ECONOMIC VIEWPOINT

The Energy Transition Is Accelerating, but Not Quickly Enough

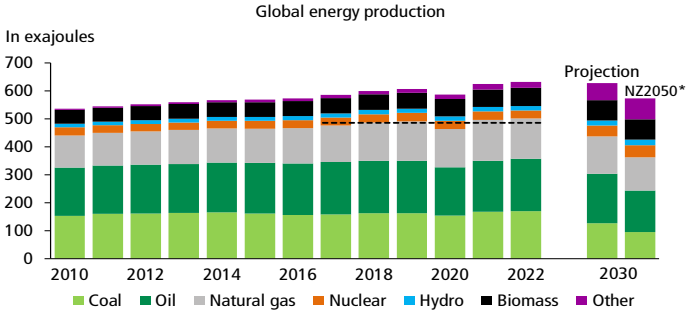
By Marc-Antoine Dumont, Economist

A growing number of countries have stepped up their decarbonization efforts in recent years. The US has introduced the *Inflation Reduction Act*, the European Union has advanced green energy projects and Canada has raised its carbon tax. But will these initiatives be enough to put the planet on the path to net zero by 2050? The way things look right now, most sectors won't be able to meet that target, despite promises to build more wind farms, battery manufacturing plants and new mines by 2030. But this doesn't mean that all hope is lost. In fact, there are a lot of promising opportunities on the horizon for countries that are willing and able to seize them.

Electrification

While it's true that the war in Ukraine accelerated the shift from fossil fuels to renewables, especially in Europe, the progress made in recent years only covers new energy needs (graph 1). As a result, fossil fuel consumption has held relatively steady since 2017. However, this doesn't mean the gains were in vain, as they've allowed us to avoid an increase in CO2 emissions. The clean energy transition is expected to pick up speed, with the latest projections from the International Energy Agency (IEA) indicating that announced projects and policies will lead to a drop in demand for fossil fuels. That said, the decline still won't be enough to put us on track to achieve net zero by mid-century.

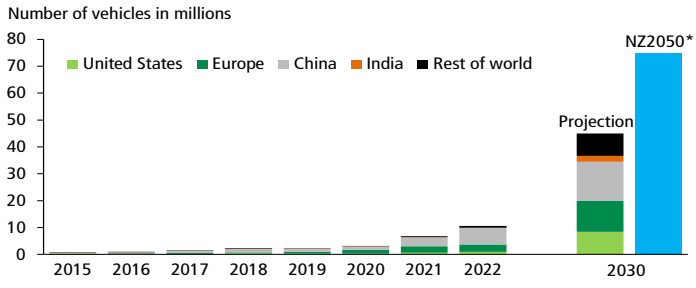
GRAPH 1
Despite Recent Efforts, Renewable Energy Growth Still Falls Short of the Net-Zero Goal



*NZ2050: Scenario to achieve net zero by 2050
Sources: International Energy Agency and Desjardins Economic Studies

Over the next decade, the biggest advances in electrification are expected to be in the transportation and heavy industries sectors, where there's ample potential for cutting emissions. Firstly, electric vehicle (EV) sales are up sharply, and the IEA expects EV sales to reach 45 million units per year in 2030, accounting for roughly 35% of total vehicle sales (graph 2). Then there's the fact that many industries still rely on fossil fuels as their primary source of energy, particularly in emerging economies. China ranks first, consuming four times as much coal as India, which claims second place. Electrification with renewables will significantly reduce the carbon footprint of various sectors. For instance, carbon emissions are currently high in the metallurgy sector, but this will change with the transition to electric arc furnaces.

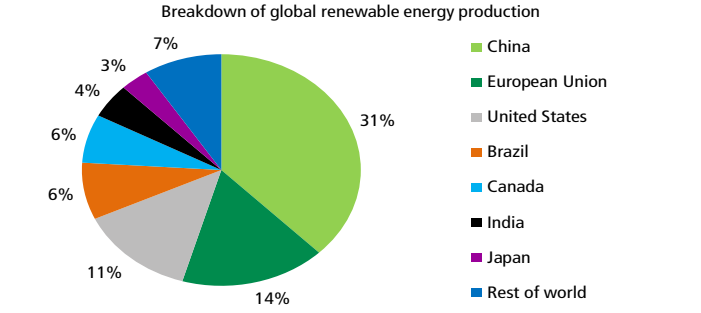
GRAPH 2
Electric Vehicle Sales Have Risen Sharply



*NZ2050: Scenario to achieve net zero by 2050
Sources: International Energy Agency and Desjardins Economic Studies

