

# Ontario's Long-Term Energy Plan



Building Our Clean Energy Future



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# foreword

Maintaining a clean, modern and reliable electricity system for all Ontarians is this government's number one energy priority. Ontario families, businesses and the economy rely on the efficiency, dependability and environmental sustainability of electric power. We have to keep the lights on in Ontario homes, schools, hospitals and businesses and power everything from the coffee-maker to the CT scanner. We also need a clean system that won't threaten the health of current and future generations.

Ontarians deserve balanced, responsible long-term energy planning for electricity to ensure that Ontario has clean air, reliable energy and a strong economy for our children and grandchildren. This report represents an update to the McGuinty government's long-term energy plan and outlines how we are helping families and businesses with increasing electricity costs.

Prior to 2003, Ontario's electricity system was weakening and unreliable. Our reliance on coal meant that our electricity sources were polluting and dirty. Between 1995 and 2003, the electricity system lost 1,800 megawatts (MW) of power — the equivalent of Niagara Falls running dry. A brief deregulated pricing experiment in 2002 resulted in sharply increased prices, prompting the government of the time to freeze consumer prices. Energy infrastructure was crumbling, a shortage of supply caused risks of brownouts.

Worst of all, Ontario relied heavily on five air-polluting coal plants. This wasn't just polluting our air, it was polluting our lungs. Doctors, nurses and researchers stated categorically that coal generation was having an impact on health increasing the incidence of various respiratory illnesses. A 2005 study prepared for the government found that the average annual health-related damages due to coal could top \$3 billion. For the sake of our well-being, and our children's well-being, we had to put a stop to coal.

Over the past seven years, the McGuinty government has made tremendous progress after inheriting a system with reduced supply and little planning for the future. Today, our system is cleaner, more modern, more reliable and we plan ahead.

The McGuinty government has made electricity cleaner: we are on track to eliminate coal by 2014, the single largest climate change initiative in North America in that timeframe. We have already reduced the use of coal by 70 per cent. Last year our greenhouse gas emissions from the electricity sector reached the lowest they have been in 45 years. In 2009, more than 80 per cent of our generation came from emissions-free sources like wind, water, solar, biogas and nuclear.

Conservation efforts have been working — many Ontario families and businesses are becoming very active energy conservers. Through various programs, Ontarians have conserved more than 1,700 MW of electricity since 2005 — the equivalent of more than half a million homes being taken off the grid.

Today we have enough electricity to power our homes, businesses, schools and hospitals. Our government has increased Ontario's energy capacity by adding over 20 per cent (more than 8,000 MW) of new supply to the system — enough to power two million homes. Investments in Ontario are transforming the electricity system and have helped to make Ontario a leading jurisdiction in North America for renewable and reliable energy. And since 2007, we've used a formal 20-year planning process to help us forecast and meet the province's electricity needs.

Ontario's electricity system is more reliable. Investments in new generation and upgrades to 5,000 kilometres of our transmission and distribution lines — about the width of Canada from coast to coast — have ensured that our electricity system is able to manage peak and sudden swings in demand and supply availability.

We are moving toward a modern, smart electricity system that will help consumers have greater control over their energy usage — even when they're not at home. A smart grid can isolate outages allowing for faster or even automated repair. This will improve overall reliability for all electricity consumers and make it easier for consumers to produce their own power.

As part of the Open Ontario plan, the McGuinty government is moving Ontario from dirty coal dependency to a clean, modern and reliable energy economy that creates jobs. Energy is one of the engines of our economy and employs more than 95,000 Ontarians. Recent investments to modernize the system are helping to create and support jobs and opportunities for people and communities across the province. Ontario's landmark Green Energy and Green Economy Act, 2009 is projected over three years to support over 50,000 direct and indirect jobs in smart grid and transmission and distribution upgrades, renewable energy and conservation.

We've accomplished a great deal in the past seven years, but there is more to do. Ontario has sufficient electricity supply — but we will require more clean power for the future. As Ontario's energy infrastructure ages, we will need to rebuild or create another 15,000 MW of generating capacity over the next 20 years. We will also need to continue to upgrade and update transmission and distribution lines.

While we are proud of our collective efforts so far, we must continue to develop cleaner forms of electricity and foster a conservation-oriented culture. We need to have a balanced low-carbon supply mix to meet energy needs cleanly and reliably — Ontario will be ready for when North America moves to greenhouse gas regulation. We also need to maximize the electricity assets we have and ensure that those assets continue to provide clean, reliable supply.

The necessary, unavoidable investments that Ontario has been making in our electricity system are paid by ratepayers. The cost to bring our system back up to date and build a clean energy economy is having an impact on household and business bills.

We are all paying for previous decades of neglect. In Ontario, in order to have clean air, reliable generation and modernized transmission, residential prices over the next 20 years are expected to increase by about 3.5 per cent per year.

Increases to electricity bills are not easy for Ontario families and businesses. Even though Ontarians are committed to clean air, every increase takes a bite out of take-home income, and that is difficult for families during lean times. To help with rising costs, the McGuinty government has created a number of tax credits for families and seniors to help manage electricity increases. But we need to do more.

In this Plan, and the government's 2010 Economic Outlook and Fiscal Review we have taken steps to ensure that we help families and businesses with electricity costs while investment in clean energy continues. On November 18, 2010, the McGuinty government introduced the Ontario Clean Energy Benefit.

If passed, the Ontario Clean Energy Benefit will give Ontario families, farms and small businesses a 10 per cent benefit on their bills for five years. That would be 10 per cent off your electricity bill every month, effective January 1, 2011.

The proposed Clean Energy Benefit will help families, hard-working small business owners and Ontario farms. The McGuinty government is doing this to help those who are feeling the pinch of the rising cost of living and especially, rising electricity prices. Every little bit helps during lean economic times.

This balanced and responsible Plan sets out Ontario's expected electricity needs and the most efficient ways to meet them.



The Honourable Brad Duguid  
Minister of Energy

## overview

### Ontario Electricity 1906-2003

On October 11, 1910, when Adam Beck lit up a Kitchener street sign that read "For the People," the town went wild, and the electrification of Ontario began. It was the first major project of the Hydro-Electric Power Commission of Ontario, created in 1906 as the world's first publicly owned electric utility. Beck, a municipal and provincial politician, believed that it was essential to the province's economic development that electricity be available to every Ontarian.

The Queenston-Chippawa power station at Niagara (renamed Sir Adam Beck I in 1950) helped Ontario meet the growing demand for electricity during the postwar economic boom. But despite continued expansion, it had become increasingly clear that hydropower alone would not be able to keep up with the province's demand.

As a result, Ontario began to diversify its supply mix in the 1950s, adding new sources of power, including six coal-fired generating stations built near areas where demand was highest. Between the early 1970s and the early 1990s, nuclear power was also added at three generating facilities. In the meantime, in 1974, the Hydro-Electric Power Commission was recognized as a crown corporation and renamed Ontario Hydro.

This trio of electricity sources — hydro, coal and nuclear — would support Ontario's economic prosperity into the 1990s. By then, much of the province's electricity infrastructure was aging and in need of replacement or refurbishment. The system had become unreliable, and there was widespread concern about whether supply would be able to meet projected demand.

Between 1996 and 2003, Ontario's generation capacity fell by six per cent — the equivalent of Niagara Falls running dry, while electricity demand grew by 8.5 per cent. Investments to build new supply and the upkeep of lines were modest. Investments in upgrades to transmission and distribution were less than half of current levels. There were no provincially funded conservation programs.

In 1998, Ontario passed legislation that authorized the establishment of a market in electricity. In April 1999, Ontario Hydro was re-organized into five successor entities. The move to break up Ontario Hydro and partially privatize the electricity system saddled Ontario with a stranded debt of over \$20 billion.

A brief market-deregulation scheme saw electricity prices spike an average of over 30 per cent in just seven months. The government of the day was forced to cap prices for residential and small business owners — an unsustainable policy. The cap just masked the underlying problem of rising cost pressures in an electricity system in need of renewal and additional supply.

Ontario was also heavily reliant on coal-fired generation. About 25 per cent of electricity generation came from polluting coal-fired plants. In addition, Ontario imported coal power from neighbouring American states. Ontario, a province with ample power resources, had become a net importer of power.

### Ontario Electricity Accomplishments 2003-2010

After taking office in 2003, the Ontario government faced a number of challenges including: a shortfall in supply, a system reliant on dirty coal-fired generation, a lack of conservation programs, an unsustainable pricing regime and little long-term planning.

The shortfall in supply was restored with investments of over \$10 billion to keep the lights on in the province's homes and businesses. Since 2003, about 8,400 megawatts (MW) of new cleaner power have come on line — over 20 per cent of current capacity. That's enough electricity to power cities the size of Ottawa and Toronto. Ontario completed the return to service of Pickering A Unit 1 and enabled hydro and other renewable projects. The province also invested \$7 billion to improve some 5,000 kilometres of transmission and distribution lines — the equivalent of the distance between Toronto and Whitehorse, Yukon.

Ontario's power has become cleaner by shutting down coal-fired generation and investing in renewables. In 2005, the government permanently shut-down the Lakeview coal-fired plant in Mississauga — the equivalent of taking 500,000 cars off the road. The province is on track to phase out coal-fired electricity by 2014, the largest climate change initiative of its kind in North America.

Currently, Ontario is Canada's solar and wind power leader, and home to the four largest operating wind and solar farms in the country. The province is developing a smart electricity grid that will help integrate the thousands of megawatts of new renewable power from these projects and others.

Public conservation programs were reintroduced to Ontario in 2005 to encourage and provide incentives for families, businesses and industry to consume less energy. Conservation is now a cornerstone of long-term electricity planning, recognizing that all Ontarians — for generations to come — will benefit from cleaner air and a lower carbon footprint.

In 2004, the government introduced a stable pricing regime that better reflected the true cost of electricity in Ontario. As a result, in 2005 the Ontario Energy Board (OEB) released a Regulated Price Plan, which brought predictability to electricity prices for residential and small business consumers. The OEB updates rates and adjusts prices every six months to reflect the costs of supply for that period.

Ontario has also taken steps to lower the stranded debt left by the previous government. Since 2003, Ontario has decreased the stranded debt by \$5.7 billion.

In 2004, the government established the Ontario Power Authority (OPA) as the province's long-term energy planner. That set into motion a planning process that would ensure that Ontario's energy infrastructure would continue to be modernized. In 2007, the OPA prepared a 20-year energy plan (formally known as the Integrated Power System Plan or IPSP). The 2007 Plan focused on creating a sustainable energy supply, targeted to improving current natural gas and renewable assets at a sustainable and realistic cost. The government has made significant progress on the items outlined in the 2007 Plan.

2007 Plan Goal/Target	Accomplishments
Ensure adequate supply	Invested over \$10-billion to bring about 8,400 MW of new supply online — enough capacity to meet the annual requirements of 2 million households.
Double the amount of renewable supply (to 15,700 MW by 2025)	More than 1,500 MW of clean, renewable energy online since 2003, enough power for more than 400,000 homes.
Reduce demand by 6,300 MW by 2025.	More than 1,700 MW of conservation (reduction in demand) since 2005, equivalent to more than 500,000 homes being taken off the grid.
Replace coal in the earliest practical time frame	Phasing out coal-fired generation by 2014 Four units closed in 2010, ahead of schedule.
Strengthen the transmission system	Over \$7 billion in investments since 2003 — upgrades to more than 5,000 kilometres of wires Moved forward on transmission projects to enable additional renewables; import potential; and refurbished nuclear generation
Ensure stable energy prices for Ontarians	The Regulated Price Plan introduced in 2005 has provided predictability Electricity prices have increased on average by about 4.5 percent per year over the past seven years Introduced energy tax credits to help residential and small business consumers with electricity costs

In 2009, the government introduced the groundbreaking Green Energy and Green Economy Act, 2009 (GEA). The GEA is sparking growth in clean and renewable sources of energy such as wind, solar, hydro, and bioenergy. A series of conservation measures in the GEA are providing incentives to lower energy use. In its first three years, the GEA will help create 50,000 clean energy jobs across the province. A clean-energy manufacturing base has been growing in the province and creating jobs for Ontarians.



## Ontario's Energy Future 2010-2030

The priorities that the government sets and the investments the government makes today are laying the groundwork for an Ontario of tomorrow that will feature a modern, clean and globally competitive economy; healthy, vibrant and liveable communities; and an exceptional quality of life for all Ontarians. The government has a responsibility to ensure a clean, modern and reliable system for the health and well-being of Ontario families and businesses.

By 2030, Ontario's population is expected to rise about 28 per cent — a gain of almost 3.7 million people. Ontario's population will become more urbanized with population growth taking place in primarily urban areas. The Greater Toronto Area (GTA) population will increase by almost 38 per cent over the same period.

The overall composition of the economy will evolve as high-tech and service industries grow and manufacturers change how they do business to keep pace with technological advances and global competition. The output of large industrial customers, which accounts for about 20 per cent of electricity demand, is expected to grow moderately.

Getting around will be easier for all Ontarians. Improved regional and local transit systems that form integrated transportation networks will make it easy to travel, both within and between urban centres. There will be more electric cars on the road — Ontario's goal is that by 2020, about one in every 20 vehicles on the road will be electric.

All of this means that Ontario needs a more modern energy system and a diverse supply mix. Clean, reliable energy is the fuel that will power Ontario's future economic prosperity. Ontario must take steps today to ensure that the right kind of energy will continue to be there for us tomorrow.

Ontario is building a culture of conservation and as a result, it is expected that the province's demand for energy will grow only moderately over the next 20 years. Increased demand in the long term will be due to the rising population, industrial growth and increased use of electrical appliances and vehicles.

### The Smart House of the Future

A smarter electricity grid will enable Smart Houses in the future by using technologies that have built-in intelligence. With Smart Grid infrastructure, homes will be able to use power when it is least expensive, charge electric vehicles, generate their own power via solar panels or other generation — and all of this can be controlled by the owner online, or by smart phone.

## The Plan

Since the 2007 Plan, developments in technology, trends in demographics, changes in the economy and the advancements of the renewable energy sector (the success of the Feed-in-Tariff program) mean that Ontario needs an updated plan. This updated long-term energy plan will help to ensure that Ontario can meet the needs of an evolving economy and shifting electricity demands, while providing affordable electricity.

Currently, Ontario's electricity system has a capacity of approximately 35,000 MW of power. The OPA forecasts that more than 15,000 MW will need to be renewed, replaced or added by 2030. Because of capacity brought online in recent years, Ontario has some flexibility moving forward. The challenge is in choosing the right mix of generation sources and the necessary level of investment to modernize Ontario's energy infrastructure to meet future needs.

Through initiatives already underway, the province will be able to reliably meet electricity demand through 2015. Ontario needs to plan now for improving the power supply capacity to meet the province's electricity needs beyond 2015. Ontario must plan in advance because:

- Insufficient investment between 1995 and 2003 left an aging supply network and little new generation
- Additional clean generation will be needed to ensure a coal-free supply mix after 2014
- Nuclear generators will need to go offline while they are being modernized
- The population is projected to grow.

To meet these needs Ontario will need a diverse supply mix. Each type of generation has a role in meeting overall system needs. Ontario requires the right combination of assets to ensure a balanced supply mix that is reliable, modern, clean and cost-effective. Ontario will also, first and foremost, make the best use of its existing assets to upgrade, expand or convert facilities.

