Question and answer form

When responding, please provide answers that are as specific and evidence-based as possible, providing data and references to the extent possible.

Please limit your answers to 400 words per question and provide supporting evidence (e.g. academic literature, market assessments, policy reports, etc.) along with your responses.

Please find below the response from techUK.

techUK is the business organisation for companies operating in the digital economy. We have over 850 members and numerous working groups focused on climate policy and action, smart mobility, smart energy and utilities and connected homes.

We have answered the questions where we have existing expertise and would welcome any follow-up questions that you may have.

The path to the 2050 target

Question 5: How big a role can consumer, individual or household behaviour play in delivering emissions reductions? How can this be credibly assessed and incentivised?
New insights from behavioural science set out a compelling case for evidence-based approaches to motivating behaviours. The traditional mix of information, rules and regulation and market incentives will not be enough to deliver the behaviour change needed. Work by Rare has attempted to quantify the role behaviour change can play in delivering emissions reductions[1]. Digital technologies have a key role in this space: **Automation**: Digital technologies can mean that we can circumvent the need to nudge behaviour changes through automation – effectively applying a default setting. There is evidence that setting the desired behaviour as default significantly increases adoption of that behaviour[2]. For example, current trends indicate that most homeowners who have thermostats do not apply settings for optimal energy use. Further, the amount of operational energy used by a building can be reduced by automatically adjusting temperature, ventilation and lighting in accordance with how a building is used. This could be as simple as movement sensors, but newer network-connected sensors and

[1] Rare, Centre for Behaviour and the Environment, 2018, *Climate Change Needs Behaviour Change: Making the Case for Behavioural Solutions to Reduce Global Warming* https://rare.org/wp-content/uploads/2019/02/2018-CCNBC-Report.pdf

[2] Centre for Research on Environmental Decisions, 2009. *The psychology of climate change communication: A guide for scientists, journalists, educators, political aides, and the interested public*. New York.

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artificial intelligence systems can "learn" the use patterns of a building and anticipate change in advance. These technologies present an opportunity to deliver 15% reductions in building energy use.

Engaging via VR/AR: Climate impacts can frequently feel detached from individual actions. The Virtual Human Interactive Lab at Stanford University is using virtual reality to give users a simulation of how carbon emissions are directly causing ocean acidification[3]. A Stanford study showed that the simulation can cause a greater sense of empathy than a video-only experience because of embodied cognition, or how the body's actions affect the mind[4]. Immersive experiences appeal directly to human emotion by giving people a much deeper and embodied understanding of the effects of climate change, and these experiences can lead to lasting change to both perception and behaviour[5].

Social norming: Social incentives and norms can be a powerful motivator for behaviour. Data visualisation and insights into the behaviour of others can provide a yardstick for individuals to assess the appropriateness of their own behaviour. These approaches have been shown to be nudge individual's energy[6,7,8] and water management[9]. Businesses are increasingly using these tools, combined with gamification, to encourage behaviour change of employees which also have the benefit of quantifying impact (for example Sky 2020).

Question 6: What are the most important uncertainties that policy needs to take into account in thinking about achieving Net Zero? How can government develop a strategy that helps to retain robustness to those uncertainties, for example low-regrets options and approaches that maintain optionality?

Some of the most significant uncertainties that remain include:

- Extent to which policy mechanisms should be directed at consumers Vs. businesses to have the most impact.
- The longevity of government strategies in the transition.

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[3] Jordan, R., 2016. *Stanford researchers release virtual reality simulation that transports users to ocean of the future*, Stanf. Woods Inst. Environ. https://news.stanford.edu/2016/10/18/virtual-reality-simulation-transports-users-ocean-future (accessed 29.01.20).

[4] Ahn, S.J., Bostick, J., Ogle, E., Nowak, K.L., McGillicuddy, K.T. and Bailenson, J.N., 2016. *Experiencing nature: Embodying animals in immersive virtual environments increases inclusion of nature in self and involvement with nature.* Journal of Computer-Mediated Communication, 21(6), pp.399-419.

[5] https://rare.org/wp-content/uploads/2019/02/2018-CCNBC-Report.pdf

[6] Rasul, I., Hollywood, D., 2012. *Behavior change and energy use: is a 'nudge' enough?* Carbon Manag., 3, pp. 349–351. https://doi.org/10.4155/cmt. 12.32 Center for Esearch on enviro decisions

[7] Miller, D.T., Prentice, D.A., 2016. *Changing norms to change behavior*. Annu. Rev. Psychol. 67, pp.339–361. https://doi.org/10.1146/annurev-psych-010814-015013 and

[8] Cialdini, R. B., and N. J. Goldstein. 2004. *Social Influence: Compliance and Conformity*. Annual Review Psychology 55:591–621.

