



White Paper

Understanding Powerdown

What organizations need to know
about the impact of liquid fuels
on communities as oil prices hike and availability wanes...

Stephen Hinton
April 2009

Understanding **POWERDOWN.**

Planned Powerdown describes a situation where, due to shortfall between supply and demand, the per capita energy intensity of a community is reduced whilst living standards are maintained at a democratically accepted level. More and more evidence is piling up that a liquid fuels shortage is coming. Public and private organizations will be debating the need for planned powerdown.

Liquid fuel scarcity changes the rules of business radically and brings sustainable development issues further into focus.

This paper is for officers in the public and private sector alike. Its purpose is to describe what we believe are the main aspects organizations need to consider in order for them to begin to craft energy depletion management strategies.

For each of the main points the paper provides further reading and analysis.

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The upshot of all this is that we are entering a historical period of potentially great instability, turbulence and hardship.

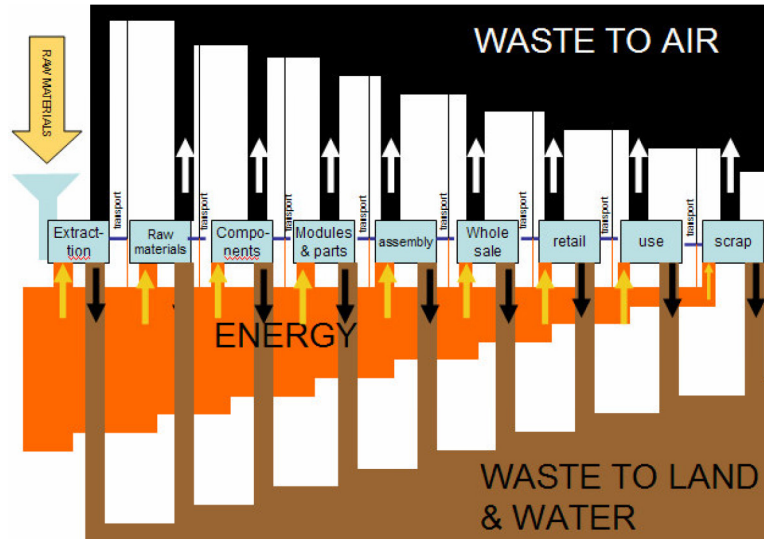
James Howard Kunstler
Author of The Long Emergency

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Sixteen aspects of Powerdown.

Oil pervades from raw material to product.....	4
Demand will outstrip supply sooner or later.....	5
The issue is a liquid fuels one.	5
No easy replacement is available.....	6
Moral challenges will overshadow technical issues.	6
The main challenge is to maintain the carrying capacity of the Earth on less fuel.	7
An economic slowdown – or worse – results from energy depletion.....	8
Huge supply chains will power down.....	9
Beware of the trap of looking for a technical solution	10
Human muscle power and animal power will re-emerge as part of the economy	10
Powerdown strategies for cultural change are starting to emerge.	11
Culture change measures offer several benefits	12
Two other likely responses: Demand restriction and city re-planning	12
Less than a 20-year time frame for mitigation could seriously impact living standards.....	13
It is better to start mitigation early than late.....	13
The strategic question is how quickly your organization can respond effectively to fuel supply shortfalls.....	13

