



Transport, Energy and Urban Form

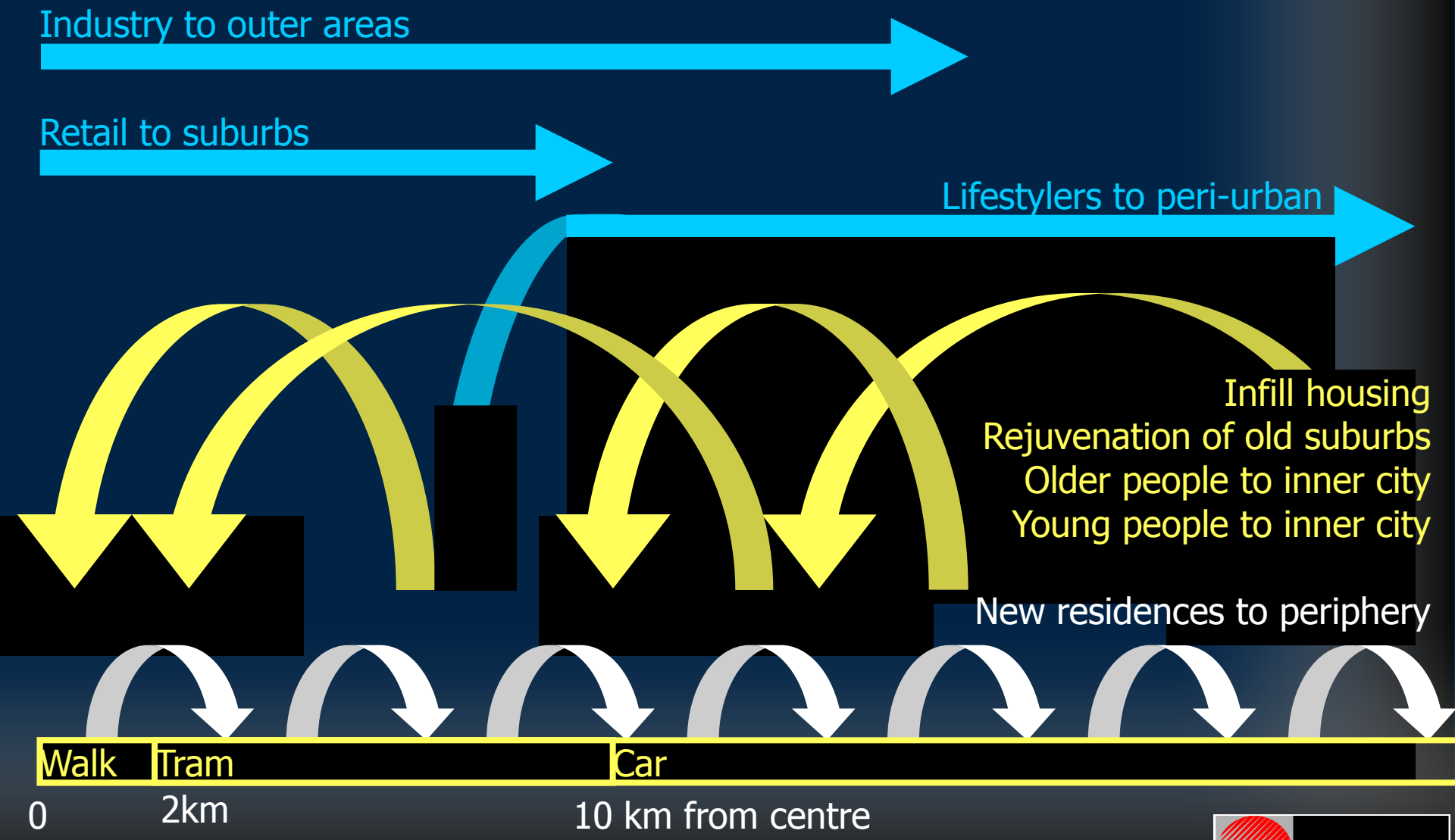
Our Future Transport, Urban Form and the Low Energy Society

