cna canadian nuclear association

PROJECTING THE FUTURE CANADIAN NUCLEAR WORKFORCE

2026 DATA REPORT

This project was overseen by a dedicated Steering Committee.

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Executive Summary

Canada is facing an unprecedented increase in energy demand in the next 25 years. The CNA's Outlook for Nuclear Energy report, published in 2025, highlights the need for at least 50GW of baseload power[1] by 2050 to meet increasing energy demand. Nuclear is best-placed to provide non-emitting baseload and is expected to be a key component of Canada's energy mix expansion in the next two to three decades. The buildout of new nuclear projects will require a ready-to-go workforce to ensure that projects are built on time and on budget to meet our energy generation needs. Thus, the CNA commissioned this study to understand the demand for skills in the nuclear sector between 2025 - 2050. This data report, which is based on the available data at the time of drafting, summarizes the findings from a workforce assessment model that was developed.

The analyses in this report are based on two scenarios – one that reflects our nuclear build-out based on announced or signalled in Ontario, Saskatchewan, New Brunswick and Alberta - calculated to be approximately 22 GW by 2050, and another that reflects our estimated baseload energy demand by 2050 – calculated to be approximately 50GW. These scenarios highlight the need to build more new energy-generation capacity and to ensure that there is a pipeline of talent to staff these jobs. In other words, building more nuclear generating capacity is an opportunity to create high-skilled, high-paying, sustainable jobs across Canada.

To understand the current and future workforce needs that may arise across the nuclear value chain as we build more projects, we have considered key sub-sectors of nuclear, including mining, fuel conversion, fuel fabrication, construction, operations, refurbishment, decommissioning, and long-term waste management. Two key supporting roles - regulatory and licensing, as well as research and development, were also included.

Workforce demand profiles were built using information from operators and subject matter specialists across the nuclear energy value chain. Secondary data sources were used to benchmark, verify, and fill in gaps. Staffing levels required for the required roles were identified and grouped by functional categories aligned to National Occupational Classification (NOC) codes. Staffing requirements at new nuclear plants were based on the scale of operations, such as unit-level versus site/station-level activities, or the size of the reactor output.

Future workforce supply was estimated using the Canadian Occupational Projection System (COPS), which provides projections on labour market conditions in Canada as a starting point. Our data gathering focused on the period from 2024 to 2033, and trends were then extrapolated to 2050 and adjusted according to additional pressures that are anticipated between 2030 and 2050, such as changes in immigration policy. Drawing on the estimates of the current nuclear workforce and growth rates from the modified COPS projections, an estimated future supply by role was calculated.

Our findings show that workforce shortages in the nuclear sector are expected to begin in 2030, based on a buildout scenario focused on planned and signalled projects. Shortages are mostly expected in the

[1] The reported value of 50 GW includes replacing existing high-emitting baseload power and building additional capacity to meet demand.

skilled trades - many of which are needed during the construction phase of a nuclear energy project- and in specialized engineering professions, including mechanical and civil engineering. Across the four provinces where nuclear projects have been signalled, planned or are currently ongoing, the expected shortages differ as expected. Ontario is likely to experience the most severe shortages, given the intention to build 4800 MW of new nuclear capacity at Bruce C, and OPG's announcement to explore the potential deployment of up to 10,000 MW of new nuclear at its Wesleyville site. The estimated number of direct jobs from buildout in Ontario alone could reach a peak of more than 25,000 direct jobs, while in Saskatchewan, New Brunswick and Alberta, peak direct jobs could reach an estimated 1065, 1900 and 8000 jobs, respectively. These values do not include calculations for indirect and induced jobs, which push estimated values higher. The numbers estimated also increase significantly when a goal of non-emitting 50 GW of baseload is considered.

Furthermore, the model estimates which professions are likely to experience the most severe shortages in labour supply, based on planned and signalled projects, reiterating the importance of the skilled trades and engineering professions. The shortages estimated per year range from civil engineers at an average gap of 58 per year starting in 2025, to iron workers at an average gap of 1,249 per year, every year, for the next 25 years.

The findings of our data analyses and engagements with stakeholders across the Canadian nuclear industry, including in new-to-nuclear jurisdictions, have contributed to the development of a **MADE for Nuclear** workforce strategy. The strategy, which makes up the second output from this study, highlights the pillars and initiatives that will support the development of a talent pipeline, especially in professions where there are likely to be shortages. The pillars of the strategy will ensure that Canada, like allied countries, invests in workforce development to enable Canadians' access to high-skilled, high-paying, sustainable jobs; and to ensure a whole-of-country approach to meet our energy demand needs.

1. Introduction

Against a backdrop of increasing demand for non-emitting and reliable baseload energy, governments across the globe are turning to nuclear energy. In addition to ensuring energy security, nuclear power supports regional economic growth through induced economic activity, provides high-skilled, high-paying direct and indirect jobs and ensures high payback rates to governments through significant GDP contributions. For example, in Canada, nuclear energy makes up 13.5% of the electricity mix through 17 operating CANDU nuclear reactors. In Ontario, where 16 of Canada's reactors are located, nuclear makes up more than 50% of the electricity grid, and in New Brunswick, 35% of electricity is fulfilled by one nuclear reactor. In addition to providing reliable non-emitting baseload energy, the Canadian nuclear sector employs 89,000 people in direct and indirect jobs and contributes more than 20 billion dollars to Canada's GDP annually. Considering the significant benefits of the nuclear sector, it is necessary to invest in a talent pipeline to ensure the continued operation of our nuclear fleet. This is an urgent need as the nuclear sector is currently facing challenges:

- An aging workforce with over 25% of those employed in nuclear reaching retirement age by 2030-2035.
- Global competition for nuclear skills amid the ambition by many countries to increase nuclear capacity.
- Shortages of skilled trades professionals, many of whom are crucial to the buildout of nuclear energy, are expected to begin from 2030.
- Evolving technology, such as small modular reactors, digital twins, data centers, and AI-driven innovations, will require novel skillsets.

Furthermore, Canada's energy demand is increasing. By 2050, it is estimated that we will need 50 GW of non-emitting baseload power. Planned and signalled projects indicate that we are on track to build 22.3 GW of new nuclear capacity in Ontario, New Brunswick, Saskatchewan and Alberta – less than half of the required 50 GW need, but a significant feat given that Canada has not embarked on large-scale nuclear buildout in decades. These projects, some of which we assume will happen concurrently, will require a ready supply of workers to fill the jobs that will be created. An increased ambition of nuclear buildout will further increase the need for workers. Framed differently, nuclear buildout in Canada will be a significant creator of direct, indirect, and induced jobs across the country. To ensure Canadians- be they young people in the skilled trades, women, transitioning professionals, and Indigenous Peoples can participate in these opportunities, we must understand the workforce supply, future demand, and the sub-sectors of nuclear where opportunities will be available.

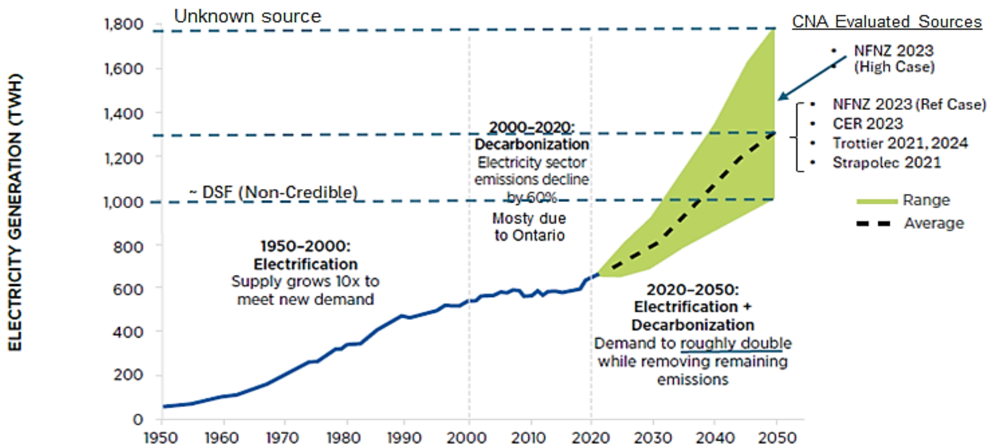


Figure 1: Forecast for energy demand in Canada (adapted from the Canada Electric Advisory Committee report), May 2024.

To assess the workforce needs of the nuclear sector, the CNA's study is based on two scenarios – completion of all planned and signalled nuclear projects (currently estimated to be 22.3 GW), and completion of 50GW of nuclear buildout to meet forecasted non-emitting baseload energy demand by 2050. Much of the analyses reported in this document are based on the first scenario of a buildout of 22.3 GW of nuclear across the country. However, some of the results reported in the results section show what the workforce gaps (i.e., the job creation opportunities) could be if Canada embarks on a 50GW buildout. All the jobs reported refer to full-time equivalent (FTE) positions, unless otherwise stated.

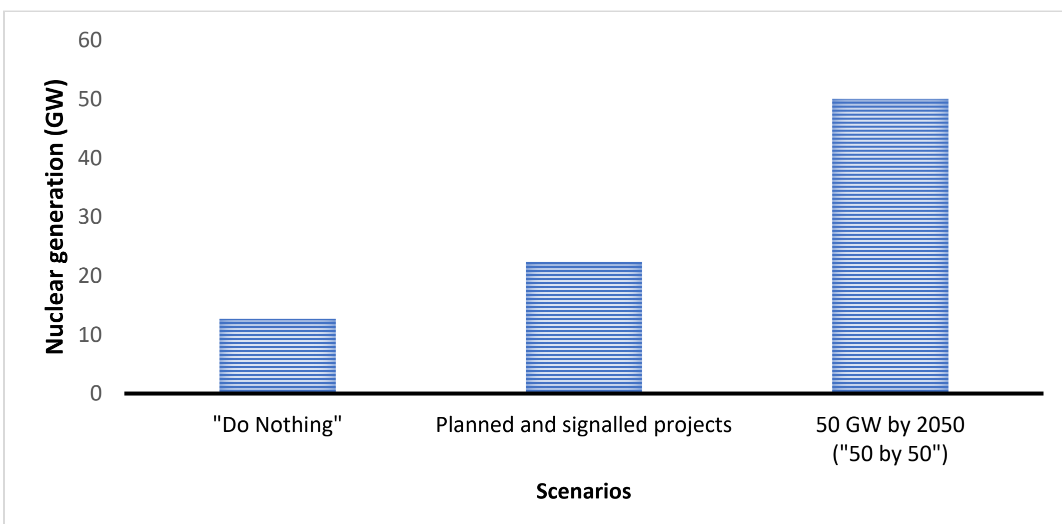


Figure 2: Nuclear energy buildout scenarios in Canada. The "Do Nothing" scenario is for reference purposes and indicates the current generating capacity of Canada's nuclear fleet. Planned and signalled projects represent approximately 76% potential increase in nuclear energy capacity in Canada.

Table 1: Breakdown of planned and signalled projects across Canada.

