

Solar Vision 2025

Canadian Solar Industries Association



Solar Vision 2025: Beyond Market Competitiveness

December 2010



Who we are: CanSIA is a national trade association that represents approximately 650 solar energy companies throughout Canada. Since 1992, CanSIA has worked to develop a strong, efficient, ethical and professional Canadian solar energy industry with capacity to provide innovative solar energy solutions and to play a major role in the global transition to a sustainable, clean-energy future.

What we see: By 2025, solar energy is widely deployed throughout Canada, having already achieved market competitiveness that removes the need for government incentives, and is recognized as an established component of Canada's energy mix. The solar industry will be supporting more than 35,000 jobs in the economy and displacing 15 to 31 million tonnes of greenhouse gas emissions per year, providing a safer, cleaner environment for generations to come.



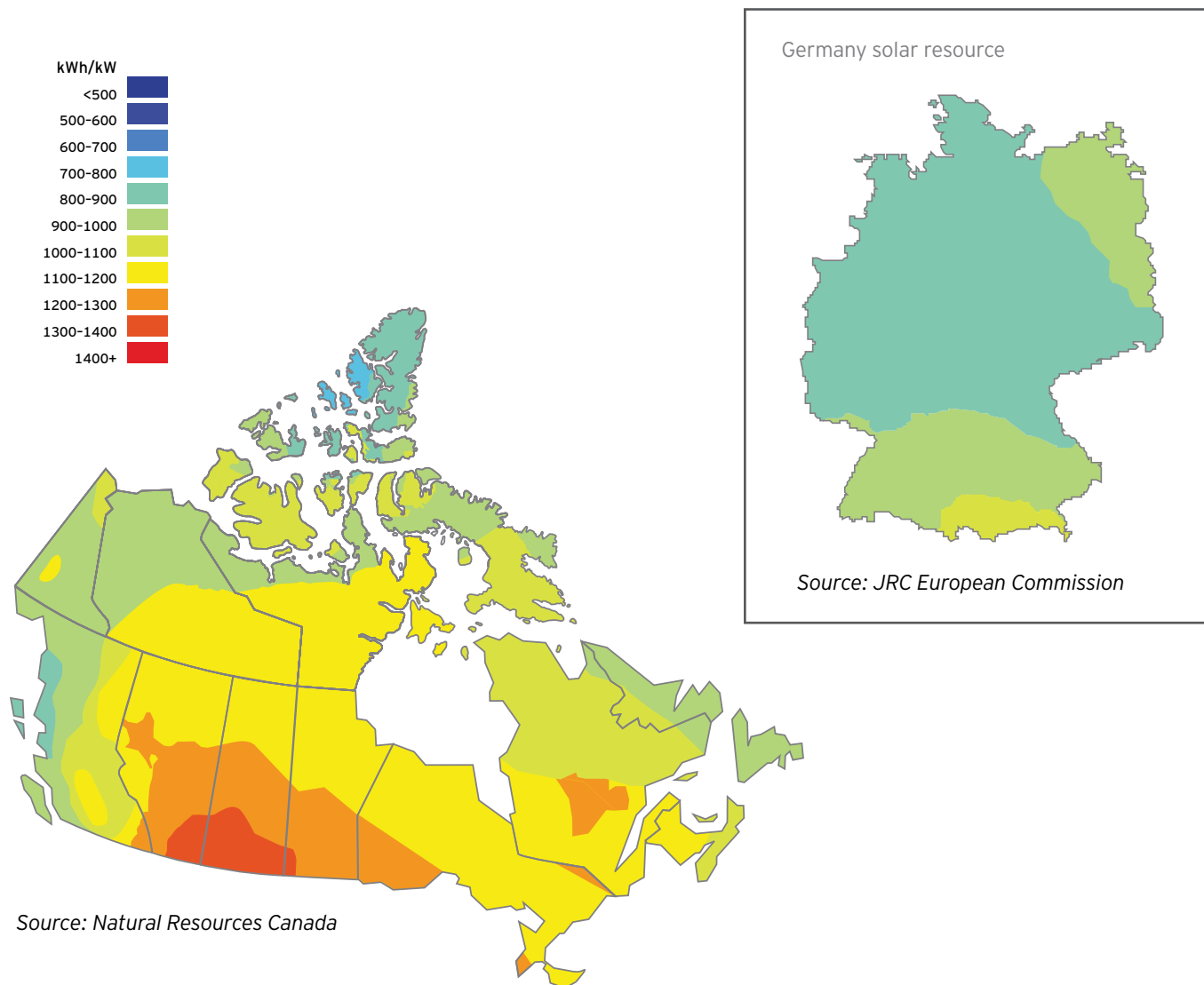


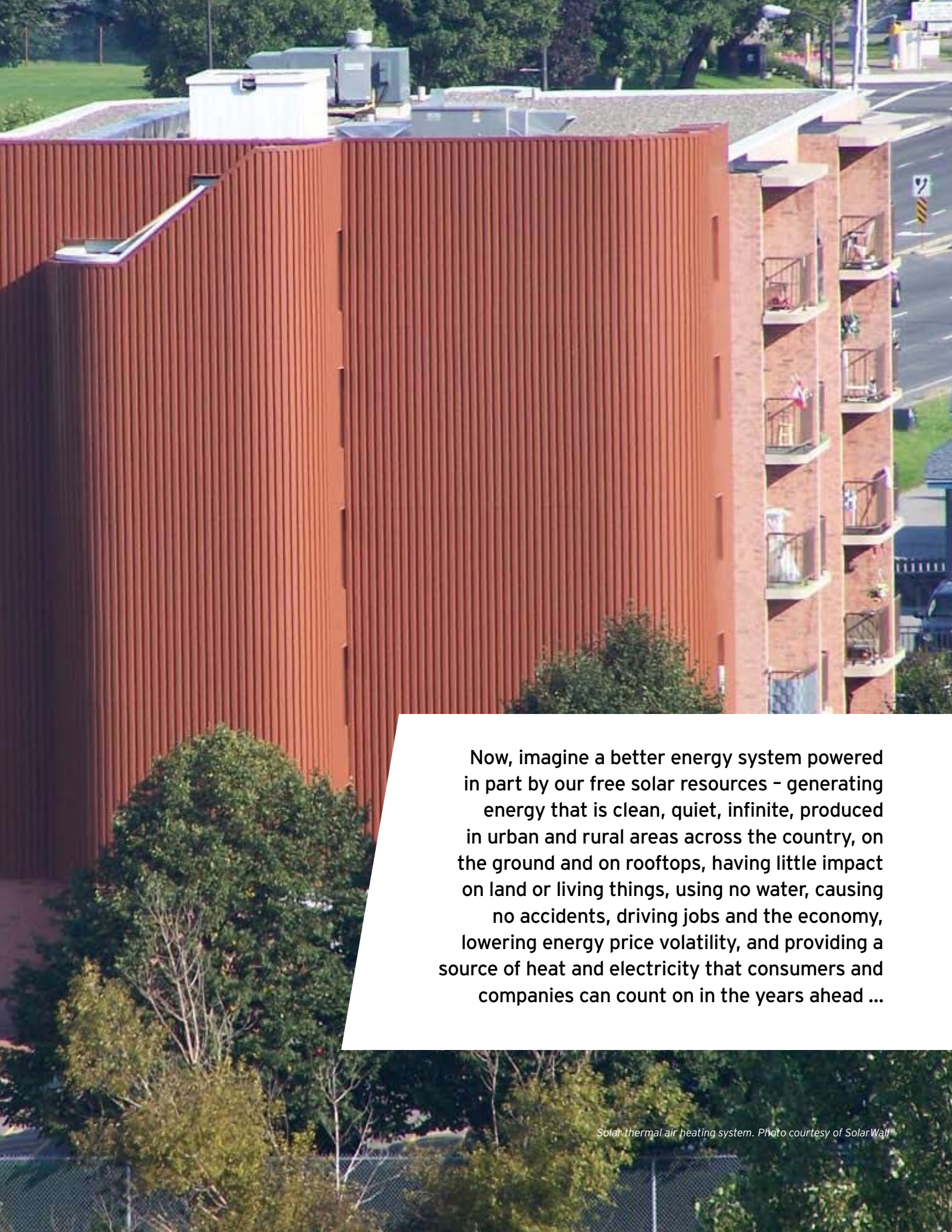
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Our Solar Resources Opportunity

Germany has the highest level of solar PV installations of any market in the world, with current installed capacity of 9.6 gigawatts, roughly 145 times Canada's current capacity. As well, Germany has considerable solar thermal capacity. The graphics below show that much of Canada has superior solar resources to Germany - an indication of the phenomenal potential of our solar industry.





Now, imagine a better energy system powered in part by our free solar resources - generating energy that is clean, quiet, infinite, produced in urban and rural areas across the country, on the ground and on rooftops, having little impact on land or living things, using no water, causing no accidents, driving jobs and the economy, lowering energy price volatility, and providing a source of heat and electricity that consumers and companies can count on in the years ahead ...

Solar thermal air heating system. Photo courtesy of SolarWall



Photo courtesy of SunEdison

Solar Vision 2025: Beyond Market Competitiveness

Our vision is a strong, responsive and diversified solar industry in Canada, which delivers high-value energy solutions as Canadian-developed solar products and services achieve market competitiveness on a global scale, requiring no government incentives.

Solar Benefits to Canada

- ▶ Drives economic and industrial development, generating domestic and export revenues while enhancing Canada's global reputation as an energy superpower
- ▶ Creates more jobs per megawatt output and per dollar invested than any other energy source¹
- ▶ Supplies energy during periods of peak demand at the place of demand
- ▶ Generates environmentally benign energy that is clean, carbon-free and renewable
- ▶ Provides long-term energy security from a free source (the sun!), lowering market risk and price volatility

What's Needed to Realize the Vision

- ▶ Solar energy industries to accelerate progress in increasing efficiencies, building scale and driving down the cost of solar through innovation
- ▶ Stable government policies and programs to provide certainty for investors and other stakeholders in the near term
- ▶ New initiatives to promote rapid adoption of solar products, including changes to building codes, interconnection and procurement policies
- ▶ A collaborative effort among stakeholders to take solar energy to the next level, incorporating solar into houses, buildings and other infrastructure
- ▶ Education, training and certification programs to meet demand for new "clean energy" skills, and promote better understanding of energy issues and opportunities

Letter from the President

We've reached a pivotal point in the development of Canada's solar industry - a time filled with boundless opportunity and coupled with uncertainty as global energy policies and markets evolve and shift.

Canada's solar industry has made remarkable gains in its relatively short history, working from the ground up. While our members' individual successes have hastened growth in solar energy in recent years, the pace is still too slow in global terms and our efforts too disjointed, reducing our effectiveness. If the Canadian solar industry is to build on our achievements and compete globally - with all the associated benefits flowing to Canadians - we must continue to increase collaboration among stakeholders.

