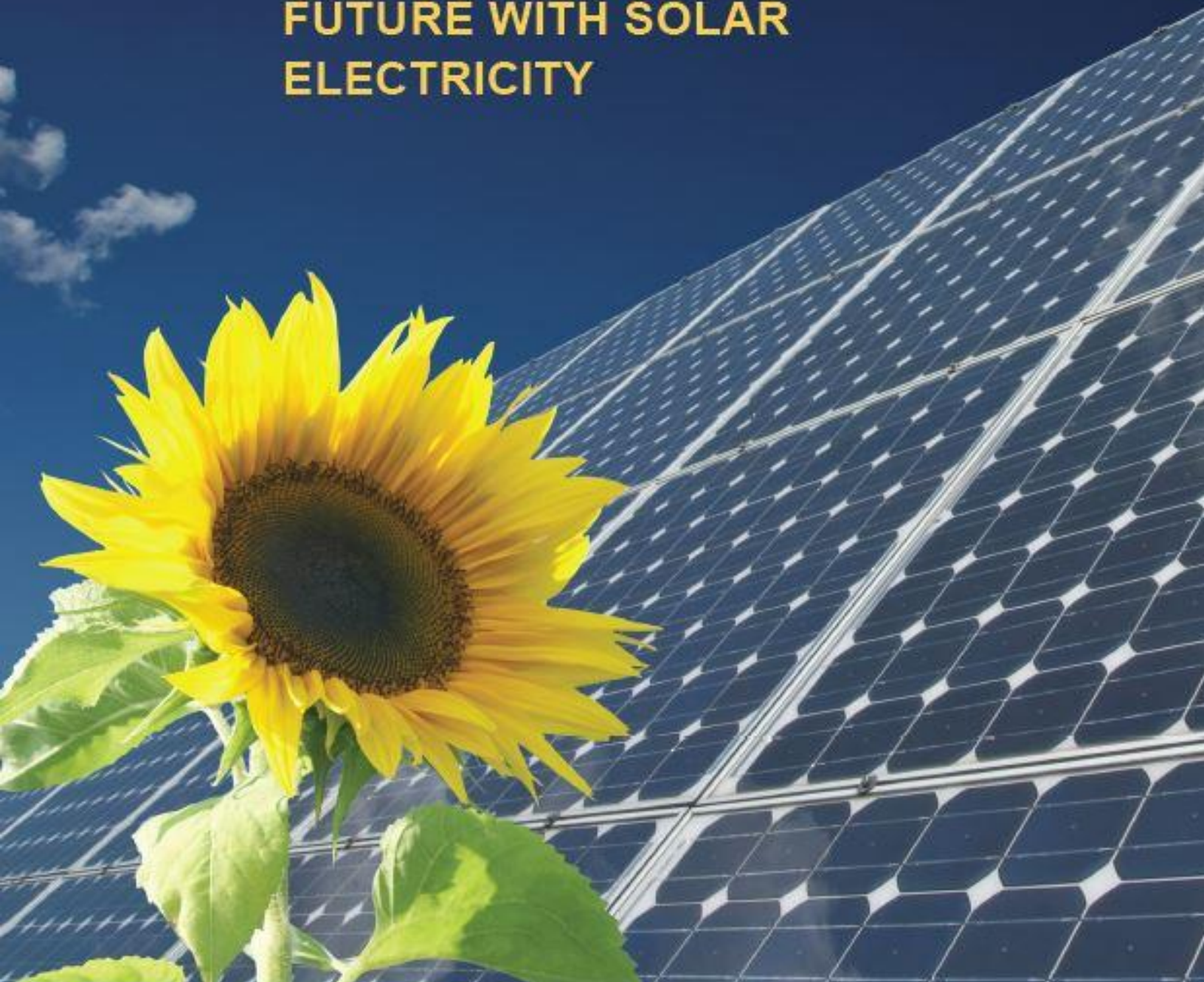




ROADMAP 2020

POWERING CANADA'S
FUTURE WITH SOLAR
ELECTRICITY



CANADIAN SOLAR INDUSTRIES ASSOCIATION

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FUTURE WITH SOLAR ELECTRICITY



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MESSAGE FROM THE PRESIDENT AND CHIEF EXECUTIVE OFFICER

“ The Canadian Solar Industries Association is pleased to share *Roadmap 2020: Powering Canada's Future with Solar Electricity*. Implementing CanSIA's *Roadmap 2020* will solidify solar electricity as an integral part of Canada's diversified electricity mix.

This is both an exciting and an opportune time to be in Canada's solar electricity sector. Increasingly, Canadians, the solar electricity industry, governments and other key stakeholders are coming to the same conclusion: solar electricity is the smart choice to power Canada's future.

Making the smart choice is what is driving the rapid pace of growth in solar electricity in our country and around the world. The International Energy Agency forecasts that the sun is poised to be the world's largest source of electricity by 2050.

Establishing solar electricity as an integral part of Canada's energy mix requires a deep understanding of the sector, a strong vision for the future, and a clear action plan to achieve the vision. I am confident that CanSIA's *Roadmap 2020* will guide the way to create a sustainable industry as solar electricity becomes cost competitive with other forms of electricity in Canada's diversified energy mix.

Dialogue is the best way to meet our shared goals for success. I welcome your thoughts on *Roadmap 2020*, and look forward to discussing it with you. ”

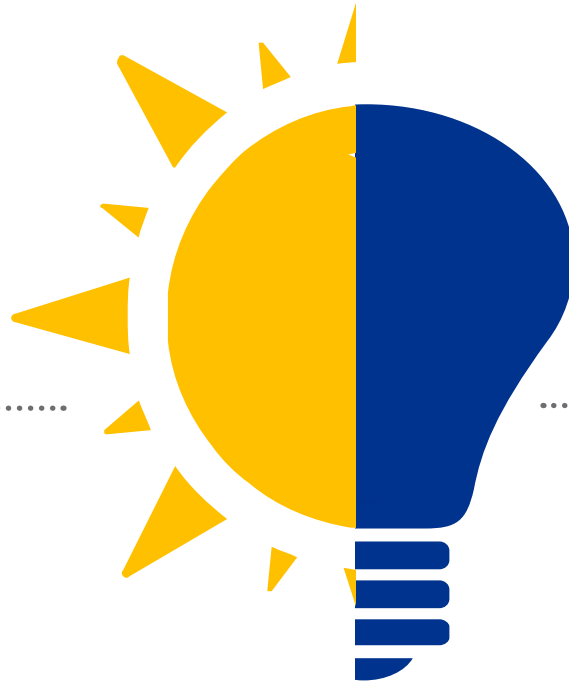


John Gorman
President and Chief Executive Officer



THE CANSIA VISION FOR CANADA'S SOLAR ELECTRICITY INDUSTRY IN 2020

In 2020



1

Solar electricity will be a **mainstream energy source** and an **integral part of Canada's diversified electricity mix**.

2

The **solar electricity industry** will be sustainable, with **no direct subsidies**, and operating in a supportive and **stable policy and regulatory environment** that recognizes the true value of solar.



EXECUTIVE SUMMARY

Solar electricity is the smart choice for Canada's energy future.

