Gas supply and demand study

Stakeholder workshop

18 May 2012

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Agenda

1. Recap on scope of study

2. Supply scenarios
   - Outline preliminary findings
   - Explain analysis framework and key results

3. Demand scenarios
   - Outline preliminary findings
   - Explain analysis framework and key results

4. Discuss next steps

Study – scope and elements

- **Objective of study**
  - Develop framework and toolset to project possible future gas supply and demand over 15 year time-frame
  - National study – but particular focus on capacity issues for Vector 'North system'

- **Components of study**
  - Supply scenarios
  - Annual gas demand scenarios
  - Peak gas demand modelling

For these issues, today's presentation focuses on the North system

Part I: Supply scenarios

Preliminary findings – supply issues

Availability of gas supply

- NZ unlikely to 'run out' of gas in next 10-15 years, as a number of factors operate to maintain broad state of balance between supply and demand
- Real issue is not availability of gas – but the price at which gas is available
- For planning purposes, relatively simple scenarios are sufficient
  - high, central, low gas price scenarios

Location of gas supply sources

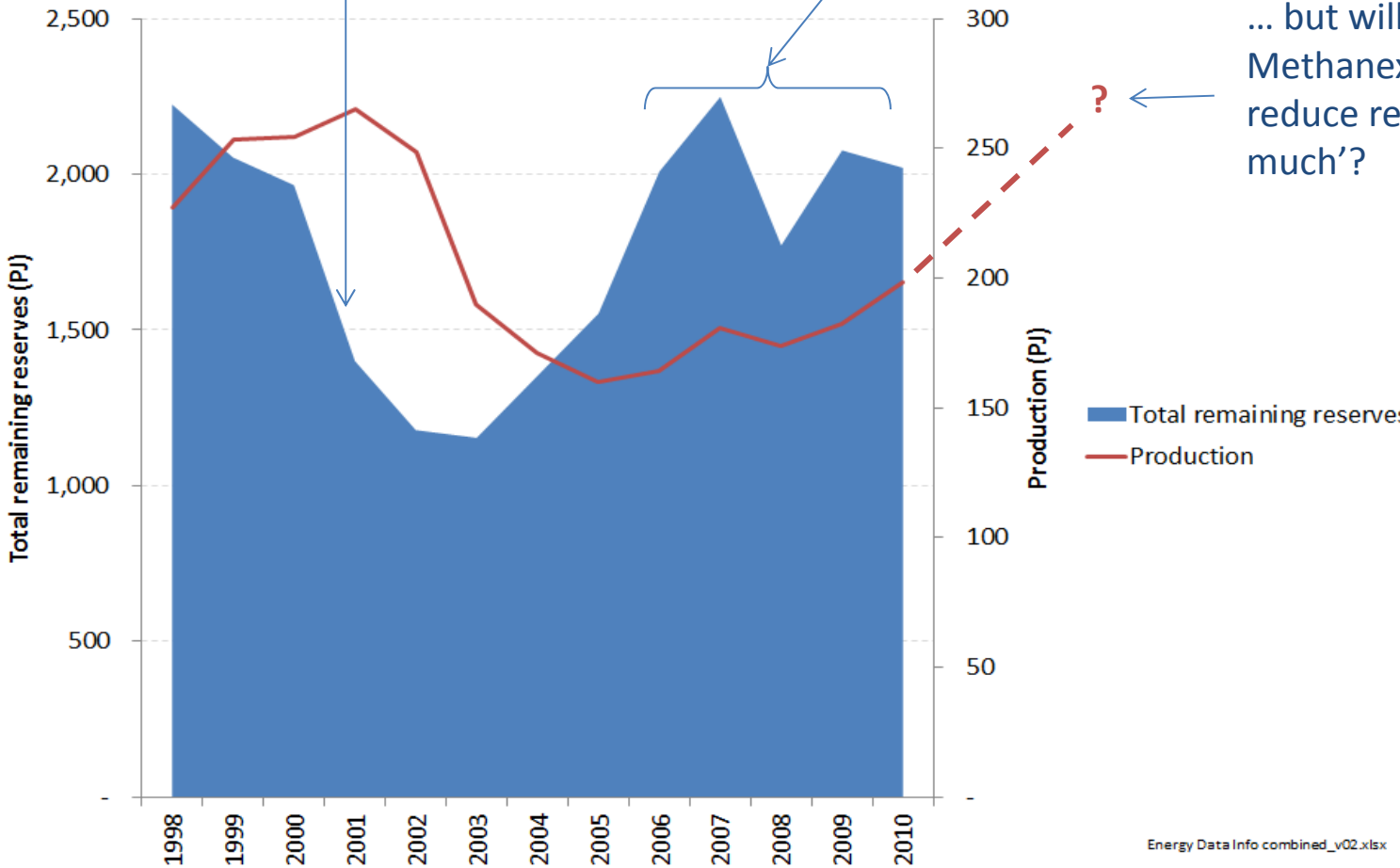
- All gas production is currently in Taranaki
- Potential exists for finds in other locations and/or import into different region
- But development lead times and economics of importation make it very unlikely that gas will be sourced from outside Taranaki in next 10-15 years
- Expect northward flow along pipelines in upper NI for next 10-15 years

