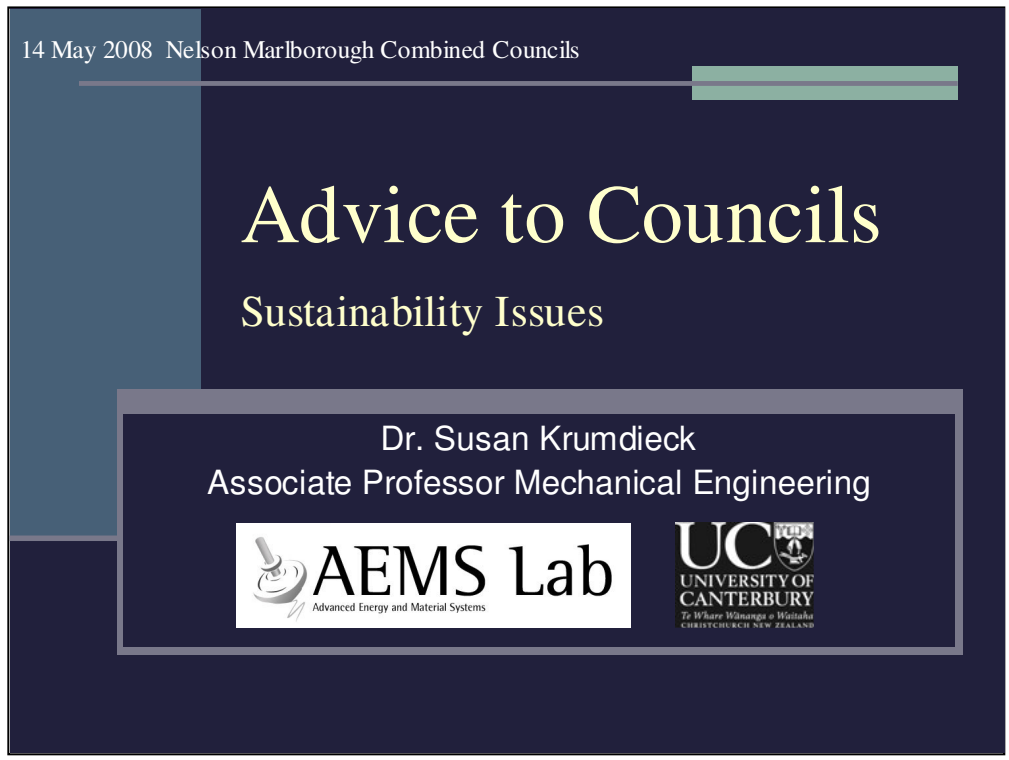


The afternoon - business ramifications of sustainability and enhancing our work through collaboration will be debated

The afternoon session will workshop a specific topic that requires joint work.

We will define what 'sustainability' means to us locally, and its impacts on our roles and responsibilities as community leaders.

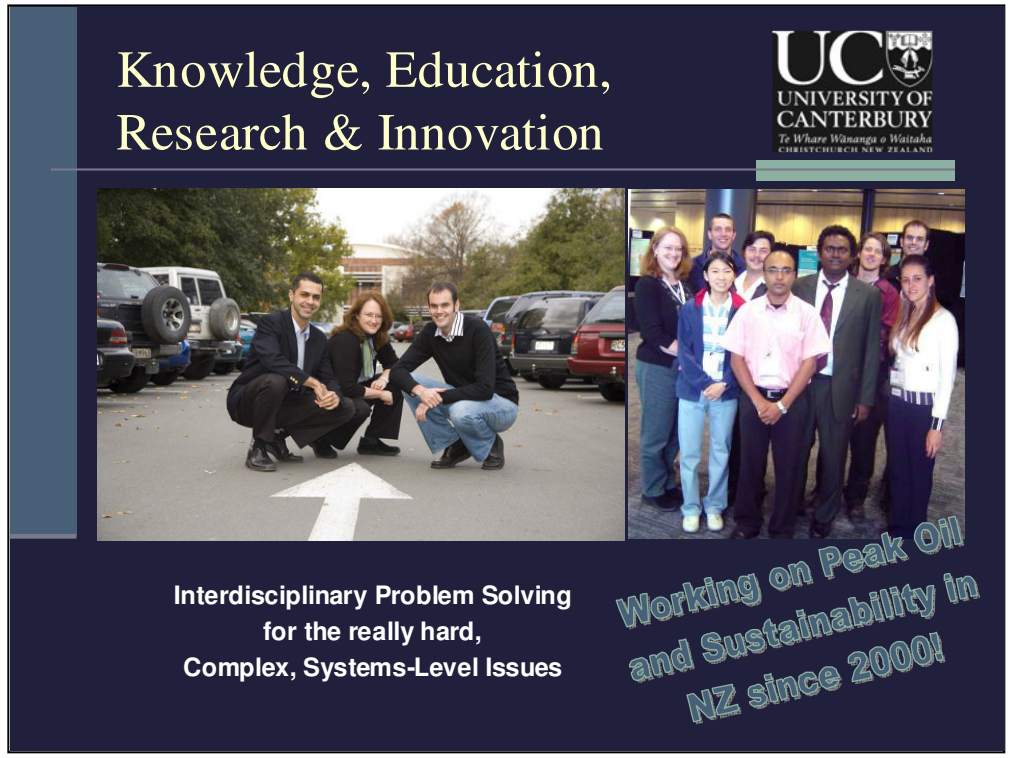
The speakers will present us with an indication of what impacts on our businesses we can realistically expect from impending changes.

