

INNOVATION AND SUPPLY CHAIN REPORT

SOUTHEAST ALBERTA RENEWABLE ENERGY STRATEGY



Medicine Hat College and Terralta Inc. employees installing solar panels on MHC Student Residence

March
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**An initiative of the Southeast Alberta Energy
Diversification Strategy (SEEDS) group**

INNOVATION AND SUPPLY CHAIN REPORT

SOUTHEAST ALBERTA RENEWABLE ENERGY STRATEGY

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The **Southeast Alberta Energy Diversification Strategy (SEEDS)** group is focused on engaging with the renewable energy industry to determine how we can support the industry to grow and thrive in Southeast Alberta.

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The SEEDS group is comprised of the following organizations in Southeast Alberta:

Alberta Labour
APEX Regional Innovation Network of Southeast Alberta
City of Brooks
City of Medicine Hat
Community Futures Entre-Corp
County of Newell
Economic Development Alliance (EDA) of Southeast Alberta
Medicine Hat College



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EXECUTIVE SUMMARY

The **Southeast Alberta Renewable Energy Strategy** will support the renewable energy industry in SE AB. Based on stakeholder input, this strategy provides a framework for coordinating activities, collaborating with other stakeholders and partners, raising awareness and education, providing resources and support, marketing and promoting, and fostering further development and innovation for the renewable energy industry in Southeast Alberta (SE AB).

The **Southeast Alberta Renewable Energy Strategy** is comprised of the following four reports focused on the renewable energy industry, workforce, and related economic development in SE AB:

1. **Industry Report**
2. **Workforce Report**
3. **Innovation and Supply Chain Report**
4. **Moving Forward Report**

This **Innovation and Supply Chain Report** focuses on **innovation and regional economic development impacts from the emerging clean technology, energy efficiency, and renewable energy industries in SE AB**. This report provides an overview of the innovation in these industries globally, nationally, provincially, and regionally; followed by sections focused on stakeholder identified opportunities and challenges and supply chains for solar, wind, and energy efficiency.

SE AB is already well known for being an innovative region with diverse agriculture, unmanned vehicle systems, emissions reduction, and federal defence research. As this report illustrates, **diversifying into renewable energy and clean technology creates new opportunities for regional businesses and innovators**. SE AB is also one of Canada's sunniest regions. Hence, stakeholders frequently identify that **SE AB is an ideal region for hosting a research and training center focused on solar energy**.

Emerging renewable, clean technology, and energy efficiency industries increase SE AB's innovation reputation and provide an opportunity for the region to emerge as Alberta's Opportunity Corner.

In addition, solar and wind projects and energy efficiency construction, renovations, and technology will utilize **broad supply chains that span multiple industries including communications, construction and trades, and transportation**. The supply chain general summaries in this report aim to better inform stakeholders in SE AB – businesses, contractors, communities – of opportunities that may be available for them to participate in these emerging industries. As these industries continue to grow over the next few decades in SE AB, **opportunities will arise for local businesses to participate in the supply chain and/or diversify their operations to take advantage of clean technology innovation and practices** – for example increased green building/energy efficient construction and renovations.

Emerging renewable, clean technology, and energy efficiency industries provide increased opportunities to diversify SE AB's economy, attract new investment, create jobs, and generate additional opportunities for regional businesses.

FOREWORD

The **Southeast Alberta Renewable Energy Strategy** is comprised of four reports focused on the renewable energy industry, workforce, and related economic development in SE AB. These include:

1. Industry Report
2. Workforce Report
3. Innovation and Supply Chain Report
4. Moving Forward Report

In total for this strategy, we engaged with over 60 stakeholders from the renewable and clean energy industries and business community in SE AB, and over 20 community and government stakeholders.

This **Innovation and Supply Chain Report** is the third report in a series of four included in the **Southeast Alberta Renewable Energy Strategy**. It focuses on renewable energy and clean technology innovation and the related supply chain impacts on local and regional economies and businesses in SE AB.

The first report in the strategy – the **Industry Report** – focused on providing a framework for growing a thriving renewable energy industry in SE AB. Based on input from stakeholders the **Industry Report** provided five recommendations:

1. Establish the SE AB Energy Diversification (SEEDS) group as a regional industry coalition comprised of regional renewable energy industry and community stakeholders.
2. Develop a plan to market and promote renewable energy in SE AB to communities and the renewable energy industry.
3. Support the development of the renewable energy workforce and build local expertise and capability in the renewable energy industry to support and promote careers in renewable energy to traditional and non-traditional pools of labour.
4. **Provide resources and support to develop a better understanding of the renewable energy industry in SE AB and the impact it has on regional businesses and economic development.**
5. **Foster a renewable energy market in SE AB that supports and attracts both large-scale and small-scale renewable energy development, innovation, investment, and research.**

This **Innovation and Supply Chain Report** focuses on the fourth and fifth recommendations from the **Industry Report**. This report provides a summary of renewable and clean energy innovation globally, nationally, provincially, and regionally. It also summarizes challenges and opportunities identified by stakeholders and explores the supply chains of large-scale solar and wind energy projects and energy efficiency innovation and programs.

This report concludes with a summary of the two related recommendations from the **Industry Report** for facilitating renewable energy innovation in SE AB and developing a better understanding of the broad supply chain impacts of solar, wind, and energy efficiency industries.

The next, and final, report in the strategy – the **Moving Forward Report** – summarizes the first three reports in this strategy and provides an analysis of the potential economic impacts of proposed renewable energy projects in SE AB over the next two decades.

BACKGROUND

Based on what is currently known about global, national, and provincial initiatives to adopt increased renewable energy, it is apparent that an opportunity exists for SE AB to capitalize on this increasing trend toward renewable energy. For over a century, SE AB has developed broad energy expertise from the region's oil and gas activity. This activity will continue to be an important part of SE AB's economy and workforce for decades to come. Additionally, the region's abundant solar and wind resources, some of the best in Canada, and its innovative nature create an opportunity for an additional energy industry to emerge in SE AB – renewable energy.

The following background section explores some of the global, national, and provincial initiatives aimed at increasing renewable energy and clean technology and the driving forces behind these initiatives.

Global Clean Technology and Renewable Energy Innovation

Clean energy is a global priority. Almost every country in the world has signed the *Paris Agreement* agreeing to limit global warming and the impacts of climate change.¹ This is an important focus, as there is **scientific consensus** that the earth's climate is changing² and global warming impacts climate, atmospheric behavior measured over relatively long periods of time (years to decades),³ Global warming leads to increased climate-related weather extremes⁴; weather being various short-term (minutes to months) atmospheric conditions⁵ – rain, wind, snow, cyclones, tornados, etc...

Global climate change, or global warming, is a concern because human activities over the last 115 years, specifically industrialization and the burning of fossil fuels, have contributed to increased greenhouse emissions (GHGs).⁶ Climate change is a global priority because it has increased air pollution and contributed to shrinking glaciers, early river ice breakup, plant and animal range shifts, changing frost cycles, and earlier flowering trees.⁷ This leads to heat waves, torrential downpours, flooding, rising sea levels, stronger storms, increased wildfires, insect outbreaks, and disruptions to typical growing seasons around the world. These changes have immense impacts for many around the world from large coastal cities to rural agriculture and livestock producers.

In the last decade, we have seen an increase globally in climate-related weather extremes, and the three warmest years on record for the world.⁸ Hence, the global concern over climate change and the reason most of the world's countries have signed on to the *Paris Agreement*. Key elements of this agreement include: keeping a global temperature rise this century well below 2°C above pre-industrial levels and strengthening the capacity of countries to deal with the impacts of climate change.⁹

Changes in the kinds of energy sources used globally will help decrease emissions that contribute to global warming. **The market will also dictate the energy sources that are used globally.** Coal has been

¹ United Nations Climate Change. (2017). The Paris Agreement. http://unfccc.int/paris_agreement/items/9485.php

² NASA. (2018). Scientific consensus: Earth's climate is warming. <https://climate.nasa.gov/scientific-consensus/>

³ NASA. (2005). NASA - What's the Difference Between Weather and Climate? https://www.nasa.gov/mission_pages/noaa-n/climate/climate_weather.html

⁴ Wuebbles, D.J., et al. (2017). Climate Science Special Report: Fourth National Climate Assessment, Volume I. U.S. Global Change Research Program, Washington, DC, USA, <https://science2017.globalchange.gov/chapter/executive-summary/>

⁵ NASA. (2005). NASA - What's the Difference Between Weather and Climate? https://www.nasa.gov/mission_pages/noaa-n/climate/climate_weather.html

⁶ Wuebbles, D.J., et al. (2017). Climate Science Special Report: Fourth National Climate Assessment, Volume I. U.S. Global Change Research Program, Washington, DC, USA, <https://science2017.globalchange.gov/chapter/executive-summary/>

⁷ NASA. (2018). The consequences of climate change. <https://climate.nasa.gov/effects/>

⁸ Wuebbles, D.J., et al. (2017). Climate Science Special Report: Fourth National Climate Assessment, Volume I. U.S. Global Change Research Program, Washington, DC, USA, <https://science2017.globalchange.gov/chapter/executive-summary/>

⁹ United Nations Climate Change. (2017). The Paris Agreement. http://unfccc.int/paris_agreement/items/9485.php

a main energy source for many countries for over a century. However, the International Energy Association (IEA) states global coal demand has dropped by 4.2% since 2014 because of lower natural gas prices, a rapid increase in renewables, and energy efficiency improvements.¹⁰ Though coal growth may continue in countries like India and southeast Asia, the IEA forecasts global coal demand to continue to drop in the coming years, especially in Canada, Europe, and the United States. Energy demand however, will not be decreasing. The IEA anticipates a global energy demand increase of 30%, with renewables being able to meet 40% of this increased demand, along with oil and natural gas.¹¹

In August 2017, the International Renewable Energy Association (IRENA) published an article entitled “Renewables and Energy Efficiency: A Dynamic Duo.”¹² In this article they state that the energy sector is often the prime contributor to a country’s emissions. However, **it is not just about the kinds of energy sources we use, but also the ways in which we use energy.** With a focus on increasing both renewable energy sources and energy efficiency, greater reductions in energy intensity and lower energy costs can be obtained. As the article states, “improved efficiency reduces total energy demand, allowing the share of renewables in the energy mix to grow faster.”