Let's make solar energy mainstream and make it market competitive faster. The world is experiencing significant economic, energy and climate change challenges, and we know solar energy is part of the solution. Let's inspire new ways of working together to solve these challenges.

Governments throughout Canada need to continue working cooperatively toward common strategic goals for the country. As an industry, we need to work with architects, building owners, industrial process managers, builders, real estate income trusts, lawyers and financiers - along with our renewable energy counterparts - to share best practices, design integrated solutions and drive efficiencies for all. A grander scheme would see the global solar industry remove trade barriers and keep markets open to meet the growing need for green energy, ensuring broad-based investment and success.

No doubt, our industry will continue to encounter challenges in addition to new opportunities as we move toward our solar vision of creating energy solutions, increasing productivity and ultimately achieving market competitiveness on a global scale. CanSIA encourages all stakeholders to keep their eyes on the horizon - and to focus on what's possible as we work together to extend the benefits of solar energy across Canada and around the world.

Elizabeth A. McDonald

President
Canadian Solar Industries Association

Let's inspire new ways of working together to solve energy, economic and climate change challenges and achieve strategic goals for Canada - we know solar energy is part of the solution



Policy stability and continued government investment are critical as solar energy accelerates towards market competitiveness while creating the jobs and industries of the future

Photo courtesy of EDF EN Canada

Letter from CanSIA's Board of Directors

Thanks to the resiliency of our solar industry and strong support from government, solar energy is gaining a foothold in many parts of Canada.

Canada has demonstrated solar leadership in recent years. In solar thermal, the country stands as the world leader for solar hot air technologies and we continue to grow our solar hot water sector.

We appreciate the support the federal government has provided to this industry through its ecoENERGY programs, which have stimulated market activity by providing financial incentives for homes

and businesses to install solar thermal technologies. The program has proved to be cost effective, enabling thousands of Canadians to lower their monthly energy costs while significantly reducing carbon emissions.

We also congratulate Ontario for being recognized globally as a leader in catalyzing the development of solar photovoltaic (PV) energy with its Feed-in Tariff (FIT) program. Solar PV installed capacity is expected to exceed 200 MWp by Q1 2011, representing impressive growth over the past few years. The

program is already paying dividends in terms of jobs and new manufacturing opportunities. And we applaud other provinces, territories and cities that are pursuing their own strategies for bringing clean, renewable alternatives into their energy generation mixes with the support of their governments.

As Canadians, we need to recognize the full potential of solar to meet our growing energy needs, create the jobs

and industries of the future, and fulfil our environmental obligations to future generations.

With the strong support and commitment of all levels of government and stakeholders, our solar industry can build on our successes to date and ultimately reach our vision of contributing solar energy that is market competitive, helping to create a brighter energy picture for Canada.

David Eisenbud
Chair
Canadian Solar Industries Association

Jon W. Kieran
Vice-Chair
Canadian Solar Industries Association



Photo courtesy of EDF EN Canada



Photo courtesy of Ottawa Solar Power

Executive Summary

Canada has built a global reputation as an energy superpower, based on abundant traditional energy resources, an export-oriented industrial sector and first-class research facilities. But while it's easy to take these strengths for granted, a whole new set of factors is driving the global energy industry in different directions. These trends are creating new risks and new opportunities for Canada, as detailed in *The Case for Solar* on page 15.

Rising demand for energy, together with the cost of replacing the country's aging generation facilities, gives Canada the opportunity to push forward with renewable energy to help create a stronger, more diversified and modern energy system. CanSIA believes that solar energy, generating both electricity and heat, will play a key role in meeting this objective.

What is "market competitiveness"?

In the solar industry, market competitiveness is commonly referred to as "grid parity." For solar PV, it is the point at which generation costs become competitive with other sources of power. For solar thermal, parity is achieved when generation costs match the costs of delivering heating from natural gas fired equipment.

Canada has been recognized by the International Energy Agency for taking a “major step toward developing a competitive, strong Canadian solar industry.”³

Beyond market competitiveness

Our vision focuses on creating high-quality energy solutions as we achieve and move beyond market competitiveness. As an emerging industry, Canada's solar industry requires strong policy support through its development stage. This support is especially important, given that we are competing with a heavily subsidized fossil fuel industry. Consider that in 2009, on a global basis, renewable energy received \$1 in government support for every \$5 to \$6 given to conventional energy.²

We recognize that our reliance on government incentives in the near term creates risk for the industry, but also the opportunity to drive innovation into product design and development, industrial processes and project execution to bring down the cost of solar. And we're making great strides on this front. The need for production incentives will decline in the coming years, as we become self-sufficient and financially sustainable.

Recent studies suggest solar PV will be market competitive within the decade. Canada's solar industry will take a leadership role in accelerating this positive global trend.

Bringing down the cost of solar

The facts show that Canada's solar industry is moving rapidly along the path to becoming market competitive:

- Our capital costs and project development costs are falling, with costs of solar photovoltaic (PV) projects forecast to drop by more than 50% by 2025. The cost of solar PV generation is expected to decline from the current range of \$300 to \$410 per megawatt-hour (MWh) to a range of \$146 to \$200 MWh.
- Already, the cost of solar PV and solar thermal is competitive at peak demand times.
- Despite a weak global economy, our markets have grown rapidly in response to higher demand for our products and services. Our solar PV sector installed 62 megawatts-peak (MW_p) in new annual capacity in 2009, up seven-fold over 2008. From 2000 to 2009, our solar thermal sector expanded at a compound annual growth rate of 20%, to approximately 260 megawatts-thermal (MW_{th}) from 20 MW_{th}.
- The industry is creating new, high-technology jobs. To date, some 3,000 solar positions have been established in Canada.^{9, 26}

Peak energy a competitive advantage

In fact, the sun's ability to generate energy when it's needed most (and when it is most expensive) – during the day – is what makes solar energy unique and particularly attractive. As a result, it not only reduces reliance on expensive conventional sources of energy to meet peak demand, but also the need to maintain and carry the costs of backup power like natural gas “peaking” plants. Additional cost savings are realized because solar energy is consumed where it is produced – individual buildings can generate heat or electricity from a rooftop or wall-mounted application.

Just as the costs of solar are coming down, wholesale power prices are forecast to rise. Upward pressure on power prices is being driven by a number of factors, including the rising long-term costs of fossil fuels and the costs of upgrading our electricity grids and aging energy generation facilities. The market competitiveness of solar energy will only accelerate when the cost of carbon is reflected in the price of fossil fuels.

Independent studies suggest that Canada will be market competitive within the decade. One study by the Boston Consulting Group concludes solar photovoltaic energy could be market competitive on a global basis by 2020.⁴ Within the U.S., “solar is already cost competitive in some states today and will be in many more in coming years as energy prices increase nationwide.”⁵ Canada's solar industry will take a leadership role in accelerating this positive global trend toward market competitiveness.



Photo courtesy of SkyPower Limited

Our Solar Vision

Within this context, we are pleased to present Solar Vision 2025. The report sets out our vision to be a strong, responsive and diversified solar industry in Canada, which delivers high-value energy solutions as Canadian-developed solar products and services achieve market competitiveness on a global scale, requiring no government incentives. It identifies specific targets for the industry and each of the two sectors, based on a range of estimates, while also providing the roadmap to reach our goals. For the industry as a whole, our target is:

By 2025, solar energy is widely deployed throughout Canada, having already achieved market competitiveness that removes the need for government incentives, and is recognized as an established component of Canada's energy mix. The solar industry will be supporting more than 35,000 jobs in the economy and displacing 15 to 31 million tonnes of greenhouse gas emissions per year, providing a safer, cleaner environment for generations to come.

The Canadian Solar Industries Association (CanSIA) is inviting all stakeholders in the solar industry and beyond to come together with their collective enthusiasm, entrepreneurship and ingenuity to drive our industry in Canada toward a new energy paradigm.

With a better understanding of the factors affecting Canada's energy future and awareness of the near certainty that solar energy will become market competitive, CanSIA is confident that more and more Canadians will see the promise of solar energy as a clean, sustainable source of heat and electricity.

Together, we can create the jobs and industries of the future, ensure Canada's continued energy security in the years ahead, and solidify our global reputation as an energy superpower.

Solar Vision 2025 has been developed with assistance from the Ernst & Young team of Renewable Energy professionals. The employment models and analysis were carried out on behalf of CanSIA by Kelly Sears Consulting Group. This document will serve as the framework for regular updates on the path to our vision.

The Benefits of Solar

The sun is the most powerful source of energy on earth, and Canada is fortunate to have a lot of it. Although our winters are cold, the sun is usually shining. Many of the products generating solar energy actually work more efficiently in colder climates like ours.

The Canadian Solar Industries Association, with its approximately 650 members, is capitalizing on the potential of our solar resources.

Economic competitiveness

We view solar, other renewable energy and energy conservation as a strong driver that will bolster Canada's economic competitiveness, ensure a reliable supply of energy and enhance our global reputation as an energy superpower.

Job creation

Solar energy creates more jobs per megawatt output and per dollar invested than any other energy source.¹ Importantly, many of these jobs will be widely distributed in small and medium-sized businesses in communities across the country - providing far-reaching economic spinoffs to Canadians.

Peak energy needs

Solar generation provides energy during the day, when demand is highest, making solar a fuel-free source of peak power. As such, it reduces the need to invest in new capacity to meet a relatively short peak-load period.

Clean, green energy

Solar energy also provides environmental benefits. Not only is it infinitely renewable, but it emits no climate-changing greenhouse gases. As well, solar energy creates no air or water pollution, has little impact on land, wildlife or ecosystems, and leaves no hazardous waste.

Cost effectiveness

While the fuel supply is free and the operating costs of solar technologies are generally low, the capital cost of systems is relatively high. However, as a result of technological advancements and improving economies of scale, costs are trending downward - facilitating the solar industry's transition to market competitiveness. When comparing the costs of solar photovoltaic or solar thermal energy at peak-supply times, they can compare favourably to conventional peak-generation costs.

In summary, it's easy to see that distributed energies like solar offer impressive competitive advantages in various energy markets, with very little downside. With increased support from stakeholders, and continued research and development, the industry is well positioned to contribute to Canada's strategic energy and economic objectives, while meeting the diverse needs of consumers.

Photo courtesy of Day4 Energy



What is "distributed energy"?

Distributed energy is energy generated from many small sources of energy, close to where it is needed, as opposed to a centralized energy system based on large coal, natural gas or nuclear facilities. Among the key benefits, distributed energy reduces the size and number of power lines needed, as well as the cost of energy lost during transmission. Solar and other renewables are distributed energies.

Introducing our two solar sectors

Today's solar technologies focus on the generation of heat and electricity directly from the sun. Currently, solar photovoltaic (PV) energy generates electricity while solar thermal heats water or air.

