THE ROYAL SOCIETY

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Submission to the Commons Environmental Audit Committee inquiry into Community Energy

Key points

- **Digital technologies have a critical and growing part to play in delivering a net zero future.** Digital technology, from smart meters to supercomputers, weather modelling and AI, are being increasingly applied across the economy and, under the right conditions, could help deliver substantial emission reductions across by 2030.
- **Decentralised energy generation will be increasingly important to future energy systems and digital technology will be critical to its success**, enabling new energy business models such as 'distributed energy sales' that underpin community energy systems. Digital tools can also help plan and identify sites for energy generation, which is particularly valuable as existing building stock is very diverse and will require a wide range of interventions.
- **Community energy projects must be designed with the community**. A collaborative effort should involve affected communities in order to develop a shared understanding of the purpose of technologies deployed in the context of net zero and to co-design approaches to navigate the associated dilemmas
- **New approaches will be needed to incorporate community energy projects into smart electricity grids.** Regulators must support and embrace disruptive innovation to deliver this.
- **Action is needed now to ensure that digital technology can contribute to delivering net zero.** The UK government must:
    - Take action now to build digital and net zero skills at all levels. Given the number of years it takes to train and build experience, it is important that focus is given to this now.
    - Ensure a trusted data infrastructure that can support applications that help achieve net zero.

Introduction:

1. The Royal Society is the national academy of science for the UK. Its Fellows include many of the world's most distinguished scientists working across a broad range of disciplines in academia, industry, charities and the public sector. The Society draws on the expertise of the Fellowship to provide independent and authoritative advice to UK, European and international decision makers.

2. This submission draws on the Society's recent report, Digital technology and the planet[1] to highlight the potential of digital technologies to support community energy projects.

What contribution could community energy (through renewable power and/or energy efficiency) make to achieving net-zero by 2050 in the energy sector and its potential role in decarbonising the heat and transport sectors?

3. On the path to net zero 2050, grid decarbonisation will be essential and require greater integration of renewable energy sources. In addition to new national sources of energy such as

[1] Royal Society (2020) *Digital Technology and the Planet* https://royalsociety.org/topics-policy/projects/digital-technology-and-the-planet/ [accessed 19 January 2021]

large offshore windfarms, new local sources of energy are also emerging, and such decentralised energy generation will be increasingly important to future energy systems.[2]

4. Digital technology will be a critical enabler of decentralised energy generation. For example, homes equipped with smart meters and fitted with clean energy sources, as well as newly developed energy storage, can plug into the grid and supply energy into distributed energy networks. Whilst plugged into the grid to charge, drawing from the grid, electric vehicles also store energy. Vehicle-to-grid discharging can, in turn, help balance the grid.
5. 'Distributed energy sales' within a district would enable individual houses to buy and sell energy to each other, for example using smart contracts and negotiated tariffs. New intermediate companies have started to enter the market to mediate this energy trading. Distributed energy sales would potentially encourage the uptake of renewable energy generation and storage, and contribute to the decarbonisation of the grid.
6. However, several challenges exist in implementing distributed energy sales. One challenge here is technical, integrating district energy generation with local network supply, and will require further research and innovation. Also, frameworks for managing information generated and used by technology for the planet will need coordinated implementation at industry-level, otherwise individuals will end up with multiple systems to manage and potentially conflicting software – eg solar panels that will not connect with a smart home system.
7. A major challenge for both 'distributed energy sales' and 'energy as a service' lies in making the cost of change worth the investment, and in balancing the costs between energy suppliers and households. Not all UK households may be able to afford home energy improvements, despite Government's Green Home Grants scheme. For energy suppliers to be ready to bear the initial cost of the necessary equipment and home upgrades, they would likely want reassurance that users would stay long enough with them to make their investment worthwhile. This is very different from the current situation in the UK, where consumers switch energy suppliers every few years or so, in order to get better tariffs.
8. A market is starting to develop, however, for corporate clients to take up new energy business models. Centrica Business Solutions offers an Energy as a Service bundle, including the design, installation and financing of on-site power generation. The supplier recovers the cost of the technology thanks to the energy savings realised through the length of the contract.

How well are the financial and technical needs of setting up and running community energy projects met by existing Government support mechanisms? What changes would be needed to the access or nature of support to develop community energy further?

9. As set out above, utilising data and digital technologies will be key to enabling 'distributed energy sales' and other community energy projects. A focus on skills is essential to enable everyone to take part and accelerate a data-enabled net zero transition. Given the number of years it takes to train and build experience, it is important that focus is given to this now.
10. Action is needed to build digital and net zero skills at all levels – from basic literacy to advanced data analysis skills, and from an appreciation of efficiency to an in-depth understanding of carbon externalities. Re-tooling the workforce in this way will require a coordinated approach to nurturing data science and net zero skills across the country.
    - The National Data Strategy, developed by DCMS, should prioritise action to equip the UK with the skills to drive a data-enabled net zero revolution, and DCMS could prioritise the use of data for net zero within the National Data Strategy missions.
    - BEIS' and the Ministry for Housing, Communities and Local Government's (MHCLG) joint Cities and Local Growth policy team should prioritise skills for a data-enabled net zero economy at the local level, providing annual reports on progress in increasing digital skills in local communities. Local Enterprise Partnerships should push digital skills in the local economy, for example by auditing whether universities and local

