IMIA

ESG Sub committee

Environment – Social – Governance

ESG: Technologies supporting the energy transition.

20th of December 2023

Picture: IMIA – photo competition

This paper has been issued with the contribution of the following persons:

Alastair Baker AXA XL

Manuela Baroncini Swiss Re Corporate Solutions

Table of Contents

1. Preamble

An IMIA ESG Subcommittee was set up in September 2022 with the following objectives:

- Enhance UWR awareness on ESG aspects, what ESG means and how it applies to our industry and our clients in the construction process.
- Provide guidance to Underwriters on how to address those issues from Underwriting stage, during construction and potentially during claims handling.
- As a follow-up step, propose key areas for an ESG risk assessment including ESG rating criteria.

This paper is one of a series of papers issued by the Subcommittee. Others are available at www.IMIA.com/ESG

2. Purpose of this paper

Global efforts to accelerate decarbonisation to reach net-zero targets by 2050 will lead to increased demand for risk-transfer. This paper is to provide construction and engineering underwriters with a high-level overview of the various strategies, challenges, and opportunities of the energy transition, whilst signposting specific IMIA papers on technical topics in relation to:

1. Renewable Energy Production
2. Decarbonisation of the various industry sectors, and
3. Cleaning of the atmosphere

This document is a collection of all those IMIA working papers related to the topic of decarbonisation.

This paper is part of a series of papers issued by the Subcommittee: See ESG PWG Website in IMIA.com

3. How to use this guide (Antitrust)

This paper has been written to help fill the awareness gap on ESG aspects for construction Insurance. It offers a starting point for insurance companies who want to start developing their own guidance.

> **"The Principles for Sustainable Insurance provide a global roadmap to develop and expand the innovative risk management and insurance solutions that we need to promote renewable energy, clean water, food security, sustainable cities and disaster-resilient communities."**
>
> UN Secretary-General (June 2012)

This paper follows the same ethos: It doesn't set standards, nor guide you on risk appetite. You are free to integrate this into your risk management framework as you see fit.

4. Introduction

Global construction accounts for 38% of total global emissions, with building and infrastructure projects the equivalent to the size of Paris being built every week (Source United Nations). Less than one per cent of them are assessed to determine their carbon footprint.

In other words, we still have a very long way to go.

However, it is undeniable that the energy transition is gaining momentum and is already driving a fundamental shift both in 'why' and 'how' construction and engineering projects are taking place.

We have identified three main engineering and construction pillars that will support the energy transition to net zero.

The first pillar of this paper will focus on renewable energy. The energy used to construct, fabricate and power our buildings and engineering assets must become less carbon intensive.

The second pillar is the reduction of greenhouse gasses from the construction supply chain. There is a tidal wave of innovation heading our way.

Some technologies will not make it to market, whilst others may become mainstream. The international Energy Association (IEA) has identified that there are currently 551 new innovations being researched, tested and commercialised across the world.

John Kerry, who at the time was the US Climate Envoy, stated that 50% of the technology we'll need to achieve net zero has not yet been invented.

Readers can peruse the full list here ETP Clean Energy Technology Guide – Data Tools – IEA.

The third pillar is the need to reduce the concentration of CO2 and other greenhouse gasses in the atmosphere to more sustainable levels.

It is our role as insurers to be aware of what is on the horizon, and to play our role in enabling the best solutions to thrive, whilst protecting the insurance market from unsustainable losses.

5. RENEWABLE ENERGY PRODUCTION

5.1 Existing technologies

Renewable energy sources currently provide 12% of total global energy supply, with oil, coal and natural gas representing 29%, 26% and 24% respectively. The energy 'mix' will significantly shift in the next decade, with renewables capacity increasing, particularly in solar and onshore wind.

These changes will present material opportunities for the re/insurance sector but also bring new risks.

In terms of opportunities, it is expected that the global renewable energy capacity will grow by 7% annually, reaching 7.8 terawatt (TW) by 2035. The bulk of the capacity will be solar (50% of total addition), which will grow by a CAGR of 10% with the next largest segment estimated to be onshore wind (32% of total addition) growing at 8.3% annually.

Offshore wind will grow rapidly (16% CAGR) during this period, although it will account for only 8% of additional capacity. Hydropower, which currently accounts for ~40% of total renewable capacity, is estimated to add around 300GW during the period and its share in total renewable capacity would decline to just 20% by 2035.

The following chart demonstrates the scale of growth (in GW of capacity) forecast by IRENA/Swiss Re Institute, with Asia Pacific leading the charge with solar and onshore wind.