Oil pervades from raw material to product



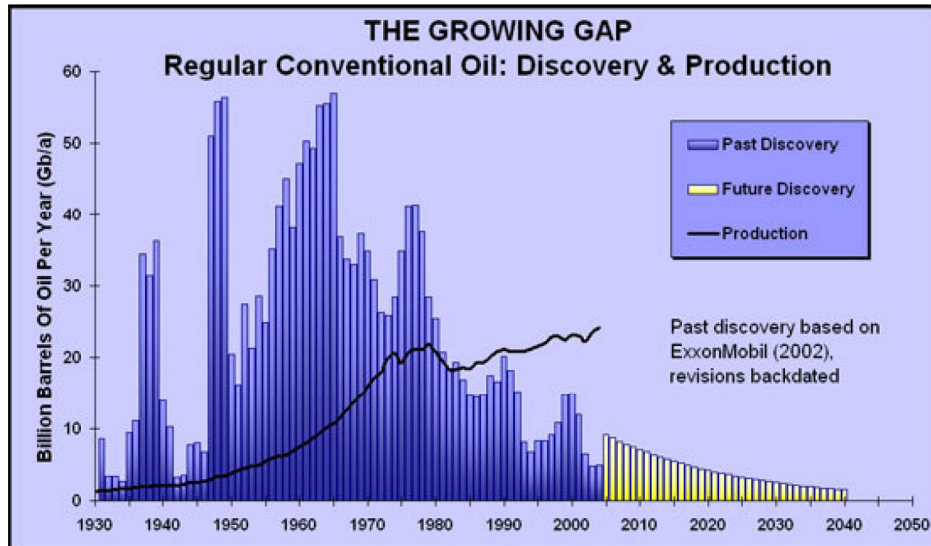
Most products coming to our homes have wandered through long supply chains. The diagram above shows schematically how each step in the chain successively uses energy (up to 70% from oil) and produces waste. Between each step there is transportation (95% oil). The waste produced in the supply chain for any given item may be as much as 30 times the weight of the item itself. So the volume of oil consumed during these steps may be far larger than imagined from just seeing the product.

For example, construction of an average car consumes approximately 27-54 barrels (1,110-2,200 gallons) of oil. And the average desktop computer consumes 10 times its weight in fossil-fuels just during its construction,

Demand will outstrip supply sooner or later.

The world is not running out of oil overnight. However, global oil discoveries peaked in the 1960s and are rapidly declining as oil becomes harder to find. Today there is a growing gap between new oil discoveries and production. Oil is a finite resource.

Sooner or later demand will outstrip supply. According to studies by the Association for the Study of Peak oil, this is imminent.



Source: ASPO Ireland

The issue is a liquid fuels one.

The majority of oil is used in transport. And the majority of transport is oil-based fuel. The transport infrastructure will take decades to convert to alternative fuels and as yet no replacement which can easily be scaled up to today's level is available.

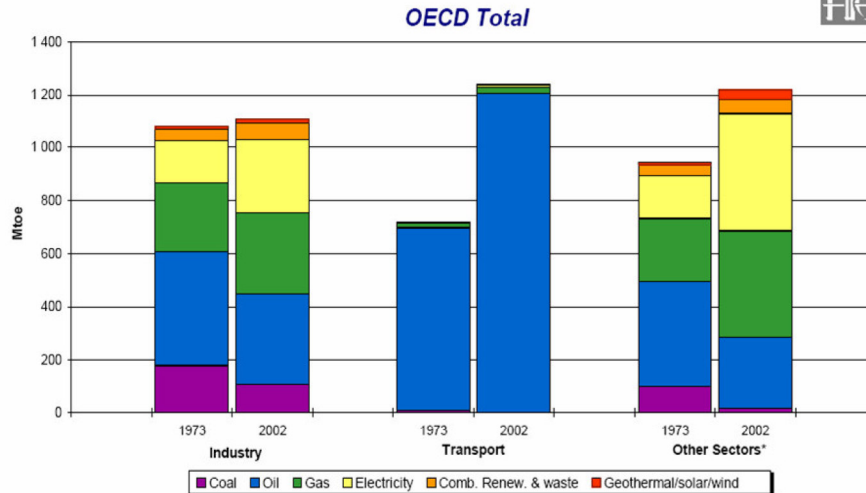


We need a wake up call. We need it desperately. We need basically a new form of energy. I don't know that there is one.



Matthew Simmons OIL INVESTOR

Breakdown of Sectorial Final Consumption by Source in 1973 and 2002



Source: IAE website

No easy replacement is available.

The amount of energy stored in oil is phenomenal. One deciliter contains enough energy to hoist a small car up the Eiffel tower and one gallon contains the equivalent of 500 hours of human muscle power. The alternatives offered either do not provide a source of energy and act just as an energy carrier (eg hydrogen) or they are difficult to extract and present environmental challenges (eg coal).

