2022 environmental outlook

The Green Book

MACKENZIE Investments

Contents

After a landmark year for clean energy and climate policy, the outlook for 2022 is less clear

The Mackenzie Greenchip team

John A. Cook, CIM
Senior Vice President, Portfolio Manager and Investor Engagement, Team Co-Lead
Mackenzie Greenchip Team

Gregory Payne, PhD, CFA
Senior Vice-President, Portfolio Manager, Team Co-Lead
Mackenzie Greenchip Team

The following is our outlook for 2022 but it is important to state up-front that we are bottom-up value investment managers focused exclusively on businesses that produce and sell environmental solutions. We do not base our investment decisions on macroeconomic outlooks or events.

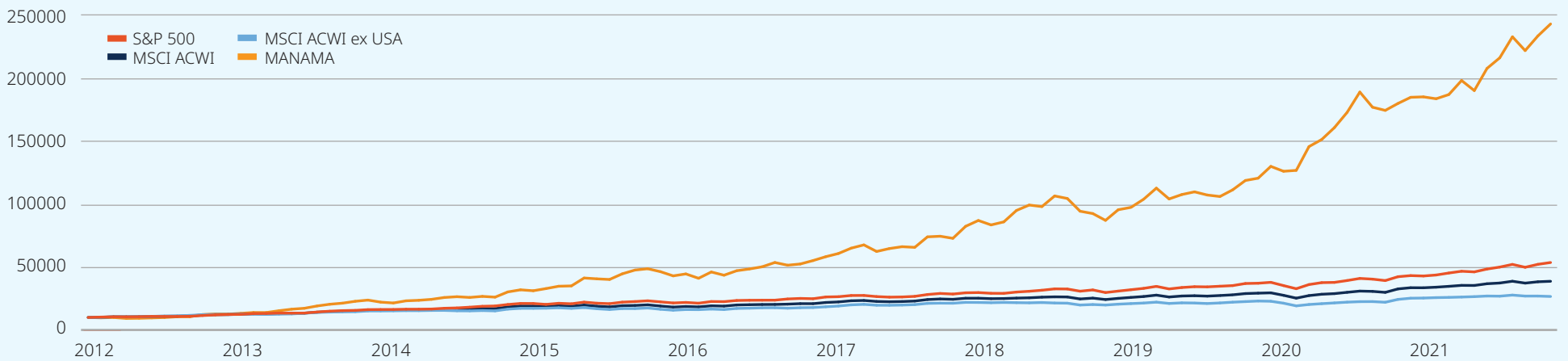
The "Great" energy transition is still in its early years but has garnered more political and investor support in the past two years than it had at any point in the previous decade. Few continue to argue that greenhouse gas emissions (GHGs) are not the primary cause of climate change. While the outcomes of the latest COP meeting were predictably disappointing to environmentalists, particularly an agreement to eliminate coal generation, most governments and increasing numbers of corporations have recently committed to net-zero targets.

Investors seem increasingly willing to allocate to ESG, environmental and low carbon strategies. From our vantage, this has created strong upward momentum for securities of listed environmental businesses. While value can still be found in less obvious places, many high-profile cleantech businesses are trading at unsupportable prices. Strangely, it is unclear that all this momentum has translated to an uptick in actual capital expenditures on renewable energy and energy efficiency projects. Finally, there seems little connection between geographic stock prices and environmental economic sector performance. This bifurcation is most noticeable between the United States and the rest of the world.

We have a long-standing belief that the US economy is much weaker than a decade of stock market outperformance would suggest, and that real inflation has been far greater than official figures or bond prices indicate. We believe the US has abused its "reserve" currency for decades, creating massive and destabilizing trade imbalances. While most global economies are currently overleveraged, we see signs that some, like China, for example, are at least trying to manage down the excesses that manufactured low-interest rates have created. History would suggest deleveraging smoothly will be challenging but at least they are trying. We see no evidence based on US fiscal or monetary policy, or political discourse, that the US has a realistic grasp on the weakness of their current economic position.

Companies whose value depends on the uncertain promise of distant profits are most vulnerable to tighter monetary policy and December brought further indication that such policy may be forthcoming. Inflation, logjammed supply chains, and Omicron isolation measures top the list of global challenges for 2022.