Why solar? It's abundant, clean, creates jobs, helps meet growing energy demand, strengthens the electricity system, is increasingly cost competitive, provides consumers with greater energy control and choice, and most importantly, **Canadians love it!**

Globally, solar electricity is now the fastest growing energy source in the world. In fact, the International Energy Agency (IEA) forecasts that by 2050, solar electricity could account for 27% of the world's electricity mix, making it the world's largest source of electricity, ahead of nuclear, fossil fuels, hydro and wind.

In Canada, the solar electricity sector is growing rapidly. Much of this success is based on the growth of the Ontario solar market where more than 99% of Canada's solar electricity is generated. Ontario has developed a globally recognized solar market sector. While it has experienced challenges, it is today one of the top 20 solar electricity markets in the world, based on solar installations.

The future is promising, but it does not come without challenges. In *Roadmap 2020: Powering Canada's Future with Solar Electricity*, CanSIA lays out a confident plan that identifies barriers to success, outlines opportunities, and makes recommendations to ensure Canada's solar electricity sector is

By 2020 solar electricity will:



Produce approximately **1%** of electricity generation in Canada, with almost **6,300 megawatts (MW)** of installed capacity.



Create approximately **65,000 job-years**, employing a labour force of approximately **10,000 people per year**, with the majority in construction and manufacturing, followed by operations and maintenance jobs.



Displace approximately **1.5 million tonnes** of greenhouse gas (GHG) emissions per year, the equivalent of removing **250,000 cars and trucks off the road each year**.

cost competitive with other forms of electricity by 2020. This plan focuses on five key areas that require strategic, coordinated and immediate action. They are:

- Develop a supportive and stable policy and regulatory environment that recognizes the total value of solar electricity, including externalities.
- Simplify and streamline permitting and processes for grid interconnection and metering of solar electricity systems.
- Reduce soft costs to levels consistent with global best practices.
- Educate the Canadian population on the true benefits and costs of solar electricity, and empower them to take action to support and adopt solar.
- Develop new and enhance existing relationships with technologies, applications and stakeholders to create synergies that enable greater solar electricity use in Canada.

Implementing CanSIA's *Roadmap 2020* will achieve two primary objectives:

- Solidify solar electricity as a mainstream energy source and an integral part of Canada's diversified electricity mix.
- Ensure the solar electricity industry will be sustainable, with no direct subsidies, and operating in a supportive and stable policy and regulatory environment that recognizes the true value of solar.

This vision for our future will require strong and confident leadership. It will also depend on the close collaboration of industry, government, stakeholders, and Canadians to make it work.

With the *Roadmap 2020* as its guide, CanSIA will lead the way for Canada's solar electricity future - **unlocking solar's full potential and cementing it as the smart energy choice for Canadians.**

SOLAR ELECTRICITY **– A GLOBAL AND** **CANADIAN CONTEXT**



Globally, **solar electricity has grown at a compound annual rate of nearly 50%** for the past decade. The International Electricity Agency (IEA) forecasts that by 2050, solar electricity could account for **27% of the world's energy mix**. If the IEA's forecast is accurate, solar electricity will become the leading source of electricity worldwide¹.

“*... the sun could be the world's largest source of electricity by 2050, ahead of fossil fuels, wind, hydro and nuclear...*”

- International Energy Agency

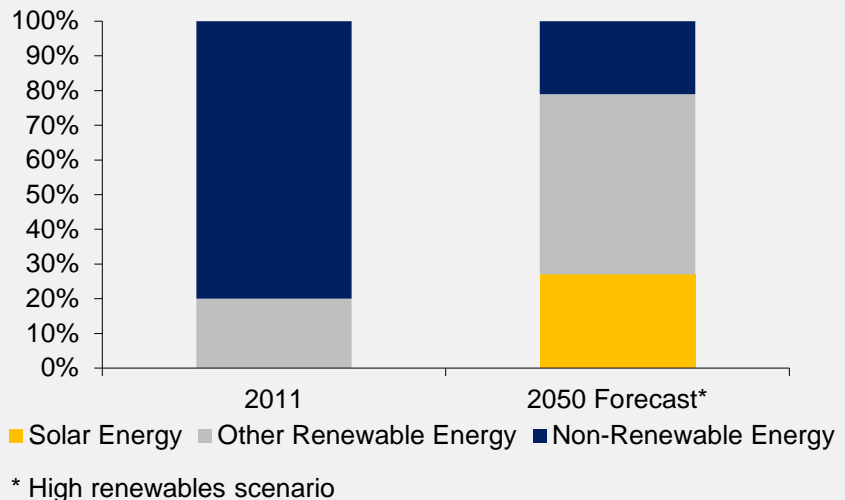
Solar electricity is the smart choice to power Canada's future. The time is right. Public support for clean, renewable and sustainable forms of energy is strong and increasing. There is also growing interest among Canadians to become “prosumers” - people who want options to both produce and consume electricity. This coincides with a dynamic and growing solar electricity industry both in Canada and globally.

In Canada, growth in the solar electricity sector is rapid. In 2013, installations of solar electricity systems grew by nearly 60% over the previous year, and the total value of the industry sales in 2013 was nearly \$1.5 billion, up from just over \$1 billion in 2012.²

The majority of Canada's growth is centered in Ontario, where more than 99% of Canada's solar electricity is generated. Ontario has developed a globally recognized solar market sector. While it has experienced challenges, it is today one of the top 20 solar electricity markets in the world, based on solar installed capacity.



Figure 1: Global Electricity Mix in 2011 and 2050 Forecast



Source: International Energy Agency

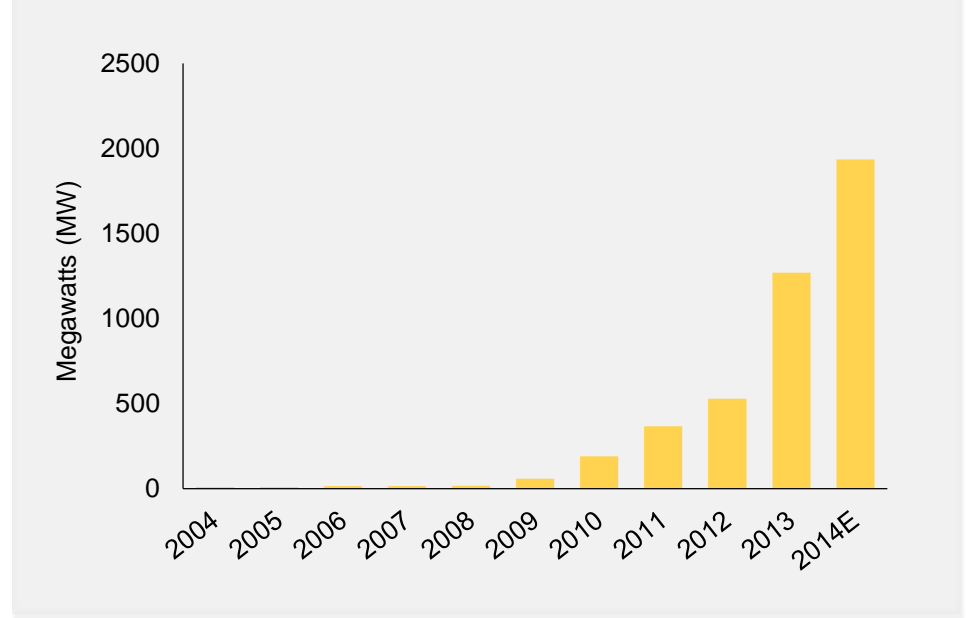
In Ontario, the Green Energy and Green Economy Act (GEGEA) passed in 2009 signaled an important commitment by the province to “remove barriers and promote opportunities for renewable projects, thus creating a green economy”³. As a result, the province has gone from having virtually zero to almost 2 GW of installed solar electricity capacity.

