Special Report: Energy Transition Trends for 2021

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Energy Transition Trends
for 2021

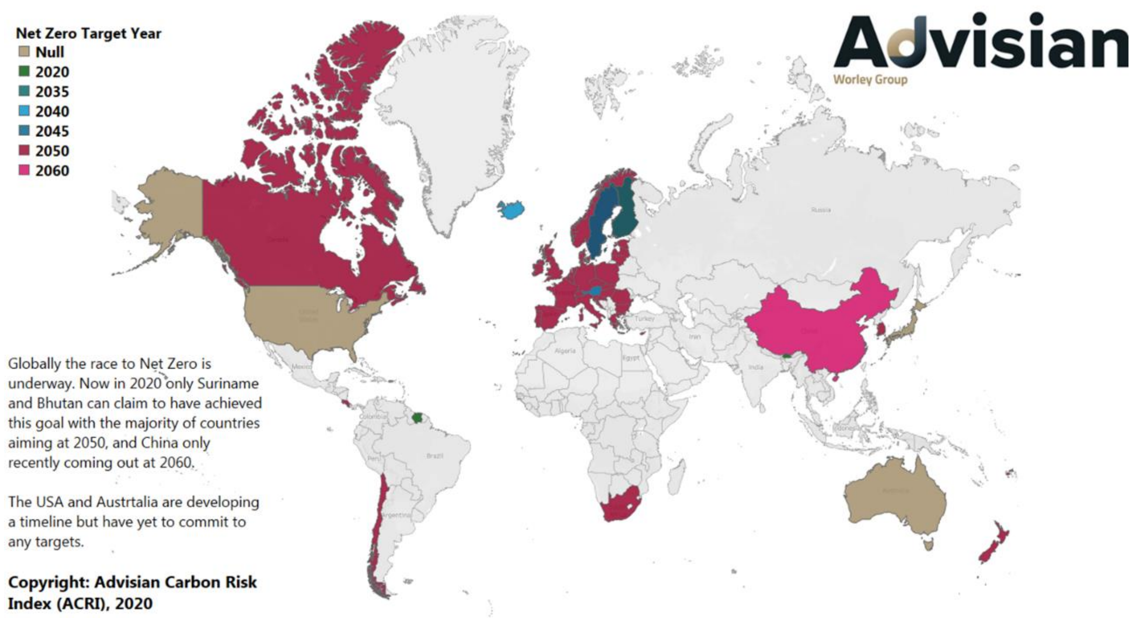
Introduction

On the 1st February Uzbekistan was the latest country to announce the goal of carbon neutrality by 2050.

2020 was a catalyst for change, in many areas including the energy transition. An increasing number of governments now have the requirement of their countries to be carbon neutral by a future date, with China currently being the outlier of 2060.

There is though a broad swathe of countries, shown in the map in gray, which have yet to take a position but remain an active participant in the energy transition.

Figure 1: 2020 Government Levels Targets for Carbon Neutrality



Corporate action is also on the increase, with now over 1,000 companies having carbon neutral, or zero carbon, targets.

This understanding of the importance of the energy transition though somewhat masking the fact that it is not simple.

There are no easy answers.

There are going to be a lot of dead ends explored and there are many hard questions to be faced.

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As part of this focus on supporting industry and providing value add to the marketplace this trend report focuses on the larger picture, on the meta trends which are currently impacting the energy transition. Areas which in 2021 will either be glossed over in the determination to focus on the easier to answer areas such as the need for the energy transition, or will start to be addressed.

1. The Creation of the Energy Transition Taxonomy

Taxonomy is defined as "a system for naming and organizing things, especially plants and animals, into groups that share similar qualities."

Taxonomic analyses of systems outside of biology are increasingly used to support the provisions of a reliable and scalable structure for the adoption and implementation of technology-based networks.

The fields of data and data analytics were one of the first to promote the use of a clear, taxonomic, system of data ordering. More recently in the field of space exploration NASA has released a detailed technology taxonomy in support of its roadmap for enabling future space missions.

