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THE SUN SHINES ON ATLANTIC CANADA

An Assessment of the Solar Energy Industry

2018

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EXECUTIVE SUMMARY

There is a diverse range of solar energy businesses in Atlantic Canada. These encompass design, manufacturing, installation, and a variety of other services. We identified 45 businesses involved in solar energy and invited them to complete a survey. Thirty-two businesses gave their responses, with gross sales ranging from under $100,000 per year to over $50,000,000 (estimated). Employees per company vary from one to over one hundred, and firm ages range between two and ninety-three years.

Solar manufacturing in the region includes both novel and long-standing products and represents the largest economic value as a category. Services include project development and management, data collection and analysis, energy storage, financing and system installation. For the larger businesses, solar energy typically represents a small portion of their activity, while smaller operations are more likely to be involved exclusively in solar energy. Manufacturers of solar energy equipment are largely export based, whereas there is a mix of export and local customers for service businesses.

Based on the values reported by twenty-nine of the companies, we estimate the total gross sales for solar energy business in Atlantic to be worth a minimum of $22.7 million per year and a median of $29.4 million.

Recent growth is strong for most participants; in 2017 over 90% of the participating companies experienced sales growth, 50% of them grew at a rate of over 10%, and 30% increased their gross sales by more than 20%.

For all the contributing businesses, materials are a substantial expense: ranging from over fifty to sixty percent of gross sales. Materials are largely imported from outside the region, mostly from Ontario and the United States. Materials for solar electricity installers are nearly 100% imported.

Solar businesses supplying the local market are extensively affected by regulatory and program changes, and there is apprehension about policy and program implementation that could incite a boom-and-bust business cycle. Those involved in residential PV installations are constrained by lack of consumer education (both in relation to solar technology and finance). Among these operators there is a consensus that a unified voice representing the private sector is wanted.

Survey participants were asked about their levels of optimism in relation to customer demand, changing technology and government programs and policy. The level of optimism about customer demand can be described as high, changing technology moderately high and government programs and policies moderate.

When asked about barriers to business growth, installers identified financing for end users, grid tariffs and bureaucratic inefficiencies. Reliable labour can be a substantial problem in some manufacturing situations, and a shortage of qualified electricians who are familiar with PV systems was also repeatedly mentioned as a constraint to growth.

Based on the responses of study participants, we offer the following six recommendations to regional policy and program developers:

1. To support long-term demand for solar installations, establish an evergreen financing mechanism that will ensure cash flow positive opportunities for solar energy.

2. To enhance efficiency for installers and support potential customers, establish a solar education service about solar technology and finance for consumers, operated by a neutral third party .

3. To ensure future opportunities for solar technology integration, adjust building code requirements so that new buildings have the load bearing capacity to support roof mounted solar installations.

4. To encourage solar technology adoption while avoiding creating a boom-and-bust cycle for business operators, offer modest incentives and long-term attractive financing.

5. Allow and encourage installation of solar electricity generating stations in the 1 to 10 MW size class at selected locations on the distribution and transmission grid across the region.

6. Support further research to identify opportunities to localize the solar industry supply chain, develop the work force, and improve training and certification.

ACKNOWLEDGMENTS

The authors acknowledge the financial support of the Province of Nova Scotia (Department of Energy), and the Atlantic Canada Opportunities Agency (ACOA) for this work. We also express our appreciation to the study's Advisory Team – Sheena Parris, Peter Craig, Matthew Wood, Blake Mann, Dr. Carolan McClarney, Hamish Malkin, David Brushett, and Gord Wilkie. We are especially grateful to the many participants in our study, who completed a survey online, shared data, or participated in an interview.

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INTRODUCTION

Solar Nova Scotia, with the support of the Nova Scotia Department of Energy (NSDOE) and the Atlantic Canada Opportunities Agency (ACOA), undertook the Atlantic Canada Solar Industry Study to assess the current state of the solar energy industry in Atlantic Canada, and to make recommendations on how to support and accelerate its growth. This is the first ever comprehensive assessment of the solar energy sector in the Atlantic region, covering the provinces of Nova Scotia, New Brunswick, Prince Edward Island, and Newfoundland and Labrador.

Solar Nova Scotia is a non-profit organization that provides education, research, and communication in support of the adoption of solar energy in our province, our region, and beyond. Our individual members are interested in solar energy education and access, while our corporate members include companies that design, manufacture, and install solar energy equipment and provide services both locally and to other regions.

Solar energy is plentiful, accessible, renewable, and emission-free. With growing interest and more affordable prices, the solar industry is expanding rapidly, providing economic opportunities while helping to meet international commitments to reduce greenhouse gas emissions and slow down climate change.

Three of the four Atlantic Provinces have established greenhouse gas emission reduction targets of 10% below 1990 levels by 2020, to be followed by reductions of between 75% and 85% by 2050 (Government of Nova Scotia, 2017) (Nova Scotia Department of the Environment, 2009) (Government of Canada, 2015) (Government of New Brunswick, ND) (Government of Newfoundland, 2011). Although Prince Edward Island has not yet set formal targets, the PEI government is supportive of targets established by neighbouring provinces (Government of Prince Edward Island, 2015). The Province of Nova Scotia also requires that 40% of the electricity sold in the province be from renewable sources by 2020.

The adoption of solar photovoltaic (PV) electricity is rapidly growing, facilitated by net metering programs in all four Atlantic Provinces. Net metering is a program that allows renewable energy generators to connect to the electricity distribution system and receive a credit for surplus generation, which can be used to reduce electricity bills. Currently, net metering participants in Atlantic Canada can trade energy at par with their utilities. Provincial legislation in Nova Scotia and New Brunswick assures net metering participants of this arrangement throughout most of the operating life of the installed PV assets (between twenty and twenty-five years) (Province of Nova Scotia, 2015), (Énergie NB Power, 2016).

Within the four Atlantic Provinces there are several unique agencies addressing the need to reduce greenhouse gas emissions. Those that embrace solar energy include Nova Scotia's Clean Foundation, a charitable organization whose offers include financing assistance for net-zero energy building upgrades. Renewables NB provides information about small-scale, renewable energy projects in New Brunswick; they are one of the 193 grassroots organizations that received project funding from the New Brunswick Environmental Trust in 2017-2018 (Renewables NB, 2018).

The Prince Edward Island 2016 Provincial Energy Strategy states that "solar is likely to play an important role in our future energy supply" and makes commitments to exploring "the potential for utility-scale solar generation… along with financing options

for the installation of solar panels on residences and businesses" (Horrelt, 2016). The Newfoundland and Labrador government has been providing support for private and not-for-profit organizations to install low-emission generating capacity through their Green Fund, including solar energy. (Government of Newfoundland, 2011).

To assess the state of the industry, we conducted a survey of Atlantic Canadian companies involved in all aspects of solar energy collection and management, including solar electricity, solar heating, solar energy storage, solar data management, and solar buildings. The survey gauged the size and types of activities of the companies in this sector, the economic impact of the solar industry and invited detailed comments to add depth and practical advice.