[2] National Grid ESO 2020 Future Energy Scenarios (see https://www.nationalgrideso.com/future-energy/future-energy-scenarios, accessed 14 October 2020)

employers are collaborating to identify and meet local digital skills and net zero skills needs.
    - To support the development of a data-enabled net zero economy across the country, research institutes, the Energy Systems Catapult and Digital Catapult, learned societies and charities should provide information resources and toolkits to support local energy and environmental initiatives led by volunteers or social enterprises. There is also a role for training providers to develop agile and nimble opportunities for individuals to reskill and upskill as the nature of their job changes due to digitalisation.
11. Government has an important part to play in ensuring a trusted data infrastructure supports applications that help achieve net zero. There should be governance arrangements in place that enable the safe and rapid use of data to support the achievement of the net zero target:
    - To ensure the transition towards a low-carbon economy harnesses the potential of data and digital technology, there needs to be coordination between initiatives happening across government, regulators, industry and the third sector. To this end, the UK Government should be informed by a cross-departmental and cross-sector taskforce devoted to the digitalisation of the net zero transition and ensuring these initiatives are connected and amplified. It should identify immediate policy interventions and develop a roadmap for the digitalisation of the net zero transition, setting out priority use cases for existing data, actions to increase data access and use, and priorities regarding new data collection and analyses. It should ensure that data that can help achieve net zero follow the FAIR principles (Findable, Accessible, Interoperable, Reusable).
    - Data that can help achieve net zero should be made accessible through appropriate arrangements. Wherever possible it should be made open, while adequately addressing social and ethical dilemmas in data use. Where data cannot be made fully open, appropriate and robust frameworks should be in place, such as data access agreements or data trusts. In the case of datasets containing sensitive data, data might be made more shareable through privacy-preserving approaches including anonymisation, synthetic data generation and other approaches. For example, smart meter data should be made open after applying differential privacy or equivalent approaches to prevent the identification of any single household.
    - Through low-carbon, outcome-focused procurement and through sponsoring pathfinder studies, Government can lead the way in driving development and adoption of digital technologies for net zero, modelling their use for others and engaging regulatory bodies in identifying the data sharing agreements and other frameworks needed to support such applications.
12. Community energy projects must be designed with the community. A collaborative effort should involve affected communities in order to develop a shared understanding of the purpose of technologies deployed in the context of net zero and to co-design approaches to navigate the associated dilemmas. This requires careful design of the interface between people and technology, and consideration of the societal impact of such technologies. Participatory design should play a central role in shaping and delivering digital solutions to the net zero challenge.[3]

What role should Ofgem play in supporting community energy and resolving regulatory issues, such as decentralisation and incorporating community energy projects into smart electricity grids?

13. Challenges such as incorporating community energy projects into smart electricity grids will require allowing disruptive innovation to come to market.
14. Regulators should provide frameworks to help business innovating in the space of digital applications for net zero, acknowledging the need for a step change in innovation to adapt to the net zero agenda and enable the green recovery. This can be based on adaptive regulations

[3] Work by the British Academy drawn from international case studies of community energy projects may be of interest here: Community Energy Generation | The British Academy

and regulatory sandboxes that provide space for experimentation. For example, Ofgem announced an expansion of its regulatory sandbox service to support innovative services and business models contributing to the decarbonisation of energy.[4] Under this service, rules can be relaxed for innovative trials, such as rules around the connection, and use of, the electricity distribution networks.

What role can local authorities play in developing community energy, for example in planning, decision making and the availability of sites for energy generation?

15. Collaborations with research projects and involvement in pilots can be highly beneficial to local authorities, and for example yield digital tools that can help planning and identifying sites for energy generation.
16. For example, London is trialling a 'solar map' that shows residents or business owners how much solar energy could be generated at their premises. https://maps.london.gov.uk/lsom/
17. The existing building stock is very diverse and will require a wide range of interventions. The Greater London Authority, in collaboration with a research team at UCL, has started using a 'digital twin' to monitor, simulate and analyse the whole city's building stock.[5] Such a simulation of the built stock can help local authorities plan their net zero transition, help occupants decide what improvements are most valuable for their property and check the impact of such interventions.[6]

What are exemplars of successful community energy systems from across the UK's urban and rural communities; what makes them so successful?

18. Aberdeen Heat and Power is an example of a successful local district heating not-for-profit company,[7] which contributed to the creation of local jobs as well as sustainable heating.
19. Lessons from this success might be transferable to the implementation of distributed energy sales and other data-enabled community energy projects. This can also contribute to the creation of local jobs.

For further information, please contact Becky.purvis@royalsociety.org

[4] Ofgem 2020 Decarbonisation programme action plan (see https://www.ofgem.gov.uk/system/files/docs/2020/02/ofg1190_decarbonisation_action_plan_revised.pdf , accessed 16 October 2020)

[5] Steadman P et al. 2020. Building stock energy modelling in the UK: the 3DStock method and the London Building Stock Model. Buildings and Cities, 1(1), 100–119. (see https://journal-buildingscities.org/articles/10.5334/bc.52/, accessed 14 October 2020)

[6] Tadj Oreszczyn. 2020. Decarbonising the built stock - a digital twin of London and smart meters. Royal Society Transforming our Futures conference, *Digital technologies and the planet: Towards net zero*. (see https://www.youtube.com/watch?v=rDPefVF43iY&list=PLg7f-TkW11iXUQ0L_vUo3W6m2qmsH005I&index=12, accessed 10 March 2021)

[7] https://www.aberdeenheatandpower.co.uk/about/