ANNEX 1: PAPER ON ACCOMODATING LOW-CARBON TECHNOLOGY UPTAKE

DEALING WITH RIIO-ED1 SCENARIO UNCERTAINTY: A NORTHERN POWERGRID WORKING PAPER

1. One of Ofgem's key objectives for the RIIO-ED1 price control review is to ensure the timely and cost effective connection of low carbon technologies to the network. Evolving customer needs should be met, connections bottlenecks should be avoided, and the risk of redundant assets should be minimised.

2. All of this must be done in the face of uncertainty over the timing and level of low carbon technology uptake. While scenarios have been developed to illustrate possible out-turns for uptake, there is still a question of how best to handle uncertainty over what will happen in practice.

3. This paper sets out Northern Powergrid's proposal for how to deal with this uncertainty while maintaining strong incentives within the price control framework. The basic idea is simple – cost allowances beyond the 'business as usual' baseline would be updated within the price control period based on actual levels of uptake and a basket of low carbon technology allowance drivers. In other words, as demand for network services rises, driving associated costs, revenues would also in response. The rest of this paper:

    - sets out the challenge we collectively face;
    - assesses the options for dealing with it;
    - sets out how the option Northern Powergrid thinks is most robust would be implemented; and
    - describes how this proposal would work within the price control period.

4. An appendix also sets out further details on the proposed approach.

The challenge we collectively face

5. While the long term objective is a decarbonised economy, there is currently significant uncertainty over the path the energy market in the UK will take to reach this, and what the exact end point will look like. No one knows at present how far and quickly individual low carbon technologies will penetrate, or what the eventual mix will be. The level of deployment, the mix between different types of

technology, and their implications for networks will instead depend on factors such as:

- technological progress;
- government policy; and
- consumer behaviour.

6. Over the near term, there is less uncertainty simply because there is less time for a major technological breakthrough to happen, and because consumer inertia may well slow down the deployment of any mass market technologies. But while mass uptake of certain technologies might be unlikely within the RIIO-ED1 period, there is still uncertainty over the timing and level of the uptake that will happen.

7. This uncertainty must be dealt with in the RIIO-ED1 price control framework while bearing in mind the purpose of RIIO. The RIIO framework was specifically developed to allow for these changes in the use of energy networks while:

- maintaining strong incentives for efficiency and value for money;
- encouraging network companies to be innovative; and
- giving companies responsibility for managing uncertainty.

8. No single part of the regulatory framework will be able to address this issue and achieve these objectives, so a balanced package of regulatory mechanisms is likely to be needed to address it in a holistic fashion. Obligations placed on the companies by relevant legislation or their licence will be relevant. Directly incentivising the speed of connection delivery may also be appropriate as part of the package (provided it does not distort the competitive parts of the connections market, and provided it is balanced with the incentives to encourage good customer service).

9. However, the above is unlikely to be a complete solution to the issue, as it leaves unaddressed the question of how the industry could respond to, and receive funding for, any significant acceleration in the deployment of low carbon technologies.

We have a range of options, but only one seems credible

10. As we have seen, addressing the uncertainty we face over low carbon technology in a way that gives strong incentives for cost efficiency and innovation, while placing responsibility on the companies, is central to the rationale for the RIIO framework.

11. The way in which this uncertainty is handled within the price control must therefore be assessed against these objectives. Although there are many possible variants on how uncertainty could be handled, there are four broad options to consider in this way:

    a. pass through, or logging up with some kind of ex-post efficiency review;

    b. fixed allowances coupled only with the efficiency sharing factor;

    c. re-openers once more information is known; and

    d. a volume driver, with cost allowances automatically updated once actual volumes are known.

12. The first of these options (a) can be ruled out easily. Pass through would certainly allow for uncertainty over costs, but it would do so by passing all of the risk to customers and would give no incentives for efficiency or innovation. Even if an ex-post efficiency review of costs is added to the mechanism, incentives for rolling out innovation may well be undermined because ex-post disallowance for inefficiency is not something that is easy for a regulator to impose.

13. Relying only on fixed allowances and the efficiency sharing factor (option b) would lead to much stronger incentives for cost efficiency and also for the role out of innovation. With allowances fixed over the eight year price control period, companies would have certainty over the rewards for pursuing commercial gains. But this option would in no way address the uncertainty over which scenario we will find ourselves in. It therefore has two significant weaknesses.

