Welsh Carbon Budgets – Call for Evidence Response

Organisation

Tata Steel UK Limited

Question 1: Does the Paris Agreement mean that Welsh emissions targets should keep open a deeper reduction in emissions than 80% by 2050? Are there implications for nearer-term targets?

We think it is fair to recognise the Paris Agreement as a landmark outcome, albeit possibly unexpected. This remains the case despite the US decision to later state its intention to withdraw. However, whilst Paris establishes a set of "binding procedural commitments," achievement of the NDCs themselves is not legally binding (nor any new financial commitments) and this needs to be borne in mind when considering how the Wales (and UK) emission targets for 2050 and carbon budgets should be framed to reflect the Agreement. The 2050 target in Wales already allows for a greater than 80% reduction as the wording is "at least 80%". That said, the 5 -yearly cycle of pledges and reviews under the Paris Agreement should provide some clarity on how much real progress is likely/actually happening. The first Global Stocktake is set for 2023 and every 5 years thereafter (although there is an interim review due in 2018 ahead of 2020 when the Agreement is in effect). Care is needed in how/when the timings of these reviews might be taken into account and potentially acted upon, bearing in mind Wales is about to set its 2016-2020 and 2021-2025 budgets. This is particularly important when considering the generally long investment cycles in the industrial sector, and the steel sector in particular.

Question 2: Do you think that leaving the EU has an impact on the targets or how they can be met?

As already mentioned in the introduction, following the move from use of "net" emissions as per the UK target, to using actual Wales direct emissions, Brexit should not affect emissions accounting.
Clearly and in particular because of the high proportion of energy intensive and industrial emissions in the Traded Sector, the UK and Wales will need to seriously consider impacts on policy areas. For example, if the UK were not allowed to or chose not to participate in EU ETS (or an identical/very similar traded and possibly linked scheme). In addition to the price signal the EU ETS also delivers auctioning revenues. However whilst we note the CPS is claimed to have been successful in contributing to low carbon generation, the distortion in UK power prices has made the UK a difficult place to operate as an energy intensive industry. The welcome introduction, eventually, of a compensation scheme has helped reduce that impact, but it does not cover the full costs faced by energy intensives and this compensation mechanism is in any case on a declining maximum allowable level under state aid rules.
In many cases it seems likely that relevant EU policy measures will be preserved or replicated by UK law. The CCC briefing paper (Oct 2016) also mentions the likely need to strengthen UK law where it's felt that EU law is insufficient. We would ask that due recognition be given to the potential impact such measures could have on energy intensive industry competitiveness in general and the steel sector in particular due to its difficulty in transitioning to a low carbon approach in the short and medium term due to the need for a step change in innovative steelmaking technologies.
One other key area that remains a significant concern is the future level of EU collaboration and innovation funding (e.g. EU ETS, Horizon 2020) which in a sector that is looking to the development of new and innovative, unproven technologies for decarbonising is vitally important.

Question 3: In the area(s) of your expertise, what are the opportunities and challenges in reducing Welsh emissions in the nearer term (e.g. to 2030)?

The challenges in reducing Welsh emissions are significantly affected by the high level of industrial emissions as a proportion of total emissions (34%) compared to the situation in the wider UK (22%). Taking that in conjunction with the fact that a large proportion of industrial emissions are attributable to only a small number of large emitters from these sectors (see Q8) brings potentially further difficulties. The variability in the short and medium term carbon abatement potential (with current technology) of some parts of the industrial sector could be said to exacerbate the difficulties.
The Welsh Government also does not have devolved competence in all areas relevant to climate change emissions reductions (e.g. energy, aviation and marine transport, building regulations).
Perhaps one of the most difficult challenges, is in the area of effective communication of the key messages and the need for quite significant changes in behaviours of the general public as consumers of goods and services and how that impacts on achievement of the carbon targets and budgets.
Opportunities for reduction of Welsh emissions in the nearer term (up to 2030) include establishing appropriate funding mechanisms that would support the implementation of energy efficiency measures (current/conventional technology) where the pay-back periods are currently outside of those that are economically viable for energy intensive industries.
Promoting and strengthening collaborations between academia and industry will be useful (for example, building on the current example of FLEXIS).
Although, a small proportion of Welsh total emissions, progressing emissions reductions within the Public

Sector will be important, not least in that it will help demonstrate leadership by the Welsh Government. The potential for land-use as a positive benefit for climate change in a country that has the unique geography of Wales is also likely to be important.
Further emission reductions within sectors that have a less difficult low carbon pathway i.e. the power sector, through increased use of renewables, and the expansion of the potential for demand side response (DSR). It should be noted that industry and the steel sector in particular can contribute positively here

Question 4: What is required by 2030 to prepare for the 2050 target for an emissions reduction of at least 80% on 1990 levels, recognising that this may require that emissions in some areas are reduced close to zero? Is there any impact of the need to go beyond 80%, either in 2050 or subsequently?

Our hope is that the achievement of at least 80% reduction in emissions from 1990, is delivered through the development of lower carbon operations in a sustainable industrial landscape which includes a thriving steel sector, and not through de-industrialisation.

Therefore ensuring that the steel sector in Wales has the opportunity to operate competitively over the short to medium term is critical. This should then enable the research and development of innovative new low/lower carbon steelmaking technologies and carbon capture storage and use (CCSU) needed to deliver the significant emission reductions by 2050.

The steel sector is under no illusions that it has to compete in a global market and therefore has to continue to innovate, reduce costs, develop new products and markets etc, but where there are particular issues in Wales (or more likely UK), that could impede or help that competitiveness, these may need intervention by governments.

Along with the rest of the steel sector, Tata Steel has expressed a number of key asks of UK Government in the context of a possible future 'sector deal' under the UK's Industrial Strategy). We believe these are crucial to ensuring a competitive steel industry which can contribute to jobs, process and product innovation and economic and act as a catalyst for decarbonisation across the Welsh economy. The key asks are summarised below:

Actions need to be taken to remove / reduce the significant electricity price differentials faced by UK industry compared to its competitors (in EU and beyond).

A more appropriate regime in respect to Business Rates so that it provides less of a disincentive to investment in productivity boosting capital investment is needed.

An R&D collaboration fund should be established, with match funding by government, to help in the long term investment in research, development and innovation. This has the potential to impact on process efficiency, productivity, product development, all of which will help in ensuring a viable sustainable business; critical developments in new steelmaking methods and CCS, which remains a critical option for the most significant CO2 savings and CCU. Noting that in respect to CCS this will most likely require shipping to a suitable offshore location e.g. potentially the Hamilton fields off the cost of North Wales which could be a first UK cluster.

Public Procurement policies should promote and support UK supply chains.

In addition to the key sectoral asks, a variety of infrastructural developments are also likely to be required. For example, electricity grid infrastructure investment will be needed in key areas in order for there to be any substantial increase in the proportion of EAF to BF/BOS route steelmaking (albeit it should be recognised that BF/BOS route steelmaking remains a substantial outlet for scrap recycling). In addition, a clearer understanding is needed of the required/available capacity of electricity demand in the longer term (2030+) if the intention is to achieve a step-change in electric vehicle use in future (especially if also coupled to greater uptake of EAF steelmaking).

If low carbon/renewable heat sources are to contribute a significant proportion of the targeted carbon emission reductions, there is a significant amount of work required over the next decade or two to enable efficient extraction, storage and distribution. This will include source mapping, development of current and new technologies and potentially significant infrastructure aligned to relevant "clusters" of producers and consumers.

Question 5: What are the respective roles of UK Government, Welsh Government, the wider public sector, business, third sector and individual or household behaviour in delivering emissions reductions between now and 2030? And, separately, between 2030 and 2050?

In respect of the UK Government (and Welsh Government) and UK Steel Sector, as well as some of the wider business sector (supply chain impacts), the roles and responsibilities are probably most

comprehensively covered within the ongoing discussions in respect to the potential Sector Deal (see answer to Question 4) and how that fits in with the Industrial Strategy.

Question 6: As a business, as a Public Sector Body, or as a citizen, how do emissions targets affect your planning and decision-making?

Tata Steel operates in an extremely competitive global (commodity) marketplace and therefore has had a significant focus on all areas that contribute to its cost base or can improve profit margins including energy and material efficiency. This has ensured that significant reductions in energy use and improvements in energy efficiency have taken place over many decades, as it has generally made good business sense to do this. These improvements were instigated and continued over periods pre-dating the setting of carbon targets.

However, as an energy intensive manufacturing operator with its main installations covered by the EU ETS, that regime has had a more immediate impact on planning and decision-making than have the carbon targets and budgets set within the UK Climate Change Act or Wales Environment Act. The EU ETS, through its decreasing cap over time has been the method chosen to achieve the European Traded Sector's contribution to emissions reduction. The impacts of EU ETS in regards to forward positions on potential free allocation levels and the cost of shortfalls have been factored into the company strategy, including asset configuration and capital investment planning.

That said, and with the potential fall-outs from Brexit, the 2050 targets set within UK Climate Change Act (and latterly Wales) clearly indicate the long-term vision and hence the political environment that Tata Steel will be operating in over the long term if it intends to continue as a sustainable business. Therefore it is currently honing its long-term strategy for delivering a sustainable business (this includes areas such as Climate Change and Circular Economy, the latter being intrinsically linked to former).

The effect of public policy on the foundation industries such as the steel industry has the potential to be profoundly positive, if Governments embrace Circular Economy and low carbon concepts in planning, procurement and product legislation. Steel products will be vital in helping society to become more sustainable because of their intrinsic durability, flexibility, re-usability and, at the end of their lives, recyclability. We strongly believe that Governments should seek to incentivise the uptake of sustainable materials and the establishment of a Circular Economy through the full suite of policy instruments at their disposal.

Question 7: In your area(s) of expertise, what specific circumstances need to be considered when setting targets and budgets for Wales and how could these be reflected in the targets?

We understand and recognise the premise that early reduction of absolute emissions (e.g. by 2030) will mean lower cumulative emissions between now and 2050 and therefore a reduced impact on the climate. However, it is fundamentally clear that the steel sector is close to the thermodynamic limits of conventional primary BF/BOS route steelmaking. As such, substantial reductions in direct emissions require the development and implementation of new steelmaking technologies. In conjunction with this, there is an expectation that there will be a move towards an increased use of scrap (for example, through an uptake of EAF) and/or implementation of new low carbon steelmaking technologies over the long term. This does also assume the availability of sufficient low carbon/renewable electricity, and possible CCS and/or CCU. Care is needed to understand the extent to which these technologies could be deployed, whether they will be accepted by the public and how the deployment and increased costs will be funded. Without the deployment of new technologies and low-carbon energy, a commitment to any particular stretching targets would be optimistic in the extreme.

In the short term the industry continues to commit substantial efforts to optimise energy consumption, material yield and other process efficiencies wherever it is cost effective to do so. Whilst such efforts are hugely important, they will provide only relatively small percentage improvements in emissions (though outside of the integrated steelmaking installations, these reductions may be considered significant in absolute terms).

We have already set out our assertion that Welsh emission reductions cannot be achieved through de-industrialisation; this would be counter-productive in global emissions terms and would carry a substantial cost for the Welsh economy and its ability to innovate and be a catalyst for global action. One way for policy makers to ensure that genuine emissions reductions are being achieved is to use consumption-based reporting, using life-cycle assessment methods to understand not only the direct emissions from the Welsh economy and society but also the indirect emissions from the production of imported goods.

Linked to consumption based reporting is the need to avoid setting simplistic targets expressed as emissions per tonne of basic production volume. In some cases, there is a life cycle benefit from investing more energy and emissions in the production stage of a product's life in order to secure an improvement in its 'in use' or 'end-of life' performance.' A classic illustration of this is the extra energy expended to produce advanced high strength steels (AHSS) leading to light-weighting e.g. in the automotive sector, which help provide reduced transport emissions and hence lower global emissions. Similarly, the carbon benefits accrued by the use of high efficiency electrical steels e.g. in transformers and motors, outweighs many times the additional impacts incurred during the manufacture of such steels. The contribution through the manufacture of premium steel products to large net savings in carbon emissions over the full life cycle of steel products should be recognised, not penalised

Another key consideration in target setting linked to product characteristics is understanding the technical limitations of various production processes for manufacturing products of the correct specification, It needs to be understood, for example, that EAF-produced steels are currently unsuitable for use in a number of applications, not least a variety of key sectors for flat steel products such as automotive. In this case, the limitations are due to high nitrogen levels and some residual elements that lead to strain ageing and low ductility issues in the final flat products and prevent EAF route supply. Therefore R&D into process improvements that may allow the EAF route to be able to supply this important sector is required and will take substantial time. This is a key factor that needs to be considered in determining the extent of any future transition to a greater uptake of the EAF route (or other new steelmaking techniques such as HISARNA) between 2030-2050.

As can be seen from the examples above, Tata Steel and the wider steel sector need “breathing space” for a broad and complex range of measures to come to fruition. We need this to be considered in setting the interim targets and carbon budgets to take into account the unavoidable back-loaded pathway for substantial emission reductions.

Unlike the move to increased electric vehicle ownership and use, the Technology Readiness Level (TRL) of potential future lower carbon steelmaking methods is low and remains unproven. Whilst Tata Steel remains hopeful in regards to a new technology HISARNA (installed at the Netherlands site) it remains at pilot plant level. The latest trial will seek to test the stability of operations over more than a month and therefore remains a very long way from being proven and then developed at a commercial scale and rolled out across the EU/World.

The TRL of such potential improvements needs to be taken into account when the options for achieving carbon emission reductions at a particular cost and by a particular time from all sectors/sub-sectors are assessed.

When considering the range of possible improvements to energy efficiency and emission reduction, care is needed to take into account that they are often either mutually exclusive (so one option being implemented would mean another wouldn’t be) or they interact to a greater or lesser extent , so the overall reduction in CO2 cannot be taken to be the sum of each individual option.

For a number of improvement options there may also be a level of interdependence, for example on an integrated steelmaking site (conventional BF/BOS route) which are very complex with several inter-linked processes, These installations produce process waste gases (BFG, COG, BOSG) from the cokemaking, ironmaking and steelmaking operations. Ideally the production of these gases (inherent and unavoidable) should slightly exceed demand, resulting in a small safety flare. However, due to site configuration, or limitations (such as age and efficiency of power generation) supply may be significantly greater than supply. Therefore installing projects that improve efficiency of combustion that just save waste gases would have no real benefit as this would just lead to increased flaring of the waste gases. Installation of sufficient additional combustion capacity (eg power generation) would possibly be required first/alongside. Such additional capacity can often be, as is usually the case in the steel sector, a significant capital expenditure.

Due to the highly capital intensive nature of our industry, there can be some critical issues relating to timing and choices made, particularly those that are being considered now in the short term. It may be that measures that appear to be essential or obvious options in the short term, are not aligned with a “possible future option” (although that option is unproven and may not come to fruition). Companies in capital intensive sectors such as steel that are already substantially constrained in terms of access to finance cannot afford to spend ‘regret capital’ implementing technologies that shortly after are shown not to be compatible with the optimal decarbonisation roadmap.

Whilst it has been made clear that the emissions targets are focussed on Wales emissions, it is important that due diligence be taken and reflected in any impact assessment of the level of imported carbon emissions when considering setting the carbon targets and budgets. It would not be sensible or appropriate if net (imported and direct) emissions were increasing/static whilst direct emissions were reducing. This would likely be a road to de-industrialisation rather than de-carbonisation.

We also believe – as described above - that taking a full life-cycle approach to the actual global impact is the correct way to go, so that the overall correct decisions are made.

A good example can be found in an independent study of Toyota Venza carried out by the University of California at Davis (https://www.worldsteel.org/steel-by-topic/life-cycle-thinking/case-studies/WorldAutoSteel---Automotive--Life-cycle-thinking-leads-to-intelligent-automotive-material-choices.html)

A full life cycle approach should also be adopted when calculating the carbon emissions associated with steelmaking, in particular in accounting for the use of steel scrap in BOS and EAF steelmaking. Steel scrap is a valuable resource (i.e. is not ‘free’ economically, nor environmentally) and its recycling into new steel should properly account for the carbon ‘embodied’ in the scrap.

Question 8: The power and industry sectors in Wales are dominated by a small number of large emitters. What are the key challenges and opportunities that this presents in setting the levels of carbon budgets and how should the process of setting them reflect these?

A key structural challenge is that a small number of large emitters are owned by a small number of companies. As such, a potentially significant burden (and capital expenditure) is likely to fall on one or two industrial/power companies. In respect to the industrial installation/operator then unlike the power company

it cannot pass on the CO2 costs to its customers.
In respect to the integrated steelmaking site, the various options considered in the last UK carbon budget report, in respect to energy efficiency and emission reductions were being considered across the whole of the UK. This meant that it was feasible to have considered , potential savings from more than one option contributing to the abatement target , whereas on a single site in Wales, they may be mutually exclusive or lead to significant interaction and lower net savings.
The integrated steelmaking installation, also does rely on a number of unproven “new technologies” on the pathway to 2050 and therefore will necessarily be biased towards longer term significant reductions in carbon emissions (and later interim targets and budgets), which will need to be duly considered.
In respect to Aberthaw power station and the UK policy of phasing out coal power, the uncertainty in the emission pathway and particular year of final closure appears to present a challenge. The Welsh Government does have the opportunity to review budgets and targets where there has been a significant change, to avoid any concerns over “hot air”.
Having a small number of large emitters does also provide a few opportunities. An example for this could be the Tata Steel Port Talbot installation which produces CO2, CO and H2, , has availability of land suitable for renewables including offshore wind and waste heat. Therefore it provides a suitable site to undertake demonstration projects in regards to the development of technologies in respect to carbon dioxide streams , waste heat and renewable energy.*
* “The potential and limitations of using carbon dioxide” –Policy Briefing, The Royal Society, May 2017, ISBN:978-1-78252-267-6

Question 9: 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?

The Committee should ensure that it takes a balanced view (and aligning with the Future Generations Act) and ensure that it considers the positive impacts and interactions (actual and potential) not just conflicts and negative impacts.
In this response we have sought to illustrate not only the benefits we bring to the Welsh economy in terms of job creation and economic development, but also the profoundly beneficial role that our products can make to achieving a more resource-efficient and circular economy throughout Wales and beyond. Only with the short term breathing space and support we need to consolidate our competitiveness, can we continue to be a positive hub of innovation in sustainable products and processes.
In addition to the economic benefits that we provide, Tata Steel also seeks to be a good neighbour and a positive contributor to the local community. We are, for example, a key partner in the management of the Eglwys Nunydd reservoir which is a recognised excellent fishing area and supports a sailing club, in addition to the wildfowl that designated it as a SSI site. Over the years Tata steel has supported other local habitats e.g. sponsoring the fen orchid and given over part of its land around the landfill site to support a local species of bee.
There may be further opportunities for active management of “urban green spaces” helping with improvements to bio-diversity, tree planting etc by industrial organisations. This could be supported through some form of benefit or credit in respect to environmental permit subsistence charges

Question 10: 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?

The Future Trends report is an interesting document, and it stimulates discussions across a wide range of areas which is a good thing. However, due to the inherent limitation in “future forecast” accuracy, the Committee will need to take care on the “weighting” it gives to the “evidence” in its assessment.

Organisation

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Soil Association

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and possibly linked scheme). In addition to the price signal the EU ETS also delivers auctioning revenues. However whilst we note the CPS is claimed to have been successful in contributing to low carbon generation, the distortion in UK power prices has made the UK a difficult place to operate as an energy intensive industry. The welcome introduction, eventually, of a compensation scheme has helped reduce that impact, but it does not cover the full costs faced by energy intensives and this compensation mechanism is in any case on a declining maximum allowable level under state aid rules.
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Although, a small proportion of Welsh total emissions, progressing emissions reductions within the Public Sector will be important, not least in that it will help demonstrate leadership by the Welsh Government. The potential for land-use as a positive benefit for climate change in a country that has the unique geography of Wales is also likely to be important.
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Public Procurement policies should promote and support UK supply chains.

In addition to the key sectoral asks, a variety of infrastructural developments are also likely to be required. For example, electricity grid infrastructure investment will be needed in key areas in order for there to be any substantial increase in the proportion of EAF to BF/BOS route steelmaking (albeit it should be recognised that BF/BOS route steelmaking remains a substantial outlet for scrap recycling). In addition, a clearer understanding is needed of the required/available capacity of electricity demand in the longer term (2030+) if the intention is to achieve a step-change in electric vehicle use in future (especially if also coupled to greater uptake of EAF steelmaking).

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In the short term the industry continues to commit substantial efforts to optimise energy consumption, material yield and other process efficiencies wherever it is cost effective to do so. Whilst such efforts are hugely important, they will provide only relatively small percentage improvements in emissions (though outside of the integrated steelmaking installations, these reductions may be considered significant in absolute terms).

We have already set out our assertion that Welsh emission reductions cannot be achieved through de-industrialisation; this would be counter-productive in global emissions terms and would carry a substantial cost for the Welsh economy and its ability to innovate and be a catalyst for global action. One way for policy makers to ensure that genuine emissions reductions are being achieved is to use consumption-based reporting, using life-cycle

assessment methods to understand not only the direct emissions from the Welsh economy and society but also the indirect emissions from the production of imported goods. Linked to consumption based reporting is the need to avoid setting simplistic targets expressed as emissions per tonne of basic production volume. In some cases, there is a life cycle benefit from investing more energy and emissions in the production stage of a product's life in order to secure an improvement in its 'in use' or 'end-of life' performance.' A classic illustration of this is the extra energy expended to produce advanced high strength steels (AHSS) leading to light-weighting e.g. in the automotive sector, which help provide reduced transport emissions and hence lower global emissions. Similarly, the carbon benefits accrued by the use of high efficiency electrical steels e.g. in transformers and motors, outweighs many times the additional impacts incurred during the manufacture of such steels. The contribution through the manufacture of premium steel products to large net savings in carbon emissions over the full life cycle of steel products should be recognised, not penalised

Another key consideration in target setting linked to product characteristics is understanding the technical limitations of various production processes for manufacturing products of the correct specification, It needs to be understood, for example, that EAF-produced steels are currently unsuitable for use in a number of applications, not least a variety of key sectors for flat steel products such as automotive. In this case, the limitations are due to high nitrogen levels and some residual elements that lead to strain ageing and low ductility issues in the final flat products and prevent EAF route supply. Therefore R&D into process improvements that may allow the EAF route to be able to supply this important sector is required and will take substantial time. This is a key factor that needs to be considered in determining the

extent of any future transition to a greater uptake of the EAF route (or other new steelmaking techniques such as HISARNA) between 2030-2050.

As can be seen from the examples above, Tata Steel and the wider steel sector need “breathing space” for a broad and complex range of measures to come to fruition. We need this to be considered in setting the interim targets and carbon budgets to take into account the unavoidable back-loaded pathway for substantial emission reductions.

Unlike the move to increased electric vehicle ownership and use, the Technology Readiness Level (TRL) of potential future lower carbon steelmaking methods is low and remains unproven. Whilst Tata Steel remains hopeful in regards to a new technology HISARNA (installed at the Netherlands site) it remains at pilot plant level. The latest trial will seek to test the stability of operations over more than a month and therefore remains a very long way from being proven and then developed at a commercial scale and rolled out across the EU/World.

The TRL of such potential improvements needs to be taken into account when the options for achieving carbon emission reductions at a particular cost and by a particular time from all sectors/sub-sectors are assessed.

When considering the range of possible improvements to energy efficiency and emission reduction, care is needed to take into account that they are often either mutually exclusive (so one option being implemented would mean another wouldn’t be) or they interact to a greater or lesser extent , so the overall reduction in CO2 cannot be taken to be the sum of each individual option.

For a number of improvement options there may also be a level of interdependence, for example on an integrated steelmaking site (conventional BF/BOS route) which are very complex with several inter-linked processes, These installations produce process waste gases (BFG, COG, BOSG) from the

cokemaking, ironmaking and steelmaking operations. Ideally the production of these gases (inherent and unavoidable) should slightly exceed demand, resulting in a small safety flare. However, due to site configuration, or limitations (such as age and efficiency of power generation) supply may be significantly greater than supply. Therefore installing projects that improve efficiency of combustion that just save waste gases would have no real benefit as this would just lead to increased flaring of the waste gases. Installation of sufficient additional combustion capacity (eg power generation) would possibly be required first/alongside. Such additional capacity can often be, as is usually the case in the steel sector, a significant capital expenditure.

Due to the highly capital intensive nature of our industry, there can be some critical issues relating to timing and choices made, particularly those that are being considered now in the short term. It may be that measures that appear to be essential or obvious options in the short term, are not aligned with a “possible future option” (although that option is unproven and may not come to fruition). Companies in capital intensive sectors such as steel that are already substantially constrained in terms of access to finance cannot afford to spend ‘regret capital’ implementing technologies that shortly after are shown not to be compatible with the optimal decarbonisation roadmap.

Whilst it has been made clear that the emissions targets are focussed on Wales emissions, it is important that due diligence be taken and reflected in any impact assessment of the level of imported carbon emissions when considering setting the carbon targets and budgets. It would not be sensible or appropriate if net (imported and direct) emissions were increasing/static whilst direct emissions were reducing. This would likely be a road to de-industrialisation rather than de-carbonisation.

We also believe – as described above - that taking a full life-cycle approach to the actual

global impact is the correct way to go, so that the overall correct decisions are made.
A good example can be found in an independent study of Toyota Venza carried out by the University of California at Davis (https://www.worldsteel.org/steel-by-topic/life-cycle-thinking/case-studies/WorldAutoSteel---Automotive--Life-cycle-thinking-leads-to-intelligent-automotive-material-choices.html)
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Question 8: The power and industry sectors in Wales are dominated by a small number of large emitters. What are the key challenges and opportunities that this presents in setting the levels of carbon budgets and how should the process of setting them reflect these?

A key structural challenge is that a small number of large emitters are owned by a small number of companies. As such, a potentially significant burden (and capital expenditure) is likely to fall on one or two industrial/power companies. In respect to the industrial installation/operator then unlike the power company it cannot pass on the CO2 costs to its customers.
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number of unproven “new technologies” on the pathway to 2050 and therefore will necessarily be biased towards longer term significant reductions in carbon emissions (and later interim targets and budgets), which will need to be duly considered.
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throughout Wales and beyond. Only with the short term breathing space and support we need to consolidate our competitiveness, can we continue to be a positive hub of innovation in sustainable products and processes.
In addition to the economic benefits that we provide, Tata Steel also seeks to be a good neighbour and a positive contributor to the local community. We are, for example, a key partner in the management of the Eglwys Nunydd reservoir which is a recognised excellent fishing area and supports a sailing club, in addition to the wildfowl that designated it as a SSI site. Over the years Tata steel has supported other local habitats e.g. sponsoring the fen orchid and given over part of its land around the landfill site to support a local species of bee. There may be further opportunities for active management of “urban green spaces” helping with improvements to bio-diversity, tree planting etc by industrial organisations. This could be supported through some form of benefit or credit in respect to environmental permit subsistence charges

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We think it is fair to recognise the Paris Agreement as a landmark outcome, albeit possibly unexpected. This remains the case despite the US decision to later state its intention to withdraw. However, whilst Paris establishes a set of "binding procedural commitments," achievement of the NDCs themselves is not legally binding (nor any new financial commitments) and this needs to be borne in mind when considering how the Wales (and UK) emission targets for 2050 and carbon budgets should be framed to reflect the Agreement. The 2050 target in Wales already allows for a greater than 80% reduction as the wording is "at least 80%". That said, the 5 -yearly cycle of pledges and reviews under the Paris Agreement should provide some clarity on how much real progress is likely/actually happening. The first Global Stocktake is set for 2023 and every 5 years thereafter (although there is an interim review due in 2018 ahead of 2020 when the Agreement is in effect). Care is needed in how/when the timings of these reviews might be taken into account and potentially acted upon, bearing in mind Wales is about to set its 2016-2020 and 2021-2025 budgets. This is particularly important when considering the generally long investment cycles in the industrial sector, and the steel sector in particular.

Question 2: Do you think that leaving the EU has an impact on the targets or how they can be met?

As already mentioned in the introduction, following the move from use of "net" emissions as per the UK target, to using actual Wales direct emissions, Brexit should not affect emissions accounting.
Clearly and in particular because of the high proportion of energy intensive and industrial emissions in the Traded Sector, the UK and Wales will need to seriously consider impacts on policy areas. For example, if the UK were not allowed to or chose not to participate in EU ETS (or an identical/very similar traded and possibly linked scheme). In addition to the price signal the EU ETS also delivers auctioning revenues. However whilst we note the CPS is claimed to have been successful in contributing to low carbon generation, the distortion in UK power prices has made the UK a difficult place to operate as an energy intensive industry. The welcome introduction, eventually, of a compensation scheme has helped reduce that impact, but it does not cover the full costs faced by energy intensives and this compensation mechanism is in any case on a declining maximum allowable level under state aid rules.
In many cases it seems likely that relevant EU policy measures will be preserved or replicated by UK law. The CCC briefing paper (Oct 2016) also mentions the likely need to strengthen UK law where it's felt that EU law is insufficient. We would ask that due recognition be given to the potential impact such measures could have on energy intensive industry competitiveness in general and the steel sector in particular due to its difficulty in transitioning to a low carbon approach in the short and medium term due to the need for a step change in innovative steelmaking technologies.
One other key area that remains a significant concern is the future level of EU collaboration and innovation funding (e.g. EU ETS, Horizon 2020) which in a sector that is looking to the development of new and innovative, unproven technologies for decarbonising is vitally important.

Question 3: In the area(s) of your expertise, what are the opportunities and challenges in reducing Welsh emissions in the nearer term (e.g. to 2030)?

The challenges in reducing Welsh emissions are significantly affected by the high level of industrial emissions as a proportion of total emissions (34%) compared to the situation in the wider UK (22%). Taking that in conjunction with the fact that a large proportion of industrial emissions are attributable to only a small number of large emitters from these sectors (see Q8) brings potentially further difficulties. The variability in the short and medium term carbon abatement potential (with current technology) of some parts of the industrial sector could be said to exacerbate the difficulties.
The Welsh Government also does not have devolved competence in all areas relevant to climate change emissions reductions (e.g. energy, aviation and marine transport, building regulations).
Perhaps one of the most difficult challenges, is in the area of effective communication of the key messages and the need for quite significant changes in behaviours of the general public as consumers of goods and services and how that impacts on achievement of the carbon targets and budgets.
Opportunities for reduction of Welsh emissions in the nearer term (up to 2030) include establishing appropriate funding mechanisms that would support the implementation of energy efficiency measures (current/conventional technology) where the pay-back periods are currently outside of those that are economically viable for energy intensive industries.
Promoting and strengthening collaborations between academia and industry will be useful (for example, building on the current example of FLEXIS).
Although, a small proportion of Welsh total emissions, progressing emissions reductions within the Public Sector will be important, not least in that it will help demonstrate leadership by the Welsh Government. The potential for land-use as a positive benefit for climate change in a country that has the unique geography of Wales is also likely to be important.
Further emission reductions within sectors that have a less difficult low carbon pathway i.e. the power sector, through increased use of renewables, and the expansion of the potential for demand side response (DSR). It should be noted that industry and the steel sector in particular can contribute positively here

Question 4: What is required by 2030 to prepare for the 2050 target for an emissions reduction of at least 80% on 1990 levels, recognising that this may require that emissions in some areas are reduced close to zero? Is there any impact of the need to go beyond 80%, either in 2050 or subsequently?

Our hope is that the achievement of at least 80% reduction in emissions from 1990, is delivered through the development of lower carbon operations in a sustainable industrial landscape which includes a thriving steel sector, and not through de-industrialisation.

Therefore ensuring that the steel sector in Wales has the opportunity to operate competitively over the short to medium term is critical. This should then enable the research and development of innovative new low/lower carbon steelmaking technologies and carbon capture storage and use (CCSU) needed to deliver the significant emission reductions by 2050.

The steel sector is under no illusions that it has to compete in a global market and therefore has to continue to innovate, reduce costs, develop new products and markets etc, but where there are particular issues in Wales (or more likely UK), that could impede or help that competitiveness, these may need intervention by governments.

Along with the rest of the steel sector, Tata Steel has expressed a number of key asks of UK Government in the context of a possible future 'sector deal' under the UK's Industrial Strategy). We believe these are crucial to ensuring a competitive steel industry which can contribute to jobs, process and product innovation and economic and act as a catalyst for decarbonisation across the Welsh economy. The key asks are summarised below:

Actions need to be taken to remove / reduce the significant electricity price differentials faced by UK industry compared to its competitors (in EU and beyond).

A more appropriate regime in respect to Business Rates so that it provides less of a disincentive to investment in productivity boosting capital investment is needed.

An R&D collaboration fund should be established, with match funding by government, to help in the long term investment in research, development and innovation. This has the potential to impact on process efficiency, productivity, product development, all of which will help in ensuring a viable sustainable business; critical developments in new steelmaking methods and CCS, which remains a critical option for the most significant CO2 savings and CCU. Noting that in respect to CCS this will most likely require shipping to a suitable offshore location e.g. potentially the Hamilton fields off the cost of North Wales which could be a first UK cluster.

Public Procurement policies should promote and support UK supply chains.

In addition to the key sectoral asks, a variety of infrastructural developments are also likely to be required. For example, electricity grid infrastructure investment will be needed in key areas in order for there to be any substantial increase in the proportion of EAF to BF/BOS route steelmaking (albeit it should be recognised that BF/BOS route steelmaking remains a substantial outlet for scrap recycling). In addition, a clearer understanding is needed of the required/available capacity of electricity demand in the longer term (2030+) if the intention is to achieve a step-change in electric vehicle use in future (especially if also coupled to greater uptake of EAF steelmaking).

If low carbon/renewable heat sources are to contribute a significant proportion of the targeted carbon emission reductions, there is a significant amount of work required over the next decade or two to enable efficient extraction, storage and distribution. This will include source mapping, development of current and new technologies and potentially significant infrastructure aligned to relevant "clusters" of producers and consumers.

Question 5: What are the respective roles of UK Government, Welsh Government, the wider public sector, business, third sector and individual or household behaviour in delivering emissions reductions between now and 2030? And, separately, between 2030 and 2050?

In respect of the UK Government (and Welsh Government) and UK Steel Sector, as well as some of the wider business sector (supply chain impacts), the roles and responsibilities are probably most comprehensively covered within the ongoing discussions in respect to the potential Sector Deal (see answer to Question 4) and how that fits in with the Industrial Strategy.

Question 6: As a business, as a Public Sector Body, or as a citizen, how do emissions targets affect your planning and decision-making?

Tata Steel operates in an extremely competitive global (commodity) marketplace and therefore has had a significant focus on all areas that contribute to its cost base or can improve profit margins including energy and material efficiency. This has ensured that significant reductions in energy use and improvements in

energy efficiency have taken place over many decades, as it has generally made good business sense to do this. These improvements were instigated and continued over periods pre-dating the setting of carbon targets.
However, as an energy intensive manufacturing operator with its main installations covered by the EU ETS, that regime has had a more immediate impact on planning and decision-making than have the carbon targets and budgets set within the UK Climate Change Act or Wales Environment Act. The EU ETS, through its decreasing cap over time has been the method chosen to achieve the European Traded Sector's contribution to emissions reduction. The impacts of EU ETS in regards to forward positions on potential free allocation levels and the cost of shortfalls have been factored into the company strategy, including asset configuration and capital investment planning.
That said, and with the potential fall-outs from Brexit, the 2050 targets set within UK Climate Change Act (and latterly Wales) clearly indicate the long-term vision and hence the political environment that Tata Steel will be operating in over the long term if it intends to continue as a sustainable business. Therefore it is currently honing its long-term strategy for delivering a sustainable business (this includes areas such as Climate Change and Circular Economy, the latter being intrinsically linked to former).
The effect of public policy on the foundation industries such as the steel industry has the potential to be profoundly positive, if Governments embrace Circular Economy and low carbon concepts in planning, procurement and product legislation. Steel products will be vital in helping society to become more sustainable because of their intrinsic durability, flexibility, re-usability and, at the end of their lives, recyclability. We strongly believe that Governments should seek to incentivise the uptake of sustainable materials and the establishment of a Circular Economy through the full suite of policy instruments at their disposal.

Question 7: In your area(s) of expertise, what specific circumstances need to be considered when setting targets and budgets for Wales and how could these be reflected in the targets?

We understand and recognise the premise that early reduction of absolute emissions (e.g. by 2030) will mean lower cumulative emissions between now and 2050 and therefore a reduced impact on the climate. However, it is fundamentally clear that the steel sector is close to the thermodynamic limits of conventional primary BF/BOS route steelmaking. As such, substantial reductions in direct emissions require the development and implementation of new steelmaking technologies. In conjunction with this, there is an expectation that there will be a move towards an increased use of scrap (for example, through an uptake of EAF) and/or implementation of new low carbon steelmaking technologies over the long term. This does also assume the availability of sufficient low carbon/renewable electricity, and possible CCS and/or CCU. Care is needed to understand the extent to which these technologies could be deployed, whether they will be accepted by the public and how the deployment and increased costs will be funded. Without the deployment of new technologies and low-carbon energy, a commitment to any particular stretching targets would be optimistic in the extreme.
In the short term the industry continues to commit substantial efforts to optimise energy consumption, material yield and other process efficiencies wherever it is cost effective to do so. Whilst such efforts are hugely important, they will provide only relatively small percentage improvements in emissions (though outside of the integrated steelmaking installations, these reductions may be considered significant in absolute terms).
We have already set out our assertion that Welsh emission reductions cannot be achieved through de-industrialisation; this would be counter-productive in global emissions terms and would carry a substantial cost for the Welsh economy and its ability to innovate and be a catalyst for global action. One way for policy makers to ensure that genuine emissions reductions are being achieved is to use consumption-based reporting, using life-cycle assessment methods to understand not only the direct emissions from the Welsh economy and society but also the indirect emissions from the production of imported goods.
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4. Yes, we agree that meeting the commitments within the Paris Agreement means adopting a deeper reduction in emissions than 80% by 2050, and a corresponding change in nearer-term targets, including for reasons of avoiding lock-in to high carbon investment. To achieve these reductions, the agriculture sector must be included. Targets to reduce Welsh GHG emissions should incorporate a strong emphasis on food and farming. Until recently, farming has been the elephant in the room when it comes to climate change. We also note that some calculations of the contribution of farming to GHG emissions (such as the calculation that farming is responsible for 10% of the EU’s overall emissions) often ignore emissions from animal feed production outside of the EU, the manufacture of nitrogen fertiliser or other agro-chemicals, and the transport of agricultural products. It also excludes the emissions related to land use change (for example, ploughing up forest or grassland for crops) or losses of soil carbon. A new report from IFOAM EU estimates that altogether, one-third of global GHG emissions could be linked to the farming and food industries – production, processing, distribution and consumption. We would like to see the emissions reductions targets adopted by Wales in the near- and long-term take into account a full assessment of food and farming related emissions.

If tackling climate change is to be a top priority for food and farming policy, emissions targets in the short and long term set out in climate change policy and by the CCC must be fully reflected in future agriculture policy too. The Soil Association has called for a commitment to zero-carbon farming by around 2050 and proposed some solutions to help achieve that goal.

Organic farming methods can help to deliver this goal and therefore

commitments," achievement of the NDCs themselves is not legally binding (nor any new financial commitments) and this needs to be borne in mind when considering how the Wales (and UK) emission targets for 2050 and carbon budgets should be framed to reflect the Agreement. The 2050 target in Wales already allows for a greater than 80% reduction as the wording is "at least 80%".
That said, the 5 -yearly cycle of pledges and reviews under the Paris Agreement should provide some clarity on how much real progress is likely/actually happening. The first Global Stocktake is set for 2023 and every 5 years thereafter (although there is an interim review due in 2018 ahead of 2020 when the Agreement is in effect). Care is needed in how/when the timings of these reviews might be taken into account and potentially acted upon, bearing in mind Wales is about to set its 2016-2020 and 2021-2025 budgets. This is particularly important when considering the generally long investment cycles in the industrial sector, and the steel sector in particular.

Question 2: Do you think that leaving the EU has an impact on the targets or how they can be met?

As already mentioned in the introduction, following the move from use of "net" emissions as per the UK target, to using actual Wales direct emissions, Brexit should not affect emissions accounting.
Clearly and in particular because of the high proportion of energy intensive and industrial emissions in the Traded Sector, the UK and Wales will need to seriously consider impacts on policy areas. For example, if the UK were not allowed to or chose not to participate in EU ETS (or an identical/very similar traded and possibly linked scheme). In addition to the price signal the EU ETS also delivers auctioning revenues. However whilst we note the CPS is claimed to have been successful in contributing to low carbon generation, the distortion in UK power prices has made the UK a difficult place to

should be more strongly supported by the Government. Evidence shows that organic farms generally emit fewer greenhouse gases, use less energy and store greater amounts of carbon in soils per hectare than non-organic farms; the IFOAM EU report estimates that conversion to 50% of EU land under organic farming by 2030 would equate to a 23% cut in agricultural GHG emissions through increased soil carbon sequestration and reduced application of manufactured nitrogen fertilisers.

operate as an energy intensive industry. The welcome introduction, eventually, of a compensation scheme has helped reduce that impact, but it does not cover the full costs faced by energy intensives and this compensation mechanism is in any case on a declining maximum allowable level under state aid rules.
In many cases it seems likely that relevant EU policy measures will be preserved or replicated by UK law. The CCC briefing paper (Oct 2016) also mentions the likely need to strengthen UK law where it's felt that EU law is insufficient. We would ask that due recognition be given to the potential impact such measures could have on energy intensive industry competitiveness in general and the steel sector in particular due to its difficulty in transitioning to a low carbon approach in the short and medium term due to the need for a step change in innovative steelmaking technologies.
One other key area that remains a significant concern is the future level of EU collaboration and innovation funding (e.g. EU ETS, Horizon 2020) which in a sector that is looking to the development of new and innovative, unproven technologies for decarbonising is vitally important.

