

Energy solutions



Planning for the long term

Short-term trends can be volatile, disruptive and unpredictable. They can distract you from your plans. Dr. Larry Martin of the George Morris Centre said he has never seen a time when expectations, predictions and plans are based on whatever happened in the previous two weeks.

John Gardiner, founder of Common Cause, said his life mission was to see “a series of great opportunities brilliantly disguised as insoluble problems.”

You can plan with confidence around long-term trends. Getting from where we are today to where we need to be means developing a long-term

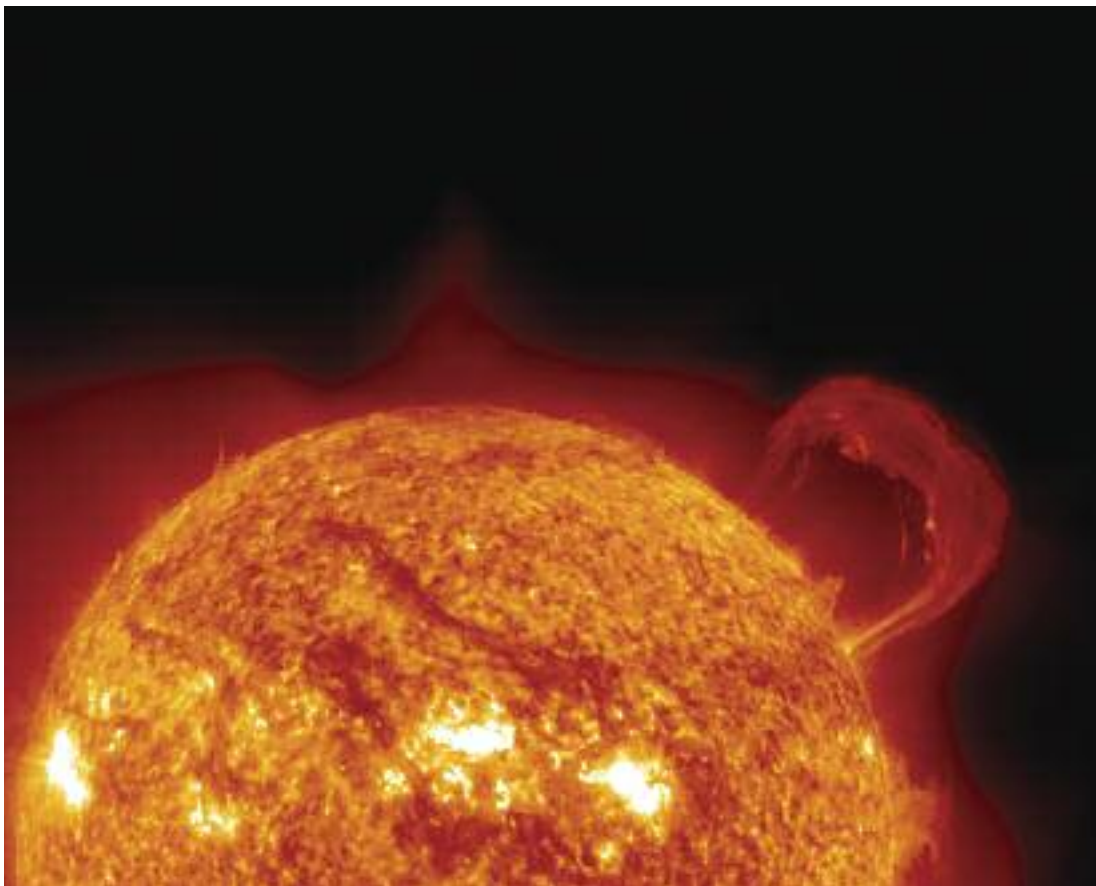
transition plan. This will help you develop mitigating strategies, capitalize on opportunities and lucrative first-mover options and avoid making reactive or crisis-driven decisions. How you decide what’s best for your business depends on your planning horizon and your beliefs about the longer term.

“There are risks and costs to a program of action. But they are far less than the long-range risks and costs of comfortable inaction.”

– John F. Kennedy

Can you manage volatile fuel prices? If so, perhaps no move at all is the best move for you. Do you want to minimize the risks of fluctuating prices? Perhaps you are interested in a capital project. Do you think oil prices will return to less expensive levels for the next 10 years? Then you might not want to pay for a technology that could end up being more expensive than a traditional fuel solution. It’s important to review each possible outcome against what you and your family or partners can handle financially and emotionally.

Scenario planning or jotting down a small grid can help		
My planning horizon	My assumptions about the future	
	Oil prices skyrocket and range between \$150-\$200/barrel	Oil prices range from \$40-\$80 due to long recession, which brings other challenges
Retire in 5 years and sell		
Retire in 7-10 years and phase out after that		
Stay in business for 20 years and have children take over		