Settlement form

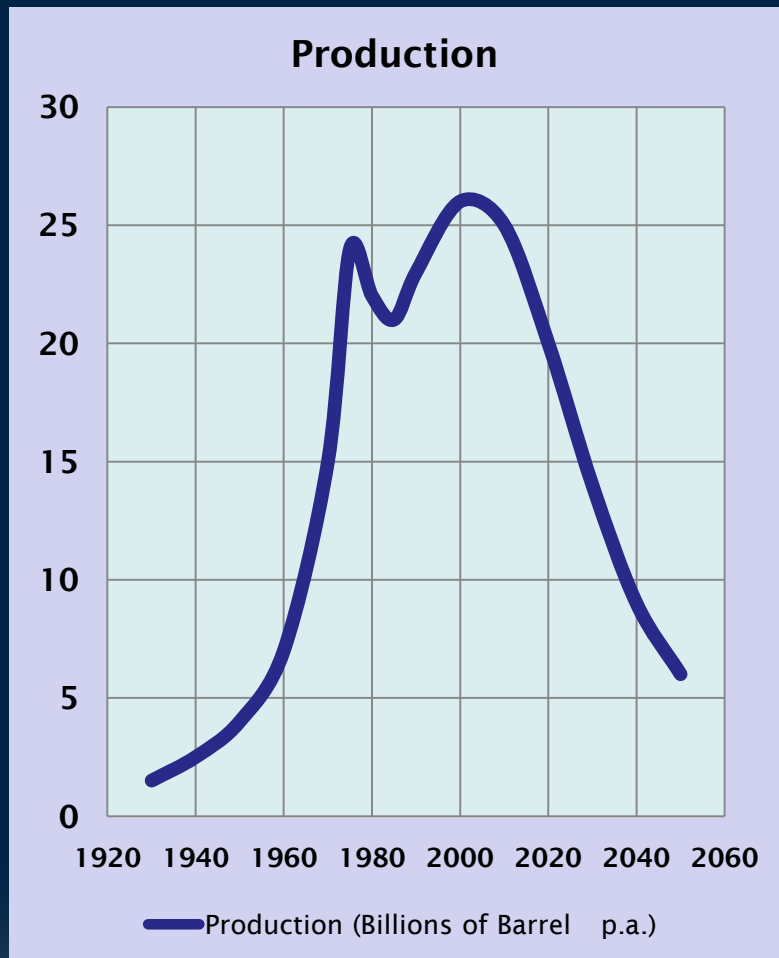
“Cities are an accumulation of past activity which we use modify and add to.”

- Transport networks have a dominant role in form.
- Transport networks enable form and the transport network creates spatial value across the settlement.
- Periodic surges in building activity establish a built form around this transport network, with the spatial value setting up an almost inseparable relationship of land-use and land value.

A static sustainable form is illusionary. Form is dynamic, change in one part of the city can trigger change elsewhere; planning may lead but is often reactionary; the imprint of the past form often remains.

