



North America | 2021

Research

Energy Outlook

The great transition: How the road to net zero will reshape real estate in energy markets

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The global energy industry is undergoing an unprecedented transformation.

The reality of climate change has raised the urgency for governments and the private sector to shift energy production toward more sustainable alternatives—a transformation being driven by commitments to achieve net zero targets, rapid technological innovation and a societal push toward sustainability.

The transition from high-emitting fossil-based energy systems to renewable and low-carbon processes is complex and multifaceted but will be key to supporting global decarbonization goals. To be successful, the transition must ensure that the world's increasing energy needs are met, a very tall order considering fossil fuels make up nearly 80% of the world's energy supply. Massive investments in renewables and new technologies will be required to satisfying a growing global energy demand.

As the energy supply shocks of 2021 can attest, high and volatile prices are partly a consequence of the energy transition, as well as increasingly disruptive weather. The ongoing shift from hydrocarbons to renewables will raise new issues of reliability and significant cost increases across the energy spectrum. This transition will occur over decades and likely be the biggest challenge society faces, with substantial implications for investors and occupiers of real estate.

Our 2021 report explores how the global race to net zero is reshaping the energy industry and its infrastructure and real estate requirements. We dive into how the transition is affecting established energy markets and forming new renewable hubs.

On the one hand, **traditional oil and gas markets are continuing to consolidate, all while investing in lower-emission capacity (hydrogen, natural gas, LNG) and/or decarbonization technologies** to lower their footprint.

On the other hand, **renewables and “enertech”^{*} companies, which are not bound to underlying resources, are clustering around cities offering easy access to capital, research communities and large populations.**

Our analysis extends to these new local markets because they could become important players in a changing energy ecosystem. This includes **New York, Los Angeles, Miami, San Francisco, Toronto, Vancouver and Montréal.**

^{*}**Enertech**, like fintech and insurtech, uses technology to improve the use and delivery of traditional energy services.



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1. *The road to net zero is long and winding*

Governments, businesses and civil society are collectively responding to the challenge of climate change, but they are operating at different paces.

Governments have shown varying degrees of ambition in their commitments to net zero. Some countries have gone further than others in their quest to reach carbon neutrality. Climate leaders, such as the United Kingdom (UK), the European Union (EU) and New Zealand, have announced aggressive measures to meet increasingly bold decarbonization targets. The UK, for instance, announced at the COP26 Summit that London will become the “first net-zero-aligned financial centre,”¹ mandating disclosure by 2023 of detailed decarbonization plans from publicly listed UK companies. This new announcement comes in addition to the recent requirements for listed companies to report on their climate-related risks in line with the Task Force on Climate-Related Financial Disclosures (TCFD) framework by 2022 (see page 8). **Both moves are meant to accelerate the transition to net zero in the UK economy, though**

they will have ripple effects across the borders as reporting of current asset holdings, investment strategies and Scope 3 emissions will also be required.²

Furthermore, starting in **2023, the EU will introduce a carbon border adjustment mechanism (CBAM)** to prevent carbon leakage.³ This is essentially a WTO-compliant border tax that will equalize the price of carbon between domestic and imported products so as not to undermine local climate policies. California already applies a border adjustment tax for certain imports of electricity. Canada and Japan are also planning similar initiatives.

In addition to making net zero pledges at COP26, governments in Europe, New Zealand, Australia, China and local jurisdictions in Canada and the U.S. have set up cap-and-trade schemes and carbon taxes (see page 7) to use market-based mechanisms to curb emissions.

¹ From Chancellor Rishi Sunak’s speech at COP26.

² The new public consultation to update the 2017 guidance notes that “Data and methodologies have matured sufficiently such that disclosure of relevant, material categories of Scope 3 emissions is now appropriate for all sectors. Disclosure is particularly important for organisations for which Scope 3 emissions account for 40% or more of the total emissions of the organization or for which Scope 3 emissions have been deemed a significant risk in their value chain.”

³ Carbon leakage occurs when polluting companies shift carbon-intensive production to jurisdictions with lax restrictions.

The hope is that these leading countries will pressure other economies wanting to trade with them to increase their emission reduction plans. It remains the case that most countries are not doing nearly enough to lower their carbon footprints. COP26 failed to achieve the sort of breakthrough agreements that could convincingly reduce emissions by enough to limit the rise in global temperatures to 1.5 degrees. Major emitters, such as China and Russia, did not attend the climate conference. Most countries did not enhance their nationally determined contributions (NDCs). Although 40 countries and several large financial institutions pledged to phase out coal and stop financing the coal industry, some of the world's biggest coal-dependent nations, such as India and the U.S., did not sign the agreement. However, there was some progress. Countries recognized the need to reduce methane emissions, halt deforestation and lay the groundwork for a global carbon market. India pledged to achieve net zero by 2070, which is positive but likely too distant in the future to make a real difference.

While the performance of most governments is perhaps disappointing, the setback may be less meaningful than it appears at first glance because the real momentum on climate action has now passed on to the private sector. The Glasgow Financial Alliance for Net Zero (GFANZ), chaired by Mark Carney and representing over 450 major financial institutions with over \$130 trillion in assets, pledged to achieve net-zero emissions by 2050 and contribute to more than half the efforts required to meet 2030 decarbonization targets. But the challenge will still be huge, even for this large capital pool. **The International Renewable Energy Agency (IRENA) estimates that well over \$130 trillion will need to be invested between now and 2050 to reach net zero greenhouse gas emissions targets.**⁴ Clearly more capital than that of GFANZ will be needed.

Civil society is ultimately the main driver of change to address global warming, applying political pressure on governments and commercial pressure on businesses to lower their carbon intensity. Employees, tenants and shareholders are increasingly asking organizations to adopt sustainable business practices, which extends to the choice of their buildings.⁵ Green building

certifications and green leases are becoming increasingly popular as a way of demonstrating an organization's commitment to carbon emission reduction.⁶

But civil society has recently shown that it can also act directly via courts. In May 2021, a court in the Netherlands ordered Royal Dutch Shell to slash carbon emissions far faster than initially pledged. This was a legal breakthrough. Until then, the Paris Accord and all past COP accords were not judged to be legally enforceable, as they were non-binding agreements (i.e., not treaties). But the resort to "tort law," a legal obligation to not knowingly injure others, may now be a means for civil society to oblige local governments to accelerate their climate actions. These are rights-based arguments—claims that the effects of climate change are harming rights protected by local laws and that a failure of the government to protect its citizens against these effects violates its obligations. Thus, while these court decisions are not directly enforcing COP treaties, they are indirectly forcing states to respect their climate obligations. Going forward, special legal action taken in local courts may be a new instrument for climate action.⁷

⁴ [Global Outlook: Energy Transformation 2050](#), IRENA, 2020, p. 97

⁵ [Decarbonizing the Built Environment](#), JLL, June 20, 2021

⁶ *Ibid.*, p. 19. "56% of occupiers state that carbon emissions reduction is being specifically addressed as part of their corporate real estate strategy. A further 29% expect to address it by 2025."

⁷ In its 2020 status review, the United Nations Environment Programme estimates that there were at least 1,550 active court cases seeking to hold nations and corporation responsible for their climate pledges (1,200 cases filed in the U.S. alone). [Global Climate Litigation Report: 2020 Status Review](#)



2. *The transition is accentuating volatility in energy markets*

The COP26 Glasgow summit took place as energy prices were soaring globally. Ironically, the worldwide shortage of energy (and notably natural gas) was partly an unintended consequence of many of the policies put into place to curb the production of fossil fuels. In short, **the race to net zero ended up contributing to ongoing energy shortages in Europe and China and to a spike in global emissions via increased coal consumption.**

Transition risks are weighing heavily on the energy sector. So far, global efforts toward net zero goals have focused on reducing the supply of fossil fuels. This has occurred either through public-policy measures such as carbon taxes and emission trading schemes or through the private sector's growing aversion to initiating any new carbon-based energy investments. This supply compression, combined with revealed deficiencies in the ability of renewables to maintain energy generation in the face of extreme weather shocks, has resulted in a spike in global energy prices.

Going forward, climate change can be expected to put upward pressure on energy prices as long as the world's green transition strategy remains unchanged. However, a change in the overall policy approach could lessen the impact on energy

inflation. While increasingly heavy carbon penalties are necessary to wean the planet off fossil fuels, more effort should be put toward subsidizing investments that could accelerate the substitution of renewables.

Adding a wrinkle to the argument, renewable energy generation has shown itself to be particularly vulnerable to the extreme weather caused by climate change. Wind droughts in the North Sea led to severe drawdowns of already low natural gas inventories, which caused prices to spike. In China, cutbacks in coal production to meet emission targets resulted in power shortages and a similar spike in natural gas prices. In the U.S., a frigid storm in Texas knocked out renewable and non-renewable energy sources alike, as well as distribution grids. This unfortunate combination of factors all boosted the price of natural gas, which is the main backup for renewables. Unfortunately, these weather shocks may have undermined public confidence in the reliability of renewables. It may be enough to urge some developing countries to increase their reliance on fossil fuels, which are seemingly less weather sensitive. However, this unfortunate conclusion would only worsen the climate situation. More investment in making renewables climate resistant would be the better course of action.

Carbon Pricing Systems and Cap-and-Trade Markets in North America

In an effort to curb climate change, local governments have instated programs designed to provide a financial incentive for consumers and firms to reduce their emissions. Emissions trading systems and carbon taxes are, broadly speaking, the two most common forms of such a program.

