



Pathways to a more Sustainable Transport Infrastructure



Vince Dravitzki

Tiffany Lester

Peter Cenek

Opus Central Laboratories



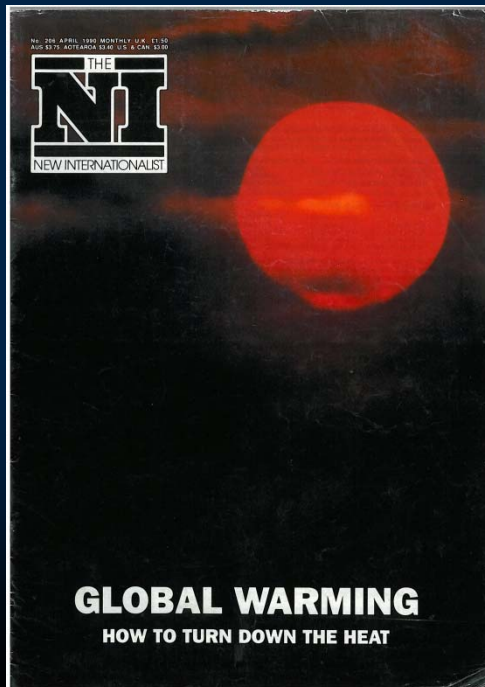
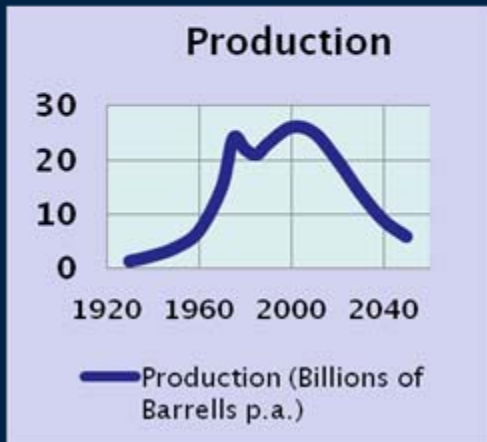
60 Years Ago We Took a Non Sustainable Pathway

- Scrapped electric trams in 9 cities, gave road space over to cars & removed PT's effectiveness.
- Changed rail from coal to diesel-electric rather than electric power.
- A road only bridge for Auckland harbour made ferry service + PT (10million passengers) obsolete and entrenched Auckland as a car based city.
- Roll-on roll-off ferry made coastal shipping obsolete.
- Established dedicated roading fund and arms length roading agency. Laid out the motorway systems in 4 cities that we are still building.
- *Increased transport energy use from 0.5 to 2 MJ per passenger.km and moved transport from an indigenous to an imported activity.*

