Coming to Terms with Oil Depletion

A submission to the Australian Senate Inquiry into Australia's future oil supply and alternative transport fuels by Lionel Orford.

Abstract

There is no doubt that oil is a rare and finite resource that its production must eventually decline. The only question is to when this decline will begin and what the consequences will be. Even the most optimistic interpretation of the data leaves little doubt that oil production will be reduced to a very small amount within 50 years. Hence I believe that the decline must begin within 5 to 10 years.

Considering that:

- oil discovery peaked long ago in 1965,
- no large oil discoveries have been made since 1978, even though seismic survey technology has enabled the entire planet to be mapped out for oil bearing rock strata,
- all the worlds large oil producers are at maximum extraction rates and most are in decline,
- even Saudi Arabia now seems unable to increase it's extraction rate,
- Kuwait has had to admit it can not maintain it's extraction rate and has overstated it's reserves by as much as two fold,
- a frantic dash is underway world-wide to develop previously uneconomic and relatively minor oil deposits,
- demand from China and India is pushing up demand faster than ever before,

I content that it is obvious to anybody who is willing to consider the matter objectively that Peak Oil is here now or will be within 5 years.

Whether or not the current oil extraction rates prove to be the highest achieved before the inevitable decline sets in is merely an academic point; what is important is that we are now entering the era of oil demand exceeding supply.

Higher oil prices can deliver only very modest amounts of additional supply and even that cannot be delivered overnight. Higher oil prices also have only a minor effect on demand in the short term because purchasing fuel is not considered a choice, but a necessity. Farmers must till the soil and harvest crops, goods need to be transported to market, people need to drive to work and so on.

However, as we know from previous escalations in the price of oil, demand will be cut back in fairly short order by the onset of economic recession. As fuel prices rise, people are unable to purchase luxury goods and services. Retail spending is the first to be affected, then follows the tourism industry and other service industries. Under these conditions, significant numbers of people start to lose their jobs, which curtails their fuel consumption and brings oil demand back to meet supply. An overshoot correction is probable as industry after industry goes into steep decline. As oil consumption is sharply reduced, so is the oil price.

As we enter this new and probably tumultuous era of the industrial age, what is most astounding to me is the profound misunderstanding of the general population, and seemingly our leaders as well, of the magnitude of the problem. Almost all make the assumption that technology will solve technology's problems. Those that have considered the matter mostly believe that as we "run out of oil" we will simply turn to "alternatives". Most fail to comprehend that there are no alternatives to oil – no transport fuels that can replace oil in anywhere near the quantities that we currently consume.

This lack of understanding is the most pressing issue to be addressed. As with most problems, facing up to the problem is the first step towards dealing with it. We are not "out of oil"; we are facing a declining supply of oil. This decline will continue for about 50 years until we are only able to use oil for production of special things like polymers and chemical feedstocks. We will no longer be able to use oil for the production of food or for transport.

Compounding the issue are the effects of Global Warming and the imperative not to increase the use of coal to replace the depleting oil. The loss of fertile land and rising sea levels will be difficult enough to deal with if we took determined action now – to radically increase coal use to replace oil is something we simply must not do.

We will soon begin the greatest forced transition ever to face civilisation – the reaching of the limits of our economic system and being forced to change – this time on a global basis.

If we, as a society, take determined action to educate our people about the need for change, even though that change involves reducing our perceived "standard of living", I believe that it is still be possible to manage this transition so as to prevent the economic calamity that now threatens to engulf us.

There is much that can be done, but most of it politically unpopular at present. With a determined effort to

- educate the people
- reduce unnecessary oil consumption,
- increase automobile energy efficiency,
- invest in alternative transport services,
- and get serious about investment in the development of renewable energy resources,

the looming economic chaos can be mitigated and perhaps even avoided.

It is a matter of forging the political will to do so.

A Brief History of Humans and Energy

About 10,000 years ago in what is now Iraq, a virulent species of hominoid, now known as Homo Sapiens, invented of the practice of cultivating and storing grass seeds. This created an energy revolution of unprecedented importance, more important even than the energy revolution created by earlier hominoids - probably Homo-erectus – the invention of the propagation of fire.

The invention of this practice of storing solar energy in prolific quantities in the form of grain allowed humans to settle in one place, rather than following their food supply around their domain. Around the same time, humans developed the practice of holding the animals that they hunted for food captive – possibly because if they hadn't do so, they would have exhausted the supply of wild game within reach of their settlements.