As part of a reliable network, the system needs both small and large generators. Nuclear power will continue to reliably supply about 50 per cent of the province's electricity needs. It does not emit air pollutants or emissions during production. Hydroelectric power is expanding to include increased capacity from the Niagara Tunnel project and the Lower Mattagami project — producing clean energy by tapping into a renewable and free fuel source. Natural gas-fired plants have the flexibility to respond when demand is high — acting as peak source or cushion for the electricity system. Natural gas is the cleanest of the fossil fuels, emitting less than half of the carbon dioxide emitted by coal.

Ontario is also planning for future energy generation that will focus on efficient, localized generation from smaller, cleaner sources of electricity rather than exclusively from large, centralized power plants transmitting power over long distances. This strategy is known as “distributed generation”. Distributed generation also opens up opportunities for smaller power producers, allowing individuals, Aboriginal communities and small co-operatives or partnerships to become generators.

Renewable energy—wind, solar, hydro, and bioenergy — is an important part of the supply mix. Once the initial investment is made in equipment and infrastructure, fuel cost and greenhouse gas emissions are zero or very low. Renewable energy makes it possible to generate electricity in urban and rural areas where it was not feasible before.

In developing this report, the government heard from over 2,500 Ontarians (individuals, energy organizations, community representatives, and First Nation and Métis leaders and groups). Their views have helped to inform this report. In addition, the Ontario Power Authority (OPA), Hydro One, Ontario Power Generation (OPG), the Ontario Energy Board (OEB) and the Independent Electricity System Operator (IESO) contributed information and advice.

Ontario’s Long-Term Energy Plan will help guide the province as it continues to build a clean, modern, and reliable electricity system for Ontario families now and well into the future. It will ensure Ontario continues to be a North American leader for clean energy jobs and technology and becomes coal-free by 2014. Key features of the plan include:

- Demand will grow moderately (about 15 per cent) between 2010 and 2030.
- Ontario will be coal-free by 2014. Eliminating coal-fired generation from Ontario’s supply mix will account for the majority of the government’s greenhouse gas reduction target by 2014. Two units at the Thunder Bay coal plant will be converted to gas and Atikokan will be converted to biomass. Two additional units at Nanticoke will be shut down in 2011.
- The government is committed to clean, reliable nuclear power remaining at approximately 50 per cent of the province’s electricity supply. To do so, units at the Darlington and Bruce sites will need to be modernized and the province will need two new nuclear units at Darlington. Investing in refurbishment and extending the life of the Pickering B station until 2020 will provide good value for Ontarians.
- Ontario will continue to grow its hydroelectric capacity with a target of 9,000 MW. This will be achieved through new facilities and through significant investments to maximize the use of Ontario’s existing facilities.
- Ontario’s target for clean, renewable energy from wind, solar and bioenergy is 10,700 MW by 2018 (excluding hydroelectric) – accommodated through transmission expansion and maximizing the use of the existing system. Ontario will continue to grow the clean energy economy through the continuation of FIT and microFIT programs.

- Natural gas generation for peak needs will be of value where it can address local and system reliability issues. Natural gas will support the increase in renewable sources over time and supplement the modernization of nuclear generators.
- Combined Heat and Power is an energy-efficient source of power and the OPA will develop a standard offer program for projects under 20 MW.
- Ontario will proceed with five priority transmission projects needed immediately for reliability, renewable energy growth, and changing demand. Future Plans will identify more projects as they are needed.
- Ontario is a leader in conservation and the government will continue to increase and broaden its targets to 7,100 MW and reduce overall demand by 28 terawatt-hours (TWh) by 2030.
- Over the next 20 years, estimated capital investments totalling \$87 billion will help ensure that Ontario has a clean, modern and reliable electricity system.
- Measures outlined in this Plan will help create and sustain jobs and investments in Ontario’s growing clean energy economy.
- Residential bills are expected to rise by 3.5 per cent per year over the next 20 years. Industrial prices are expected to rise by 2.7 per cent per year over the next 20 years.
- The government is proposing an Ontario Clean Energy Benefit to give Ontario families, farms and small businesses a 10 per cent benefit on their electricity bills for five years.

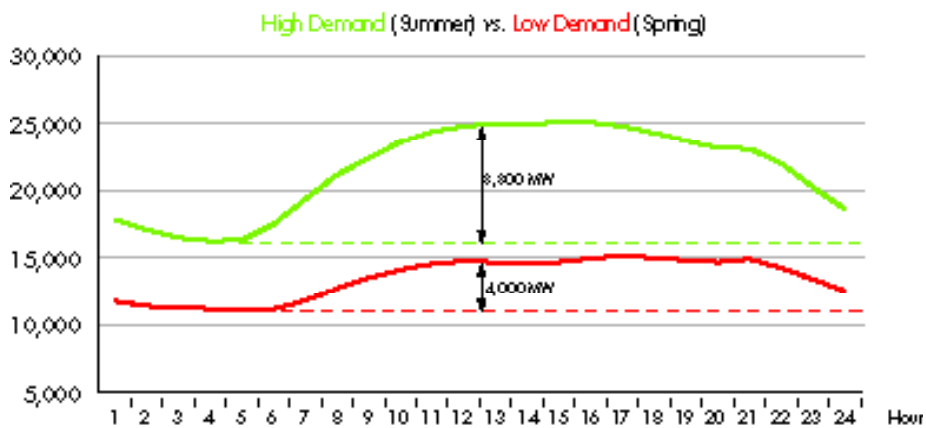
This plan will help ensure that Ontario is able to meet its electricity needs until 2030 and build a modern, clean, reliable system that will provide energy to Ontario homes and businesses for generations to come.

# 1 demand – an updated forecast

A forecast of the demand for electricity establishes the context for long-term planning — it predicts the amount of electricity Ontario will need.

System planning requires a complex forecast of the total amount of electricity that will be used over the course of a year, as well as the amount required to meet peak demand. The next step is to match these requirements with available generation and transmission capacity. Demand fluctuates with the time of day, weather, time of year and the structure of the economy. Ontario's demand can fluctuate between 11,000 MW on an early Sunday morning in spring to 25,000 MW on a hot Thursday afternoon in summer.

FIGURE 1: ONTARIO ELECTRICITY DEMAND COMPARISON



Unlike other forms of energy, electricity cannot be easily stored. Ontario's electricity system must be able to produce and move enough electricity to meet the changing demand for it instantaneously — all day and all night, every day and every night.

Ontario is part of an interconnected grid consisting of thousands of generators linked by tens of thousands of kilometres of transmission lines, crossing international, provincial and regional borders. The interconnected nature of the grid, supported by mandatory reliability standards, helps to ensure a stable power supply even when major components fail or when demand exceeds what can be met with domestic resources. Trade in electricity takes place over this interconnected system — for instance, between Ontario, Quebec and the U.S. — on a daily basis. In 2003, Ontario was a net importer and much of this imported supply came from U.S. coal power, which increased prices and reduced Ontario's air quality. Ontario is now a net exporter of electricity.

Electricity demand in Ontario has declined since reaching a peak in 2005. For the next 10 years, demand is expected to recover from the recent recession and then stay relatively flat as conservation efforts and an evolving economy change Ontario's energy needs.

## Accomplishments

Ontario families and businesses have participated in conserving energy through various government conservation programs and shifting the demand away from peak hours.

- Ontario's conservation initiatives have been successful. Since 2005, Ontarians have saved enough energy to meet the combined electricity demand of Mississauga and Windsor.
- peaksaver®, a residential and small business electricity demand reduction program that temporarily powers down central air conditioning systems, has conserved enough to power a community the size of Thunder Bay.

## Future Needs

Demand is recovering slowly in 2010 after the global economic recession. Future demand will depend on a number of factors including: the speed of Ontario's economic recovery, population and household growth, greater use of electronics in appliances and home entertainment systems, the pace of the recovery of large, energy-intensive industry and the composition of the economy (e.g. a shift to more high-tech and service jobs). Demand will also be impacted by the success of conservation efforts, as well as the potential electrification of public transit and the number of electric vehicles on the road. Weather can also have a pronounced effect.

To account for generation maintenance, extreme weather or significant changes in the amount of electricity the province needs, it is important to have electricity capacity in reserve.

## The Plan

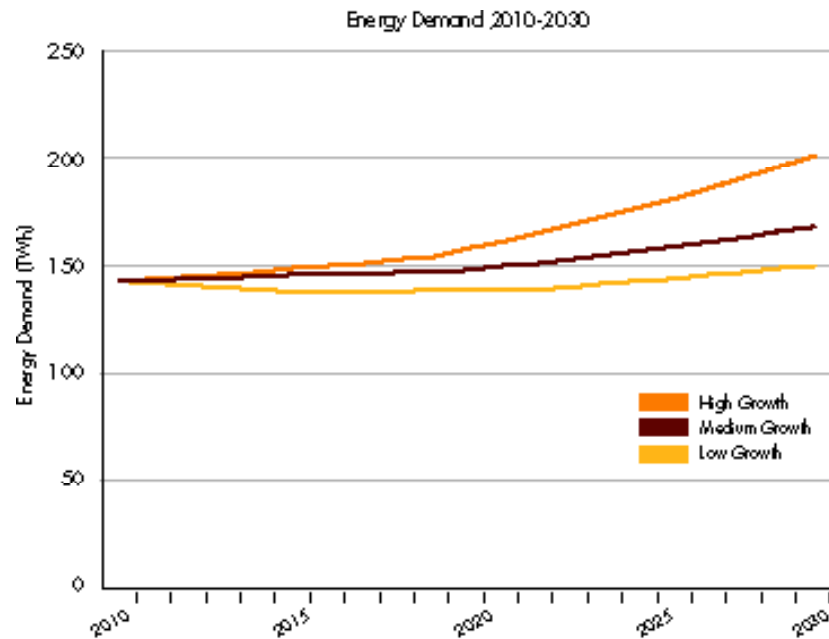
Based on OPA analysis, this Plan outlines three potential scenarios (net of conservation) for electricity demand:

1. Low growth (yellow) assumes that Ontario's manufacturing and industrial sectors continue to grow modestly in accordance with the current trend. Some of the recent decline in consumption is due to conservation, some to restructuring in the various industrial sectors, and some due to the recession. This forecast assumes a lower rate of population growth than in the other two scenarios. It further assumes that only 13 per cent of people use electricity for heating and that small appliance use accounts for 30 per cent of growth.



2. Medium growth (brown) represents moderate growth in the industrial sector and in population. This scenario assumes continued growth in the residential, commercial and transportation sectors. This forecast assumes that there is a consistent move towards high-tech and service industries and somewhat higher provincial population growth than the low growth scenario. This scenario is consistent with the current government goal for electric vehicles: five per cent by 2020.
3. High growth (orange), or aggressive electrification, assumes that there is a significant increase in electric transportation — both public and private. It assumes that there is aggressive North American greenhouse gas regulation, faster population growth than the low growth scenario, significant industrial change and that by 2030 about 12 per cent of vehicles on the road are electric.

FIGURE 2: RANGE OF ENERGY DEMAND FORECAST



The three scenarios do not differ significantly until 2018, allowing time to adjust as the Long-Term Energy Plan will be updated every three years. For planning purposes, the government is using the medium growth line to predict future electricity needs. The medium growth scenario balances the expected growth in residential and commercial sectors, with modest, post-recession growth in the industrial sector. The addition of 1.1 million households and the expected increase in the use of entertainment electronics, and small appliances will increase residential electricity demand. The addition of 132 million square metres of commercial space and the associated use of air-conditioning, lighting and ventilation will increase electricity demand in the commercial sector.

Based on the medium growth scenario, Ontario's demand will grow moderately (15 per cent) between 2010 and 2030, based on the projected increase in population and conservation as well as shifts in industrial and commercial needs. As a result, for planning purposes, the system should be prepared to provide 146 TWh of generation in 2015 rising to 165 TWh in 2030.

Ontario is also planning to create sufficient flexibility in the system to accommodate the higher growth scenario.

# 2 supply

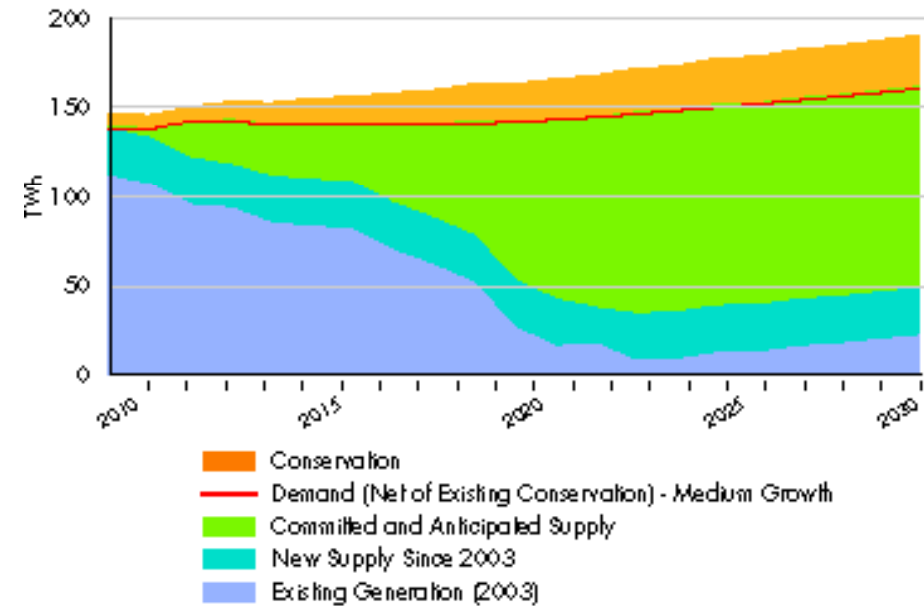
With a long-term demand forecast in place, Ontario must determine the most effective way to meet that demand so that there is no gap in supply. Ontario needs a balanced, cost-effective supply mix that supports the economy, is modern, can adapt to future changes and provides clean, reliable electricity to Ontario families and businesses for generations to come.

A clean, reliable energy system relies on a balance of resources. Good system planning includes a sustainable supply mix that meets the demands of the public. It also means continually looking for efficiencies and emphasizing the best use of current resources. Ontario's supply mix includes:

- Conservation: As the best and first resource, it reduces consumption and therefore demand on the system. By avoiding the need to build new generation, all consumers benefit through cost savings.
- Baseload power: Generation sources, such as nuclear and hydro stations, designed to continuously operate (Niagara Falls, for example). Baseload power is the foundation of a stable, secure supply mix.
- Variable or intermittent power: Generation sources that produce power only during certain times such as wind and solar projects. These are important contributors to a cleaner supply mix.
- Intermediate and peak power: Generation sources designed to ramp up and down as demand changes throughout the day such as natural gas and hydro generation with some storage capability. These function as a cushion to the system to ensure reliability when demand is highest.

This supply mix balances reliability, cost and environmental performance.