Opinions expressed in this report are those of study participants, except the recommendations section, where the research is synthesized by the authors.

1. STUDY METHOD

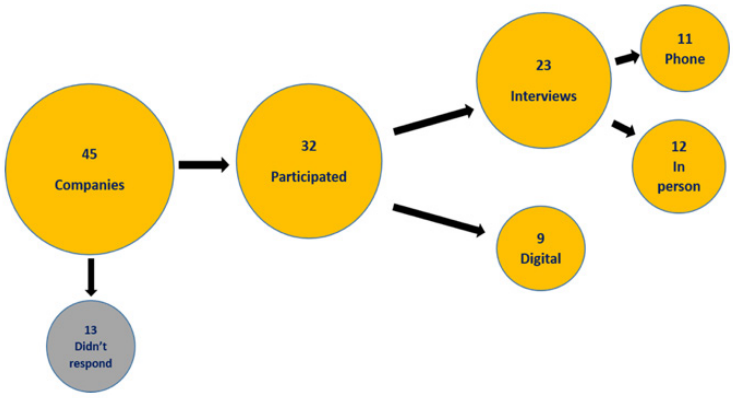
Survey participants were comprised of companies within the Atlantic Region for which all or a portion of their business involves solar energy. Lists of companies from the Solar Nova Scotia database and industry contacts were combined with results from a search of the Canadian Company Capabilities database.

Each of the companies identified were invited by email to participate in a survey which was offered in three different formats– online, telephone interview, and in-person interview. Of the 45 companies identified as potential contributors, 32 responded, a response rate of 71%.

Of these, 23 companies responded to the survey questions during interviews and 9 completed the survey online. Among those who gave an interview, 11 interviews were conducted by telephone and 12 were held in person.

Survey responses were gathered between December 2017 and May 2018.

Figure 1: Survey response formats



Most of the companies that we were able to contact directly were enthusiastic, interested in the study, and willing to participate. Of those who chose not to complete a survey, some said they couldn't allocate the time, and some had concerns about confidentiality; in such a small sector, individual businesses might be identified based on their answers. We believe that the survey is reasonably representative of the industry as a whole, because of the number and diversity of respondents.

2. SURVEY PARTICIPANTS

The largest number of the reporting companies are based in Nova Scotia, with smaller numbers in New Brunswick and PEI, and very few in Newfoundland and Labrador.

The type of solar energy work performed by the contributing companies is highly diverse. Many of them design and install residential solar energy systems, while others work in consulting, management, and financing of commercial projects, and still others manufacture equipment for solar energy projects. The companies range in age from two to 93 years, with a median age of 14 years in operation. Within the wider sample, the residential scale solar installation group is younger, with a median age of 11 years.

Survey participants were asked to identify which of a variety of solar energy industry activities their business is involved in. Participating businesses are all involved in several activities. We identified clusters of activities and arrived at the following seven categories of businesses operating within the solar energy industry.

The 14 residential scale photovoltaic system installers have the least diversified business activities within the respondent group. Seven of these businesses spend 70% or more of their time installing PV systems, and on average these companies devote almost 60% of their working time to installing PV systems.

Seven of the 32 responding companies (21%) indicated that research and development represent a portion of their business activities, and among these seven businesses, an average of 4% of their work time is allocated to these efforts.

Twelve of the 32 participants indicated that they are also involved in non-solar energy-related business, averaging one third of their operational activities, and representing a range of 5% to 95% of the workload.

Participating businesses that install PV systems were asked about the proportion of their business that is grid-connected versus off-grid, as well as the associated ratios of residential to commercial installations. Most PV installations have been residential, whether grid-connected or off-grid. However, substantial work has been done in off-grid installations for the wireless communications industry. Not all participating companies do both on- and off-grid installations.

Table 1: Categories of solar firms.

Number of firms	Category	Operations
14	Residential Scale PV Installers	Businesses focused on installing PV systems approximately sized <20 kilowatts (kW)
4	Commercial/ institutional scale PV project developers	Businesses focused on establishing PV systems approximately sized >20 kW and <1 megawatt (MW)
2	Utility scale PV project developers	Businesses focussed on establishing PV systems approximately sized > 1MW
5	Manufacturers of solar energy related products	Products related to diversified energy generation and distribution, deployable solar power systems, solar thermal equipment and solar energy storage equipment
4	Service providers for the solar energy industry	Services encompassing data collection, monitoring, optimization of energy use and solar generation, engineering and architectural design, and financing
2	Passive solar building designers	Design and project management of passive solar building construction and renovation
1	Electric utility	Municipally-owned utility with solar generation

Figure 2: Atlantic solar industry survey participants by province.

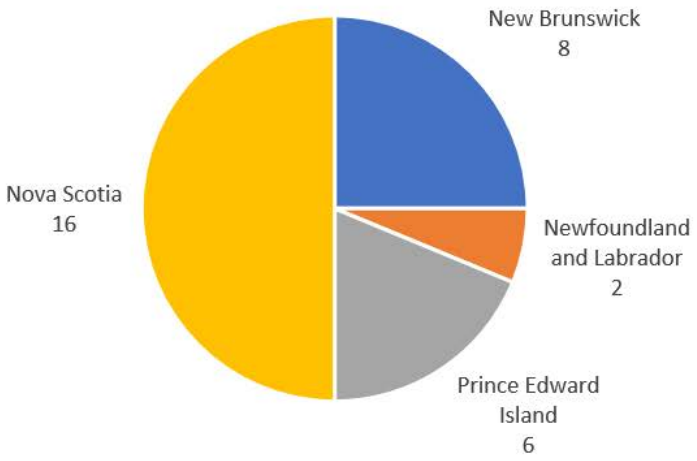


Table 2: Grid-connected PV installations – Mix of residential and commercial customers

100% residential	22%
80% residential, 20% non-residential	9%
60% residential, 40% non-residential	34%
40% residential, 60% non-residential	6%
20% residential, 80% non-residential	0%
100% non-residential	6%
Not applicable	6%

Table 3: Off-grid PV installations – Mix of residential and commercial customers

100% residential	25%
80% residential, 20% non-residential	9%
60% residential, 40% non-residential	6%
40% residential, 60% non-residential	0%
20% residential, 80% non-residential	6%
100% non-residential	9%
Not applicable	44%

3. ECONOMIC IMPACT

Gross annual sales per company range from under $100,000 to over $50,000,000 per year. When considering these figures, it is important to note that for many of the companies, especially the larger ones, solar energy represents only a small fraction of their business.

1. SALES

We estimated the total solar-related annual gross sales for the study participants by multiplying the proportion of solar energy related sales by the reported gross sales. Using the minimum values in the provided ranges for gross sales, and an absolute minimum value of $50,000 per year for the smallest sales category, we estimate a total of over $17 million in solar-related gross sales among the surveyed companies in Atlantic Canada in 2017. If the median value of the ranges is used, the gross sales estimate for 2017 is a little over $20.7 million for the 29 participating companies. Total gross sales are likely between these figures.

