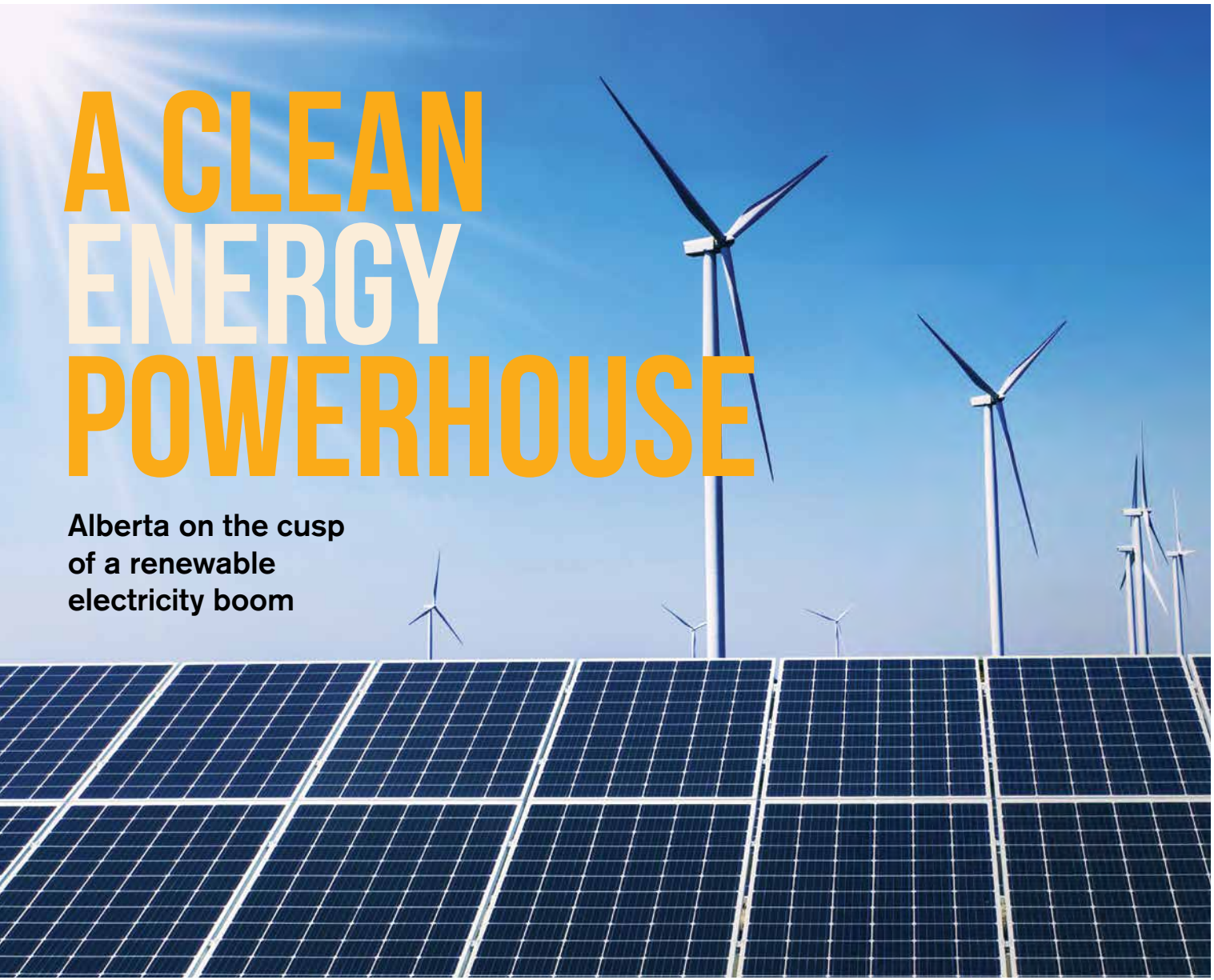
A CLEAN ENERGY POWERHOUSE

Alberta on the cusp of a renewable electricity boom



PLAINPICTURE

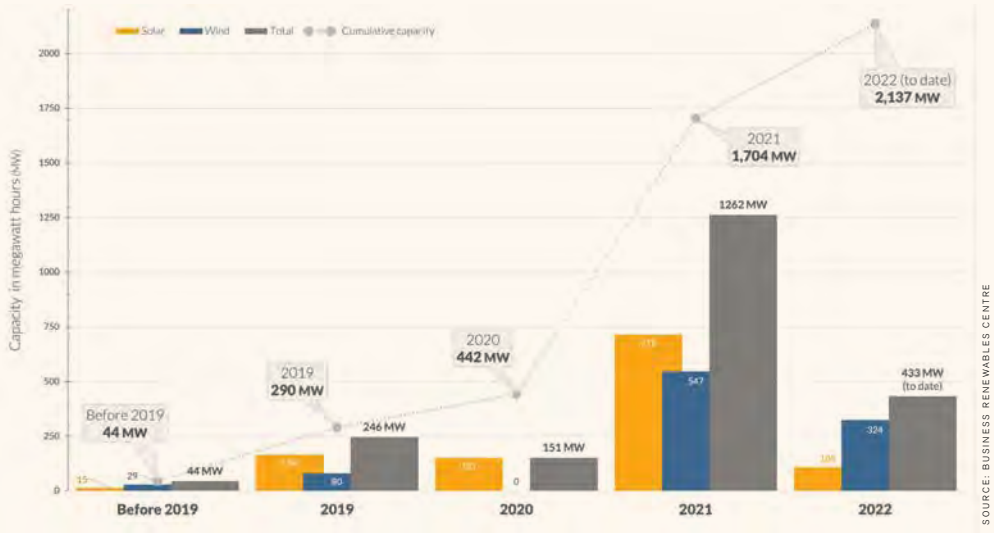
By CHRIS TURNER

LARGE-SCALE SOLAR FARMS ARE not particularly striking. They are utilitarian structures, more or less interchangeable, often standing in broad, flat, nondescript fields. Arrow-straight rows of photovoltaic panels are attached to steel and aluminum racks. A couple of small buildings house electrical gear and operating systems. These farms could almost be producing some futuristic crop. They have little in common with iconic architecture like a prairie grain elevator.

Consider three big solar installations recently erected on prairie soil in southern Alberta. Each stands in a different field not too far from Lethbridge. There's one outside Vulcan, another near the hamlet of Monarch, a third not far from Coaldale, which at least lends it some poetic irony. They vary in size and capacity from 20 to 80 megawatts, together generating enough electricity all told to power 20,000 or so homes, in the industry's preferred scaling analogy. I prefer a more telling parallel: once they've begun generating electricity by the end of 2022, these three solar farms will add power-producing capacity equivalent to roughly a quarter of the Keephills 1 coal plant near Edmonton, which was decommissioned in late 2021, just as steel support pilings began to spring stalk-like from the snow-crusted earth in those three spots in southern Alberta.

These three facilities will join other solar and wind installations, as well as natural gas conversions and some geothermal, to accelerate the end of burning coal for electricity in Alberta by 2023. The phase-out target set by Alberta's NDP government had been 2030, a goal often scoffed at by then-opposition leader Jason Kenney as he united