Powering our Province:

An Analysis of the Clean Energy Business & Workforce Opportunities for Communities in British Columbia

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Prepared By:

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SOUTHERN INTERIOR BEETLE ACTION COALITION
SIBAC

Canada's Rural Partnership
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About this Project

This project was commissioned to explore the rural business and employment opportunities associated with the clean energy and Independent Power Producer (IPP) sector in British Columbia. The study is a component of the larger "Green Energy as a Rural Economic Development Tool" project.

Research for this project included interviews with a representative sample of IPPs and clean energy technology companies in BC in order to identify:

a) The current demand for business services that could be provided by rural BC communities and to investigate the potential future business needs required to support growth and diversification of the clean energy sector in the province.

b) The current workforce opportunities, challenges, and needs within the clean energy sector in BC.

This study was made possible by funding from the following organizations:

- Cariboo-Chilcotin Beetle Action Coalition (CCBAC);
- Columbia Basin Trust;
- Federal Rural Secretariat;
- Omineca Beetle Action Coalition (OBAC);
- Southern Interior Beetle Action Coalition (SIBAC); and
- The Province of British Columbia – Pine Beetle Epidemic Response Branch.

About GLOBE Advisors

GLOBE Advisors, a subsidiary of the Vancouver-based not-for-profit GLOBE Foundation, was established in 2005 in response to an increasing demand for project-based consulting services in the environmental business sector.

GLOBE's vast networks and extensive experience in the areas of project management and consulting, partnership development, and market research makes us well-positioned to undertake a variety of endeavors to further the business of the environment.

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Executive Summary

This report seeks to identify opportunities for rural communities in BC to become engaged in the clean energy sector. The study was commissioned by the Southern Interior Beetle Action Coalition (SIBAC) and its project partners.

The findings for this study are based on extensive secondary research supplemented by opinions and insights gathered through in-depth interviews with a representative sample of Independent Power Producer (IPP) companies in BC, as well as clean energy technology developers/ manufacturers, provincial and municipal government agencies, First Nations communities, power utilities, and other key stakeholders.

Many rural communities and First Nations, as well as the provincial government, are interested in exploring how the development of clean energy resources can contribute to economic growth and diversification. This is especially true for forestry-dependent communities in the interior of the province in areas affected by the Mountain Pine Beetle epidemic and the collapse of the US housing market.

Clean energy projects can provide very real economic development opportunities for rural communities that result in well-paying local jobs and greater community stability. Clean energy projects also have measurable environmental benefits in terms of their ability to reduce greenhouse gas emissions and to improve energy security and the more efficient use of the province's abundant natural resources.

The key trends and economic realities affecting developments in the clean energy sector identified in this report include:

- The growing demand for energy in BC;
- Rising energy prices in BC that will remain low compared with other jurisdictions;
- A rapid increase in industry consolidation;
- A reliance on a knowledge-based workforce and toward technology automation;
- An uncertain public policy climate;
- The rise of carbon neutral municipalities; and
- Remote community electrification.

This report identifies five immediate business and employment opportunity areas for rural communities related to clean energy development. These are:

1. Skilled trades and construction;
2. Community and First Nations engagement;
3. Scientific and environmental monitoring;
4. Plant operations and maintenance; and
5. Indirect business support.

Rural communities can also show proactive leadership with respect to clean energy development by evaluating the feasibility of community energy projects to meet their own energy needs, advance local economic development opportunities, promote environmental and community health benefits, and improve energy security.

The research carried out in support of this report points to a number of clean energy opportunities for communities throughout the province. But it would be wrong to assume that these opportunities can be realized without an active and strategic approach. Key barriers faced by more rural communities include the lack of built infrastructure, difficulties accessing advanced education and skills training, and a shortage in capacity for skilled workers, due in part to competition and labour demand from out-of-province and urban centers.

Greater certainty and transparency in the public policy landscape, more favourable market conditions, and the need to increase clean energy knowledge and capacity building are critical factors to furthering clean energy sector growth in BC. Rural communities can work to develop enabling strategies based on local economic models that could include developing regional business service networks and labour/ skills inventories, as well as rural education and skills-based training frameworks.

Communities can also show initiative by investigating the options for developing their own clean energy projects in order to improve their energy affordability and energy security conditions. There is no better time to pursue clean energy projects at the local level and to take full advantage of the economic, social, and environmental benefits that can come from these efforts.

1. Introduction

What is Clean Energy?
For the purposes of this study, clean energy can be defined as energy that can be generated without creating environmental pollution and/or greenhouse gas (GHG) emissions. Clean energy typically comes from natural and renewable (i.e., naturally replenishing) sources, including sunlight, wind, water, geothermal heat, biomass, and biogas.

Clean energy generation can be developed on a large, utility scale or on a smaller, district or community scale (often less than 10 megawatts). Wind turbines, non-storage hydro facilities, solar photovoltaic panels, combined heat and power (CHP) plants, heat pumps, and landfill-gas capture are just some of the many available technologies that can be used to generate energy from renewable sources.

Ranked first nationwide in 2010 for its green energy portfolio[1], British Columbia has established itself as a clean energy "power house", based in part on the abundance of its renewable resources (i.e., hydro, wind, solar, wave, tidal, geothermal, and biomass), but also due to its well-established clean energy technology research, manufacturing, and investment expertise.

The provincial government in BC has pursued a number of key policies and programs that have helped to drive growth in the clean energy sector over the last decade, including the *BC Energy Plan*, the *Clean Energy Act*, the *Greenhouse Gas Reduction Targets Act*, the *Climate Action Plan*, the *Bioenergy Strategy*, the provincial carbon tax, the Innovative Clean Energy (ICE) Fund, and the *BC Climate Action Charter* for municipalities.

Clean Energy & Jobs
Clean energy development and deployment in BC can support the province's broader clean economy goals related to creating and retaining wealth and jobs, reducing the carbon footprint of communities, restoring the natural environmental balance of critical ecosystems, and implementing improvements in energy and industrial efficiency, all of which in turn can contribute to enhanced economic competitiveness.

This is the basis of the provincial government's economic strategy, the "Canada Starts Here: BC Jobs Plan", which seeks to accelerate the province's job creation potential by leveraging its abundant supply of clean energy and natural resources, as well as capitalizing upon the strengths of its skilled knowledge-based workers. Research has shown that green economy jobs have grown on average 2-3 times faster than total jobs in the economy over the last decade, and they are more resilient to market volatility and vulnerabilities.[2]

[1] Corporate Knights. 2010 Green Provincial Report Card. See: http://static.corporateknights.ca/CK31-GreenProvinces2010.pdf
[2] GLOBE Advisors (2012), West Coast Clean Economy: Opportunities for Investment & Accelerated Job Creation.

In recent years, many of BC's traditional resource-based industries have been severely affected by commodity price fluctuations and climate-related conditions. That is why many rural communities, First Nations, as well as the provincial government are exploring how clean energy development can be used to revitalize local economies and to create jobs.

This is especially true in the interior of BC where, as a result of the Mountain Pine Beetle epidemic and other market factors, industry leaders, local governments, First Nations, and other stakeholders, are keenly interested in much needed economic growth and diversification.

Clean Energy Development in BC

At the moment in BC, there are 74 clean energy projects in operation and 52 projects with Electricity Purchase Agreements (EPAs) that are under development (see Figure 1 below and Appendix A for more details).[3] These projects can be found throughout the province as illustrated in the map as part of Figure 2. BC Hydro expects that by 2016, 25% of the province's energy will be supplied by Independent Power Producers (IPPs).[4]

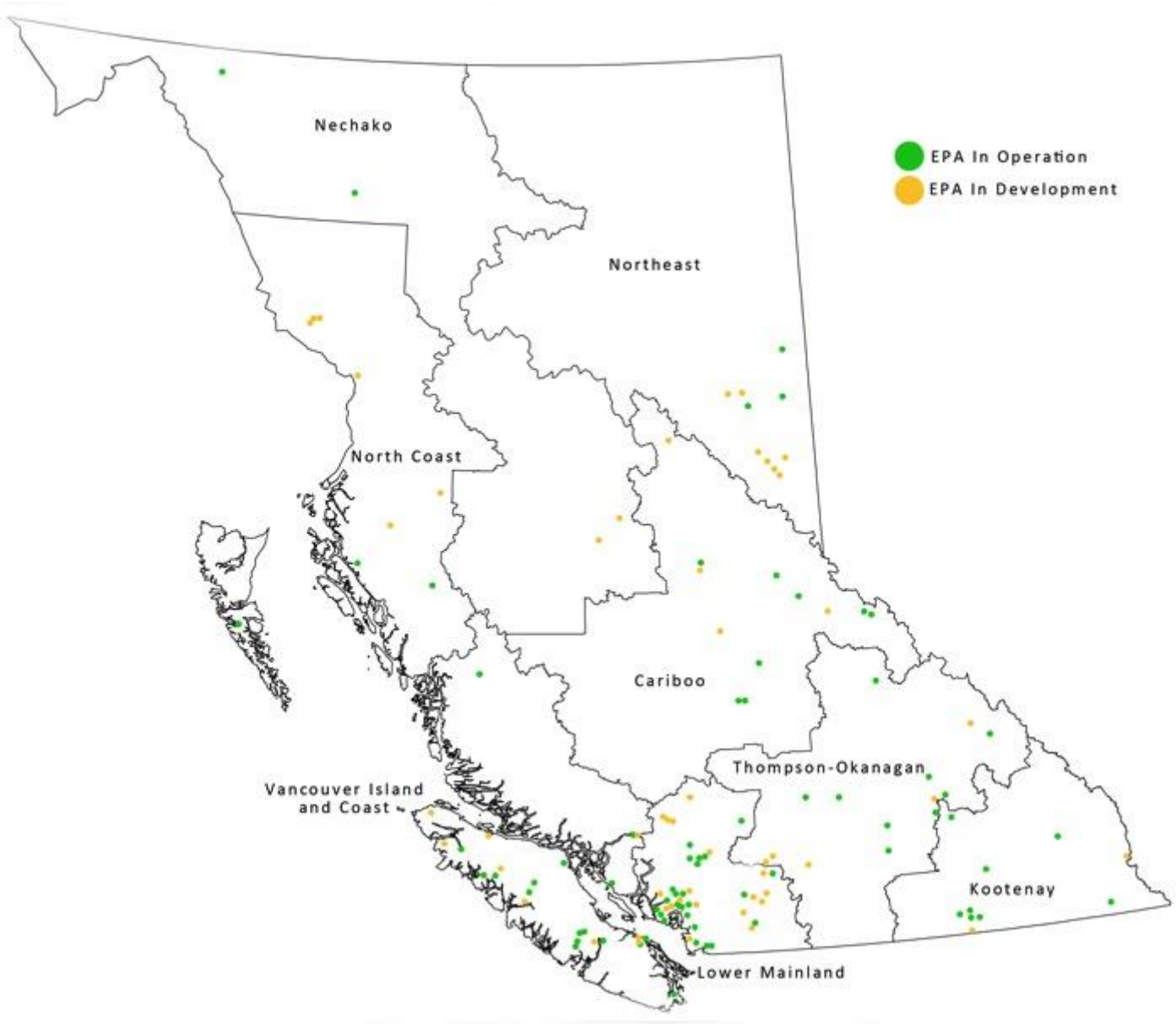
Clean Energy Technology Type	In Operation	Under Development
	Total	Total
Biomass/Biogas	13	10
Energy Recovery Generation	2	1
Gas-Fired Thermal	2	0
Municipal Solid Waste	1	1
Non-storage Hydro	45	33
Storage Hydro	9	1
Wind	2	6
Total	**74**	**52**

Source: BC Hydro, 2012

Figure 1: IPP projects in BC currently in operation and under development by clean energy technology (as of April 1, 2012).

The clean energy opportunities in British Columbia are plentiful. A comprehensive study was commissioned by BC Hydro in 2010 that identified over 7,300 potential non-storage hydro sites across the province, the majority of which have yet to be developed.[5] In addition, a 2011 study published by PriceWaterhouseCoopers (PwC) identifying the potential job creation opportunities in the construction and operation of clean energy projects with EPAs in BC shows considerable promise (see Figure 3).

[3] BC Hydro Independent Power Producers (IPPs) with projects currently supplying power to BC Hydro and currently in development April 1, 2012.
[4] Willatt, T and Saylor, S. "Canada's Provincial Power Strategies." Power. Vol. 155 (3): 45-56.
[5] BC Hydro, Run-of-River Hydroelectric Resource Assessment for British Columbia 2010 Update. http://www.bchydro.com/etc/medialib/internet/documents/planning_regulatory/iep_ltap/2012q1/2010_resource_options26.Par.0001.File.2010ResourceOptionsReport_Appendix8-A.pdf



Development Region	In Operation	Under Development
Vancouver Island/ Coast	16	10
Lower Mainland/ Southwest	25	16
Thompson/ Okanagan	9	5
Kootenay	8	2
Cariboo	8	4
North Coast	3	6
Nechako	2	2
Northeast	3	7
Total	**74**	**52**

Source: BC Hydro, 2012

Figure 2: IPP projects currently in operation or under development by economic development region in BC (as of April 1, 2012).

Construction Phase (Person Years)				
	Non-storage Hydro	**Wind**	**Thermal (Biomass/ Gas)**	**Total**
Total Employment	52,821	42,725	21,594	117,140
Direct	17,551	12,440	4,527	34,518
Indirect & Induced	35,270	30,285	17,067	82,622
Employment per MW	12	8	20	11
Operations Phase (Annual Full Time Equivalent)				
	Non-storage Hydro	**Wind**	**Thermal (Biomass/ Gas)**	**Total**
Direct Employment	263	569	3,965	4,797
Employment Supported by Operating Expenditures	1,300	1,837	3,755	6,892

Source: PriceWaterhouseCoopers, 2011[6]

Figure 3: Estimated employment impact of proposed BC clean energy projects.

Foreign investors are also interested in pursuing clean energy pilot projects in British Columbia. Recently, the Korean Institute of Science & Technology (KIST) received $6 million from Korea's Ministry of Knowledge & Economy to invest in biofuel and torrefaction pilot projects in BC. This opens up opportunities to strengthen the province as a clean energy leader.[7]

Bioenergy companies are also seeing potential with foreign export markets for wood pellets. According to the BC provincial government, the wood pellet industry is expected to grow to $2 million in 2012, up from $1.2 million in 2011. This growth is expected to continue well beyond 2013.[8]

Recent changes, however, to BC's energy strategy have resulted in some uncertainty for the IPP industry with respect to future BC Hydro calls for independent power. In addition, the relatively low price for electricity and natural gas in the province is resulting in the exit of some bioenergy companies from the BC market.

Community Energy Projects

On a different note, community energy projects and solutions are becoming more prevalent and are emerging as an area of clean energy-related opportunity where immediate benefits in the form of local economic development and energy cost savings for the entire community can be realized.

The power to develop community-based energy projects increasingly rest with municipalities and local governments, many of which are bound by stringent commitments to achieve carbon neutrality. The desire to develop strategies that

[6] PwC analysis based on BC Hydro's October 1, 2011 EPA list that includes 70 projects in operation and 48 under development.
[7] BC Government
[8] Ibid

minimize the need to purchase expensive carbon offsets is one important driver for change.

Equally important is the desire for many off-grid communities that are reliant on diesel fuel for electricity generation to seek clean energy alternatives in order to lower costs and to achieve long-term energy security. Such projects could also allow these communities to create long-term, well-paying jobs and stimulate local economic activity.

About this Study

This report analyzes the insights and opinions from clean energy industry leaders in British Columbia representing 34 clean energy IPP projects throughout the province and eight different clean energy technologies (See Figure 4). With a focus on the opportunities for rural communities, a value chain approach was used to identify the actual business service and workforce needs required by this industry throughout a project's lifecycle – from pre-feasibility through to ongoing operations and maintenance.

In addition to private clean energy companies in BC, this report captures the opinions of several communities, First Nations groups, industry associations, and power utilities in the province, thereby providing a broader qualitative analysis of the clean energy sector potential for British Columbia.[9]

Figure 4: Clean energy projects and generation technologies represented in this analysis.

[9] For more information on the research and interview process, refer to *Appendix B: Project Methodology*.

