Labour Market Intelligence for Alberta's Energy Sector

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About Electricity Human Resources Canada

Electricity Human Resources Canada (EHRC) is a national, not-for-profit organization formed in 2005 through a partnership of business, labour, education and government to provide a national voice for the Canadian electricity industry. With the mission to "strengthen the ability of the Canadian electricity industry to meet current and future needs for their workforce — one that is highly skilled, safety-focused, diverse and productive," [1] EHRC studies human resource opportunities and challenges affecting the electricity and renewable energy industry and develops tools to help industry address them.

EHRC's specific objectives are to:

- Conduct and disseminate valuable research about human resources in Canada's electricity industry
- Help the industry create and sustain a skilled and diverse labour force
- Promote awareness of career and employment opportunities in the industry
- Develop partnerships that better enable the industry to meet its human resources needs

Further information on EHRC is available at www.electricityhr.ca.

The Province of Alberta is working in partnership with the Government of Canada to provide employment support programs and services.

Cover photo credit: Soderglen, courtesy of TransAlta Corporation

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Executive summary

Alberta's electricity and renewables industry is operating in an evolving environment guided by the *Climate Leadership Plan* and *Renewables Electricity Program*. A mandatory phase-out of coal-fired generation means the province's electricity sector must transition to lower-emission sources of generation to meet continuing demand while adhering to government policy and regulations.

Past research commissioned by Electricity Human Resources Canada (EHRC) focused on the transition from legacy to next-generation infrastructure and workforce. This report examines the landscape in which the next-generation workforce will find itself over the next five years.

Building on the 2011 Power in Motion report from EHRC, this current study looks at how the transitions underway — including the adoption of new and emerging technologies — will affect Alberta's electricity workforce. It provides new information on best practices for supporting workforces in transition along with insights into the growth of Alberta's renewable energy sector. It also serves as a call to action, supporting sector human resource management planning.

The landscape is changing

The Alberta electricity sector is complex, made up of 230 organizations representing numerous sub-sectors involved in power generation, transmission and distribution[2]. Today, 47% of the province's electricity is generated from coal, 40% from natural gas and 13% from renewable energy sources including wind, hydro and biomass[3]. It is estimated that 2,400 megawatts of coal-fired generation will be converted to natural gas by the early 2020s. By 2030, 30% of Alberta's electricity will come from renewable sources such as wind, hydro and solar. Alberta electricity sector employers are preparing to transition upwards of 3,000 workers who will be affected by these changes. Human resource management will play a significant role in supporting their efforts.

Increased reliance on renewables and new technology will also significantly alter the electricity sector, changing the nature of many occupations. In recent years, the province has begun to see advances in the use of smart grids, electrical vehicles, battery storage, community generation, LED lighting and drone technology. This marks a shift after more than a decade of relative stability and few technological changes. These changes call for more and higher-level skills, and the demand for workers with multi-disciplinary and cross-functional skills will only increase.

As yet, automation has not significantly affected Alberta's electricity workforce. With the exception of certain roles like power system operator and information systems analyst, the percentage of automation associated with tasks for key occupations was less than 10% between 2011 and 2017.

Almost all stakeholders consulted as part of this study identified challenges for the sector regarding technology, particularly to address risks associated with cybersecurity and other information technology requirements.

How stakeholders are preparing

Sector employers in Alberta are readying for the transition away from coal by enhancing current workers' skillsets, supporting employees in the pursuit of dual certification, and cross-training and upskilling workers for redeployment. Some have formalized initiatives for work transition through transition teams.

The Government of Alberta and sector employers also support recognized best practices for worker transitioning workers to new occupations, including:

- Redeployment of affected workers to other jobs
- Education, training and career counselling
- Financial support for transitions to other work or retirement
- Community support
- Program and service coordination

Meanwhile, academic institutions are introducing course modules and overview courses in renewable energy that provide training on new technologies. They are also delivering content on energy storage, smart grid technology, cybersecurity, drone technology, artificial intelligence and electric charging stations.

Meeting the demands of the evolving workforce

More than 13,000 people work in Alberta's electric power generation transmission and distribution industry[4], which accounts for 0.6% of Alberta's total employment in 2018[5]. This industry is part of the overall utilities sector, which employs upwards of 21,000 workers and includes natural gas distribution and water, sewer and irrigation systems, and is expected to grow by 2.1% between 2017 and 2021[6].

Designing, constructing and maintaining Alberta's electricity infrastructure as it moves forward involves engaging most electrical occupations as well as a group of support tradespeople and specialists. EHRC's 2011 LMI divided the industry's direct employees into two groups: occupations in the electricity sector (a total of 19, including managers, engineers, technicians and the skilled trades workers) and other relevant support workers. The analysis that was part of this study focused on an expanded set of electricity sector occupations and their associated roles managing, maintaining and operating the facilities within Alberta's changing energy landscape. That expanded set of occupations included the integrations of cybersecurity specialists and smart grid, wind technicians, wind station operators and solar PV installers.

Table 1 tracks employment in 23 electricity industry occupations from 2017 to 2022. Estimates for each occupation in Alberta are projected to 2022 using a weighted average of the annual rate of change in output (measured by GDP) and investment in the sector. As illustrated, employment in Alberta's electricity and renewable industry by key occupation is expected to grow at a rate of 0.5% annually, with a cumulative increase of 2.5% between 2017 and 2022. This rate reflects the transition from coal to new forms of electricity generation, such as natural gas and renewables. The highest rates of employment growth are expected for software engineers and designers and engineering managers. Demand for highly skilled workers will continue to increase as more technological improvements are researched, developed and applied to the sector.

TABLE 1 – Current and forecasted employment in Alberta's electricity industry by occupation, 2017 and 2022

Occupation	2017	2022	% Growth 2017–2022*	Average annual Growth Rate
Engineering managers	131	135	3.0%	0.6%
Construction managers	74	75	1.4%	0.3%
Utilities managers	599	614	2.5%	0.5%
Civil engineers	158	162	2.5%	0.5%
Mechanical engineers	252	259	2.8%	0.6%
Electrical and electronics engineers	999	1,024	2.5%	0.5%
Information systems analysts and consultants (includes cybersecurity)	363	372	2.5%	0.5%
Database analysts and data administrators	53	54	1.9%	0.4%
Software engineers and designers	21	22	4.8%	1.0%
Computer programmers and interactive media developers	53	54	1.9%	0.4%
Civil engineering technologists and technicians	58	59	1.7%	0.3%
Mechanical engineering technologists and technicians	37	38	2.7%	0.5%
Electrical and electronics engineering technologists and technicians	315	323	2.5%	0.5%
Engineering inspectors and regulatory officers	32	32	0.0%	0.0%
Computer network technicians	79	81	2.5%	0.5%
Contractors and supervisors, electrical trades and telecommunications occupations	163	167	2.4%	0.5%
Electricians	16	16	0.0%	0.0%
Power system electricians	410	420	2.4%	0.5%
Electrical power line and cable workers	1,109	1,137	2.5%	0.5%
Construction millwrights and industrial mechanics	216	221	2.3%	0.5%
Residential and commercial installers and servicers (includes solar PV Installers)	11	11	0.0%	0.0%
Public works maintenance Equipment operators and related workers (includes Utility Arborists)	74	75	1.4%	0.3%
Power engineers and power systems operators (includes power system and power station operators, smart grid specialists, wind technicians, and wind station operators)	936	959	2.4%	0.5%
Electricity sector occupations	**6,159**	**6,310**	**2.5%**	**0.5%**
Other occupations**	**7,741**	**7,940**	**2.6%**	**0.5%**
Total	**13,900**	**14,250**	**2.5%**	**0.5%**

Source: C4SE forecast
* % growth 2017–2022 reflects total growth from 2017 to 2022.
** Other occupations includes all occupations in the electricity sector not listed in the table.

Despite sector growth, women and younger workers remain underrepresented compared to all other industries in Alberta. Contractors and consultants make up just under a quarter of all sector employees.

Key workforce issues

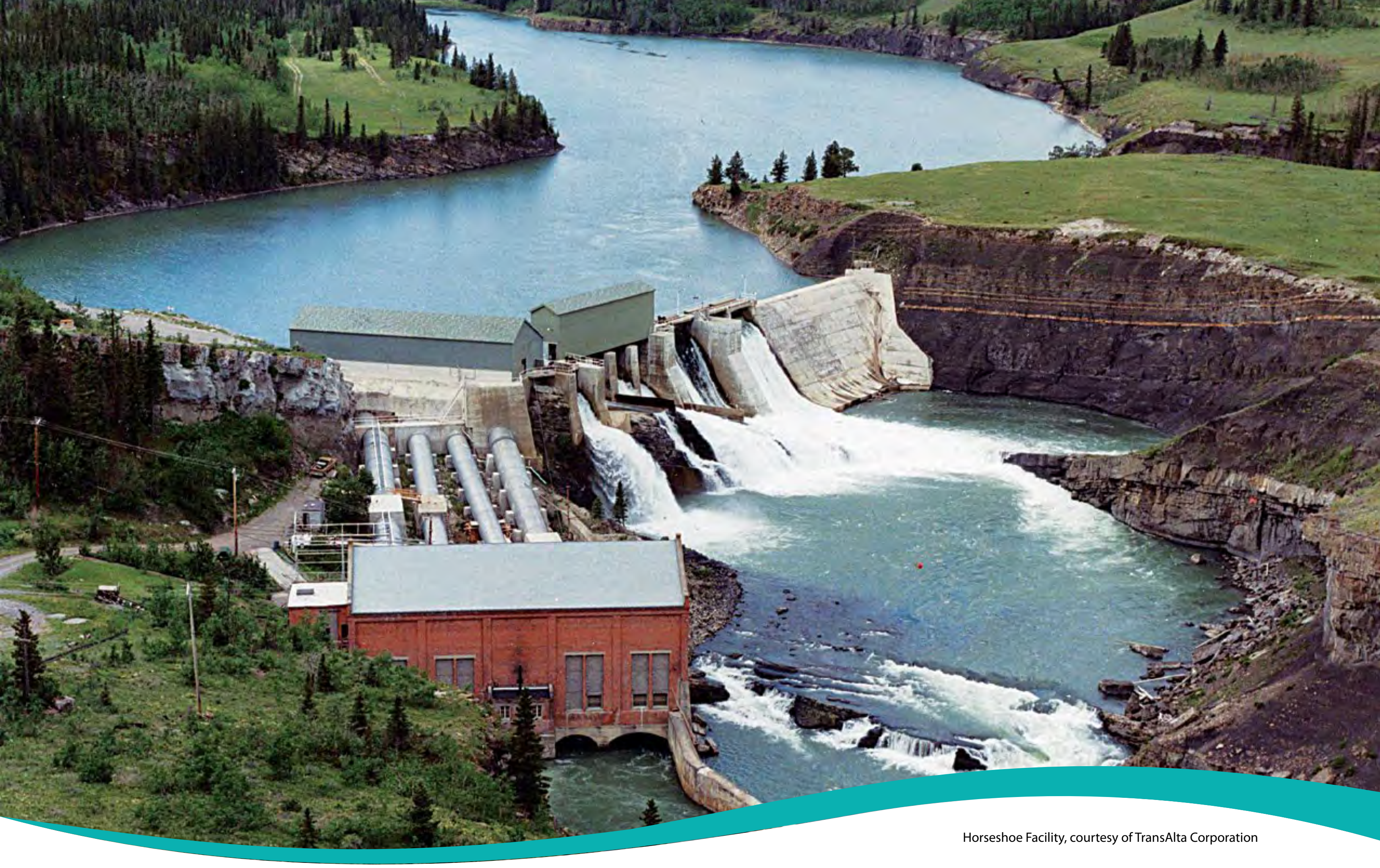
Based on the research conducted to prepare this report, the following are the main issues facing Alberta's electricity sector over the next five years:

- **Diversity:** Diversity, which concerns those characteristics that make individual workers different from one another (e.g., race, gender, ethnicity), is an important issue within the electricity industry. Lifestyle, location, education or training requirements and work culture can act as barriers to entry and transition for underrepresented groups, including women, visible minorities and Indigenous people. Despite informal work to ensure workforce diversity, only 20% of electricity industry employers surveyed have or are working to develop a formal diversity strategy or plan to broaden representation of these groups. More attention is therefore needed to engage workers of varying cultures, abilities and genders in the sector.
- **Aging workforce:** As older workers retire, the sector loses workers with years of experience and training that cannot be easily replaced. The current retirement rate for the sample of electricity industry employers surveyed was 2% and is expected to increase to 2.5% in 2019 and 6.2% in 2022. The majority of employers surveyed (87%) did not have early retirement programs or other incentives to alter retirement patterns for their organization.
- **Succession planning and knowledge transfer:** Succession planning is most commonly in place for managers and supervisors (73%) and least for information and communication technology occupations (20%) and renewable energy occupations (20%). Knowledge transfer planning is most commonly in place for managers and supervisors (73%) and least for renewable energy occupations (27%). For management positions, corporations are completing talent assessments with internal staff and implementing development plans for high-performing employees to address succession.
- **Staff turnover and retention:** Due to the most recent economic downturn and resulting low worker turnover, employers are tending to focus on worker retention versus recruitment. Retention strategies include promoting worker wellness, work-life balance, flexible benefit packages and accommodating flexible work schedules. The voluntary separation rate for electricity industry employers in Alberta who reported such departures as part of this study averaged 4%, and was most frequently for renewable energy jobs (8%).
- **Recruitment:** In 2017, the most difficult vacancies for electricity industry employers in Alberta to fill included managers, solar photovoltaic installers, smart grid specialists, and information and communication technology personnel. For the most part, these roles should become easier to fill by 2022 — with the exception of ICT positions. Vacant positions for electrical and electronics engineers, construction managers, and information and communication technologists — including cybersecurity specialists — are likely to become harder to fill.
- **Training:** Employers in the sector are identifying new and emerging competency requirements and building internal talent to meet future needs. Staff receive training through a variety of methods, including formalized courses, job shadowing, mentoring, project-based learning and cross-training. Depending on the organization, talent is also supported through leadership training and soft skills development, as well as post-secondary training and apprenticeship (including dual certification in the trades).
- **Future training needs:** Three trends are converging to produce game-changing disruptions in the electricity sector: electrification of large sectors of the economy such as transportation; decentralization through distributed energy resources, distributed storage, distributed generation, demand flexibility and energy efficiency; and digitalization of both the grid and other digital network technologies. Employers foresee increased need for both technical and soft skills in all occupations to be prepared in advance of these changes.