Solar photovoltaic

Solar PV is used primarily for grid-connected electricity to operate residential appliances, commercial equipment, lighting and air conditioning for all types of buildings. Through stand-alone systems and the use of batteries, it is also well suited for remote regions where there is no electricity source. Solar PV panels can be ground mounted, installed on building rooftops or designed into building materials at the point of manufacturing. The future will see everyday objects such as clothing, the rooftops of cars and even roads themselves turned into power-generating solar collectors.



Photos courtesy of Enerworks

Solar thermal

Solar thermal technologies are used to meet growing demand for energy-efficient space heating and cooling, and hot water systems within residential, commercial, institutional and industrial buildings. Looking ahead, there is significant opportunity to use solar thermal to enhance industrial processes and drive innovative product development and economies of scale to the benefit of all sectors. In the future, solar thermal technologies will be used to store the sun's heat for use at night or on a rainy day.



Both types of energy can be retrofitted for buildings, and used on or off the grid. The decentralized nature of solar energy not only contributes to rural or non-urban energy solutions, but also reduces the risk of a centralized facility going down. Because these technologies are modular, they allow for rapid expansion and innovative project development.

As well, they can be owned by any size of stakeholder, with the opportunity to increase the value of land or buildings and enjoy long-term energy savings.



The Case for Solar

Canada is facing significant energy issues and opportunities in the coming years as the global economy continues to evolve and shift in new directions. CanSIA members are confident that solar energy will play a key role in turning these issues and opportunities to Canada's advantage.

Our vision is a strong, responsive and diversified solar industry in Canada, which delivers high-value energy solutions as Canadian-developed solar products and services achieve market competitiveness on a global scale.

Outlined on the following pages are key arguments supporting the accelerated development of solar energy as our products and services become cost competitive with conventional energy sources.



Photo courtesy of Ottawa Solar Power

Solar industry becoming market competitive

Canada's solar industry is making solid progress toward its vision of market competitiveness as it continues to ramp up solar installations and bring down costs, and as traditional energy prices continue to increase. Through innovation, we are driving economic development and jobs, while also displacing greenhouse gases produced by fossil fuels. Our target for the industry is:

By 2025, solar energy is widely deployed throughout Canada, having already achieved market competitiveness that removes the need for government incentives, and is recognized as an established component of Canada's energy mix. The solar industry will be supporting more than 35,000 jobs in the economy and displacing 15 to 31 million tonnes of greenhouse gas emissions per year, providing a safer, cleaner environment for generations to come.

Our confidence in achieving market competitiveness is supported by recent international studies indicating that solar photovoltaic will be competitive within the decade:

- ▶ The Boston Consulting Group concludes solar PV energy could be market competitive on a global basis by 2020.⁴
- ▶ Even in 2008, solar energy was already cost competitive in some states, with the U.S. Energy Department predicting it would be cost competitive in many more states in coming years as energy prices increase nationwide.⁵
- ▶ The German Solar Industry Association expects the first non-subsidized installations in households in Germany to be feasible by 2017.⁶

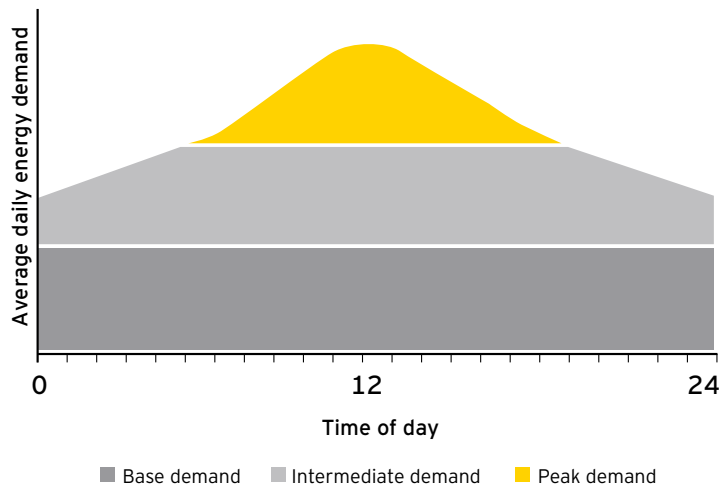
With Canada's energy mix still exposed to the rising and more volatile prices of conventional fuel sources, and solar prices continuing to fall, our solar industry is well positioned to reach market parity faster than other countries.

"Today's solar systems for industrial and office properties offset roughly 10% of the total energy needs of the property. However, it is important to note that the peak power production from a solar array (produced between 11 a.m. and 6 p.m.) offsets up to 40% of the power burden during the most critical time of day for the overall energy grid. This is where we really start to see the difference solar makes."⁷

Meeting peak energy needs

Perhaps the greatest advantage of solar energy is that it is generated during the day, when demand for energy is highest, as illustrated in the graph below. Peak power is also the most expensive energy, as additional sources of energy (often generated by fossil fuels) must be available on short notice to meet demand for short periods.

Both solar photovoltaic and solar thermal technologies provide peak energy and help utilities match supply with demand. Electricity from solar PV generation reduces reliance on fuel-cost-sensitive natural gas used for peak periods.



Demand level	Technologies employed to meet demand
Peak	Solar, natural gas (combustion), oil
Intermediate	Hydro, natural gas (combined cycle), wind, tidal
Base	Hydro, biomass, geothermal, nuclear, coal

Source: CanSIA

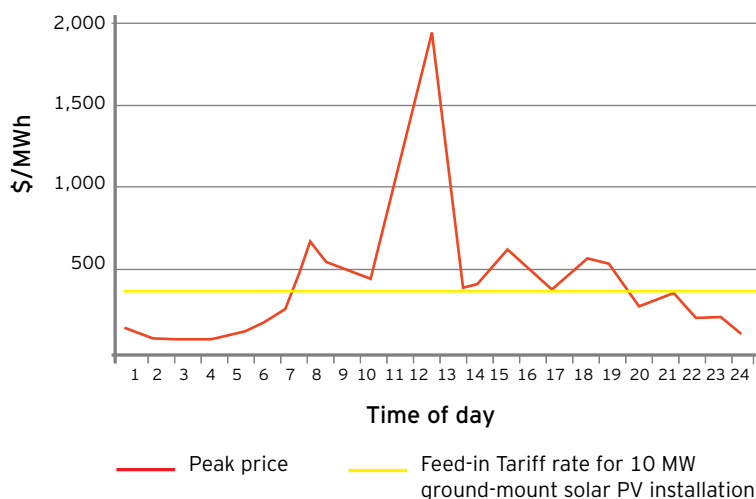
Solar PV is price competitive at peak periods

The ability of solar to provide energy at the most expensive times of day, at a known cost, greatly enhances the industry's market competitiveness.

Solar PV provides a competitive price for peak power when compared to other forms of electricity-generating plants. As an example, the graph to the right uses Ontario's Hourly Energy Price to show an average of the highest costs (representing the costs of plants used to meet peak demand) recorded hourly over the data period.

From 2006 to October 2010, the daytime cost range (between 11 a.m. and 6 p.m.) of \$292/MWh to \$1,891/MWh for conventional electricity-generating plants compared favourably with Ontario's Feed-in Tariff range of \$443/MWh to \$802/MWh provided for solar PV projects.

Implied peak electricity cost in Ontario (2006-2010)



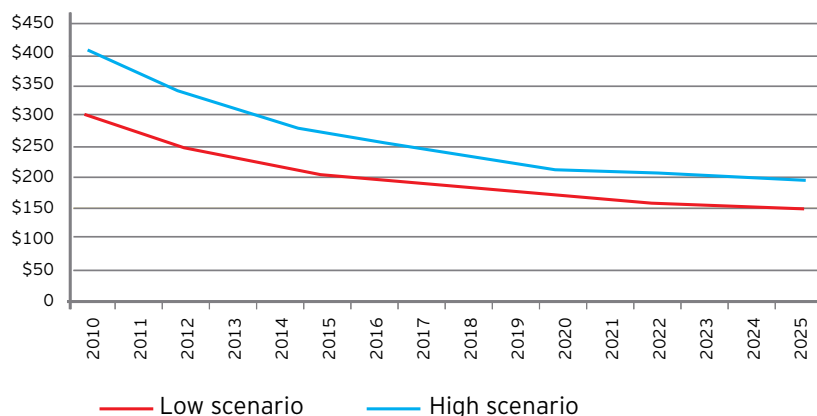
Source: Ernst & Young analysis of IESO data

Cost of solar energy is falling

Prices continue to fall as both the solar PV and solar thermal sectors strive to reduce the initial capital cost requirements and project development costs in their goal to become wholesale market competitive. The cost of solar PV modules has fallen by 30% since 2005⁸ and is estimated to drop 20% with each doubling of global solar capacity.

In fact, the highest potential cost reduction among renewable energies is solar PV, which is expected to fall another 55% by 2025.

Solar PV generation cost (\$/MWh)



Source: Ernst & Young

Opportunity to drive economic development

With the increasing shift of manufacturing and labour-intensive process activities to Asia, Canada needs to develop globally leading products and services that add value. Solar energy offers significant potential to create these products and services.

Already, the solar industry is driving economic and industrial development in Canada, and generating domestic and export revenues. For example, the solar thermal industry alone generated \$5 million in exports in 2009 through 29 MW_{th} of export sales.⁹ Solar energy not only creates new-economy businesses, but can also help leading businesses across all industries to become more competitive globally through better energy management.

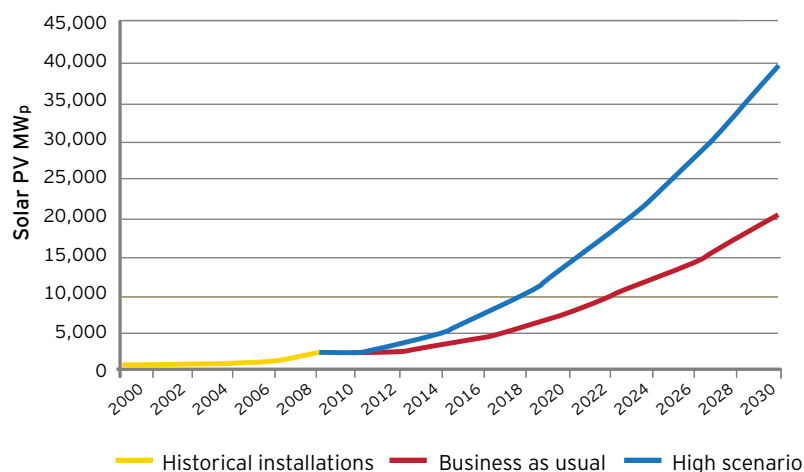
Significant export potential

The economic benefits of solar energy extend beyond our borders. Solar energy creates significant export potential as other countries develop green electricity and green heating strategies. Solar energy provides the opportunity to reduce domestic consumption of electricity and natural gas, and increase exports and national income.

