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OPTIONS FOR MODELS TO DELIVER LOCAL SUPPLY

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Section 1. Introduction

The subject of local supply of electricity has been investigated by several players in the sector. The reasons for the high level of interest varies, partly it is driven by the pressure on the existing electricity network to cope with renewable generation and increase in demand. It is of course also driven by the fact that the 6-7 years of FiT and other incentive payments have come to an end.

This paper considers the initiatives already under way which address the various challenges faced by the electricity network. Specifically it attempts to define a model for local supply of electricity which addresses many of the key challenges.

Several models have already been described and evaluated:

- https://www.regensw.co.uk/local-supply-3rd-edition
- https://www.westernpower.co.uk/docs/.../Other/Location-signals-report-18-12-17.aspx

Many of the challenges are defined in WPD's forward looking plans:

- https://www.westernpower.co.uk/About-us/Our-Business/Our-network/Strategic-network-investment/DSO-Strategy.aspx

Other references related to technical & regulatory matters:

- https://www.westernpower.co.uk/Innovation/Projects/Current-Projects/The-Smart-Energy-Isles.aspx
- https://www.westernpower.co.uk/docs/Innovation/Other/VPW-Appendix-D-v2.aspx
- http://www.legislation.gov.uk/uksi/2001/3270/schedule/4/made
- https://www.gov.uk/government/statistics/digest-of-uk-energy-statistics-dukes-2017-main-report

The document first establishes a number of assumptions which are sometimes overlooked. It then provides some observations on the existing models referenced above before describing the general and finally specify elements of a model.

There are two objectives for publishing this paper. The first is to explore whether the current proposed solutions/models, to deliver additional Low-Carbon energy through the electricity network, are adequate. the second is to propose a realistic model for small local electricity supply solutions that TECs could use to enable future projects.

Several abbreviation are used, most are expanded within the text on first appearance, others are:

DNO/DSO: Distribution Network/System Operator, Western Power Distribution (WPD) in our region

PPA: Power Purchase Agreement

Section 2. Assumptions

Establishing a common baseline for the 'de-carbonising' challenges we face is essential in agreeing a common objective. The following is a list of these:

- The overall purpose is to decarbonise to meet international obligations.
- The current transmission network has an upper capacity to deliver ~ 60 GW. Theoretically this equates to delivering ~530 TWh of energy p.a. if the network was operated at 100% of its capacity all year round. Currently the network delivers ~ 270 TWh p.a., ranging from a peak of ~50 GW in the winter to a low of ~20 GW in the summer with daily variations throughout. Realistically, and in practice, this 'spare' capacity to deliver more energy through Demand Side Response (DSR) and half hourly settlement tariffs would be significantly lower. Possibly as little as 50-100 TWh.
- One electrical vehicle (EV) per household (~40 million) would require a doubling of the residential energy delivered by the network (~140 TWh p.a.).
- Including a significant proportion of heat (currently ~510 TWh p.a.) and transport energy (currently ~700 TWh p.a.) to a decarbonised electricity network would require a significant increase in energy delivered. If half of UK's energy consumption (currently ~1,640 TWh p.a.) were to be electrified, the theoretical network capacity would need to be close to 100 GW on 100% utilisation, realistically 200 GW on 50% utilisation.
- It is unrealistic to expect the network could be reconfigured and reinforced to deliver the required levels of additional renewable energy within 5 - 15 years, especially if most of this were to be generated in large locations connected to the transmission network. Only by a combination of aggressive energy saving and increased local matching of demand and supply can the electricity decarbonisation objectives start to be realistically addressed.

Section 3. Observations

These are based on the models referenced in the introduction as well as more general observations:

- The current models do not focus on, or aim to achieve, realistic decarbonisation requirements. The priority appears to focus primarily either on extracting marginal financial benefit from the electricity market or avoidance of network re-enforcement costs.
- There is insufficient incentive or consideration given to co-locating and matching energy generation and consumption.
- There is too much focus on large, industrial scale, generation. The FiT incentive scheme, although flawed, has resulted in over 5.4 GW of smaller, mostly behind the meter, installations. This is not insignificant when compared to the ~20 GW of wind or the ~ 0.4 GW of the larger industrial FiT supported capacity. See Ofgem published data for FiT capacity in appendix A.
- The impact of behind the meter renewable installations are not always included when electricity distribution/consumption figures are calculated. This is unsurprising as their monitoring is at best geographic, not in relation to the electricity network.

Section 4. Solutions (General Points)

The following are some of the general characteristics of a solution which can meet the challenges we face:

- Must ensure every key player in the market wins, or at least does not lose.
- Needs to be economically viable and sustainable, so must be self funded by, and self motivating for, participants.
- Must deliver a substantial local matching of new demand without the need to redesign or re-enforce the existing network.
- Should encourage key outcomes, namely lower energy consumption and more low carbon generation. Coupled with minimal waste, cost and effort.
- Price controls as in Time of Use Tariff (**ToUT**), although important, should not be the central driver. It is difficult to control these to achieve long term beneficial outcomes. If price signals are too strong, consumption peaks will simply shift to other times rather than be spread. Equally if too little differentiation is offered, few will be motivated to shift their consumption behaviour. There is much evidence to suggest that monetary mechanisms alone do not result in long term behavioural change.
- Demand Side Response mechanisms (**DSR**), although important, should not be a central mechanism of control. Current thinking around this is driven by the expected rise in EV demand, which of course lends itself to DSR mechanisms. DSR, however, is not realistically appropriate for most other demand, in particular if efficient heating demand is to be delivered.