Both types of carbon pricing systems can be found in Canada. At the federal level, Canada has instated the Federal Fuel Charge (a revenue-neutral carbon tax aimed at consumers and smaller emitting business) and the Output-Based Pricing System (a carbon tax with trading elements aimed at large emitters, which also taxes emissions from industrial processes). These are backstop programs, as the federal government allows provinces to come up with their own systems so long as they meet minimum federal requirements. Most Canadian provinces have taken advantage of this opportunity, replacing one or both federal systems.

In the U.S., 11 states have introduced cap-and-trade systems, including California and New Jersey. In fact, California's cap-and-trade system is linked with the system currently in place in Québec under the Western Climate Initiative.

What are they?

A carbon tax is designed to force emitters to directly cover the cost

of the negative externalities created by their emissions. These externalities include extreme weather events brought on by climate change, a reduction in air quality, water pollution, etc. A carbon tax is a behavior-altering policy measure meant to reduce emissions. Initially, the tax puts the burden of these externalities onto emitters by imposing a set tax on each unit of emissions (typically one ton of CO₂ or its equivalent). Later, as producers pass on the cost to consumers, the burden is shifted to society. In theory, as the cost of carbon increases, consumers will substitute consumption of pricier carbon-intensive goods and services with cheaper and more sustainable alternatives, ultimately reducing emissions.

Carbon taxes can be highly regressive,⁸ as they are applied to all goods and services, and can therefore disproportionately impact low-income households. By returning the revenues generated by the carbon tax to consumers—and thus increasing their after-tax revenue—governments can effectively make these taxes revenue-neutral while providing society with a positive incentive to choose greener alternatives. This means that a firm or household that has managed to effectively reduce their emissions will stand to earn more than those that do not do so. Thus, the primary intent of a revenue-neutral carbon tax is not to raise

government revenues but instead to nudge society toward reducing its carbon footprint and investing in green innovation.

An alternative to a direct carbon tax is an emissions trading system (ETS), also referred to as a cap-and-trade system. In an ETS, the government or regulatory body overseeing the trading system sets a cap on the total amount of allowable emissions for each given period. Then, certificates allowing a given quantity are created in an amount totaling the cap. These certificates are given or auctioned off to emitters. A firm that ends up requiring more certificates can purchase them from those with a surplus.

This dynamic allows for market-based pricing on carbon and, like a revenue-neutral carbon tax, presents firms with both positive and negative incentives. Having to pay to emit should reduce demand for carbon-intensive products as if a carbon tax was imposed. Additionally, companies have a direct incentive to reduce emissions by switching to greener alternatives to sell excess certificates at a profit.

⁸ A regressive tax is applied as a percentage on the value of a good or a service. Because all individuals, regardless of their income level, must pay the same amount, the tax is disproportionately affecting lower-income individuals and can present equity challenges. Examples of a regressive tax are value-added taxes, property taxes and excise taxes.

Which is better?

In general, a revenue-neutral carbon tax is a more efficient way of reducing emissions than a cap-and-trade system. One primary reason is the transparency of the tax and its application to every economic participant, including both firms and households. A clear, visible tax encourages firms and households to reduce their emissions to earn monetary gains. In a cap-and-trade system, the price of emissions is highly volatile and is far less visible to households, which makes long-term energy-related decisions more difficult. Further, a carbon tax is simpler to set up and administer than an ETS. A carbon tax does not require a market to be created and regulated and avoids potential loopholes inherent in a cap-and-trade market. Finally, given the non-binding nature of their net zero commitments, governments have oversupplied the ETS market with polluting allowances, driving down the price of carbon to a level considered too low to incent real change.

In practice, both these regulatory approaches have so far failed to achieve carbon reductions, primarily because the price has been set too low. In the future, though, were carbon prices effectively allowed to reflect the societal cost of global warming—and consequently rise—they could prove to be a formidable policy tool to curb emissions.

TCFD: Task Force on Climate-Related Financial Disclosures

The TCFD was established in 2015 by the Financial Stability Board to improve and enforce transparency in financial reporting of publicly traded companies on climate-related matters. The framework is based on four pillars: governance, strategy, risk management and metrics and targets. It provides a standardized process of climate-related disclosure and reporting.

The TCFD standardized reporting framework focuses on three components of risk disclosure: climate-related risks, climate-related opportunities and financial impacts. Climate-related risks were divided into risks associated with the transition to lower carbon and risks associated with the physical implications of climate change. Policy and legal risks, technology risks and market risks are examples of transition risks. Physical risks include acute risks and chronic risks of short- and long-term climate events. Examples of opportunities that would be disclosed under this framework include resource efficiency, energy source and resilience. It is the onus of the company to disclose all pertinent historical and future information to demonstrate to stakeholders the active measures undertaken to limit climate change and mitigation strategies for potential risks.



3. *Real estate usage and the energy industry*

The shift to net zero will have profound implications on the demand for real estate and the energy jobs of tomorrow. **The International Energy Agency (IEA) estimates that this transformation will generate around 15 million new positions, which will displace some of the conventional energy jobs common today. The composition of these jobs, their location and the buildings needed to perform these functions will evolve considerably in the coming years.** This evolution is being driven by structural and regulatory changes within the energy industry, as well as by broader labor force and workplace trends. Changing skill sets and the growth in “enertech” are driving employment in markets where tech talent can be applied to solving energy problems. The broad geographical availability of some renewable resources reduces the distance from energy production to consumption. No longer bound by the presence of underground resources, many renewable energy companies choose to locate closer to their customers and where they can get easier access to capital and talent beyond traditional energy hubs. The implications for commercial real estate usage will depend on the company’s position within the energy supply chain and their success in adapting to this new reality.

Definitions:

Upstream

For non-renewables, this means taking the resources from the ground. For renewables, this means harnessing the power of wind, solar, biomass, geothermal, hydro and other sources.

Companies operating in the upstream segment are typically located near the greatest abundance of the resource.

- Exploration services:
 - Geophysical evaluation and design
 - Field development and maintenance
 - Engineering and construction services
- Production:
 - Drilling and extraction operations
 - Electric power generation, including wind, solar and other

Midstream

Refers to companies involved in the transmission and shipment of these fuels and energy sources to population centers where they are consumed. For renewables, this includes battery technology.

- Warehousing and storage
- Pipeline transportation
- Marine and rail transportation
- Electricity transmission
- Battery technology

Downstream

Companies convert these resources into the fuels and/or power necessary to generate economic activity for everyday life.

- Electricity distribution
- Refining and distribution
- Fuel distribution

Upstream occupiers

While conventional fossil fuel sources will continue to play a critical role in the energy mix for decades to come, **upstream entities engaged in extraction can expect to face considerable headwinds from a climate-change regulatory perspective.** As a result, some major energy companies have disposed of excess land sites in secondary and tertiary markets throughout North America while seeking to right-size their office and industrial portfolios closer to population centers. And many have experienced balance sheet pressure, leading to industry consolidation. As an example, Calgary's Cenovus and Husky Energy merged in early 2021, placing around 1 million square feet of surplus office in the downtown Calgary market. Even as the recent rebound in oil prices has improved the short-term outlook, larger energy companies have generally taken a "wait and see" approach to this trend and are maintaining footprints rather than growing in real estate markets that are clearly tenant favorable.

The introduction of technologies like fracking and horizontal drilling and the availability of non-conventional oil sources (shale, oil sands) have made it easier for companies to respond to short-term increases in demand without investing as much long-term capital. Oil and gas employment has fallen by 29% in the United States and by 5% in Canada over the past five years, predating the pandemic. As cyclicity of employment intensifies, tenants are prioritizing flexible lease terms. This demand for flexibility, combined with industry consolidation and right-sizing, has led to spiking office vacancy in several traditional energy hubs such as downtown Calgary (30.3%), Houston (27.2%), Dallas (25.3%) and Edmonton (19.9%).

Perhaps no industry is facing as much net zero pressure as coal. In 2020, coal represented 19.3% of total energy generation in the United States and 7.4% in Canada but will likely see its share fall considerably under a carbon-neutrality scenario. Coal companies have been downsizing for years, with employment in core activities falling by almost 20% since 2012. This has generated some shedding of real estate in cities like Pittsburgh, Calgary, Edmonton and Charleston. Some representative cases include Consol Energy, which recently shed around 413,000 s.f. in Pittsburgh, and Teck Resources, which recently downsized in Calgary.





However, growth is coming from emerging segments, mostly related to newer sources of the energy economy and often located in cities that are not traditionally considered energy hubs. Hydrogen and hydrogen-based fuels, which will compete more with natural gas for transportation, heating and power generation, are growing rapidly. According to CBInsights, venture capital (VC) funding for hydrogen worldwide is predicted to reach a record \$1.1 billion for 2021. Most of this funding has gone to companies engaged in the production of technology and equipment in areas like Vancouver, Columbus, Silicon Valley and Phoenix.

Companies involved in the extraction of materials like copper, lithium, nickel, zinc and other rare earth metals like neodymium, praseodymium, dysprosium and terbium—all critical inputs in the **production of electric vehicles and battery storage—will benefit from the energy transition.** This segment of demand has generated significant leasing growth in markets like Vancouver, exemplified by Rock Tech Lithium's recent expansion, and in Phoenix, highlighted by Freeport-McMoRan's new R&D facility. We expect this trend to grow in the coming years.

Also filling the void will be support services such as **engineering companies, environmental consultants, construction contractors and technology providers. These companies will play a critical role in diversifying and decarbonizing the industry** through the deployment of new technologies like CCS/U (carbon capture, storage and utilization) and the construction of new facilities. Industry contractors such as Jacobs Engineering, Bantrel, WSP and Jensen Hughes are leading the way.