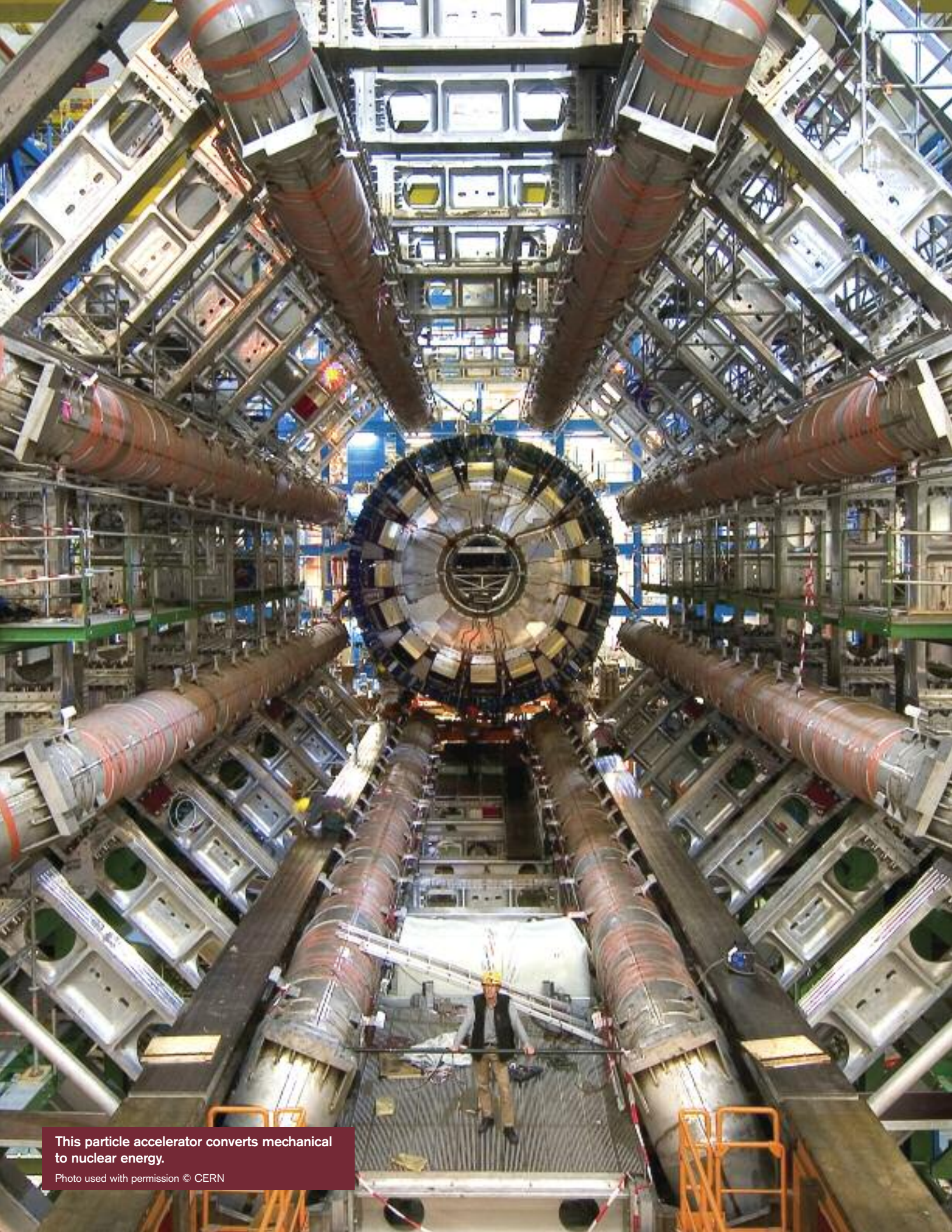


Energy sources for your business

Energy in its simplest terms is the ability to get work done. All energy originates from the sun and ends up as heat, light, nuclear, electrical, mechanical and chemical forms. It can't be created and it can't be destroyed. It simply transforms from one type to another. We have discovered many ways to convert one form into another. Others remain a mystery (Fig. 10, page 19). Some alternatives are waiting for the economics and commercialization to be right. In the face of increasing demand and rising costs of conventional sources, what may have been a pipe dream a decade ago could quickly move to the forefront. Some solutions may never take off in a big way. However, they might be perfect for your operation. Others, like hydrogen, could change the world forever.

What if you could turn manure into tractor fuel or canola into biodiesel on your own farm? How long will it take until the transportation system runs mainly on electricity or hydrogen? Imagine using a nuclear rod to power your combine. It might be easy to switch certain energy types like oil to wood or gas in combustion furnaces. Other substitutions mean reengineering the industry, supply chain and distribution networks.

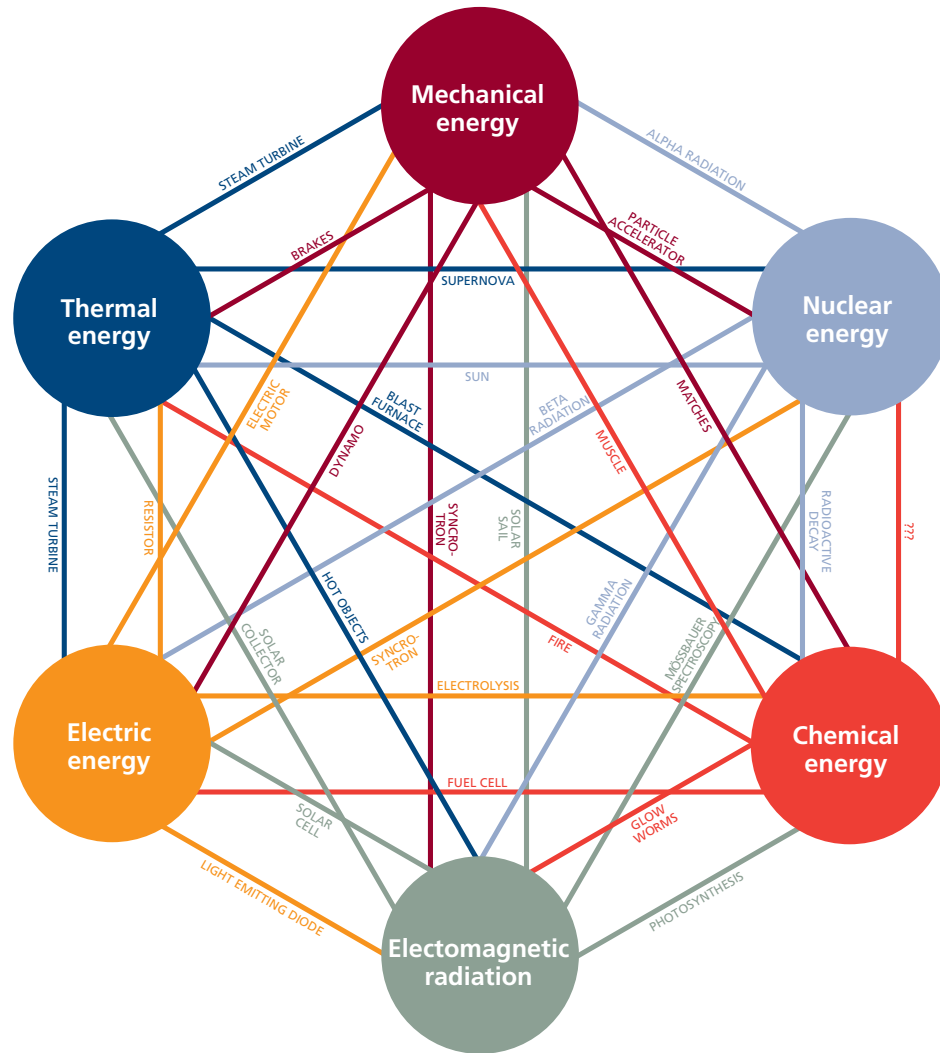
As you read through the energy options in the following pages, think about opportunities to do things differently. As part of the food value chain, you are already in the business of energy production but you may want to get involved in electricity or fuel production for your own needs or for profit.



This particle accelerator converts mechanical to nuclear energy.

Photo used with permission © CERN

Figure 10: Energy forms and how they are converted



This diagram shows energy forms and how they are converted. A solar cell, for example, converts electromagnetic radiation into electric energy. Look at the examples in the diagram and think about your energy sources. How can they be converted from one form to another to create solutions for your business?