Question 3: In the area(s) of your expertise, what are the opportunities and challenges in reducing Welsh emissions in the nearer term (e.g. to 2030)?

The challenges in reducing Welsh emissions are significantly affected by the high level of industrial emissions as a proportion of total emissions (34%) compared to the situation in the wider UK (22%). Taking that in conjunction with the fact that a large proportion of industrial emissions are attributable to only a small number of large emitters from these sectors (see Q8) brings potentially further difficulties. The variability in the short and medium term carbon abatement potential (with current technology) of some parts of the industrial sector could be said to exacerbate the difficulties.
The Welsh Government also

does not have devolved competence in all areas relevant to climate change emissions reductions (e.g. energy, aviation and marine transport, building regulations).
Perhaps one of the most difficult challenges, is in the area of effective communication of the key messages and the need for quite significant changes in behaviours of the general public as consumers of goods and services and how that impacts on achievement of the carbon targets and budgets.
Opportunities for reduction of Welsh emissions in the nearer term (up to 2030) include establishing appropriate funding mechanisms that would support the implementation of energy efficiency measures (current/conventional technology) where the pay-back periods are currently outside of those that are economically viable for energy intensive industries.
Promoting and strengthening collaborations between academia and industry will be useful (for example, building on the current example of FLEXIS).
Although, a small proportion of Welsh total emissions, progressing emissions reductions within the Public Sector will be important, not least in that it will help demonstrate leadership by the Welsh Government. The potential for land-use as a positive benefit for climate change in a country that has the unique geography of Wales is also likely to be important.
Further emission reductions within sectors that have a less difficult low carbon pathway i.e. the power sector, through increased use of renewables, and the expansion of the potential for demand side response (DSR). It should be noted that industry and the steel sector in particular can contribute positively here

Question 4: What is required by 2030 to prepare for the 2050 target for an emissions reduction of at least 80% on 1990 levels, recognising that this may require that emissions in some areas are reduced close to zero? Is there any impact of the need to go

beyond 80%, either in 2050 or subsequently?

Our hope is that the achievement of at least 80% reduction in emissions from 1990, is delivered through the development of lower carbon operations in a sustainable industrial landscape which includes a thriving steel sector, and not through de-industrialisation.

Therefore ensuring that the steel sector in Wales has the opportunity to operate competitively over the short to medium term is critical. This should then enable the research and development of innovative new low/lower carbon steelmaking technologies and carbon capture storage and use (CCSU) needed to deliver the significant emission reductions by 2050.

The steel sector is under no illusions that it has to compete in a global market and therefore has to continue to innovate, reduce costs, develop new products and markets etc, but where there are particular issues in Wales (or more likely UK), that could impede or help that competitiveness, these may need intervention by governments.

Along with the rest of the steel sector, Tata Steel has expressed a number of key asks of UK Government in the context of a possible future 'sector deal' under the UK's Industrial Strategy). We believe these are crucial to ensuring a competitive steel industry which can contribute to jobs, process and product innovation and economic and act as a catalyst for decarbonisation across the Welsh economy. The key asks are summarised below:

Actions need to be taken to remove / reduce the significant electricity price differentials faced by UK industry compared to its competitors (in EU and beyond).

A more appropriate regime in respect to Business Rates so that it provides less of a disincentive to investment in

productivity boosting capital investment is needed.

An R&D collaboration fund should be established, with match funding by government, to help in the long term investment in research, development and innovation. This has the potential to impact on process efficiency, productivity, product development, all of which will help in ensuring a viable sustainable business; critical developments in new steelmaking methods and CCS, which remains a critical option for the most significant CO2 savings and CCU. Noting that in respect to CCS this will most likely require shipping to a suitable offshore location e.g. potentially the Hamilton fields off the cost of North Wales which could be a first UK cluster.

Public Procurement policies should promote and support UK supply chains.

In addition to the key sectoral asks, a variety of infrastructural developments are also likely to be required. For example, electricity grid infrastructure investment will be needed in key areas in order for there to be any substantial increase in the proportion of EAF to BF/BOS route steelmaking (albeit it should be recognised that BF/BOS route steelmaking remains a substantial outlet for scrap recycling). In addition, a clearer understanding is needed of the required/available capacity of electricity demand in the longer term (2030+) if the intention is to achieve a step-change in electric vehicle use in future (especially if also coupled to greater uptake of EAF steelmaking).

If low carbon/renewable heat sources are to contribute a significant proportion of the targeted carbon emission reductions, there is a significant amount of work required over the next decade or two to enable efficient extraction, storage and distribution. This will include source mapping, development of current and new technologies and potentially significant infrastructure aligned to relevant

"clusters" of producers and consumers.

Question 5: What are the respective roles of UK Government, Welsh Government, the wider public sector, business, third sector and individual or household behaviour in delivering emissions reductions between now and 2030? And, separately, between 2030 and 2050?

In respect of the UK Government (and Welsh Government) and UK Steel Sector, as well as some of the wider business sector (supply chain impacts), the roles and responsibilities are probably most comprehensively covered within the ongoing discussions in respect to the potential Sector Deal (see answer to Question 4) and how that fits in with the Industrial Strategy.

Question 6: As a business, as a Public Sector Body, or as a citizen, how do emissions targets affect your planning and decision-making?

Tata Steel operates in an extremely competitive global (commodity) marketplace and therefore has had a significant focus on all areas that contribute to its cost base or can improve profit margins including energy and material efficiency. This has ensured that significant reductions in energy use and improvements in energy efficiency have taken place over many decades, as it has generally made good business sense to do this. These improvements were instigated and continued over periods pre-dating the setting of carbon targets.

However, as an energy intensive manufacturing operator with its main installations covered by the EU ETS, that regime has had a more immediate impact on planning and decision-making than have the carbon targets and budgets set within the UK Climate Change Act or Wales Environment Act. The EU ETS, through its decreasing cap over time has been the method chosen to achieve the European Traded Sector's contribution to emissions reduction. The

impacts of EU ETS in regards to forward positions on potential free allocation levels and the cost of shortfalls have been factored into the company strategy, including asset configuration and capital investment planning.
That said, and with the potential fall-outs from Brexit, the 2050 targets set within UK Climate Change Act (and latterly Wales) clearly indicate the long-term vision and hence the political environment that Tata Steel will be operating in over the long term if it intends to continue as a sustainable business. Therefore it is currently honing its long-term strategy for delivering a sustainable business (this includes areas such as Climate Change and Circular Economy, the latter being intrinsically linked to former).
The effect of public policy on the foundation industries such as the steel industry has the potential to be profoundly positive, if Governments embrace Circular Economy and low carbon concepts in planning, procurement and product legislation. Steel products will be vital in helping society to become more sustainable because of their intrinsic durability, flexibility, re-usability and, at the end of their lives, recyclability. We strongly believe that Governments should seek to incentivise the uptake of sustainable materials and the establishment of a Circular Economy through the full suite of policy instruments at their disposal.

Question 7: In your area(s) of expertise, what specific circumstances need to be considered when setting targets and budgets for Wales and how could these be reflected in the targets?

We understand and recognise the premise that early reduction of absolute emissions (e.g. by 2030) will mean lower cumulative emissions between now and 2050 and therefore a reduced impact on the climate. However, it is fundamentally clear that the steel sector is close to the thermodynamic limits of conventional primary BF/BOS route steelmaking. As

such, substantial reductions in direct emissions require the development and implementation of new steelmaking technologies. In conjunction with this, there is an expectation that there will be a move towards an increased use of scrap (for example, through an uptake of EAF) and/or implementation of new low carbon steelmaking technologies over the long term. This does also assume the availability of sufficient low carbon/renewable electricity, and possible CCS and/or CCU.
Care is needed to understand the extent to which these technologies could be deployed, whether they will be accepted by the public and how the deployment and increased costs will be funded. Without the deployment of new technologies and low-carbon energy, a commitment to any particular stretching targets would be optimistic in the extreme.
In the short term the industry continues to commit substantial efforts to optimise energy consumption, material yield and other process efficiencies wherever it is cost effective to do so. Whilst such efforts are hugely important, they will provide only relatively small percentage improvements in emissions (though outside of the integrated steelmaking installations, these reductions may be considered significant in absolute terms).
We have already set out our assertion that Welsh emission reductions cannot be achieved through de-industrialisation; this would be counter-productive in global emissions terms and would carry a substantial cost for the Welsh economy and its ability to innovate and be a catalyst for global action. One way for policy makers to ensure that genuine emissions reductions are being achieved is to use consumption-based reporting, using life-cycle assessment methods to understand not only the direct emissions from the Welsh economy and society but also the indirect emissions from the production of imported goods. Linked to consumption based reporting is the need to avoid

setting simplistic targets expressed as emissions per tonne of basic production volume. In some cases, there is a life cycle benefit from investing more energy and emissions in the production stage of a product's life in order to secure an improvement in its 'in use' or 'end-of life' performance.' A classic illustration of this is the extra energy expended to produce advanced high strength steels (AHSS) leading to light-weighting e.g. in the automotive sector, which help provide reduced transport emissions and hence lower global emissions. Similarly, the carbon benefits accrued by the use of high efficiency electrical steels e.g. in transformers and motors, outweighs many times the additional impacts incurred during the manufacture of such steels. The contribution through the manufacture of premium steel products to large net savings in carbon emissions over the full life cycle of steel products should be recognised, not penalised

Another key consideration in target setting linked to product characteristics is understanding the technical limitations of various production processes for manufacturing products of the correct specification, It needs to be understood, for example, that EAF-produced steels are currently unsuitable for use in a number of applications, not least a variety of key sectors for flat steel products such as automotive. In this case, the limitations are due to high nitrogen levels and some residual elements that lead to strain ageing and low ductility issues in the final flat products and prevent EAF route supply. Therefore R&D into process improvements that may allow the EAF route to be able to supply this important sector is required and will take substantial time. This is a key factor that needs to be considered in determining the extent of any future transition to a greater uptake of the EAF route (or other new steelmaking techniques such as HISARNA) between 2030-2050.

As can be seen from the examples above, Tata Steel and the wider steel sector need

“breathing space” for a broad and complex range of measures to come to fruition. We need this to be considered in setting the interim targets and carbon budgets to take into account the unavoidable back-loaded pathway for substantial emission reductions.
Unlike the move to increased electric vehicle ownership and use, the Technology Readiness Level (TRL) of potential future lower carbon steelmaking methods is low and remains unproven. Whilst Tata Steel remains hopeful in regards to a new technology HISARNA (installed at the Netherlands site) it remains at pilot plant level. The latest trial will seek to test the stability of operations over more than a month and therefore remains a very long way from being proven and then developed at a commercial scale and rolled out across the EU/World.
The TRL of such potential improvements needs to be taken into account when the options for achieving carbon emission reductions at a particular cost and by a particular time from all sectors/sub-sectors are assessed.
When considering the range of possible improvements to energy efficiency and emission reduction, care is needed to take into account that they are often either mutually exclusive (so one option being implemented would mean another wouldn’t be) or they interact to a greater or lesser extent , so the overall reduction in CO2 cannot be taken to be the sum of each individual option.
For a number of improvement options there may also be a level of interdependence, for example on an integrated steelmaking site (conventional BF/BOS route) which are very complex with several inter-linked processes, These installations produce process waste gases (BFG, COG, BOSG) from the cokemaking, ironmaking and steelmaking operations. Ideally the production of these gases (inherent and unavoidable) should slightly exceed demand, resulting in a small safety flare. However, due to site configuration, or limitations (such

as age and efficiency of power generation) supply may be significantly greater than supply. Therefore installing projects that improve efficiency of combustion that just save waste gases would have no real benefit as this would just lead to increased flaring of the waste gases. Installation of sufficient additional combustion capacity (eg power generation) would possibly be required first/alongside. Such additional capacity can often be, as is usually the case in the steel sector, a significant capital expenditure.

Due to the highly capital intensive nature of our industry, there can be some critical issues relating to timing and choices made, particularly those that are being considered now in the short term. It may be that measures that appear to be essential or obvious options in the short term, are not aligned with a “possible future option” (although that option is unproven and may not come to fruition). Companies in capital intensive sectors such as steel that are already substantially constrained in terms of access to finance cannot afford to spend ‘regret capital’ implementing technologies that shortly after are shown not to be compatible with the optimal decarbonisation roadmap.

Whilst it has been made clear that the emissions targets are focussed on Wales emissions, it is important that due diligence be taken and reflected in any impact assessment of the level of imported carbon emissions when considering setting the carbon targets and budgets. It would not be sensible or appropriate if net (imported and direct) emissions were increasing/static whilst direct emissions were reducing. This would likely be a road to de-industrialisation rather than de-carbonisation.

We also believe – as described above - that taking a full life-cycle approach to the actual global impact is the correct way to go, so that the overall correct decisions are made.

A good example can be found in an independent study of Toyota Venza carried out by the University of California at Davis (https://www.worldsteel.org/steel-

by-topic/life-cycle-thinking/case-studies/WorldAutoSteel---Automotive--Life-cycle-thinking-leads-to-intelligent-automotive-material-choices.html)
A full life cycle approach should also be adopted when calculating the carbon emissions associated with steelmaking, in particular in accounting for the use of steel scrap in BOS and EAF steelmaking. Steel scrap is a valuable resource (i.e. is not 'free' economically, nor environmentally) and its recycling into new steel should properly account for the carbon 'embodied' in the scrap.

Question 8: The power and industry sectors in Wales are dominated by a small number of large emitters. What are the key challenges and opportunities that this presents in setting the levels of carbon budgets and how should the process of setting them reflect these?

A key structural challenge is that a small number of large emitters are owned by a small number of companies. As such, a potentially significant burden (and capital expenditure) is likely to fall on one or two industrial/power companies. In respect to the industrial installation/operator then unlike the power company it cannot pass on the CO2 costs to its customers.
In respect to the integrated steelmaking site, the various options considered in the last UK carbon budget report, in respect to energy efficiency and emission reductions were being considered across the whole of the UK. This meant that it was feasible to have considered , potential savings from more than one option contributing to the abatement target , whereas on a single site in Wales, they may be mutually exclusive or lead to significant interaction and lower net savings.
The integrated steelmaking installation, also does rely on a number of unproven "new technologies" on the pathway to 2050 and therefore will necessarily be biased towards longer term significant reductions in carbon emissions (and later interim targets and budgets), which will need to be duly

considered.
In respect to Aberthaw power station and the UK policy of phasing out coal power, the uncertainty in the emission pathway and particular year of final closure appears to present a challenge. The Welsh Government does have the opportunity to review budgets and targets where there has been a significant change, to avoid any concerns over “hot air”.
Having a small number of large emitters does also provide a few opportunities. An example for this could be the Tata Steel Port Talbot installation which produces CO2, CO and H2, , has availability of land suitable for renewables including offshore wind and waste heat. Therefore it provides a suitable site to undertake demonstration projects in regards to the development of technologies in respect to carbon dioxide streams , waste heat and renewable energy.*
* “The potential and limitations of using carbon dioxide” –Policy Briefing, The Royal Society, May 2017, ISBN:978-1-78252-267-6

Question 9: 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?

The Committee should ensure that it takes a balanced view (and aligning with the Future Generations Act) and ensure that it considers the positive impacts and interactions (actual and potential) not just conflicts and negative impacts.
In this response we have sought to illustrate not only the benefits we bring to the Welsh economy in terms of job creation and economic development, but also the profoundly beneficial role that our products can make to achieving a more resource-efficient and circular economy throughout Wales and beyond. Only with the short term breathing space and support we need to consolidate our competitiveness, can we continue to be a positive hub of innovation in sustainable products and processes.

In addition to the economic benefits that we provide, Tata Steel also seeks to be a good neighbour and a positive contributor to the local community. We are, for example, a key partner in the management of the Eglwys Nunydd reservoir which is a recognised excellent fishing area and supports a sailing club, in addition to the wildfowl that designated it as a SSI site. Over the years Tata steel has supported other local habitats e.g. sponsoring the fen orchid and given over part of its land around the landfill site to support a local species of bee. There may be further opportunities for active management of “urban green spaces” helping with improvements to bio-diversity, tree planting etc by industrial organisations. This could be supported through some form of benefit or credit in respect to environmental permit subsistence charges

Question 10: 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?

The Future Trends report is an interesting document, and it stimulates discussions across a wide range of areas which is a good thing. However, due to the inherent limitation in “future forecast” accuracy, the Committee will need to take care on the “weighting” it gives to the “evidence” in its assessment.

Organisation

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Question 1: Does the Paris Agreement mean that Welsh emissions targets should keep open a deeper reduction in emissions than 80% by 2050? Are there implications for nearer-term targets?

We think it is fair to recognise the Paris Agreement as a landmark outcome, albeit possibly unexpected. This remains the case despite the US decision to later state its intention to withdraw. However, whilst Paris establishes a set of “binding procedural commitments,” achievement of the NDCs themselves is not legally binding (nor any new financial commitments) and this needs to be borne in mind when considering how the Wales (and UK) emission targets for 2050 and carbon budgets should be framed to reflect the Agreement.

The 2050 target in Wales already allows for a greater than 80% reduction as the wording is “at least 80%”. That said, the 5 -yearly cycle of pledges and reviews under the Paris Agreement should provide some clarity on how much real progress is likely/actually happening. The first Global Stocktake is set for 2023 and every 5 years thereafter (although there is an interim review due in 2018 ahead of 2020 when the Agreement is in effect). Care is needed in how/when the timings of these reviews might be taken into account and potentially acted upon, bearing in mind Wales is about to set its 2016-2020 and 2021-2025 budgets. This is particularly important when considering the generally long investment cycles in the industrial sector, and the steel sector in particular.

Question 2: Do you think that leaving the EU has an impact on the targets or how they can be met?

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Promoting and strengthening collaborations between academia and industry will be useful (for example, building on the current example of FLEXIS).
Although, a small proportion of Welsh total emissions, progressing emissions reductions within the Public Sector will be important, not least in that it will help demonstrate leadership by the Welsh Government. The potential for land-use as a positive benefit for climate change in a country that has the unique geography of Wales is also likely to be important.
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We understand and recognise the premise that early reduction of absolute emissions (e.g. by 2030) will mean lower cumulative emissions between now and 2050 and therefore a reduced impact on the climate. However, it is fundamentally clear that the steel sector is close to the thermodynamic limits of conventional primary BF/BOS route steelmaking. As such, substantial reductions in direct emissions require the development and implementation of new steelmaking technologies. In conjunction with this, there is an expectation that there will be a move towards an increased use of scrap (for example, through an uptake of EAF) and/or implementation of new low carbon steelmaking technologies over the long term. This does also assume the availability of sufficient low carbon/renewable electricity, and possible CCS and/or CCU. Care is needed to understand the extent to which these technologies could be deployed, whether they will be accepted by the public and how the deployment and increased costs will be funded. Without the deployment of new technologies and low-carbon energy, a commitment to any particular stretching targets would be optimistic in the extreme.
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Linked to consumption based reporting is the need to avoid setting simplistic targets expressed as emissions per tonne of basic production volume. In some cases, there is a life cycle benefit from investing more energy and emissions in the production stage of a product's life in order to secure an improvement in its 'in use' or 'end-of life' performance.' A classic illustration of this is the extra energy expended to produce advanced high strength steels (AHSS) leading to light-weighting e.g. in the automotive sector, which help provide reduced transport emissions and hence lower global emissions. Similarly, the carbon benefits accrued by the use of high efficiency electrical steels e.g. in transformers and motors, outweighs many times the additional impacts incurred during the manufacture of such steels. The contribution through the manufacture of premium steel products to large net savings in carbon emissions over the full life cycle of steel products should be recognised, not penalised
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As can be seen from the examples above, Tata Steel and the wider steel sector need "breathing space" for a broad and complex range of measures to come to fruition. We need this to be considered in setting the interim targets and carbon budgets to take into account the unavoidable back-loaded pathway for substantial emission reductions.
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Due to the highly capital intensive nature of our industry, there can be some critical issues relating to timing and choices made, particularly those that are being considered now in the short term. It may be that measures that appear to be essential or obvious options in the short term, are not aligned with a "possible future option" (although that option is unproven and may not come to fruition). Companies in capital intensive sectors such as steel that are already substantially constrained in terms of access to finance cannot afford to spend 'regret capital' implementing technologies that shortly after are shown not to be compatible with the optimal decarbonisation roadmap.
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Question 1: Does the Paris Agreement mean that Welsh emissions targets should keep open a deeper reduction in emissions than 80% by 2050? Are there implications for nearer-term targets?

We think it is fair to recognise the Paris Agreement as a landmark outcome, albeit possibly unexpected. This remains the case despite the US decision to later state its intention to withdraw. However, whilst Paris establishes a set of “binding procedural commitments,” achievement of the NDCs themselves is not legally binding (nor any new financial commitments) and this needs to be borne in mind when considering how the Wales (and UK) emission targets for 2050 and carbon budgets should be

Yes, leaving the EU will have a considerable impact in particular on how the targets can be met and in relation to the overall political priority attached to cutting greenhouse gas emissions and the need for agriculture to contribute its fair share. It is vital that climate policy and targets set in Wales or at UK level are not undermined by other areas of Government especially in the light of Brexit. For example, trade deals must be ‘climate proofed’ so that they do not erode the chances of carbon budgets being met, and they do not simply export emissions overseas.

However, the significant focus on the development of a new UK agriculture policy is an opportunity – as long as there is commitment from the highest levels in Government to ensuring this is compatible with the UK’s climate commitments domestically and globally. This compatibility between climate and agricultural policy must extend to the devolved nations too. For decades, the EU Common Agricultural Policy (CAP) has helped provide stability for many farm communities, and it has contributed increasingly to the conservation and protection of the environment. However, as most of its budget pays landowners simply for the area they farm, it has also smothered efforts to tackle climate change and this has not been a priority in policy design. In preparing to leave the EU, the UK has an opportunity to set in place policies that help our farming communities mitigate and adapt to climate change, and this opportunity must not be squandered.

framed to reflect the Agreement. The 2050 target in Wales already allows for a greater than 80% reduction as the wording is “at least 80%”.
That said, the 5 -yearly cycle of pledges and reviews under the Paris Agreement should provide some clarity on how much real progress is likely/actually happening. The first Global Stocktake is set for 2023 and every 5 years thereafter (although there is an interim review due in 2018 ahead of 2020 when the Agreement is in effect). Care is needed in how/when the timings of these reviews might be taken into account and potentially acted upon, bearing in mind Wales is about to set its 2016-2020 and 2021-2025 budgets. This is particularly important when considering the generally long investment cycles in the industrial sector, and the steel sector in particular.

Question 2: Do you think that leaving the EU has an impact on the targets or how they can be met?

As already mentioned in the introduction, following the move from use of “net” emissions as per the UK target, to using actual Wales direct emissions, Brexit should not affect emissions accounting.
Clearly and in particular because of the high proportion of energy intensive and industrial emissions in the Traded Sector, the UK and Wales will need to seriously consider impacts on policy areas. For example, if the UK were not allowed to or chose not to participate in EU ETS (or an identical/very similar traded and possibly linked scheme). In addition to the price signal the EU ETS also delivers auctioning revenues. However whilst we note the CPS is claimed to have been successful in contributing to low carbon generation, the distortion in UK power prices has made the UK a difficult place to operate as an energy intensive industry. The welcome introduction, eventually, of a compensation scheme has helped reduce that impact, but it does not cover the full costs faced by energy intensives and this compensation mechanism is

in any case on a declining maximum allowable level under state aid rules.
In many cases it seems likely that relevant EU policy measures will be preserved or replicated by UK law. The CCC briefing paper (Oct 2016) also mentions the likely need to strengthen UK law where it's felt that EU law is insufficient. We would ask that due recognition be given to the potential impact such measures could have on energy intensive industry competitiveness in general and the steel sector in particular due to its difficulty in transitioning to a low carbon approach in the short and medium term due to the need for a step change in innovative steelmaking technologies.
One other key area that remains a significant concern is the future level of EU collaboration and innovation funding (e.g. EU ETS, Horizon 2020) which in a sector that is looking to the development of new and innovative, unproven technologies for decarbonising is vitally important.

Question 3: In the area(s) of your expertise, what are the opportunities and challenges in reducing Welsh emissions in the nearer term (e.g. to 2030)?

The challenges in reducing Welsh emissions are significantly affected by the high level of industrial emissions as a proportion of total emissions (34%) compared to the situation in the wider UK (22%). Taking that in conjunction with the fact that a large proportion of industrial emissions are attributable to only a small number of large emitters from these sectors (see Q8) brings potentially further difficulties. The variability in the short and medium term carbon abatement potential (with current technology) of some parts of the industrial sector could be said to exacerbate the difficulties.
The Welsh Government also does not have devolved competence in all areas relevant to climate change emissions reductions (e.g. energy, aviation and marine transport, building regulations).
Perhaps one of the most difficult challenges, is in the area of

effective communication of the key messages and the need for quite significant changes in behaviours of the general public as consumers of goods and services and how that impacts on achievement of the carbon targets and budgets.
Opportunities for reduction of Welsh emissions in the nearer term (up to 2030) include establishing appropriate funding mechanisms that would support the implementation of energy efficiency measures (current/conventional technology) where the pay-back periods are currently outside of those that are economically viable for energy intensive industries.
Promoting and strengthening collaborations between academia and industry will be useful (for example, building on the current example of FLEXIS).
Although, a small proportion of Welsh total emissions, progressing emissions reductions within the Public Sector will be important, not least in that it will help demonstrate leadership by the Welsh Government. The potential for land-use as a positive benefit for climate change in a country that has the unique geography of Wales is also likely to be important.
Further emission reductions within sectors that have a less difficult low carbon pathway i.e. the power sector, through increased use of renewables, and the expansion of the potential for demand side response (DSR). It should be noted that industry and the steel sector in particular can contribute positively here

Question 4: What is required by 2030 to prepare for the 2050 target for an emissions reduction of at least 80% on 1990 levels, recognising that this may require that emissions in some areas are reduced close to zero? Is there any impact of the need to go beyond 80%, either in 2050 or subsequently?

Our hope is that the achievement of at least 80% reduction in emissions from 1990, is delivered through the development of lower carbon operations in a sustainable

industrial landscape which includes a thriving steel sector, and not through de-industrialisation.

Therefore ensuring that the steel sector in Wales has the opportunity to operate competitively over the short to medium term is critical. This should then enable the research and development of innovative new low/lower carbon steelmaking technologies and carbon capture storage and use (CCSU) needed to deliver the significant emission reductions by 2050.

The steel sector is under no illusions that it has to compete in a global market and therefore has to continue to innovate, reduce costs, develop new products and markets etc, but where there are particular issues in Wales (or more likely UK), that could impede or help that competitiveness, these may need intervention by governments.

Along with the rest of the steel sector, Tata Steel has expressed a number of key asks of UK Government in the context of a possible future 'sector deal' under the UK's Industrial Strategy). We believe these are crucial to ensuring a competitive steel industry which can contribute to jobs, process and product innovation and economic and act as a catalyst for decarbonisation across the Welsh economy. The key asks are summarised below:

Actions need to be taken to remove / reduce the significant electricity price differentials faced by UK industry compared to its competitors (in EU and beyond).

A more appropriate regime in respect to Business Rates so that it provides less of a disincentive to investment in productivity boosting capital investment is needed.

An R&D collaboration fund should be established, with match funding by government, to help in the long term investment in research, development and

innovation. This has the potential to impact on process efficiency, productivity, product development, all of which will help in ensuring a viable sustainable business; critical developments in new steelmaking methods and CCS, which remains a critical option for the most significant CO2 savings and CCU. Noting that in respect to CCS this will most likely require shipping to a suitable offshore location e.g. potentially the Hamilton fields off the cost of North Wales which could be a first UK cluster.

Public Procurement policies should promote and support UK supply chains.

In addition to the key sectoral asks, a variety of infrastructural developments are also likely to be required. For example, electricity grid infrastructure investment will be needed in key areas in order for there to be any substantial increase in the proportion of EAF to BF/BOS route steelmaking (albeit it should be recognised that BF/BOS route steelmaking remains a substantial outlet for scrap recycling). In addition, a clearer understanding is needed of the required/available capacity of electricity demand in the longer term (2030+) if the intention is to achieve a step-change in electric vehicle use in future (especially if also coupled to greater uptake of EAF steelmaking).

If low carbon/renewable heat sources are to contribute a significant proportion of the targeted carbon emission reductions, there is a significant amount of work required over the next decade or two to enable efficient extraction, storage and distribution. This will include source mapping, development of current and new technologies and potentially significant infrastructure aligned to relevant “clusters” of producers and consumers.

Question 5: What are the respective roles of UK Government, Welsh Government, the wider public sector, business, third sector and individual or household

behaviour in delivering emissions reductions between now and 2030? And, separately, between 2030 and 2050?

In respect of the UK Government (and Welsh Government) and UK Steel Sector, as well as some of the wider business sector (supply chain impacts), the roles and responsibilities are probably most comprehensively covered within the ongoing discussions in respect to the potential Sector Deal (see answer to Question 4) and how that fits in with the Industrial Strategy.

Question 6: As a business, as a Public Sector Body, or as a citizen, how do emissions targets affect your planning and decision-making?

Tata Steel operates in an extremely competitive global (commodity) marketplace and therefore has had a significant focus on all areas that contribute to its cost base or can improve profit margins including energy and material efficiency. This has ensured that significant reductions in energy use and improvements in energy efficiency have taken place over many decades, as it has generally made good business sense to do this. These improvements were instigated and continued over periods pre-dating the setting of carbon targets.

However, as an energy intensive manufacturing operator with its main installations covered by the EU ETS, that regime has had a more immediate impact on planning and decision-making than have the carbon targets and budgets set within the UK Climate Change Act or Wales Environment Act. The EU ETS, through its decreasing cap over time has been the method chosen to achieve the European Traded Sector's contribution to emissions reduction. The impacts of EU ETS in regards to forward positions on potential free allocation levels and the cost of shortfalls have been factored into the company strategy, including asset configuration and capital investment planning.

That said, and with the potential

fall-outs from Brexit, the 2050 targets set within UK Climate Change Act (and latterly Wales) clearly indicate the long-term vision and hence the political environment that Tata Steel will be operating in over the long term if it intends to continue as a sustainable business. Therefore it is currently honing its long-term strategy for delivering a sustainable business (this includes areas such as Climate Change and Circular Economy, the latter being intrinsically linked to former).
The effect of public policy on the foundation industries such as the steel industry has the potential to be profoundly positive, if Governments embrace Circular Economy and low carbon concepts in planning, procurement and product legislation. Steel products will be vital in helping society to become more sustainable because of their intrinsic durability, flexibility, re-usability and, at the end of their lives, recyclability. We strongly believe that Governments should seek to incentivise the uptake of sustainable materials and the establishment of a Circular Economy through the full suite of policy instruments at their disposal.

Question 7: In your area(s) of expertise, what specific circumstances need to be considered when setting targets and budgets for Wales and how could these be reflected in the targets?

We understand and recognise the premise that early reduction of absolute emissions (e.g. by 2030) will mean lower cumulative emissions between now and 2050 and therefore a reduced impact on the climate. However, it is fundamentally clear that the steel sector is close to the thermodynamic limits of conventional primary BF/BOS route steelmaking. As such, substantial reductions in direct emissions require the development and implementation of new steelmaking technologies. In conjunction with this, there is an expectation that there will be a move towards an increased use of scrap (for example, through

an uptake of EAF) and/or implementation of new low carbon steelmaking technologies over the long term. This does also assume the availability of sufficient low carbon/renewable electricity, and possible CCS and/or CCU.
Care is needed to understand the extent to which these technologies could be deployed, whether they will be accepted by the public and how the deployment and increased costs will be funded. Without the deployment of new technologies and low-carbon energy, a commitment to any particular stretching targets would be optimistic in the extreme.
In the short term the industry continues to commit substantial efforts to optimise energy consumption, material yield and other process efficiencies wherever it is cost effective to do so. Whilst such efforts are hugely important, they will provide only relatively small percentage improvements in emissions (though outside of the integrated steelmaking installations, these reductions may be considered significant in absolute terms).
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We think it is fair to recognise the Paris Agreement as a landmark outcome, albeit possibly unexpected. This remains the case despite the US decision to later state its intention to withdraw. However, whilst Paris establishes a set of “binding procedural commitments,” achievement of the NDCs themselves is not legally binding (nor any new financial commitments) and this needs to be borne in mind when considering how the Wales (and UK) emission targets for 2050 and carbon budgets should be framed to reflect the Agreement. The 2050 target in Wales already allows for a greater than 80% reduction as the wording is “at least 80%”. That said, the 5 -yearly cycle of pledges and reviews under the Paris Agreement should provide some clarity on how much real progress is likely/actually happening. The first Global Stocktake is set for 2023 and every 5 years thereafter (although there is an interim review due in 2018 ahead of 2020 when the Agreement is in effect). Care is needed in how/when the timings of these reviews might be taken into account and potentially acted upon, bearing in mind Wales is about to set its 2016-2020 and 2021-2025 budgets. This is particularly important when considering the generally long investment cycles in the industrial sector, and the steel sector in particular.

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One other key area that remains a significant concern is the future level of EU collaboration and innovation funding (e.g. EU ETS, Horizon 2020) which in a sector that is looking to the development of new and innovative, unproven technologies for decarbonising is vitally important.

Question 3: In the area(s) of your expertise, what are the opportunities and challenges in reducing Welsh emissions in the nearer term (e.g. to 2030)?

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The Welsh Government also does not have devolved competence in all areas relevant to climate change emissions reductions (e.g. energy, aviation and marine transport, building regulations).
Perhaps one of the most difficult challenges, is in the area of effective communication of the key messages and the need for quite significant changes in behaviours of the general public as consumers of goods and services and how that impacts on achievement of the carbon targets and budgets.
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Our hope is that the achievement of at least 80% reduction in emissions from 1990, is delivered through the development of lower carbon operations in a sustainable industrial landscape which includes a thriving steel sector, and not through de-industrialisation.

Therefore ensuring that the steel sector in Wales has the opportunity to operate competitively over the short to medium term is critical. This should then enable the research and development of innovative new low/lower carbon steelmaking technologies and carbon capture storage and use (CCSU) needed to deliver the significant emission reductions by 2050.

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Public Procurement policies should promote and support UK supply chains.

In addition to the key sectoral asks, a variety of infrastructural developments are also likely to be required. For example, electricity grid infrastructure investment will be needed in key areas in order for there to be any substantial increase in the proportion of EAF to BF/BOS route steelmaking (albeit it should be recognised that BF/BOS route steelmaking remains a substantial outlet for scrap recycling). In addition, a clearer understanding is needed of the required/available capacity of electricity demand in the longer term (2030+) if the intention is to achieve a step-change in electric vehicle use in future (especially if also coupled to greater uptake of EAF steelmaking).

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Question 5: What are the respective roles of UK Government, Welsh Government, the wider public sector, business, third sector and individual or household behaviour in delivering emissions reductions between now and 2030? And, separately, between 2030 and 2050?

In respect of the UK Government (and Welsh Government) and UK Steel Sector, as well as some of the wider business sector (supply chain impacts), the roles and responsibilities are probably most comprehensively covered within the ongoing discussions in respect to the potential Sector Deal (see answer to Question 4) and how that fits in with the Industrial Strategy.

Question 6: As a business, as a Public Sector Body, or as a citizen, how do emissions targets affect your planning and decision-making?

Tata Steel operates in an extremely competitive global (commodity) marketplace and therefore has had a significant focus on all areas that contribute to its cost base or can improve profit margins including energy and material efficiency. This has ensured that significant reductions in energy use and improvements in energy efficiency have taken place over many decades, as it has generally made good business sense to do this. These improvements were instigated and continued over periods pre-dating the setting of carbon targets.

However, as an energy intensive manufacturing operator with its main installations covered by the EU ETS, that regime has had a more immediate impact on planning and decision-making than have the carbon targets and budgets set within the UK Climate Change Act or Wales Environment Act. The EU ETS, through its decreasing cap over time has been the method chosen to achieve the European Traded Sector's contribution to emissions reduction. The impacts of EU ETS in regards to forward positions on potential free allocation levels and the cost of shortfalls have been factored into the company strategy, including asset configuration and capital investment planning.

That said, and with the potential fall-outs from Brexit, the 2050 targets set within UK Climate Change Act (and latterly Wales) clearly indicate the long-term vision and hence the political environment that Tata Steel will be operating in over the long term if it intends to continue as a sustainable business. Therefore it is currently honing its long-term strategy for delivering a sustainable business (this includes areas such as Climate Change and Circular Economy, the latter being intrinsically linked to former).

The effect of public policy on the foundation industries such as the steel industry has the potential to be profoundly positive, if Governments embrace Circular Economy and low carbon concepts in planning,

procurement and product legislation. Steel products will be vital in helping society to become more sustainable because of their intrinsic durability, flexibility, re-usability and, at the end of their lives, recyclability. We strongly believe that Governments should seek to incentivise the uptake of sustainable materials and the establishment of a Circular Economy through the full suite of policy instruments at their disposal.

Question 7: In your area(s) of expertise, what specific circumstances need to be considered when setting targets and budgets for Wales and how could these be reflected in the targets?

We understand and recognise the premise that early reduction of absolute emissions (e.g. by 2030) will mean lower cumulative emissions between now and 2050 and therefore a reduced impact on the climate. However, it is fundamentally clear that the steel sector is close to the thermodynamic limits of conventional primary BF/BOS route steelmaking. As such, substantial reductions in direct emissions require the development and implementation of new steelmaking technologies. In conjunction with this, there is an expectation that there will be a move towards an increased use of scrap (for example, through an uptake of EAF) and/or implementation of new low carbon steelmaking technologies over the long term. This does also assume the availability of sufficient low carbon/renewable electricity, and possible CCS and/or CCU. Care is needed to understand the extent to which these technologies could be deployed, whether they will be accepted by the public and how the deployment and increased costs will be funded. Without the deployment of new technologies and low-carbon energy, a commitment to any particular stretching targets would be optimistic in the extreme.

In the short term the industry continues to commit substantial efforts to optimise energy consumption, material yield and other process efficiencies wherever it is cost effective to do so. Whilst such efforts are hugely important, they will provide only relatively small percentage improvements in emissions (though outside of the integrated steelmaking installations, these reductions may be considered significant in absolute terms).

We have already set out our assertion that Welsh emission reductions cannot be achieved through de-industrialisation; this would be counter-productive in global emissions terms and would carry a substantial cost for the Welsh economy and its ability to innovate and be a catalyst for global action. One way for policy makers to ensure that genuine emissions reductions are being achieved is to use consumption-based reporting, using life-cycle assessment methods to understand not only the direct emissions from the Welsh economy and society but also the indirect emissions from the production of imported goods.

Linked to consumption based reporting is the need to avoid setting simplistic targets expressed as emissions per tonne of basic production volume. In some cases, there is a life cycle benefit from investing more energy and emissions in the production stage of a product's life in order to secure an improvement in its 'in use' or 'end-of life' performance.' A classic illustration of this is the extra energy expended to produce advanced high strength steels (AHSS) leading to light-weighting e.g. in the automotive sector, which help provide reduced transport emissions and hence lower global emissions. Similarly, the carbon benefits accrued by the use of high efficiency electrical steels e.g. in transformers and motors, outweighs many times the additional impacts incurred during the manufacture of such steels. The contribution through the manufacture of premium steel products to large net savings in carbon emissions over the full life cycle of steel products should be recognised, not penalised

Another key consideration in target setting linked to product characteristics is understanding the technical limitations of various production processes for manufacturing products of the correct specification, It needs to be understood, for example, that EAF-produced steels are currently unsuitable for use in a number of applications, not least a variety of key sectors for flat steel products such as automotive. In this case, the limitations are due to high nitrogen levels and some residual elements that lead to strain ageing and low ductility issues in the final flat products and prevent EAF route supply. Therefore R&D into process improvements that may allow the EAF route to be able to supply this important sector is required and will take substantial time. This is a key factor that needs to be considered in determining the extent of any future transition to a greater uptake of the EAF route (or other new steelmaking techniques such as HISARNA) between 2030-2050.

As can be seen from the examples above, Tata Steel and the wider steel sector need "breathing space" for a broad and complex range of measures to come to fruition. We need this to be considered in setting the interim targets and carbon budgets to take into account the unavoidable back-loaded pathway for substantial emission reductions.

Unlike the move to increased electric vehicle ownership and use, the Technology Readiness Level (TRL) of potential future lower carbon steelmaking methods is low and remains unproven. Whilst Tata Steel remains hopeful in regards to a new technology HISARNA (installed at the Netherlands site) it remains at pilot plant level. The latest trial will seek to test the stability of operations over more than a month and therefore remains a very long way from being proven and then developed at a commercial scale and rolled out across the EU/World.

The TRL of such potential improvements needs to be taken into account when the options for achieving carbon emission reductions at a particular cost and by a particular time from all sectors/sub-sectors are assessed.