[9] Schultz, P.W., Messina, A., Tronu, G., Limas, E.F., Gupta, R., Estrada, M., 2016. *Personalized normative feedback and the moderating role of personal norms: A field experiment to reduce residential water consumption. Environment and Behavior*, 48(5), pp.686-710.

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- The impact of the financial industries' shift away from fossil fuel investments
- The risk of creating a "green rush" with investment incentives without having first identified the overall framework for things like the energy transition.

Policy stability and certainty is essential whist being flexible enough to allow for future innovation.

To ensure we adopt robust strategies Government should:

1. Analyse the range of choices for how households, businesses and the taxpayer could contribute towards different elements of the transition to net zero.
2. Identify mechanisms to create an equitable balance of contributions
3. Maximise opportunities for economic growth as we transition to a green economy
4. Evaluate the trade-offs between cost, competitiveness, effects on consumers and impacts on the taxpayer.
5. Strive for policy stability whilst developing a regulatory framework is adaptable for innovation.

Question 7: The fourth and fifth carbon budgets (covering the periods of 2023-27 and 2028-32 respectively) have been set on the basis of the previous long-term target (at least 80% reduction in GHGs by 2050, relative to 1990 levels). Should the CCC revisit the level of these budgets in light of the net-zero target?

We support a revisit and believe that the rapid advances in digital technologies and the opportunities of the Fourth Industrial Revolution mean we can be more ambitious in decarbonising transport, buildings and industry without entailing excessive costs.

In 2017, the IEA set out the potential for digital to impact on the energy demand associated with transport, buildings and industry[10]. Smart themostats in homes, automated cars and trucks and mobility as a service and building occupancy sensors were some of the digital innovations considered to have the biggest impact on energy demand.

Question 8: What evidence do you have of the co-benefits of acting on climate change compatible with achieving Net Zero by 2050? What do these co-benefits mean for which emissions abatement should be prioritised and why?

techUK has noted the following co-benefits from the use of digital technology to act on climate change:

[10] IEA (2017) *Digitalisation and Energy*

Question 8: What evidence do you have of the co-benefits of acting on climate change compatible with achieving Net Zero by 2050? What do these co-benefits mean for which emissions abatement should be prioritised and why?

Employment: Support for the UK's low-carbon sector- which has the potential to grow 11% per year between 2015 and 2030[11]- is likely to provide new and sustainable avenues for employment. For example climate-oriented investment into advanced sensory networks, enhanced network communication infrastructure and machine learning/ AI solutions can support the development of scalable climate risk and resilience tools, which could ultimately be leveraged by city and local authorities to dynamically adjust policy stances in line with complex shifts in climate dynamics and political appetite, for example through the use of digital twins. The development of these tools in the UK, in line with the roll out of 5G, could also promote the UK's export strength, as demand for such tools is set to increase worldwide and could boost the long-run viability of expansionary fiscal policy.

Productivity: Companies are adopting and trialling 4IR technologies to support energy management and circular economy business models (such as remanufacturing[12]). This in turn can boost productivity and support the delivery of the UK's Industrial Strategy. The Made Smarter Reivew[13] said that Industrial Digital Technologies (IDTs) have a crucial role to play in developing a resource-efficient UK industrial base. The effective adoption of IDTs can help deliver over £10 billion in reduced resource costs (energy, materials and water) adding both to profits and to the nation's balance of payments through less reliance on imports and increased export opportunities.

Social Care and Health: Domestic smart energy technologies can improve the lives of vulnerable people including the elderly, those with health problems, or those on low incomes. For example, combined with temperature and humidity sensors, smart meters can help ensure householders have the information they need to make wise energy choices. Or carers could use this information to check that vulnerable householders are not under-heating their home. In countries like Japan (for example see here) energy use patterns which differ from average use patterns are being used to signal to healthcare/social care/family members when an elderly or vulnerable person might require attention. Using energy systems in this way presents benefits for families and carers, healthcare providers, adult social care services within local authorities.

Asset Value: Support for digital solutions deployed to tackle climate change could increase the quality and asset value (borne out of reduced operating costs for housing providers) of the UK's housing stock. In turn, this could enhance the UK's reputation as a world-class destination for foreign direct investment.

We do not believe that one area of emission reduction should be prioritised above enough. Work must get underway in all areas and the co-benefits simply highlight the additional benefits in doing so.

