CONSULTATION ON DISTRIBUTION FUTURE ENERGY SCENARIOS

A COMMON WEAL RESPONSE TO SCOTTISH POWER

INTRODUCTION

Common Weal welcomes the opportunity to contribute to Scottish Power's DFES questionnaire. We believe the security of energy supply and the decarbonisation of the economy to be amongst the most important tasks facing the Scottish and UK Government and indeed the world.

We believe that there is no going back to the world before Covid-19 and that many changes we have seen in behaviour including in energy consumption will be lasting. We have set out some of the ways we see these changes affecting DFES in our answers below.

1. In your view which of the overall scenario forecasts will electric vehicles most closely follow (Figure 8)? What is your reasoning?

All the scenarios place the number of "battery" electric cars in SP's network at between 1.6M and 1.8M in 2050. This compares to the total number of cars across Scotland in 2017 of around 2.5M and hence assumes that almost all cars within the SP Scottish area will be replaced like for like with a new "battery" electric model by 2050.

We believe the total number of "battery" electric vehicles will be much lower in 2050 due to:

a) less travel due to home working and increased home delivery and/or local shopping. This has been seen under Coronavirus (*https://www.jojusolar.co.uk/2020/05/15/how-has-behaviour-changed-under-covid-19-lockdown/*). However, this virus has been a tipping point for a more widespread technological change which has been with us for some time, fast internet which is leading to a lasting change in behaviour e.g. increased capacity to work from home for many families allied to a realisation amongst many firms that not all workers need to work from the office.

b) technological change expected within 5 years, including widespread use of semi autonomous and by 2030 autonomous vehicles

c) shared vehicles possibly between shifts of co-workers

d) increased reliance on and willingness to use on demand delivery reducing the need for travel to large supermarkets

e) increasing adoption of hydrogen fuel cell vehicles for cars and taxis particularly outside cities. This will become more feasible once refuelling stations are established for HGVs across the country and become an cheaper option as they do not require recharging points. They do however, require around 25% more electrical energy than "battery" electric due to the electrolysis load required for hydrogen production.

We therefore predict a total number of "battery" electric vehicles more like 1.2M which may be used more frequently and hence will require to be charged for greater times. This alongside the use of hydrogen fuel cell cars will likely increase the overall electricity demand although not necessarily at peak times.

The prediction for 2030 is likely to be towards the lower end if not below the 95,000 lower end of the graph due to:

a) Coronavirus long term effects on household budgets leading to reluctance to spend on major outlays

b) uncertainty about the "best" technology

c) rapidly changing technologies including autonomous or semi-autonomous vehicles and greater availability of hydrogen fuel cell vehicles after 2025. Statements by manufacturer, Ballard Power, and industry body, The Hydrogen Council, indicate that this increased availability is likely to follow from a dramatic reduction in fuel cell production costs. As hydrogen is likely to be produced at bulk facilities we do not believe that transport decarbonisation will map directly to increased local load.

2. Consider the Local Authority you represent, reside or operate in. Do your own expectations for battery electric vehicle uptake by 2030 and 2050 sit within our low to high forecast range (Figure 11)? What are your expectations for electric vehicle uptake in your Local Authority by these dates?

Glasgow seems to be discouraging travel to the city centre at least by private vehicles as is Edinburgh (*https://www.edinburgh.gov.uk/news/article/12714/all-aboard-for-2030-a-greener-healthier-better-connected-capital*).

There will also be limited parking and recharging points at least in the city centres and outside tenements. Bike use, cargo-bikes, e-bikes, micro-EVs, run-commuting, walking, public transport and low emission taxis will reduce car travel and car ownership along with the technological changes listed above.

3. For electric vehicles, flexibility can be delivered by smart charging and vehicle to grid. Do you believe we have correctly captured the potential of electric vehicle flexibility (Figures 9 and 10)?

We note the announcement by Tesla which anticipates significant flexibility in grid peak resources when vehicles exceed 1M (*https://electrek.co/2020/05/19/tesla-bidirectional-charging-ready-game-changing-features/*) . We are uncertain what area this covers however, the potential for reducing peak power seems real.

We anticipate most other manufacturers to add this, vehicle to grid feature, so as to reduce peak demand and potentially reduce the cost of ownership of vehicles. For many essential vehicles we would anticipate the inclusion of an off switch, partly due to increased battery degradation which will curtail the ability of SP to take power from all vehicles even at times of peak demand.

Similarly the smart charging time facility will need to have the facility to be switched off by the owner if the vehicle is required at night and they wish to be fully charged. It is however, true that many owners of "battery" electric vehicles may not use their vehicle every day and be quite happy to use the chance to reduce their

overall outgoings by “arbitraging” charging at the cheapest time and “selling” back the electricity to SP at other times. This however, relies on a flexible charging system for customers which allows them to identify and agree to the cheapest plan which may include “negative” prices for charging at times when otherwise constraint payments may be required.

We believe overall electricity demand from vehicles will be much higher, partly due to hydrogen fuel cells, however, intra-day peak demand will be smoother due to home working. Our expected lower number of “battery” electric vehicles particularly in homes will reduce the potential for smart charging and vehicle to grid. This will increase the need for grid resilience particularly in winter.

