The Alberta Electric System Operator (AESO) leads the safe, reliable and economic planning and operation of Alberta’s Interconnected Electric System (AIES). We are an independent, not-for-profit organization acting in the public interest of all Albertans. The AESO has no financial interest or investment of any kind in the power industry.

The AESO also facilitates Alberta’s fair, efficient and openly competitive wholesale electricity market, which in 2010 had about 175 participants and approximately $5 billion in annual energy transactions.

What we do
The AESO operates the provincial transmission system so that all Albertans can count on safe and reliable electricity to power our homes and businesses each and every day. The AESO also carefully plans upgrades to the system to ensure we keep pace with Alberta’s growing demand for power.

We’re listening
Powering Albertans is published to help Albertans better understand the complex electricity industry and its importance to our quality of life and the province’s economic well-being. We would love to hear what you think about our publication.

Previous editions of Powering Albertans are available at www.poweringalberta.com

We are pleased to support Inside Education, a non-profit society that provides natural resources and environment education focused on land, water, energy and related topics. By bringing engaging, balanced education programming to students and teachers, Inside Education makes important, constructive impacts on the education system and the community.

Nancy H. Arab, Publisher

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Please feel free to contact us at powering.albertans@aeso.ca or call us at 1-888-539-AESO (2376).

This publication is proudly printed in Alberta. By using 30% post-consumer recycled paper we have achieved these environmental savings as compared to virgin fibre paper: 256 trees, 314,190 litres of water, 32 cubic metres of solid waste, 13.5 metric tons of greenhouse gas emissions and 232,000,000 BTUs of energy.
Natural gas-fired generation
A gas turbine is like a jet engine. Air comes in, is compressed and then heated by burning natural gas. The high-speed rush of this hot air spins the turbine, which causes a generator to turn and create electricity. Cogeneration plants use energy efficiently by producing electricity in addition to generating the heat or steam required to power the plant. Any extra electricity can be sold back to the transmission grid.

Coal-fired generation
Coal is burned in furnaces to heat water. Boiling water creates steam that travels through pipes into a turbine. The turbine spins the generator, creating electricity.

Wind power
A turbine is placed on top of a high tower. When the wind blows, the turbine blades spin, which turns a shaft attached to the blades. As the shaft turns, it spins a generator and makes electricity.

Hydroelectric power
The force of falling water that dams create pushes against turbine blades and spins the turbine. This causes the generator to spin and produce electricity. Hydroelectric power is also generated in run-of-river plants, which use rushing river water to turn turbines that generate electricity. Some of these plants are integrated into irrigation systems.

Solar power
Solar panels use energy from the sun to generate electricity. Solar cells, typically made from a type of silicon, are arranged in a grid pattern on the panel’s surface. They collect sunlight during the daylight hours and convert it into electricity.

Biomass power
A biomass power plant uses fuels such as plants, animal manure and even garbage and landfill fumes to boil water that creates steam. The pressure of the steam spins a turbine attached to the generator and creates electricity.
How the AESO Plans and Forecasts to Meet Growing Demand for Power

Transmission needs to keep ahead of the growing demand for electricity

Alberta’s growth in electricity consumption has risen over 30 per cent in the past 10 years. This increased demand is stretching the system of transmission towers and wires that delivers electricity from where it is generated to our homes, businesses, farms and industries.

The AESO is responsible for making sure the transmission system can handle the increased demand. This means reinforcing existing parts of the grid to make sure they remain reliable, and strengthening the system in areas where it is congested so electricity can move freely. It also means providing unconstrained access to the grid for customers and new sources of generation.

“The AESO’s job is to determine the need for transmission and then ensure the transmission infrastructure is in place ahead of increased demand and planned generation,” explains John Esaiw, the AESO’s Director of Forecasting.

Forecasting the need
To anticipate what is needed, the AESO considers a range of factors including Alberta’s economic outlook. AESO engineers, economists and planners carefully analyze electricity consumption patterns in every area of the province and integrate data from many respected sources like The Conference Board of Canada, the Canadian Energy Research Institute and the Canadian Association of Petroleum Producers.

The AESO uses this research to determine where electricity demand will grow, where generation is located or planned to meet that demand, and what additional transmission infrastructure is needed.

Planning for a reliable system
“The AESO assesses the ability of the transmission system to accommodate existing and future generation supply and consumer demand,” Esaiw adds. Upgrades are planned in stages to accommodate changes in demand. As part of the planning process, the AESO identifies constraints or limitations and recommends when and where the transmission system needs to be expanded or reinforced. The results of these studies are published in the Long-term Transmission System Plan and filed with the Alberta Utilities Commission (AUC) every two years. The next edition will be released in June 2011.