Because of the massive advantages of harvesting energy in this way, agricultural humans soon dominated the much of Eurasia. Large civilisations grew up in the Middle East and subsequently Asia.

The domestication of wild cattle led to even greater ability to cultivate food – another energy revolution – as the animals were used to provide energy for ploughing and transport. Even better energy resources were later developed with the human driven evolution of the horse.

The harvesting of energy from wood, along with the excess human energy available from agriculture made the smelting of metals possible.

The next energy revolution came out of Europe, with huge steps forward in the development of ships driven by wind energy. Contemporaneously, a new form of energy was introduced into warfare that changed the world and created a technological race - the development of gunpowder and guns.

This technological race required the production of more and more iron and supplies of energy from wood, particularly on the island of Britain, were all but exhausted. Some bright spark figured out how to replace charcoal with coke made from coal, which was cheap and available in large quantities. The industrial era had begun.

Soon the easily available coal was gone and it was necessary to pump the water out of the mines to maintain supply. A solution was invented by a bloke called Thomas Newcomen, which used even more coal to drive the first steam engines to pump out the mines. The industrial revolution kicked into high gear on the basis of cheap abundant energy from coal that facilitated cheap abundant steel. The era of globalisation had begun.

The use of petroleum oil began slowly in the mid 19th century as it replaced whale oil as lamp oil. With the development of the internal combustion engine, demand for this cheap, concentrated and abundant energy source kicked into high gear. The age of cheap personal transport and industrial agriculture had begun.

Industrial agriculture has enabled a population boom of humans unprecedented in the history of the planet. We have occupied the habitat of thousands of species of other life, forcing them to extinction. The emissions from our technology threaten to destroy our own food chain and cause an extinction of life unparalleled since the demise of the dinosaurs.

The common theme is that all technological progress has been achieved by larger and larger consumption of energy. This has been taken to amazing extremes with the space race, the nuclear arms race and the race to work each day by hundreds of millions of people driving more than a tonne of steel per person along roads made of oil and rocks ground up using oil, eating food in quantities that can only be grown with agriculture powered by oil.

Another common theme to this story is that whenever the limits to utilising energy have been reached, resourceful Homo Sapiens have found alternatives, which have led to even greater availability of energy. This has led to the commonly held belief that we humans simply progress through technology to higher and higher standards of living, which extend further and further down the social strata.

The most pertinent example supporting this belief is the automobile, which is arguably the most democratising force in the history of civilisation. Because of cheap abundant steel and fuel oil, rich and poor alike in the industrial nations are able to afford a car. Our economic system has come to be based on everyone having access to a car. Public transport has been rendered nonviable in rich countries by lack of customers and has to be subsidised from the public purse in order to remain as a public service.

However, this story thus far neglects a major aspect of the history. Along the way, we humans have had to suffer some huge calamities. Modern day Iraq is hardly the basis of a great agricultural civilisation. This is primarily because the people of this first agricultural civilisation were unaware of the unsustainability of their technology. They cut down their forests for energy and building material, they grazed goats in way too large a number, destroying the potential for re-growth of their forests because the goats ate the seedling trees. Too many people had arisen for the land to support sustainably. The rains came and washed their topsoil down the

Tigress and Euphrates rivers, destroying their civilisation. Millions of people likely died of starvation.

The survivors tried again downstream in the rich Mesopotamian delta, partially created by the loss of the soils from the previous agricultural excesses. They were doing well until a Great Flood wiped them out. The flood was most likely caused by the loss of the water retaining forests and topsoil upstream. The desert we see in Iraq today is manmade.

Similar collapses have occurred on Easter Island, of the Minoans on Crete, of several civilisations in Central and South America and probably others we don't know about. There have also been others that have gone into inevitable decline but not collapsed - such as the Roman and Greek Empires and several dynasties of China.

The civilisations that collapsed all seem to have one thing in common – they all refused to acknowledge the fundamental unsustainability of their civilisations. When things went bad, they relied on the high priests of their societies for guidance. Those high priests all had the same answer – more of the same that had led to their success. More statues for Easter Island, more child sacrifice for the Mia and now for us, more Economic Growth for our industrial system that has reached its limits.

Here we industrial humans are on the verge of annihilating ourselves and we rely on our politicians and their high priests, known as economists, who recommend More, More, More as the solution to reaching the limits of our system. This is a peculiar form of madness and it will not stand for much longer.

