Beyond renewables – what's next in greenhouse gas reduction?

Alex Leung, Head of Research & Strategy, Infrastructure UBS Asset Management, Real Estate & Private Markets

Alex Leung
Head of Research & Strategy, Infrastructure UBS Asset Management, Real Estate & Private Markets

Renewable energy has been one of the most popular target sectors for infrastructure investors in recent years. With the rising maturity of renewables, returns of traditional projects such as wind and solar have compressed significantly, typically offering single digit Internal Rate of Returns (IRR) in mature markets. Investors that are looking for higher returns in this rate environment are keen to explore other technologies. For example, energy storage has become increasingly popular among investors, and is also maturing rapidly as an asset class. The natural question for energy transition investors is – what's next?

Beyond traditional renewables, energy storage and grid infrastructure, there is a world of clean energy investments that sits in non-electricity industries. The electricity and heat sectors only account for 32% of global greenhouse gas (GHG) emissions, which means there are many other sectors, such as industrials, transportation, agriculture, and buildings that will attract USD 2 trillion of annual investments in the future to enable a full energy transition, according to the International Renewable Energy Agency (IRENA).

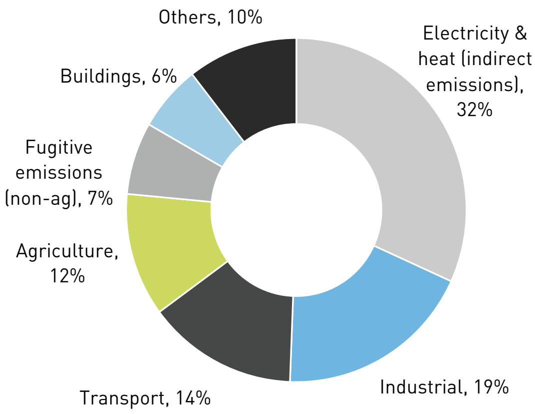
This article summarises the findings of a recent paper that we published titled *Future Green Investments*, where we explore the potential pathways to decarbonise non-electricity sectors. We touch on the business cases for carbon, capture, utilisation and sequestration (CCUS), hydrogen, clean transportation fuels, renewable natural gas (RNG), energy-as-a-service (EaaS), and others.

Industrials

Many industrial activities such as iron and steelmaking, and cement production have carbon intensive processes embedded in their daily operations.

For example, ironmaking requires the use of metallurgical coke (made from coking coal) for the direct reduction process, while blast furnaces often use pulverised coal injection to increase heat and performance. Cement production also emits significant carbon emissions due to an unavoidable chemical process that creates clinker (an intermediary product for cement) under extreme heat.

Figure 1: World greenhouse gas emissions in 2019 by sector



Source: World Resources Institute, June 2022. Note: Electricity & heat shown above has already been allocated to the end consuming sectors (i.e. it includes Scope 2 indirect emissions from electricity & heat purchased by other sectors such as industrials, transport etc.); Emissions from non-electricity & heat sectors are direct emissions from in-house energy generation, industrial processes, or other fugitive emissions.

One potential solution to tackle the emissions of these hard-to-abate industries is carbon capture, utilisation, and sequestration (CCUS). CCUS extracts the CO_2 emissions that are produced from these industrial processes, and stores it in underground caverns, or sells it to other industrial customers for extra revenues.

For example, BHP is piloting CCUS technology with China's HBIS Group, one of the world's largest steelmakers.[1] HeidelbergCement is also commissioning the world's first carbon capture project at a cement production facility in 2024.[2]

Another solution for some industries is to use hydrogen as a clean alternative to fossil fuels, especially for industrial processes that require significant heat. As renewable costs continue to fall and with the support of subsidies (such as the US Inflation Reduction Act's hydrogen production tax credit), cheap and clean electricity can perform electrolysis on water to create green hydrogen using electrolysers (alkaline electrolysers are currently the most popular technology). Green hydrogen can be combusted directly at industrial sites to create heat for industrial processes or blended into gas pipelines further upstream.

Last year, ArcelorMittal announced that it will jointly develop, build and operate offshore wind farms and hydrogen facilities with RWE,[3] which will supply renewable energy and green hydrogen that will replace the natural gas used by direct reduction plants for ironmaking.