Other provinces have also taken steps to support and grow the solar market. For example, most provinces have various types of grid connection (e.g. net-metering) programs while a few provinces provide small financial incentives to encourage solar electricity installations.

The untapped potential in Canada’s solar electricity market is enormous. As the sector grows, fair policies and regulatory regimes will shape it into a sustainable and cost competitive landscape with, among other benefits, a more stable value and supply chain. Lower risks in the market will also generate greater investment by both local and global firms, create new jobs and spin-off economic benefits, and contribute to a cleaner environment for Canadians.

The *CanSIA Roadmap 2020* plots a confident course for success - **removing barriers and maximizing opportunities** to ensure solar electricity takes its rightful place in Canada’s energy mix.

Figure 2: Solar Electricity Capacity in Canada



Source: International Energy Agency, CanmetENERGY & CanSIA





CANADA'S SOLAR ELECTRICITY
INDUSTRY *ROADMAP 2020*
ACTION PLAN

Background

This *Roadmap 2020* - conceived to respond to and anticipate Canada's unique energy market and needs - is informed by global trends, advances in policymaking and best practices for the deployment of solar electricity technology.

Implementing CanSIA's *Roadmap 2020* will solidify solar electricity as an integral part of Canada's diversified electricity mix. By 2020, solar electricity will:

- **Produce approximately 1% of electricity generation** in Canada, with almost **6,300 megawatts (MW) of installed capacity**.

- **Create approximately 65,000 job-years**, employing a labour force of approximately 10,000 people per year, with the majority in construction and manufacturing, followed by operations and maintenance jobs.
- **Displace approximately 1.5 million tonnes of greenhouse gas (GHG) emissions per year**, the equivalent of removing **250,000 cars and trucks off the road each year**.






Furthermore, solar energy will be a driving force in modernizing the Canadian electricity sector. It will enable a population of prosumers - all-in-one producers and consumers of electricity who are driven by a

commitment to manage their electricity more efficiently. Achieving this vision will require strong and confident leadership, together with determination to deliver on all of the component parts of *Roadmap 2020*.



Roadmap 2020 identifies the existing **barriers** that currently prevent solar electricity from being seen as a desirable, accessible and mainstream source of electricity in Canada. It also lists **opportunities** to address the barriers, and proposes **Roadmap 2020 solutions**. Taking action on each piece of the plan will require a holistic and integrated approach, with consideration given to the broader context of all five focus areas.

The CanSIA Roadmap 2020 Five Areas of Focus

BARRIERS

-  Unsupportive and unstable policy and regulatory environment
-  Confusing, slow and expensive electrical grid interconnection requirements
-  High non-hardware costs (i.e. soft costs) of solar electricity systems
-  Inadequately informed public regarding solar electricity benefits and applications
-  Unfulfilled relationships with conventional industry participants and synergistic sectors

SOLUTIONS

-  Develop a supportive and stable policy and regulatory environment that recognize the total value of solar electricity, including externalities.
-  Simplify and streamline permitting and processes for grid interconnection and metering of solar electricity systems.
-  Reduce soft costs to levels consistent with global best practices.
-  Educate the Canadian population on the true benefits and costs of solar electricity, and empower them to take action to support and adopt solar.
-  Develop new and enhance existing relationships with technologies, applications and stakeholders to create synergies that enables greater solar electricity use in Canada.

Removing barriers will require the collective efforts of key stakeholders, including industry, utilities (e.g. electricity distribution companies), energy and safety regulators, and all levels of governments including federal, provincial, territorial, and municipal.

The challenges Canada faces in its solar electricity sector are common in countries around the world, particularly as global markets reach a critical threshold. In Canada, this threshold is approaching quickly. In more mature markets, programs and solutions have addressed barriers, and Canada is learning from these experiences and successes. *Roadmap 2020* will enable industry and stakeholders to be better prepared to deal with challenges along the way. It will also ensure Canada's solar electricity industry is sustainable, while solar energy technologies are cost competitive with other generation sources, without the need for subsidies.

ROADMAP 2020 ACTION 1: STABILIZE THE POLICY AND REGULATORY ENVIRONMENT

The Challenge

Canada is the **only major industrial country without a national renewable energy strategy**, while at the same time **heavily supporting fossil fuel, or carbon-based, industries**.

For example, in 2011, the International Monetary Fund (IMF) estimated \$34 billion annually was given to subsidize Canada's fossil fuels industries, including direct support to producers and uncollected taxes on externalized costs. This amounts to almost \$1,000 per Canadian citizen per year⁴.

Canada's federal government is currently providing much more financial assistance to fossil fuels than renewable energy, thereby creating an uneven playing field for solar energy and renewables to compete in the Canada energy market.

Furthermore, provinces and territories throughout Canada have a patchwork system of various policies, programs and regulations. To date, the industry has relied on and responded to changing government policy and programs that support its implementation. High dependence on subsidies and unpredictable programs has created long-term uncertainty for the entire value and supply chain. In turn, this has resulted in boom-bust cycles that have hindered growth and industry sustainability. Also, high perceived risks in Canada's domestic markets have at times curbed investment in the sector by both local and global firms.

The Opportunity

CanSIA is nationally recognized as the trusted voice of the solar energy industry among all levels of government. Policy development and government relations are core functions for the Association and are among its greatest strengths.

There is currently no solar electricity policy at the federal level. Achieving a favorable federal solar electricity policy presents Canada's solar energy industry with one of its greatest opportunities. If implemented, this could create a framework to open up new markets across Canada, and initiate provincial /territorial solar policy to support or complement federal policy.

CanSIA has been very successful in shaping energy policy in Ontario, as well as facilitating and building the strong solar industry that exists in the province today. The Association has also been active in helping to shape the Alberta solar market where a new alternative and renewable electricity framework policy, encompassing solar electricity, is expected to be announced in 2015. Increasing government support to develop clean energy can aid to further enhance and grow these and other provincial and territorial markets.

Although solar technology is proven and established, solar electricity is considered by many to be new. Many governments, electricity market and safety regulators, and electrical utilities, are not familiar with the attributes and benefits of solar electricity. Here, also, is another great opportunity to inform and educate

stakeholders on the environmental and electrical (i.e. technical) benefits of solar electricity, to ensure the full value of solar electricity is recognized and accounted for in energy policy and regulations.

The CanSIA Roadmap 2020 Solution

To solidify solar electricity as a mainstream energy source and an integral part of the country's diversified energy mix, Canada's solar electricity industry must operate within a supportive and stable policy and regulatory environment.

