Consultation on ESO Forward Plan
Storelectric Response

Storelectric's view of the ESO Forward Plan is that it has many promising aspects but more worrying ones. This is largely because the report focuses on means and tools such as information provision and reports, not on overall objectives, policies and structures; the failures are in the overall objectives, policies and structures.

Loss of Resilience
These processes are all geared towards rationing existing grid assets, instead of towards developing the grid. If these principles had been in place in the past, the grid would never have been built or developed to this extent. As a result we are rapidly diminishing the resilience of the grids, and their ability to absorb the major changes implicit in the energy transition to a low-carbon society (e.g. widespread uptake of EVs). Instead, we need systems that encourage more grid infrastructure investment to be fully flexible for future developments. While this will yield a number of investments that are not fully utilised, these would be greatly outweighed by the reduced cost of adapting to future grid requirements because such adaptation is done sooner rather than later, before rather than after hitting major and costly constraints.

Earlier and More Proactive Planning
Grid operators should invite approaches from developers at a much earlier stage, i.e. pre-planning and even pre-funding. This is because knowing what and where plans/projects are can help them decide on new lines. As an example, HS2 has no grid connections available to it in Cheshire, so is building a private wire from Cellarhead. We seek to build large-scale storage in Cheshire. If National Grid and the ESO had welcomed and considered our project, they would have realised that a new transmission line is required in Cheshire, to the benefit of all. In the same manner, knowing that there are many projects in the pipeline in a given distribution area can lead to upgrading the grid rather than rationing grid connections. Discussions with developers should start at this much earlier stage, which would enable the grid operator to achieve a better-founded view of the relative certainty of different projects, and could trigger an earlier stage of interactivity which would consequently be cheaper to accommodate at this earlier stage.

Evaluating Storage's Loads
There is also an issue with storage, which is currently considered to consume its nameplate capacity when both charging and discharging. However its charging cycles are usually countercyclical and therefore add to grid capacity rather than consuming it: it was on this basis that the Leighton Buzzard, Eigha and Orkney batteries were designed. Therefore storage should be treated differently from both generation and consumption. There may be conditions put on storage whereby charging is banned during peak consumption times, and similarly discharging during

troughs - or whereby such activities are limited, those limits being set to permit them to continue offering ancillary services.

Balkanisation
In the current system, if National Grid wishes to encourage the solution of a specific challenge with a special contract (whether bilateral or experimental), it has a 56GW peak demand grid from which a single contract is only a small part and therefore not commercially distorting. In the new system of one ESO and 14 DNOs, this Balkanises the grid contracts into 15 different grids each roughly the size of Croatia, i.e. an average 4GW. Therefore any special contract is a large and distorting part of such a small grid. Therefore this Balkanisation will prevent many new and important initiatives from being tried out, just when the challenges facing the grid are at their greatest.

Short Termism, Loss of Energy Security
Your Forward Plan has an object of lowering bills for consumers. However you fail to define a timescale over which the bills will be lowered and are therefore prioritising consumers over the next two years, at immense cost to future consumers.

You contracts are almost exclusively for 2 years or shorter. The cheapest way to deliver a 2-year contract is to patch up a clapped-out and fully amortised plant to keep it running. The same will apply for the following contract, only it will be costlier to patch up, less efficient and more failure prone as it is more worn out. And so it continues with prices, emissions and outages (both planned and unplanned) rising, until it dies of old age without a replacement having been built because there was no contract of sufficient length to amortise it. Over 20 years the total cost to the electricity system is higher than if a 20-year contract had been let, which is most cost-effective to deliver with a new plant.

Apart from a very few projects proposed and largely financed before privatisation, almost no new major investment has occurred in the industry since 1990 other than by special market-distorting special financial instruments such as ROCs, CATOs, OFTOs and CfDs, all of which give 15-year (or longer) contractual certainty. This means that non-energy costs on consumers' bills have risen to over 50% and still rising, and that therefore while electricity wholesale prices are falling, retail prices are rising inexorably. Therefore the consumer loses out.

