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Analysis of Ofgem CLASS Proposals

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Executive Summary

Ofgem is currently consulting on the regulatory treatment of the provision of Customer Load Active System Services (CLASS) by Distribution Network Operators (DNOs) to the Electricity System Operator (ESO) in the RIIO-ED2 regulatory control period. CLASS is a balancing service that DNOs can provide by managing the voltage of the network in order to decrease (or increase) system demand. Energy UK asked NERA to review Ofgem's minded-to position from an economic perspective. This report sets out our response.

Ofgem's Minded-to Position Permits CLASS to Offer Ancillary Services Under Specified Terms

Ofgem's minded-to position is to allow DNOs to offer CLASS to the ESO such that:

- CLASS-specific costs will not form part of DNOs' revenue allowances determined at the price control settlement;
- DNOs will invest in developing CLASS capabilities if they consider that there is an investment case to do so based on the returns they expect to receive and DNOs can offer balancing services to the ESO at unregulated prices;
- DNOs will share any net revenues (i.e. profits or losses) from the provision of CLASS with consumers. The ratio of profits retained by the DNO will be set at the totex efficiency incentive rate. Ofgem intends this sharing of benefits to reflect that (1) CLASS builds on network assets funded by consumers; and that (2) CLASS has also benefitted from consumer-funding learning via the Low Carbon Network Fund (LCNF).

Ofgem Has Not Established that its Minded-to Position Complies with Its Statutory Duties

Ofgem's principal statutory duty is to protect the interests of current and future consumers. It must do so where appropriate by promoting competition.

Allowing a monopoly provider to use assets previously funded by consumers, without competition for access to those assets, to compete with commercial providers *per se* risks distorting the competitive process. Allowing networks to leverage their unique position to compete in ancillary services using network assets departs from the level playing field of undistorted competition. Apart from the benefits of privileged access to assets on the network, it cannot be taken for granted that DNOs' incentives in developing and deploying CLASS will mimic closely those of commercial market participants. A regulated price control provides the primary source of revenue for DNOs and Ofgem retains the power to adjust the regulatory treatment of revenues from CLASS and other ancillary services over time. Given the incompleteness of the regulatory contract, the risk of distorted competition remains even where Ofgem attempts to design the incentives for DNOs developing CLASS to align with consumer interests under RIIO-ED2: DNOs' incentives may not be truly separable from their wider regulatory setting. For instance, DNOs may have incentives to develop CLASS and bid uncommercially low to demonstrate benefits to consumers and encourage Ofgem to award future innovation funding for future uses of electricity network assets.

The fact of DNOs' participation in ancillary services markets may also affect the confidence of commercial market participants. Consumers will have a direct stake in revenues from

CLASS under the proposed regulatory arrangements. Other commercial providers may be exposed to future decisions by Ofgem that would favour CLASS as a service. The anticipation of regulatory intervention to support CLASS could deter efficient investment by lower-cost commercial providers.

The question for Ofgem to consider in carrying out its statutory duties is whether any benefit to consumers will exceed the costs both in the short and the long-run of that distortion to the competitive process. For instance, if the (social) cost of CLASS were very materially below the costs of competing technologies, Ofgem may consider that the long-term benefits to consumers outweighs the distortion to competition and its associated costs. Ofgem's Minded-to Consultation however, does not grapple with the potential for distorted competition and associated trade-offs in any meaningful way.

Ofgem's View That CLASS Will Necessarily Only Be Procured If Beneficial to Consumers Under its Minded-to Position is Unwarranted

Ofgem argues that its minded-to position will benefit consumers overall because:

- If CLASS is lower-cost than other balancing services, the ESO will procure CLASS. Consumers would benefit from the lower costs of balancing services through a decrease in the Balancing Services Use of System (BSUOS) charges;
- Consumers would also benefit from sharing any profit that DNOs may make in providing CLASS to the ESO.

Ofgem has not provided detailed analysis showing that CLASS is clearly low cost as part of its Consultation process. Ofgem's assertion that its minded-to position will lead to the development of CLASS if and only if it is an efficient, low-cost service places an extraordinary burden on the regulatory framework supposedly equalising incentives between commercial and regulated market participants.

Ofgem's argument that CLASS will be commissioned if and only if it is low-cost holds only in circumstances where the market for ancillary services functions efficiently and competition is undistorted. In practice, the market under Ofgem's minded-to arrangements may fail to deliver an efficient outcome for any of the following reasons:

1. There may be "hidden costs" (or "externalities") of the DNOs' provision of CLASS which means that DNOs' bids into ancillary services markets do not reflect the costs to society as a whole;
2. The demand side in ancillary services markets is itself a regulated construct and the procurement of balancing services, including trade-offs between CLASS and other technologies, may not be efficient over the short or long term; and
3. DNOs providing CLASS would be able to socialise part of any losses incurred across consumers, who are unable to exercise any control over the risks taken and investments made on their behalf.

We discuss how each of these market failures may apply given Ofgem's proposals for the CLASS service below.

CLASS May Have Hidden Costs, Which Ofgem Has Not Scrutinised

The private cost to the DNO of operating CLASS may be lower than the social cost of operating CLASS. Some costs of CLASS may fall on third parties by their very nature or because they are hidden or hard to identify (and therefore effectively socialised across consumers given DNOs' recovery of their overall revenue requirement). These category of hidden or external costs include that:

1. DNOs' may benefit from cross-subsidies from consumers through price controls, because network costs and CLASS-specific costs may be difficult to separate. For instance, we understand that CLASS may reduce the useful lives of some network assets, increasing the cost of maintenance and replacement costs of these assets. These additional costs will most likely be funded by consumers via increased DUOS charges, and will not be borne by the DNOs;
2. There is some evidence that CLASS may shorten the useful lives of certain machines and household appliances. Associated additional costs will be borne by consumers and will not be reflected in DNOs' bids in the ESO's tenders for balancing services;
3. CLASS increases the risks that suppliers over-procure (or under-procure) power relative to the amount their customers use. This increases the riskiness of supply businesses;
4. If DNOs are allowed to offer CLASS to the ESO, they will be competing in the balancing services market against market participants that they may serve as the monopoly network service provider. DNOs may therefore have incentives to discriminate against their competitors in their roles as DNOs or in their procurement of flexibility services for their own network. Such discriminatory behaviour would impose costs on consumers;
5. Ofgem argues that consumers do not value voltage stability because a study has shown that consumers did not notice when CLASS was activated by ENWL. Consumers may nonetheless place a value on voltage stability, e.g. because they value the knowledge that household appliances (e.g. kettles) take a consistent amount of time to operate. As in other regulated industries, Ofgem would need to conduct a willingness to pay test to assess customers' valuation of voltage stability before concluding that there is no detriment from CLASS to quality of service.

Some of these hidden costs are individually small because their impacts are distributed across the generality of consumers. Their per capita size makes them challenging to quantify and easy to overlook. However, the benefits of CLASS per consumer are also likely to be small, albeit more concentrated. Accordingly, it is unclear without further analysis whether these costs exceed the benefits of CLASS.

Since these hidden costs are not borne by DNOs, these costs will not be included in DNOs' bids in the ESO's tenders for balancing services. As a result, the ESO may procure more CLASS than would be economically efficient. At the extreme, if these hidden costs are very large compared to the private costs of CLASS provision, and the differences between the marginal costs of CLASS and other balancing technologies are relatively small, it is possible that any participation of CLASS in balancing services is economically inefficient and harmful to consumers.

Inefficiency in the Procurement of Balancing Services May Result in Over-procurement

The demand side in the ancillary services market is itself the outcome of a series of regulatory decisions by Ofgem that affect the behavior of the ESO. As a result, a complete, predictable market for ancillary services, driven purely by economic fundamentals, does not currently exist. There is a potential trade-off between the procurement of the cheapest balancing service today and the minimisation of long-run balancing costs and between the types of contracts offered to and by ancillary services providers. Only if the demand-side of the ancillary services market perfectly reflected system needs could we have complete confidence that the ESO selected the correct technologies to provide balancing services. Whilst this failure in the demand side of the market affects the procurement of all balancing services, it is arguably much more material when one of the market participants benefits from regulatory support and holds a monopoly position over CLASS assets. As a result, Ofgem's assertion that consumers will pay for CLASS if and only if it is a low-cost technology and ultimately in their interests need not be correct.

Customers are Exposed to the Risk of Losses from CLASS

Under Ofgem's minded-to position, DNOs share their net revenues from the provision of CLASS with consumers. Ofgem defines net revenues as revenues from CLASS less all CLASS-related costs, including the costs of assets, in its Consultation (although the special licence conditions are less clear). Given this definition, there is a risk that net revenues could be negative when DNOs invest in developing their CLASS capabilities, given that CLASS is a capex-heavy investment with relatively low ongoing operating costs. While DNOs will invest in CLASS if they consider that they can recover their costs and make a reasonable return on this investment, any change in the balancing market, such as the emergence of an innovative low-cost technology, carries the risk that they will not be able to recover their initial investment costs. If this is the case, DNOs' investment in CLASS will be detrimental to consumers, because consumers will share the losses made by DNOs under Ofgem's minded-to approach. Consumers are not in a position to exercise any kind of corporate governance over the investments made and risks taken on their behalf and Ofgem has not assessed whether the returns they are likely to receive for that forced investment are at commercial levels.

Conclusion

Ofgem has not conducted any quantitative analysis, still less provided an Impact Assessment, to assess the costs and benefits to consumers of its proposals. Instead, Ofgem argues qualitatively that its minded-to approach will benefit consumers because, if CLASS is lower-cost than other balancing service technologies, then the ESO will procure CLASS and consumers will benefit through (1) lower BSUOS charges; and (2) the sharing of the DNOs' profits from CLASS. In doing so, Ofgem relies on the assumption that the ancillary services market will select CLASS if and only if it is an efficient low-cost service for society as a whole. Ofgem's argument places a heavy burden, indeed the burden of perfection, on the regulatory process in aligning the interests of DNOs (as potential sellers of CLASS), National Grid (as the buyer of ancillary services) and consumers (whose long-term interests Ofgem is bound to protect). In practice, the ESO may procure CLASS even if that is not efficient or beneficial to consumers due to (1) the hidden costs associated with the provision of CLASS; and (2) inefficiencies in the ESO's procurement of balancing services; and (3) the risk that

DNOs' investment in CLASS may not be profitable. Ofgem would need to assess the impact of these factors relative to the benefits of CLASS before reaching a final decision on the treatment of CLASS at RIIO-ED2. Without further assessment, it will not be clear whether Ofgem's minded-to position is in line with its principal statutory duty of protecting the interests of current and future consumers.

1. Introduction

Ofgem is currently consulting on the regulatory treatment of the provision of Customer Load Active System Services (CLASS) by Distribution Network Operators (DNOs) to the Electricity System Operator (ESO) in the RIIO-ED2 regulatory control period. CLASS is a balancing service that DNOs can provide by managing the voltage of the network in order to decrease (or increase) system demand rapidly.

Energy UK has commissioned NERA to review and assess Ofgem's economic arguments in support of its minded-to position to allow DNOs to offer CLASS to the ESO. In this report, we analyse whether Ofgem's minded-to position is in line with its statutory duties, including to protect the interests of current and future customers, wherever appropriate by promoting competition.

