Canadian Renewable Electricity Development: Employment Impacts

Executive Summary

Low-impact, renewable electricity sources currently employ an average of six people per 10 MW of capacity. If the federal government were to encourage the development of these energy sources with a 1¢ per kilowatt hour incentive paid to power producers, they would leverage significant job creation.

The Clean Air Renewable Energy Coalition has proposed that there is the potential in Canada increase the capacity of low-impact renewable electricity to approximately 35,600 MW between 2004 and 2020. Depending on the assumptions used, building and operating this capacity would create between 12,700 and 26,900 jobs by 2015, and would sustain these jobs through to 2020.

Ninety-nine percent of these jobs would be approximately evenly distributed between onshore wind, run-of-river hydro, and biomass facilities. Over time, the job mix would steadily shift away from manufacturing and development and towards operations and management. By 2020, 54% of jobs would be dedicated to keeping existing facilities operational. The employment created from low-impact renewable electricity would be comparable to or greater than that created by an equivalent capacity of fossil fuel-based generation.

Background

Building on their report, *Vision for a Low-Impact Renewable Energy Future for Canada*, the Clean Air Renewable Energy Coalition estimated that Canada's supply of low-impact, renewable electricity could be increased to 35,600 MW (current capacity is 3,700 MW) between 2004 to 2020 (see Table 1).[1] According to their findings, of the renewable electricity types examined, onshore wind, run-of-river hydro, offshore wind, and biomass would be expected to make the largest contributions to capacity.

Table 1 — Total Capacity by Renewable Electricity Type (MW)

Renewable Electricity Type	**Year**				
	2004	*2008*	*2012*	*2016*	*2020*
Wind (onshore)	520	3,735	8,335	13,935	19,265
Wind (offshore)	-	50	550	2,450	3,600
Small Hydro	2,000	2,850	4,200	6,050	7,250
Photovoltaics[2]	12	74	154	234	344
Geothermal	-	100	200	300	400
Ocean	20	20	36	436	886
Biomass	1,619	1,969	2,699	3,349	3,849
Total	4,171	8,798	16,174	26,754	35,600

The Coalition then took this work a step further to estimate the number of jobs that could be created in Canada between 2004 and 2020 if each of these renewable electricity opportunities were to be developed. The types of job examined were manufacturing, construction and installation, fuel collection, and operation and maintenance.

[1] These estimates are described in greater detail (including numbers for missing years) in the Coalition's *"Federal Budgetary Implications of Coalition Recommendations."*

[2] Photo-voltaic capacity is not listed in Table 3 in the Coalitions *"Federal Budgetary Implications of Coalition Recommendations"* because they are supported by a different mechanism.

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Based on findings from a literature review and industry interviews, the labour requirements for pre-operation parts manufacturing, and development and construction were estimated for each renewable electricity type (expressed as job-years per MW). Similarly, the labour requirements for operations and maintenance, and fuel collection jobs were estimated for each renewable electricity type (expressed as jobs per MW). This information is presented in Table 2. Of the four largest contributors to this potential new electricity generation capacity, run-of-river hydro was predicted to be the most labour intensive per MW for pre-operational work, while biomass was found to be the most labour intensive once a facility is operational.

Table 2 — Employment Coefficients

Renewable Electricity Type	Parts Manufacturing (Job-years/MW)	Development & Construction (Job-years/MW)	Operation & Maintenance (Job / MW)
Wind (onshore)	3.04	0.88	0.10
Wind (offshore)	3.04	1.18	0.10
Run-of-river Hydro	0.50	10.80	0.22
Photovoltaics	18.80	7.10	0.10
Geothermal	—	4.00	1.70
Ocean	3.04	1.18	0.10
Biomass	— *	2.00	0.95**

*Biomass manufacturing is included in development and construction

**Includes fuel collection

Table 3 provides a qualitative assessment of the certainty of these results, based on the number of data sources available, and their consistency and transparency. Of the four largest contributors to capacity, confidence in the onshore wind energy coefficients is highest. Because information was less readily available, confidence in run-of-river hydro (parts manufacturing in particular), offshore wind, and biomass coefficients is lower.