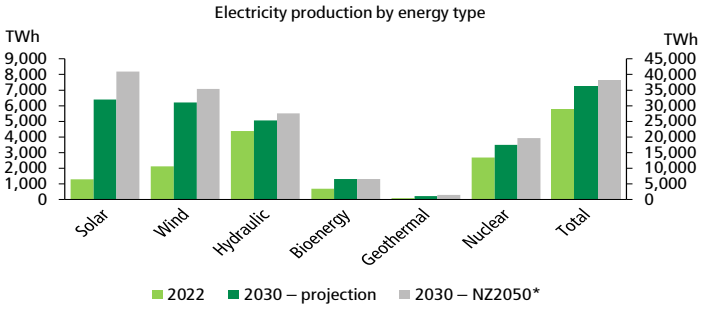
While China is the biggest emitter of CO2, it's also a renewable energy leader, with the country accounting for 31% of the 7.8 million GWh of clean energy produced in 2021 (graph 3 on page 2). The IEA estimates that electricity needs will jump by more than 25% between 2023 and 2030. To meet the growing demand, renewable power generation is expected to increase by

GRAPH 3
China Dominates Renewable Energy Production



Sources: International Renewable Energy Agency and Desjardins Economic Studies

GRAPH 4
Despite a Substantial Increase, Renewable Energy Production Remains below the Net-Zero Target



*NZ2050: Scenario to achieve net zero by 2050
Sources: International Energy Agency and Desjardins Economic Studies

25%, mainly from solar and wind (graph 4). However, this won't be enough to put us on the path to net zero by 2050.

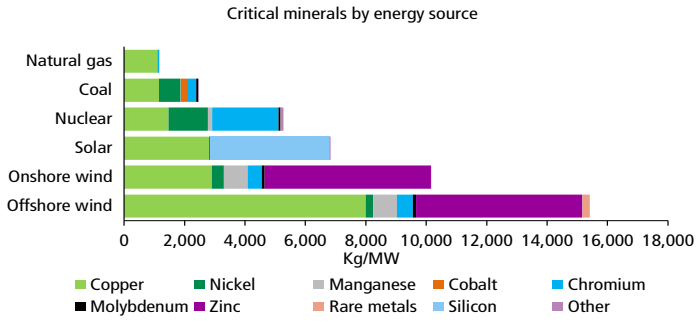
Solar and wind energy are part of the solution, but they come with important caveats. To begin with, both are intermittent sources. In order to be implemented at scale, these technologies require the proportional development of batteries to store power for use during low-production periods. Another issue is the cost and availability of materials and labour. These factors have been volatile in recent years and can have a huge impact on the construction time and total cost of facilities and related technologies. Finally, not all geographic regions are suitable for generating solar or wind power. Other renewable energy sources, like nuclear and hydroelectric power, can help mitigate these issues. But like all energy sources,[1] they come with their own set of drawbacks. Ecosystems can be destroyed when dams are built and there can be catastrophic consequences if radioactive waste is released. Plus, substantial capital costs are required for these types of facilities. At the same time, hydro and nuclear power plants offer a number of advantages as they generate a consistent and much greater amount of power, and can outlast windfarm infrastructure by two or threefold.

Regardless of which strategy is chosen, what's important is to have a plan to increase the supply of electricity. This is especially true if construction timelines are expected to be long. Intensified electrification will likely cause the demand for electricity to spike over the next decade. While the IEA anticipates that electric cars will only represent 14% of all automobiles worldwide in 2030, the proportion could reach 50% in many countries before 2040. Improving energy efficiency, through measures like better building insulation and increased car battery range, can temper growth in electricity demand. But there's no getting around the fact that more and more vehicles and devices will need to be plugged in as time goes on. What this means is that insufficient grid capacity could hold back the energy transition.

Critical Minerals Are Key to the Energy Transition

Critical minerals are absolutely essential for all the green technologies contributing to decarbonization. On a per megawatt basis, renewable energy sources require two to eight times more critical minerals than fossil fuels (graph 5). Electric vehicles require six times more critical minerals than their gas-powered counterparts, mainly due to their batteries. In anticipation of a boom in demand for these minerals, there has been a surge in mining projects and related policies in recent years. However, these new developments won't be enough to get us to the net-zero target (graph 6 on page 3). For lithium, there's a 60% shortfall. The gap is narrower for copper, but it still amounts to a colossal 3,500 kilotonnes.