Dr. Krumdieck was one of 3 invited speakers together with Dr. David Wratt of NIWA, Dr. Gillian Wratt of Cawthron Institute.

Gillian spoke about general sustainability issues

Susan spoke about peak oil and the response issues

David spoke about climate change



The role of the academic in society has several facets:

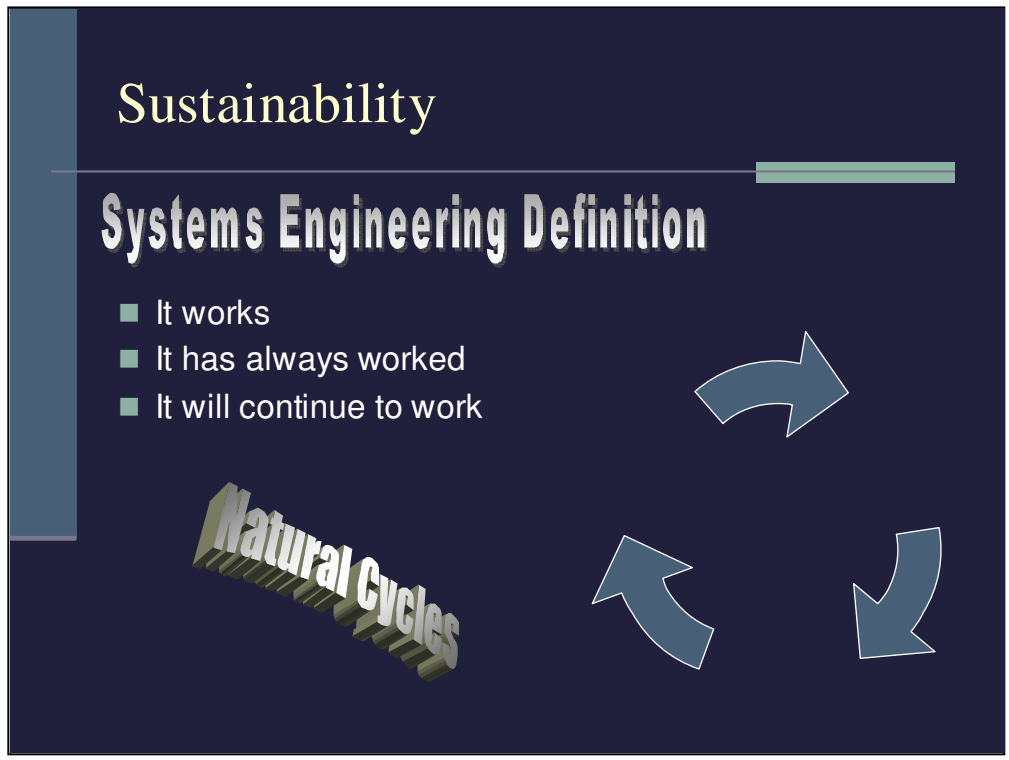
1) Through guided and examined research and study, become an “expert” in a field – e.g. work you way to the coal-face of what is known.
2) Teach what is known to people
3) Create new knowledge through correct application of scientific method
4) Create new ideas and capabilities through correct application of engineering science

At the AEMS Lab, students and colleagues have been working on the really hard problems of “sustainability” since I took up the appointment at Canterbury in 2000. The end of this presentation has some examples of the types of research and innovations we have achieved. But first, you asked me to help you make some progress on sustainability issues.

There are serious immediate problems that continued discussion of "temporary spikes" and alternatives cause us to loose ground on. Below are the problems that need plans, in order of urgency.

Problem #1 - The current economic relationships, transport networks, travel behaviour, public transport systems, government policy have no plans and mechanisms to deal with escalating fuel costs and the ensuing inflation. Hoping it goes away may seem like a plan, but it's not.