The rest of this paper is structured as follows:

- In Section 2, we provide background information on CLASS, the impact of CLASS to date on ancillary services markets, and Ofgem's Consultation and minded-to position;
- In Section 3, we discuss the hidden costs of CLASS, i.e. the costs of CLASS provision that are borne by consumers, suppliers, and other market participants, and not the DNO providing the service;
- In Section 4, we explain that the ESO may procure balancing services in a way that is not cost-minimising in the long run, due to inefficiencies in the process for procuring balancing services; and
- In Section 5, we discuss the risks to consumers from DNOs' making losses on their investments in CLASS, under Ofgem's minded-to position.

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2. Background on CLASS and Ofgem's Proposals

Ofgem is currently consulting on the regulatory treatment of the provision of CLASS by DNOs in the RIIO-ED2 regulatory control period.[1] CLASS is a balancing service consisting of managing the voltage of the network via the remote management of transformers on the primary substations of the distribution network. Through the management of voltage at voltage levels below the primary substation, CLASS allows DNOs to decrease (or increase) effective demand for electrical power rapidly. CLASS uses the existing electricity distribution network. However, DNOs also have to invest in additional technology, software and expertise in order to provide these services.[2]

2.1. Ofgem Previously Allowed CLASS to Offer Balancing Services

ENWL received funding from consumers to trial CLASS as a new service in 2014, as part of a £9 million project.[3] After concluding that CLASS was a technically-feasible service to provide with its assets, ENWL engaged with Ofgem over the future treatment of CLASS as a balancing service. Following its technical trial, ENWL commissioned Baringa to review the cost-benefit case for CLASS.[4] Baringa concluded that the social benefits of ENWL offering CLASS are approximately £200 million on a Net Present Value basis over 15 years.[5]

Reviewing the case over whether the benefits of CLASS are likely to be material is not the focus of this report. Nonetheless, the estimated benefits to society in the Baringa report are likely to be materially overstated. Baringa estimates the economic benefits of CLASS from displacing higher-cost providers of FFR and FR using bid data from the ESO's tenders.[6] Baringa estimated the economic benefits from CLASS based on the difference between the *costs* of CLASS and the *bids* of other technologies in recent tenders. However, reliance on bid data alone does not provide meaningful information about the relative costs of CLASS and other competing technologies. The tenders for balancing services are pay-as-bid auctions. The profit-maximising strategy of a provider in a pay-as-bid auction is to bid above its marginal cost, as bidding marginal cost is a strategy that can at best break even. In setting their bids, tenderers seek to guess the market price for balancing services and must trade off the risk of losing the tender against the higher margins available from bidding higher. Using bid data creates an upwards bias in the estimated cost savings from displacing competing technologies and of the social benefits of CLASS.

In 2016, based on engagement with ENWL over the benefits of CLASS, Ofgem first allowed DNOs to offer CLASS to the ESO through a Direction on the regulatory treatment of CLASS

1 Ofgem (10 February 2020), Consultation: Regulatory treatment of CLASS as a balancing service in RIIO-ED2 network price control.

2 Ofgem (10 February 2020), Consultation: Regulatory treatment of CLASS as a balancing service in RIIO-ED2 network price control, p. 4.

3 ENWL, CLASS Summary Factsheet, p. 2.

4 Baringa (31 May 2016), Assessing the impact of CLASS on the GB electricity market, p. 5.

5 Baringa (31 May 2016), Assessing the impact of CLASS on the GB electricity market, p. 54.

6 Baringa (31 May 2016), Assessing the impact of CLASS on the GB electricity market, p. 45.

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as a balancing service.[7] Under these arrangements, CLASS is a Directly Remunerated Service (DRS) which, in common with other commercial services such as connection charging performed by DNOs, DNOs charge separately to customers and which sits outside the revenue control under DNOs' licences. As a result, DNOs share their profits from the provision of CLASS (i.e. revenues less the marginal costs of providing CLASS) with customers via decreases in Distribution Use of System (DUOS) charges. DNOs also share any losses from the provision of CLASS with consumers via increases in DUOS charges. The ratio of profits retained by the DNO is set by the totex efficiency incentive rate. Ofgem considers that consumers benefit from this arrangement because:[8]

6. If CLASS is lower-cost than other balancing services, then the ESO will procure CLASS. Consumers will benefit from the lower costs of balancing services through a decrease in the Balancing Services Use of System (BSUOS) charges;
7. Consumers will also benefit from sharing any profit that DNOs may make in providing CLASS to the ESO.[9]

The only DNO to provide CLASS to the ESO so far in the RIIO-ED1 period is Electricity North West Limited (ENWL).

2.2. Ofgem's Minded-to Position is to Continue to Allow DNOs to Provide CLASS in RIIO-ED2

Ofgem's Direction in 2016 only set out the regulatory treatment of CLASS as a balancing service until the end of the RIIO-ED1 period. Ofgem is now consulting on the regulatory treatment of CLASS in RIIO-ED2, and is considering three options:

8. Option 1: Continue to allow DNOs to sell CLASS to the ESO, either maintaining the current regulatory treatment or with alternative arrangements:
   A. Ofgem is considering maintaining the current categorisation of CLASS as part of category 8 of Directly Remunerated Services (DRS8), known as "Option 1A" in the Consultation. DNOs have commercial freedom over DRS8 services and may therefore bid prices for the CLASS balancing services based on their own commercial judgement, subject to sharing the profits with consumers.
   B. Ofgem is also consulting on including CLASS in a different category of DRS (DRS9), known as "Option 1B" in the Consultation.[10] DRS9 places limits on DNOs' commercial freedom but does not require DNOs' to share net revenues with consumers.

[7] GEMA (31 March 2016), Direction issued by the Gas and Electricity Markets Authority to Electricity Distribution Network Operators for the purposes of Special Condition CRC 5C (Directly Remunerated Services) of the Electricity Distribution Licence.

[8] Ofgem (10 February 2020), Consultation: Regulatory treatment of CLASS as a balancing service in RIIO-ED2 network price control, p. 4.

[9] Consumers would also share any loss made by the DNOs. However, DNOs' have a strong incentive to make profits on the provision of CLASS.

[10] Ofgem (10 February 2020), Consultation: Regulatory treatment of CLASS as a balancing service in RIIO-ED2 network price control, p. 5.

9. Option 2: Require DNOs to provide CLASS to the ESO outside of market mechanisms and thereby to cover the costs of CLASS within the DNOs' price control. Under this option, Ofgem would determine the required capacity of CLASS to be provided by each DNO. These services would be funded by consumers through DUOS, and hence CLASS would be free to the ESO and reduce BSUOS charges paid by consumers;
10. Option 3: Prohibit the use of CLASS as a balancing service completely.[11]

Ofgem's minded-to position is to continue with the current regulatory arrangements (Option 1A), i.e. to allow DNOs to offer CLASS to the ESO, and to require the DNO to share its profits from the provision of this service with its consumers at the totex incentive rate. Ofgem argues that Option 1A best delivers its statutory objectives because:

- In Ofgem's view, allowing DNOs to offer CLASS as a balancing service to the ESO promotes efficient system balancing more than other options. Ofgem argues that it creates incentives for DNOs to invest in CLASS and provide CLASS to the ESO where there is an efficient investment case. Under Option 1A, consumers may benefit from lower BSUOS charges if CLASS is a low-cost balancing service relative to other balancing service technologies. They may also benefit from lower DUOS charges, as DNOs share their net revenues from the provision of CLASS with consumers. Ofgem argues that it is right that DNOs should share the benefits from good investments with consumers, since CLASS uses assets funded by consumers through DUOS (in addition to assets specifically purchased by the DNO for the provision of CLASS, which are not funded by consumers);[12]
- Ofgem favours Option 1A over Option 1B because (1) under Option 1A, DNOs share net revenues from the provision of CLASS with consumers; and (2) because, according to Ofgem, the cap on prices under Option 1B could distort investment signals and is unnecessary in a competitive market in general;[13]
- Ofgem argues that Option 2 (the inclusion of the costs of CLASS provision in the price control) does not incentivise the efficient use of CLASS and may create significant market distortions. It would reduce the volume of balancing services that the ESO procures on a competitive basis and may increase balancing costs for consumers. The only benefit of Option 2 that Ofgem identifies is that it may remove conflicts of interest that would arise under Option 1 from DNOs competing as providers of CLASS with customers that they are meant to serve as the monopoly DNO;[14] and
- Finally, Ofgem argues that Option 3 of prohibiting CLASS would not promote efficient system balancing because it would reduce the ESO's ability to procure balancing services from the widest range of technologies and providers. Not allowing CLASS, a network solution, to participate in the balancing services market may increase balancing costs for

[11] Ofgem (10 February 2020), Consultation: Regulatory treatment of CLASS as a balancing service in RIIO-ED2 network price control, p. 5.

[12] Ofgem (10 February 2020), Consultation: Regulatory treatment of CLASS as a balancing service in RIIO-ED2 network price control, p. 29.

[13] Ofgem (10 February 2020), Consultation: Regulatory treatment of CLASS as a balancing service in RIIO-ED2 network price control, p. 27 and 29.

[14] Ofgem (10 February 2020), Consultation: Regulatory treatment of CLASS as a balancing service in RIIO-ED2 network price control, p. 27 and 29.

consumers or preclude them from benefitting from a potentially lower-cost balancing service technology (and associated increase in market competition).[15] Similar to Option 2, the only benefit that Ofgem sees from Option 3 is that it would mitigate concerns of conflict of interest, i.e. that CLASS may affect DNOs' neutrality in tendering and undertaking monopoly activities.[16]

Ofgem's options appraisal is partial at best. It contains no serious attempt to quantify the relative benefits or disbenefits it identifies for each of the options. It also relies heavily on the alleged superior incentive properties of Option 1A over other options at ensuring that CLASS is only commissioned if it is an efficient source of balancing services. In other words, Ofgem asserts, without evidence, that remuneration under DRS8 will align customer interests and DNOs' incentives. In practice, as we explain in Section 3.6, Ofgem's proposals risk material distortions to competition resulting from CLASS being offered at prices below its true cost. It also risks overcompensation of DNOs for providing the CLASS service, which either Option 1B or Option 2 could mitigate but Ofgem neglects to mention.[17] Neither of these outcomes are in consumers' collective interest.

2.3. CLASS Has Had a Material Impact on the Fast Reserve Market

ENWL first offered CLASS into the ESO tenders for balancing services in 2018.[18] Its consultants, Baringa, concluded that CLASS would be well suited to compete for the following four categories of balancing services:[19]

[15] Ofgem (10 February 2020), Consultation: Regulatory treatment of CLASS as a balancing service in RIIO-ED2 network price control, p. 28 and 29.

[16] Ofgem (10 February 2020), Consultation: Regulatory treatment of CLASS as a balancing service in RIIO-ED2 network price control, p. 28.

[17] There are also risks of overcompensation under Option 1B and Option 2. However, under these options, the regulatory process would impose a limit on (or determine) the revenues that DNOs could make from the provision of CLASS.

[18] Ofgem (10 February 2020), Consultation: Regulatory treatment of CLASS as a balancing service in RIIO-ED2 network price control, p. 12.

[19] Baringa (31 May 2016), Assessing the impact of CLASS on the GB electricity market, p. 5.

