Wind turbines overlook a stretch of cultivated land in Alberta. **Photo © M. Bradley**

The ideal Transition to Renewable Energy Supply Must be Fair and Just

By Ruiping Luo

As the world works to achieve net-zero emissions, countries are increasingly looking to renewable sources for their energy needs. According to Ember's *Global Electricity Review 2023*, global renewable energy generation reached 39 percent in 2022, and the 2023 *Statistical Review of World Energy* report shows renewable energy generation has grown steadily since 2008. The International Energy Agency expects total renewable electricity capacity to reach 4,500 gigawatts (GW) by the end of 2024 — the total power capacity of the United States and China combined.

Canada, along with the 194 other signatories of the Paris Agreement, also committed to achieving net-zero emissions by 2050. The federal *2030 Emissions Reduction Plan* specifically mentions phasing out coal and funding for clean electricity, and Canada's clean energy sector is growing, increasing by 10.5 percent in 2022 according to the Canada Renewable Energy Association (CanREA). In Alberta, where three-quarters of the wind and solar plants in Canada were built last year, 2,848 MW of wind and 949 MW of solar had been installed as of 2022. These projects produce enough electricity to power over 1.2 million households.

Yet, as Alberta's pause on renewable energy projects shows, there are still challenges ahead for renewable

energy development. Transition to renewable energy must be done quickly to reduce emissions, but it also must take into account the environment and the communities where the projects are sited. It cannot repeat the harm caused by the oil and gas industry.

BENEFITS OF RENEWABLE ENERGY

Harnessing renewable energy sources, such as wind and solar, are essential in reducing carbon emissions. Every one percent increase in renewable energy use was found to decrease carbon dioxide (CO^2) emissions by 1.25 percent per capita. Currently, fossil fuels account for over 75 percent of greenhouse gas emissions, and the International Renewable Energy Agency (IRENA) has suggested a transition to renewable energy could decarbonize 90 percent of the power sector by 2050.

Curbing fossil fuel use and speeding up the transition to "cleaner, healthier energy systems" is vital for reducing air pollution and improving human and environmental health. The World Health Organization (WHO) estimated that 99 percent of the world's population breathed unhealthy air in 2022. Even in higher-income countries, nitrogen dioxide (NO^2) pollution — formed when fuel is burned at high temperatures — is common in cities and often exceeds WHO guidelines. This mostly comes from the engines of cars, trucks and other vehicles burning fossil fuels. In 2018, the WHO estimated that air pollution from fossil fuels caused $2.9 trillion in health and economic costs.

In addition, renewable energy can improve energy resilience — or how well the electrical grid adapts and recovers from disruptions — and independence, the capacity of a region to generate more energy than can be used. Partially, this comes from diversification: renewable energy comes from multiple sources, and unlike fossil fuels, will not eventually be exhausted. Using many different sources, along with the batteries and other storage technologies that are common in renewable energy grids, means less reliance on any one source. So, if wind is low and not much electricity is coming from wind turbines one day, we can still get energy from solar, hydro, geothermal or stored energy. Renewable energy can also allow some regions that would normally rely on imported fossil fuels to generate energy from local sources, as wind, solar, hydro or geothermal sources are readily available in many areas, allowing these areas to generate their own power.

In contrast, complete reliance on fossil fuels, like natural gas, can still cause energy shortages, especially in extremely hot or cold temperatures that the infrastructure is unprepared for. In 2023, during a summer with warmer-than-usual temperatures, Alberta issued two grid alerts in less than a week. Grid alerts are issued when the power system is under stress because it is struggling to generate enough energy to meet demand, and emergency reserves may be needed. In this case, the grid alert was caused by several factors, including the loss of approximately 600MW from natural gas generators because of the heat, as reported by the National Observer. When temperatures are too warm, it becomes more difficult to keep generators at their optimal temperature, so they must operate at a reduced capacity and generate less electricity. Similarly, in extreme cold, natural gas can freeze, forcing generators to shut down or limiting supply, as reported in Canada in 2017, 2018 and 2022.

