

Cries of Crisis – The potential consequences of a changing global environment on bio-security and food safety

Executive Summary

A perfect storm is brewing. This one is a global storm that will affect how we all live.

Peak oil is here. Eight out of the ten top producing countries have already peaked in their total production, and the remaining two countries appear to have plateaued. Once an oil field has peaked it can only ever produce less oil because of the drop in pressure. For every six barrels of oil that the world is consuming we are currently only finding one barrel of oil. And that new oil is more expensive to extract. So approximately half of the world's oil has been consumed in the last lifetime, and if we consume the other half of the world's oil in the next lifetime, then we will have a greatly decimated planet from global warming.

We are increasingly aware of the potential for climate change caused by excessive global warming gases. Each week scientists add voice to concerns that the climate is changing faster than predicted, and that the effects may be more significant than previously thought. Cap and trade systems have been put in place but they have gained little traction, and are subject to political pressures in every country. Commentators typically say, "If we adopt cap and trade it must not affect economic growth". But that is the point of such measures – to significantly and quickly move industry and consumers away from oil, coal and other greenhouse gas emitting activities.

Economic growth is embedded in our thinking and our systems. There is scant understanding that the global money supply model requires 3% annual growth to stave off collapse of the system. Commercial banks create most of our money supply. With small reserves they simply create the rest of the money to lend to customers for activities like buying a house. But the banks only create enough money for the house purchase, not the money for the interest payments. This comes from future bank creations of money to future customers, which increases the total money supply. The system functions so long as there is constant economic growth. But like a Ponzi scheme, the system works until the flow of new investors stops. The current drive is to reignite consumption in wealthy countries to restart the process. This would be fine if the planet had not begun to hit real resource constraints that affect the capacity for unlimited growth – like peak oil, peak water, peak nitrogen, peak phosphate and others.

Surprisingly economic growth in the western world over the last 50 years has had almost no impact on measures of happiness.

Energy supplies and communication systems may be further disrupted by solar storms impacting on satellites and the major transmission lines. The larger the power lines the more likely the 11 yearly solar storms will cause direct current to melt the transformers. The last sizeable solar storm was in 1867 which caused major disruption to the emerging telegraph industry. Many high power transmission lines are unlikely to withstand the impact of a solar storm of that magnitude, and a recent NASA study concluded the costs to the US are likely to be in the order of \$1 trillion to \$2 trillion in the first year after such an event.

Consumer concerns about how food is grown and processed are increasing. Issues include animal welfare, diseases passing from animals to humans, GE, food additives, and food safety practices in developing countries.

Growing awareness of the kinds of threats and concerns described above is beginning to impact on sustainable agricultural systems, energy efficient vehicles, alternative energy production, global communication systems, high speed broadband connectivity, animal welfare, human rights, international cooperation, and collective responsibility to create a better world.

This presentation outlines some of the major challenges facing the planet, and its possible impact on New Zealand's biosecurity and food safety.

Peak Oil

Wherever we look in our daily lives we will see the impact of cheap fossil fuel - transport, plastics, computers, food, electricity, clothes. One litre of oil equals as much energy output as a strong worker can produce in a week. It is no wonder that slavery was such a key feature of past societies!

However oil production is reaching a peak and is expected to then decline continuously. In eight of the 10 largest oil producing countries, production has already declined – USA, Canada, Iran, Indonesia, Russia, Britain, Norway and Mexico. In the remaining two countries, China and Saudi Arabia, production appears to have reached a plateau.

Data on oil reserves is woefully dubious. OPEC countries are permitted by their members to export based on their oil reserves, not their current oil production. In all of these countries there was a sudden increase in the stated oil reserves by an average of 45% with no explanation given for the increase. Other countries, like Mexico, inflated their oil reserves as collateral for gaining international bank loans. Calculations of the world's oil reserves also include tar sands, oil shale and oil that is not recoverable with today's technology. Some of these "reserves" consume more energy to recover than they yield.

