

The Sixth Carbon Budget and Welsh emissions targets – Call for Evidence

Background to the UK's sixth carbon budget

The UK Government and Parliament have adopted the Committee on Climate Change's (CCC) [recommendation](#) to target net-zero emissions of greenhouse gases (GHGs) in the UK by 2050 (i.e. at least a 100% reduction in emissions from 1990).

[The Climate Change Act](#) (2008, 'the Act') requires the Committee to provide advice to the Government about the appropriate level for each carbon budget (sequential five-year caps on GHGs) on the path to the long-term target. To date, in line with advice from the Committee, five carbon budgets have been legislated covering the period out to 2032.

The Committee must provide advice on the level of the sixth carbon budget (covering the period from 2033-37) before the end of 2020. The Committee intends to publish its advice early, in September 2020. This advice will set the path to net-zero GHG emissions for the UK, as the first time a carbon budget is set in law following that commitment.

Both the 2050 target and the carbon budgets guide the setting of policies to cut emissions across the economy (for example, as set out most recently in the 2017 [Clean Growth Strategy](#)).

The Act also specifies other factors the Committee must consider in our advice on carbon budgets – the advice should be based on the path to the UK's long-term target objective, consistent with international commitments and take into account considerations such as social circumstances (including fuel poverty), competitiveness, energy security and the Government's fiscal position.

The CCC will advise based on these considerations and a thorough assessment of the relevant evidence. This Call for Evidence will contribute to that advice.

Background to the Welsh third carbon budget and interim targets

Under the Environment (Wales) Act 2016, there is a duty on Welsh Ministers to set a maximum total amount for net Welsh greenhouse gas emissions (Welsh carbon budgets). The first budgetary period is 2016-20, and the remaining budgetary periods are each succeeding period of five years, ending with 2046-50.

The Committee is due to provide advice to the Welsh Government on the level of the third Welsh carbon budget (covering 2026-30) in 2020, and to provide updated advice on the levels of the second carbon budget (2021-25) and the interim targets for 2030 and 2040. Section D of this Call for Evidence (covering questions on Scotland, Wales and Northern Ireland) includes a set of questions to inform the Committee's advice to the Welsh Government.

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.

Vattenfall is a leading European energy company with approximately 20,000 employees across Northern Europe and growing numbers in the UK. For more than 100 years we have electrified industries, supplied energy to people's homes and modernised our way of living. We now want to make fossil-free living possible within one generation Vattenfall welcomes the opportunity to respond to the **Committee** on Climate Change call for evidence on its 6th Carbon Budget. Our responses below are confined to those areas where we feel we have particular experience or expertise.

A. Climate science and international circumstances

Question 1: The climate science considered in the CCC's 2019 Net Zero report, based on the IPCC Special Report on Global Warming of 1.5°C, will form the basis of this advice. What additional evidence on climate science, aside from the most recent IPCC Special Reports on Land and the Oceans and Cryosphere, should the CCC consider in setting the level of the sixth carbon budget?

ANSWER: Vattenfall believes that IPCC's special report (SR15) constitutes the most important basis for fact-based decision making on climate policy in line with the Paris Agreement's goals. The European Commission has already presented a strategy for a climate neutral EU economy by 2050, which is informed by the IPCC's conclusions to a large extent. In the UK it will be crucial that there is some urgent consideration given to GHG trajectories which the IPCC deems necessary and that there is a corresponding degree of in-depth analysis as we have seen in the EU. Besides, since the world's leading climate scientists in the IPCC concentrate on what needs to be done on a global scale, the UK must also consider what would constitute a fair contribution to reducing global GHG emissions under the Paris Agreement, reflecting its "common but differentiated responsibilities and respective capabilities" as an industrialised and developed country. Clearly, an average will not be enough.

Question 2: How relevant are estimates of the remaining global cumulative CO₂ budgets (consistent with the Paris Agreement long-term temperature goal) for constraining UK cumulative emissions on the pathway to reaching net-zero GHGs by 2050?

ANSWER: We will limit our response to simply saying that, in order to reach net-zero GHG emissions by 2050, it is important to start now. Waiting too long will make it very difficult and more expensive to achieve the target within the allocated time frame. Therefore, it is relevant and important to have ambitious tracked targets ahead of 2050 viz for 2030 and 2040.

Question 3: How should emerging updated international commitments to reduce emissions by 2030 impact on the level of the sixth carbon budget for the UK? Are there other actions the UK should be taking alongside setting the sixth carbon budget, and taking the actions necessary to meet it, to support the global effort to implement the Paris Agreement?

ANSWER: International emissions reduction credits verified by the UNFCCC can play an important role for increasing cost-efficiency and stimulate more climate actions on a global scale. In EU climate policy, the inclusion of global credits may only be considered in the context of higher EU climate ambitions, provided that a strong EU ETS carbon price is maintained. This means that first we need to take action locally (in the EU or in UK) and then we can complement with international emission reduction credits.

In Vattenfall's view it will be important to have a UK emission trading scheme (ETS) closely linked to the EU ETS, as it is a cost-efficient way to reduce GHG emissions. When the EU ETS is adjusted (e.g. when new climate targets are implemented the Linear reduction factor needs to be increased, the market stability reserve will be reviewed as well as the free allocation of allowances) the UK ETS needs to be adjusted too in order to make the systems fit and efficient.