Overall we believe the potential effect of decarbonising vehicles is overstated across the scenarios.

4. In your view, which of the overall scenario forecasts will heat pumps most closely follow (Figure 13)? What is your reasoning?

Air sourced heat pumps (ASHPs) in Scotland particularly in winter are unlikely to generate enough heat to ensure a constantly warm environment. Although across the UK it is estimated that supplementary heat for ASHPs will only be required on around 3 days, we believe this to be a significant underestimate in Scotland.

We believe that District Heating Systems (DHS) will provide for most locations a more viable alternative for existing stock. For new build we believe a “Passivhaus” build standard will be adopted which will significantly reduce heat demand. For these reasons we believe ASHPs will be installed towards the lower end of the scenarios if not below the lowest.

Our ‘Carbon-Free, Poverty-Free’ paper (***https://commonweal.scot/policy-library/carbon-free-poverty-free***) reports a levelised capex cost of £72/MWh and a levelised opex cost of £64/MWh for ASHPs for a typical rural, off-gas grid house using 14,080kWh/year of heat.

Whilst this is broadly competitive with most other options for decarbonising the heating of off-gas properties, we are unconvinced that the balance of costs and benefits to householders will be significant enough to drive a rapid uptake of ASHPs compared to other technology options, and more technologically-aware householders may be deterred by the historical over-estimations of the coefficients of performance of ASHPs compared to the results of in-situ studies. However, with some caveats, we are more optimistic as regards the potential take-up of ground source heat pumps (GSHPs).

For those householders who will need to convert away from oil and LPG-fuelled central heating systems without the option of connecting to a DHS, bioLPG offers a cheaper solution (£19/MWh capex and £74/MWh opex) without the need to replace the boiler and radiators.

GSHPs, where site-specific conditions allow and systems are not under-sized, may be more attractive to householders in rural off-gas grid areas with the financial capacity to meet their capex costs and the willingness to undertake the significant intervention needed to install them as part of a ‘whole house’ retrofit, and further potential exists for GSHPs (and water-source heat pumps) where these are incorporated in district heating systems installed in these areas, especially where these include inter-seasonal thermal storage.

In urban areas of Scotland, the potential of GSHPs is severely limited by site-specificity and the need to size systems to meet the heating needs of multiple-property housing (i.e. tenements), although again they have more potential when incorporated in DHSs. Again, ASHPs do not offer significant enough benefits over other technology options for us to predict a rapid and / or substantial uptake, and as a retrofit solution to multiple-property buildings they face the likely barrier of being viewed as aesthetically unappealing by householders, and may be prohibited by local conservation legislation for this reason.

As such, we are of the view that householders in urban areas who are seeking to decarbonise their heating without the option of connecting to a DHS are more likely to opt for alternatives such as green gas solutions (including biomethane and

hydrogen) and converting to electric heating fed by 100% renewable tariffs, supported by low-cost solar thermal and solar photovoltaics, both of which remain significantly under-exploited solutions in urban Scotland.

5. Consider the Local Authority you represent, reside or operate in. Do your own expectations for heat pump uptake by 2030 and 2050 sit within our low to high forecast range (Figure 16)? What are your expectations for heat pump uptake in your Local Authority by these dates?

See above regards urban rural divide.

6. Do you believe we have correctly captured the potential of heat pump flexibility (Figures 14 and 15)?

See our answer to Q4. We believe the flexibility of heat pumps to be overstated for Scotland.

7. In Figure 19, we set out generation forecasts by different technologies for 2030 and 205. Which of these forecasts best represents what the generation split and capacities will be in 2030 and 2050 and why?

From the definitions we believe Community Renewables (CR) represents the closest to how we believe the grid should develop e.g. local district heating schemes, less travel, local generation. However, Two Degrees has some advantages insofar as it involves greater government direction and we do not really differentiate between these two scenarios provided full decarbonisation can be achieved by 2045 at latest.

Despite the reduction in the number of vehicles and potentially more efficient heat, we still believe planning generation should be on the basis of maximising renewable generation and storage. We believe the Community Renewables scenario has the largest generation capacity and particularly storage capacity of all the scenarios and should be the target.

In general we believe that given the length of time to introduce new generation capacity and the urgency to decarbonise, as much generation capacity should be planned as possible and as early as possible as this may become a limiting factor should the government choose to fully decarbonise before 2045 as we believe this is what they should aim for.

As additional generation either from DSOs or public, private or community developers will require government support, probably through CFDs, this will be the subject of our input into National Grids FES, Ofgem and the Scottish Government's policy formulation through consultations.

Despite the expected reduction in overall heat demand due to insulation and more efficient use of DHS by 2040, ***much of current real heat demand is hidden due to widespread fuel poverty. If all households are able to afford the heat they need then electricity demand will rise and we believe this has not been fully taken account of in SPs projections***. We anticipate an increase in electricity demand from currently fuel poor households from the level shown in the models.