2. Clean Energy Industry Trends in BC

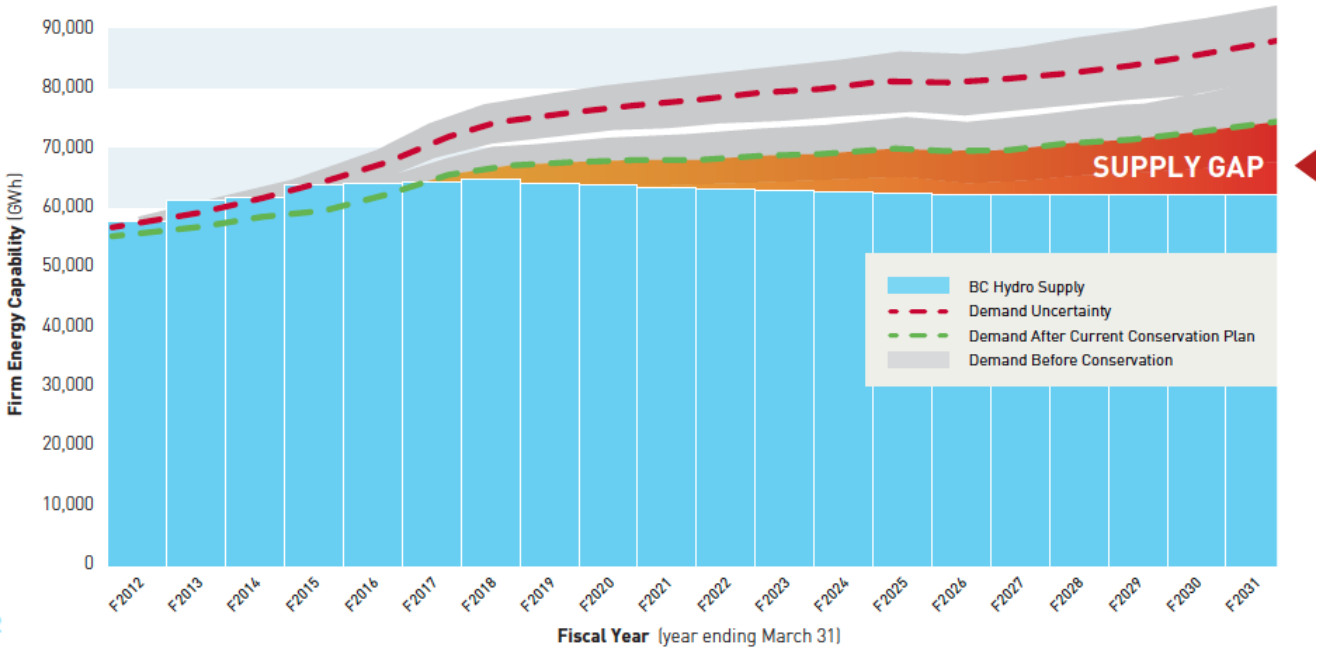
The clean energy sector in British Columbia finds itself in a constant state of flux, subject to the public policy landscape, social acceptance, technology pricing and performance, and other broader market and economic conditions. The following sub-sections touch on some of the key trends affecting this industry in BC based on the insights of industry leaders interviewed as part of this analysis.

2.1 Increasing Demand for Electricity in BC

BC Hydro forecasts that the province's energy needs will grow by up to 50% between now and 2030.[10] This growth is due primarily to new industrial activity in the mining and natural gas extraction and export sectors.

The province's new Liquefied Natural Gas (LNG) Strategy and plans by industry players to develop LNG terminals in Douglas Channel and Kitimat are expected to significantly increase demand for electricity in BC.[11]

While the growing demand for power is inevitable due to increased industrialization in the province, measures are being taken by BC Hydro to ensure adequate supplies of energy are available to avoid any potential gaps (see Figure 5).



Source: BC Hydro, 2012

Figure 5. Projection of electricity supply and demand in British Columbia up to 2031 (without additional supply).

[10] BC Hydro. Powering B.C. With Clean, Reliable, Electricity for Generations. 2012.
[11] BC Government. Liquefied Natural Gas: A Strategy for BC's Newest Industry. 2012

The increased demand for power, if not managed effectively, could make BC vulnerable to supply shortage situations that have been faced by other North American jurisdictions, such as in California during the 2001 electricity crisis and in Ontario and eight nearby US states during the 2003 Northeast blackout.[12,13]

An integral part of BC Hydro's strategy is to invest significantly in supplies of clean energy across the province, particularly in the form of non-storage hydro, wind energy, as well as through efficiency upgrades to its existing storage hydro power infrastructure.

Storage hydro already accounts for approximately 80% of electricity generation in the province.[14] Current plans for the Site C project in the Peace River region promise up to 1,100 megawatts (MWs) of additional capacity with approximately 5,100 gigawatt hours (GWh) potentially slated to come online by 2020.[15] While Site C will increase the province's long-term supply of power, it does pose a barrier to clean energy developers trying to grow the province's clean energy supply as it reduces the need for incremental power in the medium-term.

Despite plans for Site C and work to refurbish existing dams throughout the province, there is a need to diversify BC's energy portfolio to include forms of power other than storage hydro due to the potential water supply shortages tied to climate change. For example, the Hoover Dam in the US is now only operating at 30% capacity due to a drastic change in water supply conditions from relatively small climate-related shifts.[16] Diversification also allows the mitigation of energy security risks while providing a stable platform for clean energy to develop and grow in the province.

In addition to new power supply, the *Clean Energy Act* mandates that 66% of the growth in demand for power in BC be offset through energy conservation by 2020.[17] BC Hydro has adopted world-renowned demand-side management practices that encourage conservation through its "Power Smart" program.

2.2 Rising Energy Prices in BC Remain Comparatively Low

Energy pricing is a major determinant of the demand for power and a significant factor for new clean energy project development. According to an electricity comparison study, BC has lower prices than twenty-two other North American jurisdictions.[18] While BC Hydro has continually indicated that rates will increase, BC's prices will remain relatively low compared to most other locations around the world.

[12] Weare, C. The California Electricity Crisis: Causes and Policy Options. Public Policy Institute of California.
[13] CBC News. Blackout. See: http://www.cbc.ca/news/background/poweroutage/
[14] Willatt, T and Saylor, S. "Canada's Provincial Power Strategies." Power. Vol. 155 (3): 45-56
[15] BC Hydro. Powering B.C. With Clean, Reliable, Electricity for Generations. 2012.
[16] Matthew, J. Converging Currents in Climate-Relevant Conservation: Water, Infrastructure, and Institutions. PLoS Biology. 2011.
[17] BC Government. Clean Energy Act 2010. See: http://www.leg.bc.ca/39th2nd/1st_read/gov17-1.htm
[18] BC Hydro, Electricity Rate Comparison Annual Report. May, 2011.

This low price of electricity increases the opportunity costs for adopting new clean energy technologies and weakens the economic case for expanding BC's clean energy portfolio. Low energy prices in BC have had a particularly negative impact on the bioenergy sector in BC.

BC Hydro has calculated that the average energy price purchased from IPPs with long-term contracts is $124 per MWh. While IPPs and industry associations argue that this relatively higher price is attributable to accounting and financial measurement discrepancies, ratepayers continue to question public policies that may increase electricity prices for consumers. The province's utility regulator, the British Columbia Utilities Commission (BCUC), whose mandate is to ensure ratepayers can get fair and affordable electricity from utilities, has also attempted to maintain a competitively priced energy market in BC.

As shown in Figure 6, the cost per MWh from IPP generation is significantly more than the average wholesale price paid for power on the spot market and leads to further debate on why consumers are paying more for electricity. However, these projected costs are based on financial assessments, and do not account for the positive environmental externality benefits that clean energy contributes to the province, nor for the potential economic impact these projects contribute to the province as a whole. Positive environmental externalities include GHG and pollution reduction, increased climate change resiliency, and greater economic productivity and network effects.

Energy Allocation	Cost per Megawatt Hour (MWh)
Latest power call for IPP energy (long-term contract)	$124
Wholesale market price (Mid C spot market price). Figures are from the calendar year of 2010.[19]	$4.34 - $52.43
Site C (expected for BC Hydro owned asset)	$87- $95 (NPV)

Source: BC Hydro (2011), Review of BC Hydro

Figure 6: Range of energy costs in BC.

Recent modifications to the *Clean Energy Act*, which allow BC Hydro to plan electricity demands based on average water conditions with a relaxation of insurance requirements, are expected to push electricity rates even lower over the medium- to long-term horizon.[20]

[19] The wholesale market price is the range of prices at which BC Hydro can buy wholesale electricity on the Mid- Columbia energy spot market.
[20] BC Government, Liquefied Natural Gas: A Strategy for B.C's Newest Industry. 2011.

The readily available, "cheap" hydro electricity in BC has already caused many clean energy companies in BC to focus their attention on markets outside of the province – including in Asia, Latin America, and Europe. This is especially true for bioenergy companies where the provinces low electricity and natural gas prices have significantly reduced their domestic competitiveness. Many companies are exiting from the BC market and are doing so at a rapid pace.

On the contrary, IPPs with operational assets in the province have found their businesses to be lucrative, especially with long-term Electricity Purchase Agreements (EPAs) lasting between 20 and 40 years. However, this too has caused a significant change within the competitive landscape of the clean energy sector in BC and has accelerated the rate of industry consolidation over the last few years.

2.3 Industry Consolidation: Mergers, Acquisitions & Equity Joint Ventures

While the growth of clean energy sector in BC has been exponential over the last decade, the industry itself is beginning to show signs of maturity and market saturation by a few dominant players. Many IPPs that have successfully obtained EPAs have formed strategic mergers or have been acquired by larger domestic and international players. With an EPA signed with BC Hydro, many smaller IPPs are able to sell their clean energy assets at a significant premium to larger operators in order to make immediate gains.[21]

While owning an EPA may seem to be a lucrative business, there are significant pressures placed on IPPs through inflationary costs and an overly competitive electricity sales price bid. IPPs often find that despite being granted an EPA, the economic feasibility for developing their actual projects remains low. Other issues including permitting, financing, transmission, and connectivity issues also hinder some IPPs from being able to own and operate their clean energy projects and may compound the issues.[22]

As such, many IPPs find that despite being granted an EPA, the combination of an overly-competitive electricity sales price and the variance between the actual and estimated project development costs makes many projects financially unfeasible. This also makes it a challenge for IPPs to seek out buyers interested in acquiring their EPAs and assets.[23]

Mergers and acquisitions, as well as joint venture deals, for economically feasible projects have in essence become a critical activity for injecting new capital for the long-term viability of many projects. Having a solid financial position to sustain a capital-intensive clean energy project, as well as the support of an experienced IPP company, is an essential requirement for the advancement of many clean energy projects in BC.

[21] Research Capital. Clean-Tech: Clean Energy Is Here to Stay. 2009.
[22] PriceWaterhouseCooper, Economic Impact Analysis of Clean Energy Projects in British Columbia- 2010. April 2011.
[23] Merrimack Energy Group, Inc., Final Report on BC Hydro's Energy Procurement Practice. 2011.

Due to the geographically dispersed nature of clean energy projects, large power companies are able to use their acquisitions as a means of aggressively right-sizing their business operations and driving greater economies of scale. This consolidation trend also allows firms to innovate internally through research and development activities aimed to deliver greater efficiencies throughout their entire operational portfolio in BC and elsewhere.

Large players from other industries such as capital infrastructure firms are also taking advantage of the BC clean economy and aggressively diversifying into the province's clean energy sector.

While clean energy infrastructure has high upfront capital costs, its relatively low maintenance costs and the indexed long-term revenue stream from an EPA with BC Hydro can make for a lucrative and attractive strategic business model for a select number of industry players.

2.4 Reliance on a Knowledge-Based Workforce & Increased Project Automation

Clean energy technology is becoming increasingly specialized and sophisticated and while the level of knowledge and capacity in BC is growing, it is still a relatively young industry for the province outside of hydro projects.[24]

BC currently has Canada's largest clean technology cluster although from a commercialization perspective, the province is relatively weak.[25] While a significant level of research and business activity does take place in this sector, clean energy technology manufacturing (and commercialization) on a large-scale is relatively non-existent in this province. As such, the level of knowledge and support available in-province is still relatively immature for many types of innovative clean energy technologies.

Many clean energy producers have to source highly-specialized business services and skilled talent nationally and often internationally, from locations such as Germany and the United States. With industry standardization increasing, the level of skills qualification and certification is also on the rise, which may pose long-term challenges for finding the necessary skilled labour, especially for rural communities.

At the same time, many of the day-to-day operational activities are becoming increasingly automated with work being performed remotely and/ or diagnostics monitoring that can be done from a computer or a mobile device. This ultimately will result in a reduction in the amount of human resources required to operate clean energy projects as technologies become increasingly computerized.

[24] KPMG (2011), Cleantech Report Card for British Columbia.
[25] SDTC (2010). The 2010 SDTC Cleantech Growth & Go-to-market Report.

2.5 Uncertain Public Policy Climate

In 2010, the BC *Clean Energy Act* was seen as a progressive piece of legislation that expanded on the 2007 *Energy Plan* to advance the province's position as a clean energy leader. The Act outlined broad measures to:

- Ensure energy security and self-sustainability at low rates;
- Create new investments in clean, renewable power; and
- Harness BC's clean power potential in order to create jobs across the province.[26]

This legislation, combined with the fact that power supply and distribution in the province is more or less controlled and managed by a provincial monopoly, means that BC's clean energy industry is heavily reliant on provincial public policy and its commitment to creating a cleaner energy future for British Columbians. The implications of changes in policy could have a large impact on the industry, as evidenced from the uncertainty around future calls for power.

Recent changes to the provincial government's energy strategy have placed greater emphasis on the development of BC's natural gas resources and industry. As well, the province's commitment to energy self-sufficiency has been relaxed due to concerns about its financial and practical feasibility.[27] Reasons cited include the fact that times have changed since the 2007 *Energy Plan* was published, including new market conditions driven by low natural gas prices.[28] Also cited was a lagging economic recovery from the 2008 global economic crisis.[29] With only the Lower Mainland and Northern BC regions displaying significant economic activity, it is a reflection of the economic hardships faced by the province as a whole.[30]

"Without the regulatory and policy framework in place, we can't build these projects. It doesn't matter how many people you want to hire. If you can't create and maintain the policy direction, industry can't go anywhere."
– Independent Power Producer

On a positive note, while the proposed development of LNG terminals in the Northwest region suggest that some plants will be flaring their own product to meet their high energy needs, there is some optimism from the clean energy sector and IPP players that they may be able to help satisfy the plants' high demand for power through new clean energy projects.

[26] BC Government, Clean Energy Act. See : http://www.leg.bc.ca/39th2nd/1st_read/gov17-1.htm
[27] BC Government, Liquefied Natural Gas: A strategy for BC's Newest Industry. 2011
[28] Ibid.
[29] Ibid.
[30] Credit 1 Union. Economic Analysis of British Columbia 2012. Vol 32: 1.

This beacon of opportunity has also been reinforced by the provincial government's LNG strategy, suggesting that the industry will be powered by "green energy". In addition, some First Nations with territorial claims in the region have expressed interest in developing clean energy projects in order to support this initiative.

Another promising development from the *Clean Energy Act* that hasn't come to fruition was its provision to consider the development of a Feed-in-Tariff (FIT) program.[31] This program potentially would have allowed commercial operators to generate and sell clean electricity into the grid at a guaranteed price. Although BC Hydro has conducted extensive stakeholder consultations and undertaken internal preparations, the provincial government has remained uncommitted to its development, further hampering clean energy deployment across the province.

These changes compound the existing regulatory issues that IPPs have with respect to obtaining the right permits and approvals; while revisions may be done by individual ministries, it has significant rollover implications for clean energy project developers. Responding to a constantly changing regulatory and public policy landscape is not only costly, but time consuming and many smaller IPPs do not succeed because of cash flow problems.

While BC Hydro's Standing Offering Program still encourages the development of clean energy projects under 15 MWs, it does have its own stringent criteria in which many IPPs do not qualify.

The current public policy landscape does not provide a predictable framework for companies to anticipate when or how many clean energy projects will be required by BC Hydro to meet its long-term energy needs. And with a maze of regulations to navigate and constant changes to public policy direction, industry growth is severely hampered.

"The Federal ecoENERGY program is now gone, the ICE Fund is stopped, the Standing Offer Program is continually changing and makes small projects hard to get going. You have all the restrictions on run-of-river, […] all the processes they have put in place to stop projects from going forward are not going to create any jobs." –Independent Power Producer

[31] BC Government. Clean Energy Act See: http://www.leg.bc.ca/39th2nd/1st_read/gov17-1.htm#section16

2.6 Carbon Neutral Municipalities & Remote Community Electrification

While opportunities in utility-scale, grid-connected clean energy may be dwindling because of market and public policy uncertainties, there is a growing trend for communities to take clean energy projects into their own hands.

In 2007, 62 BC communities signed a *Climate Action Charter* with the province and the Union of BC Municipalities (UBCM) committing to achieve carbon neutrality by 2012.[32] Currently there are 180 out of 189 local BC governments that have signed onto the Climate Action Charter.[33]

Not being able to reach their carbon neutral goals results in communities having to buy carbon offsets from the Pacific Carbon Trust (at $30 per tonne as of July 1st, 2012).[34] Many communities are investigating clean energy solutions to help them reduce their GHG emissions and meet their own community energy needs.

