



**MINISTRY OF BUSINESS,
INNOVATION & EMPLOYMENT**
HIKINA WHAKATUTUKI

Informing the Energy Debate

Sam Thornton – Senior Energy Analyst

Modelling and Sector Trends

Infrastructure and Resource Markets



The plan for today...

1. The role the New Zealand Government plays in the Energy Sector
2. The role of Energy Information and Modelling
3. Key insights from New Zealand's Historical Energy Information
 - “Energy in New Zealand” today
 - “Changes in Energy Use” since 1990
4. What does an Energy modeller do and how do we do it?
 - What is New Zealand's Energy Outlook?
 - How do we “model” the future?
5. Some Key Insights from our Modelling
 - New Zealand’s Energy Outlook – Electricity Insight
 - Oil and gas supply modelling
6. Working for the state



Disclaimer

- This is stuff the team does
- I'm not an expert on everything
- If there is something I don't know I can put you in touch with the right person.



About me

- Grew up in Canterbury
- Studied Energy Studies at Otago
 - Research on Energy use at Fonterra Clandeboye (supervised by Zhifa) - 2007
 - Sitting where you are 7 years ago
- Energy Analyst for three years
 - Energy data. Electricity and prices
- Senior Energy Analyst
 - Energy modelling. Energy Outlook



newzealand.govt.nz



The NZ Government and the Energy Sector



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What areas does the Govt cover in the energy space?

Policy

- Policy analysis
 - Strategic
 - Allocate government funds – e.g. “Vote energy”
 - Legislation – e.g. The Electricity Act 1992

Operations/Regulations

Implementation of government policy

- Market regulators (usually Crown Agency’s)
- In general deal with technical details that may be subject to frequent change.

Statistics/Information

- Official Statistics. Statistics New Zealand
- Sometimes outside Stats NZ as need for



Energy Policy Across Government



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Ministry for the
Environment
Manatū Mō Te Taiao



Otago
Regional
Council



Ministry of **Transport**
TE MANATŪ WAKA



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Energy Policy Within MBIE

Economic Development



- Energy markets
- Energy efficiency
- Fuels and Resources
- NZ Petroleum and Minerals

Building and Housing



- Weather-tight homes
- Social housing policy

Science and Innovation



- PBRF
- National Science Challenges

Labour



- Worksafe
- Immigration



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Grow New Zealand for All



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Energy market regulators

- Electricity Authority
 - The Electricity Authority promotes competition in, reliable supply by, and the efficient operation of, the New Zealand electricity industry for the long-term benefit of consumers.
- Gas Industry Company/MBIE
 - Ensure gas is delivered safely, efficiently and reliably to new and existing customers.
 - GIC strategy is to optimise the contribution of gas to New Zealand.
- Commerce Commission
 - Lots of natural monopolies in the energy sector



Other Agencies

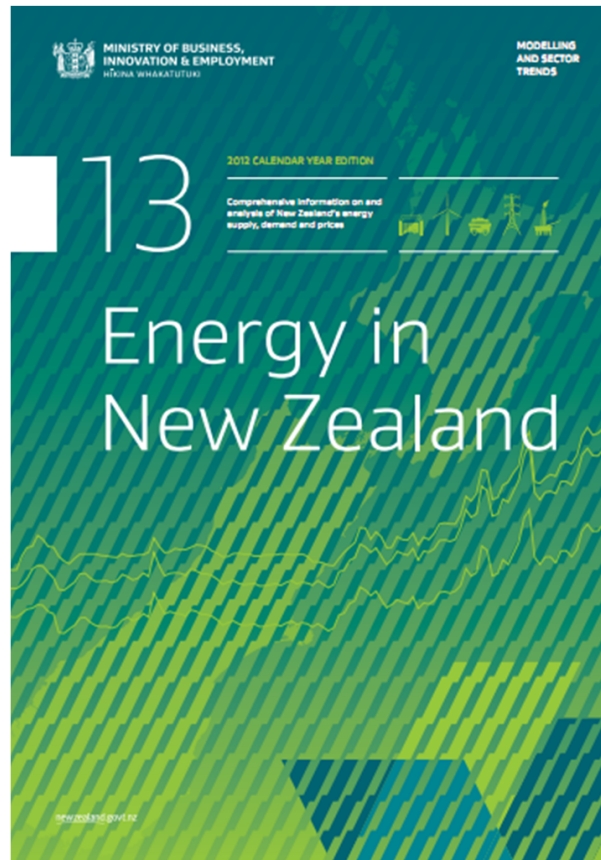


Energy Efficiency and
Conservation Authority
Te Tari Tiaki Pūngao

- Environmental Protection Agency
 - ETS
 - Major infrastructure projects of national significance
 - manages the environmental impact of activities in the EEZ, including prospecting for petroleum and minerals, seismic surveying and scientific research.
- Regional Councils
 - Resource Allocation – hugely important for renewable energy development



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The Role of Energy Information and Modelling



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Informing the Energy Debate – the role of Energy Information and Modelling

1. What energy information do we produce?
2. What is energy modelling? (short intro)
3. How is our information used?



What Energy Information do we produce?

- Our team produces base energy statistics on national
 - Energy supply
 - Energy demand
 - Prices
 - Associated greenhouse gas emissions
- National reporting – government, industry, public
- Fulfil international reporting requirements – IEA, APEC, EAS
- Aid domestic policy development



What is Energy Modelling?