We expect a very large rise in electricity demand, due to increased local manufacturing to meet reduced foreign imports of goods and agriculture. In part we expect this to result from the anti-globalisation trends partly begun from the Covid-19 crisis but evident forehand. This is also a welcome addition to a more sustainable Scotland.

We believe replacement of fossil fuel in agriculture and ammonia production has been underestimated possibly due to a reliance in the models on CCS. Electrically generated ammonia and fertiliser will increase the requirement for electricity. The effective management of bio-methane for heat or transport fuel will significantly reduce the need for fossil fuels.

We favour maximising onshore and offshore wind and solar to supply power and using surplus power for electrolysis to supply hydrogen for dispatchable power stations, for use at times of mismatch between demand and output from renewable generation sources. We also support the use of mass storage batteries and additional stored hydro for intraday demand to the maximum feasible extent. We are however aware that during winter, times of low wind and at night

additional generation from stored hydrogen via dispatchable power stations will be essential.

8. In your view which of the scenario forecasts will Solar PV generation most closely follow (Figure 22)? What is your reasoning?

As all scenarios predict a similar increase which we generally agree with we cannot differentiate between them. We do however believe that alongside solar PV and possibly more efficient than it in some areas will be direct solar thermal panels for use in district heating alongside underground heat stores. Furthermore, we are of the view that solar thermal and solar PV, at least as supplementary technologies, have the greatest cost per unit energy potential for tackling fuel poverty, and as they are currently substantially under-exploited in Scotland they represent a path of least resistance for leveraging the transition to a zero-carbon energy economy.

9. In your view which of the scenario forecasts will wind generation most closely follow (Figure 24)? What is your reasoning?

We believe it will follow Consumer Renewables most closely. This best uses the potential for onshore wind and off shore wind and provides the greatest flexibility for storage.

10. In your view which of the scenario forecasts will Storage Capacity most closely follow (Figure 25)? What is your reasoning?

We note that the report states

> "In the next five years there is likely to be more storage growth than all other technologies combined. Our forecasts show that the majority of this growth is due to larger scale stand alone storage rather than the domestic scale storage at individual properties"

Whilst we welcome SPs commitment to ensure that storage will meet demand over the next 5 years and reduce the need for constraint payments over that period we are less certain that their scenarios capture the additional requirements for both storage and generation over the longer time.

We have previously called for the Scottish Government to have a national energy storage strategy as mentioned in our original report on 'The Future of the Energy Storage Industry in Scotland' (*https://commonweal.scot/New%20Common%20Weal/cache/file/EB30DB24-4F8D-4A0F-B87B2DAECC9C6D35.pdf*).

Our summary holds that the Energy Storage Industry could be a major new sector of the Scottish Economy creating jobs, wealth and exports. If Scotland is not to miss out on this opportunity it requires a much more ambitious strategy.

In general, we expect to see storage account for around 25% of generation rising over time if reliance on wind and solar in winter are to be minimised. Much of the growth of this alongside mass storage batteries, any contribution from car to grid, and stored heat, may be in the form of hydrogen produced by electrolysis to power up combined dispatchable gas generation plants, to produce electricity during periods of mismatch between demand and renewable generation output.

In our original Energy Storage paper above we took the view that Scotland could adopt the Norwegian model of Procurement. We now believe the model could be wider and more comprehensive and are seeking discussions with the Scottish Government on this matter. In essence there needs be an ongoing discussion about how best to maximise the considerable opportunities that are now emerging in the market place. How can we secure both trading and training aspects of these ventures and what kind of Government mechanisms can be put in place to deliver sustainable distributed wealth creation particularly in rural economies.

The central issue is therefore one of procurement and its process. The Network Providers mechanisms, including SP's, and the Government mechanisms must ensure that:

— They have complete sight of the data and analysis that comes from a localised, distributed network in all its emerging complexity

— Ensure that the switching on and off of energy stores is controlled by the Network Providers or their agents under an agreed plan

— Make sure that the Network Providers and the Government mechanism have some of the Intellectual Property that results from investments in storage infrastructure

— Commit investors and operators to delivering a local training programme.

Although this may appear outwith the scope of this consultation, we believe it is essential that a clear mechanism for ensuring adequate storage is available is established across Scotland and the UK.

11. Are there any other major issues that we should be planning for the distribution network to accommodate which we have not detailed in this document? Is there any other feedback or comments that you would like to make?

We anticipate an overall reduction in aircraft travel, not least due to lasting Coronavirus fears, however, what aircraft journeys there are must be done on aircraft either running on hydrogen or other non fossil fuel. We believe the apparent reliance on Bio-fuels to be vastly overstated in the CCC Net zero modelling.

We are uncertain whether full account has been taken of the demands for removing fossil fuel from aircraft and shipping and replacing it with carbon neutral fuels produced by electrical means.

We expect a greater and very welcome reliance on holidays within Scotland and also a reduction in goods being imported.

There may be a reliance on CCS within the scenarios. Whilst this will be necessary to remove CO2 from the air, this may be a post 2040 task and should not be seen as essential for Scotland to become carbon free.

All of these factors are likely to increase electricity demand by 2045.

AUTHORS

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