A new report estimates the U.S. market for solar PV and solar thermal generation will grow 42% annually to reach 44 GW by 2020, and require \$100 billion of investment.¹⁰ This represents a tremendous opportunity for Canadian businesses to export innovative solar products and services.

A more conservative view from the U.S. Energy Information Administration (EIA) estimates that solar PV installed capacity could grow to between 19 GW_p and 39 GW_p by 2030.¹¹ At a minimum, this would create a US\$87 billion market (based on current project costs) in which Canadian businesses could create a role for themselves. The U.S. Department of Energy's "Perspectives on U.S. Solar Market Trajectory" document indicates the potential of the U.S. market in the chart below.

Forecast US solar PV installations (MW_p)



Source: EIA, Annual Energy Outlook 2009, March 2009

Job creation

Whether through technological design, industrial process or project execution, Canada has the skills and experience to create a strong solar industry and employment, and to access important export markets for our solar products and services.

Solar energy creates more jobs per megawatt output and per dollar invested than any other energy source.¹ In terms of potential for our two sectors:

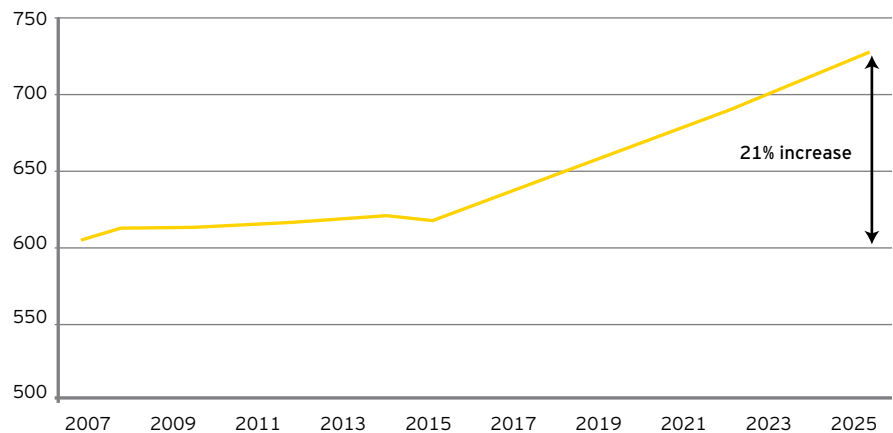
- Currently, each MW of newly installed solar PV capacity requires approximately 44 jobs.¹² By 2025, worldwide employment in solar PV is expected to reach between 2.5 million and 5.3 million. CanSIA predicts that under optimal conditions, the sector in Canada could employ up to 41,000 people by 2025, excluding the job potential created by export markets estimated at an additional 20% to 30%.
- Solar thermal is expected to grow rapidly over the next 15 to 20 years in Europe and North America. One study suggests the sector will provide more than 750,000 direct and indirect jobs in those markets by 2020.¹³ CanSIA projects the Canadian solar thermal sector could provide up to 6,400 jobs by 2025, plus the job potential of exports.

Because of its decentralized nature, solar energy creates local employment opportunities, both direct and indirect, in communities across Canada.

Escalating energy demand

Demand for heating and electricity is escalating. The International Energy Agency, for example, forecasts a 21% increase in electricity generation in Canada by 2025, a compound annual growth rate of 1%. CanSIA sees solar energy as a key solution in meeting this gap. The simple technology and flexible modular nature of solar PV and solar thermal assets allow for swift installations and expansion.

Forecast total net electricity generation in Canada (TWh)



Source: International Energy Agency

Upgrading current energy infrastructure

Our energy sector is currently operating with an outdated power grid, insufficient generation reserves and general wastefulness.¹⁴ It's clear we have no choice but to make investments, as the opportunity costs of not investing now will likely be much higher in the future. This was illustrated by the 2003 power blackout in north-eastern U.S. and Ontario, which affected 50 million people and was estimated to cost between \$4 billion and \$10 billion.¹⁵

Transitioning towards a distributed energy system

Having our heat and electricity generated primarily through large centralized facilities like coal, natural gas or nuclear adds to the risk of a concentrated energy mix. Solar energy avoids the costs to an economy of a centralized generation facility going suddenly offline.

Decentralized generation like solar and other renewable energy sources is particularly well suited to serving the needs of a geographically diverse population like Canada's, often in smaller, remote communities. Solar energy can be deployed at facilities on or off the grid, in locations outside of urban centres. Extremely flexible, it can also be retrofitted to buildings and deployed on previously idle roof space or land. Because it is generated close to where it is consumed, solar energy also reduces transmission costs.

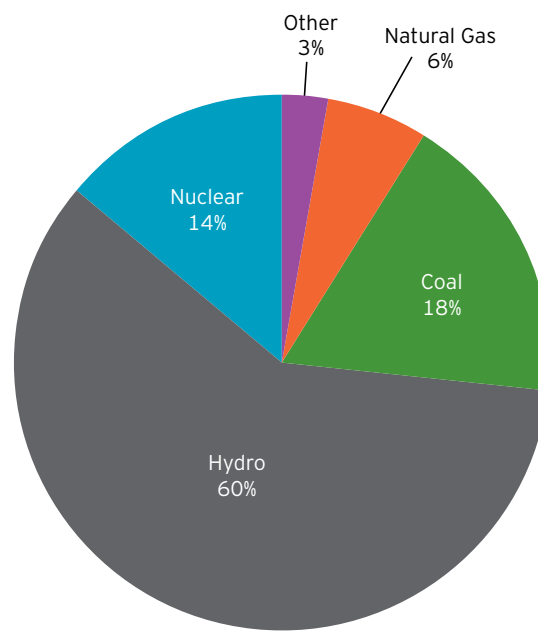
Diversifying Canada's energy portfolio

Canada and many of the provinces currently rely on one or two energy sources. This lack of diversification increases risk for our economies, much like an investment portfolio concentrated in one asset. Even large-scale hydro power, which makes up about 60% of Canada's electricity mix, is exposed to risks as a result of lower precipitation through changing weather patterns, for example.

Each province has a unique generation mix, based in part on available natural resources, growth in demand for energy, and historic political decisions. Both British Columbia and Québec source most of their electricity from hydro, while Ontario draws significant electricity from nuclear power. Alberta relies on conventional power from fossil fuel sources. Provinces relying on fossil fuels will be under increasing pressure to move to clean energy generation sources.

Solar energy provides the opportunity to diversify our energy generation mix with renewable energy delivered through a variety of products and services. By complementing generation from other energy sources, solar PV helps to even out energy supply and enhance the stability of the transmission grid.

Electricity generation in Canada (2007, 610 TWh)



Source: Natural Resources Canada¹⁶

Note: Percentages may not add up to 100% due to rounding.

Stabilizing price volatility of conventional energy commodities

The conventional energies within our current system are subject to extreme price volatility on global markets, as we have seen in recent years. Volatile energy supply prices reverberate throughout our economy, with potentially major impacts on businesses and consumers and increased uncertainty for the future. The recent price volatility at global gas centres such as the Henry Hub in the U.S. is seen in the chart below.

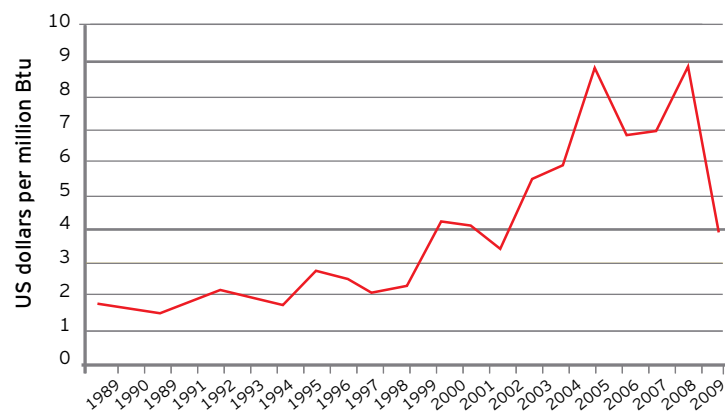
Solar energy can help protect Canada from the future price volatility of conventional energy costs. The future cost of solar energy is known, often over 20-year contracts, which helps to stabilize energy prices as part of a diversified energy system.

Clean and waste-free source of energy

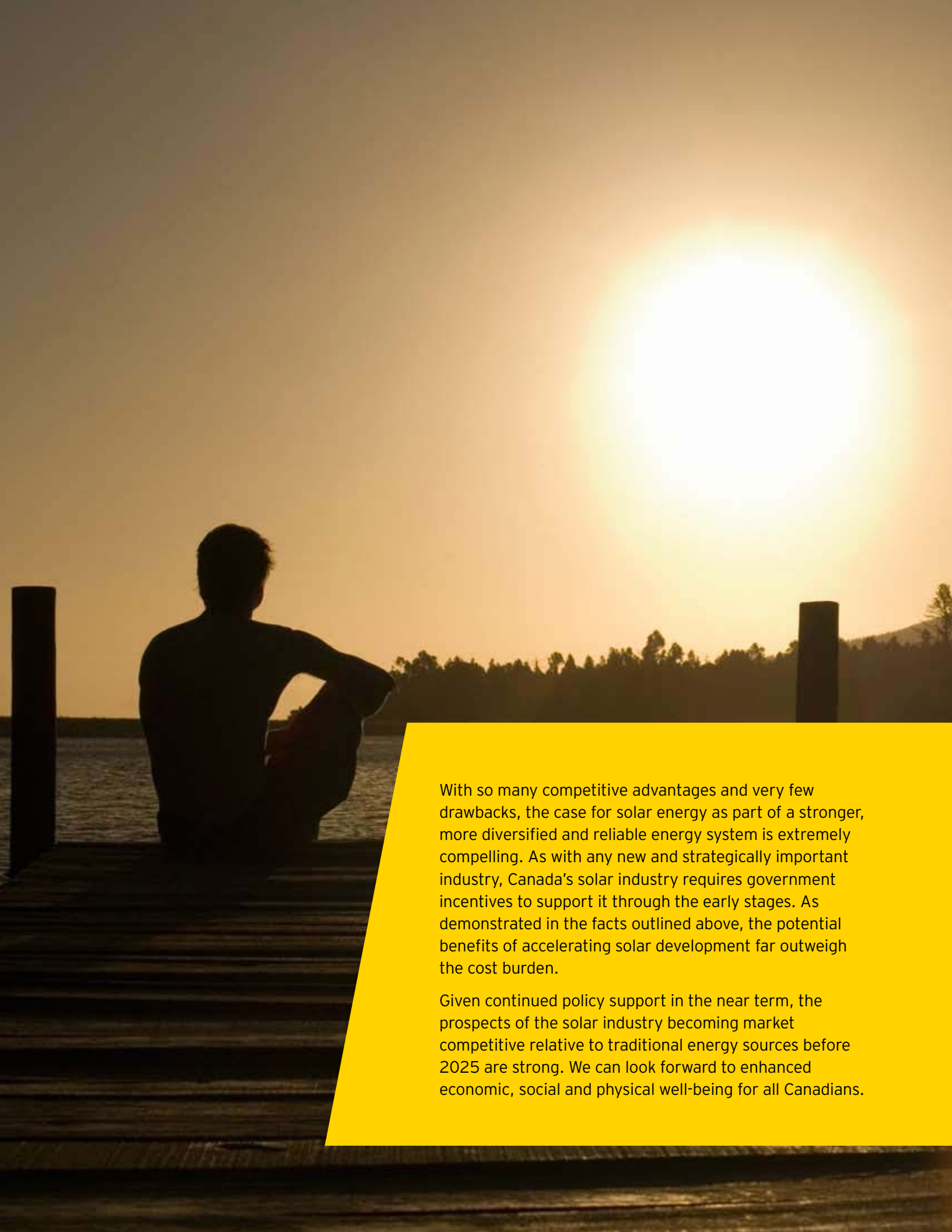
The sun offers immense potential to diversify our energy generation mix with a clean, renewable source of heat and electricity. Energy from solar generation is carbon free, making it a powerful tool to help Canada reduce its emissions, mitigate climate change and meet the growing need for energy-efficient and carbon-neutral buildings. In fact, accelerated solar generation could give Canada the opportunity to take a leadership role in the global discussion about climate change. Solar energy's cost competitiveness will be enhanced when the cost of carbon is reflected in conventional heat and electricity supplies.