Renewable energy can further improve resilience through decentralization, a change that would also reduce transmission and distribution losses. Unlike fossil fuels, which need to go through complex processing in refineries and be transported over significant distances before becoming usable, renewable energy technologies can provide power directly. Renewable energy technologies, properly installed and maintained, can more easily provide energy to remote communities, where transport of fossil fuels and safe generator use has historically been challenging, and reduce reliance on a central grid. Having generators close to where energy is needed also reduces energy lost through transportation — an average two to three percent is estimated to be lost for every 1000km of transmission lines, and Alberta Electric System Operator (AESO) calculates loss factors of three to four percent or around 2000 GWh. Decentralizing renewable energy generation would reduce reliance on a central power system, shielding local communities from grid-level disasters, and improving flexibility and reliability.

And finally, renewable energy has economic advantages. Prices for both wind and solar technology dropped dramatically in recent years — between 2009 and 2021, Pembina Institute estimates costs for solar fell by 90 percent and wind by 72 percent. Capital costs, such as installing solar panels or wind turbines, are often the highest costs for renewables, and they generally have low operating and maintenance costs. And, unlike with fossil fuels, there are no fuel costs to keep the generator working. In February, Clean Energy Canada analyzed the cost of solar at $0.06 per kWh and wind at $0.05 in 2023, a price already competitive with natural gas at roughly $0.06. These costs are expected to drop further over the coming decade, while the price of natural gas is likely to increase. Modelling by the Pembina Institute similarly found decarbonizing the grid would save household electricity costs hundreds of dollars, and be 17 to 24 percent lower than 2022 prices. As well, smaller grids can be locally owned, supporting community economic growth, and the transition to renewable energy provides employment, as workers are needed

A solar farm as viewed next to Highway 1 in southern Alberta. Prices for solar technology dropped dramatically in recent years.
Photo © R. Luo

to build and operate generators. Both employment and energy prices are more stable with renewable energy since prices will not spike depending on global markets and fuel availability.

BARRIERS TO TRANSITION

Despite the many benefits transitioning to renewable energy provides, there remain challenges and consequences to increasing renewable energy generation in Alberta.

One difficulty is in the steep, upfront costs of developing renewable technologies. Even though the cost of producing renewables is much lower than a decade ago, designing, developing and building renewables is still expensive, and it can take a while before the economic benefits are experienced. Additionally, while renewables are much less environmentally damaging than fossil fuels, there are still impacts in producing parts and building generators, and this can have devastating impacts on local communities, including Indigenous communities where materials are sourced, as the *Just Transition Guide* on Indigenous-led climate solutions describes. Particularly for disempowered communities, these costs and consequences can be overwhelming.

For private investors, another barrier to investing in renewables is the risk associated with Alberta's energy market, made worse by the recent decision to pause approvals on new renewable energy projects for seven months. Alberta has a deregulated electricity market and operates as a "fair, efficient and openly competitive market," overseen by AESO, the Alberta Utilities Commission (AUC) and other relevant agencies. Essentially, competitors can buy or sell electricity within the regulations, policies and legislation of the province. The market is affected by government decisions, as with the Renewable Electricity Program that sought bids for contracts to develop renewable energy, and with the recent pause on new approvals.

As a result of the pause, several international and domestic companies were reported to be reconsidering their investments in Alberta. Dr. Anna Bettini is a postdoctoral research associate at the University of Calgary's Institute for the Humanities whose research focuses on the perceptions and concerns raised around the energy transition. Bettini described the pause as causing a hostile environment to renewable energy in Alberta. The decision, she suggests, is not unlike Ontario's choice to cancel several renewable energy projects in 2019 which, alongside other policies, considerably slowed the renewables market there.

"They understand it's a competitive market," Bettini told me, speaking about the investors and developers of renewable energy in Alberta, "and they do appreciate the competitive market, but they're faced with

another big competitor, which is oil and gas."