HYDROGEN

Currently, hydrogen is produced from gas which will be in equal short supply as oil. Making hydrogen from water requires vast amounts of energy and even if it were produced in the quantities needed, there are serious doubts around safety.

BIOMASS

What is stopping biomass is the difficulty of scaling up production the sheer amount of energy and biomass needed to convert biomass to fuels.

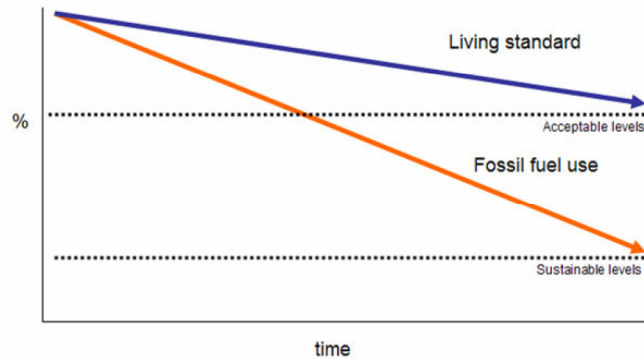
COAL

And coal as a source is fraught with environmental problems such as mercury poisoning, acid rain and increased greenhouse gas emissions.

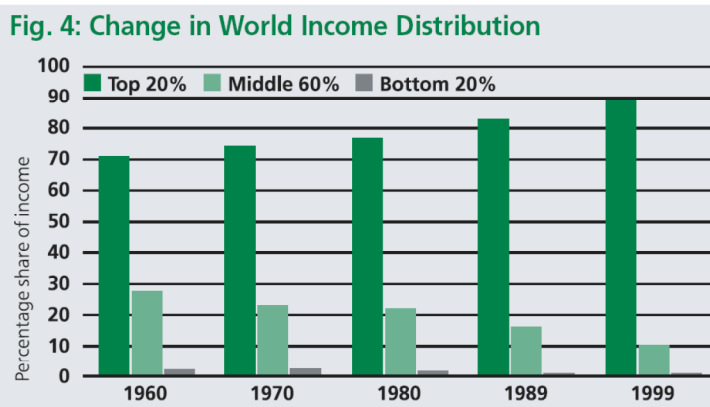
The only foreseeable option is to reorganize and reduce our transport dependence on fossil fuel by at least 80%.

Moral challenges will overshadow technical issues.

Left unmanaged, a powerdown might mean that the majority of those who enjoy a comfortable life style at the start of the powerdown may end up under the poverty line. The challenge will be to redistribute resources as the powerdown continues. That is to say: concentrate on retaining well-being of the community whilst fossil fuel use and most likely the economy decline (see diagram).



As the diagram below shows, world income distribution has been increasingly uneven over time. It could be said that those who had little have even less today. This is a particularly worrying considering rising energy process, as without a planned income redistribution extreme hardship may be encountered across the board.



source: <http://www.poorcity.richcity.org/entundp.htm> quoted in Community Solution newsletter. www.communitysolution.org

The main challenge is to maintain the carrying capacity of the Earth on less fuel.

Carrying capacity is a term often heard when discussing sustainability. A brief definition of carrying capacity is the size of a community an area can support without degradation. Liquid fuels enhance the carrying capacity of the world in a myriad of ways. Most importantly, by fuelling mechanized agriculture and transport of goods to enable more people to live in a given area.



Most immediately we face the end of the cheap-fossil-fuel era. It is no exaggeration to state that reliable supplies of cheap oil and natural gas underlie everything we identify as the necessities of modern life - not to mention all of its comforts and luxuries: central heating, air conditioning, cars, airplanes, electric lights, inexpensive clothing, recorded music, movies, hip-replacement surgery, national defense - you name it.