"You never change things by fighting the existing reality. To change something, build a new model that makes the existing model obsolete."

– Buckminster Fuller

Making it work

Some producers and processors get involved in alternative energy. Others leave it to the professionals. Bert Mucci, a greenhouse vegetable producer, found a middle ground. He considered different options but didn't want to spend all his time overseeing energy production. He wanted to focus on managing relationships with his key customers.

Mucci provides the space and REMASCO, an alternative energy company, runs the technology. The greenhouses are heated with municipal waste pellets purchased on long-term contract. Mucci feels good about reducing environmental impacts and saving on energy costs. With this energy solution in hand, he focuses on his priorities: growing vegetables and promoting his brand.

Biomass

Biomass is anything that was once alive. Where energy production is concerned, it includes crops grown specifically for biofuels, byproducts and the waste of other processes. It can be converted to energy in several ways. Eating it moves muscles. Burning it creates thermal energy that heats, cooks

and powers steam engines or turbines. Heating it at extreme temperatures is called gasification and produces gas and liquid fuels like methane and alcohol used to power generators or fuel cells.

Finally, transforming it with biochemical processes produces biofuels (Table 3).

Biodiesel

Agriculture and Agri-Food Canada funds a biodiesel project at the University of Guelph Ridgetown Campus. It will be used for technology demonstrations, education and applied research. Other projects and case studies in the Canada and the U.S.¹⁰ show how producers can make top quality fuels with resources at their disposal.

Pure or blended biodiesel can be used in diesel engines with little or no engine modifications. New technologies are unfolding for glycerine, a byproduct of biodiesel, to convert it to a source of hydrogen that could be useful for hydrogen batteries in the future. Some airlines are experimenting with the biodiesel process to make a type of kerosene fuel. If they are successful, plane engines would need very few modifications to switch over.

Table 3: Making biofuels

End product	Feedstock	Catalyst	Process	Byproducts
Biodiesel	plant or animal organic oil-based materials such as animal tallow, soy, canola, jatropha, algae and "tall oil" from trees	ethanol or methanol	trans-esterification	glycerine, mash that may have protein/carb content suitable for feed (soy cake)
Biogases*	many biomass materials like municipal, forestry, restaurant and packing plant waste, potato slurry, grape must and manure	bacteria	digestion/decomposition	fertilizer or bedding depending on feedstock used, heat, water and CO ₂
Ethanol	starchy materials or cellulosic material such as corn, cereal grains, straw, wood and switchgrass	bacteria, yeast or enzymes	fermentation	wet or dry distillers' grains with protein and minor fat content, pulp fibre

*Methane or biogas mix that can be cleaned and substituted for natural gas



Biomass can come in many forms.

Making it work

Prince Edward Island-based Cavendish Farms will transform waste from potato processing plants into heat. The multimillion-dollar investment in new alternative energy technology will see a biogas facility built beside two french fry plants. By reducing heating oil by 30 per cent, they expect to save up to 10 million litres per year. The use of renewable potato waste will reduce greenhouse gas emissions from the plant by over 30,000 tonnes per year.

The Cavendish Farms co-generation project is part of J.D. Irving's company-wide strategy to reduce its environmental footprint.

Biogas

Food manufacturers are required to treat waste and using a process like biodigestion can offset some or all energy needs. Your waste can save or make you money.

On farms, biomass is not considered waste and is often used as a fertilizer. A biodigester can be used to treat it and add value in the process. The energy byproduct can be used for the business or sold back to the grid. With fewer odours and destroyed pathogens, the leftover solid matter can be used as fertilizer and water can be cleaned and recycled.

Some companies offer services to operate digesters. Producers benefit from waste management, bedding and heat. The management company reaps the energy and carbon credits. This option may be ideal for those who want to focus on their

core business or don't want to invest capital in a biodigester.

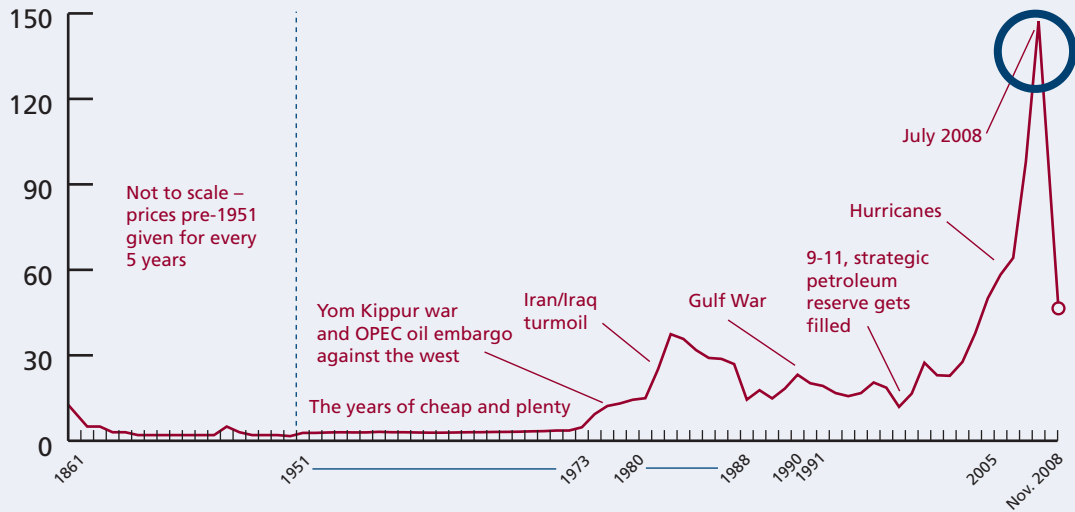
Increasingly, factories and municipalities are paying others to haul their waste away and businesses are pursuing alternative energy. More people are capitalizing on the energy in waste and exploring new sources of feedstocks. The negative price of garbage could actually become positive if biogas potential and value of byproducts is realized. As we enter new energy territory, it's important to understand the potential value of waste created by your business, value of feedstocks and the carbon credits you may be eligible for. If you already have an energy project and get your feedstocks offsite, do you have long-term contracts for feedstock supplies?