- Projections of energy supply, demand and GHG emissions
- Principal tool used is our SADEM + GEM and VFM
- Do scenarios and sensitivities with a Reference Scenario which assumed no significant changes policy settings, technologies and culture.
- Provide analysis of impact of energy sector policies and scenarios, e.g. emissions trading
- Skills include financial and economic analysis.
- This supports development of energy and climate change policies.



Modelling and Sector Trends – EIM Publications

13 Energy Greenhouse Gas Emissions 2012 CALENDAR YEAR EDITION

Key Messages

- Energy Sector Emissions **37% ABOVE** the 1990 level
- Road transportation is **27% of** all energy sector emissions
- Electricity generation emissions **INCREASE 24%** from 2007

Want a closer look? For more information visit www.mbe.govt.nz or contact the media relations group on 04-800-0000

Changes in Energy Use New Zealand 1990-2011

Introduction

The report presents an analysis of energy use in New Zealand from 1990 to 2011. It covers the energy sector, excluding transport and international aviation and shipping. The report also includes information on energy prices, energy efficiency, and energy security.

Key Messages 1990-2011

- Energy use in New Zealand has increased significantly since 1990, driven by population growth and economic activity.
- Transportation has become a major source of energy use, particularly road transport.
- Electricity generation has become a more significant part of the energy mix.

Want a closer look? For more information visit www.ecga.govt.nz or contact the media relations group on 04-800-0000

New Zealand energy quarterly March Quarter 2014

Inside This Quarterly

- Oil production in the March quarter rose from 1.6 million barrels per day in the December quarter 2013 to 1.7 million barrels per day.
- Electricity generation in the March quarter rose from 1.6 TWh in the December quarter 2013 to 1.7 TWh.
- Renewable electricity generation featured strongly in the March quarter, with renewables contributing 75% of New Zealand's electricity.

Key Indicators	Change in the previous quarter (QoQ)	Change in the previous March quarter (QoM)	Change in the March quarter's average (QoA)
Oil Production	+6.3%	+0.0%	+6.4%
Coal Production	+0.0%	+0.0%	+0.0%
Gas Production	+0.0%	+0.0%	+0.0%
Hydro Power	+0.0%	+0.0%	+0.0%
Electricity Generation	+6.3%	+0.0%	+6.3%
Renewable Share of Electricity Generation	+0.0%	+0.0%	+0.0%

13 Energy in New Zealand 2012 CALENDAR YEAR EDITION

Comprehensive information on the energy sector in New Zealand

NEW ZEALAND'S ENERGY OUTLOOK Electricity Insight

Exploring the uncertainty in future electricity demand and supply

Preview of key insights:

- Lower demand growth and excess supply should put strong downward pressure on prices for the next decade (see pages 7 and 10)
- Electricity emissions likely to reach close to 1990 levels by the mid-2020s (see page 9)
- Geothermal energy is key potential limiting price increases (see pages 8 and 10)

New Zealand's Energy Outlook 2011 Reference Scenario and Sensitivity Analysis

Key messages from the Reference Scenario and Sensitivity Analysis

Reference Scenario

- Electricity demand is projected to grow at a slower rate than in the past.
- Electricity prices are expected to decline significantly over the next decade.
- Renewable energy will continue to be a major source of electricity generation.

Sensitivity Analysis

- Electricity prices could be higher or lower than in the reference scenario.
- Renewable energy generation could be higher or lower than in the reference scenario.

Who uses our stuff?

- Within govt.
 - Energy and emission forecasts critical to many energy policy issues, e.g. ETS, electricity market review, Kyoto protocol position, petroleum exploration
 - Highlights emerging policy issues, informing policy development process
- Outside govt.
 - Energy industry and commerce, investment banks, media, researchers, general public...



Keeping an eye out...

- Ensuring information is comprehensive by monitoring energy sector developments
 - Solar PV
- Ensuring we are geared up to provide analysis of emerging energy technologies/policy developments
 - Biofuels
 - Transport mode





