Double Whammy -
The Impact of Climate Change and Peak Oil on Traffic Control

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Two key issues could overturn the foundations of our industry (and arguably our lives). They are the double whammy of climate change (global warming) and peak oil. Much has written about climate change, but the related and equally serious problem of peak oil has only recently started to attract serious attention – partly prompted by the dramatic recent increases in energy prices.

Climate change and peak oil are inextricably linked. Each one is a major issue in its own right, but their convergence has received minimal attention, which is unfortunate as it is likely to have far greater impact than the sum of the individual parts. Policy must ensure that solutions to the one reinforce, and do not conflict with, solutions to the other.\(^{(1)}\)

Climate Change

The essence of the problem of climate change is that the carbon dioxide levels produced by our current use of fossil fuels are leading to atmospheric concentrations which are higher than at any time in over 400,000 years. They have increased over the past century at a rate unprecedented in more than 20,000 years. These concentrations of greenhouse gas are leading to rising global temperatures which are already producing alarming changes around the world.

Although this point of view has been challenged by some sections of the media, the overwhelming weight of scientific opinion supports it:

The Royal Society says that “Our scientific understanding of climate change is sufficiently sound to make us highly confident that greenhouse gas emissions are causing global warming. ... The science clearly points to the need for nations to take urgent steps to cut greenhouse gas emissions into the atmosphere, as much and as fast as possible ... We must also prepare for the impacts of climate change, some of which are already inevitable.”\(^{(2)}\)

The Government’s Stern Review says “The scientific evidence is now overwhelming: climate change presents very serious global risks, and it demands an urgent global response.”\(^{(3)}\) and Lord Stern has subsequently said that his report did not go far enough “We underestimated the risks ... we underestimated the damage associated with temperature increases ... and we underestimated the probabilities of temperature increases.”\(^{(4)}\)

The global response so far is presented in the targets that are being set for reductions in carbon dioxide emissions. However it has recently been suggested that in order to limit the rise in average temperatures to less than 2°C humanity would have to reduce its emissions to zero by 2060\(^{(5)}\) – in other words a 2°C rise is inevitable, and we should be preparing to deal with a rise greater than that.

Meeting these targets will require a combination of solutions – reducing emissions by making vehicles more fuel efficient, using alternative fuels, making more use of more fuel efficient modes, and reducing the amount of travel both by reducing the number of journeys and limiting the length of trips. To achieve the required scale of reductions will mean major changes to lifestyles in western countries.
Peak Oil

Peak oil has been defined as the point when further expansion of oil production becomes impossible because those new flows that come on stream are fully balanced by production declines elsewhere – the moment when half the reserves have been used up. Why is it important? Because once we reach the tipping point our world begins to change very rapidly. As Rob Hopkins puts it in The Transition Handbook (6) “Once we pass the peak, supply begins to dictate demand, meaning that the price starts to rise suddenly and steeply, and the people with control of the remaining oil really get to start calling the shots”. There is an increasing consensus that peak oil will occur between 2010 and 2020, though some say it has already been reached.

A report prepared for the US Army Corps of Engineers says “The doubling of oil prices from 2003-2005 is not an anomaly, but a picture of the future. Oil production is approaching its peak ... As worldwide petroleum production peaks, geopolitics and market economics will cause even more significant price rises and security risks ... Oil wars are certainly not out of the question.”(7)

A US Department of Energy report (known as the Hirsch report) states, “The peaking of world oil production presents the U.S. and the world with an unprecedented risk management problem. As peaking is approached, liquid fuel prices and price volatility will increase dramatically, and, without timely mitigation, the economic, social, and political costs will be unprecedented. Viable mitigation options exist on both the supply and demand sides, but to have substantial impact, they must be initiated more than a decade in advance of peaking.”(8)

Because accurate oil data is difficult to obtain, we are unlikely to know exactly which year the global peak is reached until after the event. However, all seven of the world’s leading oil producers have already peaked or are due to peak in the next few years. UK North Sea oil and gas production peaked in 1999, and had fallen by 36% by 2006. The rate of oil discovery peaked in the mid-1960s. The rate of consumption surpassed the discovery rate in the mid-1980s. Today, the world consumes oil at five times the rate at which new discoveries are being made.(10)

Matthew Simmons (CEO of major energy bank Simmons and Co International) has carried out extensive research on Saudi Arabian oil production he suggests that its oil production is at or near peak. He also concludes that when Saudi Arabian oil production peaks, global oil production will peak. The Association for the Study of Peak Oil & Gas (ASPO) predicts Peak Oil will occur in 2011.(12)

The real problems with crude oil, or its derivatives such as petrol, start when demand exceeds supply. This could occur well before Peak Oil is reached. It appears that this may be happening now, as oil demand is already close to outstripping supply. Soaring demand in China and India, not least from rapid increases in car ownership and use, will place massive pressure on declining supplies.