Like its predecessors, this civilisation will reluctantly moderate its behaviour or be wiped out by a calamity of Biblical proportions.

The Myth of Alternative Energy Sources

Renewable Energy Viability

I have dedicated a significant part of my career as a professional engineer to the pursuit of the development of alternative energy, mainly in the form of landfill gas power generation, which has made a successful but trivial contribution to our energy resources. I was subsequently involved in pursuing business opportunities for other renewable energy resources such as wind, solar thermal and biomass, such as wood waste and crop residues, with no success. This is not because these are non-viable where appropriate; pre-industrial civilisation was developed on these very resources, but they are certainly nonviable when required to compete against the energy density of fossil fuels. Government subsidies intended to develop renewable energy sources with little success only underline the fundamental inability of these energy sources to compete with fossil fuels.

In nearly all cases, renewable energy projects are not viable for the same reason; the capital investment required to harvest the energy is too high. Nobody can make a profitable investment in bringing these energy resources to market.

I believed for many years that this was merely a lack of political will and that if appropriate carbon taxes were phased in, close to viable resources such as wind, photovoltaic solar and thermal solar power could be economically employed and real energy conservation and reform could take place. I still believe that this is true.

However, I came to understand that this is a political nightmare because it would effectively mean real cutbacks in energy use, which would place a major brake on the economy. Real cutbacks in energy use would create real cutbacks in economic growth and real cutbacks in

people's perceived "standard of living". Also, if adopted by Australia unilaterally, Australian industry would suffer a major competitive detriment.

It was abundantly clear that energy conservation was required in order to adopt renewable energy in major way because replacing our current extraordinary consumption with renewable sources is clearly non-viable due to the high level of capital investment required and the sporadic and sparse nature of most renewable energy sources.

I reluctantly came to the understanding that it is only because fossil fuels are cheap to bring to market that our current economy is viable. The barrier to adoption of renewable energy on a grand scale is far more than a political problem, it is a matter of fundamental viability. Hence renewable energy sources cannot be considered "alternatives" as they cannot sustain our economy in anything like it's current form. We must re-structure.

The discussion above primarily relates to renewable forms of electricity generation. However, the principles are common to so-called "alternative" transport fuels as well.

The immediate crisis that we are facing is a shortage of *transport fuel*, not a shortage of energy.

The energy problem is not a shortage, but that only coal can provide the cheap abundant energy on which our current economy depends. The problem caused by coal is global warming, with not fully known, but serious and far reaching consequences. Global warming is a sibling problem to Peak Oil that has monumental medium term consequences if we remain in denial and do nothing about it.

Natural Gas

In North America and Europe, in addition to Peak Oil, they also face a crisis of heating fuel (primarily natural gas) within the next few years as world-wide peaking out of natural gas occurs. North America is already close to peak natural gas extraction and will rely more and more heavily on imports from now on.

Natural gas production has a very different characteristic to oil. Whereas oil peaks and declines as the oil gets harder and harder to extract, natural gas peaks and plummets. Because it has almost no viscosity, it moves through the rock strata easily and it exhausts easily and quickly.

Although natural gas is an excellent transport fuel, relying on it as a solution to oil depletion is highly imprudent; it's already starting to peak out. The folly that has been indulged in for many decades, where Natural Gas is just burnt in flares to get rid of it, because it has been uneconomic to bring to market, will be viewed in hindsight as a prime example of the gross indulgence of the hydrocarbon party age. Another is the wide scale adoption of natural gas fired power stations in the US. They are already almost out of gas to feed them.

Natural gas may well provide a stopgap source of transport fuel for Australia as we have quite a lot of it, but it is not a long-term alternative to oil. It will be peaked out within a few years of the oil peak.

Hydrogen

The "hydrogen economy" is a joke, but not a very funny one. Unfortunately many well educated people don't know that it's a joke and seriously believe in it.

Where is the hydrogen going to come from to fuel a "hydrogen economy"?

One answer is extracting it from natural gas. However, we're already running short of natural gas and we think we can replace a significant part of 84 million barrels of oil per day! Also, natural gas is an excellent transport fuel that we can use in current technology engines without losing energy in the conversion to hydrogen.

The motivating factor behind the proponents of hydrogen is that burning it emits only water. However, if you get it from natural gas, which is primarily methane (CH4), you have to dispose of the carbon to atmosphere anyway.