Key education and training issues

The electricity and renewables sector workforce is tied directly to three streams of post-secondary education: 1) undergraduate and graduate engineering programs, 2) college programs for engineering technicians and technologists, and 3) apprenticeships. Key findings related to the supply of new employees for the electricity and renewables sector workforce include:

- **Student recruitment:** Electricity programming generally does not have specific outreach strategies for attracting students to the electricity and renewable energy programs: outreach occurs for the institutions overall. Where formal outreach strategies do exist, they tend to target international (43%) and Indigenous students (43%), visible minorities (29%), female students (29%) and students with disabilities (14%).
- **Student enrollment:** Institutions have seen generally steady or increasing enrollment in electricity-related programming over the years as a result of program promotion and the job opportunities available to graduates. Growing recognition of the renewable energy industry has increased enrollment in related educational streams. These include training programs for electricians, electrical engineers, wind turbine technicians, power system analysts and solar installation. Institutions did not report significant differences in male versus female enrollments in STEM (science, technology, engineering, mathematics) or clean energy programs. However, between 2012 and 2016, fewer individuals entered skilled trades apprenticeship programs relevant to the electricity and renewables sector — but those who did had higher rates of completion than in the past.[6]
- **Student retention rates:** Student retention is influenced mainly by interest in program content, which in turn affects degree completion. Quality instruction and flexible program delivery also support degree completion. Completion rates in electricity/renewable sector programs are historically similar to or higher than other programs, with minimal differences by gender.



Horseshoe Facility, courtesy of TransAlta Corporation

- **New programming:** Enrollment in renewable energy programming continues to grow. Over the past five years, demand has also risen for graduates who are cross-trained or hold more than one certification — to support interdisciplinary work in the energy sector. There is a need for joint business and trades training because many trades work as small contractors servicing the electricity sector; as a result, some institutions have developed multidisciplinary curricula (e.g., electrical courses for mechanical engineers, incorporating business or architectural components into renewable energy programs, etc.).

  Future employees will need to be continuous learners, learning quickly and more dynamically as provincial/federal energy policies continue to evolve and new technologies change how work is done. Modular training can support this continuous learning by allowing people already in the middle of their careers to upskill. It also allows workers to continue contributing to the labour force while acquiring skills for the transitioning operational environment.

  Furthermore, incorporating "design thinking" into university curricula will provide opportunities to study problems and develop solutions taking multiple perspectives into account, including consumer preferences, social benefits, technology and economics. Students need to learn how to challenge preconceptions, add new technologies into the electrical grid/system (e.g., distributed energy/community energy, storage, electric vehicles and blockchain), and bring context and ethical judgment to workplaces that depend increasingly on artificial intelligence.

- **Soft skills:** The sector has a growing need for workers with soft skills such as communication, leadership, project management, critical thinking and problem solving. Alberta's educational institutions are responding by integrating soft skills into programming through team and group work, capstone projects, formal courses, tutorials, support programs and project and lab work. Work ethics, teamwork and leadership skills are commonly taught informally, if at all, while written and verbal communication, time management and problem solving are formally taught by some institutions.

Recommendations

The following recommendations are made to support Alberta's changing electricity and renewables sector workforce:

1 UPDATE LABOUR MARKET AND CAREER INFORMATION REGULARLY

For employers to have a suitable supply of workers with the correct mix of skills, labour market and career information must be updated frequently to reflect the changing structure of the sector and future job opportunities. At the same time, outreach programs should be developed to draw students to relevant academic programs.

2 ENGAGE IN UNITED ACTION TO SUPPORT EDUCATION AND TRAINING

Government, electricity industry employers and academic institutions in Alberta will need to work together to understand and define emerging occupations and to prepare appropriate training or retraining pathways. These pathways could include adopting work-integrated learning programs or promoting work placements and co-op educational programs.

3 ENCOURAGE APPRENTICESHIP

Funding programs that incentivize employers to hire first-year apprentices should be researched and implemented to support the transition of new workers into the emerging renewable sector.

4 DEVELOP FUTURE-READY REGULATIONS AND STANDARDS

Regulations and formalized industry standards for renewable energy occupations — based on an understanding of how the requisite skills will be practically applied in the workplace — are needed to facilitate the evolution of Alberta's electricity sector workforce. Stakeholders recommend developing occupational standards, certifications and essential skills profiles for new and emerging occupations, as well as establishing common training outcomes that align with them.

5 EMBRACE DIVERSITY

Future skill gaps and workforce needs may be filled by hiring from non-traditional labour pools. Opportunities also exist to recruit more Indigenous workers, as much of the work in renewable energy takes place in rural locations and sometimes in close proximity to Indigenous communities. Employers should aim to establish more formal diversity hiring strategies, particularly for women, Indigenous peoples, and visible minorities.

6 ESTABLISH SUCCESSION PLANNING, RETIREMENT AND PENSION-BRIDGING PROGRAMS

A large retirement cohort will require that employers implement comprehensive succession planning, retirement or pension-bridging programs. These efforts will not only help workers transition as a result of the coal phase-out but also ensure replacement workers possess the right skills and experience to manage the loss of older workers.

List of acronyms

AESO	ALBERTA ELECTRIC SYSTEM OPERATOR
AMI	ADVANCED METERING INFRASTRUCTURE
BPP	BIOENERGY PRODUCER PROGRAM
C4SE	CENTRE FOR SPATIAL ECONOMICS
CLP	CLIMATE LEADERSHIP PLAN
EHRC	ELECTRICITY HUMAN RESOURCES CANADA
EI	EMPLOYMENT INSURANCE
GHG	GREENHOUSE GAS
ICT	INFORMATION AND COMMUNICATIONS TECHNOLOGY
IEA	INTERNATIONAL ELECTRICITY AGENCY
IT	INFORMATION TECHNOLOGY
MW	MEGAWATTS
NOC	NATIONAL OCCUPATIONAL CLASSIFICATION
PV	PHOTOVOLTAIC
RESA	RENEWABLE ELECTRICITY SUPPORT AGREEMENT
STEM	SCIENCE, TECHNOLOGY, ENGINEERING, MATHEMATICS AND COMPUTER SCIENCE

1

Bearspaw Facility, courtesy of TransAlta Corporation

A shifting environment

Government policies and regulations such as the *Climate Leadership Plan*, *Energy Efficiency Alberta Act* and *Renewable Electricity Act*, along with the mandatory, province-wide phase-out of coal-fired electricity generation, are driving change in Alberta's electricity and renewables sector. The sector must transition to lower-emission generation approaches to remain compliant while continuing to meet electricity demand.

In the move away from coal toward renewable energy sources, new skills, new technologies and increased automation will be required, with a direct impact on the workforce between now and 2030. Sector employers are preparing to transition the more than 3,000 workers who will be affected by these changes. Human resource management will play a significant role in supporting their efforts.

Recognizing the fundamental importance of human resources to the electricity and renewables sector, Electricity Human Resources Canada (EHRC) commissioned this study as part of its ongoing labour market information program, which has provided insight into the sector since 2004.

This report covers the next five years of change for more than 23 key occupations in Alberta's electricity sector. It provides new evidence about demographics, major investments and changes in labour markets, training programs and human resource management practices. It also serves as a call to action, supporting sector human resource management planning and building on EHRC's 2011 *Power in Motion* report by providing new information on best practices for transitioning workforces and insights into Alberta's growing renewable energy sector.

Specifically, this report covers:

- Employees and the workplace, including workforce demographics, trends, business lines, current training and future training needs, and use of contractors (Section 3)
- Workforce supply in Alberta, including enrollment trends, student recruitment, retention and graduation rates, transitions to the workforce, and trends and issues affecting workforce supply (Section 4)
- Recommendations to address key human resource issues (Section 5)

The findings presented here are drawn from surveys and interviews with key industry and education stakeholders, and from publically available government and academic literature and statistical data. The use of multiple lines of evidence ensures this report is comprehensive, robust and in line with the highly regarded earlier studies.

EHRC would like to thank the employers, trainers, educators and other stakeholders who contributed their time and expertise to make this study possible. This includes the 15 employers and seven educators who completed the survey, as well as the six employers and four educators who participated in stakeholder interviews (please see page 32).

Summerview Wind, courtesy of TransAlta Corporation

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Issues facing Alberta's electricity and renewable energy sector

2.A ALBERTA IN THE NATIONAL CONTEXT

A signatory to the Paris Agreement, Canada has demonstrated its commitment to deal with greenhouse gas (GHG) emissions through the *Pan-Canadian Framework on Clean Growth and Climate Change.*

The Framework, which provides a collective plan to grow the economy while reducing emissions and adapting to climate change, has four pillars: pricing carbon pollution; complementary measures to further reduce emissions across the economy; measures to adapt to the impacts of climate change and build resilience; and actions to accelerate innovation, support clean technology and create jobs. Together, these provide a foundation to foster innovation and adoption of clean technology.

The federal government has announced investments to achieve these goals, including $75 million to create the Clean Technology stream of Impact Canada as well as $200 million to support clean technology research, development and demonstration in the natural resources sector.

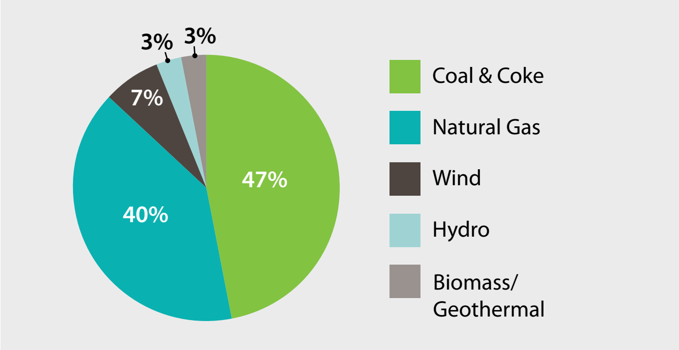
The provinces and territories have had the opportunity to build on the Framework and design tailored programs or policies to meet emissions targets within their jurisdictions. In this context, Alberta developed the Climate Leadership Plan (CLP). [7]

2.B ALBERTA'S CLIMATE LEADERSHIP PLAN

The CLP is a made-in-Alberta solution for diversifying the provincial economy that has a direct impact on the electricity and renewable energy sector. It puts a price on carbon emissions and calls for phasing out coal-fired power by 2030.[8] In place of coal, renewable power and cleaner energy sources (e.g., natural gas) will be adopted, with the target of having renewables make up 30% of Alberta's electricity production.[9]

Today, Alberta is the third largest producer of electricity in Canada, with a generating capacity of 16,602 megawatts (MW). Of that, 87% is produced from fossil fuels, 47% from coal and 40% from natural gas (Figure 2.1).[10] Only 13% of Alberta's energy production comes from renewables such as wind, hydro and biomass,[11] and the province's coal fleet is the largest in the country. In 2015, Alberta facilities were responsible for Canada's largest share of total GHG emissions (53%),[12] 9% of which was attributable to electricity generation.

FIGURE 2.1 – Electricity generation by fuel type (2016)



Source: National Energy Board. Provincial and Territorial Energy Profiles — Alberta. 2018.

Given this, the CLP presents an opportunity for the electricity sector to take a leading role in mitigating climate change and realizing a lower carbon future. It also provides a policy architecture to help the province transition to the future.

Other cornerstones of the CLP include reducing emissions from oil and gas operations in the province, particularly methane emissions; implementation of an energy efficiency and community-based energy program; investment in technology and innovation; and inclusion of Aboriginal Peoples.[13]

Why companies are converting

To facilitate the phase-out of coal generation, companies like TransAlta are converting coal-fired electricity generation plants to natural gas. The benefits include lower carbon intensity and emissions; lower operating and capital costs; and greater operating flexibility.[14] Conversion also gives employers the opportunity to redeploy their existing workforce into different positions within the organization.

TABLE 2.2 – Distribution of Coal-fired Units in Alberta

Coal Units, Owners and Associated Mines in Alberta

Federal regualtion of coal-fired emmissions (2016–2030)
- Coal-fired units meet performance standars at end-of-life (approx. 50 years) or shut down.

Alberta's action to phase-out coal-fired emissions (2030–2061)
- Zero pollution from coal-fired generation by 2030

Coal-fired generation unit and owner	Mine and Owner	Expected Closure Date
Keephills 3 Capital Power and TransAlta	Highvale TransAlta	2061
Genesee 3 Capital Power and TransAlta	Genesee Westmoreland Coal Company	2055
Genesee 1 Capital Power	Genesee Westmoreland Coal Company	2044
Sheerness 2 ATCO Power and TransAlta	Sheerness Westmoreland Coal Company	2040
Genesee 2 Capital Power	Genesee Westmoreland Coal Company	2039
Sheerness 1 ATCO Power and TransAlta	Sheerness Westmoreland Coal Company	2036
Keephills 2 TransAlta	Highvale TransAlta	2029
Keephills 1 TransAlta	Highvale TransAlta	2029
Battle River 5 ATCO Power	Paintearth and Vesta Westmoreland Coal Company	2029
Sundance 6 TransAlta	Highvale TransAlta	2029
Sundance 5 TransAlta	Highvale TransAlta	2028
Sundance 4 TransAlta	Highvale TransAlta	2027
Sundance 3 TransAlta	Highcale TransAlta	2026
Battle River 4 ATCO Power	Paintearth and Vesta Westmoreland Coal Company	2025
Sundance 2 TransAlta	Highvale TransAlta	2019
HR Milner Maxim Power	Coal Valley Westmoreland Coal Company	2019
Sundance 1 TransAlta	Highvale TransAlta	2019
Battle River 3 ATCO Power	Paintearth and Vesta Westmoreland Coal Company	2019

Focus of Alberta's action to zero emissions

LEGEND
Expected Closure Date
20XX
20XX

Export coal mines not used for electricity generation in Alberta: Not affected by phase-out of coal-fired emissions

Coal Valley Mine (Westermoreland) Hinton
Cardinal River Mine/Cheviot (Teck Coal) – Hinton
Grande Cache Coal Mine (Grande Cache Coal) – Grande Cache

* All facilities are required to meet air quality regulations and performance standards.

Source: Alberta Environment and Natural Resources (https://www.alberta.ca/climate-coal-electricity.aspx). It should be noted that the information in the chart is somewhat dated as some closures (2) have already occurred as of March 2018.

2.C THE TRANSITIONING OPERATING ENVIRONMENT AND SHIFT TO RENEWABLES

The CLP will require an adequate supply of new generation sources to maintain the reliable flow of electricity Albertans have historically relied on. The Government of Alberta is actively supporting the shift to lower-carbon generation with funding that will help the electricity sector adapt and integrate new technology and fuel types into the province's generation fleet.

Various statues and regulations that have been put in place to realize the CLP will have a direct impact on Alberta's generation fleet. These are summarized in Table 2.2 and include:

- The establishment of *Energy Efficiency Alberta* under the Energy Efficiency Alberta Act. Energy Efficient Alberta is a public agency tasked with raising public awareness of energy use and the resulting environmental consequences, designing and delivering energy-efficiency and energy-conservation programs, and promoting the development of micro-generation and small-scale energy systems in Alberta.[15]
- Amendments to Alberta's *Micro-generation Regulation*. These allow for small-scale production of electricity by individual homeowners, small businesses, and municipal or community buildings through renewable and alternative energy sources.
- The creation of the *Renewable Electricity Act*. In addition to setting the 30% renewables target by 2030, this act spawned the Renewable Electricity Program run by the Alberta Electric System Operator (AESO). To help Alberta add 5,000 MW of renewable energy capacity by 2030, the program will encourage development of renewable energy projects through a series of competitive tender processes.[16] Successful bidders will enter into a renewable electricity support agreement (RESA) with the AESO. The first tender process has significantly increased wind generation in the province: the successful bidders have committed to developing 600 megawatts of renewable electricity at a weighted average price of 3.7 cents per kilowatt-hour, the lowest renewable electricity pricing in Canada.[17]

Energy Efficiency Alberta and increased micro-generation will change consumers' relationship with the electricity sector, offering more choice of how to source electricity and better understanding of the consequences of electricity use.