British life is heavily dependent on cars and lorries, which in turn are dependent on cheap and plentiful oil supplies. Out-of-town shopping centres, business parks and low density suburban housing are difficult to operate without cars. Most of our food and other goods are supplied via road haulage, often from distant warehouses, or by plane from other parts of the world.

The major implication of peak oil for the average consumer is that fuel prices, and food prices, could realistically double or triple within the next several years. Adjustments to fuel
taxes will make no difference to somebody who can’t afford to pay £2 a litre, or £100 to fill up the family car. Those who have chosen to travel long distances to work so that they can live in attractive locations, but have little access to adequate public transport, will be particularly vulnerable.

While the electorate might today be clamouring for governments to build more tunnels and motorways to address the immediate problem of worsening traffic congestion, in the next few years when faced with the choice between filling up the car or putting food on the table they will begin asking politicians why there are insufficient buses and trains for them to get to work.

Faced with this threatening phenomenon, the UK Government appears to be in denial – presumably because it feels the electorate isn’t ready for such an unpalatable message. The 2006 Eddington Report estimated traffic levels in 2025 using a central assumption of oil prices at $35 a barrel, with a “high” assumption of $50.\(^{13}\) In response to a question about when he expected oil production to peak energy minister Malcolm Wicks said “...none of us know when the oil is going to run out, but its not in the foreseeable future ...”\(^{14}\)

Other countries have been more forward thinking in adapting to the end of the oil age. In 2006, the Swedish government’s Commission on Oil Independence set out how that country could substantially reduce its reliance on oil by 2020. The Commission recommended a 40-50% reduction in oil use for transport.\(^{15}\)

The longer action is put off, the worse the difficulties of adjustment are likely to be. The UK transport sector is particularly vulnerable to oil depletion as it is so heavily dependent on oil as its power source: 74% of oil consumption is used for transport, while 98% of the fuel used for transport is oil.\(^{16}\) Some transport modes are much more oil dependent than others. Air transport is 100% dependent on oil, with no alternative fuel in prospect. Virtually all cars and trucks are powered by oil, with the development of alternative sustainable fuels on any significant scale being many years away.

There is no easy technical fix, as no alternative energy sources can match oil for low cost and availability. Bio-fuels may be superficially attractive, but we would have to use all of the UK’s farmland to grow enough energy crops to replace current oil consumption. Hydrogen is a power carrier not a power source: hydrogen fuel has to be manufactured by either reforming fossil fuels with heat or splitting water using electricity. Both these processes require the input of energy. Professor Andrew Oswald, an economist at Warwick University, has estimated that it would require 100 new nuclear power stations or 100,000 wind turbines to allow the current oil use in UK road transport to be replaced with hydrogen. If sited off-shore, this would mean an approximately 20-kilometre-deep strip of wind turbines encircling the entire coastline of the British Isles.\(^{17}\)

The most pessimistic commentators foresee some cataclysmic future scenarios - Mark Lynas wrote in the Guardian recently If current policy continues to fail - along the lines of the "agree and ignore" scenario - then 50% to 80% of all species on earth could be driven to extinction by the magnitude and rapidity of warming, and much of the planet's surface left uninhabitable to humans. Billions, not millions, of people would be displaced.\(^{18}\) Even the Government's relatively conservative Foresight Intelligent Infrastructure Futures report (\(^{19}\) which did not explicitly consider Peak Oil) evaluated a “Tribal Trading” scenario - Tribal Trading describes a world that has been through a sharp and savage energy shock. The world has stabilised, but only after a global recession has left millions unemployed. The global economic system is severely damaged and infrastructure is falling into disrepair.
What can be done about it?

The realisation of the scale of the problem of Peak Oil can lead to what Rob Hopkins has called “post-petroleum stress disorder”\(^6\) – actual physical symptoms as well as bewilderment, fear, denial and nihilism. What we need to do is to plan how to avoid the disaster scenarios – so that humanity successfully adapts to declining fossil fuel energy availability and becomes more localised and self-reliant, an opportunity for positive change. The Transition movement\(^6\) aims to help communities plan for a future of “energy descent” by building resilience and focussing on local solutions and greatly reduced energy consumption.

The conclusions of those campaigning to tackle Peak Oil are that most of what needs to be done to prepare for Peak Oil is the same as that needed to tackle climate change. TRANSform Scotland summed up the proposals in their Peak Oil and transport briefing\(^9\):

- Mount a widespread public information campaign, so that people understand the issues and the need for action
- Foster ‘localisation’– meeting the needs of local people from local production – including community-supported agriculture; protecting local schools, shops and Post Offices; and preventing the construction of out-of-town shopping centres, business parks and education campuses
- Adopt a strategy for sensible management of demand for transport oil, including measures such as greater speed control and fuel rationing
- Re-prioritise transport investment – no subsidies for air travel or motorways, focus expenditure on local infrastructure, cycle ways, walking, public transport, rail electrification and shifting freight from road to rail and water

The Intergovernmental Panel on Climate Change (IPCC) has analysed the mitigation options\(^{20}\). The key currently commercially available mitigation technologies and practices they identified were - more fuel efficient vehicles; hybrid vehicles; cleaner diesel vehicles; bio-fuels; modal shifts from road transport to rail and public transport systems; non-motorised transport (cycling, walking); land-use and transport planning. Those that they projected to be commercialized before 2030 were second generation bio-fuels; higher efficiency aircraft; advanced electric and hybrid vehicles with more powerful and reliable batteries.

