

## Input to NPF4: What development will we need to address climate change?

Submitted by Colin Pritchard, Chemical Engineer and Senior Research Fellow at the University of Edinburgh, in a personal capacity.

This proposal follows the government's *commitment to ensuring that planning responds to the global climate emergency*. It is in the process of development as a memo to MSPs, and attempts to answer the four questions:

- What we will need to do to reach the target of net zero emissions by 2045.
- The opportunities that this could provide to support jobs and the economy.
- How places can be made more resilient to the long term impacts of climate change.
- What climate change-friendly places might look like in the future.

**THIS NOTE IS CONFINED TO CARBON CAPTURE AND STORAGE (CCS)** as a means of treating the gaseous emissions (principally carbon dioxide, but also oxides of nitrogen and unburned hydrocarbon gases such as methane) from power generation, petrochemicals manufacture, steel- and cement-works. These have the effect of trapping incoming radiation from the sun, causing the earth's atmosphere to heat up. Although the *concentrations* of these gases in the atmosphere are low (CO<sub>2</sub>, by far the most abundant, is only present at 0.04%) their effect is to give rise to serious overheating of the atmosphere, with consequent effects on weather, rainfall, plant growth, and so biodiversity . . . and these concentrations are rising inexorably year on year.

**THE ORIGIN** of this note was a joint Cross-Party group meeting between the CPG on oil and gas, and that on renewable energy and energy efficiency, held at Holyrood on 23<sup>rd</sup> January,. At this the hugely deleterious effects of these emissions scarcely received a mention. It was my conviction, and that of several others present, that insufficient attention to this issue has been paid right across the UK; and that, in the year in which Scotland was to host COP26, Parliament could and should take the lead by holding a debate on the significance of CCS, particularly for Scotland. To this end, it is important that NPF4 takes full cognisance of the potential contribution of CCS to meeting the target of *net zero emissions by 2045* –and *also* of the opportunity for Scotland to take a world-leading role in the application of this technology, bringing together the relevant technical, economic and commercial expertise that has been developed here over half a century.

**AN OPPORTUNITY FOR SCOTLAND:** A particularly significant factor in Scotland is that the permanent storage of CO<sub>2</sub> in deep, onshore or offshore geological formations utilises many of the technologies – and potentially some of the infrastructure - that have been developed over decades by the oil and gas industry; so that Scotland is well placed to provide the technological underpinning and the potential repositories needed for a workable CCS policy.

**COVID-19 AND GLOBAL OVERHEATING:** Regrettably, the immediate concerns about Covid-19 and the delay in COP26 mean that the decarbonisation of our energy mix, and CCS in particular, is not hitting headlines just now. In a soon-to-be-published report, **the Royal Academy of Engineering** observes that “The scale and impact of the COVID-19 global pandemic has for now shifted government's immediate focus away from climate change. During this time of national emergency, it is important that we do not lose sight of an important *present-day global threat*: that posed by climate change. There will be important lessons to be learned from our shared experience of COVID-19 that we can usefully apply to the huge climate challenge that still lies ahead. For example, how we can work together in the face of adversity, and how our collective action, uniting behind a common purpose, can lead to rapid behavioural, cultural and economic change. Our vision is of a

thriving, low-carbon economy by 2050, resulting from rapid and coordinated action at scale, across sectors, led by government and with a strong public mandate.”

The **RAE** also points to the positives: “Finding new ways to live within the resource constraints of our planet comes with new opportunities to make long-lasting and positive change. The UK has a chance to address societal challenges and create a world-leading decarbonised industrial economy. By pioneering this global transition, the UK can secure export opportunities, build its future skills capability and safeguard critical national infrastructure resilience.”

It is worth recognising that, even in a year of extreme economic downturn, levels of CO<sub>2</sub> in the atmosphere – and with them the burden of an overheating climate – will rise yet again this year. Indeed, the Covid-19 related economic downturn will make companies and governments less ready to make the investments needed to reduce emissions towards the Scottish target of “net zero” emissions by 2045 – (though currently this target has not the underpinning of the requisite detailed technical, economic, institutional, industrial, legal and social developments.) Meanwhile oil and gas prices are at a long-term low, “fuelled” by a price war between the USSR and Saudi Arabia; while the world’s largest, and most populous, consumers – the USA, China & India – remain set on achieving rapid development by keeping energy costs as low as possible.