Another answer is you can make it from water by electrolysis. For this, absolutely huge quantities of electricity are required. If that electricity is generated from coal, the environmental impact is beyond contemplation. We simply must not go down this path. Generation from coal and the resulting global warming is already the greatest threat to the viability of our planet for us to inhabit. Doubling or trebling those emissions is simply unthinkable.

Generating hydrogen from renewable resources such as wind or solar is subject to the same lack of economic viability explained previously, but on an even larger scale. The quantities of wind turbines, solar cells and solar thermal power stations is ridiculously large and way beyond economic viability.

On top of all this is, the much heralded hydrogen fuel cell technology suffers from a fatal flaw, which makes it unlikely to ever be viable. The cell itself uses platinum as a catalyst and as cell operates, the platinum is steadily depleted. The cell has to be replaced at about 1000 hours of operation. Not only is the sheer quantity of platinum required untenable on a mass scale, but the cells deliver about a quarter of the life of a current internal combustion engine. Fuel cells and the hydrogen economy simply can not work.

Nuclear Power

There is a growing number of Australians that propose nuclear power as a means of generating electricity to replace coal and generate hydrogen. This is a fundamental misunderstanding of the quantities of uranium available. Even if we were to undertake replacing the worlds current coal fuelled electricity with nuclear, we would have exhausted the worlds economically available uranium before the plants could even be built. It's totally impractical from an engineering perspective, without even considering enormous risks of future Chernobyl type accidents and the unsolved problem of waste disposal.

There is one more very scary Genie in the nuclear power bottle. I am referring to Fast Breeder Reactors, which actually convert Uranium 238 into Plutonium much faster than the fissionable Uranium 235 is consumed. This has the potential to multiply the amount of nuclear fuel available many times over. The problem is that the technology involves using liquid sodium metal to cool the reactor core and the risks associated with this are so large that the technology has essentially been abandoned. More attention may come to this technology in the medium term, but for now it can be considered non-viable.

I could go off even further into La-La Land and discuss Nuclear Fusion, but I won't waste your time to read it. Put simply, Nuclear Fusion will never be viable.

Electric and Hybrid Cars

Battery powered electric cars are unlikely to be ever become viable. Batteries remain a very challenging technology and consume large amounts of energy and other resources to manufacture.

The currently emerging hybrid cars are unlikely to be a success because the batteries will need to be replaced well before the vehicle has paid off the additional energy required to make the batteries. The answer lies with simple high efficiency cars using current technology – not hybrids. That's why the Mercedes "Smart Car" is not a hybrid.

Electrification of our road system to accommodate light weight electric cars may be a viable option in the medium term. There is no way that such as system can save us from the immediate problem of peak oil because it will take several decades to roll out such a system.

The other major problem is that electric cars would significantly increase electricity demand and hence carbon-dioxide emissions. Unless a viable means of storing the carbon-dioxide is achieved, generating this electricity from coal must not be allowed to happen. If at any time this carbon sequestration technology proves to be viable, it will not available for several decades.

However, with appropriate levels of investment in wind and solar electricity as well as dramatically curtailing unnecessary transport energy use, a medium term solution exists here.

Biofuels

Biofuels are even less viable than other renewable options. Like hydrogen, they are joke in terms of a outright replacement for oil, but biofuels can make a small but significant contribution to future transport fuel.

Just two primary reasons that biofuels are not viable replacements for petroleum:

1. Energy Profit Ratio (EPR) - the ratio of energy returned on energy invested. Current trials in the US have shown that production of ethanol, using industrially grown corn, uses significantly more energy in the form of oil and coal than the energy available from the ethanol fuel produced. The EPR is less than one. In other words; it takes more oil to make ethanol than just using the oil for transport fuel. No amount of government subsidy is going to make that viable. Even if the EPR can be improved four fold, it still is not a viable investment. The development of Ethanol production, as is happening in Queensland, is worthwhile but such ethanol is not available on a mass scale and never can be.

2. We need food. Food was the original energy revolution and is now more important than ever as the population of the planet soars towards 6.5 billion with no deceleration in sight. Almost all the arable land in the world has now been pushed into service to grow food and we need more. Through habitat loss to agriculture, many species have already become extinct. We cannot continue the current trend much less find vast quantities of crop land to grow biofuels. The amount of land required to grow sufficient biofuels to replace our current oil use is so large as to be absurd to try to quantify it – it is several multiples of the land we currently have for agriculture – we need several more planets, which remains a challenging objective.