To extrapolate to the remainder of the companies we found, but from whom we did not receive a survey, we assumed that the other 13 companies are solar installation businesses of modest size. If these additional companies follow a similar pattern, the total annual gross sales in the Atlantic Canadian solar industry in 2017 is estimated to be at least $22.7 million. Using the median values for gross sales ranges yields an estimate of $29.4 million. The best estimate is within that range.

As a category, residential scale PV installers represent the greatest number of companies, and typically operate the smallest businesses. Twelve companies in this category reported their gross sales ranges. If we assume this information is category in Atlantic Canada, with a total of 28 companies, gross sales for residential solar installation is estimated to be at least $10.3 million per year. If instead of the minimum value, we use the median values for the sales categories, the gross sales estimate for residential PV installation is $16.8 million per year.

Price per watt estimates for Nova Scotia grid tied installations in Tables 5 were calculated by multiplying the minimum and median gross sales figures by the predominant ranges or values reported for grid tied, residential, Nova Scotia systems and by the portion of solar work companies reported as installations.

Table 4: Estimated price per installed watt based on sales: Nova Scotia residential

Gross solar energy sales	Grid tied	Residential	Nova Scotia	Installation as portion of solar work	Cost of 1MW	Price per watt
$10,300,000.00	60%	80%	50%	78%	$1,928,160.00	$ 1.93
$16,800,000.00	60%	80%	50%	78%	$3,144,960.00	$ 3.14

There is relatively little solar energy business activity in Newfoundland and Labrador at this time, therefore it is more appropriate to think of this estimate as representing activity within the three Maritime provinces of New Brunswick, Nova Scotia, and Prince Edward Island.

Seasonality of sales is not a significant management issue for any of the respondents. In general they report having significant activity year-round. According to our survey, small-scale solar installers experience the most fluctuation by season, with sales and installation work at their lowest in winter. They typically use their winter season for business development.

Just under 70% of the companies surveyed make 100% of their sales to end users (retail). The rest of the participating companies sell between 5% and 100% of their goods and services to other businesses.

Table 5: Estimated annual gross sales for solar energy businesses in Atlantic Canada

At least: $22.7 million	Median estimate: $29.4 million

Figure 3: All study participants- gross sales ranges for all activities.

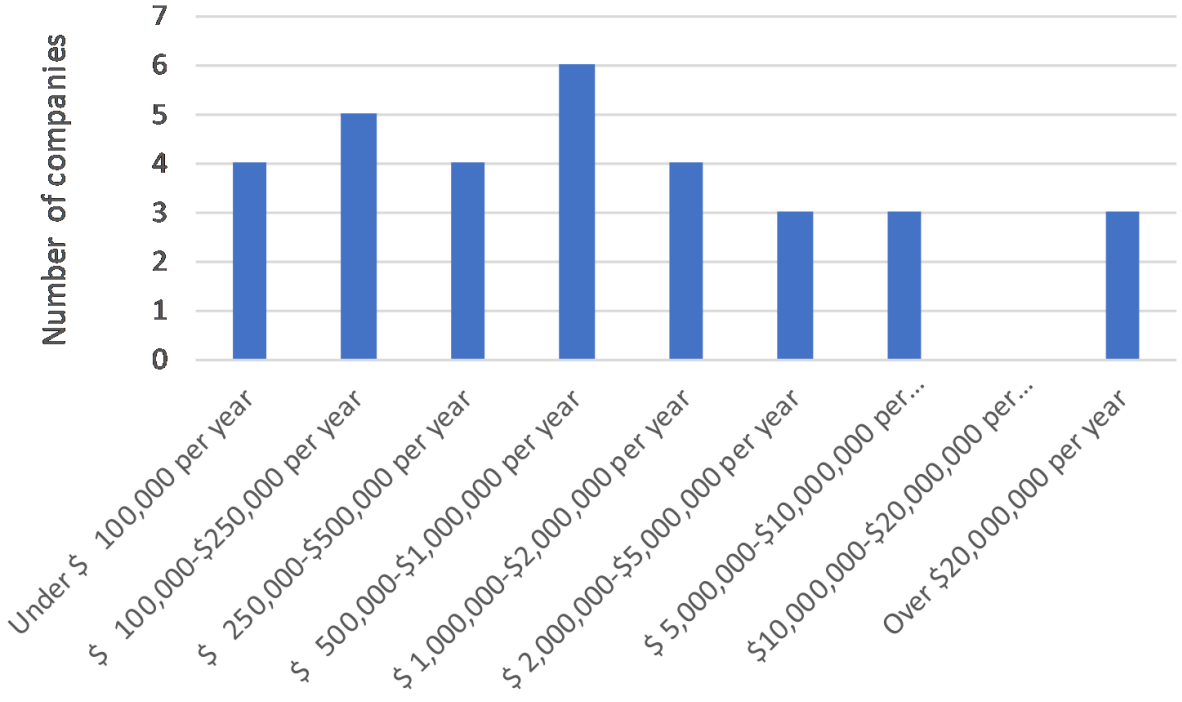
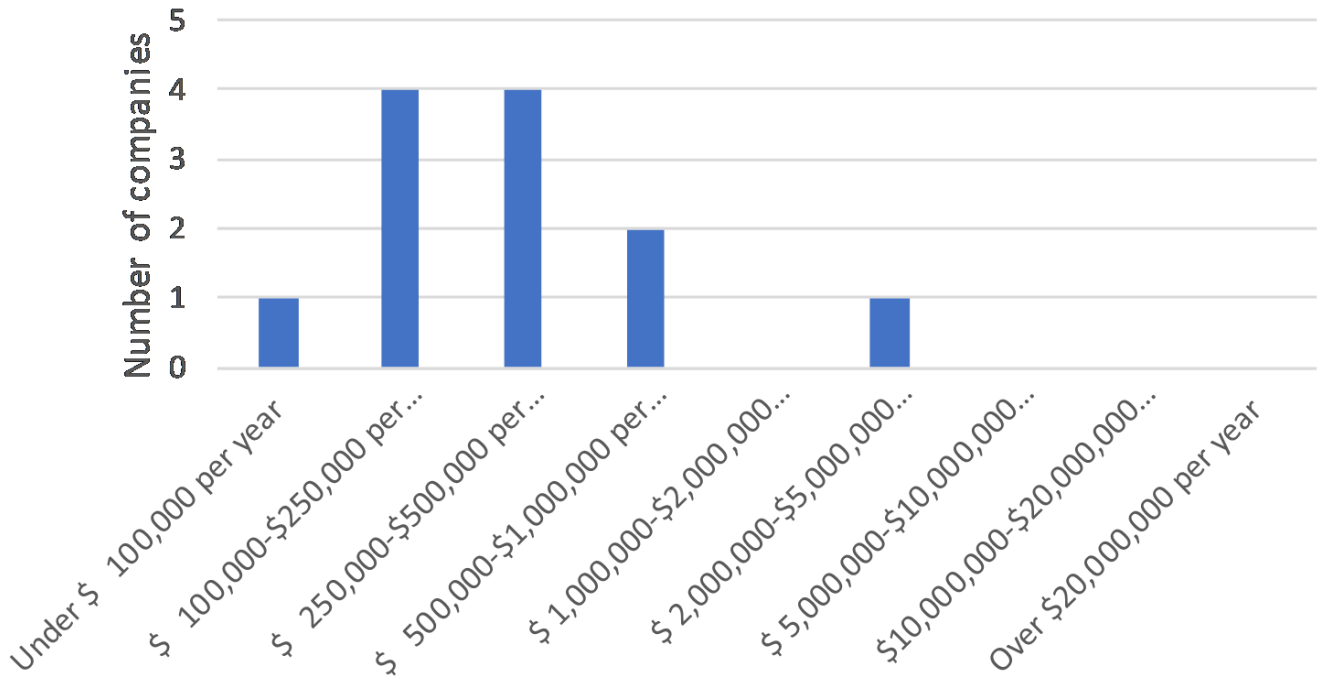