It will also be important to have strong conditions for R&D and innovation in the energy field. To achieve "net-zero" GHG emissions and reach the global 1.5 °C target, there will also be a need of negative CO₂ emissions (or CO₂ removal). These technologies need to be duly and supported to achieve market maturity.

Question 4: What is the international signalling value of a revised and strengthened UK NDC (for the period around 2030) as part of a package of action which includes setting the level of the sixth carbon budget?

ANSWER: n/a

B. 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?

ANSWER: Vattenfall has experience in the Netherlands, in the context of EVs, of how quickly behaviours can change with the right supportive policies. The effect on behaviour of even small-scale policy changes can be demonstrated by the positive outcome achieved by introducing a 5p charge on plastic bags and echoed in the ongoing debate on the use of plastics.

In the case of heat in many cases changes to heating systems will require changes within people's homes and buildings, which can be disruptive and invasive. Addressing this will require strong buy in from consumers about the need to decarbonise to accept change and regulations, incentives and innovation to ensure that customers receive the best possible service at reasonable cost. Vattenfall believes that there is scope, and a need, for a holistic review of the tax and incentives available to promote overall decarbonisation. The current system of interventions is inconsistent in promoting both decarbonisation and carbon intensive winners. To cite one example, it is our view that there is a clear need to regulate the heat networks market, as recommended by CMA. However, as yet there is

little detail regarding what that regulation might look like. We are keen to work with Government going forward on the detail of future regulation.

More broadly, it is clear that there is real urgency for climate change action and regulation should recognise that. This is critical for future consumers. There needs to be a near total removal from the atmosphere of emitted CO₂ to keep within the target of 1.5 degrees of warming. Regulation should ask itself whether it is doing as much as possible to move towards a low carbon economy. Historically this has not been the case – for example 150,000 new connections are made to the gas network each year.

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?

ANSWER: Vattenfall believes that there is now a gap in UK energy policy. The Committee on Climate Change has advised, in its 2018 *Report to Parliament*, that there is likely to be a significant low-carbon power generation shortfall in 2030 compared to where we need to be to hit carbon targets even with the delivery of new nuclear at Hinkley Point and with full utilisation of the £557 million set aside for future Contract for Difference auctions. It is our view that this can to an extent be filled by renewable generation and especially wind, though clearly the decarbonisation of heat remains a challenge as well as an opportunity. The recent Ofgem *State of the Energy Market Report* in 2019 highlights that decarbonisation of energy has retracted to its slowest rate since 2012 and to meet carbon budgets from 2023 onwards more investment

Vattenfall's view is that the UK Government has a significant role to play in supporting market mechanisms to create long-term revenue certainty for low-carbon technologies. The Government should continue to set a clear framework for investment, with long-term visibility on the type of investment it is seeking. It should be consistent in its existing frameworks, eg use of carbon price floor, but also offer the opportunity for innovation and encourage cross-sectoral development to incentivise decarbonisation of industry, heat and transport.

The financial support and regulatory framework should be applied more pragmatically to support innovation and through the innovation stages of new energy projects. There are also longer-time policy reforms which could be taken forward to support innovation, particularly around how the CfD supports and rewards higher-risk innovation (such as co-location of renewables with hydrogen electrolysis) or emerging technologies (such as floating offshore wind).

Offshore wind

Offshore wind is a scalable, proven energy source with high load factors that has shown its potential to deliver significant cost reductions; it is now close to parity with more conventional generation. It now provides circa 7% of the UK's electricity supply and can significantly increase this towards 2030. However, to do this, it will need ongoing commitment from industry and the Government. Stability is key for any future investment decisions alongside a predictable, long term policy framework.

There is a need for a broader consensus with NGOs, other stakeholders and the public about further offshore wind opportunities if we are to 'fill the gap' created by no (or limited) new nuclear. Significant offshore wind opportunities have already been realised in the last

two decades and although technical potential for up to 100GW has been identified, this will not be delivered without significant challenge. New opportunities for offshore wind will increasingly need to resolve potential conflict with other sea users and environmental receptors.

The opportunity for floating offshore wind, as an emerging technology, will become an increasingly attractive commercial prospect and there are considerable opportunities here for accessing sites in deep water, for example in Scotland. We recommend Government consider the case for differing treatment for floating offshore if it is to repeat the success seen in traditional fixed-foundation offshore wind.

Grid issues will also need to be addressed. The Offshore Transmission Owner regime (OFTO) is not, in our view, fit for purpose for a modern, integrated wind-based grid. The balance of incentives between the OFTO and generator are sub-optimal, especially as the growth of offshore wind drives a need to move beyond radial grid solutions. There is increasing recognition that a co-ordinated and strategic approach to offshore transmission infrastructure is required. This will need changes to both the licencing and regulatory regime to bring this forward.

Onshore wind

The Committee on Climate Change has advised that the UK could be 55 TWh short of low-carbon power in 2030 required to meet carbon budgets. This includes the delivery of Hinkley Point C and all of the £557 million funding for offshore wind being allocated. This is a significant gap, equivalent to circa 15% of UK electricity demand. This gap could be theoretically filled by over 20 GW of additional new-build onshore wind, noting that:

- Onshore wind is now the **cheapest** way to generate electricity.
- Onshore wind enjoys widespread **public approval**, including in rural areas.
- Onshore wind supports a vibrant **supply chain** and British jobs.