New Zealand's changing reserves position

Maui re-determination dropped NZ's reserves 'overnight'

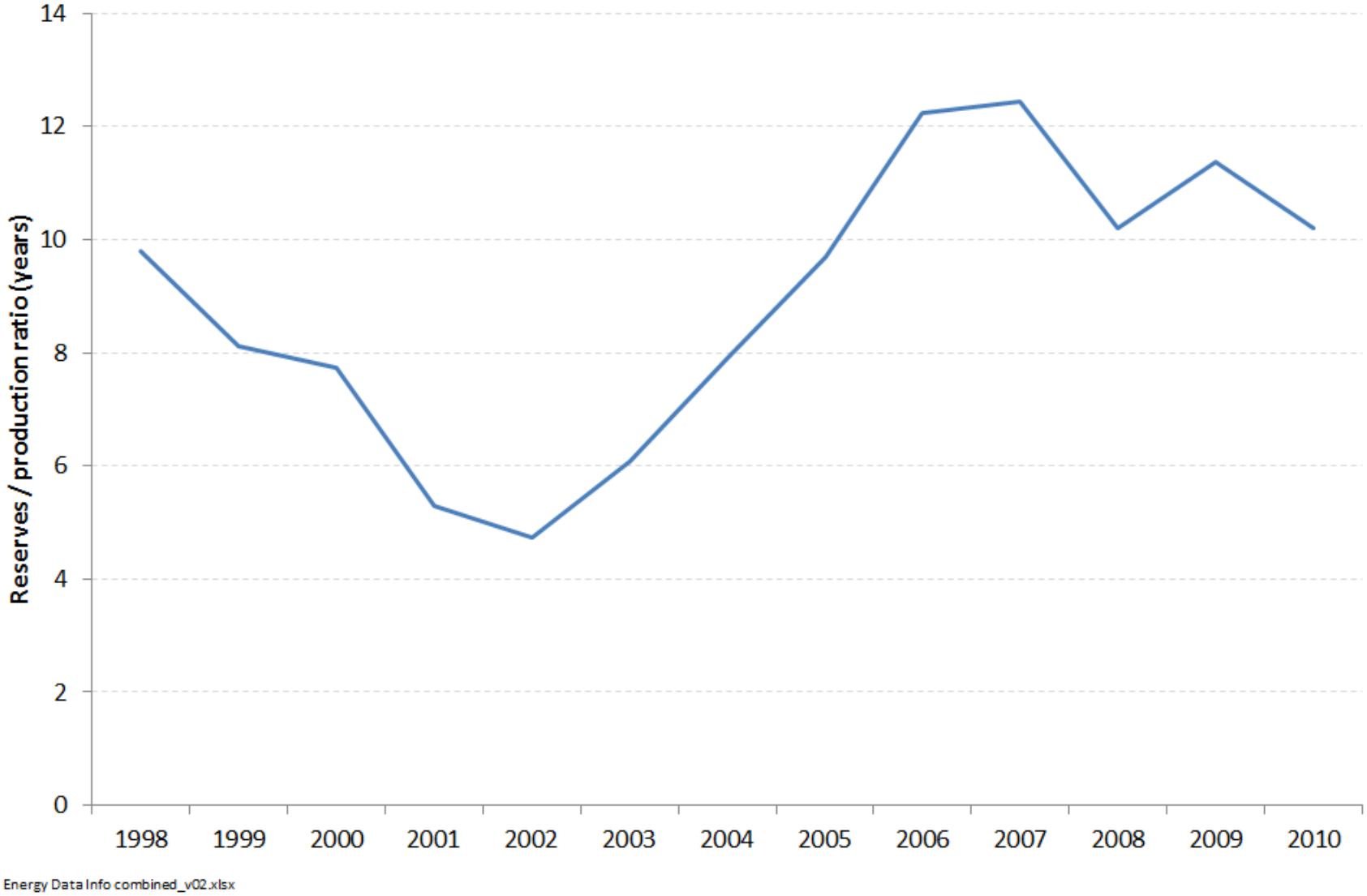
New fields (particularly Pohokura, Kupe and Turangi) have improved matters…