Figure 4: Residential scale PV installers- gross sales ranges

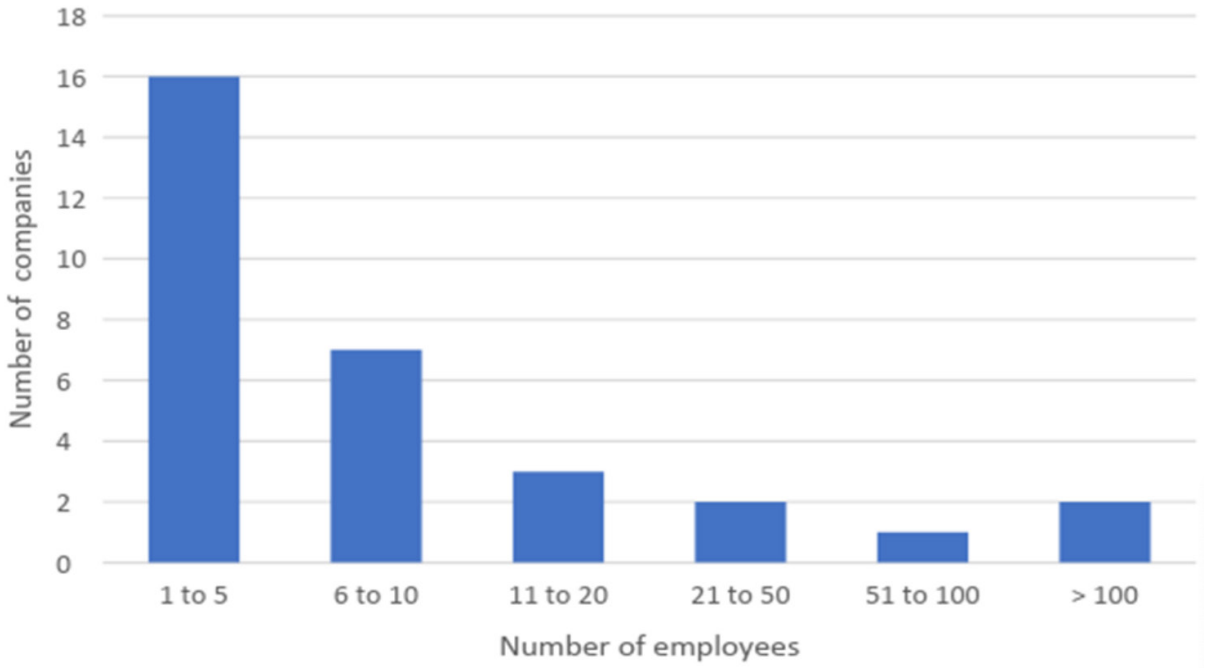


3.2 EMPLOYMENT

Employment ranges from one person to 150 people per company. Again, it should be noted that for several of the larger firms only a minor fraction of their business relates to solar energy. Based on total employment reported, adjusted by the percentage of business related to solar energy, we estimate the total number of solar jobs within the 31 companies that responded to this question to be 192 full-time equivalents (FTE) in 2017.

The residential scale PV installer businesses that participated in this study are small operations, with an average of under four employees. For comparison, the average employment level among the other companies surveyed is 29 FTEs. If we assume that the balance of the estimated 45 solar energy companies in the region are residential scale PV installers with similar employment levels, total employment in the solar energy industry in Atlantic Canada is estimated to be 245+ FTE in 2017.

Figure 5: Size of companies – number of employees 2017



Labour intensity within the participating companies varies dramatically as a percentage of operating expenses, averaging approximately 28% for the residential scale PV installer businesses and 43% for the other participating companies. These values vary widely from one company to another, as do the size and activities of the businesses studied.

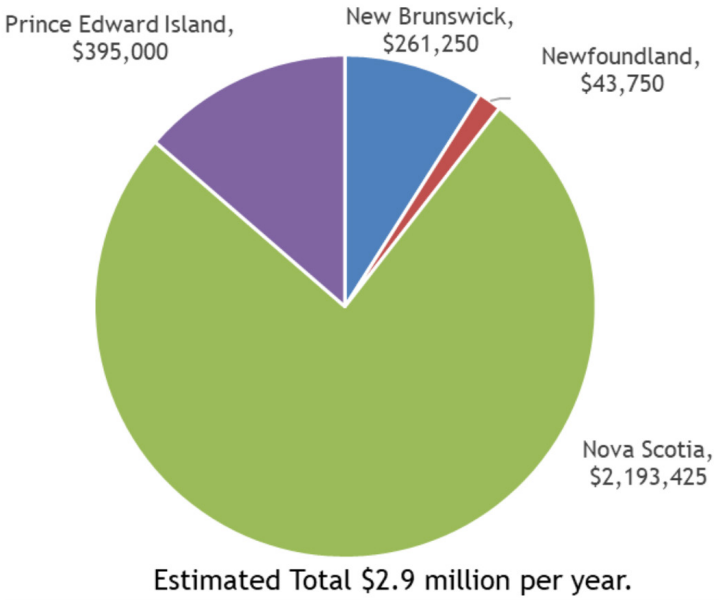
Labour expenditures average 33% of expenses among all participants, 38% among non-residential PV installers, and 28% among residential PV installers.

We estimated total labour spending associated with solar energy work for the 26 companies that provided this information, by multiplying the minimum gross sales for each company by their reported fraction of solar energy businesses and labour cost ratio. As per the supply chain calculation, we assumed a gross margin of 50%, which yielded an estimate of $2.9 million dollars for labour per year.

Using the same assumptions, we prorated the payroll spending reported by residential PV installers to generate an estimate of the total payroll for that business category, of over $1.2 million per year in Atlantic Canada in 2017.

Study participants have experienced an increase in employment numbers between 2015 and 2017. Growth has been higher within the non-residential scale installer group than the residential scale installer group, at 14% and 10% respectively.

