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Policy, regulation and public perception

The role of CCUS in a just transition

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About the CCUS Projects Network

The CCUS Projects Network comprises and supports major industrial projects underway across Europe in the field of carbon capture and storage (CCS) and carbon capture and utilisation (CCU). Our Network aims to speed up delivery of these technologies, which the European Commission recognises as crucial to achieving 2050 climate targets. By sharing knowledge and learning from each other, our project members will drive forward the delivery and deployment of CCS and CCU, enabling Europe's member states to reduce emissions from industry, electricity, transport and heat.
http://www.ccusnetwork.eu/

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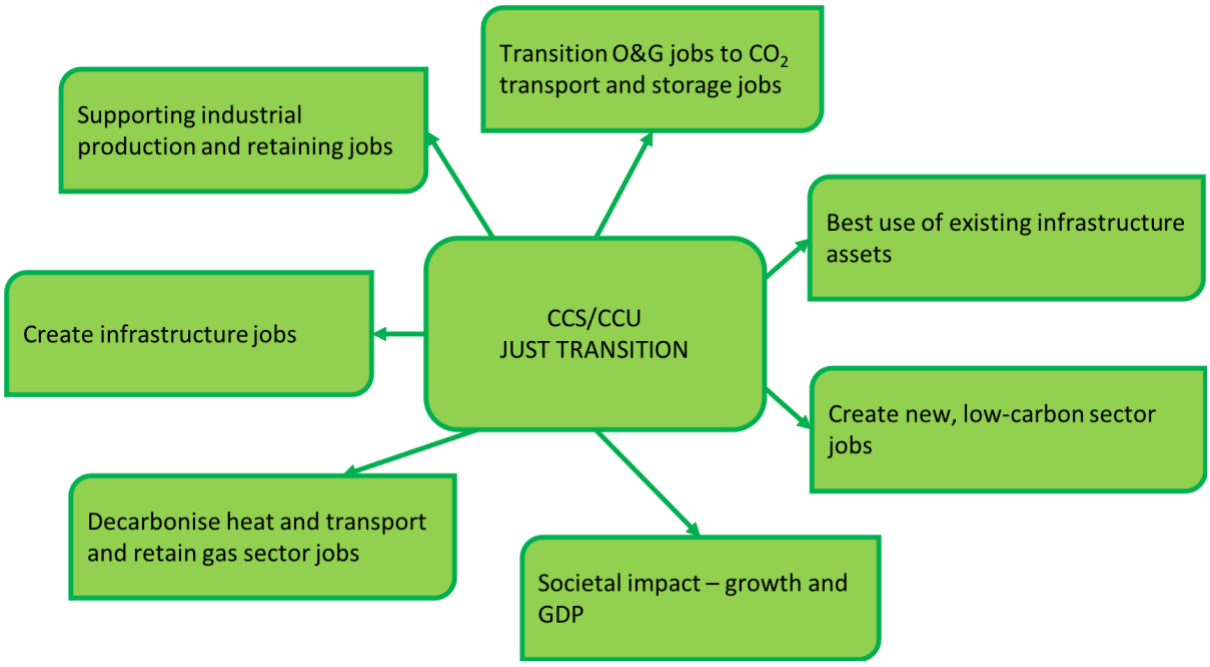
Executive summary

A just transition – that is, a transition to a net-zero emissions economy that takes place fairly - is a key component of the Paris Agreement, and complements a green recovery from the Covid-19 pandemic.

This report explores the role of carbon capture and storage (CCS) and carbon dioxide capture and utilisation (CCU) in delivering a just transition. This includes maintaining jobs in high-emitting industries; supporting oil and gas workers to move into other suitable offshore jobs; creating new jobs; supporting the decarbonisation of heat and transport across the economy by enabling bulk production of low-carbon hydrogen; and supporting construction and renewables industries through the provision of low-carbon cement and steel.

Some data has been modelled and published on the societal value of CCUS, but it is clear that there is more to be done. This report makes some suggestions of further work that needs to be undertaken by project developers, policy makers, governments and the European Commission to enable a deeper understanding of the wider economic and societal benefits of developing a CCUS industry in Europe.