… but will an increase in Methanex consumption reduce reserves by 'too much'?



NZ's long-term gas supply position appears uncertain

New Zealand's reserves to production ratio

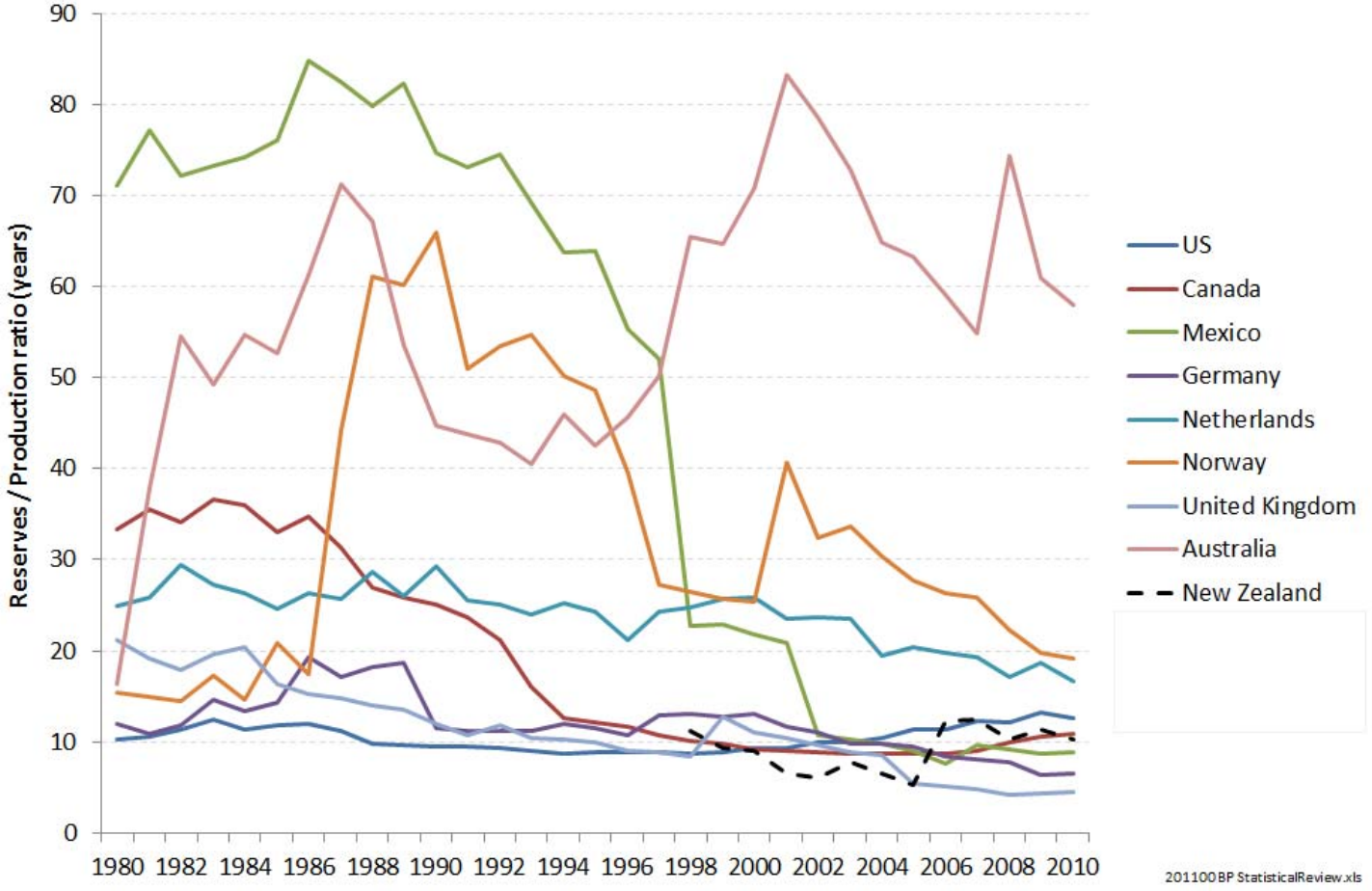


Energy Data Info combined_v02.xlsx