Marsden Point Oil Refinery at night

Energy in New Zealand Today

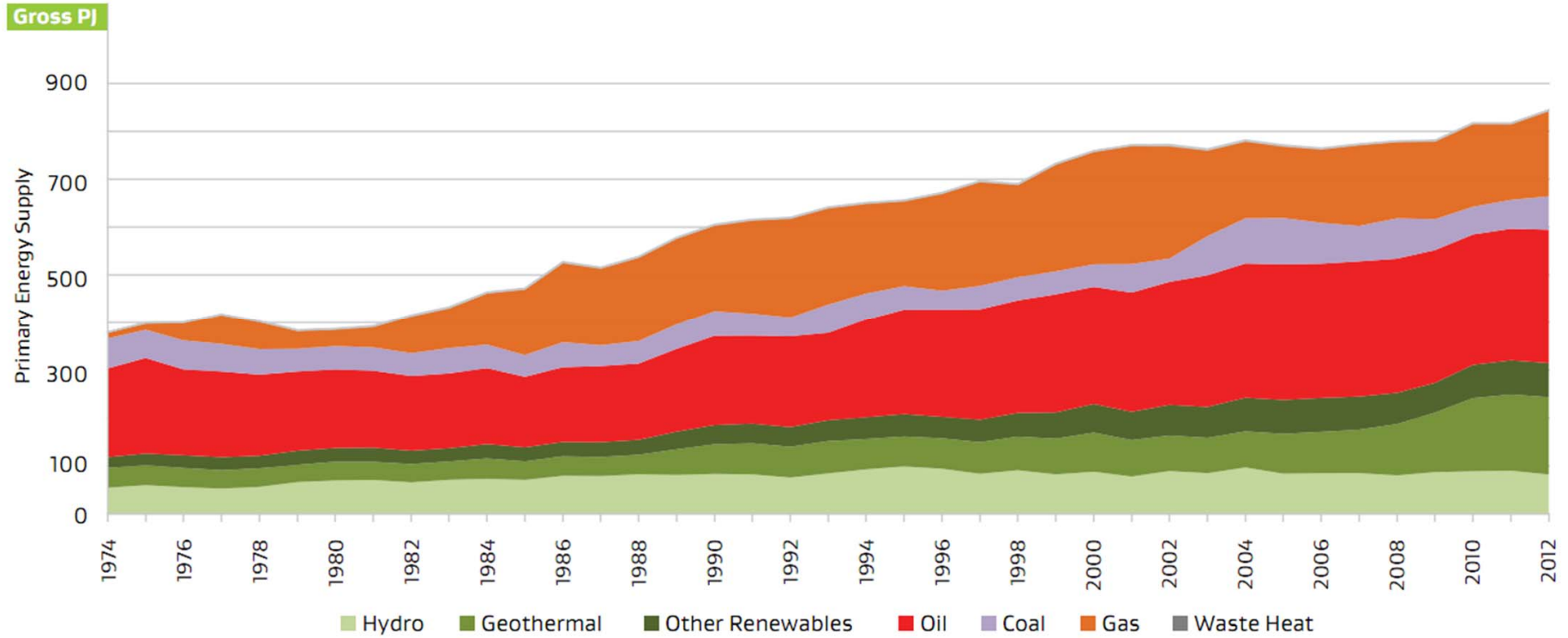


New Zealand's Energy Resources

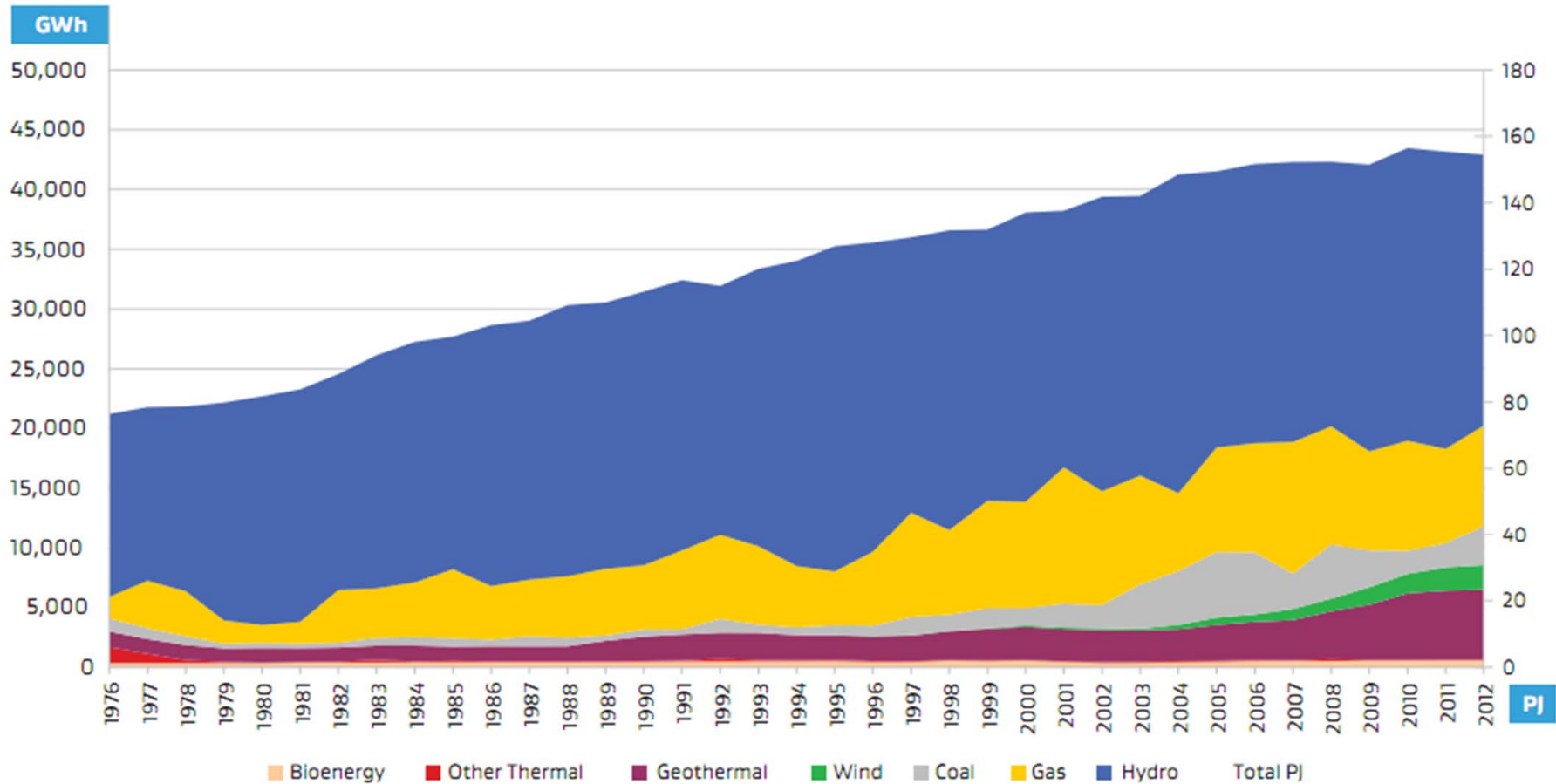
- Fossil fuels
 - Gas and oil currently limited to Taranaki
 - Most gas used for electricity in the past. Now Methanex?
 - Oil production in 2012 equated to 31% our oil product demand.
 - Coal. Large lignite (largely undeveloped) and other coal reserves.
- Renewables
 - World class hydro the backbone of our electricity system
 - World class wind and geothermal energy resources. Back of the envelope - enough already consented to cover 30 years of electricity demand growth at 1% per annum.
 - Large biomass resources – Use currently restricted to wood processing sector and smaller niche applications e.g. ¼ of the Dunedin Energy Centre.
 - Ok solar in the scheme of things (better than Germany)