Energy Efficiency Alberta's work will also have a commercial impact, as the Residential and Commercial Solar Program is expected to enable the creation of 900 new jobs in the province's solar sector by 2019.[18] That said, while programs exist to support renewable energy job creation, several electricity sector employers foresee an overall workforce reduction with the move to renewable generation because significantly fewer workers are required for many renewable energy generating facilities.

Another relevant renewable initiative arising out of the CLP budget is the Bioenergy Producer Program (BPP). The BPP was developed to support liquid biofuel production and stand-alone bio-power production for two-and-a-half years — with the aim of developing a self-supporting bioenergy industry in Alberta.[19] Financial support is provided only for bioenergy producers focused on reducing GHG emissions.[20] Bio-mass combustion, biogas electricity and heat, liquid biofuels, and wood pellets are all bioenergy sub-sectors eligible under the BPP.[21]

Coal-fired power retirements

There are 18 coal-fired electricity units currently operating in Alberta. Twelve are scheduled to close or convert to natural gas before 2030 (Table 2.3); two of these have already ceased operation as of March 2018. Three of the remaining six are export coal mines not affected by the phase-out, and the government will provide transition payments to the final three companies, which are slated to operate their coal-fired units beyond 2030.

In response to the phase-out, coal facilities are looking at retrofitting for gas-fired operations. They are unclear on the proportion of the workforce that will be retained and require retraining. (As noted previously, the Coal Transition Coalition estimates 3,000 workers affected by the coal transition.)

TABLE 2.3 – Climate Leadership Legislation Impacting the Electricity and Renewables Sector

Statute/Regulation	Implementation Date	Impact
Renewable Electricity Act and amendments to: • *Alberta Utilities Act* • *Electric Utilities Act* • *Environmental Protection and Enhancement Act* • *Hydro and Electric Energy Act*	March 31, 2017	• Target: 30% of electricity from renewable energy sources by 2030 • Establishment of the Renewable Electricity Program
Climate Leadership Act and *Climate Leadership Regulation*	January 1, 2017	• Establishment of carbon levy and approved exemptions, rebates and refunds
Micro-generation Regulation (amendment)	December 14, 2016	• Allows for micro-generation up to 5 MW and site aggregation
Energy Efficiency Alberta Act	October 27, 2016	• Support for energy efficiency, energy conservation, micro-generation and small-scale energy systems through education, outreach programs and the development of an energy-efficiency services industry

2.D SLOWLY GROWING DEMAND OVER THE LONG TERM

Economic growth is a key driver of long-term electricity demand, as industrial consumption affects production more than residential consumption. In Canada, electricity demand is forecasted to grow by 1% annually between 2014 and 2040, with the greatest increase coming from the industrial sector.[22]

Future electricity demand growth in Alberta will be gradual due to the economic downturn caused by reduced oil prices and the resulting decline in oil sands development. The recent increase in the price of oil, however, may signal a recovery in the oil and gas sector and contribute to increased economic growth going forward. The "reference case scenario" in AESO's 2017 long-term outlook suggests Alberta's electricity demand will grow at an annual rate of 0.9% until 2037.[23] This assumes a significant shift in generation from 47% coal and 13% renewables[24] to 63% natural gas and 37% renewables.

2.E EMERGING TECHNOLOGY AND AUTOMATION

Alberta's electricity sector has not undergone significant technological changes in recent years despite initiatives to maximize efficiency. Technologies introduced to date have had minimal impact on operations or employees apart from increasing the need for training. Sector employers, however, anticipate the use of drones and other emerging technologies will grow with the transition away from coal and a shift to more distributed (i.e., decentralized) power generation. Key technological changes that *will* influence the future direction of the sector and its associated labour requirements are summarized below.

Distributed generation

Increased reliance on solar power and micro-generation are both anticipated for Alberta, with corresponding focus on electricity and battery storage. Electricity sector employers expect to see more community and residential generation, especially through solar roof-top panels, as well as larger industrial businesses and cities taking care of a significant proportion of their own power needs. Emerging customer preferences will also shape the sector by driving product development and service offerings.

Smart grids

Smart grids build on and further develop existing electricity grids by incorporating digital technologies that enable communication between utilities and their customers, and allow for real-time monitoring of transmission lines.[25] They also help electricity systems make better use of renewable energy. Unlike traditional grids, which are designed for unidirectional power flows, smart grids manage power from multiple sources.[26] In Alberta, smart grids have supported the deployment of advanced metering infrastructure (AMI), demand response and self-healing grids.[27]

- AMI allows for two-way communication between smart meters and utility companies. This provides real-time data on power consumption, supports outage management, opens up new rate options, enhances electricity system loss detection, and enables linkages to in-home displays and energy management systems.
- Demand response seeks to adjust *demand* for power rather than supply. (Adjusting supply is the traditional approach and of limited efficiency.) Demand response is implemented either through a direct load control (instructional signal) sent by the utility or system operator to a customer, or through an indirect control (price signal) sent to a customer.[28]
- Self-healing grids use communication diagnostics to locate problems in the electrical grid and safely re-energize and re-connect affected areas with other parts of the grid.[29]

Smart grid technology allows for automated pre-defined load-shedding strategies, such as signals sent to cause electrical power-using devices to be turned off during periods of high demand.[30]

In 2011, the Alberta Utilities Commission released an official inquiry into smart grid technology, outlining smart grid deployment in Alberta and policy implications.[31] Five principles for the development of smart grid policies emerged from this work, including the need for policies to:

1. Be clear and well defined prior to mandating smart grid investments
2. Maintain and enhance quality electricity services
3. Support competitive generation and not create competitive advantages for one group of market participants
4. Require technology to pass a cost-benefit test to prevent unnecessary rate increases
5. Support competitive market forces in implementation of smart grid technology in Alberta[32]

The Future Smart Grid Technologies Lab at the University of Alberta Electrical and Computer Engineering Department is slated to begin operations in 2018. The lab, funded by the Canada Foundation for Innovation, will test prototype smart grid technology.[33]

Electric vehicles

The cities of Calgary and Edmonton are developing strategies to support electric vehicle use in their respective municipalities and to establish a provincial electric vehicle charging network. Electric vehicles help reduce transportation-related GHG emissions, which grew 2.5% per year between 2010 and 2015, according to the International Electricity Agency, and accounted for just under one-quarter of Canada's total GHG emissions in 2014.[34]

Alberta's use of electrical vehicles is lower than that of other provinces. In 2016, there were more than 22,700 electric vehicles and 3,694 charging stations in Canada, yet there are only about 1,000 electrical vehicles currently on the road in Alberta.[35,36] Electric vehicles made up just 2% of new vehicle sales in Alberta in 2015, with an average of 168 public chargers per million registered vehicles. That said, demand for electric vehicles[37] is growing.

As part of its electric vehicle strategy, Calgary is working with other regional economic development zones to extend the range of e-vehicles by creating a network of 15 to 20 fast-charging stations across southern Alberta.[38]

The adoption of electric vehicles is also being supported through Alberta Infrastructure's Green Building Standards, which encourage the installation of charging stations in new builds as part of the Leadership in Energy and Environmental Design (LEED) rating system. LEED provides credits for installing charging stations, which both encourages the growing electric vehicle market and helps avoid expensive retrofits.[39]

Battery storage

Battery storage can be used to provide a large amount of power to the grid relatively quickly (i.e., as a generator) and also to manage peak load by injecting a steady amount of power into the grid for an extended period to address changes in energy demand.[40]

Growing demand for electric vehicles and consumer electronics is driving advancements in battery storage, making such storage increasingly viable as a replacement for conventional power generation and managing peak load.[41] Since 2014, the cost of producing a lithium-ion battery has dropped by almost half, increasing the viability and applicability of battery storage systems.[42] Improvements in battery storage technology have implications for renewable energy integration: combining solar energy with battery storage, for instance, could allow households to consume their own power on demand.[43]

At the Alberta Energy Storage 101 Symposium sponsored by Alberta Innovates, stakeholders indicated battery storage was critical to the development and viability of renewable energy sources: as solar and wind power are intermittent, energy storage becomes crucial. Researchers expect global installed energy storage for the grid and ancillary services power capacity to grow from 538 megawatts in 2014 to 21 gigawatts by 2024.[44]

LED lighting

LED light bulbs use an average of 70% to 90% less energy than traditional incandescent light bulbs and last up to 15 years.[45] Their energy efficiency has prompted federal, provincial and territorial governments to implement various retrofitting programs aimed at reducing consumption. The Municipal Climate Change Action Centre is one example. A partnership between the Government of Alberta, the Alberta Association of Municipal Districts and Counties, and the Alberta Urban Municipalities Association, it provides funding, technical assistance and education to support Alberta municipalities in addressing climate change — including funding municipal installations of solar photovoltaics and energy audits/plans for non-profit organizations.

Today, between 10% and 20% of Alberta's electricity demand is for lighting, yet roughly two-thirds of Alberta households do not have any LED lights.[46]

Automation

The majority of tasks associated with key occupations in Alberta's electricity sector have not been automated, although certain roles — such as power systems operators and information systems analysts — have seen a 24% to 30% increase in automation from 2011 to 2017. Table 2.4 shows the percentage of automation associated with tasks for key electricity sector occupations over that period along with the percentage of change.

Where automation has occurred, it has more commonly resulted in redeployment of a small proportion of the workforce to other roles within the organization rather than layoffs.

While automation has not significantly or negatively affected Alberta's electricity sector workforce to date, employers expect there will be impacts with the move away from labour-intensive coal generation to renewable energy and new technologies.

Almost all stakeholders consulted as part of this study felt the pace of technology adoption will increase substantially in the next five years (compared to the previous five) with the move to new energy sources. Respondents also said technology and information management present considerable challenges for employers, including hiring and retaining individuals who are specialists in cybersecurity or systems protection — skillsets that are critical to maintaining a stable and secure energy supply.

TABLE 2.4 – Automation of Tasks by Position, 2011, 2017

Position	2011	2017	% Change
Power Systems Operators	10%	40%	30%
Information Systems Analysts and Consultants	8%	33%	24%
Civil and other Engineers	10%	20%	10%
Wind Technicians	10%	20%	10%
Smart Grid Specialists	20%	30%	10%
Electrical and Electronics Engineers	15%	23%	8%
Mechanical Engineers	15%	23%	8%
Electrical and Electronics Engineering Technologists and Technicians	8%	15%	7%
Mechanical Engineering Technologists and Technicians	8%	15%	7%
Civil and other Engineering Technologists and Technicians	8%	15%	7%
Radiation Technicians	8%	15%	7%
Supervisors of Electricians & Supervisors of Electrical Power Line Workers	5%	10%	5%
Construction Managers	5%	10%	5%
Electrical Power Line Workers	0%	5%	5%
Engineering Managers	13%	18%	5%
Power Station Operators	10%	15%	5%
Construction Electricians	10%	15%	5%
Industrial Electricians	10%	15%	5%
Welders	10%	15%	5%
Utilities Managers (e.g. Electric Power Plant Manager)	5%	8%	3%
Millwrights or Industrial Mechanics	10%	10%	0%
Electrical Mechanics	10%	10%	0%

Source: Survey of Alberta Electricity Employers 2017

Drone technology

Utilities in many countries are making increasing use of drone technology. Of electricity sector employers surveyed, 13% said they had significantly increased their use of drone technology in the past five years, and 7% said their drone use had increased marginally — primarily for inspections, patrolling and troubleshooting[47] to minimize losses from faults and outages and to minimize risks to personnel.[48, 49, 50, 51, 52] The first recorded pipeline and power line inspection using drone technology took place in Alberta in early 2017.[53]

Survey respondents said use of drone technology was not associated with any specific occupation, as several occupational groups could be required to generate or interpret drone data. Information technology (IT) teams were also seen to play a role in supporting the deployment and use of drone technology.

2.F BEST PRACTICES FOR WORKFORCE TRANSITION

As mentioned previously, more than 3,000 Alberta workers may be affected by the phase-out of coal-fired electricity generation and increased automation.[54] Employers are preparing to transition their workforces in a number of ways, including supporting employees' pursuits of dual certification, and cross-training or upskilling workers to enable redeployment either within their own organizations or into the external marketplace. The reality is coal requires more labour than gas and renewable generation, meaning not all workers will be able to transition within the sector. In some organizations, initiatives for work transition have been formalized through transition teams, and many employee assistance programs exist to support workers and their families. Employers also envision early retirement incentives and job-sharing will assist with worker transition.

Uncertainty around the transition has already increased worker attrition and prompted early departures. In unionized working environments, this is especially prevalent among younger workers who have the least seniority and anticipate not being retained should layoffs occur. Over the next five years, unionized workplaces will lose retiring workers as well.

Employers expect workers with highly specialized or less-transferable skills to be most affected by the transition. The many consultants and independent contractors serving coal-fired operations will also be affected deeply, as they do not have employer supports.

To ensure fairness and the political success of climate change initiatives, the Coal Transition Coalition has developed *Getting It Right: A Just Transition Strategy for Alberta's Coal Workers*, which highlights best practices for transitioning workers used successfully by other jurisdictions and sectors.

The following subsections review several of these best practices and the government actions required to implement them.