Companies involved in the generation of wind and solar power are seeing substantial growth. The IEA expects this segment of energy production to increase by 50% over the next 10 years in the United States and Canada. The need to expand electricity-generation capacity will increase demand for utilities operators, office space for administrative staff and industrial space for service operations. Another large shift in real estate usage is happening in rural areas where solar and wind farms are coexisting with agricultural use. Agri-voltaic facilities—solar-power-generation plants operating in partnership with farms—have the potential to generate excess power that supports local operations and produces excess energy that can be sold back to the utility. These installations could provide substantial leasing income for farmers. Institutional investors, who typically focus on more conventional real estate sectors, are studying this industry closely.

Midstream occupiers

Environmental concerns and legal disputes continue to thwart new oil and gas transmission projects. The cancellation of the Keystone XL pipeline, ongoing disputes over the Trans Mountain pipeline and clashes between Enbridge and the State of Michigan over the Line 5 pipeline all illustrate the issues that oil and gas pipeline operators are experiencing. **Liquefied natural gas (LNG) represents an important growth opportunity for the transport of natural gas and an alternative to conventional pipelines that are becoming politically polarizing.** This will have important implications for industrial land near LNG ports. The expansion of two LNG terminals near Corpus Christi, Texas, have helped that region become a hub for exports, opening up new opportunities for industrial investors and users.

In the electrified economy of the future, transmission lines will be the new pipelines. The integration of electricity markets across North America will require the construction of thousands of miles of new transmission lines, which will require an immense investment. Equally important will be the evolution of battery storage technology.

According to the U.S. Energy Information Administration, 10,000 MW of large-scale battery storage will be added between 2021 and 2023, roughly 10 times the capacity in 2019. Some of the leading companies driving innovation in battery technology are Ionic Materials (Boston), QuantumScape (San Jose, CA), Sila Nanotechnologies (Oakland, CA), Sion Power (Tucson, AZ), Sionic Energy (Rochester, NY), Corvus Energy (Richmond, BC), E-one Moli Energy Corp (Maple Ridge, BC), Surrrette Battery Co. (Springhill, NS), Electrovaya (Mississauga, ON) and Novonix (Halifax, NS).

Downstream occupiers

Notwithstanding long-term structural job losses in extraction sectors, employment in refinery and chemical manufacturing has remained quite stable, according to a study from Deloitte. Over the past 30 years, refining capacity in the United States and Canada has been outpaced by the growth in demand, owing principally to demand for petroleum-derivate products like plastics, ammonium and polypropylene.

For these reasons, **tenants in the refining and chemical manufacturing spaces have had a more stable demand for real estate than other parts of the fossil fuel value chain, a trend that is expected to continue.**

The shift to net zero will greatly impact the built environment in urban areas, just as much as it will impact rural regions where new solar, wind, biomass and hydroelectric installations are being built. Solar panels are increasingly affixed to homes, office buildings, industrial facilities and shopping malls. Many new construction projects are incorporating energy storage systems using lithium-ion batteries that provide the building with clean energy at a low cost that can be sold back to the grid.

There will also be a reimagining of refill stations. Prudent real estate investors are assessing their parking lots to determine if EV charging stations would be appropriate. As for gas stations, those well located at major junctions or highly trafficked corridors of dense urban areas will increasingly be redeveloped and densified. This will especially be the case in urban areas experiencing increased housing demand.

Downstream CCS/U facilities could become more commonplace as oil and gas and coal producers look to this technology to reduce their emissions. The Biden administration recently proposed an infrastructure bill that included \$3.5 billion to fund four centers to further the development of CCS/U technology. **Companies designing and building CCS/U have started to expand their office and industrial usage in key markets.** The largest office leasing transaction of 2021 in Vancouver was Svant, a carbon capture company leasing 141,000 s.f. at 8800 Glenlyon Parkway. In Houston, 11 major energy companies made a joint announcement in support of large-scale deployment of carbon capture and storage technology within the metro area. This collective effort could capture and store approximately 100 million metric tons of CO₂ per year by 2040.



4. *Ecosystem drivers*

As renewables and alternative sources grow their share in the mix of total energy production, new real estate hub markets will emerge. Traditional investment flows into the industry have ebbed and flowed with oil prices, while new frontiers are being forged in renewables, “enertech” and other sectors through substantial VC funding growth. Markets with well-established existing ecosystems like Calgary, Denver and Houston are well positioned to benefit from the energy transition, while emerging markets like Toronto and San Francisco are more recent entrants. Political and regulatory agendas have also shifted this year, setting a more favorable course for renewables and sustainability.

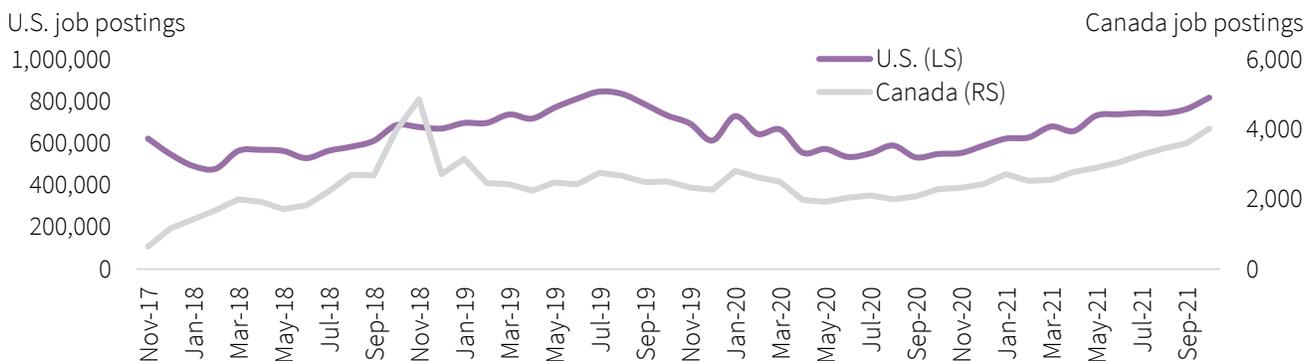
Industry investment—capital and talent

With both Brent and WTI over \$80 USD/bbl. in mid-November and natural gas over \$4.75 USD/MMBtu, much of the credit crunch of the pandemic has eased. Rig counts for both commodities have naturally experienced increases in recent weeks across the U.S. and Canada; however, much of this activity is restarting rigs and wells that were idled

during the oil price crash vs. new exploration and production. **Many oil companies are opting to use increased operating cash flows to pay down debt, return capital to stakeholders and invest in talent and technology, which could prove to be powerful assets through the energy transition.**

Unlike the Bureau of Labor Statistics and Statistics Canada, which offer historical lookbacks at jobs, EMSI provides insight into labor market analytics, in this case, traditional and renewable energy companies’ current appetite for talent. As the sector emerged from the oil price crash, Q1 2018 energy and energy-related unique job postings averaged 511,000 and 1,700 per month in the U.S. and Canada, respectively. These numbers had climbed significantly heading into the pandemic, reaching 730,000 jobs in the U.S. and 2,600 in Canada in early 2020. Emerging from layoffs and cost-cutting measures in 2021, the broader industry has rebounded to an average of 918,000 and 4,000 unique monthly job postings year-to-date in both countries, respectively.

Monthly job postings—energy



Source: EMSI

The types of roles energy companies seek to fill have also experienced a shift. Five years ago, EMSI data shows the top posted positions characterized by more office-demand-driving jobs such as sales specialists and office managers/assistants. **As energy firms look to build their workforces of the future, recruiting high-value talent has become more critical than ever.** It's not surprising to see that in 2021, top categories for job postings are project managers and software engineers, a leading indicator on where investment in intellectual capital is headed. These positions could also potentially offer more flexibility for remote work, influencing future office space demand.

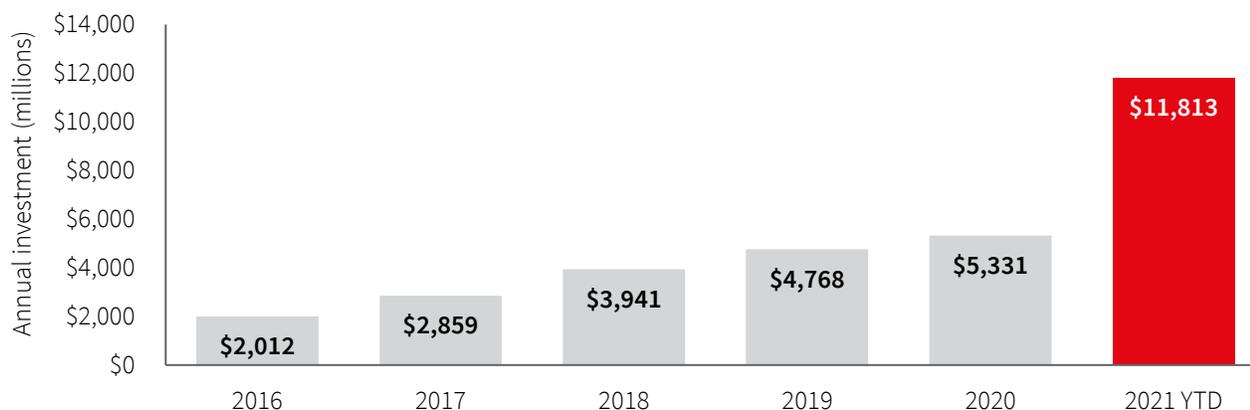
Industry investment—venture capital funding VC funding, which has long been a catalyst for real estate events in industries like life sciences and technology, has not been a straight line for the energy sector. Through VC funding, however,

perspective can be gained into early-stage investment trends and elements of the energy transition, which has broadened to include sectors such as energy storage, electric vehicles, and carbon capture and storage. The momentum behind clean energy innovation has been steadily building—in 2011, VC funding for the U.S. and Canada for renewable and emerging energy sectors totaled \$4.6 billion USD. **That investment has grown nearly 170% over the last decade, now totaling \$12.3 billion USD through November for 2021.**