FIGURE 3: FORECAST SUPPLY AND DEMAND (2010-2030)

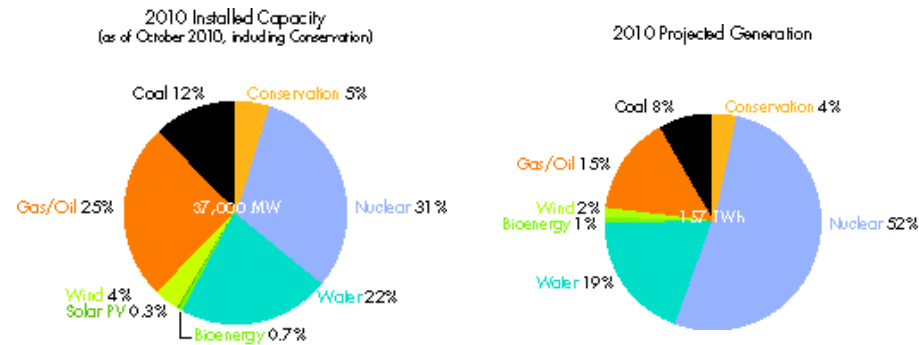


Energy Storage can help to balance the electricity grid by storing off-peak generation and using it during peak hours. This helps to reliably incorporate more renewable generation into the grid. Energy storage is an important part of the move to a Smart Grid. Ontario will continue to investigate the potential for new storage technologies. There are a number of issues that impact the development of energy storage:

- The capital costs for large-scale electricity storage are high largely due to high engineering and construction costs.
- Research is underway on flywheel storage, plug-in vehicle storage, various forms of thermal storage as well as other storage options.
- There are growing opportunities for small storage projects, particularly as battery technology improves.
- Ontario has a pumped storage facility in the Sir Adam Beck Pumping Generating Station at Niagara Falls. OPG is currently studying the possible expansion of the reservoir to allow for further storage at the station.

The capacity of the system is necessarily larger than what is actually generated. It is critical to have more capacity than generation to be able to manage normal equipment maintenance and shutdowns, unprecedented peak demands or an unexpected shutdown of an electricity generator. Generation, or the amount of electricity Ontario produces, is measured in terawatt hours (TWh or billion kWh). The capacity of the system, or what it is able to generate, is measured in megawatts (MW).

FIGURE 4:  
CONTRAST BETWEEN GENERATION AND INSTALLED CAPACITY



Selecting a supply mix and investment in supply is a matter of choices and trade-offs. A variety of power supply sources — some designed for baseload requirements, some designed for meeting peak requirements — is superior to relying heavily on only one source. For this long-term plan the government has considered environmental, economic, health, social and cost implications to come up with the best possible supply mix.

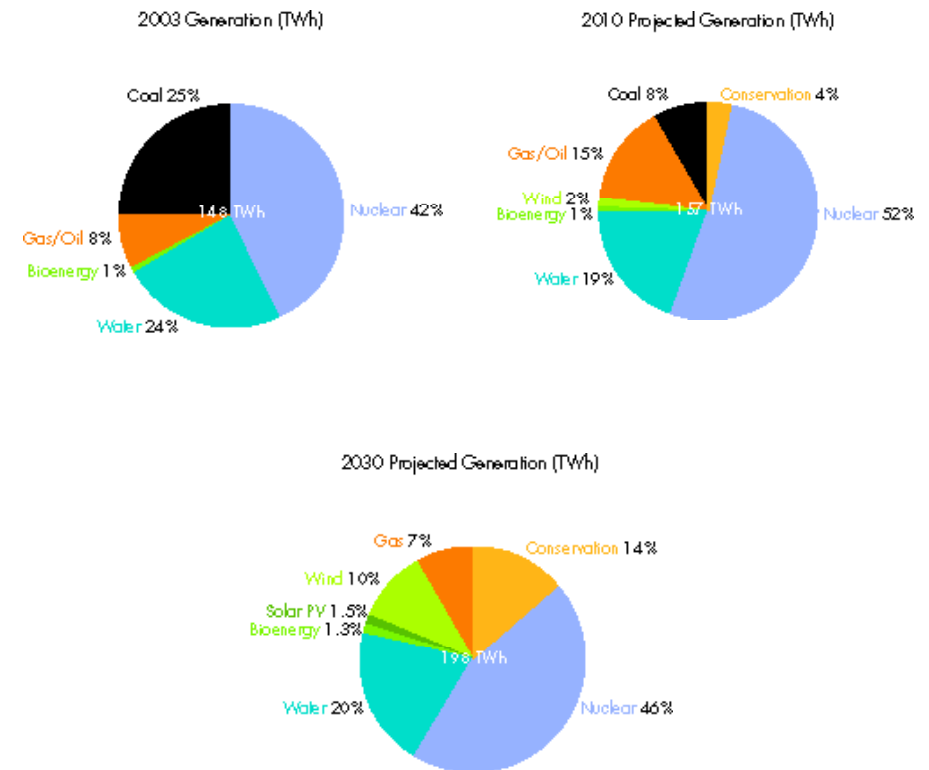
This improved supply mix will be cleaner, sustainable, modern and reliable. It phases out coal-fired generation at a faster pace, it modernizes Ontario’s nuclear fleet, it includes more renewables, it maximizes hydroelectric power over the near term, and it advances Ontario’s conservation goals.

By 2030, Ontario will have completely eliminated coal as a generation source and will have also increased wind, solar and bioenergy from less than one per cent of generation capacity in 2003 to almost 13 per cent. To ensure reliability, the strategic use of natural gas will be required to complement renewable generation. Nuclear will continue to supply about 50 per cent of Ontario’s electricity needs.

The following chapter will include a review of the various components of Ontario’s electricity supply:

- Coal
- Nuclear
- Renewables: Hydroelectric
- Renewables: Wind, Solar and Bioenergy
- Natural gas
- Combined Heat and Power (CHP)

FIGURE 5: BUILDING A CLEANER ELECTRICITY SYSTEM



### Coal Free

The Ontario government is committed to improving the health of Ontarians and fighting climate change. Coal-fired plants have been the single largest source of greenhouse gas emissions in the province and among the largest emitters of smog-causing pollutants. Ontario’s reliance on coal-fired generation shot up 127 per cent from 1995-2003, significantly polluting the province’s air. During that period Ontario also relied on importing coal-fired power from the United States. An Ontario study found the health and environmental costs of coal at \$3 billion annually (“Cost Benefit Analysis: Replacing Ontario’s Coal-Fired Electricity Generation,” April 2005).

Since 2003, the government has reduced the use of dirty coal-fired plants by 70 per cent. Eliminating coal-fired electricity generation will account for the majority of Ontario’s greenhouse gas reduction target by 2014 — the equivalent of taking 7 million cars off the road.

In addition, Ontario Power Generation (OPG) is required to meet strict government-mandated greenhouse gas emission targets, including ensuring that between 2011 and 2014 annual emissions are two-thirds lower than 2003 levels.

Ontario is the only jurisdiction in North America that is phasing out coal-fired generation. The government has committed to eliminating coal-fired generation by 2014 and is introducing clean and reliable sources of energy in its place. Until then, coal and natural gas plants will continue to provide power in peak-demand periods to maintain the reliability of the system.

**Accomplishments**

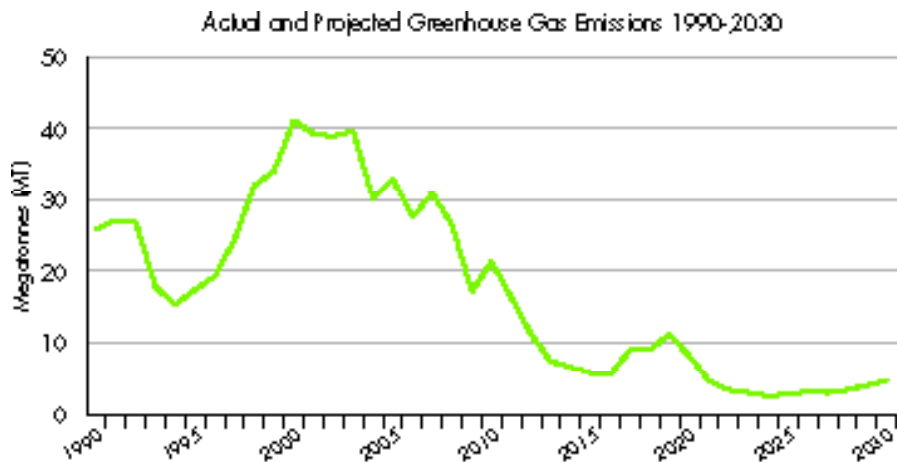
The government of Ontario has shut down eight coal units since 2003 (3,000 MW) and will close the remaining units by 2014 or earlier.

- Lakeview (Mississauga) – four units closed April, 2005
- Nanticoke – two units closed October, 2010
- Lambton – two units closed October, 2010

After the closure of four coal units on October 1, 2010, coal-fired generation makes up only 13 per cent of Ontario’s electricity capacity.

Ontario’s electricity sector emissions will decrease dramatically to only five megatonnes post-2020 as a result of becoming coal-free. Between 2015 and 2019, extensive nuclear refurbishments will take place and Ontario will rely on its natural gas-fired stations to maintain reliable electricity supply.

**FIGURE 6:  
REDUCING EMISSIONS IN ONTARIO’S ELECTRICITY SECTOR**



**The Plan**

Coal-fired plants will cease to burn coal in 2014. Ontario will shut down two additional units at Nanticoke Generating Station before the end of 2011.

The government recognizes the potential benefits of continuing to use Ontario’s existing electricity-generating assets and sites. Coal-fired plants could be converted to use alternative fuels, such as natural gas. Similar to coal, biomass and/or natural gas can provide electricity on demand for peak periods.

In line with the Growth Plan for Northern Ontario and future needs of the Ring of Fire, the province is replacing coal at Atikokan and Thunder Bay and re-powering these facilities with cleaner fuel sources.

Converting the Atikokan Generating Station to biomass by 2013 will create up to 200 construction jobs and help protect jobs at the plant. It will also support jobs in Ontario related to the production of wood pellets and sustain other jobs in the forestry sector. The project is expected to take up to three years to complete. Once converted, the plant is expected to generate 150 million kilowatt-hours of renewable power, enough to power 15,000 homes each year.

At the Thunder Bay Generating Station, two units will be converted to natural gas in a similar timeframe. The Thunder Bay plant is needed not only for local supply to the city of Thunder Bay, but for system reliability in northwestern Ontario, particularly during periods of low hydroelectric generation and until the proposed enhancement to the East-West tie enters operation. The government will work with suppliers on the planning process to convert the Thunder Bay units.

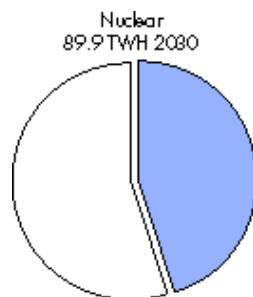
Ontario will continue to explore accelerating the closure of the remaining six units (four at Nanticoke and two at Lambton), taking into consideration the impact of the closures on system reliability.

Ontario will monitor the progress of the continued operation of nuclear units at Pickering. The government expects in 2012 to have an update on the progress of extending the life of these units. At this time, Ontario will consider the possible conversion of some of the units at Nanticoke and Lambton to natural gas, if necessary for system reliability. Due to the lead times involved, planning and approval work for the natural gas pipeline infrastructure required to Nanticoke will begin soon.

Ontario will continue to explore opportunities for co-firing of biomass with natural gas for any units converted to natural gas. Decisions on other biomass opportunities will have to carefully take into account the ability to bring in fuel supply and the cost of conversion.

## Nuclear – New/Modernized

Nuclear power is a reliable, safe supplier of the province's baseload generation needs — accounting for about 36 per cent of the province's installed electricity capacity. Nuclear operates 24 hours a day, seven days a week and it produces about 50 per cent of the electricity generated in Ontario. Nuclear power does not produce any primary air pollution or release greenhouse gases into the atmosphere.



Nuclear power plants are able to operate steadily, providing a plentiful, consistent supply of energy for decades at stable prices. In addition, the fuel cost for a nuclear power plant is a small portion of its total costs, so nuclear power is generally not impacted by fuel price escalation or fluctuations.

- Ontario has used nuclear power for more than 40 years.
- In 2009, more than half of the province's electricity came from nuclear energy.
- Ontario's nuclear power stations and waste storage facilities have an excellent safety record. OPG won the Zeroquest Platinum (Sustainability) Award from the Infrastructure Health and Safety Association (IHSA) in June 2010.
- Over 70,000 jobs in Canada are directly or indirectly related to the nuclear power industry.

### Accomplishments

A number of nuclear power producing units have been modernized and returned to service since 2003 including:

- Pickering A Unit 1, in November 2005, providing 515 MW (or about 6 per cent of new supply)
- Bruce Unit 3, in March 2004, providing 770 MW (or about 9 per cent of new supply)
- Bruce Unit 4, in November 2003, providing 770 MW (or about 9 per cent of new supply)

### Future Needs

Nuclear power is crucial to providing reliable electricity to the province. Units at Bruce B and Darlington are expected to reach the end of their service lives over the next decade. To extend the life of these units, each would have to be shut down for about three years while being modernized.

At the time of the 2007 Plan, there was a need for new nuclear planning to begin immediately. Since then, demand has declined and renewable generation has become a bigger contributor to the system. Investment in renewables, the reduction in demand and the availability of natural gas have all reduced the immediate need for new nuclear. However, to preserve the long-term reliability of the system, particularly for baseload generation, additional investment in nuclear generation will be required.

Ontario will continue to rely on nuclear power – at its current level of contribution to the supply. Nuclear generation is ideally suited for providing baseload generation because of its unique economic and operating characteristics. Nuclear plant operational design and economics depend on the plants being able to operate steadily throughout the year. A generation mix of 50 per cent nuclear combined with baseload hydroelectric generation is sufficient to meet most of Ontario's baseload requirements.

If nuclear capacity beyond this were added, the hours in the year in which nuclear capability exceeded Ontario demand could substantially increase. Under such surplus conditions, some nuclear units might need to be shut down or operate differently than intended. This could lead to significant system and operating challenges and so therefore, generating too much nuclear is undesirable.

### The Plan

Over the first 10 to 15 years of this Plan, 10,000 MW of existing nuclear capacity will be refurbished. Investment should focus first and foremost on the improvement of existing assets so that those facilities can continue to provide reliable, affordable electricity. A coordinated refurbishment schedule was agreed to in 2009 by a working group including OPG, Bruce Power, the OPA and the Ministry of Energy. This schedule will be regularly reviewed and updated to reflect current information on resources and plant performance and conditions.

The government is committed to continuing to use nuclear for about 50 per cent of Ontario's energy supply — a capacity of 12,000 MW will produce that amount of energy. The remaining nuclear capacity of 10,000 MW at Darlington and Bruce will need to be refurbished and modernized.



The remainder of the nuclear capacity that Ontario will need for its projected demand (about 2,000 MW) will be made up of new nuclear at Darlington.

The construction of new nuclear infrastructure requires a significant lead time (approximately 8 to 10 years to commercial operation) and while new nuclear supply will be needed in Ontario, it must be provided at a fair price to ratepayers. Both refurbishment and new build will have significant positive impacts on local economies – and considerable employment opportunities.

In February 2008, the government of Ontario launched a process to procure two new units at the Darlington site. Atomic Energy of Canada Limited (AECL) was one of three vendors who met the February 2009 bid submission deadline. AECL emerged as the only compliant bidder in the process; however the AECL bid price exceeded the province's target. Ontario then sought to finalize a deal with the company to procure the units at an acceptable price.

During the discussions between the Ontario government and the federal government, the federal government announced its intention to sell AECL in May 2009. The news cast a great deal of uncertainty over Ontario's procurement process. The position of uncertainty that the federal government placed AECL in, together with a much higher than anticipated price, made it very difficult for Ontario to finalize a procurement that was in the best interest of ratepayers. As a result, Ontario suspended the RFP process in June 2009.