Although some onshore wind, as the cheapest form of power generation, can and will be built on a 'merchant' basis without a specific policy intervention, it is highly unlikely that sufficient volumes to deliver on carbon targets will be built supported purely by corporate power purchase agreements, co-located zero carbon technology or wholesale electricity revenues only. This means that the low-carbon gap is likely to be more expensive to meet than it needs to be.

Confidence in the UK onshore wind sector has been affected by Government decisions to make the English planning system overly restrictive and to close the Pot 1 mechanism for Contracts for Difference. The political aspect of this decision-making does affect the overall view of the stability and predictability of the UK energy system.

We believe it is essential that Government looks again at a strategy for onshore wind, where it is wanted in Wales and Scotland in particular, focussing on whether interventions to stimulate the corporate power purchase agreement market, co-located zero carbon technology and/or reopen Pot 1 auctions would directly enable the UK to meet the carbon gap at lowest cost with associated industrial benefits.

Heat

Looking beyond power generation, heat decarbonisation has not benefitted from the same long-term regulatory or financial support interventions which have been applied to power generation. The move towards renewable heat has been largely industry and consumer driven but we do not believe that this will be sufficient to drive the required investment to deliver low-cost, low-carbon heat. HNIP was a good start but it is Vattenfall's view that

Government should have a continuing, longer term role in underwriting risk in heat networks to help create investor confidence in investment returns.

Sector Coupling

The opportunities for co-locating technologies such as storage and hydrogen will broaden the reach of decarbonisation by shifting energy from high volume periods (high wind) to periods of high demand (peak hours) through storage. Furthermore the potential of hydrogen is to produce energy during high volume periods and then transport it to areas which will struggle to benefit from low-carbon / zero-carbon energy, for example in Heavy Duty Vehicles and Public transport as well in facilitating the decarbonisation of hard to tackle industrial processes. The Renewable Transport Fuel Order for fuels on non-biological origin does provide a route to decarbonisation but will need revisiting as more zero-energy comes in to the system for the use in the transport. Continued investment beyond the Industrial Energy Transformation Fund and Clean Steel Fund, will require the support of UK Government in the near term in order to deliver on 2030, 2040 and 2050 targets.

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?

ANSWER: Yes. The available science and in particular the IPPC report supports a more robust approach.

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?

ANSWER: Growing a green economy and creating green jobs will have clear societal benefits ranging from employment and skills opportunities to wellbeing and health as emissions are reduced. In terms of priority, this should be given to sectors where these societal benefits are realised soonest – either in terms of jobs and the economy or health indicators eg through clean air legislation.

C. 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?

ANSWER: Vattenfall's view is that the UK Government has a significant role to play in supporting market mechanisms to create long-term revenue certainty for low-carbon technologies up to and beyond 2030. The Government should continue to set a clear framework for investment, with long-term visibility on the type of investment it is seeking. It should be consistent in its existing frameworks, for example the use of the carbon price

floor, but also offer the opportunity for innovation and encourage cross-sectoral development to incentivise decarbonisation of heat and transport.

The financial support and regulatory framework should be applied more pragmatically to support innovation and through the innovation stages of new energy projects. There are also longer-time policy reforms which could be taken forward to support innovation, particularly around how the CfD supports and rewards higher-risk innovation (such as co-location of renewables with hydrogen electrolysis) or emerging technologies (such as floating offshore wind).

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?

ANSWER: The role of local action and regional targets will be crucial in delivering the pace of change required on climate change. It is Vattenfall's view, for example, that stimulating and supporting demand for heat networks at local level can and should make a considerable contribution to meeting future heat decarbonisation targets. With that in mind we have been examining how community energy models can be applied to large scale district heating schemes to provide a framework which can be adopted by local authorities, developers and communities to address some of the issues seen in today's district heating schemes in the UK to add more value to the communities they serve. For example, with regards to decarbonised heat we believe that that in order to achieve a holistic overview of the potential for heat and power networks to contribute to net zero targets then community and locally owned schemes should be part of a wider, but essentially the same policy and target area. This does not preclude the possibility that there will need to be some differences in approach for policy specifically relating to local and community schemes,

An interesting question for heat is how local decision making can play a part. Where heat networks have been deployed, Local Authorities have generally played a key role. Heat regulation models may also include concepts of concessions and heat zoning, which necessarily need to reflect local circumstances and the needs of local communities. This could affect the scope, functions and activities of economic regulators in respect of heat. Another example would be the potential of decarbonisation of industrial process, which are often associated with carbon intensive systems. These local areas tend to be economic hubs for the local economy in supporting jobs and associated facilities that are suppliers to / users of the process in question. Vattenfall see that the potential for innovation centres to couple the aspects of energy, heat and industrial process would secure jobs in those area, develop new technologies and provide for local health and wellbeing with the removal of carbon from those processes.

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?

ANSWER: Vattenfall shares the Committee on Climate Change's own conclusion that decarbonisation will have a cost attached but that in the interests of vulnerable customers and fairness the whole cost cannot and should not be passed on in terms of rising

customer fuel and energy costs. There needs to be a more progressive approach through tax and fiscal incentives with industry, consumers and government all contributing to the cost of a programme of action towards net zero. Industry is already investing heavily in fossil free technologies and services, across innovation, research and development, jobs and customer solutions. More than ever industry is picking up the cost of large scale infrastructure investment. We now want to see what support government is prepared to spend in the shape of a green budget alongside ideas for how the overall costs of net zero can be properly quantified and share on a progressive and equitable basis. In this regard we look forward to the forthcoming Treasury review of the costs of decarbonisation.