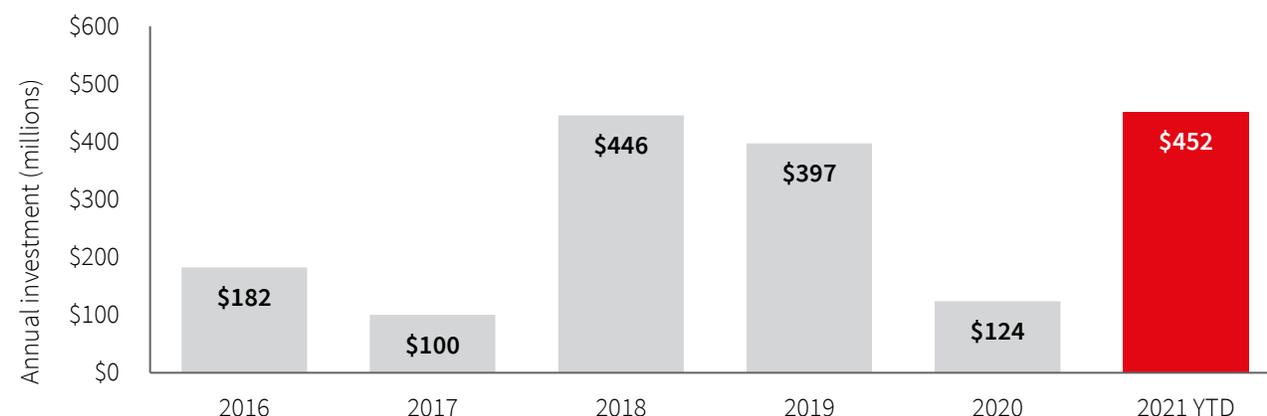
This momentum has been almost entirely driven by investments made in the U.S., where spending more than doubled between 2020 and 2021. The single largest contributor was a \$2 billion funding announcement in July of this year by green infrastructure investment firm Generate Capital. This funding could also be enhanced by the recently passed Bipartisan Infrastructure Deal.

North American Green and Renewable VC Funding

United States



Canada



Source: Crunchbase
Note: Totals in U.S. dollars

Capital flows in real estate

Real estate continues to be an extremely attractive investment vehicle, even in high-exposure energy markets where office vacancies are at historic highs. Momentum in industrial and multi-housing sales has been particularly strong in Houston, Calgary and Edmonton, the larger traditional energy economies that are still growing despite headwinds. The greatest divergence in these markets comes into play in the office and retail sectors. Many Canadian cities are still experiencing softer trade volumes for retail assets, and office liquidity has slowed considerably. This is due, in part, to oversupplied markets from the years of rapid expansion in the oil sands business.

Conversely, Houston has seen new capital come into the market while also maintaining a healthy mix of repeat buyers and bidders. There is a perception that pricing will start to rebound, and activity has increased on different vintages and classes, especially for well-located assets. New ownership has the ability to make economic sense of much lower rental rates when acquiring office buildings at a lower, reset basis.

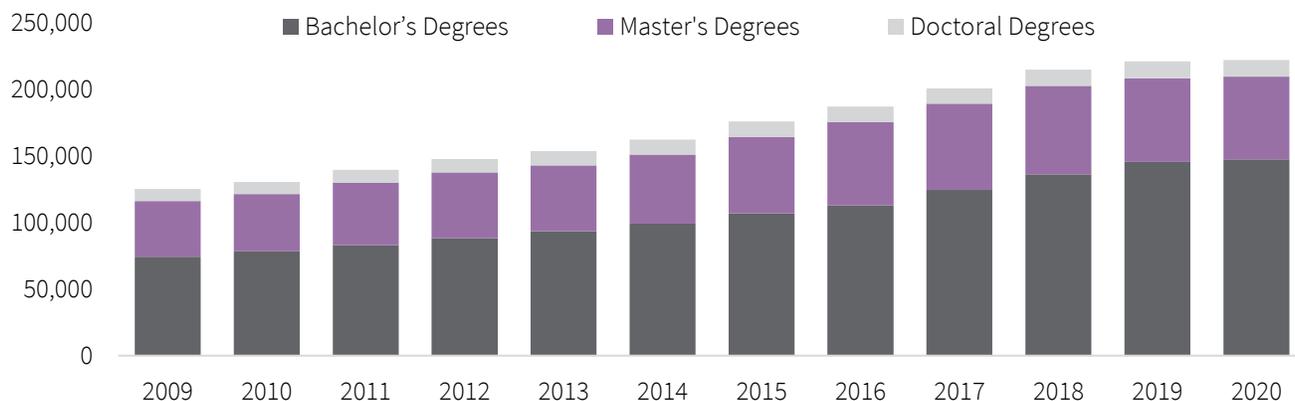
At the highest level, newer office assets are outperforming on sales metrics, largely because the longstanding flight-to-quality trend has produced higher occupancies and stronger demand on the leasing side. **Office assets that are WELL or LEED certified are generating greater investor interest. In fact, a recent analysis by JLL showed that such assets garnered, on average, +10% more bids when compared to non-WELL-certified assets.** Additionally, these buildings have seen an average 50-basis-point lower cap rate than the market as a whole, notwithstanding that some of this premium is attributable to year built, amenities and/or location. A building's environmental impact and performance will increasingly take on more importance, especially at the global level. Premiums for WELL- or LEED-certified assets are expected to continue mounting in 2022 and beyond.



Existing ecosystems—universities and talent

The two largest U.S. states by population, Texas and California, offer a wealth of energy resources, existing infrastructure and natural resources. A robust and diverse workforce, coupled with strong education systems, has helped attract top talent from all over the world. According to the American Society for Engineering Education, in 2020, a total of 221,858 students were awarded degrees in engineering in the U.S., a 26.2% increase over the past five years. Of the degrees conferred, many of these universities are in Texas and California.

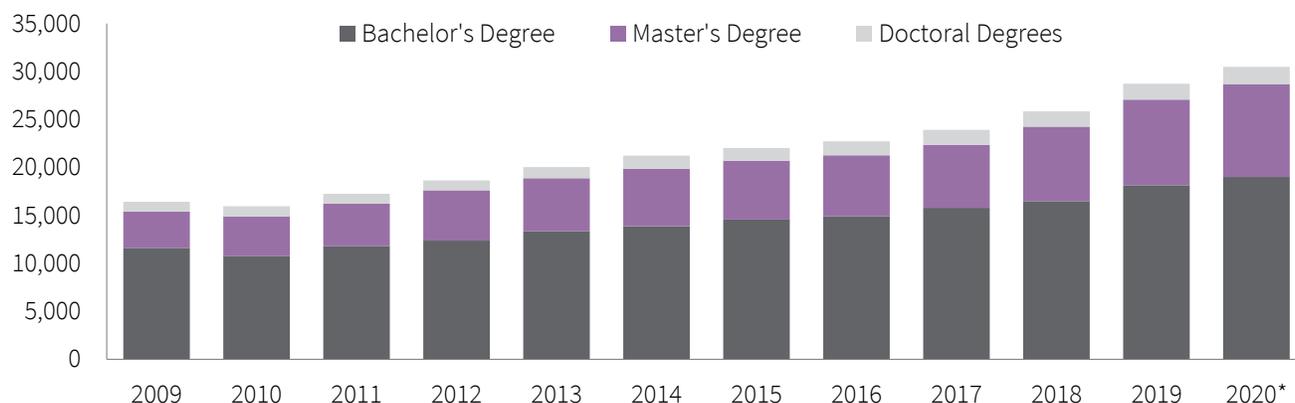
U.S. Degrees in Engineering



Source: American Society for Engineering Education

Likewise, Canada has experienced a similar trend: in 2020 an estimated 19,000 students were awarded an engineering degree, a 30.5% jump relative to 2015 levels. Most engineering degrees were awarded from universities that are not located near traditional energy hubs but in Ontario, Québec and British Columbia, Canada’s most populous provinces and the locations of vibrant tech ecosystems. Also, among engineering types, **environmental engineering continued to grow in popularity** and was the third most chosen field by undergraduate students, after biosystems and software engineering. At the same time, geological and mine engineering faculties experienced a decline in enrollment in 2018 and 2019.⁹ **This evolution in preferences reflects a demand shift from traditional oil and gas jobs. It also indicates more interest in the high-tech and green sectors, which will benefit from renewed innovation.**

Canadian Degrees in Engineering



Source: Engineers Canada (2021) | *JLL Research forecast

⁹ [Canada Engineers for Tomorrow | 2019](#)

Engineering employment

The economic vitality and well-established regional economies of California and Texas provide a strong foundation for advanced energy growth, with a total of 571,800 engineering jobs, accounting for 22.8% of the total engineering employment in the U.S.

State	Number of jobs	% of jobs
California	331,090	13.2%
Texas	240,750	9.6%
Michigan	123,150	4.9%
Florida	114,400	4.5%
New York	102,230	4.1%
Pennsylvania	97,880	3.9%

Source: Bureau of Labor Statistics, May 2020, based on architecture and engineering occupations

In Canada, however, the non-traditional energy provinces of Ontario and Québec offer more than half the engineering jobs, which explains why many of the “enertech” jobs are less concentrated around Canada’s oil patch.