Figure 1 | Increasingly concentrated group of US stocks have been driving global equity returns



Source: Morningstar Direct, Dec 2021

The "Great" energy transition is still in its early years but has garnered more political and investor support in the past two years than it had at any point in the previous decade.

That all said, our observations have had virtually no connection with investment outcomes. The S&P 500 on average has outperformed the MSCI EAFE index by over 8% each year since the financial crisis. So far this year, the S&P 500 is almost 30% ahead of the Nikkei, and 16% ahead of the Euro Stoxx 50 (Nov. 30, 2021 – adjusted to USD).

Taken a step further, much of that outperformance is being driven by what we will call the "MANAMA" stocks (Microsoft, Apple, Netflix, Amazon, Meta [ex-Facebook] and Alphabet [ex-Google]) - formerly known as FAANG. Figure 1 shows the performance of the S&P 500, the MSCI ACWI and the MSCI ACWI ex USA (the ACWI index but less its US constituents) against the seemingly unstoppable force called MANAMA.

The valuation discrepancy for environmental stocks based on geography is consistent with broader index performance. The FTSE Environmental Opportunities All Shares Index, a good representation of our investment universe, currently has 614 constituents. Of these, 144 (less than 25%) are headquartered in the US and carry an index weighted forward price/earnings average of 48.5x, while the non-US constituents trade at an average of 26.4x. Since inception, our portfolio has been significantly underweight US stocks compared to the MSCI ACWI. It is a function of where we find value not a macroeconomic calculation and it is surprising that this has not had a greater effect on our relative performance. A global reversion to the mean for EAFE investments of all sorts has been overdue for years but will it happen in 2022? We have no idea.

Perhaps we are better suited to share our outlook on environmental sectors. Keep in mind, however, that we often find value in out-of-favour places or derivative plays on faster growing sectors. For example, we believe electric vehicle (EV) sales which likely doubled in 2021 may double again in 2022 but we have not invested directly in any car manufacturers due to valuations. Instead, we have been backing power management semiconductors and other electronic equipment manufacturers that we believe will benefit from EV growth. These companies will also benefit from the broader energy transition trends of electrification and energy efficiency. This is all to say that our sectors outlook is not entirely reflective of how the portfolio is positioned or the companies we hold. The following is organized based on the six main environmental sectors we employ:

Renewable energy

Global electricity demand has been growing at almost 3% a year over the past decade. As the world further electrifies, we believe overall demand will likely double in the next two decades and renewables will account for most of the new generating CAPEX. Transmission and grid management equipment manufacturers should benefit.

Europe was the earliest adopter of renewable capacity and while recent natural gas prices and a continental push for net zero emissions should drive installations, grid constraints, site availability and NIMBYism might challenge the most optimistic outlooks.

The outlook for US renewable development took a hit in December when Biden's Build Back Better package was defeated in the Senate, of which 500 billion dollars had been earmarked for climate investment. This will be somewhat offset by the Investment Tax Credit (ITC), which was extended until 2023, making solar investments more attractive.

Developing countries like India and China have soaring electricity demand, partially driven by Western demand for the goods they manufacture. The scale of renewable deployment in emerging markets is often misunderstood in the West. We seem more focused on the sensitivities of their coal expansion (particularly in China). The reality is that intermittent renewables must be matched with baseload capacity and because emerging markets tend to have more coal than natural gas, baseload matching comes generally from coal.

Electricity planners in all countries understand that combusting coal blankets populations with dangerous airborne particulate and toxic chemicals, which partially explains why 44 of the 50 nuclear reactors currently under constriction are found in developing countries whose main alternative baseload choice is coal.