The Province continued to engage AECL, as the only compliant bidder, in discussions with the hope that a deal could still be finalized. The talks did not lead to any demonstrable progress. Consequently, the Premier of Ontario wrote to the Prime Minister requesting that the process to sell AECL be halted. It was Ontario's position that both levels of government should try to complete the procurement with AECL before the company was sold so that Ontario's need for significant nuclear refurbishment and new nuclear generation could be met while simultaneously protecting jobs and preserving the industry in Canada. This proposal was not pursued by the federal government and their process is continuing without a deal with Ontario being completed.

It is anticipated that the federal government will identify a preferred vendor by the end of this year. Ontario is expecting that the federal government will restructure AECL in a manner that will allow Ontario to be able to complete a deal with the new owner at a price that is in the best interest of ratepayers.

The decrease in demand together with the new supply added in recent years, means that Ontario is well-positioned to examine a number of options for negotiating new nuclear production at the right time and at a cost-effective price.

In the meantime, OPG is continuing with two initiatives that were underway prior to the suspension of the new build procurement process: the environmental assessment and obtaining a site preparation licence at Darlington. It is essential that the province stay ready to construct new nuclear plants as part of the government's ongoing commitment to modernize Ontario's nuclear fleet.

OPG will invest \$300 million to ensure the continued safe and reliable performance of its Pickering B station for approximately 10 years, to 2020. Following this, OPG will begin the longer term decommissioning process and will work with the community of Pickering and the advisory committee to explore future opportunities for the site.

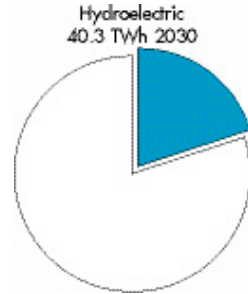
A 2010 report by the Canadian Manufacturers and Exporters estimates the employment and economic benefits from refurbishing and operating the Bruce and Darlington reactors will be substantial: almost 25,000 jobs and annual economic activity of \$5 billion.

In developing a new-build procurement and modernization strategy Ontario will:

- Secure an acceptably priced contract for construction of nuclear new build under specified timeframes.
- Pursue project terms that are in the best interest of ratepayers.
- Retain the maximum number of high-quality, high-paying nuclear industry jobs in the province while providing opportunities for long-term growth of the nuclear industry.

### Renewables: Hydroelectric

Ontario has been generating renewable power from water — hydroelectric power — for over 100 years. Hydroelectric power is clean, renewable, cost-effective and helps to contribute to clean air quality. Hydro currently makes up the vast bulk — about 90 per cent — of Ontario’s total renewable energy supply, representing 8,127 MW of capacity. It is a reliable source of electricity that can continue to provide clean energy for generations to come.



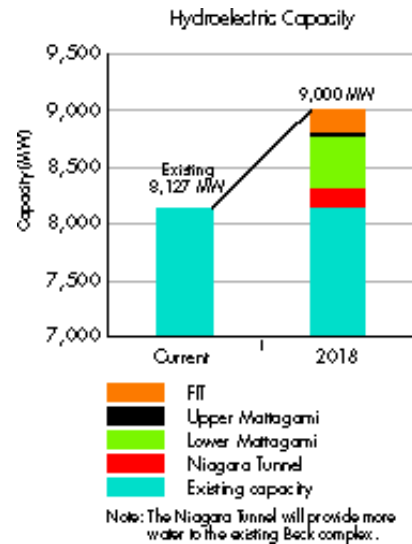
#### Accomplishments

The 2007 Plan projected a total of 7,708 MW of hydroelectric capacity by 2010. The government has exceeded this goal. Ontario has also launched significant hydroelectric projects — the first major investments in 40 years. Since October 2003, 317 MW of new hydro projects have been brought online.

FIGURE 8: HYDROELECTRIC CAPACITY

Some of the larger completed and ongoing hydro projects to meet Ontario’s future needs include:

- Niagara Tunnel project, which will increase the amount of water available for power generation at the Sir Adam Beck Generating Station
- The Lower Mattagami project expansion – the largest hydroelectric project undertaken in Ontario in 40 years. This project will add about 440 MW of clean electricity generating capacity to Ontario’s energy grid, while providing \$2.6 billion of investment in the North
- Healey Falls, a 15.7 MW facility near Campbellford, east of Peterborough
- Lac Seul Generating Station, a 12.5 MW facility near Ear Falls
- Trent Rapid Hydroelectric Station, an 8 MW facility near Peterborough
- Sandy Falls, a 5.5 MW facility on the Mattagami River, near Timmins.



#### Future need

More hydroelectric power will be added to Ontario’s electricity system in the next eight years than over the previous 40 years. Unlike Quebec, Ontario does not have the geography to support massive reliance on hydroelectric power. (Quebec has almost four times the hydro capacity of Ontario.) New hydroelectric generation will continue to be an important part of a clean, reliable system over the next 20 years. The government is also reviewing how crown land is made available for waterpower projects, particularly for smaller Feed-In-Tariff (FIT) Program projects.

#### The Plan

Ontario will continue to develop the province’s hydroelectric potential and is planning for 9,000 MW of hydroelectric capacity by 2018.

Once the Niagara Tunnel expansion is complete, it will provide enough electricity to power 160,000 homes. When the capacity expansion at Lower Mattagami is complete, the project will provide enough electricity to power over 300,000 homes. These projects will help to maximize Ontario’s existing hydro projects.

Existing hydro is the cheapest form of generation in Ontario and in many cases, it can help to meet peak power demand. There are a number of projects that are currently under consideration, such as:

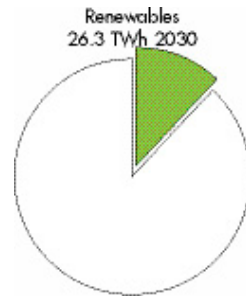
- Two hydroelectric generating stations on the Little Jackfish River (north of Lake Nipigon) that could add 100 MW of capacity
- New Post Creek, a 25 MW project in the development stage
- Mattagami Lake Dam, a 3-6 MW development at Kenogamissi Falls on the Mattagami River.

Ontario will plan for future hydroelectric development where it is cost-effective to build. This will mean FIT-level hydro projects (less than 50 MW) will also be considered.

New hydro projects complement other renewable initiatives and help to eliminate coal by 2014. Some additional projects will be considered, but large-scale projects, usually in remote locations, are not economically feasible at this time due to high capital and construction costs. Transmission, engineering and environmental factors are also challenges. However, due the importance of hydroelectric generation, Ontario will continue to study Northern hydro options over the period of the Plan.

### Renewables: Wind, Solar and Bio-energy

Ontario has become a North American leader in producing energy from sources that are continually renewed by nature such as wind, sun and bioenergy. Renewables do not produce harmful emissions, which contribute to smog, pollution and climate change. Increasing Ontario's renewable energy supply helps reduce the province's reliance on fossil fuels. Greater investments and reliance on renewable energy help to ensure that Ontario has a clean and reliable electricity system for generations to come.



#### Accomplishments

Ontario is now Canada's leading province for wind and solar capacity and home to the country's four largest wind and solar farms. The world's largest photovoltaic solar farm is in Sarnia (Enbridge's 80 MW Sarnia Solar) and Canada's largest wind farm is near Shelburne (the 199.5 MW Melancthon EcoPower Centre). In 2003, Ontario had 10 wind turbines; today, the Province has more than 700.

Since October 2003, the government has signed more than 16,000 renewable energy supply contracts from wind, water, solar and bio-energy sources. This includes almost 2,400 MW of small and large renewable power projects under North America's first comprehensive Feed-in Tariff (FIT) Program, introduced in 2009. These FIT contracts represent a private sector investment of \$9 billion and are projected to create approximately 20,000 direct and indirect clean energy jobs.

The success of the FIT Program has also attracted the notice of global investors, including a consortium of companies led by Samsung C&T Corporation, laying the foundation for Ontario to become a global clean energy production and manufacturing hub.

Ontario's Feed-in Tariff (FIT) Program combines stable, attractive prices and long-term contracts for energy generated using renewable resources.

Homeowners, business owners and developers may apply to the FIT Program if they use one or more forms of renewable energy, including wind, waterpower, solar photovoltaic (PV) power and bioenergy.

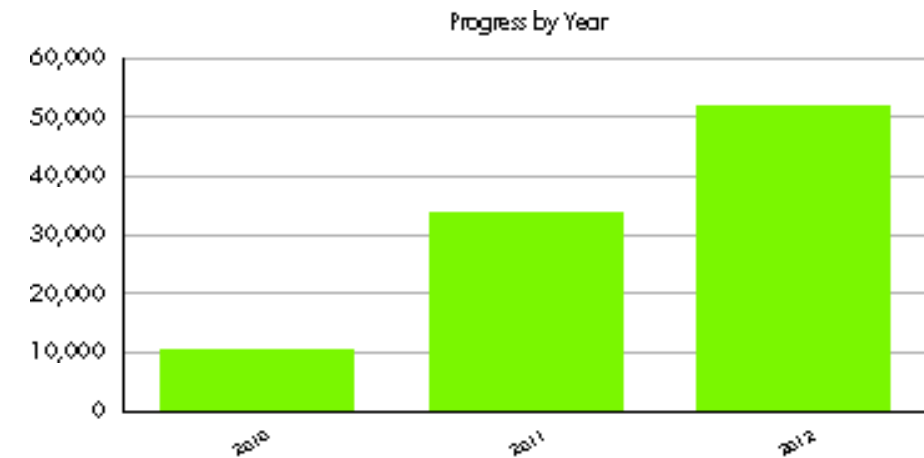
The Program is the first comprehensive FIT program in North America. It was launched through the Green Energy and Green Economy Act, 2009.

Over 1,000 FIT contracts are currently in place for clean energy projects.

Some 51 community projects will provide renewable electricity supply to the grid through the Ontario FIT program. From these projects, more than 200MW of clean electricity will be generated by communities engaging in, solar, wind and bio-energy projects across Ontario.

Thousands of Ontarians are also participating in the microFIT Program. Homeowners, farmers or small business owners, are able to develop a very small or "micro" renewable electricity generation project (10 kilowatts or less in size) on their properties. Under the microFIT program, they are paid a guaranteed price for all the electricity they produce for 20 years.

FIGURE 9: PROGRESS ON 50,000 PROJECTED GREEN ENERGY ACT JOBS



### Major Private-Sector Renewable Investments in Ontario

The \$7-billion Green Energy Investment Agreement with Samsung C&T Corporation and Korea Electric Power Corporation (Consortium), is the single largest investment in renewable energy in provincial history. It will:

- Build 2,500 MW of wind and solar power.
- Deliver an estimated 110 million megawatt-hours of emissions-free electricity over the 25-year lifetime of the project — enough to supply every Ontario home for nearly three years.
- Create more than 16,000 new clean energy jobs to supply, build, install and operate the renewable generation projects.
- Lay the groundwork with major partners to attract four manufacturing plants.

Out of the 16,000 new clean energy jobs, this investment is expected to create or sustain 1,440 manufacturing and related jobs, building wind and solar technology for use in Ontario and export across North America.

As part of the Green Energy Investment Agreement, Samsung and Siemens have announced plans to build Ontario's first wind turbine blade manufacturing plant, which will create up to 900 direct and indirect jobs. The Consortium will negotiate with manufacturing partners to locate three other plants in Ontario for wind turbine towers, solar inverters and solar module assembly.

Under the agreement, three of the four manufacturing facilities are scheduled to be ready in 2013, while the fourth is scheduled to be in operation by the end of 2015. The Consortium also intends to use Ontario-made steel and other Ontario content in its renewable energy projects for items such as wind turbine towers.

More than 20 companies have publicly announced plans to participate in Ontario's clean energy economy, in the last year. These companies are currently operating or plan to set up solar and wind manufacturing facilities in Ontario in the following categories: solar PV modules, mounting systems, inverters, wind turbine blades and wind turbine towers. Some recent examples include:

- Heliene Inc., producing modules in Sault Ste. Marie;
- Canadian Solar, will manufacture modules in Guelph;
- Photowatt, producing modules in Cambridge;
- Samco, an auto parts manufacturer now also producing solar mounting systems in Scarborough;
- Schletter, producing solar mounting systems in Windsor;
- Sustainable Energy Technologies partnering with Melitron to produce inverters in Guelph;
- Satcon, producing inverters in Burlington;
- Siemens will be producing wind turbine blades; and,
- DMI Industries is producing wind turbine towers in Fort Erie.

#### Future Needs

Ontario will continue to be a leader in renewable energy development and generation. The growth of the renewable energy sector will be influenced by electricity demand, the ability of the system to accommodate additions to the grid, continued innovation in the renewable technology sector and global demand for renewable energy production. Expansions and upgrades to the transmission and distribution system will be necessary to increase the capacity for renewable energy in Ontario.

As more and more of Ontario's electricity comes from renewable energy sources and research and innovation of Smart Grid technologies continues, there will be increased opportunities for renewable energy projects, both large and small to be established in Ontario.

There will also be greater opportunity for employment in this field. Renewable energy projects require skilled labour, such as engineers as well as construction and maintenance labour across the province. As renewable energy projects are established, the need for skilled and general labour will continue to provide jobs for thousands of Ontarians over the next decade. Innovation in new technology also contributes high skilled jobs and economic opportunities for Ontario.

Biomass is dispatchable and can be used as a peaking resource. This attribute allows it to complement increased wind and solar generation. The conversion of Atikokan Generating Station to run on biomass will contribute to long-term system reliability, especially during low water conditions in the region. The conversion from coal to biomass at Atikokan by 2013 will create up to 200 construction jobs and help protect jobs at the plant. It will also support jobs in Ontario related to the production of wood pellets and sustain other jobs in the forestry sector. Ontario will continue to monitor the conversion of Atikokan and consider future potential of biomass generation.

#### The Plan

Ontario will continue to develop its renewable energy potential over the next decade. Based on the medium growth electricity demand outlook, a forecast of 10,700 MW of renewable capacity (wind, solar, and bioenergy) as part the supply mix by 2018 is anticipated. This forecast is based on planned transmission expansion, overall demand for electricity and the ability to integrate renewables into the system. This target will be equivalent to meeting the annual electricity requirements of two million homes.

The province's renewable energy capacity target will be met with the development of renewable energy projects from wind, solar, biogas, landfill gas and biomass projects across Ontario.

Future rounds of FIT projects will be connected to the Bruce to Milton transmission line and the priority transmission projects identified as part of this Long-Term Energy Plan. This will enable 4,000 MW of new renewable energy projects to be connected.

In the near term, the OPA will be releasing information regarding the status of all FIT applications not offered contracts as of June 4, 2010. These applications will be subject to the first Economic Connection Test (ECT) under the FIT program. The ECT process, to be conducted on a regular basis and in alignment with major planning or system development milestones, will help to determine whether the costs of grid upgrades to allow a FIT project to connect to the grid are economically viable.

For the period after 2018, depending on changes in demand, Ontario will look for opportunities to increase the development of renewable energy projects and expand renewable energy capacity in the Province. Ontario will review the electricity demand outlook in the next Long-Term Energy Plan to explore whether a higher renewables capacity forecast is required.

FIT contract prices were set following extensive consultations and are designed to ensure a reasonable rate of return for investors while providing good value for clean, renewable energy for Ontario ratepayers.