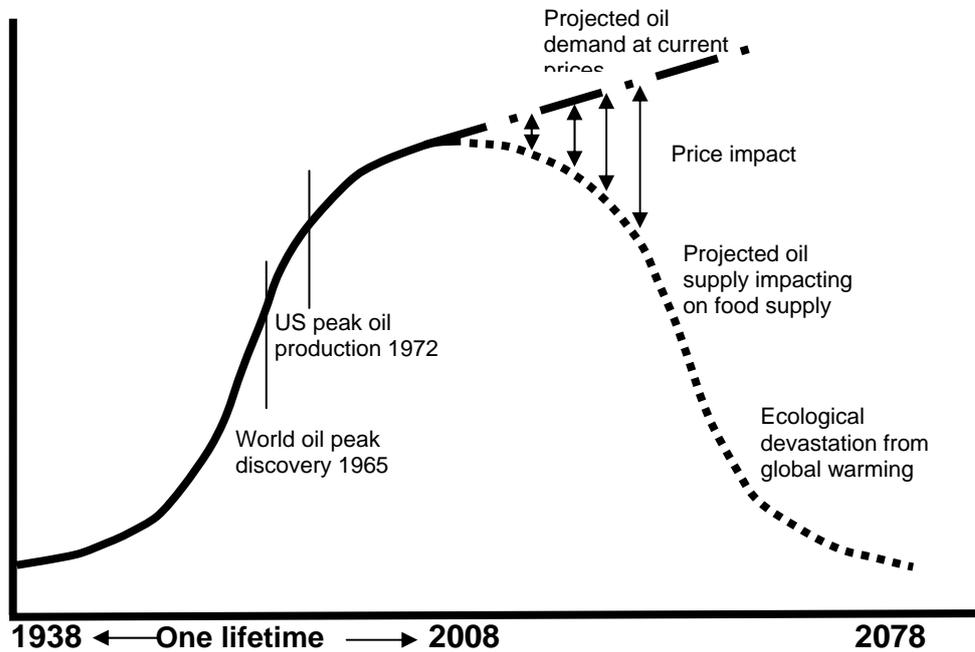
On average there is a forty year gap between when an oil field is discovered to when it reaches peak production. When about half of the oil has been extracted from a field, the pressure drops causing production to continuously decline thereafter. Peak oil discovery was in 1965, over 40 years ago. We are now discovering only one barrel of oil for every six barrels that we are consuming. And these oil finds are in ecologically fragile places like the Arctic, or in hard to recover regions like the deep oceans south of New Zealand.

World demand for oil has been rising rapidly especially in the rapidly growing economies of China, Brazil and India. Demand is also fueled by growing population, rising GDP, and increasing uses for oil. The global recession has steadied the demand but if the stimulus package is successful then the world will revert to increasing demand.

But supply is likely to decrease.

So the gap between what the world would like to consume at current prices, and what can be supplied will appear as increased prices.

The Peak Oil Crisis



Hopefully increased prices will stimulate real investment in alternative energies, and conservation of the remaining reserves. The world has consumed about half of the world's readily accessible oil in the last lifetime and if we consume the remaining half of the reserves in the next lifetime then the global warming impact means we are unlikely to have a planet that can sustain civilization as we know it.

Actions to reduce oil consumption are slow to occur. It is said that the biggest oil well lies beneath Detroit. The average US car gets only 25 miles per gallon, compared with Chinese and European cars that average 44 miles per gallon.

New Zealand remains geared for cheap oil. Of 27 countries in the OECD, only Mexico, the United States, Canada and Australia have cheaper petrol prices than New Zealand. Other countries have much higher fuel tax levels that have encouraged the purchase of smaller vehicles, investment in better public transport, and alternatives to oil fired power stations. In Britain all new houses will have to be zero carbon burning no fossil fuels such as oil by 2016. Such a radical policy is unthinkable in New Zealand's current cocoon.

Optimists are convinced that technology and alternative energies will enable a continuation of current energy consumption levels. But these hopes are not founded in any projections of science or investment.

Coal will meet its own peak in about 50 years if the current development of coal fired power stations continues. However coal releases very high levels of carbon into the atmosphere per kilowatt of energy produced and would have a devastating impact on global warming.

Nuclear is the best short term prospect for producing clean electricity on a large scale. But supply of fissionable uranium is limited, and brings concerns of disposing of the waste and the potential for terrorist activity. Politically nuclear is untenable in New Zealand, and is more expensive than other options available.