A greater focus on renewable energy development and increasing energy efficiency encourages innovation in those areas. The 2018 Global Clean Tech 100 competition received over 12,000 nominations of global companies working on “... the most innovative and promising ideas in cleantech and that are best positioned to solve tomorrow’s clean technology challenges.”¹³ Most of the companies on the 2018 Global Clean Tech 100 list focus on smart grids, energy storage, solar, recycling and waste, energy efficiency, transportation, and other clean technology. Bloomberg’s *New Energy Outlook 2017* report states “**renewable energy sources are set to represent almost three quarters of the \$10.2 trillion the world will invest in new power generating technology until 2040**, thanks to rapidly falling costs for solar and wind power, and a growing role for batteries, including electric vehicle batteries, in balancing supply and demand.”¹⁴

Increasing profitability of clean energy activity has resulted in job creation and more than \$333 billion in global annual investment in 2017.¹⁵ The economic value associated with clean technology and renewable energy is being recognized by individuals, businesses, and governments. Global oil and gas corporations also recognize the benefits of diversifying into clean technology and renewable energy. Chevron is one of the world’s largest producers of geothermal energy, and in 2015 Total announced plans to invest \$500 million a year into developing clean energy.¹⁶

Likewise, major technology players strive for 100% of their electricity to come from renewables. **Driven by sustainability initiatives and decreasing costs of renewable energy, global corporations signed a record number of power purchase agreements (PPA) for renewable energy in 2017.** According to Bloomberg New Energy Finance, 43 corporations, in 10 different countries, signed a total of 5.4

¹⁰ IEA. (2017). Coal 2017. <https://www.iea.org/coal2017/>

¹¹ IEA. (2017). World Energy Outlook for 2017. <https://www.iea.org/weo2017/>

¹² IRENA. (2017). Renewables and Energy Efficiency: A Dynamic Duo. <http://irena.org/newsroom/articles/2017/Aug/RENEWABLESANDENERGYEFFICIENCYADYNAMIC-DUO?platform=hootsuite>

¹³ I3Connect. (2018). 2018 Global Clean Tech 100. <https://i3connect.com/gct100/the-list>

¹⁴ Bloomberg New Energy Finance. (2017). New Energy Outlook 2017. <https://about.bnef.com/new-energy-outlook/>

¹⁵ Jules Kortenhorst. (2018). 6 ways to align the energy transition with economic growth. World Economic Forum. <https://www.weforum.org/agenda/2018/03/6-ways-to-align-energy-transition-and-economic-growth>

¹⁶ Willow White. (2016). How Traditional Energy Companies Are Building a Viable Future for Renewables. Alberta Oil Magazine. <https://www.albertaoilmagazine.com/2016/07/oil-gas-companies-moving-towards-viable-renewable-energy-future/>

gigawatts (GW) of clean energy PPAs in 2017.¹⁷ Google is the biggest corporate purchaser of renewable energy, followed closely by Amazon and Apple.¹⁸

Canadian Clean Technology and Renewable Energy Innovation

Renewable energy and clean technology are emerging industries in Canada. Canada's clean technology industry consists of over 800 companies, mostly small and medium enterprises (SMEs).¹⁹ **These companies bring in \$17 billion in revenue and directly employ 55,000 Canadians.**

Clean Energy Canada's recent report, *Energy Disrupted: Tracking the Energy Revolution 2018* states that **Canada needs to catch up with global energy trends toward clean energy or risk falling behind.**²⁰ In early 2018, the Canadian Chamber of Commerce released *10 Ways to Build a Canada that Wins 2018*.²¹ This report states that one of those ten ways includes making Canada the world's one-stop shop for green resources and technology. As a resource-rich and knowledge-rich country, the report encourages Canadians to "think of the economic power that could be generated by combining our capabilities more effectively to extract and process our resources with minimal environmental impact and to develop and produce cleaner and greener technologies for the world, based on successful applications in our own resource, manufacturing and processing sectors."

The number of Canadian companies on the *Global Clean Tech 100* list has increased from 2 in 2010, when the competition started, to 13 in 2018.²² These 13 companies are focused on smart grids (3), water and wastewater (2), advanced materials, energy efficiency (2), biofuels and biochemicals (2), agriculture and food (2), and conventional fuels (2).

According to a 2018 report from the Smart Prosperity Institute, Canada's share of the global clean technology market decreased 12% since 2008.²³ The report states that Canada performs well in early stages of clean energy development (research and development) but declines as these projects move toward commercialization and market deployment. These final stages are important as they facilitate the greatest wealth and job creation. Smart Prosperity Institute's co-chair Stewart Elgie believes that over the next decade clean innovation will be the next big global economic prize for nations to pursue.²⁴ He asserts, "If Canada wants to win that race, we've got to raise our game."

Funding Canada's Clean Technology and Renewable Energy Innovation

Access to funding for renewable and clean energy innovation and development is a key theme identified throughout the reports in the Southeast Alberta Energy Diversification Strategy. **To drive renewable energy and clean technology innovation in Canada, it needs to be fueled.** Much of the required fuel

¹⁷ Bloomberg New Energy Finance. (2018). Corporations Purchased Record Amounts of Clean Power in 2017. <https://about.bnef.com/blog/corporations-purchased-record-amounts-of-clean-power-in-2017/>

¹⁸ Grace Donnelly. (2017). Google Just Bought Enough Wind Power to Offset 100% of Its Energy Use. <http://fortune.com/2017/12/01/google-clean-energy/>

¹⁹ STDC. (2018). About Us. <https://www.sdte.ca/en/about-sdte/about-us>

²⁰ Clean Energy Canada. (2018). Energy Disrupted: Tracking the Energy Revolution 2018. http://cleanenergycanada.org/wp-content/uploads/2018/03/EnergyDisrupted_TER2018_Web.pdf

²¹ Canadian Chamber of Commerce. (2018). 10 Ways to Build a Canada that Wins 2018. <http://chamber.ca/media/blog/180205-10-ways-to-build-a-canada-that-wins/>

²² I3Connect. (2018). 2018 Global Clean Tech 100. <https://i3connect.com/gct100/the-list>

²³ Smart Prosperity Institute. (2018). Clean Innovation: Why it Matters & How to Accelerate it Across the Canadian Economy. <http://institute.smartprosperity.ca/library/publications/canada-s-next-edge-why-clean-innovation-critical-canada-s-economy-and-how-we>

²⁴ Mia Rabson. (2018). Act Now or Forever Play Global Catch Up on Clean Technology: Report. https://www.ctvnews.ca/sci-tech/act-now-or-forever-play-global-catch-up-on-clean-technology-report-1.3843825#_gus&_qucid=&_gup=twitter&_qsc=SBsHn2I

consists of access to financing and policies and frameworks conducive to developing renewable energy and clean technology industries in Canada.

In 2018, the Business Development Bank of Canada (BDC) announced a \$700-million-dollar investment over 5-years to grow Canada’s clean technology industry.²⁵ This new investment will allow BDC to “...take on more risk to help high-potential clean tech firms expand by providing them with the capital they need to hire new staff, develop products, support sales, and scale up and compete globally.”

Investments in clean technology are also a part of the *Pan-Canadian Framework on Clean Growth and Climate Change*.²⁶ This federal government framework was developed with the provinces and territories and in consultation with Indigenous peoples,

...to meet our emissions reduction targets, grow the economy, and build resilience to a changing climate. Our plan includes a pan-Canadian approach to pricing carbon pollution, and measures to achieve reductions across all sectors of the economy. It aims to drive innovation and growth by increasing technology development and adoption to ensure Canadian businesses are competitive in the global low-carbon economy.

The *Clean Growth Hub*, focuses on the *Clean Technology and Innovation* pillar of the *Pan-Canadian Framework on Clean Growth and Climate Change*. The hub “...is a whole-of-government focal point for clean technology focused on supporting companies and projects, coordinating programs and tracking results.”²⁷ Through the hub, clean technology businesses can access experts, information, and resources to support their business. As well, the site provides links to clean technology programs in Canada divided into the following five categories:

- research, development, and demonstration;
- growing your technology company;
- exporting your technology;
- adoption of market ready technologies; and
- general innovation measures.

Sustainable Development Technology Canada (SDTC) provides support and fills the funding gap for clean technology companies as they move their technologies toward market entry.²⁸ This arm’s length federal organization has allocated close to \$9.9 million to 350 clean tech innovation projects. SDTC is focused on clean technology because it transforms multiple industries including; oil and gas, mining, power generation, transportation, agriculture, forestry and forest products, water and energy efficiency.

