



## Let's Imagine a Sudden Oil Shortage

Posted by [Phil Hart](#) on August 29, 2009 - 10:55am in [The Oil Drum: Australia/New Zealand](#)

Topic: [Demand/Consumption](#)

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*This is a guest post from Mark Reynolds, a supply chain and sustainability consultant in Sydney.*

Let's imagine world oil supply suddenly drops by 10, 20 or 30 percent, more or less overnight, for several weeks or months to come. Don't worry about how or why – we can all think of ways a sudden oil shortage could arise. The more interesting questions are how we respond and what local impacts would follow. At the international level there is sure to be argy-bargy among countries over who gets what from where and how much we pay. It is hard to predict how these global issues may play out. In the case of a serious shortage the ways we share the remaining oil supply and set global prices will be a matter of life or death for some countries, particularly the smaller and poorer ones, so let us hope the international community surprises us with fairness.



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At the national level I expect most countries will have to do their best with 10, 20 or 30 percent less oil all of a sudden. What happens next? There's no time for you and me to make plans so if we're lucky we will find that our public servants have already done it for us, and heaven knows they've had enough warnings since 1973.

Here in Australia we have the [Liquid Fuel Emergency Act](#) which comes with significant powers to override State responsibilities and impose emergency national control over fuel supply. There have been planning sessions and desktop exercises held by our various Governments on how this legislation will work so we can assume that some thought has been given to allocation and rationing rules. It would be helpful for the responsible bodies to take the next step and make their plans public to guide the thinking of businesses and local authorities. Other countries may have similar arrangements in place, and if they don't they can always refer to the IEA's handy guide

I expect the emergency rules will work quite well after the first week or two when everyone gets used to having less fuel available. From my experience living through the oil crises of 1973 and 1980 we can look out for some truly dazzling exercises in special pleading from those who believe their own personal car use is more indispensable to the nation than anyone else's. Seriously though, how would you like to try withholding fuel from Meals on Wheels or other charities? And what about volunteer firefighters, school teachers, nurses, doctors, train drivers, priests or policemen? The list gets pretty long and we should feel sympathy for the administrators who have to take a stand and do the cutting.

### Placing some facts on the table

At this point I would like to bring numbers into the discussion. Australian authorities publish good data on national energy usage – enough for us to work out where the fuel is used today and what might have to happen if we run short. The numbers are huge of course and could be expressed in millions of litres or barrels of oil. I have chosen to present them in petajoules or PJ, a unit of energy which happens to be convenient for comparing oil with gas, coal and other fuels. The units are not as important as the relative size of the numbers between different sectors of the economy.

Here's the big picture and it's all about transport which is responsible for 72% of Australia's petroleum products consumption.

#### Australian liquid petroleum end-uses for 2006-07, including LPG and biofuels

Sector	PJ	%
Road transport	1,014	55%
Rail transport	28	2%
Water transport	62	3%
Air transport	218	12%
<i>Transport subtotal</i>	<i>1,322</i>	<i>72%</i>
Industry	189	10%
Mining	149	8%
Agriculture	85	5%
Lubes, bitumen, solvents	63	3%
Commerce & services	26	1%
Residential (mainly LPG)	12	1%
	<b>1,844</b>	<b>100%</b>

Source: [Energy in Australia 2009](#), Australian Bureau of Agriculture and Resource Economics

Why does Agriculture use so much fuel? Think tractors and harvesters. Why Mining then? Again the answer is mainly mobile equipment – Australian mines use large amounts of diesel for excavators, dump trucks and the like, which is why our diesel consumption has dropped a bit since a number of large mines went quiet last year due to the financial crisis. Industry also uses a lot of diesel, especially in the Chemicals, Non-ferrous metals and Construction sectors.

Road transport uses 55% of our liquid fuels and it's the sector that most directly affects each of us day to day. Fortunately there are so many organisations involved in road use that a great deal of interesting data is available on fuel consumption and travel purposes. Here is the breakdown of road transport fuel usage according to the Australian Bureau of Statistics' annual [Survey of Motor Vehicle Use](#), with litres converted to petajoules based on the respective energy contents of diesel,