Transport

The transport sector consists of land, sea and air sub-sectors. Overall emissions are growing and the sub-sectors are decarbonising at different paces. The decarbonization of transport benefits from converging tailwinds: falling technology costs, supportive policies and stakeholder pressure to reduce emissions.

Land transport is the most advanced in the path to decarbonisation. In 2022, 14%[4] of new cars sold were electric and charging infrastructure increased by 55% to 2.7 million units. This trend is driven by supportive public policies, changing consumer preferences and the improvement in the total cost of ownership (TCO) – a metric which looks at the cost of the electric vehicle, including fuel and maintenance over the useful life of the asset. This is driven by falling battery costs of 90% over the past decade.[5] The electric take-up is lower for commercial applications, with vans and trucks representing less than 3% electric sales. Given freight makes up 30% of transport CO_2

emissions, this represents a significant opportunity for investors looking at accelerating the transition to zero emission transportation. We expect battery electric vehicles to be dominant for road transport except for long-distance trucks where a clear technology winner has not emerged yet.

The bulk of emission reductions from air (ca 2% of global emissions) will come from sustainable aviation fuel (SAF). At present, SAF makes up around 0.15%[6] of aviation fuel demand and it cost 2-4 times more than jet fuel.[7] Upstream production of SAF needs to be scaled up to meet vast demand aligned with strong policy measures contained in the ReFuelEU Aviation (part of RePowerEU policy). This requires the use of 20% of SAF by 2035, of which 5% must be from synthetic fuels (e.g. green hydrogen based). This is a strong focus in the US too, where the subsidy up to USD 1.75 per gal of SAF under the IRA will provide a boon for the sector and, with scale, the costs could become more competitive with the current jet A-1 fuel over the longer term.

The decarbonisation pathway of the maritime sector is set by the International Maritime Organisation (IMO) regulation which targets a reduction of 40% by 2030, pursuing efforts towards 70% by 2050 versus 2008 levels. From a technology perspective, there is no clear consensus on the winning technologies, with market leaders opting for different solutions, headed by Maersk that seems to be betting on E-methanol. This gives investors less certainty and increases stranded asset risk.

In the maritime and aviation sectors, clearer short-term opportunities are in the hub infrastructure-network. As an example, ports, which generate 6-7%[8] of the total maritime emissions can invest in commercially proven technologies applications such as on-shore power (OSP) and through the electrification of port equipment. For airports, many of the ground service equipment (GSE) is already electric (e.g. baggage tractors) but there are opportunities to further reduce emissions through the adoption of fixed electric ground power (FEGP) and the electrification of other GSE such as push-back tractors for certain planes.

Agriculture

Unlike the industries that we previously discussed that emit CO2, a significant amount of GHG emissions in the agricultural sector come in the form of methane (CH4) or biogas from livestock and manure. The problem with methane is that it is over 25 times[9] more potent than CO2 in its ability to trap heat and contribute to climate change.

One way to remove this GHG is through renewable natural gas (RNG). RNG is a term to describe biogas that has been upgraded for use in place of fossil natural gas. Aside from livestock at farms, biogas is also produced from various sources, including landfills, food processing plants, and wastewater treatment facilities.

Since raw biogas has between 45-65% methane, biogas is collected and upgraded into purer methane using anaerobic digesters. At pipeline quality, the resulting RNG has methane content of over 90%. This can be used to generate electricity in power stations by displacing traditional natural gas, or can be blended into our existing natural gas pipeline networks.

Although RNG is chemically identical to fossil natural gas, the impact from its emissions is only a fraction of what the impact would have been if the methane is released directly into the atmosphere. RNG therefore has one of the lowest lifecycle GHG intensity of any clean energy sources based on its climate change impact.[10]

Currently, RNG has attracted significant capital from both strategic and financial investors. In 2022, the sector has closed almost 60 deals amounting to USD 7.6 billion of investments globally, according to Inframation.

The reason for this is because RNG project economics are attractive. In the US, developers often discuss project payback periods of around 3-5 years,[11] significantly faster than the typical infrastructure project. In the near term, the sector is benefiting from generous clean energy credits[12] that boosts near-term economics, although longer term, the price of these credits could fluctuate significantly.