Table 2.1: Balancing Services That Could Be Provided by CLASS

Service	Frequency Response[20]	Fast Reserve	Short-Term Operating Reserve	Reactive Power
Function	Changing net power offtake to manage system frequency deviations			Absorbing background AC energy movement to manage voltage
Required response time	30 seconds	2 minutes	20 minutes	
Required sustainability	30 minutes	15 minutes	2 hours	
Cost to ESO FY 2018-19	£132m	£91m	£73m	£82m

Source: Technical requirement are available from National Grid ESO's website. For costs to the ESO, see National Grid ESO (March 2019), Monthly Balancing Services Summary 2018/19, p. 9.

To date, ENWL has only competed in tenders for two categories of balancing services: Firm Frequency Response and Fast Reserve. This section focuses on the tendered markets for these services, with a discussion of non-tendered procurement towards the end.

2.3.1. ENWL only offers a smaller category of Firm Frequency Response

Firm Frequency Response (FFR) providers increase (or reduce) their net power offtake from the system in response to frequency fluctuations. The ESO separates FFR into three service segments, primary, secondary, and high, based on response speeds.[21] FFR tenders further distinguish between dynamic response, which continuously adjusts to measured frequency deviations on the grid, and non-dynamic response, typically a discrete service triggered at a defined frequency deviation.[22] The ESO currently only procures non-dynamic response in the secondary category.[23]

[20] The table specifies technical requirements for secondary frequency response.
Source: National Grid ESO Website: Firm Frequency Response. URL: https://www.nationalgrideso.com/balancing-services/frequency-response-services/firm-frequency-response-ffr?overview. Visited on 18 March 2020.

[21] Primary frequency response requires a response within 10 seconds, which can be sustained for 20 seconds.
Secondary frequency response requires a response within 30 seconds, which can be sustained for 30 minutes.
High frequency response requires a response within 10 seconds, which can be sustained indefinitely.
Source: National Grid ESO Website: Firm Frequency Response. URL: https://www.nationalgrideso.com/balancing-services/frequency-response-services/firm-frequency-response-ffr?overview. Visited on 18 March 2020.

[22] National Grid ESO Website: Firm Frequency Response. URL: https://www.nationalgrideso.com/balancing-services/frequency-response-services/firm-frequency-response-ffr?overview. Visited on 18 March 2020.

[23] National Grid ESO (February 2020), Firm Frequency Response Market Information Report for Apr-20, Appendix 1.

Table 2.2: FFR Market Size by Category, 2019

FFR Category	Monthly Capacity Procured, Minimum	Monthly Capacity Procured, Maximum	Served by CLASS
Primary	223 MW	890 MW	No
Secondary	382 MW	890 MW	Yes
High	161 MW	803 MW	No

Source: Ofgem (10 February 2020), Consultation: Regulatory treatment of CLASS as a balancing service in RIIO-ED2 network price control, p. 36.

ENWL has bid its CLASS capability into the secondary, non-dynamic market since March 2018.[24] Ofgem reports that it had a small share of this market in 2019, providing only 1.6 per cent of the total tender-procured secondary FFR.[25] According to ENWL, the prices it secures with its CLASS offering are in line with or somewhat lower than the average of accepted bids by other secondary response providers.[26] The growth of energy storage and non-CLASS load response providers has been a more material development in the FFR market.[27] In 2017, this group represented 44 per cent of FFR bidders, rising to 85 per cent in 2019.[28]

The small current share of CLASS masks the potential of DNO-provided CLASS to displace competing technologies. So far ENWL is the only DNO to have offered CLASS, it has only bid into the non-dynamic secondary FFR tenders, and it appears to have recently shifted its offering away from FFR in favour of FR. In its CBA prepared for ENWL, Baringa projected that by 2027, adding up to 3 GW of capacity and the capability to compete for dynamic and primary FFR,[29] "all other providers could be displaced, including Pumped Storage, DSR, batteries and diesel engines".[30] It is not clear whether ENWL's lack of participation in dynamic FFR is due to the technical limitations of CLASS, or if CLASS may be technically capable of providing dynamic FFR.[31] If CLASS cannot develop a dynamic response capability, its potential deployment is smaller.[32]

[24] Ofgem (10 February 2020), Consultation: Regulatory treatment of CLASS as a balancing service in RIIO-ED2 network price control, p. 12.

[25] This low share may reflect a shift in ENWL's bidding strategy rather than an inability to win a larger market share. ENWL first entered the market for Fast Reserve in April 2019. Meanwhile, its total bids in FFR tenders fell from ten (seven accepted) in December 2018, January and February 2019, to only two (one accepted) for March-December 2019. Source: National Grid ESO, FFR Post-Tender Reports TR 108-120.

[26] Lower prices could reflect ENWL only offering non-dynamic response.
Source: Ofgem (10 February 2020), Consultation: Regulatory treatment of CLASS as a balancing service in RIIO-ED2 network price control, p. 36.

[27] The FFR markets also include conventional providers such as hydro, gas, and diesel power plants.
See National Grid ESO's Firm Frequency Response Post-Tender Reports.

[28] Ofgem (10 February 2020), Consultation: Regulatory treatment of CLASS as a balancing service in RIIO-ED2 network price control, p. 38.

[29] Baringa (31 May 2016), Assessing the impact of CLASS on the GB electricity market, p. 5.

[30] Baringa (31 May 2016), Assessing the impact of CLASS on the GB electricity market, p. 46.

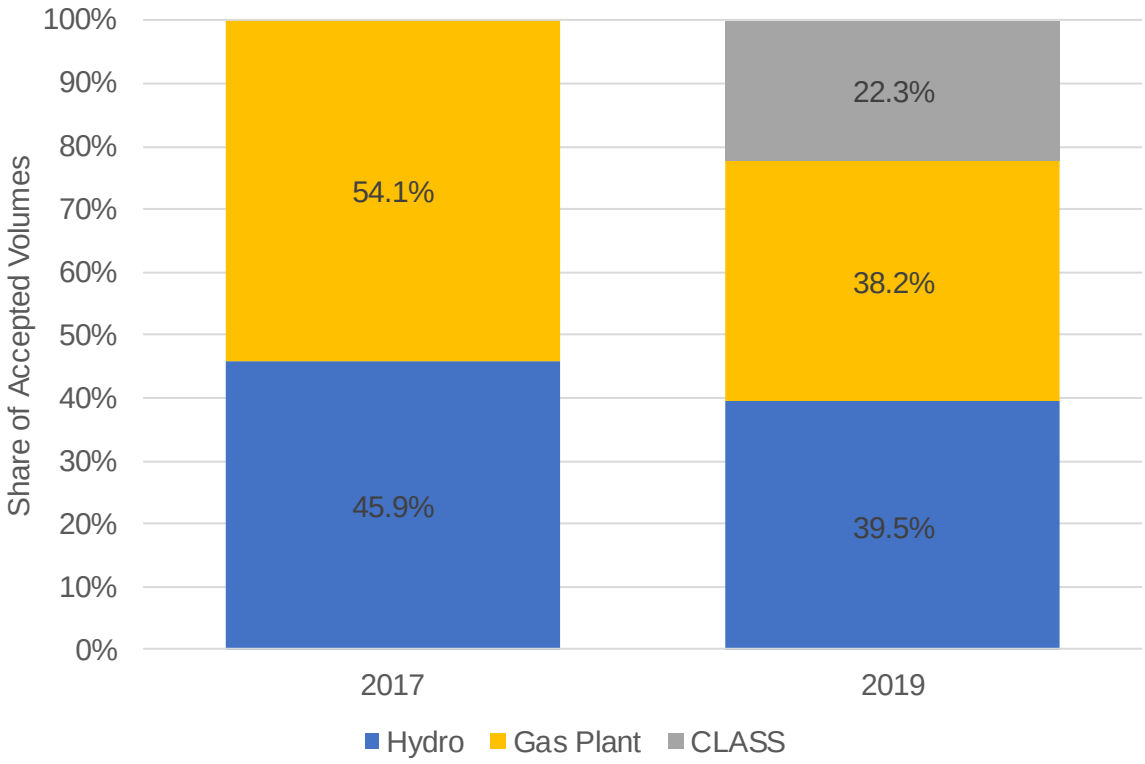
[31] The Baringa report considered both scenarios. See Baringa (31 May 2016), Assessing the impact of CLASS on the GB electricity market, p. 49.

[32] The ESO's latest FFR Market Information Report projects an average requirement per EFA block of 1061 MW of dynamic response and 97 MW of non-dynamic secondary response for April-September 2020.

2.3.2. CLASS has a material market share in Fast Reserve

ENWL's CLASS programme already has a material share in the tendered market for Fast Reserve (FR). FR is a product requiring a slower response time but a more sustained response than FFR.[33] FR is separated into "Firm" service, procured through a monthly competitive tender process, and "Optional" services purchased in bilateral agreements.[34] The market for FR is smaller than that for FFR measured in procured capacity.[35] It is also smaller measured in the total cost to the ESO, at £91m in the 2018/19 fiscal year, compared with £132m for FFR.[36]

Figure 2.1: Accepted FR by Technology, July-December Tenders



Notes: Accepted capacity weighted by duration of bid in months. Not adjusted for EFA blocks.
Source: NERA analysis of National Grid ESO Fast Reserve Post-Tender Reports July-December 2017 and July-December 2019.

Source: National Grid ESO (February 2020), Firm Frequency Response Market Information Report for Apr-20, Appendix 1.

33 The ESO requires FR to have a response time of less than two minutes with a ramping rate of more than 25 MW per minute.
Source: National Grid ESO (December 2019), Fast Reserve Market Information Report, p. 3.

34 National Grid ESO (December 2019), Fast Reserve Market Information Report, p. 3.

35 The ESO currently has a daytime (EFA blocks 3-6) FR requirement of 600 MW until the end of March, falling to 300 MW in April. Its average FFR requirement across all categories is 1158 MW.
Sources: National Grid ESO (December 2019), Fast Reserve Market Information Report, p. 6;
National Grid ESO (February 2020), Firm Frequency Response Market Information Report for Apr-20, Appendix 1.

36 National Grid ESO (March 2019), Monthly Balancing Services Summary 2018/19, p. 9.

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ENWL first offered CLASS in the ESO's FR tenders in April 2019.[37] Prior to this, pumped storage facilities and peaking thermal plants served the Firm FR market,[38] as shown in Figure 2.1. The chart shows each technology's share of capacity (weighted by the period covered by the bid) for bids accepted in the July to December tenders in 2017 (before the entry of CLASS) and in 2019 (after the entry of CLASS).[39] CLASS had a 22.3 per cent share of accepted capacity in the last six months of 2019, even with ENWL as the only current CLASS provider. An expansion of the CLASS capacity of ENWL or other DNOs could quickly result in CLASS dominating the FR market.

In the last six months of 2019, ENWL bid its CLASS capability at a lower availability and utilisation fee on average than the providers of competing technologies, as shown in Table 2.3. The average price of accepted bids from non-CLASS providers has also fallen since 2017. The prices of accepted bids fell between 2017 and 2019, as a result of lower bids by other market participants as well as due to ENWL offering CLASS at yet lower-prices. The entry of CLASS has not coincided with as large a reduction in the ESO's total reported FR costs. These were £46.2m July-December 2019, compared with £48.5m for the same period in 2017.[40] Throughout both these periods the ESO's daytime Firm FR requirement was 300 MW.[41] Existing long-term contracts or the ESO's cost of procuring from the non-tendered market could explain why costs have not fallen proportionately to tendered prices.