GRAPH 5
Clean Energy Technologies Require Substantially More Critical Minerals

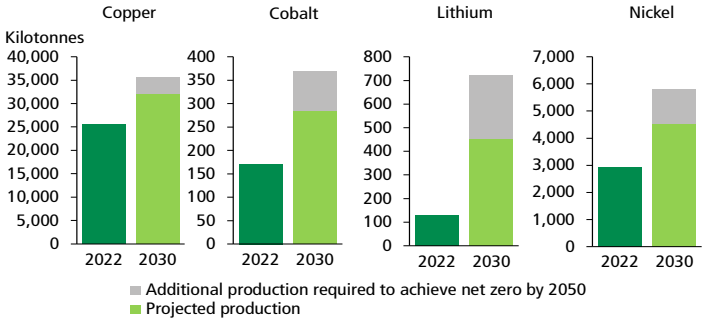


Sources: International Energy Agency and Desjardins Economic Studies

New mining projects are needed to prevent the adverse effects of a poorly coordinated energy transition, such as greenflation and key ore shortages (see "What is greenflation?" for more information). But challenges abound for mine development, as the permitting process is long and it takes years to build mining facilities and the adjacent infrastructure. There are also issues specific to certain types of ore, such as the decline in copper ore

[1] Fossil fuels contributed to the deaths of 1 to 2 million people in 2020, according to The 2022 report of the Lancet Countdown on health and climate change: health at the mercy of fossil fuels.

GRAPH 6
Critical Mineral Production Must Increase to Meet Net-Zero Targets

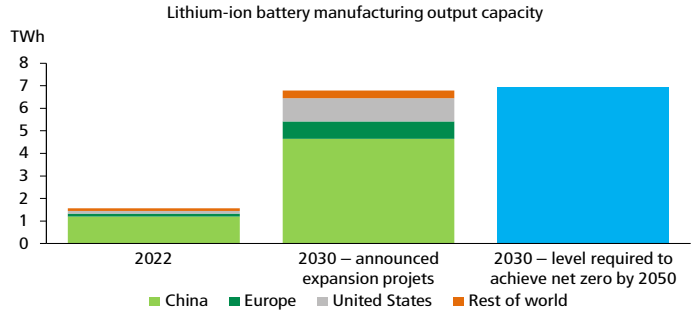


Sources: International Energy Agency and Desjardins Economic Studies

grade. That said, improving recycling processes could resolve several of these problems. Whereas 85% of steel gets recycled, just 46% of copper and 32% of nickel is recycled. To increase these rates, we need new infrastructure, new processes and a push toward eco-design.[2]

Once ore is extracted from the ground, it needs to be refined. The way things look right now, China will be responsible for 80% of the growth in the world's copper refining capacity through 2030. That number is 95% for cobalt and 60% for both lithium and nickel. Despite recently announced projects, this expanded capacity won't be enough to make the net-zero target feasible. The outlook is better for the next step, manufacturing. Battery manufacturing capacity has almost reached the level needed to support the net-zero target (graph 7). Once again, China is the global leader with 68% of the anticipated production capacity for 2030. Solar panel production is also on target. However, there are missing links in certain supply chains, such as those for the production of wind turbines and

GRAPH 7
Projected 2030 Production Capacity Is in Line with Net-Zero Targets



Sources: International Energy Agency and Desjardins Economic Studies

electrolysers (used in hydrogen generators). Having an adequate supply of critical minerals is essential, as a significant imbalance between supply and demand could hinder the energy transition.

Geopolitical Issues Are Increasingly Important

Given the number of critical minerals and their potential sources of supply, having access to these resources is a major economic and strategic issue. In addition to being increasingly important to society, they reflect a country's military capacity or that of its allies. In an electrified world, critical minerals are essential for energy independence. Oil will become less prominent in the coming decades, as the world shifts its attention to lithium, graphite, nickel and other minerals.

This new structure has prompted major economies to rethink their decarbonization strategies, particularly in recent years as geopolitical and trade tensions have escalated. China is at the heart of these issues as the country aims to become the world leader in clean energy technology and the top producer of everything that's needed to make the transition possible. In response to China's efforts to dominate the market, the West, and particularly the United States, has implemented protectionist measures. Within the G20, there has been an exponential increase in the number of trade policies, many of which are protectionist, that mention the energy transition. However, rising trade tensions—and potentially political ones—between the world's two largest economies could have negative implications for the global economy. The International Monetary Fund estimates that a complete halt in US-China trade would result in global real GDP falling 5% and a short-term spike in inflation as Americans turn to more expensive suppliers.