Many communities have already or are in the process of developing clean energy projects locally as part of the Community Energy and Emissions Planning (CEEP) efforts. Revelstoke has a biomass-based system in place and several other municipalities across the province are following suit, either as pilot projects or as commercial operations. The City of Prince George has developed a district energy system to use wood biomass to supply its downtown buildings with clean energy.

Existing demand-side management programs and incentives from BC Hydro and Fortis BC, as well as the ICE Fund, further encourage the deployment of clean energy projects province-wide.[35] These programs help optimize energy usage and in many cases, reduce consumption to a level that makes a clean energy technology viable at the community scale.

For remote communities, BC Hydro has an electrification program that encourages remote off-grid communities currently relying on diesel to transfer to clean energy solutions.[36] This program has proven that the displacement of diesel with bioenergy technologies can be equally or even more cost effective in some instances, reducing costs to the community and BC Hydro ratepayers. Many of the First Nations groups in BC are also exploring how clean energy solutions can be used to meet their demands for power.

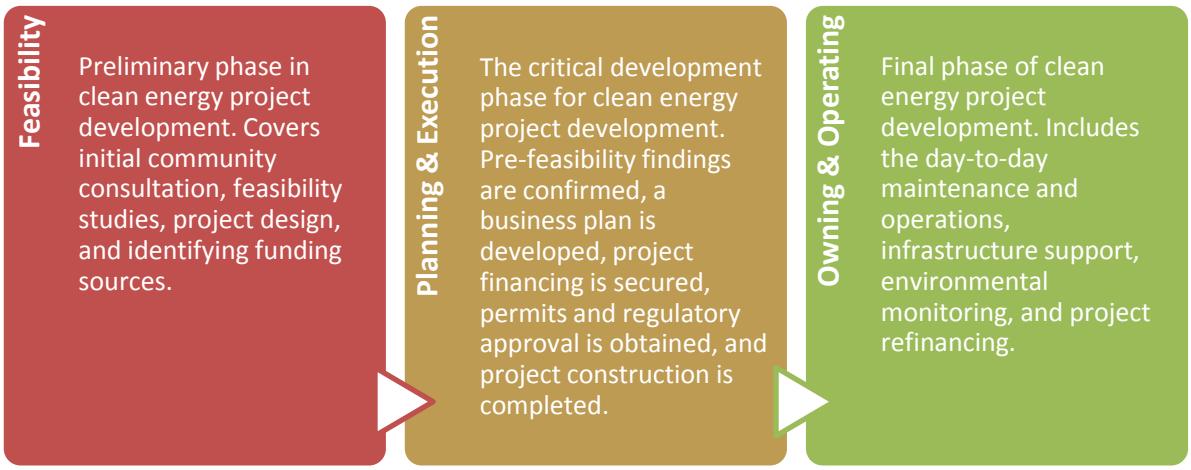
The following section explores in more detail the business and employment opportunities that come from clean energy project development.

[32] http://www2.news.gov.bc.ca/news_releases_2005-2009/2007OTP0139-001194.htm
[33] Livesmart BC. Climate Action Charter. See: http://www.livesmartbc.ca/community/charter.html
[34] Provincial Response to the Resolutions of 2011 UBCM. See: http://www.ubcm.ca/assets/Resolutions~and~Policy/Resolutions/2012-04-04%20UBCM%20Resolutions_Final.pdf#search="carbon%20neutrality"
[35] Livesmart BC Incentive Program. See: http://www.livesmartbc.ca/
[36] http://www.bchydro.com/energy_in_bc/remote_community_electrification.html

3. Clean Energy Opportunities in BC

3.1 Clean Energy Project Developers: Business & Labour Needs

Three phases for clean energy project development were identified for the purposes of this study (see Figure 7). The pages that follow highlight the various business services and workforce opportunities within each phase of the project development lifecycle or "value chain".



Source: GLOBE and BC Government

Figure 7: The three phases of the clean energy project development lifecycle.

"We go into First Nations communities and ask them for a list of skills and expertise and if their qualifications meet our criteria, we hire them to do a number of jobs; this could be in the feasibility stage, for the monitoring, for construction, through to health and safety and land clearing. During operations, we have also hired First Nations workers to help operate some of our facilities." – Independent Power Producer

Feasibility

Site Selection & Concept Development

Most IPPs that wish to initiate a clean energy project already have a set of core competencies and a desired focus in one area of clean energy project development such as hydro, wind, biomass, biogas, combined heat and power, municipal solid waste, etc. This phase allows the company to determine the optimal site and technology for their proposed project.

Internal management and engineering staff typically decide on the project concept plan, the clean energy technology, and the potential sites. Some technologies are relatively new in BC and have a higher technology risk. Such projects, especially remote community electrification, will typically require more thorough analyses than others to determine practicality and economic feasibility (see Figure 8).

Technology	Installed Capital Costs ($1,000/kW)	Operation and Maintenance ($/kWh)	Levelized Cost of Energy ($/kWh)
Generation- Firm			
Biomass	3.3-7.1	0.09-0.13	0.19-0.22
Geothermal Hot rock	3.3-4.0	0.04	0.30-0.37
Generation- Intermittent			
Non-Storage Hydro	5.1-6.2	0.01-0.08	0.07-0.33
Photovoltaic Solar	5.7-6.0	0.01-0.03	0.39
Wind	2.97-3.95	0.02-0.04	0.22-0.36
Tidal	4.9-8.5	0.189	0.24-0.42
Wave	5.25	0.03-0.085	0.27

Source: Cleantech Community Gateway 2012

Figure 8: Associated costs for different clean energy technologies available for remote community electrification in Canada.

Resource availability throughout the year will also need to be assessed for some generation types (see Figure 9). For example, while biomass energy solutions can have its fuel supply stored and transported throughout the year, other technologies such as non-storage hydro and wind are heavily dependent on weather and water/wind resource availability throughout the year.

Resource	Expected Availability				Predictability
	Real-time minutes	Hours to days	Months	Years	
Geothermal Hotrock	Fully available at all times				Decades
Biomass	Fully available provided fuel is abundant and right technology used				Years
Non-Storage Hydro	Sometimes	Yes	Sometimes	Sometimes	Days/ Months
Wind	No	Sometimes	Yes	Yes	Minutes/ Hours
Solar Photovoltaic	No	Sometimes	Sometimes	Yes	Days/Months
Tidal	No	Yes	Yes	Yes	Decades
Wave	Yes	Yes	Yes	Yes	Days/ Months

Source: Cleantech Community Gateway 2012

Figure 9: Clean energy technology energy availability and forecast predictability.

Technical site assessment tasks are typically contracted out to third-party engineering consulting firms if not performed internally. These firms may have a specialization or experience in one of the clean energy technologies and will consist of a multidiscipline engineering team. These engineers will conduct the preliminary analysis of energy needs, resource availability, system size, and a preliminary economic analysis of the system.[37]

"We rely on consultants to do engineering studies, wind resource studies, [and] environmental studies. Often [they are] managed in house, but we hire specialist consultants. If we are busy, we hire more."
– Independent Power Producer

"Someone who is generally in support of the whole clean energy objective and GHG reduction. I look for the like-minded consultants that want to pursue these kinds of projects. And then from there, someone who is willing to innovate and be part of an innovation team"
– Independent Power Producer speaking about hiring engineering consultants

As such, IPPs make significant efforts to identify the right firm with the right skills to perform the required analysis as these technical studies form the backbone of the project and corporate strategic planning. In instances where the technology is relatively new to the province such as wind and co-generation, consultants and engineers are often brought in from other parts of Canada or internationally to provide the necessary technical analysis.

[37] Focus on Energy. Renewable Energy Site Assessment. See: http://www.focusonenergy.com/renewable/renewable-energy-site-assessment.aspx

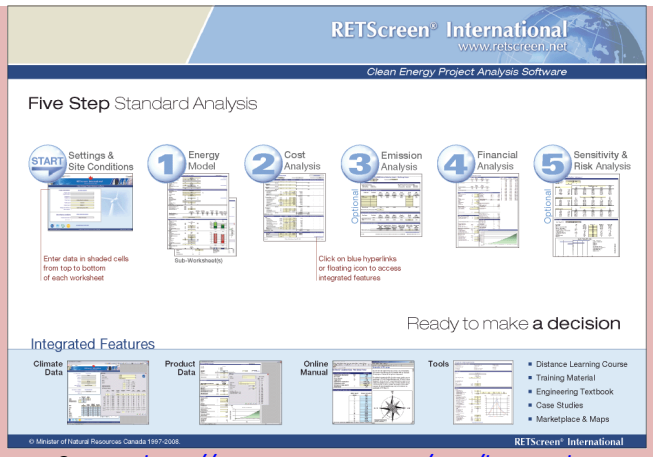
IPP companies interviewed identified that they usually assess multiple sites at the same time to find the optimal site according to their project development criteria. For some larger established IPPs, the process of site assessment is an on-going process. This optimally positions these IPPs competitively in advance of any potential future calls for power by BC Hydro.

Opportunities for Local Communities

- Most functions are performed internally or contracted to engineering firms. As such, there are limited opportunities for local communities in this stage.

Project Feasibility

Project feasibility is normally determined by the internal management and engineering team. External engineering consulting firms are usually hired to perform the in-depth technical project analysis based on the site assessment and initial pre-feasibility studies. Oftentimes, it will be the same engineering consulting firm that helped with the original project concept and site assessment. The highly technical information generated in the project feasibility phase is essential for internal decision making, external permitting, and attracting project financing.



Source: http://www.retscreen.net/ang/home.php

Figure 10: RetScreen International is a software solution that provides a basic framework for clean energy feasibility screening and analysis. However many companies will use their own proprietary software to meet their sophisticated technical needs.

Engineers from a variety of disciplines will be involved, including mechanical, electrical, environmental, and civil, as well as other specialized disciplines relating to clean energy. This multidisciplinary approach is required to conduct the various highly-specific and technical analysis required for project feasibility. For example, a non-storage hydro project may require hydrology studies to analyze river flow rates, electricity load factors, as well as energy production. For biogas, co-generation, and waste-to-energy, analysis of thermodynamics, gas flow, and capacity would also be common during this stage.

Software solutions are also used to help provide structure and quantification of the various pieces of information. Some companies will use readily available software suites while others may require customized sets of modeling software to meet their very specific needs. Custom and proprietary models are more common for large-scale projects due to the complexity and legal requirements of these projects. An example of a software solution used by the industry is RetScreen, which allows screening for clean energy project feasibility (see Figure 10 above).

As such, understanding of the commonly used industry software and analysis tools is critical for both internal and external engineering and technical personnel.

"RETScreen is a world recognized software program that was put together by a consortium of industry experts from Natural Resources Canada, NASA and the US Department of Energy. Once you understand how it works, it is great. We use it for project screening."
–Independent Power Producer

"Many of the risks and costs that stem from the legal language in an Electricity or Power Purchase Agreement (EPA or PPA) from a utility need to be modeled very specifically using a custom model." –Independent Power Producer.

Other key metrics that maybe considered during project feasibility include:

- Resource estimates (wind, water, biomass, biogas, etc);
- Land and resource ownership (Crown, First Nations, private, etc);
- Potential revenue based on unit costs for project components;
- Costs of project development at each site considered;
- Availability of workforce, business services, and existing infrastructure near a project site.[38]

Communities considering a community-based clean energy project (especially those reliant on diesel fuel electricity generation) may choose to develop a Community Energy and Emissions Plan (CEEP) in this stage. These communities often hire external consultants to perform many of the technical engineering studies on their behalf. BC Hydro and other government agencies also provide significant assistance where possible to many of these communities. This is especially the case for remote communities across BC, which may not have the available resources to properly manage a project of this size. A core factor in project development for these communities, in addition to the economic development benefits, is energy supply security.

Beyond the metrics described above used primarily by IPPs, communities looking to develop projects may also consider:

[38] BC Government, Independent Power Production in B.C. 2008

- Energy auditing to confirm alignment with the goals of their CEP;
- A gap analysis to identify forecasted demands and loads for the next 10-20 years;
- Demand-side management opportunities;
- Determining the best technology options for the community;
- A cost-benefit analysis between diesel fuel generation and the various clean energy options; and
- The potential for future grid connectivity and electricity sales to BC Hydro. [39]

This research suggests that many smaller IPPs typically have a core management team where each of the members might assume multiple functional roles by bringing to the table a comprehensive range of skill-sets. Community energy projects on the other hand typically have a project manager that helps to oversee the project feasibility and lifecycle. He or she is typically very well acquainted with the community's needs, as well as with clean energy project design for a given technology.

The project manager will also be required to oversee grant applications and will advance the permitting procedure through constant communications with BC Hydro and other key stakeholders. The actual functions of these individuals range quite widely and can include engineering, marketing, finance, accounting, legal, and strategic planning.

"Someone with a good general understanding of the power market, and the technology you are using. If it doesn't make economic sense, you have to flush that out pretty quickly." - Independent Power Producer speaking about hiring project managers.

"Someone with a lot of experience and understanding of BC Hydro and the markets you can sell electricity into." – Independent Power Producers speaking about hiring project managers.

As a result of the highly-sophisticated and multi-variable nature of project evaluation, previous experience was identified as equally important to the hard skills required. This was identified as a key barrier for IPPs navigating BC Hydro's calls for power and without the internal experience, many IPPs found the process difficult.[40] Critical skills identified by interviewees involved in the project feasibility stage include financial statement literacy, an understanding of cost- benefit analyses, an understanding of BC legislation and permitting, and an understanding of the socio-economic impacts of clean energy projects.

Opportunities for Local Communities

- Project managers for community energy projects

[39] BC First Nations Clean Energy Program, 2011
[40] Merrimack Energy Group. Final Report on BC Hydro's Energy Procurement Practice. 2011.

Project Financing

In a review of BC Hydro's energy procurement practices, access to adequate financing and funding by IPPs was highlighted as a key barrier to project development.[41] As such, strong business acumen and an understanding of the global financial landscape, capital markets, as well as knowledge of the availability of different sources of public and private funds, are extremely important.

When asked about attracting financing, all IPPs performed these duties internally while frequently engaging external financial advisors and financial institutions to evaluate all of their financing options. These financial institutions include banks, credit unions, private equity firms, and investors. The key to successfully securing adequate financing is to keep all doors open and to appreciate the different methods that exist for generating capital. A strong entrepreneurial spirit is paramount in being able to articulate the company's needs and to identify the cost of capital suitable for project financing.

"In the development business, you always need cash and you always need methods to raise equity for new projects. You can use existing cash flow but these projects are often capital intensive and you need to go out and raise additional equity and debt." – Independent Power Producer

"For financing, we usually will put our money up first and attract equity behind us. Once we have the project far enough along, we will put debt on it." – Independent Power Producer

Raising financing is not an issue exclusive to IPPs. Communities that wish to undertake a clean energy projects will also need to secure financing from a variety of public and private sources. In many instances, these communities have access to government funds through programs such as:

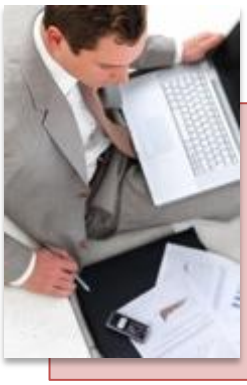
- BC Innovative Clean Energy (ICE) Fund;
- BC Gas Tax;
- BC Hydro's Remote Community Electrification Program;
- BC First Nations Clean Energy Business Fund;
- Federation of Canadian Municipalities Green Municipal Fund;
- Indian & Northern Affairs Canada grants and funding; and
- Public Sector Energy Conservation Agreement[42]

These programs may provide initial capital to fund feasibility studies through to project construction and operation with access dependent on the specific project. As such, individuals or specialized consultants that have experience with the application process

[41] Ibid
[42] BC Hydro

and dealing with the various government ministries are often engaged to assist with the funding process.

Additionally, various ownership models exist for parties looking to secure equity financing. Equity joint venture partnerships between an IPP and a community partner is a common industry practice that helps mitigate the financial risk and burden one single party might have to take bear a particular project. Furthermore, it also allows for each of the partners to focus on their core business activities and exploit long-term business and operational efficiencies.



Community Clean Energy Ownership Models

- Community builds, owns, and operates
- Community selects IPP to build, own, and operate
- BC Hydro selects IPP to build, own, and operate
- BC Hydro builds, owns, and operates

Source: BC Hydro, 2010

These joint venture projects will, in most instances, require professional financial, accounting, and legal services that specialize in areas such as joint ventures, mergers, and acquisitions, as well as commercial contract negotiations. Additionally these firms will also need to be proficient and experienced in performing thorough due diligence to assess the interest of potential partners. For example, financial capital budgeting, net present value, and net asset value calculations for the project are critical skills for project valuation and for determining the amount of equity each party would be required to invest for the partnership.