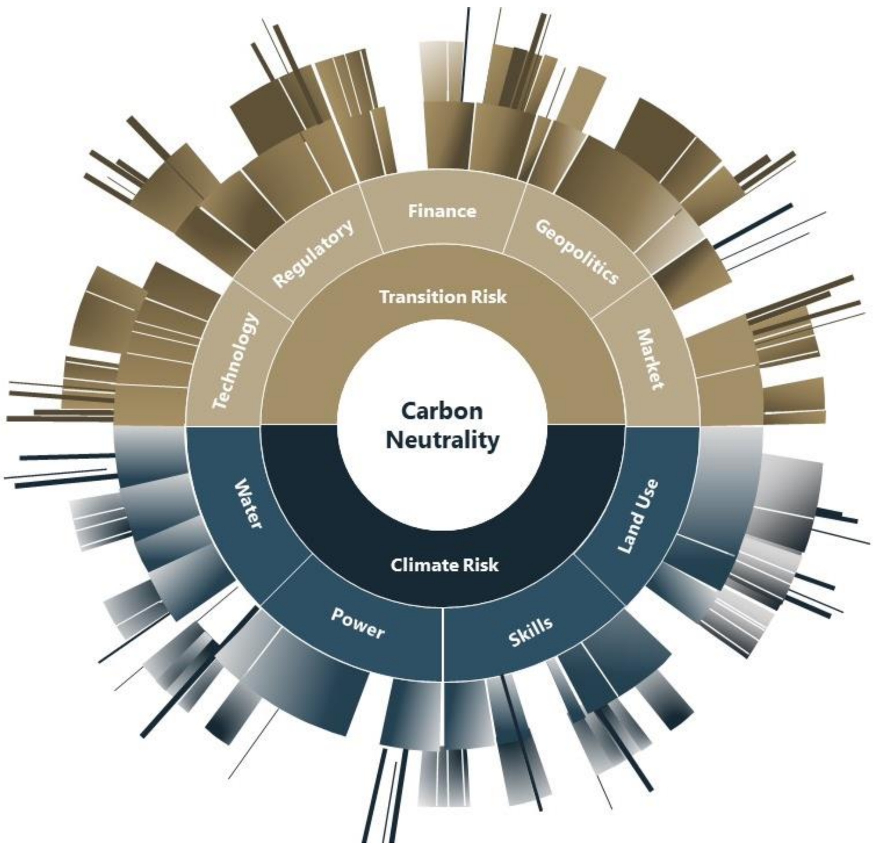
Now, with governmental level agreement on the focus on carbon neutrality, contrary to zero carbon, we are able to build the structure of the energy transition taxonomy.

The basic taxonomic structure that ACRIS has created around the Energy Transition is a six-tier hierarchy:

- ET Level 1: (Goal) Carbon Neutrality by 2050 / 2060
- ET Level 2: (Family) Transition and Climate Risks
- ET Level 3: (Sector) Within the risk grouping which sector does this fall into eg regulatory, geopolitics
- ET Level 4: (Problem) Specific problem which needs focused on e.g. reactive housing to the changing climate
- ET Level 5: (Solutions) Enabling Solutions for ET3
- ET Level 6: (Timeliness) Technology and market readiness of the solutions, e.g. global carbon accounting program

The creation of an energy transition taxonomy will enable the increased support of reliable and scalable structures for the adoption of technology-based networks.

Figure 2: The Basic ACRIS Energy Transition Hierarchy



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Each of the outlining issues to be solved (ET level 4) will have its own set of solutions (ET level 5) and whilst some of these will be cross sector, so-called sector coupling, many will problem specific solutions to be developed.

When coupled with the rise of technology mutualism (see trend 2) this taxonomy can then be seen to support the development of local and multinational roadmaps, development prioritization and potential investment decisions and efforts in the energy transition.

What is clear though is that the taxonomy is far from complete. A number of areas remain blank and the challenges, and needs arising from them, still to be articulated and agreed upon at a level to allow them to be classified. The taxonomy structure, therefore, shown here is designed to be flexible from the family level down to accommodate further tiers as and when is needed.

2. The Rise of Technology Mutualism

The history and development of technology has had a long, but not always glorious, 120 year plus, past of borrowing concepts and frameworks from biology. From evolution to punctuated equilibrium shifts in technology these frameworks allow futurologists, consultants and technology historians useful and useable models to understand and, within bounds predict, the future development paths, of technologies and critically how they interact with society.

And the energy transition is no different with the witnessing of the inexorable rise of what ACRIS terms **technology mutualism**.

In economic theory mutualism is a subset of anarchism, which favors the abolition of government in favor of self-organizing and self-governing communities and co-ops. This is not what we are outlining here!

Instead this is based on biological mutualism, which is beautifully and excitingly highlighted in the wood wide web. The wood wide web is a more snappy title for the mycorrhizal networks which are increasingly been understood to link together trees, of all types, and their communication and support pathways through the hyphae network. This network is based on co-dependence, reciprocity and mutual support. Each needing, and giving to, each other to support the whole and in the process create a healthy and viable community.