Although the RTP ratio has improved, there are still concerns it is 'too low'

Based on P50 (a.k.a. "proven & probable", or "2P") reserves

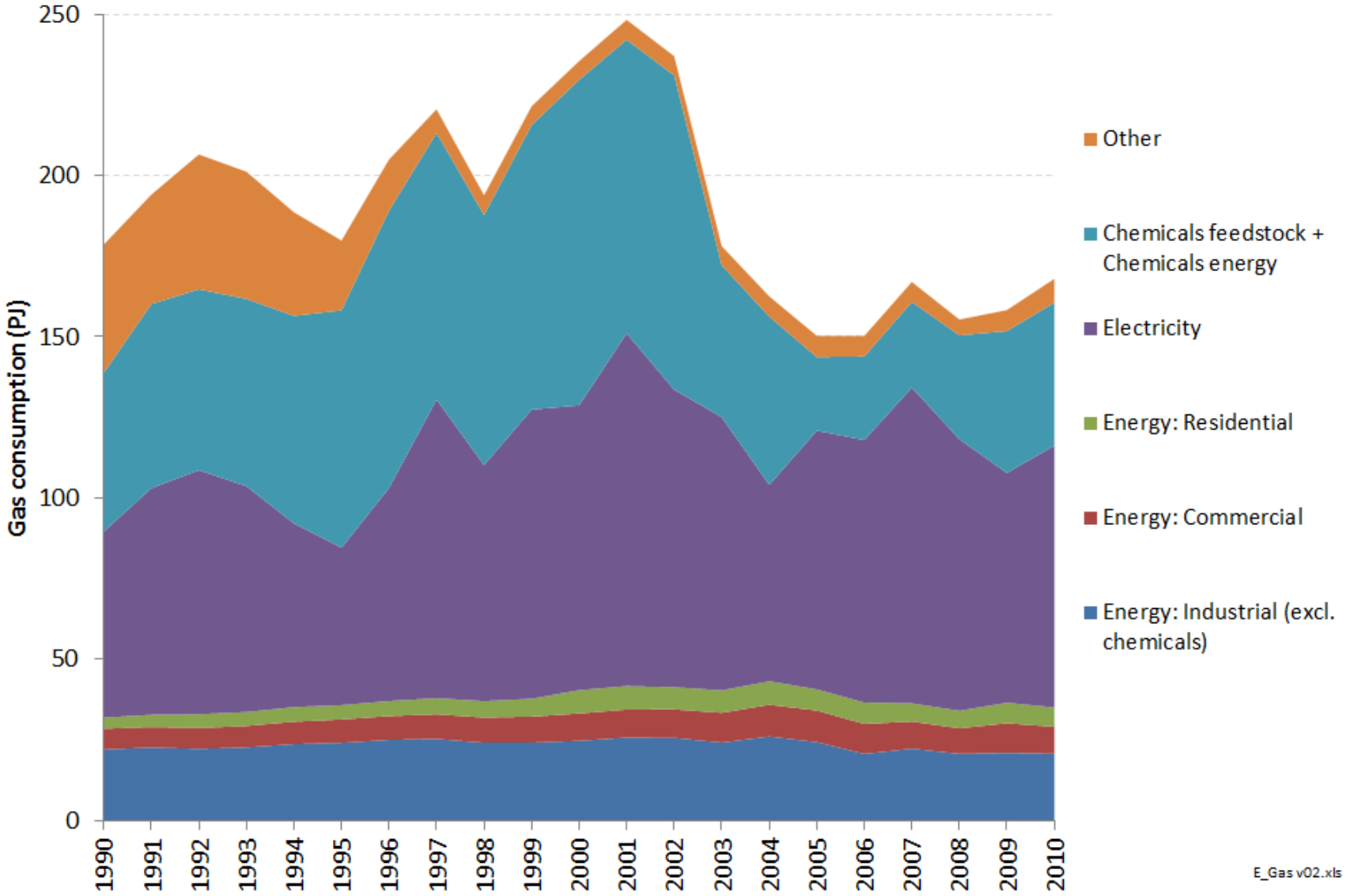
International reserves to production ratios