Each megawatt hour of solar energy displaces between 0.3 and 0.6 tonnes of greenhouse gas emissions, depending on the province. In addition, solar energy creates no air or water pollution and has little impact on land or wildlife. The environmental benefits are instantaneous from the moment the project is activated.

Natural gas prices at Henry Hub



Source: BP Statistical Review of World Energy 2010



With so many competitive advantages and very few drawbacks, the case for solar energy as part of a stronger, more diversified and reliable energy system is extremely compelling. As with any new and strategically important industry, Canada's solar industry requires government incentives to support it through the early stages. As demonstrated in the facts outlined above, the potential benefits of accelerating solar development far outweigh the cost burden.

Given continued policy support in the near term, the prospects of the solar industry becoming market competitive relative to traditional energy sources before 2025 are strong. We can look forward to enhanced economic, social and physical well-being for all Canadians.

The Solar Photovoltaic Sector

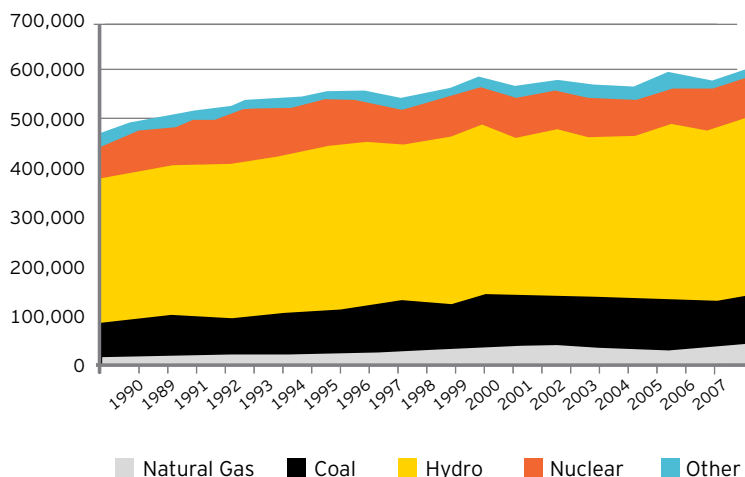


Setting the context

Solar photovoltaic (PV) is moving toward market competitiveness in Canada within our established electricity system. Solar PV modules produce electricity mainly for grid-connected electricity, but can also be used in stand-alone systems and integrated into building materials.

In Canada, electricity supply has increased by a compound annual growth rate of 1% from 1990 to 2007.³ Over this period, some of our generation from carbon-free sources has shifted towards fossil fuels, adding to the country's greenhouse gas emissions profile. Today, hydro power provides approximately 60% of our electricity needs, with the balance generated by coal (18%), nuclear (14%), natural gas (6%) and other sources (3%).¹⁶

Electricity generation in Canada (GWh)



From 1990 to 2007, electricity generation in Canada increased at a compound annual growth rate of 1%

Source: Natural Resources Canada¹⁶

Canada's generation mix and change over 17 years			
	1990	2007	Change
Natural Gas	2%	6%	+ 225%
Coal	16%	18%	+ 10%
Hydro	62%	60%	- 3%
Nuclear	16%	14%	- 15%
Other	4%	3%	- 33%

Source: Natural Resources Canada¹⁶

Note: Percentages may not add up to 100% due to rounding.

Canada has built an enviable position in the electricity market, allowing the export of surplus generation, primarily hydro and nuclear, to the U.S. In 2008, electricity exported was valued at \$3,788 million.¹⁷ This suggests that increased generation from clean energy sources like solar could reduce Canada's consumption of traditional electricity and increase exports and national income.

Solar PV 2025 target

While Canada has been fortunate to generate ample electricity to date, forecasts show that we will require 31 terawatt hours¹⁸ of additional electricity by 2025 from sources beyond coal, hydro, natural gas and nuclear. Given the global drivers for renewable energy, CanSIA is confident that solar PV will play an important role in bridging the forecast generation gap.

Globally, photovoltaic installations are growing exponentially, reflecting the suitability of solar PV to help meet national objectives for energy independence, energy security, and the decarbonization of the energy supply. From 2000 to 2009, global installations increased from 278 MW_p to 7,203 MW_p.¹⁹

In Canada, total installed PV capacity reached approximately 66 MW_p in 2009, with the on-grid market representing 87% of the total Canadian market. This was, in part, driven by Ontario's Renewable Energy Standard Offer Program enacted in 2006 (and replaced by the province's Feed-in Tariff program in 2009).

CanSIA believes the solar PV share of the required generation capacity could reach between 9 GW_p and 15 GW_p by 2025, based on a number of growth scenarios. For detailed calculations, please visit www.cansia.ca.

Scenario 1: Base case

CanSIA's solar PV base case scenario forecasts a continuation of current policies to 2015. In the period to 2015, current legislation is updated to gradually decrease support to solar PV as the sector reduces its cost base. Grid development moves ahead as planned, allowing new project development opportunities. Beyond 2015, solar PV is established in Canada, with a strong domestic industry and effective distributed generation legislation in place across Canada.

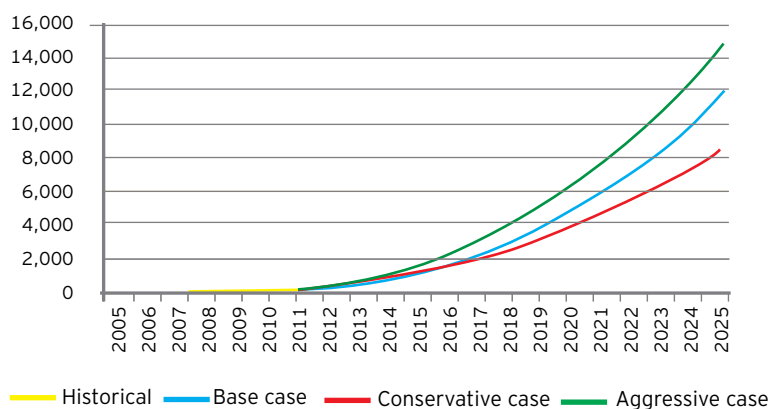
The base case scenario projects 33,000 full-time equivalent (FTE) positions could be created by 2025.

Scenario 2: Conservative case

CanSIA's solar PV conservative case scenario assumes that existing legislative support is maintained and government support is gradually reduced. However, new legislation to develop new markets is slow to materialize and growth continues at a reduced pace. Grid development is slower than expected, holding back new project development opportunities. Beyond 2015, solar PV is established in Canada, with an active domestic industry which has an important place in the global supply chain and market innovation.

The conservative case scenario projects 25,000 FTE positions could be created by 2025.

Historical and forecast cumulative solar PV installations (MW_p)



Source: CanSIA

Scenario 3: Aggressive case

CanSIA's solar PV aggressive case scenario assumes that existing legislative support is maintained and the solar PV industry meets and exceeds government objectives, prompting legislation that opens up new markets and creating a sustainable Canada-wide solar PV market. Grid development is accelerated, driven by a growing need to rehabilitate our network and to crystallize the benefits of a smart, distributed generation-based electricity grid. Beyond 2015, solar PV is a strategically important industry in Canada, driving innovation at a global level.

The aggressive case scenario projects 41,000 FTE positions could be created by 2025.

Scenario summary

For the solar PV sector, CanSIA has set a target of 12 GW_p in cumulative installations by 2025.

This projection indicates that 10 GW_p or 85% of installations to 2025 will be at market-competitive prices, requiring no government incentives. The target is driven by the sector's ability to maintain its current progress in reducing costs, by growing its markets and investing in research and development to bring down the costs of modules and project development.

	Base case		Conservative case		Aggressive case	
	2009	2025	2009	2025	2009	2025
Cumulative installations (MW _p)	95	11,796	95	8,871	95	14,721

Source: CanSIA

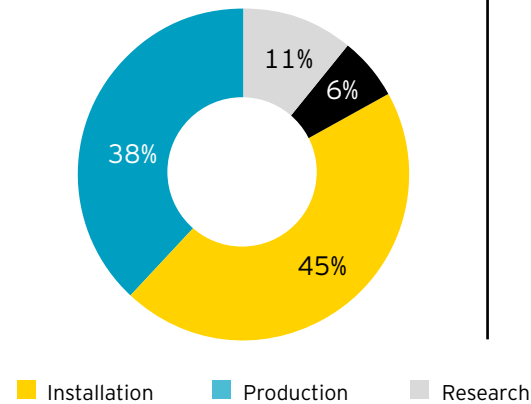
Employment

Based on a 2009 labour market survey carried out by CanSIA, the majority of employment in Canada's solar PV industry was in installation, followed by production and research and development. Looking to 2025, CanSIA forecasts that the majority of employment will remain in the installation sector.

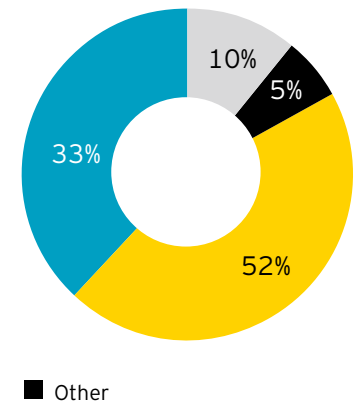
The growth in solar PV industry jobs, especially in the sales, installation, and service portion of the value chain, confirms a number of international views that development of solar energy sources "can actively contribute to job creation, predominantly among the small and medium-sized enterprises which are so central to the community economic fabric."²⁰ This is one reason why CanSIA believes public investment in solar PV energy programs makes economic sense.