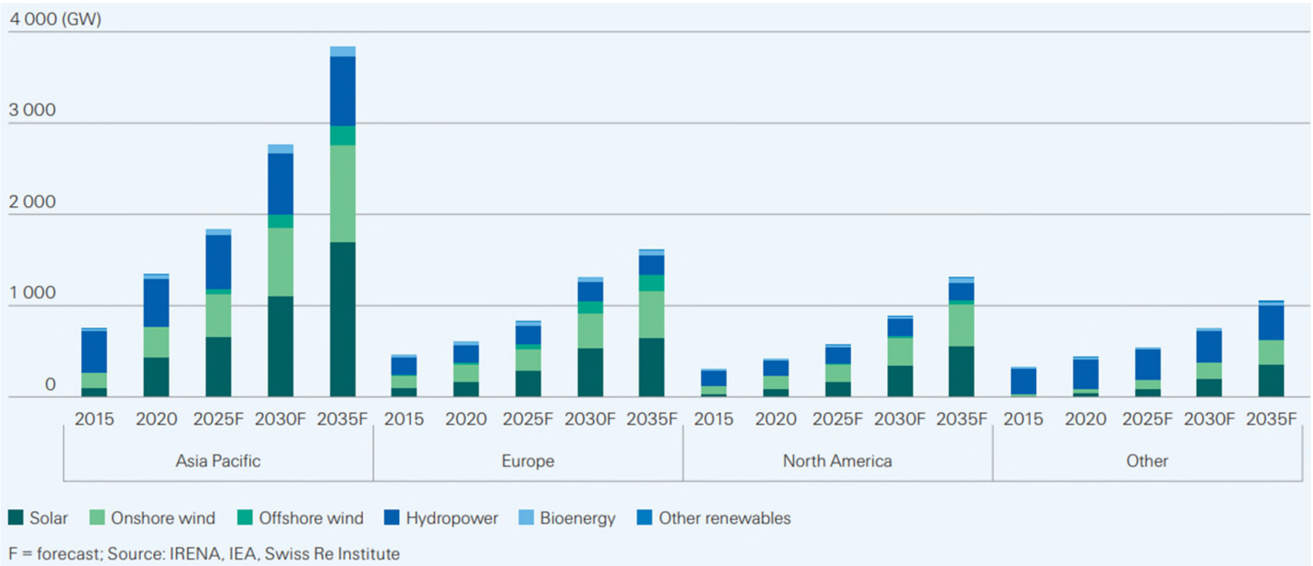

Fig.1. Cumulative installed capacity by technology and region

IMIA has developed various technical papers and presentations with a high-level overview of the challenges, opportunities and insurance implications of the various industry segments. In particular:

- CSP Solar power
- PV Solar power
- Onshore Wind Farm (new challenges for wind energy)
- Floating Offshore Wind Farm
- Hydro Power Plant
- Geothermal (Solar Thermal Plant)
- Tidal Energy
- Bioenergy
- Nuclear
- Hydrogen

Papers can be accessed by clicking on the links above or by visiting the IMIA website:

IMIA.com/knowledge/Working group papers.

Aside from wind and solar, green and blue hydrogen technologies are set to see the largest volume of investment/CAPEX across the power generation and industrial processes sectors.

5.2 New technologies and developments

As noted in the introductory section of this paper, there are many hundreds of innovations in the development pipeline. The vast majority of these relate to component innovations which look to build on existing technologies, improving their efficiency, reducing costs or maximising production.

These innovations are a natural part of the development cycle and therefore could be considered as evolutionary, however as we push the boundaries, we are likely to see new problems emerging that will need close cooperation between the innovators, manufacturers, financiers, developers, contractors and owners – and insurers.

Notable recent innovations that could be the subject of future IMIA technical papers include:

- Solar Energy
  - Building fabric integrated photovoltaic systems.
  - Transpired solar heat collectors.
  - Floating solar PV
- Wind Energy
  - Airborne wind energy systems
- Geothermal
  - Direct lithium extraction
- Tidal and Wave Energy
  - Ocean wave energy converters
  - Point absorbers
  - Attenuators
  - Oscillating water column
  - Hinged flap
- Biomass
- Compressed air energy storage
- Smart grids and interconnectors
- Carbon nanotubes
- Organic solar cells
- Microbial Fuel Cell (MFC) technology

6. Decarbonisation of the construction industry and its supply chain

The transition to net zero involves decarbonising sectors that emit greenhouse gases (steel, cement, chemicals, transport, buildings, etc). The most heavily emitting sectors are energy supply, industrial production, transport, and buildings.

The construction and engineering sector contributes 38% of the world's CO2 emissions. Concrete and steel being the largest contributors CO2 emissions. Consequently, decarbonising steel and cement and the full supply chain of the construction industry is of great consequence.