Section 5. Key Participants, Motivations and Drivers

It is useful to understand these when considering a solution and when making a case for changes to each of the these participants.

5.1 Government (via Ofgem)

- Meet decarbonisation obligations
- Fair distribution of available energy and any associated benefits (e.g. price) when using the public network.
- Minimal, if any, financial burden on government (i.e. through taxation or change in expenditure priorities).
- Maintaining the viability, safety and functionality of the network.

5.2 DNO/DSO

- Meet power/energy demands at minimal cost.
- Better manage network unpredictability in generation/consumption.
- Continue to meet regulatory requirements.
- Remain profitable.

5.3 Customers

- Lower energy prices, or lower price increases (i.e. roughly in-line with inflation).
- No or little change in behaviour and a reduction in effort/complexity.
- The un-quantified fear of the 'lights going out'.

5.4 Suppliers (Utilities)

- Increase or maintain profits, reduced costs, fees and taxes.

5.5 Community & Local Energy Groups

- Local benefit, not-for-'too much'-profit

Section 6. Solutions (Specifics)

The specific model for local supply described here shares many of the elements described in Virtual Private Wire, Peer-to-Peer Trading and Local Generation Tariffs models described in the references. This proposed model attempts to overcome some of the challenges attributed to the these models, as well as meeting all the criteria listed for a general solution.

Initially the model is likely to be limited to areas of new demand driven by either normal electricity growth (e.g. new housing/industrial sites) or decarbonising other energy demand (e.g. transport or heat). It is not intended to replace existing electricity consumption, consumers remain dependent on the grid for this supply and should pay for that facility in accordance with Ofgem regulation.

Opportunities to trial this model would best be carried out on industrial sites or new development where medium sized (100-500kWpk) solar PV rooftop installation can be installed at under £700 per KWpk and have an energy output of at least 900 kWh p.a./installed kWpk. Given the current Ofgem Charging Review is unlikely to complete in the short to medium-term, an existing 'friendly' licensed supplier will be necessary to buy/sell the energy.

There are a number of ongoing trials which required Ofgem derogation to allow a limited degree of public network usage without incurring full network charging, supply license costs and social/environmental charges. These together with Ofgem's decisions on Network Charging will be the indicators of how this model can best be implemented in the longer term. A degree of cooperation with the DNO (in terms of control/management and cost avoidance) and smart meter data aggregator (for ToUT), will also be necessary especially if small Community Energy or Local Supply organisation become a regulatory option.

- The specific model would target areas of high current/future demand and insufficient local generation or grid connection to meet new demand. Ideally this should be identified through HH energy flows at substation level (400, 11K & 33K V). A trial is not dependent on such accurate real-time monitoring as other sources can provide a reasonable estimate.
- One or more rooftop PV installations are connected direct to the grid (i.e. in front of the meter). This allows for longer pay-back periods, at least 25 years, as it no longer depends on a PPA agreement with a single consumer (as is currently the case for behind the meter model).
- Agree terms with a licensed supplier to sell the newly generated energy to everyone supplied within the designated substation at a reduced price (currently a target of not more than 10p per unit). The licensed supplier obtains most of the financial value from the sale of 'network' electricity.
- Consumers where the generation site is located could be given the option to purchase up to at least 50% of the reduced unit charge rather than pay roof rental. Other consumers would receive the benefit from the remaining energy not already sold, this could be shared equally based on a pro-rata or ToUT. The terms need to be set to encourage consumers to want new installation on their premises if they meet the required criteria and offer sufficient unit price deductions to all consumers within the substation area.

- Terms to sell the energy to the licensed operator would need to be agreed (a target of no less than 8p per unit, at current prices). This is realistic for a trial, but may be too challenging longer term without reduced regulatory charges (currently ~5.5p per unit). The cost of network re-enforcement for additional demand could also offer an ongoing incentive for consumers who want to maintain a lower cost (or carbon!) energy.
- Commercial agreements between consumer, licensed supplier and TECs should be based on 5 year or more PPAs. This includes an annual review of charges in line with TECs' open book and equitable sharing of risks and benefits.
- Although not essential for an initial trial, giving the DNO full control over local generation at the substation point (for export) could form a source of income and an incentive for the DNO. This would of course require derogation of existing exemptions or longer term charging/regulatory changes.
- Longer term, automation of HH settlement for consumption, aggregation, balancing, etc. will become more widespread, further reducing operational costs. This is particularly true for smaller, more nimble operators.
- Financial modelling at current prices/charges/costs suggests that this model is viable within the parameters set out above. This model allows raising of local funds which pay members/investors a modest inflation linked return after costs. Risks are minimised because consumption is shared amongst several consumers over a longer period than is currently the case with existing models. The model also encourages communities to work together to meet decarbonising objectives and offer a greater degree of control of their energy prices and availability.

Section 7. Appendix A

Figure 3.2: Total capacity by installation type