    - There could be significant windfall gains (or losses) for electricity network companies simply depending on which scenario we find ourselves in, and

whether allowances prove to be higher (or lower) than would actually have been necessary to handle that scenario.

- Companies wishing to insure against the risk of windfall losses may be given an incentive to plan for a higher level of uptake than currently seems likely, potentially leading to higher allowances and ultimately higher costs for end users.

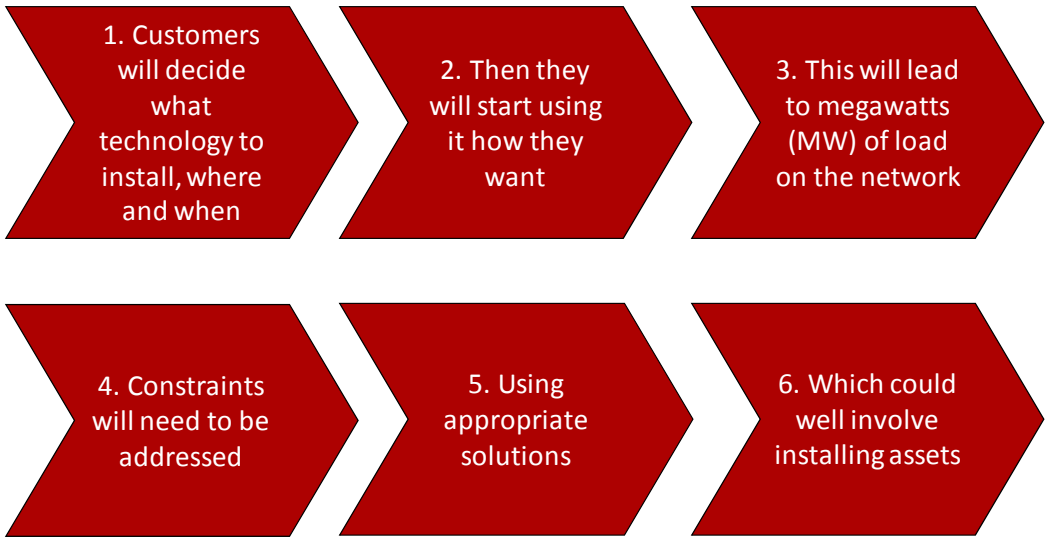
14. In terms of the third option (c), it would be relatively easy to effectively delay setting the price control until more information is known about levels of uptake and associated costs. This could be done either by having fixed dates at which further reviews of the costs associated with low carbon technology are undertaken (such as the mid-period review) or building re-opener thresholds into the price control which do not require significant low carbon technology uptake to trigger. But, while either of these would help address the weaknesses of a fixed allowances approach, they would also undermine its benefits. In particular, they would significantly undermine the benefits associated with the longer eight year price control period in terms of handing greater responsibility to companies and putting in place stronger efficiency incentives.

15. The last option (d), on the other hand, could provide strong incentives for efficiency and the roll out of innovative approaches, avoid allowances that turn out to have been set too high or too low simply because actual low carbon technology uptake differs from expectations, and reduce the incentive for companies to insure themselves from higher than expected uptake by planning for a high scenario. But in order to do this the volume driver would need to be chosen well. In particular, it would need to:

    - be objectively measurable;
    - mirror customers' demands of the network, and the associated costs; and
    - not depend on companies own actions to manage the network.

    The last of these points is important since, if the volume driver depends on companies own actions, it could affect the strength of the incentives it creates for cost efficiency and the roll out of innovation.

16. There are a range of ways in which a volume driver could be implemented, and only some of these are likely to meet these requirements. The chain of events we know will take place during the RIIO-ED1 period, mirroring additional demands of the network, is set out in the figures below. A volume driver could target any stage of this chain, and the stage which is chosen will determine its incentive properties.



17. The nearer the volume driver is to the start of the chain above the stronger the incentive will be for the full range of activities that electricity network companies undertake. For example, if a volume driver were targeted at the last stage of the chain, the number of assets installed, incentives for efficiency would be limited to trying to procure and install assets as cheaply as possible. Similarly, if the volume driver were based on the Megawatts (MW) of loading network companies actually experience at key points on their network, this would weaken the incentive they have under the volume driver to put in place commercial contracts to shift network loading in time (i.e. demand side management).