Current Transport Energy

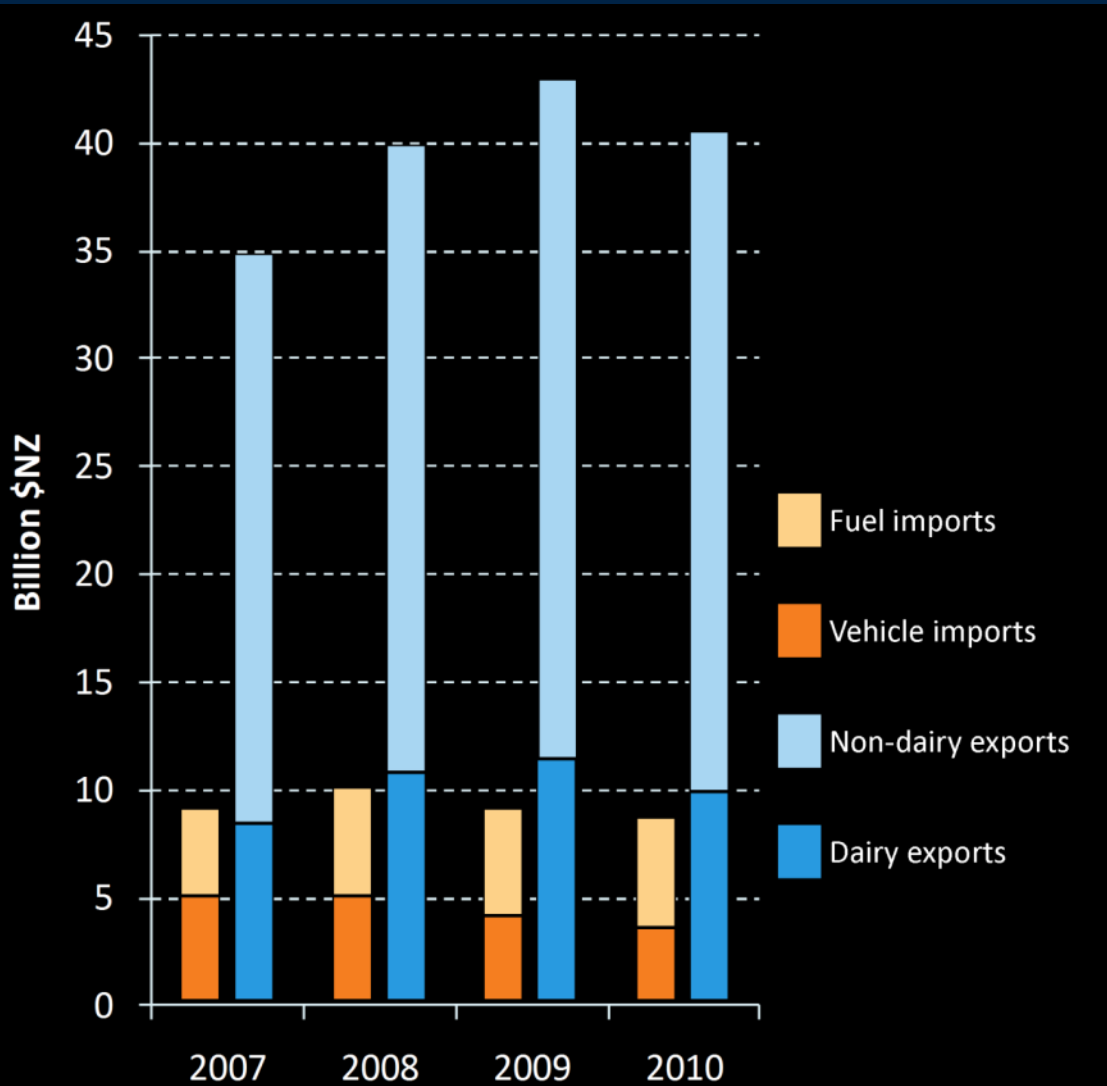
- Overall 221 PJ
 - 99% fossil fuel
 - Road transport 206 PJ (93.3%)
- Passenger Transport 147 PJ (66.7%)
 - Cars and vans 133 PJ
 - Buses 3.5 PJ
 - Rail 0.5 PJ
 - Domestic Air 10.3 PJ
- Freight Transport 74 PJ (33.3%)
 - Road 69.4 PJ
 - Rail 2.6 PJ
 - Coastal Shipping 1.5 PJ