Making it work

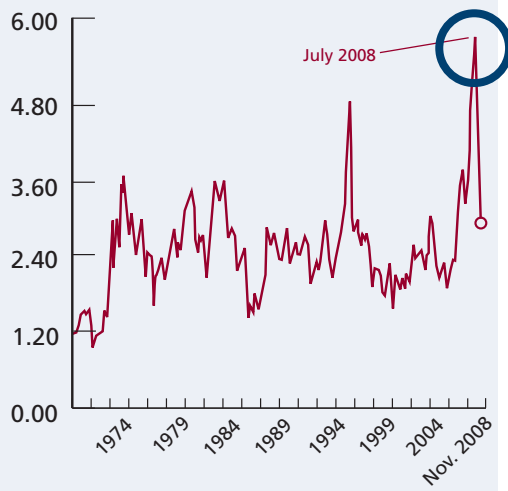
Quebec-based Ferme Famille Saint-Hilaire is a large dairy, hog and maple syrup operation. The Saint-Hilaire family invested in a low-temperature anaerobic digester to convert hog manure into biogas. The system generates heat and electricity for the operation. Not only is there less odour and runoff to contend with, but greenhouse gas emissions have gone down, phosphorous content in manure has been reduced by over 50 per cent and it's much easier to meet provincial nutrient management regulations.

Could an energy project like this help you deal with manure disposal, odour and conservation challenges?

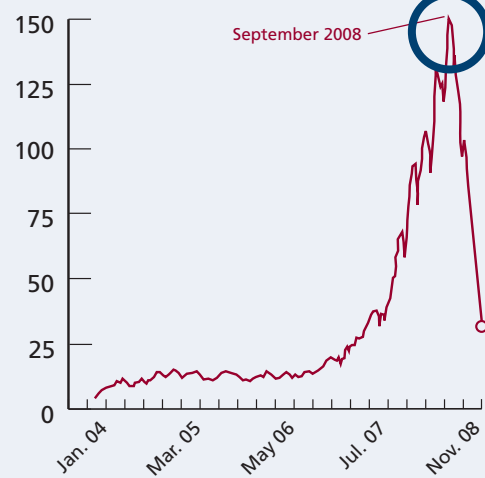
Figure 11: Historical crude oil prices (USD per barrel)



Monthly average corn price (\$/bu.)



Mosaic Company [MOS-N] (USD)



Ethanol

Some say ethanol is an American solution for an American energy problem. The U.S. offers many incentives over and above those found in Canada. In 2006, many Canadian groups undertook feasibility studies and developed marketing plans for ethanol projects. Only a handful of those ethanol projects have gone forward. Ethanol is good business when oil prices are high, feedstock prices are low and policies and incentives are in place. Here are some questions to consider:

- Can you take advantage of food, feed and all bioproduct markets? Will all of your crop go to one buyer with one supply chain, to a broker or under contract?
- Do you want to sell to a biofuel supply chain or actually buy into a biofuel company? Why are you investing?
- Can we plan in advance for energy projects and avoid reacting to crisis or missing opportunities? Can we capitalize on the next wave of biofuel developments?
- Are current feedstocks the most optimum or are there more innovative crops for biofuels?

Keep an eye on ethanol, biodiesel and natural gas developments for farm-scale projects. If you have access to your own feedstocks of cash crops, manure or cellulosic waste, you have an advantage and options. You can sell to multiple markets, including emerging energy markets, or use them to produce your own supplies.

The biggest opportunity in biofuels may be in do-it-yourself operations. Producers could take advantage of prevailing market conditions by selling grain when the price is high or by making their own fuel when the price is lower.

Biofuel discussion must include the food versus fuel debate. Prior to changes in U.S. ethanol policy, agriculture commodity markets seemed to move independently from oil markets. There is some evidence that commodities, fertilizers and crude oil prices have become more connected (Fig.11). One-third of the U.S. corn crop harvest of 2007 went to biofuels. The impacts of U.S. biofuels

Good old fashioned horse power

Animals and people are a source of energy. Many farms in the world rely on animals to do the work. Sometimes this makes sense for specialty farms, for pulling logs, collecting maple syrup or working in small places. Did you know that bike couriers burn so many calories a day, they won a tax ruling allowing them to claim extra food and snacks as fuel for their business?

policies were felt in land values, commodity prices and the share prices of companies in the commodity supply chain like Deere, Monsanto and Mosaic. The system did not have enough time to adjust supply for the new demand. One large corn crop and reductions in the amount of future ethanol that will be produced have worked their way into the marketplace. Along with the impacts of economic slowdown, commodity prices have come down across the board.

While biofuels may be part of Canada's solution, current production depends heavily on fossil fuels. Efficiency will need to improve throughout the whole value chain. As well, global demand for food and feed products will likely put more pressure on the industry. By leveraging less productive land and finding local solutions, alternatives to corn, wheat and oil seeds may be part of the answer. Crops like jatropha¹¹ and developments in enzymes and feedstocks on the cellulosic front show great promise.

Using algae is another interesting possibility. Algae are fast-growing organisms that become an oily plant mass, consuming CO₂ and emitting oxygen. They grow in almost anything wet and can purify city sewage while feeding on the nitrogen and phosphates in human waste. While algae are full of oil, current production methods make the economics for use as a widespread feedstock questionable.

For more on biofuels, check out our publication at www.fcc-fac.ca/en/learningcentre/knowledge/doc/Understanding_Biofuels_e.pdf

Wind power

Wind is the fastest growing alternative energy in North America. There are plenty of open spaces and wind resources available in our rural areas, making agriculture's connection to this alternate energy a natural.

Across Canada, 83 large wind farms and a number of single turbines are in operation, for a total of 1,410 turbines. These provide one per cent of our electricity supply. We've tapped less than five per cent of the estimated potential.

In B.C., the Nai Kun wind farm offshore from the northern coastal islands of Haida Gwaii, will be a Canadian first. This five-phase project will generate enough power for 600,000 homes. Canada's largest land-based wind project in Sault Ste. Marie, Ont., houses 126 turbines and can generate power for 40,000 homes. Ontario farm operators are partnering with an energy firm creating wind farms on the north shore of

Making it work

John Glazema owns several for-profit and not-for-profit business ventures in agriculture and land development. He's been thinking about alternative energy for years. During a trip to Holland in 2005, he bought six decommissioned windmills and shipped them to Abbotsford, B.C. and Alternative Energy Inc. became his latest business venture.

Considering wind as an option? Glazema learned a lot about wind in the past three years. Choosing energy options that fit with your location is key. Wind resources are viable in some areas and not others. Don't jump in too quickly. Glazema set up turbines in several B.C. locations, including his back yard, to monitor wind patterns and try out the equipment. Look for ways to capitalize on green energy practices. Finally, watch for government funding and policy changes that may open the door to an alternative energy future.

John has yet to sell his first windmill in Canada. When the winds are right, he'll be ready.