18. The most logical place to target a volume driver is therefore the very start of the chain. This would involve a measure of the technology customers have actually installed. In order to cater for the electrical 'size' of installations, the MW rating of the equipment would need to be accounted for (rather than simply counting the number of windfarms or heat pumps, for example). And given different technologies are likely have different associated costs, which may well differ depending on where they are connected on the network, the MW of each

technology connected at various voltages levels would probably need to be tracked separately.

19. This volume driver should also be possible to measure objectively. While network companies may not currently have access to the necessary information, it is likely that all the relevant details are being tracked systematically by one or more organisations.[12]

20. Finally, while no volume driver can be an exact proxy for the exact circumstances that will drive company costs when low carbon technologies are installed, it should still be possible for companies to develop a realistic view of what costs they would face for any level of uptake. For instance, companies should be able to take into account existing levels of capacity of their network. Likewise, they should also be able to form a view of likely levels of clustering that they will see for any given level of uptake.

It could be practically implemented through the business planning and price control process

21. As set out above, the most promising volume driver for low carbon technology uptake is the total MW rating of technology actually connected by customers, broken down by technology type, and the voltage at which it is connected. Once this is known during the course of the price control, cost allowances (above and beyond the baseline required to handle business as usual activity) would be updated using a 'basket' of pounds per MW allowance drivers.

22. It may well also be the case that for a certain level of low carbon technology uptake there would be no need for additional allowances, since the technology could be accommodated within existing headroom on the network. A de-minimis threshold could therefore be warranted, below which no additional cost allowances are triggered.

[12] Even if data protection rules makes it more difficult to pass some of this information to network companies, the approach would only require totals in any given network area, and so there should be no data protection issues.

23. Given these points, at the price control review there would be an important role for both network companies and Ofgem in establishing the:

    - basket of pounds per MW figures required as allowance drivers within the price control period;
    - level of any de-minimis threshold for each technology; and
    - 'best view' eventual uptake and cost allowance requirements.

24. As part of their business plans, network companies would therefore need to set out both their proposed basket of pounds per MW allowance drivers, and any de-minimis thresholds below which no allowances are required. They would also need to set out their 'best view' of low carbon technology uptake in their areas, and the costs that would result in this scenario. In order to develop these estimates, they would need to use the collateral they think best, which might include:

    - the smart grids forum work stream three (WS3) model;
    - prioritisation methods; and
    - load index models.

25. With companies developing plans in this way, Ofgem (and stakeholders) would be able to translate this into the costs the company is proposing for a given scenario. The cost assessment tools Ofgem has at its disposal, or which are being developed specifically for this price control review, could then be used.

    - Total business plan expenditure could be assessed across a range of scenarios for low carbon technology uptake defined by Ofgem (e.g. low, medium, high) to test how companies compare on a 'like for like' basis.
    - Sensitivities could also be undertaken to understand whether credible levels of uptake for individual low carbon technologies could change the results, to reflect the fact that actual uptake may not be 'balanced' across all technologies. In particular, while a company may be proposing a plan that appears to involve challenging cost allowances if balanced uptake occurs, it might actually be much less challenging if significant uptake of only one technology happens.

Developing challenging cost proposals could also be encouraged further by Ofgem's approach at the price control review. Both the information quality incentive and fast tracking could be used to reward those companies that submit the most challenging cost forecasts and provide Ofgem with valuable information in establishing the price control. An uncertainty mechanism in this form could assist Ofgem in how it does so.

And within the price control period it would ensure strong incentives for cost efficiency and the roll out of innovation

26. Once the price control was agreed, allowed revenues could initially be set in line with 'best view' expectations of the level of low carbon technology uptake. As out-turn levels of low carbon technology uptake in any given year become known, the 'best view' could then be updated with actual cost allowances.[13]

27. Companies would then need to deliver a network that can accommodate these technologies. Failure to deliver outputs would lead to poor performance on the interruptions incentive, customer satisfaction, complaints, and potentially licence breach. There would also be an additional marginal incentive to make sure connections are not delayed, since this releases the associated allowances sooner, wherever companies already have the network in place to do so.