As solar technology approaches cost competitiveness with other generation sources, and as solar subsidies are scaled back, it will be paramount to unlock and recognize the full value of solar electricity. This includes factoring in external variables or "externalities", such as carbon emissions, air and water pollution, and associated health care costs. It also includes taking into consideration the economic and technical benefits that solar electricity brings to the electricity grid system, including electricity security and reliability, price stability, load shifting (e.g. peak shaving), and power quality. Within this supportive and stable policy and regulatory framework, consumers and investors will have the long-term certainty they require to make long-term decisions regarding the use and development of solar electricity.

To achieve these objectives and to follow through on the following actions, CanSIA will increase its staff and consultant complement to strengthen its voice and expertise in influencing policy and regulatory environments.



Creating Supportive Policies

New and revised policy to enable the growth of solar markets will be achieved by working with all levels of government, to remove unnecessary barriers and create a fair and supportive policy framework to deploy solar electricity.

Federal

CanSIA will enhance its federal advocacy efforts with increased government relations activities including building upon its Solar Advocacy Federal Government Hill Day campaign. These efforts will serve to educate senators, ministers, members of parliament, and government officials about the benefits and value of solar electricity, international best practices, while providing policy recommendations to support and bring solar electricity to more Canadians. CanSIA will focus on tax-based policy recommendations related to areas such as, but not limited to:

- Investment tax credits
- Flow-through shares and Canadian Renewable Conservation Expenses ("CRCE")
- Accelerated Capital Cost Allowance (CCA) – Class 43.1/43.2
- Residential solar energy tax credit
- Other appropriate policy recommendations

Greater federal government leadership is required to ensure all Canadians realize the benefits of solar energy. The adoption of these types of tax-based mechanisms will put Canada on par with the US, its largest trading partner (see Case Study 1), and on a more even playing field with other energy sectors in Canada.

CASE STUDY 1

Investment and Production Tax Credits

The Solar Investment Tax Credit (ITC) in the US has been highly successful in increasing deployment and lowering the costs of small scale solar systems. The ITC is a 30% tax credit, with no upper limit, for solar systems on residential and commercial properties placed in service between January 1, 2006 and December 31, 2016. Since its implementation in 2006, annual solar installations have grown at a compound annual rate of 76%⁵. It has provided market certainty for companies to develop long-term investments that drive competition and technological innovation. In turn, this has lowered costs for consumers. The success of the ITC shows that stable, long-term incentives reduce prices significantly and create jobs in the solar industry.



Paired with the ITC, the US Production Tax Credit (PTC) was a federal incentive that provided financial support for the development of large scale renewable energy facilities. It applied to solar electricity systems larger than 150 kW placed in service between October 22, 2004 and December 31, 2013. Eligible projects received a tax credit of 1.1¢/kWh over the first 10 years of operation⁶.

Provincial / Territorial

As Canada's solar electricity industry approaches cost competitiveness with other generation sources, it will become increasingly important for provincial and territorial governments to create long-term, stable policy frameworks. As part of this framework, it will also be paramount to ensure the full value of solar electricity is recognized including its environmental, economic and electrical grid system benefits.

CanSIA will work with provincial and territorial governments, in particular the Ontario government, to maintain and grow the Ontario solar market, and with the Alberta government, to develop and grow its solar market. In addition, the Association will look for new opportunities to grow and expand markets in other jurisdiction across Canada. CanSIA, along with local governments, will collaborate to determine the best policy, program and practice options that are most appropriate for each jurisdiction, based on market size and development status.

For distributed solar electricity, proven options include feed-in-tariffs (FITs), net metering, net billing, and 'pay all, buy all.' These support mechanisms are most effective when combined with other complementary policies such as investment and/or production tax credits, and renewable energy certificates. Well managed FITs and net metering programs have proven effective in stimulating deployment, especially in nascent markets.

For utility scale solar electricity plants, proven options include renewable portfolio standards, FITs, feed-in-premiums, auctions, and renewable energy certificates. These options can also be complemented by production and/or investment tax credits, as well as renewable energy certificates. Long-term power purchase

agreements have proven to be an effective way to attract investment, by minimizing uncertainty and ensuring bankability of projects.

Provincial policies will likely differ, but the guiding principles will be the same. All should involve long-term targets to demonstrate the commitment needed to enable long-term investment by the private sector, and financial value should be attributed to the positive externalities of solar electricity when creating policies and programs. These mechanisms will provide the necessary framework as solar energy evolves into a cost competitive and sustainable industry.

Creating Supportive Regulations

Significant regulatory decisions are currently being made throughout Canada's electricity markets. As long-term investments related to electrical grid infrastructure are being considered, and with new information technology providing enhanced grid monitoring capabilities, it is a crucial time for CanSIA to strengthen its voice on regulatory matters.

The removal of unnecessary barriers and the creation of a fair and supportive regulatory environment will be achieved by working with all levels of government, but primarily with provincial, territorial, and municipal governments. This will ensure measures are implemented properly at the local level while striving for consistency throughout Canada's electricity markets.

CanSIA will strengthen its involvement in official regulatory proceedings and increase its communication with regulatory bodies, including the Ontario Energy Board, Ontario Independent Electricity System Operator, Alberta Electric System Operator, Alberta Utilities Commission, etc.



CanSIA will assess the regulatory environment in specific markets to determine key opportunities, challenges and areas of focus. Using international best practices and leading research, CanSIA will educate and inform stakeholders about the full value of solar electricity. In particular, focus will be placed on the technical and economic benefits that solar electricity brings to the electricity grid system, including price stability, load shifting (e.g. peak shaving), power quality, and electricity security and supply.

Furthermore, CanSIA will address specific regulatory matters the Association expects will be important to the growth of solar electricity, including rate design, net metering, net billing, grid interconnection, electricity market rules, capacity market rules, revenue decoupling, load displacement charges, among others. Many of these issues are currently not top-of-mind for the industry; however, they may or will in future become the barriers the solar energy industry must overcome to grow the market and build a sustainable industry. CanSIA will be proactive in addressing these matters to ensure regulatory barriers are eliminated as solar electricity is poised to take full advantage of solar cost competitiveness, leading up to 2020.



ROADMAP 2020 ACTION 2: SIMPLIFYING ACCESS TO THE GRID

The Challenge

Simple and efficient access to the electrical grid system is one of the key long-term enabling factors for the growth and sustainability of the solar electricity industry in Canada. Connecting a solar system to the grid system allows energy consumers to use the electricity grid as a back-up power supply when solar energy is not being produced.

As solar electricity approaches cost competitiveness with other generation sources, the key constraint for uptake is expected to shift from the cost of solar to limited grid access. In other words, solar electricity systems may be financially viable, but Canadians who wish to install a system may not, for various reasons, have easy access to the electrical grid system.

Currently, there are a number of barriers involved with connecting solar energy systems to the grid in Canada. To name a few, they include:

- Inconsistent grid connection and energy monitoring regulations and procedures
- High and inconsistent fees
- Excessive administration and paper work
- Multiple overlapping approvals
- Long approval wait times

The resulting inconsistencies and redundancies have slowed the development of the residential and

commercial solar electricity markets. They have caused confusion, delays, and have resulted in prohibitive costs. Furthermore, these barriers have impeded the development of scalable business models (e.g. economies of scale) necessary to quickly drive down solar electricity costs.

The process for grid interconnection is a complex one, with different standards and regulations developed by electrical utilities, municipalities and provincial regulators across various jurisdictions. Often, energy consumers interested in installing



and connecting a solar electricity system to the grid are unable to do so due to perceived or actual technical limitations. This leads to much frustration for solar industry participants and motivated solar electricity system customers, who are confused by the grid limitations and the lack of solutions to address the challenges.