Figure 6: Estimated labour spending on solar business by province (26 respondents) 2017

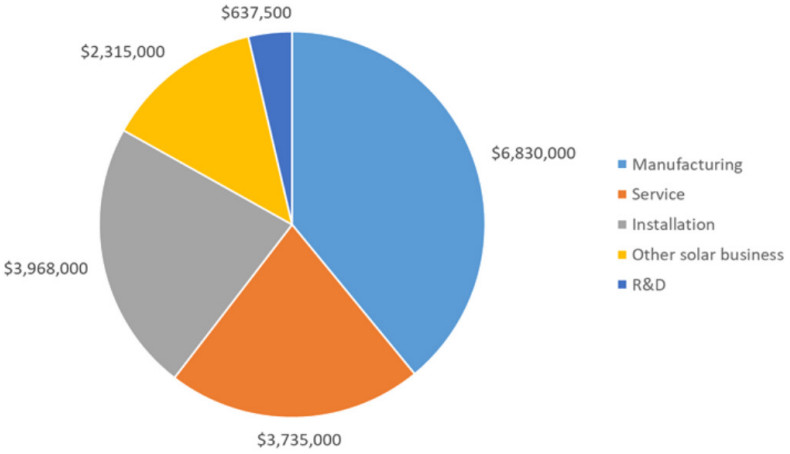


3. BUSINESS ACTIVITIES

The solar energy sector includes a variety of business activities. Study participants were asked to indicate which solar energy related activities they are involved in, what portion of their business these represent, and to identify a range that their gross annual sales fall within. We have assumed that the reported ratios of activities correlate with income and have consolidated the survey categories as presented in Figure 6.

Manufacturing of solar energy-related equipment is the largest activity in terms of economic value. The manufacturing businesses are based largely on export sales. Note that the manufacturers do not produce PV modules, but other solar components that are mostly exported. This speaks to the international relevance of the solar energy industry and the capacity of Atlantic Canadian businesses to participate competitively. It should be noted that nearly all the estimated economic activity associated with solar manufacturing in Atlantic Canada is attributable to three of the surveyed companies.

Figure 7: Economic value by activity among 29 Participating Firms



Services represent the second largest activity area, in which we include engineering, design, solar energy storage, data collection and financing (of solar technology purchases). Installation of PV projects is a major activity among solar energy businesses in Atlantic Canada. This involves projects scaled for both residential and commercial facilities. Utility- scale PV generation does not yet occur in this region.

4. MARKET CHARACTERIZATION

4.1 GEOGRAPHIC SCOPE

Survey responses indicate that the larger companies studied address a broader geographic market. These service and manufacturing companies typically have sales outside Atlantic Canada worth over 95% of their business, and international export sales of approximately 70%.

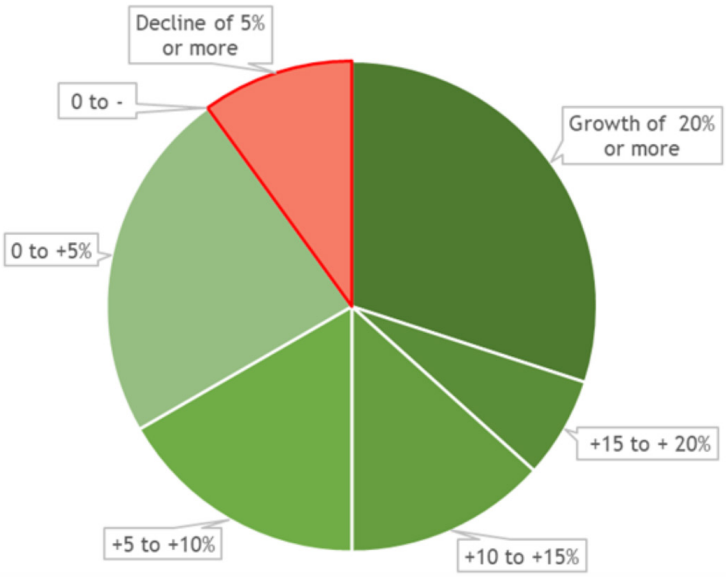
However, 25 of the 32 contributing companies do 90% or more of their solar business in their home province. Nine of 14 residential scale PV installers reported zero sales outside their province, and of these, seven businesses are Nova Scotia based residential scale installers. Installers based close to provincial borders report having customers outside their home province.

4.2 GROWTH RATES

While growth rates varied significantly from one company to another, we did not find substantial differences in growth rates between the various business categories. In 2017 over 90% of the participating companies experienced sales growth, 50% of them grew at a rate of over 10%, and 30% had gross sales more than 20% higher than the previous year. All categories of solar-related companies reported sales growth in 2017.

The five commercial/institutional scale PV project developers reported increased growth over the past three years. These firms are experiencing strong demand for PV systems on government and commercial buildings as well as farms.

Figure 8: Sales growth – 2017 compared to 2016 – all study participants



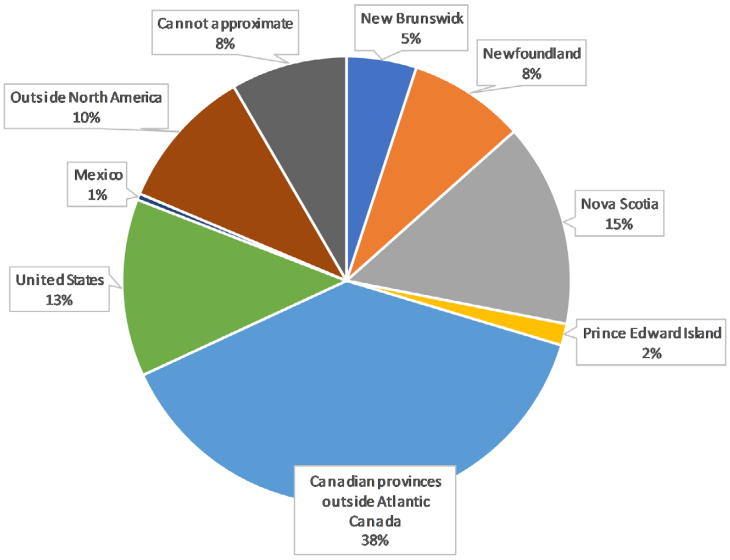
5. EXPENDITURES ON MATERIALS

5.1 SUPPLIER LOCATIONS

Companies reported that most materials are purchased from suppliers in Canadian provinces outside Atlantic Canada, primarily Ontario, and from the United States. When asked about the place of original manufacture of the material inputs, most study participants expressed uncertainty. In the global market for solar equipment, several reported that it was difficult to determine the original place of manufacture of the goods.

The following two figures illustrate that companies with smaller material expenditures tend to spend more locally (25 companies participated in this segment).