Canadian Innovation in Clean Technology and Renewable Energy

Beyond federal incentives and policies to grow clean technology and renewable energy industries, many industries are diversifying to capitalize on opportunities in these emerging industries. Three examples are the automobile industry, the oil and gas industry, and the construction industry.

Electric vehicle (EV) sales in Canada reached an all-time high in 2017 increasing 68%.²⁹ EV categories include battery-electric (BEV), plug-in hybrid (PHEV), and plug-in electric (PEV) vehicles. At the end of 2017 there were 47,800 PEVs on the road in Canada; that number is expected to reach 50,000 by the

²⁵ BDC. (2018). Government of Canada investing in clean technology. https://www.bdc.ca/en/about/mediaroom/news_releases/pages/government-canada-investing-clean-technology.aspx

²⁶ Government of Canada. (2016). Pan-Canadian Framework on Clean Growth and Climate Change: Canada's Plan to Address Climate Change and Grow the Economy. http://publications.gc.ca/collections/collection_2017/eccc/En4-294-2016-eng.pdf

²⁷ Government of Canada. (2018). Clean Growth Hub. <http://www.ic.gc.ca/eic/site/099.nsf/eng/home>

²⁸ STDC. (2018). About Us. <https://www.sdtec.ca/en/about-sdtec/about-us>

²⁹ Eric Schmidt. (2018). Electric Vehicle Sales in Canada, 2017. <https://www.fleetcarma.com/electric-vehicle-sales-canada-2017/>

end of February 2018. Sales of EVs in Canada are increasing annually (Figure 1). Many traditional car manufacturers recognize this growth trend and have introduced EV models to their lines including Chevrolet (Bolt), and Nissan (Leaf).

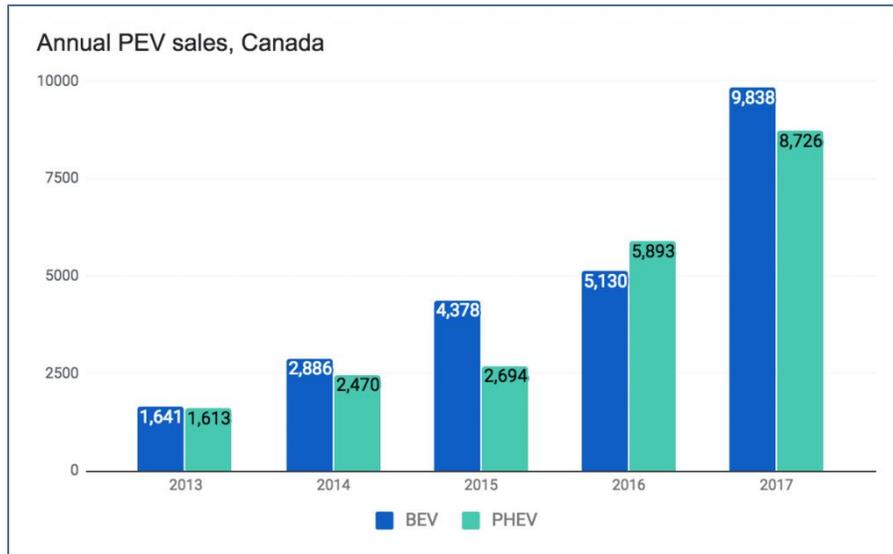


Figure 1. Annual PE Sales Canada - BEV/PEV 2013-2017³⁰

Oil and gas companies are also diversifying their portfolios to include more renewable energy. Canada’s two largest pipeline companies Enbridge and TransCanada invest in renewable energy.³¹ Enbridge owns 16 wind farms across North America and TransCanada has a diverse energy portfolio that includes hydro, solar, nuclear and wind power. Suncor changed their name to Suncor Energy to better reflect that today’s energy economy is diversified. Suncor Energy now has a renewable energy team and is currently involved in four operational wind farms in Alberta, Saskatchewan, and Ontario.³²

The construction industry in Canada is also getting greener. On the *Green Building Certification* webpage, National Resources Canada (NRC) lists an overview of green building standards and certification programs in Canada.³³ One of those programs is the *Leadership in Energy and Environmental Design* (LEED®). This is a “...third-party certification program and an internationally accepted benchmark for the design, construction and operation of high performance green buildings.” LEED focuses on sustainable design, construction, and operation of buildings; buildings can generate up to 35% of all greenhouse gases, and construction and demolition activities account for 35% of landfill waste.³⁴

The Columbia Institute reports that **meeting Canada’s climate goals could result in over 3.9 million direct jobs in the building trades by 2050**, and 19.8 million jobs if induced, indirect, and supply-chain jobs are included.³⁵ **Initiatives to green Canada’s building and infrastructure “...will require the work of a variety of tradespeople, including masons, boilermakers, pipefitters, insulators, electrical workers, glaziers, HVAC³⁶, linemen, ironworkers, and other construction trades.”** Hence, greening

³⁰ Eric Schmidt. (2018). Electric Vehicle Sales in Canada, 2017. <https://www.fleetcarma.com/electric-vehicle-sales-canada-2017/>

³¹ Willow White. (2016). How Traditional Energy Companies Are Building a Viable Future for Renewables. Alberta Oil Magazine. <https://www.albertaoilmagazine.com/2016/07/oil-gas-companies-moving-towards-viable-renewable-energy-future/>

³² Suncor. (2017). Wind Power. <http://www.suncor.com/about-us/wind-power>

³³ National Resources Canada. (2018). Green Building Certification. <https://www.nrcan.gc.ca/energy/efficiency/buildings/allies/4263>

³⁴ Canadian Green Building Council. (2018). LEED®: the international mark of excellence.

<https://www.cagbc.org/CAGBC/LEED/CAGBC/Programs/LEED/LEED.aspx?hkey=54c44792-442b-450a-a286-4aa710bf5c64>

³⁵ Tye Bridge and Richard Gilbert. (2017). Jobs for Tomorrow: Canada’s Building Trades and Net Zero Emissions. Columbia Institute.

³⁶ HVAC = Heating, Ventilation, and Air Conditioning

buildings and infrastructure can have an impact on Canada’s environmental goals; reducing waste, conserving energy, and driving innovation and economic diversification.

Alberta’s Renewable and Clean Energy Innovation

Since 2005, Alberta has had a deregulated electricity market overseen by the Alberta Electric Systems Operator (AESO). As outlined in the March 2018 *Plugging In* report from the Pembina Institute and Rocky Mountain Institute, this deregulated market allows for increased flexibility for electricity market participants.³⁷ With coal to be phased-out in Alberta by 2030, as the *Plugging In* report outlines, opportunities exist for corporations and companies to enter into power purchase agreements (PPAs) with renewable energy developers.³⁸ These agreements help developers secure funding, and they help companies and corporations offset their emissions and benefit from the Environmental Attributes (EAs) generated by the renewable projects.³⁹

Once such example in Alberta is the *Bull Creek Wind Farm*, north of Provost Alberta.⁴⁰ When Alberta’s energy market became deregulated, rural school districts in the province came together as a consortium to explore opportunities in the deregulated electricity market and pool their purchasing power. A purchasing group, the Commodity Purchasing Consortium (CPC), recommended the school districts enter into a long-term wind energy contract. The CPC facilitated a competitive bidding process with nine companies; BluEarth Renewables won the bid and constructed the 17 turbines generating 24 MW on the Bull Creek Wind Farm (Figure 2). The 26 school districts (including Prairie Rose School Division in SE AB), and their 500 schools, benefit by having long-term price stability for their electricity.

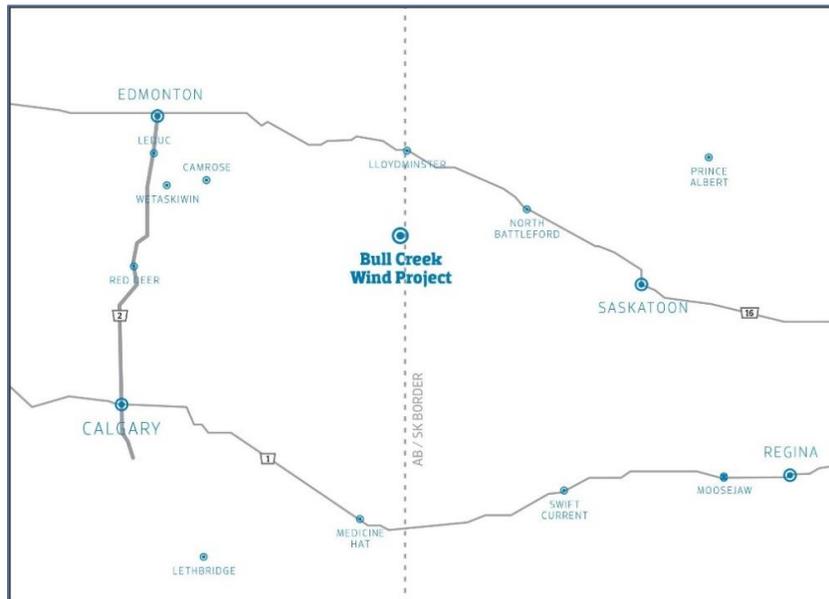


Figure 2. Bull Creek Wind Farm Site⁴¹

³⁷ Pembina Institute & Rocky Mountain Institute. (2018). *Plugging In: Opportunities to Procure Renewable Energy for Non-Utility Companies and Institutions in Alberta*. <http://www.pembina.org/pub/plugging-in>

³⁸ Pembina Institute & Rocky Mountain Institute. (2018). *Plugging In: Opportunities to Procure Renewable Energy for Non-Utility Companies and Institutions in Alberta*. <http://www.pembina.org/pub/plugging-in>

³⁹ Pembina Institute. (2018). *Perfect Timing for Renewables: Why the Time Is Right for Alberta To Lead in Non-Utility Procurement of Renewable Energy*. <http://www.pembina.org/blog/perfect-timing-for-renewables>

⁴⁰ Green Energy Futures. (2016). Episode 151. 500 Alberta schools powered by renewable wind energy. <http://www.greenenergyfutures.ca/episode/bull-creek-powers-schools>

⁴¹ BluEarth Renewables. (2017). Bull Creek Wind Facility. <http://www.blueearthrenewables.com/portfolio/bull-creek-wind/>

There are benefits for BluEarth Renewables as well, as explained by the company’s CEO Grant Arnold, “A wind farm like this, or in fact many other projects that have a large capital up front cost, are funded with equity and debt ... the long-term contracts allowed us to get very, very competitive debt on the project, which brought the price of power down, which is key in the whole scenario.”⁴² Local farmers are also provided with residual, reliable income from the project. In addition to long-term agreements for hosting the wind turbines, they also benefit from service contracts for snow-plowing, weed control, etc...