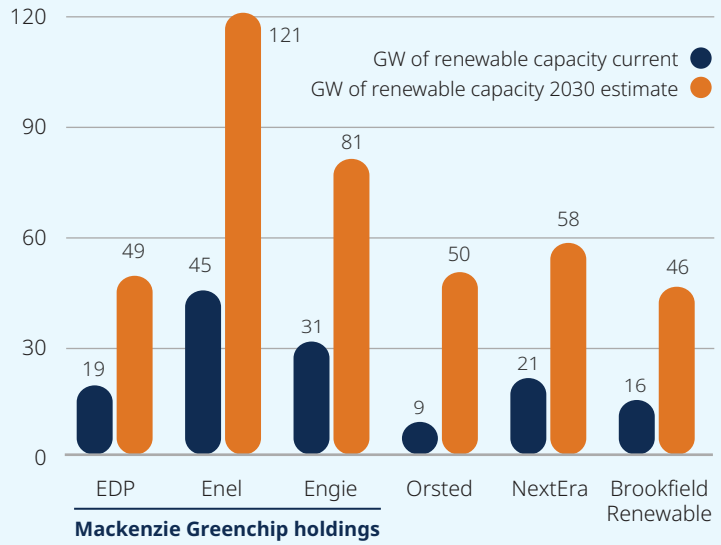
The West has largely decided to shutter its nuclear industry. Unfortunately, the nuclear/renewable combination might be a better climate/environmental bet than most environmentalists want to admit. [note: ongoing piloting of small modular reactors holds some promise but is very early stage and meaningful adoption would be decades away].

Renewable utilities

Of the developers and operators of renewable energy, we are presently finding better value in the larger integrated utilities, particularly in Europe. These companies often come with legacy assets, some of which are coal and natural gas generation. Most of them have firm dates to shutter any remaining coal and all have made net zero commitments. While this has not satisfied footprint-obsessed investors, being pragmatic about the pace of transition, our calculus is that these integrated players are better positioned to install even more renewables than their "perceived" pure-play competitors. As a result, we are of the view that they should eventually attain higher multiples. Figure 2 highlights current and estimated renewable power generation capacity (measured in gigawatts) for the integrated utilities on the left (EDP, Enel and Engie) and their "perceived" pure-play competitors on the right (Orsted, NextEra and Brookfield Renewable).

Figure 2 | Gigawatts (GW) of renewable capacity current and 2030 estimate

All figures involve estimates, adjustments, removals of storage assets to compare generating assets only.



We are finding more renewable installation at better value in integrated European utilities.

Mackenzie Greenchip

Sources: EDP: Current installed capacity, FY2020[1], Enel: Current installed capacity, FY2020[2], Engie: Current installed capacity[3], Orsted: Current installed capacity, FY2020[4], NextEra: Current installed capacity, FY2020[5], BEP (Brookfield Renewable Partners)[6]

Solar

Based on ease of installation and integration, output predictability, and relative economics, we believe solar will continue as the leading renewable technology over the next decade.

We also think that manufacturers will continue to consolidate, as we've seen in recent years. Figure 3 highlights total annual installations of solar power worldwide, with the dark blue shading representing the portion being attributed to the top 10 manufacturers. The light orange bars represent the International Energy Agency's "best-case" scenario for installations over the next few years.

We believe global supply chain problems and rising input costs will continue to plague all renewable equipment manufacturers into 2022.

Increasingly, solar installations will be paired with short-term (4 hour) storage that extends regional output into the important late afternoon/early evening hours. This does not turn solar into a baseload power source, but it enables grid systems to handle greater solar capacity than imagined even a few years ago.

And the improving levelized economics of solar/storage combinations make it cheaper than other grid balancing alternatives like gas peaking plants. At less than 3% of current global output, there is significant potential for solar growth.

Wind

Wind installation experienced a 50% year-over-year (YOY) increase from 2019 to 2020 but we don't think this level of growth will be repeated in 2021, in fact, we may see a slight YOY decline in 2022. Figure 4 highlights installations over the past 6 years and projections for 2021 (final numbers weren't available at the time of publishing) as well as the next 4 years.

Much of the growth outlook for wind was based on economic improvements for offshore installations, however, erecting these massive structures in deep waters is proving more challenging and more expensive than had been anticipated.

Another limiting factor is the availability of the specialized ships used to install offshore turbines. There are currently 16 offshore installation ships (mostly owned by private operators), while double that number would be needed to meet most offshore wind installation outlooks.