Redeploying workers to other jobs

Redeploying workers protects the investments employers have already made in them and retains the institutional knowledge they have accumulated over time.[55] Having a clear redeployment assessment process that considers seniority and skills requirements is essential to reassigning displaced workers.[56, 57]

According to best practices, workers affected by transition would have job guarantees and the right of first refusal on positions available at the plant where they currently work (if that plant is converting to an alternative fuel source such as natural gas).[58] Preferential hiring in the same or a related sector should also be available, with support for training and upskilling.[59] Relocation assistance should be offered to offset costs for workers who are prepared to move for a new job.[60]

GOVERNMENT ACTIONS

The Government of Alberta will provide transition payments to three companies that had intended to operate coal-fired units beyond 2030, and has reached agreements with employers affected by the phase-out to ensure they keep their head offices in Alberta and continue to generate power for the province's electricity market.[61]

Education, training and career counselling

Targeted training and apprenticeships for displaced workers can be helpful supports through times of transition.[62, 63] They also reduce the costs of severance for employers.[64] Education and training programs should be partly facilitated by employers and unions and made accessible as early as possible, even while workers are still employed.[65] They should be relevant to the current job market and coordinated with economic and environmental/climate policies, with coverage of tuition and related expenses.[66] Once workers are retrained, organizations can leverage their new skills to improve productivity.[67]

GOVERNMENT ACTIONS

To help workers access education and training programs, the Government of Alberta will provide:

- Tuition vouchers covering the cost of post-secondary education
- Third-party retraining programs that provide job placement, job matching and options for work exposure
- Access to professional certification courses[68]
- Alberta electricity sector employers also have access to the Canada-Alberta Job Grant, a cost-shared, employer-driven program for training new and existing employees to meet the skill needs of the changing economy.[69]

Providing financial support for transitions to work or retirement

This can include transitional allowances or income security to help affected workers maintain their quality of life while they transition to new employment.[70, 71] It can also include pension-bridging: financial assistance for a few years to bridge the gap between the end of employment and activation of pension benefits.[72]

GOVERNMENT ACTIONS

The Government of Alberta has established a $40 million Coal Workforce Transition Fund to provide financial assistance to laid-off workers, and has worked to ensure power companies fulfill existing and future legal obligations to affected employees, including severance and pension obligations.[73]

Supporting communities

The phase-out of coal will affect communities where the sector is a major source of employment, causing a decline in spending and lower revenues for government and local businesses. Best practices suggest the government should provide timely information about policies that could affect the local workforce, study local economic activity — including opportunities for growth — and make strategic investments in affected communities.[74] For example, these communities should take priority where infrastructure projects are concerned.[75]

The benefit agreements First Nation communities have with employers and the government should be re-examined, with funding provided for labour force assessments to develop a specific First Nation Training and Employment Strategy.[76]

GOVERNMENT ACTIONS

The Government of Alberta has established the Coal Community Transition Fund to support community economic development initiatives that facilitate the transition away from economic dependence on coal-fired electricity generation.[77]

Coordinating programs and services

Coordinated programming ensures the right mix of programs and services is available to displaced workers. It helps avoid situations where people are stranded in "in-between states" — for example, where one program offers one thing that's needed and another something else, but with no way to combine or bridge the programs.[78] Achieving this level of coordination for workers and communities alike requires early planning.[79, 80]

The Advisory Panel on Coal Communities recommends coordinating provincial and federal programs to reduce service gaps and develop an industry-wide strategy.[81] Stakeholders surveyed for this current report also called for the government to study:

- Effective practices for worker and community transition
- Supply and demand for occupations and skills in each affected community, identifying gaps to be filled
- How the qualifications of affected workers align (or not) with high-demand employment opportunity occupations in each affected region[82]

GOVERNMENT ACTIONS

The Government of Alberta has made resources and services available through a dedicated website (www.alberta.ca/support-for-coal-workers.apx). Facilitators with Alberta Labour will also be assigned to connect affected workers, their unions and employers to available supports.

Securing contributions from employers and government

To realize its energy and climate policy goals, Alberta must actively support the transition of workers into clean energy occupations. [83] Other jurisdictions have tackled this requirement in various ways. Australia, for example, created an independent statutory authority responsible for navigating and managing the worker and energy transition.[84]

To support this best practice, the Alberta government may work to define the respective roles of the province, the federal government and industry in the transition process. These should be communicated by executing a clear and effective communication strategy. [85]

Further, barriers in EI rules that prevent workers from accessing training and assistance programs should be removed, with eligibility extended to all displaced workers regardless of their EI eligibility, including ineligibility due to severance.[86]

For their parts, employers and unions need to ensure workers are redeployed where possible, and that educational and training programs are available to assist workers who are redeployed or searching for new employment.

GOVERNMENT ACTIONS

The Government of Alberta has reached agreements with employers and committed transition payments to ensure employers stay in the electricity generation sector and convert plants to natural gas. The province has also petitioned the federal government to immediately create new flexibility criteria in the federal EI program so workers can receive income supports without reduced EI payments, and to extend the duration of EI benefits for coal workers transitioning to new employment.[87]

St. Mary Facility, courtesy of TransAlta Corporation

3

Portrait of the workforce

The information in this section comes from multiple sources, including Statistics Canada data, key informant interviews and a survey of electricity sector employers in Alberta, who provided perspective on workforce size and composition.

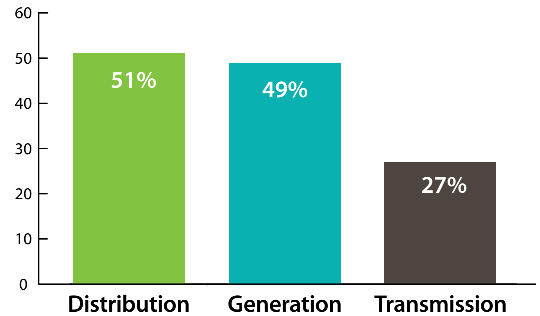
3.A ALBERTA'S ELECTRICITY SECTOR

The Alberta electricity system is complex, made up of some 230 organizations involved in power generation, transmission and distribution. Generation uses many sources, including coal, gas (simple cycle, combined cycle and cogeneration), hydro, wind, biomass and solar.

As of 2018, roughly 40 energy providers had operations in Alberta. Most operate at the provincial or local/municipal level, although some are national or international. The main business lines of provincial energy operators were determined through publically available documentation and confirmed through survey responses where available (Figure 3.1).

The electricity sector accounted for 0.4% of Alberta's employment in 2016. It is part of the overall utilities sector, which includes natural gas distribution as well as water, sewer and irrigation systems, and which is expected to grow between 2017 and 2021 by 2.1%.[88]

FIGURE 3.1 – Business lines of Alberta electricity sector employers[89]

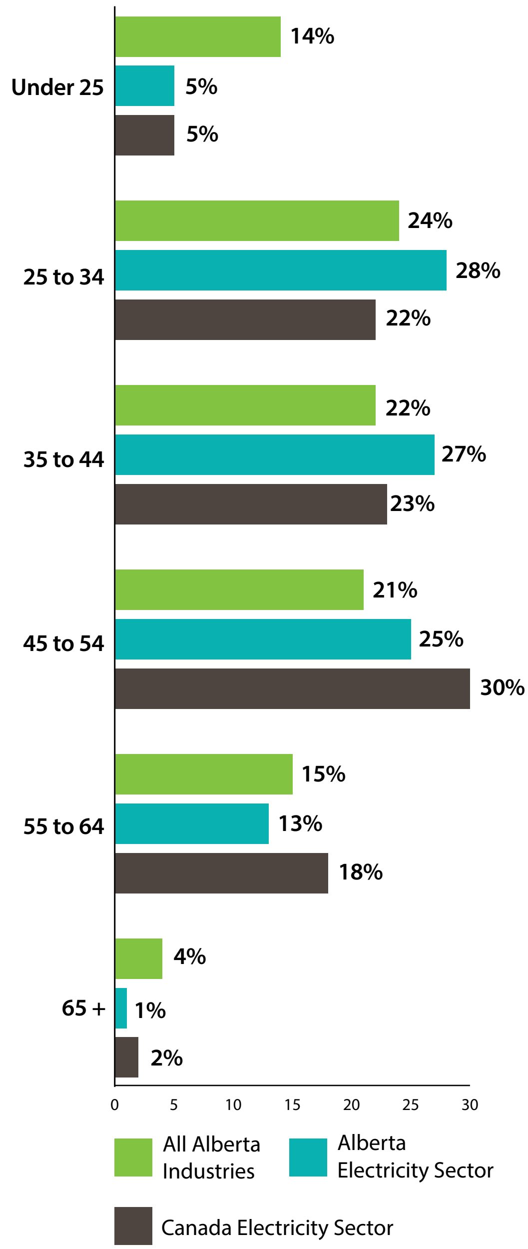


Source: EHRC Survey of Alberta Electricity Employers 2017

3.B WORKFORCE AT A GLANCE

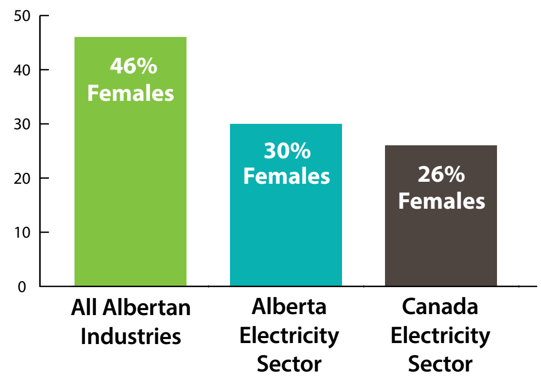
More than 13,000 people work in Alberta's electric power generation transmission and distribution industry. While workers' overall age distribution resembles other Albertan industries, the sector has disproportionately fewer under the age of 25 — just 5% compared to 14% for all industries in the province (Figure 3.2). That said, Alberta's electricity workforce is younger than the national average for the sector, with only 39% of its workers older than 45, compared to 50% across Canada as a whole.

FIGURE 3.2 – Age Distribution



Source: 2016 Census of Population – Labour. Catalogue number 98-400-X2016287.

FIGURE 3.3 – Female Representation



Source: 2016 Census of Population – Labour. Catalogue number 98-400-X2016287.

The low proportion of younger workers is potentially attributable to relatively limited use of apprenticeship in the system. Despite research from the Canadian Apprenticeship Forum indicating employers realize a net return on $1.47 for each dollar invested in apprenticeship[90], stakeholders interviewed said apprenticeship was used only modestly in Alberta's electricity sector.

On the whole, women are under-represented in the sector, making up 30% of the province's electricity labour force compared to 46% of all Albertan industries (Figure 3.3). That 30%, however, is higher than the electricity sector's national average of 26%.

The contract workforce

Based on data provided by sector employers, an estimated 22% of workers are either contractors (19%) or consultants (3%). Contract workers are most commonly hired for information technology (IT) or information and communications technology (ICT) functions, as well as for facility service, maintenance and new construction (e.g., trades and engineers) (Figure 3.4).

Over the next five years, the majority of employers expect the use of contractors and consultants to remain the same (67%), while 13% expect an increase and 2% expect a decrease.

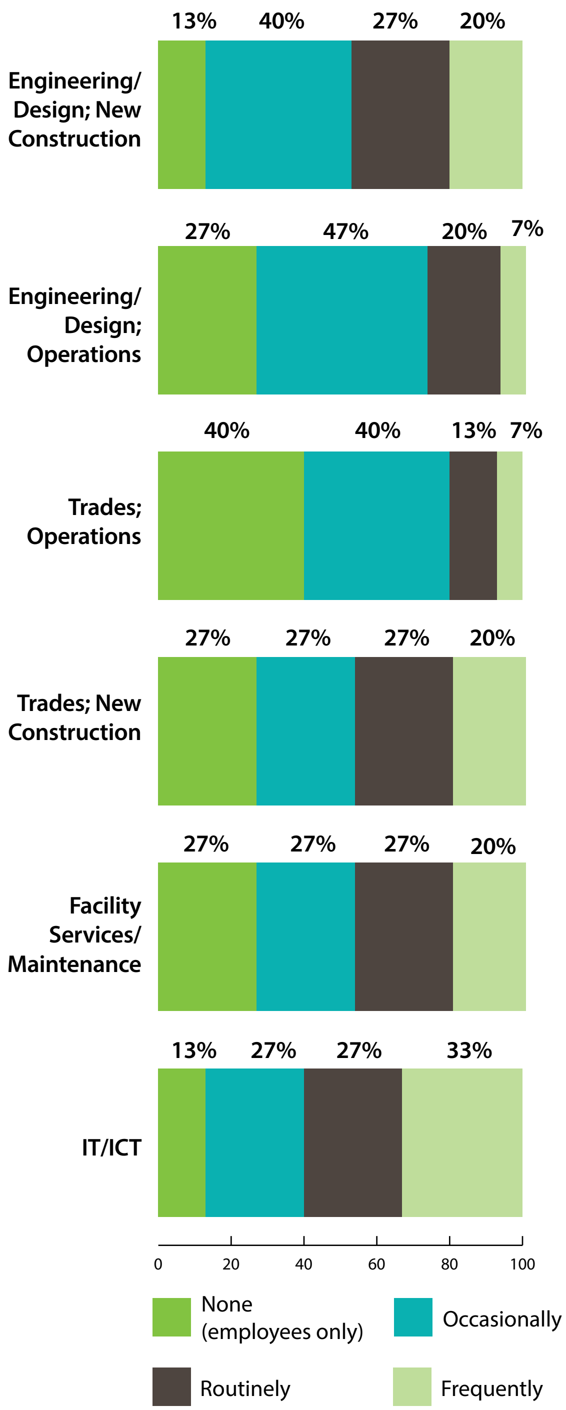
By headcount, large employers hire more contractors and consultants than small companies. However, small companies hire contractors and consultants in a higher proportion (Table 3.1).

TABLE 3.1 – Utilization of Contractors or Consultants by Size of Employer

Firm Size	Average Number of Contractors and Consultants	Average Proportion of Work Force
Small	4	26%
Medium	25	12%
Large	324	20%

Source: EHRC Survey of Alberta Electricity Employers 2017. Note: Firm size based on number of employees.