**CCS IMPLEMENTATION: SUPPORTING JOBS AND THE ECONOMY:** Nevertheless, rapid progress on the installation of this technology in CO<sub>2</sub>-emitting installations (notably power generation from oil, gas & coal, and the manufacture of steel, cement and petrochemicals) is essential if we are not to suffer a “global pandemic” of gross overheating. This issue has been carefully considered, and widely reported, by the **Intergovernmental Panel on Climate Change (IPCC)** – see

[https://www.ipcc.ch/site/assets/uploads/2018/03/srccs\\_summaryforpolicymakers-1.pdf](https://www.ipcc.ch/site/assets/uploads/2018/03/srccs_summaryforpolicymakers-1.pdf)

Although reported by the IPCC 15 years ago, this summary is still current: too little has changed since then. The background remains the same: fossil fuels are being burned; cement, steel and petrochemicals plants continue to emit greenhouse gases without any treatment; and the *environmental* cost of these emissions as a ‘waste product’ is being borne, not by the industries that profit from this, but globally, by everyone.

In all but one of the IPCC’s projected pathways CCS is required to maintain global warming below 1.5 degrees C. However, the report also recognises the *challenges* for CCS, namely: the limited pace of current deployment, the evolution of CCS technology associated with deployment, and the lack of incentives for large-scale implementation of CCS.

So long as harmful emissions are permitted without charge, polluters will turn a blind eye to the deleterious effects on climate – and indeed on habitat loss for the abundance of species on which life on earth depends absolutely. Various authors conclude that achievement of a warming scenario of no more than 1.5 degrees requires *both* radically more efficient processes to reduce global energy use *and* extensive implementation of CCS to slow, and ultimately halt, the net emissions of greenhouse gases:

<https://ccsknowledge.com/blog/ccs-required-in-ipccs-scenarios-to-keep-to-15-degrees-celcius>

A further consideration of the implications of exceeding the 1.5 degree “target” (adopted by the Paris accord in 2012, but not acted upon by most of the strongly-emitting nations) was published in 2019: <https://www.ipcc.ch/sr15/chapter/spm/>

**IN THE UK AND GLOBALLY:** Matters have not entirely stood still in the UK. The history of (the withdrawal of) investment in the UK is well documented. Currently there is European funding for the Acorn project: Acorn is a low-cost, low-risk carbon capture and storage (CCS) project, designed to be

built quickly, taking advantage of existing oil and gas infrastructure and a well understood offshore CO2 storage site. The project is located at the St Fergus Gas Terminal – an active industrial site where around 35% of all the natural gas used in the UK comes onshore. Designated as a European Project of Common Interest (PCI), Acorn is an important catalyst for clean growth in the northeast of the UK and beyond:

[https://www.globalccsinstitute.com/wpcontent/uploads/2019/06/HO\\_SS1\\_Acorn.pdf](https://www.globalccsinstitute.com/wpcontent/uploads/2019/06/HO_SS1_Acorn.pdf)

#### **HOW PLACES CAN BE MADE MORE RESILIENT TO THE LONG TERM IMPACTS OF CLIMATE CHANGE:**

The transition to low-carbon energy eg from renewables is also essential. However this does not mean we should not try to deal with the *consequences* of carbon emissions. These are not alternatives. We must attempt both. Carbon emissions - those that have already occurred, and those that are expected to occur over the next few decades - are very likely to cause a highly significant change to the climate, and consequent change to the whole natural world. Therefore amongst the things that we should be doing, in addition to moving as fast as possible to renewable energy, are taking measures for *adaptation* to the new warmer world (with much higher sea levels, etc); and also *mitigation* of the CO2 emissions that are occurring and will still occur.

In setting all these various activities in train it would be most effective if we were able to move forward as a *global community*, because of course we all share the same atmosphere. In this, we have to be sensitive to the needs for continued development by those who have very little, and at the same time encourage democratic support for huge changes in economic and industrial systems. So we face a number of problems! Sir David King (former CSA to HMG) has spoken recently and movingly about his work on climate change being “blocked at every opportunity by the most powerful nation on earth”. The current US administration does not really believe in the science, and certainly does not believe in action that could in any way be portrayed as undesirable for the US economy. In this it is supported by a significant fraction of public opinion in the US.