Demand for power has increased over 30% since 2000 and is forecast to nearly double in the next 20 years.

The AESO successfully forecast energy consumption to within 0.4 per cent accuracy in 2009 and within one per cent accuracy in 2010.
“The AESO plans transmission to support new and existing demand, meet Alberta Reliability Standards and connect new generation. If we identify a need to build, our proposed solution is based on a balance of technical and public interest considerations,” says Esaiw.

After determining the need, projects are subject to approval by the AUC, with the exception of four Critical Transmission Infrastructure (CTI) projects. The need for CTI projects is determined by the Government of Alberta. Once the need is approved, it is up to transmission facility owners to apply to the AUC to make a decision on where lines and facilities will go.

In the last 20 years, demand for electricity has increased 89% and Alberta’s population has risen 46%.

Supporting Alberta’s economy
The transmission network is like a major highway system for electricity, moving large quantities of power from where it is generated to where it is needed. Just as highways need to be repaved or widened, over time the transmission system of lines and towers must be upgraded as equipment ages, demand for electricity increases and additional sources of energy are developed in different parts of the province.

Without a strong transmission system, Alberta’s economy and standard of living are compromised. An unconstrained grid gives industries confidence to do business in the province, knowing that competitively priced power will be there when they need it. And it provides certainty to those who invest in new generation projects that they will have the opportunity to compete and the ability to ship their electricity to Alberta households and businesses.

“Alberta’s future prosperity depends on a reliable transmission system, adequate resources, investment in infrastructure and competitive markets—for the benefit of all Albertans.” adds Esaiw.

Transmission upgrades are needed to:

- **Ensure a reliable system for Albertans**
  As the province grows, so does demand for power—and the transmission system must keep pace. Upgrades are needed to replace aging infrastructure and maintain system efficiency.

- **Add transmission capacity to facilitate new generation**
  The AESO is responsible for determining the need for added capacity to the transmission grid to enable consumers and suppliers of electricity to connect to the grid.

- **Ensure a competitive wholesale generation market**
  The AESO is mandated to plan an unconstrained transmission system to ensure a fair, efficient and openly competitive wholesale generation market, ensuring all consumers with access to competitively priced power.

- **Encourage investment**
  New businesses will require a consistent, reliable supply of electricity to locate or expand in Alberta. Alberta will attract new power producers only if they can be assured of access to a robust transmission system and a fair, efficient and openly competitive market.
Regional Transmission Projects

The AESO is responsible for managing the provincial electricity grid on a 24/7 basis to ensure a reliable transmission system that attracts new generation, encourages investment and facilitates a competitive energy marketplace.

Regional transmission upgrades help maintain reliability, meet growing demand and replace aging and retiring generation units. Upgrading the system will ensure power producers are connected to supply power to the system, and customers are connected to receive power when and where they need it.

In the AESO’s 2009 Long-term Transmission System Plan, we identified four Critical Transmission Infrastructure (CTI) projects and equally important—more than 250 regional projects that are essential to meeting Alberta’s current and future electricity needs.

Together, these projects add up to big changes for the province’s transmission system.

Regional infrastructure projects contribute to the overall reliability and stability of Alberta’s transmission grid, and help deliver power throughout the entire province.
Mapping Regional Projects

To aid the planning process, the AESO divides the province into five geographic regions identified on the following map. The need for selected key projects in each region is described below.

**South Region**
- **Calgary Area Upgrades** – to improve system reliability, replace aging infrastructure, support transmission of wind generation from southern Alberta and meet growing demand in outlying communities
- **South Area Transmission Reinforcement** – to integrate 2,700 MW of wind generation in southern Alberta
- **South Area System Projects** – to meet demand, replace aging infrastructure and improve system reliability

**Northwest Region**
- **Northwest Area Reinforcement** – to reduce variations in voltage levels to improve system reliability
- **Grande Prairie Area Reinforcement** – to support growing demand and improve reliability
- **North Central (Slave Lake) Reinforcement** – to replace aging infrastructure

**Northeast Region**
- **Fort McMurray Area Upgrades** – to supply oilsands operations and ease congestion to allow power to move freely in and out of the area
- **Christina Lake Area Upgrades** – to serve growing industrial demand
- **Athabasca Area Upgrades** – to supply oilsands mining operations and pipelines in the area

**Edmonton Region**
- **Wabamun and West Edmonton Upgrades** – to meet increasing demand, replace aging infrastructure and improve system reliability
- **Fort Saskatchewan Area Upgrades** – to serve oilsands development and improve system reliability between Edmonton and the northeast area of the province