   The only reason that the population has been able to grow to the staggering proportions of today is because of industrial agriculture powered by oil. If we fail to restructure our society and develop renewable energy resources on a sufficiently large scale, we face the prospect of mass starvation within 50 years as the oil supply declines and we can no longer continue to eat oil.

Oil from Coal

Now here's a really threatening technology. Due the sanctions of the apartheid era, the South African government invested 100,000,000's of Rand into developing the technology to make oil from coal, because they have no oil. It works; and after the capital is written off, it is economic

to continue manufacturing oil in this way and it continues in South Africa today. Thankfully the technology is so high in capital investment that no further plants are currently being built or contemplated.

The problem is that it uses 2 units of coal energy for every unit of oil energy manufactured. Coal is dominantly carbon, so manufacturing oil in this way creates about 4 times the carbon dioxide emissions of directly burning oil.

Adoption of this technology on a mass scale is economically viable because coal is cheap and abundant, even in the quantities required to replace oil. It only requires an oil price that can be sustained high enough to make it profitable to invest in the plants and time to build those plants.

We can only hope that the world economy can not sustain such an oil price and that this technology remains non-viable. The American government's persistent denial of Global Warming and lack of concern about destroying our planet to save their way of life is extremely threatening as they have about 25% of the coal on the planet.

Enhanced Oil Recovery

Well this is the one that those that cling to their traditional beliefs are working on. They believe that the market creates oil on demand – it's only a matter of price. In the face of overwhelming evidence to the contrary, they cling to these irrational beliefs like believers in a Flat Earth.

It may well be true that oil extraction rates can still be increased marginally using enhanced recovery techniques. If it happens, it will provide stopgap additional supply, but make the problem worse over time. There is only so much oil in a deposit and if it is extracted aggressively, the unavoidable decline is very rapid.

This is the reason why Norway, with state of the art recovery techniques reduced in output by around 7.5% last year. Britain is also declining steeply. The great risk is that Saudi Arabia is most likely already well past it's natural peak and is due to start to decline sharply very soon. If this happens, the economic effects will be serious. Kuwait has done the sensible thing recently by cutting production, possibly to conserve it's declining fields but probably because they are simply peaked out.

Oil Sands

Oil sands are another relatively small and uneconomic resource that is only being pursued out of desperation. It has a very low EPR because a great deal of the energy mined must be used in processing the sands. It may prove to be a useful stopgap oil source, but no long term solution. Buy the way; Australia has no oil sands.

Other New Technologies

The misunderstanding of many people regarding new technologies is the belief that new technologies come about because we need them; "Necessity is the mother of invention". This is a widespread misunderstanding of cause and effect.

Agriculture was not invented because 100,000's of people were starving and needed a better food supply. Rather, it was because agriculture was a very successful way of producing reliable food, the population grew by 100,000s.

Likewise, the industrial revolution didn't happen because people needed clothes, giant cities and transport. Rather, the discovery of a cheap energy and steel enabled the development of the mass production of cloth, industrial cities and the railways.

The Internet came about because the technology became economically available, not because people needed a better form of communication.

In every case, we had functioning systems for feeding ourselves, clothing ourselves and communicating with each other. Technological progress only enabled us to have more of these things and to increase our population. Whenever any society has increased it's population above a sustainable size, it has declined or collapsed. There are no examples of a society inventing it's way out of a problem of a lack of fundamental sustainability – not one.

Even if technological solutions are found in the medium term, they have not been found yet. Once a new idea or discovery comes about, it can not appear on the market overnight. It takes decades to develop new technologies. New technologies can also only attract development capital in a prosperous economic environment, not in a recession, which appears almost inevitable.

Noah and the Flood

It is commonly said that Noah started building the Ark before it started raining. There are several lessons in this:

- Noah had the technology to build whatever craft the Ark was.
  We don't have the technology that can save our current system.

- Noah foresaw the disaster long before it actually arrived and tried to warn everybody.
  As far as the Peak Oil problem goes; we had Noah warning us in the form of the Club of Rome's "Limits to Growth" in 1972, the predictions of which predictions have proven almost entirely accurate. However, like Noah, the Club of Rome has been mocked and ridiculed. The ridiculers are being proven wrong, but still they persist even in the face of overwhelming evidence. They still believe that they can invent their way out of the problem.

