Department for Business, Energy & Industrial Strategy

CHEMISTRY GROWTH PARTNERSHIP

Chemicals Sector

Joint Industry - Government

Industrial Decarbonisation and Energy Efficiency Roadmap Action Plan

October 2017

JOINT ACTIONS TO DELIVER THE 2050 DECARBONISATION ROADMAPS

Contents

Foreword from the Minister of State

With industry representing nearly a quarter of UK emissions, helping industrial sectors decarbonise and improve their energy efficiency is a crucial part of our Clean Growth Strategy for meeting the UK's legally binding Carbon Budgets. It will also be essential for achieving the Industrial Strategy's aims of reducing business energy costs, improving industrial productivity and competitiveness, and driving clean economic growth.

Globally, investment in clean technologies is rising while costs fall. Against this backdrop, few countries have been more successful than the UK in growing their economy while reducing emissions – cutting UK emissions by over 40 per cent[1] while growing the overall UK economy by 67 per cent[2]. In parallel, the UK has been improving energy security, creating jobs and realising export opportunities from the new industries and companies that have been created.

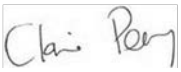
The Industrial Decarbonisation and Energy Efficiency Roadmaps project is a key collaboration between Government and industry to help industry make the low carbon transition while also maintaining its competitiveness. The publication of this action plan is an important milestone for the project, as it identifies commitments from all parties to enable the chemicals sector to decarbonise and improve its energy efficiency. These commitments build on the potential identified in Phase 1 of the Industrial Roadmaps project, which provided an evidence base of the carbon savings industry could expect to make in different decarbonisation scenarios.

The actions in this plan would not have been possible without such strong and constructive input from the chemicals sector so I would like to extend a huge thank you to them for helping us get this far. They are voluntary but provide an important framework for future decarbonisation and energy efficiency improvements, all the way up to 2050. They cover specific technological solutions such as industrial heat recovery and fuel switching, and also wider themes such as innovation, skills development and investment which are all key pillars of the Industrial Strategy.

The identification and publication of these actions is not the end of the Industrial Roadmaps project. All parties are committed to working together to implement this action plan, while also meeting future decarbonisation challenges and opportunities as the landscape evolves. So its publication is in many ways a starting point to build on for further collaborative working, as well as a key project milestone in its own right. By building on the collaborative way of working that has been so effective so far, we will ensure this Action Plan makes a significant contribution to the Industrial Strategy's aim of delivering clean economic growth, and that it maximises the economic benefits from the UK's transition to a low carbon economy.

[1] Provisional 2016 emissions: BEIS provisional UK emissions statistics 1990-2016: https://www.gov.uk/government/statistics/provisional-uk-greenhouse-gas-emissions-national-statistics-2016

[2] Office for National Statistics, 2017, ABMI GDP series,1990-2016: https://www.ons.gov.uk/economy/grossdomesticproductgdp/timeseries/abmi/pgdp



Claire Perry
Minister of State for Climate Change and Industry

Industry Foreword

We welcome this action plan and the collaborative approach between the Chemistry Growth Partnership (CGP) and government through which it has been produced. The CGP is the industry body which is working to deliver its chemistry fuelled growth vision with government. Our shared vision sees the sector's contribution to the UK economy increase by 50% by 2030. However, if we are to achieve this aim it will be critical that the sector is able to reduce its greenhouse gas (GHG) emissions and become more energy efficient while remaining competitive during the UK's low carbon transition.

We believe this action plan compliments our strategy well. Firstly, because reducing our sites' GHG emissions is a supporting priority to the growth vision. And secondly, because our main growth priorities: securing competitive energy for use as a fuel and a feedstock (raw material), accelerating innovation, and rebuilding supply chains, also align with many of the tasks in the plan. For example: increased use of bio-resources, waste and captured carbon as a feedstock, clustering, and the development and scale-up of innovative decarbonisation and energy efficiency technologies. Indeed, the latter is expected to be an enabler for climate solutions in other sectors – thereby adding to the energy saving solutions the chemical sector already provides to the UK's homes and its energy, transport and agricultural sectors

The action plan also builds on the sector's long track record for energy efficiency improvements under voluntary agreements with the UK government, most recently: the Climate Change Agreements. Indeed since 1990 the sector has improved its energy efficiency by 35%[3]. This has been achieved through a range of cost effective actions - not least investing in combined heat and power generation (CHP) - which supplies a third of the sector's power needs. While much of the potential from implementing established technologies has been realised, some remains - albeit with long paybacks.

Both this action plan and the growth strategy recognise that competitive energy related costs and a predictable policy framework are key enablers to further investment in the UK chemical sector. This includes help, where needed, to reduce carbon emissions, whether by established or new technologies. We therefore very much welcome the proposals in the Government's Industrial Strategy Green Paper which seek to address these challenges. It is critical that we do so successfully if we are to grow the UK's base of essential foundation industries like chemicals. The CGP therefore looks forward to continuing to work with government to implement this action plan and develop an effective industrial strategy for the UK chemical sector.

[3] http://www.spice3.eu/DE/about/partners/22-uk-chemical-industries-association-cia

Chairman Chemical sectors council
Steve Foots

The parties named in this action plan support the actions attributed to them, but have not made a legally binding commitment to fulfil those actions.

1. Introduction and Policy Overview

In 2015 the world committed to the historic Paris Agreement which saw 195 countries commit to take action to reduce emissions. This Agreement included the goal of keeping the global mean temperature rise to well below two degrees, whilst pursuing efforts to limit temperatures rises to less than 1.5 degrees. Additionally, the Agreement enshrines a goal of net zero greenhouse gas emissions in the second half of this century. The UK is already playing its part in delivering the Paris Agreement through its domestic climate framework. This framework includes the UK Climate Change Act which sets a target to reduce greenhouse gas emissions by at least 80% by 2050, against 1990 levels. To do so, the UK needs to move to a more energy efficient, low-carbon economy whilst also ensuring a thriving and internationally competitive industrial sector.

As part of the UKs commitment to the Act the government is required to publish a plan which sets out how the UK will decarbonise its economy through the 2020s. For industrial sectors, this plan draws on the collaborative work of the 2050 Industrial Roadmaps project and these Action Plans. The UK has already successfully reduced its territorial emissions by 38%[1] since 1990 while growing the overall economy by over 60%. Industrial carbon emissions including those from energy-intensive industries (EIIs) have halved since 1990, which has mainly been due to efficiency gains, fuel switching, a change to industrial structure of the UK and re-location of production overseas.

However, more will need to be done, and it is a shared challenge for Government and industry to realise not only these emissions savings but also the industrial opportunities of the transition to a clean economy. These emissions savings will be predominately achieved by the eight industrial sectors that currently emit approximately two thirds of industrial carbon emissions: cement, ceramics, chemicals, food & drink, glass, iron & steel, oil refining, and pulp & paper. These sectors make a significant contribution to our economy, employing around 2% of the UK's workforce - often in regions of high relative deprivation - and making up approximately 18% of our exports[4].

The merger of the business and energy portfolios under the Department of Business, Energy and Industrial Strategy is a significant opportunity to develop cohesive policies for all UK businesses. This will be vital in driving long term growth and productivity in the UK. The department will ensure that the economy grows strongly in all parts of the country, based on a robust industrial strategy and that the UK has secure energy supplies that are reliable, affordable and clean. It will encourage investment and innovation that fully utilises the UK science base; and enable a whole economy approach to deliver the UK's climate change ambitions.[5]

As Government focuses on developing a new Industrial Strategy, it is clear that the chemicals sector will continue to play a key role in supporting the UK's growth agenda and in the regional rebalancing of the UK economy.

[4] Statistics derived from ONS data on exports and workforce
[5] Nick Hurd, Minister of State for Climate Change and Industry, 04 August 2016 - https://www.parliament.uk/business/publications/written-questions-answers-statements/written-question/Commons/2016-07-11/42339/

The Chemical Sector in the UK

The chemical industry in the UK underpins UK manufacturing supply chains by providing chemical materials and products to a range of sectors such as aerospace, automotive, construction, pharmaceuticals and final consumers. The range of chemical outputs includes basic chemicals and materials such as chlorine, fertilisers and plastics, and chemical products including agrochemical, personal care, paints and coatings, adhesives and catalysts.