The best sites for hydroelectricity have already been dammed. And global warming is likely to reduce the supply of water in many countries. In New Zealand rainfall is expected to increase in the west of both islands, and diminish in the eastern provinces. Micro-hydro projects are being considered, but are currently relatively expensive options.

Biofuels had a momentary heyday until the diversion of productive agricultural land to biofuels caused an increase in the price of food leading to riots across three continents. Recent estimates show that the carbon saving impact of biofuel will take 95 years to begin, because forests are being converted to agricultural land to compensate for land lost to biofuel production. Subsidies continue to exist for biofuel production but they are unlikely to survive scrutiny. Except for the use of waste materials such as whey from the dairy industry, and perhaps wood chips from the forestry industry. The technology for using wood chips economically is still not developed. New Zealand is leading the world in developing biofuels from algae sources with nearly 10 times the energy yield from using corn.

Geothermal has some expansion potential for New Zealand, but it is likely to remain a minor contributor.

Tidal wave power has great potential for New Zealand – maybe. In theory turbines well below the surface in 10% of the Cook Strait could produce as much electricity as all of New Zealand's current electricity production with virtually no carbon footprint. However there are boulders the size of houses that crash through the Cook Strait diurnally with the tides. Finding a way to anchor turbines in the "hellzone" at the bottom of the Straits is a technical hurdle that has confounded the experts. Trials have begun in a less challenging sites in the Hokianga Harbour and French Pass.

Wind has considerable expansion potential in New Zealand, however nobody wants a wind farm in their back yard. The world's most obvious site for turbines in the hidden, wind battered hills of Makara, alongside New Zealand's arterial power grid, and next to the capital city, took four and half years to approve. Future wind farms may have to contend with much higher oil prices that feed through into the cost of turbines and construction.

Globally solar power is the great hope. However the technology is still an expensive source of electricity, is reliant on sunny weather, and cannot be stored except with inefficient battery systems. Solar is good for direct hot water heating, and may be able to contribute towards a managed power grid that balances the production of electricity from wind, solar, hydro and other sources. It is likely to take 50 years to gear up sufficient solar investment from today's infant industry levels.

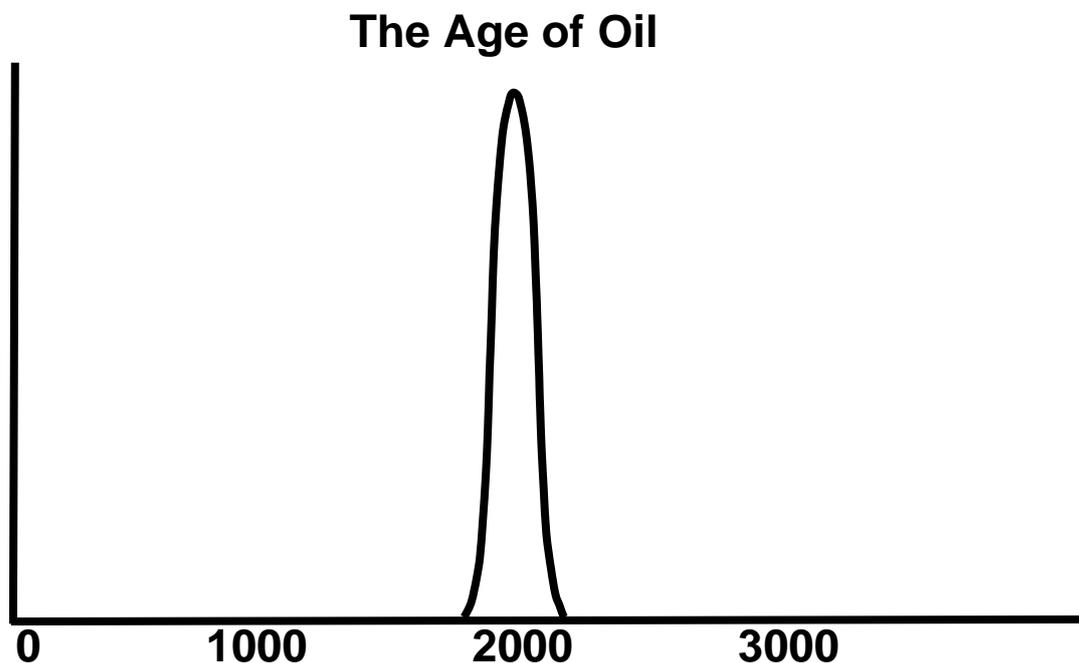
Our dependence on fossil fuels to sustain all aspects of our current lives makes the need for energy conservation and investment in sustainable energy solutions an urgent priority. For example in the United States the production of food consumes about 10 calories of energy for every calorie of food energy that it produces. Beef is much higher on 35 calories and pork is higher again on 68 calories. No wild animal could survive with these conversions from energy expended to energy consumed.