When considering the range of possible improvements to energy efficiency and emission reduction, care is needed to take into account that they are often either mutually exclusive (so one option being implemented would mean another wouldn't be) or they interact to a greater or lesser extent , so the overall reduction in

CO2 cannot be taken to be the sum of each individual option.
For a number of improvement options there may also be a level of interdependence, for example on an integrated steelmaking site (conventional BF/BOS route) which are very complex with several inter-linked processes, These installations produce process waste gases (BFG, COG, BOSG) from the cokemaking, ironmaking and steelmaking operations. Ideally the production of these gases (inherent and unavoidable) should slightly exceed demand, resulting in a small safety flare. However, due to site configuration, or limitations (such as age and efficiency of power generation) supply may be significantly greater than supply. Therefore installing projects that improve efficiency of combustion that just save waste gases would have no real benefit as this would just lead to increased flaring of the waste gases. Installation of sufficient additional combustion capacity (eg power generation) would possibly be required first/alongside. Such additional capacity can often be, as is usually the case in the steel sector, a significant capital expenditure.
Due to the highly capital intensive nature of our industry, there can be some critical issues relating to timing and choices made, particularly those that are being considered now in the short term. It may be that measures that appear to be essential or obvious options in the short term, are not aligned with a “possible future option” (although that option is unproven and may not come to fruition). Companies in capital intensive sectors such as steel that are already substantially constrained in terms of access to finance cannot afford to spend ‘regret capital’ implementing technologies that shortly after are shown not to be compatible with the optimal decarbonisation roadmap.
Whilst it has been made clear that the emissions targets are focussed on Wales emissions, it is important that due diligence be taken and reflected in any impact assessment of the level of imported carbon emissions when considering setting the carbon targets and budgets. It would not be sensible or appropriate if net (imported and direct) emissions were increasing/static whilst direct emissions were reducing. This would likely be a road to de-industrialisation rather than de-carbonisation.
We also believe – as described above - that taking a full life-cycle approach to the actual global impact is the correct way to go, so that the overall correct decisions are made.
A good example can be found in an independent study of Toyota Venza carried out by the University of California at Davis (https://www.worldsteel.org/steel-by-topic/life-cycle-thinking/case-studies/WorldAutoSteel---Automotive--Life-cycle-thinking-leads-to-intelligent-automotive-material-choices.html)
A full life cycle approach should also be adopted when calculating the carbon emissions associated with steelmaking, in particular in accounting for the use of steel scrap in BOS and EAF steelmaking. Steel scrap is a valuable resource (i.e. is not ‘free’ economically, nor environmentally) and its recycling into new steel should properly account for the carbon ‘embodied’ in the scrap.

Question 8: The power and industry sectors in Wales are dominated by a small number of large emitters. What are the key challenges and opportunities that this presents in setting the levels of carbon budgets and how should the process of setting them reflect these?

A key structural challenge is that a small number of large emitters are owned by a small number of companies. As such, a potentially significant burden (and capital expenditure) is likely to fall on one or two industrial/power companies. In respect to the industrial installation/operator then unlike the power company it cannot pass on the CO2 costs to its customers.
In respect to the integrated steelmaking site, the various options considered in the last UK carbon budget report, in respect to energy efficiency and emission reductions were being considered across the whole of the UK. This meant that it was feasible to have considered , potential savings from more than one option contributing to the abatement target , whereas on a single site in Wales, they may be mutually exclusive or lead to significant interaction and lower net savings.
The integrated steelmaking installation, also does rely on a number of unproven “new technologies” on the pathway to 2050 and therefore will necessarily be biased towards longer term significant reductions in carbon emissions (and later interim targets and budgets), which will need to be duly considered.
In respect to Aberthaw power station and the UK policy of phasing out coal power, the uncertainty in the emission pathway and particular year of final closure appears to present a challenge. The Welsh Government does have the opportunity to review budgets and targets where there has been a significant change, to avoid any concerns over “hot air”.
Having a small number of large emitters does also provide a few opportunities. An example for this could be the Tata Steel Port Talbot installation which produces CO2, CO and H2, , has availability of land suitable for renewables including offshore wind and waste heat. Therefore it provides a suitable site to undertake demonstration projects in regards to the development of technologies in respect to carbon dioxide streams , waste heat and renewable energy.*
* “The potential and limitations of using carbon dioxide” –Policy Briefing, The Royal Society, May 2017, ISBN:978-1-78252-267-6

Question 9: 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?

The Committee should ensure that it takes a balanced view (and aligning with the Future Generations Act) and ensure that it considers the positive impacts and interactions (actual and potential) not just conflicts

and negative impacts.
In this response we have sought to illustrate not only the benefits we bring to the Welsh economy in terms of job creation and economic development, but also the profoundly beneficial role that our products can make to achieving a more resource-efficient and circular economy throughout Wales and beyond. Only with the short term breathing space and support we need to consolidate our competitiveness, can we continue to be a positive hub of innovation in sustainable products and processes.
In addition to the economic benefits that we provide, Tata Steel also seeks to be a good neighbour and a positive contributor to the local community. We are, for example, a key partner in the management of the Eglwys Nunydd reservoir which is a recognised excellent fishing area and supports a sailing club, in addition to the wildfowl that designated it as a SSI site. Over the years Tata steel has supported other local habitats e.g. sponsoring the fen orchid and given over part of its land around the landfill site to support a local species of bee.
There may be further opportunities for active management of "urban green spaces" helping with improvements to bio-diversity, tree planting etc by industrial organisations. This could be supported through some form of benefit or credit in respect to environmental permit subsistence charges

Question 10: 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?

The Future Trends report is an interesting document, and it stimulates discussions across a wide range of areas which is a good thing. However, due to the inherent limitation in "future forecast" accuracy, the Committee will need to take care on the "weighting" it gives to the "evidence" in its assessment.

Organisation

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We think it is fair to recognise the Paris Agreement as a landmark outcome, albeit possibly unexpected. This remains the case despite the US decision to later state its intention to withdraw. However, whilst Paris establishes a set of "binding procedural commitments," achievement of the NDCs themselves is not legally binding (nor any new financial commitments) and this needs to be borne in mind when considering how the Wales (and UK) emission targets for 2050 and carbon budgets should be framed to reflect the Agreement. The 2050 target in Wales already allows for a greater than 80% reduction as the wording is "at least 80%".
That said, the 5 -yearly cycle of pledges and reviews under the Paris Agreement should provide

Achieving climate-friendly farming will depend on the innovation of farmers to adopt sustainable practices and deploy new methods and technologies which make the most of natural processes without the need for costly and environmentally damaging inputs. Organic farming provides a model for sustainable food security, and helps mitigate climate change. Often claims of 'food security' are used to support more intensive, industrialised agriculture but that approach ignores the need for a stable climate, clean air and water, healthy soils and restore biodiversity.

Healthy soils are a key climate mitigation tool. Healthy soil acts as a carbon sink by drawing carbon down into the soil to store it. Improving soil health is therefore a critical way to tackle climate change. Recognising the ability of soil to sequester carbon and its contribution to climate mitigation, the UK signed onto the French government's the 4 per 1000 soil carbon initiative at the UN Climate Change Convention in Paris. This initiative aims to increase soil organic carbon by 0.4% each year. This goal to increase soil carbon sequestration must be a key policy in UK agriculture policy to help reduce GHG emissions. The UK has committed to managing all England's sustainably and to tackling degradation threats by 2030. Wales has an opportunity by leading the way on soil protection and climate change by taking action and introducing policies that the rest of the UK may emulate.

For farming systems, one opportunity lies in planting many more trees – as agroforestry schemes on farms and as woodlands and forests. As the CCC has recognised, agroforestry can help mitigate climate change by sequestering carbon. In maritime climates such as the UK, the widespread adoption of agroforestry would result in estimated average emissions reduction of 0.51 tonnes CO2 per hectare per year. The CCC has calculated that, if agroforestry were expanded to cover just 2.3% of agricultural land by 2050, accompanied by woodland creation averaging 30,000 hectares per year, this would reduce greenhouse gas emissions by 16 million tonnes of CO2e annually in 2050. We view this as a conservative estimate and look forward to the forthcoming updated emission inventory, and note that it is important for policy making in the meantime to fully consider the potential contribution of agroforestry.

There are major near-term opportunities to cut emissions via more concerted efforts to reduce the use of nitrogen fertiliser. This was illustrated recently by researchers studying the environmental footprint of a loaf of bread, which found that manufactured nitrogen fertiliser alone accounted for a staggering 43% of a loaf's total emissions. Whilst the contribution of fossil fuels to climate change is widely understood, there is less public and stakeholder awareness that nitrous oxide is a potent greenhouse gas (GHG) and that this accounts for around a third of the UK

some clarity on how much real progress is likely/actually happening. The first Global Stocktake is set for 2023 and every 5 years thereafter (although there is an interim review due in 2018 ahead of 2020 when the Agreement is in effect). Care is needed in how/when the timings of these reviews might be taken into account and potentially acted upon, bearing in mind Wales is about to set its 2016-2020 and 2021-2025 budgets. This is particularly important when considering the generally long investment cycles in the industrial sector, and the steel sector in particular.

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In many cases it seems likely that relevant EU policy measures will be preserved or replicated by UK law. The CCC briefing paper (Oct 2016) also mentions the agricultural sector’s total emissions. As the CCC has noted, the majority of these emissions arise from the estimated 900,000 tonnes of nitrogen fertiliser that is applied annually on British farmland, the manufacture of which is alone responsible for an estimated 6 million tonnes of CO2, equivalent to around 1% of the UK’s emissions total. We note the CCC has estimated that measures aimed at reducing N2O emissions from agriculture – through increased the use of leguminous crops and the reduction of untimely or the excessive application of fertilisers – could deliver an annual emissions reduction of 2.7 million tonnes of CO2e by 2030. We would urge the CCC to be bold in making recommendations regarding the extent to which adoption of such practices can be widely adopted.

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Question 6: As a business, as a Public Sector Body, or as a citizen, how do emissions targets affect your planning and decision-making?

Tata Steel operates in an extremely competitive global (commodity) marketplace and therefore has had a significant focus on all areas that contribute to its cost base or can improve profit margins including energy and material efficiency. This has ensured that significant reductions in energy use and improvements in energy efficiency have taken place over many decades, as it has generally made good business sense to do this. These improvements were instigated and continued over periods pre-dating the setting of carbon targets.

However, as an energy intensive manufacturing operator with its main installations covered by the EU ETS, that regime has had a more immediate impact on planning and decision-making than have the carbon targets and budgets set within the UK Climate Change Act or Wales Environment Act. The EU ETS, through its decreasing cap over time has been the method chosen to achieve the European Traded Sector's contribution to emissions reduction. The impacts of EU ETS in regards to forward positions on potential free allocation levels and the cost of shortfalls have been factored into the company strategy, including asset configuration and capital investment planning.

That said, and with the potential fall-outs from Brexit, the 2050 targets set within UK Climate Change Act (and latterly Wales) clearly indicate the long-term vision and hence the political environment that Tata Steel will be operating in over the long term if it intends to continue as a

sustainable business. Therefore it is currently honing its long-term strategy for delivering a sustainable business (this includes areas such as Climate Change and Circular Economy, the latter being intrinsically linked to former).
The effect of public policy on the foundation industries such as the steel industry has the potential to be profoundly positive, if Governments embrace Circular Economy and low carbon concepts in planning, procurement and product legislation. Steel products will be vital in helping society to become more sustainable because of their intrinsic durability, flexibility, re-usability and, at the end of their lives, recyclability. We strongly believe that Governments should seek to incentivise the uptake of sustainable materials and the establishment of a Circular Economy through the full suite of policy instruments at their disposal.

Question 7: In your area(s) of expertise, what specific circumstances need to be considered when setting targets and budgets for Wales and how could these be reflected in the targets?

We understand and recognise the premise that early reduction of absolute emissions (e.g. by 2030) will mean lower cumulative emissions between now and 2050 and therefore a reduced impact on the climate. However, it is fundamentally clear that the steel sector is close to the thermodynamic limits of conventional primary BF/BOS route steelmaking. As such, substantial reductions in direct emissions require the development and implementation of new steelmaking technologies. In conjunction with this, there is an expectation that there will be a move towards an increased use of scrap (for example, through an uptake of EAF) and/or implementation of new low carbon steelmaking technologies over the long term. This does also assume the availability of sufficient low carbon/renewable electricity, and possible CCS and/or CCU.

Care is needed to understand the extent to which these technologies could be deployed, whether they will be accepted by the public and how the deployment and increased costs will be funded. Without the deployment of new technologies and low-carbon energy, a commitment to any particular stretching targets would be optimistic in the extreme.
In the short term the industry continues to commit substantial efforts to optimise energy consumption, material yield and other process efficiencies wherever it is cost effective to do so. Whilst such efforts are hugely important, they will provide only relatively small percentage improvements in emissions (though outside of the integrated steelmaking installations, these reductions may be considered significant in absolute terms).
We have already set out our assertion that Welsh emission reductions cannot be achieved through de-industrialisation; this would be counter-productive in global emissions terms and would carry a substantial cost for the Welsh economy and its ability to innovate and be a catalyst for global action. One way for policy makers to ensure that genuine emissions reductions are being achieved is to use consumption-based reporting, using life-cycle assessment methods to understand not only the direct emissions from the Welsh economy and society but also the indirect emissions from the production of imported goods.
Linked to consumption based reporting is the need to avoid setting simplistic targets expressed as emissions per tonne of basic production volume. In some cases, there is a life cycle benefit from investing more energy and emissions in the production stage of a product's life in order to secure an improvement in its 'in use' or 'end-of life' performance.' A classic illustration of this is the extra energy expended to produce advanced high strength steels (AHSS) leading to light-weighting e.g. in the automotive sector, which help provide reduced transport emissions and

hence lower global emissions. Similarly, the carbon benefits accrued by the use of high efficiency electrical steels e.g. in transformers and motors, outweighs many times the additional impacts incurred during the manufacture of such steels. The contribution through the manufacture of premium steel products to large net savings in carbon emissions over the full life cycle of steel products should be recognised, not penalised

Another key consideration in target setting linked to product characteristics is understanding the technical limitations of various production processes for manufacturing products of the correct specification, It needs to be understood, for example, that EAF-produced steels are currently unsuitable for use in a number of applications, not least a variety of key sectors for flat steel products such as automotive. In this case, the limitations are due to high nitrogen levels and some residual elements that lead to strain ageing and low ductility issues in the final flat products and prevent EAF route supply. Therefore R&D into process improvements that may allow the EAF route to be able to supply this important sector is required and will take substantial time. This is a key factor that needs to be considered in determining the extent of any future transition to a greater uptake of the EAF route (or other new steelmaking techniques such as HISARNA) between 2030-2050.

As can be seen from the examples above, Tata Steel and the wider steel sector need “breathing space” for a broad and complex range of measures to come to fruition. We need this to be considered in setting the interim targets and carbon budgets to take into account the unavoidable back-loaded pathway for substantial emission reductions.

Unlike the move to increased electric vehicle ownership and use, the Technology Readiness Level (TRL) of potential future lower carbon steelmaking methods is low and remains unproven. Whilst Tata Steel remains hopeful in regards to a

new technology HISARNA (installed at the Netherlands site) it remains at pilot plant level. The latest trial will seek to test the stability of operations over more than a month and therefore remains a very long way from being proven and then developed at a commercial scale and rolled out across the EU/World.
The TRL of such potential improvements needs to be taken into account when the options for achieving carbon emission reductions at a particular cost and by a particular time from all sectors/sub-sectors are assessed.
When considering the range of possible improvements to energy efficiency and emission reduction, care is needed to take into account that they are often either mutually exclusive (so one option being implemented would mean another wouldn't be) or they interact to a greater or lesser extent , so the overall reduction in CO2 cannot be taken to be the sum of each individual option.
For a number of improvement options there may also be a level of interdependence, for example on an integrated steelmaking site (conventional BF/BOS route) which are very complex with several inter-linked processes, These installations produce process waste gases (BFG, COG, BOSG) from the cokemaking, ironmaking and steelmaking operations. Ideally the production of these gases (inherent and unavoidable) should slightly exceed demand, resulting in a small safety flare. However, due to site configuration, or limitations (such as age and efficiency of power generation) supply may be significantly greater than supply. Therefore installing projects that improve efficiency of combustion that just save waste gases would have no real benefit as this would just lead to increased flaring of the waste gases. Installation of sufficient additional combustion capacity (eg power generation) would possibly be required first/alongside. Such additional capacity can often be, as is usually the case in the steel sector, a significant capital expenditure.

Due to the highly capital intensive nature of our industry, there can be some critical issues relating to timing and choices made, particularly those that are being considered now in the short term. It may be that measures that appear to be essential or obvious options in the short term, are not aligned with a “possible future option” (although that option is unproven and may not come to fruition). Companies in capital intensive sectors such as steel that are already substantially constrained in terms of access to finance cannot afford to spend ‘regret capital’ implementing technologies that shortly after are shown not to be compatible with the optimal decarbonisation roadmap.

Whilst it has been made clear that the emissions targets are focussed on Wales emissions, it is important that due diligence be taken and reflected in any impact assessment of the level of imported carbon emissions when considering setting the carbon targets and budgets. It would not be sensible or appropriate if net (imported and direct) emissions were increasing/static whilst direct emissions were reducing. This would likely be a road to de-industrialisation rather than de-carbonisation.

We also believe – as described above - that taking a full life-cycle approach to the actual global impact is the correct way to go, so that the overall correct decisions are made.

A good example can be found in an independent study of Toyota Venza carried out by the University of California at Davis (https://www.worldsteel.org/steel-by-topic/life-cycle-thinking/case-studies/WorldAutoSteel---Automotive--Life-cycle-thinking-leads-to-intelligent-automotive-material-choices.html)

A full life cycle approach should also be adopted when calculating the carbon emissions associated with steelmaking, in particular in accounting for the use of steel scrap in BOS and EAF steelmaking. Steel scrap is a valuable resource (i.e. is not ‘free’ economically, nor environmentally) and its recycling into new steel should

properly account for the carbon 'embodied' in the scrap.

Question 8: The power and industry sectors in Wales are dominated by a small number of large emitters. What are the key challenges and opportunities that this presents in setting the levels of carbon budgets and how should the process of setting them reflect these?

A key structural challenge is that a small number of large emitters are owned by a small number of companies. As such, a potentially significant burden (and capital expenditure) is likely to fall on one or two industrial/power companies. In respect to the industrial installation/operator then unlike the power company it cannot pass on the CO2 costs to its customers.
In respect to the integrated steelmaking site, the various options considered in the last UK carbon budget report, in respect to energy efficiency and emission reductions were being considered across the whole of the UK. This meant that it was feasible to have considered , potential savings from more than one option contributing to the abatement target , whereas on a single site in Wales, they may be mutually exclusive or lead to significant interaction and lower net savings.
The integrated steelmaking installation, also does rely on a number of unproven "new technologies" on the pathway to 2050 and therefore will necessarily be biased towards longer term significant reductions in carbon emissions (and later interim targets and budgets), which will need to be duly considered.
In respect to Aberthaw power station and the UK policy of phasing out coal power, the uncertainty in the emission pathway and particular year of final closure appears to present a challenge. The Welsh Government does have the opportunity to review budgets and targets where there has been a significant change, to avoid any concerns over "hot air".
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opportunities. An example for this could be the Tata Steel Port Talbot installation which produces CO2, CO and H2, , has availability of land suitable for renewables including offshore wind and waste heat. Therefore it provides a suitable site to undertake demonstration projects in regards to the development of technologies in respect to carbon dioxide streams , waste heat and renewable energy.*

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Question 9: 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?

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In addition to the economic benefits that we provide, Tata Steel also seeks to be a good neighbour and a positive contributor to the local community. We are, for example, a key partner in the management of the Eglwys Nunydd reservoir which is a recognised excellent fishing area and supports a sailing club, in addition to the wildfowl that designated it as a SSI site. Over the years Tata steel has supported other local habitats e.g. sponsoring the fen orchid and given over part of its

land around the landfill site to support a local species of bee. There may be further opportunities for active management of “urban green spaces” helping with improvements to bio-diversity, tree planting etc by industrial organisations. This could be supported through some form of benefit or credit in respect to environmental permit subsistence charges

Question 10: 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?

The Future Trends report is an interesting document, and it stimulates discussions across a wide range of areas which is a good thing. However, due to the inherent limitation in “future forecast” accuracy, the Committee will need to take care on the “weighting” it gives to the “evidence” in its assessment.

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Question 1: Does the Paris Agreement mean that Welsh emissions targets should keep open a deeper reduction in emissions than 80% by 2050? Are there implications for nearer-term targets?

We think it is fair to recognise the Paris Agreement as a landmark outcome, albeit possibly unexpected. This remains the case despite the US decision to later state its intention to withdraw. However, whilst Paris establishes a set of “binding procedural commitments,” achievement of the NDCs themselves is not legally binding (nor any new financial commitments) and this needs to be borne in mind when considering how the Wales (and UK) emission targets for 2050 and carbon budgets should be framed to reflect the Agreement. The 2050 target in Wales already allows for a greater than 80% reduction as the wording is “at least 80%”. That said, the 5 -yearly cycle of pledges and reviews under the Paris Agreement should provide some clarity on how much real progress is likely/actually happening. The first Global Stocktake is set for 2023 and every 5 years thereafter (although there is an interim review due in 2018 ahead of 2020 when the Agreement is in effect). Care is needed in how/when the timings of these reviews might be taken into account and potentially acted upon, bearing in mind Wales is about to set its 2016-2020 and 2021-2025 budgets. This is particularly important when considering the generally long investment cycles in the industrial sector, and the steel sector in particular.

Question 2: Do you think that leaving the EU has an impact on the targets or how they can be met?

As already mentioned in the introduction, following the move from use of “net” emissions as per the UK target, to using actual Wales direct emissions, Brexit should not affect emissions accounting.
Clearly and in particular because of the high proportion of energy intensive and industrial emissions in the Traded Sector, the UK and Wales will need to seriously consider impacts on policy areas. For example, if the UK were not allowed to or chose not to participate in EU ETS (or an identical/very similar traded and possibly linked scheme). In addition to the price signal the EU ETS also delivers auctioning revenues.

However whilst we note the CPS is claimed to have been successful in contributing to low carbon generation, the distortion in UK power prices has made the UK a difficult place to operate as an energy intensive industry. The welcome introduction, eventually, of a compensation scheme has helped reduce that impact, but it does not cover the full costs faced by energy intensives and this compensation mechanism is in any case on a declining maximum allowable level under state aid rules.
In many cases it seems likely that relevant EU policy measures will be preserved or replicated by UK law. The CCC briefing paper (Oct 2016) also mentions the likely need to strengthen UK law where it's felt that EU law is insufficient. We would ask that due recognition be given to the potential impact such measures could have on energy intensive industry competitiveness in general and the steel sector in particular due to its difficulty in transitioning to a low carbon approach in the short and medium term due to the need for a step change in innovative steelmaking technologies.
One other key area that remains a significant concern is the future level of EU collaboration and innovation funding (e.g. EU ETS, Horizon 2020) which in a sector that is looking to the development of new and innovative, unproven technologies for decarbonising is vitally important.

Question 3: In the area(s) of your expertise, what are the opportunities and challenges in reducing Welsh emissions in the nearer term (e.g. to 2030)?

The challenges in reducing Welsh emissions are significantly affected by the high level of industrial emissions as a proportion of total emissions (34%) compared to the situation in the wider UK (22%). Taking that in conjunction with the fact that a large proportion of industrial emissions are attributable to only a small number of large emitters from these sectors (see Q8) brings potentially further difficulties. The variability in the short and medium term carbon abatement potential (with current technology) of some parts of the industrial sector could be said to exacerbate the difficulties.
The Welsh Government also does not have devolved competence in all areas relevant to climate change emissions reductions (e.g. energy, aviation and marine transport, building regulations).
Perhaps one of the most difficult challenges, is in the area of effective communication of the key messages and the need for quite significant changes in behaviours of the general public as consumers of goods and services and how that impacts on achievement of the carbon targets and budgets.
Opportunities for reduction of Welsh emissions in the nearer term (up to 2030) include establishing appropriate funding mechanisms that would support the implementation of energy efficiency measures (current/conventional technology) where the pay-back periods are currently outside of those that are economically viable for energy intensive industries.
Promoting and strengthening collaborations between academia and industry will be useful (for example, building on the current example of FLEXIS).
Although, a small proportion of Welsh total emissions, progressing emissions reductions within the Public Sector will be important, not least in that it will help demonstrate leadership by the Welsh Government. The potential for land-use as a positive benefit for climate change in a country that has the unique geography of Wales is also likely to be important.
Further emission reductions within sectors that have a less difficult low carbon pathway i.e. the power sector, through increased use of renewables, and the expansion of the potential for demand side response (DSR). It should be noted that industry and the steel sector in particular can contribute positively here

Question 4: What is required by 2030 to prepare for the 2050 target for an emissions reduction of at least 80% on 1990 levels, recognising that this may require that emissions in some areas are reduced close to zero? Is there any impact of the need to go beyond 80%, either in 2050 or subsequently?

Our hope is that the achievement of at least 80% reduction in emissions from 1990, is delivered through the development of lower carbon operations in a sustainable industrial landscape which includes a thriving steel sector, and not through de-industrialisation.

Therefore ensuring that the steel sector in Wales has the opportunity to operate competitively over the short to medium term is critical. This should then enable the research and development of innovative new low/lower carbon steelmaking technologies and carbon capture storage and use (CCSU) needed to deliver the significant emission reductions by 2050.

The steel sector is under no illusions that it has to compete in a global market and therefore has to continue to innovate, reduce costs, develop new products and markets etc, but where there are particular issues in Wales (or more likely UK), that could impede or help that competitiveness, these may need intervention by governments.

Along with the rest of the steel sector, Tata Steel has expressed a number of key asks of UK Government in the context of a possible future 'sector deal' under the UK's Industrial Strategy). We believe these are crucial to ensuring a competitive steel industry which can contribute to jobs, process and product innovation and economic and act as a catalyst for decarbonisation across the Welsh economy. The key asks are summarised below:

Actions need to be taken to remove / reduce the significant electricity price differentials faced by UK

industry compared to its competitors (in EU and beyond).

A more appropriate regime in respect to Business Rates so that it provides less of a disincentive to investment in productivity boosting capital investment is needed.

An R&D collaboration fund should be established, with match funding by government, to help in the long term investment in research, development and innovation. This has the potential to impact on process efficiency, productivity, product development, all of which will help in ensuring a viable sustainable business; critical developments in new steelmaking methods and CCS, which remains a critical option for the most significant CO2 savings and CCU. Noting that in respect to CCS this will most likely require shipping to a suitable offshore location e.g. potentially the Hamilton fields off the cost of North Wales which could be a first UK cluster.

Public Procurement policies should promote and support UK supply chains.

In addition to the key sectoral asks, a variety of infrastructural developments are also likely to be required. For example, electricity grid infrastructure investment will be needed in key areas in order for there to be any substantial increase in the proportion of EAF to BF/BOS route steelmaking (albeit it should be recognised that BF/BOS route steelmaking remains a substantial outlet for scrap recycling). In addition, a clearer understanding is needed of the required/available capacity of electricity demand in the longer term (2030+) if the intention is to achieve a step-change in electric vehicle use in future (especially if also coupled to greater uptake of EAF steelmaking).

If low carbon/renewable heat sources are to contribute a significant proportion of the targeted carbon emission reductions, there is a significant amount of work required over the next decade or two to enable efficient extraction, storage and distribution. This will include source mapping, development of current and new technologies and potentially significant infrastructure aligned to relevant “clusters” of producers and consumers.

Question 5: What are the respective roles of UK Government, Welsh Government, the wider public sector, business, third sector and individual or household behaviour in delivering emissions reductions between now and 2030? And, separately, between 2030 and 2050?

In respect of the UK Government (and Welsh Government) and UK Steel Sector, as well as some of the wider business sector (supply chain impacts), the roles and responsibilities are probably most comprehensively covered within the ongoing discussions in respect to the potential Sector Deal (see answer to Question 4) and how that fits in with the Industrial Strategy.

Question 6: As a business, as a Public Sector Body, or as a citizen, how do emissions targets affect your planning and decision-making?

Tata Steel operates in an extremely competitive global (commodity) marketplace and therefore has had a significant focus on all areas that contribute to its cost base or can improve profit margins including energy and material efficiency. This has ensured that significant reductions in energy use and improvements in energy efficiency have taken place over many decades, as it has generally made good business sense to do this. These improvements were instigated and continued over periods pre-dating the setting of carbon targets.

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That said, the 5 -yearly cycle of pledges and reviews under the Paris Agreement should provide some clarity on how much real progress is likely/actually happening. The first Global Stocktake is set for 2023 and every 5 years thereafter (although there is an interim review due in 2018 ahead of 2020 when the Agreement is in

In the agriculture sector, to meet the 2050 target and nearer term climate objectives, we have proposed that the UK’s new UK agricultural framework should include a strategy to increase the adoption of organic farming to achieve at least 10% of UK farmland to be managed organically – alongside market based measures to ensure that conversion rates do not run ahead of market demand. Achieving 10% of farmland under organic production would help reduce the emissions from the agriculture sector and to sequester carbon into the soil.

Government recognition and support for sustainable agricultural practices - especially those that help meet carbon budgets - should also inform priorities and budget allocation for research, innovation and farming advisory services. There are many opportunities for knowledge sharing among farmer networks and these should be actively promoted and encouraged. The Soil Association is calling for Government to allocate 10% of the current R&D budget for innovative agriculture projects led by farmers themselves. A significant proportion of such projects can and should be dedicated to finding ways to cut greenhouse gas emissions.

In order to help climate-proof the agricultural sector and encourage new entrants to organic farming, research institutions and universities – particularly agricultural colleges – should be encouraged to offer courses in organic and agroecological farming practices, as part of a wider focus on what climate change means for the future of farming and how the sector can play its part in cutting GHG emissions and adapting to the impacts of climate change. Increasing R&D funding into innovative farm-driven projects would help to identify methods by which farming practices can help tackle climate change and field-test techniques that could help farmers adapt to growing in a changing climate.

effect). Care is needed in how/when the timings of these reviews might be taken into account and potentially acted upon, bearing in mind Wales is about to set its 2016-2020 and 2021-2025 budgets. This is particularly important when considering the generally long investment cycles in the industrial sector, and the steel sector in particular.

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In many cases it seems likely that relevant EU policy measures will be preserved or replicated by UK law. The CCC briefing paper (Oct 2016) also mentions the likely need to strengthen UK law where it’s felt that EU law is insufficient. We would ask that due recognition be given to the potential impact such measures could have on energy intensive industry competitiveness in general and the steel sector in

particular due to its difficulty in transitioning to a low carbon approach in the short and medium term due to the need for a step change in innovative steelmaking technologies.
One other key area that remains a significant concern is the future level of EU collaboration and innovation funding (e.g. EU ETS, Horizon 2020) which in a sector that is looking to the development of new and innovative, unproven technologies for decarbonising is vitally important.

Question 3: In the area(s) of your expertise, what are the opportunities and challenges in reducing Welsh emissions in the nearer term (e.g. to 2030)?

The challenges in reducing Welsh emissions are significantly affected by the high level of industrial emissions as a proportion of total emissions (34%) compared to the situation in the wider UK (22%). Taking that in conjunction with the fact that a large proportion of industrial emissions are attributable to only a small number of large emitters from these sectors (see Q8) brings potentially further difficulties. The variability in the short and medium term carbon abatement potential (with current technology) of some parts of the industrial sector could be said to exacerbate the difficulties.
The Welsh Government also does not have devolved competence in all areas relevant to climate change emissions reductions (e.g. energy, aviation and marine transport, building regulations).
Perhaps one of the most difficult challenges, is in the area of effective communication of the key messages and the need for quite significant changes in behaviours of the general public as consumers of goods and services and how that impacts on achievement of the carbon targets and budgets.
Opportunities for reduction of Welsh emissions in the nearer term (up to 2030) include establishing appropriate funding mechanisms that would support the implementation of energy efficiency measures (current/conventional

technology) where the pay-back periods are currently outside of those that are economically viable for energy intensive industries.
Promoting and strengthening collaborations between academia and industry will be useful (for example, building on the current example of FLEXIS).
Although, a small proportion of Welsh total emissions, progressing emissions reductions within the Public Sector will be important, not least in that it will help demonstrate leadership by the Welsh Government. The potential for land-use as a positive benefit for climate change in a country that has the unique geography of Wales is also likely to be important.
Further emission reductions within sectors that have a less difficult low carbon pathway i.e. the power sector, through increased use of renewables, and the expansion of the potential for demand side response (DSR). It should be noted that industry and the steel sector in particular can contribute positively here

Question 4: What is required by 2030 to prepare for the 2050 target for an emissions reduction of at least 80% on 1990 levels, recognising that this may require that emissions in some areas are reduced close to zero? Is there any impact of the need to go beyond 80%, either in 2050 or subsequently?

Our hope is that the achievement of at least 80% reduction in emissions from 1990, is delivered through the development of lower carbon operations in a sustainable industrial landscape which includes a thriving steel sector, and not through de-industrialisation.

Therefore ensuring that the steel sector in Wales has the opportunity to operate competitively over the short to medium term is critical. This should then enable the research and development of innovative new low/lower carbon steelmaking technologies and carbon capture storage and use (CCSU) needed to deliver the

significant emission reductions by 2050.

The steel sector is under no illusions that it has to compete in a global market and therefore has to continue to innovate, reduce costs, develop new products and markets etc, but where there are particular issues in Wales (or more likely UK), that could impede or help that competitiveness, these may need intervention by governments.

Along with the rest of the steel sector, Tata Steel has expressed a number of key asks of UK Government in the context of a possible future 'sector deal' under the UK's Industrial Strategy). We believe these are crucial to ensuring a competitive steel industry which can contribute to jobs, process and product innovation and economic and act as a catalyst for decarbonisation across the Welsh economy. The key asks are summarised below:

Actions need to be taken to remove / reduce the significant electricity price differentials faced by UK industry compared to its competitors (in EU and beyond).

A more appropriate regime in respect to Business Rates so that it provides less of a disincentive to investment in productivity boosting capital investment is needed.

An R&D collaboration fund should be established, with match funding by government, to help in the long term investment in research, development and innovation. This has the potential to impact on process efficiency, productivity, product development, all of which will help in ensuring a viable sustainable business; critical developments in new steelmaking methods and CCS, which remains a critical option for the most significant CO2 savings and CCU. Noting that in respect to CCS this will most likely require shipping to a suitable offshore location e.g. potentially the Hamilton fields off the cost of North Wales which

could be a first UK cluster.

Public Procurement policies should promote and support UK supply chains.

In addition to the key sectoral asks, a variety of infrastructural developments are also likely to be required. For example, electricity grid infrastructure investment will be needed in key areas in order for there to be any substantial increase in the proportion of EAF to BF/BOS route steelmaking (albeit it should be recognised that BF/BOS route steelmaking remains a substantial outlet for scrap recycling). In addition, a clearer understanding is needed of the required/available capacity of electricity demand in the longer term (2030+) if the intention is to achieve a step-change in electric vehicle use in future (especially if also coupled to greater uptake of EAF steelmaking).

If low carbon/renewable heat sources are to contribute a significant proportion of the targeted carbon emission reductions, there is a significant amount of work required over the next decade or two to enable efficient extraction, storage and distribution. This will include source mapping, development of current and new technologies and potentially significant infrastructure aligned to relevant “clusters” of producers and consumers.

Question 5: What are the respective roles of UK Government, Welsh Government, the wider public sector, business, third sector and individual or household behaviour in delivering emissions reductions between now and 2030? And, separately, between 2030 and 2050?

In respect of the UK Government (and Welsh Government) and UK Steel Sector, as well as some of the wider business sector (supply chain impacts), the roles and responsibilities are probably most comprehensively covered within the ongoing discussions in respect to the potential Sector Deal (see answer to Question 4) and how

that fits in with the Industrial Strategy.

Question 6: As a business, as a Public Sector Body, or as a citizen, how do emissions targets affect your planning and decision-making?

Tata Steel operates in an extremely competitive global (commodity) marketplace and therefore has had a significant focus on all areas that contribute to its cost base or can improve profit margins including energy and material efficiency. This has ensured that significant reductions in energy use and improvements in energy efficiency have taken place over many decades, as it has generally made good business sense to do this. These improvements were instigated and continued over periods pre-dating the setting of carbon targets.

However, as an energy intensive manufacturing operator with its main installations covered by the EU ETS, that regime has had a more immediate impact on planning and decision-making than have the carbon targets and budgets set within the UK Climate Change Act or Wales Environment Act. The EU ETS, through its decreasing cap over time has been the method chosen to achieve the European Traded Sector's contribution to emissions reduction. The impacts of EU ETS in regards to forward positions on potential free allocation levels and the cost of shortfalls have been factored into the company strategy, including asset configuration and capital investment planning.

That said, and with the potential fall-outs from Brexit, the 2050 targets set within UK Climate Change Act (and latterly Wales) clearly indicate the long-term vision and hence the political environment that Tata Steel will be operating in over the long term if it intends to continue as a sustainable business. Therefore it is currently honing its long-term strategy for delivering a sustainable business (this includes areas such as Climate Change and Circular Economy, the latter being intrinsically linked to former).

The effect of public policy on the foundation industries such as the steel industry has the potential to be profoundly positive, if Governments embrace Circular Economy and low carbon concepts in planning, procurement and product legislation. Steel products will be vital in helping society to become more sustainable because of their intrinsic durability, flexibility, re-usability and, at the end of their lives, recyclability. We strongly believe that Governments should seek to incentivise the uptake of sustainable materials and the establishment of a Circular Economy through the full suite of policy instruments at their disposal.

Question 7: In your area(s) of expertise, what specific circumstances need to be considered when setting targets and budgets for Wales and how could these be reflected in the targets?

We understand and recognise the premise that early reduction of absolute emissions (e.g. by 2030) will mean lower cumulative emissions between now and 2050 and therefore a reduced impact on the climate. However, it is fundamentally clear that the steel sector is close to the thermodynamic limits of conventional primary BF/BOS route steelmaking. As such, substantial reductions in direct emissions require the development and implementation of new steelmaking technologies. In conjunction with this, there is an expectation that there will be a move towards an increased use of scrap (for example, through an uptake of EAF) and/or implementation of new low carbon steelmaking technologies over the long term. This does also assume the availability of sufficient low carbon/renewable electricity, and possible CCS and/or CCU.
Care is needed to understand the extent to which these technologies could be deployed, whether they will be accepted by the public and how the deployment and increased costs will be funded. Without the deployment of new technologies

and low-carbon energy, a commitment to any particular stretching targets would be optimistic in the extreme.
In the short term the industry continues to commit substantial efforts to optimise energy consumption, material yield and other process efficiencies wherever it is cost effective to do so. Whilst such efforts are hugely important, they will provide only relatively small percentage improvements in emissions (though outside of the integrated steelmaking installations, these reductions may be considered significant in absolute terms).
We have already set out our assertion that Welsh emission reductions cannot be achieved through de-industrialisation; this would be counter-productive in global emissions terms and would carry a substantial cost for the Welsh economy and its ability to innovate and be a catalyst for global action. One way for policy makers to ensure that genuine emissions reductions are being achieved is to use consumption-based reporting, using life-cycle assessment methods to understand not only the direct emissions from the Welsh economy and society but also the indirect emissions from the production of imported goods.
Linked to consumption based reporting is the need to avoid setting simplistic targets expressed as emissions per tonne of basic production volume. In some cases, there is a life cycle benefit from investing more energy and emissions in the production stage of a product's life in order to secure an improvement in its 'in use' or 'end-of life' performance.' A classic illustration of this is the extra energy expended to produce advanced high strength steels (AHSS) leading to light-weighting e.g. in the automotive sector, which help provide reduced transport emissions and hence lower global emissions. Similarly, the carbon benefits accrued by the use of high efficiency electrical steels e.g. in transformers and motors, outweighs many times the additional impacts incurred during the manufacture of such

steels. The contribution through the manufacture of premium steel products to large net savings in carbon emissions over the full life cycle of steel products should be recognised, not penalised

Another key consideration in target setting linked to product characteristics is understanding the technical limitations of various production processes for manufacturing products of the correct specification, It needs to be understood, for example, that EAF-produced steels are currently unsuitable for use in a number of applications, not least a variety of key sectors for flat steel products such as automotive. In this case, the limitations are due to high nitrogen levels and some residual elements that lead to strain ageing and low ductility issues in the final flat products and prevent EAF route supply. Therefore R&D into process improvements that may allow the EAF route to be able to supply this important sector is required and will take substantial time. This is a key factor that needs to be considered in determining the extent of any future transition to a greater uptake of the EAF route (or other new steelmaking techniques such as HISARNA) between 2030-2050.

As can be seen from the examples above, Tata Steel and the wider steel sector need “breathing space” for a broad and complex range of measures to come to fruition. We need this to be considered in setting the interim targets and carbon budgets to take into account the unavoidable back-loaded pathway for substantial emission reductions.

Unlike the move to increased electric vehicle ownership and use, the Technology Readiness Level (TRL) of potential future lower carbon steelmaking methods is low and remains unproven. Whilst Tata Steel remains hopeful in regards to a new technology HISARNA (installed at the Netherlands site) it remains at pilot plant level. The latest trial will seek to test the stability of operations over more than a month and therefore remains a very long way from being proven and then

developed at a commercial scale and rolled out across the EU/World.
The TRL of such potential improvements needs to be taken into account when the options for achieving carbon emission reductions at a particular cost and by a particular time from all sectors/sub-sectors are assessed.
When considering the range of possible improvements to energy efficiency and emission reduction, care is needed to take into account that they are often either mutually exclusive (so one option being implemented would mean another wouldn't be) or they interact to a greater or lesser extent , so the overall reduction in CO2 cannot be taken to be the sum of each individual option.
For a number of improvement options there may also be a level of interdependence, for example on an integrated steelmaking site (conventional BF/BOS route) which are very complex with several inter-linked processes, These installations produce process waste gases (BFG, COG, BOSG) from the cokemaking, ironmaking and steelmaking operations. Ideally the production of these gases (inherent and unavoidable) should slightly exceed demand, resulting in a small safety flare. However, due to site configuration, or limitations (such as age and efficiency of power generation) supply may be significantly greater than supply. Therefore installing projects that improve efficiency of combustion that just save waste gases would have no real benefit as this would just lead to increased flaring of the waste gases. Installation of sufficient additional combustion capacity (eg power generation) would possibly be required first/alongside. Such additional capacity can often be, as is usually the case in the steel sector, a significant capital expenditure.
Due to the highly capital intensive nature of our industry, there can be some critical issues relating to timing and choices made, particularly those that are being considered now in the short term. It may be that measures that appear to be

essential or obvious options in the short term, are not aligned with a “possible future option” (although that option is unproven and may not come to fruition). Companies in capital intensive sectors such as steel that are already substantially constrained in terms of access to finance cannot afford to spend ‘regret capital’ implementing technologies that shortly after are shown not to be compatible with the optimal decarbonisation roadmap.