FIGURE 3.4 – Utilization of Contractors or Consultants in the Alberta Electricity Industry



Source: Survey of Alberta Electricity Employers 2017

3.C KEY TRENDS

Diversity hiring

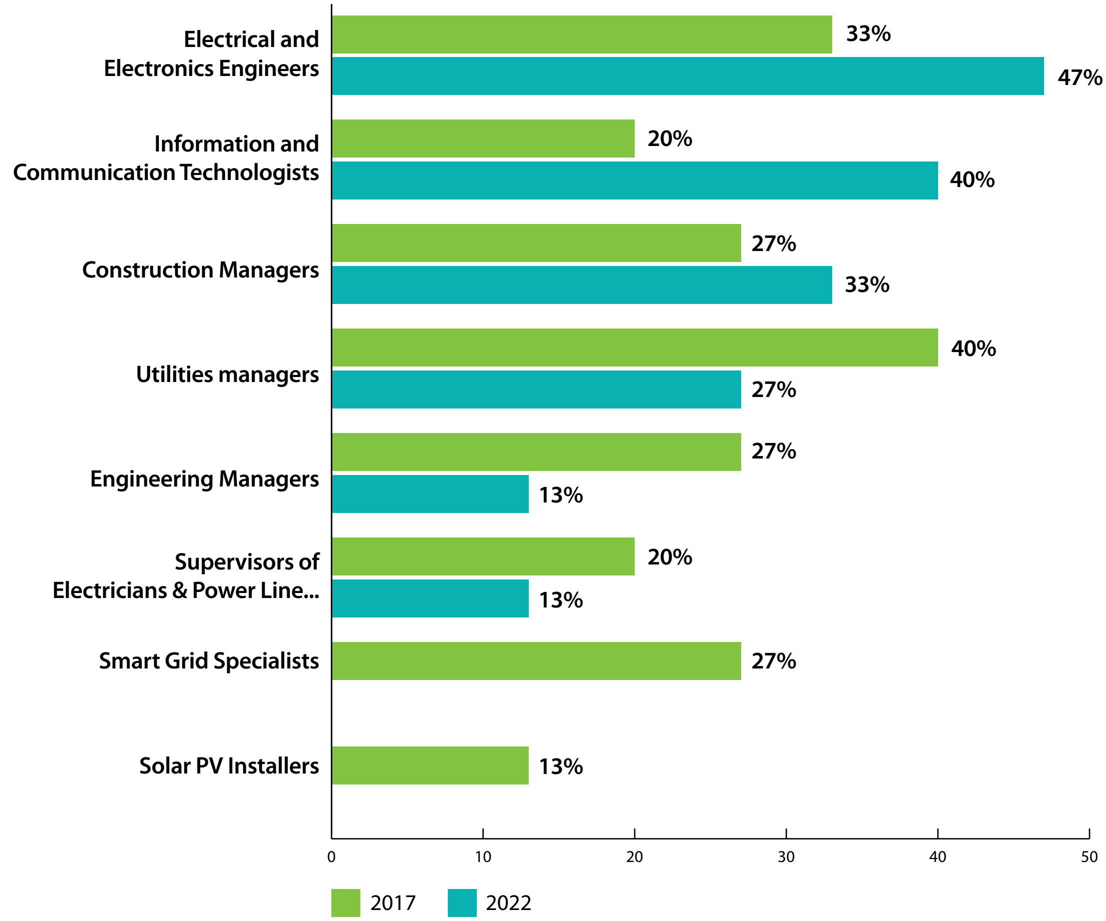
While only 20% electricity sector employers surveyed have or are working on formal diversity strategies or plans, many are working to ensure gender and minority diversity representation through a wide range of recruitment initiatives, including oversight committees, diversity censuses, diversity inclusion plans and strategies, and student workplace experience opportunities. Given the expected competition for workers as Alberta's economy recovers, electricity sector employers will need to incorporate strategies to increase participation by equity groups.

Recruitment, retention and turnover

Employers in the electricity sector tend to develop workforce competencies internally, except when new skills are required due to retirement, attrition or succession — in which cases, they have recruitment strategies to support hiring. These include job fairs, social media and capitalizing on their companies' brand reputations. The sector in Alberta has had little problem attracting workers historically, as it is viewed as stable and well paid, although it has encountered challenges with attraction and retention when other industries are also competing for talent. Employers in the sector compete for talent with other utility companies, oil and gas companies, the construction industry, and contractors and consultants.

More recently, with the downturn in the oil and gas sector (and the economy overall), it has been easier to attract and retain talent to electricity. In future, employers anticipate interest in renewable energy will attract new employees to the sector.

FIGURE 3.5 – Level of Difficulty to Fill Vacancies, 2017 and 2022



Source: Survey of Alberta Electricity Employers 2017

Recruitment challenges

When sector employers do face challenges recruiting, these tend to relate to finding workers with relevant experience in emerging technologies like smart grids or for highly technical roles (e.g., cybersecurity). Other challenge areas include hiring experienced tradespeople who are willing to relocate to rural or remote areas, and hiring workers to fill highly specialized roles (e.g., first-class power engineers, control center operators).

The hardest positions for employers to fill in 2017 were manager, solar photovoltaic (PV) installer, smart grid specialist and information and communication technology (ICT) roles. These are expected to be less difficult to fill by 2022 — with the exception of ICT positions. Challenges finding electrical and electronics engineers, construction managers and information and communication technologists are expected to increase. Employers have reported that cybersecurity experts and other IT specialist roles related to the grid and market systems have been and will continue to be difficult to fill as a result of broader competition for these skills from employers outside the electricity sector (Figure 3.5).

Hiring internationally trained workers

To fill positions, a number of electricity sector employers have hired internationally trained workers for expert positions from various locations. This supports diversity initiatives, brings new skillsets to the workplace and provides an important source of labour for smaller start-up companies.

Hiring internationally trained workers is anticipated to continue as the industry transitions to renewable generation, requiring more specialized skills and experience.

Retention

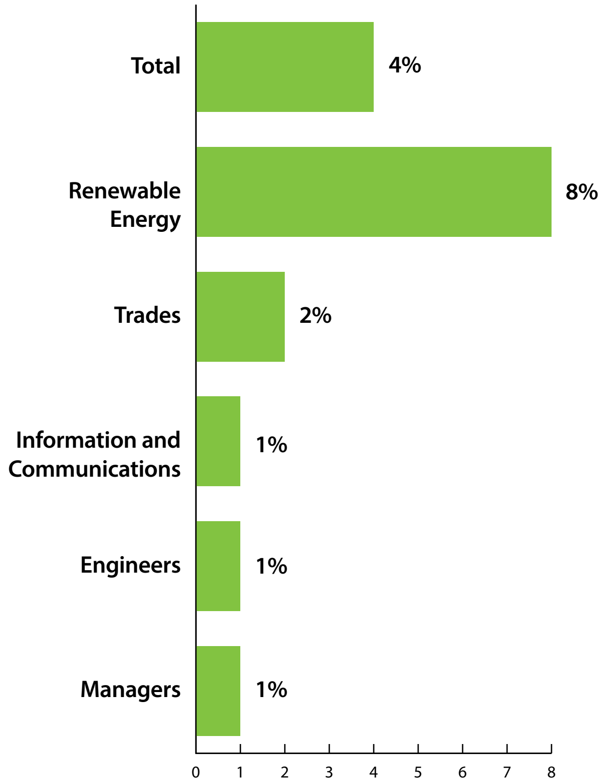
Due to the most recent economic downturn and resulting low worker turnover, employers have focused on retention rather than recruitment: promoting worker wellness, work-life balance, flexible benefit packages and flexible work schedules.

Among employers surveyed who reported voluntary separations (i.e., workers choosing to leave jobs), the total average voluntary separation rate was 4% and was highest for renewable energy jobs (8%) (Figure 3.6).

Training (current)

Employers are identifying new and emerging competency requirements and building internal talent to meet future workforce needs. In-house training is provided to reduce competency gaps, support career laddering or redeploy workers. Staff are trained through formalized courses, job shadowing, mentoring, project-based learning and cross-training. Depending on the organization, talent is also supported with leadership training and soft skills development, along with post-secondary education and apprenticeship opportunities (including dual tickets in the trades).

FIGURE 3.6 – Alberta Electricity Industry Voluntary Separation Rate



Source: Survey of Alberta Electricity Employers 2017

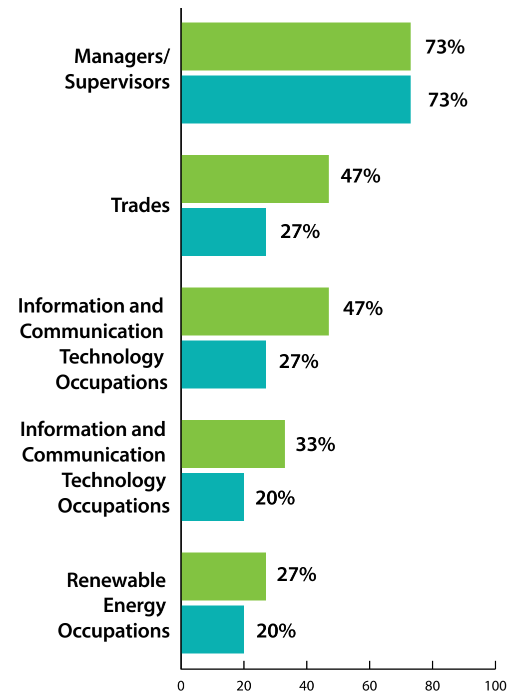
Apprenticeship support

Employers' organizational approaches to apprenticeship vary. Some sponsor apprentices while others do not. In some organizations, formal training centres exist to deliver apprenticeship programs. In others, unionization or organization size (e.g., small employers) make it difficult to bring in new employees as apprentices. Those investing in apprenticeship find the return in retention and increased job competency make it worthwhile. As noted previously, research competed by the Canadian Apprenticeship Forum suggests there is a net positive return to employers for investment in apprentices.

Future training needs

Stakeholders interviewed as part of this study said the increasing use of renewable energy, incorporation of micro generation into the grid and growth in the interrelationships between generation, transmission and distribution will require new skills of energy workers. It is expected that as utilities shift from being sole providers of electricity to "energy service companies" there will be a commensurate increase in the need for employees to have soft skills that include communication, team building, problem solving and other customer-facing skills.

FIGURE 3.7 – Succession Planning/Knowledge Transfer Among Alberta Electricity Industry Employers



Source: Survey of Alberta Electricity Employers 2017

Succession planning and knowledge transfer

Based on the employer survey conducted for this report, the current rate of retirement in Alberta's electricity sector organizations averages 2%. That is expected to rise to 2.5% in 2019 and 6.2% in 2022. Most employers surveyed (87%) said they did not have early retirement programs or other incentives in place to alter retirement patterns for their organization.

Related to retirements is the need for knowledge transfer, which typically occurs informally through crossovers between existing and new employees (although in the electricity sector, industry requirements impose standard operating procedures for many roles, which can minimize the need for extensive knowledge transfer). Succession and knowledge transfer plans are more commonly in place for managers and supervisors than for other occupations. For management roles, corporations are completing talent assessments with internal staff and implementing development plans for high-performing employees to address succession. Figure 3.7 shows the share of survey respondents who currently have succession planning and knowledge transfer procedures in place.

Summerview Wind, courtesy of TransAlta Corporation

4

Workforce supply

The data in this section come from Statistics Canada, survey findings and key informant interviews with colleges and universities in Alberta. Post-secondary institution representatives provided information on enrolments, graduations, student recruitment and programming related to electrical power systems.

4.A POST-SECONDARY EDUCATION IN ALBERTA

The electricity and renewables sector workforce is tied directly to the following three streams of post-secondary education:

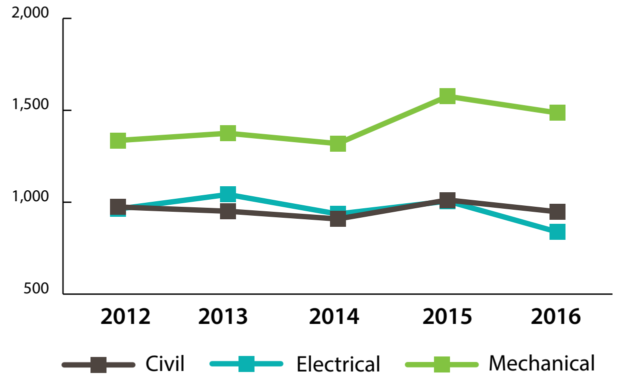
- Undergraduate and graduate programs in engineering
- College programs for engineering technicians and technologists
- Apprenticeships

Engineering

Engineering degrees directly related to the electricity and renewables sector in Alberta (NOC 2131, 2132, 2133) are four-year degree programs available at the University of Alberta and the University of Calgary. These programs can include co-op or internship placements. Post-graduate courses (i.e., master and doctoral degrees) available at these institutions contribute to the electricity and renewables sector as well, particularly for those interested in pursuing research.

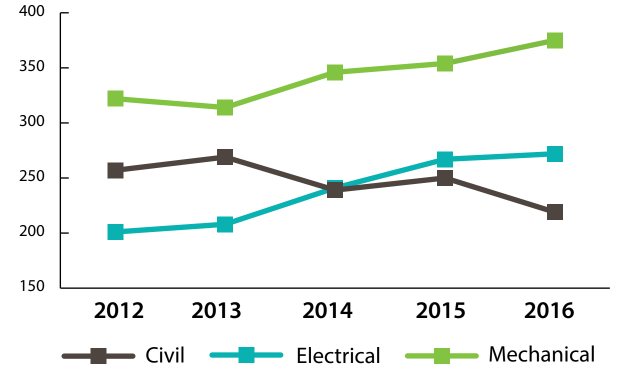
Figure 4.1a shows enrolments in accredited engineering programs by related discipline between 2012 and 2016. Figure 4.1b presents the total number of undergraduate degrees awarded by Alberta's accredited engineering programs in those disciplines across the same time period.

FIGURE 4.1A – Enrolment in Accredited Engineering Programs by Related Discipline in Alberta, 2012 to 2016



Source: Engineers Canada

FIGURE 4.1B – Total Undergraduate Degrees Awarded in Alberta by Discipline, 2012-2016

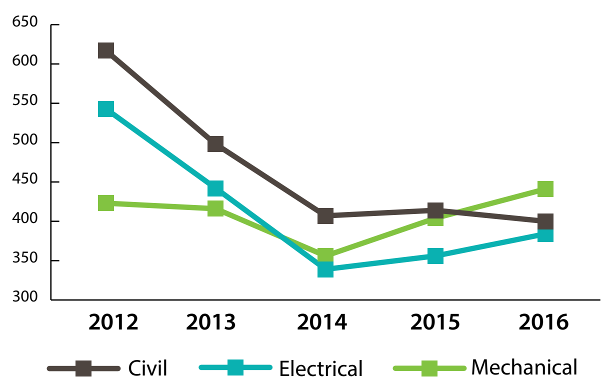


Source: Engineers Canada

The charts above show relative consistency in undergraduate enrolment and graduation across the three key disciplines, with small increases in mechanical engineering and a minor decline in civil engineering. Electrical engineering has seen a small enrolment decline but an increase in degrees awarded.

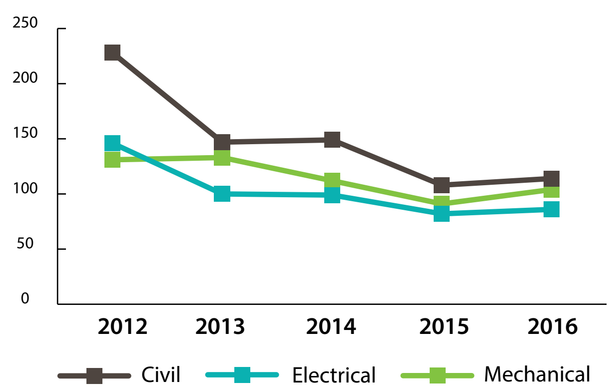
When compared to undergraduate programs, post-graduate enrolment figures declined more notably between 2012 and 2014 (Figure 4.2a). In line with this decrease, the number of post-graduate degrees awarded also declined (Figure 4.2b).

FIGURE 4.2A – Total FTE Postgraduate Student Enrolment by Discipline in Alberta, 2012 to 2016



Source: Engineers Canada

FIGURE 4.2B – Total Postgraduate Degrees Awarded (Master's and Doctorate) in Alberta by Discipline, 2012 to 2016



Source: Engineers Canada

Skilled trades

Skilled tradespeople working in the electricity and renewables sector require a range of education and training. Engineering technicians (NOC 2231, 2232, 2241) are required to complete a two-year diploma program, while other skilled trades, such as solar PV installers (NOC 7441), require a two-year diploma or its equivalent in training and experience. Other related trades, such as power engineers (NOC 9241), require certification as opposed to a diploma or degree. Diploma and certification courses are offered at different colleges in Alberta.