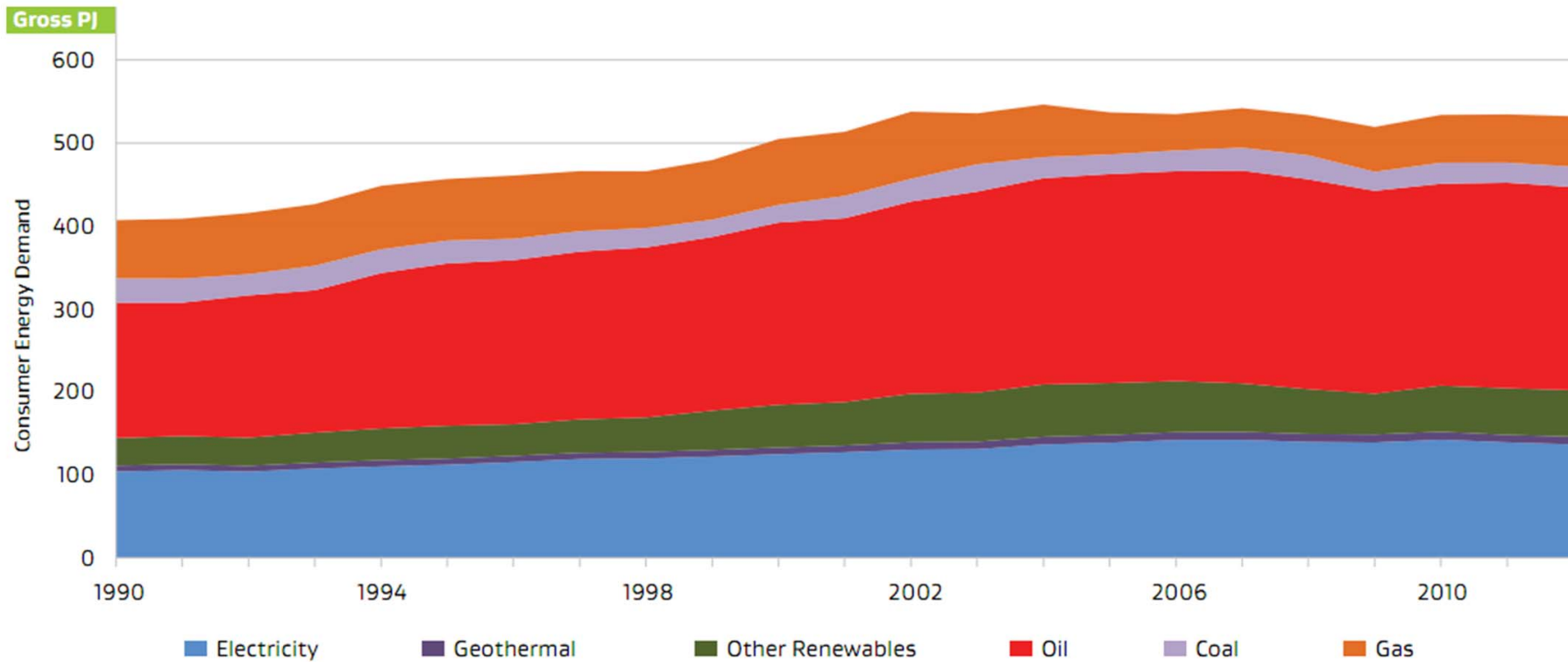
Primary Energy Supply



Hydro the backbone of electricity supply...