Solution #1 – Risk assessment projects to identify the most vulnerable citizens and highest impact supply chains. Rapid analysis to identify ways



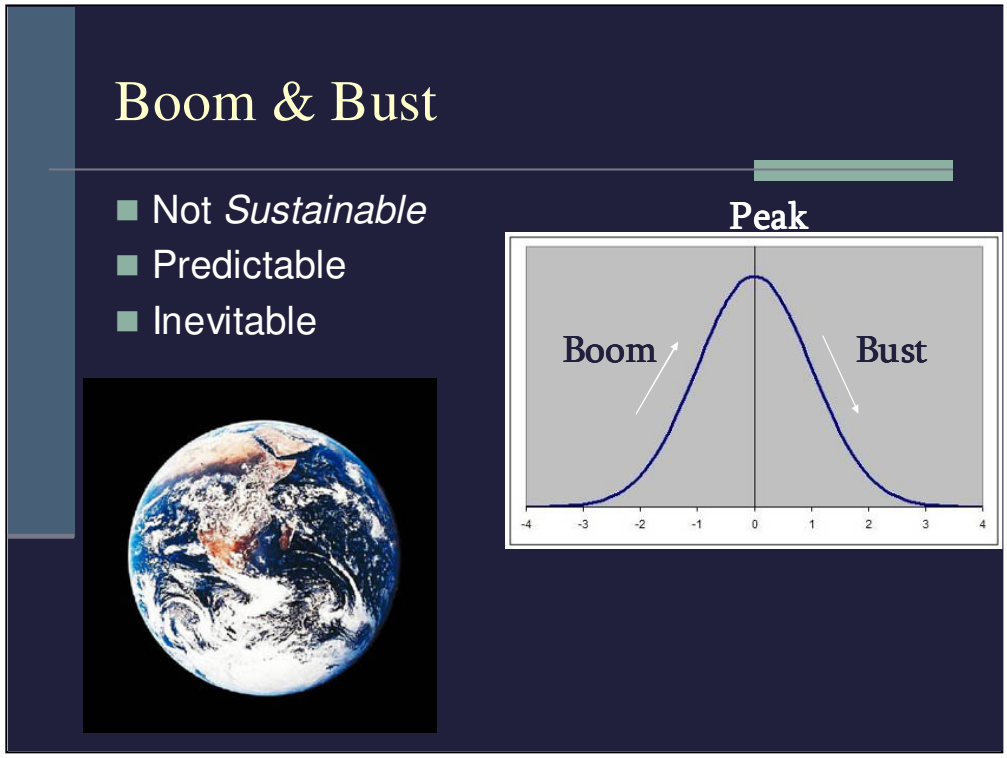
The work “sustainability” may be the first problem.

Defining sustainability has become a big distraction. Of course, you would define sustainability the same way you do other relativistic, self-evident concepts like “safety” or “security”-

How do you define safety? It’s when you are safe.

Basically, with these types of concepts, you would have to come up with particular definitions and measures for each situation. The problem is that the way most people are thinking about sustainability, as something that we can choose as an alternative, is a bit naive.

Sustainability is self-evident and it is natural. It is also inevitable. Humans are essentially sustainable unless we choose not to be. Sustainability is about cycles. Humans are born, are looked after and taught, then are productive in a wide variety of ways, chiefly in growing food and making useful things, until they are again looked after and die. This is a sustainable cycle.



When societies choose to pursue growth in material wealth and consumption, then they can set off on a boom and bust pattern. This is of course also a natural pattern. Where would we be without species that operate with "blooms" of exponential growth followed by rapid die-off. Bacteria take care of dead things in this pattern. The issue with human societies that pursue exponential growth is that it is inherently unsustainable by the most widely accepted definition. That is it definitely leaves the people on the bust side worse off than those on the boom side.

The boom and bust pattern is predictable, and the bust side is 100% predictable, regardless of what people **BELIEVE.** The fact is that we live on a finite planet, and facts trump beliefs in this instance.

Peak and decline of mineral oil supplies is predictable and inevitable because it is a boom and bust cycle.

Price escalation is also inevitable. The price rise plot here is to scale in 2001 US dollars.

It is clear that Oil Supply is a Risk that councils must consider.

How do we deal with damaging and disruptive events? Through the process of risk analysis and mitigation.

Luckily, councils and their staff understand the concepts and the projects of risk analysis and mitigation.

And What is the point of risk analysis? We can't prevent earthquakes, we can't stop floods. What do we hope to accomplish?