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1 A just transition

1.1 What do we mean by a just transition?

Broadly speaking, a 'just transition' means a move to a net zero economy in a way that is fair.

Reducing greenhouse gas emissions in line with the UNFCCC Paris Agreement (which aims to keep the global temperature increase well below 2°C and pursuing efforts to limit it to 1.5°C) means that many sectors which are viable now – including fossil fuel power generation and chemical processing – will have to either radically change their processes or cease operation by 2050. Such significant economic restructuring has the potential to do huge economic damage and have catastrophic effects on workers – or it can be done in a planned way that ensures that costs and benefits are shared fairly.

The term 'just transition,' describing the reconciliation of employment concerns and environmental issues, has been in use for over 20 years, and according to Rosemberg (2010), a just transition framework should incorporate the following:

- Sound investments in low-emission and labour-intensive technologies and sectors
- Research and early assessment of social and employment impacts
- Social dialogue and democratic consultation of social partners and stakeholders
- Training and skills development
- Social protection
- Local analysis and economic diversification plans

The need for a just transition is included in the Paris Agreement, and expanded on in the Solidarity and Just Transition Silesia Declaration, agreed at COP24 in 2018, which states that:

> "Just transition of the workforce and the creation of decent work and quality jobs are crucial to ensure an effective and inclusive transition to low greenhouse gas emission and climate resilient development, and to enhance the public support for achieving the long-term goals of the Paris Agreement"

The declaration refers to the International Labour Organisation's *Guidelines for a just transition towards environmentally sustainable economies and societies for all*, which states that:

> "A just transition for all towards an environmentally sustainable economy […] needs to be well managed and contribute to the goals of decent work for all, social inclusion and the eradication of poverty."

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1.2 What is the EU doing about it?

in 2019 the European Commission presented the European Green Deal, described as "a roadmap for making the EU's economy sustainable by turning climate and environmental challenges into opportunities across all policy areas and making the transition just and inclusive for all"; the Commission President, Ursula von der Leyen has emphasised everyone should be involved in, and benefit from, the transition (European Commission, 2020e).[1]

Investment in climate action through a Green Deal and delivering a just transition are inextricably linked, and it is crucial that current and future jobs and skills needs are planned for.

The European Green Deal aims to foster both economic growth and sustainability, where:

- there are no net emissions of greenhouse gases by 2050
- economic growth is decoupled from resource use
- no person and no place is left behind (referencing a just transition)

With a just transition a formal part of international climate change action, the European Commission has established a just Transition Mechanism to provide financial support, and a Just Transition Platform to share knowledge and information, and to provide technical and advisory support. This is in recognition that:

> "The transition to a sustainable and climate-neutral economy will require substantial investments across Europe. However, the concentration of extractive industries (hard coal, lignite, peat or oil shale) and related energy production as well as carbon intensive industries (e.g. cement, steel, aluminium, fertiliser or paper production) will pose a significant challenge to territories that are strongly reliant on such activities. These territories will need to restructure and/or diversify their economy, maintain social cohesion, and (re)train the affected workers and youth to prepare them for future jobs." (European Commission, 2020b)

There are a number of issues bound up in a just transition, and they stretch beyond national and regional boundaries. Action in Europe will be affected by actions of governments across the world: emissions reduction targets that are more stringent in the EU than in other countries risk pushing industry to relocate rather than decarbonise, meaning that jobs in Europe would be lost; unless consumption was reduced, then global manufacturing emissions would remain the same, and emissions associated with importing goods to Europe increase. Efforts to reduce this risk of 'carbon leakage' are key to both a just transition and emissions reduction.

Member states will be expected to produce Just Transition Plans, for regions that are the most carbon-intensive, or have the most people working in fossil fuels, covering the following information:

> "These plans will set out the social, economic, and environmental challenges stemming from the phasing out of fossil fuel-related activities, or decarbonising greenhouse gas-intensive processes or products. The plans will also give an outline of the transition process until 2030, including development, reskilling and environmental rehabilitation needs. The plans will indicate a timeline, as well as the set of operations and governance mechanisms to be established in order to meet the targets." (Just Transition Platform, 2020b)