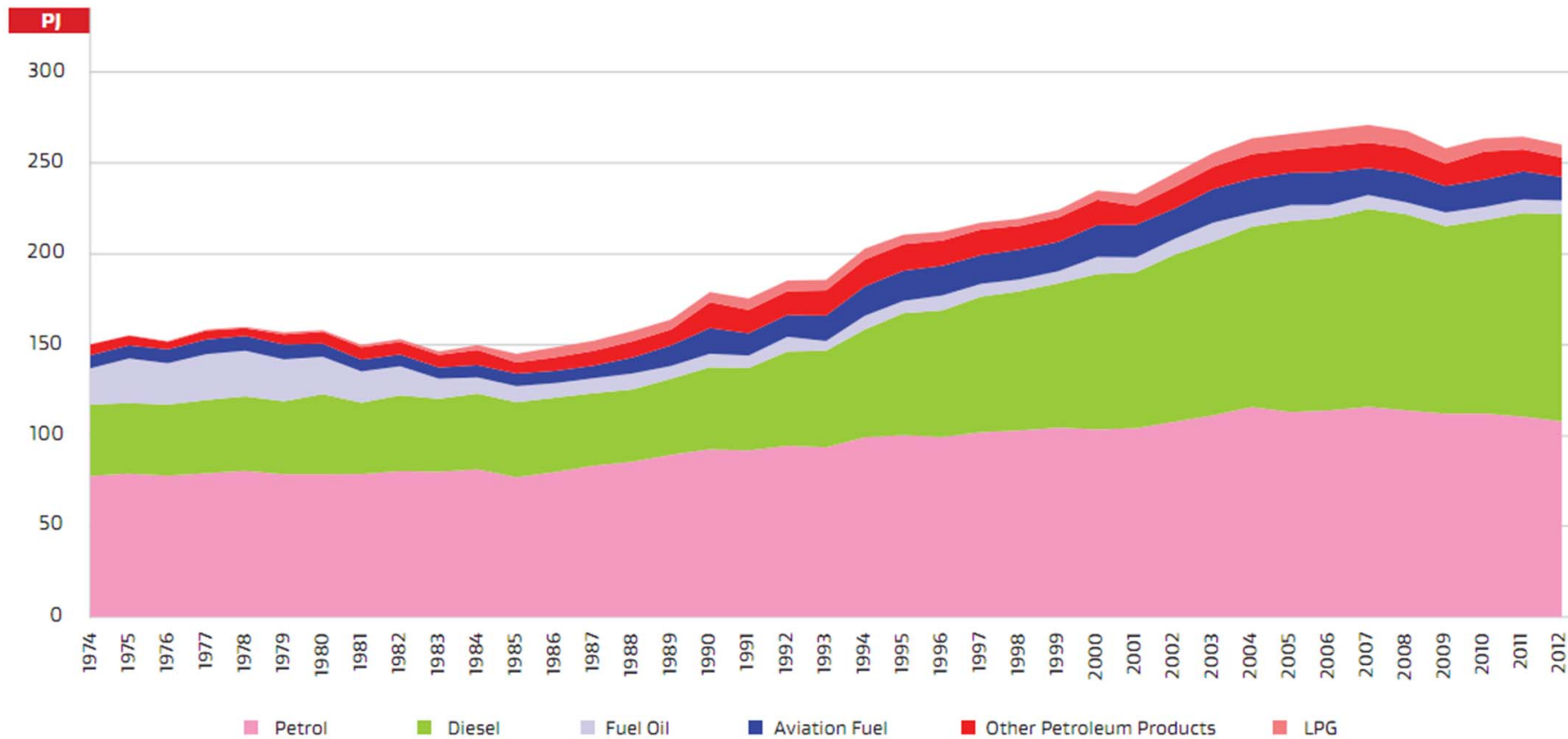


Consumer Energy Demand

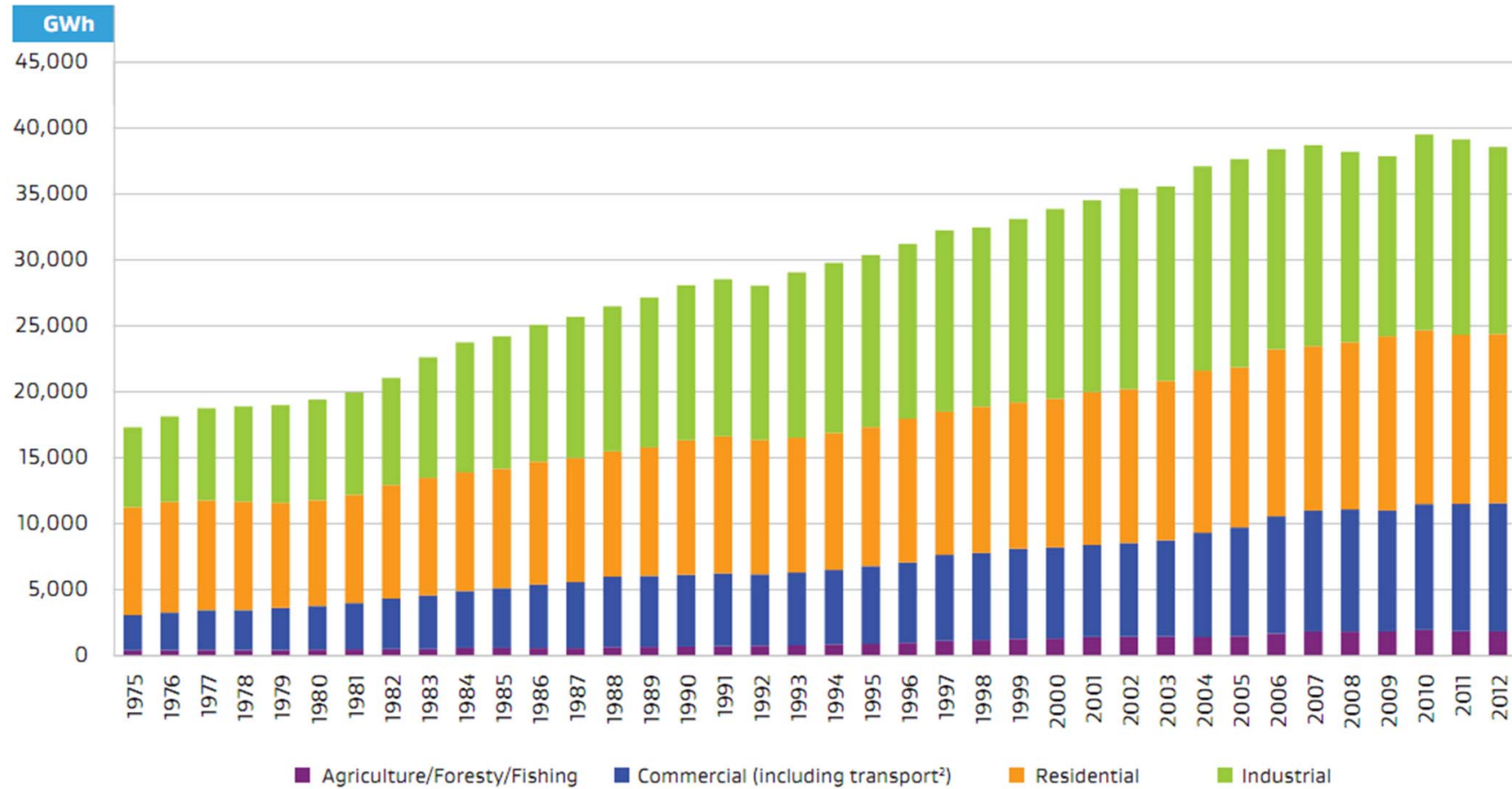


What's happening to Transport fuel demand?