### Australian liquid petroleum road transport uses for 2006-07 including LPG and biofuels

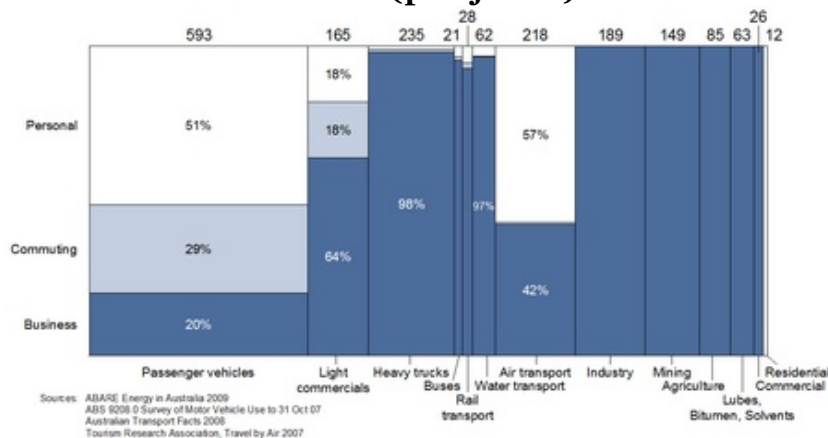
Road transport sector and travel purpose	PJ	% of total
Passenger vehicles – Personal	301	30%
Passenger vehicles – Commuting	169	17%
Passenger vehicles – Business	119	12%
<i>Passenger vehicles subtotal</i>	<b>589</b>	<b>58%</b>
Motor cycles	4	0%
Light commercials – Personal	30	3%
Light commercials – Commuting	30	3%
Light commercials – Business	106	10%
<i>Light commercials subtotal</i>	<b>165</b>	<b>16%</b>
Rigid trucks	91	9%
Articulated trucks	141	14%
Non-freight trucks	3	0%
Buses	21	2%
<b>Road transport total</b>	<b>1,014</b>	<b>100%</b>

In this we can begin to see the outline of a problem. Look at that number for Passenger vehicles – in other words our cars. To make any serious savings in fuel use that number has to come down a lot.

### The petroleum fingerprint

We now have too many numbers in front of us for easy comprehension. To integrate these tables of data we can use a graphical presentation called a Marimekko after the Finnish textiles design firm that inspired the concept. What the Marimekko shows is a series of vertical slices whose horizontal width is proportional to the fuel used by each sector in petajoules. The vertical dimension shows the share of each sector's consumption between Personal, Commuting and Business use. Area on the chart represents total volume usage.

### Australian liquid petroleum products – end-uses for 2006-07 including LPG and biofuels (petajoules)



*Click for larger image*

Personal or Leisure usage is shown white and makes up 26% of the total. Commuting (driving to and from work) is shown in a light colour and totals 11%. The remaining 63% coloured in a dark

You could regard this diagram as the fingerprint of petroleum fuel consumption for a country. I can say for certain that Australia's fingerprint is distinctively different from other countries. Without even doing the numbers I know that anywhere else will have very different shares for sectors like Buses, Air transport, Mining, Agriculture and Residential. For example some cold regions in the northern hemisphere still use large amounts of heating oil for houses in winter. On the other hand few other countries use as much fuel as Australia for mining. In some countries the military would need a sector of its own. Most low-income countries will use less air transport and more buses, trucks or rail. Each change will shift the picture and alter the local opportunities for savings if oil runs short. Note that Australia's rail sector shows hardly any commuting use of petroleum products. That's because all of Australia's significant commuter rail lines are electrified.

Surprising insights for me from the Marimekko include how much fuel air transport uses in Australia and how little buses use – only one tenth as much as air. When you consider that one bus lane on the Sydney Harbour Bridge carries more passengers per day (in one direction) than all seven car lanes in both directions you realise what an inefficient choice cars can be for moving large numbers of people.

### **So what?**

OK, I've set the scene. You can scan the Marimekko and see where our fuel goes today. Now what might we expect to happen if Australia experiences an oil supply shortage? There are all sorts of technical estimates made in publications like *Saving Oil in a Hurry* but I prefer to look at the data and think about what is really likely to play out in a country that I know.

I expect that business lobby groups will be pretty good at presenting the case that their activities are essential to everyone's well-being in today's world and should continue regardless. And I expect that most people like you and I will be pretty good at going along with emergency restrictions, as long as the rules are seen to be fair and affect everybody in the same way, and as long as food keeps turning up in the shops. In the face of drought Australians have responded well to the water restrictions introduced over the last few years. Water savings have been in the 15 - 25% range, and I think it is reasonable to expect a similar spirit of positive personal response to emergency fuel restrictions.

My estimating guidelines for short-term emergency fuel savings are as follows:

- Businesses will save only a little to start with though some mining, industrial and road transport operators can work out ways to reduce fuel use by 10% or more if pushed on the matter
- Light commercial vehicles – all those white vans and other tool-of-trade vehicles – will generally want to keep doing what they do and will provide smaller fuel savings than passenger cars
- Public transport will use slightly more fuel off a low base and then reach a capacity limit at about 10% increase
- Air transport will try to keep the status quo going (those businesses again) but will quickly accept reality and reduce leisure flights
- People are smart. Most of us are adaptable and can soon learn to cut back on personal driving or share rides for commuting to make large savings.