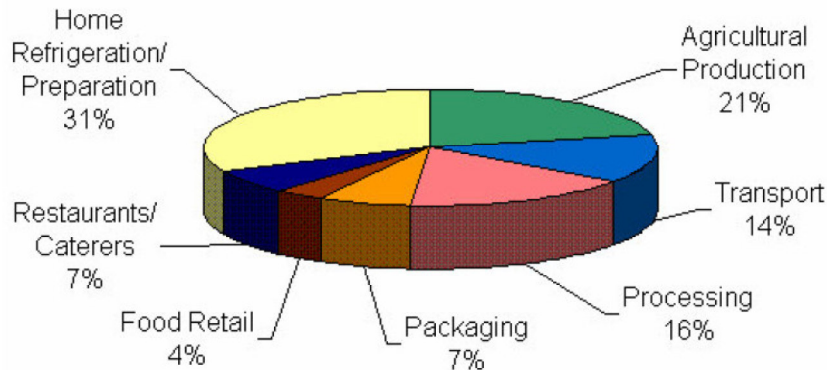
James Howard Kunstler
 Author of *The Long Emergency*



In the United States, 400 gallons of oil equivalents are expended annually to feed each American (as of data provided in 1994). Reducing the amount of fossil fuel available to agriculture will reduce yields to a fraction of what they are today. A new approach to food production will be necessary to prevent widespread shortages.

United States Food System Energy Use

Total = 10.25 Quadrillion Btu



Source: Heller and Keoleian

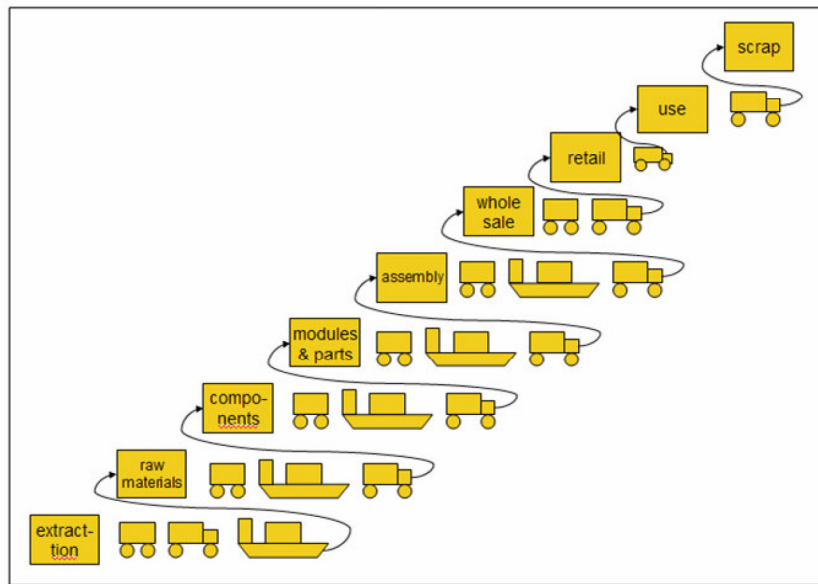
An economic slowdown – or worse – results from energy depletion

It has yet to be demonstrated to us that the debt-service economy we live in can actually function without being supplied with cheap energy. As fuel supplies run down we predict negative economic growth. It will be possible for some organizations to make a profit in the downturn, but others may find their business model unworkable. The net result looks to be a wide scale downturn in the global economy.

Studies in the USA* have confirmed the role of oil prices in the business cycle. In particular, a close correlation has been observed between oil prices and unemployment. Although unemployment is a lagging indicator, it generally rises as a result of higher inflation. The link between oil prices and unemployment becomes apparent when the higher inflation is triggered by higher oil prices – as was the case in the 1970's and as it starting to happen now.

*4 "Unemployment Equilibria and Input Prices: Theory and Evidence from the United States"
Review of Economics and Statistics, November 1998

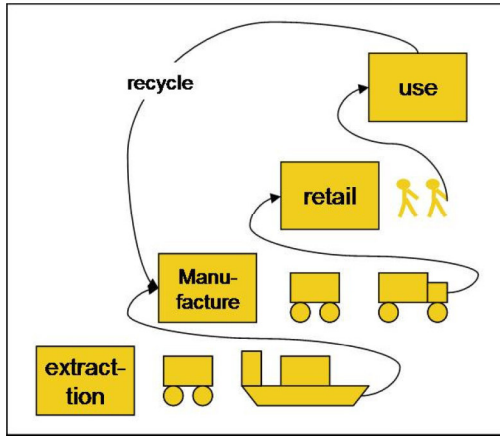
Huge supply chains will power down



The diagram represents a typical supply chain where cheap energy for transport enables materials and goods to be transported many thousands of kilometers before reaching the end customer. This is not the end of the supply chain as there is more transport of waste when the goods are no longer needed.