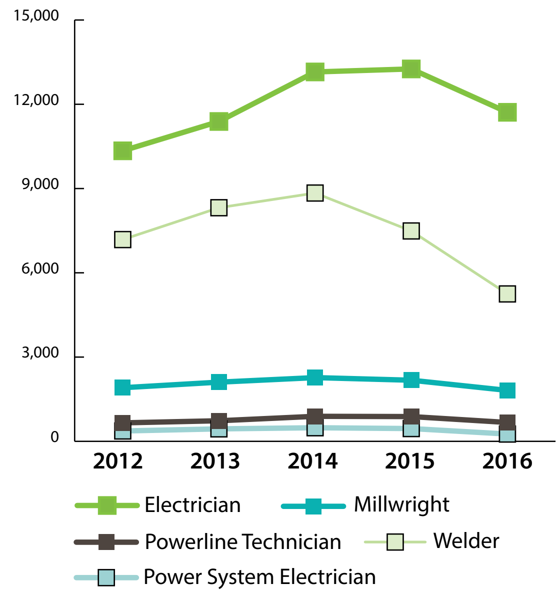
Apprenticeships

Five sector-related trades offer apprenticeships in Alberta: electrician (NOC 7241, 7242), millwright (NOC 7311), powerline technician (NOC 7244), power system electrician (NOC 7243) and welder (NOC 7237). Each involves a four-year program (three years for welders) of between 1,350 and 1,560 hours of on-the-job training per year,[90] along with seven to 12 weeks of technical training per year. These programs have standard minimum requirements for entrance. High school students can begin to earn credits towards an apprenticeship while still in secondary education through the Registered Apprenticeship Program (RAP).[91]

Figure 4.3a shows the total number of apprentices registered by trade in Alberta as at December 31 of each year. Table 4.3b indicates the number of completed apprenticeships and number of individuals issued qualification or occupation certificates.

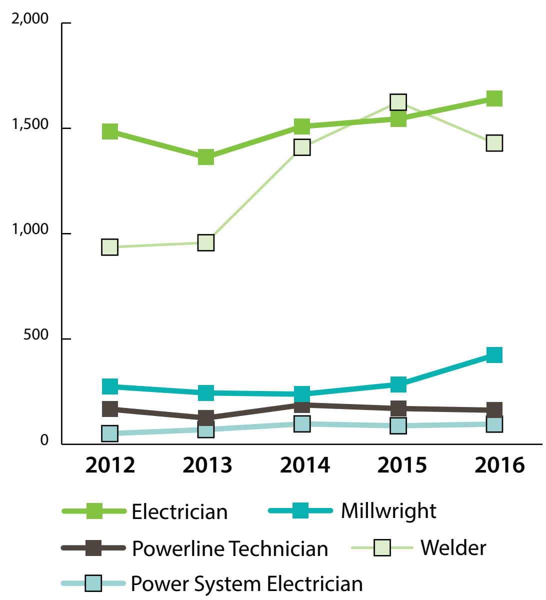
As noted previously, the use of apprenticeship in Alberta's electricity sector is limited. Figure 4.3a suggests little change in the number of apprentices in electricity-specific occupations. For example, there was a 0.02% increase in the number of registered power line technician apprentices from 2012 to 2016. Employers have yet to increase apprenticeships to meet future hiring requirements due to the large number of retirements projected for the system.

FIGURE 4.3A – Apprentices Registered by Trade in Alberta, 2012 to 2016



Source: Alberta Advanced Education

FIGURE 4.3B – Completed Apprenticeships with Individuals Issued Qualification or Occupation Certificates, 2012 to 2016



Source: Alberta Advanced Education

While power line technician apprenticeships have seen a slight overall increase, those for millwrights, power system electricians and welders all had fewer registered apprentices between 2012 and 2016. Figure 4.3b shows an increase in the number of completed apprenticeships (i.e., individuals issued qualification or occupation certificates) in related electricity and renewable sector trades between 2012 and 2016. This would suggest that, while there are fewer apprenticeships being undertaken, more are being completed.

4.B SUPPLY TRENDS

Student recruitment

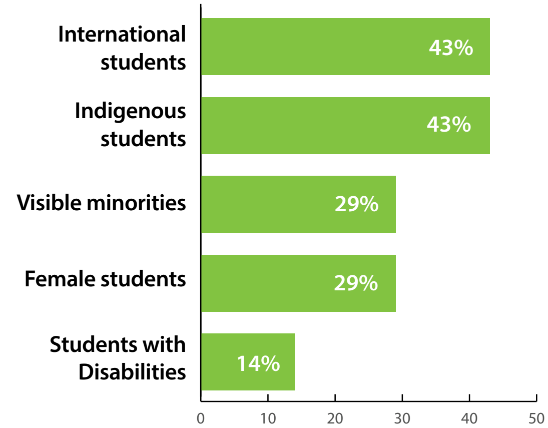
There are generally no specific outreach strategies for attracting students to electricity and renewable energy programs: outreach is conducted for institutions overall. A minority of educational institutions reported outreach strategies targeted at students from under-represented segments of the population (Figure 4.4). Formal recruitment strategies were most commonly in place for international and Indigenous students compared to other groups.

Student enrollment, retention and graduation trends

Enrollment in electricity stream programming in Alberta has generally stayed the same or increased, driven by institutions' efforts to promote programming and job opportunities on the other side of graduation. Given this, there is a correlation between the availability of apprenticeship programming, internships and enrollment rates, although enrollment is determined mostly by the job market. Increased recognition of the renewable energy industry, for example, has increased enrollment.

Institutions surveyed generally had limited access to demographic data related to applications and enrollments. Representatives estimated no change in the proportions of Indigenous, international students and students from other provinces enrolling over the past five years.

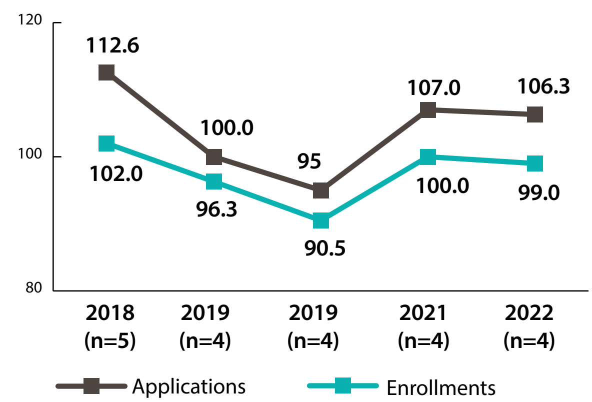
FIGURE 4.4 – Existence of formal student recruitment strategies by target group



Source: EHRC Survey of Post-Secondary Institutions 2017

Figure 4.5 shows the expected application and enrollment rates for programs related to electricity and renewable energy offered by Alberta universities and colleges.

FIGURE 4.5 – Expected applications and enrollments in electricity or renewable programs



Source: Survey of Post-Secondary Institutions 2017

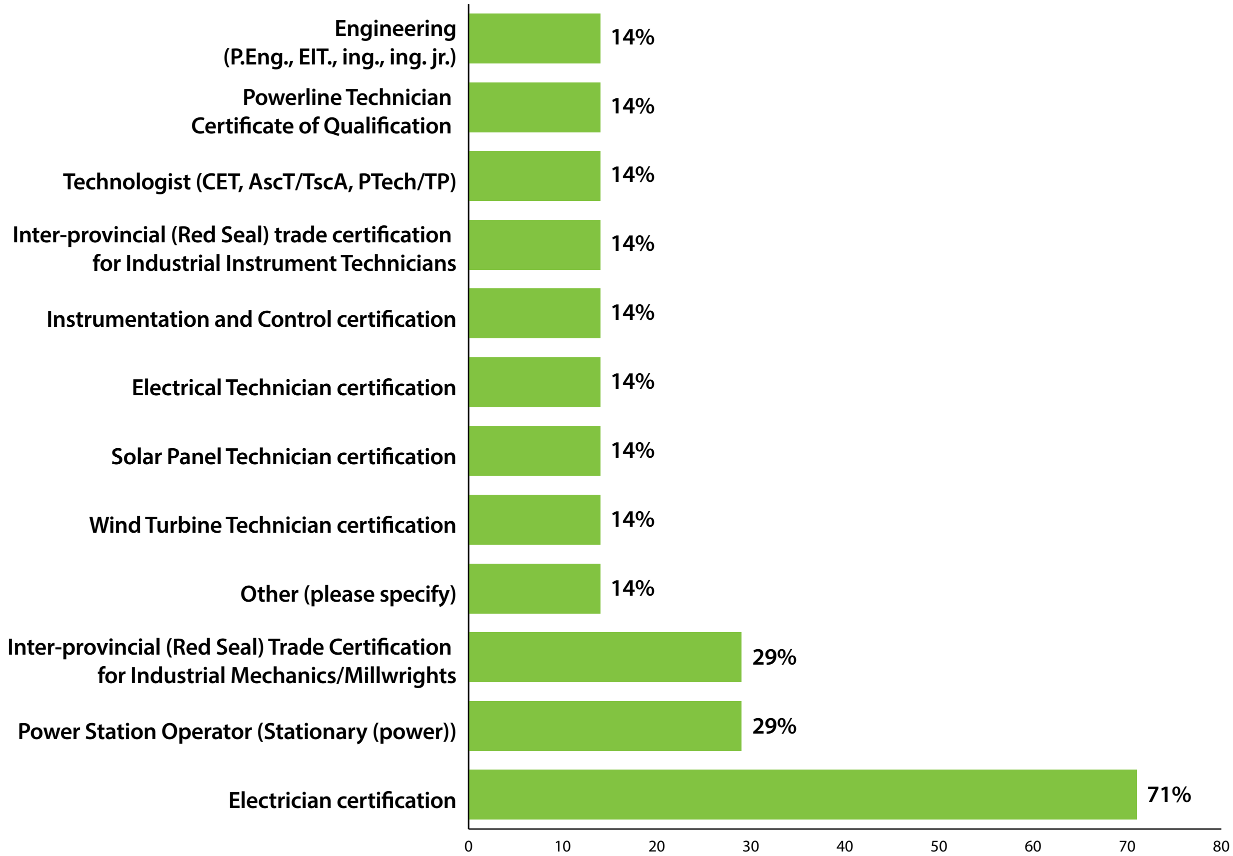
Other enrollment trends

Institutions did not report higher enrollments for male versus female students in STEM (science, technology, engineering, mathematics and computer science) or clean energy programs. Institutions also reported similar rates of drop-out and program changing among male and female students.

Student interest in program content affects degree completion, as does the application process. For programs with strong interest, entrance requirements become more stringent and only the most qualified applicants are accepted — leading to higher completion rates. Quality instruction and flexible program delivery also support degree completion. Completion rates in electricity/renewable sector programs are historically similar or higher than those of other programs.

Less than one-third of the institutions surveyed indicated differential retention rates between men and women in some electricity and renewable programs. Programs with higher female retention rates included general science and technology programs, while programs with higher male retention rates include apprenticeship courses, math and engineering.

FIGURE 4.6 – Alberta Programs and Curricula Meeting Electricity Standards and Certifications



Source: Survey of Post-Secondary Institutions 2017

Electricity and renewable energy educational and training programs

Alberta's universities and colleges offer a diverse range of courses and programs that would support transition to the electricity and renewable energy industry. These include electrician, electrical engineering, solar installation, wind turbine technician and power system analysis programs. Most commonly, the institutions surveyed tend to offer electrician (71%), power station operator (29%) and interprovincial trade certifications (29%).

Reflecting new realities

In response to the sector's evolving operational environment, academic institutions are introducing new technologies through course modules and overview courses in renewable energy. Enrollment in renewable energy programming continues to grow. In the past five years, demand has risen for graduates who are cross-trained or hold more than one certification to support the interdisciplinary work in the energy sector. There is a need for joint business and trades training because many trades work as small contractors servicing the electricity sector; as a result, some institutions have developed multidisciplinary curricula (e.g., electrical courses for mechanical engineers, incorporating business or architectural components into renewable energy programs, etc.).

Curricula are renewed frequently to keep up with technology evolution. As related standards, policies and trade certification requirements become better defined, programming areas in need of development will become clearer.

Support for applied research is also required to determine how new technologies and alternative energy can be adapted to Alberta's electricity marketplace. Consultation with industry will ensure programming meets market needs. This process requires more work, as 57% of the institutional representatives surveyed said the relationship between their institution and the electricity sector was less developed than with other industries. Stakeholders noted the sector could benefit from partnerships with educational institutions that include co-op placements, internships or mentorship initiatives.

Program development

Given that new domains such as cybersecurity have an impact on every sector and industry, programming should be developed in consultation with multiple sectors. Institutions are introducing content on energy storage, smart grid technology, drone technology, artificial intelligence and electric charging stations. Coordination with certification agencies supports the establishment of training and competency standards.

Future employees will need to be continuous learners given the ongoing evolution of provincial/federal energy policies. This can be supported through modular training that allows people mid-career to upskill. Modular training allows workers with transferable skills to obtain needed specialization or transition roles without a large time investment. Educational institutions also noted that hands-on learning is important for new technologies, and that online formats do not support this kind of experiential learning.

Supporting sector transition

Education and training must prepare students to work with the evolving power grid as it incorporates new technologies and evolves away from coal generation toward renewables and micro-generation. However, traditional skillsets will still be needed, meaning educational programming must broaden rather than purely shift focus. At the same time, workers already in the energy sector will need significant support to learn what is needed to implement such technologies for renewable generation.

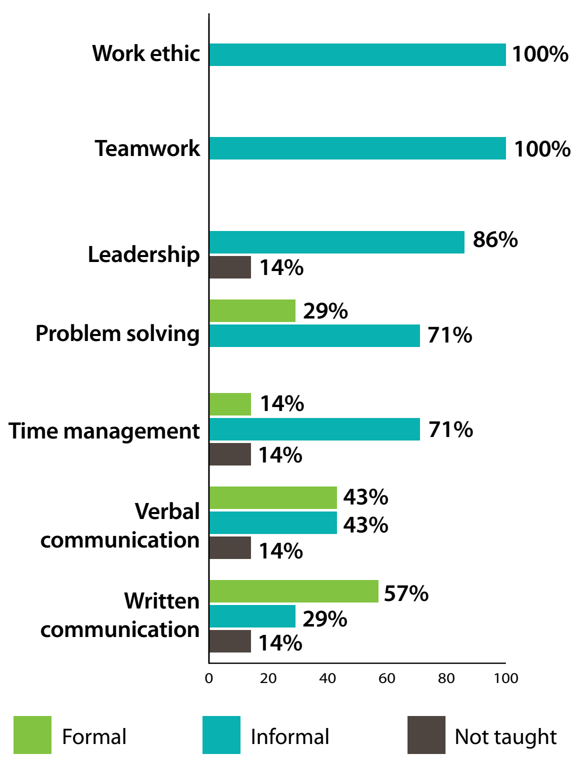
Stakeholders noted that some attention should be given to develop standardized competencies or skills requirements for emerging occupations in the renewables sector. Doing so would enable education and training providers to customize their curricula to meet the specific requirements of these new and evolving occupations.

