Zenobe Energy Limited
13 Charles II Street
London
SW1Y 4QU

Zenobē Response to National Infrastructure Commission Call for Evidence on The Second National Infrastructure Assessment Baseline Report

Our purpose at Zenobē is twofold. Firstly, we drive the uptake of renewables through the intelligent use of grid-scale battery storage. Secondly, we enable the electrification of bus fleets, facilitating the net zero transition for operators and local governments.

We have answered questions 2, 5, 8, 14, and 16.

- *Question 2: What changes to funding policy help address the Commission's nine challenges and what evidence is there to support this? Your response can cover any number of the Commission's challenges.*

PwC / GIIA research indicates that in order for the UK to achieve a successful energy transition, £400bn of infrastructure investment will be needed over the next ten years.[1] Net zero infrastructure has high capital expenditure costs that cannot be met by the public sector alone. Meeting them will require substantial private capital investment. It is necessary to develop efficient financial structures that can channel burgeoning climate finance to sectors willing to decarbonise, but currently lacking the funds and expertise. Policy and regulation must adapt to ensure that resulting new infrastructure is run in the public interest.

The challenge of meeting net zero creates a need for better coordination between public and private funding. For example, in the EV fleet sector, public funding currently has a 'winner takes all' structure. As a result, projects go forward in a piecemeal manner. We think public funding should be more evenly distributed between applicants, with private funding incentivised to come in alongside. This would help public funds to go further, faster.

- *Question 5: What are the main opportunities in terms of governance, policy, regulation and market mechanisms that may help solve any of the Commission's nine challenges for the Next Assessment? What are the main barriers? Your response can cover any number of the Commission's challenges.*

We believe that the following reforms will be necessary in order to achieve adequate infrastructure development:

- Currently, there is a lack of coordinated action on net zero across government departments. To rectify this, the Government should set up a specific net zero unit to oversee and coordinate decarbonisation and adaptation across all departments.

[1] PwC / GIIA, *Unlocking Capital for Net Zero Infrastructure*, <https://giia.net/new-report-unlocking-capital-for-net-zero-infrastructure/>.

- The Government should update the statutory duties of the regulators to take account of future challenges concerning decarbonisation and adaptation. In particular, we believe that Ofgem should have a duty to deliver net zero by 2050.
- The links between Government and the regulators should be strengthened and streamlined to ensure that infrastructure policy is met with efficient and targeted new regulation. At present, regulators are responding too slowly to Government net zero policies, which results in gaps between policy and regulation. This creates uncertainty, muddying investment signals for net zero infrastructure.
- Government should provide regulators with clear guidance on their duties to protect future consumers, as well as current consumers. A focus on present consumers is preventing the implementation of the regulation necessary to secure, for example, long-term investment in the zero-carbon energy infrastructure needed to hit net zero by 2050, and to decarbonise the electricity system by 2035. This initially requires high rates of capital expenditure, and so results in short-term increases in costs for consumers. In the long term though, it will reduce energy bills, reduce exposure to gas price shocks, and contribute to planetary climate mitigation.

- *Question 8: What are the greatest risks to security of supply in a decarbonised power system that meets government ambition for 2035 and what solutions exist to mitigate these risks?*

We find that the greatest risk to security of supply in a decarbonised GB power system would be a lack of adequate energy storage, or ‘flexibility’, provision. Flexibility is required in the GB energy system in order to:

- Manage constraints (i.e., add to the capacity of the existing transmission and distribution systems, which were not built to deal with intermittent renewable generation located predominantly in low-demand regions).
- Reduce curtailment (i.e., to avoid the need for renewable generators to curtail their power output at times of high generation and low demand. Renewable generation is locating in areas with low demand and limited transmission capability. When generation exceeds a certain threshold, the electricity system operator (ESO) pays generators to curtail their output in order to reduce pressure on the transmission network. Storage can resolve this issue by importing ‘excess’ energy, preventing wastage of renewable energy and reducing costs for the ESO).
- Manage variable weather patterns (even in a decarbonised power system with adequate transmission and distribution infrastructure, there will be a need for energy storage in order to manage periods of low wind and sun, when generation is lacking).
- Manage instability (to achieve system stability, energy systems must match generation with demand. This is easy to achieve in ‘synchronous’ fossil-fuel powered energy systems, in which energy is produced according to a schedule and in response to demand. It is more difficult to achieve in ‘non-synchronous’ renewable energy systems, in which energy generation patterns follow weather patterns. In such systems, generation and demand are often mismatched, which results in frequency and voltage disturbances. Energy storage assets resolve these problems by providing stability services such as fault-current, inertia, and frequency and voltage control).

Deployment of flexibility is not keeping pace with deployment of new intermittent renewable generation. This creates risks related to constraints, curtailment costs, and system instability. There is therefore a need for strong market signals to incentivise investment in energy storage. This can be achieved through regulatory reforms to incentivise the deployment of energy storage where system need is strongest.