The sector is highly diverse and includes over 75 large players (employing more than 250 people) and circa 2,500 SMEs and micro enterprises. In 2016 the chemicals sector generated £11.3bn GVA (6.6% of total UK manufacturing GVA and 1% of GDP); employed around 99,000 people (predominantly across 4 main clusters in the North East (Teesside), Humberside, the North West (Runcorn and other locations), and Scotland); and it was one of the largest UK manufacturing export sector by value after automotive with £24.9bn of exports, comprising 9% of all UK exports[6].

A sector already facing considerable challenges from increasing global competition, the UK's decision to leave the EU has accelerated the need to realise competitive opportunities for the UK. In the context of the Paris Agreement and potentially increased energy carbon costs, any activities to support the sector to decarbonise and become more energy efficient will be advantageous for the competitiveness of UK plants.

Carbon Emissions

The Chemicals Industrial Decarbonisation and Energy Efficiency Roadmap 2050 (the InDEE Roadmap[7]) estimated that in 2012, the sector emitted 18.4 million tonnes of CO2, the UK's second highest industrial emitter, and consumed 16.5% of all industrial energy used in the UK. Direct emissions from the sector accounted for 11.2m tonnes of CO2 (10m tonnes from fuel combustion and 1.2m tonnes from chemical processes that produce greenhouse gases as a by-product). The remaining 7.2m tonnes were from indirect emissions, i.e. related to grid-electricity used by the sector.

Thirteen UK sites were identified as producing 40% of total sector emissions, of which the largest are from sites with ammonia and hydrogen processes. There are however a large number of lower emitting operations which are still relatively energy intensive and collectively also account for significant CO2 emissions.

The thermodynamics of the sector's chemical processes mean it will always require a certain minimum amount of energy to achieve desired chemical reactions (although this is not automatically linked to the sector's direct carbon emissions). However, it is important to recognise from the outset that, driven by the need to minimise energy costs to maintain competitiveness (as a trade exposed energy intensive industry) and by climate regulations like the EU Emissions Trading System, the sector has already taken significant steps to improve its energy efficiency and reduce its carbon emissions and has reduced its GHG

[6] Source - ONS
[7] www.gov.uk/government/uploads/system/uploads/attachment_data/file/416669/Chemicals_Report.pdf

emissions by 70% in the last 20 years[8]. And it is already the default position within the sector to identify whether there are more environmentally sustainable, commercially viable products and processes it can use.

It is also important to recognise that the sector itself is a vital enabler of low-carbon industries, for example providing coatings for solar panels, lightweight materials for planes and cars, catalysts for low-carbon vehicles and insulation for homes. A 2009 study for the global chemical sector calculated that for every tonne of CO2 equivalent (CO2e) emitted by from chemicals production in 2005, the sector's products enabled 2 tonnes of CO2e to be saved[9].

Chemistry Growth Partnership (CGP) and the CGP Energy and Innovation Themed Working Group

The chemicals sector growth strategy, Chemistry at Work[10], recognised that, as one of the UK's most energy intensive industries, there are significant environmental and economic gains from delivering further decarbonisation and energy efficiency measures within the sector. The sector council, the Chemistry Growth Partnership[11] (co-chaired by BEIS Minister, Claire Perry), was therefore actively involved in the development of the 2050 Decarbonisation Roadmap for the chemicals sector (published in March 2015), supported by the Chemical Industries Association (CIA) both as Secretariat to the CGP, and whose membership also includes the 13 highest carbon emitting sites in the UK named in the Roadmap.

Following publication of the Roadmap, the CGP set up a new working group, the Decarbonisation Working Group, to work collaboratively with BEIS to develop this action plan for delivering the Roadmap. This group includes members from some of the highest emitting sites identified in the roadmap, with other high emitting sites engaged via sector workshops held during development of the action plan.

Alongside the decarbonisation agenda, the CGP continues to have a strong focus on secure and competitive supplies of energy and feedstock's, and on engaging with Government to support the development and delivery of a predictable and globally cost competitive UK energy and climate policy framework, for example through proposals for minimising carbon leakage risks from the EU Emissions Trading System and supporting provisions to enable the development of UK shale gas and other alternative feedstock's.

[8] https://www.cia.org.uk/Portals/0/Documents/Publications/Low%20carbon%20brochure_2015_MR.PDF?ver=2017-01-09-143808-563

[9] https://www.cia.org.uk/Portals/0/Documents/Publications/Low%20carbon%20brochure_2015_MR.PDF?ver=2017-01-09-143808-563

[10] http://ukchemistrygrowth.com/Portals/3/Downloads/Growth%20Strategy_Oct13_FINAL.pdf

[11] http://ukchemistrygrowth.com/Partnership.aspx

The Industrial Decarbonisation 2050 Roadmap Project and the Chemical Sector Action Plan

The Chemicals Industrial Decarbonisation and Energy Efficiency Roadmap to 2050, published in March 2015, showed that deep decarbonisation of EIIs is achievable; however, chemicals companies face significant barriers, including:

- Internal competition for resources and funding;
- Energy prices and policy costs;
- Stringent return on investment (ROI) requirements;
- Uncertainty in policy and regulation;
- Access to capital and funding;
- Commercialisation of new and unproven technology;
- High cost of research, development and demonstration (RD&D) of new technology;
- Long lifetime of major equipment.

The pathways that investigated how the sector could potentially decarbonise, to 2050, included the deployment of options comprising:

(i) Incremental improvements to existing technology;
(ii) Upgrades to utilise best available technology (BAT); and
(iii) The application of significant process changes using 'disruptive' technologies that have the potential to become commercially viable in the medium term, e.g. biomass/bioenergy and industrial carbon capture and storage/use.

Following publication of the Roadmap, the Chemistry Growth Partnership (acting on behalf of the chemicals sector) and Government have now agreed to implement this Action Plan that sets out voluntary commitments that each party will undertake to enable and support the Chemical sector to make deeper emissions reductions over the longer-term while staying competitive. This involves actions on:

1. Leadership – owning this action plan and its position as a key starting point for a strategy to lower carbon emissions from the chemicals sector and make it more energy efficient, including working to embed the role of decarbonisation in the industrial strategy – Action 1;

2. Supporting the sector to improve the assets it has and to make them more competitive, focusing on:

    - Identifying cluster opportunities for increasing energy efficiency through industrial symbiosis opportunities (Action 2), and industrial heat recovery (Action 3);
    - Consideration of potential new low carbon competitive power supplies, in particular low carbon energy generation (and demand side response) and significantly more competitive energy storage technologies (Actions 4 and 5).
    - Helping the sector to navigate its way through the range of technologies that are already available, and facilitating the sector to engage with those that are most relevant to the processes that operate in the UK, that are both

economically viable and offer the greatest opportunity to reduce carbon emissions (output from innovation report - Action 5);

3. Supporting the sector to deliver transformational changes while retaining and growing its competitiveness (Actions 5-7), by:

    - Identifying the innovative technologies that offer the most potential for reducing the sector's carbon emissions;
    - Developing a prioritised strategy for supporting the sector to develop and deploy these technologies, working across businesses and with technology companies. This will include making the transition to bioenergy and using bio resources as feedstock's and developing hydrogen from electrolysis technologies, and, once the Government's new carbon capture and storage policy is confirmed, pursuing carbon capture and storage and usage technologies so that the sector can reduce, and realise value from, its carbon emissions.

4. Identifying gaps in the innovation skills base needed to deploy the carbon reduction technologies (Action 8).

5. Taking steps to resolve the question of how to finance:

    (a) Delivering commercially ready and proven state-of-the-art (and best-available-technique) technologies, particularly where they have longer payback periods (Action 9);
    (b) Providing input to Government's long-term road map to minimise business energy costs, as that process takes shape – a stable and globally cost competitive energy and climate change policy framework is critical to businesses having confidence to invest (Action 9); and
    (c) The development and scale-up of the key technologies that offer the potential to transform the sector's carbon footprint (Action 10).

Figure 1 presents a model that plots key actions on a two-by-two matrix of technology readiness (x axis) and size of project (y axis). This enables specific actions to be plotted within one of four quadrants of the model for the purposes of understanding what type of activity (or project) each action is aiming to stimulate. The four quadrants are:

1) Carbon efficient investment – smaller projects aimed at improving existing assets using technologies that are already available. The actions are aimed at understanding and improving the techno-economics of the opportunities and finding ways to encourage project implementation.

2) Strategic replacement of assets – while many companies require industrial energy efficiency investments to achieve a short payback (typically less than 2 years), replacement or development of new assets can take place where companies make strategic business decisions and accept a longer payback.