As part of the scheduled two-year review of the FIT Program in 2011, the FIT price of renewables in Ontario will be re-examined. Successful and sustainable FIT programs in a number of international jurisdictions (such as Germany, France and Denmark) have decreased price incentives. Advances in technology and economies of scale reduce the cost of production. A new price schedule will be carefully developed to achieve a balance between the interests of ratepayer and the encouragement of investment in new clean energy in Ontario.

The response to the microFIT and FIT programs has been a tremendous. Thousands of Ontarians are participating in the program to feed clean energy into the grid.

Given the popularity of Ontario's growing clean energy economy, applications to the microFIT and Capacity Allocation Exempt (CAE FIT) program are outpacing needed upgrades to the grid. To continue to ensure the growth of small clean energy projects, Ontario will continue to invest in upgrades to the transmission and distribution systems to accommodate renewable supply.

In areas where there are technical challenges, the OPA, Hydro One and Local Distribution Companies will continue to work with proponents that have already applied to the CAE FIT or microFIT program.

## Natural Gas

Natural gas plants have the flexibility to respond well to changes in demand, making them an important cushion for Ontario's electricity system — particularly for peak periods.

Natural gas produces electricity either by burning to directly power a gas turbine or by producing steam to drive a steam turbine. A combined cycle gas plant combines these two technologies. Natural gas can supplement baseload power supply and, because it responds quickly to increases in demand, it can also complement the intermittent nature of wind and solar electricity generation.

Natural gas is much cleaner than coal. Some air emissions — particularly mercury and sulphur dioxide — are totally eliminated when natural gas replaces coal. Carbon dioxide emissions are reduced by between 40 and 60 per cent. Currently, Ontario's electricity generation capacity from natural gas is over 9,500 MW.

By replacing coal with natural gas and renewable energy sources, Ontario has greatly reduced greenhouse gas emissions from its electricity supply mix. This policy has prepared Ontario for the possibility of greenhouse gas regulation in the North American market.

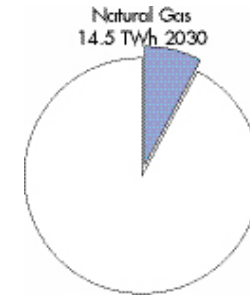
### Accomplishments

The Ontario government and the OPA have launched a number of clean natural gas and cogeneration projects since 2003 to help with local reliability and peak demand.

The 2007 Plan projected that some 12,000 MW of natural gas would be needed by 2015. Since then, changes in demand and supply — including about 8,400 MW of new, cleaner power across the system and successful conservation efforts — means that less capacity will be required.

### Future Needs

In 2009, about 10 per cent of Ontario's electricity generation came from natural gas. In the coming years, the government anticipates that it will be necessary to maintain the amount of natural gas supply at its current level in the supply mix.





## The Plan

Natural gas will continue to play a strategic role in Ontario's supply mix as it helps to:

- Support the intermittent supply from renewables like wind and solar
- Meet local and system reliability requirements
- Ensure adequate capacity is available as nuclear plants are being modernized

The 2007 Plan outlined a forecast need for an additional three gas plants in the Province, including one in the Kitchener-Waterloo-Cambridge and one in the southwest GTA.

Because of changes in demand along with the addition of approximately 8,400 MW of new supply since 2003, the outlook has changed and two of the three plants — including the proposed plant in Oakville — are no longer required. However, a transmission solution to maintain reliable supply in the southwest GTA will be required.

As indicated in 2007 Plan, the procurement of a peaking natural gas-fired plant in the Kitchener-Waterloo-Cambridge area is still necessary. In that region, demand is growing at more than twice the provincial rate.

Ontario is taking advantage of its existing assets with the conversion of two coal-fired units in Thunder Bay to natural gas. (See page 21 on Coal.)

Over the next few years, non-utility generation contracts, which were entered into between the private sector and the former Ontario Hydro in the early 1990s, will begin to expire. Many of these are natural gas-fired. These non-utility generators — or NUGs as they are known — have been part of Ontario's overall supply mix for 20 years. They can contribute up to 1,550 MW of clean power to the system. The contracts with NUGs are currently held by the Ontario Electricity Financial Corporation, an agency of the Ministry of Finance.

As non-utility generator contracts expire, the IESO and the OPA will determine if the generation is still required to help ensure reliability. The government will direct the OPA to design contracts that will encourage NUGs to operate during periods when it would most benefit the electricity system. The OPA will be authorized to enter into new contracts where this generation is needed and will negotiate to get the best value for consumers.

## CHP (Combined Heat and Power/Cogeneration)

Combined Heat and Power is the simultaneous production of electricity and heat using a single fuel such as natural gas. The heat produced from the electricity generation process is captured and used to produce steam or hot water that can then be used for industrial and commercial heating or cooling purposes, such as district energy systems.

CHP can make more efficient use of fuel and therefore reduce greenhouse gas emissions. CHP overall efficiency can exceed 80 per cent — which means that 80 per cent of the energy can be captured as electricity or usable heat.

### Accomplishments

Currently, the total industrial CHP capacity in Ontario is estimated to be about 2,000 MW, or about 6 per cent of Ontario's installed generation capacity.

In October 2006, the OPA awarded seven contracts with a total capacity of 414 MW — enough to provide the power for 400,000 Ontario homes. Much of this new capacity (395 MW) will be coming from industrial projects. These facilities are in communities across the province including: Windsor, Kingsville, London, Oshawa, Markham, Sault Ste. Marie and Thorold.

### Algoma Energy Cogeneration Facility

The 63 MW Algoma Energy Cogeneration Facility is located in Sault Ste. Marie, Ontario. The facility uses the by-product fuels from cokemaking and ironmaking (blast furnace and coke oven gas) to generate electricity and steam used for steel manufacturing operations.

The facility reduces Essar Steel Algoma's reliance on the provincial power grid by 50 per cent on average, freeing up this capacity for the rest of the province. This cogeneration facility helps to reduce Essar Steel Algoma's nitrous oxide emissions by 15 per cent (approximately 400 metric tonnes a year).

## The Plan

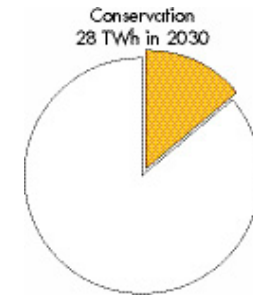
Ontario will target a total of 1,000 MW of CHP. It will be procured through the OPA and will include existing contracts, individual negotiations for large projects and a new standard offer program for smaller projects in key strategic locations.

The government will encourage new local CHP generation projects, where price, size and location make sense. The government will work with the OPA to develop options for small, targeted programs. Over the next 20 years, Ontario will see more community-scale CHP projects. The OPA will create a new standard offer program for CHP projects under 20 MW in specific locations.

The OPA will continue to negotiate larger CHP projects on an individual basis. For example, the OPA and St. Marys Paper Corporation recently signed a 10-year contract for the company to generate clean electricity at a new 30 MW biomass-fuelled plant to be built next to St. Marys existing mill in Sault Ste. Marie. The plan is expected to reach commercial operation by early 2014 and will support 550 direct and indirect jobs.

# 3 conservation

Conservation is Ontario's most environmentally friendly and cost-effective resource. Conservation initiatives save money and reduce greenhouse gas emissions. Reducing consumption reduces bills for consumers and reduces demand on the system, avoiding the need to build new generation. For every dollar that is invested in conservation, two to three dollars of net savings are realized over the life of the investment. Conservation can also create local jobs in energy audits and energy services.



## Accomplishments

From 1995 to 2003, there were no provincial conservation programs — it was not a priority. Since 2003, Ontario has had goals for conservation and as a result, this province has become a North American leader. The goal to reduce peak demand by 6,300 MW by 2025 was included in the 2007 Plan. Ontario is on target to meet this goal.

### Ontario's A+ 2009 National Energy Efficiency Report Card from the Canadian Energy Efficiency Alliance

The province raised its grade from a "C-" in 2004 to an A+ in 2009 with its strong commitment to energy efficiency and conservation as cornerstones of its energy plan. In addition to the Green Energy and Green Economy Act, 2009, the report lauds Ontario's energy conservation programs, improved energy efficiency in building codes and product standards, as well as other initiatives supporting energy efficiency.

To improve the quality of the province's air and the efficiency of the system, Ontario invested about \$1.7 billion in conservation programs from 2006 to 2010. This will save ratepayers \$3.8 billion in avoided costs.

Conservation programs also give customers the tools to help them manage costs, and balance demand in peak periods in winter and summer. Conservation programs also create jobs in the clean energy sector.

Ontario has helped to create a culture of conservation since 2003 by:

- Updating Ontario's building code to make energy efficiency a core purpose.
- Delivering the Home Energy Savings Program which has helped over 393,000 homeowners with energy audits and helped nearly 250,000 homeowners with energy savings and retrofits. Despite the federal government's early withdrawal from funding this conservation program in March 2010, Ontario will continue to support the Home Energy Savings Program until March 31, 2011. This program helped save annual greenhouse gas emissions equivalent to taking over 83,000 cars off the road.
- Initiating the OPA's Great Refrigerator Round Up which has removed more than 230,000 old appliances since 2007. It will result in lifetime savings of more than one million megawatt hours over the life of the program.
- Providing \$550 million over two years for energy retrofits in schools.
- Launching the Ontario Solar Thermal Heating Initiative for solar water and air heating projects for institutional, commercial or industrial organizations. The program continues until March 31, 2011. Almost 600 projects have been launched or completed to date.
- Moving forward with Smart Meters and Time of Use billing to encourage consumers to shift electricity consumption away from peak periods of demand; Avoided system expenditures help keep costs down for Ontarians.
- Reducing electricity consumption in government buildings through initiatives such as deep lake water cooling — a reliable, efficient and sustainable way to cool buildings while reducing demand on the grid.

Over the past five years, Ontario's conservation programs have generated over 1,700 MW of peak demand savings — the equivalent of over 500,000 homes being taken off the grid. Local Distribution Companies have been partners in helping Ontario achieve its conservation targets.

Conservation efforts are measured by looking at the results of conservation programs. The impacts of the global economic recession are not counted as part of conservation efforts, although they did result in a significant reduction in electricity demand. The recession also affected the level of participation in conservation programs which, although successful, are not expected to allow Ontario to meet its 2010 interim target. Confirmation of this will occur late in 2011, after program results undergo rigorous verification by independent third-parties. Had the global recession not had a significant impact on Ontario's economy, 2010 conservation achievements would have been significantly higher.

## The Plan

Working together to reduce electricity use at peak times makes sound economic and environmental sense. Providing consumers with the benefit of up-to-date and accurate electricity consumption readings is also critical to the creation of a culture of conservation. The government is committed to moving forward with implementation of a Time-of-Use pricing structure that balances benefits for both the consumer and the electricity system as a whole.

To help families, Ontario will move the off-peak period for electricity users to 7 p.m. which will provide customers with an additional two hours in the lowest cost period. This change will be in effect for the May 2011 Regulated Price Plan update.

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### Time-of-Use

*"On average, most farmers will pay slightly less on time-of-use billing than they currently pay. Advantages for farmers will be modest with a savings in the range of one to five per cent. However, the advantages for the power supply system will be substantial..."*

*- Don McCabe, Ontario Federation of Agriculture*

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Ontario is already a North American leader in conservation (the province conserved over 1,700 MW since 2005). The government's target is 7,100 MW and 28 TWh by 2030. This would mean the equivalent of taking 2.4 million homes off the grid. This level of conservation will reduce Ontario's greenhouse gas emissions by up to 11 megatonnes annually by 2030. These targets are among the most aggressive in North America.

As part of the Green Energy and Green Economy Act, 2009, Local Distribution Companies (LDCs) will become a more recognizable "face of conservation" and have been assigned conservation targets which they must meet as a condition of their licence. LDCs will meet their targets through a combination of province-wide and local conservation programs.

Ontario proposes to provide support for homeowners to have energy audits to become better informed of the opportunities to improve the energy efficiency of their homes.

# 4 reliable transmission/ modern distribution

## Conservation targets

Date	2015	2020	2025	2030
Capacity	4,550 MW	5,840 MW	6,700 MW	7,100 MW
Generation	13 TWh	21 TWh	25 TWh	28 TWh

These targets will be met through a combination of programs and initiatives:

- Innovative energy efficiency programs for residential, commercial and industrial sectors
- Next-generation building code updates and standards for appliances and products
- Demand response programs to help reduce peak demand
- Time-Of-Use rates

The government anticipates that the commercial sector will contribute 50 per cent of the conservation target; residential sector will contribute 30 per cent; and industrial sector 20 per cent.

Over the next 20 years, Ontario's conservation targets and initiatives are projected to save about \$27 billion in ratepayer costs on the basis of a \$12 billion investment. Conservation will also do more than that by helping to ensure that Ontario's air is cleaner and the electricity sector reduces its impact on the environment.

Ontario will continue to provide broad support for achieving these targets through policy initiatives such as bringing forward a proposed regulation to require the broader public sector (municipalities, universities, schools and hospitals) to develop energy conservation plans.

In early 2011, together with LDCs, Ontario will launch a number of new programs, which will allow the province to meet its conservation targets over the next few years and make up for the slower period between 2009 and 2010. The programs will target all sectors, be better coordinated and have greater customer focus than previous programs.

Ontario is designing, implementing and funding a province-wide electricity conservation and demand management program for low-income residential consumers. Ontario is also developing a low-income energy program comprised of natural gas conservation, customer service standards and emergency financial assistance.

These new conservation programs, together with programs for very large industrial customers, will require an investment of about \$3 billion over the next five years. The results will be significant: an avoided lifetime supply cost of \$10 billion and a net benefit to Ontario ratepayers of about \$7 billion over the life of the conservation measures.

Reliable transmission and modern delivery is the backbone of Ontario's electricity system. It is crucial for supporting Ontario's evolving supply mix, including the closing of coal-fired plants by 2014 and the further expansion of Ontario's clean energy resources. Reliable, safe transmission brings electricity from large generators to Ontario's largest industries and local distribution companies who in turn, deliver to homes and businesses. A modern distribution system, utilizing new technology, allows for greater customer control, incorporates renewable energy, enhances reliability, and supports new technology like electric vehicles.

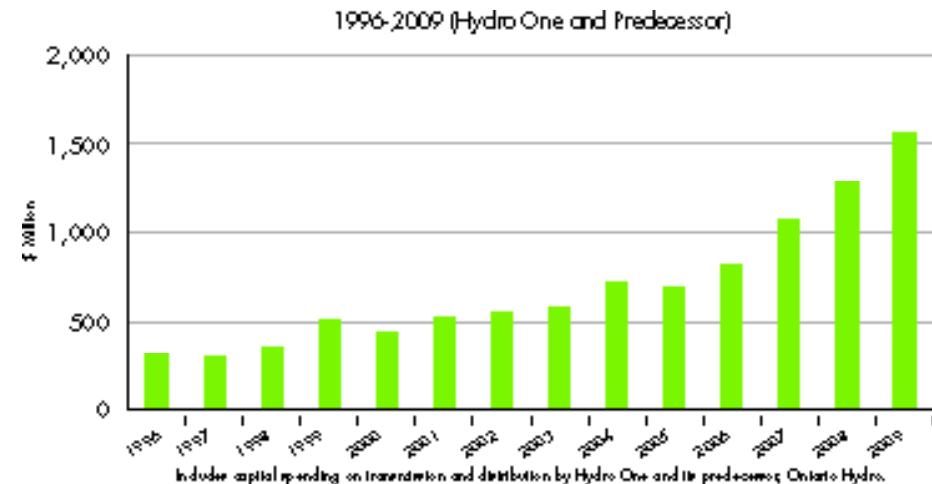
## Transmission

Ontario must take the transmission system that's been built over the past century and continue to renew and update it to meet Ontario's growing population, evolving supply mix, and enable more distributed generation.

