Decarbonisation Technology Development and Commercialisation Leading to Carbon Neutrality: a Policy Perspective

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As the title above implies, it is the development of a technology and its commercialisation that can deliver carbon neutrality. Completely new technologies are not needed as sufficient technologies already exist, as extensive analysis has shown (for example in reports from the IEA, especially the Energy Technologies Perspectives series; IRENA, as regards renewables; and the Energy Transitions Commission, which has examined hard to abate sectors; as well as numerous academic studies). By contrast, what has lagged behind the identification of technical solutions are the policy, regulatory and fiscal frameworks to facilitate their demonstration, development and deployment, as the prerequisite to commercial viability.

This article will look at how policy has faltered in enabling the scale up of clean technology commercialisation and contrast that with the notable success of renewables. It will offer some lessons policymakers must learn to put us on a path to decarbonisation by 2050.

Renewables in Power Generation

Renewables are a success story, driven by longstanding and extensive incentives or mandates.

Differing approaches have been adopted in the European Union, in countries such as the UK and Germany, Germany and in the United States.

In 2000 the UK government introduced a Renewables Obligation (RO) with a target of 10% of electricity to be supplied from renewables by 2010 (an EU Directive in 2001 also set a 10% target for UK energy overall). The RO included incentives for suppliers to meet interim targets increasing year by year, financial penalties for non-compliance and a system of tradable renewables certificates (which aimed to create an efficient market for resource allocation and to foster innovation). The 10% target was not reached until 2011/12. Progress was impeded by an unfavourable planning regime, as well as delays in providing connections to the transmission and distribution system. The tradable certificate system may also have increased the perception of risk and deterred some investment.

The Germany ‘Energiewende’ was built around a system of feed in tariffs for renewables. It drove more rapid deployment than in the UK, notably of solar panels. It was however more costly.

At the federal level in the US, time limited tax credits provided incentives for renewable projects and there were additional measures in some states. But uncertainty over whether tax

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credits would be renewed created a cycle of boom and bust. The tax credit approach was also only viable for companies which had tax liabilities against which to offset the credits.

In 2008, the European Union agreed its '20/20/20' package: a reduction of 20% in CO_2 emissions (compared to 2005), a 20% improvement in energy efficiency, and a 20% share of renewables in the energy mix, all to be achieved by 2020.

A reformed renewables incentive structure called 'Contracts for Difference' was introduced in the UK's Energy Act of 2013. A strike price discovered via competitive auctions was set for renewable power generation with suppliers paid a premium to top up lower market prices; but they were obliged to refund the difference if the market price were higher, which has been the case in the current era of high gas prices.

Carbon Capture and Storage

Analysis has consistently shown that it will be very difficult, or even impossible, to deliver Net Zero by the middle of the century without Carbon Capture and Storage (ie CCS, or if the captured carbon dioxide is reused, CCUS).

But the technology continues to be controversial: criticised by some as a way for fossil fuel companies to extend the life of their business models, as unproven, costly and not commercially viable. These criticisms ignore longstanding evidence that the technology can work (eg from projects injecting CO_2 captured from gas production in Norway and Algeria) and they overlook that, in marked contrast to renewables, CCUS has not yet received the level of support needed to drive increased deployment and bring down costs through economies of scale and learning by doing. To illustrate this, consider the proposal for a CCS funding mechanism using the proceeds from selling 600m unused allowances from the EU Emissions Trading Scheme put to the European Parliament during the enactment of the 2008 package. The Parliament adopted the proposal but redirected half of the money to renewable projects, augmenting the already extensive renewable support at EU member government level and demonstrating yet again the lack of wholehearted political support for CCS.

While demonstrator projects were initiated in many other jurisdictions in the early mid-2000's, many were cancelled because of local opposition, such as the Schwarze Pumpe and Janschwalde power station projects in Germany, or the withdrawal of financial support. Examples here include AEP's Mountaineer project which from 2009 captured CO_2 from the waste stream of a 30MW unit of a coal power plant, transported and stored it in saline aquifers. As well as investment by AEP and development partner Alstom Power, $50m was offered by the US government. But the State electricity regulator refused to top this up with a small levy on consumer bills on the grounds that there was no benefit to local consumers. The UK Treasury similarly withdrew support for a project which had previously received seed funding, and which then could not benefit from matching '300m' EU funding.