Figure 9: Supplier locations by average percentage of spending (2017)

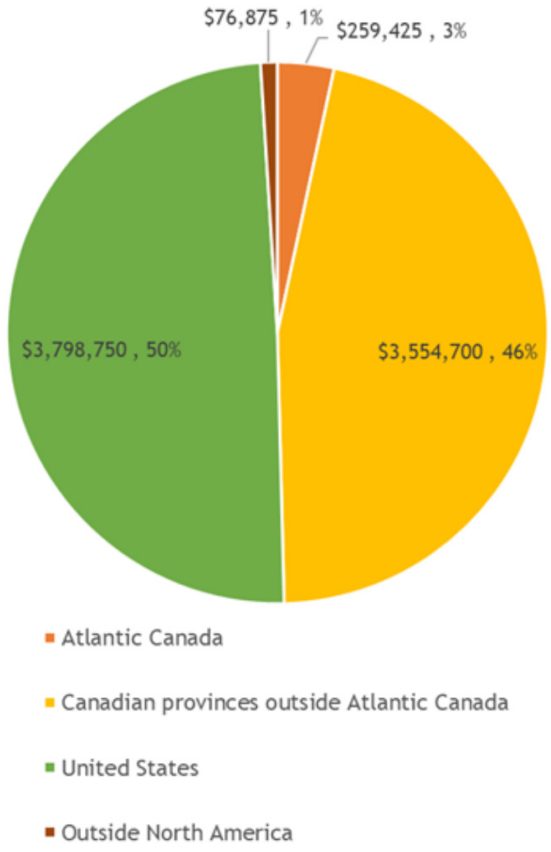


5.2 MATERIAL EXPENDITURES BY SUPPLIER LOCATION

When estimated by dollar value, the expenditures on materials predominantly go to suppliers located in the USA and Canadian provinces outside Atlantic Canada. We estimated the total value of expenditures on materials at $7.9 million, 97% of which leaves Atlantic Canada to buy materials from suppliers outside the region.

We made this estimate by multiplying the proportion of solar energy related sales by the reported gross sales and the material expense ratios for the 25 companies that answered this question. These amounts were then multiplied by the ratios that each company provided for supplier locations, to estimate spending flowing to suppliers in different regions. The amounts were prorated to estimate the total material spending for all solar energy business in the region based on a gross margin of 50%.

Figure 10: Supplier locations by estimated value of spending (2017)



5.3 INPUT COST RATIOS

Respondents provided approximate ratios indicating the cost of operational inputs: direct labour and materials (involved in the production of goods and services sold) and overhead. These values varied widely from one company to the next, which is not surprising considering how varied the participating businesses are.

Residential scale PV installers may find the following ratios of interest for benchmarking purpose.

Table 6: Labour and materials expense ratios

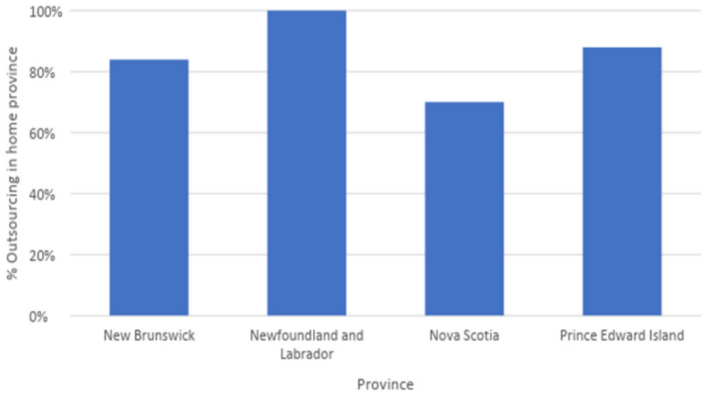
Residential Scale PV Installers		
Labour	Materials	Overhead
28%	62%	10%

All Study Participants		
Labour	Materials	Overhead
33%	52%	15%

5.4 OUTSOURCING LABOUR AND SERVICES

As illustrated below, most of the participating companies outsource or subcontract some of their services. The amount of subcontracting varies widely, from zero to 100% of services such as installation. These contracts are mostly with local service providers in each company's home province, with some outsourcing to other provinces and regions. This is particularly true of solar installation companies, which tend to contract local companies for services like structural and electrical engineering, electrical work, grid connections and carpentry.

Figure 11: Outsourcing- portion of outsourcing within home province



6. SURVEY PARTICIPANTS' COMMENTS

Our survey allowed space for participants to contribute comments on workforce development, government policy, and overall development of the solar industry. We have compiled the participants' comments here to give a picture of the views and opinions of those working in the industry.

6.1 COMMENTS ON WORKFORCE DEVELOPMENT

We invited participants to comment on barriers and challenges that they face in growing their companies. In terms of workforce development, finding employees with enough knowledge was identified by participants as the largest constraint. According to one of the large-scale companies' representatives:

"We experience a shortage of electrical engineers, and specialists on mechanical automation. Recent additions to programming don't seem to align with our needs."

The average level of employment in the residential scale installer group of companies is 3.4 full time equivalent positions per company. During interviews, we heard often that staff increases are challenging, since adding a single person represents a large proportional change in a small company.

Qualified labour is a constraint for residential scale installers, as are training and certification gaps. Typically, these operators provide in-house training, and struggle to some extent with attrition. For residential-scale PV installers, the biggest constraint is finding electricians with experience working in a direct current (DC) environment. However, it was noted that the level of interest in renewable energy among electrical apprentices is high. As one contributor put it:

"Graduates from a renewable energy program can install and design (PV systems) but we are obligated to use an electrician for the grid connection… however the electricians aren't knowledgeable of DC or sizing solar systems. So, we have to hire two people for a job that one person should be able to do!"

The need for consumer protection in the form of certified installers was identified several times by participants. One business operator said this:

"A real certification that will divide the weekend warriors from serious installers would help to ensure better quality."

6.2 COMMENTS ON CERTIFICATION AND TRAINING

"Many places don't require permits as long as installers are certified."

"The PACE* program ensures reputable companies are engaged, which is valuable."

*Authors' Note: PACE program (Property Assessed Clean Energy) refers to programs like HRM Solar City, in which municipalities provide financing for residents to install solar energy systems. PACE programs typically require that customers use qualified installers.

"Although some installers are accredited by NABCEP and SEIA, not all installers are. This may lead to some bad experiences that will taint the industry. Regulating installers needs to be done by an impartial third party to prevent conflicts of interest from arising, with repercussions for bad practice."

Participants also expressed concern about the need for additional training of electrical inspectors on how to effectively inspect PV installations.

Certifying organizations that installers referred to include the Canadian Solar Institute, the Solar Energy Industries Association (SEIA) and the North American Board of Certified Energy Practitioners (NABCEP). There is opportunity to harness local expertise; one of the contributing businesses is a training provider for NABCEP.

6.3 OPTIMISM

On a sliding five-point scale, study participants were asked to rate their level of optimism regarding three factors: future solar energy customer demand, technology improvements, and government policy and programming. Overall, participants are highly optimistic about future customer demand, generally optimistic about technology (although several perceive a current plateau), and neutral about the prospects for improved government policy and programming.

Despite the relatively low level of optimism for positive government policy and programming, several participants expressed appreciation for current

government leadership. One of the appreciative comments from a business planner:

"Nova Scotia signals have been easy to read… consistent."