The Ontario government has taken early and decisive steps to enhance existing electricity infrastructure. It is important to ensure that Ontario can efficiently upgrade the grid to carry additional renewable generation to homes, businesses and industries.

Since 2003, Hydro One has invested more than \$7 billion in its transmission and distribution systems. The average annual investment has been double what it was from 1996-2003.

FIGURE 10: GRID INVESTMENTS



Some of Ontario's recent investments include:

- The launch of the Bruce to Milton transmission expansion project — the largest electricity transmission investment in Ontario in the last 20 years, which will connect refurbished nuclear units and additional renewable energy to the grid.
- Ongoing work to reinforce the power transfer capability between northern and southern Ontario including additional 750 MW of planned clean northern generation (Lower Mattagami and some northern FIT Program projects).
- The new Ontario-Québec Interconnection Project (2010), which increased access to 1,250 MW of hydroelectric power and enhanced system reliability in eastern Ontario.
- Additional transmission projects that will facilitate the retirement of coal-fired generation, including transmission reinforcement in the Sarnia area, the installation of new transformers in the northern GTA, and voltage support facilities in the Niagara, London and Kitchener areas. These projects represent an investment of over \$400 million.
- Over 15 per cent of transformer stations across Ontario have received overhauls in the past five years, amounting to a total investment of \$850 million.
- Installation of almost 4.3 million smart meters across the province, which are already helping with outage management and remote meter reading and reducing the number of estimates for consumers.
- Early investments in Smart Grid infrastructure and technologies, including pilots and demonstration projects. These projects will help Ontario move toward a Smart Grid system that can integrate energy monitors, home automation systems, in-home renewable generation and electric cars.
- Hydro One's \$125-million Grid Control Centre opened in 2004 and uses some of the most sophisticated technology in the world to efficiently manage the bulk of Ontario's electricity network.

Reliability has also been improved since 2003 due to a combination of new generation, transmission upgrades, reduced load growth and successful conservation programs. For example, Toronto's reliability was enhanced with the installation of two new underground cables between downtown transfer stations and will be further assisted by reinforcement and upgrade projects worth about \$360 million. Annual capital investments by Ontario's Local Distribution Companies, including Hydro One, have averaged \$1.1 billion between 2004 and 2009, maintaining reliable and high quality power for Ontario's electricity customers. These investments have made the operation of the system more cost-effective, which will have an impact on Ontarians' bills over the long term.

## Modern Distribution

Local distribution systems are an important link in how electricity moves from generators to homes and businesses. In 2003, Ontario's distribution systems often relied on older technology. The government's move towards a Smart Grid was driven by the need to replace aging infrastructure, introduce customer control, incorporate more renewable energy and accommodate new adaptive technology such as electric vehicle charging. Over time, LDCs will have to replace old mechanical infrastructure with newer automated infrastructure that meets Ontario's future needs.

A modern distribution system must be able to accommodate new energy supply from a variety of sources and deliver it reliably to consumers. It must take advantage of Smart Grid technologies to enable efficient and cost-effective delivery of electricity, helping customers to better manage their electricity use, and integrate more renewable energy.

Building a Smart Grid that can coordinate the production of power from large numbers of small power producers and allow utilities to more efficiently manage their grid infrastructure is another essential element of Ontario's clean energy future. Other jurisdictions (Australia, Great Britain and California) are moving toward a smarter grid, but Ontario is leading the way in many areas. By leveraging existing communications technology, a Smart Grid will enable the two-way power flow of electricity across the grid. The Smart Grid will help incorporate distributed generation. It will also improve grid automation with real-time information that will help save energy, reduce the cost of supply over time and increase reliability.

A Smart Grid is a more intelligent grid infrastructure, incorporating communications technology and automation to:

- Maximize existing infrastructure
  - Rather than building out more traditional grid infrastructure (poles, wires, etc), a Smart Grid will use Information Technology solutions to improve and automate distribution.
- Modernize the grid
  - The current distribution system in some places is decades old. A modernized grid is critical for improving reliability, home automation and adapting to evolving transportation needs.
- Lay the foundation for Smart Homes
  - A Smart Grid will put in place the intelligent infrastructure required to support applications for home automation, conservation and smart charging for electric vehicles.

The Green Energy and Green Economy Act, 2009 identified three main areas of focus for Ontario's Smart Grid:

- Helping consumers become active participants in conservation.
- Connecting new and renewable sources of energy to the overall system (consumers and businesses produce energy that can be connected to the local system) to help address power demands.



- Creating a flexible, adaptive grid that can accommodate the use of emerging, innovative energy-saving technologies and control systems.

Smart meters provide a foundation for the Smart Grid and provide customers with timely and accurate information about their electricity use. Smart meters also provide utilities with automatic notification of outages, save on in-person meter-reading costs and enable Time-of-Use pricing.

Smart meters also help avoid system costs that in turn save money for ratepayers: Hydro Ottawa saved \$200,000 in meter reading in 2008 and Toronto Hydro estimates that smart meters will cut meter-reading costs by \$2.5 million by 2010.

Future Needs

The Ontario government, working with its agencies, will move forward responsibly on a number of new and modernizing transmission projects as well as on improving and maintaining the province's existing infrastructure across all regions in Ontario. These improvements will also balance environmental concerns and the cost to ratepayers. In addition to evaluating the province's need for transmission to integrate renewables, meet provincial demand growth and ensure reliable service, system planning will address community needs. For example, a transmission solution to maintain reliable supply in the southwest GTA will be required.

The Plan

In 2009, the government asked Hydro One to start planning and developing a series of new transmission and distribution projects. Since that time, there have been a number of developments, such as the substantial interest in the Green Energy and Green Economy Act, 2009 to develop renewable energy projects.

Based on the advice of the OPA, the government will prudently move forward with cost-effective priority transmission projects that meet current and future demand and also:

- Accommodate renewable projects;
- Serve new load; and
- Support reliability.

Ontario will proceed first with an investment of approximately \$2 billion in five priority projects to be completed in the next seven years, which will ensure a growing mix of renewable sources can be reliably transmitted across the province. These priority projects together with the Bruce to Milton line, in addition to various other station and circuit upgrades, will enable approximately 4,000 MW of additional renewable energy.

FIGURE 11: TRANSMISSION INVESTMENTS: COMPLETE, UNDERWAY AND PROPOSED

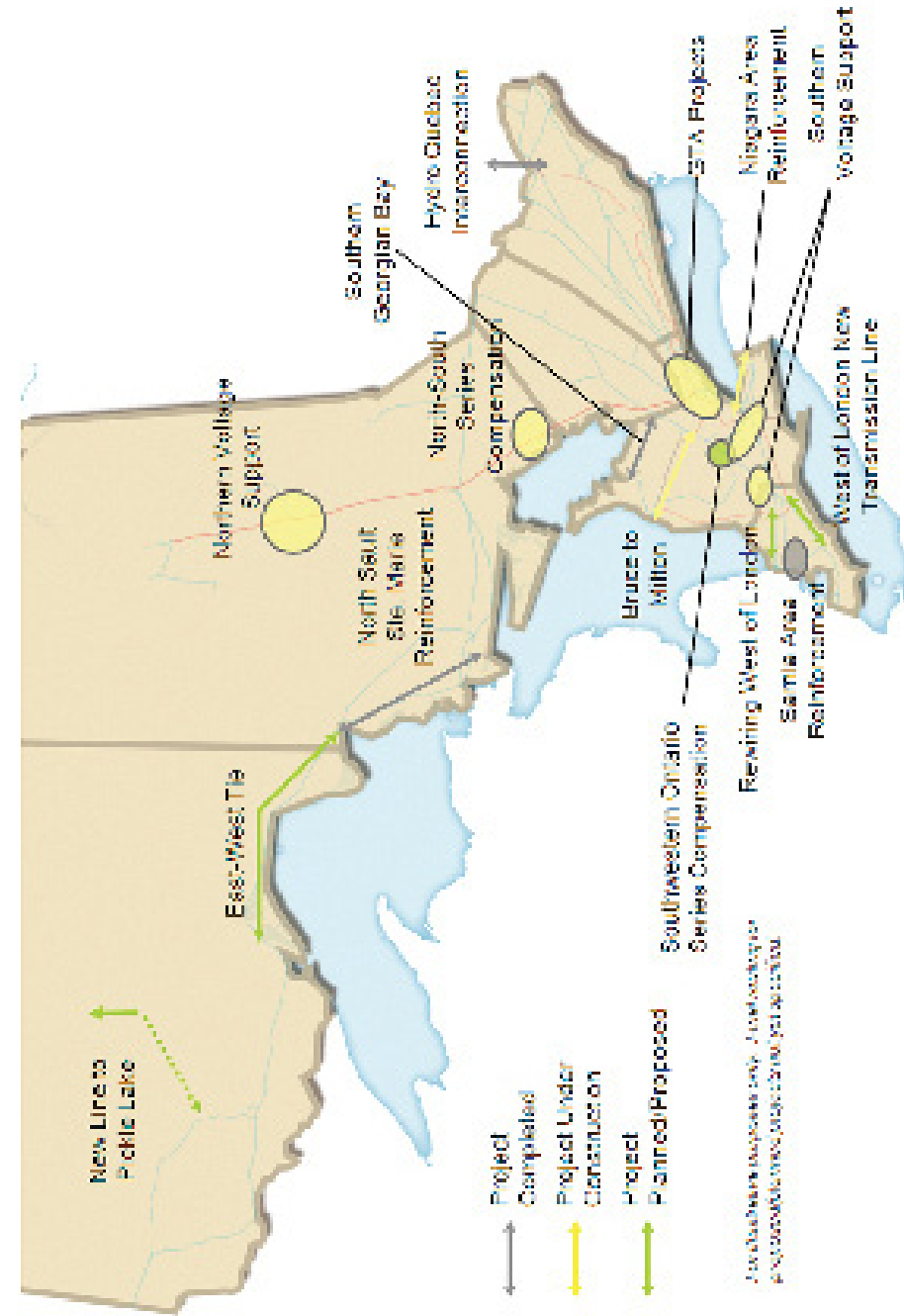


FIGURE 12: PRIORITY TRANSMISSION PROJECTS

Project	Type	Need	Target Completion Date
Series compensation in Southwestern Ontario	Upgrade	Add renewables to grid	2014
Rewiring west of London	Upgrade	Add renewables to grid	2014
West of London	New Line	Add renewables to grid	2017
East-West Tie	New Line	Maintain system reliability, allow more renewables, accommodate electricity requirements of new mineral processing projects.	2016-17
Line to Pickle Lake	New line	Serve industry needs and help future remote community connection	Pending consultation

Given the nature of the transmission upgrades in southwestern Ontario, including series compensation, rewiring and a new line west of London, the government intends to direct Hydro One to carry out these projects immediately.

The East-West tie will be submitted to the OEB to carry out a designation process to select the most qualified and cost-effective transmission company to develop the line.

To ensure successful and timely implementation of the line to Pickle Lake, the government will work with its agencies and the multiple parties involved, including the Federal government, local industries, and First Nation communities that stand to benefit from the project to establish an implementation schedule and a proponent for the line.

Transmission planning will also continue at the regional level, using an approach that considers conservation, demand management, distributed generation and transmission. Regional plans will assess needs based on a region's unique resource mixes and community priorities. Load growth and system reliability are also factors in determining system planning and transmission solutions. Ontario will continue to plan and study additional transmission projects as demand and changes to supply require.

To build a modern system, the government will issue a set of Smart Grid principles and objectives to the Ontario Energy Board. These will provide guidance to LDCs in modernizing their distribution systems and enable the smart home of the future. LDCs will develop smart grid plans and ensure that these are coordinated across the Province. The government will also establish a Smart Grid Fund in 2011 which will provide assistance to Smart Grid companies with a strong Ontario presence. This will lead to new economic development opportunities and bolster Ontario's position as a leader in the Smart Grid.

# 5 aboriginal communities

## Accomplishments

The Ontario government is committed to encouraging opportunities for Aboriginal participation in the energy sector and has launched several initiatives to support participation by First Nation and Métis communities in energy projects, including:

- The Aboriginal Energy Partnerships Program
- The FIT Program: 17 aboriginal-led or partnered projects have secured contract offers
- The \$250-million Aboriginal Loan Guarantee Program

Ontario also has a significant partnership at the \$2.6 billion Lower Mattagami hydroelectric project, which will see Moose Cree First Nation have up to a 25 per cent equity position with OPG.

## Future Needs

First Nation and Métis communities have diverse energy needs and interests. Ontario will work to ensure there is a wide range of options for Aboriginal participation in Ontario's energy future.

## Conservation

Conservation priorities and the applicability of programs will vary between First Nation and Métis communities. Community education and youth engagement are also critical for conservation success. Ontario will launch programs to support participation in conservation initiatives, including Aboriginal Community Energy Plans and targeted conservation programs.

## Renewable Energy

Future opportunities for First Nation and Métis communities include:

- Partnerships with private developers on confirmed FIT projects under development,
- Development of smaller renewable microFIT projects, like small wind or solar, to build community capacity in energy and generate income.

Existing Green Energy and Green Economy Act, 2009 support programs will be adjusted to ensure that aboriginal communities can take advantage of these opportunities. Aboriginal participation levels will also be reviewed during the regular FIT program review to determine whether adjustments are needed to the rules and incentives.

## Transmission

Where new transmission lines are proposed, Ontario is committed to meeting its duty to consult First Nation and Métis communities in respect of their aboriginal and treaty rights and accommodate where those rights have the potential to be adversely impacted. Ontario also recognizes that Aboriginal communities have an interest in economic benefits from future transmission projects crossing through their traditional territories and that the nature of this interest may vary between communities.

There are a number of ways in which First Nation and Métis communities could participate in transmission projects. Where a new transmission line crosses the traditional territories of aboriginal communities, Ontario will expect opportunities be explored to:

- Provide job training and skills upgrading to encourage employment on the transmission project development and construction.
- Further Aboriginal employment on the project.
- Enable Aboriginal participation in the procurement of supplies and contractor services.

Ontario will encourage transmission companies to enter into partnerships with aboriginal communities, where commercially feasible and where those communities have expressed interest. The government will also work with the OPA to adjust the Aboriginal Energy Partnerships Program — currently focussed on renewable energy projects — to provide capacity funding for aboriginal communities that are discussing partnerships on future transmission projects.

## The Plan

Ontario recognizes that successful participation by First Nation and Métis communities will be important to advance many key energy projects identified under a Long-Term Energy Plan. The path forward needs to be informed by regular dialogue with First Nation and Métis leadership through distinct processes. Working with First Nation and Métis leadership, Ontario will look for opportunities to promote on-going discussion of these issues.

Ontario's remote First Nation communities currently rely on diesel generation for their electricity supply — but diesel fuel is expensive, difficult to transport, and poses environmental and health risks. According to analysis done so far, transmission connection would be less expensive over the long term than continued diesel use for many remote communities.