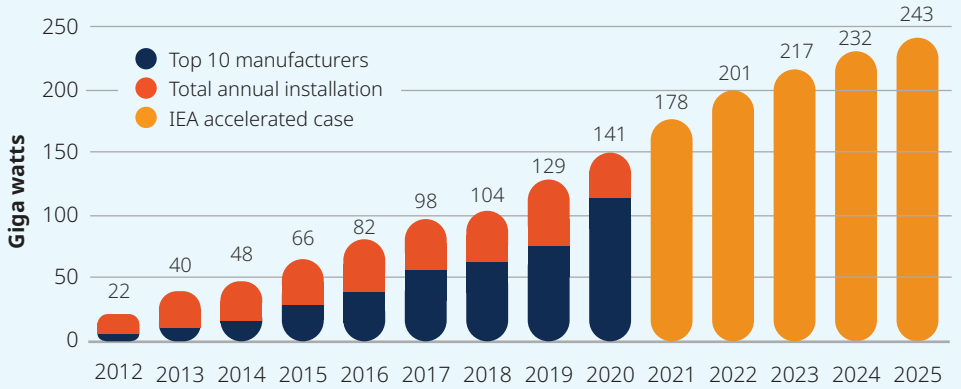
While the investment rates of return (IRRs) are marginally higher for wind over solar developments today, wind output is far less reliable. Given the choice, we believe wind eventually becomes less appealing to grid operators.

We believe global supply chain problems and rising input costs will continue to plague all renewable equipment manufacturers into 2022. It has led to price per watt increases for the first time in a decade.

Without getting into detail, we don't see much in biofuels, hydro, nuclear, or geothermal, which suggests extraordinary growth in the next few years.

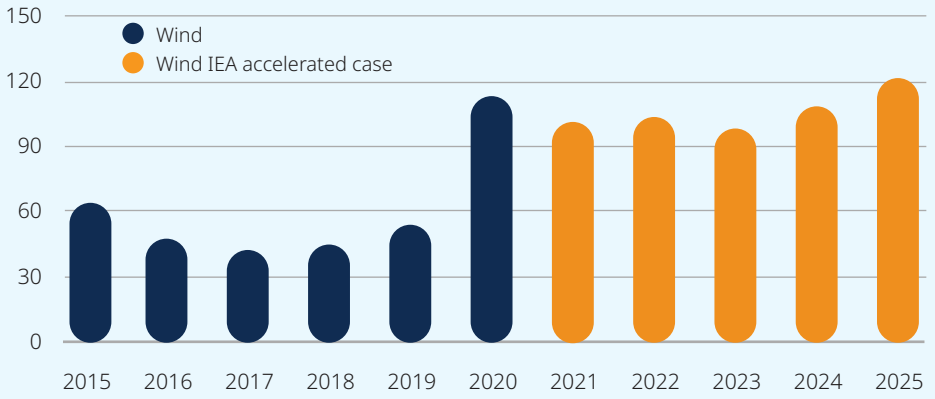
Figure 3 | Market share of top 10 module manufacturers vs. annual shipments (GW)

All figures involve estimates, adjustments, removals of storage assets to compare generating assets only.



Source: Canadian Solar, Bloomberg NEF (estimated for 2021), IEA Renewable Energy Report 2021

Figure 4 | Wind net capacity additions 2015 - 2025



Source: IEA Renewables Report 2020 and 2021

*IEA's Accelerated case assumes that governments address policy, regulatory and implementation challenges in the next couple of years.

Clean-up technologies

Technologies that help clean up the production and refining of natural resources and other materials are generally seeing increased demand. Same for end-of-life recycling and repurposing technologies. While many of these technologies have quick economic paybacks, they also become more valuable as environmental regulations and the costs of producing new materials increase.

For example, Mackenzie Greenchip has backed several packaging companies that have developed important supply chains of recycled fiber that can be reused in the manufacturing of boxboard.

In the past, we have backed technologies that could re-purpose reclaimed restaurant grease and/or waste animal fats to produce biodiesel and renewable diesel. During COVID access to the supply chains of these recycled inputs has become more challenging. We don't currently see the same opportunities in the renewable fuels space that we did even a few years ago. The risks of regulatory support waning and/or supply-demand imbalances of traditional fuels has made it harder to value these businesses.

At the same time, the reclamation and recycling of important battery metals like cobalt and lithium will become crucial as EV demand increases. Many don't realize that several countries with grand EV sales targets have extremely limited supplies of the metals needed to make the batteries - the US would be at the top of this list.