"We use accounting firms to help us do the cash flow analysis and they go out and put this package together; then we shop for money."
– Independent Power Producer

Professional service providers such as accounting and law firms are not expected to have previous experience in clean energy, but a passion and interest for such projects was identified as an advantage. Previous experience in related industries such as forestry, mining, and energy was also identified as key factor IPPs look for when considering their services.

"Equity can come from two ways: issue equity or joint venture (non-dilutive). Where you are not selling shares, you are essentially selling part of that project to another company." –Independent Power Producer

Some IPPs may decide to develop, own, and operate their clean energy assets. Many of these IPPs operating in BC raise equity in domestic and international capital markets such as the Toronto Stock Exchange (TSX), TSX Venture, NASDAQ, and New York Stock Exchange (NYSE). They may also engage in financing mechanisms such as initial public offerings (IPO), private placements, takeovers (TO), reverse takeovers (RTO), etc.

If an IPP decides to become listed as a public company, they are legally required in all instances to abide by provincial and national securities regulations. Here in BC, the British Columbia Securities Commission (BCSC) regulates and enforces the provincial securities regulations. While many public company requirements can be performed internally, such as performing internal audits and preparation of corporate disclosure documentations, it is common practice to retain professional services and transfer certain risks and liabilities to these providers as an act of insurance. Such services that would be retained may include securities lawyers, external auditors, stock brokerages, investor relations, transfer agents, as well as corporate secretarial and filing services.[43] These services are all retained and used throughout the project lifecycle and even past the operations phase.

While in many instances these professional services will be sourced from firms in the Lower Mainland, some services may be available in more rural communities. Some IPPs headquartered outside of the Lower Mainland have sourced these services from where they are located.

Opportunities for Local Communities

- Finance, accounting, and bookkeeping services
- Corporate secretarial and filing services

Dialogue & Project Definition

Communities have an essential role to play in clean energy project development and their support for a project or lack thereof can act as a significant enabler or barrier respectively. It is thus important that communities are informed and engaged throughout the project lifecycle. Part of the initial outreach efforts led by an IPP would also try to identify capacity in local communities for meeting the company's business needs.

"We would look to locate in communities with existing infrastructure including trained personnel. A good example would be locating in a community or a region of the province where forestry was quite active. We could rely on existing workforce or contractors servicing these traditional industries." – Clean Energy Technology Company

[43] British Columbia Securities Commission- BC Securities Laws and Policies. http://www.bcsc.bc.ca/securitieslaw.aspx

IPPs interviewed for this project have traditionally performed many of these outreach functions internally through their Chief Executive Officer or another senior executive. External agencies are occasionally hired and are brought on to assist them with their community and stakeholder engagement initiatives.

These professionals are expected to be able to address issues from two main perspectives:

- **Externally facing:** Engage communities and external stakeholders on behalf of the firm and provide essential information regarding the various economic, environmental, and social benefits/impacts from the development of a clean energy project.
- **Internally facing:** Engage corporate decision makers and project management staff on the comments and concerns gathered through their external stakeholder processes.

Strong local knowledge and regular interactions with communities where these projects are based were consistently identified as important for this function. As such, due to the constant interactions with various stakeholders, the so-called "soft skills" such as effective communication, listening, and a strong attention to detail were identified as most important.

Since Energy Purchase Agreements (EPAs) typical last between 20 to 40 years, successful companies become a part of the communities in which they are located and therefore require ongoing community engagement with key community stakeholders. All of the IPPs interviewed identified community and stakeholder engagement as an ongoing process. Many of these externalized job functions as result become increasingly internalized as the companies develop their own internal capacity and relationships with local communities. Many of these functions also transition from being consultative in the beginning to having more of a marketing and educational focus to keep communities apprised on the development process.

For many larger IPPs considering clean energy projects however, much of the outreach and engagement activities are internalized into the job functions of administrators, officers, and other employees from the beginning.

First Nations Consultation & Engagement

Notable stakeholders in many clean energy projects are First Nations. Since many of these projects in BC are being developed on non-treaty First Nations' lands or in designated traditional territories, understanding the cultural, territorial, and land-use issues involved are essential skills for stakeholder engagement professionals. In most

instances, meaningful First Nations consultation is legally required, and is mandatory as part of the Environmental Assessment and permitting process.[44]

As such, many IPPs contract specialized individuals and/or consulting firms that understand First Nations' issues and more importantly, have a strong working relationship with the various First Nations in the province.

It is important for these IPPs to be transparent with their interests while still engaging First Nations' parties in a respectful consultative manner. In many instances, IPPs alongside their hired consultant will meet with these First nations groups and ask them about the protocol for discussing land-use and development on territorial land. This process normally begins at the early onset of project development where the needs and concerns of each community are identified.

Any issues that arise from these discussions are typically addressed contractually between the First Nations' and the IPP. As such, skilled negotiators are required by both parties. Some interview respondents indicated that some of these commercial and contract skills are lacking in many smaller communities which makes negotiations extremely difficult at times. As such, external experts in contracting and negotiation professionals including lawyers and expert advisors may be contracted to assist in this process.

The results of many of these contractual agreements include provisions for IPPs to provide on-the-job training, procure local business services, and provide land-use lease payments.

Opportunities for Local Communities

- Community and stakeholder relations
- First Nations advising, negotiation, and consultation

Preliminary Design & Evaluation

The design of a clean energy project is also a key part of the feasibility phase. Specialized engineering firms are engaged for this stage and they are required to provide a comprehensive engineering design for the deployment of the particular clean energy generation technology that was identified in the concept development stage. This may also entail more specific analyses on the efficiency of the proposed generator and/or to address site-specific technical concerns. The preliminary designs at this stage also address concerns put forward by the various external stakeholders with respect to project development. This may require the IPP, along with its engineers, to modify the project design to meet these key stakeholder inputs.

[44] BC Government, Environmental Assessment Office Procedural Order (Section 11)- Stipulates the First Nations groups that a proponent (IPP) must consult as part of their Environmental Assessment permitting. See: http://www.eao.gov.bc.ca/pdf/EAO_User_Guide.pdf

In most instances, interviewees indicated that they continued to engage the same engineering firm that they used for their initial concept development for these engineering functions because they are familiar with many of the feasibility studies that were performed earlier. However, a second engineering consulting firm may be hired in order to validate and verify some of the new findings and to ensure accuracy.

Engineering firms with expertise in hydro project development, and increasingly in biomass and wind, exist in BC. Firms specializing in landfill gas capture, co-generation, and some combined heat and power technologies for the most part have to be brought in from out-of-province, or often from the US and Europe.

Opportunities for Local Communities

- Most functions are performed internally or contracted to engineering firms. As such, there are limited opportunities for local communities in this stage.

Planning & Execution

Permitting & Approval

Permitting and approval is a critical aspect of the clean energy project development lifecycle. Many projects fail to move forward because they are not able to obtain or maintain all of the relevant permits and approvals (see Figure 11). This process is highly technical and involves many stakeholders, as well as government agencies from municipal, provincial, and/or federal governments.

It is common to have more than one provincial government ministry is involved with this process, including the Ministry of Agriculture, the Ministry of Energy and Mines, and the Ministry of Transportation just to name a few. As such, understanding the operational dynamics and the different approval processes for each of these ministries is essential.

"For anyone dealing with government, either at a political level or in permitting, people skills are very important. Being able to see things from other perspectives and identifying common ground is as important as any technical skills." –Independent Power Producer

Pre-Construction	Construction	Post-Construction
• Crown Land Tenures • Water License	• Land Act Tenure • General Area License of Occupation • Provincial Environmental Assessment Review • Environmental Assessment Certificate • Authorization under Fisheries Act • Water Approval • Mineral Reserve • Leave to Commence Construction • Occupant License to Cut (OLTC) • Road Use Permit • Work Permits • Highway Access Permit • Powerhouse License of Occupation • Linear Components License of Occupation	• Crown Land Lease • Powerhouse Lease • Intake Structure Lease • Right-of-Way • Operational & Environmental Monitoring Program (OEMP) • Disposal at Sea • Soil Removal Permit • Mineral Reserves • Waste Discharge Permit

Source: BC Government, 2008

Figure 11: A sample of permits and approvals required for IPPs in various stages of the project lifecycle in BC.

Understanding which permits and assessments are required is equally as important. For example in BC, projects that have an energy generation capacity of greater than or equal to 50 MW or by special ministry order require a provincial Environmental Assessment.[45]

Interview respondents identified that the permitting process is one of the most strenuous aspects as it requires professionals who have a firm understanding of the BC and Canadian regulatory landscape. Due to the limited market for such specialized services, consultants with regulatory and permitting expertise are in high demand. Many companies desire having a knowledgeable firm or individual that can inform them of exactly on the process and in most instances, this quality expertise is hard to find. In many instances, companies build their own internal knowledge and expertise due to the challenges.

[45] BC Government, Environmental Assessment Office User Guide. See: http://www.eao.gov.bc.ca/pdf/EAO_User_Guide.pdf

"The BC landscape is very unique in that we are dealing with un-treaty land and dealing with a government that is so fluid and changing in terms of the administrative landscape and in terms of its policies; it would have to be someone who is very familiar with the BC landscape."
–Independent Power Producer speaking about regulatory and permitting consultants

Scientific advisors, including registered biologists, foresters, archeologists, and anthropologists, will also be brought on to complete environmental, ecological, and cultural impact studies that are required for many of these permits. Studies will often include hydrology, fish distribution, fish migration, aquatic habitat, and wildlife studies among others. Individuals will normally be contracted for the very specific purpose of providing a credible, third-party, scientific analysis resulting in permit approval. Having the relevant industry credentials and association memberships are critical. Often, IPPs will communicate with both federal and provincial agencies to verify the credentials of these professionals and/ or ask for a referral to a qualified service provider.

While many of these professionals may have an advanced academic credential such as a MSc or PhD in biology, forestry, or archeology, being accredited and having the relevant situational experience was identified as much more important. An example of the credentials sought after by IPP companies include Registered Professional Forester (RPF) and Registered Professional Biologist (RPBio).

"Regulatory and permitting consultants need to understand the process and what it takes to get the permits approved." –Independent Power Producer

Professionals engaged for permitting and regulatory affairs also need a solid communications skill-set and a significant level of knowledge and experience in their field of work. This is due to the fact that in many cases, they are the ones representing the company in many of the permitting and approval processes with the various government ministries and departments. As well, they need to be able to recognize changes in both the provincial and federal regulatory landscape as it happens. For example, they would have to understand how the new changes to the Federal Environmental Assessment procedure will affect the current and future development of projects.

Opportunities for Local Communities

- Registered biologists
- Registered foresters
- Professional archeologists and anthropologists

Bidding & Electricity Purchase Agreement (EPA) Process

This is the moment of truth for all IPP companies that wish to proceed with developing a clean energy project in the province. While IPPs generally understand that a proposed project is evaluated by BC Hydro in terms of its ability to access sufficient capital, provide reliable power generation at a competitive price, and a number of other risk factors, the actual metrics for evaluation are not always clear and causes significant uncertainty on what makes a successful bid in addition to a competitive price.[46]

As such, many internal and external parties are involved in this stage to help develop, verify, and submit a strong business case with all the appropriate relevant documents in order to provide a comprehensive and competitive bid. The level of detail and documentation that needs to be provided varies depending on the clean energy project type. For example, non-storage hydro documentation is usually less stringent than those that might be required of biomass and wind energy generation proposals. This is due to the fact that non-storage hydro technology has been tried and tested in BC while other types are relatively new and have a certain level of technology risk that need to be addressed.

Firms that the IPPs have engaged with in the past during the feasibility stage are often re-engaged for this process and additional services may be required, including commercial and contract lawyers, engineering consulting firms, and regulatory affairs professionals, as well as financial advisors and accountants.

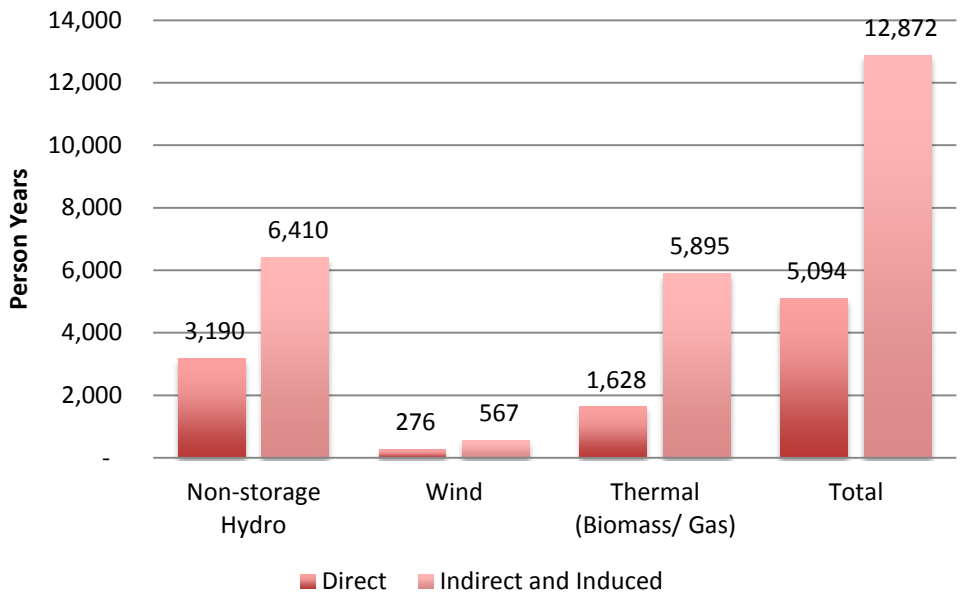
Community energy projects may undergo a different process that includes direct negotiations with BC Hydro on project development. While this may appear to be less competitive, it does not necessarily mean that it is any less demanding than the competitive bidding process and often requires the same amount of financial and human resources.

Successful IPPs and communities granted Electricity Purchase Agreements (EPAs) will be required to maintain the terms of the contract and the relationship that they have with BC Hydro. A senior manager or administrator normally does this internally while retaining legal counsel if any changes or concerns are apparent.

Equipment Procurement & Construction

According to an economic analysis study conducted by PwC, the construction stage of project development provides the highest number of business and employment opportunities and is often externalized by the IPPs to contractors (see Figure 12).[47] This is due to the number of different contractors and professionals that are required to bring the project designs into actual operating capacity.

[46] Merrimack Energy Group, Inc., Final Report on BC Hydro's Energy Procurement Practice. 2011.
[47] PriceWaterhouseCooper, Economic Impact Analysis of Clean Energy Projects in British Columbia, 2010. 2011.



Source: PriceWaterhouseCooper, 2011

Figure 12: Estimated employment impact of clean energy projects under development in BC as of 2010.

Some clean energy technologies are purchased by IPPs through equipment suppliers. For example, wind turbines and some CHP units are manufactured internationally and assembled on site. Turbines and other componentry for non-storage hydro operations may also have pre-fabricated components that are then assembled and built to project design specifications.

Project managers are often hired by the firm to oversee all phases of project construction. They are responsible for managing the triple constraints of project development; which are cost, time, and quality. As such, project managers are required to have strong budgeting, scheduling, project crashing, and cost control skills. Many of these individuals will have formal training and education in modern project management practices and may also have designations such as the Project Management Professional (PMP).

Many IPPs have identified that finding good project managers is very difficult as they are often attracted to other industries such as oil and gas. As such, project and construction managers are often brought in from out-of-province.

"Finding proper construction and project managers is very difficult […] there isn't a lot of talent that is available locally."
– Independent Power Producer

Similar to other capital projects, general contractors will be selected for the construction and assembly of clean energy projects. These services are often procured through an open bidding or request for proposals (RFP) process. The IPPs will normally make the decision internally based on their own set criteria. These contractors may often have experience developing other clean energy projects and will eventually bring in subcontractors for engineering, procurement, and construction (EPC) services.

These subcontracted services may range from those in the construction trades (including road-builders, millwrights, machinists, welders, electricians, carpenters, health and safety, construction foreman, and site monitors) to more professional services such as public outreach and equipment installation. Many of the skills can be transferred from their previous experiences in other industries and do not require previous specialized experience working on clean energy projects.

Required forestry services can often also be sourced locally and are essential for area surveying, clearing, and hauling duties. These services are most readily available in communities that already have a strong forestry base.

All IPPs interviewed expressed a strong desire to source these services locally from close to the project site. This is due to the fact that it is much more cost effective to hire locally than to bring in external contractors and establish long-term facilities in order to meet their food and accommodation needs.