- Noah started doing something about the problem before it was too late.
  We have had proponents of renewable energy, conservation and simpler lifestyles for several decades, but it's all just too hard to implement. While things are still going well, no democratic government can implement urgent action and curtailment of affluence when there isn't a problem yet. This political problem remains but it may still not be too late to mitigate the damage. It may well be too late to avoid the flood.

Houston; we have a problem.

The Apollo 13 crew knew how to deal with a problem. The first step is to announce it loud and clear so that everybody involved can get involved in finding a solution.

In contrast, the Chernobyl disaster was characterised by "Moscow, we have the problem in hand" – until the problem became a disaster and was undeniable.

At present, for political reasons, we are headed down the Chernobyl path, rather than the Apollo 13 path.

I have not made this paper a closely cross-referenced collection of facts. If facts are what you need, then simply go to the Association for Study of Peak Oil and Gas (ASPO) www.peakoil.net or the Australian affiliate www.aspo-australia.org.au. There are hundreds of other websites dedicated to the Peak Oil debate. Unfortunately, many of these sites are the alarmist doomsday type or "don't worry – there's plenty of oil" type, which discredit the reputable ones.

It is also important to acquaint yourself with the forecasts of the International Energy Agency (IEA) and the US Geological Survey (USGS). These become more discredited and laughable by the week as the facts emerge. The only explanation that I can see for these forecasts is a deep-rooted fraud, backed by wealthy interests, designed to maintain confidence in the current economic system for as long as possible. They are completely at odds with the known facts.

Why is our government and industry so strenuously denying this problem? I don't know exactly. There are a few possible components to the answer:

- **Outright ignorance.** That is, such a Flat Earth mentality prevailing that this discussion is actually news. This implies that our government so naive that it actually believes the farcical forecasts of the IEA and the USGS, where supply will always match demand, for the next 50 years or so. I find it very hard to believe that they could be so ill-informed.

- **Political expediency.** Now that has a ring of truth to it. The solutions involve unpopular actions; actions that will turn down the growth economy, actions that will reduce consumption, actions that will see any government that even proposes what needs to be done, out of office.

- **Denial.** Denial is a natural irrational reaction of humans when they are confronted with evidence for something that they don't like and which conflicts with their long-standing beliefs. It is as reliable as the sunrise each morning, and just as reliable to never solve the problem but to make it much worse. This is because those concerned fail to act to deal with the problem.

I believe that the primary driving force for this denial is the addiction to the "Growth Economy". But as Kenneth Boulding (past president of the American Economic Association) famously remarked, "only madmen and economists believe in perpetual exponential growth" - in a world of finite resources. We all know that it has to end sometime. Yet economic growth remains the fundamental indicator of economic health, the facilitator of growing prosperity and victory at the ballot box.

We need to stop denying the problem and face the facts: Peak Oil and Global Climate Change together represent the greatest crisis ever to face civilisation. No other crisis has threatened to wipe out billions of people. No other crisis has threatened the viability of the entire planet.

But it doesn't have end in disaster! All is not lost – we have the capability to solve this problem.

We have somewhat less than half of the planet's recoverable oil still in the ground – enough to manage a transition to a sustainable way of life. What we need is the political will to solve the problem. This requires the cessation of denial, education of the electorate and a genuine effort by all political parties to work towards the solution.

What to Do

The environment movement has long supported the 3 R's – Reduce, Reuse and Recycle. I propose a fourth R – Restructure. The solution lies in restructuring our society to

- reduce our energy consumption,
- provide alternative transport systems,
- provide large scale investment in the renewable energy systems to power the post fossil fuel world.

Educate the Electorate

This is indeed the most important first step. Most of the major oil companies have now admitted to Peak Oil and Chevron Texaco has taken the educational lead with www.willyoujoinus.com.

Without understanding the problem, the electorate will simply not accept the need for change. Any government that tries to impose change will be removed from office at the next election. Only when the people understand the need for change will they accept it and vote for it.

Support the Rimini Oil Depletion Protocol

There is absolutely no doubt that oil supplies will start to decline fairly soon and that restructuring will happen by one means or another. If we do not responsibly manage the reduction in our oil consumption in line with supply, the effects will be disastrous –economic chaos, possibly a complete collapse of our economic system and resource wars as the world's military powers attempt to take control of the last remaining supplies.

