



Akshay Saul
Acting Executive Director
Systems and Networks
Ofgem

Dear Akshay,

S&C Electric Company welcomes the opportunity to provide a response to your open letter, which launches work on RIIO-ED2.

S&C Electric Company has been supporting the operation of electricity utilities in the UK for over 60 years, while S&C Electric Company in the USA has been supporting the delivery of secure electricity systems for over 100 years. S&C not only supports “wires and poles” activities but has delivered over 8 GW wind and over 1 GW of solar globally.

As Ofgem has highlighted in its RIIO-2 consultations, the energy system is currently going through a period of rapid transition to a lower carbon, more flexible and decentralized, distributed system. Demand has fallen, over 50% of renewable capacity and 31% of total generation is now connected to the distribution networks and the costs for new technology including storage, solar and wind are quickly falling. These changes will continue with further rebalancing of both supply and demand as greater volumes of DG are connected and there is rapid growth in volumes of electric vehicles and electrification of heat. In its 2019 Future Energy Scenarios, National Grid estimates that up to 58% of total generation capacity could be connected to the distribution networks by 2050.¹ Electricity will therefore play a central role in the future development of the energy system.

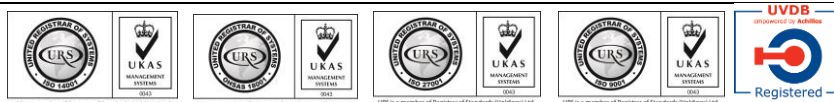
In this context, we welcome the broad range of issues that Ofgem is consulting on as part of the RIIO-ED2 open letter.

Our response focuses on three specific areas of the sector consultation:

- **Meeting the needs of consumers and networks users – Questions 21 and 22** - We want to highlight the growing importance of electricity distribution network reliability in supporting the energy system transition and ensuring there are not barriers to realising the value of network flexibility and the transition of DNOs towards active DSO roles. We consider there needs to be greater emphasis on the impact that both short and longer duration interruptions have on DG and other DERs as well as demand customers and that there would be significant benefits of introducing new financial incentives in this area as part of RII0-ED2.

There should also be a review of the exceptional event mechanisms and associated thresholds to take account of climate change and its impacts on the frequency and type of events that are occurring and to ensure there are appropriate incentives for good performance during for such events. Only incentivising average measures of CI and CML may no longer be appropriate. There's disconnect between these average metrics and what many customers experience.

¹ “Future Energy Scenarios”, National Grid, July 2019, <http://fes.nationalgrid.com/media/1409/fes-2019.pdf>





- **Business plan and totex incentives – question 44** - In the context of the energy system transition and the extent of change that is likely to take place during the RIIO-ED2 period, it will be important to maintain sufficiently strong totex incentives to drive continued innovation by the network companies.
- **Return adjustment mechanisms – question 48** - We welcome the proposal to adopt a sculpted sharing approach to the return adjustment mechanism for RIIO-ED2. This is the most pragmatic and proportionate approach and avoid the risks of an anchoring approach which could weaken the link between companies' investments and outcomes under the RIIO-ED2 performance incentives.

We would welcome an opportunity to participate in one or more of Ofgem's working groups for RIIO-ED2, with a particular interest, in the quality of service/reliability working group.

I have attached an updated version of the Annex, which I submitted in response to the RIIO-2 Sector Methodology consultation in March this year, which provides further detail on each of these topics.

If you would like to discuss the contents of this letter in more detail, please contact me on 07887 298393.

Yours sincerely,

Chris Watts
Director - Regulatory Affairs



Meeting the needs of consumers and network users – Questions 21 and 22 - Reliability as a key foundation for the energy system transition

The electricity distribution networks are at the heart of the changes we are seeing as part of the energy system transition. We consider that the reliability incentives should be reviewed and enhanced to take account of these ongoing changes. There should be financially incentivised outputs to take account of the impact of both short and longer duration interruptions on DG and other DERs as well as demand customers. There should also be a review of the exceptional event mechanisms and thresholds to take account of climate change and the impacts on the frequency and types of event that are occurring.