New Zealand's extensive farming systems are less energy hungry but the trend is for worsening energy efficiency on our farms, especially as we intensify land use with more dairying. We have edged away from New Zealand's greatest competitive advantage – a climate that produces clover that captures nitrogen to grow grass, and moved towards increased use of nitrogen fertilizer. Nitrogen fertilizer is just oil in another form. And it will take a few years before clover returns in abundance once nitrogen fertilizing stops.

Nonetheless our farming systems are industrial and cannot remain in their current form in a powered down world. Chemical sprays require considerable energy to produce. On the one hand the move from sprays to more organic food production systems may increase food safety. On the other hand they may enable pest species to invade.

Cuba had its own peak oil crisis in 1990. When the Soviet Union collapsed Cuba lost its principal oil supply. The United States compounded Cuba's difficulties by banning any ship from porting into the States within six months of visiting Cuba, and any organization from doing business in both countries. Hardship and starvation ensued, but so did the public spirit to find sustainable ways to live. Now, Cuba has a life expectancy comparable to the United States but with one seventh the carbon footprint per capita. And citizens say they are happier and healthier than before the "Special Period". Cuba has become the role model for countries taking a serious look at how to thrive through peak oil.

Peak oil is here. The current "Age of Oil" is destined to be just a blip in history.



Global Warming

Warming of the climate system is unequivocal. And the weight of evidence shows that this warming is the result of human activity and is likely to have a serious impact on the planet if urgent measures are not taken.

In this presentation I wish to focus on the possible impacts on New Zealand's bio-security.

Allergens like mould and ragwort thrive in higher concentrations of CO₂ impacting on allergies and asthma.

Warmer climates enable carriers like mosquitoes, ticks and mice to survive warmer winters, expand their range, and increase health risks. Malaria-carrying mosquitoes have been observed spreading in Europe, Russia and even 7,000 feet above sea level in the Colombian Andes. Scientists predict that warmer temperatures could also see the spread of Dengue Fever outside the tropics.

Cholera appeared in newly warmed waters of South America in 1991 for the first time in the 20th century.

Ticks that carry Lyme disease are killed by cold weather. In recent years they have been found along the coastlines of Scandinavia, causing a doubling in the disease in that area.

West Nile Virus was once confined to the tropics, and only moved into North America seven years ago. It has now infected 21,000 people in the United States and Canada, killing more than 800.

New diseases such as these, can have a devastating impact as local populations have not built any natural immunity to them.

Potential incursions that would affect our food growing industries are Mediterranean fruit fly, screw-worm fly and cattle tick. The Northern Pacific Sea Star could impact on our aquaculture industry. Marine species like the New Zealand cockle are likely to be affected by a worm parasite. Impacts on one specie can affect the whole ecosystem.

I recall sitting under a tree in Malaysia and being attacked by a colony of fire ants. Species such as these could thrive in a warmer New Zealand climate.

There is current concern over the introduced southern salt-marsh mosquito, which is capable of transmitting Ross River virus and Barmah forest virus.

The impact of such invasions is not always negative. Pacific oysters that came in on barges carrying the Auckland harbour bridge settled in the north of New Zealand creating an economic oyster industry.