The benefits of this model, for example where each step can specialize, and that work can be done where it is cheapest, will be outweighed by the cost of the interim transport. We are likely to see that only specialty goods that can be transported economically will travel, and that there will be much more local production of goods.

Below, a supply chain with reduced steps using less energy intense transport.



Beware of the trap of looking for a technical solution

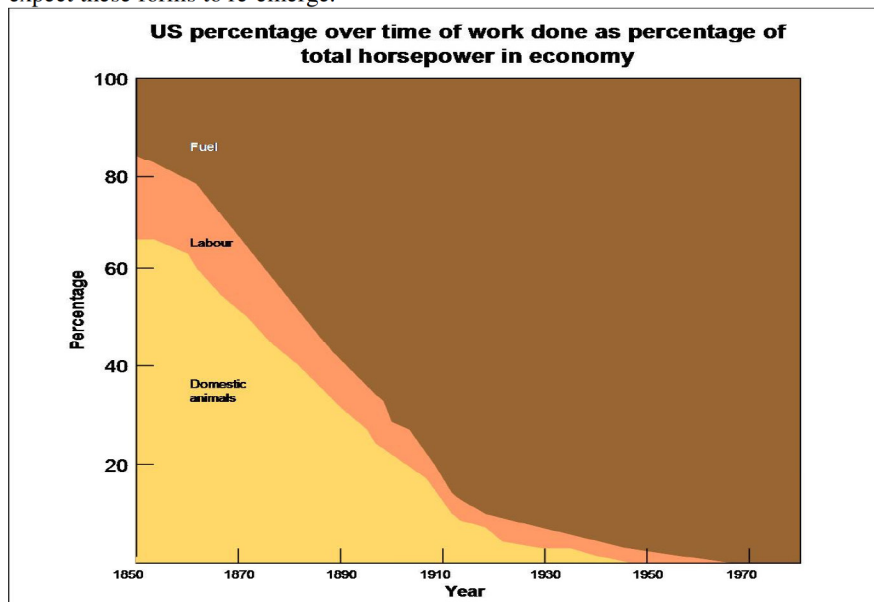
In powerdown, energy-saving devices and enhancements to increase efficiency would seem to be part of the solution.

However, organizations need to be aware that introducing more efficiency in the past has led to increased fuel use, not less. For example, the introduction of large fuel efficient jet passenger planes simply meant people flew more as fares were cheaper.

This phenomenon is known as the Jevons paradox, after its originator [William Stanley Jevons](#). Jevons observed in his book in 1865 that the improvement of the steam engine by James Watt led to increases in coal consumption even if each individual engine used considerably less fuel.

Human muscle power and animal power will re-emerge as part of the economy

As the diagram below shows, since 1850 there has been a rapid decline in use of human and animal energy sources in the economy. With cheap energy a thing of the past we expect these forms to re-emerge.



Powerdown strategies for cultural change are starting to emerge.

Requiring no or little technology, a change in culture – how we behave and our attitudes to how we solve problems – is likely to become one of the major strategies for managing powerdown.

Two examples of powerdown strategies are Chevron’s recent campaign and the dress code changes for Japanese civil servants.