Whilst it has been made clear that the emissions targets are focussed on Wales emissions, it is important that due diligence be taken and reflected in any impact assessment of the level of imported carbon emissions when considering setting the carbon targets and budgets. It would not be sensible or appropriate if net (imported and direct) emissions were increasing/static whilst direct emissions were reducing. This would likely be a road to de-industrialisation rather than de-carbonisation.

We also believe – as described above - that taking a full life-cycle approach to the actual global impact is the correct way to go, so that the overall correct decisions are made.

A good example can be found in an independent study of Toyota Venza carried out by the University of California at Davis (https://www.worldsteel.org/steel-by-topic/life-cycle-thinking/case-studies/WorldAutoSteel---Automotive--Life-cycle-thinking-leads-to-intelligent-automotive-material-choices.html)

A full life cycle approach should also be adopted when calculating the carbon emissions associated with steelmaking, in particular in accounting for the use of steel scrap in BOS and EAF steelmaking. Steel scrap is a valuable resource (i.e. is not ‘free’ economically, nor environmentally) and its recycling into new steel should properly account for the carbon ‘embodied’ in the scrap.

Question 8: The power and industry sectors in Wales are dominated by a small number of large emitters. What are the key challenges and opportunities that this presents in setting the levels of carbon budgets and

how should the process of setting them reflect these?

A key structural challenge is that a small number of large emitters are owned by a small number of companies. As such, a potentially significant burden (and capital expenditure) is likely to fall on one or two industrial/power companies. In respect to the industrial installation/operator then unlike the power company it cannot pass on the CO2 costs to its customers.
In respect to the integrated steelmaking site, the various options considered in the last UK carbon budget report, in respect to energy efficiency and emission reductions were being considered across the whole of the UK. This meant that it was feasible to have considered , potential savings from more than one option contributing to the abatement target , whereas on a single site in Wales, they may be mutually exclusive or lead to significant interaction and lower net savings.
The integrated steelmaking installation, also does rely on a number of unproven “new technologies” on the pathway to 2050 and therefore will necessarily be biased towards longer term significant reductions in carbon emissions (and later interim targets and budgets), which will need to be duly considered.
In respect to Aberthaw power station and the UK policy of phasing out coal power, the uncertainty in the emission pathway and particular year of final closure appears to present a challenge. The Welsh Government does have the opportunity to review budgets and targets where there has been a significant change, to avoid any concerns over “hot air”.
Having a small number of large emitters does also provide a few opportunities. An example for this could be the Tata Steel Port Talbot installation which produces CO2, CO and H2, , has availability of land suitable for renewables including offshore wind and waste heat. Therefore it provides a suitable site to undertake demonstration projects in regards to the

development of technologies in respect to carbon dioxide streams , waste heat and renewable energy.*
* “The potential and limitations of using carbon dioxide” –Policy Briefing, The Royal Society, May 2017, ISBN:978-1-78252-267-6

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The Committee should ensure that it takes a balanced view (and aligning with the Future Generations Act) and ensure that it considers the positive impacts and interactions (actual and potential) not just conflicts and negative impacts.
In this response we have sought to illustrate not only the benefits we bring to the Welsh economy in terms of job creation and economic development, but also the profoundly beneficial role that our products can make to achieving a more resource-efficient and circular economy throughout Wales and beyond. Only with the short term breathing space and support we need to consolidate our competitiveness, can we continue to be a positive hub of innovation in sustainable products and processes.
In addition to the economic benefits that we provide, Tata Steel also seeks to be a good neighbour and a positive contributor to the local community. We are, for example, a key partner in the management of the Eglwys Nunydd reservoir which is a recognised excellent fishing area and supports a sailing club, in addition to the wildfowl that designated it as a SSI site. Over the years Tata steel has supported other local habitats e.g. sponsoring the fen orchid and given over part of its land around the landfill site to support a local species of bee. There may be further opportunities for active management of “urban green spaces” helping with improvements to bio-diversity, tree planting etc by industrial organisations. This could be supported through some form of

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Tata Steel operates in an extremely competitive global (commodity) marketplace and therefore has had a significant focus on all areas that contribute to its cost base or can improve profit margins including energy and material efficiency. This has ensured that significant reductions in energy use and improvements in energy efficiency have taken place over many decades, as it has generally made good business sense to do this. These improvements were instigated and continued over periods pre-dating the setting of carbon targets.
However, as an energy intensive manufacturing operator with its main installations covered by the EU ETS, that regime has had a more immediate impact on planning and decision-making than have the carbon targets and budgets set within the UK Climate Change Act or Wales Environment Act. The EU ETS, through its decreasing cap over time has been the method chosen to achieve the European Traded Sector’s contribution to emissions reduction. The impacts of EU ETS in regards to forward positions on potential free allocation levels and the cost of shortfalls have been factored into the company strategy, including asset configuration and capital investment planning.
That said, and with the potential fall-outs from Brexit, the 2050 targets set within UK Climate Change Act (and latterly Wales) clearly indicate the long-term vision and hence the political environment that Tata Steel will be operating in over the long term if it intends to continue as a sustainable business. Therefore it is currently honing its long-term strategy for delivering a sustainable business (this includes areas such as Climate Change and Circular Economy, the latter being intrinsically linked to former).
The effect of public policy on the foundation industries such as the steel industry has the potential to be profoundly positive, if Governments embrace Circular Economy and low carbon concepts in planning, procurement and product legislation. Steel products will be vital in helping society to become more sustainable because of their intrinsic durability, flexibility, re-usability and, at the end of their lives, recyclability. We strongly believe that Governments should seek to incentivise the uptake of sustainable materials and the establishment of a Circular Economy through the full suite of policy instruments at their disposal.

Question 7: In your area(s) of expertise, what specific circumstances need to be considered when setting targets and budgets for Wales and how could these be reflected in the targets?

We understand and recognise the premise that early reduction of absolute emissions (e.g. by 2030) will mean lower cumulative emissions between now and 2050 and therefore a reduced impact on the climate. However, it is fundamentally clear that the steel sector is close to the thermodynamic limits of conventional primary BF/BOS route steelmaking. As such, substantial reductions in direct emissions require the development and implementation of new steelmaking technologies. In conjunction with this, there is an expectation that there will be a move towards an increased use of scrap (for example, through an uptake of EAF) and/or implementation of new low carbon steelmaking technologies over the long term. This does also assume the availability of sufficient low carbon/renewable electricity, and possible CCS and/or CCU. Care is needed to understand the extent to which these technologies could be deployed, whether they will

be accepted by the public and how the deployment and increased costs will be funded. Without the deployment of new technologies and low-carbon energy, a commitment to any particular stretching targets would be optimistic in the extreme.

In the short term the industry continues to commit substantial efforts to optimise energy consumption, material yield and other process efficiencies wherever it is cost effective to do so. Whilst such efforts are hugely important, they will provide only relatively small percentage improvements in emissions (though outside of the integrated steelmaking installations, these reductions may be considered significant in absolute terms).

We have already set out our assertion that Welsh emission reductions cannot be achieved through de-industrialisation; this would be counter-productive in global emissions terms and would carry a substantial cost for the Welsh economy and its ability to innovate and be a catalyst for global action. One way for policy makers to ensure that genuine emissions reductions are being achieved is to use consumption-based reporting, using life-cycle assessment methods to understand not only the direct emissions from the Welsh economy and society but also the indirect emissions from the production of imported goods.

Linked to consumption based reporting is the need to avoid setting simplistic targets expressed as emissions per tonne of basic production volume. In some cases, there is a life cycle benefit from investing more energy and emissions in the production stage of a product's life in order to secure an improvement in its 'in use' or 'end-of life' performance.' A classic illustration of this is the extra energy expended to produce advanced high strength steels (AHSS) leading to light-weighting e.g. in the automotive sector, which help provide reduced transport emissions and hence lower global emissions. Similarly, the carbon benefits accrued by the use of high efficiency electrical steels e.g. in transformers and motors, outweighs many times the additional impacts incurred during the manufacture of such steels. The contribution through the manufacture of premium steel products to large net savings in carbon emissions over the full life cycle of steel products should be recognised, not penalised

Another key consideration in target setting linked to product characteristics is understanding the technical limitations of various production processes for manufacturing products of the correct specification, It needs to be understood, for example, that EAF-produced steels are currently unsuitable for use in a number of applications, not least a variety of key sectors for flat steel products such as automotive. In this case, the limitations are due to high nitrogen levels and some residual elements that lead to strain ageing and low ductility issues in the final flat products and prevent EAF route supply. Therefore R&D into process improvements that may allow the EAF route to be able to supply this important sector is required and will take substantial time. This is a key factor that needs to be considered in determining the extent of any future transition to a greater uptake of the EAF route (or other new steelmaking techniques such as HISARNA) between 2030-2050.

As can be seen from the examples above, Tata Steel and the wider steel sector need "breathing space" for a broad and complex range of measures to come to fruition. We need this to be considered in setting the interim targets and carbon budgets to take into account the unavoidable back-loaded pathway for substantial emission reductions.

Unlike the move to increased electric vehicle ownership and use, the Technology Readiness Level (TRL) of potential future lower carbon steelmaking methods is low and remains unproven. Whilst Tata Steel remains hopeful in regards to a new technology HISARNA (installed at the Netherlands site) it remains at pilot plant level. The latest trial will seek to test the stability of operations over more than a month and therefore remains a very long way from being proven and then developed at a commercial scale and rolled out across the EU/World.

The TRL of such potential improvements needs to be taken into account when the options for achieving carbon emission reductions at a particular cost and by a particular time from all sectors/sub-sectors are assessed.

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For a number of improvement options there may also be a level of interdependence, for example on an integrated steelmaking site (conventional BF/BOS route) which are very complex with several inter-linked processes, These installations produce process waste gases (BFG, COG, BOSG) from the cokemaking, ironmaking and steelmaking operations. Ideally the production of these gases (inherent and unavoidable) should slightly exceed demand, resulting in a small safety flare. However, due to site configuration, or limitations (such as age and efficiency of power generation) supply may be significantly greater than supply. Therefore installing projects that improve efficiency of combustion that just save waste gases would have no real benefit as this would just lead to increased flaring of the waste gases. Installation of sufficient additional combustion capacity (eg power generation) would possibly be required first/alongside. Such additional capacity can often be, as is usually the case in the steel sector, a significant capital expenditure.

Due to the highly capital intensive nature of our industry, there can be some critical issues relating to timing and choices made, particularly those that are being considered now in the short term. It may be that measures that appear to be essential or obvious options in the short term, are not aligned with a "possible future option" (although that option is unproven and may not come to fruition). Companies in capital intensive sectors such as steel that are already substantially constrained in terms of access to finance

cannot afford to spend ‘regret capital’ implementing technologies that shortly after are shown not to be compatible with the optimal decarbonisation roadmap.
Whilst it has been made clear that the emissions targets are focussed on Wales emissions, it is important that due diligence be taken and reflected in any impact assessment of the level of imported carbon emissions when considering setting the carbon targets and budgets. It would not be sensible or appropriate if net (imported and direct) emissions were increasing/static whilst direct emissions were reducing. This would likely be a road to de-industrialisation rather than de-carbonisation.
We also believe – as described above - that taking a full life-cycle approach to the actual global impact is the correct way to go, so that the overall correct decisions are made.
A good example can be found in an independent study of Toyota Venza carried out by the University of California at Davis (https://www.worldsteel.org/steel-by-topic/life-cycle-thinking/case-studies/WorldAutoSteel---Automotive--Life-cycle-thinking-leads-to-intelligent-automotive-material-choices.html)
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Question 8: The power and industry sectors in Wales are dominated by a small number of large emitters. What are the key challenges and opportunities that this presents in setting the levels of carbon budgets and how should the process of setting them reflect these?

A key structural challenge is that a small number of large emitters are owned by a small number of companies. As such, a potentially significant burden (and capital expenditure) is likely to fall on one or two industrial/power companies. In respect to the industrial installation/operator then unlike the power company it cannot pass on the CO2 costs to its customers.
In respect to the integrated steelmaking site, the various options considered in the last UK carbon budget report, in respect to energy efficiency and emission reductions were being considered across the whole of the UK. This meant that it was feasible to have considered , potential savings from more than one option contributing to the abatement target , whereas on a single site in Wales, they may be mutually exclusive or lead to significant interaction and lower net savings.
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Having a small number of large emitters does also provide a few opportunities. An example for this could be the Tata Steel Port Talbot installation which produces CO2, CO and H2, , has availability of land suitable for renewables including offshore wind and waste heat. Therefore it provides a suitable site to undertake demonstration projects in regards to the development of technologies in respect to carbon dioxide streams , waste heat and renewable energy.*
* “The potential and limitations of using carbon dioxide” –Policy Briefing, The Royal Society, May 2017, ISBN:978-1-78252-267-6

Question 9: 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?

The Committee should ensure that it takes a balanced view (and aligning with the Future Generations Act) and ensure that it considers the positive impacts and interactions (actual and potential) not just conflicts and negative impacts.
In this response we have sought to illustrate not only the benefits we bring to the Welsh economy in terms of job creation and economic development, but also the profoundly beneficial role that our products can make to achieving a more resource-efficient and circular economy throughout Wales and beyond. Only with the short term breathing space and support we need to consolidate our competitiveness, can we continue to be a positive hub of innovation in sustainable products and processes.
In addition to the economic benefits that we provide, Tata Steel also seeks to be a good neighbour and a positive contributor to the local community. We are, for example, a key partner in the management of the Eglwys Nunydd reservoir which is a recognised excellent fishing area and supports a sailing club, in addition to the wildfowl that designated it as a SSI site. Over the years Tata steel has supported other local habitats e.g. sponsoring the fen orchid and given over part of its land around the landfill site to support a local species of bee.
There may be further opportunities for active management of “urban green spaces” helping with improvements to bio-diversity, tree planting etc by industrial organisations. This could be supported through some form of benefit or credit in respect to environmental permit subsistence charges

Question 10: 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?

The Future Trends report is an interesting document, and it stimulates discussions across a wide range of areas which is a good thing. However, due to the inherent limitation in “future forecast” accuracy, the Committee will need to take care on the “weighting” it gives to the “evidence” in its assessment.

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Question 1: Does the Paris Agreement mean that Welsh emissions targets should keep open a deeper reduction in emissions than 80% by 2050? Are there implications for nearer-term targets?

We think it is fair to recognise the Paris Agreement as a landmark outcome, albeit possibly unexpected. This remains the case despite the US decision to later state its intention to withdraw. However, whilst Paris establishes a set of “binding procedural commitments,” achievement of the NDCs themselves is not legally binding (nor any new financial commitments) and this needs to be borne in mind when considering how the Wales (and UK) emission targets for 2050 and carbon budgets should be framed to reflect the Agreement. The 2050 target in Wales already allows for a greater than 80% reduction as the wording is “at least 80%”.
That said, the 5 -yearly cycle of pledges and reviews under the Paris Agreement should provide some clarity on how much real progress is likely/actually happening. The first Global Stocktake is set for 2023 and every 5 years thereafter (although there is an interim review due in 2018 ahead of 2020 when the Agreement is in effect). Care is needed in how/when the timings of these reviews might be taken into account and potentially acted upon, bearing in mind Wales is about to set its 2016-2020 and 2021-2025 budgets. This is particularly important when considering the generally long investment cycles in the

Each and every actor, whether government, business, civil society, or the general public have an important role to play in helping to meet our climate goals. Each action, however small, can help to reduce our emissions. However, as the CCC’s most recent progress report has illustrated, a voluntary approach to emission reduction in the agricultural sector is no longer a valid approach. Government needs to take a strong position and drive forward climate goals. Wales has an opportunity to lead by example and to go faster and further than the UK overall.

Public procurement should be given more recognition as a powerful tool that can be used to tackle climate change and reduce emissions from agriculture and the food system. The UK public sector serves some 3.5 million meals each weekday across settings as varied as schools, nurseries, care homes, hospitals and prisons. While this accounts for little over 1% of the total food retail and catering market, its influence is significant. Food in schools and public institutions sets norms for the public and consumers, signals values, and gives integrity to government priorities and policies. To illustrate the potential scale of this impact, the current UK organic market is worth over £2 billion, so if the public sector went organic, it would approximately double that market.

As food consumers, we also have a part to play. Dietary change and the reduction of food waste is essential, if we are to secure a sustainable, climate-friendly food system. That includes less but better quality meat and dairy products – particularly moving away from intensively farmed animals fed on cereals – and instead switching to grass-fed beef and lamb, and to more plant-based diets, with more fruit, vegetables and wholegrains. Government policy can help achieve this behavioural shift and campaigns such as Eating Better has been strongly supporting policy revisions. Not only would this be good for efforts to tackle climate change, it would be good for our health too.

industrial sector, and the steel sector in particular.

Question 2: Do you think that leaving the EU has an impact on the targets or how they can be met?

As already mentioned in the introduction, following the move from use of “net” emissions as per the UK target, to using actual Wales direct emissions, Brexit should not affect emissions accounting.
Clearly and in particular because of the high proportion of energy intensive and industrial emissions in the Traded Sector, the UK and Wales will need to seriously consider impacts on policy areas. For example, if the UK were not allowed to or chose not to participate in EU ETS (or an identical/very similar traded and possibly linked scheme). In addition to the price signal the EU ETS also delivers auctioning revenues. However whilst we note the CPS is claimed to have been successful in contributing to low carbon generation, the distortion in UK power prices has made the UK a difficult place to operate as an energy intensive industry. The welcome introduction, eventually, of a compensation scheme has helped reduce that impact, but it does not cover the full costs faced by energy intensives and this compensation mechanism is in any case on a declining maximum allowable level under state aid rules.
In many cases it seems likely that relevant EU policy measures will be preserved or replicated by UK law. The CCC briefing paper (Oct 2016) also mentions the likely need to strengthen UK law where it’s felt that EU law is insufficient. We would ask that due recognition be given to the potential impact such measures could have on energy intensive industry competitiveness in general and the steel sector in particular due to its difficulty in transitioning to a low carbon approach in the short and medium term due to the need for a step change in innovative steelmaking technologies.
One other key area that remains a significant concern is the future level of EU collaboration and innovation funding (e.g. EU ETS,

Horizon 2020) which in a sector that is looking to the development of new and innovative, unproven technologies for decarbonising is vitally important.

Question 3: In the area(s) of your expertise, what are the opportunities and challenges in reducing Welsh emissions in the nearer term (e.g. to 2030)?

The challenges in reducing Welsh emissions are significantly affected by the high level of industrial emissions as a proportion of total emissions (34%) compared to the situation in the wider UK (22%). Taking that in conjunction with the fact that a large proportion of industrial emissions are attributable to only a small number of large emitters from these sectors (see Q8) brings potentially further difficulties. The variability in the short and medium term carbon abatement potential (with current technology) of some parts of the industrial sector could be said to exacerbate the difficulties.
The Welsh Government also does not have devolved competence in all areas relevant to climate change emissions reductions (e.g. energy, aviation and marine transport, building regulations).
Perhaps one of the most difficult challenges, is in the area of effective communication of the key messages and the need for quite significant changes in behaviours of the general public as consumers of goods and services and how that impacts on achievement of the carbon targets and budgets.
Opportunities for reduction of Welsh emissions in the nearer term (up to 2030) include establishing appropriate funding mechanisms that would support the implementation of energy efficiency measures (current/conventional technology) where the pay-back periods are currently outside of those that are economically viable for energy intensive industries.
Promoting and strengthening collaborations between academia and industry will be useful (for example, building on the current example of FLEXIS).

Although, a small proportion of Welsh total emissions, progressing emissions reductions within the Public Sector will be important, not least in that it will help demonstrate leadership by the Welsh Government. The potential for land-use as a positive benefit for climate change in a country that has the unique geography of Wales is also likely to be important. Further emission reductions within sectors that have a less difficult low carbon pathway i.e. the power sector, through increased use of renewables, and the expansion of the potential for demand side response (DSR). It should be noted that industry and the steel sector in particular can contribute positively here

Question 4: What is required by 2030 to prepare for the 2050 target for an emissions reduction of at least 80% on 1990 levels, recognising that this may require that emissions in some areas are reduced close to zero? Is there any impact of the need to go beyond 80%, either in 2050 or subsequently?

Our hope is that the achievement of at least 80% reduction in emissions from 1990, is delivered through the development of lower carbon operations in a sustainable industrial landscape which includes a thriving steel sector, and not through de-industrialisation.

Therefore ensuring that the steel sector in Wales has the opportunity to operate competitively over the short to medium term is critical. This should then enable the research and development of innovative new low/lower carbon steelmaking technologies and carbon capture storage and use (CCSU) needed to deliver the significant emission reductions by 2050.

The steel sector is under no illusions that it has to compete in a global market and therefore has to continue to innovate, reduce costs, develop new products and markets etc, but where there are particular issues

in Wales (or more likely UK), that could impede or help that competitiveness, these may need intervention by governments.

Along with the rest of the steel sector, Tata Steel has expressed a number of key asks of UK Government in the context of a possible future 'sector deal' under the UK's Industrial Strategy). We believe these are crucial to ensuring a competitive steel industry which can contribute to jobs, process and product innovation and economic and act as a catalyst for decarbonisation across the Welsh economy. The key asks are summarised below:

Actions need to be taken to remove / reduce the significant electricity price differentials faced by UK industry compared to its competitors (in EU and beyond).

A more appropriate regime in respect to Business Rates so that it provides less of a disincentive to investment in productivity boosting capital investment is needed.

An R&D collaboration fund should be established, with match funding by government, to help in the long term investment in research, development and innovation. This has the potential to impact on process efficiency, productivity, product development, all of which will help in ensuring a viable sustainable business; critical developments in new steelmaking methods and CCS, which remains a critical option for the most significant CO2 savings and CCU. Noting that in respect to CCS this will most likely require shipping to a suitable offshore location e.g. potentially the Hamilton fields off the cost of North Wales which could be a first UK cluster.

Public Procurement policies should promote and support UK supply chains.

In addition to the key sectoral asks, a variety of infrastructural developments are also likely to be required. For example,

electricity grid infrastructure investment will be needed in key areas in order for there to be any substantial increase in the proportion of EAF to BF/BOS route steelmaking (albeit it should be recognised that BF/BOS route steelmaking remains a substantial outlet for scrap recycling). In addition, a clearer understanding is needed of the required/available capacity of electricity demand in the longer term (2030+) if the intention is to achieve a step-change in electric vehicle use in future (especially if also coupled to greater uptake of EAF steelmaking).

If low carbon/renewable heat sources are to contribute a significant proportion of the targeted carbon emission reductions, there is a significant amount of work required over the next decade or two to enable efficient extraction, storage and distribution. This will include source mapping, development of current and new technologies and potentially significant infrastructure aligned to relevant “clusters” of producers and consumers.

Question 5: What are the respective roles of UK Government, Welsh Government, the wider public sector, business, third sector and individual or household behaviour in delivering emissions reductions between now and 2030? And, separately, between 2030 and 2050?

In respect of the UK Government (and Welsh Government) and UK Steel Sector, as well as some of the wider business sector (supply chain impacts), the roles and responsibilities are probably most comprehensively covered within the ongoing discussions in respect to the potential Sector Deal (see answer to Question 4) and how that fits in with the Industrial Strategy.

Question 6: As a business, as a Public Sector Body, or as a citizen, how do emissions targets affect your planning and decision-making?

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In addition to the economic benefits that we provide, Tata Steel also seeks to be a good neighbour and a positive contributor to the local community. We are, for example, a key partner in the management of the Eglwys Nunydd reservoir which is a recognised excellent fishing area and supports a sailing club, in addition to the wildfowl that designated it as a SSI site. Over the years Tata steel has supported other local habitats e.g. sponsoring the fen orchid and given over part of its land around the landfill site to support a local species of bee. There may be further opportunities for active management of “urban green spaces” helping with improvements to bio-diversity, tree planting etc by industrial organisations. This could be supported through some form of benefit or credit in respect to environmental permit subsistence charges

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Question 1: Does the Paris Agreement mean that Welsh emissions targets should keep open a deeper reduction in emissions than 80% by 2050? Are there implications for nearer-term targets?

We think it is fair to recognise the Paris Agreement as a landmark outcome, albeit possibly unexpected. This remains the case despite the US decision to later state its intention to withdraw. However, whilst Paris establishes a set of “binding procedural commitments,” achievement of the NDCs themselves is not legally binding (nor any new financial commitments) and this needs to be borne in mind when considering how the Wales (and UK) emission targets for 2050 and carbon budgets should be framed to reflect the Agreement. The 2050 target in Wales already allows for a greater than 80% reduction as the wording is “at least 80%”. That said, the 5 -yearly cycle of pledges and reviews under the Paris Agreement should provide some clarity on how much real progress is likely/actually happening. The first Global Stocktake is set for 2023 and every 5 years thereafter (although there is an interim review due in 2018 ahead of 2020 when the Agreement is in effect). Care is needed in how/when the timings of these reviews might be taken into account and potentially acted upon, bearing in mind Wales is about to set its 2016-2020 and 2021-2025 budgets. This is particularly important when considering the generally long investment cycles in the industrial sector, and the steel sector in particular.

Question 2: Do you think that leaving the EU has an impact on the targets or how they can be met?

As already mentioned in the introduction, following the move from use of “net” emissions as per the UK target, to using actual Wales direct emissions, Brexit should not affect emissions accounting.
Clearly and in particular because of the high proportion of energy intensive and industrial emissions in the Traded Sector, the UK and Wales will need to seriously consider impacts on policy areas. For example, if the UK were not allowed to or chose not to participate in EU ETS (or an identical/very similar traded and possibly linked scheme). In addition to the price signal the EU ETS also delivers auctioning revenues. However whilst we note the CPS is claimed to have been successful in contributing to low carbon generation, the distortion in UK power prices has made the UK a difficult place to operate as an energy intensive industry. The welcome introduction, eventually, of a compensation scheme has helped reduce that impact, but it does not cover the full costs faced by energy intensives and this compensation mechanism is in any case on a declining maximum allowable level under state aid rules.
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One other key area that remains a significant concern is the future level of EU collaboration and innovation funding (e.g. EU ETS, Horizon 2020) which in a sector that is looking to the development of new and innovative, unproven technologies for decarbonising is vitally important.

Question 3: In the area(s) of your expertise, what are the opportunities and challenges in reducing Welsh emissions in the nearer term (e.g. to 2030)?

The challenges in reducing Welsh emissions are significantly affected by the high level of industrial emissions as a proportion of total emissions (34%) compared to the situation in the wider UK (22%). Taking that in conjunction with the fact that a large proportion of industrial emissions are attributable to only a small number of large emitters from these sectors (see Q8) brings potentially further difficulties. The variability in the short and medium term carbon abatement potential (with current technology) of some parts of the industrial sector could be said to exacerbate the difficulties.
The Welsh Government also does not have devolved competence in all areas relevant to climate change emissions reductions (e.g. energy, aviation and marine transport, building regulations).
Perhaps one of the most difficult challenges, is in the area of effective communication of the key messages and the need for quite significant changes in behaviours of the general public as consumers of goods and services and how that impacts on achievement of the carbon targets and budgets.
Opportunities for reduction of Welsh emissions in the nearer term (up to 2030) include establishing appropriate funding mechanisms that would support the implementation of energy efficiency measures (current/conventional technology) where the pay-back periods are currently outside of those that are economically viable for energy intensive industries.
Promoting and strengthening collaborations between academia and industry will be useful (for example, building on the current example of FLEXIS).
Although, a small proportion of Welsh total emissions, progressing emissions reductions within the Public Sector will be important, not least in that it will help demonstrate leadership by the Welsh Government. The potential for land-use as a positive benefit for climate change in a country that has the unique geography of Wales is also likely to be important.
Further emission reductions within sectors that have a less difficult low carbon pathway i.e. the power sector, through increased use of renewables, and the expansion of the potential for demand side response (DSR). It should be noted that industry and the steel sector in particular can contribute positively here

Question 4: What is required by 2030 to prepare for the 2050 target for an emissions reduction of at least 80% on 1990 levels, recognising that this may require that emissions in some areas are reduced close to zero? Is there any impact of the need to go beyond 80%, either in 2050 or subsequently?

Our hope is that the achievement of at least 80% reduction in emissions from 1990, is delivered through the development of lower carbon operations in a sustainable industrial landscape which includes a thriving steel sector, and not through de-industrialisation.

Therefore ensuring that the steel sector in Wales has the opportunity to operate competitively over the short to medium term is critical. This should then enable the research and development of innovative new low/lower carbon steelmaking technologies and carbon capture storage and use (CCSU) needed to deliver the significant emission reductions by 2050.

The steel sector is under no illusions that it has to compete in a global market and therefore has to continue to innovate, reduce costs, develop new products and markets etc, but where there are particular issues in Wales (or more likely UK), that could impede or help that competitiveness, these may need intervention by governments.

Along with the rest of the steel sector, Tata Steel has expressed a number of key asks of UK Government in the context of a possible future ‘sector deal’ under the UK’s Industrial Strategy). We believe these are crucial to ensuring a competitive steel industry which can contribute to jobs, process and product innovation and economic and act as a catalyst for decarbonisation across the Welsh economy. The key asks are summarised below:

Actions need to be taken to remove / reduce the significant electricity price differentials faced by UK industry compared to its competitors (in EU and beyond).

A more appropriate regime in respect to Business Rates so that it provides less of a disincentive to investment in productivity boosting capital investment is needed.

An R&D collaboration fund should be established, with match funding by government, to help in the long term investment in research, development and innovation. This has the potential to impact on process efficiency, productivity, product development, all of which will help in ensuring a viable sustainable business; critical developments in new steelmaking methods and CCS, which remains a critical option for the most significant CO2 savings and CCU. Noting that in respect to CCS this will most likely require shipping to a suitable offshore location e.g. potentially the Hamilton fields off the cost of North Wales which could be a first UK cluster.

Public Procurement policies should promote and support UK supply chains.

In addition to the key sectoral asks, a variety of infrastructural developments are also likely to be required. For example, electricity grid infrastructure investment will be needed in key areas in order for there to be any substantial increase in the proportion of EAF to BF/BOS route steelmaking (albeit it should be recognised that BF/BOS route steelmaking remains a substantial outlet for scrap recycling). In addition, a clearer understanding is needed of the required/available capacity of electricity demand in the longer term (2030+) if the intention is to achieve a step-change in electric vehicle use in future (especially if also coupled to greater uptake of EAF steelmaking).

If low carbon/renewable heat sources are to contribute a significant proportion of the targeted carbon emission reductions, there is a significant amount of work required over the next decade or two to enable efficient extraction, storage and distribution. This will include source mapping, development of current and new technologies and potentially significant infrastructure aligned to relevant “clusters” of producers and consumers.

Question 5: What are the respective roles of UK Government, Welsh Government, the wider public sector, business, third sector and individual or household behaviour in delivering emissions reductions between now and 2030? And, separately, between 2030 and 2050?

In respect of the UK Government (and Welsh Government) and UK Steel Sector, as well as some of the wider business sector (supply chain impacts), the roles and responsibilities are probably most comprehensively covered within the ongoing discussions in respect to the potential Sector Deal (see answer to Question 4) and how that fits in with the Industrial Strategy.

Question 6: As a business, as a Public Sector Body, or as a citizen, how do emissions targets affect your planning and decision-making?

Tata Steel operates in an extremely competitive global (commodity) marketplace and therefore has had a significant focus on all areas that contribute to its cost base or can improve profit margins including energy and material efficiency. This has ensured that significant reductions in energy use and improvements in energy efficiency have taken place over many decades, as it has generally made good business sense to do this. These improvements were instigated and continued over periods pre-dating the setting of carbon targets.

However, as an energy intensive manufacturing operator with its main installations covered by the EU ETS, that regime has had a more immediate impact on planning and decision-making than have the carbon targets and budgets set within the UK Climate Change Act or Wales Environment Act. The EU ETS, through its decreasing cap over time has been the method chosen to achieve the European Traded Sector’s contribution to emissions reduction. The impacts of EU ETS in regards to forward positions on potential free allocation levels and the cost of shortfalls have been factored into the company strategy, including asset configuration and capital investment planning.

That said, and with the potential fall-outs from Brexit, the 2050 targets set within UK Climate Change Act (and latterly Wales) clearly indicate the long-term vision and hence the political environment that Tata Steel will be operating in over the long term if it intends to continue as a sustainable business. Therefore it is currently honing its long-term strategy for delivering a sustainable business (this includes areas such as Climate Change and Circular Economy, the latter being intrinsically linked to former).

The effect of public policy on the foundation industries such as the steel industry has the potential to be profoundly positive, if Governments embrace Circular Economy and low carbon concepts in planning, procurement and product legislation. Steel products will be vital in helping society to become more sustainable because of their intrinsic durability, flexibility, re-usability and, at the end of their lives, recyclability. We strongly believe that Governments should seek to incentivise the uptake of sustainable materials and the establishment of a Circular Economy through the full suite of policy instruments at their disposal.

Question 7: In your area(s) of expertise, what specific circumstances need to be considered when setting targets and budgets for Wales and how could these be reflected in the targets?

We understand and recognise the premise that early reduction of absolute emissions (e.g. by 2030) will mean lower cumulative emissions between now and 2050 and therefore a reduced impact on the climate. However, it is fundamentally clear that the steel sector is close to the thermodynamic limits of conventional primary BF/BOS route steelmaking. As such, substantial reductions in direct emissions require the development and implementation of new steelmaking technologies. In conjunction with this, there is an expectation that there will be a move towards an increased use of scrap (for example, through an uptake of EAF) and/or implementation of new low carbon steelmaking technologies over the long term. This does also assume the availability of sufficient low carbon/renewable electricity, and possible CCS and/or CCU. Care is needed to understand the extent to which these technologies could be deployed, whether they will be accepted by the public and how the deployment and increased costs will be funded. Without the deployment of new technologies and low-carbon energy, a commitment to any particular stretching targets would be optimistic in the extreme.

In the short term the industry continues to commit substantial efforts to optimise energy consumption, material yield and other process efficiencies wherever it is cost effective to do so. Whilst such efforts are

hugely important, they will provide only relatively small percentage improvements in emissions (though outside of the integrated steelmaking installations, these reductions may be considered significant in absolute terms).

We have already set out our assertion that Welsh emission reductions cannot be achieved through de-industrialisation; this would be counter-productive in global emissions terms and would carry a substantial cost for the Welsh economy and its ability to innovate and be a catalyst for global action. One way for policy makers to ensure that genuine emissions reductions are being achieved is to use consumption-based reporting, using life-cycle assessment methods to understand not only the direct emissions from the Welsh economy and society but also the indirect emissions from the production of imported goods.

Linked to consumption based reporting is the need to avoid setting simplistic targets expressed as emissions per tonne of basic production volume. In some cases, there is a life cycle benefit from investing more energy and emissions in the production stage of a product's life in order to secure an improvement in its 'in use' or 'end-of life' performance.' A classic illustration of this is the extra energy expended to produce advanced high strength steels (AHSS) leading to light-weighting e.g. in the automotive sector, which help provide reduced transport emissions and hence lower global emissions. Similarly, the carbon benefits accrued by the use of high efficiency electrical steels e.g. in transformers and motors, outweighs many times the additional impacts incurred during the manufacture of such steels. The contribution through the manufacture of premium steel products to large net savings in carbon emissions over the full life cycle of steel products should be recognised, not penalised

Another key consideration in target setting linked to product characteristics is understanding the technical limitations of various production processes for manufacturing products of the correct specification, It needs to be understood, for example, that EAF-produced steels are currently unsuitable for use in a number of applications, not least a variety of key sectors for flat steel products such as automotive. In this case, the limitations are due to high nitrogen levels and some residual elements that lead to strain ageing and low ductility issues in the final flat products and prevent EAF route supply. Therefore R&D into process improvements that may allow the EAF route to be able to supply this important sector is required and will take substantial time. This is a key factor that needs to be considered in determining the extent of any future transition to a greater uptake of the EAF route (or other new steelmaking techniques such as HISARNA) between 2030-2050.

As can be seen from the examples above, Tata Steel and the wider steel sector need "breathing space" for a broad and complex range of measures to come to fruition. We need this to be considered in setting the interim targets and carbon budgets to take into account the unavoidable back-loaded pathway for substantial emission reductions.

Unlike the move to increased electric vehicle ownership and use, the Technology Readiness Level (TRL) of potential future lower carbon steelmaking methods is low and remains unproven. Whilst Tata Steel remains hopeful in regards to a new technology HISARNA (installed at the Netherlands site) it remains at pilot plant level. The latest trial will seek to test the stability of operations over more than a month and therefore remains a very long way from being proven and then developed at a commercial scale and rolled out across the EU/World.

The TRL of such potential improvements needs to be taken into account when the options for achieving carbon emission reductions at a particular cost and by a particular time from all sectors/sub-sectors are assessed.

When considering the range of possible improvements to energy efficiency and emission reduction, care is needed to take into account that they are often either mutually exclusive (so one option being implemented would mean another wouldn't be) or they interact to a greater or lesser extent , so the overall reduction in CO2 cannot be taken to be the sum of each individual option.

For a number of improvement options there may also be a level of interdependence, for example on an integrated steelmaking site (conventional BF/BOS route) which are very complex with several inter-linked processes, These installations produce process waste gases (BFG, COG, BOSG) from the cokemaking, ironmaking and steelmaking operations. Ideally the production of these gases (inherent and unavoidable) should slightly exceed demand, resulting in a small safety flare. However, due to site configuration, or limitations (such as age and efficiency of power generation) supply may be significantly greater than supply. Therefore installing projects that improve efficiency of combustion that just save waste gases would have no real benefit as this would just lead to increased flaring of the waste gases. Installation of sufficient additional combustion capacity (eg power generation) would possibly be required first/alongside. Such additional capacity can often be, as is usually the case in the steel sector, a significant capital expenditure.

Due to the highly capital intensive nature of our industry, there can be some critical issues relating to timing and choices made, particularly those that are being considered now in the short term. It may be that measures that appear to be essential or obvious options in the short term, are not aligned with a "possible future option" (although that option is unproven and may not come to fruition). Companies in capital intensive sectors such as steel that are already substantially constrained in terms of access to finance cannot afford to spend 'regret capital' implementing technologies that shortly after are shown not to be compatible with the optimal decarbonisation roadmap.

Whilst it has been made clear that the emissions targets are focussed on Wales emissions, it is important that due diligence be taken and reflected in any impact assessment of the level of imported carbon emissions when considering setting the carbon targets and budgets. It would not be sensible or

appropriate if net (imported and direct) emissions were increasing/static whilst direct emissions were reducing. This would likely be a road to de-industrialisation rather than de-carbonisation.
We also believe – as described above - that taking a full life-cycle approach to the actual global impact is the correct way to go, so that the overall correct decisions are made.
A good example can be found in an independent study of Toyota Venza carried out by the University of California at Davis (https://www.worldsteel.org/steel-by-topic/life-cycle-thinking/case-studies/WorldAutoSteel---Automotive--Life-cycle-thinking-leads-to-intelligent-automotive-material-choices.html)
A full life cycle approach should also be adopted when calculating the carbon emissions associated with steelmaking, in particular in accounting for the use of steel scrap in BOS and EAF steelmaking. Steel scrap is a valuable resource (i.e. is not 'free' economically, nor environmentally) and its recycling into new steel should properly account for the carbon 'embodied' in the scrap.

Question 8: The power and industry sectors in Wales are dominated by a small number of large emitters. What are the key challenges and opportunities that this presents in setting the levels of carbon budgets and how should the process of setting them reflect these?

A key structural challenge is that a small number of large emitters are owned by a small number of companies. As such, a potentially significant burden (and capital expenditure) is likely to fall on one or two industrial/power companies. In respect to the industrial installation/operator then unlike the power company it cannot pass on the CO2 costs to its customers.
In respect to the integrated steelmaking site, the various options considered in the last UK carbon budget report, in respect to energy efficiency and emission reductions were being considered across the whole of the UK. This meant that it was feasible to have considered , potential savings from more than one option contributing to the abatement target , whereas on a single site in Wales, they may be mutually exclusive or lead to significant interaction and lower net savings.
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In respect of the UK Government (and Welsh Government) and UK Steel Sector, as well as some of the wider business sector (supply chain impacts), the roles and responsibilities are probably most comprehensively covered within the ongoing discussions in respect to the potential Sector Deal (see answer to Question 4) and how that fits in with the Industrial Strategy.

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Tata Steel operates in an extremely competitive global (commodity) marketplace and therefore has had a significant focus on all areas that contribute

to its cost base or can improve profit margins including energy and material efficiency. This has ensured that significant reductions in energy use and improvements in energy efficiency have taken place over many decades, as it has generally made good business sense to do this. These improvements were instigated and continued over periods pre-dating the setting of carbon targets.

However, as an energy intensive manufacturing operator with its main installations covered by the EU ETS, that regime has had a more immediate impact on planning and decision-making than have the carbon targets and budgets set within the UK Climate Change Act or Wales Environment Act. The EU ETS, through its decreasing cap over time has been the method chosen to achieve the European Traded Sector's contribution to emissions reduction. The impacts of EU ETS in regards to forward positions on potential free allocation levels and the cost of shortfalls have been factored into the company strategy, including asset configuration and capital investment planning.