The challenge with climate change is epitomized by the tragedy of the commons. Collectively we all need to reduce global warming emissions, but it is in our own self interest to continue to pollute. Countries like New Zealand have been unwilling to shoulder the burden when the world's largest polluters, the USA and China, have refused to act. Our nearest neighbour, Australia, has the highest carbon footprint per capita and also refused to sign Kyoto.

It seems to me the world needs to bite the bullet on providing real teeth to international agencies like the United Nations. We have such high expectations of this institution – prevent wars, rebuild war-torn countries, solve poverty, control epidemics, and build towards the promise of a united and fair planet.

Yet the UN budget is only the size of the New York Fire Brigade budget – and that is if they received their funding. The United States is required to pay 25% of the budget although has 33% of the world's GDP, 49% of the world's military budget, and 86% of the world's military exports. However for many years the United States only paid once every seven years, under the proviso that the UN would support US aspirations.

There has also been a concerted media campaign to discredit the UN because it is the only institution that can challenge the US for global hegemony. There is no doubt that the UN has significant issues, but it is trying to operate with both hands tied behind its back, and no genuine mandate to act.

Funding for crippling issues that affect the bulk of the world's people is miniscule. Nearly a decade ago the wealthy countries agreed to 0.7% of GDP being provided for aid and development. Only Scandinavian countries have met this target. New Zealand is doing relatively well on just 0.3% and the US is second lowest on 0.16%. And most of US aid is either military aid or funding to US citizens and businesses in developing countries. In fact just US\$8 per American actually gets to developing countries.

These figures illustrate the challenge to get political will to tackle global issues.

I see New Zealand as a leading country in formulating processes for global unity. It was a New Zealander, Leonard Clough, along with Baron Pierre de Coubertin who launched the modern Olympics. A New Zealander wrote the United Nations charter. New Zealand is the loudest voice in agricultural negotiations in the World Trade Organisation, and the most trusted by developing nations. New Zealand is English speaking, ranked as the world's strongest democracy, and also the world's least corrupt, and almost completely non-aligned. It is the people in this conference who are amongst the most likely to drive global agreements to global issues affecting food safety and bio-security.

Solutions like emerging cap and trade systems will help, but they are widely prone to abuses in measurement, or snake oil solutions for reducing carbon footprint. Personally I would like to see an additional tax of \$20/barrel on oil and \$20/tonne on coal taxed at source and paid to the United Nations. Price changes are the fastest way to kindle rapid change in behaviour. And the tax is likely to stimulate the world economy since it would all be spent in development which has a high multiplier effect on the money supply than other uses.

Money Supply

The world money supply is a peculiar beast – very peculiar! Every Econ 101 student has been taught that commercial banks create money when they give out loans. But somehow the full import of this bizarre process does not sink in.

Back in history gold smiths had vaults to store their gold. Others wanted the safety of the vaults for their gold, which they deposited in return for a paper IOU. In time these paper representations of the gold became used for trade, as they were more convenient to handle than the gold itself. Goldsmiths eventually realised that they could provide IOUs on gold they had in their safes, and even on gold they did not have. With expanding trade needing credit, the British Government about three hundred years ago legalised this process through the Bank of England.

Until the 1980s there was a reserve assets ratio that restricted banks to maintaining about 10% of the lent money in real money. But this went. All a bank needs is to determine whether you are likely to repay a loan, and they can simply create the money.

In the first eight years of this millennium this system has been fast and furious, raising the world money supply from US\$35 trillion to US\$72 trillion by 2008. Some of this money was created for the subprime housing market in the United States. Many of the borrowers are called NINJAs – no income, no jobs, no assets. As the repayment of these loans stumbled and fell, and the house prices that provided the security for the loans dropped, then the money supply system unravelled.

This would just be a market correction if it was not for another peculiar aspect of how the money supply is created. The commercial banks only create enough money for the loan. They do not create any money for the interest to service the loan. This comes from future lenders creating future money for future loans, expanding the whole money supply.

So the system requires constant economic growth to feed itself. It is like the Ponzi schemes where investors get paid great returns from new investors coming into the scheme. As soon as the flow of new investors stops the whole scheme unravels and the last in lose their shirt.