"From a technology perspective, there is no clear consensus on the winning technologies, with market leaders opting for different solutions"

Buildings

One last industry that has large GHG-emission reduction potential is real estate. Historically, energy efficiency is focused on reducing energy demand, which includes upgrading insulation, lighting, HVAC, etc. and electrifying certain appliances to reduce emissions. In the last 10 years, the improvements in technology mean that there has been a focus on improving energy supply, such as rooftop solar panels, batteries and heat pumps, and optimising operations using advanced analytics from data collected from smart meters.

As distributed energy resources become more integrated with the grid, buildings can also engage in utility demand response programs or virtual power plants (VPPs), which gives buildings the ability to generate extra revenues by ramping down demand or selling electricity to the grid, which adds to the energy cost savings.

Many enterprises have aggressive GHG emission reduction targets. However, they do not have the in-house expertise to meet their own green ambitions, especially with the rising complexities of various energy transition technologies and applications that we mentioned above.

Energy-as-a-service (EaaS) and similar business models are therefore becoming more popular. EaaS firms design, build and install all the systems for buildings with their own capital, manage the different suppliers and technologies, and then optimises the building's energy supply and demand over a contracted period. The customer then makes periodic payments to the EaaS company based on the amount of energy savings and other KPIs.

This becomes a win-win situation, as a customer with no energy management expertise can still save on energy costs and increase its green attributes, without incurring upfront capital investments. On the other hand, the EaaS company owns all the equipment and receives stable and periodic payments from their customer, as long as they deliver on the KPIs.

How to invest? Factors to consider

Many of the emerging technologies highlighted in this article are currently still in the earlier stages of development. Investors should therefore focus on several factors that could make these assets more investable and provide them with more infrastructure-like characteristics:

Attractive offtake agreements: Having a large offtaker who is willing to pay a premium for cleaner energy significantly de-risks a project regardless of technology (e.g. industrial or utility customers contracting hydrogen or RNG, airlines contracting SAF, large automakers sourcing steel from mills with CCUS etc.). With significant corporate interest in climate issues, we could see more long-term contracts even for newer businesses and technologies.

Technological maturity: A lot of the technologies highlighted in this article are already mature, including alkaline electrolysers for hydrogen, and anaerobic digesters for RNG. They simply have not been scaled up enough to enjoy the cost savings that other technologies such as wind, solar and batteries have experienced. Investors should therefore avoid unnecessary risk when examining various technological options.

Predictable regulatory revenues: Since project economics of new technologies often depend on tax credits and policies – the stability of supporting regulations is an important factor. Sometimes, revenues supported by regulations can also be volatile. Investors should therefore have a deep understanding of the many drivers behind these "regulated" revenues.

Credible strategic partners: A credible partner that has the expertise in development and operations of new projects will improve investment outcomes. In many of the businesses that we highlighted, there are already experienced companies that may be looking for financial partners to support their growth.

FOOTNOTES

1 https://www.bhp.com/news/media-centre/releases/2023/03/bhp-signs-carbon-capture-and-utilisation-pilot-agreement-with-chinas-hbis-group
2 https://www.heidelbergmaterials.com/en/carbon-capture-and-storage-ccs
3 https://corporate.arcelormittal.com/media/news-articles/rwe-and-arcelormittal-intend-to-jointly-build-and-operate-offshore-wind-farms-and-hydrogen-facilities-for-low-emissions-steelmaking-1
4 BNEF, Electric Vehicle Outlook 2023
5 Lazard's Levelized Cost of Energy Analysis 16.0
6 IATA, SAF Policy 2023
7 IATA, SAF Policy 2023
8 Figures for the EU from European Parliament, European ports becoming 'fit for 55'
9 https://www.epa.gov/gmi/importance-methane
10 Energy & Power – Biofuels: Renewable Natural Gas, Stifel Equity Research, March 2021
11 https://www.wastedive.com/news/q4-2022-earnings-wm-fish-inflation-rng-recycling/641729/
12 California Air Resources Board's Low Carbon Fuel Standard (LCFS)

UBS