New transmission supply to Pickle Lake is a crucial first step to enable the connection of remote communities in northwestern Ontario. A new transmission line to Pickle Lake — one of this plan's five priority projects — will help to service the new mining load and help to enable future connections north of Pickle Lake. Subject to cost contributions from benefiting parties, Ontario will focus on supplying Pickle Lake from the Ignace/Dryden area immediately. A line to serve the Nipigon area specifically will continue to be considered as the need for it evolves.

As part of this project, the government will also ask the OPA to develop a plan for remote community connections beyond Pickle Lake, including consideration of the relevant cost contributions from benefiting parties, including the federal government. This plan may also consider the possibility of onsite generation such as small wind and water to reduce communities' diesel use.

## 6 energy in Ontario's economy — capital investments

Energy has a significant impact on Ontario's economy. Ontario businesses rely on electricity to produce goods and services and it is essential to our quality of life.

- Ontario's electricity sector is a \$15 billion annual industry.
- Energy accounts for eight per cent of Canada's GDP.
- Some 95,000 Ontarians are currently directly and indirectly employed in the energy sector.
- More than \$10 billion has been invested in Ontario in new clean energy projects that are online or under construction.
- Ontario has attracted more than \$16 billion in private sector investments in the energy sector in the past year.

Ontario's progress in modernizing and upgrading electricity has not only benefited electricity users, it has strengthened the economy by attracting investment and creating jobs. Large infrastructure projects typically have high GDP and employment impacts, and this is also true of the ongoing and planned investments in Ontario's electricity sector.

### Hydroelectric investment

Waterpower has been helping to fuel Ontario's economic growth for more than 100 years and is the backbone of renewable supply.

Ontario hydroelectric producers spend \$250 million annually in operating and maintenance costs and in the past decade alone have made additional capital investments of \$400 million to bring new waterpower online. Today, Ontario's hydroelectric producers directly employ more than 1,600 people and support an additional 2,000 jobs.

Hydroelectric has an even greater impact in Ontario's north, where it accounts for more than 80 per cent of the electricity generated. Twenty-four of 65 generating stations run by OPG are located in Ontario's north, representing close to 2,000 MW.

Many older hydroelectric facilities date to Ontario's early industrial mining and forestry activities and some of these sites are being rebuilt at higher capacity. Recent substantial investments are playing an important economic role in the north. The Lower Mattagami River Hydroelectric Project, Ontario's largest hydroelectric project in 40 years, will bring a \$2.6-billion investment into northeastern Ontario and create up to 800 construction jobs.

In southwestern Ontario, work is underway on the Niagara Tunnel project, the single biggest construction project for the Niagara region since the Beck 2 Generating Station was built 55 years ago. The project means that region will benefit from over 230 construction jobs.

#### Wind, Solar and Bio-Energy investment

Ontario is creating a new sector for investment and is becoming a global destination of choice for clean energy developers and suppliers. Ontario's Green Energy and Green Economy Act, 2009 has laid the foundation for economic opportunities throughout the province. In the coming years, over 20,000 people will be employed in renewable energy and development activities including manufacturing triggered by North America's most comprehensive FIT program.

Ontario has already attracted more than \$16 billion of private sector investment and over 20 companies have announced plans to set up or expand operations in Ontario. This activity will create or support indirect jobs in areas such as finance, consulting and other manufacturing, service, and development industries.

Many communities that were hard-hit during the recent economic downturn are reaping benefits of Ontario's growing clean energy economy. According to the Windsor Essex Economic Development Commission, of the 6,000 new jobs created in Windsor in the past 10 months, five to 10 per cent are tied to renewable energy.

The Green Energy and Green Economy Act, 2009 has already attracted the single-largest investment in renewable energy in provincial history. The Consortium, led by Samsung C&T Corporation, is investing \$7 billion to create 2,500 MW of new wind and solar power in Ontario. The investment will lead to more than 16,000 new clean energy jobs to build, install and operate the renewable generation projects and associated manufacturing. The consortium is also working with major partners to secure four manufacturing plants in the province. This will lead to the creation of 1,440 manufacturing and related jobs to build wind and solar technology for use in Ontario and export across North America.

Plans for the first of the four plants have already been announced. Samsung and Siemens have said they intend to build Ontario's first wind turbine blade manufacturing plant, creating up to 900 direct and indirect jobs. The supply-chain of Ontario's new clean energy economy is providing benefits to other sectors of the economy. For example, the Consortium intends to use Ontario steel in its projects, subject to necessary quality standards.

The clean energy sector is also providing new opportunities to people in rural Ontario. Farmers are leasing portions of their land for wind turbines, allowing them to generate income while continuing to farm. For example, in Port Alma, local farmers and landowners are leasing their land to the 44-turbine Kruger Energy wind power project, which produces enough clean electricity to power 30,000 households.

Province-wide, farmers and agri-food businesses received a total of \$11.2 million to develop and build generating systems that produce clean energy, reduce electricity costs and contribute to local economies through OMAFRA's Biogas Systems Financial Assistance Program, which ran from September 2008 to March 2010.

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*"Building a clean energy economy is not an issue that splits left from right. It's about past and future. People of all political stripes who are entrusted in building a modern economy can – and do – look ahead."*

*- Rick Smith, founding partner of Blue Green Canada*

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#### Modernization of nuclear fleet

The nuclear sector has contributed a great deal to Ontario's economy over the past forty years. According to the Canadian Nuclear Association, the sector supports over 70,000 jobs across Canada and injects some \$6 billion into the national economy every year. The Organization of CANDU Industries estimates that its 165 members employ over 30,000 people, many of them here in Ontario. Its members supply goods and services for nuclear reactors in domestic and export markets.

Plans to upgrade and refurbish Ontario's nuclear plants are expected to create and support thousands of jobs and inject billions of dollars into this sector over the next decade. A report by the Canadian Manufacturers and Exporters estimates that the refurbishment and operation of the Bruce and Darlington units will create or sustain 25,000 jobs and provide \$5 billion in annual economic activity.

The design and construction of two new nuclear units at Darlington will employ up to 3,500 people and support many thousands more indirect jobs. Ongoing operation at the plant will require a further 1,400 tradespeople, nuclear operators, and engineering and technical support staff for the duration of the plant's life.



### Transmission upgrades

Thousands of Ontarians are employed in the province's electricity transmission sector and billions of dollars in planned upgrades to and expansion of the system are expected to support and create thousands more jobs in the future.

Fully owned by the Province of Ontario, Hydro One is the province's largest electricity transmission and distribution company. It owns 97 per cent of the transmission facilities in the province and employs approximately 5,400 workers, many of them highly skilled technicians, in communities throughout Ontario.

This Plan includes a commitment to develop five priority transmission projects. Employment on the five priority projects alone will peak at over 5,000 in 2013. This new transmission capacity will enable further generation development, including many new private-sector renewable projects.

The rollout of new transmission projects will also allow communities, including Aboriginal communities, to develop more small-scale renewable generation and, in certain cases, reduce their dependence on polluting forms of electricity generation.

### Coal plant conversion

Converting Ontario's existing coal-fired generating stations to new fuels will create new construction jobs and support clean energy jobs in operations and maintenance.

For example, the Atikokan biomass conversion project will create up to 200 construction jobs and help protect jobs at the plant. It will also support an estimated 20 to 25 jobs in Ontario related to the production of wood pellets and sustain other jobs in the forestry sector. The project will provide engineering and construction jobs during the conversion as well as ongoing employment in the forestry and transportation sectors to keep the station supplied with fuel. Natural gas conversion at Thunder Bay will provide additional jobs in pipeline construction and ongoing operations.

### Conservation

Conservation programs contribute to local and regional jobs, creating employment and new business opportunities in a number of areas, including technology and product development, manufacturing, distribution, marketing, sales, installation and maintenance. For example, Ontario's \$3-billion investment in conservation programs over the next five years is expected to create or sustain about 5,000 jobs annually.

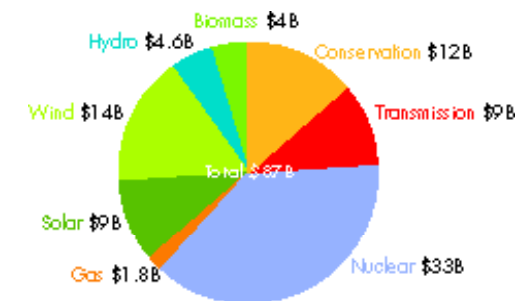
### Capital Investments

Ontario's electricity sector is a \$15-billion annual industry. Investments in the electricity system are helping to clean Ontario's air, improve the reliability of the energy supply and create jobs and economic opportunities in communities across the province. Since 2003, over \$10 billion has been invested to bring new supply on line, and over \$7 billion has been spent to strengthen the transmission system. Ontario has also attracted more than \$16 billion in private sector investment through the FIT program.

Investments over the past seven years to build new cleaner generation and modernize electricity infrastructure has increased significantly to make up for years of underinvestment. Needed capital investments in Ontario's energy system over the next 20 years will be significant, and are in line with the government's efforts to upgrade and replace aging infrastructure. For example, the ReNew Ontario Infrastructure plan invested \$30 billion over four years in capital projects across the province.

This Plan outlines essential capital expenditures to continue building a clean and modern electricity system and to keep the lights on for Ontario families and businesses. The total capital cost in 2010 dollars is estimated to be \$87 billion over the life of the Plan. This accounts for new and refurbished energy supply, transmission and distribution infrastructure and conservation investments. This Plan provides more investments over the 2007 Plan due to increased investments in renewables, updated capital cost assumptions, and more certainty on the costs of nuclear refurbishments and new build. These cost estimates will be further refined by the OPA in the coming months and then submitted to the OEB.

FIGURE 13: ESTIMATED CAPITAL COST OF LONG-TERM ENERGY PLAN: 2010 TO 2030 (\$ BILLIONS)



The capital investments outlined are through both the private and public sector, and the majority will be paid for by electricity consumers spread over many years, depending on the cost recovery mechanism. (For example, electricity generators typically recover their investment over 20 years, whereas transmission investments may take up to 40 years to be fully repaid). This ensures that the annual costs to consumers, as reflected on electricity bills are spread over a longer period of time.

Conservation expenditures in this Plan include direct program costs and additional capital expenditures driven by higher appliance energy efficiency standards and higher building code efficiency standards.

Overall, renewables account for one third of total expenditures, nuclear just over one third, and natural gas, conservation and transmission the remainder. The breakdown is reflective of the Plan's objective to deliver a balanced and diverse supply mix that is cost effective, clean and helps create clean energy jobs.

## 7 electricity prices

Over the past 20 years, the price of water, fuel oil and cable TV have outpaced the price of electricity. Over the next 20 years, Ontario can expect stable prices that also reflect the true cost of electricity. The government will need to take a balanced and prudent approach to investment and pricing that ensures that Ontario's children and grandchildren have a clean, reliable system.

Ontarians now pay the true cost of electricity to ensure that essential investments are made in clean energy and modern transmission. About 40 per cent of Ontario's electricity generation is subject to price regulation, contributing significantly to predictable prices for Ontario consumers. Regulated Price Plan (RPP) rates (adjusted every six months) ensure pricing reflects the true cost of generating electricity. This helps to provide stable and predictable electricity prices for consumers.

### Accomplishments

In 2003, the electricity system was in significant decline but Ontario families and businesses have invested in the creation of cleaner sources and the restoration of reliability. The cost of energy has increased in order to provide cleaner, more reliable energy for generations to come.

The government has also taken several steps to keep the cost of electricity down for Ontario families and businesses. Actions taken to prudently manage expenditures total over \$1 billion, including:

- Freezing the compensation structures of all non-bargained public sector employees for two years – which include the five energy agencies.
- Limiting travel costs and other expenses for public sector workers.
- Requesting that Hydro One and Ontario Power Generation revise down their 2010 rate applications to find savings and efficiencies.
- The IESO has reduced costs by \$23 million over the past seven years.
- For 2011, the OPA has reduced its overall operating budget by 4.1 per cent.
- Hydro One will reduce operations costs by \$170 million in 2010 and 2011. Information technology upgrades will save \$235 million over the next four years.
- OPG is reducing operations costs by more than \$600M over the next four years.

Ontario has taken steps to lower the hydro debt left by the previous government. In 1999, the restructuring of Ontario Hydro and the attempt to sell-off Hydro left electricity consumers with a debt of \$20.9 billion. Since 2003, Ontario has decreased that stranded debt by \$5.7 billion. Payments toward the debt are made through Payments in Lieu of Taxes, dedicated income from government energy enterprises, and by ratepayers through the Debt Retirement Charge.

The government has also launched a number of initiatives to help Ontario families and businesses manage electricity bill increases. Some of these include:

- The Northern Ontario Energy Credit, a new, permanent annual credit to help families and individuals in the North who face high energy costs. The yearly credit of up to \$130 for a single person and up to \$200 for a family would be available to over half of all northern Ontario households.
- Ontario Energy and Property Tax Credit, starting with the 2010 tax year, to low-income Ontarians who own or rent a home would receive up to \$900 in tax relief, with seniors able to claim up to \$1,025 in tax relief to help with both their energy costs and property tax. Overall, the proposed Ontario Energy and Property Tax Credit would provide a total of about \$1.3 billion annually to 2.8 million Ontarians.

**Energy Consumer Protection Act, 2010:**

On January 1, 2011, new rules will take effect under the Energy Consumer Protection Act, 2010 that will help protect electricity and natural gas consumers by putting an end to unfair practices by energy retailers. The rules will ensure that consumers receive accurate price disclosure from all energy retailers before they sign contracts, helping to protect Ontario families and seniors.

Ontario is helping low-income Ontarians with their energy costs through a province-wide strategy to help consumers better manage their energy consumption and costs, including:

- Establishing a new emergency energy financial assistance fund.
- Implementing enhanced customer service rules that will assist all customers, particularly low-income Ontarians.

Ontario is also developing a comprehensive electricity conservation program for low-income households in coordination with the natural gas utilities. Through the conservation measures, customers will be better able to manage their energy bills.

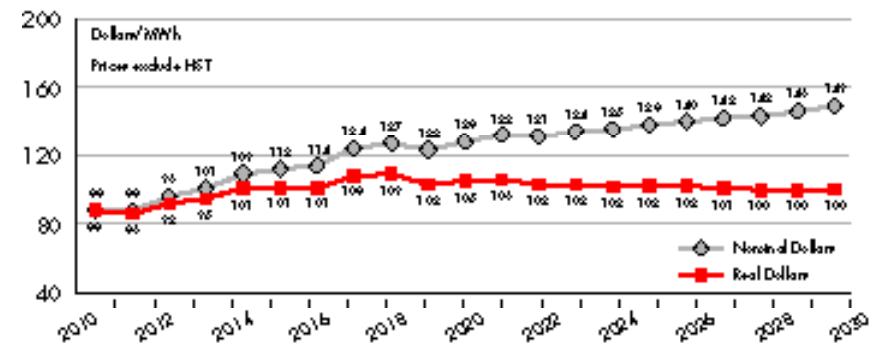
**The Plan**

**Industrial Users**

Due to investments to make the electricity system cleaner and more reliable for industry, the government projects that the industrial rate will increase by about 2.7 per cent annually over the next 20 years. The Ontario government has introduced initiatives to enhance the efficiency and competitiveness of large industrial consumers as well as protect jobs and local economies. These include:

- The Industrial Conservation Initiative will help the province's largest industrial and manufacturers to conserve energy, save on costs and increase their competitiveness. By changing the Global Adjustment Mechanism, large industrial users can shift their usage off peak times and save on electricity costs.
- The OPA's Industrial Accelerator Program has been launched to assist transmission-connected industrial electricity users to fast-track capital investment in major energy-efficiency projects.
- The Northern Industrial Energy Rate Program provides electricity price rebates for qualifying northern industrial consumers who commit to an energy efficiency and sustainability plan. On average, the program reduces prices by about 25 per cent for large facilities.