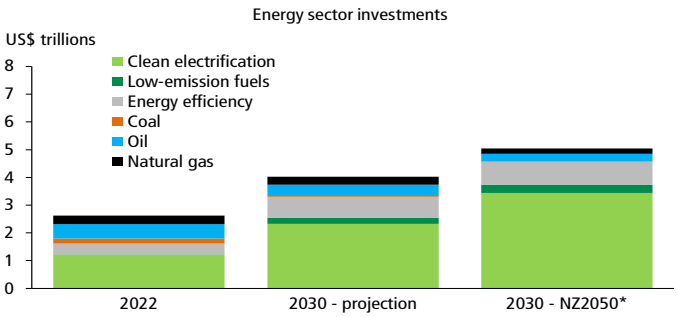
Recently, the European Union has also taken a tougher tone with China, particularly with regard to the auto industry. To level the playing field with jurisdictions where environmental standards are less stringent, the EU has introduced a new pollution tax on imports (called the Carbon Border Adjustment Mechanism or CBAM). The initial phase, which kicked off on October 1, will see a tax applied to carbon-intensive products like cement, steel, aluminum and fertilizers, but its scope will gradually be expanded to cover cars by 2030 or so. The purpose of the measure is clear: to eliminate the advantage of highly polluting imports and protect local industries. Sometimes, however, environmental considerations are used as an excuse for adopting protectionist policies to safeguard specific industries, as demonstrated by the European Commission's anti-subsidy investigation into the import of electric vehicles from China. The CBAM has nonetheless caught international attention. Even the US, which typically prefers market solutions over taxation, has introduced in the Senate the *Clean Competition Act*, legislation that includes a carbon border adjustment mechanism.

[2] Eco-design involves designing products or processes to reduce or prevent damage to the environment throughout their life cycle.

Investing in Decarbonization and Energy Independence

While some investments are being driven by environmental goals, others aim to address geopolitical concerns. The US government has published two reports, one from the Department of Energy and the other from the Department of Defense, detailing its strategy to develop battery supply chains, both domestically and with partner countries, in order to secure its clean energy transition. Since the Biden administration took office, the private and public sectors have announced investments of roughly US$160 billion in electric vehicles and their components, batteries, solar energy and offshore wind energy production. And yet, planned investments between now and 2030 fall below the intermediate target for achieving net zero by 2050 (graph 8). An additional US$157 billion per year is needed to reach the 2030 intermediate target. It's worth noting, however, that investments have been trending upward in recent years and more government support policies have been published.

GRAPH 8
More Investments Are Needed in Clean Energy



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However, these numbers paint an incomplete picture, since the IEA's outlook framework only looks at decarbonization efforts and doesn't fully take into account required infrastructure investments, which is an issue in countries with aging infrastructure. For example, the US power distribution network hasn't been significantly upgraded in over 30 years, and the US Department of Energy says it is currently being pushed beyond its original design capacity. There's no consensus on the total cost of modernizing the grid and making it resilient to natural disasters, as it depends largely on what the environmental targets and chosen solutions would be. The most recent estimates from various expert groups put the cost anywhere from US$1 trillion to US$8 trillion over a 20-year period, which amounts to US$50 billion to US$400 billion per year. The US isn't the only country in this position. Many advanced economies like Canada, Germany and Japan are in a similar situation, though with varying degrees of severity. It's inevitable that energy transition investments will impact the economy. The resulting productivity gains will play a role, as will the chosen financing method. Both households and businesses would feel the pinch if taxes went up or if there was an increase in government debt with a subsequent effect on interest rates.

Canada Is in a Strong Strategic Position

It's abundantly clear that, at present, the world is not on track to achieve net zero by 2050 or to keep the average temperature below the 1.5°C threshold. However, we can still turn things around. Promising opportunities are on the horizon for those who are willing and able to seize them, and Canada is one of the best-positioned countries to capitalize on them. Not only does Canada maintain good diplomatic relations with a large number of countries, it also has several free trade agreements with major economies like the United States and the eurozone. Plus, the US Critical Minerals Strategy depends in part on investments in the Canadian mining industry. Even though Canada's subsoil isn't the richest in critical minerals, the country has large reserves of many of these valuable resources (table) and is home to world-class mining companies. Supported by stringent environmental standards and a clean energy supply, Canadian mineral production is among the greenest in the world—especially aluminum in Quebec—which could help exported minerals avoid carbon border levies. Thanks to these important advantages, Canada is in a strong strategic position. That said, the country still has a number of challenges to contend with, such as the labour shortage in certain sectors, the environmental impact of domestic natural resource extraction, and the capacity of the electricity grid. Many of the opportunities and issues identified in this note will be addressed in subsequent analyses.

TABLE
Canada's Subsoil Is Rich in Critical Minerals

ORE	Use	% of global reserves	Rank
Cobalt	Batteries	2.7	6
Copper	Infrastructure	0.9	13
Graphite	Batteries	0.2	9
Lithium	Batteries	3.6	6
Iron	Infrastructure	2.7	6
Molybdenum	Solar panels	0.6	6
Nickel	Wind turbines	2.2	7
Zinc	Wind turbines	0.9	10

Sources: US Geological Survey and Desjardins Economic Studies