Connecting to the grid

Distributed energy (DE) projects present challenges. Utilities and grids have archaic infrastructures, and there's a long way to go to match supply with cyclical demand. Canada and the U.S. are closely tied together through shared electrical grids. There are increasing concerns about their health. And electricity cannot be stored. Hydrogen fuel cells that can store electricity may revolutionize some of these issues. Different provinces have different processes for attaching to the grid. Some operators need a permit queue. You might benefit from being first in line or you might get caught in regulatory challenges while the world figures out smart grids and small-scale distributed energy projects. There could also be surprising gaps related to the price you are paid for producing energy versus the price you pay to buy it back from the grid. Some producers choose to be self-sufficient for these reasons. Others find it profitable to produce and sell surplus.

Lake Erie. Southern Alberta is also a regional powerhouse with around 150 turbines in the vicinities of Fort Macleod, Castle River and Taber.

Turbines can have 100-metre diameter spans. Seen from a distance in fields or on water, their size can seem deceptively small.

Traditional energy companies are moving into wind production. Last year, Hydro Québec issued a request for proposal for 2,000 megawatts of wind power.¹² It is a key supplier of electricity to east coast states, and anticipates an increase in demand. In the U.S., T. Boone Pickens, the consummate oil man, plans to build a 4,000-megawatt wind ranch in Texas. At a cost of US\$6 billion, 2,000 turbines spread across the 68,000-acre ranch could supply 1.3 million homes.

As with biofuels, small-scale models are making their way to market. If an industrial-size turbine isn't for you, watch for innovation in micro-turbines.



A kite for a cargo ship? The Sky Sail can save up to 40 per cent of fuel costs. With fuel costing up to \$50,000 a day, that's no small feat.

What other types of old energy or simple tools could be made new again?

Photo used with permission © SkySails



Solar power

There are many ways of harnessing solar power that lend themselves to agribusiness applications. Typically, we think of photovoltaic (PV)³³ cells, but emerging industries are capturing solar energy in a wider variety of ways. In the U.S., a massive project called Nevada One uses curved troughs to concentrate the sun's rays 70 times to a beam, creating steam for turbines. Some methods are simpler and include solar heating of water or rocks and solar collectors like black pipes and solar walls. These can be incorporated into new buildings or roads as they are laid.

Changes are coming that will replace silicon in PV cells with inexpensive substances like cadmium. This will allow for many new applications using "thin film" PVs.

Solar power is the fastest-growing alternative energy outside of North America and shows promise for developing countries. Canada's largest solar farm in Sarnia, Ont., will consist of 60 megawatts, with hundreds of thousands of panels.

Solar power for transport won't likely break into the market any time soon, yet a solar car race between Texas and Alberta was held in summer 2008. At 95 per cent energy efficiency, they left conventional combustion engines, at 15-20 per cent, in the dust.

Poultry farms are making it work

Willem and Jacqueline Siebring continually think about alternative, low-cost energy solutions. When propane costs rose, the Siebrings transformed ideas into action. This winter, their Ontario broiler operation will be powered by three heating choices: solar, wood or propane.

A government grant helped to pay for solar walls in their two barns. When the sun heats air, fans pull it through the walls and circulate it to heat the barns. The Siebrings burn wood pellets or corn in a stove to heat water that runs through pipes above the chicks. They keep propane as a backup for cold winter nights. The couple did their research and opted for a unique energy mix.

Tired of rising energy costs? Lidner Farms in Ontario decreased heating costs in two poultry barns by using solar technology. Water is superheated in tubes, then distributed through pipes mounted in the walls of an older barn and the floor of a new barn. Not only is the poultry flock warm, the in-floor heating system eliminates the need for straw because it quickly dries manure. Less humidity means less use of fans and more savings on electrical bills.

Canadian Poultry Magazine – August 2008

Geothermal power

According to the Centre for Energy, the top six miles of the earth's crust contains 50,000 times more geothermal energy than all the oil and natural gas resources in the world. That sounds like an untapped resource! Not only can geothermal energy be tapped, new inventions are helping to store and convert the heat into many other useful functions. The upfront investment in geothermal energy is significant and the payback takes awhile. After that, it's fairly maintenance free.

Some new land developments and industrial areas incorporate the technology into every lot, along with energy-efficient building design that maximizes the geothermal investment. These energy-efficient carbon villages, sub-developments and other green field projects built from scratch have features that interest buyers. They are springing up all over the country.

Making it work

Granny's Poultry of Winnipeg runs an operation housing 12 million chicks. They created a customized energy management system projected to decrease energy costs by \$100,000 or more a year.

Sophisticated software regulates their three energy sources, automating the energy needs of a 36,000 square foot hatchery and new corporate offices. Water at a constant 7 C is drawn from 200 feet underground. It moves through the buildings with heat transfer plates, keeping them cool in the summer and warm in the winter. When the operation needs more heat, it comes from chicks developing inside the eggs or hatching. A boiler backup system kicks in on colder days.

Granny's has installed energy-efficient lighting, paying attention to details like efficient plug-ins for cars. The mix of geothermal, heat recovery technology and conservation is an ideal solution. What is the right mix for your operation?





What's next for transportation?

Energy experts see transportation possibilities heading a few different ways: plug-ins, natural gas,¹⁴ and hydrogen.¹⁵ It could be a combination of all three or even a scenario we haven't thought of yet.

Plug-ins

Developments in electric vehicle plug-ins will be the first to hit markets in a big way. It is likely that any auto industry aid will be linked to conditions for plug-in development. This has implications for electricity demand especially in big metropolises.

Natural gas power

Natural gas is another resource in Canada that can be used for heat, electricity or transportation.

Prices peaked in 2001 and 2005 after decades of stability (Fig. 12). At the time, many greenhouse producers depended on natural gas to heat their operations. The sector was hurt by the volatility in fossil fuel prices and took heed of the signals. Their experience provides a caution to others about depending on one source of power. The greenhouse sector provides inspiration for