Province	Planned and signalled projects	Project status	Generating capacity (MW)[2]
Ontario	Darlington New Nuclear Power Plant (4 x 300 MW SMRs)	Ongoing. License to construct granted.	1,200 MW
	Bruce C power plant expansion	Planned. Technology selection process underway.	4800 MW
	Wesleyville Port Hope site	Planned. Technology assessment underway.	10,000 MW
Saskatchewan	Estevan (2 X 300 MW SMRs)	Planned. Regulatory process ongoing.	600 MW
New Brunswick	600 MW[3]	Signalled	600 MW
Alberta	Capital Power SMR project	Signalled	300 MW
	Energy Alberta Peace River project	Regulatory process ongoing	4800 MW
Total buildout planned or signalled			22,300 MW

1.1. Objectives of the Study

The Canadian Nuclear Association (CNA) in collaboration with consultant firms- Kinectrics, Helixos and Pricewaterhouse Coopers, aimed to develop a workforce assessment model to assess the workforce needs for the Canadian nuclear sector and to develop a workforce strategy to address gaps. The objectives of the study were as follows:

a. Understand the current supply of professionals in the nuclear workforce, based on their Training Education, Experience and Responsibilities (TEERs).

b. Estimate gaps that may occur due to attrition and labour supply shortages as nuclear buildout increases across Canada between 2025 – 2050; and

c. Develop a workforce strategy that will inform initiatives and approaches to timeously address workforce shortages in the nuclear sector.

This data report summarizes the findings from the model developed, based on data available at the time of the study. The model considers the changing needs of the current workforce, which will be impacted by attrition and changing needs for skills given technological changes (e.g. automation). The data inputs and outputs from the model are granular as they were gathered from the Government of Canada's

[2] Announced and signalled generating capacity does not refer to the capacity of the intended sites or plans by the responsible authorities. This is solely the value of the projects announced.

[3] Based on the 2023 Government of New Brunswick Our Path to 2035 strategy which indicates adding 600 MW of new nuclear power to the New Brunswick grid.

national databases or based on international benchmarking data for nuclear operations. As a result of the granularity, estimates of workforce needs for new nuclear buildout are available in ranges that highlight the number of jobs that would be created/the workforce need, should nuclear projects receive adequate support through an enabling environment.

Since the completion of the study by the consultants, the CNA adjusted the analysis. The results presented herein reflect those adjustments.

1.2. Limitations of the Study

As with all studies involving forecasting, we wish to highlight the following limitations:

a. The findings are based on available data at the time of the report and do not reflect new decisions in the nuclear industry past 2025.
a. The model does not estimate indirect or induced jobs in its estimates. These job creation opportunities, which often occur alongside nuclear buildout, can be deduced using multiplier factors of 0.91 for indirect jobs and 1.37 for induced jobs[4].
b. As labour supply was gathered from national data sources, it was not possible to reflect a true supply/demand at the provincial level.
c. This model and the outputs derived from it are based on projections, which may change as events evolve. The CNA team will publish updates on the outputs as new information becomes available.
d. Assumptions have been made about when buildout will occur, based on signals from project proponents. However, as many of these are contingent on strong and ambitious government support, the timelines may differ, but the number of jobs created, people required and the energy buildout requirements for Canada will remain the same if the overall values of the developed scenarios remain fixed.
e. Assumptions were also made about investments in core and ancillary nuclear operations and services that would support nuclear buildout.

[4] Based on a soon-to-be-published study by Tadrous *et al*. "*Staffing the Nuclear Renaissance: An Integrated Modeling Assessment of National Workforce Requirements for Canada's 2050 Nuclear Expansion,* McMaster University.

2. Methodology

2.1. Labour Demand Dataset

The data used to understand labour demand was divided into stages of the nuclear value chain. The phases included are mining, fuel conversion and fabrication, reactor design, reactor construction, reactor operations, reactor refurbishment, reactor decommissioning, and high-level waste management (operational waste management was included under operations). In addition to the stages of the value chain, regulatory and licensing, as well as research and development, were included.

2.2. Reactor Construction Assumptions

We categorized reactors into four types and assumed the length of the construction period for each, based on average timelines observed in Canada, the US, and France. We did not consider delays in the licensing or impact assessment process in these estimated lengths of time. We also did not include the time spent on pre-development work, which would factor into a nuclear energy project. Therefore, these timelines are ambitious. However, selecting ambitious average construction periods allowed the model to statistically account for fleet deployment, schedule optimization, and the improvement of productivity over time.

Table 2: Assumed construction periods of reactor buildout.

Reactor Type	MW output	Construction period (years)
Micro reactor	<100 MW	2
Small reactor	100-330 MW	5
Medium reactor	340 – 850 MW	7
Large Reactor	1000+ MW	7

2.3. Reactor Construction Assumptions

For the supply of the nuclear workforce that currently exists, and the trends associated with our current rate of workforce preparation, we drew data from the Canadian Occupational Projection System (COPS), which provides projections on labour market conditions in Canada, focusing on the period from 2024 to 2033. COPS aims to identify potential imbalances in the labour market, guiding policy decisions and helping stakeholders understand future trends in employment, job openings, and job seekers.

We made several adjustments to the COPS projection for use in our model. The original projection spans from the years 2024 to 2033. To estimate the labour supply for the years 2034 to 2050, we applied an extrapolation assuming a consistent trend for all supply drivers included in the COPS projection.

Consequently, the growth in supply for each year from 2034 to 2050 was assumed to be equivalent to that in 2033. We also considered changes to federal government policies like immigration, international graduate students supply, etc., and the impact those would have on labour supply in Canada.

A more detailed methodology on how the model was developed can be found in the appendix.

3. Results

3.1. Labour Demand Analysis

The results show that over the next 25 years, planned and signalled projects across Canada could lead to the buildout of more than 25 nuclear energy reactors and create tens of thousands of direct, indirect, and induced jobs, if these projects proceed. Across the nuclear value chain, construction and energy generation jobs are expected to be the areas of highest demand (Figure 3). These jobs, which involve skilled trades professionals, project managers, and specialized engineering professionals, are often in the highest demand for new nuclear buildout. The results also show increased demand for mining, nuclear fuel production, construction, energy generation jobs. A growth in nuclear power may also lead to an increased need for regulatory capacity, though we have not included that data in Figure 3.

Based on the estimated timelines, the construction curve shows peak demand in the early 2040s. This is expected to play out differently depending on the provinces and the start of planned and signalled projects. For example, in Ontario, where projects are already underway, the peak may occur at a different time from a new-to-nuclear province like Saskatchewan. It is also worth noting that the construction curve shows a continuous drop as more projects are concluded in the late 2040s and more reactors come online. On the other hand, energy generation jobs increase. Considering the data is limited to a 2050 timeline, it is impossible to tell how energy generation and other job demand curves might evolve if project deployment timelines exceed 2050. We also did not estimate how automation in some job areas might impact the projected values.

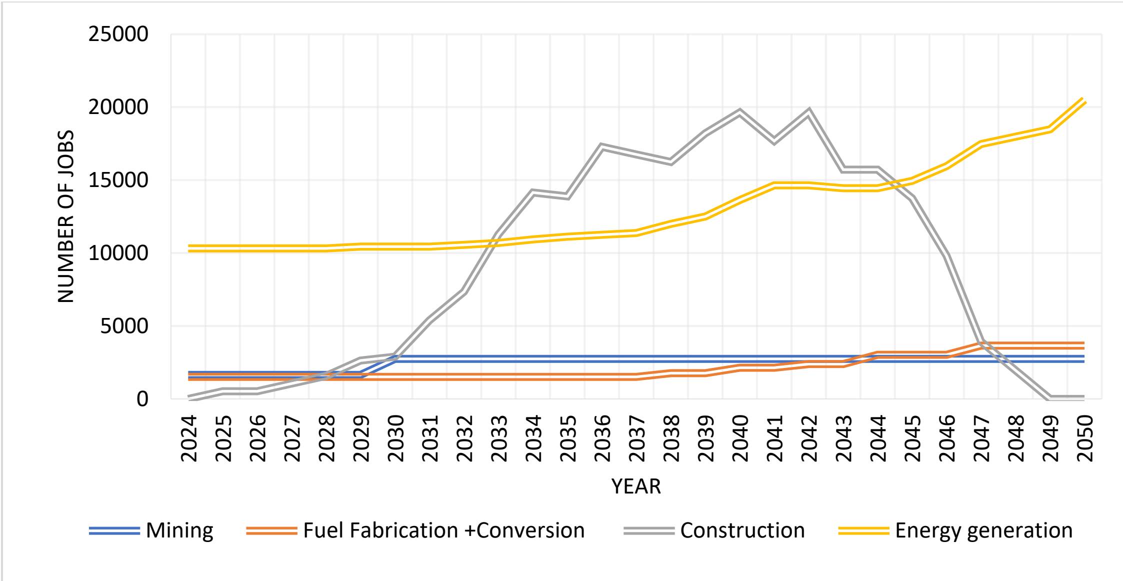


Figure 3: Estimated direct job demand curves for new nuclear buildout based on planned and signalled projects across Canada[5]**.**

3.2. Demand by NOC Codes and TEER Classification

For better specificity and to ensure that any policy levers and initiatives aimed at addressing workforce shortages in the nuclear sector, we also estimated the top 25 NOC codes that are likely to experience the highest demand (Table 4). Furthermore, Figure 4 separated labour demand by Training, Education, Experience, and Responsibilities (TEER) classification (defined in Table 3). The estimations of job demand by TEER reinforce that skilled trades professionals will be the highest demand (TEER 2), followed by specialized engineering degrees and scientists/technologists, which are often TEER 1 qualifications.

[5] This does not include indirect and induced jobs that would be created.

Table 3: Definition of TEER Classifications in Canada

TEER	Definition/Occupation types
TEER 0	Management occupations
TEER 1	Occupations that usually require a university degree
TEER 2	Occupations that usually require: • A college diploma • Apprenticeship training of 2 or more years; or • Supervisory occupations
TEER 3	Occupations that usually require: • a college diploma • apprenticeship training of less than 2 years, or more than 6 months of on-the-job training
TEER 4	Occupations that usually require: • a high school diploma, or several weeks of on-the-job training
TEER 5	Occupations that usually need short-term work demonstration and no formal education

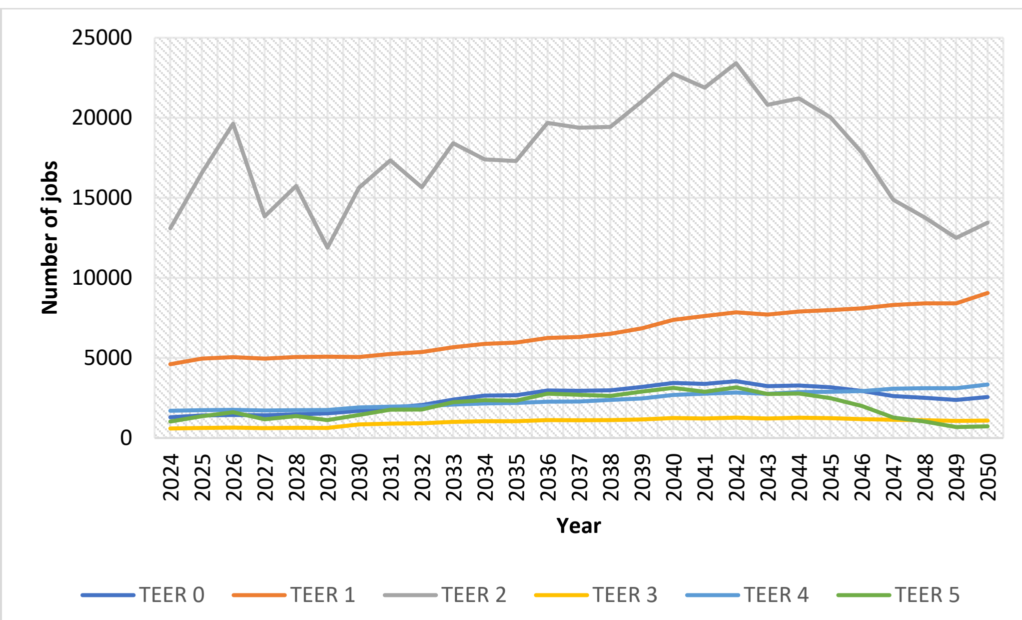


Figure 4: Job demand by TEER.