FIGURE 14: INDUSTRIAL PRICE PROJECTIONS (2010-2030)



**Helping Ontario Small Businesses and Families**

In order to ensure that Ontario has a clean, modern system that increases renewables, ensures reliability and creates jobs, continued investments in the electricity system are essential.

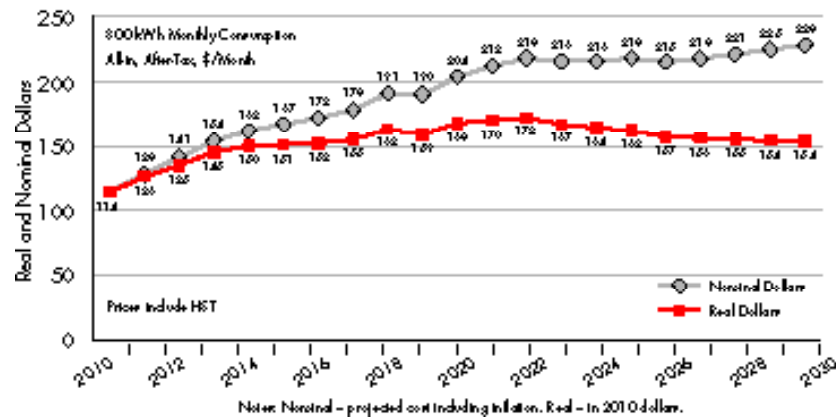
Based on the significant investments in clean, modern energy outlined in this plan, the government projects, based on current forecasts, that electricity prices will increase. Over the next 20 years, prices for Ontario families and small businesses will be relatively predictable. The consumer rate will increase by about 3.5 per cent annually over the length of the long-term plan.

Over the next five years, however, residential electricity prices are expected to rise by about 7.9 per cent annually (or 46 per cent over five years). This increase will help pay for critical improvements to the electricity capacity in nuclear and gas, transmission and distribution (accounting for about 44 per cent of the price increase) and investment in new, clean renewable energy generation (56 per cent of the increase).

Continued investments in transmission, conservation and supply are needed for a system that provides more efficient and reliable electricity to consumers whenever they need it and does not pollute Ontario's air or negatively affect the health of citizens and future generations.

After five years, Ontario will have largely completed the transition to a cleaner more reliable system due to the replacement of coal-fired generation and new renewable generation under the GEA. Once these investments have been made, price increases are expected to level off. The investments that the entire province is making in the future of electricity will help to ensure that Ontario never finds itself in the dire straits it was in just seven years ago.

FIGURE 15: RESIDENTIAL PRICE PROJECTIONS (2010-2030)



However, in the next five years, the government recognizes that the increases will have an impact on Ontario families and businesses.

The government's 2010 Ontario Economic Outlook and Fiscal Review took action to help Ontarians who are feeling the pinch of rising costs and electricity prices. The Ontario government proposed direct relief through a new Ontario Clean Energy Benefit (OCEB).

For eligible consumers, the proposed OCEB would provide a benefit equal to 10 per cent of the total cost of electricity on their bills including tax, effective January 1, 2011. Due to the length of time required to amend bills, the price adjustments would appear on electricity bills no later than May 2011, and would be retroactive to January 1, 2011.

Every little bit of assistance helps during lean times. The proposed OCEB together with the Northern Ontario Energy Credit and the Ontario Energy and Property Tax Credit will all help mitigate electricity costs for families.

Eligible consumers would include residential, farm, small business and other small users. The proposed OCEB would help over four million residential consumers and over 400,000 small businesses, farms and other consumers with the transition to an even more reliable and cleaner system.

Benefits for Eligible Consumers

Customer Monthly Consumption	Current Estimated Monthly Bill	Estimated Bill after Ontario Clean Energy Benefit	Monthly Benefit* (10%)	Yearly Benefit (10%)
Typical Residential 800kWh	\$128	\$115.20	\$12.80	\$153.60
Small Business 10,000kWh	\$1,430	\$1,287	\$143	\$1,716
Farm 12,000kWh	\$1,710	\$1,539	\$171	\$2,052

\*Typical 2011 monthly benefit for a consumer. Benefit amount will vary based on actual price, consumption and location


Providing the 10 per cent OCEB to Ontarians is a responsible way of helping Ontario families and businesses through the transition to a cleaner electricity system. The OCEB would help residential and small business consumers over the next five years as the grid is modernized. The government has introduced legislation to implement the proposed OCEB.

Working together to reduce electricity use at peak times makes sound economic and environmental sense. Providing consumers with the benefit of up-to-date and accurate electricity consumption readings is also critical to the creation of a culture of conservation. The government is committed to moving forward with implementation of a Time-of-Use pricing structure that balances benefits for both the consumer and the electricity system as a whole.

To help families, Ontario will move the off-peak period for electricity users to 7 p.m. which will provide customers with an additional two hours in the lowest cost period. This change will be in effect for the May 2011 Regulated Price Plan update.

This plan has outlined a new clean, modern and reliable electricity system for the people of Ontario. Instead of a system that was polluting, unreliable and in decline with unstable pricing, Ontarians will have a North American-leading clean energy system that keeps the lights on for generations to come, creates jobs for Ontario families and ensures that the air they breathe is cleaner.

FIGURE 16: SAMPLE BILL

Your Electricity Bill	
	Service Address: Customer name Address City, Ontario
Monthly Statement	
Account Number 000 000 000 000 0000 0	Statement Date June 30, 2011
Meter Number 0000000	
Electricity Used This Billing Period	
Metered usage in kilowatt-hours = 300 kWh	
Your Electricity Charges	
<b>Electricity</b>	
On-Peak: 153.50 kWh @ 9.90¢	\$15.21
Mid-Peak: 216.40 kWh @ 8.10¢	\$17.69
Off-Peak: 428.00 kWh @ 5.10¢	\$21.83
<b>Delivery</b>	\$49.90
<b>Regulatory</b>	\$6.04
<b>Debt Retirement Charge</b>	\$5.60
<b>Your Total Electricity Charges</b>	\$113.27
<b>HST</b>	
Federal \$5.67	\$14.73
Provincial \$9.06	
<b>Subtotal</b>	\$128.00
<b>Adjustments</b>	
Ontario Clean Energy Benefit (-10%)	-\$12.80 CR
<b>Total Amount</b>	<b>\$115.20</b>

Sample Bill for illustrative purposes only. Other adjustments may apply.

## Appendix One: who does what

**Ontario Power Generation:** Generates 60 per cent of Ontario's electricity.

**Hydro One:** Operates 97 per cent of Ontario's transmission network.

**Independent Electricity System Operator:** Ensures reliability, forecasts short-term demand and supply, monitors supply, and manages the Ontario wholesale market.

**Ontario Power Authority:** Responsible for system planning (generation, transmission, demand and conservation), contracts for new generation and conservation, and manages contracts for about 40 per cent of Ontario's generation.

**Ontario Energy Board:** Independent, quasi-judicial regulator of Ontario's energy sector

**Licensed Transmission System Operators:** Transmit electricity (There are five; Hydro One Networks is the largest).

**Local Distribution Companies:** More than 80, mostly owned by municipalities, deliver electricity and serve customers in a given area.

**Electricity Retailers:** Seventy-seven private-sector companies that sell contracts to businesses and consumers

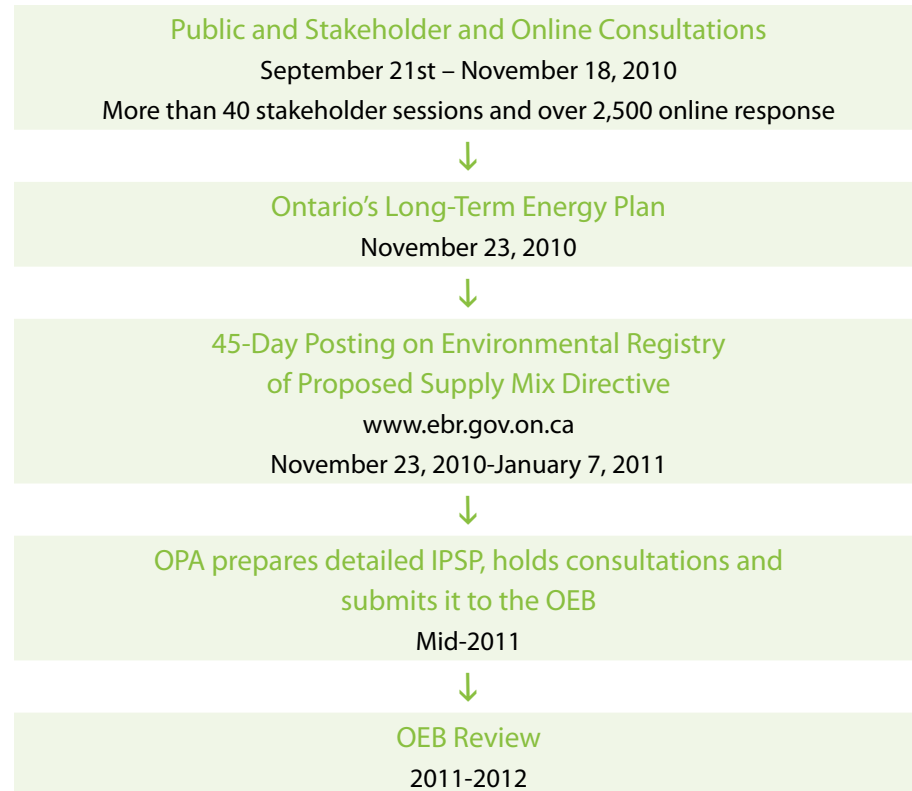
**Privately-owned generators:** Facilities that produce energy (Bruce Power, wind and solar energy companies)



## Appendix Two:

# consultations and next steps

Ontario's Long-Term Energy Plan was informed by public and stakeholder consultations as well as advice from the OPA. In addition to issuing this plan, the government is posting a proposed supply mix Directive on the Environmental Registry for a 45 day public comment period. Following this posting, the directive will be finalized and sent to the OPA. The OPA will consult publicly during the development the Integrated Power System Plan (IPSP) and submit the plan to the OEB. The OEB will conduct a review of the IPSP including public hearings. The final IPSP will constitute the detailed long-term energy plan for the next 20 years. It will be updated every three years as required by regulation.



## Appendix Three:

# installed capacity (MW)

Installed Capacity	2003	2010 (Projected)	2030 (Projected)
Nuclear	10,061	11,446	12,000
Renewables – Hydroelectric	7,880	8,127	9,000
Renewables – Wind, Solar, Bioenergy	155	1,657	10,700
Gas	4,364	9,424	9,200
Coal	7,546	4,484	0
Conservation	0	1,837	7,100
<b>Total</b>	<b>30,006</b>	<b>36,975</b>	<b>48,000</b>

# glossary – of energy terms

**Baseload Power:** Generation sources designed to operate more or less continuously through the day and night and across the seasons of the year. Nuclear and generally large hydro generating stations are examples of generators that operate as baseload generation.

**Biomass:** Energy resources derived from organic matter, including wood, agricultural waste and other living cell material that can be burned to produce heat energy or electricity.

**Demand Response (DR):** Programs designed to reduce the amount of electricity drawn by customers from the grid, in response to changes in the price of electricity during the day, incentive payments and/or other mechanisms. In Ontario, both the OPA and the IESO run demand response programs.

**Dispatchable Generation:** Sources of electricity such as natural gas that can be dispatched at the request of power grid operators; that is, output can be increased or decreased as demand or availability of other supply sources changes.

**Distribution:** A distribution system carries electricity from the transmission system and delivers it to consumers. Typically, the network would include medium-voltage power lines, substations and pole-mounted transformers, low-voltage distribution wiring and electricity meters

**Feed-in Tariff (FIT):** A guaranteed rate program that provides stable prices through long-term contracts for energy generated using renewable resources

**Greenhouse Gas (GHG):** Gases that contribute to the capture of heat in the Earth's atmosphere. Carbon dioxide is the most prominent GHG, in addition to natural sources it is released into the Earth's atmosphere as a result of the burning of fossil fuels such as coal, oil or natural gas. Widely acknowledged as contributing to climate change.

**Intermittent Power Generation:** Sources of electricity that produce power only during certain times such as wind and solar generators whose output depends on wind speed and solar intensity.

**Kilowatt (kW):** A standard quantity of power in a residential-size electricity system, equal to 1,000 watts (W). Ten 100-watt light bulbs operated together consume one kW of power.

**Kilowatt-hour (kWh):** A standard unit of electrical energy in a residential-size system. One kWh (1,000 watt-hours) is the amount of electrical energy produced or consumed by a one-kilowatt unit during one hour. Ten 100-watt light bulbs, operated together for one hour, consume one kWh of energy.

**Load or Demand Management:** Measures undertaken to control the level of energy usage at a given time, by increasing or decreasing consumption or shifting consumption to some other time period.

**Local Distribution Company (LDC):** An entity that owns a distribution system for the local delivery of energy (gas or electricity) to consumers.

**Megawatt (MW):** A unit of power equal to 1,000 kilowatts (kW) or one million watts (W).

**Megawatt-hour (MWh):** A measure of the energy produced by a generating station over time: a one MW generator, operating for 24 hours, generates 24 MWh of energy (as does a 24 MW generator, operating for one hour).

**MicroFIT:** Ontario residents are able to develop a very small or “micro” renewable electricity generation project (10 kilowatts or less in size) on their properties. Under the microFIT Program, they are paid a guaranteed price for all the electricity they produce for at least 20 years.

**Peaking Capacity:** Generating capacity typically used only to meet the peak demand (highest demand) for electricity during the day; typically provided by hydro, coal or natural gas generators.

**Peak Demand:** Peak demand, peak load or on-peak are terms describing a period in which electricity is expected to be provided for a sustained period at a significantly higher than average supply level.

**Photovoltaic:** A technology for converting solar energy into electrical energy (typically by way of photovoltaic cells or panels comprising a number of cells).

**Regulated Price Plan (RPP):** Rates (adjusted every six months) to ensure electricity pricing reflect the true cost of generating electricity. They provide stable and predictable electricity prices for consumers.

**Smart Grid:** A Smart Grid delivers electricity from suppliers to consumers using digital technology with two-way communications to control appliances at consumers' homes to save energy, reduce costs and increase reliability and transparency.

**Supply Mix:** The different types of fuel that are used to produce electricity in a particular jurisdiction. Normally the mix is expressed in terms of the proportion of each type within the overall amount of energy produced.

**Terawatt-hour (TWh):** A unit of power equal to a billion kilowatt-hours. Ontario's annual electricity consumption is around 140 TWh.

**Transmission:** The movement or transfer of electricity over an interconnected group of lines and associated equipment between points of supply and points at which it is transformed for delivery to consumers, or is delivered to other, separate electric transmission systems. Transmission of electricity is done at high voltages (50kV or higher in Ontario); the energy is transformed to lower voltages for distribution over local distribution systems.

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