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[11] https://www.imperial.ac.uk/media/imperial-college/grantham-institute/public/publications/briefing-papers/Co-benefits-of-climate-change-mitigation-in-the-UK.pdf

[12] See EPSRC *Circular 4.0 – using digital intelligence in automotive parts remanufacture to enable a circular economy*. https://connectedeverythingmedia.files.wordpress.com/2019/02/casestudy_circular-4.0.pdf

[13] BEIS (2017) *Made Smarter* https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/655570/20171027_MadeSmarter_FINAL_DIGITAL.pdf

A. Delivering carbon budgets

Question 9: Carbon targets are only credible if they are accompanied by policy action. We set out a range of delivery challenges/priorities for the 2050 net-zero target in our Net Zero advice. What else is important for the period out to 2030/2035?

Quantum Computing: Quantum computing has been identified as an emerging and transformative technology. The UK has a strong global position in the development of novel quantum technologies[14]. For climate, quantum computing lends itself particularly well in identifying chemical catalysts for CO2 storage, better batteries and enhanced climate modelling. We recommend that this is prioritised for research.

Multi-modal transport: Open data on a regional and city level can support the promotion of active travel choices via walking, cycling and public transport via apps and digital platforms. London has been a frontrunner in the UK in this space with the launch of the London Datastore. We'd support more efforts to liberate data across the country on a city and regional basis, underpinned by data protocols to support portability. Inflexibility around ticketing significantly impacts the customer experience. The legacy focus on "the ticket" rather than enabling an end-to-end journey covered by a single payment is stifling progress. Government fare-setting means, it is not possible for providers or ticket resellers to implement a more flexible and dynamic fare pricing system. Indeed, reselling capacity on the rail network is poor. The various regulatory and bureaucratic hurdles mean that becoming a certified ticket reseller is a costly, time-consuming exercise. The Government needs to seek opportunities to introduce radically different pricing structures that will facilitate a multimodal network and the provision of end-to-end journeys[15]. For rail, more work is needed to find an economically viable solution compatible with net zero.

EV deployment: In respect to EV development, techUK would like to highlight the recently published Electric Vehicle Energy Taskforce's report, Energising our Electric Vehicle Transition which sets out delivery priorities for electric vehicle deployment. While we reserve our support for standard setting at this stage, so early in the market's development, we support the remaining recommendations. Further, cars that are purchased new for commercial purposes (e.g. Fleets or PHVs) form the basis for a second-hand market that can facilitate mass adoption. Tax relief for PHV drivers or businesses purchasing EVs would stimulate domestic demand.

Charging infrastructure. While the Government's announcement that all new-build homes must include EV chargers was significant, but this could be widened to other types of new-building projects, especially major employers or destination points (e.g. shopping centre) to allow for increased out of home charging. Ultimately, we need data-driven investment to target infrastructure investments in the highest impact areas. This should cover hydrogen and electric changing.

Buildings: Recently, the IEA set out the potential for digital to impact on the energy demand of transport, buildings and industry. For buildings barriers to adoption were considered to be low, yet the UK market for these technologies remains nascent. Smart thermostats ownership in 2019

[14] Government Office for Science (2016) *The Quantum Age: technological opportunities* https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/564946/gs-16-18-quantum-technologies-report.pdf

[15] techUK (2018) *Future Mobility Services UK*, www.techuk.org/insights/reports/item/14160-future-mobility-services-in-the-uk-report

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stood at 10%, which was the same as 2018[16]. To speed adoption, government and industry must work together to help address security and privacy concerns. Funding initiatives should also be explored to drive innovation in and deployment.

Energy: Ofgem's Decarbonisation Plan[17] outlines a commitment to delivering and unblocking flexibility services. Furthermore, it explores opportunities for a greater experimentation, innovation and further investment in infrastructure. We strongly support this commitment but now need to see an action plan and timeline to deliver it. Energy data also remains fragmented and held in various datasets by different bodies. We would like to see legislation on energy data to ensure data is appropriately open, held centrally and in accordance to the principles proposed by the Energy Data Taskforce. Further, we'd recommend that Ofgem have a statutory duty in respect to decarbonisation. Members have also highlighted a need for new technologies in power generation, such as bifacial panels or PV-thermal collector panels that would require funding support to become financially sustainable for industry adoption and are not currently covered by any government support

Innovation: We need more innovation pilots and "sandbox" approaches to testing new technologies. Further, there's also an urgent need for greater coherence and lesson sharing between 'smart city' initiatives. If not, we may end up with "innovation islands". Encouraging local authorities to engage with the UK's National Digital Twin initiative could be key to driving nation-wide awareness of best practice and emerging capabilities.