Observed Oil Products Consumption

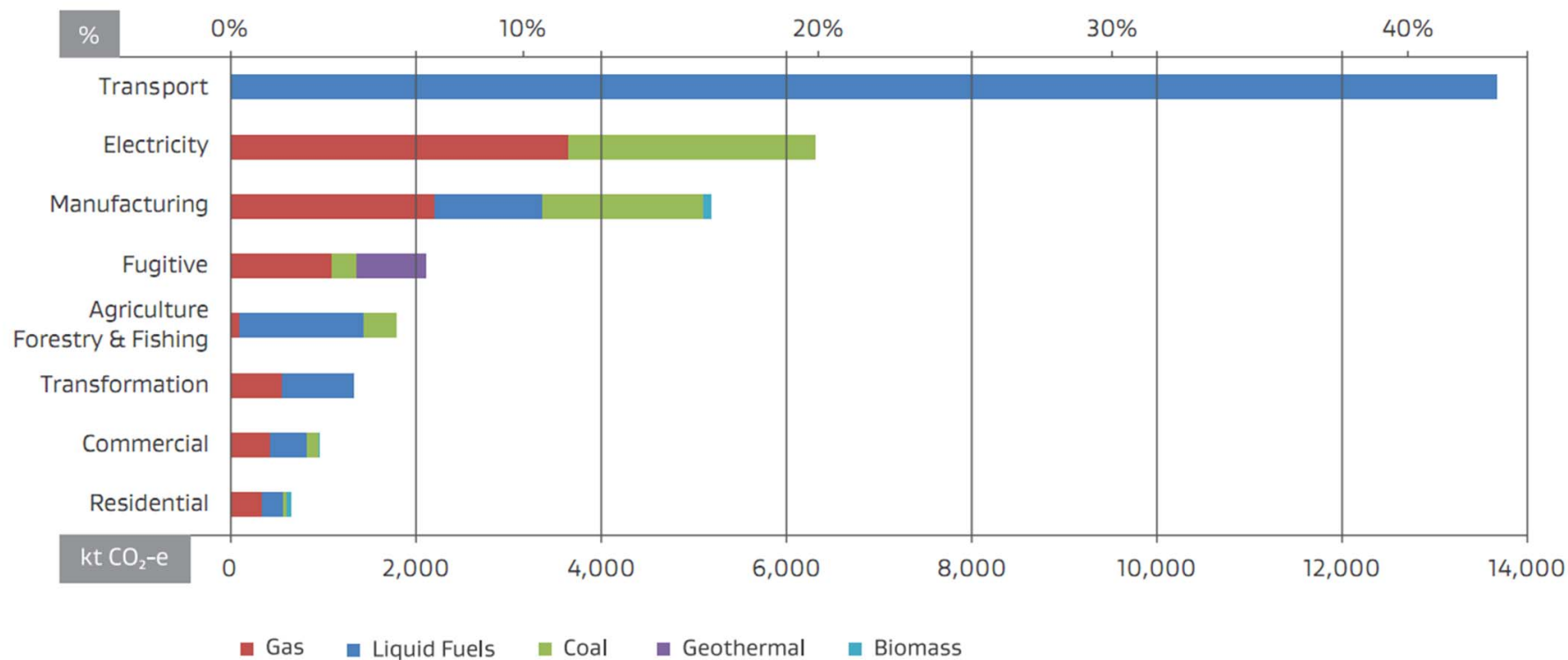


What about electricity demand?