The Oil Depletion Protocol is also known as the Rimini Protocol after the conference where it was proposed in Rimini, Italy in October 2005. The concept is for oil extracting countries to progressively reduce their extraction rates in line with their rate of depletion and for oil importing countries to progressively reduce oil imports in line with the world-wide depletion rate. New oil discoveries – if they are proven – would boost the available quota.

This would have the effect of reducing oil demand in line with available supply, stabilising the price. This would curtail the gouging profits of the oil companies and the severe economic effects of that profiteering. At present, we pay at the pump for windfall profits for Big Oil instead of that money being invested in developing long term energy resources. Obviously, Big Oil will strenuously oppose the Protocol and their political influence is not to be underestimated.

The Protocol would create a strong impetus to develop and market more fuel-efficient cars and alternative transport systems. The technology for large increases in fuel efficiency is already available, but at present there is little pressure for the market to take up this technology. Instead, big gas gusslers are as popular as ever.

The reductions in oil use would have to be enforced using a quota system. Oil quota units would be a tradable commodity so that an individual that chooses to ride their bike to work can sell their surplus quota units at market rate to people who choose to buy a gas gussling V8 to tow their speed boat.

Each year a little less oil is available overall and goods which are heavy on oil consumption would be progressively forced from the market. For example, plastic packaging would be dramatically reduced as it's cost steadily escalates. Goods packaged and imported from Europe would disappear from the market as locally produced goods receive a competitive advantage.

This is not something that Australia can tackle unilaterally. We must join with the rest of the world to establish binding protocols to manage the transition to low energy lifestyles. This will almost certainly involve uniting with the rest of the world to stand firm against the United States and its powerful corporate interests. The USA can only remain a world power if they continue to enjoy the cooperation of the rest of the world and in particular, if they can continue to buy oil. Whether or not they choose to sign on to the Rimini and Kyoto Protocols, the rest of the world can apply the protocols to them. It is infeasible for the USA to continue to take control of the remaining oil militarily as this would render them a pariah and their economy would fall. This also applies to Australia, should we decide to stay allied to the USA in these matters

Support the Kyoto Protocol

The only way to make real reductions in green house gas emissions is to significantly reduce electricity use and invest in technically viable renewable resources. Technological solutions like carbon sequestration remain decades away from implementation and will probably never work adequately.

Carbon taxes, paid with your electricity bill and at the fuel pump, are the obvious way forward. The rates should be on a progressive sliding scale, with frugal users paying no carbon tax and heavy users strongly penalised. The economic effects of these taxes need not be drastic as income tax can be reduced to keep the overall rate of taxation only marginally higher.

Some increase in tax take is required so that funds taken in Carbon Tax can be used to support the development of renewable resources. Renewable resources, such as PV and thermal solar power and wind power can become viable as a long term solution to our electricity needs if our consumption is significantly reduced over time. As previously explained, the primary problem with renewable energy sources is always the same – large capital investment for a small return. However, if the capital can be progressively invested over decades, it becomes viable in the medium term because the generation assets have excellent longevity and the fuel is free.

The negative economic effects can be offset by the rise of new industries. The benefit of these new industries is already being realised in the northern European countries that have invested strongly in wind power.

These technologies are proven and only lack investment prohibits them from meeting a major part of our energy needs and progressively expanding to meet all our energy needs in the long term:

- **Thermal Solar** only requires investment to succeed. The Solar1 and Solar2 plants in the USA, which use huge fields of tracking mirrors focussed on a boiler are a technical success. However, the capital investment is way beyond current economic viability. Big Dish type solar as worked on by ANU has some technical problems, but several other reflector systems show promise but no one can make the required investment to bring them to market.
- **Photovoltaic Solar** can make a very worthwhile contribution as it is suitable for mass small scale deployment. Its problem is the enormous monetary, energy and environmental cost of producing the solar cells. Reflector and lens based concentrator systems to get much more out of each cell are potentially viable, but require development capital.
- **Wind Power** is not a major potential source for most of Australia, but the southern ocean does have the strong consistent winds required.
- **Pumped Hydro** offers a solution to the problem of buffer storage. Although wind and sun are plentiful, they are not predictable and buffer storage on a mass scale is needed to provide reliable supply.

These energy resources are limited only by the capital investment required to harvest them and they need not take up our precious farmland or require large areas of wilderness to be dammed or otherwise destroyed.