"Over the years, lots of local firms will contact us and say we are a road builder, excavator, etc. We save them and pass them on to the general contractor and hope a lot of those opportunities go local."
– Independent Power Producer

"All the different trades and suppliers will be typically sourced from where we are. This is not always possible, but on the smaller stuff we can."
– Independent Power Producer

"Construction, health and safety, road-building, aggregates, concrete […] whatever we can get locally, we get locally because it is usually cheaper."
– Independent Power Producer

Hiring locally is not always possible however, especially with certain specialized construction and engineering functions. Clean energy technologies that require specialized assembly as per the warranty contract terms between the IPP and the equipment manufacturer is a case in point.

Often, the equipment manufacturer will have its own certified equipment installers that the IPPs use and they may come from other parts of Canada or even internationally due to the very specific requirements that these technologies demand.

"If you are looking at wind, the fact is there are not a lot of these projects built in BC so it is difficult to find the expertise locally. We tend to bring it in from elsewhere." – Independent Power Producer

"Some construction skills will be specialized. The people that operate the cranes, install the wind turbines, and lift the hubs and blades onto the tower will be very specialized and brought in from elsewhere."
– Independent Power Producer

Secondary services required during construction also include support services such as transportation and logistics. This is especially true where different raw components are being sourced from an extensive global supply chain. Getting these materials to the project sites will often require rail and trucking services. Additionally, continual environmental and contamination monitoring will be required on-site and these services are performed by environmental and site monitors.

Community energy projects typically go through the same process as IPP clean energy project construction.

Opportunities for Local Communities

- Construction and project managers
- Skilled trades and construction (i.e., carpenter, electrician, metal fitters, heavy duty equipment operators, wood cutters, welders, blasters, etc.)
- Forestry services (surveying, clearing, hauling)
- Equipment installation
- Transportation and logistics
- Business support services (accommodations, recreation, food services, retail, etc.)

Testing & Commissioning

The final stage of the Planning & Execution phase is equipment testing and commissioning. It involves engineers, plant operators, as well as representatives from government agencies and BC Hydro to ensure that the construction is up to regulatory and permitting standards. It is also a validation step to ensure that the plant is operating as per the design specifications. Upon successful testing, the regulatory authorities grant final approval and the plant becomes operational.

Opportunities for Local Communities

- Most functions are performed internally or contracted to engineering firms. As such, there are limited opportunities for local communities in this stage.

Owning, Operating & Maintenance

Ownership

Management, human resources, financial, bookkeeping, and accounting services are on-going needs of clean energy companies during commercial operations. These needs are similar to those of other businesses. According to market research from IBIS World, US clean energy producers were identified to spend approximately 15% of their revenue on wages during operations.

Since much of a plant's operations are low maintenance, most companies in the operating stage do not have a large full-time staff complement and staff that remain employed assume multiple roles. Additional job duties that employees are required to perform include ongoing public relations and marketing with the various stakeholders.

"We look for people who have well-rounded experience. There are a lot of different parts to management [including] finance, operations, and maintenance." – Independent Power Producer

Carrying forward the terms of the project's agreement made earlier on in the Feasibility phase is also important. For example, this may require the IPP to source equipment and provide external on-the-job training for members in the local community and/or First nations groups.

IPPs also engage in various public outreach activities. This may include periodically updating communities on the benefits of the clean energy project and address any concerns these stakeholders may have. In other instances, IPPs may work alongside local educational and research institutions to collaboratively innovate on new technological developments.

"Outreach for us is to universities and colleges where we collaborate on different innovations." – Independent Power Producer

External business and professional services will be retained and brought on as necessary. This may include designated accountants (CA, CGA, and CMA) to prepare the necessary financial statements and external auditing or commercial lawyers for ongoing legal counsel. Many of these services are sourced from near where the company is headquartered or sourced based on a particular specialized service they can provide.

Project refinancing is another process undertaken by some IPPs and communities with clean energy projects. This may be due to changes in cash flow positions, or strategic investments for the development of other projects. Analyzing the amount of capital that will be required for refinancing, as well as the appropriate cost of capital and the term period may be necessary. This is typically done internally with consultation from external financial experts and accountants as they prepare documentation for financial institutions including banks, credit unions, and stock brokerages.

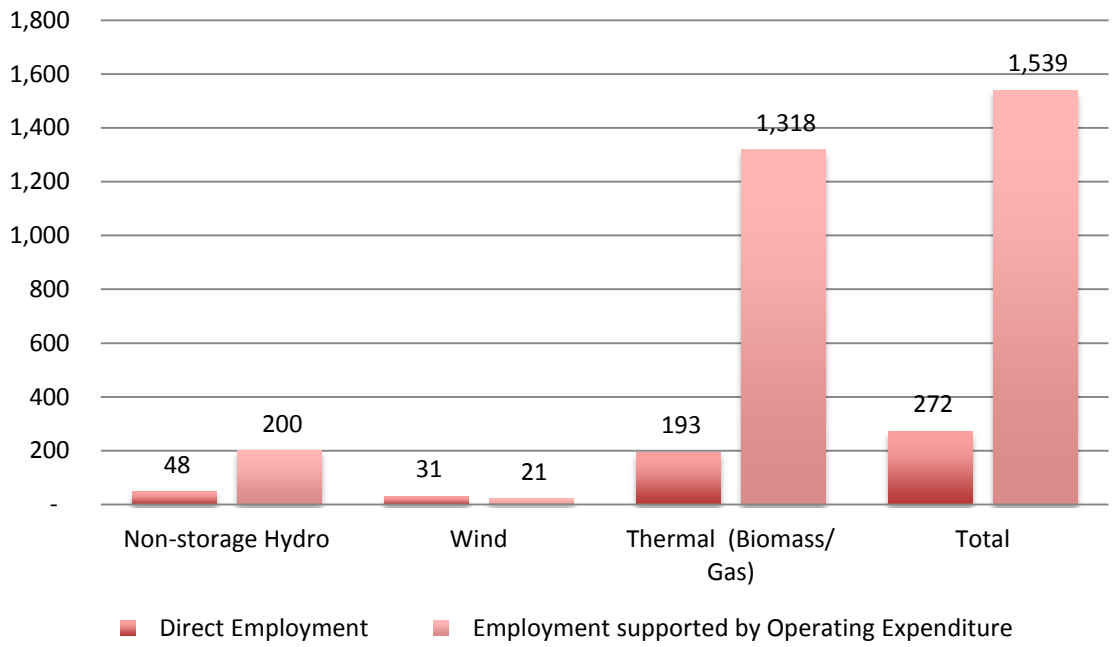
"If you need to refinance, you refinance, but normally you can roll your bridge into long-term financing. If you have done your project right, every bank wants to give you money. The risk has gone down; the front-end risk is the hard part." – Independent Power Producer

Opportunities for Local Communities

- Accounting and bookkeeping services
- Office administration and support

Plant Operations

Many clean energy power plants are increasingly being operated with minimal staffing. The 2011 PwC study estimates that a total of 272 direct and 1,539 indirect full-time equivalent jobs are expected to come from existing IPP projects in operation throughout the province (see Figure 13).



Source: PriceWaterhouseCoopers 2011

Figure 13: Estimated employment impacts of existing BC clean energy projects in the operations phase.

Automation and computer controls have become increasingly the trend for many of these projects. In the case of non-storage hydro, wind, and to a greater extent CHP operations, many projects are already controlled remotely off-site. However, periodic on-site maintenance and monitoring will be required to ensure the plants are operating at optimal capacity. For example, wind projects will periodically require a wind technician to travel on-site in order to gather meteorological data and assess the conditions of the wind turbines.

"Once a plant is commissioned, it is typical to have a full-time operator who may also have some part-time employees for bridging, etc. Maintenance of the plant is an ongoing separate issue." – Independent Power Producer

"All of our sites can be controlled remotely. However, we still employ operators to conduct manual tasks (cleaning trash racks, inspections, etc.). We will always hire operators to run these plants."
– Independent Power Producer

"[We have] operations [staff] that read and record data from the computers, check stream and intake flows, etc."
– Independent Power Producer

"Technologists who are in the mechanical and even chemical disciplines are usually hired for plant operations." – Independent Power Producer

While many plant operators will require some form of technical certification, they usually do not need to have high-level academic backgrounds. More importantly, operators need mechanical and technical expertise which could come from previous experiences such as in heating, ventilation, and air-conditioning (HVAC) maintenance.

For many of the interviewed companies, the personal attributes of the individual were more important, such as having a strong desire to learn and upgrade their skills. However, rather than taking on a full-time operator, some IPPs may contract these operational services to specialized engineering firms that may operate several plants at the same time.

"Anybody with mechanical expertise or control expertise from HVAC can be involved. These plants aren't that difficult but you have to be mechanically inclined with some electrical background. You can sometimes find that locally." – Independent Power Producer

For some clean energy projects requiring more hands-on work for their day-to-day operations such as municipal solid waste, landfill-gas-to-energy, and CHP/co-generation, the equipment manufacturer often provides mandatory equipment operations and "troubleshooting" training. In most instances, these IPPs and/or municipalities have wastewater treatment operators and technicians who are already employed and can be trained to operate the new technologies.

Other occupations important for some clean energy project operations include power operators, electrical technicians, instrumentation specialists, as well as pulp-mill technicians. These individuals typically will have completed a technical skills program and have the appropriate certification and operating tickets. For bioenergy projects, securing a solid biomass fuel supply is also essential and requires labourers that can cut, salvage, and/or transport some of these fuels to the plant operations.

Technologies such as wind will require specially-trained technicians to periodically go on-site to assess meteorological data, as well as the conditions of the turbines, and provide periodic maintenance if required.

Opportunities for Local Communities

- Power plant operators and technicians
- Casual labourers

Plant Maintenance

Plant maintenance is required on a periodic basis. While staff operators may do some maintenance internally, clean energy technologies are highly sophisticated and specialized and require professional technicians or engineers for servicing. Certain clean energy technologies will come with warranty agreements from the manufacturer. Many of these warranty agreements will require IPPs to hire specific contract technicians for equipment repairs for the first two to five years.

For ongoing plant maintenance, IPPs will normally have a contractor that will perform these more technical maintenance functions on their behalf. They may be engineers or technology maintenance professionals. In many instances, these contractors will be sourced out of province depending on the availability of skill-sets and talent in province.

"Any work done on the co-generation unit will be unique to a certain skill-set or to a certain certification that an individual will have."
– Independent Power Producer

Ongoing maintenance of plant facilities and roads may also be required, especially since most commissioned projects have a lifespan extending 20 years or more. This work can be performed by skilled trades people and can often be sourced from local communities.

Opportunities for Local Communities

- Skilled trades people (i.e., millwrights, electricians, carpenters, HVAC mechanics, machinists, etc.)

On-going Environmental & Site Monitoring

As part of its environmental stewardship and permit maintenance, IPPs are required to provide ongoing environmental monitoring. Environmental monitoring is required during a plant's operations and information gathered is reported directly to the Ministry of the Environment. A water license being granted may also be contingent on the submission of properly prepared Operational & Environmental Monitoring Program (OEMP) reports.[48]

Environmental monitoring activities may include assessing wildlife impact, water, and mineral analysis, etc. IPPs typically have an individual on staff or contract a professional biologist that will lead its environmental monitoring efforts.

[48] BC Government (2008), Independent Power Production in B.C. Guidebook.

"We have a very strong background in water so we do a lot of our own water management and monitoring. We have professionals who do that and have been doing it for many, many years."
– Independent Power Producer

Environmental monitors will typically perform the on-site assessments and provide raw data for the biologist to generate the required reports for maintaining the relevant operating licenses and permits. The skills required by these monitors include the ability to assess, identify, and respond to all ecological concerns.[49] They will also have to have a strong understanding of the various scientific and ecological processes. While some of the practical skills can be acquired through on-the-job training, relevant academic education is usually required. Oftentimes, environmental monitors can be sourced locally.

"One model is to get a biologist to come in with a local helper."
– Independent Power Producer

Opportunities for Local Communities

- Registered biologists
- Environmental monitors

[49] See: http://www.ec.gc.ca/faunescience-wildlifescience/default.asp?lang=En&n=B0D89DF1-1

3.2 Clean Energy Technology Suppliers: Business & Labour Needs

Clean energy technology providers for hydro and wind turbines, biofuels, biomass pellets, gasification technologies, and CHP/co-generation boilers were also interviewed for the purpose of this study in order to identify supply chain business and labour market opportunities in BC.

Direct Opportunities

Key findings from this research suggest that many of the staffing needs and requirements of clean energy technology companies in BC are similar to those of IPP companies in the province. These needs range from various engineering and trades-based services to business development and sales functions.

However many technology providers that innovate and create their own products require highly-skilled and specialized staff and contractors with advanced academic degrees, which include professional engineers to research scientists. Most of these companies have their research and development and manufacturing facilities headquartered in urban centers where the knowledge capacity required can be readily sourced from large research and post-secondary institutions such as UBC, SFU, UVic, and UNBC.

Other technology providers source pre-fabricated equipment from large global industrial suppliers and as such, the actual manufacturing and fabrication of equipment takes places outside of the province. This is often the situation for wind turbines, as well as boilers and other equipment for co-generation and CHP plants.

"A lot of people think wood pelletization is a "mom-and-pop shop" operation, and it might have been back in the day when it was being pioneered; but it is very specific. I would even say a very scientific process with a lot involved."
– Clean Energy Technology Company

"Wind turbine suppliers have a global supply chain and compete with each other to own or have rights throughout that supply chain."
- Independent Power Producer

"For the engineering piece, there is a large portfolio of companies that provide those kinds of services to our business."
- Clean Energy Technology Company

In many instances, there are opportunities for on-site equipment installation and for the development of the installation site that meets the specific requirements of the equipment. For example, equipment installation and some warranty services for a CHP system will be done internally by these companies with the permission of the equipment manufacturer. However, piping and building biomass storage bunkers for some of these projects will be contracted out to trades people with experience in piping, excavation, and building for example.

"They are trained on the system just through learning and/or have a machinist background, millwright tickets, welding tickets, and fabrication tickets." – Clean Energy Technology Company speaking about hiring CHP boiler technology staff.

"Contractors that offer services in transportation, preparation of the wood, wood grinding, mechanical, manufacturing and fabrication, electrical, millwright, and welding are those that we call on regularly." - Clean Energy Technology Company

Some clean energy technology companies, such as biomass pellet companies, have industrial plant facilities to develop their products on a commercial scale. Ongoing maintenance services are often required and can be performed by industrial trades workers as well, provided they have experience dealing with a similar type of system or willingness to learn new skills to perform such functions.

Services including welding, machine operation, carpentry, and electrical services were all identified as on-going needs for some of these facilities. In some parts of the province where these operations exist, there is currently a severe skill shortage for some key trades. This is especially true in the North Eastern part of the province due to competition from the oil and gas and mining industries in BC and Alberta.

"Especially in the North East region [of BC], it is a highly competitive environment; skilled trades people are in high demand."
- Clean Energy Technology Company

Indirect Opportunities

Additional opportunities exist in business support functions. Transportation and logistics functions for the transport of raw materials to the clean energy facility, as well as for shipping the product to market, are often important for local companies. This may involve domestic trucking and rail services as well as international air and ocean shipping solutions.

For many biomass focused companies, getting product to market means exporting by ship and as such, communities near ports with services related to scheduling, customs clearance, crane operation, and other general labour services for moving cargo onto freight ships may be required. Services are also required for preparing the product for shipping.

Services involving the day-to-day operations, such as printing and marketing, are often times outsourced and are usually sourced locally close to where the clean energy companies are situated. These potential business opportunities are easy for rural businesses to access. New web-based technologies could also enable local businesses to offer their services in larger markets throughout the province at competitive rates due to economies of scale.

