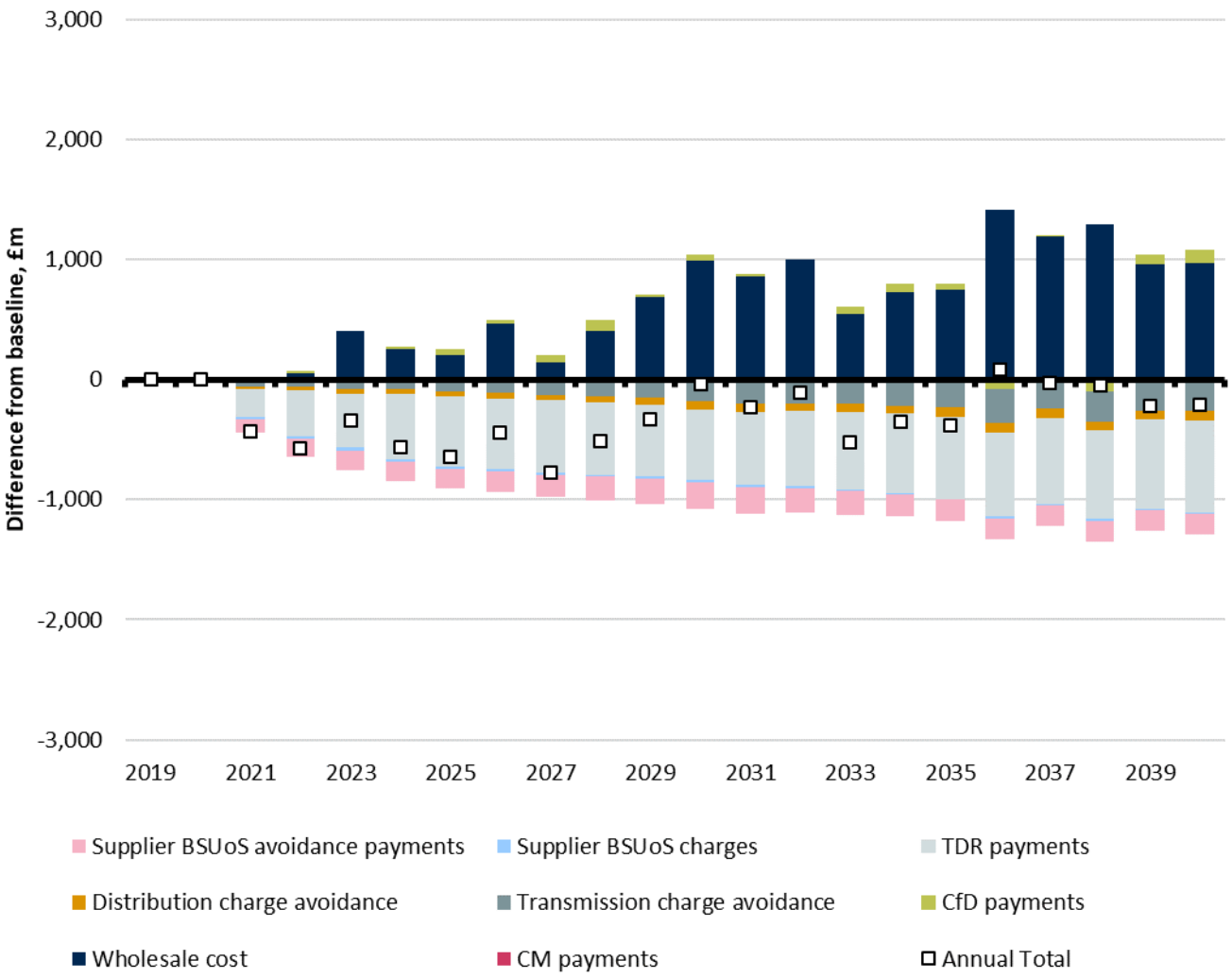
Difference between Baseline and Residual, TGR & Full BSUoS reforms (no Capacity Market)



- Changes in generation as a result of the reforms lead to impacts on the level of CO_2 emissions.
- The net impact is limited to within +- 0.5m tonnes per year, with increases in early years and decreases in later years.
- This pattern is partly driven by the displacement between domestic generation and interconnection imports (as interconnection imports make no contribution to GB CO_2 emissions).
- In addition, reductions in distribution-connected renewable generation drives increases in emissions in the early 2030s.

Consumer Costs (£m)