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?

ANSWER: See response to question 6. We agree with the Committee for Climate Change's own conclusion that the costs of the move to zero carbon should not be born by consumers in the form of consumer bills and that it is important that consumer agencies, industry and government works together to ensure that the costs (and benefits) are shared on an equitable basis with special attention paid to what additional support can and should be provided for vulnerable customers.

D. Scotland, Wales and Northern Ireland

Question 13: What specific circumstances need to be considered when recommending an emissions pathway or emissions reduction targets for Scotland, Wales and/or Northern Ireland, and how could these be reflected in our advice on the UK-wide sixth carbon budget?

ANSWER: Vattenfall is not active in Northern Ireland and therefore our comments apply chiefly to Scotland and Wales. Whilst energy policy remains a reserved issue for Westminster, the devolved nations benefit from powers in devolved areas which can be used to shape the energy industry within those nations. Specifically powers around environmental protection and planning and responsibility for local government can be valuable levers in this regard.

Scotland

On Scottish ambitions we agree with many of the Committee on Climate Change's own conclusions *viz*:

- Setting a net-zero greenhouse gas emissions target for 2045 represents a step-change in ambition for Scotland. Achieving it requires urgent action to drive down emissions and every sector of the Scottish economy must contribute fully.
- The Scottish Parliament's 2030 target to reduce emissions by 75% will be extremely challenging to meet. It must be backed up by steps to drive meaningful emissions reductions, immediately. The recent sharp reductions in emissions due to the near-complete elimination of fossil-fired electricity generation in Scotland must be maintained through sustained action in other sectors.
- Scotland's Programme for Government 2019-20, alongside other recent policies, sent a clear signal that the Scottish Government is taking its more ambitious targets seriously, but there is much more to do. Promising new measures for green finance, new-build homes and transport have been put in place – now they must

start delivering in the real world. Scotland's plans for a long-term agriculture strategy are lagging behind plans in England and Wales, annual tree planting rates must continue to rise, and energy efficiency measures must be extended to non-residential buildings.

- Scotland's ability to deliver its net-zero target is contingent on action taken in the UK, and vice versa. Westminster must match Scottish policy ambition if Scotland – and the UK as a whole – is to make progress in key sectors where legislative powers are 'reserved'. This includes: heavy industry, carbon capture and storage, electricity generation, the gas grid, vehicle standards, road freight, and a common aviation framework. Both governments must work more closely to make the best use of devolved and reserved policy levers in key areas where responsibilities are split, including the future of heating, electric vehicles and low-carbon infrastructure.

We particularly agree that in many respects Scotland's ability to deliver will be determined by their policy ambitions being matched at UK level

Wales

Welsh National Development Framework (NDF): There is widespread governmental support for the transition to a low carbon and prosperous society through the delivery of renewable energy sources - on the 12th of June 2019, the Welsh Government announced its commitment to reducing carbon emission levels by 95% by 2050 but seek to be carbon zero by 2050. Indeed, the Welsh Government's Prosperity for All: Economic Action Plan (December 2017) states:

"the shift towards a low – carbon future offers huge opportunities for our economy to diversify and grow – but it also challenges us to support business, people and places in transitioning toward that low carbon future".

in March 2019, the Welsh Government published 'Prosperity for All: A Low Carbon Future'. This plan sets the foundations for Wales to transition to a low carbon nation and sets out how it aims to meet the first carbon budget (2016 – 2020) and consequently the 2020 interim target through 100 policies and proposals. The vision of this plan states that

"in 2050, there will be different energy systems that will be ready to fully exploit the inter – relationships and synergies between the power, heat and transport sectors and we will also see greater energy efficiency in buildings and appliances, and the use of new building fabrics turning buildings into power stations".

Since then we have seen the publication of the draft National Development Framework, many of the aims of which we support. The NDF is identified within 'Prosperity for All: A Low Carbon Future' under Policy 6 as follows:

"the NDF will ensure the planning system in Wales plays a key role in facilitating clean growth and decarbonisation and helps build resilience to the impacts of climate change. Achieving our strategic decarbonisation goals is highlighted as a key driver, which all development plans must support."

This highlights just how critical the NDF will be to decarbonisation of the Welsh economy, and how critical it is that the Welsh Government publishes a framework that will deliver against the ambitions which it has set itself.

The NDF adopts a 'clear traffic light-based approach to its policy on large scale and wind and solar renewable energy projects'. According to the NDF, a strategic review of landscape impact identified the Priority Areas for Solar and Wind Energy as the most

appropriate locations to accommodate landscape change, however from Vattenfall's review of all of the consultation documents, it is clear that landscape and visual were not the only constraints applied. The draft NDF sets out that the spatial strategy is for large scale and solar development to be directed towards Priority Areas for Wind and Solar Energy. These areas provide a presumption in favour of large scale on shore wind and solar energy development, and an acceptance of landscape change and a focus on maximising benefits and minimising impacts.