Risk analysis and mitigation accepts that you can't avoid realities, but you can plan for probabilities. You can try to minimise impact and build in resilience. There are building methods that will collapse and kill people in a 3.5 magnitude earth quake. Building our structures to withstand a 6.0 scale earthquake will save lives. If a 9.0 earthquake happens, then we've done the best we could, but people will probably still die. You just have to go with the probabilities and do the best you can afford.

So how many risk assessment and mitigation projects are you doing in your council right now? (predicted response, very few)

Maybe this is the biggest problem right now. The fact that nothing is being done. Why is that?

There are a lot of things that can be done. My group have been working on a pretty impressive portfolio of projects. The thing is that we have moved on – we have got to the point where we understand the facts and can start to take the logical actions.

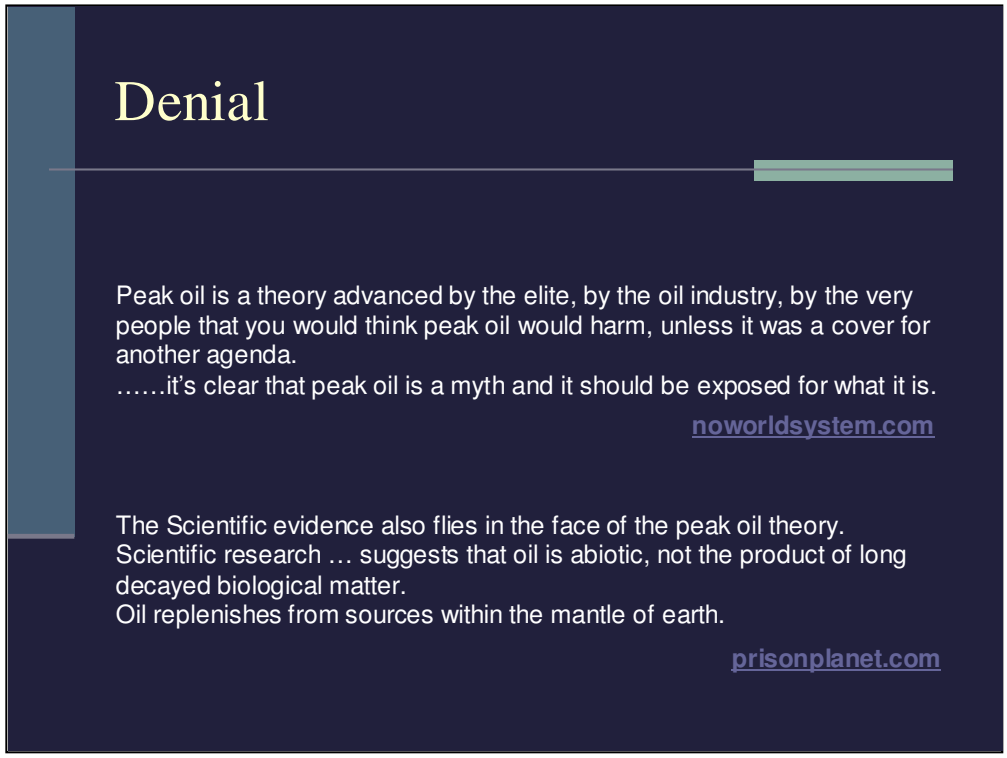
I think that the biggest thing I can help you with today is to teach you what I have learned about the process that has to happen BEFORE people will start working on the solutions. You might recognise in this framework that you, yourself may be stuck at one of these stages, and I'm sure that you can think of people you know or work with who are at different stages of progression through the process.

Of course the response progression that I've outlined here is the same as for grieving. And to a large degree, that is what Peak Oil, and of course global climate change are like. They are both really bad news that you really can't do anything to change.

Shock and Disbelief

- Oil is running out!!!
- But it's years away
- The market will take care of it
- Oil can't go above $40 because of the price of alternatives

Shock and disbelief are pretty obvious first reactions when people learn about Peak Oil. It just can't be true! Surely economics will just take care of this. The last point here is actually a quote from a discussion I had with a national leader refering to his advice from the economists. Sure, there is only so much oil, but there will never be a shortage because of economics!



Denial is very powerful. It's funny that ludicrous claims like the ones here can actually make you wonder for a moment – is there some truth in that? What if it was true? It is very easy for people to get stuck on denial. And the strong conviction of people stuck in denial can pull on others who might be ready to move on.