In Alberta, oil and gas is not only a competitor economically; there are politics involved, and renewable energy can lack public support. Bettini points to Alberta's cultural and historical association with oil and gas, but also to a lack of consultation with communities. Oil and gas, for many, is the industry that built Alberta, but it has also left scars in the abandoned wells and the poisoned land remaining. Many communities fear a repeat of these irresponsible developments, and a lack of meaningful consultation with local communities is a major cause of suspicion. Without strong community support, it can be difficult to build and maintain renewable energy projects.

There are also infrastructure challenges. While Alberta's energy system has so far coped well with the integration of more wind and solar capacity, the system's capacity to handle more generation varies across the province. Also, renewable energy projects, especially wind and solar, are by their nature intermittent generators. Power can be wasted if there is a large influx of energy — for instance, on a sunny or windy day — and the infrastructure is not able to handle all the generated energy. There also needs to be other sources of energy available during times of low energy production. Energy storage, such as batteries, can be a solution to the fluctuation in energy, and other sources such as hydro or geothermal can be integrated to help provide power during times of low power. More transmission lines may be needed to improve system capacity, and to reach renewable energy sources, which can be in different regions or have different requirements than fossil fuels. Proactive planning will be needed as more renewable energy sources are incorporated into Alberta's electricity grid.

Finally, there are the challenges presented by competing land uses. Renewable energy projects can take up a substantial area, and compete with land needed for industry, housing, roads, agriculture, and wildlife habitat. Particularly in the prairie region, where many wind and solar developments are being proposed, most land is already used for agriculture or to house the vast majority of Alberta's population. Oil and gas developments are common throughout the region, and very little of the native prairie habitat is undisturbed, making protection of the remaining area vital. A report released by the University of Calgary and The Simpson Centre estimated just over 38,000 acres, or roughly 154 km^2, are needed to achieve 'net zero' by 2035. In comparison, Alberta reported a surface disturbance of 895 km^2 in 2013 for oil sands mining, not accounting for seismic lines, tailings ponds and other pollution, and natural gas and conventional oil disturbance. Still, renewable energy developments should avoid repeating the mistakes of the past and try not to cause further damage in sensitive habitats and ecologically important areas.

WHAT WOULD AN IDEAL TRANSITION LOOK LIKE?

Some of the barriers to renewable energy development could be eased through policy decisions and a strong framework. For instance, funding or financing programs could be extended to communities struggling with high upfront costs for renewable energy. A few grants and financing options for homeowners are already available through the Canada Greener Homes Initiative and the Clean Energy Improvement Program. These programs could be expanded to improve initiatives for installation of decentralized renewable energy generators. Similarly, policies that encourage renewable energy development and reduce the market risk would help attract greater investment.

As well as investing in renewable energy development, there needs to be investment into Alberta's electricity infrastructure, and into technologies more broadly. Alberta needs a comprehensive plan for renewable energy, with an analysis of suitable areas and a strong understanding of production and development impacts. This plan must direct power plant placement, aiming to reduce harmful impacts, and clearly outline industry responsibilities to monitor and, where necessary, remediate landscapes. As well, renewable energy technologies are constantly innovating, becoming more efficient in energy production and having better resilience against extreme weather. These technologies need to be incorporated into Alberta's grid.

Most importantly, the community needs to be involved. Successful renewable energy projects in rural communities were found to consistently have local community ownership, while projects that excluded community voices usually failed long-term. The *Just Transition Guide* similarly states, "Community engagement and relationships are vital" in its key findings. Alberta needs to have meaningful engagement with communities, and ensure that local communities also receive the benefits of renewable energy project.

When I asked Bettini what an ideal transition would look like, she told me it "needs to guarantee justice": justice for the oil and gas workers trying to transition, for the landowners and farmers and local and Indigenous communities, and for all the other creatures on the landscape. Transitioning to renewable energy brings many benefits, but it must respect the people and other species that work and live on this land.