Vattenfall welcomes the spatial dimension provided by the Energy Priority Areas, but considers it is critical that the policy approach is founded on a robust evidence base if it is to deliver the Welsh Government's commitment to maximising Wales' potential for decarbonisation. From our review of the Priority Areas, and the background study that informed them, it is apparent that once the site constraint criteria used across the renewable development industry are applied, less than 10% of the identified Priority Areas are suitable for the deployment of wind turbines at the scale required to meet Welsh Government targets for renewable energy and decarbonisation. As an example, the Energy Priority Areas exclude an area of land owned by NRW in Neath Port Talbot County Borough Council which has recently completed a tender process for wind farm development. The areas also exclude large parts of the Strategic Search Areas identified in TAN8. This raises serious concerns over the robustness of the studies that informed the Energy Priority Areas.

In light of this, it is Vattenfall's view that the NDF should adopt a more positive position with respect to renewable energy development. Proposals outside the priority areas should be given the same level of 'in principle' support as those within with the priority areas retained but renamed as 'Areas where landscape change is accepted'. As currently drafted, the NDF presents a 'green light' for the priority areas but areas with 'amber lights' appear to be more closely aligned with 'red' than 'green'.

Planning and grid adequacy in mid-Wales: There is significant potential for wind energy development in mid-Wales. The Committee on Climate Change may be aware of the conjoined inquiry covering five onshore wind projects, including one taken forward by Vattenfall, necessitating increased grid infrastructure for export from Wales into England. These projects were refused by the Secretary of State in 2015 but it is understood that two projects subsequently resubmitted their applications in 2016 and are awaiting a decision. Vattenfall believes decisions on these wind farms and associated infrastructure are of national importance to Wales. Taking a whole-system view, Vattenfall further believes this infrastructure is becoming increasingly important to satisfy electricity demand for customers, particularly in mid-Wales, and is no longer simply an issue for electricity generation. As more and more of our energy demand is electrified, particularly as heat pumps replace gas and electric vehicles supplant fossil fuels, increasing demand will be placed on the electricity grid. This is particularly pertinent for customers in mid-Wales who are not well served by the high voltage national electricity transmission network. It is recognised that not all areas of Scotland and Wales have access to a proximate and robust transmission and distribution grid infrastructure that enables the deployment of renewable energy technology. However, for such areas it should be recognised that new infrastructure will be an absolutely necessary enabler to reach the UK and individual country targets and ambitions. It should be noted that such infrastructure is deemed unpopular by some sections of society but such infrastructure must be implemented nonetheless.

Question 14: The Environment (Wales) Act 2016 includes a requirement that its targets and carbon budgets are set with regard to:

- The most recent report under section 8 on the State of Natural Resources in relation to Wales;
 - The most recent Future Trends report under section 11 of the Well-Being of Future Generations (Wales) Act 2015;
 - The most recent report (if any) under section 23 of that Act (Future Generations report).
- a) What evidence should the Committee draw on in assessing impacts on sustainable management of natural resources, as assessed in the state of natural resources report?
 - b) What evidence do you have of the impact of acting on climate change on well-being? What are the opportunities to improve people's well-being, or potential risks, associated with activities to reduce emissions in Wales?
 - c) What evidence regarding future trends as identified and analysed in the future trends report should the Committee draw on in assessing the impacts of the targets?
 - d) Question 12 asks how a just transition to Net Zero can be achieved across the UK. Do you have any evidence on how delivery mechanisms to help meet the UK and Welsh targets may affect workers and consumers in Wales, and how to ensure the costs and benefits of this transition are fairly distributed?

ANSWER: n/a

Question 15: Do you have any further evidence on the appropriate level of Wales' third carbon budget (2026-30) and interim targets for 2030 and 2040, on the path to a reduction of at least 95% by 2050?

ANSWER: We understand the reasons for the lower interim targets for Wales and accept them. We would however refer to our answer to question 14 and urge that the lower target should not translate into a lack ambition or failure to act on climate change given that Wales have natural resources of wind, hydro and tidal to make a considerable contribution, subject to the resolution of the grid constraints issue identified in our response to question 14.

Question 16: Do you have any evidence on the appropriate level of Scotland's interim emissions reduction targets in 2030 and 2040?

ANSWER: Scotland's capacity for renewable generation is significant. According to Scottish Renewables figures 'Scotland's renewable electricity capacity has shown steady growth over the last few years with the average annual capacity increase over 760MW since the end of 2008' In addition there is significant additional capacity in development across Scotland, with projects either in planning or already consented which total over 12GW. Again, capacity increases in the short term will come from onshore wind, with nearly 4GW of capacity already consented and a further 3.5GW in planning. Offshore wind has 4GW already consented. There is also 306MW of solar projects at various stages of

development and 396MW of wave and tidal projects either in planning or already consented.

Scotland is also a rich environment for the development of heat networks. In a recent Scottish Renewables Report '*Piping Hot*' a total of 46 potential projects in development were identified which, with the right government support, could:

- Deliver 600 GWh of heat per year, the equivalent to 45,000 households
- Avoid 100,000 tonnes of carbon emissions per year, if built using low-carbon heat from day one
- Grow to serve 8% of Scotland's heat demand by 2030, the equivalent to 460,000 households.

The Scottish Government's own Heat Policy Statement sets out the ambition for a substantial expansion of heat networks in Scotland, offering a significant opportunity for investors, equipment vendors and network operators. The Statement proposes an increase in the amount of heat supplied through heat networks from around 0.3 TWh now to 1.5 TWh by 2020 – ie in the course of the coming year. A significant part of this ambition will be achieved through increasing the number of households connected, from around 9,000 currently to 40,000 by the end of 2020.