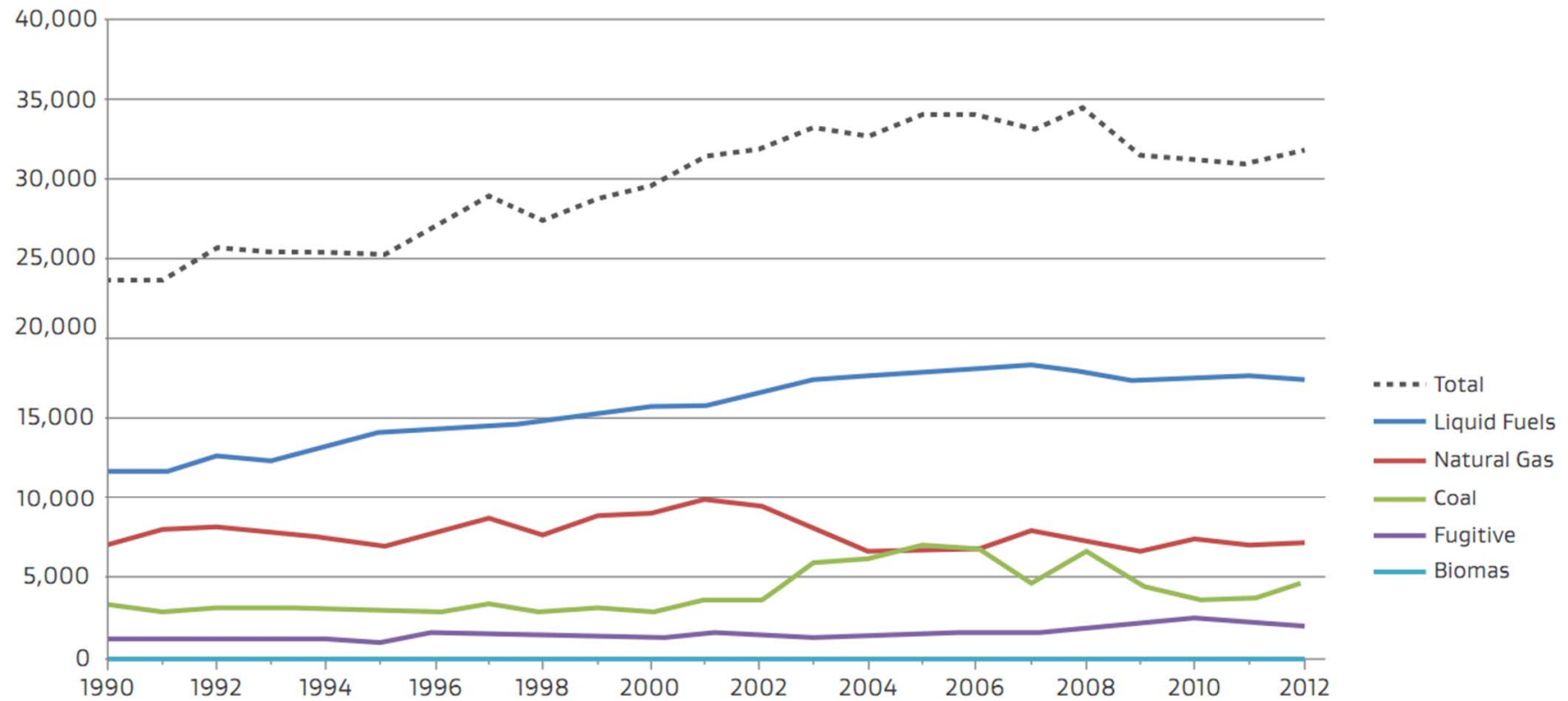
What about Energy Sector GHG Emissions?

FIGURE 1A: Energy Emissions by Sector 2012 (kt CO₂-e)



Energy emissions over time

FIGURE 3: Energy Emissions by Fuel Type (kt CO₂-e)





Explaining Changes in Energy Use since 1990



Changes in Energy Use: 1990 – 2011

- *Changes in Energy Use – New Zealand 1990-2011*: report was released September 2012 which explores what has driven energy use since 1990
- Four 'sectors' with a common activity measure: Business; Residential; Freight Transport and Passenger Transport

Method is to use Logarithmic Mean Divisia Index (LMDI) to isolate:

- the effect of energy efficiency from
- economic, demographic and technical driver

$$\Delta\text{Energy} = \Delta\text{Activity} + \Delta\text{Structure} + \Delta\text{Fuel Switching} + \Delta\text{Efficiency}$$





Transport

Freight

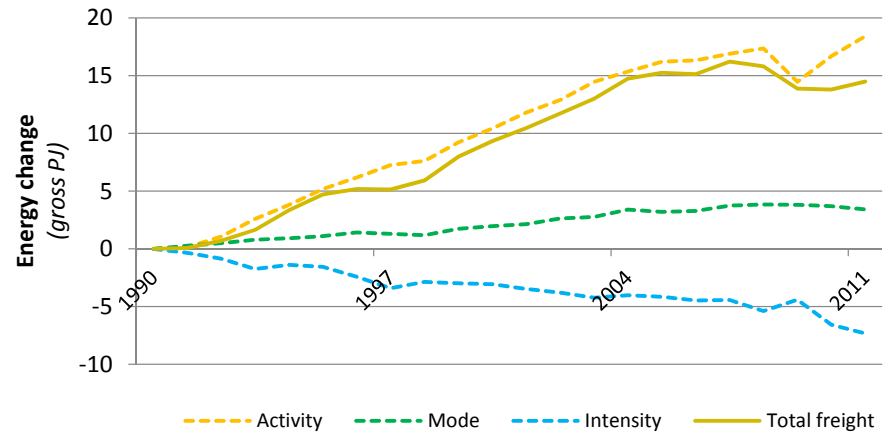
The more you move, the more you use...

67% of tonne-km freight was by road in 2011)

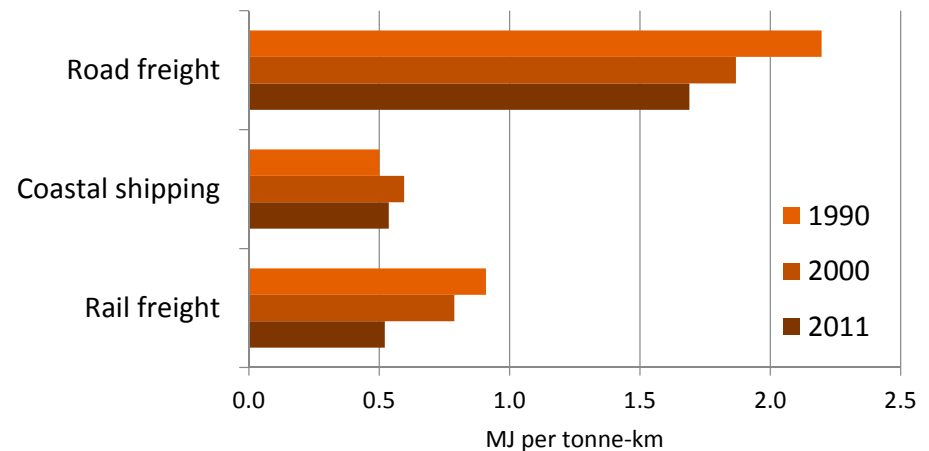
Energy intensity improving for road and rail