- Countries with high RTP ratios tend to increase exports or raise demand (& v.v.)
- RTP ratios tend to converge around 10-20 years in markets that allow trade

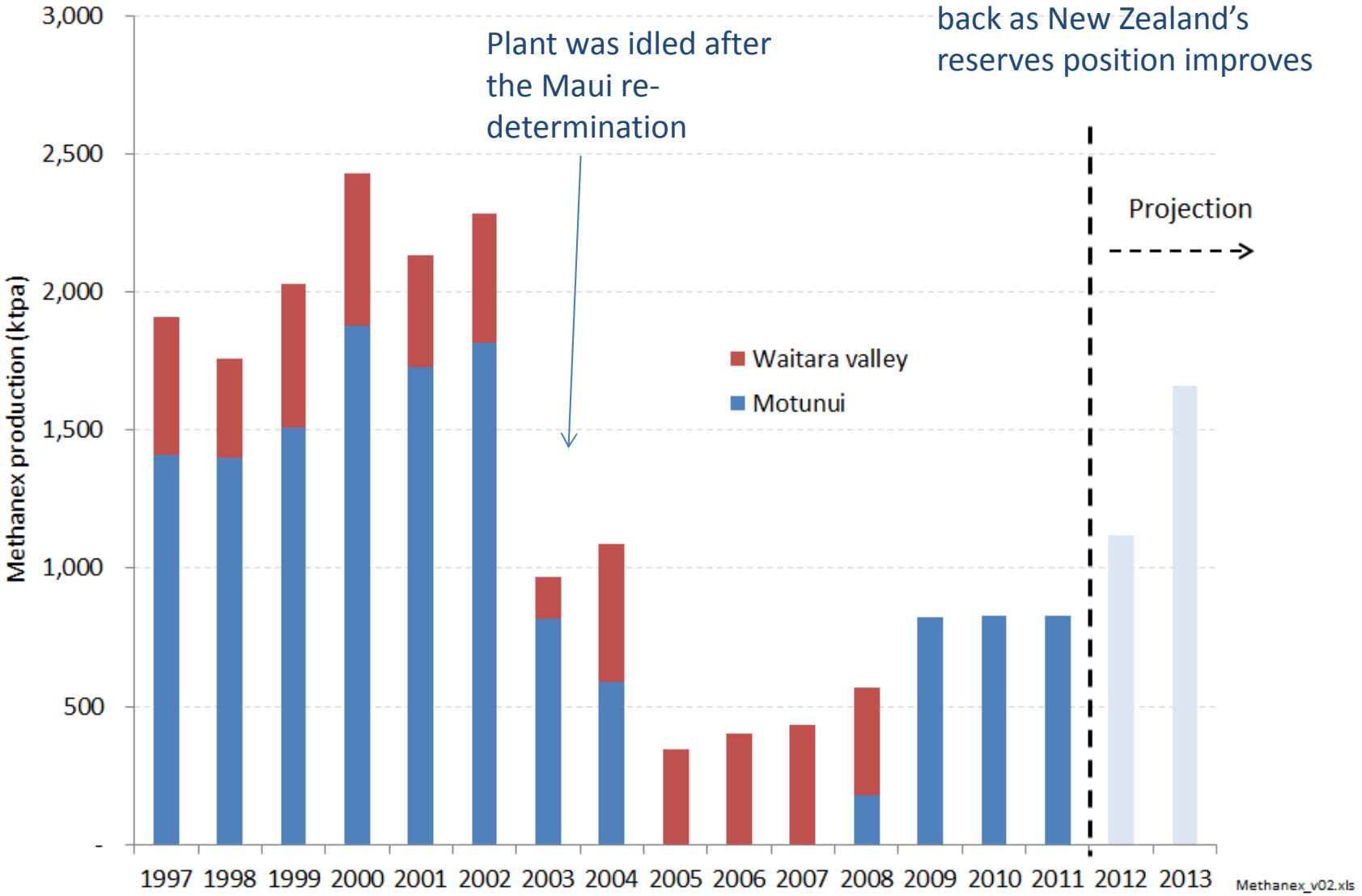
NZ's RTP ratio is not atypical by international standards