Companies that develop the ability to capture and recycle the rare earth metals used to make permanent magnets for EV motors and wind turbine generators would benefit from the same supply constraints.

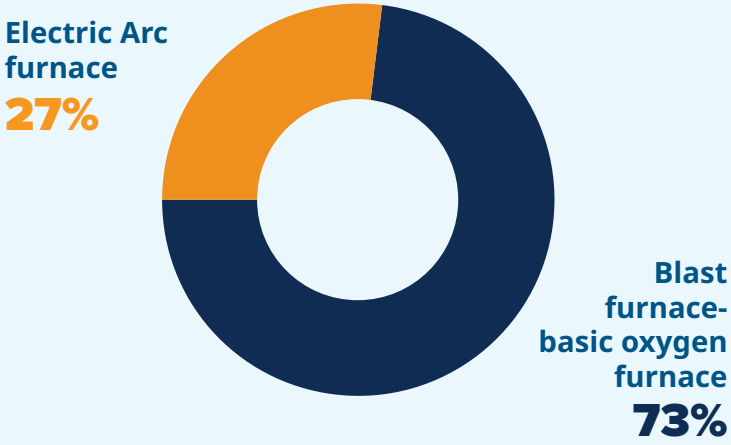
Another area that is likely to prosper long term is the reclamation of used steel. This steel can be repurposed in electric arc furnaces (EAF) to have similar structural properties as iron ore/blast furnace steel while producing only one-fifth of the emissions.

A derivative play on the EAF technology that Mackenzie Greenchip has backed are two producers of the graphite electrodes essential to the process.

- Steel is a permanent material that can be 100% recycled without loss of quality
- Electric Arc Furnaces (EAF) can reduce emissions by 50-80% vs traditional Basic Oxygen Furnaces (BOF)

Another area that is ripe for innovation and disruption is plastics. There are considerable challenges, particularly for polyethylene terephthalate (PET) plastics recycling, but several technologies look promising.

Figure 5 | Global steel production



Source: Recycling Today, World Steel Association

Electric Arc Furnaces can reduce emissions by 50-80% vs traditional Basic Oxygen Furnaces (BOF).

Energy efficiency

There are too many energy efficiency technologies to mention them all. Generally, we limit our focus to the ones that can already demonstrate economic and performance benefits or have believable paths to do so.

Efficiency technologies that can be "bolted on" to traditional industrial processes are, in our opinion, more likely to see adoption.

LED lighting is an excellent example of this, where the lights were designed to meet existing housing and/or lamp form factors. Switching to LEDs was a very low risk and economically appealing exercise for property operators.

Another example is the incredible ability of new high voltage direct current (HVDC) transmission technologies to carry electrons. For distances over a thousand kilometers, line losses are about 50% less than conventional AC transmission systems.

Other efficiency technologies that have exciting futures: variable speed drives, heat pumps, heat and pressure recapture technologies, regenerative braking, insulated building materials, logistics management software, to name a few.

Energy efficiency investment opportunities are greater than most realize, and the sector has significant innovation potential.

Energy efficiency investment opportunities are greater than most realize, and significant innovation potential remains.

Sustainable agriculture

Much of the excitement historically in the agricultural space has been related to food production using organic practices, the reduction of antibiotics, and more recently meat replacements. These met well-heeled consumer demands and were as much based on perceived health benefits as environmental attributes.

On a planet that needs to feed almost 8 billion people, we have always believed that more sustainable ways to produce food would come primarily through better resource management. Some examples of this include:

- drip irrigation to reduce water usage;
- slow-release fertilizers to reduce run-off;
- GPS systems connected to satellite and other data to reduce nutrient, water, and herbicide applications;
- more accurate mixing of nitrogen, phosphorous and potassium (the big three) fertilizers;
- crop rotation to avoid soil degradation.

We believe there are severable investable solutions in the marketplace to address these challenges.

For example, replacing the production of nitrogen fertilizer, which historically has been made from reformed natural gases producing significant emissions, with "Green nitrogen" made from ammonia and renewable electricity. Currently, it comes with a "greenium" price but it is something we're watching closely.