The construction industry has been evolving over the last 20 years and some new materials, fuels and processes used to minimise the construction industry's carbon footprint and move towards net-zero are becoming commonplace:

6.1 **Wood and engineered timber** used as slower carbon emission materials for construction, provided harvesting is done sustainably and trees are replaced when they are cut down, maintaining a cycle of regeneration and CO2 capture from trees during their growth.

6.1 **Low Carbon Steel** (ESG webinar) is produced involving less carbon emissions compared to high carbon alternatives. A Blast Furnace-Basic Oxygen Furnace is the dominant technology today. This is very carbon intensive.

In the short to medium term, lower emissions will be primarily achieved through:

- Energy efficiency improvements and
- Increased scrap collection and recycling

However, this will not be enough to achieve the net zero targets. In the long term, alternative technologies will be key. A prominent alternative is the Electric Arc Furnace with Direct Reduced Iron. The direct reduced iron produced today use natural gas, which can be replaced by green hydrogen produced using renewable energy which makes the steel carbon free.

6.3 **Green Cement** incorporating alternative materials and processes that results in lower CO2 emissions during production compared to traditional cement. Cement is harder to decarbonise compared with steel, since more than half of the carbon emissions from cement production are related to the chemical process of calcination with a smaller part being related to use of fossil fuels that power the precalciners and kilns in cement plants.

A combination of low capex methods could be initially used to decarbonise the sector, including altering the clinker to cement ratio. The most capital-intensive method to reduce emissions in the cement industry is carbon capture and storage.

6.4 **Hydrogen** as a fuel to reduce CO2 emission, making it a potential substitute for fossil fuels, although infrastructure development and cost considerations need to be addressed for widespread adoption.

6.5 **Battery storage** is key to improve the accessibility to clean energy by storing excess of renewable power, such as solar or wind, for use when the demand is high but the weather conditions are not conducive to energy production.

6.6 **Modular construction** (webinar) is another way to reduce waste and improve efficiency in the construction industry. This involves manufacturing building components off-site in a much more controlled environment, with less noise, dust, and disturbance to the surrounding ecosystem. Modular construction can improve material usage and streamline the assembly-process, enabling more efficient use of time and resources. Modular buildings for instance are designed for disassembly and reassembly, promoting the reuse of components, and reducing the use of materials.

However, to achieve net zero, a wider approach to minimising the use of virgin materials is required.

The transition towards a more sustainable and environmentally friendly industry requires the adoption of a philosophy, which to date has primarily concerned the re-use of concrete and aggregates: **The Circular Economy**.

Fig.2 – Source: UN 2022 Global Status Report for Buildings and Construction

This is a framework aimed at minimising waste, maximising resources efficiency, and reducing environmental pollution. It promotes the ease of repair, reuse and recycling of construction materials instead of discarding them. Designing for longevity, making it easier to disassemble and recover materials. Using materials wisely, choosing those with lower environmental impact and locally produced to reduce the CO_2 emitted by transportation.

7. Reducing greenhouse gasses in the atmosphere

The fundamental concept of climate change is that anthropogenic activity has resulted in more CO_2 being emitted (by both natural and human activity) than can be absorbed through carbon sinks such as the seas and forests.

The natural carbon cycle rebalances itself over very long timescales. To return the levels of CO_2 in the atmosphere back to pre-industrial levels will take hundreds of thousands of years. Reducing emissions will be unlikely to be enough to manage climate risks.

There are any many ways however to accelerate the absorption of carbon from the atmosphere.

In the last years, we have seen various emerging new technologies for carbon removal solutions. Those differ in how atmospheric CO_2 is captured, processed, transported, and stored.