The employment forecasts for 2025 outlined in the case scenarios above are based on growth expectations for Canada's own domestic markets. Given the export potential of Canadian-made solar PV goods, the number of jobs in the sector is expected to be considerably higher. CanSIA expects an additional 20% to 30% of the solar PV market is exported, and therefore Canada could enjoy considerably higher employment than forecast above.

Solar PV job categories (2008)



Solar PV job categories (2025)



Source: Kelly Sears Consulting Group

Generation costs

When compared to conventional and other renewable sources, one of the major challenges surrounding solar PV is the cost of generation. However, a prime advantage of solar PV is that it is generated during the day, when demand is highest and most expensive. When compared with current peak power costs (using Ontario as an example), solar PV proves to be market competitive.

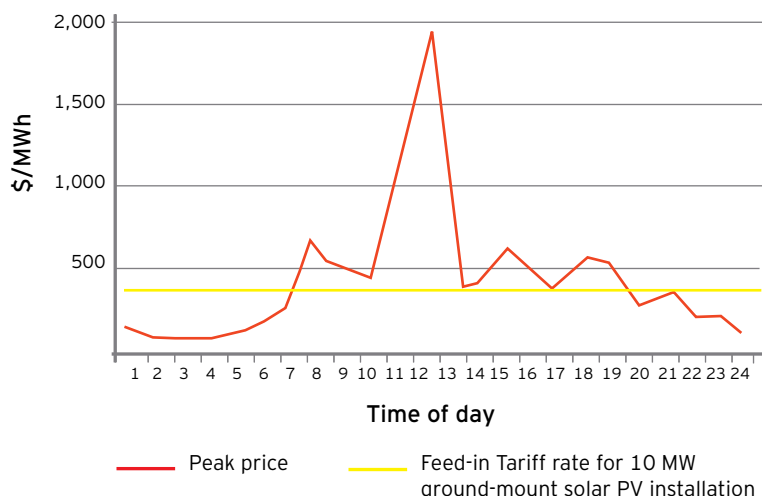
In addition, the generation costs do not reflect the many other benefits associated with solar PV and other renewable energy generation sources, including savings in transmission costs and improved air quality.

Coupled with innovative new manufacturing techniques, the solar PV sector continues to streamline its processes while working to build economies of scale and drive down costs. Global experience has shown that the price of solar PV is reduced by 20% each time there is a doubling of cumulative installed capacity.²¹

Looking forward over our vision period, the costs of solar PV are expected to decrease 55%, enhancing our competitiveness. Cost competitiveness will be further improved when the cost of carbon is reflected in conventional electricity supplies.

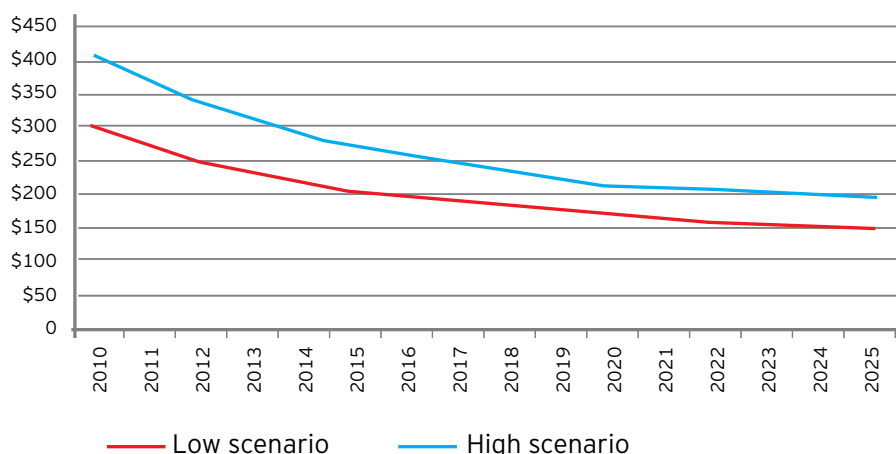
As Canada's solar PV market reaches competitiveness, solar businesses will be better able to compete with conventional energy in our country. Moreover, the sector can be expected to benefit from increased export demand, bringing export dollars back to Canada and helping to sustain the economy.

Implied peak electricity cost in Ontario (2006-2010)



Source: Ernst & Young analysis of IESO data

Solar PV generation cost (\$/MWh)



Source: Ernst & Young

The Solar Thermal Sector

Setting the context

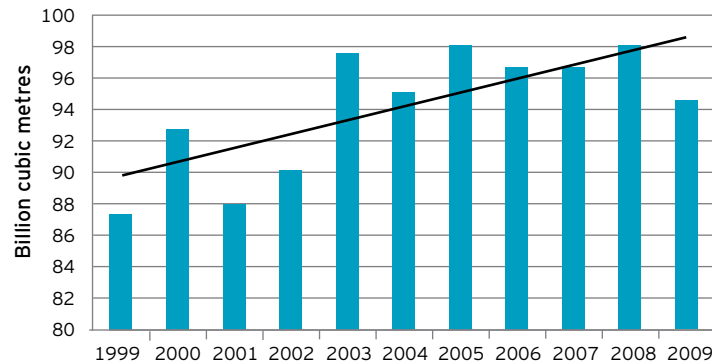
The global solar thermal market has been active and evolving since the 1970s and is now regarded as a relatively mature technology. Solar thermal technologies are used to heat water or air in residential, commercial, industrial and institutional buildings. In Canada, solar thermal is moving to market competitiveness in an industry dominated by natural gas in the provinces from British Columbia to Ontario, and by electricity from Québec to the Atlantic.

Three-quarters of natural gas production in Canada is from Alberta. British Columbia and Saskatchewan have the next highest production levels respectively. Nearly 66% of the natural gas extracted in Canada is exported to the U.S.²²

Since 1999, North American demand for natural gas has increased by nearly 10%. In Canada, demand has steadily increased from 1999 as shown in the graph to the right, with a decrease of 3.3%²³ from 2008 to 2009, due partly to a warmer-than-usual winter combined with the impact of the global recession.

The demand for natural gas in Canada is expected to increase nearly 33% by 2020,²⁴ driven primarily by industry expansion. Solar thermal hot water and hot air technologies present a significant opportunity to displace heat generation from large-scale energy-generation facilities. Solar thermal systems work in conjunction with existing electrical or natural gas heating infrastructure and reduce reliance on conventional heating sources, especially at peak demand times.

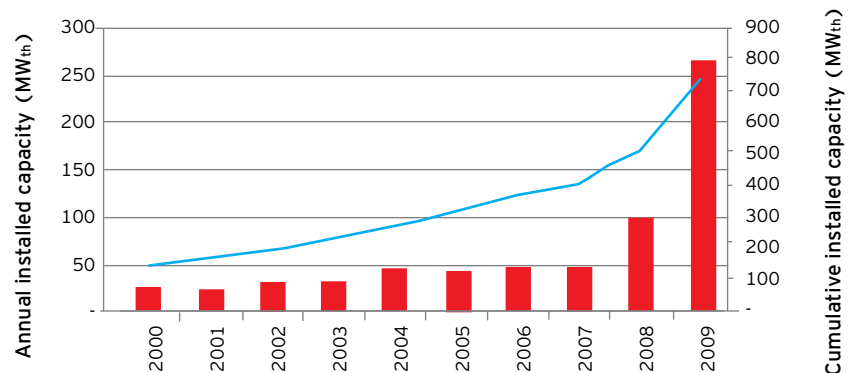
Historical natural gas demand in Canada



From 1999 to 2009, natural gas demand in Canada increased at a compound annual growth rate of 1%

Source: BP Statistical Review of World Energy 2010

Historical growth in Canadian solar thermal markets



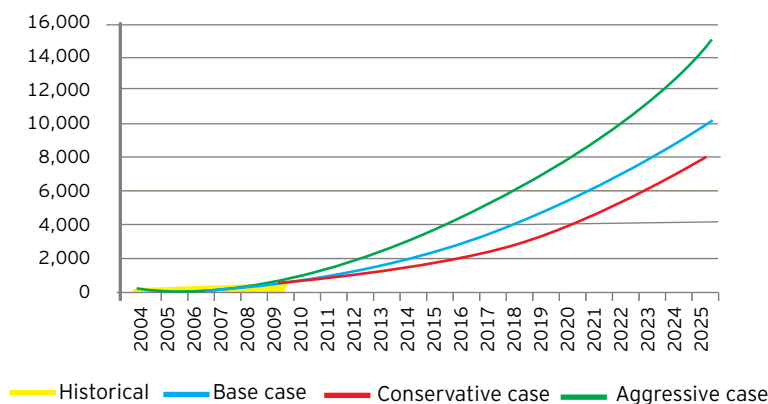
Source: SAIC Solar Thermal Industrial Surveys and CanSIA

Solar thermal 2025 target

CanSIA believes the historic growth of solar thermal technologies can continue apace, based primarily on opportunities in the commercial and industrial markets. These markets can drive innovative product development and economies of scale, with benefits passed on to the residential and other sectors. Another key area of growth is off-gas grid buildings requiring electric space and water heating solutions, as both solar thermal hot air and hot water technologies offer the advantages of a fixed-cost, highly efficient system, along with environmental benefits.

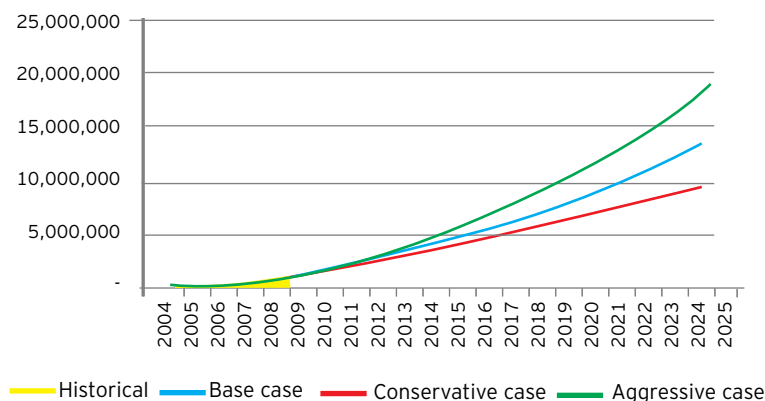
CanSIA believes the solar thermal industry can reach an installed capacity of between 8 GW_{th} and 15 GW_{th} by 2025, based on a number of growth scenarios. For detailed calculations, please visit www.cansia.ca.