Table 3 — Degree of Confidence in Employment Coefficients

Renewable Electricity Type	Parts Manufacturing (Job-years/MW)	Development & Construction (Job-years/MW)	Operation & Maintenance (Job / MW)
Wind (onshore)	High	High	High
Wind (offshore)	Low	Low	Low
Run-of-river Hydro	Medium	Medium	Medium
Photovoltaics	Medium	High	High
Geothermal	Low	Medium	Medium
Ocean	Low	Low	Low
Biomass	Low	Low	High*

*Includes fuel collection

Estimates of annual job creation were produced for each type of job and renewable electricity source by combining the newly installed capacities (Table 1) with the employment coefficients (Table 2). The resulting employment estimates are shown by renewable type in Figure 1, and by job type in Figure 2. According to predictions, onshore wind, run-of-river hydro, and biomass take a decreasing share of the total renewable electricity industry jobs, dropping from 99% to 81% between 2004 and 2020.

Interestingly, although run-of-river projects account for only 17% of total new capacity by 2020, the high labour input required for development and construction results in this energy type accounting for 27% of

new jobs. Based on job types, total employment is initially dominated by development and installation work, but, as capacity increases between 2004 and 2020, the share of total employment from operation and maintenance and fuel collection jobs increases from 5% to 54%.

Figure 1 — Job Creation Estimates by Renewable Electricity Type

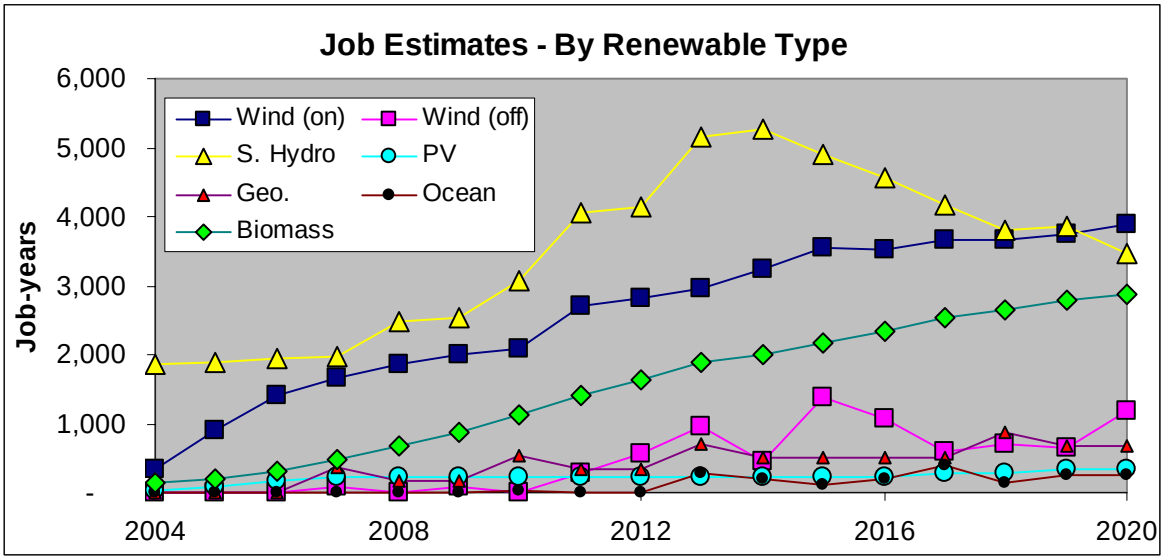
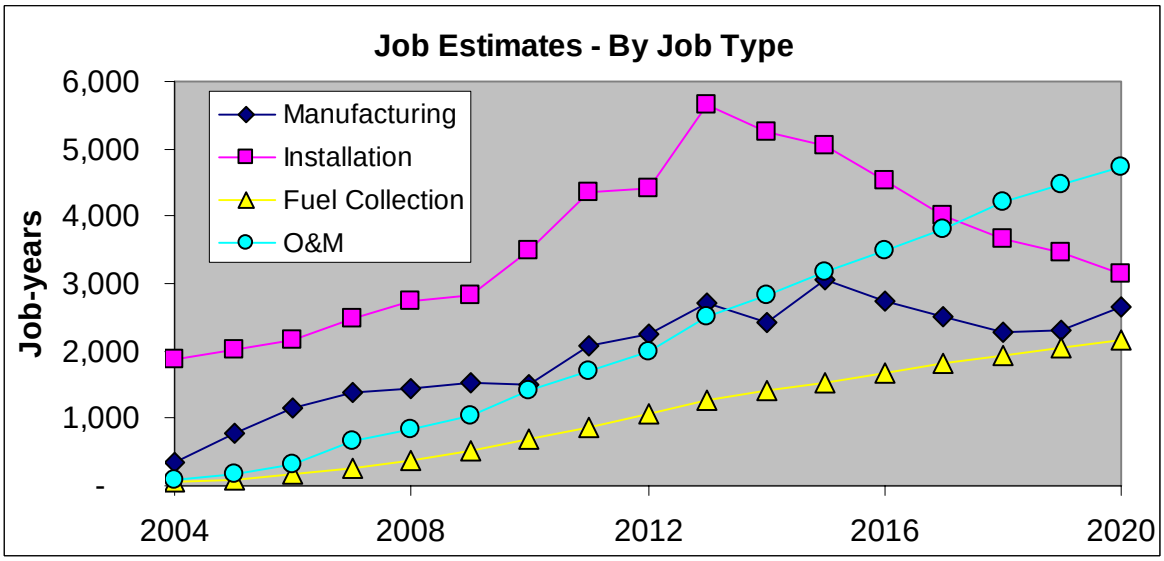