[37] Ofgem (10 February 2020), Consultation: Regulatory treatment of CLASS as a balancing service in RIIO-ED2 network price control, p. 12.

[38] Baringa (31 May 2016), Assessing the impact of CLASS on the GB electricity market, p. 5.

[39] We have chosen July-December 2017 and 2019 to have comparable six-month periods before ENWL first offered CLASS in the balancing services market (March 2018) and after its entry into the FR market (April 2019). National Grid ESO's FR tenders have been suspended starting in January 2020. July-December 2019 are therefore the most recent six tender rounds.
Source: National Grid ESO (29 January 2020), Future firm STOR and Fast Reserve tenders.

[40] National Grid ESO (January 2020), Monthly Balancing Services Summary: Data: January 2020;
National Grid ESO (January 2018), Monthly Balancing Services Summary: Data: January 2018.

[41] The ESO's requirement for tendered FR. Daytime refers to EFA blocks 3-6 in 2019, and 06:00-23:30 (Mon-Fri) and 07:00-23:30 (Sat, Sun, BH) in 2017. In 2019 the ESO also had a requirement for 150 MW of capacity at night.
National Grid ESO (May 2017), Fast Reserve Market Information for July-17, p. 2;
National Grid ESO (May 2019), Fast Reserve Market Information: Delivery from July-19, p. 5.

Table 2.3: Fast Reserve Average Prices, Accepted Bids July-December

Category	Non-CLASS 2017	Non-CLASS 2019	CLASS 2019
Availability fee, £/MW/hr	5.09	4.40	1.42
Utilisation fee, £/MWh	107.40	89.55	85.00
Monthly capacity of accepted bids, MW	573	207	59

Notes: Unweighted average of all accepted bids. Averages include bids for all times of day. Where a single bid specifies different prices for parts of the period covered, the lower price is used. "Utilisation fee" refers to the Capped Bid-Offer Price or Firm Energy Fee of the relevant bid. The reported monthly capacity of accepted bids adjusts for the duration (in months), but not the EFA blocks covered by each bid.
The ESO transitioned from multi-month to single-month contracts starting August 2019, which could deflate the duration-weighted capacity figures reported for 2019 relative to 2017.
Source: NERA analysis of National Grid ESO Fast Reserve Post-Tender Reports July-December 2017 and July-December 2019.

That CLASS has offered lower prices than other competing technologies does not necessarily mean that it has been a cheaper technology to society than competing technologies (albeit that it will have resulted in lower balancing costs for consumers at least in the short-run). However, as should be clear from Table 2.3 above, CLASS has at the very least coincided with a reduction in the quantity and prices for alternative technologies of around 15 per cent on utilisation and availability fees.

On average, CLASS has underbid non-CLASS technologies by around 5 per cent. The underbidding is most material in the daytime (EFA blocks 3-6), as shown in Figure 2.2 and Figure 2.3 below. As the ESO's tenders are pay-as-bid, prices bid may not reflect differences in cost. That CLASS has repeatedly underbid non-CLASS technologies may indicate either that it is a lower cost provider or that ENWL as a regulated monopoly business does not face the same commercial incentives to predict market prices. We discuss this further in Section 3.6.

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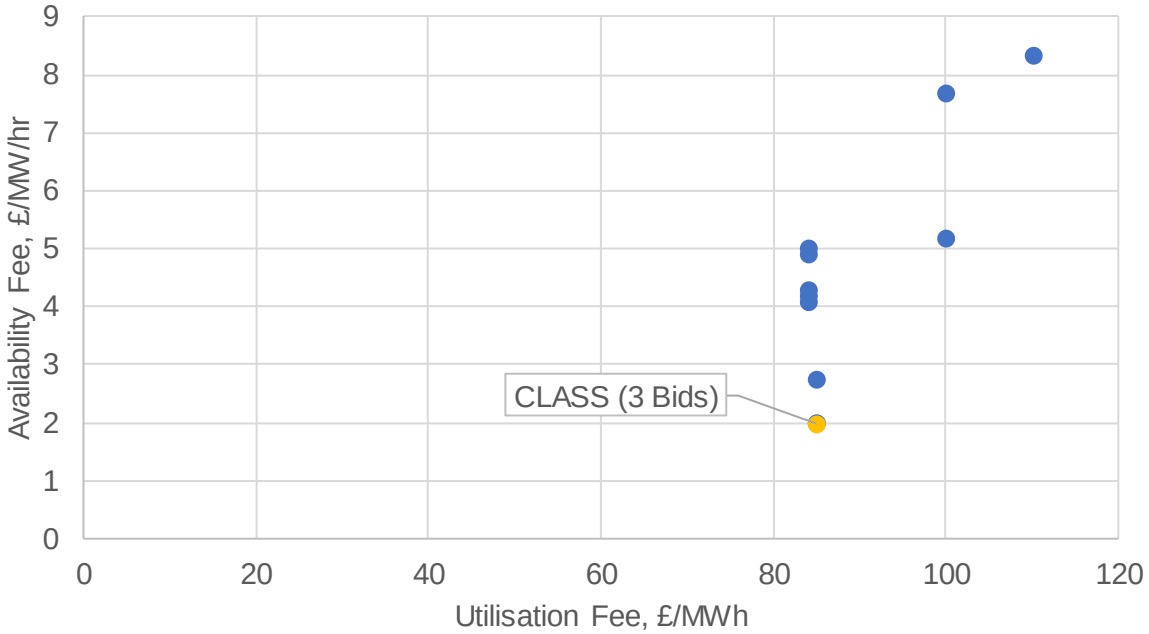
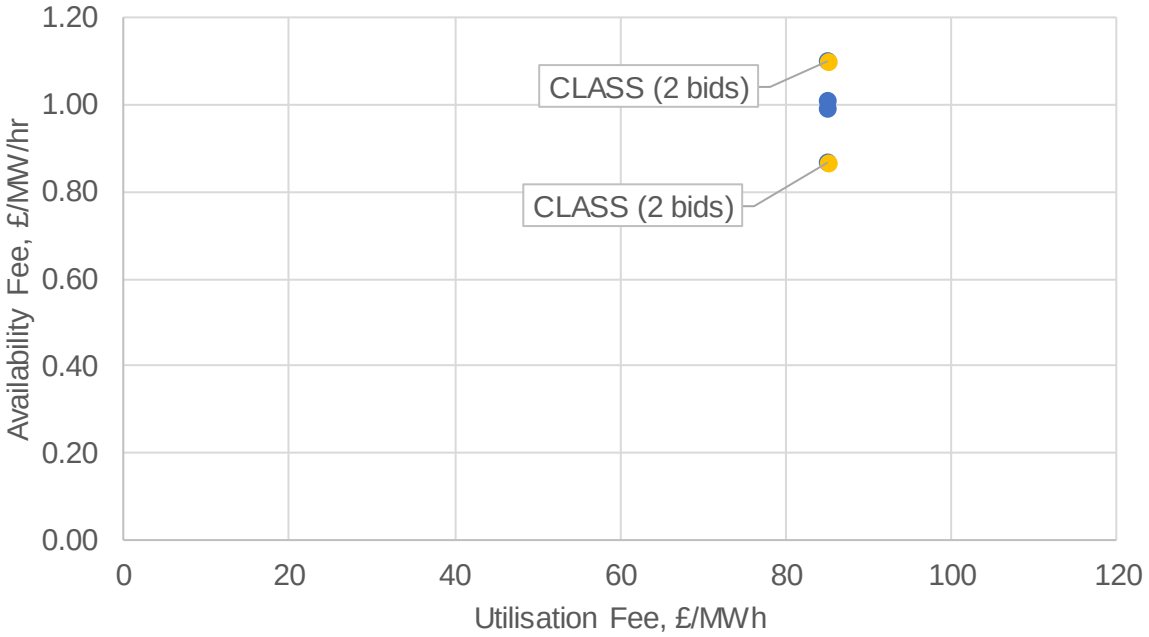
Figure 2.2: Accepted Daytime FR Bids, July-December 2019



Source: NERA analysis of National Grid ESO Fast Reserve Post-Tender Reports July-December 2019.

Figure 2.3: Accepted Nighttime FR Bids, July-December 2019



Source: NERA analysis of National Grid ESO Fast Reserve Post-Tender Reports July-December 2019.

2.3.3. CLASS may also displace providers in the non-tendered market

The ESO also buys balancing services through untendered agreements. In particular, it may procure Mandatory Frequency Response (MFR), an obligatory service by large generators, as

an alternative to tendered FFR.[42] The ESO can also substitute FR bought through bilateral agreements for tendered FR. In each of these cases, non-tendered contracting is still costly to the ESO, and there is a degree of competition between providers in the tendered and non-tendered markets for the same products. CLASS has the potential to also displace non-tendered providers, either through the tendered market or by offering its services outside of the ESO's tenders.[43]

ENWL's CLASS programme already has a large market share in the tendered Fast Reserve market. So far it has only provided CLASS in the small non-dynamic secondary sub-segment of the FFR tenders, and it is unclear whether CLASS has the technical capability to compete in the larger dynamic response market. If CLASS has the deployment potential projected by Baringa, and the future capability to compete not just for dynamic FFR but also services like short-term operating reserve (STOR) and reactive power, then CLASS could dominate the British balancing services markets.

2.4. Ofgem's Statutory Duties and their Application to CLASS

Ofgem's principal statutory duty is to protect the interests of current and future consumers. Further, Ofgem is required to carry out its duties in a way that promotes effective competition between market participants engaged in the generation, transmission, distribution or supply of electricity. In performing its duties, Ofgem must also have regard to the need to secure that all reasonable demands for electricity are met, and the need to secure that licence holders are able to finance the activities necessary to meet their obligations. Ofgem must also have regard to the principles that its regulatory activities should be transparent, accountable, proportionate, consistent and targeted only at cases in which action is needed.[44]

Ofgem argues that its minded-to position is in line with its principal statutory duty of protecting the interests of current and future consumers, because:

1. The changes in voltage that result from CLASS are not perceivable to consumers, and hence cannot lower the quality of service;

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[42] See National Grid ESO Website: Mandatory Frequency Response. URL: https://www.nationalgrideso.com/balancing-services/frequency-response-services/mandatory-response-services?overview. Visited on 19 March 2020.

[43] While there is less available data on bilateral agreements between the ESO and providers, we understand that ENWL has already offered some optional FR.
Source: Ofgem (10 February 2020), Consultation: Regulatory treatment of CLASS as a balancing service in RIIO-ED2 network price control, p. 37.

Baringa attempts to estimate the economic benefits of CLASS displacing non-tendered providers. It does this using alternative approaches that do not rely on tender data. For Fast Reserve, it creates a "proxy unit" representing the non-tendered providers based on the ESO's total reported costs and volumes. Baringa then enters this proxy unit into its supply stack analysis as if it were a unit based on tender data.

Baringa's report does not provide figures for these costs or volumes, or enough detail for us to assess this methodology, but the level of cost attributed to the non-tendered providers suggests a flaw. Baringa enters the proxy unit with a cost of almost £20 per MW per hour, well in excess of the £5.9-9.1 per MW per hour it reports for the tendered market. Since the ESO can substitute tendered and non-tendered products to most economically meet its balancing services requirements, we find it unlikely that it would choose non-tendered providers at a price more than double of what it pays in the tendered market. This disparity suggests its report could overestimate the cost savings from displacing non-tendered providers, although it is not possible to be certain without more information on non-tendered prices or Baringa's approach. See: Baringa (31 May 2016), Assessing the impact of CLASS on the GB electricity market, p. 38.