We consider that the use of the average CI and CML metrics for the reliability incentives should be reviewed as there is a disconnect between these and the reliability performance many customers experience. There would be benefits from performance being reported at a more granular level and updating the core reliability incentives to address the spread of CI and CML performance and performance for worst served customers. There are additional metrics such as the IEEE Customers Experiencing Multiple Interruptions (CEMI) metrics and Customers Experiencing Long Interruption Duration (CELID) metrics which have been used elsewhere and might be adopted by Ofgem and which I discuss in more detail later in this Annex.

Review of the Interruption Incentives

The Interruptions Incentive Scheme was first introduced by Ofgem in April 2002 against a background of large centralised generation feeding through the transmission and distribution networks to inflexible demand at the base of the system. It was introduced before many of the changes towards today's increasingly digitalised economy.

The incentive scheme gives equal weighting to all users of the networks and it focuses on sustained interruptions which last for 3 minutes or longer. The form of these reliability incentives has remained broadly the same since then although there have been refinements in the rules defining the measurement of interruption, incentive rates, the treatment of planned interruptions, and exceptional events. The targets, incentive rates and caps and collars on the incentives have been reset with each successive price control. The current exceptional event arrangements were developed at DPCR5 and there is a need to review that types of event that are covered and the associated thresholds.

Rapid change is affecting electricity distribution networks

The current design of the Interruption Incentive Scheme didn't anticipate some of the dramatic changes that are underway in the energy sector and which will continue to evolve quickly.

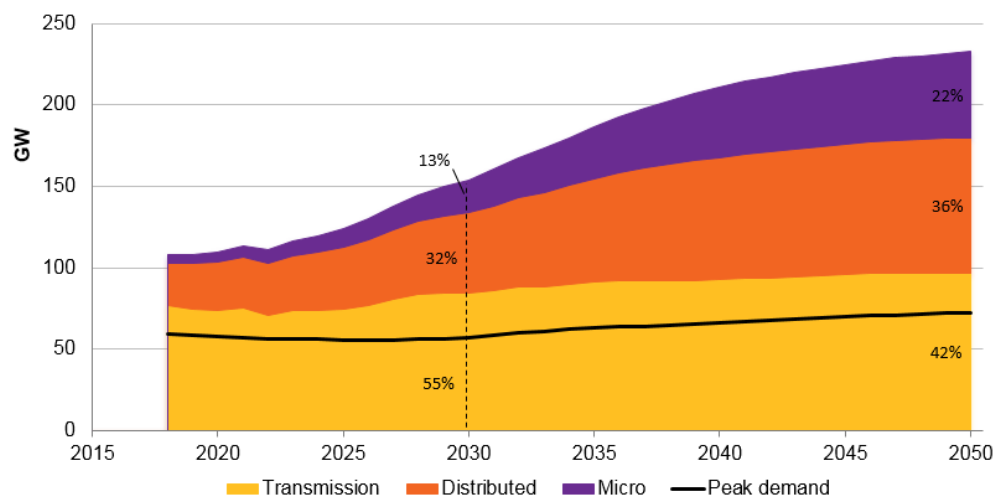
Over the past decade the requirements of demand customers have changed with a move to an increasingly digitalised economy. There is an increasing proliferation of electronics and power electronic devices that are sensitive to short interruptions and power quality issues. Domestic customers are increasingly irritated at the loss of internet access and video streaming when their routers take several minutes to reset following a short interruption. Retail businesses are upset at the cost and lost sales while their equipment reboots. Factories make increasing use of digital interfaces, smart sensors and alarms which would all be affected by short interruptions and lead to lost



production and waste. Research carried out in the US suggests that the average cost to a commercial and industry customer for a single short interruption is over \$12,000 (£10,000).²

Over the past decade the share of electricity generation from renewable sources has increased dramatically as the costs of new technology (including storage, solar and wind power) have fallen at rapid rates. Over 50% of total renewable electricity generation capacity (and 31% of total capacity) is now connected to the local distribution networks. Most of this is likely to be connected to the overhead network, which will typically experience higher fault rates than the underground network. The National Grid Future Energy Scenarios suggest that this could increase to 58% by 2050 as shown in the chart below.