Table 4: Top 25 jobs in demand for planned and signalled projects by NOC codes.

NOC Code	Job Title	Average yearly demand	Total Demand (2025-2050)
92100	Power engineers and power systems operators	2613	70557
21301	Mechanical engineers	2317	62549
64410	Security guards and related security service occupations	1593	43015
72201	Industrial electricians	1152	31094
72999	Other technical trades and related occupations	1064	28735
72301	Steamfitters, pipefitters, and sprinkler system installers	1037	28000
72310	Carpenters	877	23666
72105	Ironworkers	871	23504
75119	Other trades helpers and labourers	798	21535
22100	Chemical technologists and technicians	733	19783
20010	Engineering managers	622	16806
92024	Supervisors, other products manufacturing, and assembly	580	15666
72103	Boilermakers	578	15593
70012	Facility operation and maintenance managers	544	14690
21310	Electrical and electronics engineers	531	14323
11200	Human resources professionals	497	13425
21399	Other professional engineers	478	12908
22311	Electronic service technicians (household and business equipment)	447	12070
75110	Construction trades helpers and labourers	443	11971
72100	Machinists and machining and tooling inspectors	419	11306
22302	Industrial engineering and manufacturing technologists and technicians	404	10917
72014	Contractors and supervisors, other construction trades, installers, repairers, and servicers	378	10210
72400	Construction millwrights and industrial mechanics	376	10155
72020	Contractors and supervisors, mechanic trades	353	9535
83100	Underground production and development miners	319	8602

It is worth reiterating that the numbers reported in Table 4 only show demand for planned and signalled projects across Canada. Table 5 below shows demand for a significantly more ambitious nuclear buildout, thereby highlighting the magnitude of increase between scenarios.

Table 5: Top 25 jobs in demand for the 50GW by 2050 scenario by NOC codes

NOC Code	Job Title	Average yearly demand	Total Demand (2024-2050)
92100	Power engineers and power systems operators	3386	91428
21301	Mechanical engineers	2929	79074
72201	Industrial electricians	2819	76125
72301	Steamfitters, pipefitters, and sprinkler system installers	2596	70105
72105	Ironworkers	2538	68535
75119	Other trades helpers and labourers	2202	59450
64410	Security guards and related security service occupations	2141	57818
72310	Carpenters	1804	48717
22100	Chemical technologists and technicians	1598	43138
20010	Engineering managers	1294	34948
72999	Other technical trades and related occupations	1248	33704
72103	Boilermakers	935	25255
21310	Electrical and electronics engineers	802	21657
70010	Construction managers	732	19767
72100	Machinists and machining and tooling inspectors	711	19201
70012	Facility operation and maintenance managers	708	19128
21399	Other professional engineers	660	17814
92024	Supervisors, other products manufacturing, and assembly	644	17394
75110	Construction trades helpers and labourers	630	17012
11200	Human resources professionals	556	15002
22311	Electronic service technicians (household and business equipment)	498	13438
22302	Industrial engineering and manufacturing technologists and technicians	484	13069
21300	Civil engineers	451	12169
72102	Sheet metal workers	445	12002
72014	Contractors and supervisors, other construction trades, installers, repairers, and servicers	421	11362

The sequencing of project buildout could also amplify workforce shortages over time across the country, highlighting the importance of project coordination. But, regardless of coordination, we can still expect shorts. For the sake of this study, we have assumed concurrent builds across the country at different times. The numbers shown in the graph do not take into consideration a higher appetite for nuclear energy, which is becoming more evident at the time of publication. Since the completion of the analyses, Nova Scotia has indicated interest in building nuclear energy.

3.3. Provincial Demand Profiles

The number of jobs that will be created varies significantly between provinces, as shown in Figure 5, with Ontario having the highest job demand while Saskatchewan, New Brunswick and Alberta show more modest demand profiles. This tracks with the current state of the nuclear sector, given that

Ontario has forecasted a higher future demand for energy and a higher appetite for nuclear projects (planned and signalled projects in Ontario alone add up 16 GW of new nuclear). The projects considered position Alberta as the province with the second-highest buildout ambition – 5100 MW of nuclear. Peak demand for jobs in Alberta also occurs as demand in Ontario begins to taper off, based on the timelines assumed, indicating opportunities to engage skilled labour from other regions in new projects. This also highlights the importance of sequencing projects across the country to ensure projects are adequately staffed. In the case that peak buildout in Alberta coincides with peak buildout in Ontario, it is expected that workforce shortages will be more severe. In the other provinces of Saskatchewan and New Brunswick, an increase in ambition would push the peaks observed north of the values estimated by the model. Also note that the jobs estimated here do not include indirect and induced jobs, both of which indicate much higher estimates than what is reported. For a more detailed breakdown on regional demand, please see the appendix.

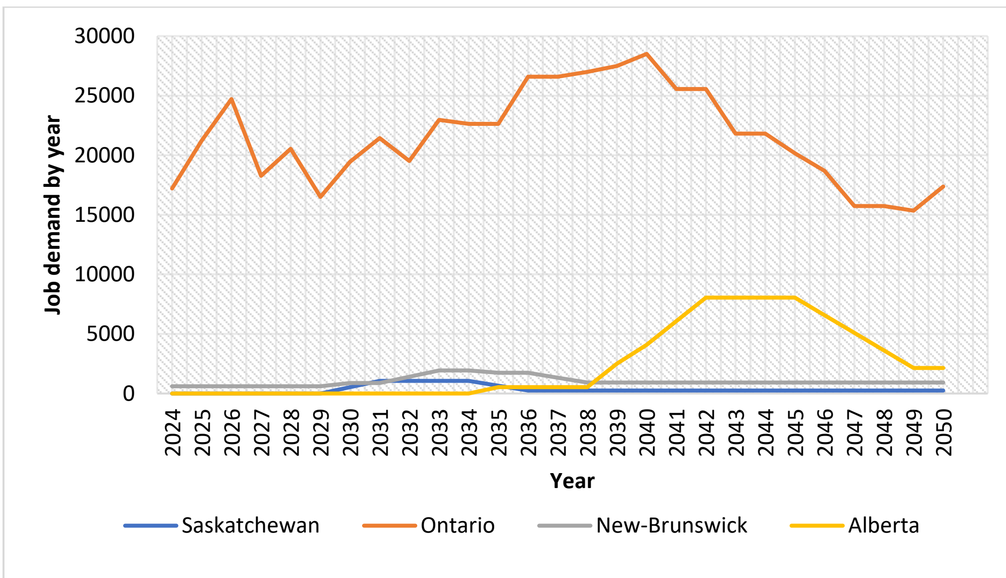


Figure 5: Jobs demand profiles for the different provinces based on planned and signalled projects.

3.3.1. Provincial Job Demand Profiles by TEER Levels by scenario

As can be seen in the graphs below, regardless of the location of buildout, TEER 2 professions, where many skilled trades would fall, show the highest demand. The graphs provide a comparison of job demand by TEER, based on assumed timelines for buildout and based on the two scenarios considered during the development of the model. Assumptions have also been made about the level of job demands for these projects. As the model was developed to reflect a range of values, the following assumptions have guided the selection of data for the graphs.

- In Ontario and New Brunswick, it is assumed that the job demand will be on the lower side of the range due to the existing presence of nuclear skills in these provinces and the possibility of deploying these skills in new projects. Therefore, the values displayed in the graphs represent the lower range limit for these provinces.

- In Saskatchewan and Alberta – both new-to-nuclear jurisdictions, job demand is expected to be on the higher side of the range due to a lack of existing workforce capacity.

Assumptions were also made about how much nuclear each province would build in a 50 GW by 2050 scenario, making this scenario highly subjective. Note that the jobs reported do not include indirect and induced jobs. It is also worth noting that for the sake of this study, assumptions were made about the timelines for project buildout. For the planned and signalled projects, these assumptions were based on signals from some of the project proponents; however, actual timelines may differ as proponents navigate regulatory and financing requirements for their projects. Thus, the focus for these analyses was to show the evolution of job demand over time. In other words, the graphs below show how the job demand for different TEERs would play out even if the buildout timelines change. For more detailed analyses on the provinces, see the appendix.

- **Ontario**

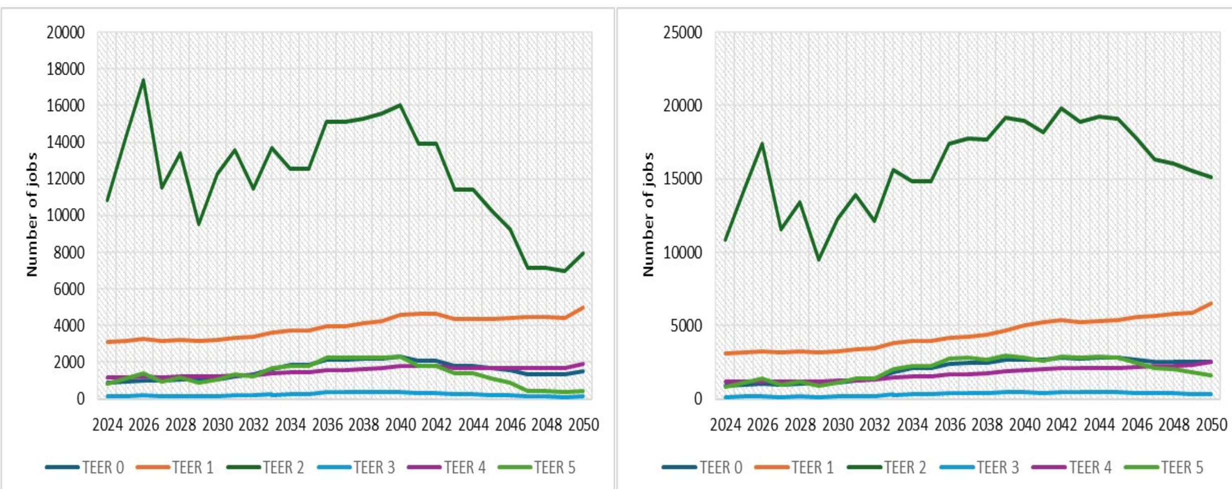


Figure 6: Job demand by TEER in Ontario for planned and signalled projects (left) and the 50GW by 2050 scenario (right). The zigzag form of TEER 2 demand in both scenarios reflects subjective assumptions on when buildout will begin and end. Actual events will depend on project coordination and sequencing. Refurbishment projects have also been considered in estimations.

