COUNCIL FOR SCIENCE AND TECHNOLOGY

10 Victoria Street,
London,
SW1H 0NB

The Rt Hon Kwasi Kwarteng MP,
House of Commons,
London,
SW1A 0AA

23 September 2020

Dear Minister Kwarteng,

Addressing key net-zero challenges

We are writing to follow up our previous advice to the Prime Minister and in response to your request for further briefing.

In January 2020, CST issued advice to the Prime Minister on a systems approach to net-zero carbon emissions. When members met with you at their quarterly meeting in March, you requested a more detailed discussion of the latest scientific, engineering and technological thinking on decarbonising homes and the development of a hydrogen economy, including key challenges, opportunities and prospects for success. The briefing sessions were held with you on the 28th May and 18th June, respectively, in collaboration with the Royal Society and Royal Academy of Engineering. We are now writing to offer some thoughts on key issues discussed at these sessions.

Firstly, we would like to reiterate the significance of the UK's legal commitment to achieving net zero by 2050. This provides an ambitious but achievable target as an important first step. This should now be backed up by publication of a **coherent vision on the pathways for change** across all sections of UK economy and society, supported by policies and regulation to guide urgent action.

- Continued **leadership from government** is essential to achieve the speed and scale of transformation needed.
- To give **certainty** to businesses and citizens who will be central to delivering net zero, you and your Ministerial colleagues have important **choices to make between different pathways** to achieving transformation of each sector.
- Using a **systems approach** can help understand the interactions within and between systems in each sector, explore the economic and social implications of different scenarios for policy and regulation, and enable a cross government approach, that takes account of local and regional opportunities

and differences and helps enable and align national efforts around a consistent vision.

This is a huge **opportunity**: investment in a transition to net zero emissions can significantly contribute to economic recovery post-COVID. A systems approach should enable you and your Ministerial colleagues to choose 'low regrets'[1] pathways with confidence, to shape markets, transform industries and identify specific goals or 'challenges' where innovation will be needed to deliver further carbon reductions.

Secondly, we offer some comments on issues on the two topics covered in the briefings:

Decarbonising homes

1. We welcome your announcement in June of funding for decarbonisation measures including residential retrofitting[2]. Government will need to demonstrate a **clear, long-term vision and leadership** to gain trust within the sector and give businesses confidence to make the sustained investment necessary in skills and innovation.

2. Decarbonising housing is an example of transforming a complex system. The Government's approach will need to consider not only the **heterogeneity of dwellings** themselves but also the **infrastructure** (e.g. water, energy, transport, internet) they rely upon, alongside the diverse needs and behaviours of **property owners and users**. For example, there is significant debate around the varying suitability of low carbon heating options for different housing stock. Given that 85% of UK dwellings are connected to the gas infrastructure[3], converting the existing gas network to hydrogen for use with home boilers could be a viable solution worth exploring and can be done so in parallel with other solutions such as heat pumps or district networks. The multiplicity of power sources that will service future homes will further increase complexity and demand new thinking on resilience and system management.

3. Future policy and standards should be ambitious and go beyond energy efficiency and heating systems, as set out in the future homes standard, to **embody energy during construction**[4]. To achieve this outcome, it will be important to engage with the diverse range of sub-industries within construction (e.g. domestic Renovation Maintenance Investment (RMI); infrastructure; Local, Social & Commercial Construction) to enable the specific changes required in the housing sector. Improving performance standards for new buildings will also influence the availability of skilled contractors, low

[1] low-regret options are those that would make sense under most strategies to meet the 2050 target

[2] https://www.gov.uk/government/news/80-million-boost-to-cut-emissions-from-homes-and-industry

[3] Sub-national estimates of households not on the gas grid, 2015 - 2018

[4] https://www.gov.uk/government/consultations/the-future-homes-standard-changes-to-part-l-and-part-f-of-the-building-regulations-for-new-dwellings

carbon materials and technologies for retrofitting, and enable circular economy principles to be adopted.