Connection Location of Installed Generation – National Grid Future Energy Scenarios 2019 – Community Renewables Scenario³



Worldwide, short interruptions, are becoming less tolerable given increasing volumes of distributed generation. Even a short-interruption of 5 seconds will knock generation offline. Different types of generation have different recovery times. Some recover quickly, within a few minutes, and others may be subject to manual intervention of complex startup sequences, meaning they are offline for a longer period, even though the service is restored to the feeder and the load is fully present. Taken in scale (such as during a large storm with many scattered outages) this is bad news for the DNO/DSO as a growing portion of the generation is not available when it is most needed. This can aggregate from a small local problem to a larger distribution network problem as generation availability is shifting on and off.

In summary such short interruptions mean:

- The renewable resource is unable to export.

² Updated Value of Service Reliability Estimates for Electric Utility Customers in the United States, Ernest Orlando Lawrence Berkeley National Laboratory, January 2015.

³ "Future Energy Scenarios", National Grid, July 2019, <http://fes.nationalgrid.com/media/1409/fes-2019.pdf>



- Demand previously met by distributed generation now must be met through additional reserve from conventional generators.
- Distribution-network loading under the planning standard, must be managed in a way that does not take DG into account.

Generation connections will have a direct financial loss associated with such outages, meaning that the tolerance for such short interruptions will become less and less over time.

When the broader growth in DERs are considered the impacts are even greater. DERs such as energy storage and generation will be unable to provide services to the distribution network or other users when the network is unavailable.

Development in flexibility services and the transition to DSO

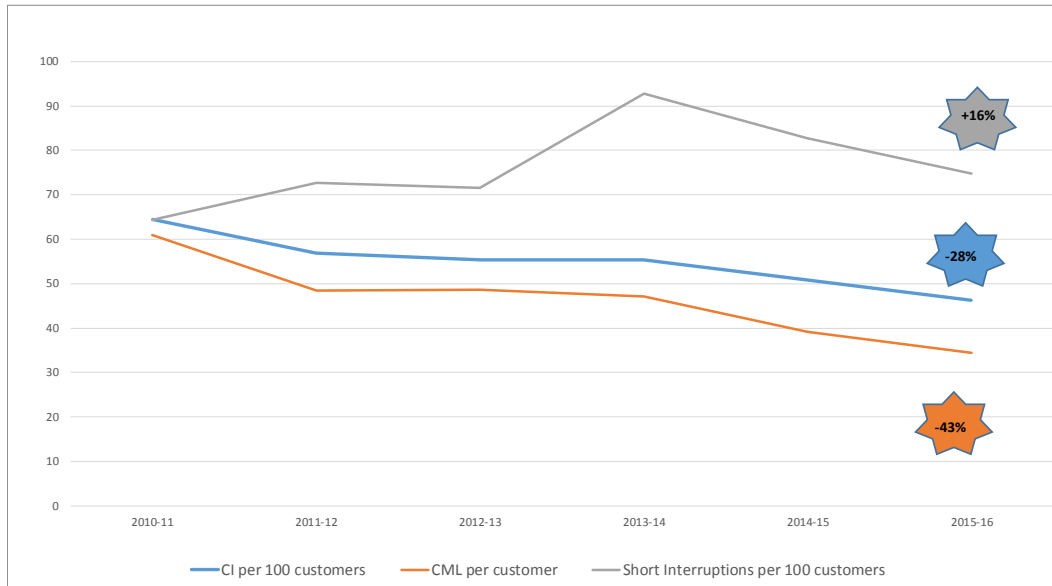
Over the past 5 years we have seen DNOs procure increasing volumes of flexibility services such as peak demand shaving from DERs through Constraint Management Zone tenders or similar approaches to defer the need for distribution reinforcement. All the DNOs have now committed to market testing significant reinforcement schemes against such alternative solutions. Ofgem and BEIS' Smart System and Flexibility Plan highlights benefits of a smarter, flexible energy system to be £17-40bn to 2050. However, it should not be forgotten that most of flexibility resources will be connected to distribution feeders and therefore will depend on distribution system reliability to provide services when they are needed.