In March 2018, the Government of Alberta introduced two proposed diversification focused bills. Bill 1, the *Energy Diversification Act*, focuses on creating and supporting petrochemical and petrochemical feedstock initiatives to get the best value from Alberta’s oil and gas resources.⁴³ If passed, the proposed initiatives in this bill are expected to attract **\$10 billion in private investment and support 8,000 construction jobs and hundreds more operational jobs**. The second Bill, the *Growth and Diversification Act*, is focused on increasing high-tech training and boosting tax credits to stimulate investment to address the shortage in Alberta’s high-tech sector.⁴⁴ If passed, this bill would **add 3,000 new spaces for technology programs at Alberta post-secondary institutions** over the next five years.

Bolstering Alberta’s energy and high-tech sectors will not only attract investment and diversify its economy, but also help Alberta catch up to other provinces, and countries, in clean technology innovation and development. **A record-breaking 13 Canadian companies are on the 2018 Global Clean Tech 100 list; however, none of these companies are Alberta-based.**⁴⁵ Ten of the companies are based in British Columbia and Ontario, and the remaining companies are based in Nova Scotia, Quebec, and Manitoba. As Alberta increases its focus and support for renewable and clean energy innovation, more Alberta-based companies may start to appear on this list.

Support for Energy Innovation in Alberta

Alberta Clean Technology Industry Alliance (ACTia), Alberta Innovates, and Emissions Reduction Alberta (ERA) are a few of the organizations focused on supporting renewable energy and clean technology growth and innovation in Alberta. As well, Alberta’s Climate Leadership Plan also contributes to driving clean energy innovation and economic diversification in the province.

Alberta Clean Technology Industry Alliance

Since 2011, ACTia has been the voice of Alberta’s clean technology (cleantech) sector.⁴⁶ As a multi-stakeholder, industry-focused organization, ACTia aims “to position Alberta as a world leader in clean technology.” In 2017, ACTia published *Alberta Clean Technology Sector 2016: Ready for Liftoff*, a baseline study of Alberta entrepreneurs working in technology-driven initiatives focused on improving environmental and economic outcomes.⁴⁷ In the report, **cleantech is defined as “novel services, processes, products and activities that improve economic performance and reduce environmental**

⁴² Green Energy Futures. (2016). Episode 151. 500 Alberta schools powered by renewable wind energy. <http://www.greenenergyfutures.ca/episode/bull-creek-powers-schools>

⁴³ Government of Alberta. (2018). Energy Diversification Act. <https://www.alberta.ca/energy-diversification-act.aspx>

⁴⁴ Government of Alberta. (2018). Growth and Diversification Act. <https://www.alberta.ca/growth-diversification-act.aspx>

⁴⁵ Government of Canada. (2018). Backgrounder: Canadian companies on the 2018 Global Cleantech 100 list. http://www.international.gc.ca/gac-gmc/news-nouvelles/2018-01-24-backgrounder-document_information.aspx?lang=eng

⁴⁶ ACTia. (2018). About ACTia. <https://www.actia.ca/about>

⁴⁷ ACTia. (2017). Alberta Clean Technology Sector 2016: Ready for Liftoff. <https://www.actia.ca/alberta-cleantech-sector-report>

footprint relative to the baseline.” The cleantech sector in Alberta is “... fueled by innovations in chemical processes, followed by clean power generation, materials & nanotech, and internet of things”.

ACTia’s *Ready for Liftoff* report focuses specifically on Alberta’s ‘pureplay cleantech companies’, which they “... define as companies that are based in Alberta, show technology or business model innovation, and indicate an environmental benefit as a core part of their value proposition.”⁴⁸ A summary of key takeaways from this report includes:

- **Alberta has what it takes to be a global launch pad for cleantech;** large inflows of capital in the natural resource sector, recognized brand as an international energy hub, skilled and trained people from around the world, provincial policies for environmental innovation, and an innovation sector focused on tackling carbon emissions, water efficiency and bio-sector productivity.
- Alberta’s pureplay cleantech sector currently employs over 1,200 people.
- It is a young sector, over half of the companies surveyed were formed in the last five years.
- Companies that have reached meaningful scale offer high-wage jobs for highly skilled individuals, paying on average just under \$100,000 per year; over 90% plan to grow their staff this year.
- **Together, they brought \$307 million in revenues into Alberta in 2015.**

Alberta Innovates

According to ACTia’s *Ready for Liftoff* report, Alberta Innovates is also a funding option for clean technology Alberta businesses; over 51% of respondents listed Alberta Innovates as a funder.⁴⁹ As outlined on their website, “Alberta Innovates is the place where innovators, businesses and researchers can access cross sectoral knowledge and expertise, funding, business supports, networks and research facilities to turn their ideas into products and products into companies.”⁵⁰

Alberta Innovates promotes itself as a catalyst for innovation and has four focus areas: Bio Solutions; Health Solutions; Energy and Environment Solutions; and Technology Futures.⁵¹ Their “... mandate is to support and accelerate research, innovation and entrepreneurship.”⁵² They support innovative projects across their focus areas such as C-FER Technologies exploration into using geothermal power to produce electricity; expertise that could create a market for Alberta technology globally.⁵³

Emissions Reduction Alberta

ERA was also listed as a funder for Alberta clean technology businesses in the ACTia *Ready for Liftoff* report; however, only 9% of respondents listed ERA as a funder.⁵⁴ As their website states, ERA works with government, industry and innovators to accelerate development of innovative technologies that reduce GHG emissions.⁵⁵ They are focused on helping Alberta transition to a lower carbon future with a stronger, more diversified economy.

ERA sponsored the *2018 Cleantech Directions: Spotlight Alberta* report focusing on clean technology growth trends, market drivers, barriers and opportunities.⁵⁶ Quoted in the report is ERA CEO Steve

⁴⁸ACTia. (2017). Alberta Clean Technology Sector 2016: Ready for Liftoff. <https://www.actia.ca/alberta-cleantech-sector-report>

⁴⁹ ACTia. (2017). Alberta Clean Technology Sector 2016: Ready for Liftoff. <https://www.actia.ca/alberta-cleantech-sector-report>

⁵⁰ Alberta Innovates. Home. (2018). <https://albertainnovates.ca/>

⁵¹ Alberta Innovates. Home. (2018). <https://albertainnovates.ca/>

⁵² Alberta Innovates. About Us. (2018). <https://albertainnovates.ca/about-us/>

⁵³ Alberta Innovates. Creating Power Using Geothermal Sources. <https://albertainnovates.ca/project/creating-power-using-geothermal-sources/>

⁵⁴ ACTia. (2017). Alberta Clean Technology Sector 2016: Ready for Liftoff. <https://www.actia.ca/alberta-cleantech-sector-report>

⁵⁵ ERA. (2017). About ERA. <http://eralberta.ca/about-era/>

⁵⁶ Cleantech Canada. (2017). 2018 Cleantech Directions: Spotlight Alberta. http://eralberta.ca/wp-content/uploads/2017/05/CleanTechDirections2018_LR.pdf

MacDonald who states, “**The bridge between economic development and meeting climate change goals is technology**”. Many of the technologies that innovators are working on in Alberta can be implemented worldwide, “... commercializing and selling these new technologies presents the province with a great opportunity to build on its export-oriented energy industry as world markets begin to demand energy sources with lower carbon intensity.”

Alberta’s Climate Leadership Plan

The 2018 *Cleantech Directions: Spotlight Alberta* report states that **introducing “...new regulations is one of the few tried and true methods for driving innovation.”**⁵⁷ In late 2015, the Government of Alberta released the *Climate Leadership Plan*.⁵⁸ This made-in-Alberta plan commits to producing 30% of the provinces’ energy from renewables by 2030, reducing greenhouse gas emissions, introducing carbon pricing with revenues invested directly to green energy research and innovation, increasing green infrastructure, and helping Albertans reduce their energy costs with energy efficiency programs.