Furthermore, incorporating "design thinking" into university curricula will provide opportunities to study problems and develop solutions that take into account multiple perspectives, including consumer preferences, social benefits, technology and economics. Students need to learn how to challenge preconceptions, add new technology such as distributed energy/community energy, storage, electric vehicles and blockchain into the electrical grid/system, as well as bring context and ethical judgment to workplaces that depend increasingly on artificial intelligence.

Soft skills

Increasingly, employers require workers with soft skills such as communication, leadership, project management and problem solving. Educational institutions are responding by integrating soft skills into programming through team or group work, capstone projects, formal courses, tutorials and support programs, and project and lab work. Work ethic, teamwork and leadership skills are commonly taught informally, if at all, while written communication, verbal communication, time management and problem solving are formally taught at some institutions.

FIGURE 4.7 – Methods used by Alberta academic institutions to teach soft skills



Source: Survey of Post-Secondary Institutions 2017

Education and training gaps

To improve education and training for electricity and renewable energy occupations, Alberta institutions recommend developing occupational standards, certifications and essential skills profiles for new and emerging occupations, as well as establishing common training outcomes that align with them. To increase the speed with which skilled renewables workers are available to industry, institutions suggest incorporating required training into existing trade pathways. However, several obstacles hinder these efforts, including limited capital equipment funding for training aids and space, as well as insufficient access to qualified, experienced and knowledgeable program designers, curriculum developers and instructors. Additionally, there is no clear link between demands for specialized training and hiring practices, as employers may choose to use current manpower rather than hire new workers with specialized skills.

Transitions to the workforce, apprenticeship and further education

One to two years of job experience is typically needed for graduates to be considered fully competent for programs at Alberta institutions. Programs requiring more than three years include trade certification for industrial mechanics, electrician certification and cybersecurity. Power line technician, electrical technician and wind turbine technician programs require less than a year of experience for graduates to become fully competent.

Student transitions are best supported through industry networking opportunities that allow them to connect with and learn about different companies, careers and workplace opportunities. Summer or internship positions could give exposure to new roles in the renewable sector. In Alberta, many college programs have learning pathways that articulate into university programs or have direct application in the workplace. These have been developed because of the strong partnerships between industry and academic institutions.

Forecasted demand and supply

To forecast future employment in the industry and the total number of hires required to expand as needed and replace exiting workers, this study relied on an econometric forecast modelling system (provincial occupational modelling [POM]) maintained by the Centre for Spatial Economics (C4SE). This model incorporates numerous economic variables, including provincial GDP growth, population growth and migration trends, to generate an estimate of total employment and hiring requirements for Alberta's electricity sector. For this study, the forecast developed for Alberta also incorporated information provided by employers such as the age distribution of their workforce as well as insights into future hiring requirements. Appendix A provides additional information about the C4SE POM system.

Labour requirements for Alberta's electricity and renewable industry are derived from expansion demand and replacement demand. Expansion demand refers to the change in employment as workforce activity grows or contracts each year in response to economic conditions. Replacement demand is the need to replace positions vacated due to retirement or death. This section of the report provides an overview of labour market conditions for the core electricity sector occupations and provides demand and supply measures from 2017 to 2022 based on the C4SE POM analysis.

Expansion demand

Electricity industry employment estimates in Alberta are projected to 2022 for each occupation using a weighted average of the annual rate of change in output (measured by GDP) and investment in the sector. Employment in Alberta's electricity and renewable industry is expected to grow at a rate of 0.5% annually, with a cumulative increase of 2.5% between 2017 and 2022. This rate reflects the transition from coal to new forms of electricity generation such as natural gas and renewables. The highest rates of employment growth are expected for software engineers and designers and also for engineering managers.

As highlighted in Table 4.1, expansion demand related to the overall growth trend is modest. This is consistent with the Alberta utilities sector overall, at only 2.1% by 2021.

TABLE 4.1 – Current and Forecasted Employment in the Electricity Industry by Occupation, 2017 and 2022

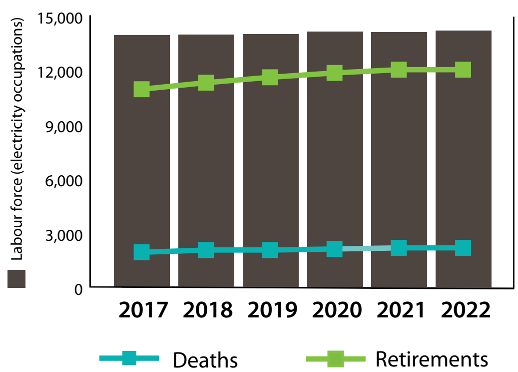
Occupation	2017	2022	% Growth 2017–2022*	Average annual Growth Rate
Engineering managers	131	135	3.0%	0.6%
Construction managers	74	75	1.4%	0.3%
Utilities managers	599	614	2.5%	0.5%
Civil engineers	158	162	2.5%	0.5%
Mechanical engineers	252	259	2.8%	0.6%
Electrical and electronics engineers	999	1,024	2.5%	0.5%
Information systems analysts and consultants (includes cybersecurity)	363	372	2.5%	0.5%
Database analysts and data administrators	53	54	1.9%	0.4%
Software engineers and designers	21	22	4.8%	1.0%
Computer programmers and interactive media developers	53	54	1.9%	0.4%
Civil engineering technologists and technicians	58	59	1.7%	0.3%
Mechanical engineering technologists and technicians	37	38	2.7%	0.5%
Electrical and electronics engineering technologists and technicians	315	323	2.5%	0.5%
Engineering inspectors and regulatory officers	32	32	0.0%	0.0%
Computer network technicians	79	81	2.5%	0.5%
Contractors and supervisors, electrical trades and telecommunications occupations	163	167	2.4%	0.5%
Electricians	16	16	0.0%	0.0%
Power system electricians	410	420	2.4%	0.5%
Electrical power line and cable workers	1,109	1,137	2.5%	0.5%
Construction millwrights and industrial mechanics	216	221	2.3%	0.5%
Residential and commercial installers and servicers (includes Solar PV Installers)	11	11	0.0%	0.0%
Public works maintenance Equipment operators and related workers (includes Utility Arborists)	74	75	1.4%	0.3%
Power engineers and power systems operators (includes power system and power station operators, smart grid specialists, wind technicians and wind station operators)	936	959	2.4%	0.5%
Electricity Sector Occupations	**6,159**	**6,310**	**2.5%**	**0.5%**
Other Occupations**	**7,741**	**7,940**	**2.6%**	**0.5%**
Total	**13,900**	**14,250**	**2.5%**	**0.5%**

Source: C4SE Forecast.
Note: * % Growth 2017-2022 reflects total growth from 2017 to 2022.
** Other occupations includes all occupations in the electricity sector not listed in the table.

Replacement demand

Replacement demand has been estimated for each occupation using the C4SE POM analysis, which shows the proportion of retirements from the Alberta electricity workforce will remain relatively constant: from 1.8% in 2017 to 2.0% in 2022. The analysis suggests there will be very limited growth in the total number of workers due to demand expansion, although there will be a cumulative requirement to replace approximately 12% to 14% of the current workforce over the next five years.

FIGURE 4.8 – Retirement Projections for the Alberta Electricity Industry Workforce



Source: C4SE POM Forecast

Total demand

The total annual change in labour force requirements from expansion and replacement are provided in Figure 4.9. Expansion demand is severely limited over the next two years but is expected to rebound by 2020, remaining higher for 2021 and 2022. Overall, more than two-thirds of new hires projected (2,399 workers) will be needed to replace retirees and 20% to meet the needs of an expanding workforce.

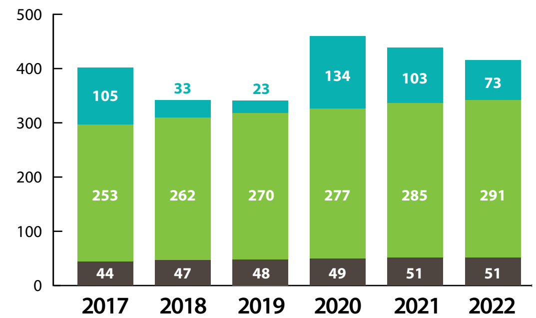
Even with only moderate expansion growth, the total number of employees required by the electricity sector in the next five years surpasses the current Alberta electricity sector workforce by 17%.

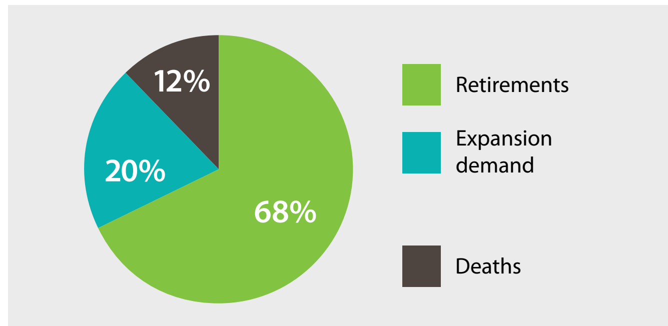
TABLE 4.2 – Total Labour Requirements: Alberta Electricity Industry, 2017 to 2022

Demand Type	Total Requirement 2018–2022	Percent of Current Labour Force (2018)	Share of Total Requirement
Expansion Demand	471	3%	20%
Retirements	1,638	12%	68%
Deaths	290	2%	12%
Total	**2,399**	17%	100%

Source: C4SE POM Forecast

FIGURE 4.9 – Total Recruitment Requirements: Electricity Sector Occupations, 2017 to 2022





Source: C4SE POM Forecast

Supply side measures

The C4SE POM system does not provide an analysis of workforce supply by specific industry. On examining provincial trends, however, it does provide insights as to where the electricity sector's future workforce will be sourced from.

A combination of sources will be needed to meet supply requirements. Historically, workforce demands were met through the recruitment of:

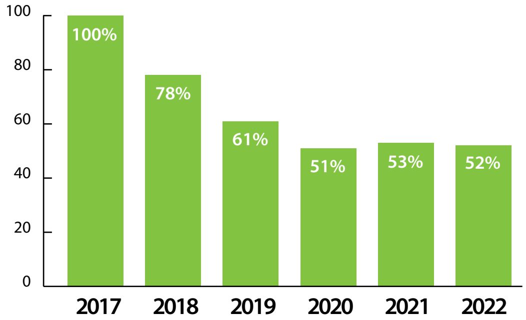
- New entrants to the workforce
- Interprovincial migrants
- International migrants
- Other in-mobility (net additions to the labour force through workers changing occupations, etc.)

As Figure 4.10 shows, new entrants are expected to make up the bulk of the available labour supply over the next five years. Negative interprovincial migration and negative in-mobility will reduce the pool of experienced workers. In 2016–2017, nearly all needs were met by Alberta's provincial workforce, either by new entrants or existing unemployed workers, with negative outmigration for both interprovincial and international workers.

Although the C4SE POM analysis predicts a recovery in the net inflow of workers from other provinces and countries over time, Alberta cannot expect to see a return to a period in which workforce requirements are met by in-migration alone. Furthermore, significant competition to recruit new labour force entrants can be expected from all industries in Alberta.

While international migrants can be used to offset the reduced supply of experienced workers, given that more than half the labour supply for the next five years will comprise new domestic entrants, employers will need to develop in-house training programs to ensure hires have the right skills. Alternatively, the sector could work closely with universities and colleges to ensure comprehensive training is provided to meet employers' changing needs.

FIGURE 4.10 – Proportion of Labour Supply from New Domestic Entrants in Alberta



Source: C4SE POM Forecast

Ranking workforce demand and supply

The demand and supply measures outlined above for specific occupations can be consolidated into a set of three market rankings: demand rank, supply rank and unemployment gap rank.

Demand rank focuses on "demand pressure" as measured by the number of job openings for an occupation divided by the size of the available labour force in the previous year. This is similar to the labour force growth rate for the occupation. High growth in demand for a given occupation relative to that for other occupations earns a higher demand rank, as more effort will likely be required to find workers.

Supply rank focuses on migration and is measured as the ratio of required net in-migration to the occupation's labour force in the previous year. Where supply requirements are met largely through migration, those occupations may be at risk without additional immigration or if Canadian workers are unavailable or unwilling to move to the particular locations of need.

The unemployment rate gap rank is the difference between an occupation's actual and normal unemployment rate. Occupations with negative unemployment rate gaps reflect tighter labour markets.

A weighted average of the three rankings has been used to establish an overall labour market tightness rank for selected occupations across all industries. These rankings are presented in Table 4.3a.

TABLE 4.3A – Labour Market Rankings for Electrical Occupations in Alberta

Electrical Occupations	2017	2018	2019	2020	2021	2022
Engineering managers	2	3	3	3	2	2
Construction managers	2	3	2	2	2	2
Utilities managers	3	3	3	3	3	3
Civil engineers	2	4	4	3	3	2
Mechanical engineers	2	4	3	3	2	2
Electrical and electronics engineers	2	4	3	3	2	2
Information systems analysts and consultants (includes cybersecurity)	3	2	2	2	3	3
Database analysts and data administrators	3	2	3	3	3	3
Software engineers and designers	3	2	2	2	2	2
Computer programmers and interactive media developers	3	2	2	2	2	2
Mechanical engineering technologists and technicians	2	4	3	3	2	2
Mechanical engineering technologists and technicians (includes Wind Technicians)	3	3	3	3	2	2
Electrical and electronics engineering technologists and techni-cians	3	3	3	3	3	3
Engineering inspectors and regulatory officers	3	3	3	3	3	2
Computer network technicians	3	2	2	2	3	3
Contractors and supervisors, electrical trades and telecommu-nications occupations	2	3	2	2	2	2
Electricians	2	2	2	2	2	2
Power system electricians	3	2	2	3	2	2
Electrical power line and cable workers	3	2	2	2	2	2
Construction millwrights and industrial mechanics	3	3	3	3	2	2
Residential and commercial installers and servicers (includes Solar PV Installers)	2	2	2	2	2	2
Public works maintenance Equipment operators and related workers (includes Utility Arborists)	3	3	3	3	3	3
Power engineers and power systems operators (includes power system and power station operators, smart grid specialists, wind technicians and wind station operators)	3	3	3	3	2	2

Source: C4SE POM Forecast

TABLE 4.3B – Labour Market Rankings Defined

Rankings and Descriptions	
1	**High Excess Supply** A situation where there are more than sufficient workers available to meet demand. Demand pressure is much lower than normal, there is little to no reliance on migrants to fill jobs. The unemployment rate is noticeably higher than the normal rate. It should be very easy to find workers.
2	**Slight Excess of Supply** A situation where there are slightly more workers available than normal to meet demand. Demand pressure is lower than normal; there is less reliance than normal on migrants to fill jobs. The unemployment rate is slightly higher than the normal rate. It could be easier than normal to find workers.
3	**Balanced Market** Represents a normal market situation where organizations can rely on their traditional methods for obtaining workers. Demand pressure is normal, organizations may have to rely on migrants to meet supply, but this situation is not different from what they have faced in the past. The unemployment rate gap is very small.
4	**Slight Excess of Demand** A type of market situation where demand pressure is stronger than usual. More emphasis than normal must be placed on organizations to access migrants to meet their worker requirements. The unemployment rate is slightly below its normal rate. It could be a little more difficult to find workers.
5	**High Excess Demand** A type of market situation where demand pressure is quite strong. More emphasis than normal must be placed on organizations to access migrants to meet their worker requirements. The unemployment rate is noticeably below its normal rate. It will be very difficult to find workers.