New Zealand gas consumption



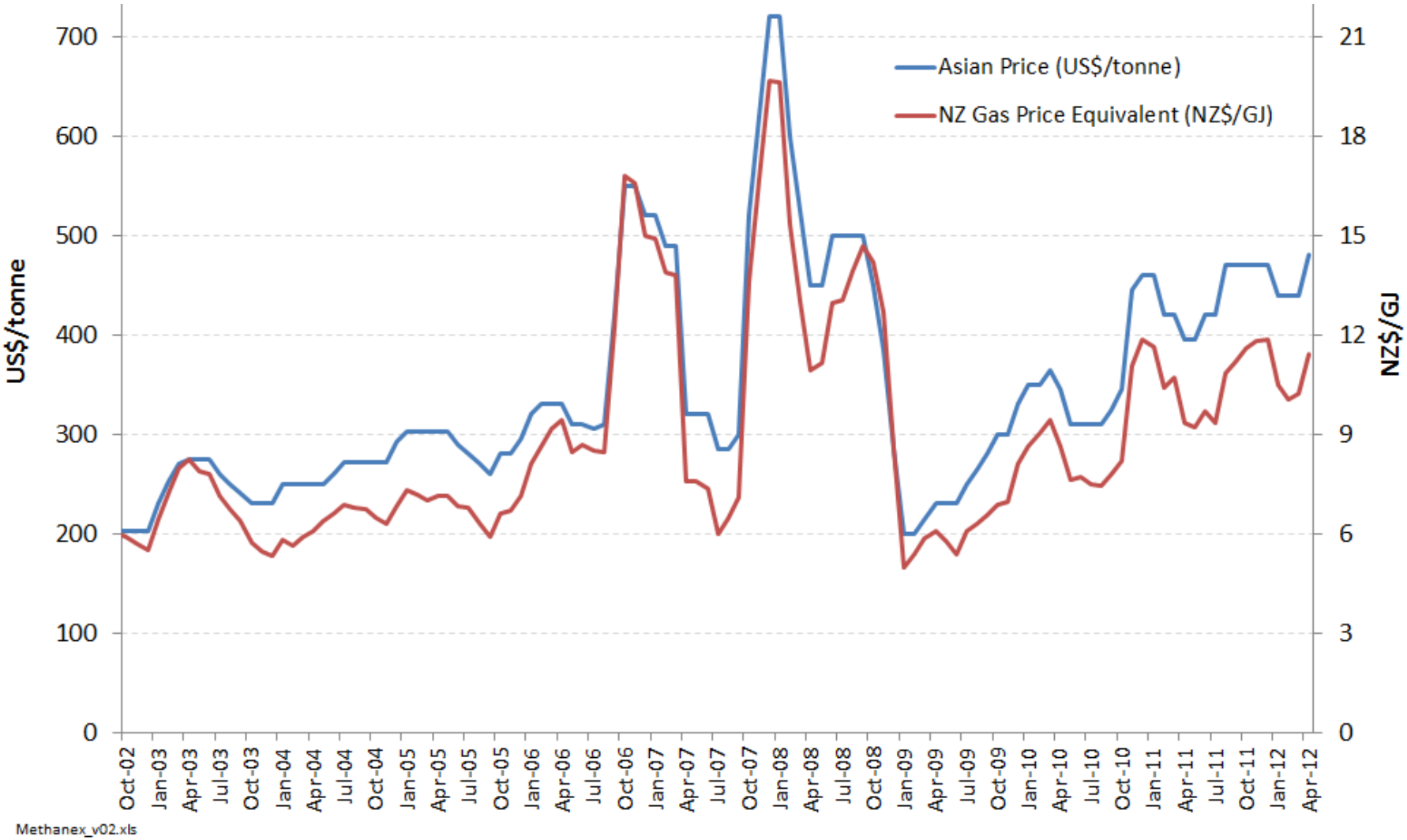
Some gas users likely to 'swing' to reflect reserve position