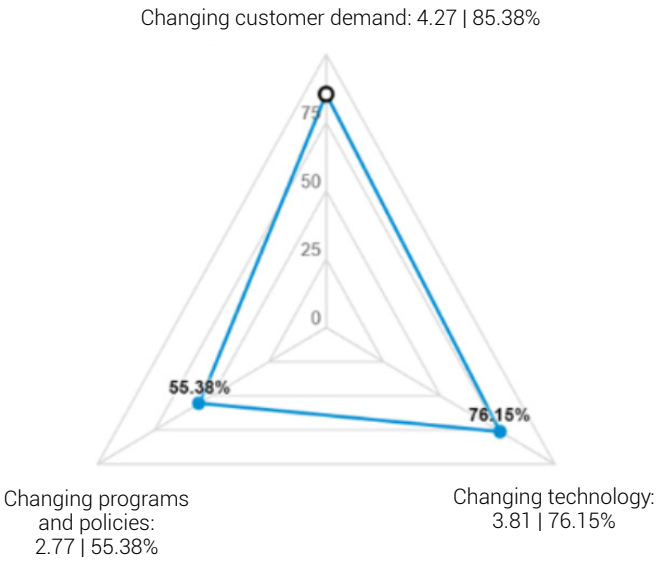
Optimism about future demand is clearest in the commercial/institutional scale installer category:

"Commercial projects are now financially viable- between depreciation and tax incentives some are getting a 10% ROI. Residential installations aren't getting any support. Programs that facilitate a cash flow neutral installation would be a big boost."

Export opportunities are well described in the following comment from a survey participant:

"There is a market for packaging solutions. In Asia and Africa where electrification is recent, solar is viable. An example is community charging stations. There is a future in bundling technologies that integrate solar."

Figure 12: Optimism regarding: Customer demand, Technology, Programs and Policies



6.4 COMMENTS ON GOVERNMENT POLICY AND PROGRAMS

Participants made numerous comments about government policy and programs, from incentives to land-use planning. Many participants recognized the positive programs that already exist. For example, several study contributors remarked that without a net metering program they would not have a business. Participants offered advice on how to make policy and programs more effective. Having "great community presence" in program deployment, "enabling people to help themselves", and "rewarding measured results" were offered as hallmarks of success for program opportunities.

The recent Nova Scotia Solar Electricity for Community Buildings (SECB) Pilot program is recognized by several study participants as a positive initiative; however, respondents did also discuss some reservations and gave suggestions for more effective program design. The SECB program is open to not-for-profit community organizations, and these candidates may possess little knowledge of solar technology, the energy market, finance or awareness of the full range of project costs. They are often volunteer-based and provide essential social value in their communities. Some respondents were concerned that such organizations may become vulnerable by accepting the full risks associated with solar generation projects.

Installers are called upon to assist with proposals, however may experience conflict of interest if advising on bid prices for multiple proposals, while also competing for the installation contracts.

Participants called for implementation of a Feed-In Tariff (FIT) program to offer pre-set prices for solar electricity. It was also pointed out that the option to remain grid-tied beyond the 20-year term of the Power Purchase Agreement for these projects is not assured, which creates an undesirable uncertainty.

Low interest loans and rebates to customers were identified as good options for stimulating demand for residential scale solar PV installations. Several participants expressed enthusiasm for the previous COMFIT program and encouragement that this be resumed to include solar energy. However, another study participant expressed the opinion that:

"COMFIT created an artificial market which is volatile. It is better to support organic growth which is sustainable over the long term".

MicroFIT programming (feed in tariffs for small renewable energy projects, approximately 5 to 100KW) is also encouraged by study participants, who expressed that this region should proceed carefully and learn from the experiences of Ontario private and public-sector efforts. Particular effort should be made to avoid a boom-and-bust cycle.

"Reductions in Ontario FIT pricing have resulted in a significant contraction in the Ontario solar industry. This speaks to the fact that the solar industry is still at a stage where favorable policies and programs are essential. Any federal or provincial solar programming that is developed should be done in a measured manner with a 10-year view to provide long term certainty to business and not create a short term "boom and bust" cycle in the market."

Widespread adoption of advanced metering infrastructure, with smart meters that are bi-directional and that frequently send production and consumption data to an online database, is seen by some PV installers as an enabler of further growth in renewable energy uptake (provided that the data is easily accessible to customers).

It was pointed out that in Nova Scotia, residential customers of electric utilities are rebated the provincial portion of the HST on their purchases of electricity, and that this could logically be extended to include the provincial portion of HST on solar energy systems. Participants were keenly aware of the relationship between investment in energy efficiency and renewable energy and commented on the importance of energy efficiency standards being associated with solar incentives. Energy sustainability logically prioritizes a tight building envelope:

"Raising standards is more important than programs."

However, requiring envelope standards to qualify for incentives may be contradicted by market forces:

"Typically, the capital outlay (for PV systems) is too large for homeowners. This is especially true for new homes where the power bill is only $1,000 per year. This consumption level doesn't warrant an investment without an incentive. Older homes can realize a greater saving, so owners are more motivated."

Several study participants expect that the introduction of carbon taxes on the purchase of fossil fuel energy will have a positive impact on the demand for solar technology.

Participants identified the importance of land-use planning, bylaws and regulations to ensure that new housing development is designed to optimize solar energy access. For example, the orientation, size,

spacing, and height of buildings all should provide for solar energy access as a priority.

Progressive modifications to the building code so that new buildings have sufficient load bearing strength to support solar installations were urged by several participants, with the goal of making buildings solar-ready without increasing total construction costs.

Regarding the potential that a surge in demand could bring installers from outside the region, a study participant offered the following paraphrased comments:

"Lots of people want to buy this technology until they see the price. Incentives will bring other experts, but I'm happy to compete, I just need a market to compete in! Local installers have lots of advantages over out of province: no travel expenses, local reputation... competition makes the work better; it drives innovation and efficiency."

Policy promoting larger-scale (utility scale and commercial/industrial scale) solar is encouraged by study participants, regardless of whether this represents their direct line of business. The following comments are excerpts from interview notes:

"Large scale solar capacity and job creation won't happen in the residential market. Homeowners are challenged by a high capital cost and 15-year payback."

Note that the comment above was made prior to implementation of the Nova Scotia Solar Homes incentive, which has decreased the payback period for homeowners in the province of Nova Scotia.

"These residential customers are very cost sensitive, and often lack the knowledge required to assess the quality of a system proposal or installation. Government and institutions have great potential for solar installations, since they own buildings long term. A sustainable solar industry with healthy companies and competition will happen with the large-scale adoption of solar from government and institutional customers."

6.5 COMMENTS ON BARRIERS TO GROWTH

Participants offered comments on the barriers to healthy growth of the solar energy industry. The most frequent of these comments are given here:

Several study participants offered the opinion that the current 100-kW limit on net metering for renewable electricity installations is too small and is a critical barrier to development. Others suggested that reconsideration of grid tariffs for renewable energy is warranted:

"The Renewable to Retail program isn't getting any traction because the tariffs that NSP is charging for grid access are prohibitive."

Greater clarity from regulators and better information for consumers and inspectors were identified as opportunities to enhance the sector. The permitting process and building code were described as onerous. Consistency between provinces is considered desirable.