They also suggested that changes in lifestyle and behaviour patterns can contribute to climate change mitigation across all sectors, such as:

- Transport Demand Management, which includes urban planning (that can reduce the demand for travel) and provision of information and educational techniques (that can reduce car usage and lead to an efficient driving style) can support GHG mitigation;
- Other measures and instruments shown to be environmentally effective are mandatory fuel economy, bio-fuel blending and CO2 standards for road transport – but partial coverage of the vehicle fleet may limit effectiveness;
- Taxes on vehicle purchase, registration and use including motor fuel taxes and road and parking pricing are also effective, but the effectiveness may drop with higher incomes;
- Influencing mobility needs through land use regulations and infrastructure planning can be particularly appropriate for countries that are building up their transportation systems;
• Investment in attractive public transport facilities and non-motorised forms of transport.

Implications for the Traffic Control Industry

To mitigate climate change all of us should travel a lot less, and because of Peak Oil we may all be forced to do so. We need to consider what happens if people, when faced with the choice between filling up the car or putting food on the table, decide to eat, and most congestion goes away.

Our industry has developed to control increasing traffic flows which are dependent on the continuing availability of cheap energy. We tend to focus our resources on the busiest times of day and the most congested parts of the network. When we look at efficiency we tend to define it in relation to delay and capacity, not energy.

I believe that we need to consider how we change from being traffic controllers to enablers - those who help move people and goods around in the most energy efficient way. If we don’t make this transition then our employers and customers may look for someone else who will.

What should we be looking at to achieve the change required?

We need to be prepared for people to change to more energy efficient modes, and to share cars more. The information we provide at present is too often presented in silos – public transport separate from private, and often nothing at all about some modes like walking, taxis and private hire. Our information should allow travellers to choose the most appropriate combination of modes for each journey. The information should cover all of the journey – including where parking is available and the best route to take to walk or cycle either to replace a car trip or as part of more energy efficient journey.

Travellers will not want to be held up by unexpected incidents, or what little congestion may remain. They will want to get to their destinations as efficiently as possible at all times of day, and to be warned about problems which will affect their journeys. We need to be sharing our increasing real-time information about the state of the network with all travellers, particularly those making essential trips, so that they can optimise their journeys. We will need to give more of our attention to freight movements to help them minimise the transport costs of essential goods.

We need to consider the energy which will be consumed throughout the life of our installations – off peak as well as peak – by the equipment and by the vehicles travelling through the network.

Switching to LED heads will save a lot of energy, the cost/benefit ratio is improving markedly as energy costs rise and the equipment is becoming more reliable. Do we need as many heads as we are now putting up, could reduced peak levels of traffic give us the opportunity for different layouts?

Could we design junctions which could safely be switched off, or to a “flashing amber” mode at less busy times? If we can’t use flashing amber in these circumstances is there another indication we could use?

Should we optimise timing plans for minimum use of fuel, and not worry so much about delay? Are our current traffic control computing tools still fit for purpose – can we learn from abroad or from other industries?
There are many questions, and, so far few answers. But these changes are coming, and it will be up to the rising stars of our industry to develop the engineering solutions which the world needs to move people and goods in a less energy dependent future.
References

(1) Ian T. Dunlop, Climate Change & Peak Oil - an integrated policy, March 2007, Submission to the Australian Prime Ministerial Task Group on Emissions Trading

(2) The Royal Society - A guide to facts and fictions about climate change, March 2005

(3) Stern Review: The Economics of Climate Change, Jan 2007

(4) “Stern takes bleaker view on warming”, Financial Times, 16 April 2008


(8) Peaking of World Oil Production: Impacts, Mitigation & Risk Management. Robert L. Hirsch, SAIC

(9) Peak Oil and transport briefing - Version 1.1, Published by TRANSform Scotland, 30th April 2007


(11) Simmons, Matthew (2005), Twilight in the Desert: The Coming Saudi Oil Shock and the World Economy.

(12) ASPO newsletter, March 2007, www.aspo-ireland.org/contentFiles/newsletterPDFs/newsletter75_200703.pdf

(13) The Eddington Transport Study Dec 2006

(14) David Strahan, The Last Oil Shock 2008


(18) Mark Lynas, Climate chaos is inevitable. We can only avert oblivion; The Guardian Comment is free June 12 2008

(19) Foresight, Intelligent Infrastructure Futures, The Scenarios – Towards 2055