3) Actions aimed at demonstrating innovative tools, techniques, systems and technologies on existing plants/assets, i.e. supporting less mature solutions.

4) Joint government – industry demonstration projects, or larger breakthrough technology or processes which require public and private sector consortium funding and delivery.

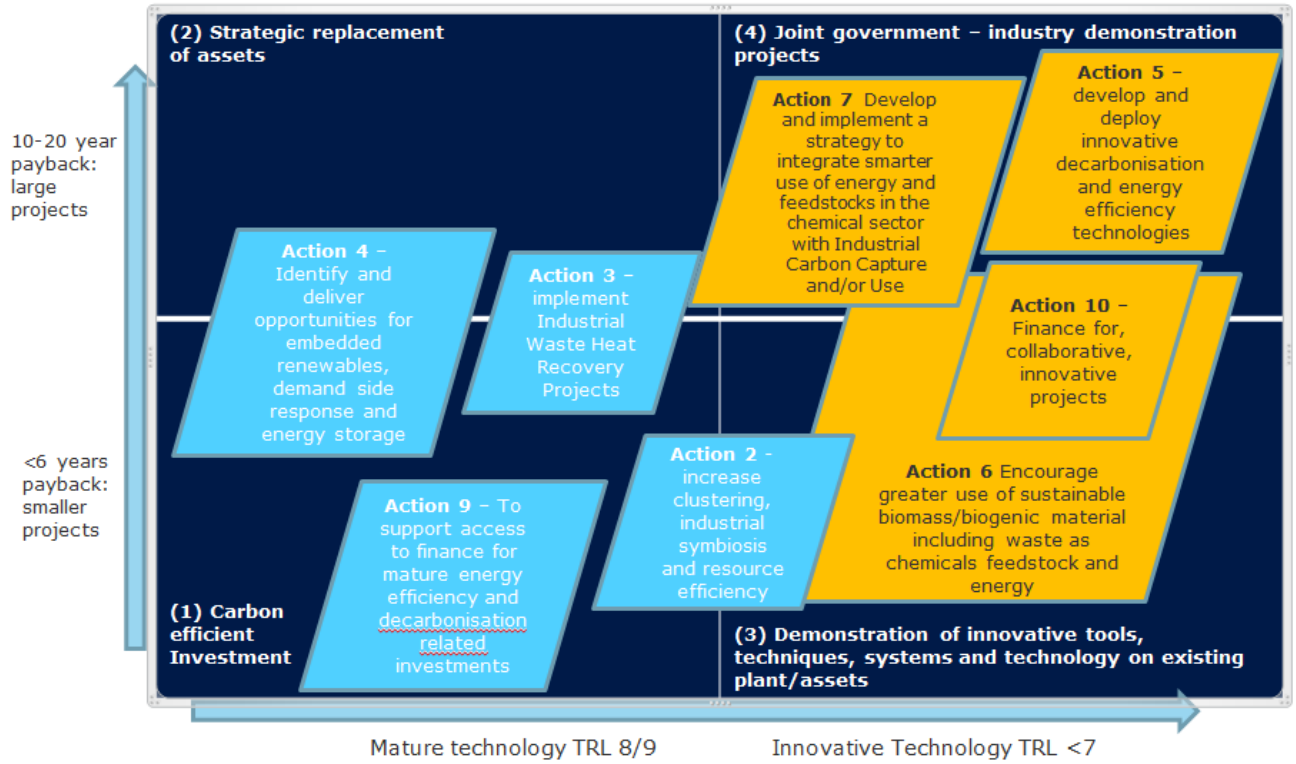


Figure 1

Sign up and Monitoring

This Action Plan is voluntary and jointly-owned between government and industry. Government and the Chemistry Growth Partnership will work with the chemicals sector together to oversee delivery of the Action Plan and future work, regularly updating on progress.

2. ACTIONS

2.1 Action 1: Strategy, Leadership and Organisation

- The Chemistry Growth Partnership (CGP) will provide leadership within the sector to actively develop the strategic themes in the action plan and monitor the progress of all actions. More specifically, it will:
    1) Communicate an industry and government joint vision about the economic and environmental importance of transitioning the chemical industry to a low carbon competitive future;
    2) Embed the action plan into the Industrial Strategy plans for the sector reflecting the integral relationship between the decarbonisation work and wider CGP agendas on supply chain development, energy supply, innovation drive and skills development.
- The objectives of the action are to provide leadership and to engage the sector with the Action Plan, the decarbonisation agenda and its value to the sector's competitiveness and growth.
- Although this action is important immediately, it must continue in the long-term throughout the period of this plan, and any further decarbonisation strategy that develops from this plan, to ensure that the priorities of decarbonisation, energy efficiency and competitiveness in the sector are maintained.
- This action underpins all the actions in the plan; the majority of the CGP leadership role identified above is picked up in the specific actions throughout this plan.
- As this is the key enabler for all other actions in this plan its impact cannot be quantified in isolation. However, it will be central to achieving the reductions identified in the rest of the plan.

Action 1 Tasks

Task 1A: Drive the decarbonisation agenda across the sector by ensuring reducing carbon emissions continues to be firmly embedded as a specific theme of the CGP growth strategy (and in any strategy refresh or Sector Deal proposed under Government's Industrial Strategy). The CGP Comms Group will be engaged to communicate the value of decarbonisation and energy efficiency measures and key best practice examples that are delivered.
Task Owner: CGP
Timing: 2017 onwards

Task 1B: The CGP (through the Decarbonisation Working Group) will actively develop the strategic themes to deliver this action plan, providing updates on delivery at CGP meetings.
Owners: CGP (Decarbonisation Working Group)
Timing: 2017 and on-going

2.2 Action 2: To increase clustering, industrial symbiosis and resource efficiency to realise benefits to UK business including the UK Chemical Sector

- This action aims to support increased clustering and industrial symbiosis activity both within the sector and on a cross-sector basis to realise further energy efficiency and carbon reduction opportunities[12].
- The objective of the action is to identify the potential for, and then deliver, successful clustering projects that deliver lower carbon emissions and improved competiveness. For each cluster, it aims to deliver a list of potential projects (short to long term, quick wins to more challenging opportunities) together with identification of the organisations that should be involved.
- This action and its tasks are both short and long term.
- This action links to all other actions in this action plan.
- Implementation of this action will deliver reduced energy consumption and lower input costs, as well as creating new commercial value, e.g. from new industrial/material symbiosis opportunities identified.

[12] Clustering includes physical integration to realise benefits and collaboration across different sectors, sharing information (and therefore being open about potential opportunities), sharing technologies and proposals.

Action 2 Tasks

Task 2A: Carry out commercial and technical feasibility studies to establish opportunities for strengthening energy-saving and emissions-reducing clusters, including cross-sector commercial benefits of clustering opportunities. The objective of these studies will be to identify suitable technologies and approaches to deliver potential energy savings, commercial benefits and decarbonisation opportunities arising from taking a clustering approach, including energy / utilities (e.g. waste heat use) and material symbiosis (e.g. use of wastes, bioenergy and CO_2 as feedstock).
Task Owner: LEPs[13], beginning with Humber, using the experience gained from/model undertaken by Tees Valley Process Industries study[14] supported by CGP supply chain group / cluster organisations.
Timing: 2017 – 2019

Task 2B: LEPs to engage companies to develop business cases for the most promising opportunities identified from the cluster opportunity studies to prove the 'opportunity' identified is commercially and technically sound. This work should draw on the technology opportunities identified in the innovation mapping work (see Action 5).
Task Owner: LEPs, local authority or combined authority, starting with TVPI (on behalf of TVU), and Humber supported by CGP supply chains group and cluster organisations.
Timing: 2017 – 2019

[13] There are 39 Local Enterprise Partnerships across England. They are local business-led partnerships between local authorities and businesses and play a central role in determining local economic priorities and undertaking activities to drive economic growth and the creation of local jobs. They can act as a gateway to government funding. The LEPs most relevant to the main chemicals clusters are the Tees Valley Unlimited (TVU) LEP, The Humber LEP, the North East LEP, the York, North Yorkshire and East Riding LEP, and the Cheshire and Warrington LEP.

[14] This methodology notes that clustering is not in the core activities of a company and includes infrastructure, utilities, logistics, very large and very small companies need to be engaged to share what they want, what they have and how information can be shared without breaching confidentiality and sensitivities.