All outages including shorter and longer duration interruptions matter. DERs cannot provide flexibility services to Transmission or Distribution System Operators or peer-to-peer services to other customers if the network is not available. Interruptions mean that such services are less reliable, and the full benefits of flexibility cannot be realised.

No longer enough just to address CI and CML

It is no longer enough just to address CI and CML. Ofgem's interruption incentives have worked very successfully in terms of driving major improvements in both CI and CMLs across all the DNOs. These improvements have been achieved through a range of approaches such as more effective deployment of field crews, improved condition-based asset replacement and refurbishment, automated switching, reclosing and using auto-sectionalizers to manage transient faults on tee or spur lines.

The chart below highlights the GB trends in CI and CML and Short Interruptions since 2010-11.



*The graph is based on Ofgem data excluding SSEN as data was not available for them the full period for short interruptions

There was a vast improvement in sustained outage performance from 2010-11 to 2015-16 - a 28% reduction in CI and a 43% reduction CML over this period. However, there's something that has been missed here, which is not well reported. There has been a corresponding increase in short interruptions. The reason for both the increase in short interruptions and a lack of detailed reporting information is that there are no outputs or financial incentives associated with short interruptions.

Reported short interruptions have increased by 16%. However, the real increase in short interruptions may be significantly larger as there are questions over the robustness of the short interruptions data, as common recording and reporting practices haven't developed in the same way as for CI and CML.

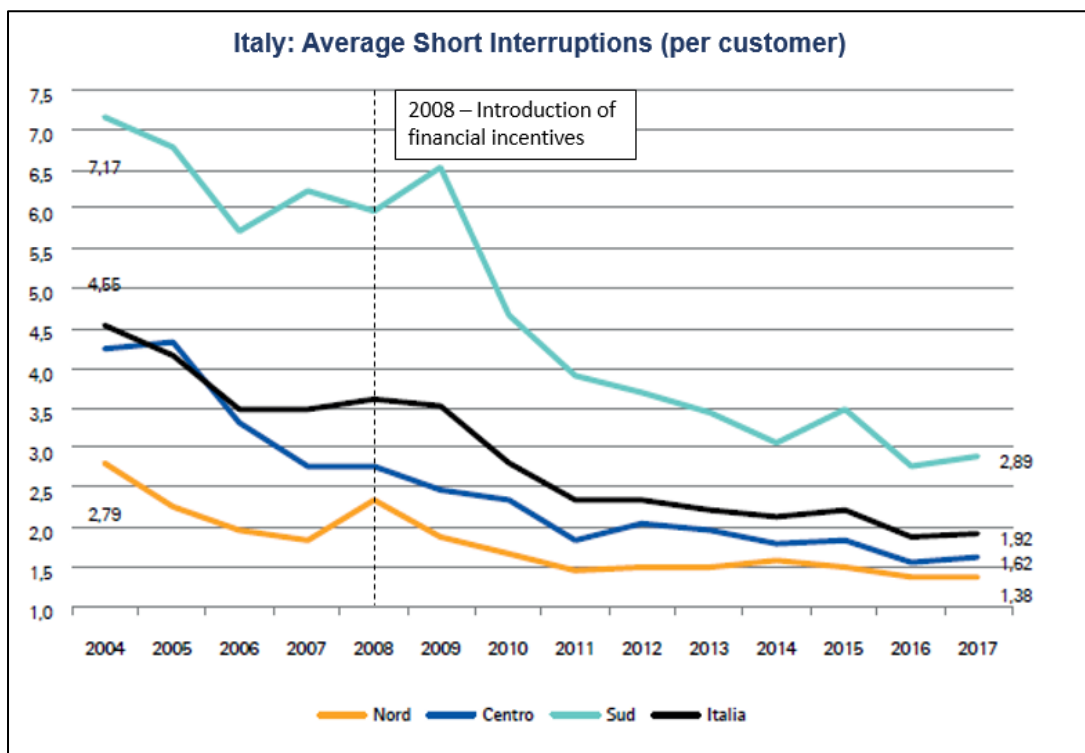
The strategies being used to manage CI and CML are giving rise to another problem in the form of short interruptions. Approximately 70 to 80% of faults affecting overhead lines are transient in nature. A key part of the way in which CI and CML have been tackled for transient faults is to replace fuses on tee or spur lines with auto-sectionalisers. This meets the objectives of improving reliability in terms of longer duration interruptions because you no longer have transient faults blowing fuses which requires the line crews to go to the field searching for a problem that is no longer there. However, when you take fuses out and use sectionalisers together with up-line breakers or reclosers, short interruptions increase significantly, because the auto-sectionalisers do not contain the fault to the tee or spur it occurs on. All customers on the main feeder are now affected, meaning 100s or 1,000s of customers experience a disruption instead of just 10s of customers on the affected spur. Such technologies worked well in the conventional energy system but aren't well suited to the modern grid with large proportions of generation and other DERs connected to distribution feeders.