We are therefore of the view that the ambitious targets set for Scotland – 75% by 2030 - are right and achievable. It is only by setting such ambitious targets and supporting them with the right policy frameworks that the net zero ambition. To achieve it, however, will require a step up in heat policy and support.

Question 17: In what particular respects do devolved and UK decision making need to be coordinated? How can devolved and UK decision making be coordinated effectively to achieve the best outcomes for the UK as a whole?

ANSWER: Devolved Administrations have made good progress towards their own climate change targets and it is Vattenfall's hope that they can continue to develop distinct agendas, using the powers at their disposal (planning, environment, local business finance) to lead the way in what can be achieved through a more radical approach to policy making.

We recognise that different geographies have different demands and can therefore a 'one size fits all' approach is not sufficient to address climate change issues. Devolved and local government should be given the ability (through funding and relevant powers) to better support growth in specific areas – for example heat and the electrification of transport – to meet local needs (albeit within a national framework).

In other areas, such as the electrification and decarbonisation of industrial processes, policy and support mechanisms (RTFO, carbon pricing, emissions standards) should be driven centrally and be part of UK wide approach.

E. 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?

ANSWER: n/a

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

ANSWER: n/a

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?

ANSWER: n/a

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?

ANSWER: n/a

Question 22 (Industry): What policy mechanisms should be implemented to support decarbonisation of the sectors below? Please provide evidence to support this over alternative mechanisms.

- a) Manufacturing sectors at risk of carbon leakage
- b) Manufacturing sectors not at risk of carbon leakage
- c) Fossil fuel production sectors
- d) Off-road mobile machinery

ANSWER: n/a

Question 23 (Industry): What would you highlight as international examples of good policy/practice on decarbonisation of manufacturing and fossil fuel supply emissions? Is there evidence to suggest that these policies or practices created economic opportunities (e.g. increased market shares, job creation) for the manufacturing and fossil fuel supply sectors?

ANSWER: The European power association (Eurelectric) has produced a recent study which demonstrates that the EU electricity supply can be made CO₂ neutral before 2050, at even while demand for CO₂ free electricity grows significantly to replace fossil fuels in other sectors such as heating and cooling, transport and industry. Electricity is increasingly becoming cleaner, and since electricity is affordable, reliable, secure and more efficient in end use than any other fuels, electrification will be a key enabler for decarbonising the economy.

Vattenfall is already involved in a number of strategic partnerships with industry partners, e.g. in the steel industry, cement industry and refining industry. Our HYBRIT project for example is a collaboration of a mining company, a steel manufacturer and Vattenfall with the objective of having a completely fossil free process for steel manufacture by 2035. Coking coal has been an essential component in steel production for more than a hundred years. Today, this makes the sector one of the largest emitters of CO₂. In a joint venture – HYBRIT - steel producer SSAB, mining company LKAB and Vattenfall together aim to transform the process. It is our estimate that HYBRIT (Hydrogen Breakthrough Ironmaking Technology) can reduce Sweden's CO₂ emissions by 10% and Finland's by 7%, if implemented at full-scale. In 2018 the construction started of a pilot plant in Luleå, Sweden. The pilot will become operational in 20225 and the full-scale fossil free process for steel manufacturing should be ready by 2035.

The aim is to decarbonise the steel industry by replacing the coking coal (traditionally used in steel production to convert iron ore to iron), with hydrogen made from fossil free electricity (primarily wind power) and water. A process called direct reduction will replace the current blast furnace process. The by-product will be water, which in turn can be recovered for the production of hydrogen gas.

We have other examples of where Vattenfall is building partnerships across northern Europe, developing hydrogen as a technology to decarbonise industrial processes and would be happy to provide case studies to share our experience as these schemes develop

Question 24 (Industry): How can the UK achieve a just transition in the fossil fuel supply sectors?

ANSWER: The key to a just transition lies in re-skilling and upskilling. Many of the skills from the fossil fuel supply sectors are transferable given a commitment to an upskilling programme supported by industry and government agencies in partnership. The renewables sector has the ability to stimulate a growth spurt in employment. The CBI predicts that by the end of 2020, the number of green jobs is likely to increase by around 1.4m by late 2020– from a current figure of 1m. However according to a Global Action Plan study conducted by YouGov the UK is failing to equip young people with the skills they need for the green jobs of the future. The poll discovered that half of teachers in Great Britain think their school is not preparing students for an economy where the number of green jobs will grow. 63% of teachers think their school is not doing anything specifically

aimed at developing the skills needed for green jobs and only 13% of teachers have supplemented the curriculum with classes on developing green job skills. It is important that these issues are addressed as a priority and that the need for a just transition does not slow the pace of change towards fossil free living.

Question 25 (Industry): In our Net Zero advice, the CCC identified a range of resource efficiency measures that can reduce emissions (see Chapter 4 of the Net Zero Technical Report, page 115), but found little evidence relating to the costs/savings of these measures. What evidence is there on the costs/savings of these and other resource efficiency measures (ideally on a £/tCO₂e basis)?

ANSWER: n/a

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?

ANSWER: It is our strong view that efficient district heating networks can considerably save conventional energy and provide substantial shares of renewable based heat. District heating is pro-active climate protection. The heat can be provided from various sources, some of which may only be made usable if a heat network is available to distribute the heat. Renewable energies including renewable electricity and the use of existing excess heat potentials play a leading role from the outset and will be able to provide a climate-neutral heat supply in the medium to long term.