[1] This was not the first time that the European Commission has addressed a just transition: the Coal Regions in Transition Platform (launched in 2017) is one example, although it has been argued that 1951 Fund for the training and redeployment of workers is an even earlier instance (Robert Schuman Foundation 2020)

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The Just Transition Mechanism aims to mobilise upwards of €150 billion through the three pillars:

- A new Just Transition Fund of €40 billion, generating at least €89-107 billion in investments
- InvestEU "Just Transition" Scheme mobilising €30 billion in investments
- European Investment Bank public sector loan facility of €10 billion in loans, backed by €1.5 billion of the EU budget, mobilising up to €30 billion of investments

1.3 How is it linked to a green recovery from Covid-19?

The Covid-19 pandemic has shown that governments can take rapid, decisive and unprecedented measures in the face of a looming threat, and this has prompted calls to use investment to 'build back better' as countries recover. This complements the Green Deal in its intention to use investment to deliver a just transition.

The Covid-19 pandemic is expected to hit the global economy harder and take longer to recover from than the 2008 financial crisis (IMF, 2020). The EU's €1.8 trillion stimulus package to rebuild a post-Covid Europe includes a clear commitment that 30% of the budget will be spent on fighting climate change, in addition to funding through the Just Transition Fund. This stimulus package, a combination of the EU's long-term budget, together with the NextGenerationEU initiative, a temporary instrument designed to boost the recovery, "will reinforce specific programmes under the long-term budget for 2021-2027 by a total of €15 billion" (European Commission, 2020b).

The UK's independent Climate Change Committee (CCC) advised the government on measures to address the aftermath of the pandemic, with the committee's chair, Lord Deben, quoted as saying: "Recovery means investing in new jobs, cleaner air and improved health. The actions needed to tackle climate change are central to rebuilding our economy." (CCC, 2020)

The Committee's (CCC, 2020) advice is based on six principles, which strongly echo both just transition and green new deal considerations:

- Use climate investments to support economic recovery and jobs
- Lead a shift towards positive, long-term behaviours
- Tackle the wider 'resilience deficit' on climate change
- Embed fairness as a core principle
- Ensure the recovery does not lock-in greenhouse gas emissions or increased risk
- Strengthen incentives to reduce emissions when considering tax changes (CCC, 2020)

These recommendations echo the EU's ambition for a "greener, more digital and more resilient Europe" (European Commission, 2020).

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2 What do we mean by CCS & CCU?

Carbon capture and storage (CCS) describes a suite of technologies used to prevent carbon dioxide (CO_2) reaching the atmosphere. CCS can in theory be applied to any process where CO_2 is emitted. In practice, it is most suitable for industrial processes, for example where there is a demand for heat and steam that can only be met with fossil fuels, or where CO_2 emissions are an integral part of the process (for example in cement manufacture or in reforming hydrogen from methane); or where fossil fuels, waste or biomass are burned to produce heat and/or power at a large scale – that is on large point sources of CO_2. Where the CO_2 is of biogenic origin – that is, not from fossil fuels – its capture and storage can be considered as greenhouse gas removal, or 'negative emissions,' enabling states to reach net zero by offsetting residual GHG emissions in other parts of the economy which are hard to decarbonise, such as agriculture.

CCS has three broad stages: capture, transport and storage. These could be carried out as separate projects, or as part of the same project.

- **Capture** involves separating CO_2 from other gases in a flue stream, then cleaning and compressing the CO_2.
- **Storage** of CO_2 is in offshore geological formations, often depleted oil and gas fields, at least 800m below the seabed.
- **Transport** of CO_2 from capture to storage site is commonly done by pipeline – both onshore and offshore – with increasing interest in transport by ship. Onshore transport by road and rail is also a possibility.

CCUS includes CO_2 utilisation (CCU) as well as CO_2 storage – captured CO_2 can be used in a range of processes, including agriculture, food and drink and building materials.