"There is a local company that will come down here for some of the bigger equipment installations and pick the shipping container up with the boiler, plumbing, and electric equipment inside and put that on a flatbed truck and take that to the site." – Clean Energy Technology Company

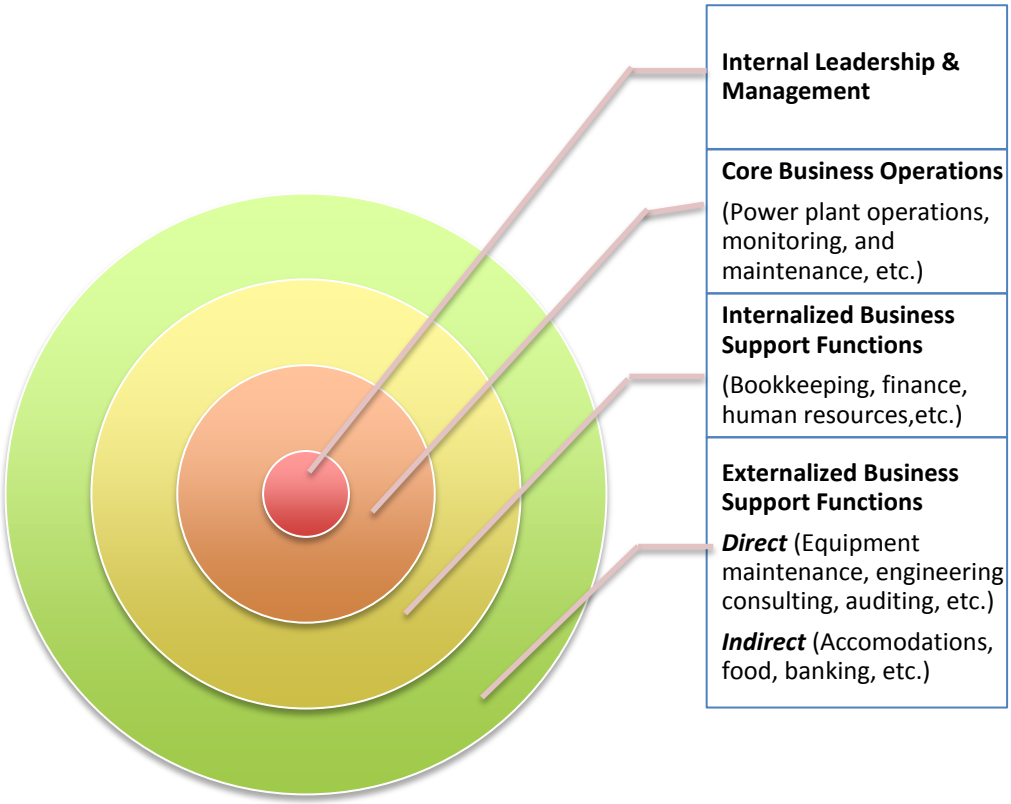
"We have a company in Salmon Arm actually fabricate, weld, and design specialized shipping containers for some of our bigger systems and we transport these systems on a flatbed truck to wherever the site is."
– Clean Energy Technology Company

"There are a few marketing companies that we use to do all the printing for our business cards and point-of-sales displays."
–Clean Energy Technology Company

4. Clean Energy Opportunities for Rural Communities

4.1 Opportunities Related to IPP & Utility-Scale Energy Projects

All of the clean energy companies interviewed have a core management team that run the day-to-day business operations (see Figure 14). This includes leadership, business development, finance attraction, and administrative services. Depending on the business model, some IPPs have their own in-house operations staff for plant operations while others may contract the operations to specialized engineering firms or power plant operators.



Source: GLOBE, 2012

Figure 14: Business service and labour needs for clean energy companies.

The availability of skilled operators and maintenance staff can be an issue in the province, especially since many of these clean energy technologies have yet to be validated for commercial scale use and as such, require extensive out-of-province support. These externalized services are potential business opportunities that BC can look to develop locally in the medium- to long-term.

"There is a shortage of good trades people and power engineers."
–Independent Power Producer

Based on the findings from the interviews with IPP and clean energy technology company representatives, five potential business service and labour market opportunity areas were identified for rural communities as described below. These opportunities reflect the reality that clean energy projects are highly-technical and in most cases, require specialized personnel that may not be available in smaller communities throughout the province.

1. **Opportunities in Skilled Trades & Construction:** This opportunity area was consistently identified by IPP and clean energy technology companies as having the highest potential for rural communities. There are many skilled trades workers that can be sourced from local communities with an industrial base that have traditionally relied heavily on local labour supply. The certification and tickets that many of these workers possess are often transferable to opportunities in clean energy project development, particularly for construction phase activities. These jobs include millwrights, heavy machine operators, electricians, carpenters, machinists, pipefitters, woodcutters, welders, blasters, etc.

   Support services including those in trucking, rail, and logistics are also required. In many instances, construction and pre-fabricated materials will need to be delivered from major hubs and ports to the project site. For some remote locations, this may also create opportunities for road, transmission line construction, and on-site facilities construction.

2. **Opportunities in Community & First Nations Engagement:** Local and cultural knowledge is extremely important for project development starting in the feasibility stage. Individuals that have an understanding of the policy and legal landscape and have experience and skills dealing with multiple stakeholders including First Nations, as well as a strong relationship with the communities surrounding these projects are valuable assets to IPP companies.

3. **Opportunities in Scientific & Environmental Monitoring:** Continuous on-site environmental monitoring is required for most clean energy projects in BC. For non-storage hydro projects, constant environmental monitoring is required to obtain and maintain their water licenses. Wind farms also require a wind technician to periodically monitor meteorological data from their on-site meteorological towers and other monitors to constantly assess the site conditions. Biologists, foresters, and archeologists/anthropologists are also occupations that can be sourced from rural communities.

   Many of these requirements are due to licensing and permitting and as such, IPPs prefer to source these services from communities near their site. While these services may require the monitor to have training and education related to the environment and ecology, practical skills can be acquired on-the-job. Most IPPs have programs to provide the necessary on-the-job training to qualified individuals and ensure they have the practical skills to perform the assessments on a long-term basis.

4. **Opportunities in Plant Operation & Maintenance:** While limited in terms of job numbers, operators at pulp and paper plants, sawmills, and diesel electricity plants have transferable skills that will enable them to seize opportunities in clean energy plant operations. In many instances, CHP and non-storage hydro plant operations have employed individuals with this kind of prior experience.

5. **Opportunities in Indirect Business Support:** There are other opportunities from the business-support side that can be sourced from rural communities. These may include providing accommodation, food services, telecommunications, entertainment, as well as various corporate secretarial, marketing and communication services. However in most instances, these opportunities are limited to the construction phase where the majority of the business activity surrounding project development occurs.

In terms of the broader clean energy opportunities for rural communities, it was identified that communities with local economies based on industries such as mining, forestry, chemical processing, and manufacturing may have a competitive advantage to fully reaping the clean energy opportunities and rewards. This is primarily due to the availability of transferable skill-sets from these associated industries that can be applied to clean energy project development.

"Depends on the community; if it is an industrial community, there is probably a supply of workers, especially if the community has a pulp mill or another industry, saw mill, or chemical plant. If there is an industrial base, the skills are probably transferable." - Independent Power Producer speaking about sourcing local business and labour services.

It is important to note that the policy landscape for clean energy development is not as optimal as it was when the *Clean Energy Act* and the *Energy Plan* were enacted. The development of the Site C storage hydro project, the recent changes to the Clean Energy Act to eliminate the province's commitment to energy self sufficiency, and the shift in focus towards liquefied natural gas opportunities have left many IPPs feeling uncertain about future calls for power. These changes directly affect rural communities from exploiting clean energy for economic development and have weakened the short- and medium-term growth prospects for this industry.

However, with a total of 52 EPAs that have been granted for projects under development across the province, opportunities still exist for communities to provide services and tap into the workforce needs of IPPs.

BC Hydro's draft *Integrated Resource Plan* is also considering a renewed call for power in the near-term in light of recent developments surrounding LNG plant proposals and the natural gas opportunities in the province.[50]

4.2 Opportunities Related to Community Energy Projects

Community energy and emissions planning is also a growing trend with many positive benefits for local economic development and is unaffected by the uncertainty of BC Hydro's call for power. Community-based energy projects are an opportunity for rural communities to promote economic development in their regions.

These projects could include district energy systems that may provide heating and energy needs for closely situated structures/ buildings (particularly when found close to an industrial/ institutional or other major heat source), or larger scale generation projects such as non-storage hydro project that could provide enough electricity to not only meet a community's energy needs, but with excess that could be sold into the grid system. However, construction costs need to be properly managed, particularly for in the case of CHP and bioenergy heating projects. The material costs for piping can become prohibitive for locations with low population density and for smaller scale projects.

In terms of broader clean energy technology opportunities, some interviewees suggested that bioenergy solutions could be a potential opportunity for some communities. BC Hydro and the Fraser Basin Council provide support to remote communities through their Remote Community Electrification and the Remote Communities Implementation programs respectively. These programs are helping some remote communities in the province perform feasibility studies by looking at opportunities to displace diesel generation with district energy systems.

Some interviewed respondents also suggested that harvesting of mountain pine beetle infested timber surrounding communities vulnerable to forest fires could be adopted as part of a forest fire mitigation strategy. This potential feedstock could provide heat and electricity benefits to these communities while strengthening their defense against the threat of forest fires. As a result, woodcutting, harvesting, and processing opportunities could be developed in these communities.

"Our industry as a pellet manufacturer works directly with trees, so that obviously becomes part of our skill-set" - Clean Energy Technology Company

Feedstock supply security has also been called into question in recent weeks with devastating sawmill explosions, the latest one in Prince George, which has threatened plans for the local biomass district energy systems.

[50] Clean Energy BC. Executive Directors Report. May 2012.

Some municipalities with 20-year agreements with local sawmills to supply biomass for their operations have also expressed concern about meeting their longer-term supply needs. There is already a growing export market for biomass wood pellets, but there is also a domestic market for these products in the mid to long-term as more biomass-powered technologies are adopted across the province.

With the potential bioenergy opportunities comes the need to continue to implement effective forest management practices and to ensure that environmental and socio-economic issues can be balanced. Many of these opportunities can be developed provided they are implemented incrementally while considering the systematic impacts from their development.

Additional opportunities exist to take the lessons learned from locations such as Revelstoke and Enderby and actively apply them across rural parts of the province.

"We do find that, especially in Northern BC, a lot of rural communities including First Nations, have enough of a population and are close enough together [that] having district energy system running on biomass makes a lot more sense."- Clean Energy Technology Company

"For communities that have biomass available for clean energy projects, this can potentially displace their reliance on fossil fuels and generate energy self-sufficiency."
– Clean Energy Technology Company

5. Knowledge, Skills & Capacity Development

5.1 External Development: Education, Training & Experience Factors

While clean energy generation in BC has provided significant economic benefits to many communities near where these projects are located, tapping into the opportunities is not without its challenges. Even with a strong commitment to clean energy knowledge development from research facilities, post-secondary institutions, and centers of excellence across the province, there is still a significant knowledge and experience gap that exists province-wide. Many of today's youth, regardless of where they live or work, are finding themselves in situations where they require unprecedented high-levels of education and technical skills to compete. Lack of education and training was consistently identified by interviewees as one of the key barriers for rural communities for seizing the opportunities that come from clean energy project development.

"The more academic streams don't really meet the needs of a number of the folks and people in the communities that I have been dealing with. They are looking for practical hands on skills. People that live in these remote communities don't have the time to upgrade and spend two years getting a certificate; they need these skills now." – BC Rural Community

In some instances, highly-skilled and experienced technical workers and researchers are still being brought in from other parts of Canada, the United States, and Europe to help fill these gaps. This is a reality that the clean energy industry is facing as a whole and it is due to the relatively sparse technology deployment across the province. In instances where the academic capacity exists in the province, ironically there are not enough projects for these graduates to work on.

"Northern Lights College has had wind technician graduates for the past three years, but their issue is that there isn't enough wind projects on the ground to employ all of these technicians. They have to go to Nova Scotia and Southern Alberta to find work." – Independent Power Producer

Experience is critical for industry development and is apparently lacking. For example, cellulosic ethanol production in BC is using such new technology that most individuals working in this area do not have the 10-15 year experience that would have been required for a similar job in other established sectors.

Some CHP and co-generation plants for example, source most of their ongoing technical maintenance support from the United States and Germany due to the highly-specialized nature of the technology. While this practice is not cost-effective and sustainable in the long-term, it is the only present option as there are no viable alternative solutions available within the province.

That being said, many IPPs operating in the province have recognized this problem and have sought long-term solutions to mitigate some of these challenges. For example, some IPPs have paired with post-secondary educational institutions (including BCIT, UNBC, and SFU) to develop the required knowledge and skill-sets within the province to support industry growth and development.

Certain interviewed non-storage hydro companies have paired with universities and colleges in the province to educate students on the technologies and practices that are being utilized in their operations. Other companies have directly invested in training facilities to provide the necessary training for power plant operations.

"We have our operations staff trained and certified by certified engineers. We contract that out to accredited electrical engineers."
– Independent Power Producer

As wind technology is relatively new to BC, certain wind energy developers interviewed also have established educational partnerships with institutions such as BCIT, North Island College, Northern Lights College, and UNBC. While this is building a strong wind technology workforce, more wind projects are needed in order to sustain this workforce in BC.

Interview respondents also identified co-operative education programs (co-ops) as being extremely effective in providing graduates with practical work experience to support theoretical in-class learning. It was also stated that all post-secondary academic programs should be lengthened to accommodate co-op programs and allow graduates to enter the workforce with at least 1 to 2 years of work experience.

"Graduates are eager. They don't know as much but they usually have a good academic background in computer software and are very strong in all the different processes with respect to reporting and monitoring."
– Independent Power Producer

There is an increasing trend for post-secondary and technical institutions across the province to deliver curriculum that not only weaves sustainability into its programming, but also has dedicated courses designed to meet industry needs. However, for many individuals in rural communities, obtaining education and certification may be a significant challenge in itself.

While not all opportunities within the clean energy industry require advanced education, many require some form of industry certification or credential. This is true despite the fact that certain technical operations are simple enough to only require practical skills-based training. However, with a trend towards industry standardization, certification of various job functions has become increasingly common.

5.2 Internal Development: On-the-Job Training, Rotations & Mentorship

Respondents to this study identified that on-the-job training is an essential part of their companies' operations. While the majority of in-house training initiatives do not result in formal certification or credentials, they do equip employees with the necessary skills to perform their day-to-day responsibilities.

"Plant operations graduates have to learn how to run a plant. What that means is they go around with somebody and go through all the daily logging that has to happen, the maintenance, and the upkeep. They get a sense of output, temperatures, and all the equipment that needs to be monitored, replaced, and maintained, and they do that over a period of time." – Independent Power Producer

Due to the fact that most clean energy technologies in the province are relatively new (with the exception of storage- and non-storage hydro), there are very few skilled workers available locally who have the technical skills required to operate these projects. As such, employers are not able to require extensive experience requirements as would have been required for job postings in other industries. Internal capacity building has become characteristic of many clean energy businesses.

"It's just the hands-on experience and the practicalities that usually take a few years to get them there. You can usually find young people that are really quite keen on getting into this sector […]. They are usually the ones who end up running the company." – Independent Power Producer

Thus to build this knowledge and experience capacity, many of these companies are offering team-based learning and mentorship opportunities for staff, especially new hires. This allows senior team members to provide practical skills-based training to junior staff and to help develop the necessary critical thinking required to adapt to changes in the workplace.

Mentorship programs for some remote and First Nations' communities provided by the Fraser Basin Council and Human Resources & Skills Development Canada were also identified as organizations with programs in place that are helping to build the necessary skills in these communities.

Both internal and external training programs were identified and the delivery of these programs are directly related to the level of sophistication and operational job requirement.

For example, to address the high-level of sophistication and technical know-how for operating co-generation and waste-to-energy energy operations, the technology supplier is often contractually obligated to train staff operators at their facilities. This is also characteristic of other clean energy projects including wind, and CHP.

"In many cases, you can't go into the plants without the proper certification due to Worksafe BC. They need to have the appropriate credentials and be certified for plant operations. If they don't have that, we bring in parties to train them and get them up to speed and go through testing."
– Independent Power Producer

Some interviewed IPPs expressed a strong willingness to provide the necessary workforce training to communities near their projects. For clean energy projects like non-storage hydro and wind, on-the-job training is often a negotiable item between the IPP and its community partners during the feasibility phase. This is most common where the community partner is a First Nations group. These are critical negotiations for helping to build skills, services, and capacity that these communities can then offer locally and potentially on a more regional scale. In some instances however, these job-training offers are overshadowed by discussions surrounding financial returns and project ownership.

"What we have done with one First Nations group is purchased an entire hydrology monitoring kit – $10,000 worth of equipment. Not only are we providing the tools, we are providing the training so that they can add this to their services." – Independent Power Producer

"To run some of these operations, we have developed homegrown skills within the organization. We train our own employees to become operators of a facility. That is something that is specialized that we are doing and I am sure our competitors are doing the same thing."
- Clean Energy Technology Company

6. Key Barriers for Rural Communities

Rural and First Nations' communities within the province face significant economic development and capacity building challenges. While both the federal and provincial governments have developed financial and social assistance programs for these communities, their programs alone are not enough. While government assistance can help to build capacity and generate economic activity in rural communities, assisting these communities in developing long-term infrastructure, building knowledge-based expertise, and addressing social issues is equally important.

"Economies of scale are significant issues for small communities."
- Clean Energy Technology Company

The challenges that follow not only make it difficult for clean energy companies looking to develop and operate projects in rural communities, but also for the communities themselves as they look to develop projects independently.

"There is a huge continuum of clean energy workforce needs. Some of the challenge is that each community is unique in terms of their internal capacity. It is whether these individuals have the skill-sets to do this kind of work and/or if they have the right number of bodies."
– BC Rural Community

6.1 Lack of Built Infrastructure

Many of the companies interviewed have indicated that operating in rural communities is part of their corporate growth strategy. This is particularly true with bioenergy companies, which rely heavily on their access to feedstock material to support their core business activities.