Province	Number of jobs	% of jobs
Ontario	148,913	42.4%
Québec	74,351	21.2%
Alberta	51,176	14.6%
British Columbia	47,318	13.5%
Manitoba	6,363	1.8%
Saskatchewan	6,214	1.8%

Source: Statistics Canada, January 2021, based on NOC Codes 213, 214, 215 and 2173.

Market trends and natural endowments

The world of energy supply has undergone a paradigm shift. Renewable energy has continued to grow in investment and output, thanks in part to healthy government subsidies, lower operation costs, advances in capture and storage technologies and consumer demand. Provincial and state governments participate in the global energy transition shift at different levels, with a mutual long-term focus on slowly transitioning energy away from oil and gas.

Renewable energy as a whole was the second most produced electricity source in the U.S. in 2020, according to the U.S. Energy Information Administration (EIA). Renewable energy sources, including wind, solar, biomass, hydroelectric and geothermal energy, accounted for 21% and 67% of all the electricity generated in the U.S. and Canada, respectively.

In Canada, Québec leads all provinces in using renewable energy sources for electricity generation. According to data from Statistics Canada, renewables accounted for 99% of electricity production in the province in 2020, the vast majority of which comes from hydroelectric (nearly 94% of total electricity production). Renewables have been at or around that mark since 2013. Québec has also seen significant growth in the use of wind-power generation, which has increased from 0.2% of total electricity production in 2008 to over 5% in 2019 and 2020.

Canada’s two other largest provinces by population, BC and Ontario, are also heavily reliant on renewable energy sources for their electricity production. **In BC in 2020, hydroelectric stations produced nearly 88% of its total electricity, with all renewables accounting for 92% in total. Ontario generated a third of its electricity from renewable sources in 2020, as well as 56% from non-carbon-emitting nuclear sources.**

Texas’s depth of natural resources has helped it lead the nation in energy production, with renewable energy providing more than 20% of all utility-scale net generation in 2020. According to the EIA, Texas leads the nation in wind-power generation, producing 28% of wind-powered electricity nationwide. In addition, Texas is expected to lead the U.S. in solar power generation by 2024. **California is one of the nation’s top producers of electricity from geothermal, solar and biomass energy** and ranked second in conventional hydroelectric power generation in 2019.

In commercial real estate, owners, operators and occupiers have been working to reduce operating costs and increase revenues through a number of means. Some of the earliest steps taken include boosting energy efficiency and shifting energy consumption to renewable sources.

Regulations and legislation

The energy industry is very heavily regulated, and with the profound influence of carbon emissions, companies could be mandated to accept greater responsibility for their role in climate change.

Commitment to alternative and cleaner forms of energy has not historically been a top priority for the United States; however, global momentum around ESG and decarbonization could accelerate processes. In contrast, Canada has remained committed to the 2015 Paris Agreement agreed to at COP21, including increased carbon pricing and significant emissions reductions.

Recent updates:

Canada

COP26

- Reaffirmed emission reduction measures as major steps toward achieving a net zero economy by 2050
- Announced plans to end exports of thermal coal no later than 2030, while also committing \$1 billion to help developing countries transition to cleaner power
- Promised to impose a hard cap on oil and gas sector emissions

>> **Potential real estate impact: Medium**

2021 Federal Budget:

- **The Strategic Innovation Fund's Net Zero Accelerator**, launched in 2020 with a net budget of \$3 billion, has been **augmented to \$8 billion** under Budget 2021 to speed up decarbonization projects with large emitters, to scale up clean technology and to accelerate Canada's industrial transformation across all sectors
- **The Clean-Tech Startup Fund of \$1 billion**, providing seed money for start-up companies operating in renewable energy, including biofuels; clean tech in oil and gas; smart grid and energy storage
- **50% tax rate reductions** for zero-emission technologies that will be applied to the manufacturing of renewable machinery and equipment (e.g., wind turbines, solar panels, etc.), as well as **100% depreciation opportunities** for qualifying clean energy equipment

- **Low-Carbon and Zero-Emission Fuels Fund** earmarking \$1.5 billion for low-carbon alternatives, such as hydrogen, renewable natural gas and diesel, biocrude, etc.

>> **Potential real estate impact: High**

Greenhouse Gas Pollution Pricing Act:

- The federal carbon tax on provinces that do not already have their own carbon pricing system sets a minimum price per tonne of carbon emission equivalent
- The price is set to reach \$50/tonne in 2022 and will progressively increase to \$170 by 2030

>> **Potential real estate impact: High**

United States

Bipartisan Infrastructure Bill—\$1.2 trillion

- Upgrade power infrastructure to deliver clean, reliable energy across the country, including advanced energy technology to achieve a zero-emissions future
- Make infrastructure resilient against the impacts of climate change, cyber attacks and extreme weather events
- Major investment in legacy pollution to clean up Superfund and brownfield sites and capping orphaned oil and gas wells

>> **Potential real estate impact: High**

Build Back Better—\$2.0 trillion

- Seeks to ensure clean energy technology will be built in the United States with American-made materials and job creation
- Advancement of environmental causes through a new Clean Energy and Sustainability Accelerator that will invest in projects around the country
- Invests in natural solutions for climate change including forest management, coastal restoration and soil conservation

>> **Potential real estate impact: Medium**



5. *Established and frontier markets*

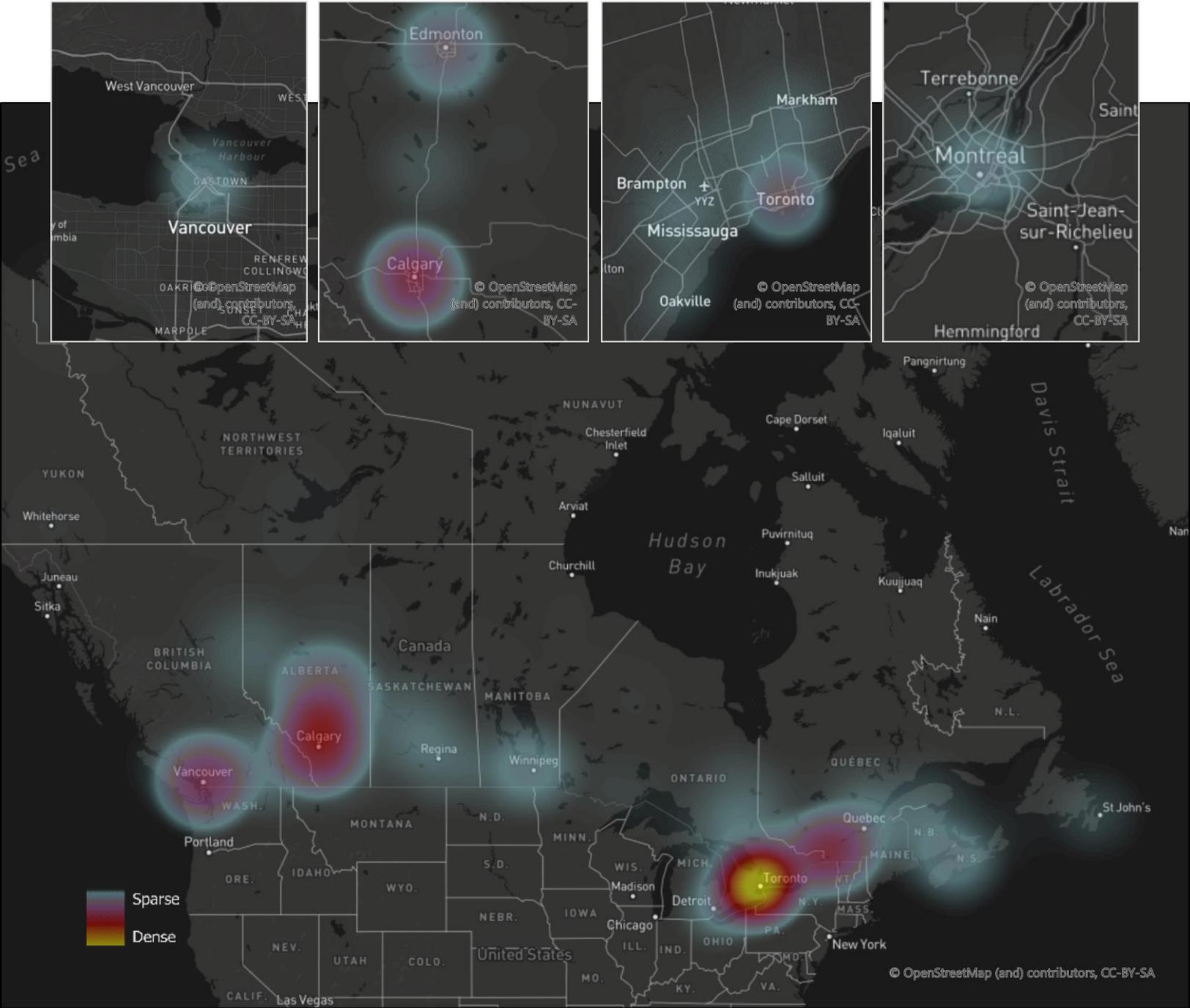
A common theme in this report is the reallocation of jobs from traditional energy markets focused on fossil fuel production to non-traditional markets like Toronto, Montréal, Vancouver, Phoenix, Austin and the Bay Area, where innovation is concentrating and investment capital is being deployed. **These new energy cities are typically better characterized as tech clusters than energy clusters. Easier access to capital markets, proximity to a larger client base and the presence of research centers** matter more to the renewables industry than the location of the resource itself, in contrast to the fossil fuels

industry. The following heat maps show the Canadian and American cities that are driving the production of renewable energy. While established energy markets continue to be critical hubs, others are also important players in the new energy economy.