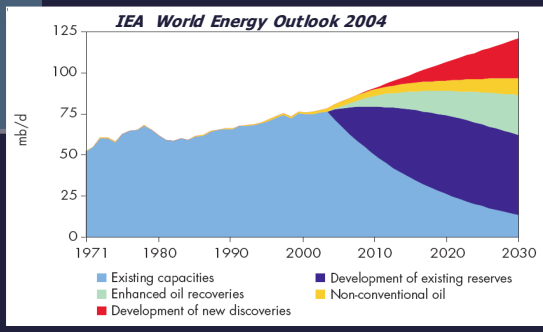
Full Quotes:
Peak oil is a theory advanced by the elite, by the oil industry, by the very people that you would think peak oil would harm, unless it was a cover for another agenda. Which from the evidence of artificial scarcity being deliberately created, the reasons for doing so and who benefits, it's clear that peak oil is a myth and it should be exposed for what it is.
noworldsystem.com

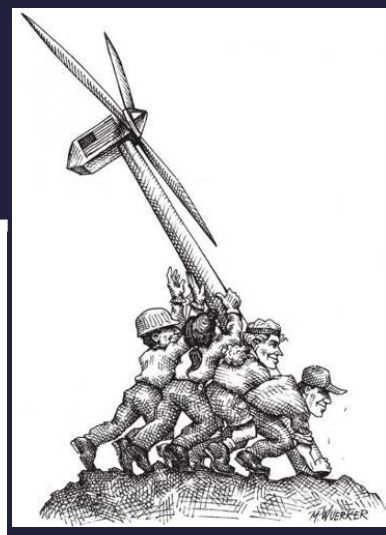
The Scientific evidence also flies in the face of the peak oil theory. Scientific research dating back **over a hundred years**, more recently updated in a **Scientific Paper** Published In 'Energia' suggests that oil is abiotic, not the product of long decayed biological matter. Oil, for better or for worse, is not a non-renewable resource. It, like coal, and natural gas, replenishes from sources within the mantle of earth.

prisonplanet.com

Bargaining

- Oil sands
- Biofuels
- Renewable Energy
- Electric Cars





OK, so cheap oil (existing capacities) will decline. But new investment will bring new supplies so growth will continue!

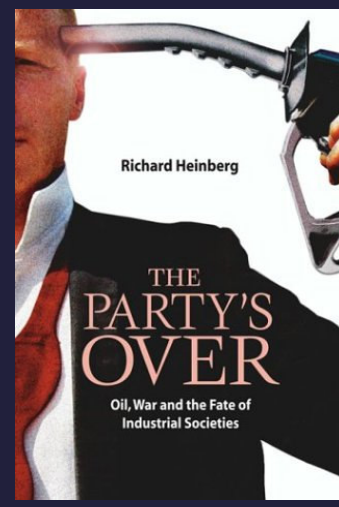
And OK, so the CO2 may be a problem in 2012, so we'll "substitute" fossil fuel with biofuel, or wind or solar or Electric Cars!

Once you start to grasp the reality of a big problem, you can get quite stuck thinking about how to bargain your way out of it, rather than facing it. The technical realities of all of these bargaining positions doesn't change the fact at all that existing capacities are at peak and are declining. They don't change the fact that every million tonnes of fossil fuel we burn is further adding to the strange atmospheric chemistry experiment we have started regardless of if we put up some more wind turbines.

Basically, bargaining does not gain anything, but it certainly does hold back progress.

Guilt

- It's our own fault
- Nature's punishment…
- What about the kids?



Of course we should feel bad about the way things have gone. Even if you've been an unwitting participant in a collectively wrong decision, you do feel bad about it. And you should particularly feel bad if innocent people are going to be affected. But, you don't make anything better just by feeling bad. Somebody has to move on.

Anger

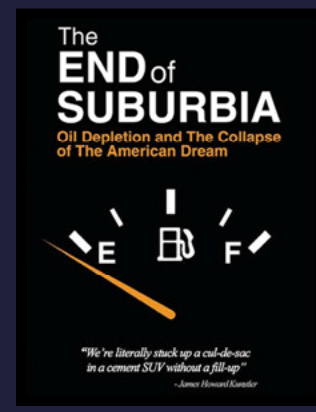
- Why aren't people listening?
- Oil companies making out like bandits
- People won't change selfish behaviour

Anger is usually the thing you move on to after feeling guilty. There are a lot of people stuck in the anger stage at the moment. There's so much to be angry about, really, isn't there? Prices are skyrocketing! That's hurting people. People keep being stupid, and driving hummers. And what about wars? We're really having people getting killed so we can drive our cars? I hope people are angry.

Be careful with anger, whether justified or not. You can easily get stuck here, and not actually do anything except try to get other people angry too.