28. It would be up to companies to do these things efficiently and innovatively, and the efficiency sharing factor would give strong incentives to do so. Once a company knows its total cost allowances based on actual uptake of low carbon technology, it would still be exposed to out- and under-performance of these allowances. It would also be commercially exposed to decisions to invest ahead of need since investment would only be funded once it was used and useful. While investment ahead of need may well reduce the overall costs companies will incur, and so be incentivised through the cost efficiency incentives, companies would need to take commercial decisions to do so. Where these decisions prove to have been ill-founded it would be their own funds that are at risk (not the funds of end users).

[13] This could be done with a lag, as is proposed for incentive schemes, in order to give suppliers advance visibility of changes in allowed revenues.

29. There may, however, be some circumstances in which it may be necessary to cap and collar company out-performance under the cost efficiency incentive. Extreme levels of out-performance, or companies finding their allowances are insufficient, should be much less likely under this approach than under a simple fixed allowance. But they cannot be ruled out, especially if innovation or out-turn customer behaviour means the cost to serve a given level of low carbon technology uptake changes. Caps and collars on reinforcement related out-performance could be put in place to manage this scenario.

30. Once caps and collars are hit, marginal incentives on cost efficiency could cease to apply (or could be reduced relative to the standard level), which would undermine the incentive properties of the settlement. In this case, a detailed review of costs to date would be appropriate.

    - It might be perfectly reasonable that the collar on out-performance has been hit due to a company choosing to invest ahead of need, in which case marginal incentives should remain in place.
    - Equally, if the cap is hit because new innovative technologies have significantly reduced costs, a re-calibrated set of pounds per MW allowance drivers might be needed for the rest of the period.

    These reviews could also further encourage deployment of innovative technologies, by making sure higher (but still reasonable) returns on these new technologies are allowed, to take into account the higher risks companies are taking by using them.

Conclusion

31. We face uncertainty over the level of uptake of low carbon technologies, and finding a way to allow companies to respond to this is fully consistent with the objectives of RIIO.

32. Northern Powergrid believes that the mechanism set out above, involving allowances drivers based on pounds per MW of low carbon technology actually connected by customers, is the most robust way of achieving this. It would place responsibility on the network companies for proposing credible plans that deal

with the range of possible outcomes for low carbon technology uptake that might be experienced during the RIIO-ED1 period. It does this without resorting to simple allowances that might prove to be either significantly too high or too low, depending on actual uptake levels. It also avoids excessive reliance on re-openers, or the mid-period review, to handle situations in which the actual scenario differs from the one companies assumed in their business plan.

33. The proposal should also ensure there are strong incentives to control the cost of providing capacity for low carbon technologies, while not leading to the possibility of excessive rewards or risk exposure to network companies (if caps and collars are implemented on out- or under-performance).

34. Finally, it would allow Ofgem to transparently compare one plan with another, and put in place strong incentives for companies to submit challenging cost forecasts.

APPENDIX 1 – FULL DETAILS OF THE PROPOSED FRAMEWORK

This appendix sets out full details of the proposed volume driver, including:

- how low carbon technology uptake would be measured
- how allowances drivers would be established
- the role of take up thresholds; and
- how caps and collars on out-performance could be implemented.

Measurement of low carbon technology uptake

1. The framework depends on accurate and verifiable figures being available for the actual uptake of low carbon technologies in each network company's service area. Estimates based on network loading would not be appropriate, since this may discourage network companies from implementing solutions to capacity constraints such as demand side management. Instead, a measure of the total rating of equipment being installed is required.

2. While it may be necessary to draw data from a number of sources, Northern Powergrid believes the majority of the required information would be available somewhere.

    - Other than G83 micro-generation, network companies should be aware of the connection of generation installations to their network, and the associated capacity, from their own connections records.
    - The feed in tariff register should provide details and the location of renewable G83 micro-generation installations.
    - The DVLA should hold details and the registered address of electric vehicles.
    - The renewable heat incentive register should provide details on heat pump installations.

3. Network company access to detailed customer data on each of these may well be required for the safe and cost effective operation of the network. However even if there are data protection concerns that may prevent network company access to

location specific data from the most comprehensive centrally held data sources, the volume driver would only require totals in each network company's service area. There should be no privacy issues with this information being collated and passed on to Ofgem and network companies on this basis.