The Opportunity

Although solar technology is proven and established, the application of solar electricity is new to many stakeholders including electricity market regulators, electrical safety regulators, and electrical utilities. The solar electricity industry has a great opportunity to share international case studies and best practices to inform and educate stakeholders on the technical characteristics, attributes and benefits of solar electricity, to ensure the full value of solar electricity is recognized and accounted for in electricity regulations.

Further research and discussion is required to better understand the impacts of solar on the grid system and to determine the solutions that will give all Canadians the opportunity to connect solar energy to the grid in a simple and efficient manner, while at the same time ensuring a safe, reliable and secure grid system.

CASE STUDY 2

Hawaii's Solar Boom and the Resulting Halt in Grid Access

Hawaii was the first US state to reach solar cost competitiveness, due largely to high priced imported fuels and the state's supportive policy and financial mechanisms. Hawaii's 35% state tax credit for solar electricity systems resulted in more than 10% of consumers installing rooftop solar systems⁷. A typical system in Hawaii pays for itself in only four years, returning a long-term profit of more than four times its cost during its useful life.

These factors led to a boom in new installations that saw solar rise from 8 GWh of production in 2007 to 378 GWh in 2013⁸. However, the industry came to a crashing halt in late 2013 when Hawaiian Electric Company (HECO) abruptly stopped approving residential solar grid-connected applications for most communities on the island of Oahu. HECO claimed the grid was over-saturated with solar and that further study and infrastructure upgrades were required to restart the interconnection process. The sudden shift left thousands of consumers and investors stranded and caused large-scale lay-offs, resulting in significant setbacks for the Hawaiian solar market⁹.



The CanSIA Roadmap 2020 Solution

Success will require the **collective efforts of many energy and regulatory stakeholders**. CanSIA will facilitate this discussion to include all relevant stakeholders.

Creating a supportive and stable regulatory environment which standardizes and streamlines connection, metering, permitting and approval processes will only occur if requirements and rewards are fair for both consumers and electrical utilities. This creates a win-win scenario that provides incentives, or reduces barriers, for all energy stakeholders to connect solar electricity systems. These elements are critical for the mass adoption of solar electricity throughout Canada and the sustainability of the solar industry.

CanSIA believes that a proactive, focused, and collaborative effort, equipped with adequate financial and human resources, will result in simplified, efficient, and streamlined grid connection, metering and permitting requirements in Canada by 2020.

The **Solar PV Task Force is expected to launch officially in the first half of 2015.**

While this initiative is currently focused on Ontario, expansion to cover other provinces and territories is expected.

CanSIA will take a lead role to conduct, collect, analyze and share research and information related to international case studies and best practices. This will allow stakeholders to better understand the impact of solar electricity on the grid system and determine the solutions that will give all Canadians the opportunity to connect solar energy to the grid in a simple and efficient manner, while at the same time ensuring a safe, reliable and secure grid system.

The Ontario Solar PV Task Force

CanSIA is already taking action to simplify and streamline grid access and will continue to make advances in this area. The Association has been working with the Ontario Ministry of Energy to develop the Ontario Solar PV (photovoltaic) Task force.

The Ontario Solar PV Task Force will bring together key energy and solar industry stakeholders, such as electricity distributors, utilities, power producers and energy regulators. The purpose of the Task Force is to work cooperatively, conduct research, share information, and propose recommendations to policy makers and regulators to create consistent and simplified solar electricity connection and metering frameworks. Implementation will require educating electrical utilities and municipalities on best practices for permitting and approvals to achieve consistency across regions and to eliminate redundant requirements and slow permitting processes.



ROADMAP 2020 ACTION 3: REDUCE SOFT COSTS



The Challenge

In the solar electricity sector, soft costs are commonly referred to as anything that doesn't include manufactured hardware, such as modules, mounting systems and inverters.

Soft costs include:

- Permitting
- Interconnection
- Inspection
- Installation
- Maintenance costs
- Financing
- Customer acquisition

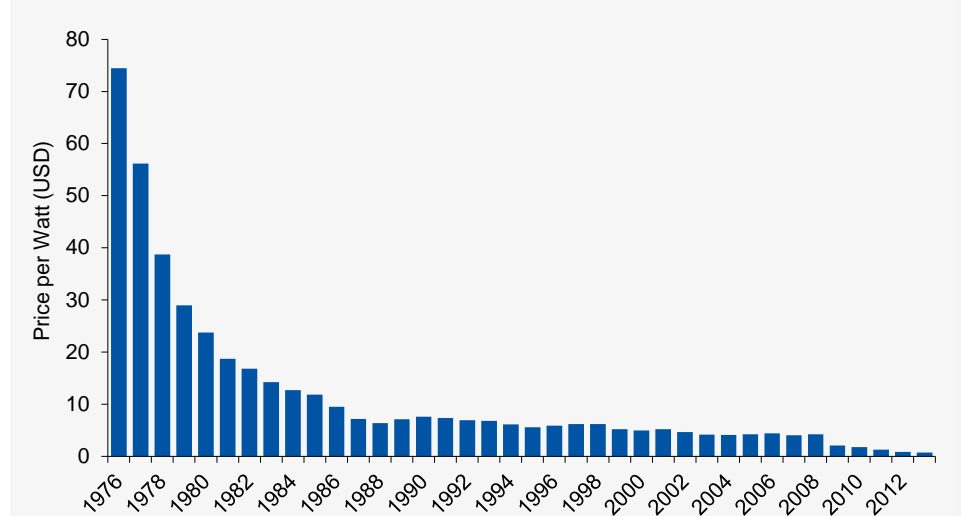
Soft costs associated with new installations of solar electricity systems are a barrier to cost competitiveness in Canada. There is limited formal research on soft costs in Canada, although they are perceived to be among the highest in the world. Significant reductions in non-hardware costs must be achieved to ensure future growth.

Reducing soft costs in solar electricity markets is a common challenge around the world and the focus of growing discussion, particularly in large established markets. While soft costs pose a challenge, in various jurisdictions hardware costs such as solar electricity cells and modules have become highly commoditized. Costs are being driven downward with advances in technology and growing global adoption of solar electricity (See Figure 3) .