Historical and forecast cumulative solar thermal installation scenarios (MW_{th})



Source: CanSIA

Historical and forecast cumulative solar thermal installation scenarios (m²)



Source: CanSIA

Scenario 1: Base case

CanSIA's solar thermal base case assumes the ecoENERGY for renewable heat credit will be extended during Q1 2011; as such, no growth is seen in 2011 installation levels over 2010. CanSIA expects installations in subsequent years to increase with maintained federal support and predicts Canadian growth will mirror the global marketplace.

The base case scenario projects that a minimum of 2,389 full-time equivalent (FTE) positions could be created by 2025.

CanSIA recognizes the level of current and forecast employment is underestimated as a result of the diverse nature of the solar thermal sector in Canada. The sector consists of several small to mid-sized businesses involved in plumbing, heating, cooling, installation and pool operations.

Scenario 2: Conservative case

CanSIA's solar thermal conservative case scenario takes a pessimistic view on the renewal of the ecoENERGY for renewable heat credit, assuming the credit is not renewed before expiry in 2011. This would lead to a significant market contraction in 2011. Realizing the loss to Canadian businesses, CanSIA forecasts the program (or a provincial equivalent) will be reinstated in 2011/2012 and that growth will return to the market. The increased perceived political risk from not renewing the ecoENERGY program in 2011 increases investment hurdles and subsequently challenges the industry in future years. CanSIA forecasts growth at a historic European level, mirroring a market which has experienced its own political challenges.

The conservative case scenario projects at least 2,297 FTE positions could be created by 2025.

Scenario 3: Aggressive case

CanSIA's solar thermal aggressive case scenario takes a positive view on the ecoENERGY for renewable heat credit and assumes an early renewal, which drives a continuation of the existing Canadian growth rate, employment and innovation. This scenario forecasts a number of provinces enacting supporting legislation for solar thermal and the whole Canadian market expanding in line with historical growth rates seen at the global level.

The aggressive case scenario projects a minimum of 6,365 FTE positions could be created by 2025.

Scenario summary

For the solar thermal sector, CanSIA has set a target of 10 GW_{th} installed by 2025.

This target indicates that 7 GW_{th} or 70% of the projected installations will be cost-competitive with conventional heating systems and require no government incentives. Projections are driven by the sector's ability to continue to build scale and reduce costs through innovation, and to design energy solutions to assist the industrial sector in replacing natural gas and enhancing its international competitiveness.

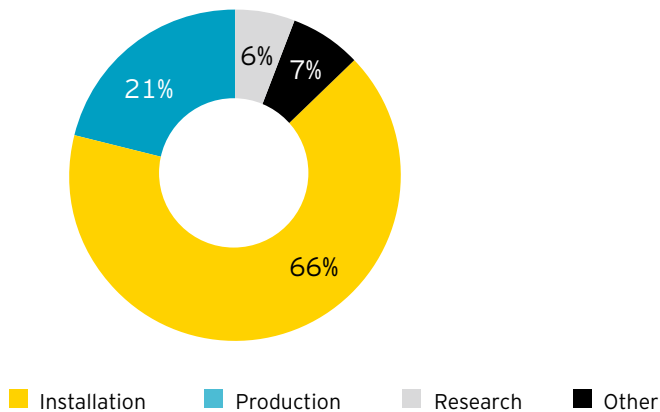
	Base case		Conservative		Aggressive	
	2009	2025	2009	2025	2009	2025
Cumulative installations (MW _{th})	790	10,127	790	7,607	790	15,112
Cumulative installations (m ²)	939,309	12,802,203	939,309	9,617,270	939,309	19,104,544

Source: CanSIA

Employment

Ongoing surveys by Natural Resources Canada have tracked employment distribution within the solar thermal sector. Given the relatively mature nature of the sector, CanSIA forecasts the distribution of jobs will remain constant as the sector grows from 2008 to 2025, with the majority of positions remaining in installation, followed by production.

Solar thermal job categories (2008-2025)



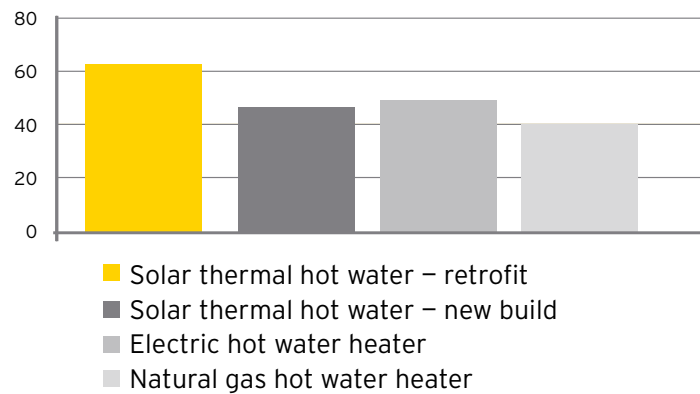
Source: Kelly Sears Consulting Group

CanSIA's forecast for employment levels by 2025 in the case scenarios outlined earlier are inherently conservative, as these levels only include growth expectations for domestic markets and exclude employment for export markets. CanSIA's expectations are that an additional 20% to 30% of the solar thermal markets are exported, and therefore Canada could enjoy considerably higher employment than forecast above.

Generation costs

Following is a comparison between solar thermal generation costs and conventional heating sources, using residential hot water as an example.

Generation costs of residential water heating systems in 2010 (\$/million Btu)



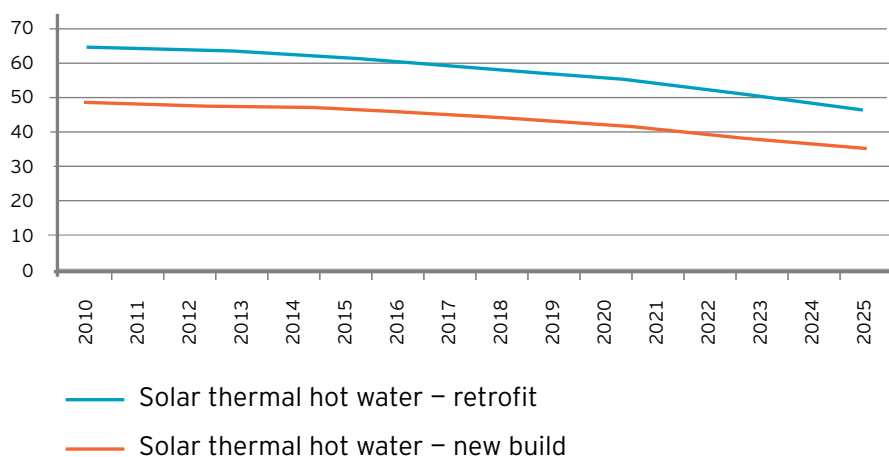
Source: Ernst & Young

From the above chart, it is clear that solar thermal hot water systems need to reduce their operating cost models to be comparable with natural gas.

When employing a solar thermal hot water system in a new-build scenario, generation costs are only marginally greater than a natural gas alternative. The analysis does not factor in the cost of carbon or the benefit that solar provides in stabilizing the price volatility of natural gas.

While solar thermal technologies are considered relatively mature, the global industry is not yet mainstream and, as such, economies of scale benefits are still to be realized. The solar thermal sector continues to invest in research and development to bring down project costs while growing its markets.

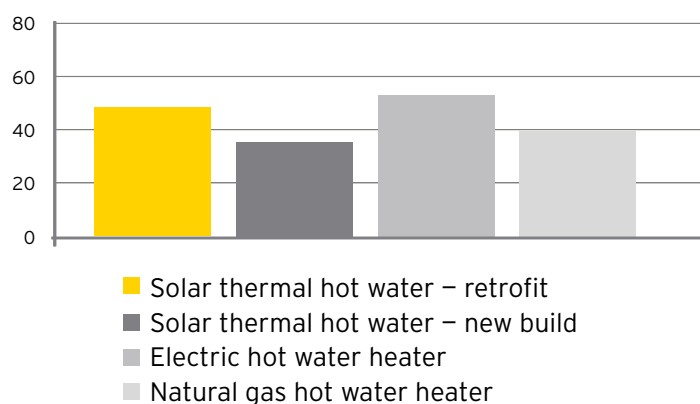
Forecast generation cost of solar thermal from 2010-2025 (\$/million Btu)



Source: Ernst & Young

Based on a Moore's Law style paradigm and a conservative estimate of a 5% reduction in capital costs following a doubling of global capacity, generation costs from solar thermal hot water systems could be competitive in both new-build and retrofit scenarios. This analysis is based on conventional cost comparative technologies being fully mature, with no discernible capital reductions being made.

Generation costs of residential water heating systems in 2025 (\$/million Btu)



Source: Ernst & Young

As the solar thermal sector reaches competitiveness, all homes and businesses in Canada will have the opportunity to enjoy enhanced energy security and long-term cost savings. Solar thermal products and services will also compete on a global scale, bringing export dollars back to Canada and helping to grow our economy.



Realizing Our Vision

We all have a stake in Canada's energy future. Achieving our vision of a strong, competitive solar industry will create long-term benefits for everyone – a more sustainable economy, energy security, new businesses and jobs, and a cleaner environment. From industry members to governments and consumers, we all have the opportunity to play a role in accelerating the development of solar energy and creating a competitive industry.

Following are some key actions that CanSIA is recommending to open dialogue, stimulate new ideas and help us work toward our shared goals for Canada.

Enhance productivity, drive down costs

The volume of solar installations has climbed sharply and the costs of solar energy have declined in recent years. However, there is still much potential for the industry to enhance its productivity and drive down costs as it reaches market competitiveness.

The industry needs to invest in innovation throughout the entire value chain to better compete against conventional energy sources. The focus for the industry must be to:

- ▶ boost investment in research and development to design more highly efficient solar modules and lower the cost of systems installation and ongoing maintenance
- ▶ build scale by creating niche markets for export, leveraging quality Canadian workmanship
- ▶ create value through comprehensive energy solutions that help Canada's leading businesses to manage their energy and increase their own global competitiveness
- ▶ develop tools to streamline processes, dismantle barriers to adoption of solar energy and increase efficiencies at all stages of the value chain

As an example of streamlining processes, the industry could move quickly to standardize legal documents and insurance policies. Even small process enhancements like this could make a measurable difference to industry productivity when multiplied across numerous solar projects.

In terms of dismantling barriers, the industry could move to a universal position for interconnection standards to eliminate the requirements by local and regional electric distribution companies to install redundant and expensive disconnects for solar PV systems.



Commit to stable policy and program incentives

Critical to driving the market growth that will propel the industry to competitiveness is government commitment to policy and program stability. A few key government programs have had a tremendous success in creating immediate demand for solar technologies. However, unequivocal commitment is needed to give the industry and investors the confidence they need to take market risks and invest in Canada's energy future. One need only look at the experience of Spain, which quickly turned from solar leader to laggard, to see how fast policy instability can drive investment dollars from a country.