- **Saskatchewan**

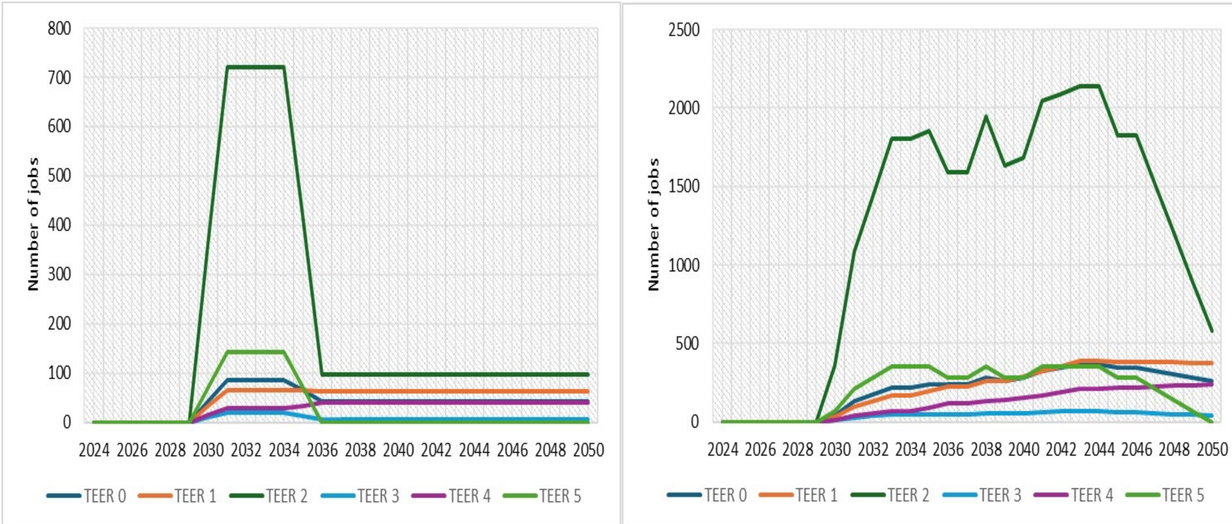


Figure 7: Job demand by TEER in Saskatchewan for planned and signalled projects (left) and the 50GW by 2050 scenario (right). The zigzag form of TEER 2 demand in the 50 GW by 2050 scenario reflects highly subjective assumptions on when buildout will begin and end. Actual events will depend on project coordination and sequencing.

- **New Brunswick**

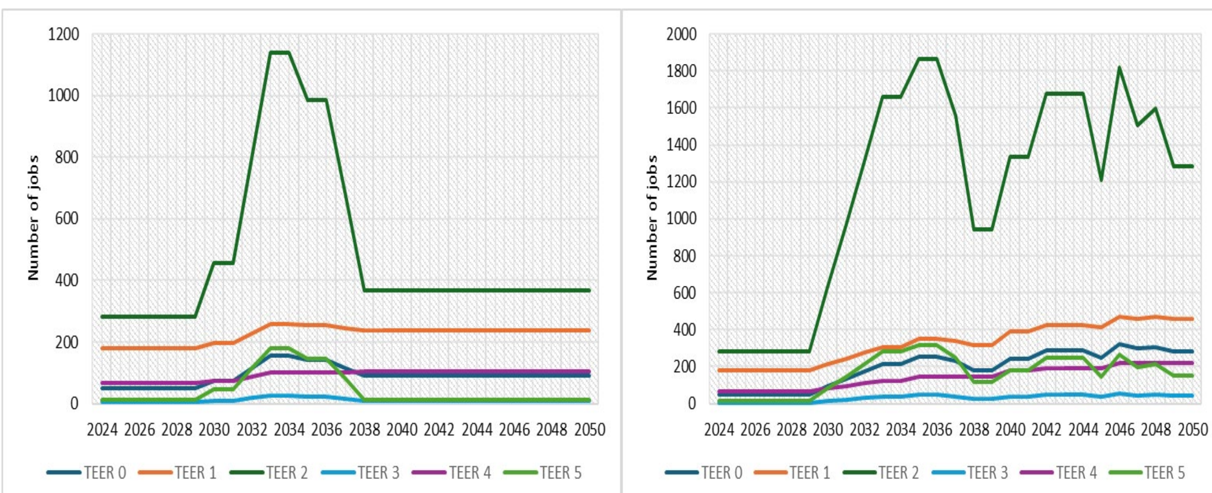


Figure 8: Job demand by TEER in New Brunswick for planned and signalled projects (left) and the 50GW by 2050 scenario (right). The zigzag form of TEER 2 demand in the 50 GW by 2050 scenario is simply a reflection of highly subjective assumptions on buildout. Actual events will depend on project coordination and sequencing. For planned and signalled projects, actual buildout timelines may differ, but the job demand profiles for the different TEERS would be similar.

- **Alberta**

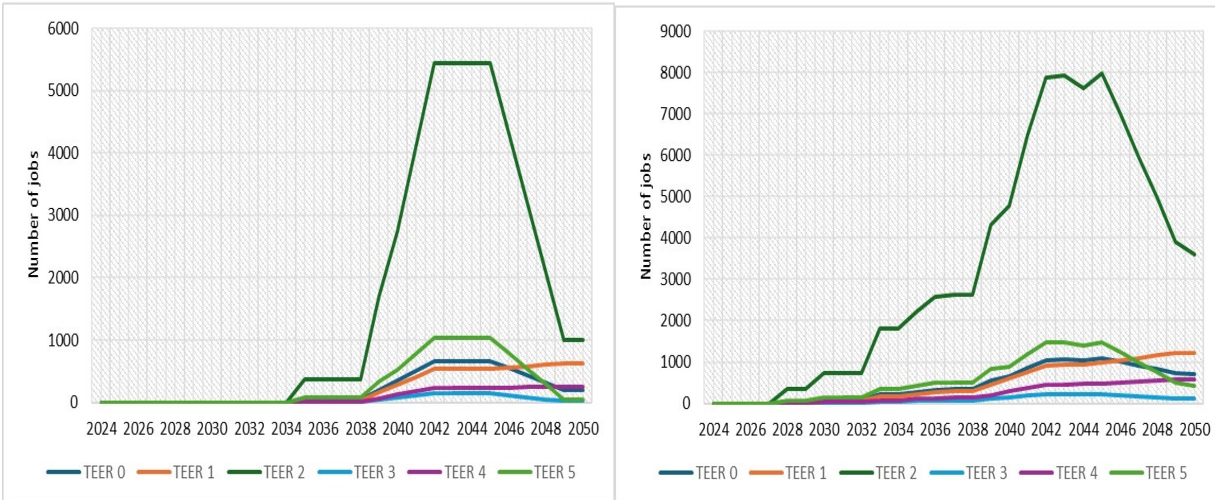


Figure 9: Job demand by TEER in Alberta for planned and signalled projects (left) and the 50GW by 2050 scenario (right). The zigzag form of TEER 2 demand in the 50 GW by 2050 scenario is simply a reflection of highly subjective assumptions on buildout. Actual events will depend on project coordination and sequencing.

3.4. Gap Analysis

The demand profiles reported in Section 3.3 highlight the number of direct jobs that will need to be filled to meet demand. To estimate potential workforce shortages, we subtracted the demand from the supply of jobs available for each NOC code. We expect shortages to begin in 2030, as skilled workers retire at a rate that's higher than the entry of new workers, and to worsen by the early 2040s. Figure 10 shows the overall shortages that can be expected by year in the two scenarios considered – planned and announced projects vs 50 GW by 2050.

For planned and announced projects in Figure 10, gaps in the workforce begin to worsen from 2030, and only abate in the mid-2040s when we anticipate most anticipated construction projects to have been completed. As we move further away from the present time, there is less certainty in project approvals. This explains the lift at the tail-end of the graph, which shows an increase in workforce supply as fewer projects are initiated. As expected, the workforce gap is significantly amplified should we proceed towards a 50 GW by 2050 scenario.

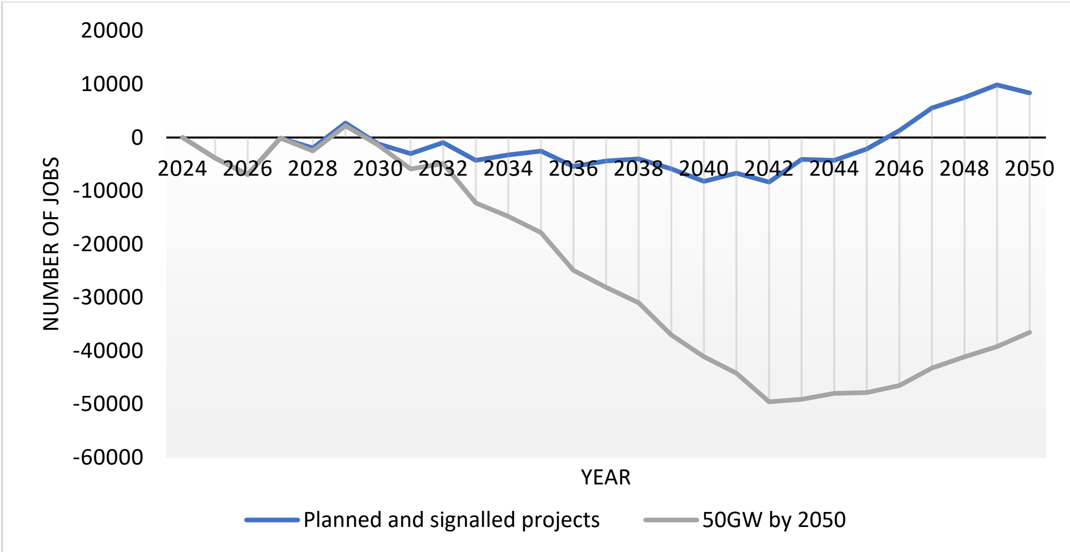


Figure 10: Total gap in workers nationally across time for planned and signalled projects and the 50GW by 2050 scenario.

The initial period between 2024-2029, where there is fluctuation in the trend of supply exceeding demand, is driven by contracts for TEER 2 jobs in refurbishments before the acceleration of project approvals in 2030. Refurbishment has a high demand for workers primarily in the trades, with estimates between 1500-5000; when refurbishment contracts are active, there are spikes in demand, and when the contracts are not needed according to refurbishment timelines, there are lulls.

Other TEERs appear to have relatively small gaps, but the likelihood of filling a singular vacancy in some roles will differ from others due to varying levels of specialization, certification, competition, etc. Therefore, even roles where the total number needed is low may still represent a significant gap, because they may be more difficult to fill and retain. Examples of this include jobs in radiation protection, where even though fewer are needed per site in comparison to other trades, the market is highly competitive. Many are likely to move away from rural sites to urban Canadian cities and to other countries where they might receive higher salaries.