Local authorities: Local government has a key role in supporting climate innovation from the promotion of sustainable mobility to supporting local smart grids. We should incentivise local authorities who set and met decarbonisation targets with cash rewards. We outline other measures needed to support LAs in Q10.

Consolidation of distributed IT: We note that there are some very significant energy saving opportunities – probably approaching 2TWh/year – in areas like distributed IT and legacy hardware where the intelligent application of measures to encourage the consolidation of distributed IT and hardware audit could be productive. Consolidation can reduce energy demand by around two thirds, yet in-house activity is still estimated to represent 50-70% of the data centre market. Cloud computing should also be encouraged.

Question 10: How should the Committee take into account targets/ambitions of UK local areas, cities, etc. in its advice on the sixth carbon budget?

Local authorities play a particularly key role in the adoption and deployment of climate solutions and more so given the recent trend of local climate emergency strategies in a growing number of areas.

[16] Unpublished Gfk/techUK figures (2019)
[17] Ofgem (2020) *Ofgem Decarbonisation Programme Action Plan* https://www.ofgem.gov.uk/system/files/docs/2020/02/ofg1190_decarbonisation_action_plan_web.pdf

Question 10: How should the Committee take into account targets/ambitions of UK local areas, cities, etc. in its advice on the sixth carbon budget?

We believe they should be further incentivised through the setting of decarbonisation targets and rewards for those meeting them.

Further, to support local authorities in developing credible strategies and in ensuring they don't become innovation islands the focus should be on:

- **Enhancing coordination between different local authorities**, especially in terms of their procurement strategies and insight sharing mechanisms.

- **Strengthening local government's analytical capacity** through industry engagement and developing climate-related skills/ awareness across local government departments and at senior stakeholder level. There is a role for UK national government to develop best practice frameworks for local communities that provide them with urban planning and civil engineering guidelines that they could not develop on their own.

- **Local climate initiatives should receive longer-term support in efforts to build long-term, sustainable projects, rather than short-term pilot projects**. While technology is often proved in short pilots, the accompanying market isn't.

Question 11: Can impacts on competitiveness, the fiscal balance, fuel poverty and security of supply be managed regardless of the level of a budget, depending on how policy is designed and funded? What are the critical elements of policy design (including funding and delivery) which can help to manage these impacts?

Deployment of digital technologies to develop smart systems is increasing recognised as a key enabler to support cost-effective, and competitive, zero carbon trajectories (National Infrastructure Commission, 2016; Green Alliance, 2019, Energy Vehicle Taskforce, 2020).

For example, Green Alliance have estimated that smart EV integration could save up to £270m pa by 2030 in avoided network upgrades and lower energy peak demand while smart charging can cut bills by an average £300 per year compared to 'dumb' charging. Overall smart charging could save £180m.

However, the infrastructure underpinning the digital economy, particularly electro-intensive data centres, are primarily concerned with security of supply and competitiveness. While in theory it should be possible to manage these impacts, in practice this would require a change in policy and funding:

Stop escalating energy costs: Existing energy policy has increased UK energy costs significantly through the escalation of non-commodity charges. Electro-intensive businesses are placed at competitive disadvantage and business is driven offshore, potentially resulting in carbon leakage. Energy intensive businesses are already strongly motivated to implement efficiency measures and energy taxation regimes that remove the very resource that would be used to fund those measures can be counterproductive. At the same time, the price signal for non-energy intensive businesses is unlikely to be enough to drive behaviour change.

Learn from success: Current schemes like the Climate Change Agreement provide a useful combination of carrot (tax concession) and stick (targets and buy-out obligations) and have been successful in improving energy stewardship and transparency of sector energy consumption (see

Question 11: Can impacts on competitiveness, the fiscal balance, fuel poverty and security of supply be managed regardless of the level of a budget, depending on how policy is designed and funded? What are the critical elements of policy design (including funding and delivery) which can help to manage these impacts?

our three formal CCA reports First Findings, Target 1 and Target 2). However, they are not enough to tackle large, capital intensive, projects with longer ROI. We hope the IETF will assist here.

Funding the transition: Achieving net zero is a national priority and renewable generating capacity is part of our critical national infrastructure. The burden of funding the transition to low carbon generation should not be met by energy users alone. HS2 is not being funded by rail users alone.

Change policy focus from energy consumption to carbon productivity: Most policy measures are focused on energy consumption rather than carbon productivity. Future policy should be oriented to encourage renewable uptake and to drive additional renewable capacity.