the right behind a great many antiquated notions that included digging and burning more coal to make electricity. (As recently as 2014, Kenney's forebears in the PC government had been planning to allow the burning of coal in Alberta for another 40 years.) Alberta's new solar plants might not be monumental architecture, but they are evidence of a real triumph.

CORPORATE RENEWABLE-ENERGY DEALS IN CANADA (Q1 2022)



SOURCE: BUSINESS RENEWABLES CENTRE

A driver of Alberta's renewables boom is businesses (e.g., Amazon) and institutions (e.g., schools, Alberta Infrastructure) supporting the construction of renewables and sourcing electricity directly from the same companies. In 2021 a record number of such deals were struck.

THE CONTEXT FOR THIS IS THAT THE GLOBE IS transitioning from energy sources that emit greenhouse gases to those that do not. This transition was still considered marginal if not downright fanciful as recently as 2010, when Alberta's government could be found taking out ads in the *New York Times* and *Washington Post* to defend the virtues of the Keystone XL pipeline. But the pace has accelerated rapidly over the past decade, exceeding the expectations of even its boosters. The energy transition is now a mainstream phenomenon worldwide. Wind and solar power in particular have seen astronomical growth and become the world's primary sources of new electricity. China now routinely adds more solar power to its grid each year than existed everywhere on earth in 2010. Several European energy companies are planning gigawatt-scale offshore wind installations—comparable in size to a major coal-fired power plant. "For projects with low-cost financing that tap high-quality resources," the International Energy Agency (IEA) announced in its 2020 *World Energy Outlook* report, "solar PV is now the cheapest source of electricity in history."