Task 2C: LEPs to support companies (e.g. developers) to realise the proven decarbonisation and energy saving opportunities identified in feasibility studies. This will include supporting companies to identify funding sources and mechanisms, and collaboration opportunities, to enable delivery, e.g. of pilot projects, where appropriate. LEPs will collate evidence if there are policy barriers preventing these opportunities from being taken forward and feed them into Government (via the CGP).
Task Owner: Each individual LEP, local authority or combined authority, starting with TVPI (on behalf of TVU), and Humber supported by CGP supply chains group and cluster organisations.
Timing: 2017 – 2019

Task 2D: Using the outputs of Task A, the innovation mapping work and outputs from the CGP supply chains working group, take a UK-wide strategic approach to identify which clusters have unique characteristics in terms of assets, processes and supply chain gaps – and therefore which new projects/processes are best suited to which clusters. Government [DIT] to work with LEPs / Devolved Administrations and individual clusters to develop a marketing strategy for UK energy-saving clusters to attract new national and international businesses to the sites to attract investment so that supply chains are strengthened and regional growth is delivered. Utilising available best practice (e.g. in Tees Valley, Germany, the Netherlands and Belgium), to complement this, DIT will develop a method to understand and sell the combined value of UK clusters.
Task Owner: DIT (engaging Devolved Administrations, LEPs, cluster groups and the CGP supply chain group).
Timing: 2017- 2018

2.3 Action 3: to identify and implement industrial Waste Heat Recovery projects that realise benefits to UK business including the Chemical Sector

- To identify and implement industrial heat recovery projects that realise benefits for the sector
- Industry and Government will collaborate to identify and deliver industrial heat recovery projects that realise benefits for manufacturing sites in England and Wales. Government will support this by introducing an Industrial Heat Recovery Scheme. This will provide financial support for feasibility studies, to identify opportunities for recoverable heat projects and assess their costs and benefits. It will also provide financial support for capital investment, to help make industrial heat recovery projects commercially viable.
- The objective of this action is to develop a pipeline of industrial heat recovery projects, some of which companies will be able to take forward themselves, and some of which may be eligible for capital support from government. The action will enable and encourage more industry investment in, and deployment of, recoverable heat technologies, in order to reduce primary energy demand and increase low carbon heat use. It will help to tackle financial barriers to uptake, and realise economic and commercial potential for recoverable heat in industry.
- This action links to the actions relating to finance and clustering.
- Implementation of this action will contribute to a potential for industrial heat recovery in the UK in the range of 5 TWh/yr to 28 TWh/yr, arising from hundreds of source-sink-technology combinations from just 73 large industrial sites. Also primary energy demand will be reduced, leading to a reduction in fuel bills. (https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/294900/element_energy_et_al_potential_for_recovering_and_using_surplus_heat_from_industry.pdf)

Action 3 Tasks

Task 3A: Introduce Industrial Heat Recovery Scheme (IHRS) to de-risk capital investment in industrial heat recovery technologies:

- Government to introduce a financial support programme, providing:

  (i) match-funding support for onsite feasibility studies to increase knowledge and understanding of, and identify opportunities for, installation of industrial heat recovery technologies. This will help develop a pipeline of projects, some of which companies can take forward themselves, and some which may be eligible for capital support.

  (ii) capital support for industrial heat recovery investments, which have the potential to result in significant energy and carbon savings but which are not commercially viable by themselves.

- This will be a short term action, running from 2017 – 2021. It links to the clustering, Action 2.

Task Owner: BEIS, with input from industry

Timing: 2017 - 2021

Task 3B: To explore the potential for additional technologies, such as burners, process control, industrial boilers, heat recovery etc. which could be included in the Energy Technology List (ETL) to encourage wider investment opportunities through Enhanced Capital Allowances. The Carbon Trust are already doing a study to assess the potential for adding technologies to the ETL.

- The objective of this task is to encourage investment in industrial heat recovery, through exploring the inclusion of appropriate heat recovery technologies on the ECA ETL. This would help de-risk investment and increase the uptake of IHR.

Task Owner: BEIS

Timing: 2017 - 2020

Task 3C: Improve knowledge sharing and exchange of best practice in Industrial waste heat recovery:

- Improve knowledge sharing and exchange of best practice in industrial waste heat recovery. Government, industry, academia and others will look to improve knowledge sharing and exchange of best practice in the field of industrial waste heat recovery. This information could be contained on the online portal mentioned in Action 1 and Action 3.

- Dependencies / links with other actions – this action will help increase uptake of the Industrial Heat Recovery Scheme, and is therefore linked to Task A above. It is also linked to work to engage clusters (Action 2) to identify IHR opportunities – industry should seek to realise opportunities across sectoral boundaries.

Specific sub tasks:

(i) BEIS to explore improving knowledge sharing and exchange of best practice in the field of industrial waste heat recovery, including via the online portal mentioned in Action 1 and Action 3.

(ii) Supply case studies, including drawing on good examples from across Europe – Industry - 2017 → led by the Chemical Industries Association (CIA), coordinating with clusters/LEPs. BEIS (InDEE team) would develop a template, which trade associations (CIA) could circulate to members. This template would also be sent to any IHRS participants.

(iii) Implement mechanism for knowledge sharing of the case studies above - BEIS (supported by industry), and through CIA best practice events - 2017 → (dependent on actions (i), (ii) and (iii)).

Task Owner: BEIS

Timing: 2017 onwards

Task 3D: Investigate further options for incentivising the reuse of industrial waste heat:

- Further work to be undertaken on the options around incentivising reuse of waste heat in industry, using the experience from the Industrial Heat Recovery Scheme to assess the need for future support – links to the clustering actions and finding opportunities to create value across the 8 EII sectors.

- The objective of this task is to increase the evidence base and understanding of the costs and benefits of IHR, to enable further consideration of the need for providing an incentive beyond the IHRS.

- This will be a medium term action, from 2018 onwards.

- Dependencies / links with other actions – this task relies on evidence and experience gained from feasibility studies and projects undertaken through the Industrial Heat Recovery Scheme, and is therefore linked to Tasks A & B.

Specific sub tasks:

(i) Industry to develop an evidence base on the level of support needed, based on IHRS feasibility studies – Industry – 2018-2020 - Led by the CIA by encouraging its members have submitted relevant evidence, including case studies but also intelligence on possible projects that fall outside of scope for the IHRS (including projects of a high value), to BEIS, in order that an informed decision can be made.

(ii) BEIS to consider technical and economic case for providing an incentive post-IHRS – BEIS – 2020-2021 (dependent on action (i))

Task Owner: BEIS.

Timing: 2019 – 2021

Task 3E: Work collaboratively with industry seeking to export waste heat to heat networks with a view to (1) quantifying the benefits of export; (2) understanding the perceived risks associated with supply to a network; (3) identifying technical and contractual solutions which mitigate these risks; and (4) sharing examples of these solutions in practice.

Task Owner: BEIS with input from CIA, industry, Heat Trust, local authorities, and Scottish Government.

Timing: 2017-2018

2.4 Action 4: Identify and deliver opportunities for embedded generation, demand side response and energy storage

- Identify and deliver opportunities to use energy storage, demand side response and increased deployment – either embedded on-site, via private wire or via the network to lower carbon emissions, improve security of supply, improve flexibility and lower energy costs.
- The objective of this action is to integrate the emerging opportunities of energy storage, intermittent renewable generation on the network and demand side response and embedded low carbon generation to lower carbon emissions and energy costs.
- This action begins with short term tasks but extends to long term opportunities.
- The action links to action 2, both actions are aimed at lowering carbon emissions and improving energy efficiency and competitiveness at existing assets.
- Implementation of this action could result in a multitude of benefits including lower carbon emissions due to increased use of renewables, lower energy costs and better matching of supply and demand – boosting the productivity of the energy network.