Setting cost drivers

4. Companies would be required to submit a basket of pounds per MW cost allowance drivers as part of their business plan submission, which would apply to incremental connections of additional technology during the RIIO-ED1 period.

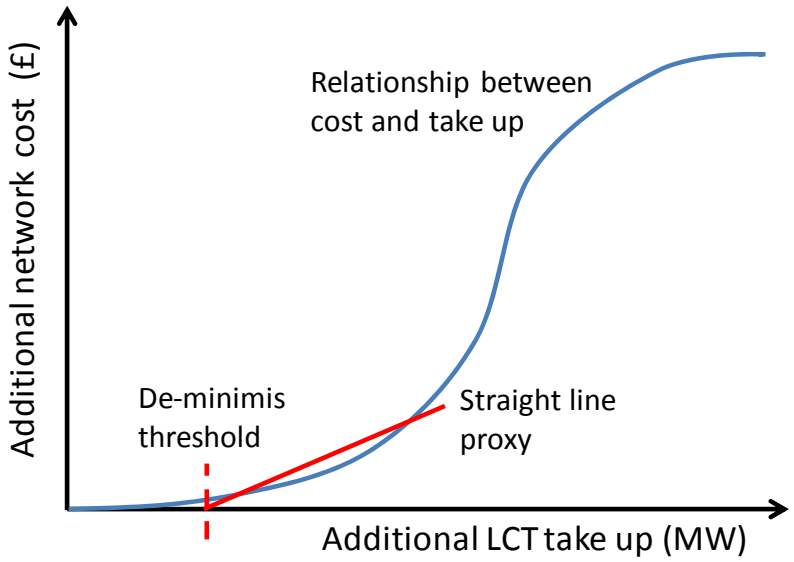
5. MW would be measured using the rating of the equipment, so the allowance driver (pounds per MW) would need to take into account any assumptions the company was making in terms of utilisation factors for different technologies that could lead to different patterns of loading on the network. Likewise, implicit assumptions would be needed on the degree of clustering likely to materialise given the levels of uptake in question.

6. Since different types of low carbon technologies will have different implications for costs (per MW of equipment installed), there would need to be several baskets, and this may also need to take into account the voltage the equipment is connected to for some technologies (e.g. whether wind generation is connected at HV or EHV). The table below illustrates this.

£/MW rate required	G83 generation / domestic load	Non-G83 LV / non-domestic LV load	HV	EHV
PV	✓	✓	✓	Outside normal scope
Wind	✓	✓	✓	✓
Biomass	✓	✓	✓	✓
Heat Pumps	✓	✓	✓	Outside normal scope
Electric Vehicles	✓	✓	✓	Outside normal scope

Take up thresholds

7. There may be a non-linear relationship between technology uptake and cost. At low levels of uptake there may in fact be zero cost, as it may be possible to accommodate this within existing capacity (or capacity that had to be installed as part of the business as usual investment programme). As take up increases, there will come a point when this is no longer possible, and additional costs would be driven into the business. The figure below illustrates what this relationship might look like, with the blue line representing to total additional cost required to facilitate any given level of uptake of low carbon technologies (LCTs)



8. In the illustration above, a certain amount of take up can be supported without driving additional network cost, which would depend on network characteristics and the level of low carbon technology uptake that had happened prior to the RIIO-ED1 period. Beyond this stage, costs begin to rise as further technology is connected. For a certain level of take up, the additional cost can be proxied by a straight line, or a fixed pounds per MW allowance driver. Even further beyond this level of uptake, a higher cost per MW may be driven into the business with additional connections. Similarly, there may well come a stage (likely to be beyond the RIIO-ED1 period), where the average cost of providing additional capacity reduces, as saturation is approached and new installations are increasingly connected to parts of the network that have already been reinforced.

9. Based on this relationship, a lower threshold for technology uptake, below which no change in cost allowances is associated with outturn uptake, may be appropriate. It may also be necessary to have an upper threshold beyond which the linear cost allowance driver no longer holds, and beyond which a separate review of on-going costs may be necessary. This would correspond to a scenario in which take up was well above levels currently expected, and is unlikely.