Government policy is currently supportive of flexibility, but regulation is not changing fast enough to reflect this support. For example, the transmission charging regime continues to disincentivise the deployment of storage in regions where constraint management, curtailment alleviation, and stability services are most needed. We find that this is symptomatic of a wider pattern whereby regulation is not changing fast enough to enable effective implementation of climate policy.

- Question 14: What are the barriers to and solutions for expanding recycling capacity, both now and in the future to deliver environmental and net zero targets?

EV batteries have a lifetime of seven to eight years for first-life applications. Given the rapid uptake of electric vehicles, there is a substantial risk that without adequate policy and regulation to stimulate battery re-use and recycling, a wave of discarded batteries could overwhelm existing battery repurposing and recycling capacity, posing considerable environmental and social threats.

Enhancing domestic battery repurposing and recycling capacity could also reduce the UK's dependence on volatile and opaque international critical minerals supply chains. In turn, this would reduce demand for new mineral extraction, alleviating the negative environmental and social impacts of the energy transition in mineral-rich countries with inadequate mining regulations.

The UK is currently increasing its battery manufacturing capacity. In light of these developments, the Government should pursue new regulation to embed circular economy considerations into the battery design phase. Batteries are not currently designed with re-use and recycling in mind (for example, many manufacturers use glues rather than screws, which complicates the dismantling process).

Government should consult with industry and other relevant parties on how to ensure that UK-manufactured batteries are compatible with circular economy approaches.

Government should also review current regulations in which batteries are returned to manufacturers at end-of-life. There is considerable scope to develop onshore second-life and recycling industries in the UK. However, current regulation sees batteries returned to manufacturers at end-of-life. If not addressed, this could see a linear flow of batteries passing into and out of the UK, with poor visibility of what happens to batteries once returned to overseas manufacturers. Instead, the UK should take advantage of an opportunity to construct a domestic circular battery economy.

Second-life battery usage is the process of testing, rehousing, and repurposing used batteries. At the end of their first life powering a vehicle, EV batteries retain 70-80% of their original capacity. While unable to power a vehicle, they can at this point fulfil other applications, such as stationary electricity storage. Before being rehoused and reused, batteries must pass tests to screen out internal failures and ensure adequate capacity remains.

In order for a second life battery to be a viable product, it needs to be cheap compared to a first life battery. For the price to be low, the cost of labour in testing and repurposing needs to be low. This requires production at scale, with automation in as much of the process as possible.

Government should therefore pass legislation to make it mandatory to test EV batteries for second-life applications once they complete their first life powering a vehicle. This would send a clear signal to incentivise investment in the UK second-life industry, helping to achieve scale, reduce costs of labour, and drive uptake of automation. In turn, this would stimulate the economy and drive innovation, while reducing carbon emissions and other environmental damages in the battery supply chain.

Using batteries in second life applications has both environmental and economic benefits:

- More CO_2 is saved thanks to a longer lifetime: on average 335 tonnes CO_2 saved per battery lifetime
- Providing power in place of polluting technologies like, for example, diesel generators can save 100 litres of fuel a day
- Fewer batteries need to be manufactured from scratch, saving materials
- By extending the usable life, recycling processes have time to improve, meaning less material loss, particularly if this can be dealt with on a local basis

- *Question 16: What evidence is there of the effectiveness in reducing congestion of different approaches to demand management used in cities around the world, including, but not limited to, congestion charging, and what are the different approaches used to build public consensus for such measures?*

We think that to build consensus, congestion charging must be combined with other measures to improve public transport services including:

- Installation of bus lanes
- Regular, frequent bus services
- Ensuring routes serve the needs of customers
- Effective cross-subsidies for routes that are not commercially viable, to ensure that all communities have access to public transport
- Transferable tickets eligible for use on services run by different operators

Such measures will enable public transport to compete more effectively with private transport. They will accelerate modal shift by demonstrating the benefits of incentivising more sustainable transport use, including through the use of congestion charges.

Fleet electrification complements measures to increase the speed, frequency and ease of use of bus services. Better bus services with clean technologies provide an exciting alternative to cars, improve public mobility, and cut carbon emissions. They result in increased ridership, which is associated with reducing congestion.

Zenobe Energy Limited is a company registered at
13 Charles II Street, London, SW1Y 4QU, Company Number 10436249

For example, in 2017 Shenzhen Bus Group electrified their fleet, and introduced new routes and an on-demand app. Ridership increased by 2.4%.[2]

[2] Berlin, A., Zhang, X., and Chen, Y., (with ESMAP support), ‘Case Study: Electric buses in Shenzhen, China’, extracted from World Bank, Shenzhen Bus Group, UC Davis, China Development Institute, *The Electrification of Public Transport – a Case Study of Shenzhen Bus Group*, <https://iea.blob.core.windows.net/assets/db408b53-276c-47d6-8b05-52e53b1208e1/e-bus-case-study-Shenzhen.pdf>.