The money supply system has more or less worked for the last 300 years. However for the first time constant economic growth is not assured as the planet meets real resource constraints – peak oil, peak water, peak nitrogen, peak phosphate, and others. Climate change is tied to GDP growth – only Denmark and Cuba have been able to achieve economic growth without increasing fossil fuel use per capita.

Many things about the money supply system make no sense. Why are commercial banks the only ones who can create money – why not governments? Governments are only able to create the notes and coins that represent just 2% of the money supply.

Why have a system that is cyclical – in boom times banks create more money and in bust times they create less. This leaves it to governments to use blunt instruments like official interest rates and government spending and taxes to try to fix up the mess. But they don't work well.

Why do governments allow only the banks to create money and then burden their taxpayers with paying interest to banks?

Why have a system that has to have constant 3% growth to function at all? Three percent may not seem a lot, but year on year this is exponential growth. And therefore it is an exponential demand on the world's resources. Moreover GDP growth only means increased growth in economic activity, whether that activity is good or bad. So employing a nanny over the mother gives GDP growth. Wars add to GDP. Working longer hours adds GDP. Volunteerism reduces GDP.

And why is the system geared for consumption in wealthy countries. The current economic crisis calls for the wealthy countries, the United States in particular, to borrow more from poor countries to generate high consumption of things people do not need to create jobs in poor countries.

As one Chinese manufacturer said, "I am constantly astonished at the orders that come through. Surely people don't really want these things. But the next month the order triples and I am forced to believe people really do buy these things. And then I am told they throw them away."

Current efforts to stimulate demand at mindboggling public expense may work to restart the global economy, but it cannot last. Are insane levels of lending really the answer to a problem caused by insane levels of lending?

What is needed is a new money supply system that is sustainable. There are several suggestions. The most popular idea is for money to be created by the government when needed through investment in infrastructure. No interest is payable on this money so it does not require constant growth. If the money supply growth becomes inflationary then the government can withdraw money from circulation through taxing citizens and retiring the funds. Existing banking loans continue as normal until they are paid off, but banks would no longer be able to create money. Such a system would enable money to be created during hard times, and constrained during boom times.

Since the world's money supply is a global entity then it would be better to ultimately create a single global currency, created by expenditure on global infrastructure and development.

Trade blocs have been moving towards this. The United States created a single currency for its states. Europe created the Euro. There are four other monetary unions and eight more planned around the world. Even China, Japan, Korea and ASEAN are discussing a single regional currency.

These global solutions to the money supply may be nearer than we think, if the current money supply system proves inadequate to cope with the present challenges.

Happiness

Despite massive increases in consumption in the western world over the last 50 years, longitudinal studies show happiness has barely moved.

There is a dramatic increase in happiness from increases in wealth that enable satisfactory levels of housing, food and education. Beyond that level, happiness barely correlates with income. Where income does increase, researchers are finding that happiness increases only when people become more generous with their wealth.

The challenge in a powered down world is to keep those factors that lead to happiness – reasonable standard of living, safety, family connectedness, community connectedness, health, meaningful work, giving, political stability and choice.

Solar Storms

A NASA assembled committee has recently released a report entitled "Severe Space Weather Events - Understanding Societal and Economic Impacts". It concluded that a major event could short-circuit high-voltage transformers, causing hotspots of up to 400°C in the metal, and lead to the failure of large swathes of the electricity grid. The potential cost is estimated at US\$1 trillion to US\$2 trillion in the first year in the US alone, and full recovery could take four to 10 years.

Solar storms occur about once every 11 years when the sun's magnetic field switches. The next storm is due to peak in 2012, however predictions are that it will be less severe than most storms. But the THEMIS satellite has discovered a gigantic hole five times the diameter of the Earth in the planet's magnetic shield. This is allowing 10 to 20 times more solar particles through than expected

Solar storms have been known to damage high transmission power lines. A 1989 solar storm caused a major blackout across all of Quebec. A conservative estimate by Minnesota Power and Electric is that during a solar maximum period, the damage to their power grid exceeded \$100 million.

A large scale solar storm occurred in 1859 when auroras were seen far from the poles. Thousands of miles of telegraph wires had been erected across Europe and the States. Electrical currents, induced by the changing magnetic fields from the solar storm, were so powerful that batteries were not needed to send the telegraph signals. Some operators were even treated for near electrocution.