To ensure continued strong investment in the solar market, CanSIA urges policymakers to:

- ▶ signal clear and longer-term commitment to existing government programs for renewable energy
- ▶ extend the federal government's ecoENERGY program for renewable heat, preferably well before it is set to expire in March 2011 to ensure no interruption in investment plans
- ▶ maintain commitment to provincial programs that have made investment

in solar energy so attractive. In Ontario, the Renewable Energy Standard Offer Program (RESOP) and Feed-in Tariff (FIT) program have enabled the province to become a North American leader in solar PV installation. CanSIA is calling on all provinces to make a clear commitment to the industry that will allow us to retain and build on our solar energy leadership

Collaborate to increase opportunities

CanSIA sees great benefits for all stakeholders to work together to identify barriers to growth, enabling the industry to respond faster to rising demand for solar products and services.

Cost barriers to development are a significant issue for a growing industry like solar. Governments could work with industry representatives, where possible, to:

- ▶ streamline development timelines by breaking down government "silos" that are slowing project development, and adding to development costs
- ▶ establish a new, enhanced and "smart" grid that better manages the increasingly diverse mix of renewable energy and reduces the burden of system upgrades to solar development

- ▶ develop joint energy strategies across provinces that would eliminate boundaries and create a larger single market for solar products and services

At the same time, industry members could collaborate with other stakeholders such as architects, building owners, industrial process managers and real estate income trusts to design integrated solutions. Similarly, alliances could be created with our renewable energy counterparts and utilities to share best practices and collaborate with policymakers to increase the competitiveness of all renewable energy industries.

New policy initiatives to drive demand

To build on the success of existing programs, CanSIA urges governments to consider additional initiatives to promote rapid adoption of solar products and services.

Some of the potentially most effective initiatives require little or no cost on the part of the adopting government. For example, to:

- ▶ require building owners in the institutional sector (including municipalities, universities, schools and hospitals) to incorporate solar thermal and solar PV energy systems
- ▶ update building codes to require that all new buildings meet minimum thresholds for energy self-sufficiency by a certain deadline
- ▶ mandate provincial and territorial governments to generate a percentage of electricity and heat from non-hydro renewable sources, with specified solar energy requirements

Mechanisms to help with the financing of solar products and services would make these technologies instantly accessible to a much broader market. Provincial governments could provide municipalities with an enhanced rebate for taxes paid on costs incurred during the development of a solar energy project, such as technology feasibility studies. Other investment tax credits could help spur demand. To assist homeowners and businesses in financing solar energy products and services, governments could provide loans that would be paid back through property and corporate tax bills as energy savings are realized by the borrower.

Training and education

To enable the industry to achieve its full potential, CanSIA believes it is paramount that stakeholders focus on two key areas: training aimed at building industry capabilities through skills development, and the need to educate consumers about the energy issues and opportunities facing the industry.

The solar industry, educational institutions, governments and labour must work together to ensure Canada has the new “clean energy” skills to meet escalating demands for solar energy. We need to anticipate new requirements, put education, training and certification programs in place, and ensure they are structured to evolve with changing needs.

Through a range of coordinated and effective programs, we can ensure quality manufacturing and installations while increasing confidence in our solar products and services.

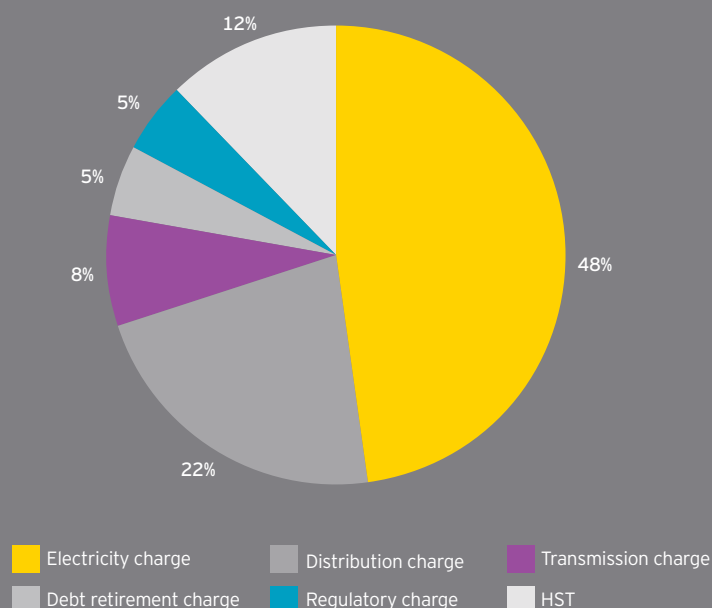
Another key step in building a competitive market is to help consumers gain a better understanding of Canada’s current energy situation and expectations for the future. The solar industry has the opportunity to work with consumers, not only in Canada but globally, to dispel myths and misconceptions regarding the impact of renewable energy on electricity rates. Adding renewable energy to the energy generation mix is only one of many factors affecting the upward trend in prices, as can be seen in the sidebar to the right.



Photo courtesy of Enerconcept

Case study: Raising awareness about changing electricity rates

Breakdown of Ontario electricity bills

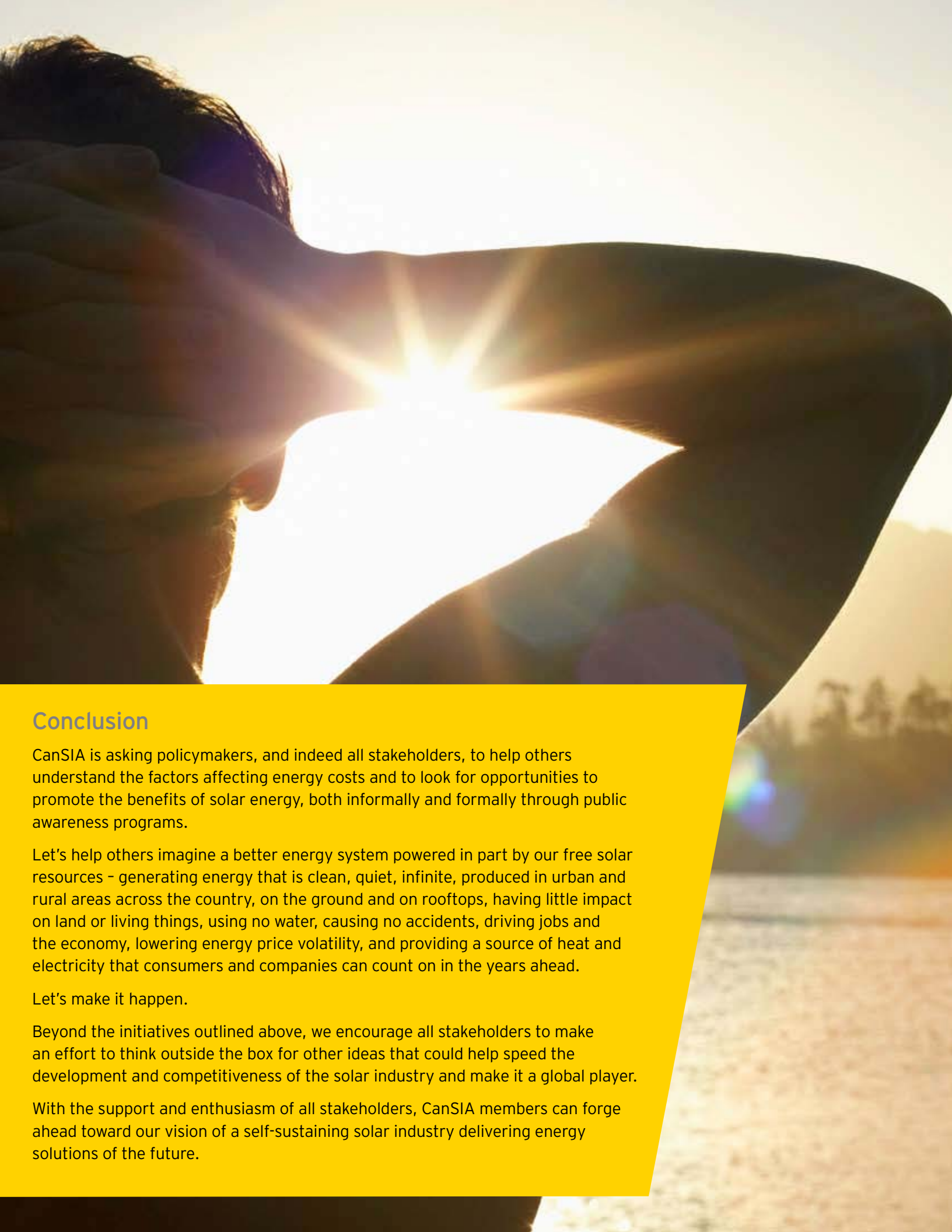


Source: Burlington Hydro Inc, Fall 2010

Using Ontario's electricity rates as an example, some of the key factors that could be communicated to help build understanding and support for renewable energy policies and initiatives are:

- ▶ New generation, no matter what type, will cost more than Ontario's existing, largely depreciated generation fleet. The Ontario Power Authority forecasts that more than 15,000 MW will need to be renewed, replaced or added by 2030.²⁵
- ▶ Maintenance and upgrading of Ontario's grid network is required across the province, regardless of plans to incorporate renewable energy. The Ontario government's Long-Term Energy Plan estimates the cost of planned upgrades and expansion of the transmission system at \$9 billion.²⁵
- ▶ Any time and cost overruns on existing and planned maintenance would not only increase project costs but also require the need for and cost of backup generation.
- ▶ As Ontario comes out of recession, energy demand is expected to rise, increasing pressure on the electricity grid infrastructure. Demand is expected to grow by 15% to 2030.²⁵
- ▶ Expected new demand from innovations like electric vehicles will need to be integrated and the costs passed on to rate payers. Ontario's goal is that by 2020, about one in every 20 vehicles on the road will be electric.²⁵

The chart shows a typical electricity bill for Ontario showing six different categories, including the new harmonized sales tax. The pie chart shows that over half of the total bill reflects costs other than electricity charges.



Conclusion

CanSIA is asking policymakers, and indeed all stakeholders, to help others understand the factors affecting energy costs and to look for opportunities to promote the benefits of solar energy, both informally and formally through public awareness programs.

Let's help others imagine a better energy system powered in part by our free solar resources - generating energy that is clean, quiet, infinite, produced in urban and rural areas across the country, on the ground and on rooftops, having little impact on land or living things, using no water, causing no accidents, driving jobs and the economy, lowering energy price volatility, and providing a source of heat and electricity that consumers and companies can count on in the years ahead.

Let's make it happen.

Beyond the initiatives outlined above, we encourage all stakeholders to make an effort to think outside the box for other ideas that could help speed the development and competitiveness of the solar industry and make it a global player.

With the support and enthusiasm of all stakeholders, CanSIA members can forge ahead toward our vision of a self-sustaining solar industry delivering energy solutions of the future.

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