Gas demand for methanol production



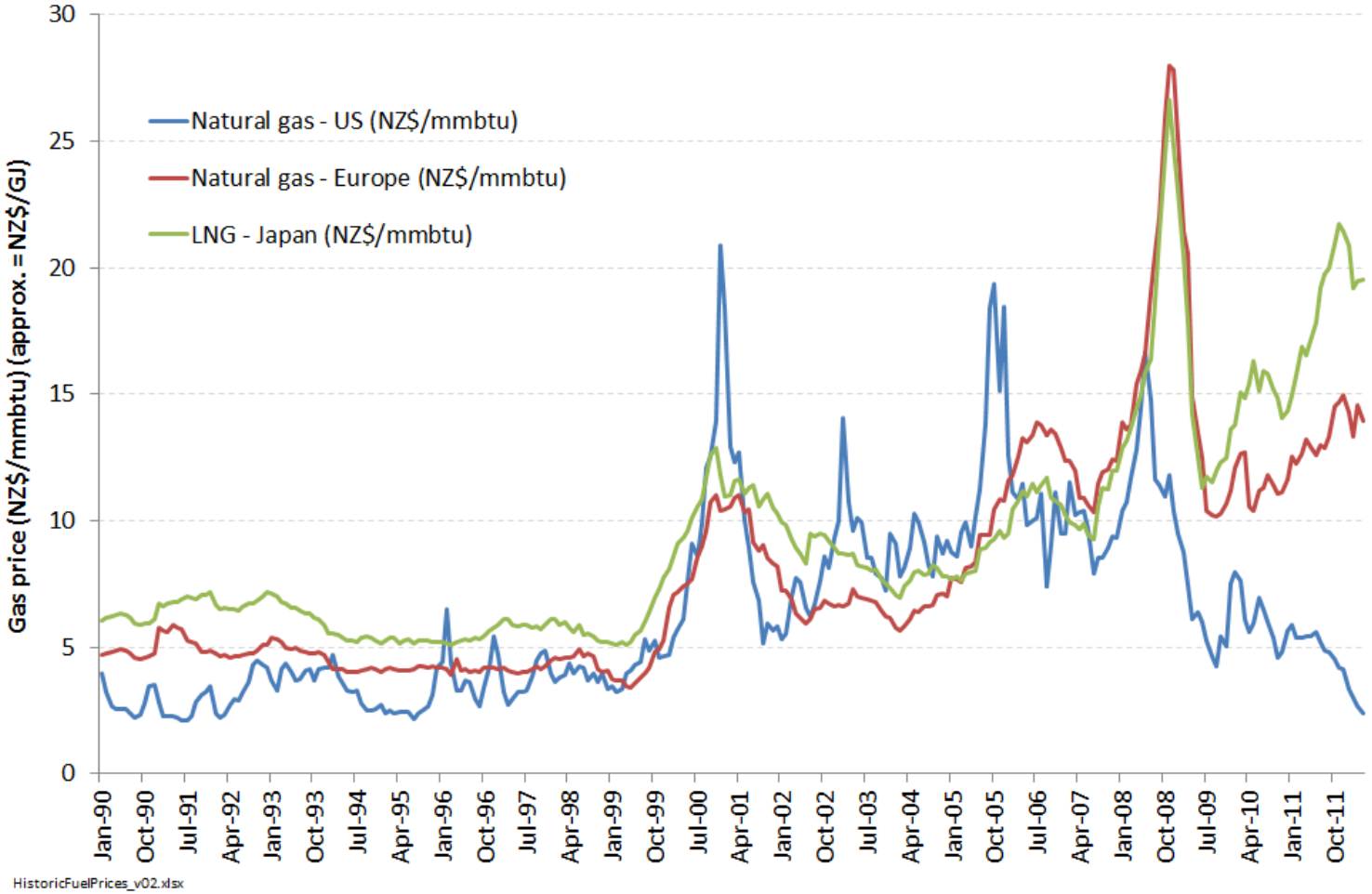
Methanol production changes to match NZ reserves position

Methanol - short term gas netback