> **Technology mutualism is in stark contrast to the approach of the market search for a single "winning" technology. Technology mutualism explicitly recognizes that climate efficiency is approached through a system of technology co-dependence, reciprocity and mutual support.**

This concept is in stark contrast to the "which technology will win" questions which remains a common topic of focus during conferences, panel debates and on client calls.

The implication from this question is that with perfect foresight, or an ability to control and develop the marketplace, one solution, or technology option, will come to dominate, and the rest will either be locked out or left to play a niche role. There can be only one!

Whilst we can argue that this current fixation on winners and looser, in the west at least, is an offshoot of current entrenchment of neoliberal capitalist thinking, the reality for the energy transition is very different.

Mirroring the hyphae network underpinning the wood wide web this model of technology co-dependence, reciprocity and mutual support leads to the understanding that there is no winner, and no one size fits all solutions.

At its most effective, the energy transition will be a patchwork of local, hyper local and some national options each developed and integrated to suit the needs of situation. Whilst this is clearly not efficient, in that each situation needs analyzed to best understand the needs, it does highlight the need for a range of technologies and systems, each working together and supporting each other to answer the problem.

Again, borrowing from the terminology and science of the wood wide web, the energy transition will have a number of "mother" technologies, cornerstones in each solution, which form the backbones of the networks. These will be the big hitters such of offshore wind, energy storage using batteries, flow batteries, and electrolysers. The inter-connectors, the equivalent of the mycorrhizal fungi in the hyphae network are the power electronics, the data connectors, and the overall system interface. These areas remain rich in need with innovation but sadly remain much lower in terms of focus of development from the public sector purse.

This model of co-existence also requires us to fundamentally understand that our traditional way of thinking of efficiency is somewhat blinkered and to adopt the approach based on climate efficiency not technology efficiency.

Finally, the ability to create, build and deploy such networks will require a rapid increase in creative thinking, in energy transition engineers who are able to see past the current boxed up solutions and develop a much more nuanced approach to the provision of energy, transport, heat and lighting. It will also highlight the need for an increase in digital design with digital twinning allowing a clear analysis of each situation before any decisions are made on potential solutions.

3. Carbon Offsetting, Green Colonialism and the Just Transition

2020 has seen a gold rush towards land use carbon offsetting, where companies have either being buying other companies to acquire their carbon bank or investing in projects which are planting or protecting trees and rehabilitating mangrove swamps.

The reasons for this gold rush are complex but, in many cases, boil down to volumes available at a cheaper cost of carbon than adopting a range of harder to implement, and more costly, technical fixes. In other words, right now carbon offsetting is cheaper than changing behavior.

In 2021 the EU is opening up the process to bring forestry under the EU's emissions trading scheme (ETS).

Land use carbon offsetting is here to stay with, in 2021, the European Union opening up the process to bring forestry under the EU's emissions trading scheme (ETS), and the recognition that to achieve climate neutrality by 2050, it will need to increase the available carbon sink to 300 million tons CO_2 eq by 2030.[1]

The other side of this debate though is centered around land rights and land use rights. For many indigenous communities' land use rights are historic, traditional and not always wrapped up in a neat written contract which can then to be used in carbon trade negotiation.

Who owns the land, the peat bogs, the seaweed, the trees and the other forms of potential carbon sinks and therefore who has the right to sell off any savings is not always clear-cut.

With current claims of green colonialism on the rise there is an increasing need for the requirement by governments of a just transition, not just for their own peoples, but also the peoples of the lands that are impacted by companies and business which operate outside of their borders.

A just transition is one where the transition towards a climate-resilient and low-carbon economy maximizes the benefits of climate action while minimizing hardships for workers and their communities.[2]

How to ensure green colonialism does not take root under the auspices of global ETS schemes is not going to be easy. With companies increasingly signing up to reporting under the Taskforce on Climate-Related Financial Disclosures (TCFD) somehow modifying and expanding on this to certify that investments are just might be one option.

But it comes down who monitors the ethicacy of the energy transition to ensure that in 2050 we don't look back to say we reduced our carbon but in doing so we denuded our global culture and cultural diversity even further.

And whilst such carbon offset "integrity issues are unresolved, the purchasers of carbon credits run the risk of these offsets being labelled as purely "greenwashing", thereby damaging their own reputations.