The Opportunity

Solar hardware costs have decreased over the past number of years. Soft cost reductions now represent the greatest opportunity to lower the cost of solar electricity in Canada and accelerating cost competitiveness with other generation sources. This will be a key factor in solidifying solar energy as a mainstream technology option. Some countries have been successful in launching programs to reduce the burdens of soft costs. In one high profile case, the US government's Department of Energy is addressing soft costs through the SunShot Initiative (See Case Study 3)¹⁰

Figure 3: Price of Crystalline Silicon Photovoltaic Cells, \$ Per Watt



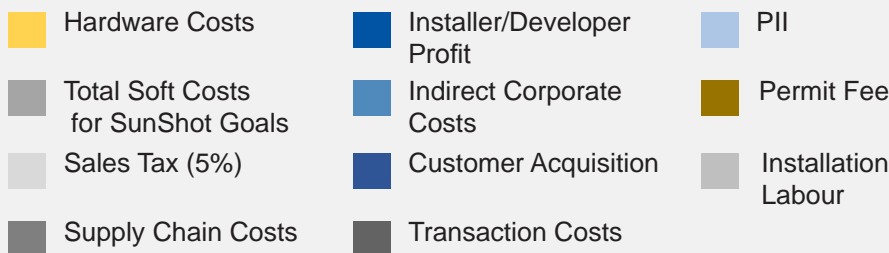
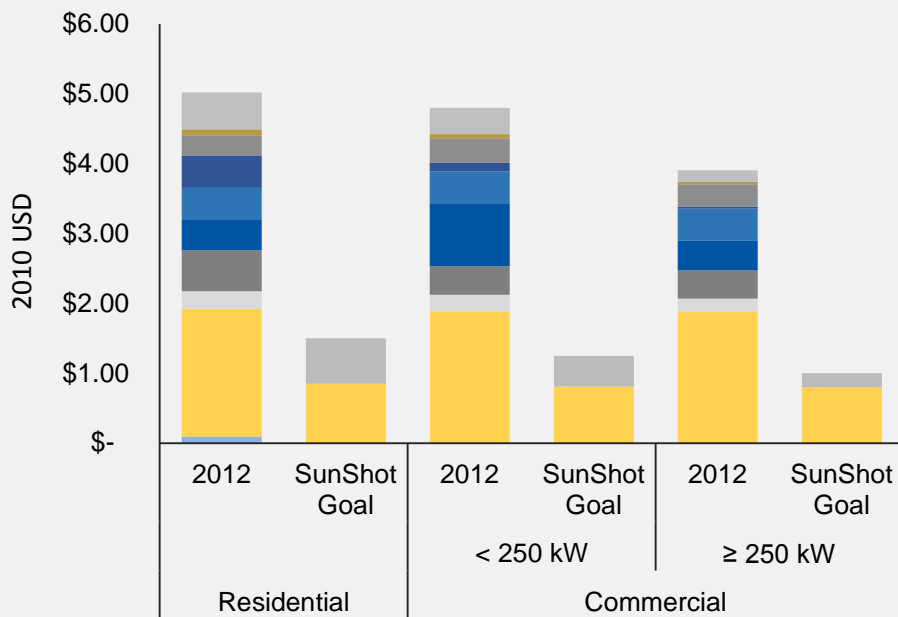
Source: Bloomberg New Energy Finance



CASE STUDY 3

The U.S. Department of Energy's SunShot Initiative

Figure 4: Total Electricity System Price in U.S.A., by Sector and System Size (First Half of 2012, in 2010 USD)



Source: Friedman et al

In 2012, US soft costs accounted for 52% of the price of a large commercial system at \$2.10/W, 61% for a small commercial system at \$3.01/W, and 64% for a residential system at \$3.32/W. This is broken down in Figure 4 (in 2010 USD)¹¹. These 2012 soft costs have remained virtually stable since 2010, while during the same period total hardware costs were cut by half.

The SunShot Initiative has established soft cost targets. They are:

- \$0.65/W for residential systems
- \$0.44/W for commercial systems
- \$0.22/W for utility scale systems

Overall, the objective is to make solar energy cost competitive with other forms of electricity by 2020 at \$0.06/kWh¹². To achieve this goal, the DOE is supporting activities led by private companies, academia, communities, and national laboratories to drive research, manufacturing, and market solutions for solar energy.

SunShot funding for soft costs supports market transparency, workforce training, local solutions, and process improvements to make solar deployment faster, easier, and less expensive. The program has been successful in fostering collaboration between stakeholders and in lowering costs for customer acquisition, inspection, financing, installation, and permitting¹³.

The CanSIA Roadmap 2020 Solution

Canada, led by CanSIA and the solar industry, will launch a program similar to SunShot to ensure solar electricity in Canada is cost competitive on a stand-alone basis by 2020. This effort will require collaboration from a wide range of stakeholders, as soft costs tend to be localized within jurisdictions. Stakeholders include:

- Solar developers
- Property owners
- Utilities
- Energy and safety regulators
- Financial institutions and lenders
- All levels of government
- Retailers

Together with its members and other key industry players, CanSIA will actively lead this initiative by providing data and participating in sponsored projects. By making soft cost reductions a priority, 2020 is a realistic timeframe to achieve substantial reductions.

CanSIA's initiative will be an effective and pragmatic response to addressing soft costs targeting and isolating individual costs through separate unique projects, and focusing on small scale successes to develop solutions for the broader market. CanSIA will reduce soft costs to levels consistent with global best practices. Initial steps will be implemented to gather information and create a framework for further action. These steps are outlined in the table below.

INITIAL KEY STEPS

Step 1 – Collect soft cost baseline information (By 2015)

Currently, there is no reliable source of information detailing soft costs in Canada. CanSIA and its industry partners will build a detailed baseline of current solar project cost structures to quantify each soft cost category. Data will be collected through surveys and industry consultations to model and analyze the true 'all-in' cost of an interconnected solar electricity system. Data baselines should be built at a provincial and national level so that jurisdictional cost differences can be identified, understood and addressed.

Step 2 - Benchmark soft cost information against best practices (By 2015)

Provincial and territorial baselines will be benchmarked against national and international data points to target soft costs that can be improved in Canada and its regional jurisdictions. This exercise will assist CanSIA and its partners to understand the potential scale of cost savings opportunities.

Step 3 – Establish targets (By 2015 to 2016)

Create meaningful mid- and long-term cost reduction targets based on benchmarks in Step 2. US targets should be used as preliminary Canadian targets until the jurisdictional baseline has been developed and analysis is complete.

Step 4 – Create and implement an action plan (By 2016 to 2020)

Create and implement a comprehensive action plan to reach established soft cost reduction targets.

ROADMAP 2020 ACTION 4: DEVELOP PUBLIC AWARENESS AND EDUCATION CAMPAIGN

The Challenge

Canadians love solar energy and want to see it become an integral part of Canada's diversified electricity mix. Although public support for solar energy is high among Canadians, the challenge has been converting this broad support into actionable solar policies at all levels of government, with the Ontario government being the notable exception. As previously mentioned Canada is the only major industrial country in the world without a renewable energy strategy. Instead, what exists currently is a patchwork of policies, programs and practices throughout provinces and territories.

Another key challenge for the solar industry is the high degree of misinformation and misconceptions in the public sphere, particularly as it relates to the cost of solar. This myth acts as a significant barrier to the industry's objective to influence the development of supportive policy

and consumer adoption. Much of this information is outdated. Many Canadians and political decision makers are not aware that the price of solar electricity has fallen dramatically over the last five years and is now on target to be cost competitive with other generation sources. In short, the solar industry is evolving much more quickly than most people realize.

Furthermore, residential and commercial customers struggle with the uncertainty and confusion around investing in solar electricity systems. For example, misinformation regarding financing/leasing options, insurance risks, and installation requirements inhibits the motivated consumer in making the choice to purchase a solar electricity solution.

The Opportunity

The solar industry is fortunate to have such strong, broad public support. The vast majority of Canadians support

CanSIA has an opportunity to expand on its success as the recognized voice of the solar industry, and build a stronger unified voice demanding change, while enhancing its focus and interaction with the broader public, including voters and consumers.

solar energy¹⁴ and see it as the most desirable energy source for their communities.