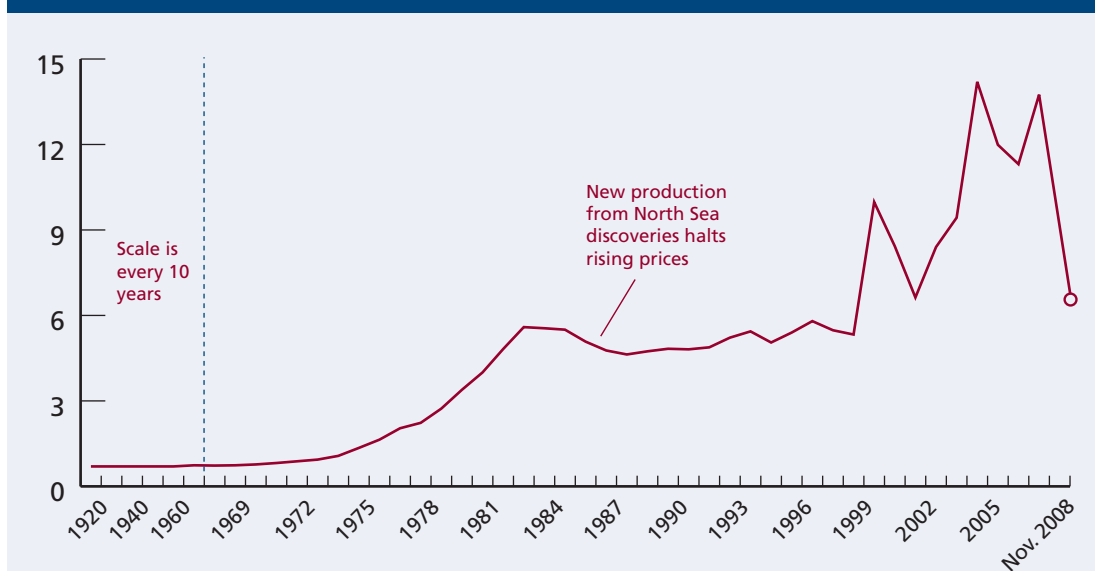
planning ahead and experimenting with alternative energy.

While natural gas could also hit its peak in the next half century, it is readily available, cleaner than coal and oil and relatively inexpensive compared to crude. While it is a non-renewable fossil fuel, it could be used as part of a long-term transition to new solutions.

Liquid natural gas (LNG) could potentially power all types of vehicles and fuel cells, relieving the auto industry from its dependence on crude. About 120,000 U.S. vehicles and 1.5 million each in Argentina, Brazil and Pakistan are powered by LNG. What's stopping us from moving to this fuel? Affordable vehicles and refuelling stations are scarce, and LNG-powered vehicles are challenged by cold weather. Experts predict by 2015, five per cent of vehicles on the road could be powered by LNG. LNG may be a solution for heavy vehicles, while plug-ins are focused on light vehicles.

With new U.S. production coming on stream, and prices already lower than their crude oil equivalent, natural gas could be an attractive energy alternative.

Figure 12: Commercial natural gas prices (USD per thousand cubic feet)



Hydrogen power

Hydrogen can be combusted as a gas, used to create electricity in a fuel cell and used as an energy carrier. Most scientists and environmentalists agree that hydrogen will become an important platform for the future. A significant number of fuel cell vehicles in the world use Canadian technology.

Hydrogen gas is a great source of energy but is never found naturally as a pure gas. It's always combined with other elements and needs to be extracted. Water (H₂O) is the cleanest source but electrolyzing the hydrogen out of it is expensive. "Cracking" it from methane (CH₄) is much cheaper, but releases GHGs. Other potential sources include algae and bacteria excretions.

Once hydrogen is isolated, it is fed into a fuel cell (battery) along with oxygen from the air to produce electricity, heat and water.

Unlike electricity, hydrogen can be stored until it's needed and converted to electricity upon demand. It can also be transported in containers or pipelines detached from the grid. It has a flexibility and independence that the electrons on the grid do not. It could revolutionize the entire grid and how we use it. It's already happening. If a windmill or small water turbine creates more electricity than your operation needs at any given time, hydrogen development is nearly at the stage where surplus can be stored as hydrogen and used later in a fuel cell.

Global demand for hydrogen fuel cells will double in the next five years. Tiny cells are already being made for laptops and cell phones. Small fuel cells can power electric cars and larger ones can provide electricity in out-of-the-way places with no power lines or backups for emergencies.

Most vehicle manufacturers have fuel cell development programs. Timing? It will be at least a decade before we see affordable, hydrogen-powered vehicles with the infrastructure to support the industry.

Other power sources

Nuclear power, hydro and coal are critical to Canada's energy mix. In their present form, they are mainly suitable for large-scale projects. All could potentially be used for smaller projects and indeed are already. Coal was once used for heating homes and in small engines; nuclear rods are used in submarines and rockets; privately held micro-hydropower setups are found across the country. Water has been converted into mechanical energy to turn mill wheels for thousands of years. It is realistic that they could be adapted for small-scale use again in future.

Although Canada is the top country for uranium production, the U.S. and France are the top users of nuclear energy. Canada leads the world in hydroelectricity production, created by harnessing the energy of big rivers, tides and waves.

Quebec's James Bay projects are well known, B.C. Hydro is looking to capture wave power near Canada's surfing mecca at Ucluelet and Nova Scotia Power produces electricity from the highest tides in the world. Denmark takes hydroelectricity a step further with wave dragons that resemble robotic water lizards, ride swells and create energy.

Hydro and nuclear are seen as green and coal is seen as dirty. Consumer acceptance varies for each.

Copying natural systems: cogeneration and biorefineries

All the talk of waste, feedstocks and energy sounds a little like ecology. Waste for one is food for another and systems operate in closed loops. Energy projects modelled on this principle are called cogeneration/poly-generation plants or integrated biorefineries.

Cogeneration and poly-generation occur when the same fuel is used for multiple purposes and produces two or more energy types or outputs. Steam is a byproduct of electricity generation that can be recaptured for heating, cooling or other uses. Before clean-burning and cogeneration

existed, coal-burning power plants only converted about one-third of the fuel inputs into useful energy. The rest escaped to pollute the air. Cogeneration increases this efficiency up to 80 per cent. Lower waste management costs, less pollution and more output equals cleaner energy alternatives.

TransCanada Energy has partnered with nitrogen fertilizer and potash companies in a poly-generation arrangement. The \$4-billion plant in Belle Plaine, Sask. represents the province's largest-ever investment into a single project.

Efficient engineering

From hybrid semi-trucks to direct seeders almost 90 feet in width, innovation is a hallmark of changing times. New ideas that save time and money and create efficiencies are bountiful on the energy front. Aircraft companies are using new composite materials that are strong, lightweight and drop fuel costs 20 per cent. Imagine a high-clearance sprayer made from Kevlar. Self-auditing heavy equipment that makes energy optimization adjustments is coming into production. What about energy-efficient green buildings with everything from light and water sensors to passive solar storage?

Transitioning to a broader use of alternate energy sources (plug-in, LNG or hydrogen) will be felt across many industries. Combustion engines and powertrains will be modified. Parts of the transportation industry including refuelling and support infrastructure, services for fuel cells, and retrofitting large equipment will require overhauls of many value chains. Electricity demand in cities will increase markedly with the mass introduction of plug-ins. Perhaps some companies will build from scratch. Work is already underway. Peterbilt Motors launched road-ready hybrid trucks that feature an LNG powertrain. They're also experimenting with fuel cell technology.