Our modern technology has increased the likelihood of a severe event. The power grid is increasingly interconnected so a power outage can overload alternative pathways. This was what happened in the Auckland central blackout, as well as the 2003 event that caused a blackout across the whole of the US eastern seaboard.

High voltage transmission lines exceeding 500,000 kilovolts lines act as an antennae attracting geomagnetic storms. In August 1972, a 230,000-volt transformer at the British Columbia Hydroelectric Authority blew up when shifting magnetic fields induced a current spike. New Zealand's major arterial route is 700,000 kilovolts and it is reportedly heating to damaging levels from the current electricity loads. China is attempting to build networks of 1 million kilovolts.

Unlike earthquakes and hurricanes which are a localized event, a major solar storm is likely to affect power supplies in many countries at the same time with increasing intensity closer to the poles.

Electricity is not the only service to be affected. Solar storms damage satellites disrupting some telecommunications. And pipelines have been known to explode from overheating the metal.

Solutions are being explored to develop relatively inexpensive resistors where the transformers connect with the ground. However the solution is not yet available and scant regard is being given to the risks of solar storms on energy security and the global economy.

Consumer Expectations for Food Safety

Many consumers are taking more notice of the source of their food. For example, New Zealanders have recently been appalled at the factory farming of pigs when the practices were graphically shown on television. Consumers are seeking labeling to know where the animals have been grown and in what circumstances.

Coupled with this are indications that the recent swine flu may have begun in a very large factory pig farm in Mexico.

Some years ago one of the authors did a major study on the organics industry for Industry New Zealand. At the time I thought there were probably merits in growing GE food but concluded that New Zealand should remain GE free to capture higher prices in the market for guaranteed GE free status.

As my knowledge of GE grew, it became apparent that GE production was unwise and risky. Gene fragments are bombarded into the chromosome rather than carefully placed so it is unclear what the genes are coding for.

The process requires small amounts of antibiotic material to be added to the genome. Daily consumption of small doses of antibiotic may reduce their efficacy.

Many GE seed companies add terminator genes to ensure new stock must always be bought from the licence holder, and cannot be saved as seed for the next year. There is no assurance that these terminator genes cannot skip species affecting the reproduction of other plants. Reliance on seeds with terminator genes shifts the power balance from farmers to seed companies, especially in developing countries where seeds are saved for next year's planting.

And rat studies are showing animals becoming ill and dying on diets high in GE foods.

GE foods may have benefits but the risks described above appear to outweigh any benefits for plants grown in the environment. This raises a border control issue to ensure GE seeds do not erroneously arrive in New Zealand. And it requires enforcement of truth in labeling.

Organic produce is expensive, although proponents say that non-organic produce does not pay for the true costs of environmental damage. Organics come in many shades of purity, with different labeling schemes reflecting different standards.

Many consumers want their produce to be more sustainably and ethically produced but do not wish to pay the full premium for organics. For example pigs grown organically in New Zealand are usually fed on organic grain shipped in from Australia to meet the organic standard. Consumers want to know that the pigs have had a reasonable quality of life, but would accept them being fed on standard grain. So new labels are appearing such as free range, cage free, SPCA certified, and in the case of plants, spray free. Ensuring such standards are met and that there is truth in labeling is a challenge.

Food additives are becoming a concern. With MSG, companies have begun to change their formulations and label produce as MSG free. Question marks are being raised about the health safety of aspartame, including research showing removing aspartame from the diet of diabetics reduces average weight by nearly 10kg.

Certification systems are emerging for sustainable forest management. More of these kinds of systems are likely to emerge for pressuring other products to reduce their impact on global warming.

As these and other issues move in consumer consciousness, it places more emphasis on regulatory systems that enable consumers to make ethical and health choices.

In Summary

The world is likely to be a very different place within a few short years. Perhaps we are moving towards a golden age characterized by sustainability, closer links to community and nature, and global solutions for global problems. But along the path there will be immense challenges and the sooner they are faced the more effortlessly we can transition to a powered down world.

Many of those at this conference will be the key people in enabling us to rapidly move towards our best chosen future.