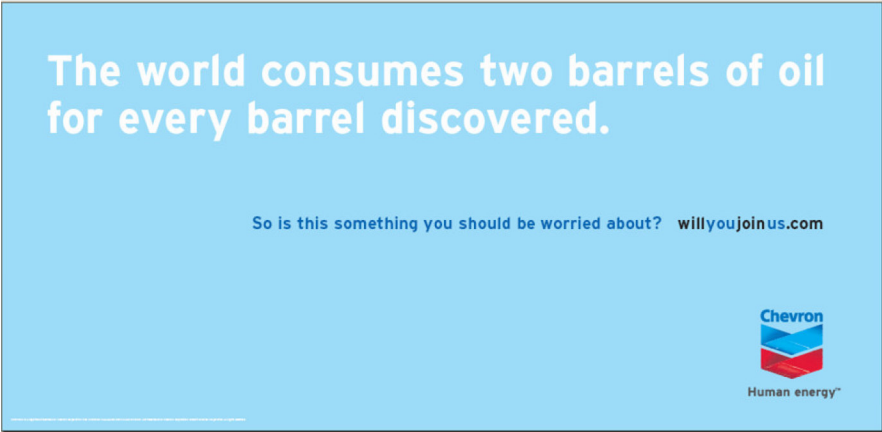
Japanese shed ties in sustainability culture change.

A government report urges Japan to secure channels for a stable energy supply as global energy demand is expected to surge in the next 25 years. The paper said Japan needs to continue energy stockpiling, conserve more energy and reduce its dependence on oil and other resource imports to lower the risk of an energy shortage

Government officials follow the custom of dressing in suit and ties, even in summer. Many feel the strict dress code preserves dignity. A cool 25 degree indoors though means hefty air conditioning bills. The dress code and the air temperature control systems are the major contributory factors. It would be reasonable to forego the code for lighter clothing and reduce air conditioning.


So the government plans to introduce a casual dress code and raise the indoor temperature to 28 degrees. Chief Cabinet Secretary and Hiroyuki Hosoda, appeared on TV demonstrating the government’s new energy-saving dress code clad in a new blue dress shirt without tie or jacket, Jiro Kawasaki, chairman of the Lower House Steering Committee, has asked major parties to consider new no-tie dress codes for summer.

Chevron drives change together with customers



The world consumes two barrels of oil for every barrel discovered.

So is this something you should be worried about? willyoujoinus.com

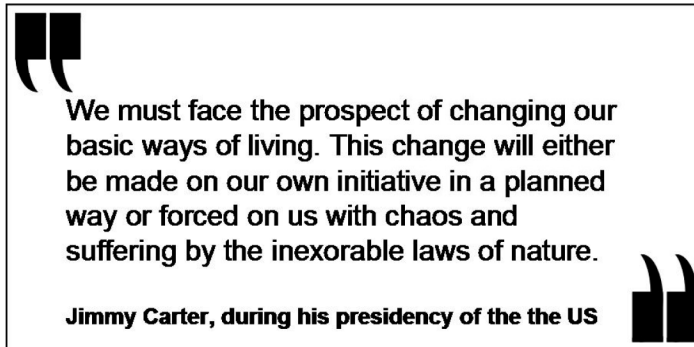

Human energy™

Chevron, on its site willyoujoinus.com seeks to engage consumers and others in discussing how to meet the energy needs in future. A lot can be gained from engaging customers in the discussion, to ensure that the oil company can continue to supply in an ordered way and possibly finding ways to beat the competition through this dialogue.