Meanwhile our grid security of supply becomes largely dependent on imported electricity – on which we cannot depend because all major EU countries (and we've analysed the 6 biggest) have energy transition plans that, sooner or later, depend on imports during times of system stress. Most of these times of system stress (e.g. after sunset on a windless winter evening; the *kalte dunkel Flaute*) occur concurrently in all our neighbours. So if we're all importing, who's exporting? Therefore the interconnectors cannot be relied upon during times of system stress.

Please see the associated 9-page document A 21st Century Electricity System, appended to this consultation response, which offers a solution to this crisis.

Real Market Scenarios

The major reasons behind the problems that are mounting rapidly within the electricity system include:

1. Dependence on statistical tools;
2. Dependence on unproven and unaffordable technologies, e.g. CCS;
3. Dependence on suppliers adhering to unrealistic schedules, e.g. nuclear;
4. Other rash assumptions that don't fully consider their consequences.

The statistical tools such as de-rated capacity, Loss Of Load Expectation (LOLE) and average demand fall down when entire classes of supply / consumption move in synchronicity with each other. For example, all solar stops generating after dark; most or all wind stops generating when the wind drops; a large proportion of vehicles will be charged simultaneously, and when EV penetration is sufficiently high, this is regardless of the roll-out of smart charging; all electric heating is used primarily in the winter during morning and evening peaks.

Supply-side scenarios should include questions such as:

- How will we deliver energy during an entire peak and night, when the sun goes down on a windless winter evening (too long duration for batteries and DSR; can't rely on interconnectors as our neighbours are also in their peak demand periods and probably have little or no wind too)?
- How will we deliver it during the *kalte dunkel Flaute*, which the French and Germans have identified as weather patterns which extend the above evening peak challenge to up to a fortnight at a time, across large swathes of the continent?
- What do we do with the surplus electricity during a summer minimum in demand on windy, sunny days (again, too long for batteries and DSR, and can't use interconnectors because it is usually similar on the continent)?

Demand-side scenarios should consider real human behaviour (e.g. we cook and commute at similar times), real financial flows (e.g. what incentive is there for offices and shopping malls to charge up EVs with solar electricity so that householders can earn from supporting the grid in the evening? What compensation would there be for EV owners in supporting the grid, as each charging cycle reduces the life of their battery?), real policy scenarios (e.g. most new housing and workplace developments are far from public transport) and the real challenges of new technologies (e.g. a shared car has 6 trips to take 3 people to different places, which increases the mileage rather than decreasing it; FES assumes a decrease by over 90%).

CCS is unaffordable and unproven. It's so expensive that Equinor's (ex-Statoil) CCS project needs a €60/tonne carbon price despite having numerous advantages over CCS power stations, including location directly over the reservoir, pipes already laid into the reservoir, high concentrations of CO2 to extract in much cheaper ways, benefits from enhanced oil recovery cross-subsidising its costs. It's so expensive that America has had numerous CCS generation projects, all of which they have

cancelled prior to construction because even they can't afford it. It imposes a 33% fuel consumption increase on the power station. And nobody will underwrite the insurance risk: the White Rose and Peterhead projects were cancelled a fortnight after the EU said that they couldn't, which they had been asked to do by all 6 countries around the North Sea who had said that they couldn't.

Nuclear is expected to deliver all power stations on schedule, despite the fact that Hinckley Point C was originally scheduled to be in service in 1991; the French and Finnish reactors may possibly come online this year, many years late; Toshiba / Westinghouse have pulled out of Moorside nuclear power station….

Other rash assumptions include that by 2040 most vehicles will be electric or hybrid, all new heating is on electric heat pumps, all gas networks will be fed by hydrogen (where their demand is not converted to electricity) which is created by methods that are electricity-intensive, all of which increases the load on the electricity system by well over 4 times while demand is forecast only to increase by 15%.

Another rash assumption is that batteries and DSR can deliver their nameplate capacity of support services, regardless of the fact that need will greatly exceed their durations.