From this plan, Energy Efficiency Alberta (EEA) was formed as a new provincial agency, mandated to:

- raise awareness among energy consumers of energy use and the associated economic and environmental consequences;
- promote, design and deliver programs and carry out energy efficiency activities, energy conservation and the development of micro-generation and small-scale energy systems in Alberta, and;
- promote the development of an energy efficiency services industry in Alberta.⁵⁹

As of early 2018, EEA offers residential, business, and renewable programs and rebates including:

ENERGY EFFICIENCY ALBERTA PROGRAMS 2018		
RESIDENTIAL	BUSINESS	RENEWABLE
<p>Online rebates for eligible, energy-efficient refrigerators, clothes washers, smart thermostats or furnaces with high efficiency motor (ECM).⁶⁰</p>	<p>Business, Non-Profit and Institutional Energy Savings Program offers incentives to encourage organizations to choose high-efficiency lighting, HVAC, water heating etc... products.⁶¹</p>	<p>The Residential and Commercial Solar Program offers rebates to homeowners, businesses and non-profits that install solar photovoltaic (PV) systems.⁶²</p>
<p>Home improvement rebates for drain water heat recovery, insulation, windows, and tankless hot water heaters. Contractor database helps homeowners find contractors in their region, contractors can register online. ⁶³</p>	<p>Non-Profit Energy Efficiency Transition (NEET) Program provides funding to non-profit and volunteer-based organizations in Alberta to obtain detailed energy audits and energy management plans (EMPs).⁶⁴</p>	<p>The Community Energy Capacity Building Program provides funding for capacity building activities. Projects with activities focused on community energy development, could include but are not limited to, renewable energy project feasibility studies, business case development, webinars and training.⁶⁵</p>

Table 1. Energy Efficiency Alberta Programs as of March 2018

⁵⁷ Cleantech Canada. (2017). 2018 Cleantech Directions: Spotlight Alberta. http://eralberta.ca/wp-content/uploads/2017/05/CleanTechDirections2018_LR.pdf

⁵⁸ Government of Alberta. (2018). Alberta’s Climate Leadership Plan. <https://www.alberta.ca/climate-leadership-plan.aspx>

⁵⁹ Energy Efficiency Alberta. (2018). About Us. <https://www.energycanada.ca/about/>

⁶⁰ Energy Efficiency Alberta. (2018). Online Rebates. <https://www.energycanada.ca/online-rebates/>

⁶¹ Energy Efficiency Alberta. (2018). Business, Non-Profit and Institutional Energy Savings Program. <https://www.energycanada.ca/business-non-profit-and-institutional/>

⁶² Energy Efficiency Alberta. (2018). Residential and Commercial Solar Program. <https://www.energycanada.ca/solar/>

⁶³ Energy Efficiency Alberta. (2018). Home Improvement Rebates. <https://www.energycanada.ca/home-improvement/>

⁶⁴ Energy Efficiency Alberta. (2018). Non-Profit Energy Efficiency Transition (NEET) Program. <https://www.energycanada.ca/business/non-profit-energy-efficiency-transition-program/>

⁶⁵ Energy Efficiency Alberta. (2018). Community Energy Capacity Building Program. <https://www.energycanada.ca/solar/community-energy-capacity-building-program/>

These programs help residential, commercial, and non-profit energy consumers affordably increase their energy efficiency and decrease their energy costs. In addition, **EEA offer opportunities for Alberta businesses, solar installers, and trades contractors to supply the goods and services for these rebates and programs.** The EEA website has a contractor database for individuals to find qualified contractors to help them install equipment offered by the EEA programs such as solar panels and hot water heaters.

Clean Energy in Alberta's Automobile and Oil and Gas Industries

Albertans are also increasingly looking for cleaner, less emissions-intensive means to fuel their transportation. 2017 saw more EVs added to the Alberta market and sales of BEVs increased in Alberta from 2016 to 2017 by 42%.⁶⁶ In late 2017, an announcement was made for Alberta's first EV charging corridor supported by Natural Resources Canada's *Electric Vehicle and Alternative Fuel Infrastructure Deployment Initiative*, a \$62.5-million federal investment to fund new fast-charging infrastructure for EV charging stations along key transportation corridors in Canada.⁶⁷ Alberta's first charging corridor will be along Highway 2 with charging stations installed at Canadian Tire gas stations in Edmonton, Red Deer, and Calgary. Currently, there are more than 1,000 BEV and PHEV vehicles registered in Alberta; the EV market is still small in Alberta, but as charging infrastructure increases, so too may the EVs on Alberta's roads.

Some CEOs in Alberta's oil and gas industry support the *Alberta Climate Leadership Plan* and initiatives to curb emissions and phase out coal. When the plan was announced in November 2015 by Alberta Premier Rachel Notley, she was joined on stage by Suncor Energy Inc. chief executive Steve Williams, Shell Canada head Lorraine Mitchelmore, Cenovus Energy Inc. CEO Brian Ferguson and Canadian Natural Resources Ltd. chairman Murray Edwards, to endorse the plan.⁶⁸ Mr. Ferguson was quoted as stating the plan would position Alberta as a climate leader and allow for ongoing oil and sector innovation.

Southeast Alberta Renewable Energy Innovation

SE AB is a region known for innovation. The region is home to one of eight federal research centers across Canada, Defence Research and Development Canada (DRDC), the largest military training base in the Commonwealth, Canadian Forces Base (CFB) Suffield, and unmanned vehicle research and manufacturing from Qinetiq and the Foremost UAS Range. Atlantis Research Labs Inc. is also based in the region, they are a research and development company focused on aerospace, defense, and energy.⁶⁹ According to their website, Atlantis' *PureJet* waste gas treatment technology uses jet engine propulsion technology that reduces emissions by 99%, uses solar powered ignition and monitoring, and can scale across the entire energy supply chain.

The region's main post-secondary training institution is also committed to innovation. Medicine Hat College (MHC) serves over 8,000 learners at their main campus in Medicine Hat and a smaller campus 100 km away in the City of Brooks. MHC offers multiple programs that incorporate aspects of renewable energy and clean technology development from trades programs to the Environmental Reclamation program. Regional innovators and entrepreneurs can also access 3D printing and design services at MHC. A skilled

⁶⁶ Eric Schmidt. (2018). Electric Vehicle Sales in Canada, 2017. <https://www.fleetcarma.com/electric-vehicle-sales-canada-2017/>

⁶⁷ JWN. (2017). Alberta is getting its first electric vehicle charging corridor. <http://www.jwnenergy.com/article/2017/11/alberta-getting-its-first-electric-vehicle-charging-corridor/>

⁶⁸ Jeff McIntosh. (2015). Alberta carbon plan a major pivot in environmental policy. Globe & Mail. <https://www.theglobeandmail.com/news/alberta/alberta-to-release-climate-change-policy-at-edmonton-science-centre/article27433002/>

⁶⁹ Atlantis Research Labs Inc. (2017). <http://atlantislabs.ca/>

technician is on staff to support individuals to design and print concept models, prototypes, tools, and end-use parts from various materials including ABS and nylon.⁷⁰

MHC is also committed to clean energy innovation. In late 2017 and early 2018, federal and provincial funding was announced for a solar canopy project to complement MHC's planned *Community Renewable Energy Microgrid Demonstration Project* (CREMDP). The CREMDP is a collaborative partnership between MHC and numerous community and business partners including the City of Medicine Hat. It provides a 'plug and play' environment in which energy system developers can evaluate prototypes and showcase products. Additionally, the CREMDP will teach people from across North America how renewable energy systems can be used to solve community challenges in energy generation and carbon emissions mitigation. Located on the MHC campus, the CREMDP will be a unique teaching and learning tool for MHC students, municipalities, land owners, and organizations seeking the opportunity for practical engagement in renewable energy solutions. According to MHC, **the CREMDP has the potential to help SE AB businesses rise to the challenge of creating a new homegrown, renewable energy industry.**⁷¹

Technical help for businesses looking to enter or diversify into renewable or clean technology industries is readily available in SE AB. A technology development advisor from Alberta Innovates has office hours at the MHC main campus weekly. Alberta Innovates and MHC, along with Community Futures Entre-Corp, are members of the APEX Regional Innovation Network of Southeast Alberta. APEX equips "... entrepreneurs with the coaching, community, capital and creative learning spaces needed to build a successful business in SE Alberta."⁷²

In early 2017, APEX received funding from the Government of Alberta for the *APEX Incubator Project*, a 2-year initiative that "...will increase outreach and capacity to support unemployed or under-employed post-secondary graduates seeking entrepreneurial or innovative opportunities, individuals displaced from the traditional energy sector, and other budding entrepreneurs with innovative ideas or potential projects."⁷³ Through the incubator, individuals can access free entrepreneurship training, mentorship, and guidance on accessing start-up funding at Community Futures Entre-Corp, with an entrepreneurship specialist.

Another example of innovation in SE AB is the City of Medicine Hat's *HAT Smart* program⁷⁴. Launched in 2008, this award-winning municipal program educates consumers and promotes energy conservation and renewable energy initiatives in Medicine Hat. The *HAT Smart* program is funded by the City's *Environmental Conservation Charge*; a levy charged to high-consumption electric and natural gas residential utility customers. This program is also one of the few municipal energy efficiency and renewable energy rebate and incentive programs in Alberta.