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[1] To put this in perspective this somewhat akin to the reforestation of Germany.
[2] https://www.ituc-csi.org/IMG/pdf/ituc_frontlines_climate_change_report_en.pdf

4. The Energy Transition Is Creating Significant Opportunities for Current Energy Intensive Heavy Industries

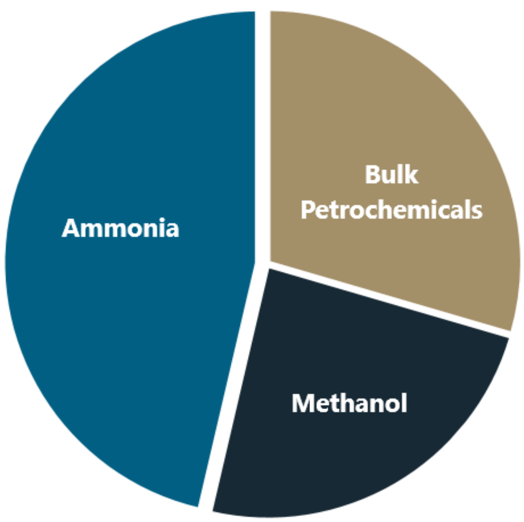
As has already been documented earlier in this short report, technical changes for heavy industry are limited in terms of practical options and often require significant upfront investment.

Also, often the same industries are facing long term demand destruction for core products, or, if they can get their houses in order, the development of new market opportunities.

Ammonia is one such industry.

Currently, ammonia is the most energy-intensive commodity chemical and is responsible for 1-2% of global energy consumption and 1.8% of global CO2 emissions.

Figure 3: Direct CO2 Emissions from Primary Chemical Production, 2018



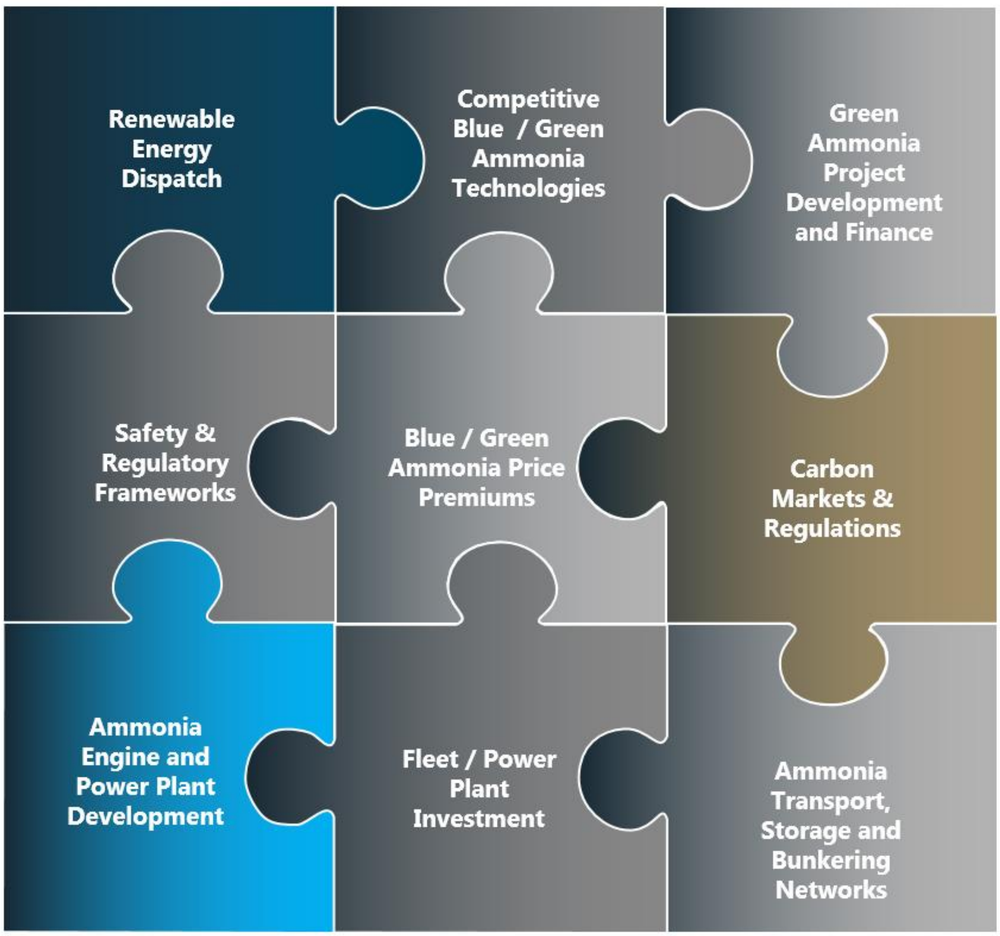
Source: IEA, 2020[3]

[3] IEA, Direct CO2 emissions from primary chemical production in the Sustainable Development Scenario, 2015-2030, IEA, Paris https://www.iea.org/data-and-statistics/charts/direct-co2-emissions-from-primary-chemical-production-in-the-sustainable-development-scenario-2015-2030

On the flip side, Ammonia is a potentially carbon free liquid energy vector via blue / green ammonia, seeing rising demand as a shipping fuel, and a hydrogen carrier, and an increase in fertilizer demand driven by bio-fuel feedstock demand increase.