**WHAT ABOUT THAT COST?** However CCS necessarily involves *additional costs* for capture as well as storage. The cost of building such a plant would be more than that of building a conventional power station having the same net power output, and the underground storage of CO2 will add to the overall costs. (But repeated studies for implementation in the US that show that transport and storage costs are a relatively small fraction of the overall CCS cost, and that there is plenty of storage capability for CO2.) So with a global market intent on minimising the cost of energy (and of cement, steel, petrochemicals), there needs to be in each situation a level of *carbon tax* that would make such investments viable.

Pollution control only “makes money” if taxes or levies are imposed to make the polluter pay for the damage to environmental and human health; in economics, this is described as “internalising the external costs”. CCS becomes economically attractive if and only if polluters are required to pay a tax or levy greater than the cost of implementing CCS. To obtain a true picture of the costs and benefits of CCS, these factors have to be, and in some cases have been, considered. We take for granted many technologies that involve higher costs: electrostatic precipitators, catalytic converters in car exhausts, activated sludge plants and so on.

Economic cost estimates for CCS from a large-scale power plant are around \$50 per ton of CO2 captured and stored. There is a broad range around this: a 2015 report by Rubin explains the pitfalls and scope for ambiguity: <https://cedmcenter.org/wp-content/uploads/2017/10/Understanding-the-pitfalls-of-CCS-cost-estimates.pdf> (For comparison, vehicle fuel duty in the UK is equivalent to around £200 (US\$ 250) per tonne of CO2 emitted). In the UK and following (particularly) the London smogs of 1952, the clean air act: [www.legislation.gov.uk/ukpga/Eliz2/4-5/52/enacted](http://www.legislation.gov.uk/ukpga/Eliz2/4-5/52/enacted) was passed to limit particulate pollution and its huge impact on health; and the costs of cleanup were borne by the

industries themselves. Subsequently, similar legislation has been adopted in many countries, with the general appellation “the polluter pays”- and with major reductions in ill-health and hospitalisation (though many cities, spectacularly Delhi, Mumbai, Beijing, Xian, . . have still to enforce tight legislation).

**A CARBON TAX?** It’s vital to recognise that any tax on carbon emissions should not be an *additional* tax; it should be a “revenue-neutral fiscal shift” - as in British Columbia where there have been very conspicuous payments back to low-income groups from the carbon levy, and where it now seems to be generally accepted. In BC, none of the serious provincial parties is proposing scrapping the carbon levy; the debate is over the size of the levy and how to redistribute it. Meanwhile the Federal government of Canada is trying to get other provinces to do the same. What has been demonstrated in BC is that *a regional policy to align with an ambitious target* such as “carbon neutral by 2045” can be effective in reducing CO2 emissions significantly.

#### **WHAT CLIMATE CHANGE-FRIENDLY PLACES MIGHT LOOK LIKE IN THE FUTURE.**

Above all, Scotland does not need to await international agreement on a “carbon tax”. This is the message I would want to convey, through NPF4, to all MSPs. Individual jurisdictions can take effective action to curb their own emissions, irrespective of what others do. This is a political question. The emission of CO2 can be “subject to a revenue-neutral fiscal shift” just like anything else that can be quantified (eg income, purchasing goods and services, buying a house, etc). *How* you do the taxing, and *what you do with the cash*, is again political. No-one suggests that the tax on tobacco must be the same everywhere: why then on CO2 emissions? CCS will only happen if a sufficiently high price is put on GHG emissions. If/when that happens, the private sector will get on and do the CCS: the technology is tried and understood. What law-makers have to do is ensure that there are no perverse consequences or regulatory barriers. And they should decide how and at what level to set a carbon levy, *and what to do with the proceeds*.

My colleague Richard Darton, a former President of the Institution of Chemical Engineers and of the European Society of Chemical Engineers, has observed: “The need for evidence-based policy has never been greater, when the government of the most powerful nation on earth stridently dismisses a vast body of scientific evidence on the topic - namely the work, over some decades now, of the IPCC. We all tend to prefer the literature that chimes with our own opinions. But there is a difference between factual research, refereed and carefully reported, and opinion pieces.” So please do follow-up the references in the text, as the basis for **a Parliamentary debate on how Scotland may harness its skills and experience for the benefit of all the world’s people.**

Colin Pritchard

Earth Day, 22<sup>th</sup> April 2020