[44] Ofgem (19 July 2013), Our powers and duties. Link: https://www.ofgem.gov.uk/publications-and-updates/our-powers-and-duties

2. If CLASS is a low-cost technology for providing balancing services, then DNOs will invest in CLASS, the ESO will procure CLASS from DNOs, and balancing costs (and hence consumers' BSUOS charges) will fall as a result;
3. Consumers will benefit from CLASS by receiving a share of DNOs' profits from the provision of CLASS, through a reduction in DUOS charges;
4. It is unlikely that DNOs' net revenues from CLASS will be negative, given DNOs' own incentives to maximise profits from CLASS. Hence, Ofgem argues that there is little risk to consumers from sharing net revenues, because net revenues are unlikely to be negative.
5. Further, Ofgem argues that allowing CLASS to compete with other technologies to offer balancing services is in line with its statutory duty to promote effective competition, because this decision allows a pool of technologies and providers to compete with each other to provide balancing services to the ESO.

In other words, Ofgem believes that implementing Option 1A will not distort competition and will allow the market to select CLASS as a least-cost option for consumers if and only if it is indeed least cost to consumers.

In practice, it is far from clear that Option 1A will deliver these outcomes. At the very least, Ofgem's position is poorly-evidenced: While Ofgem argues that the above conditions hold qualitatively, it has not conducted any quantitative assessment of the costs and benefits of its minded-to approach, or any assessment of the historical benefits to consumers from ENWL's provision of CLASS to the ESO. The market under Ofgem's minded-to position may fail to deliver an efficient outcome for any of the following reasons:

1. **There may be hidden costs of the DNOs' provision of CLASS:** Ofgem's proposal is to allow a regulated network company to compete with commercial providers. The assumption that the market for ancillary services will select the least-cost solution places a heavy burden, indeed the burden of perfection, on that regulatory process. In particular, procuring CLASS results in externalities (the private cost to the DNO of operating CLASS may be lower than the social cost of operating CLASS) wherever CLASS has hidden costs not accounted for in Ofgem's regulatory process. These hidden costs may comprise cross-subsidies from consumers, conflicts of interest and positive externalities from the development of competing technologies. If there are hidden costs, then CLASS may be more expensive than competing technologies, even if the ESO procures CLASS, because DNOs' bids will reflect the private costs to DNOs of operating CLASS, as opposed to the higher social costs;
2. **The procurement of balancing services may not be efficient:** The demand side in the ancillary services market is itself the outcome of a series of regulatory decisions by Ofgem that affect the behavior of the System Operator. As a result, a complete, predictable market for ancillary services, driven purely by economic fundamentals, does not currently exist. The cheapest solution today, for a one-year contract, may not be the cheapest solution over the lifetime of a set of assets. There is potential trade-off between the procurement of the cheapest balancing service today and the minimisation of long-run balancing costs and between the types of contracts offered to and by ancillary services providers. Only if the demand-side of the ancillary services market perfectly reflected system needs could we have complete confidence that the Grid Operator selected the correct technologies to provide balancing services. Whilst this failure in the demand side

of the market affects the procurement of all balancing services, it is arguably much more material when one of the market participants benefits from regulatory support and holds a monopoly position over CLASS assets.

3. **DNOs' investment in CLASS may not be profitable:** DNOs may make losses on their investment in CLASS, and this may be detrimental to consumers as DNOs will share their net revenues with consumers under Ofgem's minded-to approach. If net revenues are defined as revenues from CLASS less all CLASS-related costs, as Ofgem suggests they are,[45] then there is a risk that net revenues could be negative when DNOs invest in developing their CLASS capabilities, given that CLASS is a capex-heavy investment with relatively low ongoing operating costs. Consumers may therefore incur a large up-front cost when the DNO makes its capex investment, by sharing the DNO's large negative net revenues in the year the DNO develops its CLASS capabilities. The DNO makes the large initial capital investment based on its judgement that over the lifetime of the project, it will be able to recover its costs and make and a reasonable return. However, because this investment is very capex-heavy, any change in the balancing market, such as the emergence of an innovative low-cost technology, carries high risk that it will not be able to recover its initial investment costs. If this is the case, DNOs' investment in CLASS will be detrimental to consumers, because consumers will share the losses made by DNOs under Ofgem's minded-to approach.

We discuss each of these three points in the following chapters of this report.

[45] Ofgem (10 February 2020), Consultation: Regulatory treatment of CLASS as a balancing service in RIIO-ED2 network price control, pp. 17-18.

3. The Hidden Costs of CLASS

Ofgem's qualitative assessment of CLASS implicitly assumes that if DNOs invest in CLASS and the ESO procures CLASS in the balancing market, then CLASS is necessarily a competitive, low-cost way of providing balancing services to the ESO. If CLASS is low-cost, then consumers benefit from a reduction in BSUOS charges, in addition to a potential further benefit to consumers from the sharing of the net revenues of CLASS provision with DNO.

Ofgem does not sufficiently assess the potential for hidden costs in the provision of CLASS. Specifically, some of the costs of CLASS provision may be borne by consumers, suppliers, and other market participants, and not the DNO providing the service. If there exist significant "hidden costs" to CLASS, then CLASS may not be beneficial to consumers even if it seems competitive in the balancing services market based on the bids of DNOs. This is because DNOs will not include the full costs of CLASS provision in their bids, but will only include the costs of CLASS provision that they themselves incur (i.e. their private costs of providing CLASS).

There are a number of potential hidden costs in the provision of CLASS, including:

- Consumers may bear some of the costs of CLASS through the price control, because it may be difficult to separate network costs from CLASS costs precisely in all instances;
- CLASS may have an impact of the asset life of certain machines and household appliances, potentially increasing costs for consumers;
- Suppliers' costs may increase from CLASS, e.g. due to the impact of CLASS on the imbalance volumes of suppliers. Suppliers may then pass on any increases in their own costs that results from CLASS to consumers;
- CLASS re-introduces a conflict of interest that Ofgem and other European regulators have repeatedly attempted to remove over a period of years with increasingly-strict unbundling: If DNOs act in a discriminatory manner in their role as monopoly network companies against their competitors in the balancing services markets, they may force out cheap competition, thus harming consumers; and
- Consumers may value voltage stability and hence CLASS may reduce the quality of service for consumers.

We discuss each of these areas of potential hidden costs in turn below.

3.1. Cross-subsidies from Consumers Through the Price Control

The private costs of CLASS to DNOs will be below the social costs (i.e. there will be externalities) wherever the costs of CLASS are not entirely separable and consumers cross-subsidise CLASS through the price control process.

In providing CLASS, DNOs must rely on the distribution network that consumers fund through DUOS charges. However, in order to provide CLASS, DNOs must also invest in additional technology, software and expertise, and must also incur additional operating and maintenance costs. Under Ofgem's minded-to approach, DNOs would have to fund these investments and additional operating costs themselves, and these costs should not be funded by consumers through increases in DUOS charges. In other words, costs that are attributable

to the provision of CLASS and are not required for the efficient operation of the distribution network should be funded by the DNO itself as a commercial investment and should not be funded from the allowed revenues determined through the price control review process.

However, it may not be possible to ensure that no CLASS-related costs are funded through the price control settlement, for two reasons:

1. First, CLASS-related costs and network costs may, in some instances, be genuinely difficult to separate;
2. Second, DNOs have a clear incentive to include CLASS-related costs within the price control to the extent possible, in order to receive higher allowed revenues and to share any over or underspend with consumers through the totex incentive mechanism.

Ofgem's Consultation assumes that the costs of CLASS are always separable and can be clearly identified with strict rules that prevent misclassification. In practice, CLASS is a classic case of joint products where multiple services are being provided by the same factors of production. It is a well-known result, dating back to Alfred Marshall in 1890, that the costs of joint products are not uniquely identifiable.[46]

For instance, two areas where network and CLASS-related costs may be difficult to identify separately are:

1. **Maintenance and asset replacement costs:** we understand that CLASS may reduce the asset lives of some network assets (such as transformers and tap changers), because CLASS increases the use and hence wear and tear of certain network assets, i.e. assets that are funded by consumers through the price control settlement (via DUOS charges).[47] If asset lives fall, this will increase the maintenance and replacement costs of these assets. It is not possible to identify the maintenance and asset replacement costs that are CLASS-related and that are network costs robustly. Customers will share these additional costs with companies through the totex incentive mechanism, and companies' allowed revenues will also increase at the price control settlement due to CLASS as companies' historical and forecast maintenance and asset replacement costs increase (and these increases feed through to Ofgem's assessment of companies' efficient costs).[48]
2. **Staff costs:** some staff costs may be allocated exclusively to CLASS, such as the costs of the bid team (i.e. the costs of any staff responsible for bidding into the ESO's tenders for balancing services). Other staff costs, such as the costs of senior management, , may be difficult to separate between network costs and CLASS-related costs, because the time of senior management will be shared between the two activities. If all senior management

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[46] Alfred Marshall explored this idea in detail in his book, *The Principles of Economics*, Chapter 6. In his own work he proposed relying on a Long-Run Incremental Cost standard, which differs from Ofgem's own use of short-run marginal costs, to identify the separate costs of lamb and wool in the sheep-farming industry.

[47] For instance, we understand from SEMBCORP that FR services may drastically reduce the expected asset lives of transformers. Additionally, a report commissioned by ENWL from the University of Manchester and the University of Liverpool on the impact of CLASS techniques on the health of assets found that CLASS will have a negative impact on the lifetime and maintenance schedule of tap changers. The report prepared by the Universities of Manchester and Liverpool relied on a sample of just three transformers and we understand that no detailed study of the impact of CLASS on a wider range of assets in real-world conditions exists.

See: University of Manchester, University of Liverpool (28 September 2015), WP3: Final Report, p.76.

[48] By contrast to maintenance and replacement cost, some costs associated with the provision of CLASS may be easy to identify. For instance, the initial capex associated with CLASS provision may be straightforward to identify.

costs are assumed to be network costs, then consumers would be cross-subsidising the DNOs' provision of CLASS, because they would be funding these costs through the price control settlement (via DUOS charges). Similar costs that may be difficult to identify separately include the costs of HR/payroll staff and the costs of training and mentoring for the balancing services bid team.

Because some of DNOs' CLASS-related costs may be included within the network costs that companies submit to Ofgem, DNOs' provision of CLASS may increase DUOS charges not just for the given DNO's customers that provides CLASS but also for the customers of all other DNOs. Specifically, due to the features of Ofgem's cost assessment approach at price controls, if the costs used in the benchmarking are higher for a single company due to CLASS (because of the failure to correctly separate network costs and CLASS-related costs), allowed revenues may be slightly higher for all benchmarked companies.

Cross-subsidies from consumers to DNOs for the provision of CLASS would distort market outcomes, because more CLASS would be procured by the ESO in the balancing market than is economically efficient. At the extreme, if the hidden costs of CLASS (including cross-subsidies from consumers) are large, it may not be economically efficient for CLASS to participate in balancing services at all. We discuss the impact of hidden costs on CLASS in more detail in Section 3.6.