The model also suggests trends in response to certain policy levers. One area of potential interest in the future of nuclear is the increasing use and development of advanced technology, such as AI. As innovations are introduced across the nuclear life cycle, the common assumption is that they will result in fewer jobs and therefore less benefit to local populations. However, the model suggests that advanced technology will reduce the magnitude of the workforce gap, decreasing the real-life potential of delays that may arise as a result of simultaneous projects across Canada. The increased productivity potential that advanced technology will yield will increase the likelihood of achieving ambitious build-out targets, which in turn will yield more jobs in operation. Additionally, advanced technology will necessitate the introduction of entirely new skillsets that will be needed within the nuclear industry and across indirect jobs to support production, quality control, and maintenance.

Table 6: Top 25 jobs experiencing the largest gaps for planned and signalled projects by NOC codes.

NOC code	Job Title	Average Yearly Gap (2025-2050)	Median Yearly Gap (2025-2050)
72105	Ironworkers	-1249	-1290
75119	Other trades helpers and labourers	-1072	-1116
72301	Steamfitters, pipefitters, and sprinkler system installers	-726	-616
21301	Mechanical engineers	-573	-458
72201	Industrial electricians	-566	-543
20010	Engineering managers	-441	-472
22100	Chemical technologists and technicians	-433	-398
70010	Construction managers	-351	-366
92100	Power engineers and power systems operators	-224	-13
72102	Sheet metal workers	-218	-225
64410	Security guards and related security service occupations	-187	-85
22221	User support technicians	-175	-180
70012	Facility operation and maintenance managers	-158	-150
21300	Civil engineers	-156	-165
21310	Electrical and electronics engineers	-147	-151
22303	Construction estimators	-108	-122
73400	Heavy equipment operators	-107	-114
73300	Transport truck drivers	-102	-109
42101	Firefighters	-88	-84
22233	Construction inspectors	-86	-89
74204	Utility maintenance workers	-75	-81
22301	Mechanical engineering technologists and technicians	-68	-58
65312	Janitors, caretakers, and heavy-duty cleaners	-67	-69
22310	Electrical and electronics engineering technologists and technicians	-60	-66
22300	Civil engineering technologists and technicians	-58	-62

In addition to productivity, impacts to the supply of the workforce will inform the magnitude of the gap. A higher retirement rate or a reduced supply of graduates (as policy changes effect the funding and resources available to schools) will further increase the gap and disadvantage build-out ambitions, whereas increased output from schools and training facilities can have the opposite positive effect.

Another major influence on the potential workforce is the length of construction for reactor technologies. As construction timelines increase, the role of productivity rates per worker decreases in importance, but the likelihood of simultaneous projects increases, hindering the capacity of workers to fulfill multiple contracts across multiple sites. The result is decreased transferability of the workforce, and therefore an increase in the workforce gap.

Ultimately, the model demonstrates that a skilled workforce functions as a core driver of the carrying capacity of nuclear buildouts.

4. Conclusions

This report highlights outputs from a model that was developed to estimate the workforce assessment needs of the nuclear sector. It specifically addresses direct full-time employment and does not capture indirect or induced employment, unless otherwise specified. Although the workforce demand was developed with expert judgement, secondary sources, and data where available from organizations, it projects estimates of the jobs that would be required to achieve nuclear buildout based on assumptions on the timeline of buildout. Thus, the model should be considered a starting point for conversations on supporting nuclear energy projects and developing an adequate strategy to inform directional action and initiatives that will ensure jobs growth and workforce development in the sector.

As reported, initiatives should target skilled trades professions, specialized engineering degrees, and other support roles within the sector. The results also show the estimates of provincial job demands – a beneficial starting point, especially for new-to-nuclear jurisdictions. To achieve a buildout of 22.3 GW, the workforce need is high. To achieve 50 GWE, even more would be required.

In conclusion, it is worth reiterating that the opportunities for workforce development and job creation, even for planned and signalled projects, will not be realized without government support for nuclear projects. To achieve this buildout goal, strong signals from the government - regulatory efficiency, reducing regulatory burden, articulating buildout targets per year, and a coordinated financing framework that attracts private investment into the nuclear sector – are crucial. The data analysis has shown that the nuclear sector can create high-skilled, high-paying careers with the right policy levers and initiatives. Hence, a nuclear workforce strategy has been developed based on the findings of this report.

APPENDICES

Appendix A: Detailed Analyses by Province

A1: Alberta (Job demand by phase of project; assumption of high job demand)

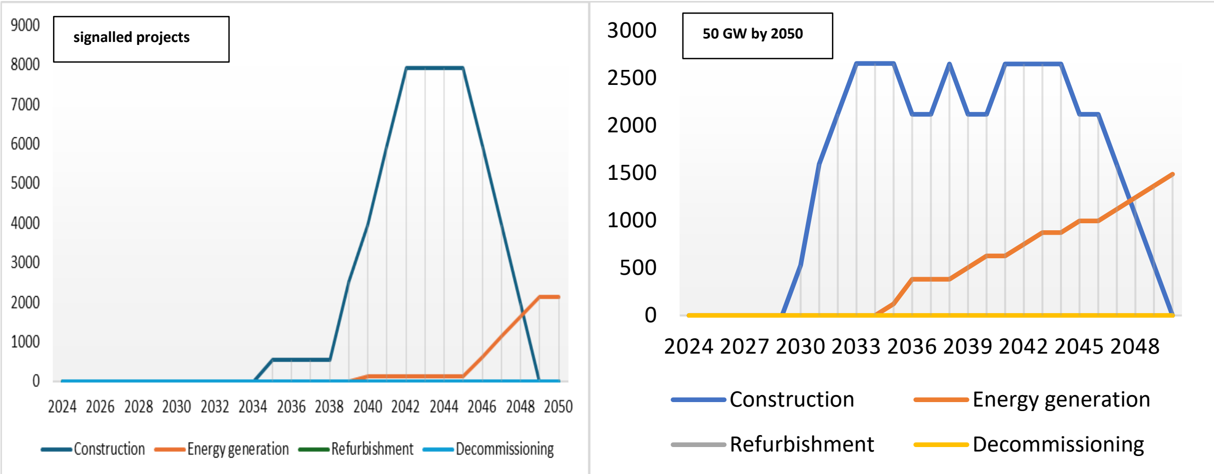


Figure A1.1: Planned and signalled projects (left); 50 GW by 2050 scenario (right)

Table A1.1: Top 25 Jobs that will be in demand for planned and signalled projects in Alberta.

NOC code	Job title	Total 2024-2050
72105	Ironworkers	7564
72201	Industrial electricians	7564
72301	Steamfitters, pipefitters, and sprinkler system installers	7040
75119	Other trades helpers and labourers	6310
72310	Carpenters	4194
22100	Chemical technologists and technicians	3567
20010	Engineering managers	2765
70010	Construction managers	2125
64410	Security guards and related security service occupations	1908
21301	Mechanical engineers	1865
92100	Power engineers and power systems operators	1735
72103	Boilermakers	1587
72100	Machinists and machining and tooling inspectors	1348
72102	Sheet metal workers	1320
21310	Electrical and electronics engineers	1140
22221	User support technicians	1058
21399	Other professional engineers	1015
21300	Civil engineers	944
75110	Construction trades helpers and labourers	810
72999	Other technical trades and related occupations	796
22232	Occupational health and safety specialists	564
22303	Construction estimators	536
42101	Firefighters	536
22233	Construction inspectors	522
73300	Transport truck drivers	522

Table A1.2: Top 25 Jobs that will be in demand for 50 GW by 2050 in Alberta

NOC code	Job title	Total 2024-2050
72105	Ironworkers	15248
72201	Industrial electricians	15248
72301	Steamfitters, pipefitters, and sprinkler system installers	14272
75119	Other trades helpers and labourers	12864
72310	Carpenters	8488
22100	Chemical technologists and technicians	7682
20010	Engineering managers	5885
92100	Power engineers and power systems operators	5101
64410	Security guards and related security service occupations	5010
21301	Mechanical engineers	4638
70010	Construction managers	4272
72103	Boilermakers	3282
72100	Machinists and machining and tooling inspectors	2704
72102	Sheet metal workers	2676
21310	Electrical and electronics engineers	2383
22221	User support technicians	2188
21300	Civil engineers	2187
75110	Construction trades helpers and labourers	1714
72999	Other technical trades and related occupations	1700
70012	Facility operation and maintenance managers	1172
22232	Occupational health and safety specialists	1095
22303	Construction estimators	1067
42101	Firefighters	1067
22233	Construction inspectors	1053
73300	Transport truck drivers	1053

Note that the values reported do not show a gaps analysis due to inability to ascertain existing supply. This is difficult to estimate based on constraints with the data and the lack of a known nuclear workforce in Alberta. Transitioning professionals from other sectors may be able to fill certain job roles and should be taken into consideration when estimating precise need.

The estimates reported also only show direct jobs and do not report on induced or indirect jobs that may be created.

A2: New Brunswick (Job demand by phase of project; assumption of low job demand)

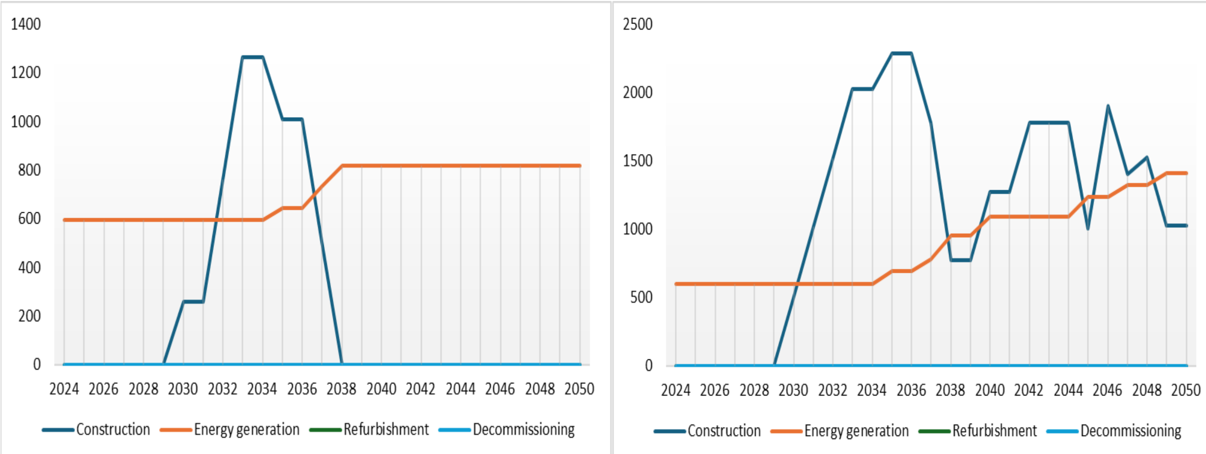


Figure A2.1: Planned and signalled projects (left); 50 GW by 2050 scenario (right)

Table A2.1: Top 25 jobs that will be in demand for planned and signalled projects in New Brunswick