Question 12: How can a just transition to Net Zero be delivered that fairly shares the costs and benefits between different income groups, industries and parts of the UK, and protects vulnerable workers and consumers?

techUK is not well placed to provide detailed evidence on this. However, we would like to flag that the deployment of digital technologies to develop smart systems is increasing recognised as a key enabler to support cost-effective, and competitive, zero carbon trajectories (National Infrastructure Commission, 2016; Green Alliance, 2019, Energy Vehicle Taskforce, 2020).

For example, from a systems perspective, smart charging can cut reinforcement costs for distribution network operators (DNSs) and operational costs for electricity system operators (ESO) by between £2.7-£6.5bn by 2050. From a consumer perspective, smart charging can cut charging costs by an estimated £300 per year. Because EVs can play an important role in balancing renewable energy sources, smart charging can even result in the customer being paid to charge their vehicle.

More generally, we believe there should be a debate in how we fund the energy transition. Currently, most of the costs of the UK's existing efforts to decarbonise are paid for through people's bills, not taxes. For example, electricity bill payers currently contribute about £7 billion a year towards the roll-out of low-carbon power stations. This is expected to increase to around £12 billion a year by 2030. By choosing to pay for these policies in this way, the costs disproportionately fall on the poorest in society. Increasing levies on bills to fund energy and climate change policies is problematic since it is likely to hit hardest those least able to pay.

According to the UK Energy Research Centre, 70% of households would be better off if energy policies were paid for through general taxation rather than bills. The most vulnerable consumers could be further protected by mandating that social housing are required to provide smart appliances, DSR and use technology such as heat pumps mandatory so those who rely on this type of housing have access to the cutting-edge technology that reduces their bills.

Finally, if the energy transition is to be affordable, flexibility must be at its heart. We need to see government and regulators commit to delivering it and incentivise energy suppliers to offer dynamic tariffs. Failure to do so could add as much as £90bn to the cost of the transition[18].

[18] Smart Power, 2016, National Infrastructure Commission https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/505218/IC_Energy_Report_web.pdf

B. Scotland, Wales and Northern Ireland

C. Sector-specific questions

Question 18 (Surface transport): As laid out in Chapter 5 of the Net Zero Technical Report (see page 149), the CCC's Further Ambition scenario for transport assumed 10% of car miles could be shifted to walking, cycling and public transport by 2050 (corresponding to over 30% of trips in total):

a) What percentage of trips nationwide could be avoided (e.g. through car sharing, working from home etc.) or shifted to walking, cycling (including e-bikes) and public transport by 2030/35 and by 2050? What proportion of total UK car mileage does this correspond to?

b) What policies, measures or investment could incentivise this transition?

A growing body of research (e.g. ITF, UC Davis ITS, LBNL) suggests that combining sharing mobility, active transport, electric mobility with automation technologies can reduce on-road vehicles by 90% or more and cut transportation's climate impact by as much as 80%.

From a policy perspective this would require a much broader range of policy interventions: strong support trip sharing, public and active transport; support for driverless cars in rural areas to increase the cost effectiveness of running services; support and investment in public transport; increased investment in bike and e-bike sharing platforms and cycling infrastructure; policies on urban planning; government coordination of mobility as a service; new policies on EV and AV; and, open data and smart ticketing to support seamless networks for trip planning and payment.

We would also like to highlight the role of drones in tackling the last mile transport emissions, which is often cited as the least efficient and most carbon intensive leg of a journey due to the smaller efficiencies on offer. Connected and autonomous vehicles – such as driverless robotic cars and drones all hold promise. techUK therefore believes that the Department for Transport should widen its ambition for the last mile and look to how it sees commercial deliveries developing over the next twenty years, which in our view means drones, autonomous barges, electric only vehicles as well as driverless robotic vehicles, cars and vans.

There are numerous trials and case studies across the globe that should be analysed. Swisspost[19] use drone technology to fly letters and small parcels to remote communities and are successfully using drones to deliver healthcare consignments (supplies, blood, test samples etc.) across labs, universities and hospitals. The tests saw delivery times reduce from a 45-minute car journey to a flight under 10 minutes and as well as obvious patient benefits, it means one less vehicle on the road and fewer carbon emissions.

Finally, there is evidence that encouraging homeworking – facilitated by connectivity, cloud computing and smart phones - could bring about annual savings of 3m tonnes of CO_2e.[20]

[19] See https://www.post.ch/en/about-us/innovation/innovations-in-development/drones

[20] Carbon Trust (2014) *Homeworking: helping businesses cut costs and reduce their carbon footprint* https://www.carbontrust.com/media/507270/ctc830-homeworking.pdf

Question 19 (Surface transport): What could the potential impact of autonomous vehicles be on transport demand?