Peak oil and Climate Change: Imperatives for early action



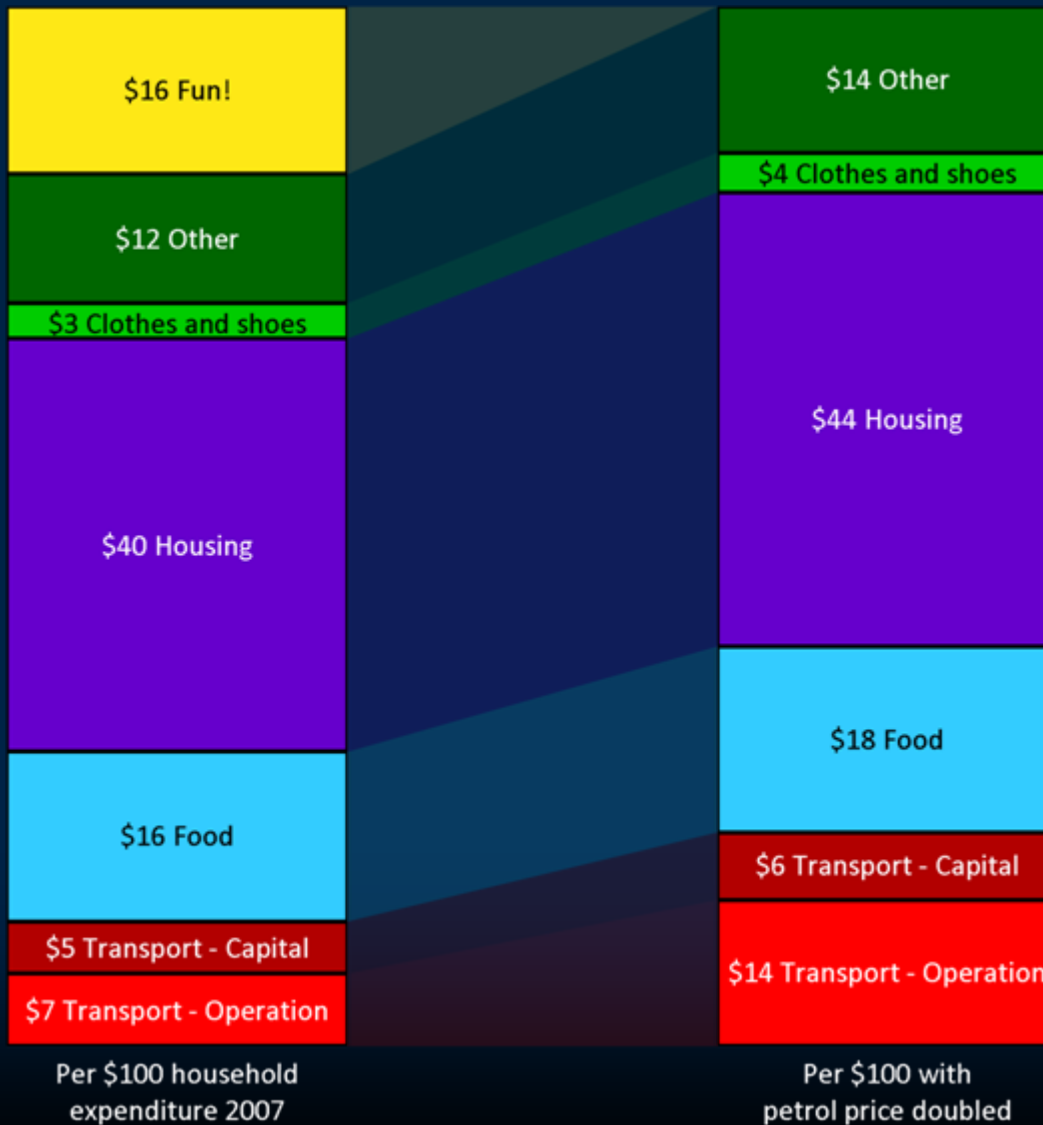
- Peak Oil (or Plateau Oil): A geological rather than market phenomenon.
- Timing is uncertain at a global level but many indications of its imminence.
 - **Falling yields; consumption is 4 X discovery; has occurred regionally.**
- Forecast price rises (\$3-\$10/L) and potential rationing, but very unpredictable.
- Climate Change Response:
 - **Failure to respond locks in uncompetitive high energy paradigm**
 - **Unacceptable trading partner and tourist destination if not part of the collective effort**

National expenditure - Transport imports and New Zealand's exports



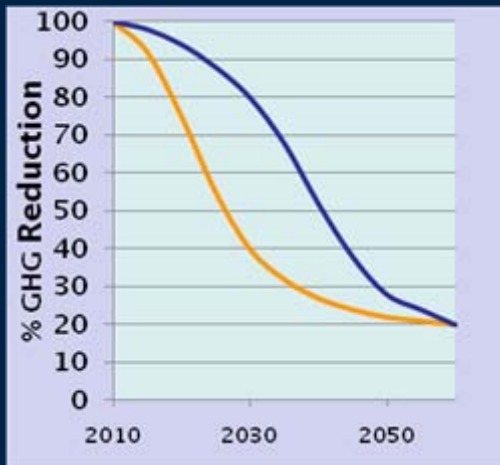
- We import all our transport
- Transport imports = dairy exports
- Sustained high energy costs trigger economy wide inflation
- Ongoing volatility further increases inflationary effect

Household expenditure - \$100



- Doubling of petrol price → +10% economy-wide inflation
- Volatility increases inflationary effect

Weakness of the 2008 NZLTS



- Mixed approach: more walking, PT, bio-fuels, fuel efficient vehicles, electric vehicles.
 - Diffuse goals blur focus. No clear priorities, just “live better”.
 - Can only get part of the way, a 50% reduction but can’t provide higher reductions needed (80%).
 - Many parts slow to implement.
 - Focus more on alternate energy rather than lower energy risks competitiveness
- Current New Zealand investment (\$14Billion) is in Roads of National Significance, not the strategy.

Bio-fuels Pathway

- Current waste streams will provide about 15PJ of liquid fuel.
- A purpose grown forest yields about 1 PJ per 10,000 hectares.
 - Need 2million Hectares (current plantations are 1.5 million Hectares).
 - 25 years to mature.
 - \$ Billions to establish forests + infrastructure + processing.
 - Oil to be US\$180 per barrel to be viable.
- Unfortunately not low cost or low energy, but continues status quo with manufactured fuel.
 - Price will match oil + a premium.
 - Probably will be exported.
 - Environmental impacts and displacement of other land uses at about 1 million Hectares.
 - 20% of GHG embedded in vehicle manufacture.