Medicine Hat is one Canada's sunniest cities with an average of 2544 hours and 330 days of sunshine per year. It is also one of the few municipalities in Canada who own and operate their own utility. This has allowed for flexibility to be innovative with renewable and clean energy technology. In 2014, the City installed a 1 MW Concentrated Solar Thermal (CST) demonstration system, the first of its kind in

⁷⁰ MHC (2010). 3D Printing at MHC. <https://www.mhc.ab.ca/AboutMHC/PartnerWithUs/3DPrinter>

⁷¹ Tim Kalinowski. (2017). MHC micro-grid a step toward renewable future. <http://medicinehatnews.com/news/local-news/2017/03/09/mhc-micro-grid-a-step-toward-renewable-future/>

⁷² APEX. (2018). Home. <https://www.apexalberta.ca/>

⁷³ MHC. (2017). The APEX Incubator project receives provincial funding. <https://www.mhc.ab.ca/newsandevents/stories/2017/february/apexincubator>

⁷⁴ City of Medicine Hat. (2017). Hat Smart. <https://medicinehat.ca/government/departments/utility-sustainability/hat-smart>

Canada, and the first of its kind globally in a northern climate (Figure 3).⁷⁵ As explained on the City’s website, “CST integrates solar thermal energy with one of the four combined cycle generation units at the Medicine Hat power plant. Thermal energy from a parabolic trough collector field is used to generate steam; the solar steam is combined with the steam produced in the Unit 15 heat recovery steam generator, and the combined steam flow is directed to one, or both, of the existing 33 MW steam turbine generators.”



Figure 3. City of Medicine Hat Concentrated Solar Thermal (CST) demonstration system⁷⁶.

The City of Medicine Hat is also home to the *Box Springs Wind Farm*. These three wind turbines were installed in 2014 through a public-private partnership with the Box Springs Wind Corporation⁷⁷. Each turbine generates up to 2MW of electricity at capacity. Annually, the turbines are expected to generate an estimated 16,000 MWh, enough electricity for about 2,000 homes. As outlined on the City’s website, the Box Springs Wind Corporation built and maintains the site. For a 20-year contract period, the City purchases all the electricity generated from the turbines and receives the carbon credits from the project, which are used to offset emissions from the City-owned power plant.

As has been shown in previous reports in this strategy, SE AB’s abundant solar and wind resources make it an ideal location for developing clean energy projects, from large-scale renewable energy projects to municipal rebate and incentive programs for energy efficiency. Combined with a lengthy history of oil and gas development experience, a strong and ever-growing innovative culture, and a wealth of supports and expertise for innovators and entrepreneurs, **SE AB seems well-suited to emerge as Alberta’s Opportunity Corner** capitalizing on the emerging renewable energy and clean technology industries in Alberta.

⁷⁵ City of Medicine Hat. (2017). Power Plan Solar Thermal. <https://www.medicinehat.ca/government/departments/utility-sustainability/hat-smart/city-initiatives/power-plant>

⁷⁶ City of Medicine Hat. (2017). Power Plan Solar Thermal. <https://www.medicinehat.ca/government/departments/utility-sustainability/hat-smart/city-initiatives/power-plant>

⁷⁷ City of Medicine Hat. (2017). Box Springs Wind Farm. <https://www.medicinehat.ca/government/departments/utility-sustainability/hat-smart/city-initiatives/box-springs>

CHALLENGES AND OPPORTUNITIES FOR RENEWABLE ENERGY INNOVATION AND SUPPLY CHAINS IN SE AB

Stakeholders were interviewed and asked to provide their opinions regarding the challenges and opportunities they perceive regarding energy innovation and supply chains in SE AB. Below is a summary of the stakeholder identified challenges and opportunities.

Challenges	Opportunities
<ul style="list-style-type: none"> Limited awareness in SE AB of renewable and clean technology industries and opportunities associated with them down the supply chain. 	<ul style="list-style-type: none"> Increased multi-industry collaborations across banking, training, government, etc... to help fuel innovation and business development in clean technology and renewable energy.
<ul style="list-style-type: none"> No one wants to go first. It's risky to have a start-up in a new industry. 	<ul style="list-style-type: none"> Alberta has a strong entrepreneurial spirit; when people see and better understand the opportunities in these emerging industries they will take advantage of the opportunities that exist.
<ul style="list-style-type: none"> We have a lot of people in our region who like to refer to SE AB as the 'forgotten corner', this makes our region look unattractive to developers and investors. 	<ul style="list-style-type: none"> So many opportunities exist for renewable and clean technology development in SE AB. It's a perfect storm right now of decreased costs, government policies, and investor interest.
<ul style="list-style-type: none"> Financing is limited by the novelty of clean energy projects, financiers do not want to take a chance on new projects. 	<ul style="list-style-type: none"> New pools of provincial and federal funding are available specifically for innovative clean energy projects.
<ul style="list-style-type: none"> Standards and regulations for clean energy technology vary provincially, nationally, and globally. Strict standards may make it hard for smaller companies to develop. 	<ul style="list-style-type: none"> Alberta has great resources to help entrepreneurs and innovators develop technologies and understand regulations.
<ul style="list-style-type: none"> Growing clean tech industry in AB, but limited knowledge exists in SE AB for driving innovation and marketing technologies. 	<ul style="list-style-type: none"> SE AB region has a lot of experience with research and innovation and entering new markets (e.g. unique agriculture, unmanned vehicles).
<ul style="list-style-type: none"> AB is late to the large-scale development game, it's hard to attract head offices here as they are already established in ON and BC. 	<ul style="list-style-type: none"> SE AB has good selling points for companies – decreased labour costs, city-owned utility in MH, numerous large projects planned for SE AB.
<ul style="list-style-type: none"> Supply chain for renewable energy product development is limited in North America, products need to be shipped from China. 	<ul style="list-style-type: none"> As these industries grow in SE AB the neighbour effect will take place, more projects will come, and distribution and manufacturing facilities may be attracted to the region.
<ul style="list-style-type: none"> Limited options for the region becoming a hub for the renewable energy industry. Too far from the ocean, and border crossings are inadequate. Offloading station for wind turbine blades is already established in southern Alberta. 	<ul style="list-style-type: none"> SE AB is ideally suited to be a transportation and distribution hub for renewable energy industries. The Trans-Canada highway goes through much of the region, close to the US border, and SK border – where lots of renewable energy projects are also planned.
<ul style="list-style-type: none"> Developers and investors are unsure who to contact in the region to learn more about the developing projects in the region. 	<ul style="list-style-type: none"> Communities could work together to attract renewable energy investment into the region.
<ul style="list-style-type: none"> Limited energy literacy, especially for energy consumers. 	<ul style="list-style-type: none"> Innovations in renewable energy could help communities address problems e.g. decreasing

	<p>energy costs with community awareness of renewables and tips to decrease energy use.</p> <ul style="list-style-type: none"> • City of Medicine Hat, HAT Smart program is an education and incentive program that could easily be modelled in other communities.
<ul style="list-style-type: none"> • Need for more PPA (power purchase agreement) contracts, greater understanding in the region and from financiers on how renewable energy works and saves money. 	<ul style="list-style-type: none"> • Lots of opportunities in SE AB for innovative collaborations between large power users (JBS, Methanex, CF, Good Year, greenhouses, data mining) and renewable power developers.
<ul style="list-style-type: none"> • Lack of support for renewable energy and clean technology development from many regional leaders. • Leaders in the region speaking out against renewable energy in person and on social media isn't good for attracting industry or investors. 	<ul style="list-style-type: none"> • Regional leaders need greater support and resources from industry and associations to help them better understand the benefits and risks of renewable development. • Multiple opportunities exist for cities and towns in the region to work with industry to pilot innovative renewable energy and clean technology projects.
<ul style="list-style-type: none"> • No clear guidelines or flexibility with some municipalities for renewable project development. • Municipal staff often lack knowledge about renewable energy projects and are not sure how to deal with new projects or what steps they need to complete to move forward. 	<ul style="list-style-type: none"> • Municipalities could develop policies or plans for dealing with project proposals outside the normal scope.
<ul style="list-style-type: none"> • Energy costs keep rising and the carbon tax makes it more expensive for transportation. • Many see the Alberta Government as just using renewable energy to get another tax out of people. 	<ul style="list-style-type: none"> • Medicine Hat and Brooks are the perfect sized cities for piloting electric or autonomous buses. • Carbon tax rebates could help homeowners invest in energy efficient upgrades and decrease energy costs for residential and business energy consumers. Industries could invest in renewable to offset their carbon emissions.
<ul style="list-style-type: none"> • Utility companies are not eager to support customers producing their own energy. • City of Medicine Hat owns their own utility, but as a municipally owned utility they appear to be risk-averse to innovative renewable and clean energy technologies in the last few years. 	<ul style="list-style-type: none"> • City of MH could work with industry stakeholders on projects that ensure reliable energy income for the City owned utilities while allowing interested customers options for making their own energy.
<ul style="list-style-type: none"> • Lots of naysayers and people in the region against renewable energy development. • Municipalities in the region are risk-averse. 	<ul style="list-style-type: none"> • Education is key to the paradigm shift to renewable energy and clean technology. • Towns and cities in the region are good sized for exploring the societal impacts and perceptions of piloted clean energy projects.
<ul style="list-style-type: none"> • Strong status-quo mentality in the region for taking on innovation that does not involve oil and gas or agriculture. • Many people in the region too focused on trying to revive the declining oil and gas industry. 	<ul style="list-style-type: none"> • Lots of opportunities exist in SE AB for co-generation of renewable power with oil and gas energy (e.g. solar panels on well sites). • Empty industrial size buildings in the region could be used by renewable energy companies as service centers (for wind turbine blades or product development).