Residential scale PV installers often identified consumer education as a major challenge and expense. An example given by one company is that for every two days of time spent installing systems, the company invests a half-day in customer development. Much of this business development work is dedicated to explaining the technology and its

investment profile. Government-sponsored education materials and communication were recommended by several study participants.

A lack of incentives to support solar energy investment is lamented by many of the study participants. To paraphrase one contribution:

"In the US, almost every state has at least a 30% tax write off available for solar energy installations. Some states have multiple programs. There is currently no support here, instead it seems efforts are against adoption, especially from our utility. Regulations are slowing us down; it takes between a month and a half to two months to get approvals. There is no incentive for consumers, but a good program would motivate adoption."

Again however, program design must be sensitive to the hazards of large incentives that can create a boom-and-bust cycle. Another participant offered this:

"Installations will surge, it's inevitable... We are already struggling to manage in an environment where demand is so strong… Then in five years there will be too many installers and not enough work… let competition dictate demand."

In discussion with study participants, subscription-based solar gardens or farms were identified as a potential solution to the inefficiencies associated with current restrictions on off-site consumption of solar electricity and prohibitive transmission rates. This is a concern especially for residential consumers:

"Residential areas are often too crowded or shaded for successful solar installations."

7. RECOMMENDATIONS

Solar energy is unique among renewable energy sources in its potential for wide distribution and a broad range in scale for viable installations. By supporting development of solar energy at the residential, commercial/ institutional and utility scales we can enhance sustainability and grow opportunities for businesses in our region. Its investment profile. Government-sponsored education materials and communication were recommended by several study participants.

Canadian provinces are anticipating a significant federal capital influx allocated to reducing greenhouse gas emissions. In Nova Scotia and New Brunswick, where electricity generation is high- emitting, solar energy installations represent an excellent opportunity. However, avoiding a damaging "boom and bust cycle" for installers is also very important. We understand that the federal capital program will dictate an investment period of approximately three years.

Given those considerations, and the responses of study participants, we make the following six recommendations to support long-term growth in the solar energy industry in Atlantic Canada:

7.1 EVERGREEN FINANCING

To support long-term demand for solar installations, establish an evergreen financing mechanism that will ensure cash flow positive opportunities for solar energy.
Evergreen financing is a program of loans that continue to be available for new customers indefinitely, as the repayments from loans in the first years are used to continue offering loans in later years. An evergreen

fund that provides low cost financing for residential and community PV installations would make solar accessible to many more people. Financing terms should achieve a cash flow neutral or positive situation for customers, which requires an estimated 15-year amortization.

To achieve this, we recommend using federal program capital to finance installations of an appropriately proportioned number of lease-to-own PV systems on both privately owned residential properties and community buildings, plus using this capital to install solar PV systems on publicly owned institutional buildings, early in the program period.

The larger institutional installations will utilize capital quickly, which will help to address the anticipated federal program time constraint. Paired with initial residential and community building installations, these commercial/institutional scale projects will help spread demand across a range of installation companies. The institutions would then pay the market rate for generated solar electricity to the Evergreen Solar Fund, which will be used to provide loans and/or leases for solar installations for residential customers. The fund will charge interest,and will use the repayments to fund new loans to solar customers, continuing for many years.

7.2 CONSUMER EDUCATION AND PROTECTION

To enhance efficiency for installers and support potential customers, establish a solar education service for consumers about solar technology and finance, operated by a neutral third party.
Considerable inefficiency for residential installers occurs due to the high cost of customer education in relation to both technology and finance. We recommend support for a neutral third-party organization to provide highly accessible educational content and guidance for consumers.

Information on installed system ratings and output is difficult for the average user to find and appears to be inconsistently presented, potentially creating confusion among prospective solar energy customers. We recommend that accurate information about what to expect from a solar energy system should be made widely available. Clarity on the meaning of DC and AC system ratings and specifications of different systems is paramount in such educational resources.

Identification of appropriately certified solar installers by a neutral third party is recommended, as well as requiring that certified installers be used in association with solar incentive programs.

7.3 BUILDING CODE AND BYLAW AMENDMENTS

To ensure future opportunities for solar technology integration, adjust building code requirements so that new buildings have the load bearing capacity to support roof mounted solar installations.

An amendment to the building code that requires sufficient load bearing capacity to accommodate roof mounted panels in new buildings or roof renovations will help ensure the efficiency of future solar installations. The marginal cost of these enhanced structures is expected to be very modest.

Regulations that require new property subdivisions and buildings to plan for optimal solar energy access are recommended as a complement to incentives.

7.4 INCENTIVES

To encourage solar technology adoption without creating a boom-and-bust cycle for business operators, offer modest incentives and long-term attractive financing.

Based on the goals of increasing solar adoption yet avoiding a dramatic boom and bust cycle for businesses, we recommend implementing a 15% rebate on residential solar energy systems, coupled with long-term low-interest loans with 15-year terms. Combining a small incentive with access to a preferred loan will moderately increase demand for solar installations, allowing the solar industry to grow at a healthy pace over the long term.

The intent of the suggested 15% rebate level is to effectively eliminate HST on solar installations in the region. This level of rebate is substantial enough to increase demand and engage private capital in the sector, yet modest enough to avoid the difficulties of a "boom and bust" cycle.

We recommend a substantial loan financing component for the incentive, because this allows customers to participate and benefit even if they do not have access to up-front capital. For customers, the loan payments should be offset by their energy savings. For the loan fund, the repayments and interest will allow the fund to continue to offer loans for many years, potentially indefinitely, thus enhancing long-term sustainable growth in solar energy in the region.

7.5 LARGE SCALE PV

Allow and encourage installation of solar electricity generating stations in the 1 to 10 MW size class at selected locations on the distribution and transmission grid across the region. To realize the optimal efficiency of solar electric generation will require utility-scale installations. PV generating stations on the scale from 1 to 10 MW each, preferably locally-owned and developed by communities, will provide solar energy opportunities at a scale that provides efficient economics, while still allowing the resilience and community benefits of distributed generation.

Most of the provinces in Atlantic Canada now have significant amounts of wind energy on their grid systems. Adding multiple megawatts of solar electricity generation is complementary to the system load, because demand on the electricity system is consistently higher in the daylight hours, when solar is producing, than it is at night. For Nova Scotia alone, one estimate places this extra daytime load at about 200 MW (Groszko, 2014). As Nova Scotia's solar generation capacity is now close to 3 MW (2017), there is plenty of room to grow.

We recommend that regulatory policy be amended to accommodate utility-scale PV installations. We believe an effective and achievable way to achieve this, would be to re-introduce the Community Feed- in Tariff (COMFIT) program, and include solar energy this time. The COMFIT program was successful in setting the conditions for community- owned, utility-scale renewable electricity generation, mostly with wind power, and we believe it would be similarly successful for solar power.

7.6 FURTHER RESEARCH

Support further research to identify opportunities to localize the solar industry supply chain, develop the work force, and improve training and certification.

To maximize the local economic benefit from the global growth of solar energy, we need to better understand how companies in Atlantic Canada can provide innovative goods and services to the supply chain for solar energy development in the region and worldwide.

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