Action 4 Tasks

Task 4A: Communicate and promote the current and emerging opportunities for the chemical sector in relation to all forms of energy storage including how it can support existing and new processes and reduce carbon emissions and/or increase competitive energy supply.
Task Owner: CGP Decarbonisation Working Group
Timing: 2017 – 2018

Task 4B: Revisit the 2014 internal then-DECC study on deployment of CHP and update with latest energy and economic estimates, including for biomass, based on the DECC research, "*Factors affecting the uptake of gas CHP and Tackling Non-Financial* Barriers *to Gas CHP .*"
Task Owner: BEIS
Timing: 2017-2018

Task 4C Investigate how the chemical industry can maximise opportunities from the de-stressing electrical network through use of flexible production and demand side response.
Task Owner: CGP Decarbonisation Working Group, also engaging the EII committee on developing a programme given all 8 energy intensive industries on the group could benefit.
Timing: 2017 – 2018

2.5 Action 5: Support development, scale-up and awareness raising of key innovative decarbonisation and energy efficiency technologies

- An innovation mapping report[15] has been developed which accompanies this action plan. It's objective is to:
  (i) Navigate through the range of technologies that are already available, identifying those which could be added to existing processes to support decarbonisation and energy efficiency, based on knowledge of processes that exist in the UK;
  (ii) Provide a case study for industrial symbiosis (e.g. energy flows, material streams, technologies, service, etc.) to assist with identifying opportunities and assess their feasibility via cost benefit as well as environmental assessment, highlighting the drivers that were necessary for industry to engage with this activity,
  (iii) Provide an assessment of key emerging innovations and technologies mapped against specific plants and processes in the UK (CO2 reduction + economic impact), that would support decarbonisation and energy efficiency, working across business, focusing on the Tees Valley cluster as a starting point. It highlights the issues that would need to be addressed to develop and deploy those technologies – and considers the read across to other UK clusters.
  (iv) Provide a more complex, longer-term model where the assessment includes plants and processes that do not already exist within the cluster, i.e. what strategic technologies and businesses would need to arrive into the cluster to realise increased decarbonisation and economic potential.

- Responding to the innovation mapping report, the tasks that make up this action are short term (within this Parliament) and focus on the development of the technical and commercial potential of processes, paving the way to longer term actions that will continue to support the sector's decarbonisation to 2050.
- The tasks outlined under this Action are closely linked to Actions 7 (skills), 8 (access to finance), and 9 (increasing RD&D), below.
- The impact of the action is not defined quantitatively but the action has the potential to deliver significant carbon emissions reduction.

[15] http://ukchemistrygrowth.com/Growth.aspx

Action 5 Tasks

Task 5A: Work through the Chemistry Growth Partnership (CGP) Energy and Innovation Working Group to develop a prioritised strategy for delivering against the conclusions of, and recommendations from, the innovation mapping report[16] to develop / scale-up / deploy the technologies it identified. This should include the following key elements:

- Identify mechanisms to disseminate, and to support industry to engage with, the conclusions and benefits[17] of the innovation mapping study through regional workshops, and by tying the conclusions into clustering opportunities studies (link to action 2) – engaging LEPs and local authorities. While the sector as a whole will be engaged, the conclusions will also be targeted to the 13 highest emitting sites in the UK, identified in the Chemicals Roadmap.
- Develop mechanisms to encourage and facilitate collaboration to develop and deploy the technologies and innovations identified in the innovation mapping study.
- Identify where further research is needed and how this would be delivered for example to support industry to make the transition to bioenergy and using bio resources as feedstocks and for developing hydrogen from electrolysis technologies, and private wire opportunities.
- Identify policy and other barriers which would prevent the technology / innovation opportunities from being realised, e.g. incentivise the integration of utilities and processing and overcome the policy barriers relating to the conversion of biomass and wastes to high value chemical products (also part of Action 6);
- Consideration of a cross-sector approach is proposed to include other sectors such as food & drink, pulp & paper, steel and the waste/resources/utilities sectors.

Task Owner: CGP Decarbonisation Working Group (who will engage LEPs, academia, CPI, other innovation centres, investors and companies to collaborate in networks that can create the low carbon processes of the future).

Timing: 2017

[16] http://ukchemistrygrowth.com/Growth.aspx

[17] E.g. reduced costs of complying with environmental regulation, reduced energy consumption and therefore costs.

Task 5B: Map existing UK research expertise, centres and areas of strength in relation to innovation development and scale-up relevant to the key decarbonisation technologies identified in the innovation mapping work.
Task Owner: KTN
Timing: 2017-2018

Task 5C: Identify specific projects required to realise integrated supply chains / industrial symbiosis opportunities for the chemicals sector in the UK based on the innovation mapping and clustering opportunities studies.
Task Owner: CGP (Decarbonisation Working Group).
Timing: 2017

Task 5D: Identify development opportunities to integrate waste collection and treatment with development of low carbon, high value process industries in or near population centres. The Decarbonisation working group will indentify the best uses of non-biogenic waste as fuels and feedstocks for the chemicals sector, based on the technologies and processes identified as having the greatest carbon reduction and economic impact. Any work on identifying best use of limited resource will use agreed carbon accounting methods, assessing the overall life-cycle carbon impact, compared to that of alternatives. Industry will provide specific evidence / case studies to Government on the policy / regulatory / incentive barriers to using these resources (e.g. to making chemicals from waste, in particular low volume but high-value chemicals) in order to explore policy options to encourage the conversion of wastes into higher value products.
Task Owner: CGP Decarbonisation Working Group (who will engage LEPs, academia, CPI, other innovation centres, investors and companies to collaborate in networks that identify the most economic and 'investable' low carbon processes).
Timing: 2017 / 2018

Task 5E: Seek to influence the design of relevant technology and innovation programmes (e.g. Industrial Strategy Challenge Fund) to enable funding for key technologies, for example low cost, flexible, highly efficient electrolysis technology, and development of a local hydrogen economy.
Task Owner: CGP
Timing: 2017 / 2018

2.6 Action 6: Encourage greater use of sustainable biomass/biogenic material including waste as chemicals feedstock and energy to deliver a competitive and lower carbon footprint within the chemicals sector

- BEIS to facilitate the setting up of a cross-sector group to consider issues relating to biomass and biogenic waste availability, its environmental sustainability including with respect to air quality, and to develop a collective view on the best uses of bioenergy for, and across, each sector.
- The objective of this action is to identify the best uses of biogenic materials and the technologies available that will support the use of these materials across a range of outputs (including across sectors). This action should also identify barriers that are preventing opportunities for greater use of bioenergy or bio-feedstock's from being realised.
- Initial studies will be carried out in the short-term, with an ambition to have initial demonstration projects underway in the medium term in order to drive adoption in the longer-term.
- The action is dependent on Action 5 (Innovation), and is linked to Action 4 (low carbon competitive power supply).
- The estimated size of the potential carbon reduction has been subject to much assessment. It depends greatly on the type, location and transport of biomass, the timescale over which an assessment is made and the counterfactual – what is assumed to have happened to the carbon within the biomass if it had not been used for bioenergy or bio-feedstocks. In the BEIS roadmaps model[18], bioenergy in the chemical sector was assumed to reduce carbon emissions by 85% while bio-feedstocks were assumed to reduce carbon emissions by 26%.

[18] https://www.gov.uk/government/publications/industrial-decarbonisation-and-energy-efficiency-roadmaps-to-2050

Action 6 Tasks

Task 6A: Government and industry to set up a cross-sector group to develop a collective view of the best uses of bioenergy across industry. This group will use existing analytical tools to identify the likely future supply and demand of different bio-resources, their costs and their environmental sustainability, for example air quality – e.g. BEIS's Bioenergy Resource Model and UK land use assessments[19]. The group will be informed by evidence of the role bioenergy could play in the UK's future decarbonisation objectives, and by the emerging findings from the Government's Bio-economy Strategy regarding the role of bioenergy in the UK's wider bio-economy.
Task Owner: BEIS, e.g. through work on the Clean Growth Strategy, and working with the bio-economy related industry councils[20].
Timings: 2017-2019

Task 6B**:** the Decarbonisation WG will indentify the best uses of biogeneic waste and biofeedstocks for the chemicals sector, including which fuels/feedstocks, based on the technologies and processes identified as having the greatest carbon reduction and economic impact. Any work on identifying best use of limited resource should use agreed carbon accounting methods, assessing the overall life-cycle carbon impact, compared to that of alternatives. Industry will provide specific evidence / case studies to Government on the policy / regulatory / incentive barriers to using bioresources (e.g. to making chemicals from waste, in particular low volume but high-value chemicals) in order to explore policy options to encourage the conversion of wastes into higher value products.
Task owner: CGP Decarbonisation Working Group (who will engage LEPs, academia, CPI, other innovation centres, investors and companies to collaborate in networks that identify the most economic and 'investable' low carbon processes).
Timing: 2017 - 2018