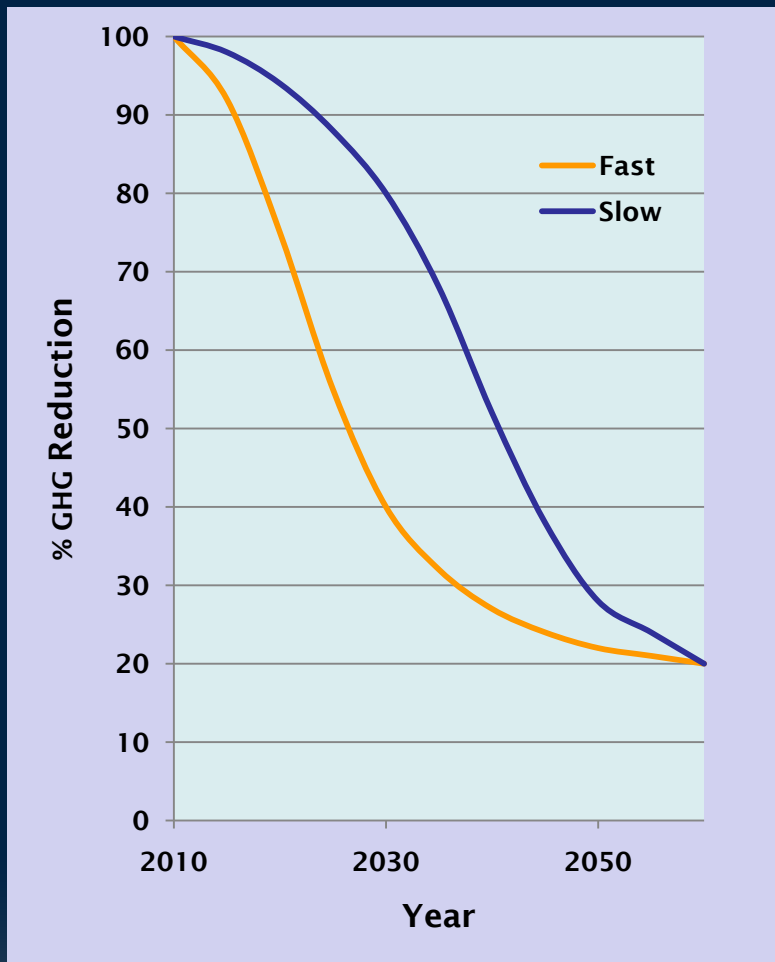


Peak oil: The time of declining production



- A geological rather than market phenomenon
- Already proven on a continental basis. (USA 1969)
- Worldwide: now?
 - 1 trillion barrels used;
Is it 1 or 2 trillion left?
- Consumption is four times rate of discovery.
- Yield is down.
 - Now need 10 times inputs compared to 1950's
- Forecast price rises \$3-\$10/L
- A 15% decline in 10 years = rationing

Climate change and transport



- Current New Zealand goal is 50% per capita reduction GHG by 2040.
- A greater reduction (80%) is likely to be needed.
- Mixed approach: more walking, PT, bio-fuels, fuel efficient vehicles, electric vehicles.
- Current New Zealand behaviour is a 38% per capita increase since 1990 and upward trend continues.
- A fast response is much more effective at reducing GHG accumulations than a slow response

Programme Outcome and Goals

- The outcome that this research contributes to is that we do much more than just cope with the changes needed but instead seize the opportunities that arise from changes to transport energy, to greatly increase the wealth and liveability of our cities.
 - As we move from global to local manufactured energy it is a country's energy profile that will shape economic success.
- The goal of the proposed programme of research is to clarify that dynamic nature of form in a new transport energy context:
 - Determine how the nature of our cities will alter in response to changes in transport and transport energy; and
 - Identify the nature and strength of the driving forces behind this change in urban form.

Economic Outcomes

- Providing the means to identify infrastructure projects that will be less relevant in the future.
- Providing the means to identify building locations that will change in value within a realigned transport system;
- Facilitating densification around mixed land uses, that is already known to increase economic output by 20-40% when properly implemented;
- Revealing how more effective changes to urban form can be leveraged off market forces through the identification of land value thresholds that trigger changes in land use;
- Developing a tool to enable businesses to select preferred locations in relation to future transport networks

Social, Cultural and Environmental Outcomes

- Identifying how the market can facilitate a better integration of residential, commercial and cultural land uses, thereby improving liveability
- Avoiding the possible negative effects of changed urban form, such as character suburbs or city centres being overwhelmed by new development resulting in their heritage character being lost
- Improving environmental performance by minimising negative social and economic impacts that would derail the implementation of environmentally beneficial transport system.

Methodology

- To understand cities as an integrated system our methodology selects four different, but related, areas relating to settlements, and investigate the relationships between them to show them functioning as a dynamic system.
 - **Transport functionality**
 - **Residential location**
 - **Location of Retail and Business**
 - **Governance mechanisms**
- Two scenarios: one based on the transport system that is the 2030 target of the NZLTS; and a scenario with a very strong passenger transport element.
- We use a metropolitan city and a provincial city to frame our studies, ensuring applicability to a range of New Zealand city types.