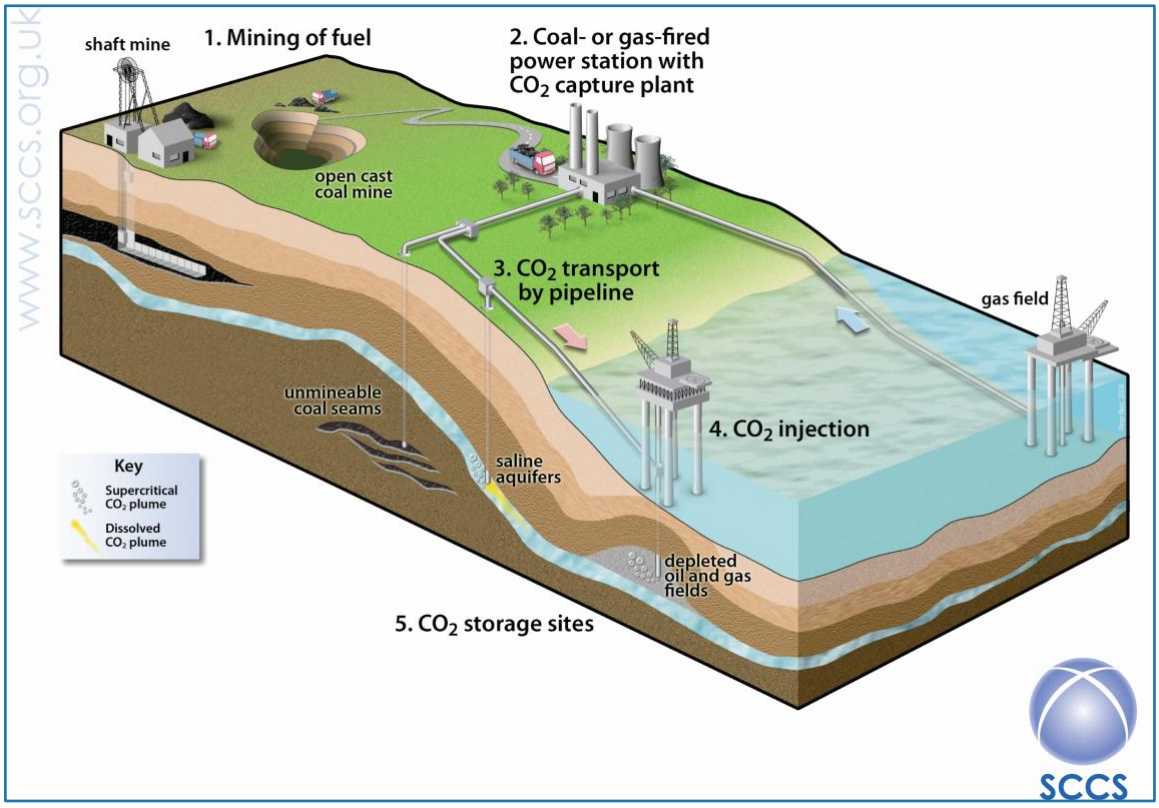

Figure 1: The CCS chain

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3 What roles can CCS & CCU play in a just transition?

Several studies have begun to explore the role of CCUS in a just transition. Swennenhuis et al (2019) found opportunities in "the re-use of existing infrastructure, the possibility to draw on existing technical knowledge within the region for subsea activity, and the potential to reduce emissions from industries such as steel while keeping them in business." Turner *et al* (2019c) found that "It would utilise existing onshore and offshore energy supply industry, pipeline infrastructure and associated extensive supply chain links, and provide attractive upskilling and reskilling opportunities for existing workers in the sector and appealing career prospects in a low carbon industry context for the next generation."

The Norwegian Labour Union sees CCS as integral to achieving a just transition (Acorn 2018), and the European Zero Emissions Platform (ZEP 2018) has stated that "incentives can be created for CCUS at national level with EU support. This will enable a transition that is regarded as just by the citizens of individual countries and Europe as a whole."

The CCUS Projects Network surveyed the network members to find their views on the role of CCUS in a just transition (see textbox).

Textbox 1: CCS/CCU project view

The majority of CCS/CCU projects see themselves as part of a just transition, and some as contributing to the green recovery, individual views on their projects are:

- Contributes to employment (construction and long-term operations).
- Delivers low carbon energy to everyone at current market prices, with acceptable government support.
- Setting up a CO_2 transport and storage value chain will make it possible for industry to move into a net-zero world and thus protect jobs.
- By helping reduce the cost of CO_2 capture facilities, we help the conversion of industries and thus ensuring job retention in areas that rely on these industries for their survival.
- Operation of a storage site requires a wide range of expertise in the gas/oil sector, for example CO2 transport via ship building on experience in liquid natural gas handling.