Culture change measures offer several benefits

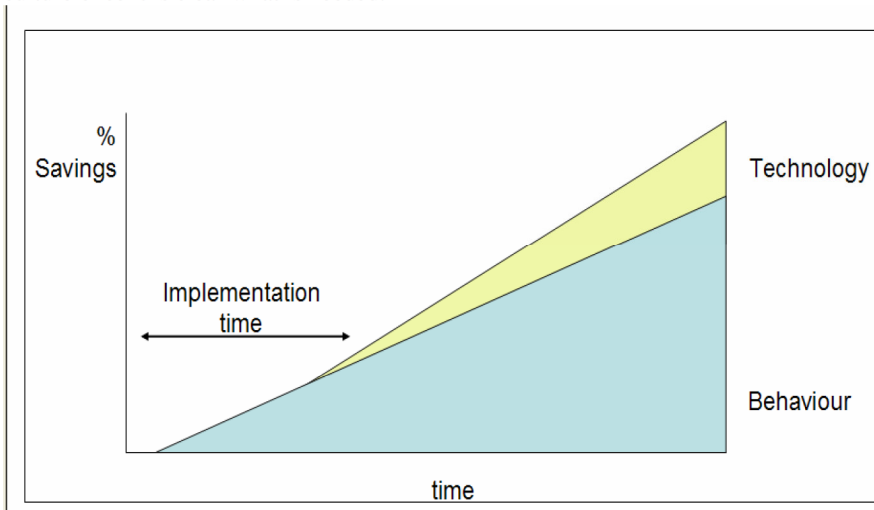
EASY TO MONITOR

Consumer behaviour is fairly easy to monitor as these systems are already in place.



FAST INTRODUCTION

As they mostly require behaviour changes they can be introduced quickly. Engaging people also means each person's will and intelligence are involved in developing the culture once it is clear what is needed.



LOW INVESTMENT

Most culture change programs require investment in time and information, but not the really expensive infrastructure changes associated with urban environments for example.

Two other likely responses: Demand restriction and city re-planning

Demand restriction is already being considered in Asia for gasoline. Global restrictions may hit airlines.


City re-planning may emerge. There are already signs of responses to powerdown like extension of public transport, congestion zone charging, enabling more walking in cities, etc. Road transport takes up 30-40% of city space measured in transport area alone.

As man moves more and more in being a city dweller, a new paradigm for cities without fossil fuel transport must emerge.


The book "Inventing for the Sustainable Planet" presents a city planning methodology called radiality, which eliminates most personal transport needs. See appendix.

Less than a 20-year time frame for mitigation could seriously impact living standards

According to a study led by Robert L. Hirsch, SAIC, of the three scenarios studied, (waiting until demand started to outstrip supply, beginning mitigation 10 years before and 20 years before) only a crash program starting 20 years before peak would enable technology and society to adjust equitably.


 ...more than a decade of intense implementation will be required for world scale impact, because of the inherently large scale of world oil consumption.

Robert L. Hirsch, SAIC
Quote from report: **PEAKING OF WORLD OIL PRODUCTION: IMPACTS, MITIGATION, & RISK MANAGEMENT**




It is better to start mitigation early than late

The Hirsch team investigated the risks of starting late compared to the risks of starting too early. According to their report, the costs of starting too early are minimal in comparison to those of starting powerdown too late.

 The end-of-the-fossil-hydrocarbons scenario is not therefore a doom-and-gloom picture painted by pessimistic end-of-the world prophets, but a view of scarcity in the coming years and decades that must be taken seriously. Forward-looking politicians, company chiefs and economists should prepare for this in good time, to effect the necessary transition as smoothly as possible.

ASPO



The strategic question is how quickly your organization can respond effectively to fuel supply shortfalls

If the level of uncertainty is high about when and how shortfalls in energy supply will affect your organization, many business strategists suggest investing in a crisis management training program. This lowers the response time to manage the situation. The American government has already run a couple of simulations to increase preparedness. See the appendix for references.

This simulation, sponsored by Securing America's Future Energy and the National Commission on Energy Policy, and involving former government officials, revealed how the US economy, and indeed world economy are vulnerable to oil shortages.

The simulation played out a series of accidents and terror actions which sent gasoline and oil prices through the ceiling, prompting a world recession. The main lessons: even a minor shortfall in oil supplies can crash economies. And there is little preparedness and infrastructure for alternatives.

About the author

Stephen Hinton works as a sustainable development consultant. Specializing in program management, he spent six years in the telecom industry, among other things responsible for Ericsson's program to replace outdated IT systems in their Supply Chain Division with a modern SAP platform. A Natural Scientist by training, has been involved in sustainability throughout his career, Stephen is the author of e-book "Inventing for the Sustainable planet" and several other AVBP white papers.

About AVBP

AVBP develops and applies materials, methodologies and instruments designed to promote and accelerate sustainability. AVBP's network of consultants offers these tools to individuals, companies and public sector organizations working towards sustainable development individually as well as with their customers and suppliers.