In 2009, 74 per cent of the generating capacity on Alberta's grid came from coal plants, with wind chipping in just 2 per cent of the balance and large-scale solar non-existent. There were barely 100 rooftop-scale solar installations in the province back then. By 2017 renewables—mostly wind—had expanded to 16 per cent of the grid, but the province's first utility-scale solar plant (a 17-megawatt solar farm near Brooks) had only just been completed. Skip ahead to the end of 2021, and witness the birth of a genuine boom: a dozen solar plants were up and running, nearly 8,000 rooftop-scale systems were in place province-wide, and half of all the new wind energy installed across Canada that year and the overwhelming majority of the country's new solar developments were in Alberta. This includes the country's largest solar farm, a 132-megawatt facility near Claresholm. It will soon be dwarfed by the massive 465-megawatt Travers Solar installation being built by Calgary's Greengate Power east of Vulcan. It all lends credence to the boast of the company's CEO, Dan Balaban, that Alberta is now "the Sunshine State of the North."

ALBERTANS, LONG WEDDED TO digging energy resources from deep underground, have begun to discover that the province is also blessed with extraordinary untapped power from above. Strong, steady winds have turned turbine blades across southern Alberta fields for nearly three decades now, but the large-scale embrace of the prairie sun's power is a more recent development.

Alberta's wind and solar resources are world class, and the Notley-era coal phase-out is helping renewables too.

Pincher Creek is the wind farm capital of Canada; strong winds have turned turbine blades across the region for nearly three decades. Alberta's large-scale embrace of the sun's power is a more recent development. Lethbridge is drenched in sunshine 333 days of the year.

Lethbridge, for example, receives at least some sunshine 333 days of the year on average—2,507 hours in all. That's about 300 more hours of annual sunlight than shines down on Copacabana Beach in Rio de Janeiro. This state of affairs has, of course, not attracted many sunbathers to southern Alberta farm fields, but it does mean that the southern third of the province is some of the best solar energy terrain in the country. Add to this the plunging cost to generate solar, which has fallen by more than 80 per cent in the last decade, leading the IEA in 2020 to declare solar "the new king of electricity."

The trio of solar farms in Vulcan, Monarch and Coaldale emerged together from a partnership between Concord Green Energy, a renewable energy developer, and the Athabasca Chipewyan First Nation (ACFN), the governing body of the Dene peoples of Fort Chipewyan, downstream from Alberta's vast oil sands mines.

"I think it's the right move not only for green energy," ACFN chief Allan Adam said when the projects were launched, "but to promote ACFN and go down that path, because it's a source of revenue that will always be there for future generations."

There is a powerful symbolism in the ACFN's solar investments. Fort Chipewyan has a particularly complex relationship with the energy business. Oil production upriver along the Athabasca has forever despoiled the traditional lands of Indigenous peoples throughout the region and cast dark shadows over local food production and public health. Industrial-scale energy has been an uninvited, outsized, damaging incursion on the landscape in northeastern Alberta, and the Indigenous peoples of the region have had no real voice in the scale or pace of its development and growth. At the same time, several First Nations—including the ACFN—profit directly from the oil sands industry, running lucrative oilfield services companies and the like. This has perhaps placed them in a better position than most rural communities to venture into energy development projects themselves.

When it comes to electricity, Fort Chipewyan (like many places in the North) has long been dependent on diesel-burning generators for the bulk of its power—an expensive and heavily polluting source vulnerable to supply disruptions. In the winter, the community is heavily reliant on diesel tanker trucks navigating the treacherous ice road from Fort McMurray. Which is to say the status quo has few champions.

In any case, when ATCO came looking for an Indigenous partner in a local renewable energy project in 2017—grants were available for energy developers open to such partnerships—the ACFN jumped at it. The community's other local Indigenous groups (the Mikisew Cree and the Fort Chipewyan Metis Association) were soon brought in as partners, and Three Nations Energy launched to bring a community-scale solar power plant to Fort Chipewyan. "Many in and outside the community view this as a landmark achievement," the ACFN's Community Energy Plan noted in 2018, explaining that it represented not just a way to introduce the community to the renewable energy business but to encourage wider co-operation between the local First Nations.

In November 2020, 2.2 megawatts of solar power began feeding the local grid in Fort Chipewyan, ready to provide as much as 25 per cent of the community's annual electricity needs and displace 800,000 litres of diesel fuel.

The ACFN's move into renewable energy is not simply a matter of replacing diesel generators with solar panels. It's the seed for a wholly new relationship between the First Nation and the energy business. The ACFN is not providing ancillary

"It's a source of revenue that will always be there for future generations."

ALLAN ADAM,
ATHABASCA CREE FIRST NATION CHIEF

The 2.2 MW solar farm at Fort Chipewyan. The project is owned jointly by the Athabasca Chipewyan and Mikisew Cree First Nations and the Metis Association of Fort Chipewyan. It provides locals with 25 per cent of their electricity needs and reduces the need for diesel.

services to an unwanted corporate behemoth whose profits and decisions flow to and from distant boardrooms in Calgary or Houston or London. It's the co-owner and developer of new energy resources, which by their smaller scale and much more widely distributed nature encourage community participation and control in ways the fossil fuel industries never could.