Such interruptions trip off distributed generation for several minutes or longer. As noted above when taken at scale during a large event such as a storm, this can mean that a growing proportion of generation is not available when most needed. This loss of generation can cause further stability issues for the network. A loss of network availability will also mean that means that services cannot be provided on a peer-to-peer basis or to support distribution, transmission, or overall system operation.

Regulatory approaches can address short interruptions effectively

Financial incentives on short interruptions have already been implemented in several countries internationally and it would be worthwhile Ofgem building on these examples. For example, the Service Target Performance Incentive Scheme (STPIS) for 2016-20 for Powercor in Victoria, Australia includes financial incentives for the Momentary Annual Interruption Frequency Index (MAIFI) which specifies target levels of performance and short interruption incentive rates for urban, short rural and long rural networks. The CENS reliability in Norway and the incentives in Finland apply to both short interruptions and sustained interruptions.

The Italian energy regulator extended financial incentives to short interruptions as well as sustained interruptions in 2008 and since then the number of short interruptions has fallen by 46% as illustrated in the chart below⁴.



We have also seen examples in the US of the utilities measuring multiple momentaries as indicators of worse served customer performance.

We recognise that measuring and baselining short interruptions could take several years here given limitations in data that is currently available. So, we consider it is worthwhile also pursuing an approach that is more immediate. Since short interruptions can trip off distributed generation, there is a good case for RIIO-2 is to include new incentives on DG interruptions (DGI) and minutes lost (DGML), as a separate customer class, covering both short interruptions and longer duration outages. Instead of trying to measure and incentivise difficult-to-measure short interruptions directly, the incentives could be aimed at a very useful, important, and quantifiable measure that is intended to protect DG from any type of outage.

⁴ Figure 2.33 on page 121 of Relazione Annuale Sullo Stato Dei Servizi E Sull'Attività Svolta, Italian Energy Regulator, ARERA, 31 March 2018



There are now smart devices such as single phase reclosers that can tell you accurately what has been happening to short and sustained interruption performance based on recorded event or trip logs. Instead of waiting around for years to collect data to try to establish a baseline, a financial incentive can be based on directly recorded improvements in performance for both generation and demand customers.