The most important development would be a change to Western dietary habits, including consuming less meat and dairy – cows burp vast quantities of methane, a powerful GHG. The health benefits of plant-based meat alternatives have likely been overstated in recent years. But the environmental benefits are real and as the initial euphoria of overvalued "beyond meat" type stocks wanes, it is an area that investors might want to pay more attention to.

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Water

Energy supply depends on water and water supply depends on energy – many investors fail to understand this interdependency.

For example, Brazil had trouble meeting electricity demand earlier this year when drought reduced hydroelectricity production. In past years, we have seen water availability affect Chinese coal generating output and warming sea temperatures limit the operating capacity of Scandinavian nuclear facilities.

According to the International Energy Association, desalination in the Middle East could account for almost 15% of final energy consumption by 2040.[7]

But the biggest challenges related to water are simply supply-related. The Midwest US supplies 30% of the world's corn and soybean supplies, about a third of which is irrigated from the Ogallala aquifer which extends south between South Dakota and Texas. The entire aquifer is expected to be 70% depleted within 50 years! Around the world, climate-related droughts are affecting food yield.

Despite the importance of water availability, we have significantly underinvested in existing water infrastructure and technologies to clean, desalinate, pump, and transport water.

Generally, the water sector is dominated by a few global technology leaders and service providers but there are also hundreds of small entrepreneurial businesses emerging globally with unique water management technologies.

While the growth is very exciting for many of these companies, they are generally trading at lofty valuations.

Mackenzie Greenchip's main holding in the water space has been Veolia and Suez (the former will soon finalize the acquisition of the latter). We believe the combined entity positions the company extremely well to capitalize on global water services growth.

Looking forward, the greatest challenge for water companies may be public sector budget constraints.

According to the International Energy Association, desalination in the Middle East could account for almost 15% of final energy consumption by 2040.[7]

Efficient transportation

Transportation accounts for about one-fifth of global emissions, of which half comes from operating passenger vehicles (far less than electricity generation or industrial manufacturing).

Yet nothing has garnered more investment attention in recent years than the electric car (EV).

Electric vehicles (EVs)

EVs accounted for about 4% of global car sales in 2020 and likely doubled in 2021.[8] While this is extremely encouraging, we believe it is impossible for sales to continue doubling year over year. First, governments have been subsidizing much of the growth to date and cannot afford to continue as volumes increase. Second, the decline in the price of batteries should stabilize or even increase in the coming years as basic material prices inflate. Third, it will take time for the manufacturing capacity to meet exploding demand. For these reasons (and company valuations), we have invested instead in the electric components and materials producers (which also have other applications) rather than betting on the car companies themselves. As you'll see in figure 6 below, after dramatic declines in the past decade, battery prices have begun to stabilize. As demand for EVs increases, battery prices may even move higher.

We also believe it is far more efficient to move people on buses and trains than private automobiles so Mackenzie Greenchip has backed several mass transit equipment manufacturers.

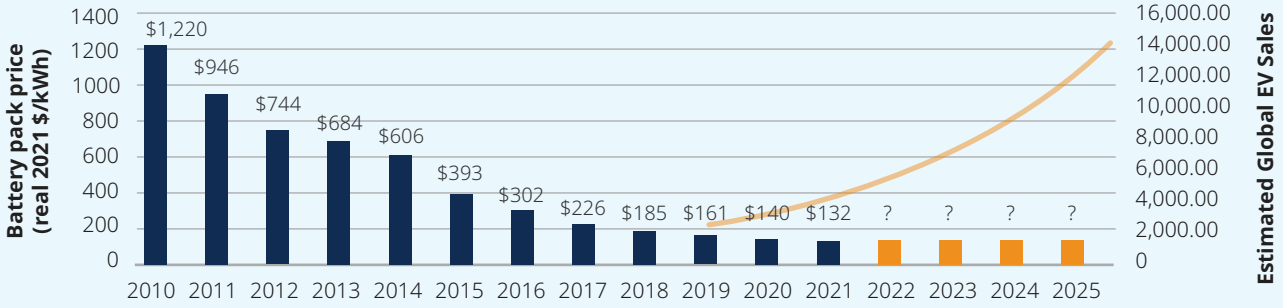
Operators face a more challenging period, COVID has affected passenger volumes and they are likely to remain low for at least another year. On the other hand, we see several years of back orders for subway and train running stock and signalling equipment. While it is challenging to predict when operator's business could return to normal, demand for rail equipment is strong.