4. There is a significant **industry skills gap** for the development and implementation of retrofitting measures, in digital skills required to design a smart home system, in the re-training of the home heating installation trade and associated standards. The need to upskill users and professionals involved in design, installing and maintaining these systems must be planned for if building performance standards are to be achieved. Minor implementation errors can produce large efficiency losses. This is an opportunity to develop a new, technologically skilled workforce but a challenge given the fragmented structure of the industry and dominance of small businesses.

5. **Procurement for public sector buildings** can be an important enabler for change in the sector as a whole. Retrofitting measures for these buildings should prioritise whole life carbon emissions reductions, alongside other procurement considerations, which will in turn help reduce operational costs, increase employment opportunities, help transform the market and could deliver important co-benefits such as economic growth and improved health outcomes.

6. **Monitoring and understanding what works in practice** will be critical to achieve the most effective combination of industry guidance, user support, standards frameworks, regulation, and enforcement to deliver the transformation needed. It is also crucial to understand why previous efforts have failed, to avoid repeating past mistakes. The 'What Works Centre' model could be used to bring together the necessary input from a range of disciplines. The value of early trials should not be underestimated to enable learning, help build confidence in new approaches and technologies, and encourage bring public buy in so transformation can be delivered at pace.

<u>Developing hydrogen at scale</u>

1. The next 12 months will be crucial if the UK is to be a global leader in hydrogen production. We have seen recent developments from countries including Germany investing heavily in electrolyser technology. If you decide hydrogen is an important part of the future UK energy system, there is a clear need to incentivise rapid deployment of available technology. The aim should be to establish strong foundations for an industry in the UK, which can be built on and improved in later years.

2. A central challenge is how to encourage investment from the private sector. Government needs to de-risk investment by
    a. introducing a systems view roadmap for the technology, making firm commitments to the use of hydrogen,
    b. stimulating competition through appropriate funding support (e.g. a National Investment Bank)
    c. reforming relevant regulations, and

    d. removing hidden subsides for existing fuels.

3. The two key sectors which appear to have the strongest potential for hydrogen application are **‘point to point’ road transport** (e.g. buses, trucks) and **home heating**.

4. Applications will need to be demonstrated and refined at a local level. Two opportunities were highlighted:
    a. encouraging **fleet transport systems** (e.g. buses and road haulage), where a centralised refuelling hub can be established, and
    b. **industrial clusters,** which could then be scaled up through connection on a national level.

5. A spectrum of methods for hydrogen production exist (e.g. green, blue, grey, black), each with different economics and carbon emission lifecycles. Given the scale of demand that could be generated from development of hydrogen applications, hydrogen produced using higher emissions methods may be needed as an interim step to build a viable hydrogen economy in the short term. However, it is crucial that government policy provides **long-term incentives for low emissions production methods** over the whole life cycle (e.g. energy source by-products, production methods, transportation).

6. Whilst hydrogen will hold an important role in the future UK energy grid, it is important to view this as part of a wider suite of actions that will contribute to the UK’s net zero ambitions. Development of a hydrogen economy, and exploiting its full potential as an energy vector, is **long term, system transformation.**

Finally, across both these topics, continued dialogue with industry and academia will be important to help understand challenges and evidence needs around deployment of technology. We are grateful to the departmental Chief Scientific Advisers (CSAs) who participated in the briefing sessions. They play a vital role in forging these connections, and the network of departmental CSAs is a powerful mechanism for exploring evidence needs on cross-sector systems issues.

We are grateful to the Royal Society and Royal Academy of Engineering for supporting the briefing sessions. They have offered to work with relevant CSAs to help bring expertise together on key areas of research interest to help inform you and other Ministerial colleagues in your thinking.

We would like to thank Dervilla Mitchell (Director of Arup) and Paul Stein (Chief Technology Officer, Rolls-Royce plc) for leading the briefing sessions and development of this advice.

We are copying this letter to the Prime Minister, the Secretary of State for Business, Energy & Industrial Strategy, the Secretary of State for Housing, Communities and Local Government, the Cabinet Secretary, the Permanent Secretaries at BEIS, MHCLG, DEFRA and DfT and the Chief Executive of UK Research and Innovation.

Yours sincerely,

Sir Patrick Vallance
(co-Chair)

Professor Dame Nancy Rothwell
(co-Chair)