Exceptional event arrangements

A key part of Ofgem's core reliability incentives is the treatment of periods of severe weather and other exceptional events. The current exceptional event arrangements were developed as part of decisions for DPCR5, with the thresholds updated in RIIO-ED1. Ofgem's severe weather mechanism removes the impact of extreme weather periods, such as storms, from DNOs' performance under the core reliability incentives, provided they meet certain pre-defined thresholds. The one-off exceptional events mechanism removes certain incidents for which the DNOs have limited ability to prevent or reduce their impact such as wilful damage or theft of a DNOs assets. These events are covered separately by guaranteed standards for supply restoration in severe weather conditions and in response to large events that require that DNO to make payments to customers if they aren't restored within certain timescales.

One of the effects of climate change is an increase in the occurrence of severe weather events, such as lightning, high winds and flooding, with the DNOs also carrying out investments to harden their networks and improve resilience. Climate change has also led to changes in the types of events that take place such as more prolonged very dry, hot periods in the summer.

It would therefore be worthwhile reviewing the mechanisms to ensure that an appropriate scope of events is included, the thresholds are set an appropriate level reflecting recent history and that there are enough incentives on the DNOs to provide an excellent level of service in response to exceptional events.

Average CI and CML

Since the initial design of the interruption incentives, they have focused on average CI and CML performance, which has driven the major improvements in performance discussed earlier in this Appendix. However, as the average has improved, there is a growing disconnect between these metrics and the experience of many customers receiving poorer service. Equally some areas within a DNO will experience much poorer levels of performance than others. There would be merit in the DNOs reporting and publishing performance at a more granular level and designing incentives that consider the spread of CI and CML performance and worst served customers as well as the average.

In the US, many of the State Public Utility Commissions monitor other metrics such as the IEEE Customer Experiencing Multiple Interruptions (CEMI-X) metrics and Customers Experiencing Long Interruption Durations (CELID-X) metrics. For example, CEMI-5 is the proportion of customers experiencing more than 5 sustained interruptions per year and CELID-3 is the proportion of customers experiencing at least one interruption longer than 3 hours per year. The CEMI-4 metric is part of the overall package of financial reliability incentives in Sweden.



Business plan and totex incentives – question 44

The current range of totex incentive rates in electricity distribution is 53.3% to 70%, with an average of 58.6%. Ofgem is proposing to set the strength of the totex incentives in the range 15 to 50% in RIIO-2 using a 'blended sharing factor' approach. Under this approach Ofgem notes that it would determine the proportion of a company's proposed totex in which it has high confidence based on its ability to independently set a baseline cost allowance. Other elements would be considered 'low-confidence baseline' costs. The greater the proportion of high-confidence baseline costs a company has in its plan, the higher its totex incentive.

The extent and scope of changes to the energy system over the coming decade will be unprecedented. This includes the shift from DNO to Distribution System Operator roles, the greater range of options available to network utilities from traditional investment options to non-wires alternatives, the continued growth in flexibility services and the scope for further innovation and whole system solutions. It will be important that there are sufficiently strong incentives for network companies to make the most of these opportunities and develop an efficient, reliable, smart and flexible grid.

While totex incentives rates towards the top end of the 15 to 50% range are likely to be less of a concern as strong incentives would be maintained, a drop in the strength of incentives towards the bottom of the range would represent a significant weakening of incentives for many of the network companies. This would occur a time when these incentives will be most important in driving innovation and the efficient development of the networks.

Return adjustment mechanisms (RAMs) – question 48

We welcome Ofgem's proposal to adopt a sculpted sharing approach for the RAMs for RIIO-ED2. We consider that this is a pragmatic and proportionate approach, which preserves the relationship between performance such as reliability and incentives earnings, allowing companies to build effective business cases for investments to improve performance. Customers have seen the benefit of this in terms of over 47% and 59% improvements in CI and CML since 2002-03. Customer satisfaction has also increased dramatically to the extent that the network companies are achieving comparable scores with household name companies such as Amazon and John Lewis.

Under the anchoring proposal, there would have been a significant risk that the links between investment, improvements in performance and financial incentives would have been broken. Under that approach the incentives or penalties earned could have depended on other companies' performance across a broader range of incentives.