"The reason I'm so excited about these projects is we're part of an expanding demonstration of the real economic potential of solar energy, and more broadly renewable energy, in Canada and here in Alberta," says Rob Macintosh, senior partner at GreenPlanet Energy Analytics, which is advising the ACFN on its solar projects in southern Alberta. "We're also seeing now that, done properly, we're able to take risks and still get the financial backing of major lenders, who themselves understand how the tides are turning and the true investment potential and economic viability of renewable energy."

This would represent a promising new direction anywhere for the industries charged with providing vital energy resources. But Alberta is in a particularly sweet spot—obliged by legislation to find promising new avenues beyond fossil fuels, blessed with the assets for doing so, and boasting the talent to make it happen. If Alberta had a different kind of government right now, it might well recognize there is no better face to put on the province's embrace of the future of energy than a First Nation from the heart of the oil patch that has become a partner in building some of the largest solar farms in Canada.

THE POTENTIAL TO REPOSITION Alberta's economy as a clean energy powerhouse extends far beyond solar panels and wind turbines and offers opportunities at global as well as community scale. Consider the curious case of Eavor Technologies, founded in Calgary in 2017 to pursue one of the most elusive but potentially massive prizes in clean energy: affordable, ubiquitous geothermal. There's no trick to the ubiquitous aspect—the ground beneath our feet everywhere on earth is warmer than the surface in colder weather, and cooler than the surface in warmer weather. Exploiting that differential for human purposes is a practice as old as the first prehistoric hominids to bathe in hot springs. Even advanced applications—heating buildings, generating electricity—are well established in places where geothermal energy is especially abundant and easy to access, particularly islands such as the Philippines and Iceland that are perched atop active volcanoes. Harnessing affordable energy from the heat beneath the earth's surface everywhere else, however, has proven much trickier.

Eavor emerged from Alberta's long-standing expertise with drilling wells in the oil and gas industry. The company's co-founders—a group of oilpatch veterans led by engineering physicist John Redfern—were playing with ideas for what to do with the orphan wells scattered across the province. Paul Cairns, now the company's head of business development, suggested the idea of a closed-loop system of pipes like a car radiator, with cool liquid piped underground and then directed horizontally to gather heat before the warmed liquid rises up the far side of the loop to be used to heat buildings or generate steam for power production. Its heat spent, the cooled liquid would again descend through the loop to gather more geothermal energy. The gravitational rise and fall of the liquid in the loop means very little energy is required to circulate it, which in turn keeps costs low. The technology to build and operate the loop is mostly off-the-shelf gear already in use in the drilling business. And a single one of these "Eavor-Loops" (the company's name rhymes with "ever") can generate enough heat to keep 16,000 homes warm in the harsh prairie winter, though it's more likely to be harnessed to generate electricity. This amounts to a potentially huge breakthrough in an elusive sector of the clean energy economy.

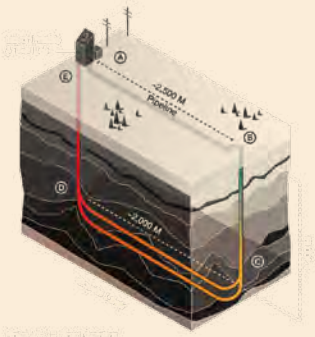
Within a couple of years of the company's founding, Eavor had seed funding from Alberta Innovates and Emissions Reduction Alberta and a test site up and running near Rocky Mountain House. Michael Liebreich, the founder of Bloomberg New Energy Finance—among the world's most authoritative sources on the clean energy industry—joined the company's advisory board in 2020. "I believe its closed-loop approach could be a game-changer in the geothermal sector and within the broader clean energy transition," Liebreich said at the time. "We may have, in Eavor, a clean power and heat technology that can work almost anywhere in the world, scale to very large projects, benefit from strong learning curves, and be dispatchable. That is a very exciting prospect." Which is to say that unlike other geothermal applications to date, Eavor promises to generate industrial-scale energy, regardless of the quality of the geothermal resource, which would get cheaper and easier to install as it proliferates, and would provide power on demand.