Electric cars like the Chevy Volt, which is scheduled for a 2010 release, could serve the needs of 75 per cent of drivers who drive under 60 km per day. Currently, electric vehicles cannot deliver the power that those with traditional or LNG powertrains can. Promising breakthroughs will be made and traditional engines will be phased out over the next 25 years.

When an industry is in transition, switching to a new model at the right time can be tricky. Consider how long the old, oil-dependant models will be around for parts and what will it cost to fuel them. Will the cost of holding on and claiming tax depreciation be greater than the cost of switching to more efficient designs? Will the equipment manufacturers go down the electric path, LNG or hydrogen? A tax accountant or financial planner may help you budget.

Making it work

Mike Kotelko is the co-owner of Highland Feeders, an Alberta feedlot with capacity for 36,000 head of cattle. Mike believes climate change is here to stay, the cost to produce energy will increase and agriculture will have a role in the new energy economy. He's getting in the game now.

In 2005, Mike and others created a renewable energy company at the feedlot. Using anaerobic digester technology, manure is transformed to biogas. Now they're ready for the next phase, an ethanol plant that forms a closed-loop biorefinery. The inputs? Primarily manure and wheat. The outputs? Electricity, bio-based fertilizer, fuel ethanol and wet distillers' grain that will be fed to cattle to produce more manure so the cycle continues.

Mike's key learnings? Grants and government programs are worth the effort. Be prepared for higher costs than you anticipated and build partnerships that grow with the project. For Kotelko and his partners, investing in alternative energy means a more secure future.

Energy conservation

One way to reduce costs and dependency on fossil fuels is to use less.

Ask yourself whether you have done all the simple things first. It may seem trivial to read tips on tire inflation or changing light bulbs, yet these practices could reduce your energy bill. Before you invest in a new energy project, see if you have done everything you can to conserve by reviewing current practices.

Consider field work, trucking and transportation. Reducing transportation distance reduces cost and carbon emissions. Where is your market, what do you pay to move products and are there markets closer to home? Will consumer demand for conservation and a lower carbon footprint create markets that weren't previously viable for you?

If you're a producer, you might want to look at crop inputs and application practices. They depend heavily on the state of the fossil fuel market and are priced accordingly. Canola crop innovations allow for direct combining, eliminating the need for swathing and saving one pass on the field. Seed companies are working on technologies to improve nutrient uptake in plants and nitrogen fixation processes leading to less fertilizer application.

Do you need to drive as much as you do? One Toronto-area winemaker realized that the bill for automatically scanned toll booth charges of their delivery trucks was exorbitant. The charges flagged how inefficient their delivery system was. They sat down with maps, planned deliveries and negotiated sales calls. Toll charges and the fuel bill were greatly reduced. It can be as simple as charting out your operation's comings and goings. Larger, complex businesses can use software and logistics to help with supply chain management.

Use all the data at your disposal to analyze your work patterns. Did you plant your fields in order? Are different moisture levels and microclimates found in different areas that affect spraying, desiccating and planting patterns? Do you use the most efficient routes? Do you take advantage of

Making it work

Bernard and Martin Prince, a father and son team in west-central Saskatchewan, strive to minimize fuel, natural gas and power consumption on their grain farm.

The Princes plan in the pre-season by selecting field and seeding order, keeping mileage in mind. Travel for seeding, spraying, swathing and especially harvest are optimized and kept to a minimum. They ensure tire pressures are optimum for conditions and shut down engines after short cool-down periods. When grain trucks are emptied during harvest, the hoist is raised and the engine is turned off while the grain flows out. The same process is used in the spring or the fall when they fill the seeding equipment.

The combine holds 1,500 litres of diesel fuel and will run for over 25 hours. Full, that's 1,300 kg of weight. Depending on the weather, some harvesting days last only 12 hours, so half a tank is sufficient.

Electricity is shut off at the breakers on unused buildings, eliminating creep consumption and guarding against vandalism.

Running to town for errands is part of the equation. Large material and hazardous goods are hauled by truck. Small parts are hauled by a more fuel-efficient car or even motorcycle. Communication is important. By sharing trip-to-town intentions, the total number of trips can be minimized.

The Prince family finds new ways to conserve energy every day, right down to eliminating the one-toast-at-a-time practice for breakfast.

GPS and light bar technology, ensuring minimum passes over the field?

You can perform an energy audit on your farm or business site. There are many excellent resources to help. Some utility companies offer free consultation on ways to reduce total energy costs and increase efficiencies. Some offer incentives to encourage smart design.¹⁶ You could hire a professional from Leadership in Energy and





Environmental Design (LEED), a green building rating system.

Businesses that are energy intensive or dependent on transportation fuels have the most to gain with a comprehensive energy plan. Streamlining operations, reducing energy costs, improving process flow or increasing efficiency in the supply chain helps to maintain a competitive advantage in the marketplace. Some businesses brand themselves around energy and environmentally responsible practices.

Watch for new business opportunities

Energy transitions bring new opportunities. Keep your eyes open for new kinds of services and products. Watch for agribusiness services like:

- advising and energy audits
- equipment sales
- abatement
- production data services and analysis
- telematics – remote energy usage intelligence
- smart buildings
- mapping, GPS, logistical planning
- branding opportunities
- managing environmental or ecological services
- carbon credit and certification companies.

Early adopters could capitalize on being first, looking into side businesses or consulting. Some who have installed an energy project

“There are opportunities for many companies, large and small, to play a role in the coming era of new energy. Most of them will involve renewable energy, and many of them will involve decentralized or localized energy. And it will be lucrative, with many opportunities for innovation and exciting business possibilities.”

– Glen Hiemstra, founder of the Futurist Organization

find themselves helping and installing or dealing for others.

Jim Carroll, a leading international futurist, says “growers that make innovation one of their core values will find success, focusing on the triple need for growth, efficiency and ingestion of new science. It will be by adopting new methodologies, products, partnerships and ideas that they will thrive.”

Carbon credit markets are opening for business

Carbon is big news. The reduction of carbon is a tradable commodity and for industries involved in carbon cycles, such as agriculture, this could present an opportunity. Producers can earn carbon credits through biogas production, wind, carbon capture, production practices (nitrogen application), new projects in low-till and no-till and reforestation.

Making it work

Glen Jennings runs Bayview Poultry Farms in Nova Scotia. In 2007, he installed three on-farm wind turbines. Based on his cost savings, he expects a payback period of 12 years for the capital investment. Branded as environmentally friendly, his eggs are sold to specialty markets in Atlantic Canada.