For ENWL in particular, it is also possible that other costs of CLASS provision have been funded by consumers, via the Low Carbon Networks Fund (LCNF) that operated under Ofgem's DPCR5 price control period. We understand that the assets themselves have been funded by ENWL, however, ENWL benefitted from consumer-funded learning via the LCNF. In other words, ENWL may not have incurred the full costs of developing CLASS capabilities, because some of these costs (e.g. costs to develop know-how, etc.) have been funded by consumers via the LCNF. These costs are also hidden costs of CLASS provision, at least for ENWL.

3.2. Other Cost Increases for Consumers

In addition to cross-subsidising CLASS through the price control (i.e. through the DUOS charges they pay), consumers may also incur higher costs if CLASS is allowed to participate in the balancing market for other reasons. Specifically, we understand from discussion with SEMBCORP that CLASS may have a small impact on the asset lives of machines and household appliances that use a motor, such as refrigerators, computers, microwave ovens and washing machines. We understand that this is because these appliances will need to adjust the amount of power they draw from the grid in response to changes in the voltage. More frequent and larger changes in the voltage from CLASS may cause additional wear and tear to some specific components of these machines and appliances, and hence reduce the expected useful lives of these assets.

Even a small decrease in the expected useful life of machines and household appliances may have substantial cost implications. For instance, a simple back of the envelope calculation suggests that each UK household may have to spend an additional £1.9 a year on household appliances, if the useful live of these assets drops by a month from an assumed average of ten

years.[49] While an extra £1.9 a year may be a negligible sum for each household, this cost increase would amount to £51.9 million across the UK (summed across all 27.6 million UK households). We note that focussing only on households is conservative, as appliances outside of households (such as at schools, hospitals, office buildings, factories and stores) may also be affected by CLASS, including potentially-sensitive industrial equipment.

This analysis is of course not definitive, as it is not clear how much of an impact CLASS may have on the asset lives of household appliances. However, we have seen no evidence that Ofgem has considered this potential impact of CLASS on asset lives in reaching its minded-to decision on CLASS, even to dismiss it. We consider that it would be appropriate for Ofgem to commission engineering experts to assess and quantify this potential impact of CLASS as well as the impact on wider network assets, before reaching a final decision on the regulatory treatment of CLASS during the RIIO-ED2 price control.

3.3. Increased Costs for Suppliers

In addition to cross-subsidies from consumers, CLASS may also offload some risks to suppliers. Specifically, suppliers have their own forecasts for their customers' power consumption, and they purchase power on the wholesale market to match these forecasts. If CLASS is activated by a DNO and the DNO is directed to reduce load, customers' consumption will fall and the supplier will find that is has over-procured against its customers' actual consumption. (By contrast, if the DNO is directed to increase load, then its customers' consumption will increase and the supplier will find that is has under-procured against its customers' actual consumption.)

It is not clear whether CLASS will increase or decrease suppliers' profits, as the impact will depend on a range of factors, including (1) whether suppliers were directed by the ESO to increase or decrease load; (2) how the supplier's power purchase price compares to the price at which any imbalance will be settled. However, CLASS does increase risks for suppliers. Widespread use of CLASS across ancillary services will make supply businesses more risky, and these businesses may require a higher profit margin to continue operating in the market. Ultimately, consumers will bear the costs of the additional risk that CLASS imposes on suppliers.

CLASS may also displace Demand Aggregators in the market both in the provision of ancillary services but also for the delivery of power in the half-hourly market in at least three ways:

(1) **Adjustments to baselines:** Demand aggregators aggregate consumers' loads to offer reduced power consumption to the system at times of high prices or system stress. National Grid measures the reduction in consumption relative to baselines calculated using customers' historical metered consumption. By reducing or increasing metered

[49] We use the ONS estimate of an average household spending on household appliances of £4.3 per week. This includes most major household appliances, but seems to exclude laptops, for instance. Hence, actual spending on relevant appliances may be higher.

See: ONS, Family spending in the UK: April 2017 to March 2018. Link: https://www.ons.gov.uk/peoplepopulationandcommunity/personalandhouseholdfinances/expenditure/bulletins/familyspendingintheuk/financialyearending2018

consumption, CLASS affects these baselines and the ability of aggregators to offer demand reduction.

(2) **Increasing customer load:** In principle, DNOs could be using CLASS to increase load on a distribution network at the same time that a demand aggregator was attempting to reduce load (perhaps because there was a local excess of power but a national shortage). In such circumstances, a demand aggregator may be unable to offer the anticipated and/or contracted metered load reduction.

(3) **Displacement:** CLASS acts effectively as aggregation of (involuntary) demand side response and displaces voluntary demand side response. It is unclear whether reducing the consumption of all consumers rather than those the lowest valuation of lost load is likely to be more efficient, even if the former has a lower (private) cost to the DNO.

3.4. Costs of Conflict of Interest

Additional cost and inefficiency may result from the conflict of interest that arises from DNOs competing as providers of CLASS with customers that they are meant to serve as the monopoly DNO. Specific examples of how DNOs may discriminate against other providers of balancing service include:

1. DNOs could discriminate against potential competitors in the balancing services market, such as batteries planning to connect to the distribution network, for instance by increasing connection times or charges for these market participants or imposing more stringent requirements on connecting parties to remain within voltage limits (we understand, for instance, that batteries on energisation already need to remain within tighter voltage limits than DNOs in operating the network);
2. "DNOs have an increasing role as a neutral buyer of services to meet network and system needs".[50] If the same flexibility provider that the DNO is competing with in the balancing services market could provide flexibility services to the DNO, then the DNO may discriminate against that flexibility provider in its own procurement process. For instance, if the DNO does not procure a low-cost flexibility provider's services in order to force it out of business and hence to reduce the competition it faces in the balancing services market, this would increase costs for consumers (through increased DUOS and BSUOS charges).
3. Alternatively, as the procurer of flexibility services for the distribution network, the DNO may also have access to privileged information on some of its competitors in the balancing services market. The DNO may be able to use this privileged information to gain an unfair advantage over its competitors, for instance by using this information to inform its bids into the ESO's tenders for balancing services.

Unlike many of the other hidden costs discussed in this section, Ofgem has specifically considered the DNOs' ability to discriminate against its competitors in the balancing services market (using its separate monopoly role) in its consultation on CLASS. Ofgem argues that:

1. There are existing protections to mitigate the risks of discriminatory behavior from DNOs, including various licence requirements (1) requiring DNOs not to abuse their

[50] Ofgem (10 February 2020), Consultation: Regulatory treatment of CLASS as a balancing service in RIIO-ED2 network price control, p. 39.

special position; (2) prohibiting discrimination, both in the provision of connection services and use of system, and in their procurement processes;

2. If DNOs breach any of the above requirements, Ofgem has the powers to take action;
3. Price controls provide DNOs with incentives that would, according to Ofgem, deter them from offering certain types of customers poor service; and
4. Ofgem and BEIS are taking further steps to improve transparency and conflict mitigation in DNO decision-making.[51]

Ofgem recognises in its consultation that two of the options for the regulatory treatment of CLASS (the inclusion of CLASS in the price control and the prohibition of CLASS) would address conflict of interest concerns. However, Ofgem argues that these options are not proportionate to the risk of discriminatory behaviour from DNOs.

Stating that the risk of discrimination from allowing DNOs to participate in markets is low is a novel position for Ofgem which has so far been limited to CLASS alone. Ofgem has previously argued against the participation of DNOs in competitive markets. For instance in its recent decision to introduce a new condition in the electricity distribution licence to ensure that DNOs cannot operate storage:

> "Where competitive activities are carried out by monopoly network operators, there is potential for competition to be distorted, for new market entrants to be deterred, and for network operators' incentives to invest efficiently in their networks to be affected".[52]

Ofgem has also decided against the participation of DNOs in the commercial aggregation of customer demand. For instance, Ofgem argued that it "did not see models in which the DNO operates as a commercial operator in the long term interests of customers",[53] leading to the removal of commercial aggregation from WPD's Project Entire.[54] In essence, CLASS is also the commercial aggregation of consumer demand by the DNO.

Ofgem does not clearly state its justification for adopting a different policy for CLASS, which DNOs are able to operate uniquely amongst electricity balancing services. However, Ofgem argues that CLASS, unlike storage and commercial aggregation, is a network solution that can only be provided DNOs.[55] "This is because, in addition to assets specifically required for CLASS, it involves the operation of monopoly network assets that are essential

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51 Ofgem (10 February 2020), Consultation: Regulatory treatment of CLASS as a balancing service in RIIO-ED2 network price control, p. 39-41.

52 Ofgem (20 December 2018), Decision on enabling the competitive deployment of storage in a flexible energy system: Changes to the electricity distribution licence. Link: https://www.ofgem.gov.uk/publications-and-updates/decision-enabling-competitive-deployment-storage-flexible-energy-system-changes-electricity-distribution-licence

53 WPD (10 June 2019), Next Generation Network: Project Entire – Closedown Report, p. 27.

54 WPD's Project Entire was a project aimed at demonstrating the commercial viability of flexibility services for the DNO and the service provided. It was funded under the Networks Innovation Allowance from 2016 to 2019. See: https://www.westernpower.co.uk/projects/project-entire

55 Ofgem (10 February 2020), Consultation: Regulatory treatment of CLASS as a balancing service in RIIO-ED2 network price control, p. 30.

for the DNO's business as usual operation to provide a reliable system".[56] In fact, it is unclear whether it would be possible for commercial providers to provide CLASS. In principle, DNOs could auction the rights to invest in and operate the CLASS service where the revenue streams from providing that service would be governed in a contract between the commercial participants and the DNOs. Allowing commercial participants to operate CLASS would enable competition for the service and consumers to get the best possible deal in delivery of the service as well as resolve conflicts of interest between DNOs and their customers.

As an additional justification for its minded-to position, Ofgem also explains that it sees no evidence that ENWL has leveraged its monopoly position as a network operator to improve its relative commercial performance.[57] Even if ENWL has not engaged in discriminatory behaviour to date, this does not mean that ENWL (or indeed other DNOs that may invest in CLASS) will not engage in discriminatory behaviour in the future. In fact, ENWL has a clear incentive not to engage in discriminatory behaviour before Ofgem makes its final decision about the regulatory treatment of CLASS in the RIIO-ED2 period. Hence, the lack of evidence of discriminatory behaviour to date does not imply that DNOs will not engage in discriminatory behaviour in the future.

It is difficult to quantify the costs of the conflict of interest and the associated potential discriminatory actions of DNOs that may result from CLASS. However, as a general principle, the fundamental rationale for the unbundling of natural monopoly activities from competitive markets is to eliminate those conflicts of interest on the basis that the (often hidden) costs of DNOs participating in the electricity market outweigh any benefits. There are a number of academic studies that show that there are significant economic benefits from unbundling.[58] For instance, a 2008 paper by Brunekreeft measures the social costs and benefits for consumers and producers of the unbundling of the German TSOs in the context of the EU's Third Energy Package. The author finds net benefits of approximately EUR 313 million per year from 2010 to 2030, driven by the positive effect for consumers (while producers are worse off).[59] Converting this estimate to the UK by scaling for differences in power consumption between the UK and Germany, we estimate that the benefits from

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[56] Ofgem (10 February 2020), Consultation: Regulatory treatment of CLASS as a balancing service in RIIO-ED2 network price control, p. 9.