The following year, Eavor attracted more than US$40-million in venture capital, with the investment arms of oil giants BP and Chevron among the contributors, and Natural Resources Canada chose the company as one of three geothermal innovators to back with federal money. The company has found potential customers in Japan and the US and cut deals in Germany. Alberta might not be the very best place to operate its closed-loop systems—the province's "geothermal gradient," the rate of increase in temperature as you dig deeper into the earth, is not as steep as other locations—but Eavor is still very much an Alberta company. "Alberta is a great place for geothermal because we have the people and the knowledge and expertise," Eavor executive Neil Ethier explained to an oil industry trade journal. "We are drilling geothermal wells the exact same way as we drill an oil and gas well, with the same men and women running the rigs."

FOR ALBERTA, WHICH HAS BOTH HIGH-QUALITY resources and decent financing options, the energy transition has swept across the prairie despite little in the way of recent government encouragement. The NDP's coal phase-out plan did oblige the Alberta Energy System Operator (AESO) to commission a number of large wind farms, but neither Rachel Notley's government nor the United Conservatives have been particularly aggressive on solar power. Suppliers and customers of renewable energy alike are flocking to Alberta on its own merits.

The AESO estimates that the rest of the decade will only see accelerating growth—as much as 3.6 gigawatts of new wind power and 2.7 gigawatts of new solar in Alberta by 2030 in its "clean tech scenario," which is built on the assumption that the province's emissions-cutting efforts, including the coal phase-out and the federally mandated price on carbon, will yield economic opportunities. This new renewable

GREEN ENERGY FUTURES



An Eavor-Loop geothermal system connects two vertical wells with horizontal multilateral wellbores, creating a closed, sealed, radiator-like system.

"The closed-loop approach could be a game-changer in the geothermal sector and within the broader clean energy transition."

MICHAEL LIEBREICH, EAVOR ADVISORY BOARD

generation would be just a little shy of the generating capacity of the province's current fleet of natural-gas-fired power plants, which generate the bulk of Alberta's electricity today. And even the AESO's near-term estimates for the cost of new renewables are roughly equal to or cheaper than the cost of natural-gas-powered combined cycle plants.

These are almost certainly underestimations of the energy transition's potential. Virtually every expert energy analysis from the IEA on down dramatically underestimated the growth in renewables worldwide over the past decade. A 2009 Pembina Institute study, meanwhile, didn't even consider utility-scale solar in Alberta and saw only a negligible role for "micropower" technologies such as rooftop solar arrays.

Alberta's advantages as an emerging renewable energy hub are significant. In addition to the resources themselves, Alberta's coal phase-out has created significant momentum for renewables. And its fully deregulated electricity market, which simplifies gaining access to the power grid and eliminates much of the foot-dragging elsewhere in Canada by incumbent monopolies with "hydro" in their names, makes it the easiest place in the country to develop new wind and solar.

Many of the projects driving this provincial wave are well outside the scope of the phase-out—independent deals cut between local developers and international companies keen to add emissions-free power to their portfolios. Amazon, for example, has an agreement in place for 400 megawatts of the solar power expected to be produced by the mammoth Travers facility. This doesn't mean Amazon facilities in Alberta will ever be connected directly to the solar array but rather that the company has provided the financing for a share of the facility's power equivalent to its use of polluting power elsewhere—a sort of "virtual power plant' connection to green energy increasingly popular among major international corporations pursuing net-zero emissions targets.

IT'S INTRINSIC TO THE NATURE of the global energy transition that every jurisdiction need not reinvent the clean-energy wheel. Alberta has ample solar and wind resources, but the panels and turbine blades will be manufactured in China, the developers may be based in Ontario or BC, and the main customer could be in Seattle. But Alberta will have to slash emissions in every facet of its economy. Grid, transportation, industry, homes and businesses—all of it. And there are niches where Albertans can lead. Eavor is surely the exact type of company Calgary Economic Development had in mind when it commissioned a study in 2021 to explore the scope of the economic opportunities presented by the energy transition. The study estimated that as much as $61-billion and 170,000 jobs could be generated in Alberta from now until 2050.

That transition will happen with or without local leadership—Alberta is beating its coal phase-out target in part because global market forces are moving much faster than the tepid ambitions of its lawmakers. Right now, though, the whole world is looking for solutions, from low-cost, ubiquitous geothermal energy to the carbon-capture technology that sometimes seems like the only kind of emissions reduction our provincial government wants to talk about. There are big opportunities for Alberta. This is the best way to look at those generic solar farms in fields outside Vulcan, Monarch and Coaldale—not as another hundred megawatts on a grid but as the start of a much greater force. Emissions-free, Indigenous-backed, part of a global transformation of the way the world makes and uses energy. A whole new Alberta advantage, if we want it. ■

Chris Turner has won numerous National Magazine Awards. His newest book is How to be a Climate Optimist *(Random House).*

EAVOR