District heating is particularly suitable for the supply of the urban building stock, where both the possibilities to reduce the heat demand by suitable insulation methods and the direct use of renewable based heating are somewhat technically and financially limited. In addition to the achievable reduction in heat demand, the remaining heat demand via district heating can be covered in the medium term without the use of fossil fuels. This achieves the goal of a CO₂-free heat supply or a CO₂-neutral building stock.

A consistent and long-term regulatory framework for district heating could enable this potential to be unlocked within manageable timeframes. The underpinning regulatory framework should support district heating based on low carbon heat sources. As noted, there is a distinct need to decarbonise heat supplies to achieve climate change targets. The main purpose of heat networks is to support that aim, which can only be achieved if the heat sources supplying the networks are low carbon.

There is a need to ensure that the costs of low carbon heat networks are countered by policies which are supportive of investment. In general, district heating networks are suffering from a lack of a level playing field compared to other utilities and especially the existing gas infrastructure. Reviewing current business rates for district heating networks would be the first necessary step to make a heat transition happen.

Heating related CO2 emissions from fossil fuels such as crude oil or natural gas, have no economic impact on the choice of a heating system. A real level-playing field between the fossil fuels and e.g. a renewable based heating grid needs to be created. This could be achieved either via sufficient final support for heating networks and alternative heating concepts or there might be scope for introducing an appropriately designed CO2 based taxation of energy sources in the heating market to act as an incentivisation with appropriate compensatory measures to limit the impact on the end consumer.

Vattenfall's view is that the promotion of renewable energy and carbon neutral excess heat or cold in the heating/cooling sector the UK requires specific targets up to 2030. In addition, a pathway should be agreed for the further decarbonisation of the heating sector by 2050.

The UK Government should put in place adequate measures to incentivize "efficient district heating and cooling infrastructure"¹ to accommodate the development of high-efficiency cogeneration (CHP) and the use of heating and cooling from excess heat and renewable energy sources.

Ideally, regulation should promote stronger synergies between electricity and heat and ensure a level playing field. High efficiency district heating based on renewables, Combined Heat and Power (CHP) plants, "electricity to district heating" concepts using increasing excess power from renewable energies, and "excess heat" offer substantial renewables-based, carbon-neutral heating in urban areas. Particularly "electricity to district heat" opens the possibility of cross-sectoral integration of renewables and thus to make the energy system more efficient and sustainable by integrating electricity from wind to the heating sector. Any support for district heating and cooling systems should be directed to make both direct use of renewables (biomass, geothermal, solar-thermal) and of electricity from e.g. windfarms for power-to-heat (PtH) or power-to-gas (PtG) application.

Other specific measures might include:

- Designing heat networks to future proof them for a wide range of low carbon heat sources, for example using low flow temperatures and large thermal stores.
- Ensuring that the counterfactual reflects decarbonisation costs. Current benchmark is against gas and fossil-based technologies, the continuing use of which will not meet carbon targets.
- Facilitating collaboration across industry and government to drive cost reduction in heat networks through innovation and quality standards.
- Taking a lifetime view of costs

On behaviour change we would refer you to our answer to question 5 above

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?

ANSWER: Creating a low carbon buildings programme requires a broad range of skills including:

- Design Engineers
- Procurement Officers
- Contract Managers
- Project Managers
- Health and Safety Advisors
- Construction –Architects, Builders
- Mechanical Engineers
- Electrical Engineers
- Heating Engineers
- Civil Engineers
- Pipe Fitters/Welders
- Insulation Installers
- IT and Comms
- Plumbers
- Joiners
- Electricians
- Suppliers –Materials and Equipment

In addition to these applied skills there is work to be done in terms of consumer awareness and customer liaison. Many of the above skills exist within traditional fossil fuel industries and what is required in terms of a just transition to low carbon is a programme of upskilling to map available skills to a growing green economy, Industry is already engaged in the process both on a project by project basis and, in partnership with skills agencies, on a pan industry level.

Question 28 (Buildings): How can local/regional and national decision making be coordinated effectively to achieve the best outcomes for the UK as a whole? Can you point to any case studies which illustrate successful local or regional governance models for decision making in heat decarbonisation?

ANSWER: Vattenfall would like to cite The London Plan - as a good example of a case study of successful regional government providing a template or model for decision making in heat decarbonisation. The elements of the plan which make it of interest to private sector developers are the long term and strategic goals which it sets itself. It provides an overall strategic plan for London, setting out an integrated economic, environmental, transport and social framework for the development of London over the next 20–25 years. It brings together the geographic and locational aspects of other strategies – including those dealing with:

- Transport
- Economic Development
- Housing
- Culture
- a range of environmental issues such as climate change (adaptation and mitigation), air quality, noise and waste
- the framework for the development and use of land in London, linking in improvements to infrastructure (especially transport); setting out proposals for implementation, coordination and resourcing; and helping to ensure joined-up policy delivery by the GLA Group of organisations (including Transport for London)

- the strategic, London-wide policy context within which boroughs should set their detailed local planning policies

It sets a framework, in its long term and strategic vision begins to de-risk the investment landscape for heat developers and we would commend it as a model which could ladder up into a national approach to joined up economic development.

<https://www.london.gov.uk/what-we-do/planning/london-plan>

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?