The majority of occupations will experience balanced markets or markets with slight excess supply from 2017 to 2022. Some occupations (such as engineers and some technicians) will have a slight excess of demand due to a decrease in the size of the labour force, an increase in the number of job openings, low actual unemployment or reduced net in-migration.

Specifically, mechanical and electrical engineer and civil engineering technologist occupations will experience this slight excess of demand in 2018, while civil engineers and non-destructive testers and inspection technicians will do so in 2019. With major projects slated to begin in 2018, these occupations will experience more immediate demand pressures. Beyond 2020, the model predicts a balanced or slight excess supply of workers.

The model shows labour force supply will have decreased in 2017 due to lower economic activity. In consultations, key stakeholders said specific sub-groups of occupations (namely, software engineers and designers) are proving difficult to fill despite the model showing only modest labour market pressure.

Security (and specifically cybersecurity) is also an area of concern, as the electricity sector is critical to the operation of the entire Alberta economy. Protecting it from online threats is vital. Stakeholders said there is a very limited supply of cybersecurity experts available in Alberta, meaning competition for their skills is intense. In this context, it appears the model may not adequately capture demand pressures for select IT/information management occupations.

Spray Facility, courtesy of TransAlta Corporation

5

Recommendations

To support Alberta's changing electricity and renewables sector workforce, the following actions are recommended — in no particular order of priority:

1 UPDATE LABOUR MARKET AND CAREER INFORMATION REGULARLY

Ensuring a suitable supply of workers with the correct mix of skills requires frequently updated labour market and career information that reflects the changing structure of the sector and future job opportunities. Outreach programs should be developed to attract students to relevant academic programs — with the aim of producing a diverse, highly skilled workforce of post-secondary graduates and tradespersons. While some work is being done in this area, more effort is needed to inform up-and-coming workers of the opportunities in the electricity and renewables sector.

2 ENGAGE IN UNITED ACTION TO SUPPORT EDUCATION AND TRAINING

Whether the driver is the phase-out of coal, the growth of renewables, the adoption of new technologies or the retirement of current workers (or all of the above), education and training (or re-training) will be essential to meeting the broader skills needs of the future – both technical and critical "soft skills". As a result, government, Alberta sector employers and academic institutions will need to continue to work collaboratively to:

- Understand and define emerging occupations in the renewable energy sector and prepare appropriate training pathways for these careers. New investments will also be required so colleges and universities can provide the necessary technology and focus on required disciplines such as cyber security.
- Adopt practices that recognize the importance of work-integrated learning and the opportunities it gives students to become familiar with real work environments and expectations, and to practice non-technical/soft skills.
- Develop and make available work placements and co-op programs that promote course completion, provide on-the-job experience and facilitate workplace recruitment. As an example, employers should engage in the continuous hiring of co-op and summer students from engineering programs and recruit new grads to maintain a talent pipeline that will help address upcoming retirements.
- Support the provision of demand-driven retraining programs to facilitate workforce transitions in the new regulatory environment. This would represent an implementation of best practices. Redeploying existing workers is more cost-effective than laying them off and hiring anew, as it retains invaluable institutional knowledge accumulated over time. Modular training would allow workers to continue productively in their work while gaining the necessary skills for transition.

3 ENCOURAGE APPRENTICESHIP

Research completed by the Canadian Apprenticeship Forum indicates that for every $1 spent on apprenticeship training, an employer receives a benefit, on average, of $1.47 or a net return of $0.47.

Funding programs that incentivize employers to hire first-year apprentices should be researched and implemented to support the transition of new workers into the emerging renewable sector.

Programming aimed at first-year apprentices in occupations related to renewables would help emerging companies meet their workforce requirements and give new workers exposure to the field. It would also help ensure all apprentice seats are filled and may support the development of more dual-certified workers.

4 DEVELOP FUTURE-READY REGULATIONS AND STANDARDS

Regulations and formalized industry standards for renewable energy occupations — based on an understanding of how the requisite skills will be practically applied in the workplace — are needed to facilitate the evolution of Alberta's electricity sector workforce. It is further recommended that occupational standards, certifications and essential skills profiles be developed for new and emerging occupations, as well as, common training outcomes that align with them be established.

5 EMBRACE DIVERSITY

Alberta's electricity industry workforce has traditionally been stable, with workers commonly recruited and trained within the industry. Competition for new talent was linked to the strength of the oil and gas industry. The uncertain future of that industry due to volatile commodity prices has meant more workers are leaving it in search of jobs elsewhere. The rapidly changing employment market — with heavy competition, particularly for occupations that are portable out of the electricity sector (e.g., information and communication technology occupations) — poses steep challenges for workers. Whether or not this surplus labour force will be available to meet the needs to the electricity sector will depend on the changes in technology integration that are occurring in the electricity industry as well as developments in the oil and gas sector.

Future skill gaps and workforce needs may be filled by hiring from non-traditional labour pools. Yet only 20% of Alberta electricity employers surveyed for this study have or are working to develop formal diversity strategies or plans. Employers should aim to establish more formal diversity hiring strategies, particularly for women, Indigenous peoples, diversity groups and immigrants.

Such strategies would not only meet workforce needs but also increase innovation capacity and foster inclusive work cultures. Outreach and hiring strategies for attracting women and other under-represented groups need to address both the recruitment process and the labour pool — ensuring target groups enter programs that will give them the training to be "right-skilled" workers for the future electricity sector.

The sector can leverage its reputation as a source of stable and attractive employment. It can also tap into the appeal of renewable energy, which is sparking fresh interest in the industry and attracting more diverse workers — particularly women and Indigenous people — who see renewables as an opportunity to make a difference in the world, protect the environment and improve quality of life.

6 ESTABLISH SUCCESSION PLANNING, RETIREMENT AND PENSION-BRIDGING PROGRAMS

Of those workers due to retire by 2022, some may not be transferable in the interim to gas or to renewable generation jobs either because their skills are specialized to coal or simply because gas and renewable operations require fewer workers. At the same time, the majority of sector employers surveyed said they do not have early retirement programs or other incentives to alter retirement patterns for their organizations.

As a result, employers will be required to implement comprehensive succession planning, retirement or pension-bridging programs. These efforts will not only help workers transition as a result of the coal phase-out but also ensure that replacement workers are provided with the right skills/experience to manage the loss of significant experience associated with the retirement of older workers.

Photo courtesy of Alberta Electric System Operator

6

Conclusion

The electricity sector in Alberta will undergo significant change over the next five years as it manages the closure of coal-fired generation facilities and initiates integration of renewable electricity and new technologies. As a result, the skills and requirements of the future workforce will be different from the skills possessed by the current workforce. While renewable generation requires a smaller workforce than coal, it also demands more cross-training and more technical skills. At the same time, as more technological improvements are researched, developed and applied to the sector, highly skilled workers will be in more demand.

How the industry navigates these transitions will be driven by the extent to which united action is exercised in embracing opportunities through the implementation of key recommendations proposed.

Our thanks to study participants

We would like to acknowledge the generous time and support of the employers, educational institutions and other key stakeholders who participated in this study.

Organizations

Alberta Electric System Operator

AltaLink Management Ltd.**

ATCO Electric*

ATCO Power

Belair Power & Production Equipment Inc.

Bowark Energy Ltd.

Capital Power Corporation **

Dapp Power Ltd.

ENMAX Corporation**

Fortis Alberta Inc.**

Ghost Pine Wind Farm LP

Lakeland REA Ltd.

NextEra Energy Canadian Operating Services Inc.

Rocky Rural Electrification Association Ltd.

Sensus Metering Systems Inc.

TransAlta Corporation**

Educational institutions

Lethbridge Community College

Southern Alberta Institute of Technology**

Keyano College

Lakeland College**

Grande Prairie Regional College

Medicine Hat College

University of Alberta

Red Deer College*

University of Calgary*

*Key informant interview

**Survey response and key informant interview

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Appendix A:
Study methodology and the C4SE modelling system

The study that produced this report had several goals. The first was to provide current, real-time information and long-term (up to five-year) estimates and assessments of labour demand and supply for Alberta's electricity sector. As well, the study aimed to build an updated body of knowledge to inform and improve the sector's capabilities in workforce planning, needs analysis and the identification of training requirements. In doing so, it is the shared goal of industry and the provincial government to advance policy within the larger context of a national energy strategy.

The research team took a mixed-method approach designed to yield robust evidence. This included a literature review and environmental scan, a review of secondary data from Statistics Canada, province-wide surveys of employers and educational institutions, interviews with key industry and educational stakeholders, and a review of best practices for transitioning workers from declining industries and jobs to new employment. Data were run through a provincial occupational modelling (POM) system developed by the Centre for Spatial Economics (C4SE) to forecast labour supply and demand conditions.

C4SE Provincial Economic Modeling System

C4SE maintains a modeling system that consists of a set of provincial macroeconomic models. The models are linked together through trade, financial markets and inter-provincial migration. They are multi-sector models, which incorporates the purchasing patterns from Statistics Canada's input output tables.

The C4SE Provincial Economic Modeling System was designed to incorporate information on major capital projects in all industries for each province. The major project inventory contains specific information about each project, including the constriction costs and number of construction and operation jobs associated with the project. Major project investment assumptions are utilized to determine the direction, magnitude and timing of investment in the forecast and are a major forecast driver within the provinces. For the purposes of this project, C4SE focused on projects in the electricity generation, transmission and distribution industry which also includes renewable energy projects. The Ontario inventory includes the refurbishments of the Bruce Darlington Nuclear Generating Stations and many others. The Alberta inventory includes construction of gas-fired power generation plants owned by Capital Power, MAXIM Power and ENMAX Corporation, transmission power line projects owned by AltaLink Management and wind farms owned by NextEra Canada. There are many other proposed electric sector projects in the inventory, these projects are reviewed and updated regularly as changes are announced. These projects will help us to estimate the demand for electric power workers while accounting for the phasing out of coal generation as some of these projects are directly associated with replacing coal-generating stations.

The Provincial Economic Modeling System produces forecasts of real GDP, consumer spending, exports/imports, employment, personal income, unit labor costs, as well as government revenues/budgetary balances, as well as many other important macroeconomic variables.

Provincial occupations models (POMS) labour market information models

The POMS labour market information models bring together the macroeconomic and demographic information from the Provincial Economic Models to generate forecast of labour demand and supply. Labour demand forecasts are generated provincially for over 70 NAICS industries by 500-4 digit NOC categories. Labour force supply is determined by the local population, its composition by age and sex, labour force participation rates by age and sex, immigration, emigration and interprovincial migration. C4SE conducted forecasting for the following NOC occupations for this report:

- #0211 Engineering managers
- #0711 Construction managers
- #0912 Utilities managers
- #2131 Civil engineers
- #2132 Mechanical engineers
- #2133 Electrical and electronics engineers
- #2171 Information systems analysts and consultants (includes cyber security)
- #2172 Database analysts and data administrators
- #2173 Software engineers and designers
- #2174 Computer programmers and interactive media developers
- #2231 Civil engineering technologists and technicians
- #2232 Mechanical engineering technologists and technicians
- #2241 Electrical and electronics engineering technologists and technicians
- #2261 Non-destructive testers and inspection technicians
- #2262 Engineering inspectors and regulatory officers
- #2281 Computer network technicians
- #7202 Contractors and supervisors, electrical trades and telecommunications occupations
- #7241 Electricians
- #7243 Power system electricians
- #7244 Electrical power line and cable workers
- #7311 Construction millwrights and industrial mechanics
- #7441 Residential and commercial installers and servicers (includes solar PV Installers)
- #7522 Public works maintenance equipment operators and related workers (includes utility arborists)
- #9241 Power engineers and power systems operators (includes power system and power station operators, smart grid specialists, wind technicians, wind station operators)

POMS is able to conduct occupation demand and supply projections for each province and role them up to produce projections for Canada as a whole. It is used to produce occupation outlooks consistent with the SECINC provincial macroeconomic outlooks.

In POMS, workforce supply and demand are interdependent — supply responds to changes in demand and changes in supply can affect demand. Almost all of the other approaches undertaken in occupational modelling assume that workforce supply is an input to their workforce outlooks. That is, they assume that the demand and supply for the workforce are independent of each other. This approach allows them to show large persistent imbalances between supply and demand that are inconsistent with the way the world works. In the real world, such large imbalances would cause wages, prices, and other economic variables such interest rates, participation rates, and the exchange rate to adjust to reduce these imbalances. The occupation projections made using POMS reflect a "requirements" approach for both demand and supply. This approach starts with the macroeconomic models where workforce demand and supply adjust over time to balance aggregate labour markets. An important part of this adjustment is an "optimal" immigration approach where the federal government is the residual source of workforce supply. The macroeconomic models employ the latest federal immigration policy targets in the short term and when targets are available, and in the longer term, the models adjust immigration levels to appropriate levels to assist the national labour market in maintaining a relatively healthy balance. Under this approach, there are no persistent large imbalances at the aggregate level of the economy across the country. Nevertheless, there may be temporary shortages or surpluses for some occupations over the economic cycle that will need to be taken into account in workforce planning.

In the POMS there is an outlook for demand requirements and the required supply to meet these demand requirements. The demand requirements are changes in employment, people retiring from the workforce, and people dying. The sources of supply to meet these requirements are young people entering the workforce after finishing school or changing jobs, both international and interprovincial net in-migrants, and other sources such as people changing occupations and deciding to enter the labour force because of more job opportunities and higher wages.

While there are no major and forever lasting labour market imbalances in the POMS outlooks, POMS does employ a labour market tightness ranking approach that takes into account the fact that the supply requirements computed may not be achieved. It attempts to identify occupations that may be difficult for organizations to find in the future. Occupations with relatively strong demand growth, for example, may be more difficult to find than those where demand growth is weaker. Moreover, occupations where supply requirements are largely met through migration may be at risk if the federal government does not accommodate these requirements through additional immigration or Canadian workers do not wish or are not available to move to the particular location in question. There may also be some tightness issues over economic cycles and for specific occupations. This tightness is incorporated in the ranking approach.

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