[57] Ofgem (10 February 2020), Consultation: Regulatory treatment of CLASS as a balancing service in RIIO-ED2 network price control, p. 26.

[58] Nillesen and Pollitt (2011) quantify the effects of mandated unbundling in New Zealand in the late 90s, which created independent distribution network operators. They find that the reform resulted in higher quality of the distribution service and in a decrease of operational costs of the system at an annual rate of 2.7% per unit distributed and 2.2% per customer. Source: P. Nillesen, M, Pollitt (2011), Ownership Unbundling in Electricity Distribution: Empirical Evidence from New Zealand. Review of Industrial Organization 38, 61-93.

Tierney and Kahn (2007) estimate that the benefits of unbundling in the New England market amounted to approximately 2.25 per cent of wholesale costs. We note however that the reforms in New England also included the opening up of the market to competition (through the break-up of vertically integrated power companies with a regional monopoly over generation, distribution and supply of power). Hence, benefits come both from the removal of any conflict of interest from network companies' participation in the supply and generation of power, and from the opening up of wholesale markets to new entrants. Source: S. Tierney, E. Kahn, M. Barmack (2007), A Cost-Benefit Assessment of Wholesale Electricity Restructuring and Competition in New England. Journal of Regulatory Economics 31, 151-184.

[59] G. Brunekreeft (2008), Ownership Unbundling in Electricity Markets: a Social Cost-Benefit Analysis of the German TSOs. UNECOM Discussion Paper 2008-05.

unbundling in the UK amount to approximately £148 million per year Some of these benefits may be lost if DNOs are allowed to offer CLASS to the ESO, as this is a step away from the unbundling of electricity markets.

We note that even if DNOs do not participate in discriminatory behaviour as a result of CLASS, e.g. due to their licence requirements and the additional steps that Ofgem and BEIS will take to mitigate the impact of conflicts, the presence of conflict of interest may in itself increase costs for market participants. For instance, the presence of conflicts of interest may reduce investors' confidence in the regulatory environment and increase the perceived riskiness of investments in flexibility services, thus increasing the return required by these investors, and hence the costs of their investments. These additional costs may be passed through to consumers or more likely, some of those investments will simply not be made.

3.5. Customers' Valuation of Voltage Stability

In its Consultation, Ofgem states that the impact of CLASS on voltage levels was "shown to be unperceivable to consumers", referring, in a footnote, to the trials conducted by ENWL.[60] Specifically, ENWL commissioned a number of studies in relation to customers who were subject to CLASS trials in 2014 and 2015. Its largest-scale study consisted of a Randomised Control Trial (RCT), where customers who were and were not subject to CLASS were asked if they had observed any impact on their power quality. Since similar proportions of customers reported voltage changes in both the affected- and control-groups, ENWL concluded that small changes in voltage levels do not affect customers.[61]

Ofgem does not, however, present or refer to any evidence of customers' valuation of voltage stability. In particular, Ofgem does not demonstrate that customers' willingness-to-pay (WTP) to avoid the impact of CLASS is zero, as Ofgem implicitly assumes in its minded-to position of allowing DNOs to provide this service without offering direct compensation to customers. As such, Ofgem fails to consider negative externalities associated with CLASS.

Ofgem's implicit assumption is that, because customers do not notice a change in voltage, they do not experience any detriment, in other words, if they do not notice a change then they cannot incur any costs as a result. In actual fact, customers are likely to place a positive value on voltage stability, and the other elements of the quality of service they receive in the absence of CLASS. For instance, if a kettle takes longer to boil, customers may suffer detriment from low voltage. That customers are unable to subsequently recall or identify the speed with which their kettle boils or attribute it to the change in voltage on their electricity grid does not mean that they would not prefer for their voltage level to remain consistent.

In competitive industries, policymakers typically rely on consumers to vote with their feet in such circumstances and select the service that best fits their needs. In regulated industries, where consumers are subject to changes in the service they receive which are beyond their control (because they are provided by a monopolist), it is best practice to conduct WTP valuation research of customers' valuation of the attributes of service that make-up the changes in service. In practice, regulated companies often use stated preference WTP surveys to obtain valuations for particular attributes, as electricity distribution companies

[60] Ofgem (10 February 2020), Consultation: Regulatory treatment of CLASS as a balancing service in RIIO-ED2 network price control, p. 9.

[61] ENWL (18 June 2015), Customer Load Active System Services, Customer Survey Initial Summary Report.

used at RIIO-ED1 to value investment to replace overhead lines with underground cables. Rather than use surveys to understand customers' WTP for voltage stability, ENWL's trial focused on surveying whether or not customers noticed changes in their voltage stability while subject to CLASS.

Companies (and regulators) commonly account for customers' willingness for small changes in level of service, even though these changes are not perceptible to customers. For example, in the UK water sector, Ofwat has set companies targets ("performance commitments") for elements of service such as level of leakage, resilience to long-term water restrictions and probability of supply interruptions. For these attributes, Ofwat penalises companies for missing targets (through "Outcome Delivery Incentives") using customers' marginal willingness to pay for the disutility caused by missing targets. Ofwat requires companies to compensate customers even though customers would not have noticed companies' poor performance around these attributes.

Since "voltage stability" is not a customer-facing attribute in itself, ENWL would also need to consider attributes related to it, for instance, the value of time lost due to appliances taking longer to operate (e.g. a kettle) and the disamenity caused to customers due to homes heating up more slowly.

We note that there is evidence that CLASS may also increase the number of Customer Minutes Lost, because CLASS requires some transformers to be tripped, thus reducing the redundancy of the network.[62] According to Baringa however, the cost impact of this on consumers is negligible, because the amount of load lost is minimal.[63] It is possible that, in addition to having an impact on Customer Minutes Lost and Customer Interruptions, CLASS would also increase the number of momentary interruptions (i.e. interruptions that take less than three minutes), which impose a cost on consumers but which are not reflected in Ofgem's RIIO-ED1 regulatory framework.

In its assessment of CLASS, Ofgem should quantify and take account of the value of voltage stability of customers, potentially quantified using customers' willingness to pay. The individual detriment to customers, at least as CLASS is currently used, is likely to be small. However, across the 25 million customers in Great Britain, even small costs to consumers may be material relative to any benefits of CLASS.

3.6. Impact of Hidden Costs

Due to the various potential hidden costs discussed above, CLASS may seem low-cost relative to other technologies and providers in the balancing services market. Its full social costs may be significantly higher than the DNOs' private costs of providing CLASS. They may also be higher than the costs of alternative balancing service technologies.

The impact of these hidden (external or social) costs is that more CLASS will be procured by the ESO in its tenders for balancing services than is economically efficient. At the extreme, depending on the relative costs of the different balancing services, it may not be economically efficient for any amount of CLASS to participate in the provision of balancing services to the ESO. In other words, given the potential hidden costs of CLASS, there may

62 Baringa (31 May 2016), Assessing the impact of CLASS on the GB electricity market, p. 49.

63 Baringa (31 May 2016), Assessing the impact of CLASS on the GB electricity market, p. 49, 52.

not be a level-playing field between CLASS and other balancing service technologies. This lack of level-playing field distorts competition in balancing markets.

Ofgem has not considered most of the areas of hidden costs discussed above at all in reaching its minded-to position of allowing DNOs to offer CLASS to the ESO. It has qualitatively considered some hidden costs, such as the potential discriminatory behavior of DNOs due to a conflict of interest, but has not attempted to quantify any of the hidden costs associated with CLASS. Without a robust assessment of these hidden costs, it is not clear whether Ofgem's minded-to position will in fact drive benefits for consumers. If hidden costs are large and the differences between the marginal costs of CLASS and competing balancing services are relatively small, then any participation of CLASS may be inefficient.

It is possible that some participation of CLASS is economically efficient in the balancing services market. However, the various hidden costs that CLASS imposes on consumers may mean that consumers are nonetheless worse off if CLASS does participate, due to the combined impact on consumers of:

1. Cross-subsidies via DUOS charges to the DNOs for the provision of CLASS;
2. Costs from the potential reduction of the asset lives of various electrical appliances;
3. The increased supply costs passed through to consumers, due to the increase in the riskiness of supply business from CLASS;
4. The costs of DNOs' discriminatory behavior that consumers may ultimately bear, at least in part;
5. The lack of voltage stability under CLASS, which consumers may have a positive valuation for.

If the costs that CLASS imposes on consumers exceeds the benefits that consumers may realise from CLASS, then Ofgem's minded-to position to allow DNOs to offer CLASS to the ESO would not be in line with its principal statutory duty of protecting the interests of current and future consumers. For instance, if consumers cross-subsidise CLASS to a large extent then it is possible for consumers to be worse off and for DNOs to be better off from CLASS. Given the depth and analysis of Ofgem's Consultation and the absence of a formal Impact Assessment, it is not possible for it to appraise whether its decision-making is in line with its statutory duties.

In the tight timeframes available for responding to Ofgem's Consultation, it is not within the scope of this report to attempt to quantify these costs in detail. As we explained above, whether the participation of CLASS in balancing services is economically efficient will ultimately depend on (1) the magnitude of these costs; and (2) the difference in the marginal costs of CLASS and alternative balancing service technologies. The consumer impact will depend on both these factors and will be a function of the costs that consumers bear as a result of CLASS (including hidden costs), and the benefits that consumers realise through potential reductions in BSUOS and DUOS charges from CLASS. If hidden costs are large and the differences between the costs of CLASS and other balancing service technologies are small, then Ofgem's minded-to position of allowing DNOs to offer CLASS to the ESO will likely (1) lead to the economically inefficient participation of CLASS in balancing markets; and (2) will likely harm consumers.

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We have not been able to identify any robust data on the costs of CLASS and other balancing service technologies, to allow us to identify differences in the marginal costs of CLASS and competing technologies. The bids submitted to the ESO's tenders for balancing services are not likely to be a good proxy for the costs of these technologies, because the ESO's tenders are pay-as-bid auctions. Participants in these tenders maximise their profits by considering (1) the expected probability that a given bid will be accepted by the ESO; and (2) their profit margin assuming that the bid is accepted. Hence, participants have incentives to bid in a significantly higher price than their marginal costs if they consider there is a high probability that their bid (at such high price) will be accepted.

In lieu of other data, we considered data on the bids submitted by CLASS and other technologies at the ESO's tenders:[64]

- In the FR market (as explained in Section 2.3.2), CLASS was significantly cheaper than its competitors based on accepted availability fees in 2019 (July to December), but only slightly cheaper based on the utilitisation fee. Specifically, the availability fee for non-CLASS technologies for accepted bids was £4.40/MW/hour on average, almost 210 per cent higher than the average availability fees for CLASS of £1.42/MW/hour. The average utilisation fee for non-CLASS providers (of £89.55/MWh) was only 5 per cent higher than the average utilisation fee for CLASS of £85/MWh.
- In the secondary FFR market, the average overnight availability price of accepted bids in 2019 was £1.48/MW/hour, about 29 per cent higher than the average accepted bids from ENWL for CLASS of £1.15/MW/hour.[65] In the daytime market, the average accepted availability price (of £2.30/MW/hour) was about 2 per cent lower than the average accepted availability price from CLASS (of £2.35/MW/hour).