NOC code	Job title	Total 2024-2050
92100	Power engineers and power systems operators	3972
21301	Mechanical engineers	2318
64410	Security guards and related security service occupations	2088
72105	Ironworkers	815
72201	Industrial electricians	815
92024	Supervisors, other products manufacturing, and assembly	783
72301	Steamfitters, pipefitters, and sprinkler system installers	765
22100	Chemical technologists and technicians	748
75119	Other trades helpers and labourers	690
20010	Engineering managers	673
21310	Electrical and electronics engineers	640
22311	Electronic service technicians (household and business equipment)	621
11200	Human resources professionals	513
72014	Contractors and supervisors, other construction trades, installers, repairers, and servicers	513
72400	Construction millwrights and industrial mechanics	486
72310	Carpenters	450
70012	Facility operation and maintenance managers	361
14200	Accounting and related clerks	351
21399	Other professional engineers	344
62029	Other services supervisors	324
21221	Business systems specialists	297
72203	Electrical power line and cable workers	275
21311	Computer engineers (except software engineers and designers)	270
72200	Electricians (except industrial and power system)	270
70010	Construction managers	252

Table A2.2: Top 25 jobs that will be in demand for 50 GW by 2050 in New Brunswick

NOC code	Job title	Total 2024-2050
92100	Power engineers and power systems operators	5194
72105	Ironworkers	3960
72201	Industrial electricians	3960
72301	Steamfitters, pipefitters, and sprinkler system installers	3718
21301	Mechanical engineers	3441
75119	Other trades helpers and labourers	3355
64410	Security guards and related security service occupations	3260
22100	Chemical technologists and technicians	2375
72310	Carpenters	2178
20010	Engineering managers	1993
70010	Construction managers	1116
21310	Electrical and electronics engineers	1085
72103	Boilermakers	847
92024	Supervisors, other products manufacturing, and assembly	783
72100	Machinists and machining and tooling inspectors	780
70012	Facility operation and maintenance managers	762
72102	Sheet metal workers	726
22311	Electronic service technicians (household and business equipment)	621
21300	Civil engineers	599
22221	User support technicians	572
21399	Other professional engineers	544
41210	College and other vocational instructors	525
11200	Human resources professionals	513
72014	Contractors and supervisors, other construction trades, installers, repairers, and servicers	513
72400	Construction millwrights and industrial mechanics	486

Note that the values reported do not show the gaps analysis and it has been assumed that the existing workforce in New Brunswick will be able to fill some of the supply gaps. Transitioning professionals from other sectors may also be able to fill certain job roles and should be taken into consideration when estimating precise need.

The estimates reported also only show direct jobs and do not report on induced or indirect jobs that may be created.

A3: Ontario (Job demand by phase of project; assumption of low job demand)

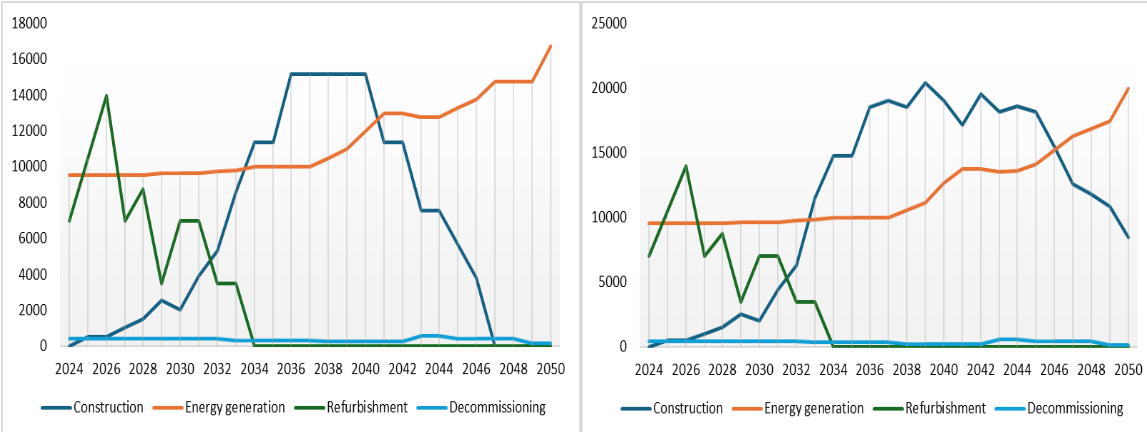


Figure A3.1: Planned and signalled projects (left); 50 GW by 2050 scenario (right)

Table A3.1: Top 25 jobs that will be in demand for planned and signalled projects in Ontario.

NOC code	Job title	Total 2024-2050
92100	Power engineers and power systems operators	61769
21301	Mechanical engineers	37254
64410	Security guards and related security service occupations	32535
72201	Industrial electricians	27755
72301	Steamfitters, pipefitters, and sprinkler system installers	26143
72310	Carpenters	22574
72105	Ironworkers	22289
72999	Other technical trades and related occupations	18758
75119	Other trades helpers and labourers	18595
22100	Chemical technologists and technicians	15212
72103	Boilermakers	14968
92024	Supervisors, other products manufacturing, and assembly	14502
20010	Engineering managers	13198
21310	Electrical and electronics engineers	12455
22311	Electronic service technicians (household and business equipment)	11582
72100	Machinists and machining and tooling inspectors	10081
75110	Construction trades helpers and labourers	10054
72014	Contractors and supervisors, other construction trades, installers, repairers, and servicers	9714
11200	Human resources professionals	9621
72400	Construction millwrights and industrial mechanics	9078
21399	Other professional engineers	8551
70010	Construction managers	6768
14200	Accounting and related clerks	6574
62029	Other services supervisors	6052
72106	Welders and related machine operators	5647

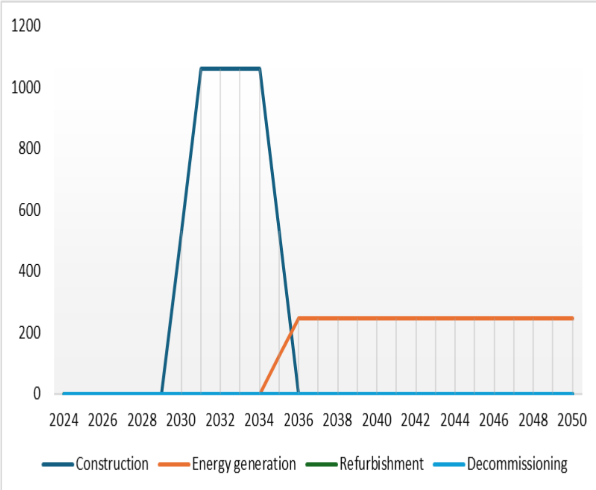
Table A3.2: Top 25 jobs that will be in demand for 50 GW by 2050 in Ontario

NOC code	Job title	Total 2024-2050
92100	Power engineers and power systems operators	65113
72201	Industrial electricians	45211
72301	Steamfitters, pipefitters, and sprinkler system installers	42386
21301	Mechanical engineers	41397
72105	Ironworkers	39745
64410	Security guards and related security service occupations	36715
75119	Other trades helpers and labourers	33213
72310	Carpenters	32230
22100	Chemical technologists and technicians	23443
72999	Other technical trades and related occupations	20614
20010	Engineering managers	19622
72103	Boilermakers	18680
21310	Electrical and electronics engineers	15135
92024	Supervisors, other products manufacturing, and assembly	15008
72100	Machinists and machining and tooling inspectors	13231
22311	Electronic service technicians (household and business equipment)	12000
75110	Construction trades helpers and labourers	11932
70010	Construction managers	11667
21399	Other professional engineers	10214
72014	Contractors and supervisors, other construction trades, installers, repairers, and servicers	10066
11200	Human resources professionals	9973
72400	Construction millwrights and industrial mechanics	9408
72102	Sheet metal workers	7018
14200	Accounting and related clerks	6816
62029	Other services supervisors	6272

Note that the values reported do not show the gaps analysis, and it has been assumed that the existing workforce in Ontario will be able to fill some of the supply gaps. Transitioning professionals from other sectors may also be able to fill certain job roles and should be taken into consideration when estimating the precise need.

The estimates reported also only show direct jobs and do not report on induced or indirect jobs that may be created.

A4: Saskatchewan (Job demand by phase of project; assumption of high job demand)



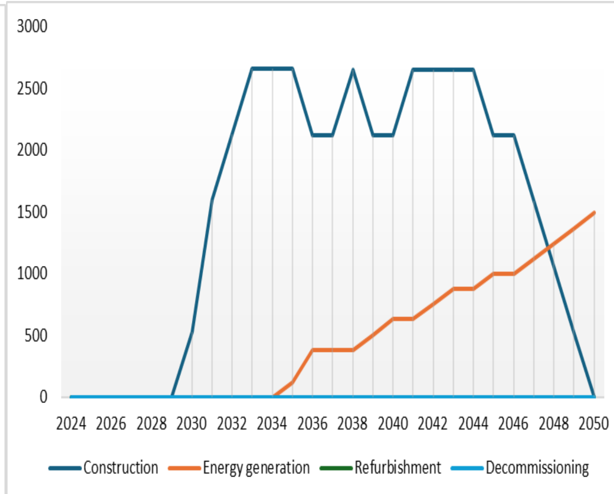


Figure A4.1: Planned and signalled projects (left); 50 GW by 2050 scenario (right)

Table A4.1: Top 25 jobs that will be in demand for planned and signalled projects in Saskatchewan.

NOC code	Job title	Total 2024-2050
92100	Power engineers and power systems operators	1023
64410	Security guards and related security service occupations	714
72105	Ironworkers	680
72201	Industrial electricians	680
72301	Steamfitters, pipefitters, and sprinkler system installers	640
75119	Other trades helpers and labourers	580
21301	Mechanical engineers	575
22100	Chemical technologists and technicians	496
72310	Carpenters	380
20010	Engineering managers	364
70012	Facility operation and maintenance managers	310
41210	College and other vocational instructors	248
21100	Physicists and astronomers	248
70010	Construction managers	190
10019	Other administrative services managers	186
72203	Electrical power line and cable workers	155
72103	Boilermakers	150
72401	Heavy-duty equipment mechanics	124
72100	Machinists and machining and tooling inspectors	120
72102	Sheet metal workers	120
21300	Civil engineers	110
21310	Electrical and electronics engineers	110
22221	User support technicians	100
13201	Production and transportation logistics coordinators	93
72999	Other technical trades and related occupations	80

Table A4.2: Top 25 jobs that will be in demand for 50 GW by 2050 in Saskatchewan

NOC code	Job title	Total 2024-2050
72105	Ironworkers	5304
72201	Industrial electricians	5304
72301	Steamfitters, pipefitters, and sprinkler system installers	4992
75119	Other trades helpers and labourers	4524
92100	Power engineers and power systems operators	3411
22100	Chemical technologists and technicians	3035
72310	Carpenters	2964
64410	Security guards and related security service occupations	2774
21301	Mechanical engineers	2421
20010	Engineering managers	2310
70010	Construction managers	1487
72103	Boilermakers	1175
70012	Facility operation and maintenance managers	1050
72100	Machinists and machining and tooling inspectors	936
72102	Sheet metal workers	936
21300	Civil engineers	846
21310	Electrical and electronics engineers	846
41210	College and other vocational instructors	816
21100	Physicists and astronomers	816
22221	User support technicians	780
72999	Other technical trades and related occupations	624
75110	Construction trades helpers and labourers	624
10019	Other administrative services managers	612
72203	Electrical power line and cable workers	525
72401	Heavy-duty equipment mechanics	408

Note that the values reported do not show the gap analysis. This is difficult to estimate based on constraints with the data and the lack of a known nuclear workforce in Saskatchewan. Transitioning professionals from other sectors may be able to fill certain job roles and should be taken into consideration when estimating the precise need.