An educated and knowledgeable energy consumer will want to make the smart choice-solar-once they are aware of all the facts and information. Ensuring the buying public has the most up-to-date information on the value of solar and other energy costs will result in the growth and expansion of solar electricity in Canada.



The CanSIA Roadmap 2020 Solution

CanSIA is committed to lead the charge in educating the Canadian public and policymakers on the true costs and benefits of solar electricity. The Association is hiring communications and marketing personnel to develop and manage a comprehensive national awareness program, but will call on the support and participation of the following to raise awareness and support for solar electricity:

- Members
- The solar energy industry as a whole
- Federal, provincial and municipal government leaders
- The Emerging Leaders for Solar Energy (ELSE) organization
- Other advocacy groups
- Citizens

The awareness program will have a wide range of messengers but a consistent message:

“*... solar energy is the smart choice to power Canada's future ...*”

CanSIA believes a well-executed plan can achieve public support for more solar energy in the electricity mix, and that 2020 is more than enough time to achieve this goal.

Stand Up for Solar

The CanSIA national awareness campaign will build on the platform it has established with Stand Up for Solar—the online engine and information repository that has acted as the “grassroots” vehicle for public information, awareness and support. In keeping with the *Roadmap 2020* principle of leveraging expertise and knowledge of other jurisdictions, CanSIA will seek to partner with the highly successful US platform, Vote Solar.

The Stand Up for Solar platform, together with the support of the Emerging Leaders in Solar (ELSE) organization, provide the cornerstones of a strong platform to increase public awareness.

The program will have two overall goals:

- Create a population of Canadians that want to be “prosumers” – Canadians who both produce and consume electricity and feel motivated to manage their own electricity future efficiently. This will drive demand for residential solar electricity systems.
- Create an informed voting population that pushes for more solar electricity in Canada's electricity mix as well as solar electricity-friendly policy and legislation, and puts pressure on decision makers at critical times to make this a reality.

CASE STUDY 4

Vote Solar

Vote Solar provides citizens with valuable information that allows them to put pressure on their local decision makers at critical points. It works with policymakers, other advocacy groups, and most importantly private citizens to make sure that new laws benefiting solar are enacted. It then takes on a ‘watchdog’ role to ensure that enacted laws are implemented properly, operating effectively, protected from opposing interests, and amended when necessary.

In 2013 in Arizona, facing a utility proposed \$50-\$100 monthly charge for net metering that was backed by millions in anti-solar advertising, Vote Solar intervened in the proceeding to question the utility's math and help engage grassroots solar support from Arizona residents, eventually shutting down the proposed fee.¹⁵



ROADMAP 2020 ACTION 5: ENHANCE TECHNOLOGY AND APPLICATION ENABLER RELATIONSHIPS

The Challenge

CanSIA has identified technologies and applications, called enablers, that have strong synergies with solar energy and are expected to have a significant impact on the development and growth of the solar electricity industry in Canada - once barriers are addressed (See Figure 5). Many of these enablers are emerging and not yet fully mature or proven. Or, they face other financial, adoption or awareness constraints. The challenge lies in the development and merging of solar electricity with enabling technologies and applications in a practical and real-world environment.

Figure 5: Technology and Application Enablers for Solar Electricity in Canada

Energy Storage

Smart Grids

Electric Vehicles

Green / Net-Zero Building Design

For example, energy storage and electric vehicles are still considered nascent technologies and have some technical and financial challenges to overcome. Smart grid technology is proven; however, it requires enormous up-front investment capital to fully integrate the technology into the existing and evolving grid system. Green or net-zero building design is a proven application and becoming increasingly popular, but it still experiences integration and

awareness challenges within the larger building and regulatory environment.

The Opportunity

Solar electricity, as a stand-alone technology in its current and evolving form, has the potential to become a mainstream energy source and an integral part of Canada's diversified energy mix. These enablers offer opportunities for the solar electricity industry to create mutually beneficial strategic partnerships working together to enhance each other's value. Couple solar technology with other emerging synergistic technology and application enablers, and solar energy has the potential to dominate the energy landscape and reshape society and the economy in the 21st century.

Energy Storage

Energy storage allows solar electricity to enhance its value and benefit to the existing electrical grid through technical solutions including load shifting (e.g. peak shaving), load balancing, power quality, voltage control, diversity of supply, among many others. All of these attributes enable the grid system to be stronger and more robust.

Mature solar electricity markets also tend to experience growing energy storage demand, as the two technologies are very complementary. For example, Ontario has developed a pilot project to procure energy storage facilities within its electrical grid system. Many local solar companies are participating in this program. This should help provide new opportunities to gain information and share best practices about the integration of solar electricity with energy storage.

Smart Grids

Smart grids are network grid systems that use digital communication technologies to collect, share and analyze energy usage information. Couple this information with the ability of smart grid technologies to better facilitate the movement of electricity in two directions, and it provides a very supportive and enabling environment for prosumers to consume, produce and manage their own electricity.

Canada has been proactive at exploring and integrating smart grid technology into the existing electricity system. Building upon this experience, and coupling it with increased adoption of solar electricity, can make Canadian companies leading integrators of distributed energy with smart grids. In addition to developing domestic expertise, companies would be able to export this know-how to global markets in the form of products, processes and consulting services.

Electric Vehicles

Consumers who purchase electric vehicles (EV) often have a strong interest in clean energy and energy efficiency. In addition, EVs operate as a form of mobile storage device within the grid system, helping to enhance the flexibility and robustness of the overall electricity system.

As sales of EVs increase, the grid will also require more energy to power these vehicles. EV charging station infrastructure is being built throughout Canada, which will encourage mass adoption. Solar electricity can play a key role in meeting this increased supply requirement. For example, the marketplace continues to provide

new solutions including EV charging stations combined with residential and commercial solar electricity systems.

Green / Net-Zero Building Design

Green building design creates structures using environmentally responsible and energy efficient elements in the construction and operation of the building, often incorporating solar electricity and other renewable energy technology. Net-zero building design creates structures with zero net energy consumption, meaning the total amount of energy used by the building on an annual basis is equal to the amount of solar or other renewable energy created on-site. These design applications lend themselves to all types of buildings - residential, commercial, industrial and institutional.

There are various reasons why consumers and building owners would prefer a green or net-zero building, including the opportunity to lower and control their energy costs market themselves as stewards of the environment, or promote their energy technology savviness. Numerous programs are now present which provide certificates and other marketing tools to build awareness and profile of green and net-zero buildings.



CASE STUDY 5

PowerStream Gets Moving with Solar + Electric Vehicles

PowerStream is one of the largest municipally owned utilities in Ontario that has also embraced solar electricity, including the development, ownership and operation of solar electricity systems. PowerStream has taken a leadership position in implementing 'smart' solar enabling technologies at its head office in Vaughan. The utility and its partners have successfully connected solar electricity with electric vehicles, energy storage and smart grid applications to create an integrated micro grid system that can operate independently of the electric distribution system.