10. The further estimates that network companies would need to provide in order to implement the proposed mechanism, in addition to the pounds per MW allowance drivers, are illustrated by the two tables below.

De-minimis threshold required	G83 generation / domestic load	Non-G83 LV / non-domestic LV load	HV	EHV
PV	✓	✓	✓	Outside normal scope
Wind	✓	✓	✓	✓
Biomass	✓	✓	✓	✓
Heat Pumps	✓	✓	✓	Outside normal scope
Electric Vehicles	✓	✓	✓	Outside normal scope

Upper threshold required	G83 generation / domestic load	Non-G83 LV / non-domestic LV load	HV	EHV
PV	✓	✓	✓	Outside normal scope
Wind	✓	✓	✓	✓
Biomass	✓	✓	✓	✓
Heat Pumps	✓	✓	✓	Outside normal scope
Electric Vehicles	✓	✓	✓	Outside normal scope

11. The de-minimis threshold should be at the discretion of the network company based on its evaluation of its own network and business plan. This de-minimis

threshold should probably also be based on the company undertaking the 'least cost' baseline of expenditure i.e. the plan the company would submit if no low carbon technology uptake was going to happen. The allowance drivers themselves would cater for investment ahead of need, by providing funding once the low carbon technologies were connected.

12. The upper threshold could either be guided by Ofgem or left to the discretion of network companies. If Ofgem chose to provide guidance, it could for instance suggest that the network companies should all base the upper threshold on their translation of a particular national uptake scenario to their own areas. If it was set solely by network companies, then if a company chose an upper threshold that did not cover the range of plausible outcomes for low carbon technology uptake during the RIIO-ED1 period, an alternative approach would be needed in its plan to demonstrate how the uptake of low carbon technologies could credibly be handled. In both cases, the possibility of the upper threshold being breached could be addressed by a specific re-opener, or alternatively handled through the mid period review given there would have been a significant change in requirements associated with connecting low carbon technologies during the RIIO-ED1 period.

Caps and collars on out-turn cost out-performance

13. This approach is aimed at providing funding for the capacity required to handle increased demand and generation load on the network, regardless of whether this is undertaken via traditional reinforcement of more innovative solutions.

14. Since actual cost allowances will be established based on actual uptake and the basket of pounds per MW allowance drivers, network companies will retain an incentive to choose the lowest cost approach to providing the capacity for that uptake. Specifically, this will result from the efficiency sharing factor which will be applied to the difference between costs and allowances.

15. However, it is possible that the actual costs could ultimately be significantly above or below the allowances. Beyond a certain level of out- or under-performance, this may be considered inappropriate, both in terms of potential requirement for

customers to pay for expenditure that has not been necessary, and in terms of the risk exposure to companies of costs significantly exceeding allowances.

16. Caps and collars could therefore be applied on the level of out-turn cost out-performance that network companies can experience under the full efficiency sharing factor. Beyond these caps and collars, a reduced or zero cost efficiency incentive rate could be applied.

17. In order to measure cost out-performance for the purpose of these caps and collars, the obvious starting point would be reinforcement expenditure relative to:

    - the ex-ante reinforcement allowance for baseline business as usual investment; plus
    - the additional allowance driven by the low carbon technology uncertainty mechanism.

    Since reinforcement expenditure is already tracked under the current price control settlement, this should not be challenging.

18. However, many other types of expenditure may also ultimately be capable of providing capacity for low carbon technology uptake during the RIIO-ED1 period, and this should not be discouraged. This might include the implementation of smart technologies, any associated new control room and communications equipment, or funding of demand side management initiatives. Therefore, if the cap or collar threshold is breached, or potentially even likely to be breached, it should be possible for the relevant network company or Ofgem to trigger a re-opener which involves a full assessment of all relevant expenditure, to assess the implications for how the price control progresses for the remainder of the period. For example:

    - It might be perfectly reasonable that the collar on out-performance has been hit due to a company choosing to invest ahead of need, in which case marginal incentives should remain in place.
    - Equally, if the cap is hit because new innovative technologies have significantly reduced costs, a re-calibrated set of costs per MW for the rest of the period might be needed.

These reviews could also further encourage deployment of innovative technologies, by making sure higher (but still reasonable) returns on these new technologies are allowed, to take into account the higher risks companies are taking by using them.