However, not all members are able to articulate clearly the evidence for these statements. Some projects have undertaken analysis to support these statements, and there is analysis available in the literature. But it is not clear that the role of CCUS in a just transition, nor the wider economic value to regions and Europe, has been sufficiently described.

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CCUS can be part of a just transition in a number of ways, as shown in Figure 2, and as climate action and investment increases, that role will be increasingly prominent.

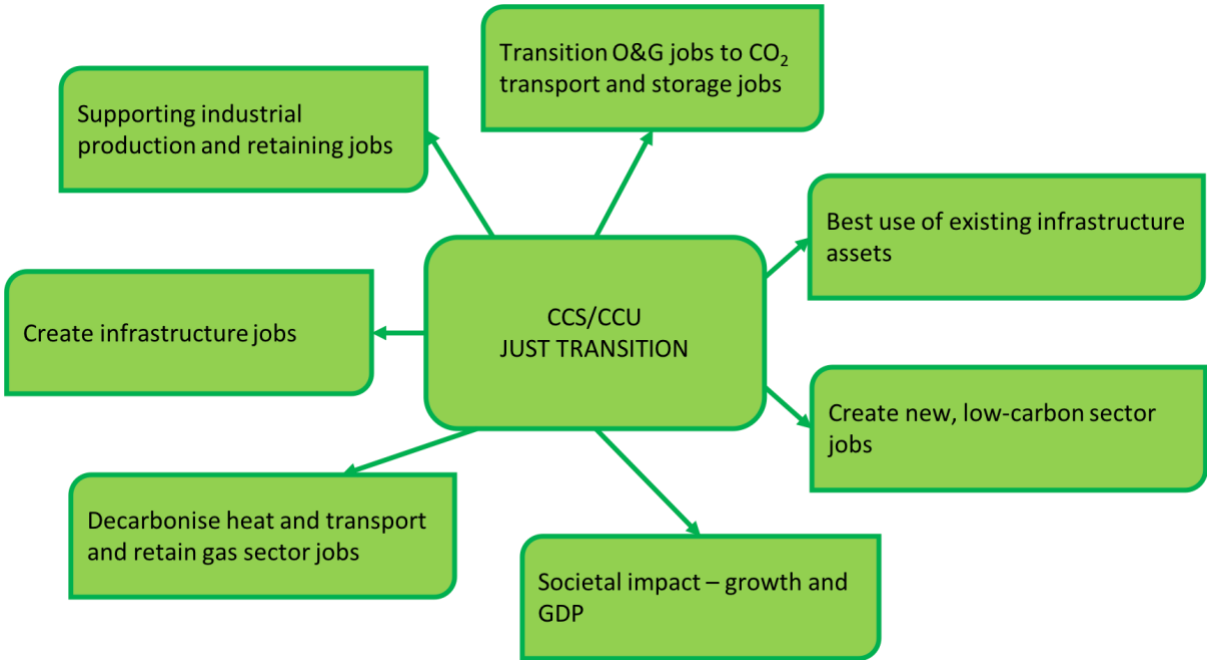

Figure 2: CCUS in a just transition[2]

3.1 Supporting industrial production and retaining jobs

"The most just transition takes place when a job is never lost, but is made sustainable." (ACT Acorn, 2018)

CCS has a core role in retaining jobs in existing high-emitting industries by preventing the CO_2 produced reaching the atmosphere, and thus making production compliant with net zero targets and avoiding carbon leakage. This narrative around retaining existing jobs was concluded to be the most useful way to communicate the impact of investment in CCUS (Turner *et al,* 2019a) and several studies have considered the 'multiplier effect' of direct employment in these industries on indirect (supply chain) jobs and induced (goods and services used by workers) jobs in the region.

High-emitting industries account for a quarter of EU CO_2 emissions, and reducing these emissions in line with net zero targets cannot be achieved without CCS (ZEP, 2018). CCS is particularly important for decarbonising industries with process CO_2 emissions – such as cement manufacture and steam methane reforming of hydrogen – and those with a heat demand that relies on the use of fossil fuels. Other measures that contribute to decarbonisation are available – such as switching fuel to renewable electricity, hydrogen or biomass, or more circular approaches to manufacturing - but these measures cannot achieve the necessary decarbonisation alone.