[19] This analysis needs to take into account the diverging views of the carbon intensity of different types of biomass and the fact that efficient use of biogenic material as feedstock and energy can have additional carbon benefits relative to the use of biogenic materials solely for energy.
[20] The Chemistry Growth Partnership (CGP), the Industrial Biotechnology Leadership Forum (IBLF), the Medicines Manufacturing Industry Partnership, the Agri-Food Technology Leadership Council, and the Synthetic Biology Leadership Council

Task 6C: Innovation centres in collaboration with industry, to demonstrate the technical and commercial viability of promising bioenergy/bio-feedstock technologies, drawing on the conclusions of the innovation mapping and clustering opportunities studies on which are the key bioenergy / bioresource technologies and opportunities and where these could best be deployed, e.g. for gasification, bio refineries. This will include exploring opportunities for funding from Innovate UK and other funding sources / mechanisms. The findings of, and wider opportunities to the sector from, any demonstration projects will be disseminated to the sector, e.g. in the first instance from the Bio-Pilots UK project being taken forward by the relevant UK innovation centres, including CPI and the Bio renewables Development Centre (BDC). This links to Task A, i.e. there may be technologies which increase the efficiency of limited resources/feedstock's by enabling multiple outputs from a single resource at different points in the value chain. This would therefore influence work around 'best uses'.
Task Owner: Innovation centres including CPI and the Bio renewables Development Centre (BDC), through their Bio Pilots UK programme in collaboration with the chemical sector
Timings: 2017 onwards

Task 6D: The chemical sector to actively engage with the development of, and opportunities arising from, the industry/Government UK Bio-economy Strategy as a key developer (particularly the industrial biotechnology end of the sector) and user of bio-based materials. This is expected to include a specific focus on exploiting UK feedstocks. It will also further support the chemical sector's decarbonisation by offering opportunities to replace fossil fuel based resources and processes with renewable options, including bioenergy. This links to Task A, i.e. the bio-economy strategy will support the development and exploitation of technologies which increase the efficiency of limited resources/feedstocks by enabling multiple outputs from a single resource at different points in the value chain. This would therefore influence work around 'best uses'.
Task Owner: CGP lead via its innovation workstream, working with BEIS and supported by KTN.
Timings: 2017 onwards

2.7 Action 7: Develop and implement a strategy to integrate smarter use of energy and feedstocks in the chemical sector with Industrial Carbon Capture, Usage and Storage (CCUS)

- This action aims to facilitate the deployment of CCUS in the chemicals sector, as set out in the tasks, including by undertaking studies on the potential of various technologies, and the potential of industrial clusters for deployment of CCUS. It also includes tasks on raising industry awareness of best practice and existing resources; and on public awareness and acceptance.
- A significant amount of relevant activity is already underway. For example, research into options for commercial models for large scale industrial CCS adoption, commissioned by Tees Valley Unlimited and funded by BEIS was published on 7 February 2017[21].
- The CCS Commercialisation Programme's Key Knowledge Deliverables have also provided government, industry and academia with valuable technical and commercial insight on how cost effective CCS may be deployed in the future.
- The objective of the action is to help develop an understanding of what is required in order to deploy CCUS, and to support and create the conditions for their deployment. It will involve collaboration between central government, industry and local authorities, including through existing forums.
- This action links to the innovation Action 5 above.
- The specific decarbonisation impact of this action is hard to quantify, but CCS has significant decarbonisation potential. Industrial CCS overall, if deployed in the maximum technology pathway developed in Phase 1 of the Roadmaps project could be the largest contributor to decarbonisation across the eight sectors, with a total emission reduction potential of 23 million tonnes of CO2 per annum in 2050 (37% of the total combined reduction in the Max Tech pathway)[22]. In the BEIS roadmaps model[23], carbon capture and/or use in the chemical sector was estimated to reduce carbon emissions by up to 63%.
- Carbon capture and Usage (CCU) is an important option and offers economic opportunities, but it is unlikely, on its own, to be sufficient, as not all CO_2 usage technologies lead to CO_2 savings and others are energy intensive. Importantly though, deploying CCU can reduce the costs of capture technology and can be tested at existing UK industrial sites. CCU can also lower the carbon footprint of products,

[21] http://www.teessidecollective.co.uk/wp-content/uploads/2017/02/0046_TVCA_ICCSBusinessModels_FinalReport_v200.pdf
[22] *Industrial Decarbonisation & Energy Efficiency Roadmaps 2050, Cross sector summary*, DECC BIS March 2015
[23] https://www.gov.uk/government/publications/industrial-decarbonisation-and-energy-efficiency-roadmaps-to-2050

and provides opportunities for industrial symbiosis with commensurate economic benefits.

- As well as the specific tasks set out in this action, HMG has set out details of its new approach to CCUS in the Clean Growth Strategy, which was published at the same time as this document. This approach is relevant to industrial sectors, and Government will work with the chemicals sector as part of the ongoing roadmaps process, to help them realise the opportunities that it presents for them.

Action 7 Tasks

Task 7A: Assess the potential of CO_2 utilisation in the UK through a study to identify the most promising applications of CCU and how CCU commercialisation can be facilitated.
Task Owner: BEIS
Timing: 2017-2018

Task 7B: Build understanding of the potential for deploying CCUS at industrial clusters by commissioning reports on the level of development at existing clusters, including opportunities for making further progress, and on the options for deploying CCUS at industrial sites that are isolated from carbon transport and storage infrastructure.
Task Owner: BEIS
Timing: 2018

Task 7C: Undertake activity to raise public awareness of the relevance of CCUS for industrial decarbonisation, for example in areas close to industrial clusters. This should be done as part of BAU engagement activity. Detailed and bespoke public engagement on CCUS would ultimately be taken forward as part of any specific CCUS project.
Task Owner: CIA in collaboration with members, cluster organisations and local authorities.
Timing: 2017 - 2018

Task 7D: Using any completed LEP/cluster opportunities study, LEPs and the KTN should help industry to identify carbon capture technologies deployable to UK sites, and crucially, markets for the captured carbon. DIT should also be engaged in order to align potential inward investment opportunities with this. This task links with the innovation development and deployment task above and is dependent on the completion of the clustering task on feasibility studies on opportunities within clustering.
Task Owner: Individual LEPs, starting with the Humber LEP (using lessons learned as appropriate from activity already delivered in this area by TVU LEP), supported by KTN and DIT.
Timing: 2017

Task 7E: Showcase (electronically and via roadshows and other mechanisms) demonstration projects already underway so others can take a considered view on the value drawing on existing activity, e.g. in the Tees Valley.
Task Owner: KTN supported by IUK.
Timing: 2017

2.8 Action 8: To increase skills and knowledge within the sector to enable a low carbon competitive future for the chemicals industry

- This action aims to ensure that industry has access to appropriate skilled resources to identify and deploy decarbonisation and energy efficiency projects.
- The task that makes up this action are short term, 2017-8, but is linked to the long term overall aim of ensuring a flow of appropriately skilled resources into the UK chemicals sector.
- This action underpins all other actions in the plan particularly those with medium to long term tasks.
- The decarbonisation impact of implementing this action, and the competiveness impact for sector, is that an increase in skills and knowledge will lead to greater efficiencies and improvements in ways of working.

Action 8 Tasks

Task 8A: As an innovation centre, and therefore on the front-line of new emerging technologies, CPI will conduct a review of what decarbonisation and energy efficiency innovation skills are required by the sector and where there are training gaps, engaging other high value manufacturing Catapults and innovation centres, e.g. Bio renewables Development Centre (BDC), Industrial Biotechnology Innovation Centre (IBioIC), etc. and the professional skills bodies.
Task Owner: CPI (engaging other innovation centres and the professional skills bodies)
Timing: 2017-18

2.9 Action 9: To support access to finance for mature energy efficiency and decarbonisation-related investments

- This action aims to increase deployment of finance for decarbonisation and energy efficiency projects, to help energy/carbon efficiency investments compete more effectively with other investment opportunities. This includes public and institutional funding and third party finance. This action will be useful for a wide range of companies, especially SMEs which often lack the capacity to identify and access external funding and finance options.
- The objective of this action is to increase investment in mature energy and efficiency and decarbonisation projects by ensuring that industry is aware of the full range of funding and finance sources that could be used to support mature energy efficiency and decarbonisation investments.
- This action, which should be initiated in the short term, is intended to provide immediate and on-going support for delivering mature energy efficiency technologies.
- This action links to the actions on increased clustering and industrial heat recovery.
- Encouraging greater investment in industrial energy efficiency and decarbonisation could lead to significant emission savings and competitiveness benefits. BEIS' Industry Pathways Models estimate that further improvements to industrial energy efficiency in the UK chemical sector could save up approximately 1 – 1.5 MtCO2e annually[24].