In this section, we conduct a SWOT analysis (strengths, weaknesses, opportunities, threats) for some of the cities/regions identified by the maps and how they address the evolving needs of the energy industry.

Canada

Renewable energy companies 2021



Calgary

Calgary has historically been the hub for oil and gas companies and professionals, boasting the highest number of energy head offices in all of Canada. Because of its limited diversification, the central district moves in tandem with the fortunes of the oil and gas sector, resulting in volatility in all supporting industries (i.e., real estate). Since the U.S. shale oil boom of 2014, the Canadian energy sector has been rattled and the city of Calgary has seen an economic decline. Calgary's downtown office vacancy rate reached 30.3% in Q3 as the COVID-19 pandemic compounded a situation of office oversupply that resulted from the years of rapid expansion in the oil sands business. Oil and gas tenants have recently undergone consolidation and merger and acquisition activity, notably the Husky Energy merger that brought over 1 million square feet of Class A sublease space to market.

Alberta Innovates, Alberta's largest research and innovation agency, has been investing in clean resources such as bioenergy, the hydrogen economy, hydrocarbon products and bio-industrial materials. The provincial government is investing \$50 million in 23 programs in tandem with Alberta Innovates to create jobs and grow the clean-tech industry in Calgary and Edmonton.

S W O T

Strengths

- Canada's oil & gas capital
- Large talent pool of available O&G specialists
- Access to the world's third-largest crude oil reserves and some of the cheapest and highest-quality wind resources in the country
- The Clean Energy Improvement Program to recover costs for energy-efficient upgrades
- SAIT's Green Building Technologies program to convert vacant office buildings into residential
- Most affordable of all CBD markets

Weaknesses

- Economy historically tied to the WCS
- High vacancy rates and unemployment due to consolidation and M&A activity
- Risk of stranded assets with the transition
- Limited economic diversification and established infrastructure prevents a swift transition into renewable energy

Opportunities

- \$2.3 billion investment program earmarked for digital transformation activities for the renewable energy sector through 2024
- The TIER Economic Recovery Program promotes innovation in reducing emissions
- Provincial programs to innovate on extraction processes and non-fuel applications for bitumen
- Announced that by 2030, the rate of land reclamation is equal to or better than the rate of land disturbance

Threats

- Risk that further O&G consolidation will cause the hollowing out of the downtown economy
- Public outcry against Keystone XL pipeline and other oil and gas infrastructure to stunt growth of large-energy occupiers
- Lack of new commercial construction in downtown Calgary
- Increased availability of sublease space following further industry consolidation

Edmonton

The energy industry in Edmonton is dominated by the oil and gas sector. While most major Canadian oil and gas players have their offices headquartered in Calgary, oil and gas firms have a strong industrial presence in Edmonton. This includes two refineries, fabrication facilities and many distribution and supply companies. There is also a fledgling renewable-/low-carbon-energy sector growing in Edmonton. Several major renewable energy projects are under way. Included among these are the Badger Lands and Airport City solar farms and the Strathcona Refinery Renewable Diesel Expansion, which will “use canola, soy, and/or sunflower oils in combination with hydrogen, produced from natural gas with carbon-sequestration facilities, to make its renewable diesel.” The University of Alberta is a leader in the research and implementation of clean energy processes and infrastructure. The university works with the municipal government and Albert Innovates (a research and innovation hub) to accelerate the city’s and province’s shift into renewable energy.

S W O T

Strengths

- Experienced talent with transferable skills to renewables
- Abundance of O&G-dedicated industrial space
- Deregulated energy markets to incent private investment in energy projects
- The city partnered with Enerkem, a waste-to-biofuel conversion company, to divert 90% of its municipal waste out of landfills
- Since 2019, local organic waste has been used to replenish coal mining sites to grow crops for biomass feedstock

Weaknesses

- A relative lack of diversity in energy sources
- The carbon tax and Alberta’s Technology Innovation and Emissions Reduction (TIER) System—a hybrid carbon pricing system with both carbon tax and ETS elements—to negatively impact traditional oil and gas firms

Opportunities

- The Alberta Petrochemical Incentives Program to provide funding for energy projects with capital costs \geq \$50M
- The Trans Mountain pipeline expansion project to boost exports outside the US Midwest at a higher price
- Air Products already plans to have a \$1B+ Net-Zero Hydrogen Energy Complex running in Edmonton by 2024
- The Strathcona Refinery Renewable Diesel Expansion to incent the transition to renewables

Threats

- Proposed hard cap on emissions
- Stranded assets are a risk
- The termination of the Keystone XL pipeline to reduce exports

Toronto

As the nation's largest city, the opportunity for growth in the renewable energy sector in Toronto is high. As the city strives to meet its 2050 net zero target—a goal shared by many other North American cities—demand for sustainable energy in the city will greatly increase. Toronto is well positioned to become a hub for the research and development and tech needs required to meet these ambitious targets.

Currently, much of Ontario's energy is generated using hydro and nuclear sources. Further investment in these, along with renewables like wind and solar power, is likely to occur.

S W O T

Strengths

- Largest talent pool in Canada, with prestigious university and vibrant tech ecosystem
- Canada's financial capital
- Among the cleanest grids in North America due to the use of nuclear, hydroelectric, biomass and solar
- Presence of anchor companies in renewables

Weaknesses

- Real estate costs are high relative to the rest of the country, which can price out smaller firms
- Electricity rates have greatly increased over the past decade, doubling from 2009 to 2019

Opportunities

- City's commitment to net zero by 2050 to stimulate renewable industry's growth and increased real estate demand
- One of the highest amounts of VC funding flowing into the renewables sector
- Ontario Power Generation is developing small modular reactor (SMR) technology
- The Darlington Nuclear Station refurbishment project expected to generate \$89.9 billion in economic benefits and create 14,200 jobs per year
- Hydro One and Ontario Power Generation partnering on the Ivy Charging Network, the largest electric vehicle charging network in Ontario
- City incentives to improve household energy efficiency
- Provincial/federal \$590 million grant to fund upgrades to the Ford plant in neighboring Oakville to produce electric vehicles (EVs)

Threats

- The rise in electricity rates could introduce uncertainty re: transition
- Safety concerns re: deployment of nuclear energy

Montréal

The province of Québec is Canada's largest producer and a net exporter of hydroelectric power. Because 99% of its electricity is generated through renewable sources, it has one of the world's cleanest grids. The province has made swift steps to meet GHG emission targets and established tough regulations to hold energy producers accountable. Montréal and Québec City—the only two cities with refineries—house companies that run energy supply within the province. Energir, the province's largest natural gas distributor based in Montréal, has diversified into wind and other renewable-energy investments.

Montréal is committed to research and development on alternative clean energy sources and is home to some of the world's leaders in the development of fuels through bio-materials. The provincial government recently invested \$5.9 million to develop advanced biofuels from locally sourced forestry waste. This aligns with Québec's goal to increase bio-energy production by 50% by the year 2030.

S W O T

Strengths

- Montréal-based Hydro-Québec is one of the world's largest hydroelectric companies
- Montréal has low electricity costs (49% lower than the G7 countries on average)
- The province is the second-biggest producer of windpower in Canada
- Energir is the largest natural gas distribution company in Québec and has diversified into wind energy and renewable-energy investments
- One of the world's cleanest grids
- Vibrant tech and “enertech” ecosystems
- New York State will be powered by Hydro-Québec for 25 years, beginning in 2025

Weaknesses

- The province has no crude oil capacity and only two large refineries (Montréal Refinery from Suncor and Jean Gaulin Refinery from Valero near Québec City)
- Québec transportation industry still heavily reliant on petroleum products as cost to rent or buy electric vehicles remains very high; the transportation sector remains the highest emitter of GHGs in Québec

Opportunities

- Province's green commitments and related incentives to spur innovation
- Government funding for research in renewable energy and transportation electrification (InnovEE) likely to benefit Montréal
- McGill University to open new research center for innovation in energy storage and conversion
- Québec carbon recycling plant expected to be among largest of its kind in the world

Threats

- Border tensions between Maine and the province of Québec to build a hydroelectricity link between Québec and Massachusetts
- Hydro-Québec is struggling to liquidate surplus product into its main importer—the U.S.

Vancouver

Vancouver has a relatively small ecosystem of traditional energy companies, mostly focused on the transportation of energy commodities and the mining out of province oil sand deposits. Extensive commitments at federal, provincial and municipal levels to invest in renewable energy, as well as access to VC and PE funding, is turning Vancouver into a world-class leader in the development of CCU/S, fuel cell technologies and hydrogen. The city's quality of life is playing an important role in the growth of the energy sector, helping it attract talent and capital investments from major players in the renewable energy space. Another bright spot is Vancouver's mining industry. Local companies have started to branch out into key minerals like copper, lithium and rare earths, which are very important in the manufacturing of solar panels, wind turbines and EV batteries.