3.1.1 Estimated impacts

Several country or region-specific studies have attempted to quantify the full range of jobs associated with high-emitting industry, giving an indication therefore of the levels of employment that would be at risk across the economy should that industry cease to operate in Europe. ZEP

[2] Diagram source: Scottish Carbon Capture & Storage (www.sccs.org.uk)

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(2018) highlights the costs to governments in terms of lost taxes, and higher social welfare costs which are linked to unemployment.

ZEP (2018) found that Germany's three highest-emitting industries emitted almost 137Mt CO_2 per year, and that even after fully implementing non-CCS climate change mitigation measures, Germany would still have almost 50Mt of residual CO_2 process emissions. These industries in Germany support over half a million direct jobs, and millions more indirect and induced jobs, which would be at risk without the availability of CCS infrastructure to enable them to decarbonise.

In Norway, the Confederation of Norwegian Enterprise (NHO), the Confederation of Trade Unions (LO), the United Federation of Trade Unions, the Federation of Norwegian Industries, the Norwegian Oil and Gas Association and the Industri Energi trade union commissioned a study on the value of CCS to employment in Norway, which found that a CO_2 management industry could retain 30,000 process industry jobs (Størset *et al,* 2018).

Similarly, in the UK, the Trades Union Congress (TUC) looked at decarbonising carbon-intensive industry and stated that more than 800,000 people worked in these industries and their supply chains (TUC, 2012) and that 160,000 jobs could be retained through the deployment of CCS (TUC, 2014).

Turner *et al* (2019b) found that the chemicals industry in Scotland directly employs 5,691 full-time equivalent (FTE) jobs, as well as 7,796 FTE in supply chains. Munday and Turner (2020) found that the steel industry in Wales employees around 8,000 and supports another 2,000 jobs in the value chain.

The role of CCS in industry is not just about achieving decarbonisation, but about building and maintaining support for decarbonisation: ACT Acorn (2018) found that it is difficult to gain support from some trades unions for a just transition and for low carbon jobs if the transition is seen as threatening jobs in carbon-intensive sectors.

3.2 Transition offshore oil and gas jobs to CO_2 transport and storage jobs

CO_2 transport and storage could be compared to the oil and gas industry, but in reverse. Instead of pumping oil and gas from rocks over a thousand metres below the seabed and transporting it by pipeline to onshore industrial sites, CO_2 is carried by pipeline from industry to offshore sites, where it is injected into the same types of rock for secure, permanent storage.

Scotland's Just Transition Commission saw the role of CCUS as being part of 'support to enable the oil and gas industry to transition,' recommending that: "Government should consider supporting a programme of focussed research in collaboration with industry, with the aim of delivering a reduction in the costs of deploying these energy solutions in a way that secures a just transition for workers and stakeholders." (Just Transition Commission 2020a). This was echoed by the UK Climate Change Committee (2020) in its advice to government on a green recovery.

Because the processes are so similar, CCS will need the same kind of skills and experience as the offshore oil and gas industry, making it a relatively easy transition for workers, although varying degrees of re-training and re-skilling will be needed in order for workers to make the transition (ACT Acorn, 2018).

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3.2.1 Estimated impacts

The Norwegian Labour Union sees the skills in the current offshore industry as the basis for the development of CCS. A centralised, storage hub in the Norwegian North Sea is envisaged to have more than 10,000 direct jobs associated with it, and the wider effects of this industry could employ a further 5,000 to 10,000 people in Norway (Størset *et al*, 2018). However, ACT Acorn (2018) found that the high salaries associated with oil and gas might mean that skilled workers don't look for jobs outside that industry – although this may well change as oil and gas extraction winds down (ACT Acorn, 2018).

Economic multiplier modelling has been used to estimate the number of jobs supported by the oil and gas industry in Scotland. Turner *et al* (2019c) cite work that "shows that the onshore support industry currently employs around 26,000 people on a full-time equivalent (FTE) basis. When jobs in the wider supply chain, and those supported by spending of worker incomes, are taken into account, in 2014 the total number of Scottish FTE jobs supported by the onshore industry was over 44,000."