[24] For details of assumptions and modelling see - https://www.gov.uk/government/publications/industrial-decarbonisation-and-energy-efficiency-roadmaps-to-2050

Action 9 Tasks

Task 9A: Ensuring industries have confidence that investments with longer payback projects (i.e. more than 2 years) will pay off, and that senior management is confident pursuing cost-effective energy saving opportunities (ESOs) in its key investment decisions is key to making investment decisions. Critical factors are establishing a stable and globally cost competitive policy and regulatory framework that will provide a sustainable basis for decarbonisation and energy efficiency investment decisions. Noting the commitment made in the January 2017 Industrial Strategy Green paper, for Government to "set out in 2017 a long-term road map to minimise business energy costs," and that Government will commission "a review of the opportunities to reduce the cost of achieving our decarbonisation goals in the power and industrial sectors," the chemicals sector will provide input to that process as it takes shape.
Task owner: BEIS supported by the CGP Decarbonisation and Energy working groups. Government to commission "a review of the opportunities to reduce the cost of achieving our decarbonisation goals in the power and industrial sectors," CGP Decarbonisation and Energy working groups to lead chemical sector input to that process as it takes shape.
Timing: On-going

Task 9B: Government to establish an industrial energy efficiency scheme to help large companies install measures to cut their energy use and their bills.
Task Owner: BEIS
Timing: 2017-2022

Task 9C: BEIS will organise a working group to facilitate dialogue between the finance sector and industry to explore how external finance could be used to support mature energy efficiency and decarbonisation investments, and to overcome the barriers to affordable external finance. The working group will set out its own Terms of Reference, including how frequently it should meet.
Task Owner: BEIS (CIA will lead on encouraging engagement from the chemicals sector, including identifying participants / individual businesses for the group).
Timings: 2017-2019

Task 9D: The CGP Decarbonisation WG will review funding and finance mechanisms and consider their suitability for delivering a portfolio of decarbonisation and energy efficiency projects, including where these would support aggregating energy efficiency projects (mature) into larger schemes that might be able to go ahead with more players involved and more scale.
Task Owner: CGP (Decarbonisation Working Group) supported by BEIS, Innovate UK and Private Sector Stakeholders[25]. (Link to portal at Task B)

Task 9E: Enhanced Capital Allowances (ECA) Schemes allow 100% of the cost of an investment in qualifying plant and machinery to be written off against the taxable profits of the period in which the investment is made, improving cash flow for businesses. BEIS to explore the potential for additional technologies, such as burners, process control, industrial boilers, heat recovery etc. which could be included in the Energy Technology List (ETL) to encourage wider investment opportunities through Enhanced Capital Allowances. The Carbon Trust are already doing a study to assess the potential for adding technologies to the ETL.
Task Owner: BEIS
Timing: 2017 – 2020

Task 9F: Trade associations to raise awareness of the existing Enhanced Capital Allowances Scheme. Companies are currently unaware of it and therefore don't use it or factor it into their business cases, potentially meaning the UK is losing out on investment. While action should be taken forward to raise awareness of the ECA Scheme and the opportunities it offers, this mechanism would also be included if an online portal, as per Action 10 Task A, is delivered.
Task Owner: CIA
Timing: 2017

[25] Depending on the type and size of innovation, these stakeholders could include venture capitalists, start-ups, large technology companies and existing manufacturers.

2.10 Action 10: Increase research, development and demonstration (RD&D) with potential applications for energy efficiency and decarbonisation in the chemical sector

- This action will influence, identify and communicate sources of funding to companies and academics to enable them to increase research, development and demonstration (RD&D) of decarbonisation and energy efficiency technologies at lower technology readiness levels (below 7).
- The objective is to stimulate RD&D in order to generate projects that can feed a pipeline of breakthrough innovations in the sector.
- This action should be implemented in the short-medium term, and will lead to longer-term innovation actions.
- This action is a precursor to some of the tasks within Action 5 (Innovation) and links to Action 8 (Skills).
- The impact of this action will be reduced energy consumption and lower energy costs. Carbon reduction impact cannot be quantified as this action should stimulate new areas of technology development.

Action 10 tasks

Task 10A: Launch a web portal that facilitates greater industry collaboration by enabling companies in the chemicals sector to share information on R&D, best practice, knowledge and access to funding opportunities. BEIS will develop and launch a website that facilitates greater industry collaboration by enabling companies in the chemicals sector to share information on research and development, best practice, knowledge sharing and access to funding opportunities. The website will be designed through close engagement with the (Chemicals Trade Associations) and its member companies to help ensure it meets business requirements.
Task Owner: BEIS, with input from the CIA
Timing: 2018

Task 10B: Maintain a portal that enables industry to collaborate and share information. BEIS will maintain the website (task A) that facilitates greater industry collaboration through the sharing of information on research and development, best practice, knowledge sharing and access to funding opportunities, subject to its annual review (task C).
Owners: BEIS
Timing: Ongoing

Task 10C: Undertake annual reviews of the portal that enables industry to collaborate and share information. BEIS will be supported by industry to undertake annual reviews of the portal (task A) that facilitates industry collaboration through information sharing to ensure that it continues to be effective, utilised and aligned to business requirements.
Owners: BEIS
Timing: Ongoing

Task 10D: To complement and enhance the value of the online portal, the KTN will continue to support and help speed-up business-led innovation to develop and scale up decarbonisation and energy efficiency technologies. They will do this by providing links to innovation partners and funding (industry, RTOs (research technology organisations), academia, investors), as well as offering support for developing business cases, fulfilling assessment criteria, confirming the accounting treatment of different types of investment, and identifying aggregation options for smaller investment. This takes the form of 1:1 working with a company, an event (real or virtual), establishing on-line communities, building collaborative consortia, finding the right funding etc.
Task Owner: Innovate UK, delivered by the KTN.
Timing: 2017

Task 10E: The CGP Decarbonisation WG will identify mechanisms for reaching out to companies in or across regions to co-ordinate investments and potentially aggregate energy efficiency projects, e.g. supporting collaboration in developing key decarbonisation / energy efficiency technologies, helping to address industry reluctance to engage in developing innovative technologies alone. This task links to Action 5 on developing, scaling up and deploying innovative decarbonisation and energy efficiency technologies.
Task Owner: CGP Decarbonisation working group.
Timing: 2017

Task 10F: Industry to support the increased adoption of innovative technology by engaging with, and seeking to influence, the design of funding calls, such as the new Industrial Strategy Challenge Fund, to ensure it backs priority decarbonisation technologies. Industry should follow this by ensuring it disseminates information on, and exploits funding opportunities / competitions.
Owners: CGP (Innovation Working Group) will lead on engaging with UK Research and Innovation[26] to seek to influence the design of the Challenge Fund. CIA and the KTN will lead on disseminating information on funding opportunities and competitions to the sector. Individual companies would be charged with applying to funding opportunities and competitions. The KTN would play a role in supporting individual companies to do so. (Potential link to portal at Action 9, Task B.)
Timing: 2017-2019

Task 10G: BEIS to run an Industrial Energy Efficiency Accelerator (IEEA) programme which is open to EIIs and worth £9.2m over four years. The accelerator will reduce energy costs for industry by funding the demonstration of close-to-market energy efficiency innovations and their wider roll out across the sector, while leveraging private sector investment.
Owners: BEIS
Timing: 2017-2021

[26] UKRI – a new public body in place of the 7 Research Councils, Innovate UK, and the research and knowledge exchange functions of the Higher Education Funding Council for England.