That said, and with the potential fall-outs from Brexit, the 2050 targets set within UK Climate Change Act (and latterly Wales) clearly indicate the long-term vision and hence the political environment that Tata Steel will be operating in over the long term if it intends to continue as a sustainable business. Therefore it is currently honing its long-term strategy for delivering a sustainable business (this includes areas such as Climate Change and Circular Economy, the latter being intrinsically linked to former).

The effect of public policy on the foundation industries such as the steel industry has the potential to be profoundly positive, if Governments embrace Circular Economy and low carbon concepts in planning, procurement and product legislation. Steel products will be vital in helping society to become more sustainable because of their intrinsic durability, flexibility, re-usability and, at the end of

their lives, recyclability. We strongly believe that Governments should seek to incentivise the uptake of sustainable materials and the establishment of a Circular Economy through the full suite of policy instruments at their disposal.

Question 7: In your area(s) of expertise, what specific circumstances need to be considered when setting targets and budgets for Wales and how could these be reflected in the targets?

We understand and recognise the premise that early reduction of absolute emissions (e.g. by 2030) will mean lower cumulative emissions between now and 2050 and therefore a reduced impact on the climate. However, it is fundamentally clear that the steel sector is close to the thermodynamic limits of conventional primary BF/BOS route steelmaking. As such, substantial reductions in direct emissions require the development and implementation of new steelmaking technologies. In conjunction with this, there is an expectation that there will be a move towards an increased use of scrap (for example, through an uptake of EAF) and/or implementation of new low carbon steelmaking technologies over the long term. This does also assume the availability of sufficient low carbon/renewable electricity, and possible CCS and/or CCU.
Care is needed to understand the extent to which these technologies could be deployed, whether they will be accepted by the public and how the deployment and increased costs will be funded. Without the deployment of new technologies and low-carbon energy, a commitment to any particular stretching targets would be optimistic in the extreme.
In the short term the industry continues to commit substantial efforts to optimise energy consumption, material yield and other process efficiencies wherever it is cost effective to do so. Whilst such efforts are hugely important, they will provide only relatively small

percentage improvements in emissions (though outside of the integrated steelmaking installations, these reductions may be considered significant in absolute terms).

We have already set out our assertion that Welsh emission reductions cannot be achieved through de-industrialisation; this would be counter-productive in global emissions terms and would carry a substantial cost for the Welsh economy and its ability to innovate and be a catalyst for global action. One way for policy makers to ensure that genuine emissions reductions are being achieved is to use consumption-based reporting, using life-cycle assessment methods to understand not only the direct emissions from the Welsh economy and society but also the indirect emissions from the production of imported goods.

Linked to consumption based reporting is the need to avoid setting simplistic targets expressed as emissions per tonne of basic production volume. In some cases, there is a life cycle benefit from investing more energy and emissions in the production stage of a product's life in order to secure an improvement in its 'in use' or 'end-of life' performance.' A classic illustration of this is the extra energy expended to produce advanced high strength steels (AHSS) leading to light-weighting e.g. in the automotive sector, which help provide reduced transport emissions and hence lower global emissions. Similarly, the carbon benefits accrued by the use of high efficiency electrical steels e.g. in transformers and motors, outweighs many times the additional impacts incurred during the manufacture of such steels. The contribution through the manufacture of premium steel products to large net savings in carbon emissions over the full life cycle of steel products should be recognised, not penalised

Another key consideration in target setting linked to product characteristics is understanding the technical limitations of various production processes for manufacturing products of the

correct specification, It needs to be understood, for example, that EAF-produced steels are currently unsuitable for use in a number of applications, not least a variety of key sectors for flat steel products such as automotive. In this case, the limitations are due to high nitrogen levels and some residual elements that lead to strain ageing and low ductility issues in the final flat products and prevent EAF route supply. Therefore R&D into process improvements that may allow the EAF route to be able to supply this important sector is required and will take substantial time. This is a key factor that needs to be considered in determining the extent of any future transition to a greater uptake of the EAF route (or other new steelmaking techniques such as HISARNA) between 2030-2050.

As can be seen from the examples above, Tata Steel and the wider steel sector need "breathing space" for a broad and complex range of measures to come to fruition. We need this to be considered in setting the interim targets and carbon budgets to take into account the unavoidable back-loaded pathway for substantial emission reductions.

Unlike the move to increased electric vehicle ownership and use, the Technology Readiness Level (TRL) of potential future lower carbon steelmaking methods is low and remains unproven. Whilst Tata Steel remains hopeful in regards to a new technology HISARNA (installed at the Netherlands site) it remains at pilot plant level. The latest trial will seek to test the stability of operations over more than a month and therefore remains a very long way from being proven and then developed at a commercial scale and rolled out across the EU/World.

The TRL of such potential improvements needs to be taken into account when the options for achieving carbon emission reductions at a particular cost and by a particular time from all sectors/sub-sectors are assessed.

When considering the range of possible improvements to energy

efficiency and emission reduction, care is needed to take into account that they are often either mutually exclusive (so one option being implemented would mean another wouldn't be) or they interact to a greater or lesser extent , so the overall reduction in CO2 cannot be taken to be the sum of each individual option.
For a number of improvement options there may also be a level of interdependence, for example on an integrated steelmaking site (conventional BF/BOS route) which are very complex with several inter-linked processes, These installations produce process waste gases (BFG, COG, BOSG) from the cokemaking, ironmaking and steelmaking operations. Ideally the production of these gases (inherent and unavoidable) should slightly exceed demand, resulting in a small safety flare. However, due to site configuration, or limitations (such as age and efficiency of power generation) supply may be significantly greater than supply. Therefore installing projects that improve efficiency of combustion that just save waste gases would have no real benefit as this would just lead to increased flaring of the waste gases. Installation of sufficient additional combustion capacity (eg power generation) would possibly be required first/alongside. Such additional capacity can often be, as is usually the case in the steel sector, a significant capital expenditure.
Due to the highly capital intensive nature of our industry, there can be some critical issues relating to timing and choices made, particularly those that are being considered now in the short term. It may be that measures that appear to be essential or obvious options in the short term, are not aligned with a "possible future option" (although that option is unproven and may not come to fruition). Companies in capital intensive sectors such as steel that are already substantially constrained in terms of access to finance cannot afford to spend 'regret capital' implementing technologies that shortly after are shown not to be compatible

with the optimal decarbonisation roadmap.
Whilst it has been made clear that the emissions targets are focussed on Wales emissions, it is important that due diligence be taken and reflected in any impact assessment of the level of imported carbon emissions when considering setting the carbon targets and budgets. It would not be sensible or appropriate if net (imported and direct) emissions were increasing/static whilst direct emissions were reducing. This would likely be a road to de-industrialisation rather than de-carbonisation.
We also believe – as described above - that taking a full life-cycle approach to the actual global impact is the correct way to go, so that the overall correct decisions are made.
A good example can be found in an independent study of Toyota Venza carried out by the University of California at Davis (https://www.worldsteel.org/steel-by-topic/life-cycle-thinking/case-studies/WorldAutoSteel---Automotive--Life-cycle-thinking-leads-to-intelligent-automotive-material-choices.html)
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Question 8: The power and industry sectors in Wales are dominated by a small number of large emitters. What are the key challenges and opportunities that this presents in setting the levels of carbon budgets and how should the process of setting them reflect these?

A key structural challenge is that a small number of large emitters are owned by a small number of companies. As such, a potentially significant burden (and capital expenditure) is likely to fall on one or two industrial/power companies. In respect to the industrial installation/operator then unlike

the power company it cannot pass on the CO2 costs to its customers.
In respect to the integrated steelmaking site, the various options considered in the last UK carbon budget report, in respect to energy efficiency and emission reductions were being considered across the whole of the UK. This meant that it was feasible to have considered , potential savings from more than one option contributing to the abatement target , whereas on a single site in Wales, they may be mutually exclusive or lead to significant interaction and lower net savings.
The integrated steelmaking installation, also does rely on a number of unproven “new technologies” on the pathway to 2050 and therefore will necessarily be biased towards longer term significant reductions in carbon emissions (and later interim targets and budgets), which will need to be duly considered.
In respect to Aberthaw power station and the UK policy of phasing out coal power, the uncertainty in the emission pathway and particular year of final closure appears to present a challenge. The Welsh Government does have the opportunity to review budgets and targets where there has been a significant change, to avoid any concerns over “hot air”.
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Question 9: 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?

The Committee should ensure that it takes a balanced view (and aligning with the Future Generations Act) and ensure that it considers the positive impacts and interactions (actual and potential) not just conflicts and negative impacts.
In this response we have sought to illustrate not only the benefits we bring to the Welsh economy in terms of job creation and economic development, but also the profoundly beneficial role that our products can make to achieving a more resource-efficient and circular economy throughout Wales and beyond. Only with the short term breathing space and support we need to consolidate our competitiveness, can we continue to be a positive hub of innovation in sustainable products and processes.
In addition to the economic benefits that we provide, Tata Steel also seeks to be a good neighbour and a positive contributor to the local community. We are, for example, a key partner in the management of the Eglwys Nunydd reservoir which is a recognised excellent fishing area and supports a sailing club, in addition to the wildfowl that designated it as a SSI site. Over the years Tata steel has supported other local habitats e.g. sponsoring the fen orchid and given over part of its land around the landfill site to support a local species of bee. There may be further opportunities for active management of “urban green spaces” helping with improvements to bio-diversity, tree planting etc by industrial organisations. This could be supported through some form of benefit or credit in respect to environmental permit subsistence charges

Question 10: 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?

The Future Trends report is an interesting document, and it

stimulates discussions across a wide range of areas which is a good thing. However, due to the inherent limitation in “future forecast” accuracy, the Committee will need to take care on the “weighting” it gives to the “evidence” in its assessment.

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Question 1: Does the Paris Agreement mean that Welsh emissions targets should keep open a deeper reduction in emissions than 80% by 2050? Are there implications for nearer-term targets?

We think it is fair to recognise the Paris Agreement as a landmark outcome, albeit possibly unexpected. This remains the case despite the US decision to later state its intention to withdraw. However, whilst Paris establishes a set of “binding procedural commitments,” achievement of the NDCs themselves is not legally binding (nor any new financial commitments) and this needs to be borne in mind when considering how the Wales (and UK) emission targets for 2050 and carbon budgets should be framed to reflect the Agreement. The 2050 target in Wales already allows for a greater than 80% reduction as the wording is “at least 80%”. That said, the 5 -yearly cycle of pledges and reviews under the Paris Agreement should provide some clarity on how much real progress is likely/actually happening. The first Global Stocktake is set for 2023 and every 5 years thereafter (although there is an interim review due in 2018 ahead of 2020 when the Agreement is in effect). Care is needed in how/when the timings of these reviews might be taken into account and potentially acted upon, bearing in mind Wales is about to set its 2016-2020 and 2021-2025 budgets. This is particularly important when considering the generally long investment cycles in the industrial sector, and the steel sector in particular.

Question 2: Do you think that leaving the EU has an impact on the targets or how they can be met?

As already mentioned in the introduction, following the move from use of “net” emissions as per the UK target, to using actual Wales direct emissions, Brexit should not affect emissions accounting.
Clearly and in particular because of the high proportion of energy intensive and industrial emissions in the Traded Sector, the UK and Wales will need to seriously consider impacts on policy areas. For example, if the UK were not allowed to or chose not to participate in EU ETS (or an identical/very similar traded and possibly linked scheme). In addition to the price signal the EU ETS also delivers auctioning revenues. However whilst we note the CPS is claimed to have been successful in contributing to low carbon generation, the distortion in UK power prices has made the UK a difficult place to operate as an energy intensive industry. The welcome introduction, eventually, of a compensation scheme has helped reduce that impact, but it does not cover the full costs faced by energy intensives and this compensation mechanism is in any case on a declining maximum allowable level under state aid rules.
In many cases it seems likely that relevant EU policy measures will be preserved or replicated by UK law. The CCC briefing paper (Oct 2016) also mentions the likely need to strengthen UK law where it’s felt that EU law is insufficient. We would ask that due recognition be given to the potential impact such measures could have on energy intensive industry competitiveness in general and the steel sector in particular due to its difficulty in transitioning to a low carbon approach in the short and medium term due to the need for a step change in innovative steelmaking technologies.
One other key area that remains a significant concern is the future level of EU collaboration and innovation funding (e.g. EU ETS, Horizon 2020) which in a sector that is looking to the development of new and innovative, unproven technologies for decarbonising is vitally important.

Question 3: In the area(s) of your expertise, what are the opportunities and challenges in reducing Welsh emissions in the nearer term (e.g. to 2030)?

The challenges in reducing Welsh emissions are significantly affected by the high level of industrial emissions as a proportion of total emissions (34%) compared to the situation in the wider UK (22%). Taking that in conjunction with the fact that a large proportion of industrial emissions are attributable to only a small number of large emitters from these sectors (see Q8) brings potentially further difficulties. The variability in the short and medium term carbon abatement potential (with current technology) of some

parts of the industrial sector could be said to exacerbate the difficulties.
The Welsh Government also does not have devolved competence in all areas relevant to climate change emissions reductions (e.g. energy, aviation and marine transport, building regulations).
Perhaps one of the most difficult challenges, is in the area of effective communication of the key messages and the need for quite significant changes in behaviours of the general public as consumers of goods and services and how that impacts on achievement of the carbon targets and budgets.
Opportunities for reduction of Welsh emissions in the nearer term (up to 2030) include establishing appropriate funding mechanisms that would support the implementation of energy efficiency measures (current/conventional technology) where the pay-back periods are currently outside of those that are economically viable for energy intensive industries.
Promoting and strengthening collaborations between academia and industry will be useful (for example, building on the current example of FLEXIS).
Although, a small proportion of Welsh total emissions, progressing emissions reductions within the Public Sector will be important, not least in that it will help demonstrate leadership by the Welsh Government. The potential for land-use as a positive benefit for climate change in a country that has the unique geography of Wales is also likely to be important.
Further emission reductions within sectors that have a less difficult low carbon pathway i.e. the power sector, through increased use of renewables, and the expansion of the potential for demand side response (DSR). It should be noted that industry and the steel sector in particular can contribute positively here

Question 4: What is required by 2030 to prepare for the 2050 target for an emissions reduction of at least 80% on 1990 levels, recognising that this may require that emissions in some areas are reduced close to zero? Is there any impact of the need to go beyond 80%, either in 2050 or subsequently?

Our hope is that the achievement of at least 80% reduction in emissions from 1990, is delivered through the development of lower carbon operations in a sustainable industrial landscape which includes a thriving steel sector, and not through de-industrialisation.

Therefore ensuring that the steel sector in Wales has the opportunity to operate competitively over the short to medium term is critical. This should then enable the research and development of innovative new low/lower carbon steelmaking technologies and carbon capture storage and use (CCSU) needed to deliver the significant emission reductions by 2050.

The steel sector is under no illusions that it has to compete in a global market and therefore has to continue to innovate, reduce costs, develop new products and markets etc, but where there are particular issues in Wales (or more likely UK), that could impede or help that competitiveness, these may need intervention by governments.

Along with the rest of the steel sector, Tata Steel has expressed a number of key asks of UK Government in the context of a possible future ‘sector deal’ under the UK’s Industrial Strategy). We believe these are crucial to ensuring a competitive steel industry which can contribute to jobs, process and product innovation and economic and act as a catalyst for decarbonisation across the Welsh economy. The key asks are summarised below:

Actions need to be taken to remove / reduce the significant electricity price differentials faced by UK industry compared to its competitors (in EU and beyond).

A more appropriate regime in respect to Business Rates so that it provides less of a disincentive to investment in productivity boosting capital investment is needed.

An R&D collaboration fund should be established, with match funding by government, to help in the long term investment in research, development and innovation. This has the potential to impact on process efficiency, productivity, product development, all of which will help in ensuring a viable sustainable business; critical developments in new steelmaking methods and CCS, which remains a critical option for the most significant CO2 savings and CCU. Noting that in respect to CCS this will most likely require shipping to a suitable offshore location e.g. potentially the Hamilton fields off the cost of North Wales which could be a first UK cluster.

Public Procurement policies should promote and support UK supply chains.

In addition to the key sectoral asks, a variety of infrastructural developments are also likely to be required. For example, electricity grid infrastructure investment will be needed in key areas in order for there to be any substantial increase in the proportion of EAF to BF/BOS route steelmaking (albeit it should be recognised that BF/BOS route steelmaking remains a substantial outlet for scrap recycling). In addition, a clearer understanding is needed of the required/available capacity of electricity demand in the longer term (2030+) if the intention is to achieve a step-change in electric vehicle use in future (especially if also coupled to greater uptake of EAF steelmaking).

If low carbon/renewable heat sources are to contribute a significant proportion of the targeted carbon emission reductions, there is a significant amount of work required over the next decade or two to enable efficient extraction, storage and distribution. This will include source mapping, development of current and new technologies and potentially significant infrastructure aligned to relevant “clusters” of producers and consumers.

Question 5: What are the respective roles of UK Government, Welsh Government, the wider public sector, business, third sector and individual or household behaviour in delivering emissions reductions between now and 2030? And, separately, between 2030 and 2050?

In respect of the UK Government (and Welsh Government) and UK Steel Sector, as well as some of the wider business sector (supply chain impacts), the roles and responsibilities are probably most comprehensively covered within the ongoing discussions in respect to the potential Sector Deal (see answer to Question 4) and how that fits in with the Industrial Strategy.

Question 6: As a business, as a Public Sector Body, or as a citizen, how do emissions targets affect your planning and decision-making?

Tata Steel operates in an extremely competitive global (commodity) marketplace and therefore has had a significant focus on all areas that contribute to its cost base or can improve profit margins including energy and material efficiency. This has ensured that significant reductions in energy use and improvements in energy efficiency have taken place over many decades, as it has generally made good business sense to do this. These improvements were instigated and continued over periods pre-dating the setting of carbon targets.

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19. For Wales to achieve its climate goals, agricultural practices will have to change dramatically. Isolated islands of good practice and innovation are simply not enough to achieve the changes required. Wales has an opportunity to show leadership by reorienting its farming and food system dramatically in order to mitigate and adapt to the realities of climate change.

Contact phone number

01633 474731

Question 1: Does the Paris Agreement mean that Welsh emissions targets should keep open a deeper reduction in emissions than 80% by 2050? Are there implications for nearer-term targets?

We think it is fair to recognise the Paris Agreement as a landmark outcome, albeit possibly unexpected. This remains the case despite the US decision to later state its intention to withdraw. However, whilst Paris establishes a set of "binding procedural commitments," achievement of the NDCs themselves is not legally binding (nor any new financial commitments) and this needs to be borne in mind when considering how the Wales (and UK) emission targets for 2050 and carbon budgets should be framed to reflect the Agreement. The 2050 target in Wales already allows for a greater than 80% reduction as the wording is "at least 80%".
That said, the 5 -yearly cycle of pledges and reviews under the Paris Agreement should provide some clarity on how much real progress is likely/actually happening. The first Global Stocktake is set for 2023 and every 5 years thereafter (although there is an interim review due in 2018 ahead of 2020 when the Agreement is in effect). Care is needed in how/when the timings of these reviews might be taken into account and potentially acted upon, bearing in mind Wales is about to set its 2016-2020 and 2021-2025 budgets. This is particularly important when considering the generally long investment cycles in the industrial sector, and the steel sector in particular.

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should not affect emissions accounting.
Clearly and in particular because of the high proportion of energy intensive and industrial emissions in the Traded Sector, the UK and Wales will need to seriously consider impacts on policy areas. For example, if the UK were not allowed to or chose not to participate in EU ETS (or an identical/very similar traded and possibly linked scheme). In addition to the price signal the EU ETS also delivers auctioning revenues. However whilst we note the CPS is claimed to have been successful in contributing to low carbon generation, the distortion in UK power prices has made the UK a difficult place to operate as an energy intensive industry. The welcome introduction, eventually, of a compensation scheme has helped reduce that impact, but it does not cover the full costs faced by energy intensives and this compensation mechanism is in any case on a declining maximum allowable level under state aid rules.
In many cases it seems likely that relevant EU policy measures will be preserved or replicated by UK law. The CCC briefing paper (Oct 2016) also mentions the likely need to strengthen UK law where it's felt that EU law is insufficient. We would ask that due recognition be given to the potential impact such measures could have on energy intensive industry competitiveness in general and the steel sector in particular due to its difficulty in transitioning to a low carbon approach in the short and medium term due to the need for a step change in innovative steelmaking technologies.
One other key area that remains a significant concern is the future level of EU collaboration and innovation funding (e.g. EU ETS, Horizon 2020) which in a sector that is looking to the development of new and innovative, unproven technologies for decarbonising is vitally important.

Question 3: In the area(s) of your expertise, what are the opportunities and challenges in reducing Welsh emissions in the nearer term (e.g. to 2030)?

The challenges in reducing Welsh emissions are significantly affected by the high level of industrial emissions as a proportion of total emissions (34%) compared to the situation in the wider UK (22%). Taking that in conjunction with the fact that a large proportion of industrial emissions are attributable to only a small number of large emitters from these sectors (see Q8) brings potentially further difficulties. The variability in the short and medium term carbon abatement potential (with current technology) of some parts of the industrial sector could be said to exacerbate the difficulties.
The Welsh Government also does not have devolved competence in all areas relevant to climate change emissions reductions (e.g. energy, aviation and marine transport, building regulations).
Perhaps one of the most difficult challenges, is in the area of effective communication of the key messages and the need for quite significant changes in behaviours of the general public as consumers of goods and services and how that impacts on achievement of the carbon targets and budgets.
Opportunities for reduction of Welsh emissions in the nearer term (up to 2030) include establishing appropriate funding mechanisms that would support the implementation of energy efficiency measures (current/conventional technology) where the pay-back periods are currently outside of those that are economically viable for energy intensive industries.
Promoting and strengthening collaborations between academia and industry will be useful (for example, building on the current example of FLEXIS).
Although, a small proportion of Welsh total emissions, progressing emissions reductions within the Public Sector will be important, not least in that it will help demonstrate leadership by the Welsh Government. The potential for land-use as a positive benefit for climate change in a country that has the unique geography of Wales is

also likely to be important. Further emission reductions within sectors that have a less difficult low carbon pathway i.e. the power sector, through increased use of renewables, and the expansion of the potential for demand side response (DSR). It should be noted that industry and the steel sector in particular can contribute positively here

Question 4: What is required by 2030 to prepare for the 2050 target for an emissions reduction of at least 80% on 1990 levels, recognising that this may require that emissions in some areas are reduced close to zero? Is there any impact of the need to go beyond 80%, either in 2050 or subsequently?

Our hope is that the achievement of at least 80% reduction in emissions from 1990, is delivered through the development of lower carbon operations in a sustainable industrial landscape which includes a thriving steel sector, and not through de-industrialisation.

Therefore ensuring that the steel sector in Wales has the opportunity to operate competitively over the short to medium term is critical. This should then enable the research and development of innovative new low/lower carbon steelmaking technologies and carbon capture storage and use (CCSU) needed to deliver the significant emission reductions by 2050.

The steel sector is under no illusions that it has to compete in a global market and therefore has to continue to innovate, reduce costs, develop new products and markets etc, but where there are particular issues in Wales (or more likely UK), that could impede or help that competitiveness, these may need intervention by governments.

Along with the rest of the steel sector, Tata Steel has expressed a number of key asks of UK Government in the context of a possible future ‘sector deal’ under the UK’s Industrial

Strategy). We believe these are crucial to ensuring a competitive steel industry which can contribute to jobs, process and product innovation and economic and act as a catalyst for decarbonisation across the Welsh economy. The key asks are summarised below:

Actions need to be taken to remove / reduce the significant electricity price differentials faced by UK industry compared to its competitors (in EU and beyond).

A more appropriate regime in respect to Business Rates so that it provides less of a disincentive to investment in productivity boosting capital investment is needed.

An R&D collaboration fund should be established, with match funding by government, to help in the long term investment in research, development and innovation. This has the potential to impact on process efficiency, productivity, product development, all of which will help in ensuring a viable sustainable business; critical developments in new steelmaking methods and CCS, which remains a critical option for the most significant CO2 savings and CCU. Noting that in respect to CCS this will most likely require shipping to a suitable offshore location e.g. potentially the Hamilton fields off the cost of North Wales which could be a first UK cluster.

Public Procurement policies should promote and support UK supply chains.

In addition to the key sectoral asks, a variety of infrastructural developments are also likely to be required. For example, electricity grid infrastructure investment will be needed in key areas in order for there to be any substantial increase in the proportion of EAF to BF/BOS route steelmaking (albeit it should be recognised that BF/BOS route steelmaking remains a substantial outlet for scrap recycling). In addition, a clearer understanding is needed of the required/available capacity

of electricity demand in the longer term (2030+) if the intention is to achieve a step-change in electric vehicle use in future (especially if also coupled to greater uptake of EAF steelmaking).

If low carbon/renewable heat sources are to contribute a significant proportion of the targeted carbon emission reductions, there is a significant amount of work required over the next decade or two to enable efficient extraction, storage and distribution. This will include source mapping, development of current and new technologies and potentially significant infrastructure aligned to relevant “clusters” of producers and consumers.

Question 5: What are the respective roles of UK Government, Welsh Government, the wider public sector, business, third sector and individual or household behaviour in delivering emissions reductions between now and 2030? And, separately, between 2030 and 2050?

In respect of the UK Government (and Welsh Government) and UK Steel Sector, as well as some of the wider business sector (supply chain impacts), the roles and responsibilities are probably most comprehensively covered within the ongoing discussions in respect to the potential Sector Deal (see answer to Question 4) and how that fits in with the Industrial Strategy.

Question 6: As a business, as a Public Sector Body, or as a citizen, how do emissions targets affect your planning and decision-making?

Tata Steel operates in an extremely competitive global (commodity) marketplace and therefore has had a significant focus on all areas that contribute to its cost base or can improve profit margins including energy and material efficiency. This has ensured that significant reductions in energy use and improvements in energy efficiency have taken place over many decades, as it has

generally made good business sense to do this. These improvements were instigated and continued over periods pre-dating the setting of carbon targets.

However, as an energy intensive manufacturing operator with its main installations covered by the EU ETS, that regime has had a more immediate impact on planning and decision-making than have the carbon targets and budgets set within the UK Climate Change Act or Wales Environment Act. The EU ETS, through its decreasing cap over time has been the method chosen to achieve the European Traded Sector's contribution to emissions reduction. The impacts of EU ETS in regards to forward positions on potential free allocation levels and the cost of shortfalls have been factored into the company strategy, including asset configuration and capital investment planning.

That said, and with the potential fall-outs from Brexit, the 2050 targets set within UK Climate Change Act (and latterly Wales) clearly indicate the long-term vision and hence the political environment that Tata Steel will be operating in over the long term if it intends to continue as a sustainable business. Therefore it is currently honing its long-term strategy for delivering a sustainable business (this includes areas such as Climate Change and Circular Economy, the latter being intrinsically linked to former).

The effect of public policy on the foundation industries such as the steel industry has the potential to be profoundly positive, if Governments embrace Circular Economy and low carbon concepts in planning, procurement and product legislation. Steel products will be vital in helping society to become more sustainable because of their intrinsic durability, flexibility, re-usability and, at the end of their lives, recyclability. We strongly believe that Governments should seek to incentivise the uptake of sustainable materials and the establishment of a Circular Economy through the full suite of

policy instruments at their disposal.

Question 7: In your area(s) of expertise, what specific circumstances need to be considered when setting targets and budgets for Wales and how could these be reflected in the targets?

We understand and recognise the premise that early reduction of absolute emissions (e.g. by 2030) will mean lower cumulative emissions between now and 2050 and therefore a reduced impact on the climate. However, it is fundamentally clear that the steel sector is close to the thermodynamic limits of conventional primary BF/BOS route steelmaking. As such, substantial reductions in direct emissions require the development and implementation of new steelmaking technologies. In conjunction with this, there is an expectation that there will be a move towards an increased use of scrap (for example, through an uptake of EAF) and/or implementation of new low carbon steelmaking technologies over the long term. This does also assume the availability of sufficient low carbon/renewable electricity, and possible CCS and/or CCU.
Care is needed to understand the extent to which these technologies could be deployed, whether they will be accepted by the public and how the deployment and increased costs will be funded. Without the deployment of new technologies and low-carbon energy, a commitment to any particular stretching targets would be optimistic in the extreme.
In the short term the industry continues to commit substantial efforts to optimise energy consumption, material yield and other process efficiencies wherever it is cost effective to do so. Whilst such efforts are hugely important, they will provide only relatively small percentage improvements in emissions (though outside of the integrated steelmaking installations, these reductions may be considered significant in absolute terms).
We have already set out our

assertion that Welsh emission reductions cannot be achieved through de-industrialisation; this would be counter-productive in global emissions terms and would carry a substantial cost for the Welsh economy and its ability to innovate and be a catalyst for global action. One way for policy makers to ensure that genuine emissions reductions are being achieved is to use consumption-based reporting, using life-cycle assessment methods to understand not only the direct emissions from the Welsh economy and society but also the indirect emissions from the production of imported goods. Linked to consumption based reporting is the need to avoid setting simplistic targets expressed as emissions per tonne of basic production volume. In some cases, there is a life cycle benefit from investing more energy and emissions in the production stage of a product's life in order to secure an improvement in its 'in use' or 'end-of life' performance.' A classic illustration of this is the extra energy expended to produce advanced high strength steels (AHSS) leading to light-weighting e.g. in the automotive sector, which help provide reduced transport emissions and hence lower global emissions. Similarly, the carbon benefits accrued by the use of high efficiency electrical steels e.g. in transformers and motors, outweighs many times the additional impacts incurred during the manufacture of such steels. The contribution through the manufacture of premium steel products to large net savings in carbon emissions over the full life cycle of steel products should be recognised, not penalised

Another key consideration in target setting linked to product characteristics is understanding the technical limitations of various production processes for manufacturing products of the correct specification, It needs to be understood, for example, that EAF-produced steels are currently unsuitable for use in a number of applications, not least a variety of key sectors for flat steel products such as

automotive. In this case, the limitations are due to high nitrogen levels and some residual elements that lead to strain ageing and low ductility issues in the final flat products and prevent EAF route supply. Therefore R&D into process improvements that may allow the EAF route to be able to supply this important sector is required and will take substantial time. This is a key factor that needs to be considered in determining the extent of any future transition to a greater uptake of the EAF route (or other new steelmaking techniques such as HISARNA) between 2030-2050.

As can be seen from the examples above, Tata Steel and the wider steel sector need "breathing space" for a broad and complex range of measures to come to fruition. We need this to be considered in setting the interim targets and carbon budgets to take into account the unavoidable back-loaded pathway for substantial emission reductions.

Unlike the move to increased electric vehicle ownership and use, the Technology Readiness Level (TRL) of potential future lower carbon steelmaking methods is low and remains unproven. Whilst Tata Steel remains hopeful in regards to a new technology HISARNA (installed at the Netherlands site) it remains at pilot plant level. The latest trial will seek to test the stability of operations over more than a month and therefore remains a very long way from being proven and then developed at a commercial scale and rolled out across the EU/World.

The TRL of such potential improvements needs to be taken into account when the options for achieving carbon emission reductions at a particular cost and by a particular time from all sectors/sub-sectors are assessed.

When considering the range of possible improvements to energy efficiency and emission reduction, care is needed to take into account that they are often either mutually exclusive (so one option being implemented would mean another wouldn't be) or they interact to a greater or

lesser extent , so the overall reduction in CO2 cannot be taken to be the sum of each individual option.
For a number of improvement options there may also be a level of interdependence, for example on an integrated steelmaking site (conventional BF/BOS route) which are very complex with several inter-linked processes, These installations produce process waste gases (BFG, COG, BOSG) from the cokemaking, ironmaking and steelmaking operations. Ideally the production of these gases (inherent and unavoidable) should slightly exceed demand, resulting in a small safety flare. However, due to site configuration, or limitations (such as age and efficiency of power generation) supply may be significantly greater than supply. Therefore installing projects that improve efficiency of combustion that just save waste gases would have no real benefit as this would just lead to increased flaring of the waste gases. Installation of sufficient additional combustion capacity (eg power generation) would possibly be required first/alongside. Such additional capacity can often be, as is usually the case in the steel sector, a significant capital expenditure.
Due to the highly capital intensive nature of our industry, there can be some critical issues relating to timing and choices made, particularly those that are being considered now in the short term. It may be that measures that appear to be essential or obvious options in the short term, are not aligned with a “possible future option” (although that option is unproven and may not come to fruition). Companies in capital intensive sectors such as steel that are already substantially constrained in terms of access to finance cannot afford to spend ‘regret capital’ implementing technologies that shortly after are shown not to be compatible with the optimal decarbonisation roadmap.
Whilst it has been made clear that the emissions targets are focussed on Wales emissions, it is important that due diligence be taken and reflected in any impact

assessment of the level of imported carbon emissions when considering setting the carbon targets and budgets. It would not be sensible or appropriate if net (imported and direct) emissions were increasing/static whilst direct emissions were reducing. This would likely be a road to de-industrialisation rather than de-carbonisation.
We also believe – as described above - that taking a full life-cycle approach to the actual global impact is the correct way to go, so that the overall correct decisions are made.
A good example can be found in an independent study of Toyota Venza carried out by the University of California at Davis (https://www.worldsteel.org/steel-by-topic/life-cycle-thinking/case-studies/WorldAutoSteel---Automotive--Life-cycle-thinking-leads-to-intelligent-automotive-material-choices.html)
A full life cycle approach should also be adopted when calculating the carbon emissions associated with steelmaking, in particular in accounting for the use of steel scrap in BOS and EAF steelmaking. Steel scrap is a valuable resource (i.e. is not 'free' economically, nor environmentally) and its recycling into new steel should properly account for the carbon 'embodied' in the scrap.

Question 8: The power and industry sectors in Wales are dominated by a small number of large emitters. What are the key challenges and opportunities that this presents in setting the levels of carbon budgets and how should the process of setting them reflect these?

A key structural challenge is that a small number of large emitters are owned by a small number of companies. As such, a potentially significant burden (and capital expenditure) is likely to fall on one or two industrial/power companies. In respect to the industrial installation/operator then unlike the power company it cannot pass on the CO2 costs to its customers.
In respect to the integrated steelmaking site, the various options considered in the last UK carbon budget report, in respect

to energy efficiency and emission reductions were being considered across the whole of the UK. This meant that it was feasible to have considered , potential savings from more than one option contributing to the abatement target , whereas on a single site in Wales, they may be mutually exclusive or lead to significant interaction and lower net savings.
The integrated steelmaking installation, also does rely on a number of unproven “new technologies” on the pathway to 2050 and therefore will necessarily be biased towards longer term significant reductions in carbon emissions (and later interim targets and budgets), which will need to be duly considered.
In respect to Aberthaw power station and the UK policy of phasing out coal power, the uncertainty in the emission pathway and particular year of final closure appears to present a challenge. The Welsh Government does have the opportunity to review budgets and targets where there has been a significant change, to avoid any concerns over “hot air”.
Having a small number of large emitters does also provide a few opportunities. An example for this could be the Tata Steel Port Talbot installation which produces CO2, CO and H2, , has availability of land suitable for renewables including offshore wind and waste heat. Therefore it provides a suitable site to undertake demonstration projects in regards to the development of technologies in respect to carbon dioxide streams , waste heat and renewable energy.*
* “The potential and limitations of using carbon dioxide” –Policy Briefing, The Royal Society, May 2017, ISBN:978-1-78252-267-6

Question 9: 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?

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However, as an energy intensive manufacturing operator with its main installations covered by the EU ETS, that regime has had a more immediate impact on planning and decision-making than have the carbon targets and budgets set within the UK Climate Change Act or Wales Environment Act. The EU ETS, through its decreasing cap over time has been the method chosen to achieve the European Traded Sector's contribution to emissions reduction. The impacts of EU ETS in regards to forward positions on potential free allocation levels and the cost of shortfalls have been factored into the company strategy, including asset configuration and capital investment planning.

That said, and with the potential fall-outs from Brexit, the 2050 targets set within UK Climate Change Act (and latterly Wales) clearly indicate the long-term vision and hence the political environment that Tata Steel will be operating in over the long term if it intends to continue as a sustainable business. Therefore it is currently honing its long-term strategy for delivering a sustainable business (this includes areas such as Climate Change and Circular Economy, the latter being intrinsically linked to former).

The effect of public policy on the foundation industries such as the steel industry has the potential to be profoundly positive, if Governments embrace Circular Economy and low carbon concepts in planning, procurement and product legislation. Steel products will be vital in helping society to become more sustainable because of their intrinsic durability, flexibility, re-usability and, at the end of their lives, recyclability. We strongly believe that Governments should seek to incentivise the uptake of sustainable materials and the establishment of a Circular Economy through the full suite of policy instruments at their disposal.

Question 7: In your area(s) of expertise, what specific circumstances need to be considered when setting targets and budgets for Wales and how could these be reflected in the targets?

We understand and recognise the premise that early reduction of absolute emissions (e.g. by 2030) will mean lower cumulative emissions between now and 2050 and therefore a reduced impact on the climate. However, it is fundamentally clear that the steel sector is close to the thermodynamic limits of conventional primary BF/BOS route steelmaking. As such, substantial reductions in direct emissions require the development and implementation of new steelmaking technologies. In conjunction with this, there is an expectation that there will be a move towards an increased use of scrap (for example, through an uptake of EAF) and/or implementation of new low carbon steelmaking technologies over the long term. This does also assume the availability of sufficient low carbon/renewable electricity, and possible CCS and/or CCU. Care is needed to understand the extent to which these technologies could be deployed, whether they will be accepted by the public and how the deployment and increased costs will be funded. Without the deployment of new technologies and low-carbon energy, a commitment to any particular stretching targets would be optimistic in the extreme.

In the short term the industry continues to commit substantial efforts to optimise energy consumption, material yield and other process efficiencies wherever it is cost effective to do so. Whilst such efforts are hugely important, they will provide only relatively small percentage improvements in emissions (though outside of the integrated steelmaking installations, these reductions may be considered significant in absolute terms).

We have already set out our assertion that Welsh emission reductions cannot be achieved through de-industrialisation; this would be counter-productive in global emissions terms and would carry a substantial cost for the Welsh economy and its ability to innovate and be a catalyst for global action. One way for policy makers to ensure that genuine emissions reductions are being achieved is to use consumption-based reporting, using life-cycle assessment methods to understand not only the direct emissions from the Welsh economy and society but also the indirect emissions from the production of imported goods.

Linked to consumption based reporting is the need to avoid setting simplistic targets expressed as emissions per tonne of basic production volume. In some cases, there is a life cycle benefit from investing more energy and emissions in the production stage of a product's life in order to secure an improvement in its 'in use' or 'end-of life' performance.' A classic illustration of this is the extra energy expended to produce advanced high strength steels (AHSS) leading to light-weighting e.g. in the automotive sector, which help

provide reduced transport emissions and hence lower global emissions. Similarly, the carbon benefits accrued by the use of high efficiency electrical steels e.g. in transformers and motors, outweighs many times the additional impacts incurred during the manufacture of such steels. The contribution through the manufacture of premium steel products to large net savings in carbon emissions over the full life cycle of steel products should be recognised, not penalised

Another key consideration in target setting linked to product characteristics is understanding the technical limitations of various production processes for manufacturing products of the correct specification, It needs to be understood, for example, that EAF-produced steels are currently unsuitable for use in a number of applications, not least a variety of key sectors for flat steel products such as automotive. In this case, the limitations are due to high nitrogen levels and some residual elements that lead to strain ageing and low ductility issues in the final flat products and prevent EAF route supply. Therefore R&D into process improvements that may allow the EAF route to be able to supply this important sector is required and will take substantial time. This is a key factor that needs to be considered in determining the extent of any future transition to a greater uptake of the EAF route (or other new steelmaking techniques such as HISARNA) between 2030-2050.

As can be seen from the examples above, Tata Steel and the wider steel sector need “breathing space” for a broad and complex range of measures to come to fruition. We need this to be considered in setting the interim targets and carbon budgets to take into account the unavoidable back-loaded pathway for substantial emission reductions.

Unlike the move to increased electric vehicle ownership and use, the Technology Readiness Level (TRL) of potential future lower carbon steelmaking methods is low and remains unproven. Whilst Tata Steel remains hopeful in regards to a new technology HISARNA (installed at the Netherlands site) it remains at pilot plant level. The latest trial will seek to test the stability of operations over more than a month and therefore remains a very long way from being proven and then developed at a commercial scale and rolled out across the EU/World.

The TRL of such potential improvements needs to be taken into account when the options for achieving carbon emission reductions at a particular cost and by a particular time from all sectors/sub-sectors are assessed.

When considering the range of possible improvements to energy efficiency and emission reduction, care is needed to take into account that they are often either mutually exclusive (so one option being implemented would mean another wouldn’t be) or they interact to a greater or lesser extent , so the overall reduction in CO2 cannot be taken to be the sum of each individual option.

For a number of improvement options there may also be a level of interdependence, for example on an integrated steelmaking site (conventional BF/BOS route) which are very complex with several inter-linked processes, These installations produce process waste gases (BFG, COG, BOSG) from the cokemaking, ironmaking and steelmaking operations. Ideally the production of these gases (inherent and unavoidable) should slightly exceed demand, resulting in a small safety flare. However, due to site configuration, or limitations (such as age and efficiency of power generation) supply may be significantly greater than supply. Therefore installing projects that improve efficiency of combustion that just save waste gases would have no real benefit as this would just lead to increased flaring of the waste gases. Installation of sufficient additional combustion capacity (eg power generation) would possibly be required first/alongside. Such additional capacity can often be, as is usually the case in the steel sector, a significant capital expenditure.