Could green energy create new opportunities for your business?

Some producers involved in energy projects find that the financier of the project or the utility companies they sell to want carbon credits as part of the deal. As industry works out standards and common practices, there are implications to including future credits in negotiations. You need to be abreast of evolving terms, standards and conditions: whether credits are a one-off deal, transferable with property or include other considerations.

Although credits aren't likely to be a large source of income, they could provide some revenue to offset a project cost.

Compliance markets require emitters to purchase credits that offset emissions. Credits are purchased from those whose practices are approved as carbon reducing. Many regional groups are forming to trade carbon credits. Several provinces, including B.C., Ontario and Quebec, have signed an agreement with western U.S. states to join the Western Climate Initiative (WCI).

In voluntary carbon markets, credits are purchased by companies like News Corporation and Yahoo, intent on reducing their carbon footprint, even if they're not required to do so. Different standards of credits are sold at various prices based on the quality of the carbon reduction or a certainty that the action will reduce greenhouse gases in the long term.

Pay attention to the customer

Know what customers value about energy and the environment and you'll be in a better position to do business. Consumers and retailers are demanding traceability, specific animal husbandry practices, sound transportation methods and safe environmental practices. They want low carbon footprints in the supply chain. Governments are increasingly regulating pollution, carbon credits, taxes and environmental practices.

Russel Marcoux, CEO of Saskatchewan's Yanke Group of Companies,¹⁷ says it's in our best interest to understand these demands and where they will lead over the next five to 10 years.

"Environmentally sound decisions will be the table stakes," he says. "We will lose our businesses if we don't get on board and be proactive about these shifts."

Parma, Italy is transitioning to a net zero-carbon city. Their key products (Parmigiano and provolone cheeses, prosciutto ham) will be branded as carbon responsible. As a strong pork and dairy centre, Quebec could look to Parma to learn where others are headed with these trends. Some of Canada's export markets like EU and Japan, are years ahead of North American consumers when it comes to food advocacy.

Green companies, clusters, villages and cities can save money, proactively embrace trends, be a model for rebuilding after disasters, or in the case of Parma, align a brand with customer values by selling zero-carbon products.

Have you ever had an idea that seemed like such a bright idea, you couldn't believe you hadn't thought of it before? For us, that idea was using solar power. Seems obvious, doesn't it? We make SunChips®, after all. So we've started using solar energy instead of fossil fuel to help make SunChips® in California. And although it's only one of the eight plants we use to make SunChips®, it's a small step in the right direction.

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WARNING



Hydrogen 350 bar
(5000 psi)

ble, High pressure gas.
motor. Dispense only
ct pressure vehicle tanks.

to comply may result in
r bodily injury.





What's on the horizon?

No one knows for certain what's coming. However, we can paint some likely pictures by watching the actions of those who shape and invest in things beyond today: investors and venture capitalists, architects, corporations, governments, self-organized citizens, scientists and pioneers.

Nanotechnology scientists are close to creating artificial photosynthesis. This could produce

hydrogen for vehicles and be used as a sink to mop up carbon dioxide from the atmosphere. A new form of energy called "dark energy" has been discovered and it's behind the expansion of the universe. It could be an energy we learn how to harness. Frozen, jelly-like gas hydrates have been found on the continental shelves and contain more carbon than any other source. Incorporating energy and life forms into buildings will become common.

The future of agribusiness is already here

Po Kim gets up in the morning to go to work. She hops on a high-speed MagLev train that floats on a magnetic field, is propelled by a linear induction motor and follows guidance tracks with magnets. There is no train conductor.

She crosses an ocean causeway going to the Shanghai Greenport,¹⁸ a river delta that was particularly vulnerable to urban sprawl. Deltas are among the most fertile and ecologically diverse lands.

She smiles at the tourists and locals getting off the train to board a state-of-the-art sky train or canal boat. Stops along the way include many different learning and recreation stations or simply enjoying the waterways, animals, nature, landscape and green spaces.

Her workplace is not Disney World. It's a 27-km² agro-park combining an entertainment complex, an environmental preserve and enough agriculture resources and processing facilities to feed an entire city. Tens of thousand of pigs, chickens, crops and biomaterials, are housed in aesthetically beautiful surroundings. All buildings are powered by the most advanced ecological and energy-efficient technologies. It is a circle economy, every waste and byproduct is an input to another part of the cycle. It has zero waste, zero emissions and is a net energy contributor to the city.

Amazingly, it isn't a government-subsidized demo site. It's a profitable venture with returns to employees and agri-food entrepreneurs. This is what metropolitan agriculture could look like as part of a solution to feed the cities of the world.



Managing through transition

We live in challenging times. We've seen dizzying energy prices, a world teetering on the edge of financial collapse and a volatility that has economists and analysts saying they just don't know what the next year will bring. In a culture that has known little but steady progress for the last 50 years, this is a dramatic shift. What could it mean to the values of society? People may search more often for local food supplies, decentralize power generation and increase self-sufficiency.

One of the greatest skills you can have is to be capable of resiliency and expanding your capacity for change. A key to success will be the ability to generate positive visions of future, to harness the power of engaged optimism,¹⁹ no matter what the short term looks like. This frame of mind helps you see things that others do not and take advantage of opportunities

It is said that in good times we reach in the pocketbook, in rough times we reach into heart and character. Can you be a source of positive transition for your family, business, community and professional organization?

Power your future

Agriculture is uniquely positioned to influence a sustainable energy future. Whether growing crops for biofuels, using rural land for wind and solar installations, or simply having easy access to waste materials for biogas, producers and industry entrepreneurs understand biomass, food energy

and living systems. The agri-food industry and your role as a steward are part of the answer. Who is better positioned to find answers and leverage know-how and resources?

Against this backdrop, we will reach peak oil. The demand for conservation and reduced carbon footprints will increase, and there will be more government regulation.

Understanding long-term trends is an important first step. While these trends can slow because of shorter-term events and blips, planning with a long-range view will help you shape your future. Mitigating strategies, capitalizing on opportunities and avoiding crisis-driven decisions will keep you in good standing.

Some will transition to save money, decrease risk and improve comfort-levels for their business. Some will be motivated by personal values, believing it's the right thing to do. Others see huge opportunities in a time of transition. For some, the best decision is to do nothing. Some answers will come through technology revolutions like the smart grid. Others may come from those who remember what it was like to live in a world that used less energy.

Those who deal with energy challenges early will be better positioned for success in the next energy era. Darwin said it wasn't the strongest or the most intelligent species that survive, but the ones most responsive to change.

What will your response be?