The estimates reported also only show direct jobs and do not report on induced or indirect jobs that may be created.

Appendix B: Detailed Methodology

B1 Labour Demand Dataset

The labour demand constitutes the workforce required to sustain nuclear buildout.

The data used to understand labour demand was divided by stages of the nuclear value chain. The phases included are mining, fuel conversion and fabrication, reactor design, reactor construction, reactor operations, reactor refurbishment, reactor decommissioning, and high-level waste management (operational waste management was included under operations). In addition to the stages of the value chain, regulatory and licensing, as well as research and development, were included as important elements to the success of the industry.

B1.1 Mining

For the mining phase, we assumed 5 active operations throughout the 25-year period of evaluation. The active operations are likely to change over this period, but currently include Cigar Lake Mine, Key Lake Mill, McArthur River Mine, and McClean Lake Mill.[6] Throughout the projection period, two additional uranium mines are expected to enter operation, including NexGen's Rook 1 Mine and Denison's Wheeler River Mine.

Workforce estimates were developed through input from Cameco, NexGen's Rook 1 Environmental Impact Statements, and SMA mining labour market analysis[7], and subject matter experts across the Canadian nuclear sector. These inputs provided values that enabled data triangulation and the development of an estimated workforce to meet mining needs.

B1.2 Fuel Conversion and Fabrication

Fuel conversion workforce role estimates were based on familiarity with the fuel conversion process to produce UO_2 and UF_6 from refined UO_3 feedstock. The current scale of production is sufficient to support the nuclear fuel bundle manufacturing requirements for the existing fleet of CANDU reactors (approximately 13,000 MWe) with consideration of the process monitoring, control, and quality assurance to meet the CSA N299 procurement standards. Existing production processes were assumed to be used, without consideration of efficiencies provided by further automation.

For the fuel-conversion facilities, we included the two currently operational facilities, Port Hope Conversion and Nuclear Facility Blind River Refinery. Subsequently, a new facility is assumed to come online with every 7 GW of generation capacity. This assumption is based on the 13 GW of current capacity being serviced by 2 facilities.

Fuel fabrication estimates were based on familiarity with the fuel fabrication processes, including production of Zircaloy components, pellets, and bundle assembly with consideration of the required process monitoring, control, and quality assurance to meet the CSA N299 procurement standards. The estimates assumed the bundle assembly process (pellet loading, element welding, bundle assembly, and welding) was largely automated, with production sufficient to meet the annual fuel bundle demands of approximately 7,000 MWe of power production by CANDU reactors. In estimating labour demand, we have assumed that the fuel fabrication capacity will increase with

6 Uranium mines and mills, Government of Canada
7 https://saskmining.ca/wp-content/uploads/2025/01/SK-Mining-Labour-Market-Analysis-final-resized-for-email-1.pdf

demand and additional shifts. However, there will be automated systems to handle the additional capacity, and the labour force will remain the same.

For the fuel-fabrication facilities, we included the three active facilities, Cameco Fuel Manufacturing Inc, BWXT Nuclear Energy Canada Inc, Toronto and Peterborough, and assumed an additional facility would be required once an additional 4 GW of power was brought online. Fuel fabrication estimates were derived from the more automated processing of the Cameco Fuel Manufacturing facility.

B1.3 Construction

As we have not completed the construction of a nuclear reactor in Canada in the past 30 years, we have derived construction workforce estimates by unit size using data from the U.S. Department of Energy (DOE), which provided average workforce requirements for large-scale reactor designs such as the ESBWR, ABWR, and AP1000, with an average output of 1,350 MW. The occupational roles associated with these construction activities were mapped to corresponding NOC codes in Canada to develop a representative workforce profile for a 1,300 MW reactor. This profile was subsequently scaled to reflect the workforce requirements for a 1,200 MW unit.

To estimate the construction workforce for smaller units (i.e., reactors between 75 – 300 MW), data from NuScale's 12-module, 924 MW power plant was utilized. The total workforce estimate for this plant was proportionally scaled to align with the outputs of the smaller units and distributed across the construction occupations as defined by the DoE workforce estimates. A learning factor of 0.95 was implemented, meaning that there is a 5% improvement in productivity with subsequent reactor builds, to account for construction efficiencies in non-First-Of-A-Kind (FOAK) designs, established supply chains, and deployment experience. We used additional Canadian workforce projections from planning completed by utilities and vendors considering small reactors to validate the compiled numbers.

B1.4 Reactor Operations

Based on the assumed timeline for new reactor deployment, we identified the specific workforce requirements at the job profile level for each set of reactors and each phase. These estimates were based on input from companies in the nuclear value chain, international benchmarking, and reported workforce estimates by organizations. The different sizes of reactors included were micro-reactors (<100 MW), small reactors (100-300 MW), medium reactors (300-850 MW), and large reactors (1000+ MW).

The operational workforce for a 1,200 MW nuclear reactor was estimated using workforce data from the United States nuclear industry. This approach assumed that the Canadian nuclear workforce composition and operational structure are comparable to those of the U.S. sector, as there are no installed units of this size in Canada. Data from the U.S. Bureau of Labour Statistics (BLS) was utilized, specifically drawing from Sector 22, which includes utilities such as nuclear electric power generation, transmission, and distribution. Occupational roles identified within this sector were mapped to corresponding NOC codes to create a representative operational workforce profile.

A learning factor of 0.95, meaning that there is a 5% improvement in productivity with subsequent reactor builds, to account for operational efficiencies, including experience and standardized procedures.

To estimate the operational workforce for smaller reactors (75 - 300 MW), workforce data from NuScale's 12-module, 924 MW power plant was also used. Occupational roles provided by NuScale were similarly mapped to relevant NOC codes, and workforce numbers were proportionally scaled to match each unit size. In the high-case scenario, a scale-up factor of 1.5 was applied based on findings from an International Atomic Energy Agency (IAEA) study, which indicated that staffing intensity for small reactors can increase to approximately 1.5 personnel per MW(e), due to reduced economies of scale and operational inefficiencies.[8]

Within each phase, relevant occupational roles defined by Canada's NOC codes were identified and subsequently grouped by functional categories. These categories include engineering, administrative (including human resources, finance, and administration), production, professional and physical science occupations, technical (including technicians and technologists), trades, supervisors and management, and support workers. Following this classification, full-time equivalent (FTE) requirements were assigned to each occupation.

B1.5 Refurbishment and Decommissioning

B1.5.1. Refurbishment

Labour requirements for refurbishment are based on the standard normal complement for a station and an estimated labour force composed of noted skilled trades in reports on the Darlington refurbishment[9]. In addition, refurbishment requires significant project management staff, so these positions were added.

B1.5.2. Decommissioning

Labour requirements for decommissioning were created by a subject matter specialist with 30 years of international experience in Waste Management and Decommissioning and were based on the experience of being involved in a number of nuclear decommissioning projects. While this experience was gained on non-CANDU decommissioning, the fundamental principles of decommissioning do not change. The skills required for decommissioning are different from those for the operation of facilities, but operational staff play a significant role in the decommissioning process, as they have in-depth knowledge of the facility.

To estimate the decommissioning workforce for a large nuclear unit, workforce projections from the planned decommissioning of the Pickering Nuclear Generating Station (PNGS) A were utilized. PNGS A comprises four units with a combined output of approximately 2,060 MW. The associated workforce estimates were proportionally scaled to reflect the requirements for a 1,200 MW facility. Based on input from subject matter specialists, a range of values was provided, enabling the development of both high-case and low-case scenarios to account for variability in decommissioning strategy and efficiency.

It should also be noted that to enable decommissioning to take place in facilities where decommissioning was never considered during building design, it is often necessary to perform construction of services to allow for decommissioning to be performed. These activities include, but are not restricted to construction of additional HVAC, the construction of waste handling and assay areas and other support services. Where such additional facilities are required, it is common practice to reuse ancillary buildings such as turbine halls, but this may not be possible and new temporary constructions may be required.

Decommissioning activity continues beyond 2050, but workforce requirements are focused on the years immediately post-closure. We have assumed that the first 10 years following shutdown require a workforce to move into a safe store state, then the following 5 years are a scale-down period, and all subsequent years are a

[8] https://www-pub.iaea.org/MTCD/Publications/PDF/te_1193_prn.pdf Staffing requirements for future small and medium reactors (SMRs) based on operating experience and projections. IAEA.
[9] https://auditor.on.ca/en/content/annualreports/arreports/en18/v1_302en18.pdf Auditor report on the NGS Refurbishment Project stated that about 1,500 contractor staff were working on the project
Nuclear News, 2017 noted that there are now over 5,000 supplemental workers on site, specifically construction trades, including boilermakers, carpenters, welders, electricians, and pipefitters. An average between these two figures was used for a more conservative approach.

safe store with minimal staffing needs (20% of decommissioning staff).

B1.6 Research and Development

To assess the workforce growth associated with research and development (R&D) in support of an expanding nuclear sector, the occupational profile of a national nuclear laboratory was used as a benchmark. It was assumed that the occupational structure required in Canada would be comparable to that of the U.S.-based Idaho National Laboratory (INL), which is currently expanding its R&D capacity to support next-generation nuclear reactor technologies. Occupational roles identified at INL were mapped to corresponding NOC codes to align with the Canadian workforce framework. Where possible, data from the Canadian Nuclear Laboratories was used as a benchmark, but information obtained was limited.

An estimate of the current Canadian nuclear R&D workforce was obtained through input from subject matter specialists, and this value was proportionally distributed across the occupational categories identified from the INL profile. To project future growth in R&D workforce demand, a growth rate of 17% over five years, sourced from the Canadian Nuclear Association (CNA), was applied iteratively to model R&D workforce expansion through to 2050.

Based on this assumption, it is projected that the workforce in the R&D sector will increase from 793 to 1852 full-time equivalents (FTEs) between 2025 and 2050. The number of the R&D workforce remains consistent across different scenarios and does not fluctuate.

Reactor design was included as its own category and was calculated by reviewing the number of staff at various reactor developers who are undertaking pre-construction design and licensing activities. Assuming a five-year design process aligned to successful design reviews, the total number of job-years was evaluated. This value was validated against the design certification process for the Westinghouse AP-1000.

B1.7 Waste Management

Waste management associated with general operations was included in the reactor operations staffing profile; however, this separate category includes the construction and operations of the Deep Geologic Repository (DGR). The proposed timelines were found on the NWMO website and included pre-construction & regulatory approvals in 2028, construction in 2033, and operations starting in 2043.[10] To develop the workforce estimates, information was compiled using NexGen's Rook 1 EIS, considering that the construction of a mine and the construction of the DGR are likely to share many common factors. Workforce estimates for operations consider both the mine operations and above-ground operations. Above-ground operations were derived from the labour estimates from Possiva (Finland) for their DGR, including both their labour estimates and their 2021 and 2023 financial reports.