**Central Region**
- **Hanna Area Transmission Development** – to serve growing pipeline demand forecast to double by 2017, and to connect wind generation
- **Central East Area Upgrades** – to serve oil-related demand forecast to grow at more than six per cent per year until 2018, and to replace aging infrastructure that currently cannot accommodate additional generation without system upgrades
- **Red Deer Area Upgrades** – to serve growing demand forecast to increase by more than three per cent per year until 2018, and to improve system reliability and address current transmission capacity concerns
Follow the Flow of Electricity!
From its Source to Your Home

A. Generating plants
Power is generated using a fuel source to create a rotating motion that is turned into electricity.

B. Transmission substation
A set of large transformers increases the voltage of power coming from a generating plant for the long journey through the transmission grid to customers.

D. Intertie
Connections with neighbouring electric systems allow power to move in or out of the province, enabling a stable and reliable supply of electricity.

C. Transmission line
Transmission is the backbone of the electrical system, moving power from where it is generated to where it is needed in our homes, farms, businesses and industries. Towers and poles support sets of high capacity wires that move electricity throughout the province.

E. Solar Panels
When sunlight hits thin metallic plates called photovoltaic cells, it creates electrical currents that produce electricity. Photovoltaic cells are grouped together to form solar panels that can be installed on roofs of houses, office towers, barns and other buildings to supply electricity.
**F. Industrial customer**

Industry uses about 60 per cent of Alberta’s total electricity supply. Some facilities generate waste heat that can be converted into electricity and used as a power source or sold back to the transmission grid.

**G. Distribution substation**

Power lines enter a substation where a transformer reduces voltage to a level that can be safely carried on the lines that deliver electricity to homes, farms and businesses.

**H. Distribution line**

Low voltage power lines are best for transporting electricity over short distances. These distribution lines carry electricity from a substation to homes, farms and businesses.

**I. Power meter**

Power meters measure the amount of electricity delivered to a home, farm or business.

**J. Run-of-river hydro power**

The flow and elevation drop of a river is harnessed to generate electricity. Some of the river’s water is diverted through a pipe leading to turbines, then returned to the river downstream. Run-of-river projects do not require dams and flooding of surrounding land so the impact on people and the environment is minimal.
Localized Generation

It’s a natural question: If a city or town needs more electricity, why not build more power plants nearby?

Power plants that generate electricity close to where it will be used are called localized generation facilities.

Alberta needs more power plants to meet growing electricity demand and localized generation is an important part of a reliable electricity system. Yet, while it can help fix local power imbalances, it does not necessarily provide infrastructure for future supply and demand in other parts of the province. Localized generation facilities and a strong transmission grid rely on each other much like we rely on emergency medical services.

Imagine you are in serious accident. You expect an ambulance will get to you quickly and take you to a hospital. But what if a blizzard or traffic jam delays or prevents the ambulance from reaching you? An effective and reliable emergency medical system serves everyone in the province. When you call for an ambulance, you want to know you can count on it to reach you when you really need it.

Alberta’s electricity system can be compared to the emergency medical services system. To benefit everyone, pockets of generation must be linked by a reliable network of transmission lines so electricity can be delivered whenever and wherever it is needed.

Just as we would feel stranded if an ambulance could not reach us because roads did not exist or were too congested, electricity consumers would be isolated without a network of interconnecting transmission lines to deliver power. When localized generation plants have a scheduled or unscheduled shutdown, the community that relies on them could have its power supply interrupted. A robust transmission grid supplies every community with a reliable supply of power.

QUICK FACTS about localized generation

- Relying only on localized generation could mean consumers in those markets have limited price and supply options.
- Generation plants, on average, are down 10 to 15 per cent of the time for planned and unplanned maintenance. Transmission lines are available 99 per cent of the time.
- Localized generation benefits a portion of the population while a strong, robust transmission grid distributes electricity throughout the province and benefits everyone.
- Transmission lines must move power across the province when local generation sources are not sufficient to meet consumer demand.
**THE MARKET decides the type and location of new generation in Alberta**

In Alberta’s deregulated power market, private investors decide where and when to build a new power generation plant and bear all of the associated costs and risks. As defined in legislation, the AESO’s mandate is to enable all generation facilities that are approved by the Alberta Utilities Commission—regardless of type or location—to connect to the transmission grid.

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**61%**  
INDUSTRIAL

**19%**  
COMMERCIAL

**16%**  
RESIDENTIAL

**4%**  
FARM

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**The transmission grid delivers power to where it is needed**

Consumers want competitively priced, reliable power that comes from diverse sources. A strong transmission grid supports diverse sources of generation and delivers the highest system reliability while relying upon no single source of generation.