S

W

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Strengths

- Major transportation hub, with the largest port facilities in Canada
- The third most active VC and PE market in Canada
- Public-private partnership project to create the Clean Energy and Low-Carbon Innovation Center to be managed by the University of British Columbia
- The world's third best city for quality of life (Mercer, 2019) and a primary destination for international and inter-provincial migration
- Critical mass of more than 200 companies in the green economy, with over \$1.7B in sales
- Home to some of Canada's most dynamic mining companies involved in the production of key minerals like copper, lithium and rare earth minerals, key for the energy transition

Weaknesses

- One of the highest costs of living and of commercial real estate in Canada
- Regulated electricity markets in BC limit the competition from alternative electricity providers and constrain existing companies to upscale locally. BC Hydro is currently the largest player, controlling 90% of the market.
- Vacancy taxes, rent controls and various land and environmental protections increase the costs of building and managing real estate in the province

Opportunities

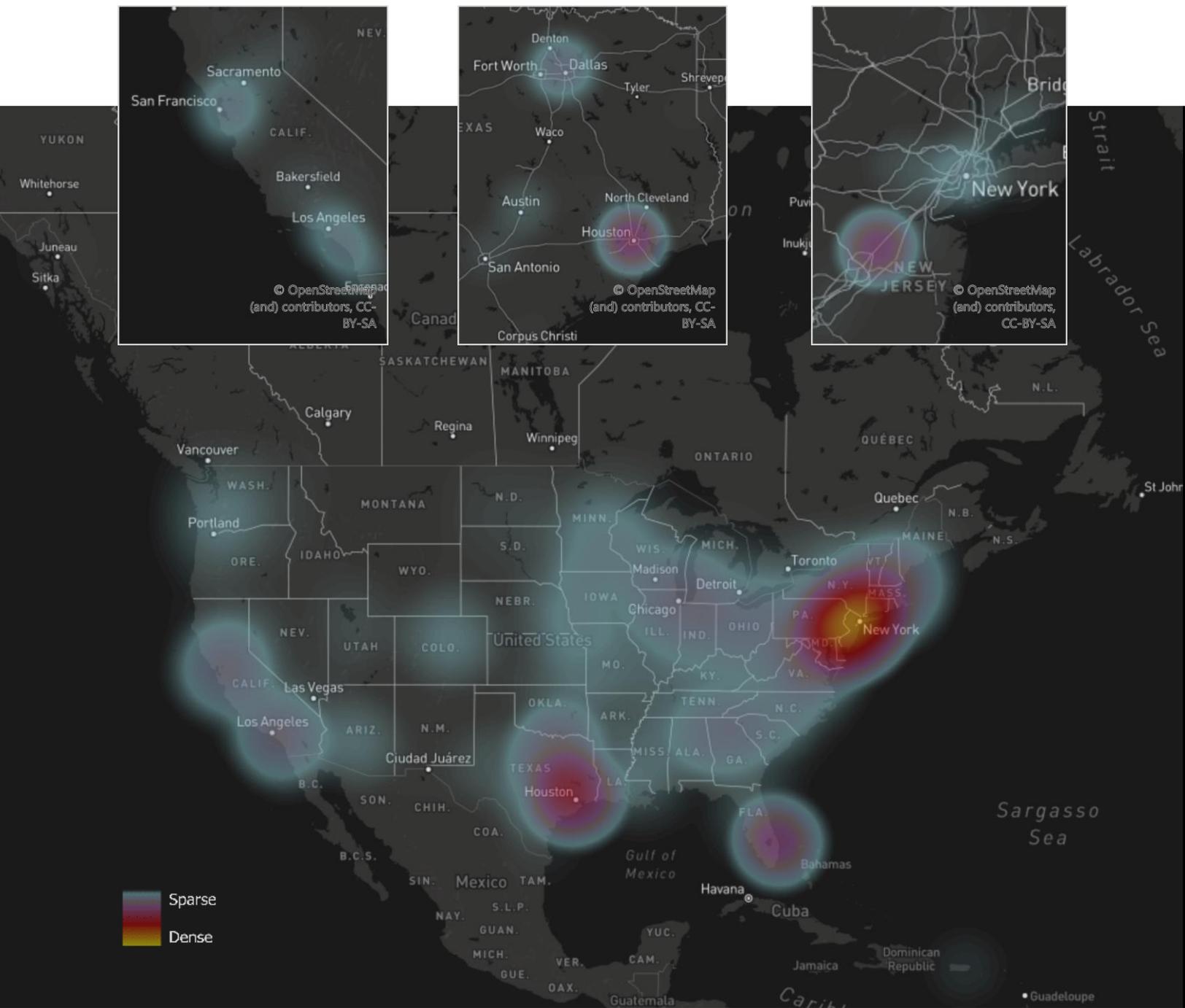
- Commitment to net zero targets by 2025. A key aspect of this plan is renewables-powered Neighborhood Energy Centres.
- Completion of the Trans Mountain pipeline and the construction of the new LNG Canada export terminal, a new frontier for real estate investment, is appearing in northern BC
- Large renewable energy potential (11,800 MW), primarily from hydropower

Threats

- Continuing political battles with Alberta and the federal government over pipeline and other related projects can have negative impacts on oil and gas-related real estate in the province
- Extreme weather events such as floods, mudslides and forest fires may cause supply chain disruptions and increase insurance premiums and the cost of doing business in the area

United States

Renewable energy companies 2021
(revenue over \$10M)



Houston

Houston has long been a key Gulf Coast and U.S. hub for every facet of the broader energy industry, and it is the same fundamental attributes that can make the metro an innovator and leader in the world's low-carbon transition. Most major energy companies have a presence here, and many are choosing to double down on the metro area as they advance their respective clean energy and sustainability initiatives for the future.

S W O T

Strengths

- Houston has a strong technology infrastructure and sizable presence of 4,600 energy-related firms, including companies in the E&P, downstream and clean energy sectors
- The metro area offers a well-educated and diverse STEM workforce, including the largest concentration of engineers in the U.S.
- With deep renewable resources, Texas is the nation's biggest wind-energy generator, and many wind farms are managed through Houston

Weaknesses

- Even though Houston's economy has diversified, the mainstream oil and gas industry accounts for over 20% of Houston's GDP, not including engineering and related industries that service the sector
- The COVID-19 pandemic, macroeconomic concerns and a volatile energy market are driving a sustained slowdown in energy tenants' leasing activity

Opportunities

- Houston's established ecosystem and talent, along with growth in energy technology, make the market uniquely positioned to lead the transition and redefine itself as the clean energy capital of the world
- Major integrated players are making significant investments in carbon capture, advanced plastics recycling and the like within the metro area

Threats

- Generally lower oil prices and demand challenges have heavily impacted upstream and oilfield services jobs. Energy employment is unlikely to ever reach its 2014 peak again, contributing to Houston's record-high office vacancy.
- Continued energy-company bankruptcies and M&A activity, along with right-sizing and hybrid work shifts, are expected to add more vacant office space to the market

Denver

Denver's location quotient has made it a natural hub for energy growth, serving as a "midpoint" for businesses and operations spanning north to Calgary and south to Houston. However, the health of the market is heavily reliant on the price of oil and activity within the industry, especially in the northern region of Weld County for field operators and in the CBD for office-using headquarters.

S W O T

Strengths

- Talent-rich magnet metro that increasingly attracts newcomers—many who are highly educated in STEM roles falling within the energy sector
- Broad-based, diverse workforce within the energy sector; among the U.S.'s leading metros for employment in solar and wind, along with fossil fuel payrolls
- Colorado (led by the DEN metro) boasts one of the nation's leading per capita concentrations of "intellectual resources" by way of 33 federally funded research facilities

Weaknesses

- Investment in traditional fossil fuels has been made exceedingly difficult given increasingly frequent rule changes and legal challenges happening during energy transition
- Though up from pandemic-induced depths, Colorado's active rig count through Q3 was down sharply from same period two years earlier
- Given excess supply and curbed demand, in the CBD alone, the energy industry accounts for one of every two square feet currently available for sublease

Opportunities

- Transition to renewable clean energy is backed by voters, the governor and the state's largest utility provider; Xcel commits to 80% renewables by 2050
- Oil prices have stabilized, and demand is returning; natural gas demand (and pricing) has increased markedly, boding well for Denver and the state (seventh-largest producing state)
- Transitioning to clean energy should unleash a wave of innovation in energy-related technologies (battery storage, carbon capture, etc.); Denver is rich in highly educated renewable energy expertise

Threats

- The pandemic and remote work have decreased demand for office, causing Denver's total office vacancy to reach a record-setting 30% availability rate within the CBD
- Demand and commodity pricing have stabilized, but energy users are starting to adapt to the new hybrid workplace model—shedding space, making existing footprints available for sublease, signing smaller leases
- Denver's energy-sector workforce skews older in age than other industries; nearly one-quarter of workers are 55 or older; this "retirement wave" hastens loss of experience/expertise

Pittsburgh

Pittsburgh has an established ecosystem of traditional energy companies, including recent successes in the natural gas sector, given the richness of the Marcellus and Utica Shale formations. The metro area has been developing a master plan to limit emissions and identify alternative energy solutions, which could threaten local traditional energy company growth, though its critical location in the Appalachian basin will certainly keep it a player in the energy future of the U.S.

S W O T

Strengths

- Access to skilled and affordable labor compared to primary energy markets
- Pittsburgh is at the center of the Marcellus and Utica Shale formations, and Washington County has the most active wells in the southwestern Pennsylvania region
- Major hub for energy company headquarters outside of primary markets; offers a lower cost of living and corporate operations compared to other cities

Weaknesses

- The health of the market is heavily reliant on the price of oil and activity within the industry, especially in the energy submarket of Southpointe
- Older warehouse and manufacturing inventory creates challenges for adapting and transitioning to alternative energy solutions
- The scarcity and price of land have limited the growth of new industrial development in the region

Opportunities

- Government officials, including Pittsburgh's new mayor, have a renewed focus on job creation in southwestern PA
- Transitioning to clean energy could attract federal grants to reuse or upgrade existing plants and mines in energy-industry-dependent regions like Appalachia, rather than companies shuttering sites due to inadequate funds

Threats

- The pandemic and remote work has decreased office demand, causing total office vacancy to reach a record high of 21.6%
- While oil prices have rebounded, energy companies are becoming more efficient as they balance the hybrid work model. As a result, energy tenants have continued to dispose of excess space.