While this is true with bioenergy companies needing access to feedstock material, they are not the only ones looking at this factor. IPPs also look to areas where they do not have to invest heavily on road construction and portable work camps for their contractors during the construction phase.

Companies also indicated that having proper roads, housing, access to electricity and transmission infrastructure, as well as other essential services including health care, recreation, and educational facilities, are critical determinants for their site selection. Companies that operate in rural areas desire to place their permanent employees in communities they can call home. As such, for many of these companies, it is not financially feasible to operate in locations where they have to invest significantly to develop the necessary infrastructure.

Access to modern information technology (IT) solutions in some rural and remote communities is also oftentimes lacking. Many clean energy projects such as wind projects are monitored off-site and require wireless network infrastructures to communicate data from the turbines to the monitoring stations.

Beyond the fact that sourcing workforce and materials locally is more cost effective than establishing a distribution supply chain, providing opportunities to local communities also supports socio-economic development in these communities. In instances where a project becomes an integral part of the local economy, the workforce also helps to generate economic multipliers for the community through spending activities. As a result, having infrastructure support that can provide goods and services to these individuals is also something company's look for when evaluating where they develop their projects.

"Wages are important, benefits are important, a place to live is important, ensuring rural communities have the recreational infrastructure is also important." - Clean Energy Technology Company

"As an employer, we provide a sustainable long-term career where people are willing to invest their lives into a community through a job we can provide." - Clean Energy Technology Company

6.2 Academic Inflation & Accessibility of Education/Training

While many job functions relating to clean energy will require an advanced post-secondary level of education, there are duties that can be performed with more basic skills-based training. However, with the increasing global trend toward individuals having higher levels of education and technical training, many of these less technical jobs are increasingly requiring some form of certification.

In a 2010 study by ECO Canada, 39% of professionals working in clean energy and eco-efficiency had at least a Bachelors degree compared to the national average of 22%.[51] Academic inflation poses a challenge for many individuals, particularly those in rural communities. The availability of general workers in larger urban centers and towns is raising industry standards, but these standards do not necessarily reflect the real needs of smaller communities. As a result, many of the duties that once did not require formal training now may require both a strong academic education and professional certification.

The issues with academic credentials and certifications also transfer a significant risk to communities. Many communities are being required to operate these projects with

[51] ECO-Canada (2010), Profile of Canadian Environmental Employment. See: http://www.eco.ca/pdf/Profile-Of-Canadian-Environmental-Employment-ECO-Canada-2010.pdf

individuals who don't have the proper qualifications and certifications. While these individuals are highly capable at executing the day-to-day operations, an accident could result in the community assuming most of the liability. This situation is very common in BC, especially in some remote communities where professionally-certified and experienced individuals are often difficult to source.

As such, there is demand for a level of education and training that reflects the real needs of rural communities and a large void in this area exists. There is also a lack of activities designed to help develop essential skills within some of these communities which poses long-term and cyclical challenges for them.

Another issue is the accessibility of education, which is often a problem for many living in rural and remote communities. For many individuals in smaller communities, education can be unaffordable. For others, especially those living in more remote communities, leaving their communities to attend post-secondary school or training institutions in other parts of the province can poses significant challenges – and often times, these individuals do not return once they have left.

"There doesn't seem to be anything that reflects the education and training needs of a smaller community. You don't necessarily need a formal degree or formal technical training behind you to keep a clean energy project running to meet the community's needs."
– BC Rural Community

"There should be some training and qualifications that people can get that are not as rigorous as you would look for from someone in a larger city or town. Right now, there is a huge void here." – BC Rural Community

"A number of people in these communities are looking to upgrade their skill-set and have some recognizable skills [qualification] that they can take to another community. Right now in this area, the kind of commitment they need to meet the education level required is well beyond what is realistic. From a First Nation's perspective, this has been a frustration."
– BC Rural Community

6.3 Competition from Out-of-Province & Urban Centers

Interview participants identified that competition for labour from other jurisdictions is a significant challenge to meeting some of their short- and long-term staffing needs. Be it attraction of workers from larger urban centers promising more opportunities or other provinces providing significant financial incentives, loss of skilled workers from rural communities is an issue.

As a member of the New West Partnership (NWP 2010) and a founding signatory of the Trade, Investment, and Labour Mobility Agreement (TILMA 2006), BC, alongside Alberta and Saskatchewan, has agreed to remove barriers to trade, investment, and labour mobility between the provinces.[52]

While these agreements are strengthening Western Canada as a strategic economic powerhouse, it has also inadvertently caused a significant labour outflow from BC into neighboring provinces, most notably Alberta. Attracted by higher wages and benefits working in the northern Alberta's oil and gas sector, many local clean energy companies are finding it difficult to attract and retain employees, especially for occupations in the skilled trades.

"They can make a year's worth of salary in three months in Fort McMurray." – Independent Power Producer

Some companies have begun to use strategic hiring approaches for operations personnel. For example, one interviewed company is hiring more new graduates and is also engaging the under-employed population between 50 and 60 years of age in order to meet its staffing challenges for its plant operations. The interviewee indicated that investments made to on-the-job training for these individuals are proving to be more strategic and cost effective than engaging in expensive salary wars with competing employers.

"You can get people who are 50 to 60 years old who just want to work part time, and then you can get those who are straight out of university and you can put those two together." – Independent Power Producer

For a lot of the technical expertise, we are relying a lot on larger metropolitan cities to assist us." – BC Rural Community

Loyalty and retention strategies are also being deployed in many respects to reduce employee turnover rates. However, this is not always effective and practical as many skilled trades workers, for example in construction, are often hired on as subcontractors. It is therefore extremely difficult to reverse the general outflow of trades and skilled labour to higher-paying jobs in Alberta in the short-term.

[52] New West Partnership http://www.newwestpartnershiptrade.ca/the_agreement.asp

7. Enabling Strategies for Rural Communities

7.1 Local Community & Economic Development Models

Economic performance disparities between rural communities and their urban cousins pose significant risks for the entire country. Weak performances in rural regions risks lower regional productivity and prosperity and under-utilizes available resources. As such, it is important for rural communities to seek new innovative means to generate long-term economic development opportunities that allow them to insulate themselves from market shocks and trends.

Development models such as engaging private enterprise in public-private partnerships to develop critical infrastructure and creating an entrepreneurial climate that attracts businesses to these communities can help. This may mean aggregating and co-operating with neighboring communities to build capacity that is critical for scaled economies in order for businesses to operate efficiently and effectively.

This will require strong leadership at all political levels in order to find new methods and engage entire communities in this process.

7.2 Rural Education & Skills-based Training Frameworks

Rural communities not only need to build up their economic capacity but also their knowledge-based capacity. Developing mobile modular-based training programs that can be delivered in communities would enable many rural and remote communities to gain essential practical knowledge on clean energy technologies and operations. This could also pave way for a regional skills-based certification that is recognized throughout the province by industry.

Beyond leveraging the existing support services provided by the federal government's Community Futures program[53], provincially-run Rural BC Business Services Centers similar to the pilot project in Alberta, could also assist local communities to develop commercial capacity and business acumen.[54] This would enable entrepreneurial-minded individuals to develop critical business planning and negotiate skill-sets that will allow them to engage with and sell their products and services to companies such as IPPs.

[53] For more on Community Futures British Columbia, see: http://www.communityfutures.ca
[54] Rural Alberta Business Centre Pilot Project. See: http://www.cfnwa.ab.ca/services/self_employment.php

7.3 Community Readiness: Developing a Labour & Skills Inventory

Not every rural community is one in the same. As such, the skills and resources available in each are variable. Many IPPs have in the past requested lists of available skills and talents from First Nations communities.

By developing inventories of available skills and talents that exist from existing industrial activity, this could allow for IPPs to easily gain access to this information and consider their contracting and subcontracting options. An inventory of education and training programs offered at local post-secondary institutions could also help identify core skill-sets that maybe available in nearby communities.

Such inventories would help to reduce the need for many potential contractors to individually self-promote their skill-sets, qualifications, and experiences, as the information would be readily available to potential employers and investors.

7.4 Regional Business Service Networks

Interviewees were asked how they source their labour and business services. While many post opportunities online, use recruitment agencies, social media, and local print media, many business services are sourced from word-of-mouth. This is due to the importance of validation from others in industry.

By establishing a rural business services network, the labour and skills inventory can be managed and used to market these skills to clean energy project developers across the province. This would allow BC rural communities to open their communities to new project developments using an aggregated strategic marketing approach.

This would allow for rural community businesses and individuals to develop critical knowledge capacity while also expanding their potential market reach to nearby communities and exploit greater regional and territorial opportunities.

Leveraging Business Service Networks across the province could effectively market business services and skills to potential IPPs, clean energy technology companies and general contractors on an on-going basis.

7.5 Wealth Creation through Community Energy Projects

Rural and First Nations communities also have significant opportunities to develop their own clean energy projects and create business and job opportunities that stay local. Rural communities can begin by conducting feasibility studies that analyze the most practical solutions to meeting their own energy needs and deliver economic development opportunities. Understanding existing government programs for clean energy project development and beginning the dialogue with BC Hydro can also create opportunities for individuals to get involved early on in the project development lifecycle.

There are also many BC communities that have energy projects under development or in operation and starting a dialogue with them could help to facilitate the development of local knowledge and capacity. This could include creating resources such as business cases and checklists for rural district energy deployment which would encourage communities to begin conducting feasibility studies that analyze the most practical solutions to meeting their own energy needs.

Understanding the critical success factors for some of these community energy projects in BC can help map the way towards a prosperous and secure energy future for rural communities.

8. Conclusion

British Columbia is uniquely blessed with vast amounts of renewable resources that can be tapped for the province's energy needs into the future. However, in order to build a robust clean energy industry in BC, clear and stable public policy frameworks are required and determination from all levels of government and civil society is essential.

At the moment in BC, there are 74 clean energy projects in operation and 52 projects with BC Hydro electricity purchase agreements that are under development. These projects are in different stages of operation and/or development, all of which present their own unique business and employment opportunities for communities located close to where these projects are situated.

As outlined earlier in this report, the business and employment opportunities available to communities exist in five main areas:

1. Skilled trades and construction;
2. Community and First Nations engagement;
3. Scientific and environmental monitoring;
4. Plant operations and maintenance; and
5. Indirect business support.

Indirect business and employment opportunities in support of clean energy project development range from food and beverage services, to accommodations, recreational services, and commercial retail.

Clean energy projects bring many positive benefits to the province of BC, however, the future prospects for the industry as a whole remain somewhat uncertain. With recent changes to the province's *Clean Energy Act* self-sufficiency policy, more stringent regulatory requirements, and low-priced electricity and natural gas in BC, the IPP industry is struggling to adapt and survive.

Furthermore, realizing the economic benefits from community energy project development is contingent on the successful design, approval, and construction of these projects and requires leadership, perseverance, and time, all of which are in short supply.

Communities can seize the opportunities by showing their readiness to potential investors and IPP companies and by building their local workforce capacity and knowledge-based expertise through education and training. Communities can also create their own energy project opportunities in order to rely less on external factors that are limiting the growth of the utility-scale projects. Local, community-driven projects present long-term business opportunities and good paying jobs that stay in the community.

That being said, significant challenges do exist for smaller communities looking to develop clean energy projects. Strategies for helping these more remote communities are needed in order to facilitate their access to the potential economic, social, and environmental benefits.

Clean energy is no longer sourced from expensive, unproven technologies; the technologies in many cases are more cost effective than conventional alternatives. By building new innovative partnerships based on clear, reliable public policy frameworks, the business and employment opportunities for communities throughout British Columbia show considerable promise for the future.

9. Links & Additional Resources

- **BC Bioenergy Network:** http://www.bcbioenergy.com
- **BC Climate Action Toolkit:** http://www.toolkit.bc.ca
- **BC Community Energy Association:** http://www.communityenergy.bc.ca
- **BC Energy Plan:** http://www.energyplan.gov.bc.ca
- **BC Hydro:** http://www.bchydro.com
- **BC Sustainable Energy Association:** http://bcsea.org
- **BC Utilities Commission:** http://www.bcuc.com
- **Canadian Geoexchange Coalition:** http://www.geo-exchange.ca/en/
- **Canada Wind Energy Association:** http://www.canwea.ca
- **Clean Energy BC:** http://www.cleanenergybc.org
- **Community Futures BC:** http://www.communityfutures.ca
- **Fortis BC:** http://www.fortisbc.com
- **Fraser Basin Council:** http://www.fraserbasin.bc.ca
- **Ocean Renewable Energy Group:** http://www.oreg.ca/
- **RetScreen International:** http://www.retscreen.net
- **Solar BC:** http://www.solarbc.ca

Appendices

Appendix A: IPP Projects in British Columbia

Projects in Operation

Company Name*	Project Name	Type
Cedar Road LFG Ltd.	Cedar Road LFG Inc.	Biogas
Maxim Power (BC) Inc.	Vancouver Landfill Gas Utilization- Ph 2	Biogas
Maxim Power Corp.	Hartland Landfill Gas Utilization	Biogas
Maxim Power Corp.	Vancouver Landfill Gas Utilization- Ph 1	Biogas
Canfor Pulp Ltd. Partnership	PGP Bio Energy Project	Biomass
Domtar Inc.	Kamloops Green Energy	Biomass
Howe Sound Pulp and Paper Corporation	Howe Sound Green Energy	Biomass
Louisiana-Pacific Canada Ltd.	LP Golden Biomass	Biomass
NW Energy (Williams Lake) LP	NEW Williams Lake WW	Biomass
Catalyst Paper, general partnership	Powell River Generation	Biomass
Tembec, a General Partnership	Skookumchuk Power Project	Biomass
Tolko Industries Ltd.	Armstrong Wood Waste Co-Gen (RVG)	Biomass
Zellstoff Celgar LP	Celgar Green Energy	Biomass
EnPower Green Energy Generation LP	150 Mile House ERG	Energy Recovery Generation
EnPower Green Energy Generation LP	Savona ERG	Energy Recovery Generation
McMahon Cogeneration Plant JV	McMahon Generating	Gas-Fired Thermal
V.I. Power LP	Island Generation	Gas-Fired Thermal
Covanta Burnaby Renewable Energy, Inc.	SEEGEN (Burnaby Incinerator)	Municipal Solid Waste
Advanced Energy Systems 1 LP	South Cranberry Creek	Non-Storage Hydro
Advanced Energy Systems 1 LP	South Cranberry Creek 2	Non-Storage Hydro
Ashlu Creek Investments LP	Ashlu Creek Water Power	Non-Storage Hydro
Barr Creek LP	Barr Creek	Non-Storage Hydro
Boralex Ocean Falls LP	Ocean Falls	Non-Storage Hydro
Boston Bar LP	Boston Bar Hydro (Scuzzy Creek)	Non-Storage Hydro
Canadian Hydro Developers, Inc.	Akolkolex	Non-Storage Hydro
Canadian Hydro Developers, Inc.	Upper Mamquam Hydro	Non-Storage Hydro
Canoe Creek Hydro Company	Canoe Creek Hydro	Non-Storage Hydro
Clowhom Power LP	Lower Clowhom	Non-Storage Hydro
Clowhom Power LP	Upper Clowhom	Non-Storage Hydro
Coastal Rivers Power LP	Mamquam Hydro	Non-Storage Hydro
CP Renewable Energy (B.C.) LP	Miller Creek Power	Non-Storage Hydro
Crofter's Gleann Enterprises	Coats IPP	Non-Storage Hydro
Doran Taylor Hydro (JV Partnership)	Doran Taylor	Non-Storage Hydro
Fitzsimmons Creek Hydro LP	Fitzsimmons Creek	Non-Storage Hydro
Furry Creek Power Ltd.	Furry Creek	Non-Storage Hydro
Harrison Hydro LP	Kwalsa Energy	Non-Storage Hydro
Harrison Hydro LP	Upper Stave Energy	Non-Storage Hydro