AVBP cooperates closely with the POST CARBON INSTITUTE, a not for profit organization dedicated to preparing people for a less energy – intensive world.

Contact AVBP for more information

Each organisation needs to explore how the key areas in this paper will affect them. AVBP offers several techniques which may be of help including multilateral collaboration and the setting up of think-tanks.

Please see our website for white papers on a number of related subjects, like behaviour based program approaches and developing a think tank using the latest creativity and innovation techniques.

References

Association for the Study of Peak oil www.peakoil.net

Offers a detailed assessment of the oil supply situation

Millennium Assessment <http://www.maweb.org/en/index.aspx>

The Millennium Assessment brings together hundreds of researchers from all over the planet to identify the current status of the services provided by the ecosystem and its effects on society, including a latest report on business impact.

Global Public Media <http://www.globalpublicmedia.com> an excellent source of interviews and news on sustainability issues and re-localization of community activities. Includes links to the Hirsch report

AVBP web site avbp.net

Presents our services and offers white papers and other documents for downloading on meeting the sustainability challenge.

Post Carbon Institute www.postcarbon.org

Post Carbon Institute is an educational institution and think tank that explores in theory and practice what cultures, civilisation, governance & economies might look like without the use of (non-renewable) hydrocarbons as energy and chemical feedstocks.

A discussion of Mat Simmons' book about the peaking of Saudi Arabian oil is on the link: <http://www.postcarbon.org/node/587>

Economic effects of Powerdown

For a comprehensive analysis see the book:

[The Future of Money:](#)

[Creating New Wealth, Work, and a Wiser World](#) by [Bernard Lietaer](#)

ISBN: 0712683992

POWERDOWN

By Richard Heinberg

<http://www.powerdown.ws/>

As we briefly rest on the plateau of world oil production peak, Heinberg's book first outlines the possible unpleasant paths our society may take through energy decline. He then makes it devastatingly clear that a humane post-carbon future depends on urging our governments to powerdown, while we start to relocalise our economies and build community lifeboats.

Life After the Oil Crash <http://www.lifeaftertheoilcrash.net>

Matt Savinar's site on the oil issue. Comprehensive research.

The Long Emergency: Surviving the Converging Catastrophes of the Twenty-first Century

by [James Howard Kunstler](#)

In this book, distinguished commentator and analyst James Howard Kunstler explains what to expect after we pass the tipping point of peak oil production, and sets out to prepare us for economic, political, and social changes of an unimaginable scale. Riveting, authoritative and ultimately hopeful, The Long Emergency brings new urgency and accessibility to the critical issues that will shape our future, and that we can no longer afford to ignore. It looks set to change the way we think about the world, and our place in it.

Inventing for the Sustainable Planet

By Stephen Hinton

In this eco-fiction novel, journalist Max Wahlter uses advanced innovation techniques to try to create sustainable technology. We hear from the tapescripts of Max's visualized visits to a city where everyone is living in a sustainable way that Max gets more and more frustrated as he finds no new technology but a new social order. The novel challenges the reader to look for solutions in ways they may never have dreamed of before, and challenges some deeply held assumptions about the way we organize ourselves here on Earth.

Available as a downloadable e-book from <http://avbp.net/html/porena.html>

U S simulation of oil shortages: a newspaper article
<http://www.dailybreeze.com/news/articles/1777027.html>

CUBA

Cuba is a country that has experienced powerdown in conjunction with supplies of soviet oil being stopped as the soviet union collapsed. One web site with analysis of CUBA is www.communitysolution.org

Inventing for the Sustainable planet <http://avbp.net/html/porena.html>

This e- novel presents several possible approaches to Powerdown. Max Wahler, a journalist specializing in science and technology, decides his new career is in sustainability. Having come across an innovation technique called Image Streaming he proceeds to create a vision of the sustainable society, publishing the results on his web log.

The book presents technology and sustainability but above all, it discusses what might be the deepest, best kept secrets of living sustainably yet to be uncovered.

Although the visions put forward are purely fiction, a full account of attempts to verify the validity of the insights via the Internet is provided.