Another rash assumption is that interconnectors are dispatchable despite them only being able to be so (a) with previously un-contracted capacity and (b) if the grids at the other end have surplus energy / demand at the right times – for the latter, see comments on supply-side scenarios, above.

These issues are dealt with more fully in my consultation response to FES, which I would be happy to send on request mhowitt@storelectric.com.

Market Distortions
The only way in which the markets can be said to be delivering a truly technology neutral and optimal outcome is if new technologies and new capital investment are incentivised within the standard market framework. Bringing in different tools and contractual provisions distort the market. Arbitrarily restricting their applications (e.g. no CfDs for storage) distorts it even more. Having the majority of the retail bill consisting of levies and charges to pay for these distortions (because they are correctives to the even greater distortion inherent in the short-termism of current contracts as illustrated by their lack of ability to pay for the industry to invest in its own development) merely shows how distorted the electricity market is – while simultaneously preventing its correction.

Reduced Environmental Damage???
Your refusal to consider the fuel in awarding contracts is actually building major future costs into the system.

The extent of the change in the industry to achieve a zero-carbon 2050, and the long operational life (40+ years) of major capital equipment in the industry, mean that all

new investment should be very low or zero carbon. Otherwise we are building major investments that will have no commercial use well before the ends of their lives (and consequent political pressure to distort the rules and fail on our climate change commitments for the sake of those businesses) while failing to build sufficient major plant to deliver our future zero-carbon requirements.

If, for example, you encourage a gas-fired power station to be built, then it will have a 5-10 year economic life because the 2030 5th Carbon Budget requires no more gas-fired power station emissions by then than in 2010, and this entire allowance will be taken up with currently existing plants. Therefore your encouragement of new plant will be considered legally as an implicit promise of a full productive life for the asset, and the country / National Grid will be liable for hundreds of millions of pounds-worth of compensation. And in the meantime, insufficient dispatchable zero-carbon generation / storage will have been built to supply our future needs.

Benefits for Society as a Whole???
Preparing for the Future???
The above issues (under the headings Loss of Resilience, Short Termism, Market Distortions and Reduced Environmental Damage) are all enormous harms being done to the future society as a whole.

Capacity Market and Balancing Mechanism
The Capacity Market was created to provide back-up to the intermittency of renewable generation. The Balancing Mechanism was created to provide extra energy when needed. Both of these require dispatchability. Both require long durations of 4 hours or more, or additional follow-on suppliers will be needed, with a consequent increase in the capacity that needs to be contracted. Making intermittent generation and short-duration storage able to bid for such contracts destroys their purpose and means that the costs of these two mechanisms will have to rise enormously or be supplemented by another costly new mechanism.

Pathfinder Projects, Network Innovation
The remit for pathfinder projects and network innovation needs to be expanded to include first-of-a-kind (FOAK) commercial plant, otherwise the only innovations that achieve implementation will be cheap, small and virtual (software) ones. This involves providing incentives, whether they be one or more of: payments, contracts of suitable length and comprehensiveness, grid code changes (temporary or permanent) or other means.

Currently the rules prevent any such support being given to storage, on the basis that the operator is not permitted to invest in storage. But if storage can offer the system solutions that the system needs (e.g. inertia, balancing, ancillary services, black start) then a FOAK needs to be incentivised or it will never be built, leading to vastly sub-optimal and more expensive work-arounds in future. The same applies to other technologies that are currently banned from ownership by transmission and/or distribution operators.

- One potential mechanism for doing so would be to undertake such developments under the management of Ofgem, with Ofgem invoicing the NIC/NIA budgets of the operators to reflect the costs of Ofgem-managed innovations.

And currently the rules dictate that the funding organisation gains rights to the intellectual property of the innovation being funded. This is unique in the entire financial services industry and makes it suicidal for many innovators to propose solutions to you. It needs to change.

Reducing Uncertainty for Market Participants
Please see the appended document A 21st Century Electricity System and the above comments on Short Termism and Earlier and More Proactive Planning.