Research Plan

Research Objective	Timing
1: The Functionalities of Transport Systems.	2009-2012
2: Household Relocation Decisions under Changed Transport Functionality	2009-2012
3: Determine New Zealand's Future Urban Form as Shaped by Changes to Retailing and Commerce	2009-2012
4: Identify Models for Governance Sector and Market Sector Engagement that Deliver Settlements of High Liveability and Economic Growth	2010-2012

Some Transport Decisions 60 years ago

- Scrapped electric trams in 9 cities and gave road space over to cars.
- Changed rail from coal to diesel rather than electric power.
- A road bridge for Auckland harbour made ferry service + PT (10million passengers) obsolete and set up the north shore 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
- Passenger Transport 147 PJ
 - Cars and vans 133 PJ
 - Buses 3.5 PJ
 - Rail 0.5 PJ
 - Domestic Air 10.3 PJ
- Freight Transport 74 PJ
 - Road 69.4 PJ
 - Rail 2.6 PJ
 - Coastal Shipping 1.5 PJ

The alternatives and issues

- Human powered and assisted human powered vehicles
 - Have the range and journey speeds acceptable, but lack comfort and weather protection and ability to take passengers
- Low powered urban vehicles
 - Suitable for urban trips, but are small, may not meet modern safety requirements and do not fulfil many of the reasons people have cars.
- High fuel efficiency cars
 - May be smaller than desired, 20% of lifecycle GHG in manufacture stage, will be more expensive.
- Bio-fuels
 - Direct replacement for existing fuels and vehicles can be used as before.
- Electric Vehicles
 - Energy efficient but still developmental issues to resolve

Alternatives and Issues: Biofuels

- 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
 - Oil to be US\$180 per barrel
- 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

The alternatives and issues (continued) Electric Vehicles

- Emerging but at a slower rate than forecast five years ago.
- The light fleet needs 40 PJ. Road transport would need 70 PJ about 90% of renewable electricity
- Have an acceptable speeds & range of 100-200km so suitable for most trips but not for longer social/recreational trips and holidays.
- Very fuel efficient to operate.
- Slow to recharge; hours not a few minutes.
- Urban speed medium commercial vehicles are available.
- Electric vehicles represent a high cost pathway:
 - Batteries are expensive and probably won't last the life of the vehicle. Some key components may be in short supply.
 - Still high GHG embedded in manufacture.
 - Standard sized vehicles are expensive and will remain so being priced at a premium.

Alternatives and Issues: National impacts

- We import our transport. From 2006-2010 transport imports are equal to dairy exports at \$9.4 billion or 25% of total exports.
 - Transport equipment \$1.8 billion
 - Passenger vehicles \$2.8 billion
 - Crude Oil \$3.6 billion
 - Petrol and Avgas \$1.2 billion
- We are not well placed to absorb big increases in vehicle or fuel prices
- Sustained high energy prices trigger economy wide inflation.
- Transport is currently 14% of household budgets. We spend as much on cars as we do on food.

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



- 90% of our electricity could come from renewable sources. (extra capacity 155PJ)
- 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

- 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 achieved 0.35 to 0.5MJ per passenger.km
- Better use of resources
 - We spend \$3billion per year on cars which could double if we buy new, but use them only 5% of day and for main purpose a few times per month
- Household budgets benefit
 - PT use can reduce transport expenditure by >50%
- Economic growth is associated with PT and active modes
- High value immigrants are attracted
- Additional productivity gains

Low-cost, low-energy society: a pathway

- Focus investment in renewable electricity. 120PJ are needed for 90% re-newables and then for transport.
- Bring modern PT network planning to public transport, and allow the city to evolve around this network. Further shape the city by lead 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**
- 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.

More?

- See

www.successfulcities.co.nz