For the ammonia industry to manage its risk, and carbon exposure, multiple pieces must be in place.

Figure 4: The Ammonia Energy Transition Matrix



Source and copyright: ACRIS, 2020

Key areas include managing, documenting and certifying the supply chain, accounting for carbon reductions, showcasing hydrogen removal technologies from ammonia, etc.

It is important here to remember that this is a transition, which takes time, but that for industry to profit for it there needs to be pathway to decarbonizing and publicly putting your house in order.

As an example of the pace of change, in September 2020, Saudi Aramco announced it had successfully exported the world's first shipment of carbon-neutral ammonia to Japan, helping to fuel the nascent Japanese hydrogen economy. CO_2 emissions from ammonia and hydrogen production are being captured for use in enhanced oil recovery (EOR). The ammonia is being used in pilot trials for low carbon power generation in a number of locations. Saudi Aramco sees this pilot shipment of 40 tonnes is an important realization of the hydrogen economy for both the Kingdom of Saudi Arabia and Japan. Other ammonia producers will be taking note, and eyeing opportunities for exports into major global markets.

5. Disruptive Technologies Will Continue to Garner Strong Headlines but Market Readiness Remains a Challenge

ACRIS defines a disruptive technology as any technology that through adoption can reduce the carbon exposure of an industry by more than 10%.

For aluminium an example would be the launch and adoption of carbon free anodes. Currently, carbon anodes react to CO_2 in the smelting process, creating significant process emissions. For ammonia the mass adoption of electrolytically produced hydrogen.

But disruptive technologies not only need to be developed, but also the market readiness needs to be at a level that allows for adoption.

At a high level the ACRIS MRL (market readiness levels) scale is:

- MRL 1 Basic market dynamics documented and analyzed
- MRL 2 Government intervention to remove legal barriers. Companies move from batch to low initial low volume mechanized manufacturing
- MRL 3 Demand remains primarily demonstration phase with increased focus on moving the sector forward
- MRL 4 First major multi-site customers come forward and government subsidy is available underwrite initial scale orders. Geographical availability still highly limited.

In the energy transition the public purse continues to focus on the development of the technologies with less collective focus on the development of an open marketplace. In many cases this will retard adoption into energy-intensive industries due to their, understandably, low tolerance to risk and inability to rapidly pivot

- MRL 5 Codes and standards alignment across regions to allow cross border trade. Equity and debt investment sees an increase
- MRL 6 Installation insurance is available to the customer, order to deployment is less than 6 months
- MRL 7 Geographical availability is unlimited, with demand in any region able to be met.
- MRL 8 Project finance is readily accessible, no direct barriers to adoption. Volume available on demand

And for some technologies there is a specific MRL 9 with regards to pricing.

The ACRIS MRL classification is separate from the Technical Readiness Level (TRL), which has been widely adopted worldwide for defining the technical maturity of a technology. Its first development is accredited to NASA.

The MRL levels start when a technology reaches TRL 8 or 9 and from MRL 1 – 8 can be as short as a year or can be multi-year. But without the market being ready a technology can be available for years without market take off.

In the energy transition the public purse continues to focus on the development of the technologies with less collective focus on the development of an open marketplace. In many cases this will retard adoption into energy-intensive industries due to their, understandably, low tolerance to risk and inability to rapidly pivot. What we will see is adoption of disruptive technologies into areas where consumer pull through exists, such as green aluminium into electric vehicles.

2021 will continue to see the focus, in many areas, on the development of technologies along the TRL scale, but the lack of focus on the MRL scale.

For energy intensive industries therefore 2021 will likely to see an overall increase in the Advisian Carbon Risk Index score, representing the carbon exposure of an industry, before a longer-term downturn as markets and industries start to bifurcate and pivot towards lower carbon production.

Summary

These insights are generated from the Advisian Carbon Risk Index Service, a subscription-based service offered by Advisian focusing on understanding

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the level of carbon exposure in cornerstone industries and the rapidly emerging opportunities both generated from the energy transition.

Analyze Risk

Understand Opportunities

Navigate the Energy Transition

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