Depression

- It's too late, we've mucked it up
- Just don't want to think about it
- Might as well party now
- To heck with it

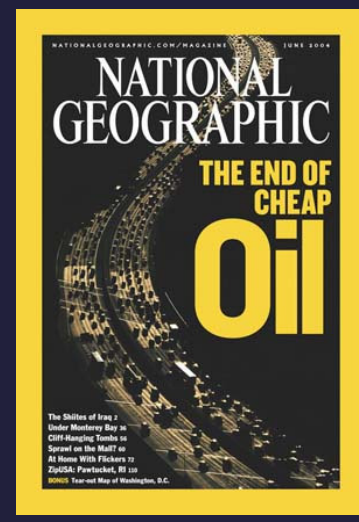


And once you calm down, you are very right to get depressed about the whole thing. We've already invested so much in something that was a giant tragedy of the commons, and it's all going to come down on our heads. In fact, this depression thing can be quite entertaining. Maybe we could make money by helping other people get depressed! Be very careful – it is ever so easy to get stuck in the depression stage.

And finally, you start to really understand the facts. You float back down to reality and see that we all have huge challenges we need to get onto. What is really important is that you understand, really understand that what we are talking about is CHANGE. Once you accept that things are going to change, you are ready at last to move on.

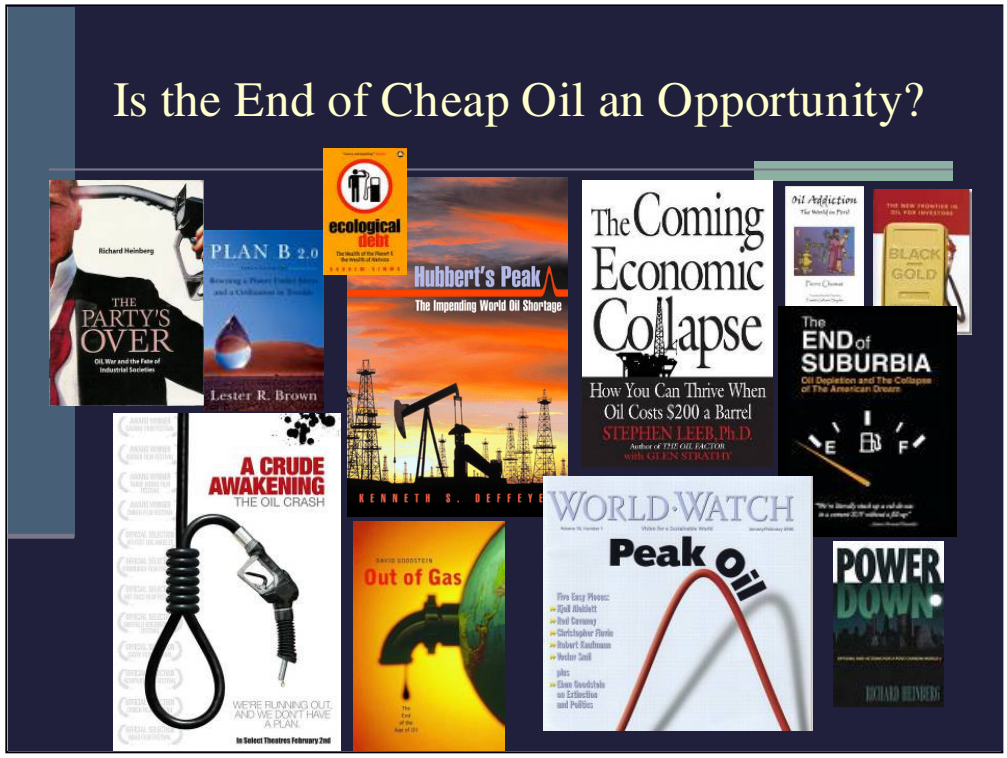
Move On

- Risks
- Responsibilities
- Opportunities
- Management
- Planning
- Innovation



Now you are one of the few people who is actually going to take the actions that are going to make a difference for everyone. We have to recognise that we can't wait until everyone is ready to move on to decide what to do. This is where our governance structure of representative democracy will be too slow on this issue. Democracy has to wait until people want something. Our political leaders will actually be some of the last people taking real action here. The big mistake so far has been waiting for the GOVERNMENT to do something about peak oil or global warming. The government did not grant the right to vote to women, women demanded it. The government did not decide to end apartheid in South Africa, humanity demanded it. And in every one of these cases, it was not a majority of the population at all that did the demanding, it was a few people who had been through a whole journey of understanding and were willing to move on and do something.