Figure 2 — Job Creation Estimates by Job Type



Given that a range of parameter estimates was found in the literature, conservative assumptions were made to create this base case scenario. To accurately account for the full range of data found in the literature, the following two alternate scenarios were also examined:

1. The base case job creation coefficients presented in Table 2 were replaced with high-end estimates as found in the initial literature review.
2. Of parts manufacturing and development and installation employment, 100% was assumed to be filled domestically. (The base case assumed that a portion of the employment would be awarded to non-Canadian firms and workers.)

The results of these alternative scenarios are shown in Figure 3, where the four lines indicate total jobs in a given year assuming, 1) base case values, 2) base case job coefficients with 100% domestic employment, 3) optimistic job coefficients with base case domestic employment, and 4) optimistic job coefficients with 100% domestic employment. Employment estimates range from 2,300 to 4,100 in 2004, growing steadily to 12,700 to 26,900 by 2015, and then levelling off through to 2020.

Figure 4 compares the base case and optimistic job scenarios with employment estimates for coal and natural gas plants with identical capacities, based on Kammen's (2004) assessment of employment required for a variety of generation technologies. Natural gas is the lowest job creation option, while coal falls between the base case and optimistic renewables estimates in terms of job creation.

Figure 3 — Total Job Estimates

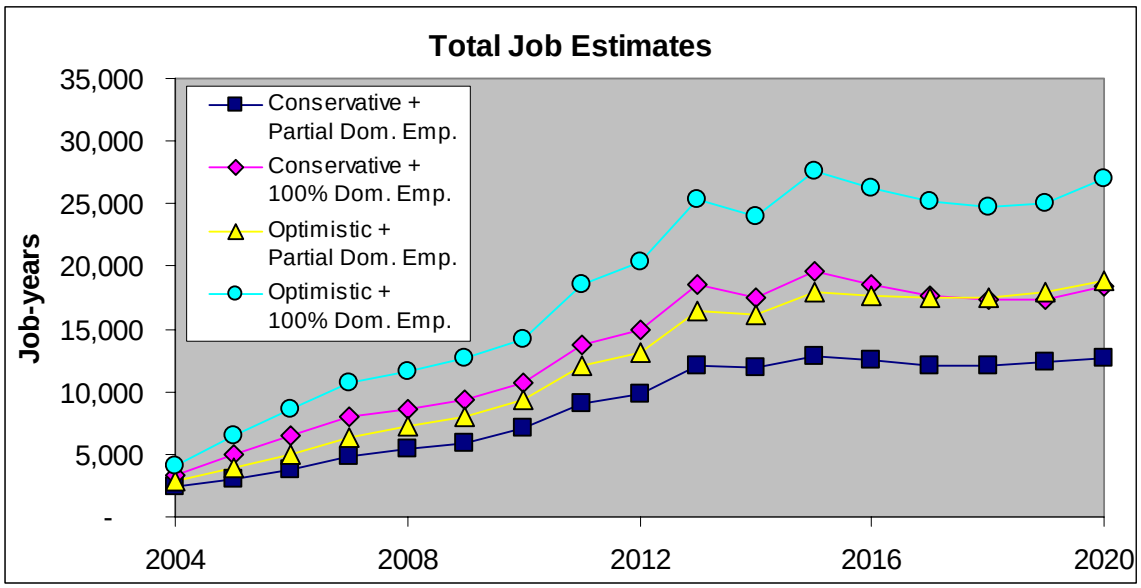
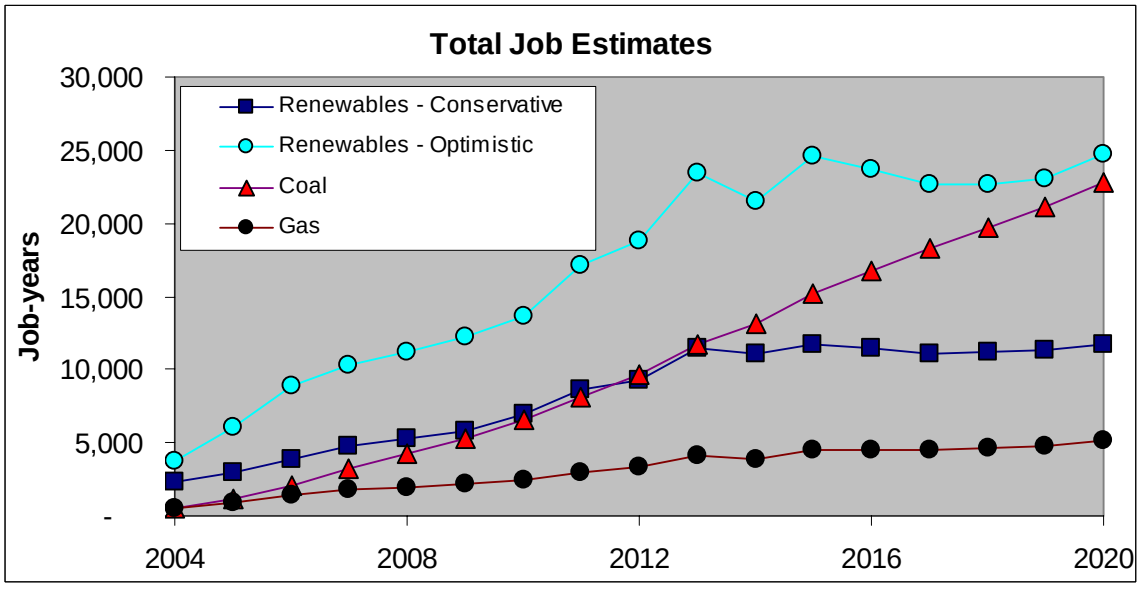


Figure 4 — Job Creation Potential: Renewables versus Conventional



Conclusion

This research provided a high-level perspective on the potential employment implications of low-impact renewable electricity development. In summary, increasing Canada's capacity of low-impact renewable electricity to 35,600 MW between 2004 and 2020 would create between 12,700 and 26,900 jobs by 2015, and these would be maintained to 2020. These jobs would be associated mainly with onshore wind, run-of-river hydro, and biomass facilities. By 2020 the majority of jobs would be focused on keeping existing facilities operational. The employment created from this development would be comparable to or greater than an equivalent capacity of fossil fuel-based generation.

Many avenues remain to be explored, and possible next steps in this research include the following:

- Refining the contrast with conventional electricity options.
- Determining the potential regional employment impacts of renewables development.
- Examining the quality of new jobs created in terms of education and skills required, and compensation offered.

References

The following references were used in the research for the report. All supporting assumptions and calculations for the employment predictions are available upon request.

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