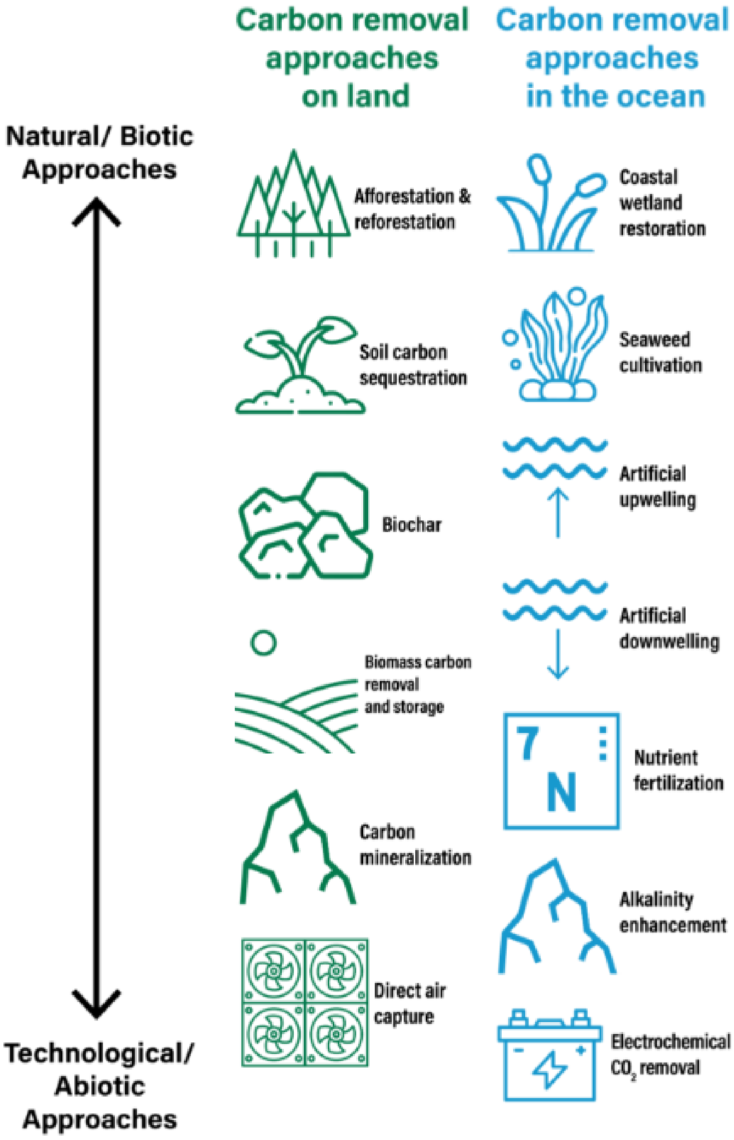

Fig.4 New Developments in Carbon Dioxide Removal,

Source (New Developments in Carbon Dioxide Removal | World Resources Institute (wri.org))

There are three main categories of carbon removal solution (Source Swiss Re):

- **Nature-based solutions** that use biological processes to capture CO2 from the atmosphere and store it in the form of organic matter.
- **Hybrid solutions** which combine nature-based and technological processes.
- **Technological solutions** that use engineering tools to filter CO2 from air and store/process it in concentrated form.

Many of the natural approaches such as afforestation/reforestation, wetland restoration and soil carbon sequestration are outside the scope of engineering and construction. It is the hybrid and technological solutions in development and commercialisation that we will see impacting our market.

Notable technologies include:

7.1 Bioenergy with Carbon Capture and Storage (BECCS)

This is a technology that combines the use of bioenergy, typically derived from biomass such as plants or crops, with the capture and storage of carbon dioxide emissions. BECCS enables carbon removal because biomass absorbs CO2 as it grows, and this CO2 is not re-released when it is burned. Instead, it is captured and injected into deep geological formations, removing it from the natural carbon cycle.

7.2 Direct air capture and storage (DACS)

Large-scale fans or chemical processes capture CO2 directly from ambient air, compressed, and then injected into geological formations deep underground for permanent storage. This is a technology that can complement other carbon reduction strategies. It is still in the early stages of development, and challenges include high energy requirements, cost, and the need for suitable storage sites. Continues research and development are essential to improving the efficiency and feasibility of this technology for large-scale deployment. In terms of key risks, those are outlined in this report from Marsh.

7.2 Electrochemical CO2 removal

There are several different processes that fall under the umbrella of electromechanical CO2 removal. As the name suggests, all of them require electricity to power the processes which include electrolysis, deionisation, and reversible redox reactions.

When paired with a renewable energy source, this technology does have the potential play a major role in removing CO2 from the oceans and the atmosphere. It is 'one to watch' as several technological barriers remain before it can be commercially viable.

7.3 Carbon mineralisation

Carbon mineralisation is a process that naturally occurs over hundreds of thousands of years. The process can be accelerated by combining concentrated CO2 with alkaline rocks to form carbonates. This can be done above ground (ex-situ) to produce carbonates, or the CO2 can be pumped directly underground in specific locations with suitable geology (in-situ).

In the above-ground method, the resulting carbonates are stable and can be used in materials, including concrete. The potential of this technology is vast, with the World Resources Institute forecasting that 25% (10 Gigatons) of global emissions CO2 could be removed per year by 2050.

The requirement for alkaline feedstocks does however present environmental hurdles such as more extensive mining, groundwater pollution and seismic risks.

Further information can be found here: Carbon mineralization pathways for carbon capture, storage and utilization | Communications Chemistry (nature.com)

***