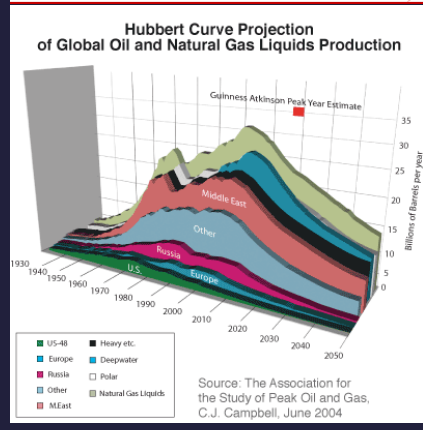
What needs to be done? It's pretty obvious really – treat this as a risk, look at it from many perspectives, identify responsibilities, look for opportunities. Get different groups to work on management, at all levels. Start working these risk assessment and mitigation issues into planning for business, investment, etc. And mostly, don't be afraid if you don't know what to do or how you're going to do it. Innovation doesn't happen where there's already a known and useful solution to a problem! Innovation happens when we have problems we don't know how to solve yet. Get your innovators to work on real problems!



Here we have a sampling of the popular press about the scary thing that is "peak oil"

Investors are Planning for Opportunity!

GUINNESS ATKINSON FUNDS



Guinness Atkinson Funds is estimating the global peak oil production year will occur between 2015 and 2020 (see chart at left). We suspect that soon, daily oil demand will outstrip daily oil production capacity, potentially creating an opportunity to profit from the ownership and exploitation of the world's dwindling hydrocarbon reserves.

www.gafunds.com/lp6.asp?GOoilpeak

Did I say opportunities? Yes, some people have already identified some opportunities.

But the kind of things I was thinking about are more around changes for the better.

Advice to Councils

Move On

- Understand the Reality of the Challenge
- Add Oil Risk, Resiliency, Adaptation projects to your long list of things to do
- Find Good Information and Engineering Support
- Work on innovative solutions with good modelling (can't afford bad investments)
- Work with Action Groups
- Support Transition Groups (be willing to adapt regulations)

My advice to councils, businesses, action groups? MOVE ON. Understand the reality of change, and understand your normal psychological reaction to this. Please understand that everyone else is going to have to move through these stages as well. Help them if you can. But, if you find yourself ready to move on, then please, be one of those people who make a difference. If you find that there are people with energy and initiative and they have found a project to work on that they feel will reduce risks to their community or improve their resiliency, then please, facilitate their work. Be a catalyst for adaptation.

The rest of these slides outline some of our projects at the AEMS Lab. You can find more details at our website.

Innovations for Oil Reduction Planning

- Problem Solving
- Risk analysis and engineering
- Modelling
- Short and long range planning
- Participation with community and business

AEMS Lab
Advanced Energy and Material Systems

Urgent Projects

Short Term – 1 Year Horizon

Current Activity Systems

Resiliency – Adaptation to High Fuel Price and Fuel Shortages

Long Term – 2 to 50 Year Horizon

Future Infrastructure and Activity Patterns

Viability – Adaptation to Reducing Fuel Supply

Fuel Shortage Risk Model

Current Year:	2008	Fuel Supply reduction from 2006
Probability that the fuel shortage level will occur:	85%	2 % reduction
	42%	7% reduction
	20%	10% shortage
	1.5%	15% shortage
	0%	20% shortage

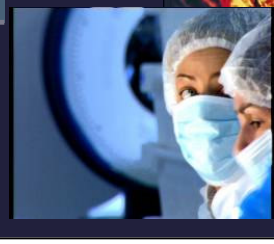
Resilience

Transport Activities at Risk

Access to Activities:
Work & School
Goods & Markets
Services & Social





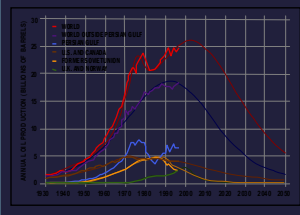

Urban Personal Transport Risk

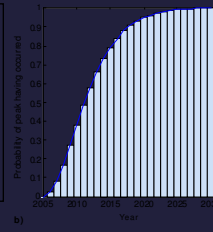
RECATS 1 - Fuel Shortage

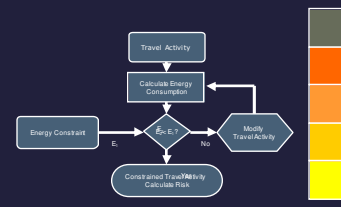
- **Low Impact** for resilient cities
- **High Impact** if essential needs not met

RECATS is our acronym for a software program that implements a method to assess the risk of energy constraints on activities in transport systems. It can be implemented for a given urban form, so it may also be used as a planning tool.