3.3 Supporting the decarbonisation of heat and transport

Heat and transport are two sectors where fossils fuels are burned directly – in gas boilers and vehicle engines – with CO_2 emitted where the fuel is used. It would be very impractical to capture the CO_2 from these millions of dispersed sources, so there is a need to phase out the direct and unabated use of fossil fuels in these applications. One way to do this is by replacing these fuels with hydrogen.

Hydrogen is now recognised as integral to decarbonisation in line with the Paris Agreement, and will be supported through various EU funding mechanisms (European Commission 2020c). Hydrogen can be produced in bulk from methane – natural gas – with CO_2 as a by-product, which can easily be captured and stored. Studies suggest that hydrogen could be used for heating in existing domestic boilers, meaning that there would be less disruption to householders than if they were to replace their gas systems with electric heating (Frazer-Nash Consultancy 2018). Current gas engineering skills and jobs could be transferred from natural gas to hydrogen without significant need for retraining.

Hydrogen production is included in the EU Sustainable Taxonomy, which includes steam methane reforming as long as the threshold of <100gCO_2e/kWh is met, which therefore requires that CCS is applied to the system (European Commission, 2020d).[3]

In its letter to the UK Prime Minister, the Climate Change Committee (2020) wrote that "New hydrogen and CCS infrastructure will be needed to support the next phase of the net-zero transition. Post-COVID-19 economic recovery presents an opportunity for governments, regulators and the industry to work together to accelerate these investments."

3.3.1 Estimated impacts

Natural gas supplies about half of the energy consumption in the Netherlands, and the gas supply sector in the Netherlands was estimated in 2012 to employ 1,600 full time equivalent (FTE) jobs directly, 31,500 indirectly and 23,300 induced jobs (RVO, 2012). The ability to produce low-carbon hydrogen from natural gas means that some oil and gas extraction jobs can continue to be supported in economies on a path to net-zero.

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The Norwegian study found that a new industry developed to produce hydrogen from natural gas for export could result in between 25,00 and 35,000 new jobs. Turner et al (2018a) (cited in ZEP 2018) found that: "almost three times as many UK supply chain jobs and more than twice as much domestic GDP may be supported by hydrogen vehicles, as is currently the case with petrol and diesel supply chains. The core explanation for such positive multiplier results is the sustained role of existing gas and/or electricity supply networks/sectors and their strong pre-existing domestic supply chains."

3.4 Make best use of existing assets

As well as making the most of sunk investment in manufacturing plants, CCS offers the opportunity to re-purpose existing infrastructure – including gas pipelines and port facilities – and the data and knowledge held in the oil and gas industry. In line with circular economy principles and the waste hierarchy, reusing existing assets is preferable to building new, and Alcalde *et al* (2019) found that this would significantly reduce the capital cost of a CCS project.

Following circular economy principles, gas pipelines can be re-used for CO_2 transport – extending their life, deferring the need for decommissioning and cost to the public purse of decommissioning and the associated emissions, and reducing the capital cost associated with developing CCS.

For example, the Leeds 21 HyNet project in the UK studied the conversion of city infrastructure to use distributed hydrogen as heating fuel (ZEP, 2018). Heating has several special factors: the infrastructure is embedded in the city and discontinued use would lead to significant asset stranding. The Leeds 21 project proposed that converting the heating gas supply from methane to hydrogen would enable continued use of existing infrastructure at acceptable conversion cost.

3.4.1 Estimated impacts

Reuse of home supply and distribution networks for hydrogen will retain jobs in the gas supply sector, and reuse valuable, existing assets. In the UK, the currently underway Iron Mains Replacement Programme, which addresses the integrity of gas supply to reduce methane leakage from old iron pipes by replacing them with plastic piping, is forecast to cost £15-16 billion (which comes from public energy bills) but makes this infrastructure compatible with hydrogen use (HSE, 2014).

In Norway, CO_2 will be transported by ship and they envisage a need for a fleet of more than 600 vessels, providing employment for 8-10,000 people; and that shipbuilders, shipping companies and associated services will also benefit from this new sector (Størset *et al*, 2018).