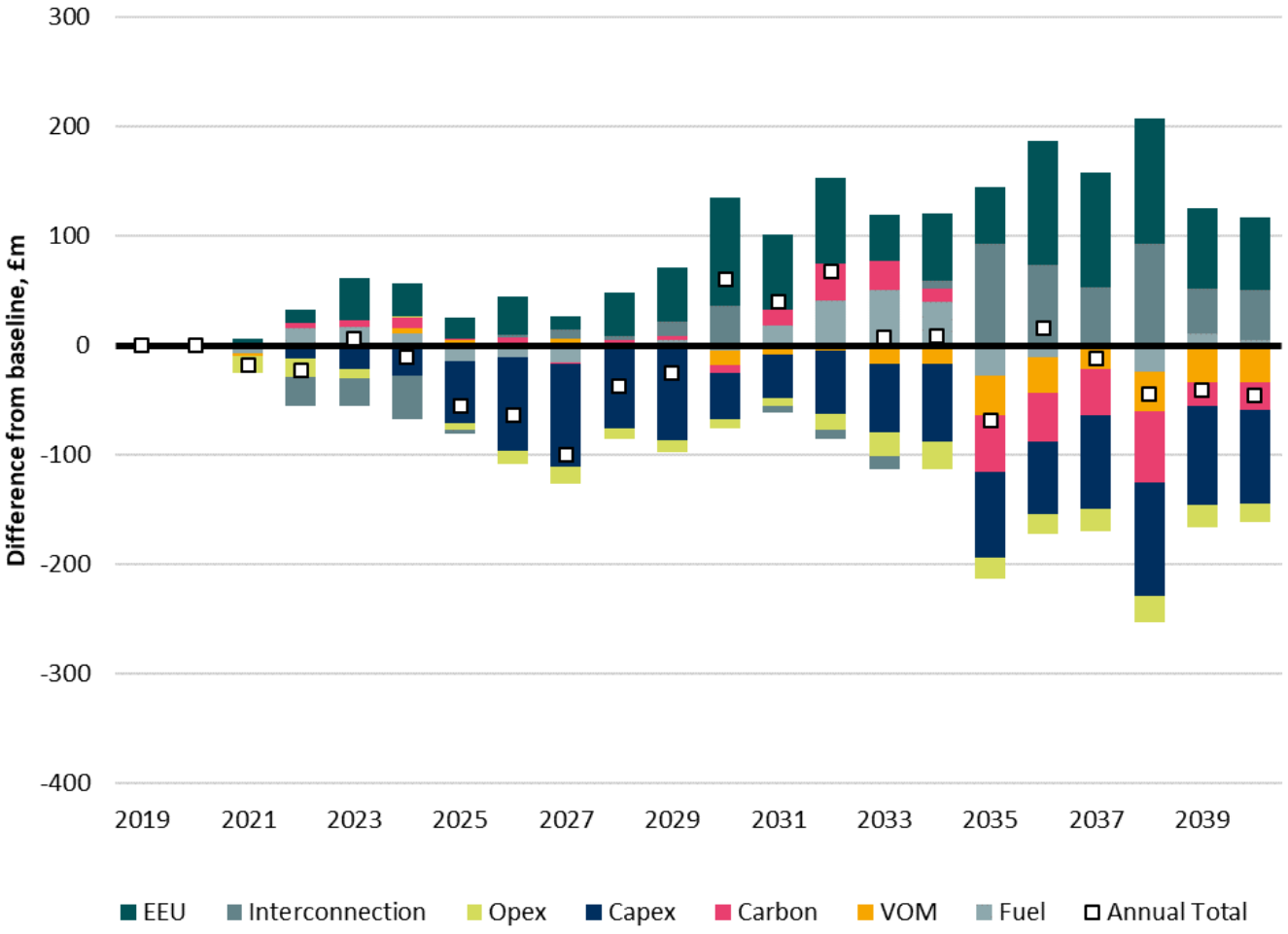
Difference between Baseline and Residual, TGR & Full BSUoS reforms (no Capacity Market)



- Overall, the results show that consumer costs are reduced by **£4.81bn** (NPV 2019-40)
- Consumers benefit from savings due to lower TDR payments, lower supplier BSUoS avoidance payments, and lower transmission charge avoidance payments. These are broadly similar to the benefits seen in the previous results (with the CM in place).
- However, the offsetting costs to consumers now primarily come through higher wholesale costs, rather than through higher Capacity Market payments.
- The higher wholesale costs reflect the full impact of price spikes implied by the LOLE (i.e. rising to the administrative VoLL price cap of £6,000/MWh)
- CfD costs only rise slightly, with higher strike prices (to recover lost revenue streams) offset by lower top-ups when wholesale prices are high.

System Costs (£m)

Difference between Baseline and Residual, TGR & Full BSUoS reforms (no Capacity Market)



- Overall, the results show that system costs are reduced by **£0.23bn** (NPV 2019-40).
- This is a result of investment in generation becoming more efficient with the reforms removed. This comes through as savings in capex, variable operating & maintenance (VOM) and fixed opex, which offset some increases in fuel and interconnection import costs.
- However, the largest offsetting change in system cost is the increase in Expected Energy Unserved (EEU) due to the increase in LOLE, which we assume is valued at £17,000/MWh*.
- One reason system benefits are lower than shown in the previous analysis (with CM in place) is that the administrative VoLL price of £6,000/MWh (which sets the maximum price in the energy market) is below this appraisal price for VoLL. This means market participants are not incentivised to invest up to a level consistent with this appraisal value.

* Appraisal value for VoLL used by BEIS in capacity market impact assessments, based on: https://www.ofgem.gov.uk/ofgem-publications/82293/london-economics-value-lost-load-electricity-gbpdf

Use of our work

Interpretation and Limitations

The results presented in this slide pack are dependent on the assumptions used and the modelling methodology applied. In particular, long term forecasts are subject to significant uncertainty and actual market outcomes may differ materially from the forecasts presented. Frontier Economics and LCP can therefore accept no liability for losses suffered, direct or consequential, arising out of any reliance on the results presented.

In particular:

- The scenarios presented do not take into account all changes that could potentially occur in the power market. More extreme market outcomes than those presened are therefore possible.
- The relationship between the cost of generation and prevailing market prices has been assessed based on historical data, market fundamentals and current forward power prices. To the extent that this relationship changes over time results could vary.
- The modelling results are based on all market participants having a common view on future market outcomes. To the extent that views vary between market participants the results could be considerably different to those presented in this report.
- The modelling makes use of a power plant database maintained by LCP. Assumptions on individual plant characteristics have been estimated where required.

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