Analysis by the Institute of Transportation Studies[21] outline the potential impact of autonomous vehicles under three different scenarios.

It highlights the inherent uncertainties of the market. A wide range of potential impacts of full vehicle automation have been discussed in the literature[22]. In terms of energy use (and consequently CO2), the range of potential impacts is estimated to be wide and uncertain, due to impacts on many aspects of travel and vehicle efficiency[23,24:] these include improved technical vehicle efficiency, eco-driving, reduced traffic congestion and platooning. On the other hand, reductions in travel cost and new traveller groups could lead to significantly more driving, while faster driving and increased use of energy-using features could lead to more energy use per kilometre.

The net effects tend toward significant increases in driving and efficiency, with a wide range of possible net impacts on energy use, from large increases to large decreases.

However, the analysis by the ITS suggests that if regulated properly it has an important role to play alongside shared and active transportation and electric mobility in cutting emissions from surface transport.

Question 20 (Surface transport): The CCC recommended in our Net Zero advice that the phase out of conventional car sales should occur by 2035 at the latest. What are the barriers to phasing out sales of conventional vehicles by 2030? How could these be addressed? Are the supply chains well placed to scale up? What might be the adverse consequences of a phase-out of conventional vehicles by 2030 and how could these be mitigated?

The biggest barrier that could exist and prevent the phasing out of conventional vehicles will be if infrastructure deployment is slow and or insufficient to accommodate the growing demand for electric vehicles. Network infrastructure must be capable of meeting future demand.

Therefore, barriers linked to network reinforcement and management of the increasing load from electric vehicles need to be urgently addressed. The next price control (RIIO2) will be key in determining the preparedness of the system to accommodate for the growth in electric vehicles and this will need to drive some investment to manage the growing demand for electricity during the price control period.

Further, a data-driven approach to investment in charging infrastructure – both electric and hydrogen – must be adopted and incentivised. Consumers and businesses will only transition to low carbon vehicles with the knowledge that the infrastructure is compatible and widespread.

[21] https://steps.ucdavis.edu/wp-content/uploads/2017/05/STEPS_ITDP-3R-Report-5-10-2017-2.pdf

[22] Beiker, S., & Meyer, G. (2014). Disruptive Innovation on the Path to Sustainable Mobility. Road Vehicle Automation. https://doi.org/10.1007/978-3-319-05990-7

[23] Brown, A., Gonder, J., & Repac, B. (2014). An Analysis of Possible Energy Impacts of Automated Vehicle. Road Vehicle Automation, 61–70. https://doi.org/10.1007/978-3-319-05990-7

[24] Wadud, Z., MacKenzie, D., & Leiby, P. (2016). Help or hindrance? The travel, energy and carbon impacts of highly automated vehicles. Transportation Research Part A: Policy and Practice, 86, 1–18. https://doi.org/10.1016/j.tra.2015.12.001

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Finally, techUK also considers that cars that are purchased new for commercial purposes (e.g. Fleets or PHVs) will form the basis for a second-hand market that can facilitate mass adoption so some initial incentives targeting this segment of the market can help seed the market.

We outline policy and fiscal recommendations to address charging infrastructure and fleet purchases in Q21.

techUK agrees with the barriers outlined, and the majority of the recommendations to address them, as set out in the Electric Vehicle Energy Taskforce's report to achieve these outcomes. However, the Taskforce uses the government's "Road to Zero" targets as its benchmark and the proposals in its report should be considered with this in mind. Bringing forward phase-out of conventional cars will mean the recommendations outlined in the report must be pursued more urgently.

Question 21 (Surface transport): In our Net Zero advice, the CCC identified three potential options to switch to zero emission HGVs – hydrogen, electrification with very fast chargers and electrification with overhead wires on motorways. What evidence and steps would be required to enable an operator to switch their fleets to one of these options? How could this transition be facilitated?

Fundamentally, affordability and reliability will be key.

To tackle affordability fiscal policy support adoption, for example:

- The changes to benefit-in-kind tax rules for charging electrified company cars should be extended to all commercial vehicles.
- New requirements for major employers or destination points (e.g. shopping centres) to install EV charging to allow for increased out of home charging.
- A phased in VAT reduction, or scrappage scheme, could help businesses transition, especially in LGVs and HGVs where the price differential is significant.
- A year one 'no-tax' benefit for companies switching will also reduce running costs for fleet operators.
- A data-driven, nationwide hydrogen and electric charging network.