Restructure Transport Infrastructure

We can not revert to agrarian self sufficient lifestyles within a few decades; we must revise the infrastructure that we have. We must offer people realistic alternatives and abandon some of our long standing preconceptions. Investment in infrastructure has long been a strong provider of jobs and prosperity in our economy and this can continue with appropriate investment of funds from carbon taxes.

A few achievable initiatives:

- **Get the gas gusslers off the road.** Higher fuel prices don't seem to be having much effect. It's time to make LPG users pay their tax and to legislate to require the existing technology of smaller high efficiency engines to be used for all cars.
- **Start work on a Very Light Rail network** which uses many small high efficiency electric carriages. This would provide people with a viable alternative means of getting to work. The technology already exists for completely automatic control of these carriages or they could provide employment for drivers. Having many small units would mean that an appropriate number of units could be deployed according to the time of day, resulting in high occupancy rates making the system highly efficient. The system could be built along the current roadway corridors and even share the road as trams do.
- **Get serious about providing bikeways and shower facilities for cyclists.** At present riding to work is rendered much too dangerous for most people by the necessity to share the road with cars. Also, one needs a shower after riding to work; not having one available renders riding to work socially unacceptable. These problems currently prevent many people from riding to work – even if they live within a viable cycling distance of their workplace.
- **Upgrade the current rail network.** As fuel oil becomes scarcer, we will be forced to abandon the wasteful practice of trucking most of our freight. The reasons that trucking is competitive is that the trucking companies do not have to invest in the road infrastructure and delivery is point to point, rather than involving multiple loading and unloading operations. Long distance passenger rail could be made much more efficient and viable using smaller, light weight rolling stock. Trains are likely to become viable again as air travel is progressively curtailed by lack of fuel oil.

Promote Local Economy

If the Rimini and Kyoto Protocols are adopted in a serious manner, the result will be a move towards more locally based economies. People will walk or bicycle to work. Food will be primarily grown locally, not on another continent. In the long term, as the oil disappears, the survivors of the coming decades will have no choice but adopt locally based, low energy consuming lifestyles.

Whether we have a managed transition to locally based economies or whether they are eventually formed by the survivors of an economic and societal collapse is the choice that we now have to make.

We must reconsider our whole way of thinking about how and where we live. We can not create the change overnight, it requires decades of intelligent restructuring.

Phasing out the Growth Economy

Real reductions in energy use mean real reductions in consumption overall, which essentially means abandoning the growth economy. Economic growth must however eventually be curtailed as the reality of oil depletion and limits to food production take hold.

During the transition to a sustainable economy, the loss of economic growth can be offset to some extent by the investment in restructuring our transport infrastructure and building an entire system of renewable energy generation.

I do not contend that there is any easy solution to this problem. I believe that the believers in a "no regrets" transition are simply unrealistic. We all must take a cut in standard of living as it is conventionally viewed and move towards simpler, less materialistic lifestyles. I can not see any way that this transition can be made easy.

Conclusion

The change required is politically unpopular, but the responsibility now falls upon our government to abandon collective denial, stop listening to “Flat Earthers” and take effective all-party action to start dealing with the reality that we face. The solutions are deeply unpopular, particularly with vested corporate interests, just as it is unpopular when the beer runs out at a party.

What is required entails a progressive reduction of the entire apparatus of global capitalism. Capitalism holds enormous power over our governments and us - it will not just disappear quietly. If left unrestrained, it will indulge in more and more strident denial, until the reality and the consequences are inescapable.

As the steps I have put forward here are so deeply politically unpopular, I am realistic enough to understand that they probably won’t become reality until we as a society are forced to suffer the results of our collective denial and inaction. We seem to be in for a very bad ride.

If we continue to deny the problems of oil depletion and global warming and fail to act, we may well bring about a collapse of civilisation and mass starvation within our lifetimes.

This is very sad indeed, when what needs to be done is known and within our capability, but the solution seems to be effectively blocked by the fundamental selfishness and denial of human beings.

About the Author
Lionel Orford is a Professional Electrical Engineer with a long standing interest in sustainable energy and the means buy which such energy systems can be implemented. Although primarily a technologist, he also has a strong understanding of the commercial and political realities that form such a large part of the energy conundrum.

He has extensive experience with development of Landfill Gas electricity generation and of business development of other potential renewable resources.

Lionel is open to any expression of interest from the Australian Government to more fully research, cost or develop any or all of the ideas put forward in this submission.