In Alberta, the natural resources we rely on for electricity are often located far from major population centres and depend on transmission lines to carry the electricity they produce to where it is needed in the province. Like a reliable medical emergency service, a well-planned transmission grid delivers the safe and reliable service all Albertans expect and deserve.
Renewing Alberta’s Energy Sources

More renewable and low-emission energy sources in Alberta’s future

As aging coal-fired generation plants retire and new, more diverse sources of power come online, Alberta’s electricity industry will see a greener future.

Coal has long been Alberta’s primary source of electricity, but new technologies and environmentally friendly alternatives are changing our unique mix of energy resources.

Bringing alternative energy to your door

The Alberta government’s Provincial Energy Strategy calls for transmission lines to be built to areas with potential for renewable or low-emission electricity. Environmentally friendly energy sources are often location specific, so we need a reliable transmission system to deliver power throughout the province.

New transmission lines will strengthen the system and ensure that electricity flows from wherever it is produced to the homes, farms, businesses and industries that need it.

Integrating wind

The AESO’s Long-term Transmission System Plan anticipates the development of more renewable energy like wind, and must make sure the province’s electricity system is ready to handle the changes. Nearly 800 megawatts (MW) of wind power is currently connected to the provincial grid, and the AESO has received 45 requests to interconnect approximately 7,000 MW more, mainly in southern and central Alberta. Right now Alberta’s grid is too congested to fully accommodate these additional connection requests so transmission system reinforcements are needed to meet the challenge.

Natural gas potential

Alberta has abundant natural gas reserves and over 75 per cent of Canada’s natural gas production comes from this province. Natural gas is a safe, clean burning and economical fossil fuel used mostly in the industrial sector and in the production of electricity. While there is enough conventional natural gas to meet our needs for decades to come, new technologies are being developed to access unconventional sources such as shale gas, which could make a significant contribution to Alberta’s future natural gas supply.

The future of coal

Coal will continue to be an important power source in the province, and new technologies will help the industry evolve. For example, Carbon Capture and Storage (CCS) and clean coal technologies such as in situ (or underground) coal gasification are moving forward in the province. In situ coal gasification involves controlled combustion of deeply buried coal to produce synthetic gas. This gas can be used as fuel similar to natural gas for clean power generation.

Having a diverse mix of power sources from coal, natural gas, wind, water and biomass ensures Alberta’s electricity system remains robust and reliable.

Since 2000, electricity generated from natural gas and wind power has increased.
Since 2002, Alberta has imported twice as much power as it has exported. At the same time, since 2000, demand for power in the province has increased by over 30 per cent. Continued demand for power and a transmission system in need of upgrades to ease congestion means Alberta will continue to rely on interties—power lines that connect with neighbouring electric systems—to ensure a reliable supply of power at all times.

The importance of interties
The ability to import and export power when we need to is made possible through interties. They work much like valves that can be opened and closed to control how much electricity flows through to balance supply and demand. Open the valves, and power flows in or out depending on whether the electricity system has too much or not enough power to meet current demand.

Alberta has two interties: one connecting to B.C. and another with Saskatchewan. Alberta relies on these markets to support consumer demand during peak power use, typically between 4 p.m. and 7 p.m. daily.

Interties benefit all Albertans
Alberta has one of the least interconnected electricity systems in North America. The Alberta government recognizes that interties to other markets are necessary to ensure a reliable supply of electricity to Alberta as well as to facilitate development of wind generation. That is why the Provincial Energy Strategy calls for new and improved interties to keep pace.

Since electricity cannot be stored, interties play an important role in ensuring that supply and demand for power within an electric system is constantly balanced. Interties provide immediate access to power from neighbouring systems in emergencies, such as when outages occur at power plants or when severe storms cause equipment failures.

Consumers benefit from competitive prices because interties allow power to be imported when the price of electricity is lower in another market or when the Alberta system does not have enough electricity to meet demand.

Stronger connections are needed
If the transmission system is not upgraded and interties are not utilized to their full capacity, Alberta may not realize the full market potential of its electricity system. The price of electricity will not benefit from competition if fewer generators are attracted to the market.

To encourage much needed generation to connect to the system and interties to operate at their capacity, Alberta’s transmission system needs to be reinforced. Upgrades will decrease Alberta’s reliance on imported power and allow greater control of its electricity resources.