<ul style="list-style-type: none"> • Focus in the region for development seems to be on large wind and solar projects, less on encouraging growth of residential and commercial renewable energy and energy efficiency. 	<ul style="list-style-type: none"> • The utility development game is getting crowded, but the residential game has room for lots of people to capitalize on it in SE AB. • SE AB is ideal for creating green communities and building net-zero homes and buildings.
<ul style="list-style-type: none"> • Suitability for EVs in SE AB is limited by the lack of fast charging stations. 	<ul style="list-style-type: none"> • If the mall, shopping centers, or restaurants in the region had fast charging stations EV users would use their facilities while they charge.
<ul style="list-style-type: none"> • Municipalities need increased clarity about how different processes align – from AUC (Alberta Utilities Commission) to AESO to municipal bylaws. 	<ul style="list-style-type: none"> • Industry and governing organizations could co-host information sessions for communities and municipal leaders.
<ul style="list-style-type: none"> • Need for greater engagement with residents and businesses from industry as to how businesses can enter the supply chain for renewable energy. 	<ul style="list-style-type: none"> • Create opportunities for subcontractors and local trades people to interact/engage with the renewables industry and promote their services.
<ul style="list-style-type: none"> • Not sure what types of opportunities exist for the little guys, big corporations run these projects and it is unclear as to how they do their bidding and tendering processes. • Local companies think they are too small to take on the contracts from these big guys. Local companies may not have the manpower to take them on. 	<ul style="list-style-type: none"> • Regional construction association could work together to develop a better understanding of renewables and what is involved in developing and maintaining these projects so local companies feel more confident bidding on them. • Renewable industry needs to have a better understanding of what supply chain businesses exist in the region, market the workers and businesses in SE AB to the renewables industry.
<ul style="list-style-type: none"> • Limited information exists in SE AB on renewable energy and clean technology, the technology changes quickly and it's hard to keep up. 	<ul style="list-style-type: none"> • SE AB could house an innovation center for advancing solar and clean energy in AB. Canada's sunniest city is the perfect place to do that. • SE AB is great for advancing net-zero and energy efficient home/building construction.
<ul style="list-style-type: none"> • Current electrical transmission lines may not be able to handle renewable energy development. 	<ul style="list-style-type: none"> • Municipalities in the region could be actively exploring opportunities for innovative energy storage (e.g. geothermal and abandoned wells or depleted oil/gas pools).
<ul style="list-style-type: none"> • Residential solar panels are expensive and have a long return on investment. 	<ul style="list-style-type: none"> • Rebates and incentives are available through Energy Efficiency Alberta for solar, and then you can also take advantage of the MH HAT Smart solar rebate if you are a City of Medicine Hat electricity customer.
<ul style="list-style-type: none"> • Alberta is late to the clean energy and renewable energy game and won't see as many opportunities from manufacturing and distribution as other more established areas like Ontario and the U.S. 	<ul style="list-style-type: none"> • Long-term regional plan or roadmap for renewable energy and clean technology development would be beneficial to attracting industry and investment.

Table2. Stakeholder Identified Challenges and Opportunities in SE AB

SOLAR, WIND, AND ENERGY EFFICIENCY SUPPLY CHAINS

Many business, industry, and economic development support organizations in SE AB are aware that renewable energy industries could provide additional economic opportunities for various businesses in the region spanning communications, construction, landscaping, transportation, and trades. However, these organizations are unable to provide statistics on members that are directly or indirectly impacted by clean energy industries, as these industries are just beginning to emerge in SE AB.

Many of these support organizations recognize a need to provide additional information and resources to interested members to highlight opportunities where they could capitalize on clean energy. These opportunities could involve entering the supply chains of clean energy industries emerging in SE AB including large-scale renewable energy projects, residential and commercial energy efficiency, and electric vehicles. However, most are unsure as to where to obtain information and resources.

The supply chains of industries like solar, wind, and energy efficiency are broad. They are also similar to other industries, such as oil and gas and can be categorized into the following stages:

RENEWABLE ENERGY SUPPLY CHAIN STAGES		
STAGE	ACTIVITIES	EXAMPLES
Upstream	Production	<ul style="list-style-type: none"> • Mining silicon for solar PV panels. • Manufacturing wind turbine blades. • Designing smart thermostats.
Midstream	Connection between the upstream and downstream phases.	<ul style="list-style-type: none"> • Shipping of solar panels. • Rail transportation of wind turbine blades. • Marketing of smart thermostats.
Downstream	Installation and Operation	<ul style="list-style-type: none"> • Installing residential solar panels. • Construction of a wind farm. • Connecting a smart thermostat.

Table 3. Renewable Energy Supply Chain Stages.

This report focuses on the downstream supply chain activities of solar, wind, and energy efficiency, as there are currently no options for upstream and midstream related stages in SE AB. However, as these industries continue to grow in the region, opportunities for manufacturing and distribution may develop.

For this report, the downstream supply chain of each of these industries will be further divided into the following three phases:

1. **Development**
2. **Construction/Installation**
3. **Operations and Maintenance**

Based on input from industry stakeholders, much of the work in the development phase of large-scale solar and wind energy projects is done inhouse with the project developer. **Much of the construction and installation phase is contracted locally, regionally, or nationally. And much of the operations and maintenance phase is procured locally.**

The following supply chain sections provide a general overview to inform stakeholders in SE AB – businesses, contractors, communities – of opportunities that may be available for them to participate in

regional renewable and clean energy projects. These supply chain summaries focus on some of the direct opportunities related to the downstream activities of solar, wind, and energy efficiency projects.

Additional indirect opportunities from these projects can also impact local/regional retail, office/building rentals, fuel and vehicle maintenance, restaurant, accommodation, and entertainment industries.

Solar Supply Chain

Large-scale solar projects take years to develop; approvals and permitting for Elemental Energy’s *Brooks Solar Project* began in 2012, but project construction did not start until mid-2017. As indicated in Figure 4 below, projects may also change hands during the development process.



Figure 4. Elemental Energy – Brooks Solar Project Timeline⁷⁸

Solar PV energy is applicable for both large utility-scale (solar farms) and small-scale (residential and commercial) levels. The solar supply chain overview below (Table 4) is focused on utility-scale projects; however, some of the sample activities and occupations required below could be applicable to small-scale solar as well.

⁷⁸ Elemental Energy. (2017). Brooks Solar. <http://elementalenergy.ca/portfolio/brooks-solar/>

SOLAR SUPPLY CHAIN (Large-Scale)		
PHASE	SAMPLE ACTIVITIES	SAMPLE OCCUPATIONS/BUSINESSES THAT MAY BE REQUIRED
Development	<ul style="list-style-type: none"> • Applications and approvals • Capital/equipment procurement • Environmental assessment and monitoring • Government relations • Human resources • Land acquisition • Land lease negotiation • Land surveying • Legal • Marketing • Meteorological assessment • Permitting • Project design • Project financing • Project management • Public relations • PV system design • Reporting • Research • Site assessment • Site identification • Software development • Stakeholder engagement 	<ul style="list-style-type: none"> • Administrator • Analyst • Attorney • Civil Engineer • Consultant • Controller • Document Control • Electrical Engineer • Energy Asset Manager • Energy Engineer • Environmental Assessor • Environmental Scientist • Finance Manager • Human Resources Manager • Land Agent • Management Professional • GIS/Mapping Technologist • Marketing/Graphic Designer • Mechanical Engineer • Project Manager • Public Relations Professional • Purchaser • Software Developer • Solar System Designer • Supply Chain Manager • Surveyor
Construction & Installation	<ul style="list-style-type: none"> • Access mats and road prep • Base preparation • Building construction (onsite) • Connection to grid • Construct transmission lines • EMS/Safety • Equipment, materials, and logistics procurement • Excavation • Fencing • Ground mount drilling • Land clearing and grading • Local HR recruitment • Metal fabrication/welding for racking • Road building • Sanitation (portable restrooms) 	<ul style="list-style-type: none"> • Assembler/Fabricator • Concrete Companies • Construction Worker • Electrician • EMS/ Safety Professional • Energy Services Company • Excavation Contractor • Forklift/Skidlift Operators • General Contractor • Heavy Equipment Operators • Human Resources Manager • Labourers • Metal Fabrication • Pile Driving Contractor • Power Linemen • Road Construction • Safety Trainer

	<ul style="list-style-type: none"> • Site preparation • Transportation of panels • Trenching and cable laying 	<ul style="list-style-type: none"> • Sanitation Companies • Security • Solar Installer • Transport Driver • Welders
Operations & Maintenance	<ul style="list-style-type: none"> • Decommissioning • Equipment maintenance • Groundskeeping • Monitoring and assessment • Road maintenance • Security • Solar panel and inverter maintenance • Systems controls 	<ul style="list-style-type: none"> • Controller • Data Analyst • High-voltage Electrician • Environmental Reclamation Technician • Environmental Scientist • Grader Operator • Landscaper/Groundskeeper • Safety Professional • Security Professional • Site Manager • Solar Plant/Farm Technician

Table 4. Large-Scale Solar Supply Chain Overview

Wind Energy Supply Chain



Figure 5. Halkirk Wind Farm (Central Alberta) – Capital Power⁷⁹

Wind energy projects have similar lengthy project development timelines and broad supply chains as large-scale solar. Decreasing capital costs for wind energy, and the recent Government of Alberta REP Round 1 announcements averaging \$37/MWh, resulted in wind energy becoming the lowest cost option for new electricity generation in Canada.⁸⁰ Two of the REP Round 1 projects are in SE AB, and more are planned for the region; these projects will be discussed further in the final report of this Strategy – the **Moving Forward Report**. Wind energy projects provide numerous economic benefits to communities over their lifespan. Almost \$1 billion will be invested into the two REP wind projects announced for SE AB (Figure 6).