Due to the highly capital intensive nature of our industry, there can be some critical issues relating to timing and choices made, particularly those that are being considered now in the short term. It may be that measures that appear to be essential or obvious options in the short term, are not aligned with a “possible future option” (although that option is unproven and may not come to fruition). Companies in capital intensive sectors such as steel that are already substantially constrained in terms of access to finance cannot afford to spend ‘regret capital’ implementing technologies that shortly after are shown not to be compatible with the optimal decarbonisation roadmap.

Whilst it has been made clear that the emissions targets are focussed on Wales emissions, it is important that due diligence be taken and reflected in any impact assessment of the level of imported carbon emissions when considering setting the carbon targets and budgets. It would not be sensible or appropriate if net (imported and direct) emissions were increasing/static whilst direct emissions were reducing. This would likely be a road to de-industrialisation rather than de-carbonisation.

We also believe – as described above - that taking a full life-cycle approach to the actual global impact is the correct way to go, so that the overall correct decisions are made.

A good example can be found in an independent study of Toyota Venza carried out by the University of California at Davis (https://www.worldsteel.org/steel-by-topic/life-cycle-thinking/case-studies/WorldAutoSteel---Automotive--Life-cycle-thinking-leads-to-intelligent-automotive-material-choices.html)

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Question 8: The power and industry sectors in Wales are dominated by a small number of large emitters. What are the key challenges and opportunities that this presents in setting the levels of carbon budgets and how should the process of setting them reflect these?

A key structural challenge is that a small number of large emitters are owned by a small number of companies. As such, a potentially significant burden (and capital expenditure) is likely to fall on one or two industrial/power companies. In respect to the industrial installation/operator then unlike the power company it cannot pass on the CO2 costs to its customers.
In respect to the integrated steelmaking site, the various options considered in the last UK carbon budget report, in respect to energy efficiency and emission reductions were being considered across the whole of the UK. This meant that it was feasible to have considered , potential savings from more than one option contributing to the abatement target , whereas on a single site in Wales, they may be mutually exclusive or lead to significant interaction and lower net savings.
The integrated steelmaking installation, also does rely on a number of unproven “new technologies” on the pathway to 2050 and therefore will necessarily be biased towards longer term significant reductions in carbon emissions (and later interim targets and budgets), which will need to be duly considered.
In respect to Aberthaw power station and the UK policy of phasing out coal power, the uncertainty in the emission pathway and particular year of final closure appears to present a challenge. The Welsh Government does have the opportunity to review budgets and targets where there has been a significant change, to avoid any concerns over “hot air”.
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Question 9: 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?

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In addition to the economic benefits that we provide, Tata Steel also seeks to be a good neighbour and a positive contributor to the local community. We are, for example, a key partner in the management of the Eglwys Nunydd reservoir which is a recognised excellent fishing area and supports a sailing club, in addition to the wildfowl that designated it as a SSI site. Over the years Tata steel has supported other local habitats e.g. sponsoring the fen orchid and given over part of its land around the landfill site to support a local species of bee.
There may be further opportunities for active management of “urban green spaces” helping with improvements to bio-diversity, tree planting etc by industrial organisations. This could be supported through some form of benefit or credit in respect to environmental permit subsistence charges

Question 10: 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?

The Future Trends report is an interesting document, and it stimulates discussions across a wide range of areas which is a good thing. However, due to the inherent limitation in “future forecast” accuracy, the Committee will need to take care on the “weighting” it gives to the “evidence” in its assessment.

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20. No response

Question 1: Does the Paris Agreement mean that Welsh emissions targets should keep open a deeper reduction in emissions than 80% by 2050? Are there implications for nearer-term targets?

We think it is fair to recognise the Paris Agreement as a landmark outcome, albeit possibly unexpected. This remains the case despite the US decision to later state its intention to withdraw. However, whilst Paris establishes a set of "binding procedural commitments," achievement of the NDCs themselves is not legally binding (nor any new financial commitments) and this needs to be borne in mind when considering how the Wales (and UK) emission targets for 2050 and carbon budgets should be framed to reflect the Agreement. The 2050 target in Wales already allows for a greater than 80% reduction as the wording is "at least 80%".
That said, the 5 -yearly cycle of pledges and reviews under the Paris Agreement should provide some clarity on how much real progress is likely/actually happening. The first Global Stocktake is set for 2023 and every 5 years thereafter (although there is an interim review due in 2018 ahead of 2020 when the Agreement is in effect). Care is needed in how/when the timings of these reviews might be taken into account and potentially acted upon, bearing in mind Wales is about to set its 2016-2020 and 2021-2025 budgets. This is particularly important when considering the generally long investment cycles in the industrial sector, and the steel sector in particular.

Question 2: Do you think that leaving the EU has an impact on the targets or how they can be met?

As already mentioned in the introduction, following the move from use of "net" emissions as per the UK target, to using actual Wales direct emissions, Brexit should not affect emissions accounting.
Clearly and in particular because of the high proportion of energy

intensive and industrial emissions in the Traded Sector, the UK and Wales will need to seriously consider impacts on policy areas. For example, if the UK were not allowed to or chose not to participate in EU ETS (or an identical/very similar traded and possibly linked scheme). In addition to the price signal the EU ETS also delivers auctioning revenues. However whilst we note the CPS is claimed to have been successful in contributing to low carbon generation, the distortion in UK power prices has made the UK a difficult place to operate as an energy intensive industry. The welcome introduction, eventually, of a compensation scheme has helped reduce that impact, but it does not cover the full costs faced by energy intensives and this compensation mechanism is in any case on a declining maximum allowable level under state aid rules.
In many cases it seems likely that relevant EU policy measures will be preserved or replicated by UK law. The CCC briefing paper (Oct 2016) also mentions the likely need to strengthen UK law where it's felt that EU law is insufficient. We would ask that due recognition be given to the potential impact such measures could have on energy intensive industry competitiveness in general and the steel sector in particular due to its difficulty in transitioning to a low carbon approach in the short and medium term due to the need for a step change in innovative steelmaking technologies.
One other key area that remains a significant concern is the future level of EU collaboration and innovation funding (e.g. EU ETS, Horizon 2020) which in a sector that is looking to the development of new and innovative, unproven technologies for decarbonising is vitally important.

Question 3: In the area(s) of your expertise, what are the opportunities and challenges in reducing Welsh emissions in the nearer term (e.g. to 2030)?

The challenges in reducing Welsh emissions are significantly affected by the high level of industrial emissions as a

proportion of total emissions (34%) compared to the situation in the wider UK (22%). Taking that in conjunction with the fact that a large proportion of industrial emissions are attributable to only a small number of large emitters from these sectors (see Q8) brings potentially further difficulties. The variability in the short and medium term carbon abatement potential (with current technology) of some parts of the industrial sector could be said to exacerbate the difficulties.
The Welsh Government also does not have devolved competence in all areas relevant to climate change emissions reductions (e.g. energy, aviation and marine transport, building regulations).
Perhaps one of the most difficult challenges, is in the area of effective communication of the key messages and the need for quite significant changes in behaviours of the general public as consumers of goods and services and how that impacts on achievement of the carbon targets and budgets.
Opportunities for reduction of Welsh emissions in the nearer term (up to 2030) include establishing appropriate funding mechanisms that would support the implementation of energy efficiency measures (current/conventional technology) where the pay-back periods are currently outside of those that are economically viable for energy intensive industries.
Promoting and strengthening collaborations between academia and industry will be useful (for example, building on the current example of FLEXIS).
Although, a small proportion of Welsh total emissions, progressing emissions reductions within the Public Sector will be important, not least in that it will help demonstrate leadership by the Welsh Government. The potential for land-use as a positive benefit for climate change in a country that has the unique geography of Wales is also likely to be important.
Further emission reductions within sectors that have a less difficult low carbon pathway i.e.

the power sector, through increased use of renewables, and the expansion of the potential for demand side response (DSR). It should be noted that industry and the steel sector in particular can contribute positively here

Question 4: What is required by 2030 to prepare for the 2050 target for an emissions reduction of at least 80% on 1990 levels, recognising that this may require that emissions in some areas are reduced close to zero? Is there any impact of the need to go beyond 80%, either in 2050 or subsequently?

Our hope is that the achievement of at least 80% reduction in emissions from 1990, is delivered through the development of lower carbon operations in a sustainable industrial landscape which includes a thriving steel sector, and not through de-industrialisation.

Therefore ensuring that the steel sector in Wales has the opportunity to operate competitively over the short to medium term is critical. This should then enable the research and development of innovative new low/lower carbon steelmaking technologies and carbon capture storage and use (CCSU) needed to deliver the significant emission reductions by 2050.

The steel sector is under no illusions that it has to compete in a global market and therefore has to continue to innovate, reduce costs, develop new products and markets etc, but where there are particular issues in Wales (or more likely UK), that could impede or help that competitiveness, these may need intervention by governments.

Along with the rest of the steel sector, Tata Steel has expressed a number of key asks of UK Government in the context of a possible future ‘sector deal’ under the UK’s Industrial Strategy). We believe these are crucial to ensuring a competitive steel industry which can contribute to jobs, process and

product innovation and economic and act as a catalyst for decarbonisation across the Welsh economy. The key asks are summarised below:

Actions need to be taken to remove / reduce the significant electricity price differentials faced by UK industry compared to its competitors (in EU and beyond).

A more appropriate regime in respect to Business Rates so that it provides less of a disincentive to investment in productivity boosting capital investment is needed.

An R&D collaboration fund should be established, with match funding by government, to help in the long term investment in research, development and innovation. This has the potential to impact on process efficiency, productivity, product development, all of which will help in ensuring a viable sustainable business; critical developments in new steelmaking methods and CCS, which remains a critical option for the most significant CO2 savings and CCU. Noting that in respect to CCS this will most likely require shipping to a suitable offshore location e.g. potentially the Hamilton fields off the cost of North Wales which could be a first UK cluster.

Public Procurement policies should promote and support UK supply chains.

In addition to the key sectoral asks, a variety of infrastructural developments are also likely to be required. For example, electricity grid infrastructure investment will be needed in key areas in order for there to be any substantial increase in the proportion of EAF to BF/BOS route steelmaking (albeit it should be recognised that BF/BOS route steelmaking remains a substantial outlet for scrap recycling). In addition, a clearer understanding is needed of the required/available capacity of electricity demand in the longer term (2030+) if the intention is to achieve a step-change in electric vehicle use in

future (especially if also coupled to greater uptake of EAF steelmaking).

If low carbon/renewable heat sources are to contribute a significant proportion of the targeted carbon emission reductions, there is a significant amount of work required over the next decade or two to enable efficient extraction, storage and distribution. This will include source mapping, development of current and new technologies and potentially significant infrastructure aligned to relevant “clusters” of producers and consumers.

Question 5: What are the respective roles of UK Government, Welsh Government, the wider public sector, business, third sector and individual or household behaviour in delivering emissions reductions between now and 2030? And, separately, between 2030 and 2050?

In respect of the UK Government (and Welsh Government) and UK Steel Sector, as well as some of the wider business sector (supply chain impacts), the roles and responsibilities are probably most comprehensively covered within the ongoing discussions in respect to the potential Sector Deal (see answer to Question 4) and how that fits in with the Industrial Strategy.

Question 6: As a business, as a Public Sector Body, or as a citizen, how do emissions targets affect your planning and decision-making?

Tata Steel operates in an extremely competitive global (commodity) marketplace and therefore has had a significant focus on all areas that contribute to its cost base or can improve profit margins including energy and material efficiency. This has ensured that significant reductions in energy use and improvements in energy efficiency have taken place over many decades, as it has generally made good business sense to do this. These improvements were instigated and continued over periods pre-

dating the setting of carbon targets.
However, as an energy intensive manufacturing operator with its main installations covered by the EU ETS, that regime has had a more immediate impact on planning and decision-making than have the carbon targets and budgets set within the UK Climate Change Act or Wales Environment Act. The EU ETS, through its decreasing cap over time has been the method chosen to achieve the European Traded Sector's contribution to emissions reduction. The impacts of EU ETS in regards to forward positions on potential free allocation levels and the cost of shortfalls have been factored into the company strategy, including asset configuration and capital investment planning.
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Question 1: Does the Paris Agreement mean that Welsh emissions targets should keep open a deeper reduction in emissions than 80% by 2050? Are there implications for nearer-term targets?

We think it is fair to recognise the Paris Agreement as a landmark outcome, albeit possibly unexpected. This remains the case despite the US decision to later state its intention to withdraw. However, whilst Paris establishes a set of “binding procedural commitments,” achievement of the NDCs themselves is not legally binding (nor any new financial commitments) and this needs to be borne in mind when considering how the Wales (and UK) emission targets for 2050 and carbon budgets should be framed to reflect the Agreement. The 2050 target in Wales already allows for a greater than 80% reduction as the wording is “at least 80%”. That said, the 5 -yearly cycle of pledges and reviews under the Paris Agreement should provide some clarity on how much real progress is likely/actually happening. The first Global Stocktake is set for 2023 and every 5 years thereafter (although there is an interim review due in 2018 ahead of 2020 when the Agreement is in effect). Care is needed in how/when the timings of these reviews might be taken into account and potentially acted upon, bearing in mind Wales is about to set its 2016-2020 and 2021-2025 budgets. This is particularly important when considering the generally long investment cycles in the industrial sector, and the steel sector in particular.

Question 2: Do you think that leaving the EU has an impact on the targets or how they can be met?

As already mentioned in the introduction, following the move from use of “net” emissions as per the UK target, to using actual Wales direct emissions, Brexit should not affect emissions accounting.
Clearly and in particular because of the high proportion of energy intensive and industrial emissions in the Traded Sector, the UK and Wales will need to seriously consider impacts on policy areas. For example, if the UK were not allowed to or chose not to participate in EU ETS (or an identical/very similar traded and possibly linked scheme). In addition to the price signal the EU ETS also delivers auctioning revenues. However whilst we note the CPS is claimed to have been successful in contributing to low carbon generation, the distortion in UK power prices has made the UK a difficult place to operate as an energy intensive industry. The welcome introduction, eventually, of a compensation scheme has helped reduce that impact, but it does not cover the full costs faced by energy intensives and this compensation mechanism is in any case on a declining maximum allowable level under state aid rules.
In many cases it seems likely that relevant EU policy measures will be preserved or replicated by UK law. The CCC briefing paper (Oct 2016) also mentions the likely need to strengthen UK law where it’s felt that EU law is insufficient. We would ask that due recognition be given to the potential impact such measures could have on energy intensive industry competitiveness in general and the steel sector in particular due to its difficulty in transitioning to a low carbon approach in the short and medium term due to the need for a step change in innovative steelmaking technologies.
One other key area that remains a significant concern is the future level of EU collaboration and innovation funding (e.g. EU ETS, Horizon 2020) which in a sector that is looking to the development of new and innovative, unproven technologies for decarbonising is vitally important.

Question 3: In the area(s) of your expertise, what are the opportunities and challenges in reducing Welsh emissions in the nearer term (e.g. to 2030)?

The challenges in reducing Welsh emissions are significantly affected by the high level of industrial emissions as a proportion of total emissions (34%) compared to the situation in the wider UK (22%). Taking that in conjunction with the fact that a large proportion of industrial emissions are attributable to only a small number of large emitters from these sectors (see Q8) brings potentially further difficulties. The variability in the short and medium term carbon abatement potential (with current technology) of some parts of the industrial sector could be said to exacerbate the difficulties.
The Welsh Government also does not have devolved competence in all areas relevant to climate change emissions reductions (e.g. energy, aviation and marine transport, building regulations).
Perhaps one of the most difficult challenges, is in the area of effective communication of the key messages and the need for quite significant changes in behaviours of the general public as consumers of goods and services and how that impacts on achievement of the carbon targets and budgets.
Opportunities for reduction of Welsh emissions in the nearer term (up to 2030) include establishing appropriate funding mechanisms that would support the implementation of energy efficiency measures (current/conventional technology) where the pay-back periods are currently outside of those that are economically viable for energy intensive industries.
Promoting and strengthening collaborations between academia and industry will be useful (for example, building on the current example of FLEXIS).
Although, a small proportion of Welsh total emissions, progressing emissions reductions within the Public

Sector will be important, not least in that it will help demonstrate leadership by the Welsh Government. The potential for land-use as a positive benefit for climate change in a country that has the unique geography of Wales is also likely to be important.
Further emission reductions within sectors that have a less difficult low carbon pathway i.e. the power sector, through increased use of renewables, and the expansion of the potential for demand side response (DSR). It should be noted that industry and the steel sector in particular can contribute positively here

Question 4: What is required by 2030 to prepare for the 2050 target for an emissions reduction of at least 80% on 1990 levels, recognising that this may require that emissions in some areas are reduced close to zero? Is there any impact of the need to go beyond 80%, either in 2050 or subsequently?

Our hope is that the achievement of at least 80% reduction in emissions from 1990, is delivered through the development of lower carbon operations in a sustainable industrial landscape which includes a thriving steel sector, and not through de-industrialisation.

Therefore ensuring that the steel sector in Wales has the opportunity to operate competitively over the short to medium term is critical. This should then enable the research and development of innovative new low/lower carbon steelmaking technologies and carbon capture storage and use (CCSU) needed to deliver the significant emission reductions by 2050.

The steel sector is under no illusions that it has to compete in a global market and therefore has to continue to innovate, reduce costs, develop new products and markets etc, but where there are particular issues in Wales (or more likely UK), that could impede or help that competitiveness, these may need intervention by governments.

Along with the rest of the steel sector, Tata Steel has expressed a number of key asks of UK Government in the context of a possible future 'sector deal' under the UK's Industrial Strategy). We believe these are crucial to ensuring a competitive steel industry which can contribute to jobs, process and product innovation and economic and act as a catalyst for decarbonisation across the Welsh economy. The key asks are summarised below:

Actions need to be taken to remove / reduce the significant electricity price differentials faced by UK industry compared to its competitors (in EU and beyond).

A more appropriate regime in respect to Business Rates so that it provides less of a disincentive to investment in productivity boosting capital investment is needed.

An R&D collaboration fund should be established, with match funding by government, to help in the long term investment in research, development and innovation. This has the potential to impact on process efficiency, productivity, product development, all of which will help in ensuring a viable sustainable business; critical developments in new steelmaking methods and CCS, which remains a critical option for the most significant CO2 savings and CCU. Noting that in respect to CCS this will most likely require shipping to a suitable offshore location e.g. potentially the Hamilton fields off the cost of North Wales which could be a first UK cluster.

Public Procurement policies should promote and support UK supply chains.

In addition to the key sectoral asks, a variety of infrastructural developments are also likely to be required. For example, electricity grid infrastructure investment will be needed in key areas in order for there to be any substantial increase in the proportion of EAF to BF/BOS route steelmaking (albeit it should be recognised that BF/BOS route steelmaking remains a substantial outlet for scrap recycling). In addition, a clearer understanding is needed of the required/available capacity of electricity demand in the longer term (2030+) if the intention is to achieve a step-change in electric vehicle use in future (especially if also coupled to greater uptake of EAF steelmaking).

If low carbon/renewable heat sources are to contribute a significant proportion of the targeted carbon emission reductions, there is a significant amount of work required over the next decade or two to enable efficient extraction, storage and distribution. This will include source mapping, development of current and new technologies and potentially significant infrastructure aligned to relevant "clusters" of producers and consumers.

Question 5: What are the respective roles of UK Government, Welsh Government, the wider public sector, business, third sector and individual or household behaviour in delivering emissions reductions between now and 2030? And, separately, between 2030 and 2050?

In respect of the UK Government (and Welsh Government) and UK Steel Sector, as well as some of the wider business sector (supply chain impacts), the roles and responsibilities are probably most

comprehensively covered within the ongoing discussions in respect to the potential Sector Deal (see answer to Question 4) and how that fits in with the Industrial Strategy.

Question 6: As a business, as a Public Sector Body, or as a citizen, how do emissions targets affect your planning and decision-making?

Tata Steel operates in an extremely competitive global (commodity) marketplace and therefore has had a significant focus on all areas that contribute to its cost base or can improve profit margins including energy and material efficiency. This has ensured that significant reductions in energy use and improvements in energy efficiency have taken place over many decades, as it has generally made good business sense to do this. These improvements were instigated and continued over periods pre-dating the setting of carbon targets.

However, as an energy intensive manufacturing operator with its main installations covered by the EU ETS, that regime has had a more immediate impact on planning and decision-making than have the carbon targets and budgets set within the UK Climate Change Act or Wales Environment Act. The EU ETS, through its decreasing cap over time has been the method chosen to achieve the European Traded Sector's contribution to emissions reduction. The impacts of EU ETS in regards to forward positions on potential free allocation levels and the cost of shortfalls have been factored into the company strategy, including asset configuration and capital investment planning.

That said, and with the potential fall-outs from Brexit, the 2050 targets set within UK Climate Change Act (and latterly Wales) clearly indicate the long-term vision and hence the political environment that Tata Steel will be operating in over the long term if it intends to continue as a sustainable business. Therefore it is currently honing its long-term strategy for delivering a sustainable business (this includes areas such as Climate Change and Circular Economy, the latter being intrinsically linked to former).

The effect of public policy on the foundation industries such as the steel industry has the potential to be profoundly positive, if Governments embrace Circular Economy and low carbon concepts in planning, procurement and product legislation. Steel products will be vital in helping society to become more sustainable because of their intrinsic durability, flexibility, re-usability and, at the end of their lives, recyclability. We strongly believe that Governments should seek to incentivise the uptake of sustainable materials and the establishment of a Circular Economy through the full suite of policy instruments at their disposal.

Question 7: In your area(s) of expertise, what specific circumstances need to be considered when setting targets and budgets for Wales and how could these be reflected in the targets?

We understand and recognise the premise that early reduction of absolute emissions (e.g. by 2030) will mean lower cumulative emissions between now and 2050 and therefore a reduced impact on the climate. However, it is fundamentally clear that the steel sector is close to the thermodynamic limits of conventional primary BF/BOS route steelmaking. As such, substantial reductions in direct emissions require the development and implementation of new steelmaking technologies. In conjunction with this, there is an expectation that there will be a move towards an increased use of scrap (for example, through an uptake of EAF) and/or implementation of new low carbon steelmaking technologies over the long term. This does also assume the availability of sufficient low carbon/renewable electricity, and possible CCS and/or CCU. Care is needed to understand the extent to which these technologies could be deployed, whether they will be accepted by the public and how the deployment and increased costs will be funded. Without the deployment of new technologies and low-carbon energy, a commitment to any particular stretching targets would be optimistic in the extreme.

In the short term the industry continues to commit substantial efforts to optimise energy consumption, material yield and other process efficiencies wherever it is cost effective to do so. Whilst such efforts are hugely important, they will provide only relatively small percentage improvements in emissions (though outside of the integrated steelmaking installations, these reductions may be considered significant in absolute terms).

We have already set out our assertion that Welsh emission reductions cannot be achieved through de-industrialisation; this would be counter-productive in global emissions terms and would carry a substantial cost for the Welsh economy and its ability to innovate and be a catalyst for global action. One way for policy makers to ensure that genuine emissions reductions are being achieved is to use consumption-based reporting, using life-cycle assessment methods to understand not only the direct emissions from the Welsh economy and society but also the indirect emissions from the production of imported goods.

Linked to consumption based reporting is the need to avoid setting simplistic targets expressed as emissions per tonne of basic production volume. In some cases, there is a life cycle benefit from investing more energy and emissions in the production stage of a product's life in order to secure an improvement in its 'in use' or 'end-of life' performance.' A classic illustration of this is the extra energy expended to produce advanced high strength steels (AHSS) leading to light-weighting e.g. in the automotive sector, which help provide reduced transport emissions and hence lower global emissions. Similarly, the carbon benefits accrued by the use of high efficiency electrical steels e.g. in transformers and motors, outweighs many times the additional impacts incurred during the manufacture of such steels. The contribution through the manufacture of premium steel products to large net savings in carbon emissions over the full life cycle of steel products should be recognised, not penalised

Another key consideration in target setting linked to product characteristics is understanding the technical limitations of various production processes for manufacturing products of the correct specification, It needs to be understood, for example, that EAF-produced steels are currently unsuitable for use in a number of applications, not least a variety of key sectors for flat steel products such as automotive. In this case, the limitations are due to high nitrogen levels and some residual elements that lead to strain ageing and low ductility issues in the final flat products and prevent EAF route supply. Therefore R&D into process improvements that may allow the EAF route to be able to supply this important sector is required and will take substantial time. This is a key factor that needs to be considered in determining the extent of any future transition to a greater uptake of the EAF route (or other new steelmaking techniques such as HISARNA) between 2030-2050.

As can be seen from the examples above, Tata Steel and the wider steel sector need “breathing space” for a broad and complex range of measures to come to fruition. We need this to be considered in setting the interim targets and carbon budgets to take into account the unavoidable back-loaded pathway for substantial emission reductions.

Unlike the move to increased electric vehicle ownership and use, the Technology Readiness Level (TRL) of potential future lower carbon steelmaking methods is low and remains unproven. Whilst Tata Steel remains hopeful in regards to a new technology HISARNA (installed at the Netherlands site) it remains at pilot plant level. The latest trial will seek to test the stability of operations over more than a month and therefore remains a very long way from being proven and then developed at a commercial scale and rolled out across the EU/World.

The TRL of such potential improvements needs to be taken into account when the options for achieving carbon emission reductions at a particular cost and by a particular time from all sectors/sub-sectors are assessed.

When considering the range of possible improvements to energy efficiency and emission reduction, care is needed to take into account that they are often either mutually exclusive (so one option being implemented would mean another wouldn’t be) or they interact to a greater or lesser extent , so the overall reduction in CO2 cannot be taken to be the sum of each individual option.

For a number of improvement options there may also be a level of interdependence, for example on an integrated steelmaking site (conventional BF/BOS route) which are very complex with several inter-linked processes, These installations produce process waste gases (BFG, COG, BOSG) from the cokemaking, ironmaking and steelmaking operations. Ideally the production of these gases (inherent and unavoidable) should slightly exceed demand, resulting in a small safety flare. However, due to site configuration, or limitations (such as age and efficiency of power generation) supply may be significantly greater than supply. Therefore installing projects that improve efficiency of combustion that just save waste gases would have no real benefit as this would just lead to increased flaring of the waste gases. Installation of sufficient additional combustion capacity (eg power generation) would possibly be required first/alongside. Such additional capacity can often be, as is usually the case in the steel sector, a significant capital expenditure.

Due to the highly capital intensive nature of our industry, there can be some critical issues relating to timing and choices made, particularly those that are being considered now in the short term. It may be that measures that appear to be essential or obvious options in the short term, are not aligned with a “possible future option” (although that option is unproven and may not come to fruition). Companies in capital intensive sectors such as steel that are already substantially constrained in terms of access to finance cannot afford to spend ‘regret capital’ implementing technologies that shortly after are shown not to be compatible with the optimal decarbonisation roadmap.

Whilst it has been made clear that the emissions targets are focussed on Wales emissions, it is important that due diligence be taken and reflected in any impact assessment of the level of imported carbon emissions when considering setting the carbon targets and budgets. It would not be sensible or appropriate if net (imported and direct) emissions were increasing/static whilst direct emissions were reducing. This would likely be a road to de-industrialisation rather than de-carbonisation.

We also believe – as described above - that taking a full life-cycle approach to the actual global impact is the correct way to go, so that the overall correct decisions are made.

A good example can be found in an independent study of Toyota Venza carried out by the University of California at Davis (https://www.worldsteel.org/steel-by-topic/life-cycle-thinking/case-studies/WorldAutoSteel---Automotive--Life-cycle-thinking-leads-to-intelligent-automotive-material-choices.html)

A full life cycle approach should also be adopted when calculating the carbon emissions associated with steelmaking, in particular in accounting for the use of steel scrap in BOS and EAF steelmaking. Steel scrap is a valuable resource (i.e. is not ‘free’ economically, nor environmentally) and its recycling into new steel should properly account for the carbon ‘embodied’ in the scrap.

Question 8: The power and industry sectors in Wales are dominated by a small number of large emitters. What are the key challenges and opportunities that this presents in setting the levels of carbon budgets and how should the process of setting them reflect these?

A key structural challenge is that a small number of large emitters are owned by a small number of companies. As such, a potentially significant burden (and capital expenditure) is likely to fall on one or two industrial/power companies. In respect to the industrial installation/operator then unlike the power company

it cannot pass on the CO2 costs to its customers.
In respect to the integrated steelmaking site, the various options considered in the last UK carbon budget report, in respect to energy efficiency and emission reductions were being considered across the whole of the UK. This meant that it was feasible to have considered , potential savings from more than one option contributing to the abatement target , whereas on a single site in Wales, they may be mutually exclusive or lead to significant interaction and lower net savings.
The integrated steelmaking installation, also does rely on a number of unproven “new technologies” on the pathway to 2050 and therefore will necessarily be biased towards longer term significant reductions in carbon emissions (and later interim targets and budgets), which will need to be duly considered.
In respect to Aberthaw power station and the UK policy of phasing out coal power, the uncertainty in the emission pathway and particular year of final closure appears to present a challenge. The Welsh Government does have the opportunity to review budgets and targets where there has been a significant change, to avoid any concerns over “hot air”.
Having a small number of large emitters does also provide a few opportunities. An example for this could be the Tata Steel Port Talbot installation which produces CO2, CO and H2, , has availability of land suitable for renewables including offshore wind and waste heat. Therefore it provides a suitable site to undertake demonstration projects in regards to the development of technologies in respect to carbon dioxide streams , waste heat and renewable energy.*
* “The potential and limitations of using carbon dioxide” –Policy Briefing, The Royal Society, May 2017, ISBN:978-1-78252-267-6

Question 9: 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?

The Committee should ensure that it takes a balanced view (and aligning with the Future Generations Act) and ensure that it considers the positive impacts and interactions (actual and potential) not just conflicts and negative impacts.
In this response we have sought to illustrate not only the benefits we bring to the Welsh economy in terms of job creation and economic development, but also the profoundly beneficial role that our products can make to achieving a more resource-efficient and circular economy throughout Wales and beyond. Only with the short term breathing space and support we need to consolidate our competitiveness, can we continue to be a positive hub of innovation in sustainable products and processes.
In addition to the economic benefits that we provide, Tata Steel also seeks to be a good neighbour and a positive contributor to the local community. We are, for example, a key partner in the management of the Eglwys Nunydd reservoir which is a recognised excellent fishing area and supports a sailing club, in addition to the wildfowl that designated it as a SSI site. Over the years Tata steel has supported other local habitats e.g. sponsoring the fen orchid and given over part of its land around the landfill site to support a local species of bee.
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Question 1: Does the Paris Agreement mean that Welsh emissions targets should keep open a deeper reduction in emissions than 80% by 2050? Are there implications for nearer-term targets?

In assessing the impact of climate change and of mitigation efforts, the committee we must continue to rely on science and data. It is essential to base decisions on independently verified and peer-reviewed science that is rigorous and unbiased. One role of civil society to act as a watch-dog and to continue to stress the importance of scientific rigour. Citizen science may also offer a contribution. Farmers can provide vital real-world evidence and key data points to help build out a fuller picture of climate impacts and of the efficacy of measures introduced to cut greenhouse gas emissions. Transparent data which is made public through open source platforms allows for greater public confidence.

We think it is fair to recognise the Paris Agreement as a landmark outcome, albeit possibly unexpected. This remains the case despite the US decision to later state its intention to withdraw. However, whilst Paris establishes a set of "binding procedural commitments," achievement of the NDCs themselves is not legally binding (nor any new financial commitments) and this needs to be borne in mind when considering how the Wales (and UK) emission targets for 2050 and carbon budgets should be framed to reflect the Agreement. The 2050 target in Wales already allows for a greater than 80% reduction as the wording is "at least 80%".
That said, the 5 -yearly cycle of pledges and reviews under the Paris Agreement should provide some clarity on how much real progress is likely/actually happening. The first Global Stocktake is set for 2023 and every 5 years thereafter (although there is an interim review due in 2018 ahead of 2020 when the Agreement is in effect). Care is needed in how/when the timings of these reviews might be taken into account and potentially acted upon, bearing in mind Wales is about to set its 2016-2020 and 2021-2025 budgets. This is particularly important when considering the generally long investment cycles in the industrial sector, and the steel sector in particular.

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Public Procurement policies should promote and support UK supply chains.

In addition to the key sectoral asks, a variety of infrastructural developments are also likely to be required. For example, electricity grid infrastructure investment will be needed in key areas in order for there to be any substantial increase in the proportion of EAF to BF/BOS route steelmaking (albeit it should be recognised that BF/BOS route steelmaking remains a substantial outlet for scrap recycling). In addition, a clearer understanding is needed of the required/available capacity of electricity demand in the longer term (2030+) if the intention is to achieve a step-change in electric vehicle use in future (especially if also coupled to greater uptake of EAF steelmaking).

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amount of work required over the next decade or two to enable efficient extraction, storage and distribution. This will include source mapping, development of current and new technologies and potentially significant infrastructure aligned to relevant “clusters” of producers and consumers.

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In respect of the UK Government (and Welsh Government) and UK Steel Sector, as well as some of the wider business sector (supply chain impacts), the roles and responsibilities are probably most comprehensively covered within the ongoing discussions in respect to the potential Sector Deal (see answer to Question 4) and how that fits in with the Industrial Strategy.

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The effect of public policy on the foundation industries such as the steel industry has the potential to be profoundly positive, if Governments embrace Circular Economy and low carbon concepts in planning, procurement and product legislation. Steel products will be vital in helping society to become more sustainable because of their intrinsic durability, flexibility, re-usability and, at the end of their lives, recyclability. We strongly believe that Governments should seek to incentivise the uptake of sustainable materials and the establishment of a Circular Economy through the full suite of policy instruments at their disposal.

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We understand and recognise the premise that early reduction of absolute emissions (e.g. by 2030) will mean lower

cumulative emissions between now and 2050 and therefore a reduced impact on the climate. However, it is fundamentally clear that the steel sector is close to the thermodynamic limits of conventional primary BF/BOS route steelmaking. As such, substantial reductions in direct emissions require the development and implementation of new steelmaking technologies. In conjunction with this, there is an expectation that there will be a move towards an increased use of scrap (for example, through an uptake of EAF) and/or implementation of new low carbon steelmaking technologies over the long term. This does also assume the availability of sufficient low carbon/renewable electricity, and possible CCS and/or CCU.

Care is needed to understand the extent to which these technologies could be deployed, whether they will be accepted by the public and how the deployment and increased costs will be funded. Without the deployment of new technologies and low-carbon energy, a commitment to any particular stretching targets would be optimistic in the extreme.

In the short term the industry continues to commit substantial efforts to optimise energy consumption, material yield and other process efficiencies wherever it is cost effective to do so. Whilst such efforts are hugely important, they will provide only relatively small percentage improvements in emissions (though outside of the integrated steelmaking installations, these reductions may be considered significant in absolute terms).

We have already set out our assertion that Welsh emission reductions cannot be achieved through de-industrialisation; this would be counter-productive in global emissions terms and would carry a substantial cost for the Welsh economy and its ability to innovate and be a catalyst for global action. One way for policy makers to ensure that genuine emissions reductions are being achieved is to use consumption-based reporting, using life-cycle

assessment methods to understand not only the direct emissions from the Welsh economy and society but also the indirect emissions from the production of imported goods. Linked to consumption based reporting is the need to avoid setting simplistic targets expressed as emissions per tonne of basic production volume. In some cases, there is a life cycle benefit from investing more energy and emissions in the production stage of a product's life in order to secure an improvement in its 'in use' or 'end-of life' performance.' A classic illustration of this is the extra energy expended to produce advanced high strength steels (AHSS) leading to light-weighting e.g. in the automotive sector, which help provide reduced transport emissions and hence lower global emissions. Similarly, the carbon benefits accrued by the use of high efficiency electrical steels e.g. in transformers and motors, outweighs many times the additional impacts incurred during the manufacture of such steels. The contribution through the manufacture of premium steel products to large net savings in carbon emissions over the full life cycle of steel products should be recognised, not penalised

Another key consideration in target setting linked to product characteristics is understanding the technical limitations of various production processes for manufacturing products of the correct specification, It needs to be understood, for example, that EAF-produced steels are currently unsuitable for use in a number of applications, not least a variety of key sectors for flat steel products such as automotive. In this case, the limitations are due to high nitrogen levels and some residual elements that lead to strain ageing and low ductility issues in the final flat products and prevent EAF route supply. Therefore R&D into process improvements that may allow the EAF route to be able to supply this important sector is required and will take substantial time. This is a key factor that needs to be considered in determining the

extent of any future transition to a greater uptake of the EAF route (or other new steelmaking techniques such as HISARNA) between 2030-2050.

As can be seen from the examples above, Tata Steel and the wider steel sector need “breathing space” for a broad and complex range of measures to come to fruition. We need this to be considered in setting the interim targets and carbon budgets to take into account the unavoidable back-loaded pathway for substantial emission reductions.

Unlike the move to increased electric vehicle ownership and use, the Technology Readiness Level (TRL) of potential future lower carbon steelmaking methods is low and remains unproven. Whilst Tata Steel remains hopeful in regards to a new technology HISARNA (installed at the Netherlands site) it remains at pilot plant level. The latest trial will seek to test the stability of operations over more than a month and therefore remains a very long way from being proven and then developed at a commercial scale and rolled out across the EU/World.

The TRL of such potential improvements needs to be taken into account when the options for achieving carbon emission reductions at a particular cost and by a particular time from all sectors/sub-sectors are assessed.

When considering the range of possible improvements to energy efficiency and emission reduction, care is needed to take into account that they are often either mutually exclusive (so one option being implemented would mean another wouldn’t be) or they interact to a greater or lesser extent , so the overall reduction in CO2 cannot be taken to be the sum of each individual option.

For a number of improvement options there may also be a level of interdependence, for example on an integrated steelmaking site (conventional BF/BOS route) which are very complex with several inter-linked processes, These installations produce process waste gases (BFG, COG, BOSG) from the

cokemaking, ironmaking and steelmaking operations. Ideally the production of these gases (inherent and unavoidable) should slightly exceed demand, resulting in a small safety flare. However, due to site configuration, or limitations (such as age and efficiency of power generation) supply may be significantly greater than supply. Therefore installing projects that improve efficiency of combustion that just save waste gases would have no real benefit as this would just lead to increased flaring of the waste gases. Installation of sufficient additional combustion capacity (eg power generation) would possibly be required first/alongside. Such additional capacity can often be, as is usually the case in the steel sector, a significant capital expenditure.

Due to the highly capital intensive nature of our industry, there can be some critical issues relating to timing and choices made, particularly those that are being considered now in the short term. It may be that measures that appear to be essential or obvious options in the short term, are not aligned with a “possible future option” (although that option is unproven and may not come to fruition). Companies in capital intensive sectors such as steel that are already substantially constrained in terms of access to finance cannot afford to spend ‘regret capital’ implementing technologies that shortly after are shown not to be compatible with the optimal decarbonisation roadmap.

Whilst it has been made clear that the emissions targets are focussed on Wales emissions, it is important that due diligence be taken and reflected in any impact assessment of the level of imported carbon emissions when considering setting the carbon targets and budgets. It would not be sensible or appropriate if net (imported and direct) emissions were increasing/static whilst direct emissions were reducing. This would likely be a road to de-industrialisation rather than de-carbonisation.

We also believe – as described above - that taking a full life-cycle approach to the actual

global impact is the correct way to go, so that the overall correct decisions are made.
A good example can be found in an independent study of Toyota Venza carried out by the University of California at Davis (https://www.worldsteel.org/steel-by-topic/life-cycle-thinking/case-studies/WorldAutoSteel---Automotive--Life-cycle-thinking-leads-to-intelligent-automotive-material-choices.html)
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Question 8: The power and industry sectors in Wales are dominated by a small number of large emitters. What are the key challenges and opportunities that this presents in setting the levels of carbon budgets and how should the process of setting them reflect these?

A key structural challenge is that a small number of large emitters are owned by a small number of companies. As such, a potentially significant burden (and capital expenditure) is likely to fall on one or two industrial/power companies. In respect to the industrial installation/operator then unlike the power company it cannot pass on the CO2 costs to its customers.
In respect to the integrated steelmaking site, the various options considered in the last UK carbon budget report, in respect to energy efficiency and emission reductions were being considered across the whole of the UK. This meant that it was feasible to have considered , potential savings from more than one option contributing to the abatement target , whereas on a single site in Wales, they may be mutually exclusive or lead to significant interaction and lower net savings.
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number of unproven “new technologies” on the pathway to 2050 and therefore will necessarily be biased towards longer term significant reductions in carbon emissions (and later interim targets and budgets), which will need to be duly considered.
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throughout Wales and beyond. Only with the short term breathing space and support we need to consolidate our competitiveness, can we continue to be a positive hub of innovation in sustainable products and processes.
In addition to the economic benefits that we provide, Tata Steel also seeks to be a good neighbour and a positive contributor to the local community. We are, for example, a key partner in the management of the Eglwys Nunydd reservoir which is a recognised excellent fishing area and supports a sailing club, in addition to the wildfowl that designated it as a SSI site. Over the years Tata steel has supported other local habitats e.g. sponsoring the fen orchid and given over part of its land around the landfill site to support a local species of bee. There may be further opportunities for active management of “urban green spaces” helping with improvements to bio-diversity, tree planting etc by industrial organisations. This could be supported through some form of benefit or credit in respect to environmental permit subsistence charges

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Question 1: Does the Paris Agreement mean that Welsh emissions targets should keep open a deeper reduction in emissions than 80% by 2050? Are there implications for nearer-term targets?