Many governments have now shifted focus towards 'industrial clusters' which not only test CCUS but also build production capacity for hydrogen – a future key contributor to decarbonising

some industries and forms of transport (or even potentially domestic heating). In many industrial applications, there are few if any alternatives to CCS for decarbonisation. And 'negative emission' technologies, such as for capturing CO_2 from the atmosphere ('Direct Air Capture'), will certainly be needed to reach net zero alongside nature based solutions.

Conclusions

Space limits the policy approaches which can feature in an article such as this, but they have been selected to illustrate some key lessons on what works to drive the commercialisation of carbon neutral technologies.

i) Policymakers and businesses need to devote considerable effort to explaining the case for these technologies, not only for achieving net zero but also their benefits to host communities and the true level of risk. The abandonment of promising CCS projects at an advanced stage in Germany owing to people's refusal to accept that storage of CO_2 was safe seems particularly strange in a country using (and storing) large quantities of methane. This is a potentially toxic and explosive gas while CO_2 is something we all exhale when we breathe. Early engagement through trusted interlocutors is crucial.

ii) Businesses need to be involved at the design stage of policies to ensure they are 'investment grade' and are technically workable. Market based policy approaches can contribute to greater cost efficiency, but unless they are designed with an eye to perceived risk they can negatively impact the appetite for investment. This is where the German FIT approach seems to have won out over the UK RO, albeit at a cost. Whether speed of scale up matters more than cost effectiveness needs to be addressed upfront.

iii) Investment appetite depends very materially on the predictability of the policy, regulatory and financial regimes – allowing for reasoned judgements concerning lifetime viability of projects. The structure of the EU ETS, with a clear direction of travel and multi-year trading periods largely insulated from day to day political influence offers one model here. This can be contrasted with the highly political decision making process in the US on the extension, or not, of a tax credit regime and its associated risk of a boom and bust cycle which is not ideal for building sustainable supply chains.

iv) Even where political decisions are front and centre, it is possible to give a credible long term signal as did the EU 2008 package. This will positively affect business appetite and the development of the supplier market. The prospect of a huge growth market for solar in Europe must have been a factor in the Chinese government's thinking in growing its solar industry to compete globally; thus helping to drive dramatic cost reductions, in a way that other countries with nascent solar industries failed to do.

v) Delays from external factors can be avoided by taking a 'whole system' approach, considering the planning regime, grid connection availability, or – in the case of CCS and hydrogen – developing business models to ensure the whole complex value chain can operate.

Finally, market based frameworks should be adopted where appropriate, not only to amplify or create the markets for carbon neutral technologies but to enhance cost effectiveness and incentivise innovation. In other cases, different approaches will be needed. But whether market based or not, policies and regulation must be consistent over time, with clear signals on adoption reflecting the state of the technology. The stark reality is that stop and start approaches, particularly in the case of CCS, have not only been wasteful but have delayed the delivery of available emissions reductions by some years – a delay that was far from inevitable had advantage been taken of the state of the technology. This could cost us dear in the future race to get to net zero. Ensuring that the needed policies urgently extend across all sectors and geographies, and are consistent over time, is now the key to driving scale up, and to do it fast.

Writer's Profile

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Ms. MacNaughton is a Non Executive Director of Heathrow Airport Holdings Limited, where she chairs the Sustainability and Operational Risks Committee; a Director (Trustee) of the Green Purposes Company. She sits or has sat on several other boards in the academic, public and corporate sectors, including currently the Advisory Boards of the Grantham Institute, the Joint Institute for Strategic Energy Analysis, and Equans UK plc. She is one time Vice Chair of the UN High Level Panel on the CDM, former Chair of the Governing Board of the IEA, former Director General of Energy in the UK Government, former Chair of the Climate Group, and a founding Board member of Powerful Women, where she led the mentoring programme designed to increase the representation of women at senior levels in the energy sector.