In 2010, there was a 9% increase in Alberta’s imports and a 10% decrease in overall exports.
Power FACTS

Tips on Saving Electricity

Mobile phones, gaming systems, dishwashers...electricity powers our lives all day, every day. Here are some easy tips to help you save energy and money from the first buzz of the alarm clock in the morning until the last flick of the light switch at bedtime.

LAUNDRY

- Looking to upgrade your old washer and dryer? Consider a front-loading ENERGY STAR appliance. Front-loading washing machines can reduce water use by nearly 40% and electricity use up to 65% compared to a top-loading machine.
- Wash your laundry in cold water and try to always wash full loads.
- Avoid the energy rush hour and do your laundry at off-peak times like early in the morning or late at night.

WASHING UP

- Looking to upgrade your old dishwasher? An ENERGY STAR dishwasher is up to 25% more efficient and can save up to 20% on water heating costs.
- Only run your dishwasher when it’s full and use the energy saving cycle.
- Let your dishes air dry when the wash cycle is complete.

REFRIGERATOR

- Clean your fridge’s coils and air intake grill regularly to improve efficiency.
- Don’t overfill the fridge—it blocks air circulation. But keep the freezer full because it will perform better than if it’s empty.
- Cool hot foods on the counter before putting them in the fridge.

STAYING CONNECTED

- Plug your computer and printer or your TV and digital devices into a sensing power bar. Simply turn off the power bar to turn off all the equipment with one switch.
- Unplug your mobile phone charger when it is not in use. A plugged-in charger still draws a small amount of power even when it is not connected to a device.

WATER USAGE

- Replace your existing showerhead with a low-flow version to reduce water consumption by half.
- Take short showers instead of baths.
- Insulate your hot water heater and decrease the temperature by 5°C. You won’t notice the difference in temperature but could save up to 15% on your heating bill.

What is ENERGY STAR?

ENERGY STAR is an international symbol of energy efficiency.

The ENERGY STAR symbol helps consumers quickly and easily identify major appliances and other energy-using equipment that save energy. ENERGY STAR identifies products as the top high efficiency performer in their category.

ENERGY STAR is a dynamic government/industry partnership that makes it easy for businesses and consumers to save money and protect the environment.

Source: www.nrcan.gc.ca
Log on to Win!

As the organization responsible for managing Alberta’s power grid and keeping the lights on, the AESO is committed to providing helpful, fact-based and unbiased information about the electricity industry and how it works.

www.poweringalberta.com is an important part of the AESO’s ongoing public engagement program. Visit the site for fact sheets on a variety of topics including smart grid technology, underground transmission, and how the pool price for electricity is determined. You will also find past issues of Powering Albertans.

To help you track your energy usage and save money too, the AESO is offering Powering Albertans readers a chance to win a power consumption meter courtesy of P3 International Corp. These meters measure energy usage and the cost of powering everything in your home. Simply connect the meter to your favourite electronic device or appliance to find out how much money it costs to run each day, week, month or year. You can also find out how much money is lost through vampire power.

What is vampire power? Visit www.poweringalberta.com to find out!

To enter, please go to www.poweringalberta.com/contest and complete the short entry form. If you would prefer to enter by mail, please complete and return this form to:

Powering Albertans Contest
Alberta Electric System Operator
2500, 330 – 5th Avenue SW
Calgary, AB T2P 0L4

All entries must be received by midnight, April 30, 2011. A random draw to determine the winner will be held on May 5, 2011.

Name
Address
City
Province
Postal Code
Email
Daytime Phone
Evening Phone

☐ I have read and agree to the rules and regulations.

RULES AND REGULATIONS This Contest is only open to legal residents of Alberta who are at least 18 years of age. AESO employees, contractors, agents, servants, and members of each of their immediate families and persons living in their households are not eligible to participate. Only one entry per person will be accepted. Full contest rules and regulations are available at www.poweringalberta.com/contest. To request a written copy of the rules and regulations, write to Powering Albertans Contest at the address shown above, or call 1-888-539-AESO (2376).
Inside Education is thrilled to introduce
Generate 2011 – A Youth Energy Literacy Summit.

From March 17-20, 2011, 20 high school ‘Energy Literacy Teams’ will
gather in beautiful Kananaskis Country for a once in a lifetime learning
experience. The 80 students and 40 teachers attending Generate will
spend three days learning with and from Alberta’s leaders from across the
spectrum in energy.

We at Inside Education extend our sincere thanks to all our Summit
Partners – including the Alberta Electric System Operator – and wish all
Summit participants an exciting, eventful and rewarding learning experience.

For more information about Generate 2011 – visit www.gener8.ca

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education programming for Alberta schools, go to www.insideeducation.ca