- more on the vehicles
- more efficient vehicles

Freight energy-use changes by effect



Freight mode intensity comparison





Transport *Passengers*

Demand pushed up by:

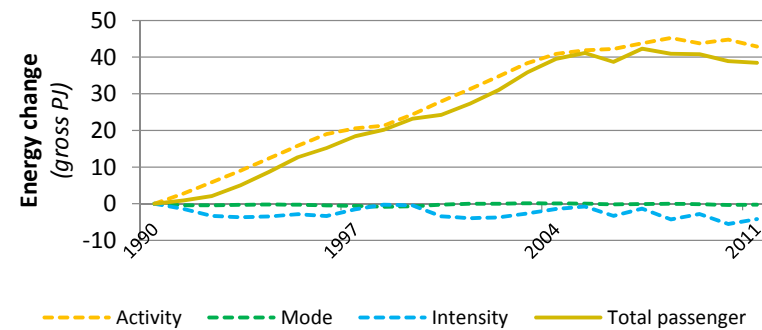
- Activity (i.e. more 'passenger-kilometres' travelled)

Demand pushed down by:

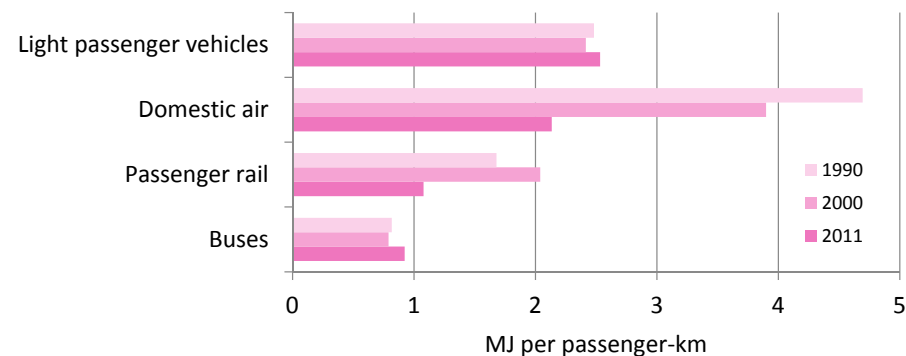
- Big energy intensity improvements in domestic air travel and passenger rail due to operational efficiencies and better load factors

Interesting fact: in 2011 the energy intensity of domestic air travel was slightly less than that of car travel

Passenger energy-use changes by effect



Passenger mode intensity comparison



Changes in Energy Use

Business



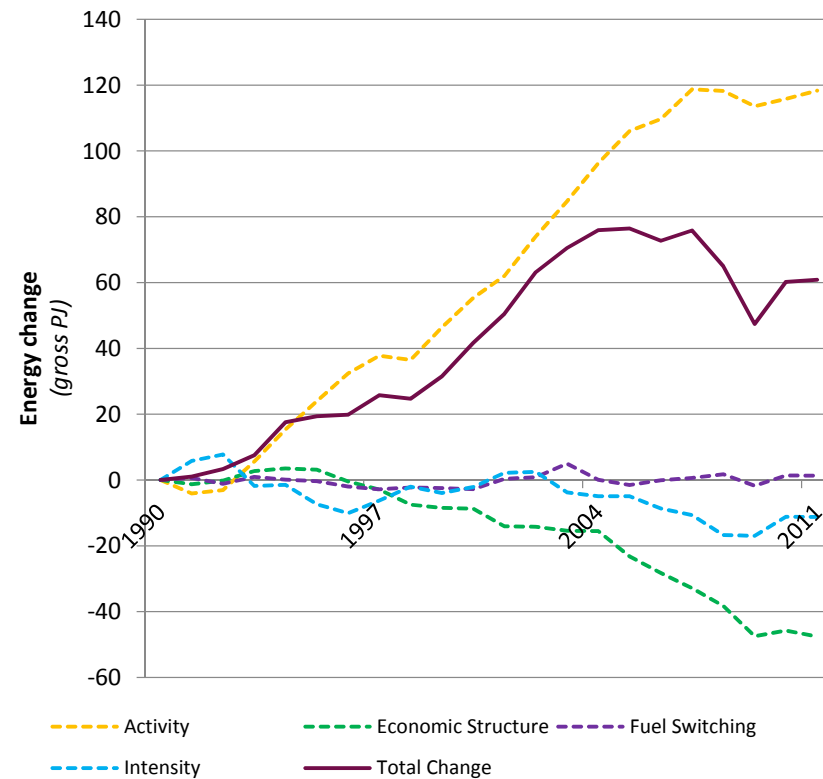
Demand pushed up by:

- Economic activity

Demand pushed down by:

- Structural change in the economy
- Improvements in the energy intensity of many of the industries within the business sector

Business sector energy-use changes by effect



Changes in Energy Use

Residential



Demand pushed up by:

- Population growth
- Fewer people per dwelling
- Bigger dwellings

Demand pushed down by:

- Fuel switching
- Intensity improvements due to technology improvements in household appliances, improved housing stock, and conservation due to increased energy prices

Residential energy-use changes by effect