Company Name* (continued)	Project Name	Type
Hauer Creek Power Inc.	Hauer Creek (aka Tete)	Non-Storage Hydro
Homestead Hydro Systems	Seaton Creek Hydro (Homestead)	Non-Storage Hydro
Bear Hydro LP	Lower Bear Hydro	Non-Storage Hydro
Marion Creek Hydro Inc.	Marion 3 Creek	Non-Storage Hydro
McDonald Ranch & Timber Co. Ltd.	McDonald Ranch	Non-Storage Hydro
McNair Creek Hydro LP	McNair Creek Hydro	Non-Storage Hydro
Morehead Valley Hydro Inc.	Morehead Creek	Non-Storage Hydro
MPT Hydro LP	Hluey Lake Project (SNP)	Non-Storage Hydro
MPT Hydro LP	Salmon Inlet (Sechelt Creek SCG)	Non-Storage Hydro
Pacific Cascade Hydro Inc.	Eagle Lake C2 Micro Hydro	Non-Storage Hydro
Pingston Creek Hydro Joint Venture	Pingston Creek	Non-Storage Hydro
Raging River Power & Mining Inc.	Raging River 2	Non-Storage Hydro
Robson Valley Power Corp.	Robson Valley (Ptarmigan Creek - RBV)	Non-Storage Hydro
Rockford Energy Corp.	Brandywine Creek Small Hydro	Non-Storage Hydro
Rutherford Creek Power Ltd.	Rutherford Creek Hydro Project	Non-Storage Hydro
Soo River Hydro	Soo River	Non-Storage Hydro
South Sutton Creek Hydro Inc.	South Sutton Creek	Non-Storage Hydro
Synex Energy Resources Ltd.	Cypress Creek	Non-Storage Hydro
Synex Energy Resources Ltd.	Mears Creek	Non-Storage Hydro
Toba Montrose General Partnership	East Toba and Montrose	Non-Storage Hydro
Upnit Power LP	China Creek Small Hydroelectric	Non-Storage Hydro
Valemount Hydro LP	East Twin Creek Hydro	Non-Storage Hydro
Valemount Hydro LP	Hystad Creek Hydro	Non-Storage Hydro
Valisa Energy Inc.	Bone Creek Hydro	Non-Storage Hydro
Walden Power Partnership	Walden North	Non-Storage Hydro
XEITL LP	Pine Creek	Non-Storage Hydro
Arrow Lakes Power Corp.	Arrow Lakes Hydro	Storage Hydro
Brilliant Expansion Power Corp.	Brilliant Expansion 1	Storage Hydro
Brilliant Expansion Power Corp.	Brilliant Expansion 2	Storage Hydro
Coastal Rivers Power LP	Queen Charlotte Power Corporation	Storage Hydro
CP Renewable Energy (B.C.) LP	Brown Lake Hydro	Storage Hydro
District of Lake Country	Eldorado Reservoir	Storage Hydro
Rio Tinto Alcan Inc.	Alcan Long Term Electricty Purchase	Storage Hydro
Tyson Creek Hydro Corp.	Tyson Creek Hydro	Storage Hydro
Zeballos Lake Hydro LP	Zeballos Lake	Storage Hydro
Bear Mountain Wind LP	Bear Mountain Wind Park	Wind
Dokie General Partnership	Dokie Wind	Wind

Source: BC Hydro, 2012

* Companies in some instances have entered equity joint ventures or have been acquired by larger corporate entities.

Projects Under Development

Company Name*	Project Name	Type
Regional District of Nanaimo	Greater Nanaimo PCC Cogeneration	Biogas
Fraser Richmond Soil & Fibre Ltd	Fraser Richmond Soil and Fibre	Biogas
Cariboo Pulp and Paper Company	Cariboo Pulp and Paper	Biomass
Conifex Timber Inc.	Conifex Green Energy	Biomass
Harmac Forest Products Ltd.	Harmac Biomass	Biomass
West Fraser Mills Ltd.	Chetwynd Biomass	Biomass
West Fraser Mills Ltd.	Fraser Lake Biomass	Biomass
Western Bioenergy Inc.	Fort St. James Green Energy	Biomass
Western Bioenergy Inc.	Merritt Green Energy	Biomass
PG Interior Waste to Energy Ltd.	PGWE2008	Biomass
AltaGas Ltd.	Crowsnest Pass	Energy Recovery Generation
Green Island Energy Ltd.	Gold River Power	Municipal Solid Waste
AltaGas Income Trust	Forrest Kerr Hydroelectric	Non-Storage Hydro
AltaGas Ltd.	McLymont Creek	Non-Storage Hydro
AltaGas Ltd.	Volcano Creek	Non-Storage Hydro
Advanced Energy Systems Ltd.	Cranberry Creek Power	Non-Storage Hydro
Axiom Power Inc.	Clint Creek Hydro	Non-Storage Hydro
Bear Hydro Limited Partnership	Upper Bear Hydro	Non-Storage Hydro
Box Canyon Hydro Corporation and Sound Energy Inc.	Box Canyon	Non-Storage Hydro
Castle Mountain Hydro Ltd.	Castle Creek (formerly Benjamin Creek)	Non-Storage Hydro
C-Free Power Corp.	Jamie Creek	Non-Storage Hydro
Cloudworks Energy Inc.	Big Silver- Sovel Creek	Non-Storage Hydro
Cloudworks Energy Inc.	Northwest Stave River	Non-Storage Hydro
Cloudworks Energy Inc.	Tretheway Creek	Non-Storage Hydro
Cloudworks Energy LP	Mkw'alts Creek	Non-Storage Hydro
Cogenix Power Corp.	Log Creek Hydroelectric	Non-Storage Hydro
Columbia Power Corp.	Waneta Expansion	Non-Storage Hydro
Creek Power Inc.	Upper Lillooet River	Non-Storage Hydro
Creek Power Inc.	North Creek Hydroelectric	Non-Storage Hydro
Creek Power Inc.	Boulder Creek	Non-Storage Hydro
ENMAX Syntaris Bid Corp. (an Affiliate of Syntaris Power Corp.)	Culliton Creek	Non-Storage Hydro
Highwater Power Corp.	Kookipi Creek Hydroelectric	Non-Storage Hydro
Hupacasath First Nation	Corrigan Creek	Non-Storage Hydro
Kwagis Power Limited Partnership	Kokish River	Non-Storage Hydro
Kwoiek Creek Resources Limited Partnership	Kwoiek Creek Hydroelectric	Non-Storage Hydro
Maroon Creek Hydro Partnership	Maroon Creek Hydro	Non-Storage Hydro
NI Hydro Holding Corp.	Ramonas- CC Creek- Chickwat	Non-Storage Hydro
Pacific Greengen Power	Bremner - Trio	Non-Storage Hydro

Company Name*	Project Name	Type
Plutonic Power Corporation and GE Energy Financial Services Company	Upper Toba Valley	Non-Storage Hydro
Run of River Power Inc.	Skookum Power (aka Mamquam Skookum)	Non-Storage Hydro
Second Realty Effects Inc.	Fries Creek	Non-Storage Hydro
Selkirk Power Company Ltd.	Beaver River (Ventego, Cupola)	Non-Storage Hydro
Spuzzum Creek Power Corp.	Sakwi Creek Run of River	Non-Storage Hydro
Swift Power Corp.	Dasque- Middle	Non-Storage Hydro
Synex Energy Resources Ltd.	Victoria Lake Hydroelectric	Non-Storage Hydro
Long Lake Joint Venture	Long Lake Hydro	Storage Hydro
CP Renewable Energy (B.C.) Limited Partnership	Tumbler Ridge Wind	Wind
CP Renewable Energy (B.C.) Limited Partnership	Quality Wind	Wind
Finavera Renewables Inc.	Bullmoose Wind Project	Wind
Finavera Renewables Inc.	Wildmare Wind	Wind
Finavera Renewables Inc.	Meikle Wind	Wind
Sea Breeze Energy Inc.	Cape Scott (formerly Knob Hill Wind)	Wind

Source: BC Hydro, 2012

* Companies in some instances have entered equity joint ventures or have been acquired by larger corporate entities.

Appendix B: Project Methodology

GLOBE Advisors conducted a comprehensive analysis of the clean energy industry sector in British Columbia in order to identify key trends with respect to business and employment opportunities.

This report analyzes qualitative insights and opinions from clean energy industry leaders in BC based on 25 in-depth interviews. The interviews covered 34 clean energy IPP projects in the province and eight different clean energy technologies, including: biomass, biogas, biofuel (cellulosic ethanol), CHP and co-generation, landfill gas, biogas, non-storage hydro, municipal solid waste, and wind (see Figure A1).

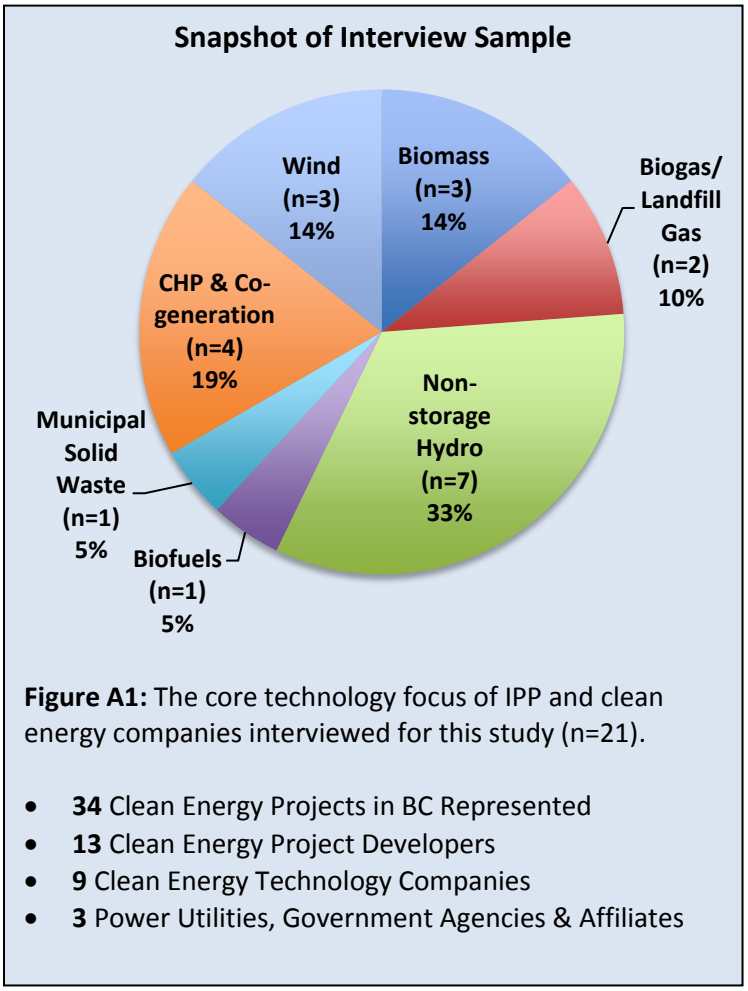


Figure A1: The core technology focus of IPP and clean energy companies interviewed for this study (n=21).

- **34** Clean Energy Projects in BC Represented
- **13** Clean Energy Project Developers
- **9** Clean Energy Technology Companies
- **3** Power Utilities, Government Agencies & Affiliates

In addition to interviewing private clean energy companies, GLOBE researchers interviewed power utilities and a number of municipalities, First Nations communities, and industry associations in the province in order to obtain a comprehensive, qualitative analysis of the clean energy industry landscape in British Columbia.

Using BC Hydro's information on Independent Power Producers (IPPs) and the geographic distribution of clean energy projects in the province, the information was analyzed and projects classified according to BC Hydro's 10 Power Supply Regions. Individual projects with EPAs were traced to their corporate entities and were approached for this study in order to obtain a representative sample of IPP project types at all phases of development through to ongoing operation and maintenance.

A value-chain analysis approach was undertaken to identify key business and employment needs required at each phase/stage of project development. Information from the US Bureau of Labor and Statistics (US BLS) and GLOBE Advisors' work on clean economy industry and occupational codes was used as a basis for identifying key supply chain opportunities for each clean energy type.

Interviews were primarily conducted both in-person and by telephone. In a few instances, correspondence by e-mail and fax was used. The length of the in-person/ telephone interviews ranged from 20 minutes to 1.5 hours following a questionnaire that was designed to examine the clean energy value chain opportunities, recruitment practices, business service procurement practices, and training and development issues (see Appendix B). Comprehensive notes were taken and where permitted, interviews/ meetings were recorded and transcribed for later analysis.

Individuals who participated in the interview process for this study had job titles ranging from Chief Executive Officer, to Business Development Manager, Project Manager, Department Manager, and Vice President of Operations. Each interview participants was identified as having an in-depth understanding of the BC clean energy industry and their respective business needs. For a list of companies and organizations that participated in the interview process, see Appendix C.

Appendix C: Interview Questionnaire

BUSINESS & WORKFORCE NEEDS

1) From the list below, which business services/workforce categories has your company hired from in the last 1-2 years *or anticipate hiring from over the next 1-2 years?*

	As an employee	As a contractor
Design/ Planning		
Construction/ Engineering		
Equipment Installation		
Site Assessment/ Monitoring		
Manufacturing		
Research & Development		
Public Education/ Outreach		
Stakeholder Engagement		
Marketing/ Communications/ PR		
Sales		
Business Development		
Management Services/ Training		
Finance/ Investment Attraction		
Legal/ Accounting		
Other: _____		

2) From the above list of your company's recently hired business services/workers, what essential skills do you look for within each area?

3) What transferable skills from other industries have you found useful for your operations?

4) Do you believe these skills are readily available in rural communities? If not, what are some of the key barriers?

5) What kinds of business services do you/ would you prefer to source from rural communities where your projects are based?

6) We have identified 3 phases in clean energy project development; in your experience, do you believe this is a good representation of the phases your project is going/ has gone through during development?
    a. Pre-Feasibility Stage
    b. Planning & Execution Stage
    c. Owning, Operating, Refinancing Stage

RECRUITMENT CHALLENGES

1) What are some of the key staffing challenges (if any) that your company is currently facing or have faced in the past?
    a. Do you believe these challenges are exclusive to XXXX type projects or to all clean energy businesses in general?

2) Has your company developed any strategies to meet your staffing needs or challenges in the short- and/or long-term? Please elaborate.

3) Can you identify any key barriers for smaller, more rural communities in terms of their abilities to meet your staffing needs?

4) Has your company engaged any First Nations communities in meeting its labour/ business needs? If so, can you provide examples?

5) What recruitment/ business service procurement source(s) do you use for hiring?
    a) Online posting (i.e. job board, RFP, etc)
    b) Print Media (Newspaper, magazines, etc)
    c) Social Media (Facebook, Linked In, etc)
    d) Recruitment/ Third-party Agency
    e) Word-of-Mouth
    f) Other?

TRAINING & CONTINUOUS DEVELOPMENT

1) Can you describe any formal professional development or on-the-job training that your company provides to its staff? In which occupational areas?

2) How do you think educational institutions across the province could better equip new graduates with the skills needed to meet your company's workforce challenges?

COMPANY PROFILE

1) What stage would you say your company is at with respect to its project(s)? (FOR IPPs ONLY)
    a. Pre-feasibility
    b. Planning (Design, Bid)
    c. Execution (Contract, Commission)
    d. Operation
    e. Refinancing

2) Which clean energy types best describe your company's project(s)/core focus? (Select all that apply)
    a. Biomass
    b. Biogas
    c. Energy Recovery Generation
    d. Gas-Fired Thermal
    e. Municipal Solid Waste
    f. Non-Storage Hydro
    g. Storage Hydro
    h. Wind
    i. Solar
    j. Other, Please specify: _____

3) How many of each of the identified clean energy project types do you currently have under development/in operation in BC? If relevant, how many have Electricity Purchase Agreements (EPAs)?

4) In which part(s) of BC does your company have operations and/or staff during the course of a year? Please check all that apply:
    a. Vancouver Island
    b. Lower Mainland
    c. Kelly Lake Nicola
    d. Selkirk
    e. Revelstoke-Ashton Creek
    f. East Kootenay
    g. Mica
    h. Central Interior
    i. North Coast
    j. Peace River

5) How many “full-time” and “part-time” employees are currently employed in your organization in BC?

6) Please indicate which range captures your organization’s 2011 revenues.
    a. Less than $500,000
    b. $500,001 to $1,000,000
    c. $1,000,001 to $5,000,000
    d. $5,000,001 to $25,000,000
    e. More than $25,000,000
    f. Do not know/ Prefer not to say

Appendix D: List of Companies & Organizations Interviewed

Atlantic Power Corp.
BC Bioenergy Network
BC Hydro & Power Authority
Bionera Resources & PRT Growing Services Ltd.
City of Prince George – Planning and Development Services
Catalyst Power Inc. & Catalyst Agri-Innovations Society
Coastal First Nations – Great Bear Initiative
Covanta Burnaby Renewable Energy Inc.
Endurance Wind Power Inc.
Finavera Wind Energy
Fink Machines Inc.
First Power Canada
Fortis BC
Gitga'at Nations (Hartley Bay Council)
Lignol Energy Corp.
Nanaimo Bioenergy Centre
Nexterra Systems Corp.
Pacific Bioenergy Corp.
Regional District of Nanaimo – Wastewater Services
Revelstoke Community Energy Corp.
Run of River Power Inc.
Sea Breeze Power Corp.
Siemens AG (International)
Veresen Inc. & subsidiaries
XEITL LP