RECATS Risk Assessment Method







Risk = Probability * Impact

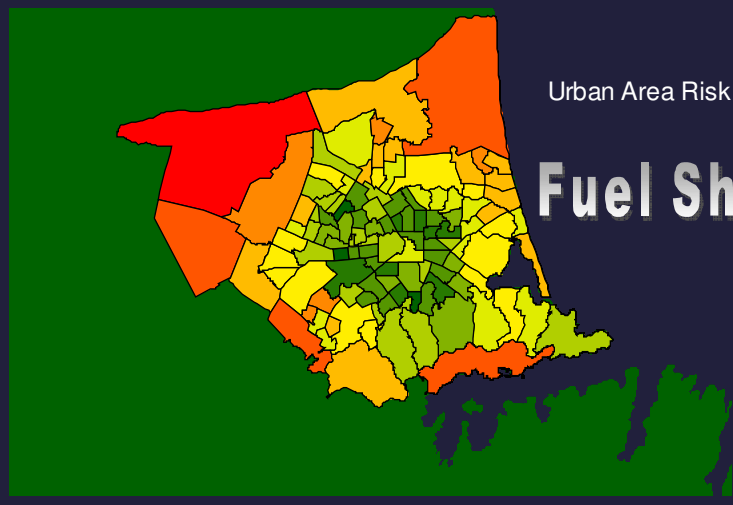
Dantas, A., S. Krumdieck, S. Page, Risk of energy constrained Activity-transport systems (RECATS), *Journal of Eastern Asia Society for Transportation Studies,* 7 (2007) 1164-1179.

Saunders, M. J., S. Krumdieck, A. Dantas, Energy reliance, urban form and the associated risk to urban activities, *Road & Transport Research,* Vol 15 No 1 (2006) 29-43.

Dantas, A., S. Krumdieck, A. Hamm, M. Saunders, S. Minges, Performance-Objective Design for Energy Constrained Transportation System, *Journal of Eastern Asia Society for Transportation Studies,* 6 (2005) 3276-3292.

Dantas, A., S. Krumdieck, M. Saunders, Assessing the risk to suburban activities associated with transport energy availability as a function of urban form, Transportation Research Board 85th Annual Meeting (Washington D.C. January 22-26, 2006).

Resiliency of Christchurch



Urban Area Risk Assessments

Fuel Shortage

Risk Case Study – Viability

Greater Christchurch Urban Development Strategy

2025
60% probability
20% fuel reduction

High Density

Sprawl

Long Term Planning

FRMS

Fuel Retail Management System

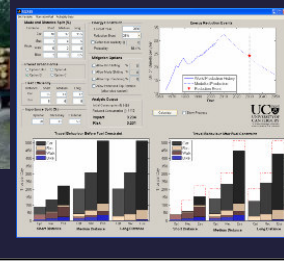
TACASim – Audit & Survey

Travel Adaptation Computer Animation

Personal Response

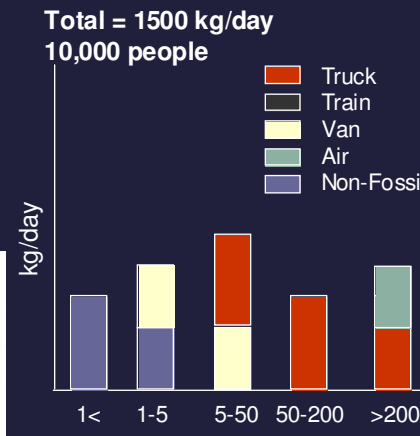
Travel Adaptation

Freight and Agriculture



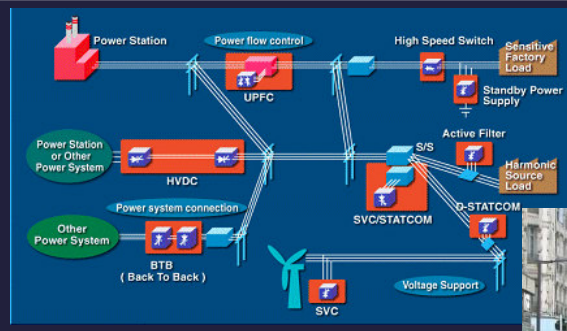
Risk Adaptive Freight Logistics

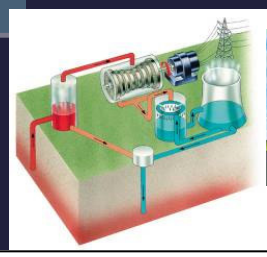
- Bread in Burnside



Distance Bread Travels
Producer - Market

Renewable Energy Transport Modelling





What if we were sustainable – what would our innovators have come up with, and what would life be like in Christchurch? This is an on-going virtual reality modelling and inventing project. Any ideas you want to add in?

Transition Problem Solving & Projects

- Action Groups
- Transition Movements
- Youth Activism
- Facilitation

Conclusions: Advice to Councils

- Understand the Reality of the Challenge
- Add Oil Risk, Resiliency, Adaptation projects to your long list of things to do
- Find Good Information and Engineering Support
- Work on innovative solutions with good modelling (can't afford bad investments)
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