Applying these guidelines to current fuel usage numbers leads to the two scenarios below, one for 10% less fuel use and the other for 20% less. The 20% scenario is confronting enough to put me off thinking about what 30% might look like. You may wish to try some different guidelines but I will be surprised if you can come up with an answer that doesn't depend on a big cut in passenger vehicle usage.



## Two petroleum supply shortfall scenarios

Sector and travel purpose	2006-07 baseline (PJ)	10% supply cut (PJ)	% change	20% supply cut (PJ)	% change
Passenger vehicles - Personal	301	241	-20%	151	-50%
Passenger vehicles - Commuting	169	135	-20%	101	-40%
Passenger vehicles - Business	119	107	-10%	95	-20%
Motor cycles	4	4	5%	4	10%
Light commercials - Personal	30	27	-10%	24	-20%
Light commercials - Commuting	30	27	-10%	24	-20%
Light commercials - Business	106	100	-5%	95	-10%
Heavy trucks	235	223	-5%	211	-10%
Buses	21	22	5%	24	10%
Rail transport	28	29	5%	30	8%
Water transport	62	64	3%	65	5%
Air transport	218	185	-15%	174	-20%
Industry	189	179	-5%	174	-8%
Mining	149	141	-5%	137	-8%
Agriculture	85	82	-3%	81	-5%
Lubes, bitumen, solvents	63	56	-10%	50	-20%
Commerce & services	26	25	-5%	25	-5%
Residential (mainly LPG)	12	11	-5%	11	-8%
<b>Totals</b>	<b>1,844</b>	<b>1,659</b>	<b>-10.0%</b>	<b>1,474</b>	<b>-20.0%</b>

A startlingly simple rule of thumb emerges from this scenario analysis. For Australia;

A 5% cut in fuel supply requires a 10% drop in car usage

A 10% cut in fuel supply requires a 20% drop in car usage

A 20% cut in fuel supply requires a 40% drop in car usage

Just keep doubling the numbers until you run out of options.

### The cruelty of averages

Something else to think about is what it actually takes to achieve an average 40% drop in car usage. An average implies that some people will have to do more because others will do less. Once you factor in all the necessary exemptions for worthy causes like charities and public service occupations I suspect the rest of us will be facing cuts quite a bit deeper than 40% if the nation is to save enough. Perhaps that is why I remember startlingly empty roads, long petrol queues and a surge in motorcycle sales back in 1973.

### How would commuters cope?

A sudden shortage means we need to manage with what we have. Public transport is not a magic pudding that can just expand overnight to service extra demand. Nobody keeps very many spare buses lying around just in case, and most peak-hour rail services are already close to capacity. There is some useful capacity to be gained from time-shifting where a percentage of workers start their day an hour or two earlier or later than usual. This spreads peak loads over a broader time period and increases the total numbers who can be carried by public transport each day. However public transport is practically absent in country areas and doesn't run to every place that people want to go in cities. What other options are there besides staying home, walking or cycling?

When you think about it our most under-utilised transport resource is all those cars driving round with one person in them. If you can double average car occupancy from the typical 1.2 people to 2.4 you've halved fuel usage instantly. The logic of ride-sharing is compelling if there is enough

The Oil Drum: Australia/New Zealand | Let's Imagine a Sudden Oil Shortage <http://anz.theoil Drum.com/node/5709>  
pressure to force us into sharing the cosy private spaces we enjoy inside our cars. Ride-sharing used to be common practice for commuters and was a rich source of humour about social interactions – anyone remember Dagwood cartoons?

The western world has never had a fuel crisis in the age of iPhones and Twitter. I expect that simple mobile-phone-based ride-sharing facilitation schemes will spread like a virus around cities and suburbs if the need emerges. Some localities already have ride-share websites which link up passengers and drivers. The software community is working on more sophisticated "[Dynamic Ridesharing](#)" tools which may come in useful one day.

So there are some predictable consequences of a sudden oil shortage. Some of them might even be fun. Let's see when such an event happens. I hope these thoughts encourage you to consider the local and personal angles and think about what you and your family would be able to do. Good general advice is perhaps to buy a sturdy bicycle, get to know your neighbours better and ponder about how you can get around with much less fuel.

*Thanks to Mark Reynolds for this thought provoking guest post.*



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