⁷⁹ Capital Power. (2017) Halkirk Wind Farm. <http://www.capitalpower.com/generationportfolio/CA/Pages/Halkirk.aspx>

⁸⁰ CanWEA. (2018). Record-low price tops wind energy news in 2017. <https://canwea.ca/news-release/2018/01/30/record-low-price-tops-wind-energy-news-2017/>



Figure 6. REP Round 1 SE AB Wind Project Potential Impacts⁸¹

The *Alberta Wind Energy Supply Chain Study*,⁸² completed by the Delphi Group for CanWEA in 2017, found that the **total** supply chain of wind energy over all stages (upstream, midstream, and downstream) includes over **65 industries** (Figure 7).

⁸¹ SEEDS. (2017). www.seedsalberta.ca

⁸² Delphi Group (2017). *Alberta Wind Energy Supply Chain Study*. Prepared for CanWEA <https://canwea.ca/wp-content/uploads/2017/09/Delphi-AB-Wind-Supply-Chain-Study-Final-Report.pdf>



Figure 7. CanWEA Wind Energy Opportunities⁸³

However, the study also states that “nearly all large and specialized wind turbine equipment and component replacement parts (e.g., blades, nacelle components, etc.) are currently being imported to Alberta from outside the province or internationally.” Hence, the supply chain overview below (Table 5) focuses on the downstream stage of large-scale wind energy projects; developing, constructing, operating, and maintaining a wind farm.

WIND ENERGY SUPPLY CHAIN (Large-Scale)		
PHASE	SAMPLE ACTIVITIES	SAMPLE OCCUPATIONS/BUSINESSES THAT MAY BE REQUIRED
Development	<ul style="list-style-type: none"> • Applications and approvals • Capital/equipment procurement • Environmental assessment and monitoring • Government relations • Human resources • Land acquisition • Land lease negotiation • Land surveying • Legal • Marketing • Meteorological assessment • Permitting • Project design • Project financing • Project management • Public relations • Reporting • Research • Site assessment • Site identification • Software development • Stakeholder engagement 	<ul style="list-style-type: none"> • Administrator • Analyst • Attorney • Civil Engineer • Consultant • Controller • Document Control • Electrical Engineer • Energy Asset Manager • Energy Engineer • Environmental Assessor • Environmental Scientist • Finance Manager • Human Resources Manager • Land Agent • Management Professional • GIS/Mapping Technologist • Marketing/Graphic Designer • Mechanical Engineer • Project Manager • Public Relations Professional

⁸³ CanWEA. (2017). www.canwea.ca

		<ul style="list-style-type: none"> • Purchaser • Software Developer • Supply Chain Manager • Surveyor
Construction & Installation	<ul style="list-style-type: none"> • Access mats and road prep • Base preparation • Building construction (onsite) • Concrete and gravel supply and delivery • Connection to grid • Construct transmission lines • EMS/Safety • Equipment, materials, and logistics procurement • Excavation • Fencing • Ground mount drilling • Land clearing and grading • Local HR recruitment • Metal fabrication/welding for racking • Road building • Sanitation (portable restrooms) • Site preparation • Transportation of blades, nacelles, and tower • Trenching and cable laying • Wind turbine assembly 	<ul style="list-style-type: none"> • Assembler/Fabricator • Concrete/Gravel Companies • Construction Workers • Crane Operators • Electricians • EMS/Safety Professional • Excavation Contractor • Grader Operator • Gravel Truck Operators • Heavy Equipment Operators • Human Resources Manager • Instrumentation • Iron Workers • Labourers • Machinists • Metal Fabricators • Power Linemen • Quality Control Inspectors • Safety Trainer • Sanitation Companies • Transport drivers • Welders • Wind Turbine Technician
Operations & Maintenance	<ul style="list-style-type: none"> • Decommissioning • Equipment maintenance • Groundskeeping • Monitoring and assessment • Road maintenance • Security • Systems controls 	<ul style="list-style-type: none"> • Data Analyst • Environmental Reclamation Technician • Environmental Scientist • HVAC Technician • Landscapers/Groundskeepers • Instrumentation • Maintenance Manager • Security Guard • Site Manager • Wind Turbine Technician

Table 5. Large-Scale Wind Supply Chain

Energy Efficiency Supply Chain

For the purposes of this report, energy efficiency will broadly cover **building construction and renovations and electric vehicles**. Below is an overview of the some of the activities and sample occupations or businesses required for energy efficiency supply chains (Table 6).

ENERGY EFFICIENCY SUPPLY CHAIN (Construction, Renovations, EVs)		
PHASE	SAMPLE ACTIVITIES	SAMPLE OCCUPATIONS/BUSINESSES THAT MAY BE REQUIRED
Development	<ul style="list-style-type: none"> • Electric vehicle sales • Research • Residential, commercial, and industrial energy audits and assessments • Residential, commercial, and industrial energy efficiency building design 	<ul style="list-style-type: none"> • Alternative Energy Technologist • Architects • Building Inspector • Certified Energy Manager • Consultant • Energy/Sustainability Advisor/Specialist • Energy Analyst/Auditor • Energy Coordinator • Environmental Economist • Industrial Engineer • LEED Specialist • Net-zero Mechanical Engineer • Program Manager • Salesperson • Solar Technician
Construction & Installation	<ul style="list-style-type: none"> • Energy efficiency building renovations (insulation, windows, plumbing, HVAC) • Energy efficient building construction • Industrial energy efficient retrofits • Installation of EV chargers 	<ul style="list-style-type: none"> • Automobile Mechanic • Boilermakers • Carpenter • Construction Worker • Electrician • General Contractor • Geothermal Technician • Glaziers/Window Installer • Home Builders • HVAC Technician • Insulator • LEED Specialist • Pipefitter/Plumber • Project Manager • Solar Technician • Wholesalers/Distributors
Operations & Maintenance	<ul style="list-style-type: none"> • Building maintenance • EV maintenance • Regular maintenance on equipment 	<ul style="list-style-type: none"> • Boilermakers • Building Manager • EV Trained Auto Mechanic • HVAC Technician • Pipefitter/Plumber • Solar Technician

Table 6. Energy Efficiency Supply Chain

RECOMMENDATIONS AND SUGGESTED ACTIONS

The following two recommendations and suggested actions were identified in the **Industry Report** of the **Southeast Alberta Energy Diversification Strategy**. Additional suggested actions, if any, to achieve these two recommendations, based on input collected for this Workforce Report, are bolded.

RECOMMENDATION SUGGESTED ACTIONS

RECOMMENDATION	SUGGESTED ACTIONS
<p>Provide resources and support to develop a better understanding of the renewable energy industry in SE AB and the impact it has on regional businesses and economic development.</p>	<ul style="list-style-type: none"> • Conduct a supply chain analysis for the wind and solar industries in SE AB to contribute to a greater understanding of complementary industries and services required by the renewable energy industry. • Provide relevant renewable energy data for business planning support. • Conduct industry-specific feasibility studies for the region (e.g. land-use, solar roof mapping potential, etc...). • Conduct regional mapping to highlight major energy projects in our region, display these projects on an interactive on-line map on the SEEDS website. • Support small business innovation and growth to address the needs of the renewable energy industry. • Ensure small businesses have information and resources that allow them the opportunity to participate in the supply chain. • Create an online supply chain map of local businesses and suppliers for renewable energy, clean technology, and energy efficiency industries to access.
<p>Foster a renewable energy market in SE AB that supports and attracts both large-scale and small-scale renewable energy development, innovation, investment, and research.</p>	<ul style="list-style-type: none"> • Create a plan and invest in promoting SE AB as a renewable energy hub provincially and nationally for renewable energy innovation, investment, manufacturing, and distribution. • Support the development of demonstration projects in the region (e.g. promotion, assistance with development, etc...). • Explore opportunities for developing a center for renewable energy training, research, and development driven by industry needs, focused on attracting students locally, nationally, and internationally. • Showcase complementary industries for the renewable energy industry. • Foster collaboration and transfer of knowledge for new research/commercialization partnerships in renewable energy technology. • Host events (e.g. conferences, seminars, lunch and learns, etc...) to help promote and raise awareness of renewable energy potential and current projects in the region.

CONCLUSION

SE AB is already well known for being an innovative region with diverse agriculture, unmanned vehicles, and federal defence research. In addition to large-scale, residential, and commercial renewable energy projects and energy efficiency programs, numerous innovative renewable energy projects are also on the horizon for SE Alberta including microgrid demonstration projects at Medicine Hat College. **Emerging renewable or clean energy industries increase SE AB's innovation reputation and provide an opportunity for the region to become known as Alberta's Opportunity Corner.**

In addition, large-scale solar and wind projects and energy efficiency construction and renovations will utilize extensive **supply chains that span multiple industries including communications, trades, and transportation.** These projects provide economic opportunities for various businesses in SE AB and diversify the region's energy economy.

The next, and final, report in the strategy – the **Moving Forward Report** – summarizes the three preceding reports and provides an analysis of the potential economic impacts of proposed renewable energy projects in SE AB over the next two decades.