Electric Vehicles Pathway

- Emerging but at a slower rate than forecast five years ago.
 - Still some technical issues but will be solved
 - Urban speed medium commercial vehicles are available.
- Very fuel efficient to operate.
 - The light fleet needs 40 PJ. Road transport would need 70 PJ about 90% of renewable electricity
- Electric vehicles represent a high cost pathway that will be slow to implement:
 - Standard sized vehicles are expensive and will remain so being priced at a premium and will need to be bought new.
 - Batteries are expensive and probably won't last the life of the vehicle. Some key raw materials may be in short supply.
 - Still high GHG embedded in manufacture.

A More Sustainable Transport Infrastructure

- We should use a time of change to recast the way we live to become a more successful and sustainable society.
- How can the transition be used as an economic solution?
- What are New Zealand's advantages to become a low cost low energy society?
- *Our goal should be a society in which the major portion of personal transport is by electrified public transport or by active modes, & freight is by electrified railways, electric vehicles and bio-fuelled vehicles.*



NZ's advantages to being a low-cost low-energy society



- We have a very large additional renewable electricity capacity (160PJ). 90% of our electricity could come from renewable sources.
- We do not have a vehicle manufacturing sector to shape our responses.
- Many cities are small & readily fit natural distances:
 - Walking (2kms), Cycling (5kms), Conventional PT (12kms)
 - Large parts of our cities were formed in the public transport era.

- The two medium cities (Wellington and Christchurch) are well configured for PT. A more sophisticated PT system is needed for Auckland but it is viable and affordable.
- Rail still connects our towns and cities.

Benefits

- Immediate implementation is possible and therefore risk of high economic impacts via peak oil effects and climate change responses is greatly lessened.
 - Quality PT is an existing technology.
- Energy use is lower.
 - Modern PT can achieve 0.2 MJ per passenger km compared to current car use of 2.0 MJ per passenger km.
 - Old trams (1910)achieved 0.35 to 0.5MJ per passenger.km
- Better use of resources
 - We spend \$3billion per year (\$45 billion every 15 years) on cars which could double if we have to buy new, but use them only 5% of day and for main purpose a few times per month
 - PT can be used all day.

Benefits (continued)

- Household budgets benefit.
 - PT use can reduce household transport expenditure by >50% in contrast to their likely doubling for cars.
- Ability to readily accommodate a growing population of uncertain size as densification is more attractive.
 - 5M ?, 6M ?, 8M ?, by 2050.
- Economic growth is associated with PT and active modes.
 - GDP growth around PT modes is already measureable in Auckland.
- High value immigrants are attracted.
 - Highly liveable low energy societies will attract skilled immigrants and retain local skills.
- Additional productivity gains
 - Travel time can be used productively. Invigorated by walking.

Low-cost, low-energy society: The Energy Supply

- Focus investment in renewable electricity.
- 221 PJ of Petroleum equate to about 60PJ of electrical energy because it is much more efficient.
- 60 PJ extra are needed for electricity to meet the 90% from renewable sources target.

Source	High Probability	High-Medium Probability
Hydro	925MW	1,790MW
Geothermal	365MW	435MW
Wind	2,450MW	4,885MW
Wave		1,750MW
Total	3,730MW	8,860MW (160PJ)

- Sequencing and integrating development of energy infrastructure and transport Infrastructure is critical.

Low-cost, low-energy society: a pathway (1)

- Lead Investment in transport initiates changes in form but over 20-40 year timeframe.
- Bring modern PT network planning to public transport, and allow the city to evolve around this network. Further shape the city by lead public transport investment.
 - **Fast, comfortable and frequent, targeting weekend and evening travel as well as work and education.**
- Move retail back to main street.
 - **Delivery as part of the retail service**
- Decision making probably needs political component as 'predict-and-supply' is less relevant.

Low-cost, low-energy society: a pathway (2)

- Cater for the out-of-town social and recreational travel in ways that avoid car ownership.
 - In the car uptake phase each car owned removed 300 PT trips.
- Ensure rural and small centre populations have access to the fuel efficient and electric vehicles that they need.
- Electrify rail for freight.
 - Heavy freight, and therefore the economics of exports, is highly vulnerable to volatile petroleum prices.
 - Rail links all our main towns and cities and ports.
 - Electric medium sized freight vehicles are viable.
 - Track condition also needs to be upgraded.

More?

- See

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