3.5 Creating new jobs

As well as retaining jobs in high-emitting industries, and providing alternative employment for the oil and gas workforce, CCS can create new jobs, both in the construction of CCS projects and in new industries that could be encouraged to re-locate to a region by the existence of a CO_2 'takeaway service'.

In particular, the transport and storage infrastructure for CO_2 networks - where existing infrastructure cannot be re-used – is a significant area for investment and jobs.

The Silesia Declaration (2018) states that "the development measures to make infrastructure climate resilient and enhance institutional capacity in this respect have the potential to be a source of

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decent jobs creation" and that increased global ambition would result in even more jobs. This echoes the approach of the Green New Deal and the UK Climate Change Committee (CCC) advice on green recovery that investment in climate change mitigation infrastructure would also help reduce unemployment. The CCC highlights that "many such investments are labour-intensive, geographically spread and have high multiplier effects". The Zero Emissions Platform (2018) found that "regions without a major industrial base, but with significant storage potential could benefit from a CCUS infrastructure through associated job gains".

The Just Transition Commission (2020b) in Scotland recommended public investment in facilitating infrastructure for offshore net zero activity (including CCS) as part of its green recovery recommendations, suggesting that this infrastructure investment could and should be brought forward.

3.5.1 Estimated impacts

Several studies have highlighted the job creation opportunities associated with CCS, including:

- ACT Acorn (2018) highlights the Norwegian study (Størset *et al*, 2018) which "suggested that establishing a European CCS industry in Norway could generate up to 40,000 additional (direct and indirect) jobs in 2030, and up to 90,000 by 2050, due to a growing demand for storage services as more industrial sites deeply decarbonise."
- Turner *et al* (2020) found that a £1.75 billion investment in CCS over 6 years would result in the creation of 1,700-3,850 additional full time equivalent (FTE) jobs per year.
- Vivid Economics (2020) found that deploying CCS in the Humber region, UK, would support up to 25,200 high quality jobs in construction
- The East Coast study undertaken by Summit Power found CCS deployment would enable the creation/retention of 225,600 jobs by 2060 (Summit Power, 2017).

3.6 Gross domestic product (GDP) growth

As a result of its impact on job retention and creation, CCS is expected to have a positive impact on GDP and gross value added (GVA). For example, Turner *et al* (2020) found that, in the UK, investment in CCS would provide a cumulative gain in GDP of £0.2million for every £1million spent.

However, GDP growth does not necessarily mean fair distribution, and it is clear that in order for CCS to be part of a just transition, the benefits need to accrue in the right place. ACT Acorn (2018) cautions that there needs to be a public interest case for CCS, with the benefits accruing (and being seen to accrue) to local communities, while Swennenhuis *et al* (2019) identify three criteria that a CCS project must meet in order to be part of a just transition:

> (a) make a contribution to climate change imperative;
>
> (b) help to mitigate the economic and employment effects arising from declining or maturing industries; and
>
> (c) be undertaken in a manner that helps to redress (or at least does not increase) uneven vulnerabilities and inequalities in society.

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4 Conclusion

A just transition – that is, a transition to a net-zero emissions economy that takes place fairly - is a key component of the Paris Agreement, and complements a green recovery from the Covid-19 pandemic. Members of the CCUS Projects Network have a crucial role to play in this transition, through their CCS and CCU projects. This includes maintaining jobs in high-emitting industries; supporting oil and gas workers to move into other suitable offshore jobs; creating new jobs; supporting the decarbonisation of heat and transport across the economy by enabling bulk production of low-carbon hydrogen; and supporting construction and renewables industries through the provision of low-carbon cement and steel.

It is clear that there are many thousands of jobs potentially at risk in carbon-intensive industries, oil and gas extraction and processing, and the natural gas supply sector. This comes along with the loss of GDP and potential risk to the construction industry and renewables, and hence society as a whole, if we are unable to decarbonise steel and cement production. It would be useful to better understand this impact across society in Europe to better articulate the potential contribution of CCUS to a just transition. Other societal benefits to investigate linked to a just transition include energy security, fuel poverty, air quality to which CCUS projects will also contribute.

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