PEMBINA institute

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British Columbia clean energy jobs map

Methodology backgrounder

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The data used for this map was created by cross-referencing several databases to identify renewable energy projects currently operating and under construction in British Columbia. Currently operating project data comes from the Canadian Industrial Energy End-Use Data and Analysis Centre's (CIEEDAC) Canadian Renewable Energy Database, as well as B.C. Hydro's IPP supply list from October 2014. Further online cross-referencing was done with B.C Hydro, Fortis BC, Columbia Power, with several independent power producers and through direct conversations with independent power producers operating in B.C. Project locations were identified from direct conversation with project operators, referencing project literature and, if unavailable, from locating the project on Google Earth.

Table 1: Job Factors used by the Pembina Institute (jobs/MW)

	Large hydro	**Run-of-river**	**Biomass**	**Wind**	**Solar**	**Biogass**
Construction (direct)	8.87	5.76	20.15	1.83	15.30	11.58
Construction (indirect)	12.78	12.78	13.00	8.77	13.20	11.35
Operation (direct)	0.04	0.08	1.90	0.18	0.20	1.02
Operation (indirect)	0.03	0.11	2.13	0.19	0.10	0.56

Note: These job factors do not include transmission jobs. Transmission jobs are added in post based on % generation by the technology as described below

The map shows job numbers as a snapshot in time (i.e., the number of jobs the industry currently supports in B.C., effective until the end of Q2 2015) and includes direct and indirect jobs. Induced jobs, while significant, are not included. The number of jobs are primarily calculated from job factors developed by Clean Energy Canada, which in turn are based on BC Hydro's 2013 Resource Options Reports Update. The job factors were cross-referenced with the academic literature, notably Wei et al. (2010). Whereever the job factors were inconsistent in the literature for a particular generation technology (see Appendix A), the Pembina Institute contacted companies operating the technology in B.C., and developed job factors based on the actual number of employees that the companies have operating their power stations.

Projects currently under construction were identified using the B.C. Major Projects Inventory. In the inventory, only projects were included that have a status of "Construction started" and are consistent with the MIT definition of clean energy. To be conservative, only projects with an expected completion date of the end of Q2 2015 were included; projects with an expected earlier completion data are counted in the operating category. Construction job numbers give full time equivalent (FTE) employment over the construction period. To give a snapshot in time, the total FTE number was divided by the average length of construction for that type of project (calculated from recently completed projects in the major projects database).

Table 2: Job factors (person years/$ million)

	Upgrades BC Hydro (per $ million)	Transmission lines (per $ million)
Construction Direct	1.57	2.87
Construction Indirect	2.12	0.64

Table 3: Construction length (years)

Type	Length
Large Hydro upgrade	5.6
Run-of-river	3.0
Wind	2.0
Biomass	3.0
Transmission	3.0

Transmission jobs information was not available using the sources listed above. This information was taken from the 2011 Review of BC Hydro, which gives a detailed breakdown of the number of jobs through eight different sectors of BC Hydro, including transmission. Transmission jobs data was reduced in line with BC Hydro's overall decrease in employment from 2011 to 2014. Furthermore, only 93 per cent of the remaining transmission jobs are included, reflecting the legislated share of clean electricity the utility must produce. Transmission jobs information was then added to the direct employment of the generating technologies, based on the technology's contribution to total provincial electric capacity (e.g., wind energy employs 88 direct operating FTEs and accounts for three per cent of B.C.'s generating capacity. Transmission of clean energy by BC Hydro employs 2,966 FTE. Adding three per cent of the transmission jobs gives total direct operation jobs for wind of 183.).

Review process

Detailed project information including location and/or employment information was reviewed by the operators and owners in as many instances as possible, including Alterra, Innergex and GDF-Suez Canada (Sea Breeze Power Corp.). The list of projects, as well as general information regarding ownership, capacity and location was reviewed by Clean Energy BC. The job factors are based on factors created by Clean Energy Canada and reviewed to a standard that was approved by them. All information presented is the responsibility of the Pembina Institute, and not the reviewers.

Appendix: Comparison of factors from different studies

The two technologies where the job factors differed significantly in the literature were hydro, run-of-river and biomass. Below is a detailed view of the factors found.

Table 4: Job factors from various sources (jobs/MW)

	BC Stats (input-output model)	Survey with companies	Wei et al (2010) (direct)	Clean Energy Association of BC (2011) (direct)	Average (direct)
Hydro Run-of-River					
Run-of-river construction (person years)	Direct: 11.22 Indirect: 12.78	5.76	5.71	4.0	7.0
Run-of-river operation and maintenance (full time equivalent)	Direct: 0.75 Indirect: 0.11	0.08	1.14	0.06	0.7
Biomass					
Biomass Construction (person years)	Direct: 20.15 Indirect: 13.00	N/A	4.3 / 8.5	4.2	11.0
Biomass operation and maintenance (full time equivalent)	Direct: 1.90 Indirect: 2.13	N/A	1.53 / (0.24+1.34)	0.5	1.31

* Wei *et al.* (2010) describes only direct jobs but has information on jobs multiplier for the resource type. This source also includes manufacturing information. For Biomass, indirect job growth is ~2.1 person years per megawatt (total of both construction and operations). Wei et al. cited multiple findings for biomass, which explains the two numbers in that column.