INTELLECTUAL PROPERTY

Tomorrow's renewable ambitions depend on today's innovations

Patent filings can tell you a lot about which markets and technologies are likely to propel the energy transition forward. *Georgina Ainscow*, *Andrew Carridge* and *Duncan Nevett*, partners at Reddie & Grose, analyse recent developments.

The call to reduce global greenhouse gas emissions grows louder every year, and the need for clean energy technology has never been greater. It's clear that the way in which we consume and produce energy is unsustainable. The UK is aiming to reduce all its greenhouse gas (GHG) emissions to net zero by 2050. This means that any emissions produced in the UK must be balanced by measures to offset an equivalent amount of GHGs, such as planting trees or capturing and storing carbon.

Achieving net zero requires radical changes to not only the ways in which we supply energy but also our usage habits.

According to the IEA's *Energy Technology Perspectives 2020* report, more than a third of the emissions reductions required to achieve net zero by 2050 will stem from technologies that are not commercially available today.

So, what are the emerging technologies that could get us there faster? And how can the companies working to innovate in renewables use intellectual property protection to generate the breakthroughs that will help us reach net zero?

Climeworks, a Swiss-based CCUS start-up, holds several patents on its direct air capture technology

Photo: Climeworks

Assessing the landscape

Renewables' share of UK electricity generation increased to 37% in 2019 – a record high – with 119 TWh electricity generated from renewable sources. However, this is no reason to become complacent. A report from the National Infrastructure Commission (NIC) indicated that the UK must be running on 50% renewable energy by 2030 to set it on a cost-effective path to achieving net zero by 2050. That's quite the jump and emphasises the need for breakthroughs in the near term.

According to the IEA, rapid progress towards net zero depends on faster innovation in four key technologies: electrification, hydrogen, biofuels and carbon capture, utilisation and storage (CCUS). However, the report also finds that after a strong decade of growth in the number of low-carbon technology patents being filed, there has been a notable decline since 2011.

It's true that patents offer an insight into the research activities that are generating innovation and commercial value, though the decline since 2011 could have occurred for a number of reasons. Among them are high production costs, technologies reaching maturity, or companies focusing on other areas of green technology not picked up by the report. What the patent landscape does show is a crowded market, and it seems unlikely that one single company will be able to provide the 'silver bullet' to crack the renewable energy conundrum.

Instead, the path to net zero could largely be paved by many

incremental contributions that will unlock further innovations. Companies with robust patent filing programmes will be able to commercialise their technological breakthroughs and invest in further innovation.

Easing into electrification

One of the central tenets of the move towards net zero is the electrification of the world economy. Between 1990 and 2019 global annual electricity demand grew on average by 3% per annum. In the IEA report, increased electrification of end-use sector is set to account for approximately 30% of the annual carbon dioxide (CO_2) reductions in 2070.

A significant portion of these reductions are due to come from the transport sector, largely thanks to the expected uptake of electric vehicles (EVs). First, in light vehicles such as cars, and later in heavy duty-vehicles such as buses and trucks.

Global electricity systems must become more flexible to cope with increased electrification. Unless the necessary steps are taken, the widespread expansion of EV fleets could result in EV charging increasing the peak of daily loads.

In the building sector, growth in the use of electricity for space heating or cooling through heat pumps in buildings could also increase peak loads. Green hydrogen – produced by electrolysis using renewable energy sources, could be the answer – providing a means for storing energy to overcome variability in renewable energy supply.

The transport sector is traditionally reliant on fossil fuels. So, reducing CO_2 emissions in this area will be vital in reaching net-zero. When it comes to powering the engine of an EV, there are two viable approaches – large batteries that can be charged with electricity from the grid, or smaller batteries that are constantly charged by fuel cells.

While Tesla CEO Elon Musk is sceptical of hydrogen fuel cell batteries, Toyota and General Motors have placed their bets on both technologies, building significant patent portfolios in both large batteries and fuel cells. Hydrogen fuel cells are much lighter than large batteries. In fact, the adoption of hydrogen fuel cells could even allow for the electrification of transport forms where excess weight is undesirable, such as commercial aviation.

From a patent perspective, filing numbers related to battery electric vehicles (BEVs) have increased 400% in the last ten years. At just a 20% increase in the same amount of time, fuel cells are outshone by the number of patents filed for battery technologies. However, fuel cell filings are steadily increasing. To date, the companies with the largest fuel cell patent portfolios are car manufacturers, with the largest number of patents being filed by Toyota, Hyundai, Nissan and Honda. This also illustrates that East Asia has dominated the market in this area.

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If BEVs are to truly help us on the path to net zero, a solution will need to be found for the significant amount of GHG emissions that result from the extraction of raw materials needed for batteries. At the very least, there will need to be advancements in recycling methods. As it stands, fuel cells are currently the cleanest overall option. So, it's not unlikely that hydrogen fuel cells will become more widespread in the future.

Harnessing the potential of CO_2

CCUS technologies involve capturing CO_2 from fuel combustion or industrial processes and recycling it for further usage. CCUS for mitigating climate change is a relatively new field, with 95% of all patents being filed in the last ten years. In fact, CCUS recently hit the headlines when Elon Musk offered a $100mn prize for the development of technology that can most effectively capture carbon emissions.

According to the IEA report, CCUS is set to account for 15% of cumulative emissions savings by 2070. The success of CCUS as part of a decarbonisation strategy depends on the commercial availability of technologies at various stages of the process. An additional factor is the development of CO_2 storage and transport networks.

For CCUS to be successful, multiple components need to be in sync for the removal or capture of CO_2 from the atmosphere (followed by its utilisation or storage). CO_2 is currently used commercially in a multitude of ways, including in the production of carbonated drinks and urea, which is used for nitrogen-based fertilisers. Other use-cases are emerging, such as in building materials, and feedstocks for synthetic fuels.

Many of the major players in CCUS have recognised the importance of patent filing when it comes to encouraging innovation.

One such company is Lanzatech, which has developed technology for turning CO_2 into a feedstock opportunity. The company aims to one day reduce global CO_2 emissions by 10%. Lanzatech wants to create a circular carbon economy by recycling carbon from industrial off-gases, effectively converting pollution into fuels and chemicals using bacteria. These fuels and chemicals can then be used as aviation fuel or to create synthetic materials.

The IEA's Sustainable Development Scenario anticipates that biofuels will reach around 10% of aviation fuel demand by 2030, and close to 20% by 2040. Whilst Lanzatech is making breakthroughs in CCUS and partnering with the likes of Virgin Atlantic to develop jet fuel from carbon waste gases, they are able to leverage their intellectual property to generate revenue. Enabled by a comprehensive patent portfolio, they are able to licence their technology to customers who may then implement the circular economy in their supply chain and product offering.

This is an example of how a strong patent portfolio can be a significant asset when it comes to generating revenue, which in turn can be used to fund further technological developments and ease these innovations into the mainstream.

Across the CCUS sector, many other companies are also seeing the benefits of utilising patents to foster a climate of continuous innovation. Climeworks, a Swiss-based CCUS start-up, holds several patents on its direct air capture technology. Its intellectual property was integral in helping them to secure one of the largest ever investments into direct air capture, totalling $110mn in 2020.

The way forward

The transition to net zero won't happen overnight. However, it's clear from the patent landscape that companies are seeing the value in patent filing strategies to effectively exploit their research and innovation. It's also clear that patents have a role to play in commercialising innovation in areas where the technology is yet to be proven.

In these ways, companies with robust patent-filing systems are helping push forward the technological innovation that will get us to net zero by 2050 – and ensuring that other companies in the sector can build on their innovations. ●

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