3. Case Study

Project	CO_2 capture and utilisation, Jubail, Saudi Arabia
Relevant Action(s) No.	Demonstration of Carbon Capture and Use at Commercial Scale – Action 7
Description	In 2015, SABIC completed an innovative and unique new cross-site project at its Jubail manufacturing site in the Kingdom of Saudi Arabia that converts CO2 waste from one facility into valuable products in other facilities. This project will improve resource efficiency, decrease greenhouse gas intensity, improve economic performance, and provide inspiration for similar solutions that can help build a sustainable future for the planet. In the early stages of SABIC's sustainability program a material-loss metric was developed. The measurement helps to reduce the amount of materials released to the environment by identifying ways to more efficiently use resources. Since then, the focus has been on the most significant opportunity to reduce material loss: the venting of carbon-based resources, including CO2. SABIC is uniquely positioned to share by-products and otherwise wasted materials, such as CO2, between Saudi manufacturing affiliates, because they are in close proximity. As one of the world's largest producers of ethylene glycol, concentrated CO2 vent streams are by-products of the production process. Near the source of these streams, several of the manufacturing affiliates use CO2 as a feedstock, presenting an opportunity to improve resource efficiency through the integration of materials between sites. The first step toward capitalizing on this opportunity involved innovation at United, a SABIC affiliate that produces ethylene glycol in Jubail. To do so, SABIC assisted in building a purification process unit to remove impurities from the CO2 vent stream, making the output so pure that the gas can be sold to the food and beverage and medical industries. The facility, which came online in 2015, is now the world's largest CO2 purification plant, with the capacity to handle up to 500,000 metric tons per year. The second step was the first significant sustainability project requiring cross-site collaboration. To share CO2 from the new purification plant, SABIC built a grid to deliver the purified stream to other nearby SABIC affiliates that use the gas to produce products such as urea, methanol, and 2-ethylhexanol.
Opportunities	The key opportunities were presented by the scale of CO2 available in concentrated vent streams and the close proximity of manufacturing units that could beneficially employ the separated and purified CO2 stream as additional feedstock. The project was internally financed and did not rely on external support grants or concessions.

Outcome and benefits	This project increases economic returns, enhances the social value of producing more products from the same amount of raw material, and improves environmental emissions. It is an excellent example of how we are building value for all the dimensions of sustainability and creating 'Chemistry that Matters™'[27]. The project has: • Helped the Jubail complex to reduce carbon emissions; • Acted as a pioneering case study to illustrate viable routes to lower carbon emissions – indeed SBAIC plan to execute similar projects at other locations; • Provided a substantial new feedstock source to support incremental methanol and urea manufacture; • Enabled supply of CO2 to the food and drinks sector; • Added to the companies' industrial gases business. The project has contributed substantially towards the reduction in SABIC's greenhouse gas intensity, measured in metric tonnes of CO2 equivalent per metric tonne of product sales. The 2015 intensity fell 2.6 percent below 2014 and is 7.8 percent lower than 2010, the baseline year for measurement. The project increases economic returns, enhances the social value by producing more products from the same amount of raw materials and improves environmental emissions. SABIC has identified similar opportunities for capturing and using CO2 as feedstock at other facilities. These opportunities are currently being developed and reviewed in terms of their technical and financial feasibility. Aside from the direct business benefits, the project serves as a highly visible demonstration of the Kingdom of Saudi Arabia's and SABIC's commitment to industrial decarbonisation. SABIC's leadership in this area was recognised during the Carbon Sequestration Leadership Forum (CSLF) Ministerial Meeting in November 2015, an international climate change initiative, where the project received a certificate of recognition.
Lessons Learnt	Proof of concept. The key interdependency of CO2 availability at scale and local opportunities to exploit the purified stream as feedstock, including the availability of co-feed and other utilities.
Cost of implementation	Confidential

[27] https://www.sabic.com/en

Year	The plant was commissioned in 2015.
References	http://www.icis.com/resources/news/2015/07/13/9902416/corrected-s-arabia-s-sabic-starts-up-co2-utilisation-plant-in-end-15/ http://www.reuters.com/article/us-sabic-co2-linde-idUSBRE97K0NN20130821
Contact	Mr Abdulaziz M Al-Jodai, Director-Corporate Programs Technology & Innovation (aljodai@sabic.com)

4. Glossary

Term	Definition
Action	An activity that will be delivered through a series of separate tasks
Task	A specific piece of work to deliver an action
Impact	A qualitative or quantitative description of the impact on carbon, financial or competitiveness as a result of successfully implementing the action
Dependency	How one action might influence another action, for example a shorter term action may be linked to longer term actions or ambitions.
Resources	Staff or funding required to deliver a specific task
Objective	The impact on strategic outcome of the action (e.g. increased energy efficiency in xx sector – or the objective is to decarbonise and do this using CCS technology and a transport and storage network).
Output	[Tangible] Result achieved by the action being undertaken (e.g. better awareness amongst industry managers of opportunities etc.) – an Emphasis on the overall action delivery or result – e.g. delivers Carbon capture network so that industry can use it to capture and store carbon.
Short Term Action	Action that will be undertaken between 2017 and 2020
Longer Term Action	Action that will take place beyond 2020
Barrier	A factor that needs to be overcome for an action to be achieved
Energy Savings Opportunity Scheme (ESOS)	A mandatory energy assessment scheme for organisations in the UK that meet the qualification criteria. These assessments are audits of the energy used by their buildings, industrial processes and transport to identify cost-effective energy saving measures.
Enhanced Capital Allowances (ECAs)	ECAs let businesses that invest in certain energy-saving equipment write off the total cost of the equipment against their taxable profit as a 100% first-year capital allowance. Waste Heat Energy Recovery has recently been added as a new technology.
Energy Technology List (ETL)	The ETL (or Energy Technology Product List, ETPL) is a government-managed list of energy-efficient plant and machinery. For a product to be on the ETL, it must meet specific energy-saving or energy-efficient criteria. It is part of the Enhanced Capital Allowance (ECA) tax scheme for businesses.

Term	Definition
Climate Change Agreements (CCAs)	A voluntary scheme which enable EIIs to pay reduced main rates of CCL in return for signing up to agreed energy efficiency or carbon reduction targets (current phase runs to March 2023). For operators who hold a CCA, the CCL is reduced by 90% on electricity bills and by 65% on other fuels. The government has decided not to take sectors forward for a mid-term target review, and are currently seeking views and evidence on options with regard to the buy-out price.
Greenhouse Gas reporting	Simplified Energy and Carbon Reporting Framework: government recognises the importance of businesses' ability to measure and understand their energy consumption and carbon emissions, facilitating action to improve energy efficiency. The government will introduce a simplified energy and carbon reporting framework for introduction by April 2019. This will reduce the administrative burdens of an overlapping system while improving the incentive to save energy and reduce carbon emissions. This will replace the obligation for some organisations to report their energy consumption under the CRC.
BEIS Innovation Programme	Innovation has a key role to play in driving the development of cheaper clean technologies. BEISs energy innovation programme has over doubled to £500 million over this Parliament, providing funding to support the development of low-carbon technologies and research.
Innovate UK (formerly the Technology Strategy Board)	IUK is the UK's innovation agency. It works with people, companies and partner organisations to find and drive the science and technology innovations that will grow the UK economy - delivering productivity, new jobs and exports. Industry can apply for funding to test the feasibility of ideas and to research, develop and demonstrate them. Innovate UK will invest around £561 million in helping businesses to innovate and grow in the financial year 2016 to 2017.
Knowledge Transfer Network (KTN)	The Knowledge Transfer Network is Innovate UK's network partner and also provides innovation networking for other funders in line with its mission to drive UK growth. It links new ideas and opportunities with expertise, markets and finance through its network of businesses, universities, funders and investors.
The Catapult Programme	A network of world-leading centres designed to transform the UK's capability for innovation in specific areas and help drive future economic growth. The High Value Manufacturing (HVM) Catapult is a catalyst for the growth and success of UK advanced manufacturing. HVM Catapult provides access to world-class equipment, expertise and collaborative opportunities. It works with manufacturing businesses of all sizes and from all sectors to help turn ideas into commercial applications by

Term	Definition
	addressing the gap between technology concept and commercialisation.
Devolution Deals	By giving local areas powers over economic enablers such as housing, transport, skills and infrastructure, they will be able to boost economic growth and productivity locally. Devolved systems offer greater scope for local areas to innovate and experiment. For example, Tees Valley Unlimited, a Local Enterprise Partnership (LEP), has been awarded £1 million funding by the BEIS to develop a feasibility study for deploying industrial carbon capture and storage (ICCS) in the Teesside cluster.
Industrial Strategy Challenge Fund: joint research and innovation	The Industrial Strategy Challenge Fund is a Government fund to strengthen UK science and business innovation. It was created to provide funding and support to UK businesses and researchers, part of the government's £4.7 billion increase in research and development over the next 4 years. It was designed to ensure that research and innovation takes centre stage in the Government's Industrial Strategy.