We think it is fair to recognise the Paris Agreement as a landmark outcome, albeit possibly unexpected. This remains the case despite the US decision to later state its intention to withdraw. However, whilst Paris establishes a set of "binding procedural commitments," achievement of the NDCs themselves is not legally binding (nor any new financial commitments) and this needs to be borne in mind when considering how the Wales (and UK) emission targets for 2050 and carbon budgets should be framed to reflect the Agreement. The 2050 target in Wales already allows for a greater than 80% reduction as the wording is "at least 80%". That said, the 5 -yearly cycle of pledges and reviews under the Paris Agreement should provide some clarity on how much real progress is likely/actually happening. The first Global Stocktake is set for 2023 and every 5 years thereafter (although there is an interim review due in 2018 ahead of 2020 when the Agreement is in effect). Care is needed in how/when the timings of these reviews might be taken into account and potentially acted upon, bearing in mind Wales is about to set its 2016-2020 and 2021-2025 budgets. This is particularly important when considering the generally long investment cycles in the industrial sector, and the steel sector in particular.

Question 2: Do you think that leaving the EU has an impact on the targets or how they can be met?

As already mentioned in the introduction, following the move from use of "net" emissions as per the UK target, to using actual Wales direct emissions, Brexit should not affect emissions accounting.
Clearly and in particular because of the high proportion of energy intensive and industrial emissions in the Traded Sector, the UK and Wales will need to seriously consider impacts on policy areas. For example, if the UK were not allowed to or chose not to participate in EU ETS (or an identical/very similar traded and possibly linked scheme). In addition to the price signal the EU ETS also delivers auctioning revenues. However whilst we note the CPS is claimed to have been successful in contributing to low carbon generation, the distortion in UK power prices has made the UK a difficult place to operate as an energy intensive industry. The welcome introduction, eventually, of a compensation scheme has helped reduce that impact, but it does not cover the full costs faced by energy intensives and this compensation mechanism is in any case on a declining maximum allowable level under state aid rules.
In many cases it seems likely that relevant EU policy measures will be preserved or replicated by UK law. The CCC briefing paper (Oct 2016) also mentions the likely need to strengthen UK law where it's felt that EU law is insufficient. We would ask that due recognition be given to the potential impact such measures could have on energy intensive industry competitiveness in general and the steel sector in particular due to its difficulty in transitioning to a low carbon approach in the short and medium term due to the need for a step change in innovative steelmaking technologies.
One other key area that remains a significant concern is the future level of EU collaboration and innovation funding (e.g. EU ETS, Horizon 2020) which in a sector that is looking to the development of new and innovative, unproven technologies for decarbonising is vitally important.

Question 3: In the area(s) of your expertise, what are the opportunities and challenges in reducing Welsh emissions in the nearer term (e.g. to 2030)?

The challenges in reducing Welsh emissions are significantly affected by the high level of industrial emissions as a proportion of total emissions (34%) compared to the situation in the wider UK (22%). Taking that in conjunction with the fact that a large proportion of industrial emissions are attributable to only a small number of large emitters from these sectors (see Q8) brings potentially further difficulties. The variability in the short and medium term carbon abatement potential (with current technology) of some parts of the industrial sector could be said to exacerbate the difficulties.
The Welsh Government also does not have devolved competence in all areas relevant to climate change emissions reductions (e.g. energy, aviation and marine transport, building regulations).
Perhaps one of the most difficult challenges, is in the area of effective communication of the key messages and the need for quite significant changes in behaviours of the general public as consumers of goods and services and how that impacts on achievement of the carbon targets and budgets.
Opportunities for reduction of Welsh emissions in the nearer term (up to 2030) include establishing appropriate funding mechanisms that would support the implementation of energy efficiency measures (current/conventional technology) where the pay-back periods are currently outside of those that are economically viable for energy intensive industries.
Promoting and strengthening collaborations between academia and industry will be useful (for example, building on the current example of FLEXIS).
Although, a small proportion of Welsh total emissions, progressing emissions reductions within the Public Sector will be important, not least in that it will help demonstrate leadership by the Welsh Government. The potential for land-use as a positive benefit for climate change in a country that has the unique geography of Wales is also likely to be important.
Further emission reductions within sectors that have a less difficult low carbon pathway i.e. the power sector, through increased use of renewables, and the expansion of the potential for demand side response (DSR). It should be noted that industry and the steel sector in particular can contribute positively here

Question 4: What is required by 2030 to prepare for the 2050 target for an emissions reduction of at least 80% on 1990 levels, recognising that this may require that emissions in some areas are reduced close to zero? Is there any impact of the need to go beyond 80%, either in 2050 or subsequently?

Our hope is that the achievement of at least 80% reduction in emissions from 1990, is delivered through the development of lower carbon operations in a sustainable industrial landscape which includes a thriving steel sector, and not through de-industrialisation.

Therefore ensuring that the steel sector in Wales has the opportunity to operate competitively over the short to medium term is critical. This should then enable the research and development of innovative new low/lower carbon steelmaking technologies and carbon capture storage and use (CCSU) needed to deliver the significant emission reductions by 2050.

The steel sector is under no illusions that it has to compete in a global market and therefore has to continue to innovate, reduce costs, develop new products and markets etc, but where there are particular issues in Wales (or more likely UK), that could impede or help that competitiveness, these may need intervention by governments.

Along with the rest of the steel sector, Tata Steel has expressed a number of key asks of UK Government in the context of a possible future 'sector deal' under the UK's Industrial Strategy). We believe these are crucial to ensuring a competitive steel industry which can contribute to jobs, process and product innovation and economic and act as a catalyst for decarbonisation across the Welsh economy. The key asks are summarised below:

Actions need to be taken to remove / reduce the significant electricity price differentials faced by UK industry compared to its competitors (in EU and beyond).

A more appropriate regime in respect to Business Rates so that it provides less of a disincentive to investment in productivity boosting capital investment is needed.

An R&D collaboration fund should be established, with match funding by government, to help in the long term investment in research, development and innovation. This has the potential to impact on process efficiency, productivity, product development, all of which will help in ensuring a viable sustainable business; critical developments in new steelmaking methods and CCS, which remains a critical option for the most significant CO2 savings and CCU. Noting that in respect to CCS this will most likely require shipping to a suitable offshore location e.g. potentially the Hamilton fields off the cost of North Wales which could be a first UK cluster.

Public Procurement policies should promote and support UK supply chains.

In addition to the key sectoral asks, a variety of infrastructural developments are also likely to be required. For example, electricity grid infrastructure investment will be needed in key areas in order for there to be any substantial increase in the proportion of EAF to BF/BOS route steelmaking (albeit it should be recognised that BF/BOS route steelmaking remains a substantial outlet for scrap recycling). In addition, a clearer understanding is needed of the required/available capacity of electricity demand in the longer term (2030+) if the intention is to achieve a step-change in electric vehicle use in future (especially if also coupled to greater uptake of EAF steelmaking).

If low carbon/renewable heat sources are to contribute a significant proportion of the targeted carbon emission reductions, there is a significant amount of work required over the next decade or two to enable efficient extraction, storage and distribution. This will include source mapping, development of current and new technologies and potentially significant infrastructure aligned to relevant "clusters" of producers and consumers.

Question 5: What are the respective roles of UK Government, Welsh Government, the wider public sector, business, third sector and individual or household behaviour in delivering emissions reductions between now and 2030? And, separately, between 2030 and 2050?

In respect of the UK Government (and Welsh Government) and UK Steel Sector, as well as some of the wider business sector (supply chain impacts), the roles and responsibilities are probably most comprehensively covered within the ongoing discussions in respect to the potential Sector Deal (see answer to Question 4) and how that fits in with the Industrial Strategy.

Question 6: As a business, as a Public Sector Body, or as a citizen, how do emissions targets affect your planning and decision-making?

Tata Steel operates in an extremely competitive global (commodity) marketplace and therefore has had a significant focus on all areas that contribute to its cost base or can improve profit margins including energy and material efficiency. This has ensured that significant reductions in energy use and improvements in

energy efficiency have taken place over many decades, as it has generally made good business sense to do this. These improvements were instigated and continued over periods pre-dating the setting of carbon targets.
However, as an energy intensive manufacturing operator with its main installations covered by the EU ETS, that regime has had a more immediate impact on planning and decision-making than have the carbon targets and budgets set within the UK Climate Change Act or Wales Environment Act. The EU ETS, through its decreasing cap over time has been the method chosen to achieve the European Traded Sector's contribution to emissions reduction. The impacts of EU ETS in regards to forward positions on potential free allocation levels and the cost of shortfalls have been factored into the company strategy, including asset configuration and capital investment planning.
That said, and with the potential fall-outs from Brexit, the 2050 targets set within UK Climate Change Act (and latterly Wales) clearly indicate the long-term vision and hence the political environment that Tata Steel will be operating in over the long term if it intends to continue as a sustainable business. Therefore it is currently honing its long-term strategy for delivering a sustainable business (this includes areas such as Climate Change and Circular Economy, the latter being intrinsically linked to former).
The effect of public policy on the foundation industries such as the steel industry has the potential to be profoundly positive, if Governments embrace Circular Economy and low carbon concepts in planning, procurement and product legislation. Steel products will be vital in helping society to become more sustainable because of their intrinsic durability, flexibility, re-usability and, at the end of their lives, recyclability. We strongly believe that Governments should seek to incentivise the uptake of sustainable materials and the establishment of a Circular Economy through the full suite of policy instruments at their disposal.

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We have already set out our assertion that Welsh emission reductions cannot be achieved through de-industrialisation; this would be counter-productive in global emissions terms and would carry a substantial cost for the Welsh economy and its ability to innovate and be a catalyst for global action. One way for policy makers to ensure that genuine emissions reductions are being achieved is to use consumption-based reporting, using life-cycle assessment methods to understand not only the direct emissions from the Welsh economy and society but also the indirect emissions from the production of imported goods.
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We think it is fair to recognise the Paris Agreement as a landmark outcome, albeit possibly unexpected. This remains the case despite the US decision to later state its intention to withdraw. However, whilst Paris establishes a set of “binding procedural

commitments," achievement of the NDCs themselves is not legally binding (nor any new financial commitments) and this needs to be borne in mind when considering how the Wales (and UK) emission targets for 2050 and carbon budgets should be framed to reflect the Agreement. The 2050 target in Wales already allows for a greater than 80% reduction as the wording is "at least 80%".
That said, the 5 -yearly cycle of pledges and reviews under the Paris Agreement should provide some clarity on how much real progress is likely/actually happening. The first Global Stocktake is set for 2023 and every 5 years thereafter (although there is an interim review due in 2018 ahead of 2020 when the Agreement is in effect). Care is needed in how/when the timings of these reviews might be taken into account and potentially acted upon, bearing in mind Wales is about to set its 2016-2020 and 2021-2025 budgets. This is particularly important when considering the generally long investment cycles in the industrial sector, and the steel sector in particular.

Question 2: Do you think that leaving the EU has an impact on the targets or how they can be met?

As already mentioned in the introduction, following the move from use of "net" emissions as per the UK target, to using actual Wales direct emissions, Brexit should not affect emissions accounting.
Clearly and in particular because of the high proportion of energy intensive and industrial emissions in the Traded Sector, the UK and Wales will need to seriously consider impacts on policy areas. For example, if the UK were not allowed to or chose not to participate in EU ETS (or an identical/very similar traded and possibly linked scheme). In addition to the price signal the EU ETS also delivers auctioning revenues. However whilst we note the CPS is claimed to have been successful in contributing to low carbon generation, the distortion in UK power prices has made the UK a difficult place to

operate as an energy intensive industry. The welcome introduction, eventually, of a compensation scheme has helped reduce that impact, but it does not cover the full costs faced by energy intensives and this compensation mechanism is in any case on a declining maximum allowable level under state aid rules.
In many cases it seems likely that relevant EU policy measures will be preserved or replicated by UK law. The CCC briefing paper (Oct 2016) also mentions the likely need to strengthen UK law where it's felt that EU law is insufficient. We would ask that due recognition be given to the potential impact such measures could have on energy intensive industry competitiveness in general and the steel sector in particular due to its difficulty in transitioning to a low carbon approach in the short and medium term due to the need for a step change in innovative steelmaking technologies.
One other key area that remains a significant concern is the future level of EU collaboration and innovation funding (e.g. EU ETS, Horizon 2020) which in a sector that is looking to the development of new and innovative, unproven technologies for decarbonising is vitally important.

Question 3: In the area(s) of your expertise, what are the opportunities and challenges in reducing Welsh emissions in the nearer term (e.g. to 2030)?

The challenges in reducing Welsh emissions are significantly affected by the high level of industrial emissions as a proportion of total emissions (34%) compared to the situation in the wider UK (22%). Taking that in conjunction with the fact that a large proportion of industrial emissions are attributable to only a small number of large emitters from these sectors (see Q8) brings potentially further difficulties. The variability in the short and medium term carbon abatement potential (with current technology) of some parts of the industrial sector could be said to exacerbate the difficulties.
The Welsh Government also

does not have devolved competence in all areas relevant to climate change emissions reductions (e.g. energy, aviation and marine transport, building regulations).
Perhaps one of the most difficult challenges, is in the area of effective communication of the key messages and the need for quite significant changes in behaviours of the general public as consumers of goods and services and how that impacts on achievement of the carbon targets and budgets.
Opportunities for reduction of Welsh emissions in the nearer term (up to 2030) include establishing appropriate funding mechanisms that would support the implementation of energy efficiency measures (current/conventional technology) where the pay-back periods are currently outside of those that are economically viable for energy intensive industries.
Promoting and strengthening collaborations between academia and industry will be useful (for example, building on the current example of FLEXIS).
Although, a small proportion of Welsh total emissions, progressing emissions reductions within the Public Sector will be important, not least in that it will help demonstrate leadership by the Welsh Government. The potential for land-use as a positive benefit for climate change in a country that has the unique geography of Wales is also likely to be important.
Further emission reductions within sectors that have a less difficult low carbon pathway i.e. the power sector, through increased use of renewables, and the expansion of the potential for demand side response (DSR). It should be noted that industry and the steel sector in particular can contribute positively here

Question 4: What is required by 2030 to prepare for the 2050 target for an emissions reduction of at least 80% on 1990 levels, recognising that this may require that emissions in some areas are reduced close to zero? Is there any impact of the need to go

beyond 80%, either in 2050 or subsequently?

Our hope is that the achievement of at least 80% reduction in emissions from 1990, is delivered through the development of lower carbon operations in a sustainable industrial landscape which includes a thriving steel sector, and not through de-industrialisation.

Therefore ensuring that the steel sector in Wales has the opportunity to operate competitively over the short to medium term is critical. This should then enable the research and development of innovative new low/lower carbon steelmaking technologies and carbon capture storage and use (CCSU) needed to deliver the significant emission reductions by 2050.

The steel sector is under no illusions that it has to compete in a global market and therefore has to continue to innovate, reduce costs, develop new products and markets etc, but where there are particular issues in Wales (or more likely UK), that could impede or help that competitiveness, these may need intervention by governments.

Along with the rest of the steel sector, Tata Steel has expressed a number of key asks of UK Government in the context of a possible future 'sector deal' under the UK's Industrial Strategy). We believe these are crucial to ensuring a competitive steel industry which can contribute to jobs, process and product innovation and economic and act as a catalyst for decarbonisation across the Welsh economy. The key asks are summarised below:

Actions need to be taken to remove / reduce the significant electricity price differentials faced by UK industry compared to its competitors (in EU and beyond).

A more appropriate regime in respect to Business Rates so that it provides less of a disincentive to investment in

productivity boosting capital investment is needed.

An R&D collaboration fund should be established, with match funding by government, to help in the long term investment in research, development and innovation. This has the potential to impact on process efficiency, productivity, product development, all of which will help in ensuring a viable sustainable business; critical developments in new steelmaking methods and CCS, which remains a critical option for the most significant CO2 savings and CCU. Noting that in respect to CCS this will most likely require shipping to a suitable offshore location e.g. potentially the Hamilton fields off the cost of North Wales which could be a first UK cluster.

Public Procurement policies should promote and support UK supply chains.

In addition to the key sectoral asks, a variety of infrastructural developments are also likely to be required. For example, electricity grid infrastructure investment will be needed in key areas in order for there to be any substantial increase in the proportion of EAF to BF/BOS route steelmaking (albeit it should be recognised that BF/BOS route steelmaking remains a substantial outlet for scrap recycling). In addition, a clearer understanding is needed of the required/available capacity of electricity demand in the longer term (2030+) if the intention is to achieve a step-change in electric vehicle use in future (especially if also coupled to greater uptake of EAF steelmaking).

If low carbon/renewable heat sources are to contribute a significant proportion of the targeted carbon emission reductions, there is a significant amount of work required over the next decade or two to enable efficient extraction, storage and distribution. This will include source mapping, development of current and new technologies and potentially significant infrastructure aligned to relevant

"clusters" of producers and consumers.

Question 5: What are the respective roles of UK Government, Welsh Government, the wider public sector, business, third sector and individual or household behaviour in delivering emissions reductions between now and 2030? And, separately, between 2030 and 2050?

In respect of the UK Government (and Welsh Government) and UK Steel Sector, as well as some of the wider business sector (supply chain impacts), the roles and responsibilities are probably most comprehensively covered within the ongoing discussions in respect to the potential Sector Deal (see answer to Question 4) and how that fits in with the Industrial Strategy.

Question 6: As a business, as a Public Sector Body, or as a citizen, how do emissions targets affect your planning and decision-making?

Tata Steel operates in an extremely competitive global (commodity) marketplace and therefore has had a significant focus on all areas that contribute to its cost base or can improve profit margins including energy and material efficiency. This has ensured that significant reductions in energy use and improvements in energy efficiency have taken place over many decades, as it has generally made good business sense to do this. These improvements were instigated and continued over periods pre-dating the setting of carbon targets.

However, as an energy intensive manufacturing operator with its main installations covered by the EU ETS, that regime has had a more immediate impact on planning and decision-making than have the carbon targets and budgets set within the UK Climate Change Act or Wales Environment Act. The EU ETS, through its decreasing cap over time has been the method chosen to achieve the European Traded Sector's contribution to emissions reduction. The

impacts of EU ETS in regards to forward positions on potential free allocation levels and the cost of shortfalls have been factored into the company strategy, including asset configuration and capital investment planning.
That said, and with the potential fall-outs from Brexit, the 2050 targets set within UK Climate Change Act (and latterly Wales) clearly indicate the long-term vision and hence the political environment that Tata Steel will be operating in over the long term if it intends to continue as a sustainable business. Therefore it is currently honing its long-term strategy for delivering a sustainable business (this includes areas such as Climate Change and Circular Economy, the latter being intrinsically linked to former).
The effect of public policy on the foundation industries such as the steel industry has the potential to be profoundly positive, if Governments embrace Circular Economy and low carbon concepts in planning, procurement and product legislation. Steel products will be vital in helping society to become more sustainable because of their intrinsic durability, flexibility, re-usability and, at the end of their lives, recyclability. We strongly believe that Governments should seek to incentivise the uptake of sustainable materials and the establishment of a Circular Economy through the full suite of policy instruments at their disposal.

Question 7: In your area(s) of expertise, what specific circumstances need to be considered when setting targets and budgets for Wales and how could these be reflected in the targets?

We understand and recognise the premise that early reduction of absolute emissions (e.g. by 2030) will mean lower cumulative emissions between now and 2050 and therefore a reduced impact on the climate. However, it is fundamentally clear that the steel sector is close to the thermodynamic limits of conventional primary BF/BOS route steelmaking. As

such, substantial reductions in direct emissions require the development and implementation of new steelmaking technologies. In conjunction with this, there is an expectation that there will be a move towards an increased use of scrap (for example, through an uptake of EAF) and/or implementation of new low carbon steelmaking technologies over the long term. This does also assume the availability of sufficient low carbon/renewable electricity, and possible CCS and/or CCU.
Care is needed to understand the extent to which these technologies could be deployed, whether they will be accepted by the public and how the deployment and increased costs will be funded. Without the deployment of new technologies and low-carbon energy, a commitment to any particular stretching targets would be optimistic in the extreme.
In the short term the industry continues to commit substantial efforts to optimise energy consumption, material yield and other process efficiencies wherever it is cost effective to do so. Whilst such efforts are hugely important, they will provide only relatively small percentage improvements in emissions (though outside of the integrated steelmaking installations, these reductions may be considered significant in absolute terms).
We have already set out our assertion that Welsh emission reductions cannot be achieved through de-industrialisation; this would be counter-productive in global emissions terms and would carry a substantial cost for the Welsh economy and its ability to innovate and be a catalyst for global action. One way for policy makers to ensure that genuine emissions reductions are being achieved is to use consumption-based reporting, using life-cycle assessment methods to understand not only the direct emissions from the Welsh economy and society but also the indirect emissions from the production of imported goods. Linked to consumption based reporting is the need to avoid

setting simplistic targets expressed as emissions per tonne of basic production volume. In some cases, there is a life cycle benefit from investing more energy and emissions in the production stage of a product's life in order to secure an improvement in its 'in use' or 'end-of life' performance.' A classic illustration of this is the extra energy expended to produce advanced high strength steels (AHSS) leading to light-weighting e.g. in the automotive sector, which help provide reduced transport emissions and hence lower global emissions. Similarly, the carbon benefits accrued by the use of high efficiency electrical steels e.g. in transformers and motors, outweighs many times the additional impacts incurred during the manufacture of such steels. The contribution through the manufacture of premium steel products to large net savings in carbon emissions over the full life cycle of steel products should be recognised, not penalised

Another key consideration in target setting linked to product characteristics is understanding the technical limitations of various production processes for manufacturing products of the correct specification, It needs to be understood, for example, that EAF-produced steels are currently unsuitable for use in a number of applications, not least a variety of key sectors for flat steel products such as automotive. In this case, the limitations are due to high nitrogen levels and some residual elements that lead to strain ageing and low ductility issues in the final flat products and prevent EAF route supply. Therefore R&D into process improvements that may allow the EAF route to be able to supply this important sector is required and will take substantial time. This is a key factor that needs to be considered in determining the extent of any future transition to a greater uptake of the EAF route (or other new steelmaking techniques such as HISARNA) between 2030-2050.

As can be seen from the examples above, Tata Steel and the wider steel sector need

“breathing space” for a broad and complex range of measures to come to fruition. We need this to be considered in setting the interim targets and carbon budgets to take into account the unavoidable back-loaded pathway for substantial emission reductions.
Unlike the move to increased electric vehicle ownership and use, the Technology Readiness Level (TRL) of potential future lower carbon steelmaking methods is low and remains unproven. Whilst Tata Steel remains hopeful in regards to a new technology HISARNA (installed at the Netherlands site) it remains at pilot plant level. The latest trial will seek to test the stability of operations over more than a month and therefore remains a very long way from being proven and then developed at a commercial scale and rolled out across the EU/World.
The TRL of such potential improvements needs to be taken into account when the options for achieving carbon emission reductions at a particular cost and by a particular time from all sectors/sub-sectors are assessed.
When considering the range of possible improvements to energy efficiency and emission reduction, care is needed to take into account that they are often either mutually exclusive (so one option being implemented would mean another wouldn’t be) or they interact to a greater or lesser extent , so the overall reduction in CO2 cannot be taken to be the sum of each individual option.
For a number of improvement options there may also be a level of interdependence, for example on an integrated steelmaking site (conventional BF/BOS route) which are very complex with several inter-linked processes, These installations produce process waste gases (BFG, COG, BOSG) from the cokemaking, ironmaking and steelmaking operations. Ideally the production of these gases (inherent and unavoidable) should slightly exceed demand, resulting in a small safety flare. However, due to site configuration, or limitations (such

as age and efficiency of power generation) supply may be significantly greater than supply. Therefore installing projects that improve efficiency of combustion that just save waste gases would have no real benefit as this would just lead to increased flaring of the waste gases. Installation of sufficient additional combustion capacity (eg power generation) would possibly be required first/alongside. Such additional capacity can often be, as is usually the case in the steel sector, a significant capital expenditure.

Due to the highly capital intensive nature of our industry, there can be some critical issues relating to timing and choices made, particularly those that are being considered now in the short term. It may be that measures that appear to be essential or obvious options in the short term, are not aligned with a “possible future option” (although that option is unproven and may not come to fruition). Companies in capital intensive sectors such as steel that are already substantially constrained in terms of access to finance cannot afford to spend ‘regret capital’ implementing technologies that shortly after are shown not to be compatible with the optimal decarbonisation roadmap.

Whilst it has been made clear that the emissions targets are focussed on Wales emissions, it is important that due diligence be taken and reflected in any impact assessment of the level of imported carbon emissions when considering setting the carbon targets and budgets. It would not be sensible or appropriate if net (imported and direct) emissions were increasing/static whilst direct emissions were reducing. This would likely be a road to de-industrialisation rather than de-carbonisation.

We also believe – as described above - that taking a full life-cycle approach to the actual global impact is the correct way to go, so that the overall correct decisions are made.

A good example can be found in an independent study of Toyota Venza carried out by the University of California at Davis (https://www.worldsteel.org/steel-

by-topic/life-cycle-thinking/case-studies/WorldAutoSteel---Automotive--Life-cycle-thinking-leads-to-intelligent-automotive-material-choices.html)
A full life cycle approach should also be adopted when calculating the carbon emissions associated with steelmaking, in particular in accounting for the use of steel scrap in BOS and EAF steelmaking. Steel scrap is a valuable resource (i.e. is not 'free' economically, nor environmentally) and its recycling into new steel should properly account for the carbon 'embodied' in the scrap.

Question 8: The power and industry sectors in Wales are dominated by a small number of large emitters. What are the key challenges and opportunities that this presents in setting the levels of carbon budgets and how should the process of setting them reflect these?

A key structural challenge is that a small number of large emitters are owned by a small number of companies. As such, a potentially significant burden (and capital expenditure) is likely to fall on one or two industrial/power companies. In respect to the industrial installation/operator then unlike the power company it cannot pass on the CO2 costs to its customers.
In respect to the integrated steelmaking site, the various options considered in the last UK carbon budget report, in respect to energy efficiency and emission reductions were being considered across the whole of the UK. This meant that it was feasible to have considered , potential savings from more than one option contributing to the abatement target , whereas on a single site in Wales, they may be mutually exclusive or lead to significant interaction and lower net savings.
The integrated steelmaking installation, also does rely on a number of unproven "new technologies" on the pathway to 2050 and therefore will necessarily be biased towards longer term significant reductions in carbon emissions (and later interim targets and budgets), which will need to be duly

considered.
In respect to Aberthaw power station and the UK policy of phasing out coal power, the uncertainty in the emission pathway and particular year of final closure appears to present a challenge. The Welsh Government does have the opportunity to review budgets and targets where there has been a significant change, to avoid any concerns over “hot air”.
Having a small number of large emitters does also provide a few opportunities. An example for this could be the Tata Steel Port Talbot installation which produces CO2, CO and H2, , has availability of land suitable for renewables including offshore wind and waste heat. Therefore it provides a suitable site to undertake demonstration projects in regards to the development of technologies in respect to carbon dioxide streams , waste heat and renewable energy.*
* “The potential and limitations of using carbon dioxide” –Policy Briefing, The Royal Society, May 2017, ISBN:978-1-78252-267-6

Question 9: 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?

The Committee should ensure that it takes a balanced view (and aligning with the Future Generations Act) and ensure that it considers the positive impacts and interactions (actual and potential) not just conflicts and negative impacts.
In this response we have sought to illustrate not only the benefits we bring to the Welsh economy in terms of job creation and economic development, but also the profoundly beneficial role that our products can make to achieving a more resource-efficient and circular economy throughout Wales and beyond. Only with the short term breathing space and support we need to consolidate our competitiveness, can we continue to be a positive hub of innovation in sustainable products and processes.

In addition to the economic benefits that we provide, Tata Steel also seeks to be a good neighbour and a positive contributor to the local community. We are, for example, a key partner in the management of the Eglwys Nunydd reservoir which is a recognised excellent fishing area and supports a sailing club, in addition to the wildfowl that designated it as a SSI site. Over the years Tata steel has supported other local habitats e.g. sponsoring the fen orchid and given over part of its land around the landfill site to support a local species of bee. There may be further opportunities for active management of “urban green spaces” helping with improvements to bio-diversity, tree planting etc by industrial organisations. This could be supported through some form of benefit or credit in respect to environmental permit subsistence charges

Question 10: 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?

The Future Trends report is an interesting document, and it stimulates discussions across a wide range of areas which is a good thing. However, due to the inherent limitation in “future forecast” accuracy, the Committee will need to take care on the “weighting” it gives to the “evidence” in its assessment.

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Question 1: Does the Paris Agreement mean that Welsh emissions targets should keep open a deeper reduction in emissions than 80% by 2050? Are there implications for nearer-term targets?

The Carbon Trust

4. Yes, we agree that meeting the commitments within the Paris Agreement means adopting a deeper reduction in emissions than 80% by 2050, and a corresponding change in nearer-term targets, including for reasons of avoiding lock-in to high carbon investment. To achieve these reductions, the agriculture sector must be included. Targets to reduce Welsh GHG emissions should incorporate a strong emphasis on food and farming. Until recently, farming has been the elephant in the room when it comes to climate change. We also note that some calculations of the contribution of farming to GHG emissions (such as the calculation that farming is responsible for 10% of the EU's overall emissions) often ignore emissions from animal feed production outside of the EU, the manufacture of nitrogen fertiliser or other agro-chemicals, and the transport of agricultural products. It also excludes the emissions related to land use change (for example, ploughing up forest or grassland for crops) or losses of soil carbon. A new report from IFOAM EU estimates that altogether, one-third of global GHG emissions could be linked to the farming and food industries – production, processing, distribution and consumption. We would like to see the emissions reductions targets adopted by Wales in the near- and long-term take into account a full assessment of food and farming related emissions.

If tackling climate change is to be a top priority for food and farming policy, emissions targets in the short and long term set out in climate change policy and by the CCC must be fully reflected in future agriculture policy too. The Soil Association has called for a commitment to zero-carbon farming by around 2050 and proposed some solutions to help achieve that goal.

Organic farming methods can

help to deliver this goal and therefore should be more strongly supported by the Government. Evidence shows that organic farms generally emit fewer greenhouse gases, use less energy and store greater amounts of carbon in soils per hectare than non-organic farms; the IFOAM EU report estimates that conversion to 50% of EU land under organic farming by 2030 would equate to a 23% cut in agricultural GHG emissions through increased soil carbon sequestration and reduced application of manufactured nitrogen fertilisers.

Question 2: Do you think that leaving the EU has an impact on the targets or how they can be met?

Yes, leaving the EU will have a considerable impact in particular on how the targets can be met and in relation to the overall political priority attached to cutting greenhouse gas emissions and the need for agriculture to contribute its fair share. It is vital that climate policy and targets set in Wales or at UK level are not undermined by other areas of Government especially in the light of Brexit. For example, trade deals must be 'climate proofed' so that they do not erode the chances of carbon budgets being met, and they do not simply export emissions overseas.

However, the significant focus on the development of a new UK agriculture policy is an opportunity – as long as there is commitment from the highest levels in Government to ensuring this is compatible with the UK's climate commitments domestically and globally. This compatibility between climate and agricultural policy must extend to the devolved nations too. For decades, the EU Common Agricultural Policy (CAP) has helped provide stability for many farm communities, and it has contributed increasingly to the conservation and protection of the environment. However,

as most of its budget pays landowners simply for the area they farm, it has also smothered efforts to tackle climate change and this has not been a priority in policy design. In preparing to leave the EU, the UK has an opportunity to set in place policies that help our farming communities mitigate and adapt to climate change, and this opportunity must not be squandered.

Question 3: In the area(s) of your expertise, what are the opportunities and challenges in reducing Welsh emissions in the nearer term (e.g. to 2030)?

Achieving climate-friendly farming will depend on the innovation of farmers to adopt sustainable practices and deploy new methods and technologies which make the most of natural processes without the need for costly and environmentally damaging inputs. Organic farming provides a model for sustainable food security, and helps mitigate climate change. Often claims of 'food security' are used to support more intensive, industrialised agriculture but that approach ignores the need for a stable climate, clean air and water, healthy soils and restore biodiversity.

Healthy soils are a key climate mitigation tool. Healthy soil acts as a carbon sink by drawing carbon down into the soil to store it. Improving soil health is therefore a critical way to tackle climate change. Recognising the ability of soil to sequester carbon and its contribution to climate mitigation, the UK signed onto the French government's the 4 per 1000 soil carbon initiative at the UN Climate Change Convention in Paris. This initiative aims to increase soil organic carbon by 0.4% each year. This goal to increase soil carbon sequestration must be a key policy in UK agriculture policy to help reduce GHG emissions. The UK has committed to managing all

England's sustainably and to tackling degradation threats by 2030. Wales has an opportunity by leading the way on soil protection and climate change by taking action and introducing policies that the rest of the UK may emulate.

For farming systems, one opportunity lies in planting many more trees – as agroforestry schemes on farms and as woodlands and forests. As the CCC has recognised, agroforestry can help mitigate climate change by sequestering carbon. In maritime climates such as the UK, the widespread adoption of agroforestry would result in estimated average emissions reduction of 0.51 tonnes CO2 per hectare per year. The CCC has calculated that, if agroforestry were expanded to cover just 2.3% of agricultural land by 2050, accompanied by woodland creation averaging 30,000 hectares per year, this would reduce greenhouse gas emissions by 16 million tonnes of CO2e annually in 2050. We view this as a conservative estimate and look forward to the forthcoming updated emission inventory, and note that it is important for policy making in the meantime to fully consider the potential contribution of agroforestry.

There are major near-term opportunities to cut emissions via more concerted efforts to reduce the use of nitrogen fertiliser. This was illustrated recently by researchers studying the environmental footprint of a loaf of bread, which found that manufactured nitrogen fertiliser alone accounted for a staggering 43% of a loaf's total emissions. Whilst the contribution of fossil fuels to climate change is widely understood, there is less public and stakeholder awareness that nitrous oxide is a potent greenhouse gas (GHG) and that this accounts for around a third of the UK agricultural sector's total emissions. As the CCC has

noted, the majority of these emissions arise from the estimated 900,000 tonnes of nitrogen fertiliser that is applied annually on British farmland, the manufacture of which is alone responsible for an estimated 6 million tonnes of CO2, equivalent to around 1% of the UK's emissions total. We note the CCC has estimated that measures aimed at reducing N2O emissions from agriculture – through increased the use of leguminous crops and the reduction of untimely or the excessive application of fertilisers – could deliver an annual emissions reduction of 2.7 million tonnes of CO2e by 2030. We would urge the CCC to be bold in making recommendations regarding the extent to which adoption of such practices can be widely adopted.

Question 4: What is required by 2030 to prepare for the 2050 target for an emissions reduction of at least 80% on 1990 levels, recognising that this may require that emissions in some areas are reduced close to zero? Is there any impact of the need to go beyond 80%, either in 2050 or subsequently?

In the agriculture sector, to meet the 2050 target and nearer term climate objectives, we have proposed that the UK's new UK agricultural framework should include a strategy to increase the adoption of organic farming to achieve at least 10% of UK farmland to be managed organically – alongside market based measures to ensure that conversion rates do not run ahead of market demand. Achieving 10% of farmland under organic production would help reduce the emissions from the agriculture sector and to sequester carbon into the soil.

Government recognition and support for sustainable agricultural practices - especially those that help meet carbon budgets - should also inform priorities and budget allocation for

research, innovation and farming advisory services. There are many opportunities for knowledge sharing among farmer networks and these should be actively promoted and encouraged. The Soil Association is calling for Government to allocate 10% of the current R&D budget for innovative agriculture projects led by farmers themselves. A significant proportion of such projects can and should be dedicated to finding ways to cut greenhouse gas emissions.

In order to help climate-proof the agricultural sector and encourage new entrants to organic farming, research institutions and universities – particularly agricultural colleges – should be encouraged to offer courses in organic and agroecological farming practices, as part of a wider focus on what climate change means for the future of farming and how the sector can play its part in cutting GHG emissions and adapting to the impacts of climate change. Increasing R&D funding into innovative farm-driven projects would help to identify methods by which farming practices can help tackle climate change and field-test techniques that could help farmers adapt to growing in a changing climate.

Question 5: What are the respective roles of UK Government, Welsh Government, the wider public sector, business, third sector and individual or household behaviour in delivering emissions reductions between now and 2030? And, separately, between 2030 and 2050?

Each and every actor, whether government, business, civil society, or the general public have an important role to play in helping to meet our climate goals. Each action, however small, can help to reduce our emissions. However, as the CCC's most recent progress report has illustrated, a voluntary approach to

emission reduction in the agricultural sector is no longer a valid approach. Government needs to take a strong position and drive forward climate goals. Wales has an opportunity to lead by example and to go faster and further than the UK overall.

Public procurement should be given more recognition as a powerful tool that can be used to tackle climate change and reduce emissions from agriculture and the food system. The UK public sector serves some 3.5 million meals each weekday across settings as varied as schools, nurseries, care homes, hospitals and prisons. While this accounts for little over 1% of the total food retail and catering market, its influence is significant. Food in schools and public institutions sets norms for the public and consumers, signals values, and gives integrity to government priorities and policies. To illustrate the potential scale of this impact, the current UK organic market is worth over £2 billion, so if the public sector went organic, it would approximately double that market.

As food consumers, we also have a part to play. Dietary change and the reduction of food waste is essential, if we are to secure a sustainable, climate-friendly food system. That includes less but better quality meat and dairy products – particularly moving away from intensively farmed animals fed on cereals – and instead switching to grass-fed beef and lamb, and to more plant-based diets, with more fruit, vegetables and wholegrains. Government policy can help achieve this behavioural shift and campaigns such as Eating Better has been strongly supporting policy revisions. Not only would this be good for efforts to tackle climate change, it would be good for our health too.

Question 6: As a business, as a Public Sector Body, or as a

citizen, how do emissions targets affect your planning and decision-making?

18. Emissions targets are important for ensuring organisations involved in the agriculture and food sector consider the climate impact of their practises and adjust their approach to reduce and mitigate their emissions. Near-term as well as longer term targets are important to help producers alter their practices in order to mitigate risk. Gathering data through farm sensors and soil testing can inform farming practices to make them more environmentally sensitive and climate-friendly. Additionally, creating transparent open-source models that producers are able to access can help with future planning and more precise farming practices. Not only can these practices help reduce GHG emissions from farming and help mitigate climate change, but they can also prove a cost-effective measure of farmers by reducing unnecessary and costly inputs and increasing yields.

Question 7: In your area(s) of expertise, what specific circumstances need to be considered when setting targets and budgets for Wales and how could these be reflected in the targets?

19. For Wales to achieve its climate goals, agricultural practices will have to change dramatically. Isolated islands of good practice and innovation are simply not enough to achieve the changes required. Wales has an opportunity to show leadership by reorienting its farming and food system dramatically in order to mitigate and adapt to the realities of climate change.

Question 8: The power and industry sectors in Wales are dominated by a small number of large emitters. What are the key challenges and opportunities that this presents in setting the levels of carbon budgets and how

should the process of setting them reflect these?

20. No response

Question 9: 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?

In assessing the impact of climate change and of mitigation efforts, the committee we must continue to rely on science and data. It is essential to base decisions on independently verified and peer-reviewed science that is rigorous and unbiased. One role of civil society to act as a watch-dog and to continue to stress the importance of scientific rigour. Citizen science may also offer a contribution. Farmers can provide vital real-world evidence and key data points to help build out a fuller picture of climate impacts and of the efficacy of measures introduced to cut greenhouse gas emissions. Transparent data which is made public through open source platforms allows for greater public confidence.

Question 10: 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?

No response

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farming. Until recently, farming has been the elephant in the room when it comes to climate change. We also note that some calculations of the contribution of farming to GHG emissions (such as the calculation that farming is responsible for 10% of the EU's overall emissions) often ignore emissions from animal feed production outside of the EU, the manufacture of nitrogen fertiliser or other agro-chemicals, and the transport of agricultural products. It also excludes the emissions related to land use change (for example, ploughing up forest or grassland for crops) or losses of soil carbon. A new report from IFOAM EU estimates that altogether, one-third of global GHG emissions could be linked to the farming and food industries – production, processing, distribution and consumption. We would like to see the emissions reductions targets adopted by Wales in the near- and long-term take into account a full assessment of food and farming related emissions.

If tackling climate change is to be a top priority for food and farming policy, emissions targets in the short and long term set out in climate change policy and by the CCC must be fully reflected in future agriculture policy too. The Soil Association has called for a commitment to zero-carbon farming by around 2050 and proposed some solutions to help achieve that goal.

Organic farming methods can help to deliver this goal and therefore should be more strongly supported by the Government. Evidence shows that organic farms generally emit fewer greenhouse gases, use less energy and store greater amounts of carbon in soils per hectare than non-organic farms; the IFOAM EU report estimates that conversion to 50% of EU land under organic farming by 2030 would equate to a 23% cut in agricultural GHG emissions through increased soil carbon sequestration and reduced application of manufactured nitrogen fertilisers.

Question 2: Do you think that leaving the EU has an impact on the targets or how they can be met?

Yes, leaving the EU will have a considerable impact in particular on how the targets can be met and in relation to the overall political priority attached to cutting greenhouse gas emissions and the need for agriculture to contribute its fair share. It is vital that climate policy and targets set in Wales or at UK level are not undermined by other areas of Government especially in the light of Brexit. For example, trade deals must be 'climate proofed' so that they do not erode the chances of carbon budgets being met, and they do not simply export emissions overseas.