ANSWER: For offshore wind it is undoubtable that the Sector Deal has helped create a more stable policy framework and therefore an attractive investment environment. The introduction of the CfD has also helped. For onshore wind policy has not improved the situation from the perspective of investors. Indeed, certain recent decisions – the removal of CfD, the planning policy review – have acted against investment. For low-carbon heat, we welcome HNIP as a short-term boost to investment. We also welcome the announcement in 2019 on zero-carbon heat for new build homes by 2025. However, there is still a lack of a short to medium term policy framework for heat networks for new build or a longer-term approach to heat decarbonisation in existing buildings.

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?

ANSWER: n/a

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?

ANSWER: Hydrogen clearly has a pivotal role to play in any future energy mix and we are already seeing the first applications particularly in terms of public transport where economies of scale can be achieved. Key to unlocking potential will be the right planning and regulatory regime which allows for the scalable and flexible production and storage of hydrogen allied to wind generation.

In the long term we expect more applications of hydrogen as an energy carrier in the transport sector, heat and industrial processes. For example, the HySynGas project for use as a replacement for natural gas, and the HyBrit in the production of Fossil Free Steel (See question 23 above. Undoubtedly the production of Hydrogen from Steam Methane Reduction with Carbon Capture will unlock a wider potential market, however the Carbon Capture is not evolved sufficiently to be deliver in the short term. Therefore, the production of Hydrogen from renewable energy sources (electrolysis) is a proven and deliverable now technology for zero carbon transport, heat and decarbonization of industrial processes.

Question 32 (Aviation and Shipping): In September 2019 the Committee published advice to Government on international aviation and shipping and Net Zero. The Committee recognises that the primary policy approach for reducing emissions in these sectors should be set at the international level (e.g. through the International Civil Aviation Organisation and International Maritime Organisation). However, there is still a role for supplementary domestic policies to complement the international approach, provided these do not lead to concerns about competitiveness or carbon leakage. What are the domestic measures the UK could take to reduce aviation and shipping emissions over the period to 2030/35 and longer-term to 2050, which would not create significant competitiveness or carbon leakage risks? How much could these reduce emissions?

ANSWER: n/a

Question 33 (Agriculture and Land use): In Chapter 7 of the Net Zero Technical Report we presented our Further Ambition scenario for agriculture and land use (see page 199). The scenario requires measures to release land currently used for food production for other uses, whilst maintaining current per-capita food production. This is achieved through:

- A 20% reduction in consumption of red meat and dairy
- A 20% reduction in food waste by 2025
- Moving 10% of horticulture indoors
- An increase in agriculture productivity:
 - Crop yields rising from the current average of 8 tonnes/hectare for wheat (and equivalent rates for other crops) to 10 tonnes/hectare
 - Livestock stocking density increasing from just over 1 livestock unit (LU)/hectare to 1.5 LU/hectare

Can this increase in productivity be delivered in a sustainable manner?

Do you agree that these are the right measures and with the broad level of ambition indicated? Are there additional measures you would suggest?

ANSWER: n/a

Question 34 (Agriculture and Land use): Land spared through the measures set out in question 33 is used in our Further Ambition scenario for: afforestation (30,000 hectares/year), bioenergy crops (23,000 hectares/year), agro-forestry and hedgerows (~10% of agricultural land) and peatland restoration (50% of upland peat, 25% lowland peat). We also assume the take-up of low-carbon farming practices for soils and livestock. Do you agree that these are the key measures and with the broad level of ambition of each? Are there additional measures you would suggest?

ANSWER: n/a

Question 35 (Greenhouse gas removals): What relevant evidence exists regarding constraints on the rate at which the deployment of engineered GHG removals in the UK (such as bioenergy with carbon capture and storage or direct air capture) could scale-up by 2035?

ANSWER: n/a

Question 36 (Greenhouse gas removals): Is there evidence regarding near-term expected learning curves for the cost of engineered GHG removal through technologies such as bioenergy with carbon capture and storage or direct air capture of CO₂?

ANSWER: n/a

Question 37 (Infrastructure): What will be the key factors that will determine whether decarbonisation of heat in a particular area will require investment in the electricity distribution network, the gas distribution network or a heat network?

ANSWER: It is essential that any pathway towards net zero sees electrification and power generation as part of a holistic picture with heat and networks being two other vital components. The aim should be to identify synergies drawing out where there is an infrastructure requirement and making the case for public infrastructure investment. There are no strong drivers to encourage existing buildings to connect to heat networks or use other forms of low carbon heat. Implementing synergies between electricity and heat through highly efficient district heating, CHP plants combined with heat storage, "electricity to district heating" concepts or heat pumps should gain stronger support. In less densely populated areas in particular the gas grid can be supplemented by hydrogen to decrease emissions but the main barrier here, as in all these scenarios, is cost. Thus, the use of zero-emission technologies must be made more attractive by incentivising promising projects with funding to lower what remains a very high investment requirement.

There are pathways for decarbonising heat but there remain significant political and behavioural social risks associate achieving these. It will be critical in any scenario to find ways to ensure that, for example, appropriate heat offtake from thermal processes is always made use of and that, again, there are strong incentives to drive change. The

recent Climate Change Committee Report on Hydrogen in a Low Carbon Economy rightly suggested that hydrogen could have a role in heat, but that electrification and heat networks are the key technologies.

Question 38 (Infrastructure): What scale of carbon capture and storage development is needed and what does that mean for development of CO₂ transport and storage infrastructure over the period to 2030?

ANSWER: n/a