These estimates are rough estimates based on broad assumptions. NWMO is anticipating reviewing their workforce estimates in 2026.

B1.8 Regulatory and Licensing

For the current CNSC efforts, a list was established for CNSC based on the Government Electronic Directory Service with extracted staff names and titles within the relevant groups.[11] A subject matter expert then considered the total of 594 staff positions and considered if the position was directly linked to performing licensing and

[10] https://www.nwmo.ca/Frequently-asked-questions
[11] https://geds-sage.gc.ca

compliance for nuclear facilities or providing support for this activity (what is usually referred to as Nuclear Regulations). If so, then the job was categorized by NOC code and included in the estimated labour required. Regulatory and licensing on the industry side were estimated using data from Canadian utilities. The licensing of new reactor designs is included in the reactor design workforce demand estimates.

Additional regulatory and licensing support will be required as additional reactors come online, as the increase of staff is proportional to the increase in operating reactors.

B2 Reactor assumptions

With the energy scenarios and the demand inputs supplied, we categorized reactors into four types and made an associated assumption on the length of the construction period for each, based on average timelines observed in Canada, the US, and France. We did not consider possible delays in the licensing or impact assessment process in these estimated lengths of time, and therefore, these timelines are ambitious. However, selecting ambitious average construction periods allowed the model to statistically account for fleet deployment, schedule optimization, and the improvement of productivity over time.

Table B2: Reactor types and associated construction periods

Reactor Type	MW output	Construction period (years)
Micro reactor	<100 MW	2
Small reactor	100-330 MW	5
Medium reactor	340 – 850 MW	7
Large Reactor	1000+ MW	7

B3: Labour Supply Methodology

B3.1. Sources

For the supply of the nuclear workforce that currently exists, and the trends associated with our current rate of workforce preparation, we drew data from the COPS System, which provides projections on labour market conditions in Canada, focusing on the period from 2024 to 2033. COPS aims to identify potential imbalances in the labour market, guiding policy decisions and helping stakeholders understand future trends in employment, job openings, and job seekers.

The growth in labour market supply includes the number of job seekers entering the labour market, which consists of new graduates, immigrants, and other individuals re-entering the workforce. To estimate the retirement rate between 2025 and 2028, data from the Center for Energy Workforce Development was used. Their report forecasts a retirement rate of 2.4% in the utilities industry in the United States between 2018 and 2028.[12] We used it as a proxy for the Canadian nuclear industry. Between 2029 and 2050, we assumed a retirement age of 65 and projected the evolution of the retirement rate throughout the entire period based on demographic forecasts.

[12] 2019-GapsintheEnergyWorkforce-SurveyResults.pdf Center for Energy Workforce Development

Individuals who complete their education and enter the labour market are a significant part of the supply. Immigration plays a smaller role in the labour supply, with new immigrants contributing to the pool of job seekers. Transitioning workers include those transitioning from other occupations or industries and from unemployment. These projections help in understanding the future availability of workers in various occupations and industries, guiding policy decisions related to education, training, and immigration to ensure a balanced labour market. The projections are based on assessments of recent labour market conditions and future labour demand and supply, using models and the NOC. The last version was published in early 2025 and is based on the assumptions during the spring of 2024. Therefore, it does not consider the changes to immigration targets announced in October 2024. These changes were accounted for in the adjustments detailed below.

B3.2. Adjustments to the general supply of labour

We made several adjustments to the COPS projection for use in our model.

The original projection spans from the years 2024 to 2033. To estimate the labour supply for the years 2034 to 2050, we applied an extrapolation assuming a consistent trend for all supply drivers included in the COPS projection. Consequently, the growth in supply for each year from 2034 to 2050 was assumed to be equivalent to that in 2033.

As indicated above, the COPS projection was developed before changes to immigration targets, specifically:

- the decrease in permanent resident targets.
- the decrease in worker visas.
- and the decrease in student visas.

To adjust the supply projections to reflect these policy changes, we used data published and announced by the Government of Canada to calculate a percentage decrease for the supply of new immigrants, the change in study permits, and the change in new graduates. Currently, the Canadian government's targets for immigration levels have changed for the years 2025 - 2027.

To assess the supply of new immigrants, we compared the change in objectives for net immigrants per 1000 people. This indicator accounts for both incoming and outgoing immigrants. Over the next three years, this percentage has resulted in a reduction in the supply of new immigrants.

Similarly, based on changes to study permits and new graduates, we analyzed the proportion of international students within the total student population in Canada for the 2022/2023 academic year. The Federal government announced it would cut international study permits by 35% in 2024 and a further 10% in 2025. Based on data for permits distributed in the first six months of 2025, actual issued permits will be far below the target. The government has announced a strategy to continue cutting issued permits each year until at least 2028.[13] We compared the government's announced target for new study permits to the total number of students in Canada. This updated percentage of international students was then compared to previous figures to estimate the variation in the supply of new graduates.

Canadian demographics data was used to calculate the growth rate of the working-age population (24-64) from 2033 to 2050. This growth rate was applied in the model to increase the future supply of job seekers.

To account for the number of individuals retiring from the nuclear workforce, we used two different methods. For the period between 2025 and 2028, we used data from the Center for Energy Workforce Development which

[13] 2025 Provincial and territorial allocations under the international student cap, Government of Canada. 2025 provincial and territorial allocations under the international student cap - Canada.ca

estimates a retirement rate of 2.4% in the United States in the utilities industry between 2018 and 2028.[14] The sector in Canada has a similar demographic structure compared to the United States and may experience the same retirement rate. For the rest of the period, the estimation was based on the 2025 retirement rate and estimating future changes to that rate using demographic forecasts. We used demographic projections from Statistics Canada up to the year 2050, comparing the number of individuals turning 65 annually as a percentage of the population aged 25-64. This percentage was then converted into a ratio to examine the trends in new retirees and how the retirement rate is projected to evolve until 2050.

B3.3. Estimation of the current supply of nuclear workers

We estimated the future supply of workers in the nuclear sector by applying growth rates in each occupation in our projections to the findings 2024 Nuclear Jobs Study by CNA. This was completed by taking the following key steps:

a) Estimation of nuclear workforce by occupation:

Data on the number of workers in each occupation in the nuclear industry is not available. Therefore, we estimated the current labour supply in the relevant occupation by using data about existing nuclear operational facilities in Canada and then using the demand inputs estimated. The occupations used in our estimates are based on NOC code categories used by Statistics Canada.

b) Estimation of employment by occupation for Canada:

To estimate the total size of the entire Canadian workforce in each occupation relevant to the nuclear sector, we used census data. This is the most detailed occupation data available (6-digit NOC), but it is only available until 2021. To estimate the data for 2024, we applied the actual growth rate of the 2-digit NOC between 2021 and 2024.

c) Estimation of supply growth:

We combined the figures above to calculate the percentage of labour in the nuclear industry relative to the total number of workers by NOC codes in 2024. This percentage was the basis for determining the supply of workers available for each NOC code over time.

For example:

$$Percetange\ of\ workers\ in\ the\ NOC\ 10011\ related\ to\ the\ nuclear\ industry =$$

$$\frac{Number\ of\ workers\ estimated\ with\ the\ demand\ inputs\ for\ 10011}{Number\ of\ workers\ in\ 2024\ for\ 10011} \text{ x } 100$$

To estimate how the current supply would evolve over time without strategic intervention to grow the nuclear workforce in accordance with buildout need, we drew on COPS to identify the total number of workers entering each occupation in each year and assumed that for each of the relevant occupations the share of workers employed by the nuclear sector will remain at its current estimated level over the projection period.

d) Estimation of labour supply for construction

In 2024, one reactor project (a BWRX-300 SMR at Darlington) began site preparation, and two refurbishment projects were underway (one at Bruce and one at Darlington). There are not many active projects in comparison to the buildout ambition, so the methodology applied to other phases of nuclear underestimate the current supply by failing to account for construction

[14] Gaps in the Energy Workforce 2019 Pipeline Survey Results, Center for Energy Workforce Development

workers that can transfer into nuclear from other non-nuclear major projects. To capture that transferable supply, we applied a different methodology to the supply of the construction workforce.

Our approach was to identify the total size of the construction workforce that is available for major projects and estimate how many could be available for nuclear construction projects, based on the total number of projects under construction in each year.

Natural Resources Canada (NRCan) defines major projects as significant natural resource initiatives that are either currently under construction or planned within the next decade. These projects aim to enhance, expand, or improve natural resource production in Canada. They encompass new extraction projects, infrastructure developments, major processing facilities, and substantial expansion projects.

To qualify as a major project according to NRCan, the following capital thresholds must be met:

- **Energy and mining sectors**: Minimum capital investment of $50 million
- **Electricity and forest sectors**: Minimum capital investment of $20 million
- **Clean energy and clean technology projects**: Minimum capital investment of $10 million[15]

Nuclear reactors are included within this definition and listed in the inventory available on the NRCan website. We calculated the number of employees engaged in major projects nationwide, distributing these figures equally among all major projects under construction. This is a simplifying assumption, as we do not know specific employment for each project. To do this, we took the following steps:

1. Estimated the total size of the construction workforce using COPS projections.
2. Estimated the share of the construction workforce involved in major projects using the split of major projects compared to other types of construction (e.g. commercial, residential) from IBIS industry analyst reports, which provide in-depth industry research, offering data-driven insights on market trends, competitive dynamics, and financial benchmarks to support strategic decision-making.
3. Estimated the number of major projects happening using data from NRCan (to 2034) and applied a linear extrapolation to 2050 based on previous trends.
4. Assumed that the number of workers in the major project construction workforce are split evenly between the total number of major projects in each year as a simplifying assumption.

B3.4: Limitations of supply data

There are several limitations implicit in the supply data. The assumptions listed above to estimate the distribution of the total construction workforce are very simplistic, which may impact final numbers, although sensitivity analyses suggest this impact would be minimal. There is also a lack of supply data at a regional level, which prevents a true provincial analysis of gaps. Additionally, there is no data available on the demographic breakdown of the nuclear sector, even with a custom census pull. As such, this prevents analyses by demographic or projections based on gender, race, etc.

[15] https://natural-resources.canada.ca/science-data/data-analysis/major-projects-inventory

Appendix C: Disclaimer

The model was created, and subsequently, this report was developed in accordance with the scope of work and subsequent changes approved by the Canadian Nuclear Association (CNA). Upon submission, the CNA also completed additional revision and analysis. CNA is responsible for all management functions and decisions relating to this engagement, including establishing and maintaining internal controls. CNA is also responsible for the results achieved from using the services or deliverables. The model is the property of CNA.

Appendix D: Use Limitations

This report has been prepared by Kinetrics and PWC solely for the use and benefit of the CNA, its members, and the project partners of the Steering Committee. This model report is current to the applicable changes incorporated into the model as of November 2025. This publication is not expected to be redacted as CNA, or its partners, make changes in the model, but subsequent reports may be published as new data inputs become available for the model.

This report and related analysis must be considered as a whole. Any changes made by CNA and its members to the model will no longer be representative of the analysis shown in this report.