In July 2011, PowerStream bolstered its vehicle fleet with the first two Nissan LEAFs ever delivered in Canada. These cars are 100% electricity powered with zero fuel and tailpipe emissions. The utility is using these vehicles in combination with its EV smart charging station and a solar car port which is powered by a 5 kW solar electricity system. In November 2014, PowerStream announced that a new high-speed charging station at its head office would be made publicly available to EV owners at no cost. This unit will charge EVs for free in less than 30 minutes, and will serve the roughly 300 EVs currently owned in the utility's service territory¹⁶.

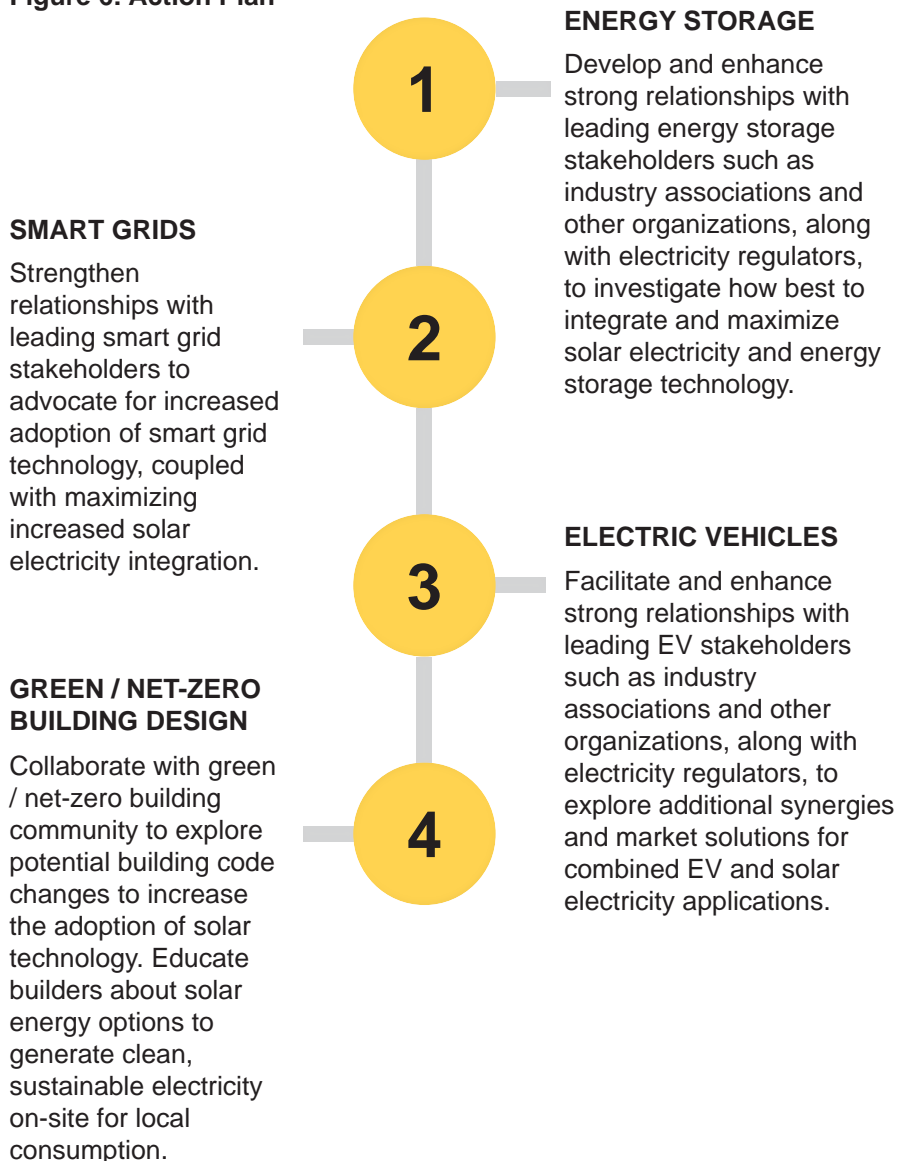
PowerStream, a leading Canadian utility example, is demonstrating how collaboration, innovation and public participation can work seamlessly to advance solar electricity integration with other complementary and enabling technologies.

The CanSIA Roadmap 2020 Solution

Solar electricity technology, coupled with other emerging technology and application enablers, have the potential to be 'game changers' and to completely revolutionize the energy system. To reach this grand vision, CanSIA and solar electricity industry participants will build synergistic relationships with leading stakeholders involved in the enabling technology and application sectors identified. This will enable solar electricity to maximize the value it can provide consumers, investors, and society as a whole.

CanSIA's *Roadmap 2020* action plan to develop these synergistic and enabling relationships is summarized in Figure 6.

Figure 6: Action Plan





Conclusion

Solar electricity is a proven and reliable source of energy today, while at the same time having the potential to be a 'game changer' and completely revolutionize the energy system tomorrow.

It is apparent that Canada's solar electricity sector is a complex yet very promising one. On the one hand, solar electricity has many appealing attributes. Canadians love solar as it is abundant, clean, creates jobs, and is the fastest growing energy source in the world. Furthermore, Canada has developed an emerging solar industry and market place which has put Canada on the global solar map. The sector has seen rapid growth and now boasts world-class leaders in manufacturing, technology and

in developing and building solar electricity projects.

On the other hand, there are barriers that must be overcome before Canada can benefit fully from the potential that solar electricity offers. However, the barriers are not insurmountable. For each there are practical, workable solutions—from creating a more supportive and stable policy and regulatory environment to educating Canadians about the value of solar electricity.

Canadians are making the transition from consumers to prosumers, and it is clear that solar electricity is the smart choice for Canada's electricity future. As industry, governments and other stakeholders work increasingly

together to realize the potential of solar as a viable, cost effective and sustainable choice for Canada's energy mix, it will become the natural choice for individuals and businesses alike.

Roadmap 2020 provides the pathway to solidify solar electricity as a mainstream energy source and an integral part of Canada's diversified electricity mix. This objective will not happen of its own accord by 2020. To realize this vision, solar industry participants and key stakeholders all have important roles to play.

If we work together, we will not only power Canada's electricity future with solar energy, we will create a country, and a world, that future generations will be proud to call home.

GLOSSARY



TERMS	DESCRIPTION
Distributed solar	Solar energy produced at or near the location that it is consumed.
Feed-in-Tariff	A Feed-in-Tariff (FIT) is a policy mechanism that promotes renewable energy investments. FITs are created and regulated by government. FITs consist of long-term agreements between electricity producers and the local or national electricity utility whereby the producer receives fixed payments in exchange for the energy they produce and feed into the power grid.
Net billing	Allows producers of solar energy to use the power they generated and sell the excess energy. The excess energy is sold to the utility company.
Net metering	A method of compensating electricity consumers who use electricity produced by their solar electricity system over a certain period of time. The compensation is typically a credit on the consumer's electricity bill.
Net zero building	A building that creates as much energy on site as it consumes on an annual basis (also known as a zero-energy building, zero net energy building, etc.).
Pay all, buy all	Consumers who produce their own energy are paid for all the energy they produce, regardless of whether they used it or fed it into the grid. The consumer then pays for all energy they consumed, regardless of the source.
Peak shaving	Reducing electrical power consumption during periods of maximum demand on the power grid.
Solar cost competitiveness	Solar produces electricity at or near the same levelized cost of electricity as other generation sources.
Utility scale solar	Large-scale solar production that is sold to wholesale utility buyers rather than end-consumers.



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