Dallas–Fort Worth

While energy remains an important industry in DFW, it is no longer a leading economic driver compared to a decade ago. The current energy sector is anchored by various global and regional headquarters, ranging from traditional conglomerates to companies specializing in power plant development. Given DFW's success attracting company headquarters, it could prove to be an attractive location for renewable-energy companies in the future.

S W O T

Strengths

- As clean energy gains momentum, DFW's strong tenant base in asset management and financing, including local banks with significant energy lending practices, will be a strong draw
- DFW's economic diversity and energy-sector diversity have insulated it from some individual company hotspots
- A diverse and well-educated workforce supports the corporate functions for numerous energy companies and related business services

Weaknesses

- Energy sublet space totals over 750,000 s.f. in DFW—new energy sublessors in 2021 include Matador Resources and Montage Resources. Softer overall market conditions will make sublet blocks difficult to fill.
- The lower cost-effectiveness in the Barnett Shale continues to decrease its production: after peaking in 2011 at 5.2 billion cubic feet (BCF), production dropped below 2 BCF this year for the first time since 2007

Opportunities

- Tenants are using the pandemic as an opportunity to right-size space and real estate holdings, and redevelopment of vacant office space to mixed-use could follow
- Rising energy prices will boost revenue for major oil producers and could lead to industry expansion; strongest players could expand through strategic acquisitions to fill underutilized or new space

Threats

- While energy remains an important industry in the DFW office market, especially for its secondary effects on the professional services sector, it is no longer a leading economic driver
- The energy industry is plagued by the same threats facing the broader economy—costs and timelines are increasing due to supply chain issues, and companies face difficulty hiring qualified workers at wages they are offering

Miami

Florida is a prime location for renewable energy expansion, particularly solar, and Miami specifically is a metro to watch with potential for significant growth in the clean energy space. In fact, the area is cultivating a burgeoning technology ecosystem that presents opportunities for talent acquisition, partnerships and joint ventures for the green energy ecosystem.

S W O T

Strengths

- Miami has a robust talent pipeline fueled by domestic and international migration and a premier state university system
- Miami is a connected, truly global city with a deepwater port and several airports offering hundreds of daily direct flights around the country and the world

Weaknesses

- Real estate costs are rising as corporate migration from the Northeast boosts demand
- Miami's cost of living is roughly 14.5% higher than the national average, fueled mostly by housing costs

Opportunities

- Florida can provide considerable tax savings, with no state income tax for individuals, S corps or limited partnerships. Sales and use tax exemptions exist on machinery, R&D labor, electricity used for manufacturing, aerospace and more
- Florida Power and Light and Crown Castle are both major employers in Miami and recently downsized, cutting jobs and releasing seasoned employees into the workforce

Threats

- Florida tends to be sensitive to environmental issues, even in Republican districts, and NIMBYism could threaten the development opportunities of new energy infrastructure
- Rising sea levels and more frequent and severe hurricanes pose a risk to both energy infrastructure and administrative offices

New York

New York State has one of the most aggressive climate and clean energy initiatives in the nation since retiring one of the state's four nuclear power plants in 2021, coupled with its goal to reach economy-wide carbon neutrality. Many large-scale renewable projects, including ways to power New York City from upstate New York and Canada, are aimed at accelerating the state's economic recovery from COVID-19. This could foster job growth into the generation, transmission and distribution of a green energy environment.

S W O T

Strengths

- New York holds one of the top five spots in the U.S. for engineering positions involved with the advancement of energy growth
- High concentration of venture capital investments in green energy, including renewables, energy storage, solar power and carbon management software

Weaknesses

- New York City has one of the highest costs of living across the nation, making it difficult to sustain career longevity
- Even though the market has seen strong growth in renewable energy sectors, in 2020, nuclear power accounted for 29% of New York's utility-scale net generation

Opportunities

- The new governor aims to bring billions of dollars into reducing building emissions, scaling up solar, clean transportation initiatives and supporting NY Green Bank commitments to help overall societal benefits statewide
- The New York Bight, an area of shallow water between Long Island and the New Jersey coast, has become a priority Wind Energy Area from the Biden administration, supporting a community of operations and maintenance jobs annually

Threats

- With New York State's progressive tax system, corporate and capital migration from the Northeast is increasing to other states such as Florida and Texas
- As some companies reduce office footprints or shed extra space, vacancy is on the rise and leasing activity is well below historical levels; an imbalance of supply and demand is expected to continue

San Francisco

The San Francisco Bay Area remains at the center of renewable energy solutions, with concentrations in solar, energy storage and electric mobility solutions. Bay Area energy and electric vehicle companies have received over \$14 billion in venture capital investment since 2020 spread across 120 companies. The region has led the decoupling of growth in gross regional product (GRP) and greenhouse gas emissions, achieving its GHG reduction goals of 20% below 1990 levels by 2020 despite realizing the highest GRP growth of any major metro over the previous decade.

S W O T

Strengths

- Significant concentration of renewable and energy storage companies HQs with a gross market cap of over \$50B
- Highest concentration of VC investments in cleantech, including renewable energy, energy storage and electric mobility
- Large ecosystem of electric charging companies based here, including ChargePoint, Volta and Tesla
- Renewable, battery and vehicle talent highly concentrated in the Bay Area

Weaknesses

- Expensive energy prices—on peak, rates reach as high as \$0.32 kWh.
- Significant barriers to entry to power producers in which they must undertake significant oversight through the CPUC
- Manufacturing challenges due to the high cost of living, leading to offshoring renewable energy technologies to other, more affordable markets
- Hydroelectric power continues to slide as a share of total zero-carbon power as “water first” policies and ongoing drought limit production

Opportunities

- Aggressive renewable energy commitments including 40% GHG reduction goals below 1990 levels by 2030
- Most robust electric vehicle charging coverage in the country and continued adoption of solar roof on SFR and commercial properties
- Battery storage solutions becoming increasing integrated as resiliency infrastructure for affluent communities prone to power loss, leading to further consumer growth in the Bay Area

Threats

- Significant liability risks associated with grid transmission and distribution infrastructure due to ongoing climate change risks
- Traditional fossil fuel industry under significant scrutiny and oversight, including hydrocarbon mfg/processing operations
- Chevron has hinted on multiple occasions of relocating its HQ out of the Bay Area but has yet to do so
- Remote work has the risk of decentralizing talent out of the Bay Area to more affordable markets

Los Angeles

Increasing environmental and health concerns of traditional oil and gas activities have created new opportunities for renewable energy companies in the LA metro area. Added to that, Los Angeles's entrepreneurial climate, combined with a deep pool of leading research institutions, talented workers and STEM graduates, makes the region fertile grounds for a thriving clean energy sector.

S W O T

Strengths

- The electric vehicle sector has a significant and expanding presence, with major companies like Fisker, EVgo, Tesla, Xeal, Canoo and VinFast all calling LA home
- Strong popular sentiment around fighting climate change has nurtured a supportive legislative environment for incentives targeting renewable energy growth

Weaknesses

- The Los Angeles Department of Water and Power lags other California utilities in its renewables targets due to its continued emphasis on cost minimization
- Conflicts over water rights and water distribution imperil public health and California's farm economy

Opportunities

- The companies, capital and talented workforce that make up the Silicon Beach ecosystem of tech start-ups stand to benefit from state and federal green energy initiatives like the Build Back Better bill, which includes \$555B for clean energy investments nationwide
- Even with a growing economy and population, California has the lowest greenhouse gas emissions per capita of any state

Threats

- Growing densification and urbanization of the Los Angeles metro area challenges the growth of the oil and gas extraction sector regionally
- Investor-owned California utility companies like PG&E continue to lobby against programs like the state's proposed solar mandate for new commercial buildings

The energy industry is the sum of many parts, which continue to grow into a more complex and diverse whole.

The transition will have important implications for real estate investors, owners and occupiers.

From a macro perspective, consolidation in the oil and gas establishment will continue, though at a more moderate pace than during the 2014 and 2020 waves, as demand for natural gas, LNG and hydrogen are set to increase through 2050.

Although hiring is expected to accelerate, it is too early to say whether that will mean a corresponding rise in demand for space, as most companies in this segment remain overleased and have not defined their hybrid work strategies.

The situation is the opposite in the renewables segment, where we expect substantial growth in company formation and occupancy levels. Commercial real estate demand in local markets that cater to the renewables and abatement technology industry are bound to benefit from these trends.

On a micro level, companies in the energy sector will try to squeeze out as many carbon offsets as possible, even from their buildings. They will do so by placing higher intrinsic value on newer, more naturally energy-efficient assets (WELL or LEED certified). Additionally, they will consider adding smarter utilities or advanced technology infrastructure to older assets to attain higher energy efficiency.

As we move through the transition, we expect Houston to be reinforced as the “Energy Capital of the World,” with the other traditional energy-centric markets—Calgary, Edmonton, Denver, Pittsburgh and Dallas–Fort Worth—also leveraging strong existing ecosystems to their advantage.

Emerging hubs like Miami, New York, San Francisco, Los Angeles, Toronto, Montréal and Vancouver stand poised to gain market share in the vast renewable and “enertech” spaces. They are markets we will be watching in 2022 and beyond.



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