Question 26 (Buildings): For the majority of the housing stock in the CCC's Net Zero Further Ambition scenario, 2050 is assumed to be a realistic timeframe for full roll-out of energy efficiency and low-carbon heating.

a) What evidence can you point to about the potential for decarbonising heat in buildings more quickly?

b) What evidence do you have about the role behaviour change could play in driving forward more extensive decarbonisation of the building stock more quickly? What are the costs/levels of abatement that might be associated with a behaviour-led transition?

techUK has no specific evidence but several of our members, who also manufacture products such as air source heat pumps and fuel cells, report that the UK remains a difficult market in which to install these technologies into domestic dwellings, with refusals from DNOs relatively commonplace.

Members report buoyant markets in France, Italy, Spain and Ireland.

In France, the European market leader for heat pump deployment, 35% of heat pumps are deployed in new build, and the remainder in the renovation sector, driven by a new *coup de pouce* – a subsidy scheme which offsets nearly 100% of installation costs for families on modest incomes and 50% of costs for the remainder. The new subsidy is expected to drive up deployment by a further 50%.[25]

In Ireland, residential installation has been encouraged through variable tariffs: customers with heat pumps qualify for cheaper electricity costs[26]. Installation grants are available via the Sustainable Energy Authority of Ireland to reduce the cost of installation for all homes built before 2011.

On a behaviour change approach to decarbonisation of homes, we'd again point to the answers we provided in Q5 in respect to automation and social norming.

Question 27 (Buildings): Do we currently have the right skills in place to enable widespread retrofit and build of low-carbon buildings? If not, where are skills lacking and what are the gaps in the current training framework? To what extent are existing skill sets readily transferable to low-carbon skills requirements?

There remains a skills gap in respect to the installation of heat pumps. There are currently fewer than 1000 MCS qualified installers for heat pumps in the UK today. We support calls from BEAMA for BEIS to conduct a review of skills needs for the sector and a review of the minimum competency frameworks for training programmes.

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[25] See presentation via the European Heat Pump Association www.ehpa.org/fileadmin/red/09._Events/2019_Events/Market_and_Statistic_Webinar_2019/EHPA_webinar_FR_market_AFPAC.pdf (accessed 01/02/2020)

[26] See https://www.electricireland.ie/residential/products/electricity-and-gas/heat-pump-price-plan (accessed 01/02/2020)

Question 29 (Power): Think of a possible future power system without Government backed Contracts-for-Difference. What business models and/or policy instruments could be used to continue to decarbonise UK power emissions to close to zero by 2050, whilst minimising costs?

The UK's data centre sector can play an important role to play in carbon reduction through strategic energy purchasing. Data centres are large electricity users, with stable consumption patterns and predictable demand. They are already important anchor customers of renewable power and operators are already considering more proactive purchasing approaches. These include:

Locating operations near to under-used renewable power sources: Provided there is adequate connectivity, some types of data centre operation are location agnostic. However, incentives will be needed to encourage data centre builds outside traditional metro markets. In the UK a few facilities are co-located with EFW plants but the real success stories are in Scandinavia, for example Lulea, a post-industrial site that has reinvented itself as a data centre hub.

Generating power onsite: this is generally restricted to new builds with available land. With or without policy measures, retrofitting is likely to be impractical on legacy (older) sites and in urban areas.

Adopting power purchase agreements (PPAs) to stimulate additional renewable generation: PPAs are contracts between customer and generator and stimulate additional renewable capacity by providing long term funding for utility scale renewable projects: as such PPAs present a very important route to the provision of additional renewable capacity without the need for CfD. In fact, there is increasing adoption of Power Purchase Agreements (PPAs) within the data centre sector. Google is leading the field here with 34 agreements in place since 2010 and is the world's largest corporate renewable energy purchaser. We anticipate that these agreements will become more widespread, but this will take time, because PPAs are not for the faint-hearted. They are non-straightforward, involve risk and require considerable expertise. Policy initiatives that reward additionality in terms of renewable capacity could help. Policy initiatives that de-risk some aspects of the process might make PPAs accessible to a larger cohort of operators.

Purchasing certified renewables from energy suppliers: over 75% of energy purchased by commercial data centre operators in the UK is certified renewable (see our Data Centre Energy Routemap). However, this uses up existing capacity and does not stimulate additional renewable generation: demand for renewables lags behind supply. In the past, CCL was not charged on certified renewables but evidence from our industry suggests that this created market distortion because the energy suppliers marked up renewables by the value of the CCL. This suggests that policy levers need to be applied with caution. Within our sector, reputation and reporting obligations are important drivers.