Often overlooked by investors is the other half of transportation – the movement of goods. Global supply chains are a mess, partially due to COVID. When "just-in-time" returns to just in time is not clear to us yet.

Changing weather patterns will also make bulk goods transportation more challenging. The recent floods in BC are a good example of this as ports in Vancouver struggle to clear the docks.

Supply chains and COVID complicate freight businesses. Innovation in other areas like ship propulsion systems, transport truck engines, and new fuels such as hydrogen, present opportunities for investors with longer-term horizons.

Figure 6 | EV demand and metals inflation could lead to battery prices increasing



Sources: Battery pack prices: Bloomberg. Estimated Global EV Sales: BNEF (Bloomberg New Energy Finance), Dec 2021

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A final thought looking forward to 2022 - Producing and consuming energy on this planet has grown into an extremely complex and interconnected system, unlike anything we've known in the past. Population growth, resource scarcity and climate change are forcing this system to transition at an accelerated pace. Yet investors should try to maintain a historical and realistic perspective on the pace of this change while recognizing that this transition will likely play out over the course of several decades.

Remember, we are in the early stages of a "great" energy transition that is likely to play out over the rest of this century.

John Cook and Greg Payne,
Mackenzie Greenchip

Footnotes:

Figure 1 – Morningstar Direct, Dec 2021
Figures 2 – All figures involve estimates, adjustments, removals of storage assets to compare generating assets only.

[1] EDP: Current installed capacity, FY2020 Source: Sustainability Report EDP 2020_1.pdf. For 2030 capacity estimate, 2025 targets were used with assumption that another 10GW of solar and wind could be added from 2025-2030 Source: Ambition 2030 | Goals and targets 2025 (edp.com)
[2] Enel: Current installed capacity, FY2020 Source: FY 2020 Consolidated results (enel.com). 2030 capacity estimate assumes exit from oil at the same rate as their exit from gas (0 by 2040), linear rate. Source: Results presentation (west.com)
[3] Engie: Current installed capacity, Who is ENGIE more details from analyst pack available Financial results 2020 | ENGIE. 2030 capacity estimate, Source: Putting Strategy Into Action (engie.com) and FY Results 2020 (engie.com)
[4] Orsted: Current installed capacity, FY2020 Source: annual-report-2020.ashx (azureedge.net). Estimates made in determining electricity generation capacity from biomass, thermal power ex biomass was assumed at a 70/30% gas/coal split. 2030 capacity estimate, Source: orsted-cmd-2021.ashx (azureedge.net). Assumption: fossil phase out timeline based on net zero timeline.
[5] NextEra: Current installed capacity, FY2020 Source: 2021_NEE_ESG_Report_vF.pdf (nexteraenergy.com). 2030 Capacity Estimate, Source: 2021_NEE_ESG_Report_vF.pdf (nexteraenergy.com). Assumptions based on 2030 FPL and GP projected mix, solar targets, maintaining gas assets and phasing out coal.
[6] BEP (Brookfield Renewable Partners): Current installed capacity, FY2020 Source: BEP 2020 Annual Report (brookfield.com). 2030 Capacity based on current pipeline of 31GW, assuming similar mix of wind/solar as current capacity. Source: https://bep.brookfield.com/sites/bep-brookfield-ir/files/brookfield/bep/presentation/brookfield-renewable-corporate-profile-aug-2021-vF.pdf
Figure 3 – Canadian Solar, Bloomberg NEF (estimated for 2021), IEA Renewable Energy Report 2021
Figure 4 – IEA Renewables Report 2020 and 2021
Figure 5 – Recycling Today, World Steel Association (source)
Figure 6 – Battery pack prices: Bloomberg. Estimated Global EV Sales: BNEF (Bloomberg New Energy Finance), Dec 2021

Sources:

[7] International Energy Agency (IEA) Renewables Report – 2021
[8] https://insideevs.com/news/558357/global-plugin-car-sales-november2021/