However, the significant focus on the development of a new UK agriculture policy is an opportunity – as long as there is commitment from the highest levels in Government to ensuring this is compatible with the UK's climate commitments domestically and globally. This compatibility between climate and agricultural policy must extend to the devolved nations too. For decades, the EU Common Agricultural Policy (CAP) has helped provide stability for many farm communities, and it has contributed increasingly to the conservation and protection of the environment. However, as most of its budget pays landowners simply for the area they farm, it has also smothered efforts to tackle climate change and this has not been a priority in policy design. In preparing to leave the EU, the UK has an opportunity to set in place policies that help our farming communities mitigate and adapt to climate change, and this opportunity must not be squandered.

Question 3: In the area(s) of your expertise, what are the opportunities and challenges in reducing Welsh emissions in the nearer term (e.g. to 2030)?

Achieving climate-friendly farming will depend on the innovation of farmers to adopt sustainable practices and deploy new methods and technologies which make the most of natural processes without the need for costly and environmentally damaging inputs. Organic farming provides a model for sustainable food security, and helps mitigate climate change. Often claims of 'food security' are used to support more intensive, industrialised agriculture but that approach ignores the need for a stable climate, clean air and water, healthy soils and restore biodiversity.

Healthy soils are a key climate mitigation tool. Healthy soil acts as a carbon sink by drawing carbon down into the soil to store it. Improving soil health is therefore a critical way to tackle climate change. Recognising the ability of soil to sequester carbon and its contribution to climate mitigation, the UK signed onto the French government's the 4 per 1000 soil carbon initiative at the UN Climate Change Convention in Paris. This initiative aims to increase soil organic carbon by 0.4% each year. This goal to increase soil carbon sequestration must be a key policy in UK agriculture policy to help reduce GHG emissions. The UK has committed to managing all England's sustainably and to tackling degradation threats by 2030. Wales has an opportunity by leading the way on soil protection and climate change by taking action and introducing policies that the rest of the UK may emulate.

For farming systems, one opportunity lies in planting many more trees – as agroforestry schemes on farms and as woodlands and forests. As the CCC has recognised, agroforestry can help mitigate climate change by sequestering carbon. In maritime climates such as the UK, the widespread adoption of agroforestry would result in estimated average emissions reduction of 0.51 tonnes CO2 per hectare per year. The CCC has calculated that, if agroforestry were expanded to cover just 2.3% of agricultural land by 2050, accompanied by woodland creation averaging 30,000 hectares per year, this would reduce greenhouse gas emissions by 16 million tonnes of CO2e annually in 2050. We view this as a conservative estimate and look forward to the forthcoming updated emission inventory, and note that it is important for policy making in the meantime to fully

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There are major near-term opportunities to cut emissions via more concerted efforts to reduce the use of nitrogen fertiliser. This was illustrated recently by researchers studying the environmental footprint of a loaf of bread, which found that manufactured nitrogen fertiliser alone accounted for a staggering 43% of a loaf's total emissions. Whilst the contribution of fossil fuels to climate change is widely understood, there is less public and stakeholder awareness that nitrous oxide is a potent greenhouse gas (GHG) and that this accounts for around a third of the UK agricultural sector's total emissions. As the CCC has noted, the majority of these emissions arise from the estimated 900,000 tonnes of nitrogen fertiliser that is applied annually on British farmland, the manufacture of which is alone responsible for an estimated 6 million tonnes of CO2, equivalent to around 1% of the UK's emissions total. We note the CCC has estimated that measures aimed at reducing N2O emissions from agriculture – through increased the use of leguminous crops and the reduction of untimely or the excessive application of fertilisers – could deliver an annual emissions reduction of 2.7 million tonnes of CO2e by 2030. We would urge the CCC to be bold in making recommendations regarding the extent to which adoption of such practices can be widely adopted.

Question 4: What is required by 2030 to prepare for the 2050 target for an emissions reduction of at least 80% on 1990 levels, recognising that this may require that emissions in some areas are reduced close to zero? Is there any impact of the need to go beyond 80%, either in 2050 or subsequently?

In the agriculture sector, to meet the 2050 target and nearer term climate objectives, we have proposed that the UK's new UK agricultural framework should include a strategy to increase the adoption of organic farming to achieve at least 10% of UK farmland to be managed organically – alongside market based measures to ensure that conversion rates do not run ahead of market demand. Achieving 10% of farmland under organic production would help reduce the emissions from the agriculture sector and to sequester carbon into the soil.

Government recognition and support for sustainable agricultural practices - especially those that help meet carbon budgets - should also inform priorities and budget allocation for research, innovation and farming advisory services. There are many opportunities for knowledge sharing among farmer networks and these should be actively promoted and encouraged. The Soil Association is calling for Government to allocate 10% of the current R&D budget for innovative agriculture projects led by farmers themselves. A significant proportion of such projects can and should be dedicated to finding ways to cut greenhouse gas emissions.

In order to help climate-proof the agricultural sector and encourage new entrants to organic farming, research institutions and universities – particularly agricultural colleges – should be encouraged to offer courses in organic and agroecological farming practices, as part of a wider focus on what climate change means for the future of farming and how the sector can play its part in cutting GHG emissions and adapting to the impacts of climate change. Increasing R&D funding into innovative farm-driven projects would help to identify methods by which farming practices can help tackle climate change and field-test techniques that could help farmers adapt to growing in a changing climate.

Question 5: What are the respective roles of UK Government, Welsh Government, the wider public sector, business, third sector and individual or household behaviour in delivering emissions reductions between now and 2030? And, separately, between 2030 and 2050?

Each and every actor, whether government, business, civil society, or the general public have an important role to play in helping to meet our climate goals. Each action, however small, can help to reduce our emissions. However, as the CCC's most recent progress report has illustrated, a voluntary approach to emission reduction in the agricultural sector is no longer a valid approach. Government needs to take a strong position and drive forward climate goals. Wales has an opportunity to lead by example and to go faster and further than the UK overall.

Public procurement should be given more recognition as a powerful tool that can be used to tackle climate change and reduce emissions from agriculture and the food system. The UK public sector serves some 3.5 million meals each weekday across settings as varied as schools, nurseries, care homes, hospitals and prisons. While this accounts for little over 1% of the total food retail and catering market, its influence is significant. Food in schools and public institutions sets norms for the public and consumers, signals values, and gives integrity to government priorities and policies. To illustrate the potential scale of this impact, the current UK organic market is worth over £2 billion, so if the public sector went organic, it would approximately double that market.

As food consumers, we also have a part to play. Dietary change and the reduction of food waste is essential, if we are to secure a sustainable, climate-friendly food system. That includes less but better quality meat and dairy products – particularly moving away from intensively farmed animals fed on cereals – and instead switching to grass-fed beef and lamb, and to more plant-based diets, with more fruit, vegetables and wholegrains. Government policy can help achieve this behavioural shift and campaigns such as Eating Better has been strongly supporting policy revisions. Not only would this be good for efforts to tackle climate change, it would be good for our health too.

Question 6: As a business, as a Public Sector Body, or as a citizen, how do emissions targets affect your planning and decision-making?

18. Emissions targets are important for ensuring organisations involved in the agriculture and food sector consider the climate impact of their practises and adjust their approach to reduce and mitigate their emissions. Near-term as well as longer term targets are important to help producers alter their practices in order to mitigate risk. Gathering data through farm sensors and soil testing can inform farming practices to make them more environmentally sensitive and climate-friendly. Additionally, creating transparent open-source models that producers are able to access can help with future planning and more precise farming practices. Not only can these practices help reduce GHG emissions from farming and help mitigate climate change, but they can also prove a cost-effective measure of farmers by reducing unnecessary and costly inputs and increasing yields.

Question 7: In your area(s) of expertise, what specific circumstances need to be considered when setting targets and budgets for Wales and how could these be reflected in the targets?

19. For Wales to achieve its climate goals, agricultural practices will have to change dramatically. Isolated islands of good practice and innovation are simply not enough to achieve the changes required. Wales has an opportunity to show leadership by reorienting its farming and food system dramatically in order to mitigate and adapt to the realities of climate change.

Question 8: The power and industry sectors in Wales are dominated by a small number of large emitters. What are the key challenges and opportunities that this presents in setting the levels of carbon budgets and how should the process of setting them reflect these?

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Public procurement should be given more recognition as a powerful tool that can be used to tackle climate change and reduce emissions from agriculture and the food system. The UK public sector serves some 3.5 million meals each weekday across settings as varied as schools, nurseries, care homes, hospitals and prisons. While this accounts for little over 1% of the total food retail and catering market, its influence is significant. Food in schools and public institutions sets norms for the public and consumers, signals values, and gives integrity to government priorities and policies. To illustrate the potential scale of this impact, the current UK organic market is worth over £2 billion, so if the public sector went organic, it would approximately double that market.

As food consumers, we also have a part to play. Dietary change and the reduction of food waste is essential, if we are to secure a sustainable, climate-friendly food system. That includes less but better quality meat and dairy products – particularly moving away from intensively farmed animals fed on cereals – and instead switching to grass-fed beef and lamb, and to more plant-based diets, with more fruit, vegetables and wholegrains. Government policy can help achieve this behavioural shift and campaigns such as Eating Better has been strongly supporting policy revisions. Not only would this be good for efforts to tackle climate change, it would be good for our health too.

Question 6: As a business, as a Public Sector Body, or as a citizen, how do emissions targets affect your planning and decision-making?

18. Emissions targets are important for ensuring organisations involved in the agriculture and food sector consider the climate impact of their practises and adjust their approach to reduce and mitigate their emissions. Near-term as well as longer term targets are important to help producers alter their practices in order to mitigate risk. Gathering data through farm sensors and soil testing can inform farming practices to make them more environmentally sensitive and climate-friendly. Additionally, creating transparent open-source models that producers are able to access can help with future planning and more precise farming practices. Not only can these practices help reduce GHG emissions from farming and help mitigate climate change, but they can

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Question 8: The power and industry sectors in Wales are dominated by a small number of large emitters. What are the key challenges and opportunities that this presents in setting the levels of carbon budgets and how should the process of setting them reflect these?

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No response

Organisation

Soil Association

Email

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01173145133

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01443 845957

4. Yes, we agree that meeting the commitments within the Paris Agreement means adopting a deeper reduction in emissions than 80% by 2050, and a corresponding change in nearer-term targets, including for reasons of avoiding lock-in to high carbon investment. To achieve these reductions, the agriculture sector must be included. Targets to reduce Welsh GHG emissions should incorporate a strong emphasis on food and farming. Until recently,

farming has been the elephant in the room when it comes to climate change. We also note that some calculations of the contribution of farming to GHG emissions (such as the calculation that farming is responsible for 10% of the EU's overall emissions) often ignore emissions from animal feed production outside of the EU, the manufacture of nitrogen fertiliser or other agro-chemicals, and the transport of agricultural products. It also excludes the emissions related to land use change (for example, ploughing up forest or grassland for crops) or losses of soil carbon. A new report from IFOAM EU estimates that altogether, one-third of global GHG emissions could be linked to the farming and food industries – production, processing, distribution and consumption. We would like to see the emissions reductions targets adopted by Wales in the near- and long-term take into account a full assessment of food and farming related emissions.

If tackling climate change is to be a top priority for food and farming policy, emissions targets in the short and long term set out in climate change policy and by the CCC must be fully reflected in future agriculture policy too. The Soil Association has called for a commitment to zero-carbon farming by around 2050 and proposed some solutions to help achieve that goal.

Organic farming methods can help to deliver this goal and therefore should be more strongly supported by the Government. Evidence shows that organic farms generally emit fewer greenhouse gases, use less energy and store greater amounts of carbon in soils per hectare than non-organic farms; the IFOAM EU report estimates that conversion to 50% of EU land under organic farming by 2030 would equate to a 23% cut in agricultural GHG emissions through increased soil carbon sequestration and

reduced application of manufactured nitrogen fertilisers.

Question 2: Do you think that leaving the EU has an impact on the targets or how they can be met?

Yes, leaving the EU will have a considerable impact in particular on how the targets can be met and in relation to the overall political priority attached to cutting greenhouse gas emissions and the need for agriculture to contribute its fair share. It is vital that climate policy and targets set in Wales or at UK level are not undermined by other areas of Government especially in the light of Brexit. For example, trade deals must be 'climate proofed' so that they do not erode the chances of carbon budgets being met, and they do not simply export emissions overseas.

However, the significant focus on the development of a new UK agriculture policy is an opportunity – as long as there is commitment from the highest levels in Government to ensuring this is compatible with the UK's climate commitments domestically and globally. This compatibility between climate and agricultural policy must extend to the devolved nations too. For decades, the EU Common Agricultural Policy (CAP) has helped provide stability for many farm communities, and it has contributed increasingly to the conservation and protection of the environment. However, as most of its budget pays landowners simply for the area they farm, it has also smothered efforts to tackle climate change and this has not been a priority in policy design. In preparing to leave the EU, the UK has an opportunity to set in place policies that help our farming communities mitigate and adapt to climate change, and this opportunity must not be squandered.

Question 3: In the area(s) of your expertise, what are the

opportunities and challenges in reducing Welsh emissions in the nearer term (e.g. to 2030)?

Achieving climate-friendly farming will depend on the innovation of farmers to adopt sustainable practices and deploy new methods and technologies which make the most of natural processes without the need for costly and environmentally damaging inputs. Organic farming provides a model for sustainable food security, and helps mitigate climate change. Often claims of 'food security' are used to support more intensive, industrialised agriculture but that approach ignores the need for a stable climate, clean air and water, healthy soils and restore biodiversity.

Healthy soils are a key climate mitigation tool. Healthy soil acts as a carbon sink by drawing carbon down into the soil to store it. Improving soil health is therefore a critical way to tackle climate change. Recognising the ability of soil to sequester carbon and its contribution to climate mitigation, the UK signed onto the French government's the 4 per 1000 soil carbon initiative at the UN Climate Change Convention in Paris. This initiative aims to increase soil organic carbon by 0.4% each year. This goal to increase soil carbon sequestration must be a key policy in UK agriculture policy to help reduce GHG emissions. The UK has committed to managing all England's sustainably and to tackling degradation threats by 2030. Wales has an opportunity by leading the way on soil protection and climate change by taking action and introducing policies that the rest of the UK may emulate.

For farming systems, one opportunity lies in planting many more trees – as agroforestry schemes on farms and as woodlands and forests. As the CCC has

recognised, agroforestry can help mitigate climate change by sequestering carbon. In maritime climates such as the UK, the widespread adoption of agroforestry would result in estimated average emissions reduction of 0.51 tonnes CO2 per hectare per year. The CCC has calculated that, if agroforestry were expanded to cover just 2.3% of agricultural land by 2050, accompanied by woodland creation averaging 30,000 hectares per year, this would reduce greenhouse gas emissions by 16 million tonnes of CO2e annually in 2050. We view this as a conservative estimate and look forward to the forthcoming updated emission inventory, and note that it is important for policy making in the meantime to fully consider the potential contribution of agroforestry.

There are major near-term opportunities to cut emissions via more concerted efforts to reduce the use of nitrogen fertiliser. This was illustrated recently by researchers studying the environmental footprint of a loaf of bread, which found that manufactured nitrogen fertiliser alone accounted for a staggering 43% of a loaf's total emissions. Whilst the contribution of fossil fuels to climate change is widely understood, there is less public and stakeholder awareness that nitrous oxide is a potent greenhouse gas (GHG) and that this accounts for around a third of the UK agricultural sector's total emissions. As the CCC has noted, the majority of these emissions arise from the estimated 900,000 tonnes of nitrogen fertiliser that is applied annually on British farmland, the manufacture of which is alone responsible for an estimated 6 million tonnes of CO2, equivalent to around 1% of the UK's emissions total. We note the CCC has estimated that measures aimed at reducing N2O emissions from agriculture – through increased the use of leguminous crops and the

reduction of untimely or the excessive application of fertilisers – could deliver an annual emissions reduction of 2.7 million tonnes of CO2e by 2030. We would urge the CCC to be bold in making recommendations regarding the extent to which adoption of such practices can be widely adopted.

Question 4: What is required by 2030 to prepare for the 2050 target for an emissions reduction of at least 80% on 1990 levels, recognising that this may require that emissions in some areas are reduced close to zero? Is there any impact of the need to go beyond 80%, either in 2050 or subsequently?

In the agriculture sector, to meet the 2050 target and nearer term climate objectives, we have proposed that the UK's new UK agricultural framework should include a strategy to increase the adoption of organic farming to achieve at least 10% of UK farmland to be managed organically – alongside market based measures to ensure that conversion rates do not run ahead of market demand. Achieving 10% of farmland under organic production would help reduce the emissions from the agriculture sector and to sequester carbon into the soil.

Government recognition and support for sustainable agricultural practices - especially those that help meet carbon budgets - should also inform priorities and budget allocation for research, innovation and farming advisory services. There are many opportunities for knowledge sharing among farmer networks and these should be actively promoted and encouraged. The Soil Association is calling for Government to allocate 10% of the current R&D budget for innovative agriculture projects led by farmers themselves. A significant proportion of such projects can and should be dedicated to finding ways to cut greenhouse gas

emissions.

In order to help climate-proof the agricultural sector and encourage new entrants to organic farming, research institutions and universities – particularly agricultural colleges – should be encouraged to offer courses in organic and agroecological farming practices, as part of a wider focus on what climate change means for the future of farming and how the sector can play its part in cutting GHG emissions and adapting to the impacts of climate change. Increasing R&D funding into innovative farm-driven projects would help to identify methods by which farming practices can help tackle climate change and field-test techniques that could help farmers adapt to growing in a changing climate.

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Leaving the EU will not have a direct impact on Wales' targets but it could indirectly impact how efficiently and effectively targets can be achieved. A significant number of EU funding programmes such as Horizon 2020 and ERDF for example, continue to support decarbonisation in Wales. Leaving the EU is likely to mean that such funding would cease to be available. It is therefore essential to understand how European funding is currently contributing to reducing emissions in Wales, and to consider how this could be replaced in future, either through like-for-like funding or other means.

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emissions overseas.

However, the significant focus on the development of a new UK agriculture policy is an opportunity – as long as there is commitment from the highest levels in Government to ensuring this is compatible with the UK's climate commitments domestically and globally. This compatibility between climate and agricultural policy must extend to the devolved nations too. For decades, the EU Common Agricultural Policy (CAP) has helped provide stability for many farm communities, and it has contributed increasingly to the conservation and protection of the environment. However, as most of its budget pays landowners simply for the area they farm, it has also smothered efforts to tackle climate change and this has not been a priority in policy design. In preparing to leave the EU, the UK has an opportunity to set in place policies that help our farming communities mitigate and adapt to climate change, and this opportunity must not be squandered.

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Reducing Welsh emissions in the nearer term needs be considered through three lenses: demand, supply and integration:

· Demand: Energy efficiency continues to be the most cost-effective way to reduce emissions in many contexts. Improving energy efficiency should therefore be a central pillar of Wales' emissions reduction strategy and should span domestic, SME, industrial and public sector contexts.

· Supply: Wales can reduce its electricity emissions in the nearer term through a variety of generation technologies that Wales is well-placed to exploit, including offshore wind, and tidal power, in addition to solar, onshore wind and hydro which have seen reasonably good uptake in Wales over the past number of years. Wales can reduce its heat emissions by continuing to accelerate the deployment of heat networks and also potentially by introducing hydrogen for heat and industry. Wales can reduce its transport emissions by accelerating the roll-out of electric and hydrogen vehicles.

· Integration: Carbon capture and storage (CCS), energy storage and demand side management and flexibility will play an increasingly important role in future energy systems. Identifying and implementing the best options presents both a challenge and an opportunity.

Analysis of the relative opportunities presented by some of the above options can be found in the Carbon Trust's Low Carbon R&D Strategy for Wales. This study for the Welsh Government, conducted in 2013, prioritised opportunities in offshore renewables and smart grids – based on quantifying the economic opportunity and mapping the Welsh supply chain capabilities.

One of the key overall challenges facing Wales in reducing its emissions is taking strategic investment decisions that (1) support the achievement of both nearer term and longer term targets; and (2) retain optionality in the face of significant and unavoidable uncertainty. An example of a decision-making approach designed for this context is the Carbon Trust's 'Analysis of Electricity System Flexibility for Great Britain' from 2016, which uses a 'least worst regrets' methodology.

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Healthy soils are a key climate mitigation tool. Healthy soil acts as a carbon sink by drawing carbon down into the soil to store it. Improving soil health is therefore a critical way to tackle climate change. Recognising the ability of soil to sequester carbon and its contribution to climate mitigation, the UK signed onto the French government's the 4 per 1000 soil carbon initiative at the UN Climate Change Convention in Paris. This initiative aims to increase soil organic carbon by 0.4% each year. This goal to increase soil carbon sequestration must be a key policy in UK agriculture policy to help reduce GHG emissions. The UK has committed to managing all England's sustainably and to tackling degradation threats by 2030. Wales has an opportunity by leading the way on soil protection and climate change by taking action and introducing policies that the rest of the UK may emulate.

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There are major near-term opportunities to cut emissions via more concerted efforts to reduce the use of nitrogen fertiliser. This was illustrated recently by researchers studying the environmental footprint of a loaf of bread, which found that manufactured nitrogen fertiliser alone accounted for a staggering 43% of a loaf's total emissions. Whilst the contribution of fossil fuels to climate change is widely understood, there is less public and stakeholder awareness that nitrous oxide is a potent greenhouse gas (GHG) and that this accounts for around a third of the UK agricultural sector's total emissions. As the CCC has noted, the majority of these emissions arise from the estimated 900,000 tonnes of nitrogen fertiliser that is applied annually on British farmland, the manufacture of which is alone responsible for an estimated 6 million tonnes of CO2, equivalent to around 1% of the UK's emissions total. We note the CCC has estimated that measures aimed at reducing N2O emissions from agriculture – through increased the use of leguminous crops and the reduction of untimely or the excessive application of fertilisers – could deliver an annual emissions reduction of 2.7 million tonnes of CO2e by 2030. We would urge the CCC to be bold in making recommendations regarding the extent to which adoption of such practices can be widely adopted.

Question 4: What is required by 2030 to prepare for the 2050 target for an emissions reduction of at least 80% on 1990 levels, recognising that this may require that emissions in some areas are reduced close to zero? Is there any impact of the need to go beyond 80%, either in 2050 or subsequently?

In the agriculture sector, to meet the 2050 target and nearer term climate objectives, we have proposed that the UK's new UK agricultural framework should include a strategy to increase the adoption of organic farming to achieve at least 10% of UK farmland to be managed organically – alongside market based measures to ensure that conversion rates do not run ahead of market demand. Achieving 10% of farmland under organic production would help reduce the emissions from the agriculture sector and to sequester carbon into the soil.

Government recognition and support for sustainable agricultural practices - especially those that help meet carbon budgets - should also inform priorities and budget allocation for research, innovation and farming advisory services. There are many opportunities for knowledge sharing among farmer networks and these should be actively promoted and encouraged. The Soil Association is calling for Government to allocate 10% of the current R&D budget for innovative agriculture projects led by farmers themselves. A significant proportion of such projects can and should be dedicated to finding ways to cut greenhouse gas emissions.

In order to help climate-proof the agricultural sector and encourage new entrants to organic farming, research institutions and universities – particularly agricultural colleges – should be encouraged to offer courses in organic and agroecological farming practices, as part of a wider focus on what climate change means for the future of farming and how the sector can play its part in cutting GHG emissions and adapting to the impacts of

climate change. Increasing R&D funding into innovative farm-driven projects would help to identify methods by which farming practices can help tackle climate change and field-test techniques that could help farmers adapt to growing in a changing climate.

Question 5: What are the respective roles of UK Government, Welsh Government, the wider public sector, business, third sector and individual or household behaviour in delivering emissions reductions between now and 2030? And, separately, between 2030 and 2050?

Each and every actor, whether government, business, civil society, or the general public have an important role to play in helping to meet our climate goals. Each action, however small, can help to reduce our emissions. However, as the CCC's most recent progress report has illustrated, a voluntary approach to emission reduction in the agricultural sector is no longer a valid approach. Government needs to take a strong position and drive forward climate goals. Wales has an opportunity to lead by example and to go faster and further than the UK overall.

Public procurement should be given more recognition as a powerful tool that can be used to tackle climate change and reduce emissions from agriculture and the food system. The UK public sector serves some 3.5 million meals each weekday across settings as varied as schools, nurseries, care homes, hospitals and prisons. While this accounts for little over 1% of the total food retail and catering market, its influence is significant. Food in schools and public institutions sets norms for the public and consumers, signals values, and gives integrity to government priorities and policies. To illustrate the potential scale of this impact, the current UK organic market is worth over £2 billion, so if the public sector went organic, it would approximately double that market.

As food consumers, we also have a part to play. Dietary change and the reduction of food waste is essential, if we are to secure a sustainable, climate-friendly food system. That includes less but better quality meat and dairy products – particularly moving away from intensively farmed animals fed on cereals – and instead switching to grass-fed beef and lamb, and to more plant-based diets, with more fruit, vegetables and wholegrains. Government policy can help achieve this behavioural shift and campaigns such as Eating Better has been strongly supporting policy revisions. Not only would this be good for efforts to tackle climate change, it would be good for our health too.

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Purely from a technological perspective, going beyond 80% cost effectively is likely to require a step change in the deployment of energy efficiency technologies and of 'conventional' renewable technologies such as wind and solar, but it is also likely to require the deployment of negative emissions technologies, such as bio-CCS for example and other early stage and emerging technologies.

Technology however cannot be the only solution and there is a need to incentivise, support and empower Welsh organisations and citizens - society as a whole - to engage with the decarbonisation agenda. Proactive engagement to all sectors of society will be required to stimulate behavioural and cultural change and empower communities.

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There are major near-term opportunities to cut emissions via more concerted efforts to reduce the use of nitrogen fertiliser. This was illustrated recently by researchers studying the environmental footprint of a loaf of bread, which found that manufactured nitrogen fertiliser alone accounted for a staggering 43% of a loaf's total emissions. Whilst the contribution of fossil fuels to climate change is widely understood, there is less public and stakeholder awareness that nitrous oxide is a potent greenhouse gas (GHG) and that this accounts for around a third of the UK agricultural sector's total emissions. As the CCC has noted, the majority of these emissions arise from the estimated 900,000 tonnes of nitrogen fertiliser that is applied annually on British farmland, the manufacture of which is alone responsible for an estimated 6 million tonnes of CO2, equivalent to around 1% of the UK's emissions total. We note the CCC has estimated that measures aimed at reducing N2O emissions from agriculture – through increased the use of leguminous crops and the reduction of untimely or the excessive application of fertilisers – could deliver an annual emissions reduction of 2.7 million tonnes of CO2e by 2030. We would urge the CCC to be bold in making recommendations regarding the extent to which adoption of such practices can be widely adopted.

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Question 10: 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?

No response

Organisation	This is a complex question to which the only simple answer is that all these stakeholders and more will have important roles to play. Welsh Government's role will be critical in delivering emissions reduction in Wales, as all stakeholders will require clear legislation, guidance and support in order to make the changes
Soil Association	

Email

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4. Yes, we agree that meeting the commitments within the Paris Agreement means adopting a deeper reduction in emissions than 80% by 2050, and a corresponding change in nearer-term targets, including for reasons of avoiding lock-in to high carbon investment. To achieve these reductions, the agriculture sector must be included. Targets to reduce Welsh GHG emissions should incorporate a strong emphasis on food and farming. Until recently, farming has been the elephant in the room when it comes to climate change. We also note that some calculations of the contribution of farming to GHG emissions (such as the calculation that farming is responsible for 10% of the EU's overall emissions) often ignore emissions from animal feed production outside of the EU, the manufacture of nitrogen fertiliser or other agro-chemicals, and the transport of agricultural products. It also excludes the emissions related to land use change (for example, ploughing up forest or grassland for crops) or losses of soil carbon. A new report from IFOAM EU estimates that altogether, one-third of global GHG emissions could be linked to the farming and food industries – production, processing, distribution and consumption. We would like to see the emissions reductions targets adopted by Wales in the near- and long-term take into account a full assessment of food and farming related emissions.

required to play their part in reducing emissions.

The Carbon Trust is working together with the Energy Systems Catapult to develop an approach to map out the respective roles of stakeholders in the energy transition – the "Whole Energy Systems Methodology (WESM)". The future energy transition is going to be far more dependent on a broader set of stakeholders than the old, centralised approach. Understanding these stakeholders, their needs and interactions presents a challenge that is not currently well served by an approach to energy policy grounded in the old, centralised approach. WESM provides a practical solution to this challenge. This approach could be aligned with the Wellbeing of Future Generations' five ways of working: 'long-term', 'prevention', 'integration', 'collaboration' and 'involvement'.

If tackling climate change is to be a top priority for food and farming policy, emissions targets in the short and long term set out in climate change policy and by the CCC must be fully reflected in future agriculture policy too. The Soil Association has called for a commitment to zero-carbon farming by around 2050 and proposed some solutions to help achieve that goal.

Organic farming methods can help to deliver this goal and therefore should be more strongly supported by the Government. Evidence shows that organic farms generally emit fewer greenhouse gases, use less energy and store greater amounts of carbon in soils per hectare than non-organic farms; the IFOAM EU report estimates that conversion to 50% of EU land under organic farming by 2030 would equate to a 23% cut in agricultural GHG emissions through increased soil carbon sequestration and reduced application of manufactured nitrogen fertilisers.

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Yes, leaving the EU will have a considerable impact in particular on how the targets can be met and in relation to the overall political priority attached to cutting greenhouse gas emissions and the need for agriculture to contribute its fair share. It is vital that climate policy and targets set in Wales or at UK level are not undermined by other areas of Government especially in the light of Brexit. For example, trade deals must be 'climate proofed' so that they do not erode the chances of carbon budgets being met, and they do not simply export emissions overseas.

However, the significant focus on the development of a new UK agriculture policy is an opportunity – as long as there is commitment from the highest levels in Government

to ensuring this is compatible with the UK's climate commitments domestically and globally. This compatibility between climate and agricultural policy must extend to the devolved nations too. For decades, the EU Common Agricultural Policy (CAP) has helped provide stability for many farm communities, and it has contributed increasingly to the conservation and protection of the environment. However, as most of its budget pays landowners simply for the area they farm, it has also smothered efforts to tackle climate change and this has not been a priority in policy design. In preparing to leave the EU, the UK has an opportunity to set in place policies that help our farming communities mitigate and adapt to climate change, and this opportunity must not be squandered.

Question 3: In the area(s) of your expertise, what are the opportunities and challenges in reducing Welsh emissions in the nearer term (e.g. to 2030)?

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No response

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Energy and carbon targets are often based on energy system models and other analysis that focus on techno-economic considerations, i.e. what are the most cost-effective technological solutions. The real-world consists of people and their rational and irrational needs and fears. These factors become even more relevant and important in the context of high potential disruption and uncertainty, both of which are almost inevitable in the kind of large-scale energy transition facing Wales. Therefore, Wales needs to fully integrate factors surrounding cultural and behavioural change into its thinking, strategy and targets.

Question 1: Does the Paris Agreement mean that Welsh emissions targets should keep open a deeper reduction in emissions than 80% by 2050? Are there implications for nearer-term targets?

4. Yes, we agree that meeting the commitments within the Paris Agreement means adopting a deeper reduction in emissions than 80% by 2050, and a corresponding change in nearer-term targets, including for reasons of avoiding lock-in to high carbon investment. To achieve these reductions, the agriculture sector must be included. Targets to reduce Welsh GHG emissions should incorporate a strong emphasis on food and farming. Until recently, farming has been the elephant in the room when it comes to climate change. We also note that some calculations of the contribution of farming to GHG emissions (such as the calculation that farming is responsible for 10% of the EU's overall emissions) often ignore emissions from animal feed production outside of the EU, the manufacture of nitrogen fertiliser or other agro-chemicals, and the transport of agricultural products. It also excludes the emissions related to land use change (for example, ploughing up forest or grassland for crops) or losses of soil carbon. A new report from IFOAM EU estimates that altogether, one-third of global GHG emissions could be linked to the farming and food industries – production, processing, distribution and consumption. We would like to see the emissions reductions targets adopted by Wales in the near- and long-term take into account a full assessment of food and farming related emissions.

If tackling climate change is to be a top priority for food and farming policy, emissions targets in the short and long term set out in climate change policy and by the CCC must be fully reflected in future

agriculture policy too. The Soil Association has called for a commitment to zero-carbon farming by around 2050 and proposed some solutions to help achieve that goal.

Organic farming methods can help to deliver this goal and therefore should be more strongly supported by the Government. Evidence shows that organic farms generally emit fewer greenhouse gases, use less energy and store greater amounts of carbon in soils per hectare than non-organic farms; the IFOAM EU report estimates that conversion to 50% of EU land under organic farming by 2030 would equate to a 23% cut in agricultural GHG emissions through increased soil carbon sequestration and reduced application of manufactured nitrogen fertilisers.

Question 2: Do you think that leaving the EU has an impact on the targets or how they can be met?

Yes, leaving the EU will have a considerable impact in particular on how the targets can be met and in relation to the overall political priority attached to cutting greenhouse gas emissions and the need for agriculture to contribute its fair share. It is vital that climate policy and targets set in Wales or at UK level are not undermined by other areas of Government especially in the light of Brexit. For example, trade deals must be 'climate proofed' so that they do not erode the chances of carbon budgets being met, and they do not simply export emissions overseas.

However, the significant focus on the development of a new UK agriculture policy is an opportunity – as long as there is commitment from the highest levels in Government to ensuring this is compatible with the UK's climate commitments domestically and globally. This compatibility between climate and agricultural policy must extend to the devolved

nations too. For decades, the EU Common Agricultural Policy (CAP) has helped provide stability for many farm communities, and it has contributed increasingly to the conservation and protection of the environment. However, as most of its budget pays landowners simply for the area they farm, it has also smothered efforts to tackle climate change and this has not been a priority in policy design. In preparing to leave the EU, the UK has an opportunity to set in place policies that help our farming communities mitigate and adapt to climate change, and this opportunity must not be squandered.

Question 3: In the area(s) of your expertise, what are the opportunities and challenges in reducing Welsh emissions in the nearer term (e.g. to 2030)?

Achieving climate-friendly farming will depend on the innovation of farmers to adopt sustainable practices and deploy new methods and technologies which make the most of natural processes without the need for costly and environmentally damaging inputs. Organic farming provides a model for sustainable food security, and helps mitigate climate change. Often claims of 'food security' are used to support more intensive, industrialised agriculture but that approach ignores the need for a stable climate, clean air and water, healthy soils and restore biodiversity.

Healthy soils are a key climate mitigation tool. Healthy soil acts as a carbon sink by drawing carbon down into the soil to store it. Improving soil health is therefore a critical way to tackle climate change. Recognising the ability of soil to sequester carbon and its contribution to climate mitigation, the UK signed onto the French government's the 4 per 1000 soil carbon initiative at the UN Climate Change Convention in Paris. This initiative aims to increase

soil organic carbon by 0.4% each year. This goal to increase soil carbon sequestration must be a key policy in UK agriculture policy to help reduce GHG emissions. The UK has committed to managing all England's sustainably and to tackling degradation threats by 2030. Wales has an opportunity by leading the way on soil protection and climate change by taking action and introducing policies that the rest of the UK may emulate.

For farming systems, one opportunity lies in planting many more trees – as agroforestry schemes on farms and as woodlands and forests. As the CCC has recognised, agroforestry can help mitigate climate change by sequestering carbon. In maritime climates such as the UK, the widespread adoption of agroforestry would result in estimated average emissions reduction of 0.51 tonnes CO2 per hectare per year. The CCC has calculated that, if agroforestry were expanded to cover just 2.3% of agricultural land by 2050, accompanied by woodland creation averaging 30,000 hectares per year, this would reduce greenhouse gas emissions by 16 million tonnes of CO2e annually in 2050. We view this as a conservative estimate and look forward to the forthcoming updated emission inventory, and note that it is important for policy making in the meantime to fully consider the potential contribution of agroforestry.

There are major near-term opportunities to cut emissions via more concerted efforts to reduce the use of nitrogen fertiliser. This was illustrated recently by researchers studying the environmental footprint of a loaf of bread, which found that manufactured nitrogen fertiliser alone accounted for a staggering 43% of a loaf's total emissions. Whilst the contribution of fossil fuels to climate change is widely

understood, there is less public and stakeholder awareness that nitrous oxide is a potent greenhouse gas (GHG) and that this accounts for around a third of the UK agricultural sector's total emissions. As the CCC has noted, the majority of these emissions arise from the estimated 900,000 tonnes of nitrogen fertiliser that is applied annually on British farmland, the manufacture of which is alone responsible for an estimated 6 million tonnes of CO2, equivalent to around 1% of the UK's emissions total. We note the CCC has estimated that measures aimed at reducing N2O emissions from agriculture – through increased the use of leguminous crops and the reduction of untimely or the excessive application of fertilisers – could deliver an annual emissions reduction of 2.7 million tonnes of CO2e by 2030. We would urge the CCC to be bold in making recommendations regarding the extent to which adoption of such practices can be widely adopted.

Question 4: What is required by 2030 to prepare for the 2050 target for an emissions reduction of at least 80% on 1990 levels, recognising that this may require that emissions in some areas are reduced close to zero? Is there any impact of the need to go beyond 80%, either in 2050 or subsequently?

In the agriculture sector, to meet the 2050 target and nearer term climate objectives, we have proposed that the UK's new UK agricultural framework should include a strategy to increase the adoption of organic farming to achieve at least 10% of UK farmland to be managed organically – alongside market based measures to ensure that conversion rates do not run ahead of market demand. Achieving 10% of farmland under organic production would help reduce the emissions from the agriculture sector and to sequester carbon into the soil.

Government recognition and support for sustainable agricultural practices - especially those that help meet carbon budgets - should also inform priorities and budget allocation for research, innovation and farming advisory services. There are many opportunities for knowledge sharing among farmer networks and these should be actively promoted and encouraged. The Soil Association is calling for Government to allocate 10% of the current R&D budget for innovative agriculture projects led by farmers themselves. A significant proportion of such projects can and should be dedicated to finding ways to cut greenhouse gas emissions.

In order to help climate-proof the agricultural sector and encourage new entrants to organic farming, research institutions and universities – particularly agricultural colleges – should be encouraged to offer courses in organic and agroecological farming practices, as part of a wider focus on what climate change means for the future of farming and how the sector can play its part in cutting GHG emissions and adapting to the impacts of climate change. Increasing R&D funding into innovative farm-driven projects would help to identify methods by which farming practices can help tackle climate change and field-test techniques that could help farmers adapt to growing in a changing climate.

Question 5: What are the respective roles of UK Government, Welsh Government, the wider public sector, business, third sector and individual or household behaviour in delivering emissions reductions between now and 2030? And, separately, between 2030 and 2050?

Each and every actor, whether government, business, civil society, or the general public have an

important role to play in helping to meet our climate goals. Each action, however small, can help to reduce our emissions. However, as the CCC's most recent progress report has illustrated, a voluntary approach to emission reduction in the agricultural sector is no longer a valid approach. Government needs to take a strong position and drive forward climate goals. Wales has an opportunity to lead by example and to go faster and further than the UK overall.

Public procurement should be given more recognition as a powerful tool that can be used to tackle climate change and reduce emissions from agriculture and the food system. The UK public sector serves some 3.5 million meals each weekday across settings as varied as schools, nurseries, care homes, hospitals and prisons. While this accounts for little over 1% of the total food retail and catering market, its influence is significant. Food in schools and public institutions sets norms for the public and consumers, signals values, and gives integrity to government priorities and policies. To illustrate the potential scale of this impact, the current UK organic market is worth over £2 billion, so if the public sector went organic, it would approximately double that market.

As food consumers, we also have a part to play. Dietary change and the reduction of food waste is essential, if we are to secure a sustainable, climate-friendly food system. That includes less but better quality meat and dairy products – particularly moving away from intensively farmed animals fed on cereals – and instead switching to grass-fed beef and lamb, and to more plant-based diets, with more fruit, vegetables and wholegrains. Government policy can help achieve this behavioural shift and campaigns such as Eating Better has been strongly

supporting policy revisions. Not only would this be good for efforts to tackle climate change, it would be good for our health too.

Question 6: As a business, as a Public Sector Body, or as a citizen, how do emissions targets affect your planning and decision-making?

18. Emissions targets are important for ensuring organisations involved in the agriculture and food sector consider the climate impact of their practises and adjust their approach to reduce and mitigate their emissions. Near-term as well as longer term targets are important to help producers alter their practices in order to mitigate risk. Gathering data through farm sensors and soil testing can inform farming practices to make them more environmentally sensitive and climate-friendly. Additionally, creating transparent open-source models that producers are able to access can help with future planning and more precise farming practices. Not only can these practices help reduce GHG emissions from farming and help mitigate climate change, but they can also prove a cost-effective measure of farmers by reducing unnecessary and costly inputs and increasing yields.

Question 7: In your area(s) of expertise, what specific circumstances need to be considered when setting targets and budgets for Wales and how could these be reflected in the targets?

19. For Wales to achieve its climate goals, agricultural practices will have to change dramatically. Isolated islands of good practice and innovation are simply not enough to achieve the changes required. Wales has an opportunity to show leadership by reorienting its farming and food system dramatically in order to mitigate and adapt to the realities of climate change.

Question 8: The power and industry sectors in Wales are

dominated by a small number of large emitters. What are the key challenges and opportunities that this presents in setting the levels of carbon budgets and how should the process of setting them reflect these?

20. No response

Question 9: 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?

In assessing the impact of climate change and of mitigation efforts, the committee we must continue to rely on science and data. It is essential to base decisions on independently verified and peer-reviewed science that is rigorous and unbiased. One role of civil society to act as a watch-dog and to continue to stress the importance of scientific rigour. Citizen science may also offer a contribution. Farmers can provide vital real-world evidence and key data points to help build out a fuller picture of climate impacts and of the efficacy of measures introduced to cut greenhouse gas emissions. Transparent data which is made public through open source platforms allows for greater public confidence.

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