Question 30 (Power): In Chapter 2 of the Net Zero Technical Report we presented an illustrative power scenario for 2050 (see pages 40-41 in particular):

a) Which low-carbon technologies could play a greater/lesser role in the 2050 generation mix? What about in a generation mix in 2030/35?

b) Power from weather-dependent renewables is highly variable on both daily and seasonal scales. Modelling by Imperial College which informed the illustrative 2050 scenario suggested an important role for interconnection, battery storage and flexible demand in a future low-carbon power system:

   i. What other technologies could play a role here?

   ii. What evidence do you have for how much demand side flexibility might be realised?

techUK is best placed to respond to questions in respect to demand side flexibility.

Open Energi conducted research in 2016 which identified 6GW of peak-shifting potential and 750MW of dynamic flexibility available for real-time grid balancing[27] whereas the Association of Decentralised Energy estimate that by 2020 the UK will have 9.8GW of demand side capacity.[28] . If just 5% of peak demand is met by demand side response solutions, collectively we could save up to approximately £200 million a year and benefit consumers by £790 million.[29] Deploying flexible technologies is a crucial step if the UK's journey to net-zero is going to be delivered at the least cost to consumers.

However, we'd like to repeat our concern re progress more generally with flexibility. Market surveys conducted by members consistently highlight that the main challenge now is knitting together the enabling technologies into a coherent, integrated system[30]. Survey evidence also flag the difficulty in obtaining market value via flexibilities which means that price signals may be needed too[31]. Members also highlight significant regulatory barriers: removing them will see uptake for smart and flexible technologies (EVs, Battery and Storage, Renewable Energy, Demand Side Response, Smart Grids) accelerate.

We need to see government push forward with the commitments made in the Smart Systems and Flexibility Plan and the recommendations from the National Infrastructure Commission in respect to smart energy. Ofgem must deliver on its flexibility commitments outlined in its recent decarbonisation plan by producing an action plan and timeline for delivery.

More specifically, we'd likely to highlight the potential role of data centres. The current business model for UK data centres is that of large consumers dependent on grid power. However, with the right technologies, policies and expertise, data centres can play a significant role in a smart energy landscape.

Embedded capacity: We estimate that the UK data centre sector has around 2-3 GW of embedded emergency capacity in the form of diesel plant, installed to deal with supply shortcomings.

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27 See Open Energi (2016) *UK Demand Side Flexibility Mapped* https://www.openenergi.com/uk-demand-side-flexibility-mapped/

28 The Association of Decentralised Energy (2016) *Bringing Energy Together* https://www.theade.co.uk/assets/docs/resources/Flexibility_on_demand_full_report.pdf

29 Ovo Energy (2017) https://www.ovoenergy.com/guides/demand-side-response.html

30 For example, CGI and Utility Week (2018) *Demand Side Flexibility: Transforming the Power System by 2030*

31 Ibid

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Regulatory constraints (MCPD, SGC and IED) render this unavailable for balancing services / demand-response.[32]

Energy storage: Advances in battery technology present data centre operators with new options for emergency supply for longer term outages and in time, there could be more opportunity to make stored capacity available without compromising business continuity. Further, many larger operators (Microsoft and Equinix for example) are trialling fuel cells to power data centres. Fuel cells are financially viable if fully utilised, so operators anticipate that they would supply baseload power (roughly 80%) with top up from grid or battery.

Data Centres as prosumers: Operators are actively seeking ways to move away from dependence on the grid and to reposition themselves as energy prosumers within the energy market. The objective is to reverse the current market arrangement: instead of 100 per cent dependence on grid power, a data centre could in future supply the majority of its own power requirements, using the grid for top-up or reserve, with potential capacity to export stored energy at times of need. See section 5 (page 10) of our Energy Routemap.

Question 31 (Hydrogen): The Committee has recommended the Government support the delivery of at least one large-scale low-carbon hydrogen production facility in the 2020s. Beyond this initial facility, what mechanisms can be used to efficiently incentivise the production and use of low-carbon hydrogen? What are the most likely early applications for hydrogen?

Some members are already signalling plans to use hydrogen for larger vehicles in their fleet which they have identified as currently the most effective solution

As a priority we need to be planning for hydrogen refilling infrastructure so that hydrogen electric vehicles can be used, reflecting that the market will, at least initially, be driven by logistics/corporate targets and strategies. Again, we recommend a data-driven approach using consumer and driver data to target infrastructure at the highest impact areas.

[32] See our note on Emergency Generation in Data Centres, our briefing on NOx, our MCPD Guidance and our Sector Energy Routemap.