We have explained above that bids in the ESO's tenders are likely not a good proxy for the costs of different technologies. However, assuming that they are (in lieu of any robust data on costs), this suggest that:

- Based on the overnight availability fees for FFR, if the hidden costs of CLASS are about 29 per cent (or more) of the private costs of CLASS, then CLASS may not be competitive with other technologies;
- Based on the daytime availability fees for FFR, CLASS may not have cost advantages over non-CLASS technologies even assuming there are no hidden costs;
- In the FR market, based on availability fees, the hidden costs of CLASS would need to be approximately 210 per cent of its private costs for CLASS not to be competitive;

[64] The Baringa report does include some information on the costs of CLASS for ENWL and on the expected bids of different technologies, based on actual bids in the ESO's tenders and Baringa's assumptions about changes in the bidding behaviour of market participants over time and assumptions about the entry and bids of new market participants. The source of Baringa's assumptions is not clear. We have therefore not used the Baringa data in our analysis.

[65] Ofgem (10 February 2020), Consultation: Regulatory treatment of CLASS as a balancing service in RIIO-ED2 network price control, p. 30.

- In the FR market, based on the utilisation fees, CLASS may not be competitive with other technologies if its hidden costs exceed 5 per cent of its private costs.[66]

As explained above, bids in pay-as-bid tenders are not a good proxy for the costs of different bidders. Hence, the fact that ENWL has been bidding much lower than its competitors in some markets is not necessarily indicative of the low cost to ENWL of providing CLASS, relative to other balancing service providers. Specifically, all other agents participating in the ESO's tenders for balancing service follow what they believe to be the profit-maximising bidding behavior, weighing the expected probability of a given bid getting accepted with the level of profits they expect to make if the given bid is accepted. As a regulated natural monopoly business, ENWL may not behave as other commercial businesses. For instance, ENWL may be bidding low in some markets as a regulatory strategy to show to Ofgem that the participation of CLASS in balancing services reduces balancing costs for consumers. Once Ofgem reaches a final decision on the regulatory treatment of CLASS at RIIO-ED2, ENWL may increase its bids in the balancing market in order to increase its profits.

Hence, ENWL and DNOs in general may bid differently from commercial market participants in balancing markets (because they have different incentives). Therefore, the ESO's procurement of CLASS on the balancing market does not necessarily mean that CLASS is cheaper than other technologies at providing balancing services, or that CLASS is competitive. Instead, it may reflect the different incentives that DNOs face, such as incentives to influence regulatory decisions, relative to purely commercial market participants.

3.7. Conclusions on Hidden Costs

In summary, we have identified a series of hidden costs that various market participants, including consumers, may incur as a result of CLASS. Because these hidden costs are not borne by DNOs, these costs will not be included in DNOs' bids in the ESO's tenders for balancing services. Hence, the ESO may procure more CLASS than would be economically efficient. At the extreme, if these hidden costs are very large compared to the private costs of CLASS provision, it is possible that any participation of CLASS in balancing services is economically inefficient and harmful to consumers. In other words, due to the presence of hidden costs in the provision of CLASS, there cannot be a level playing field for balancing services between CLASS and network solutions. These hidden costs, and the resulting lack of a level playing field introduces distortions in market outcomes, such as the potential over-procurement of CLASS relative to other balancing technologies.

Ofgem has not to date conducted any quantitative analysis of the magnitude of hidden costs and has not even conducted any qualitative assessment of many of the areas of hidden costs identified. Ofgem should carefully assess these hidden costs before reaching a final decision on the treatment of CLASS at RIIO-ED2. Without further assessment, it will not be clear whether Ofgem's minded-to position is in line with its principal statutory duty of protecting the interests of current and future consumers.

[66] This is a very simplistic analysis. To produce a more accurate analysis, we would need access to: (1) information on the costs of CLASS incurred by the DNO; (2) information on the costs of all other balancing service technologies and the capacity available.

4. Procurement of Balancing Services

Hidden costs and externalities discussed in the previous chapter suggest that the supply-side of the market may be distorted and result in over-procurement of CLASS. Ofgem's assumption that the market will procure the efficient volume of CLASS also depends on the presence of an undistorted demand-side of the market.

Putting aside the hidden costs of CLASS, if balancing markets were perfectly competitive, then the procurement of balancing services would be cost-minimising under standard economic theory (i.e. would be economically efficient). Even if all balancing services were procured by a profit-maximising monopsonist (a single buyer), the monopsonist would minimise cost such that it would procure the lowest cost combination of balancing services. In other words, both perfectly competitive balancing markets and a profit-maximising monopsonist of balancing services would deliver the same outcome under standard economic theory (at least provided both procured or were required to procure the same quantity of services), i.e. the cost-minimising, economically efficient pattern procurement of balancing services.

The ESO in GB largely passes its costs through to consumers via BSUOS charges. Hence, while it is the single buyer of balancing services, it may not be a cost-minimising buyer of balancing services, because, as a regulated natural monopoly business, it does not maximise profits in the traditional way. For instance, the cheapest solution today, for a one-year contract, may not be the cheapest solution over the lifetime of a set of assets, not least in the uncertain environment facing market participants in the energy sector over the lifetime of those assets. Due to the pass-through of balancing costs to consumers and the incentives it faces, the ESO in GB may not minimize balancing costs in the long run. Indeed, the challenges associated with designing regulatory incentives for the ESO are well-established. The have influenced Ofgem's proposed arrangements for the regulation of the ESO. They also inform the debate around the benefits of formal separation between the ESO and National Grid as an owner and operator of networks.

Ofgem explains in its consultation on CLASS that there are obligations on the ESO to develop competitive approaches to procuring balancing services wherever this is in the interest of current and future electricity customers.[67] Further, Ofgem has given guidance to the ESO that "it must balance short-term reductions in balancing costs against the longer-term development of balancing services markets".[68] Even given this guidance and the ESO's obligation, the ESO may not procure balancing services in a cost-minimising way in the long run.

Because the ESO may not minimise the cost of balancing services in the long run, it may procure CLASS even when there are alternative technologies that are cheaper in the long run. Moreover, the definitions of ancillary services that may be provided are not static and may be influenced by the products that CLASS may offer rather than system needs. Hence, even putting aside the argument on hidden costs, the ESO's procurement of CLASS does not

[67] Ofgem (10 February 2020), Consultation: Regulatory treatment of CLASS as a balancing service in RIIO-ED2 network price control, p. 38.

[68] Ofgem (10 February 2020), Consultation: Regulatory treatment of CLASS as a balancing service in RIIO-ED2 network price control, p. 24.

necessarily indicate that CLASS is a low-cost balancing technology, relative to alternative technologies (such as energy storage or DSR) in the long run.

In principle, one could advance the argument set out above regarding the failure of the demand side in ancillary services markets in respect of the trade-offs between any pair of ancillary services providers. However, it is arguably much more material when one of the market participants benefits from regulatory support and holds a monopoly position over CLASS assets. It also undermines Ofgem's case that the market will select the most cost effective technology to provide ancillary services by definition. As a corollary to which, it undermines Ofgem's Minded-to position which places limited controls on the participation of CLASS in ancillary services markets.

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5. Risk of Losses from CLASS

As explained above in Section 2.2, under Ofgem's minded-to position, DNOs would share their net revenues from the provision of CLASS with their customers through reductions or increases in DUOS charges, based on the sharing factor defined under the totex efficiency incentive. If net revenues are negative in any year, consumers would share some of these losses made by DNOs' via increased DUOS charges. Ofgem recognises that net revenues could be negative, but argues that: "The DNO will be incentivised to make a profit (and avoid losses) because it would keep a share of the income and would be exposed to the risk of losses".[69] Ofgem therefore implicitly assumes that it is unlikely that DNOs' would make losses and thus it is likely that consumers will be better off from its minded-to position on CLASS.

The special condition of the electricity distribution licence defines net revenues as the difference between revenues from a value added service (in this case, CLASS) and the marginal costs of the given value added service.[70] In economics, marginal costs are typically understood to mean the additional costs incurred to produce one more unit of output. We understand from the Baringa report that the provision of CLASS is a high capex, low opex activity: i.e. a DNO must incur high initial investment costs to be able to offer CLASS, after which the costs of operating CLASS are relatively low. Specifically, the Baringa report sets out that the total capex to ENWL of CLASS provision was £21 million, whereas the estimated annual opex was £0.5 million.[71] This evidence suggests that the marginal costs to the DNOs of providing CLASS are low. On this basis, we agree with Ofgem that it is unlikely that the net revenues from the provision of CLASS would be negative.

However, in its consultation on CLASS, Ofgem explains that "Net revenue is the gross revenue earned by participating in balancing services (i.e. what the ESO have paid the DNO) that year, less CLASS specific costs incurred or allocated that year, for example bid team costs and any assets paid for".[72] Ofgem's explanation suggests that all costs associated with CLASS, including the costs of any assets paid for (i.e. capex), would be subtracted from revenues from CLASS to estimate net revenues. If capex as well as opex is subtracted from revenues to estimate net revenues, then there is a higher risk that net revenues may will be negative in some years, and that DUOS charges may increase overall for consumers.

Specifically, if Ofgem's statement is correct, then consumers may incur a large up-front cost when the DNO makes its capex investment, by sharing the large negative net revenues made by the DNO, e.g. in the year that it invests in developing its CLASS capabilities. The DNO makes the large initial capital investment based on its judgement that over the lifetime of the project, it will be able to recover its costs and make and a reasonable return. However, because this investment is very capex-heavy, any change in the balancing market, such as the emergence of an innovative low-cost technology, carries high risk that it will not be able to

[69] Ofgem (10 February 2020), Consultation: Regulatory treatment of CLASS as a balancing service in RIIO-ED2 network price control, p. 18.

[70] Schedule 1: Modifications to the special conditions of the electricity distribution licences held by the four licensees owned by WPD, p. 81. Link: https://www.ofgem.gov.uk/ofgem-publications/98695

[71] Baringa (31 May 2016), Assessing the impact of CLASS on the GB electricity market, p. 5.

[72] Ofgem (10 February 2020), Consultation: Regulatory treatment of CLASS as a balancing service in RIIO-ED2 network price control, pp. 17-18.

recover its initial investment costs. There is evidence of rapid changes in the balancing services market in recent years. For instance, the share of demand side flexibility providers in the number of bidders in the FFR market increased from 44 per cent in 2017 to 85 per cent in 2019.[73] Rapid changes in the market and the potential emergence of new technologies carry risks for consumers as well as DNOs, due to the capex-heavy nature of CLASS investments and the sharing of net revenues between DNOs and consumers under Ofgem's proposals.

Consumers are unable the exert the usual corporate governance pressures that commercial investors are in assessing risk and reward. Ofgem's minded-to position may therefore amount to forcing consumers to invest in a risky investment with an uncertain pay-off without commensurate control over that investment. Ofgem's minded-to position places no valuation on that risk or assessment of whether consumers are earning an appropriate return for assuming that risk.

In summary, it is not clear whether there is a significant risk to consumers from the sharing of any net revenues from CLASS with the DNOs, because it is not clear how these net revenues are defined. If net revenues are defined as revenues from CLASS less all CLASS-related costs, then Ofgem should carefully consider the potential risks to consumers from its proposals. Under some states of the world, especially where new low-cost balancing technologies emerge after DNOs' make their initial capital investments in CLASS, Ofgem's minded-to approach may be detrimental to consumers.

[73] Ofgem (10 February 2020), Consultation: Regulatory treatment of CLASS as a balancing service in RIIO-ED2 network price control, p. 38.

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