Methanol prices mean Methanex may have a relatively high *ability* to pay…

International gas prices

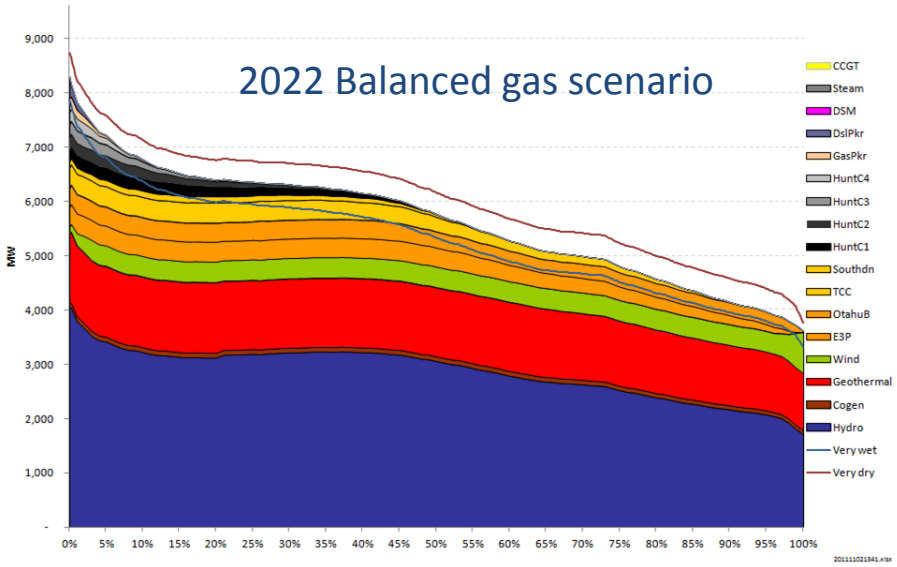


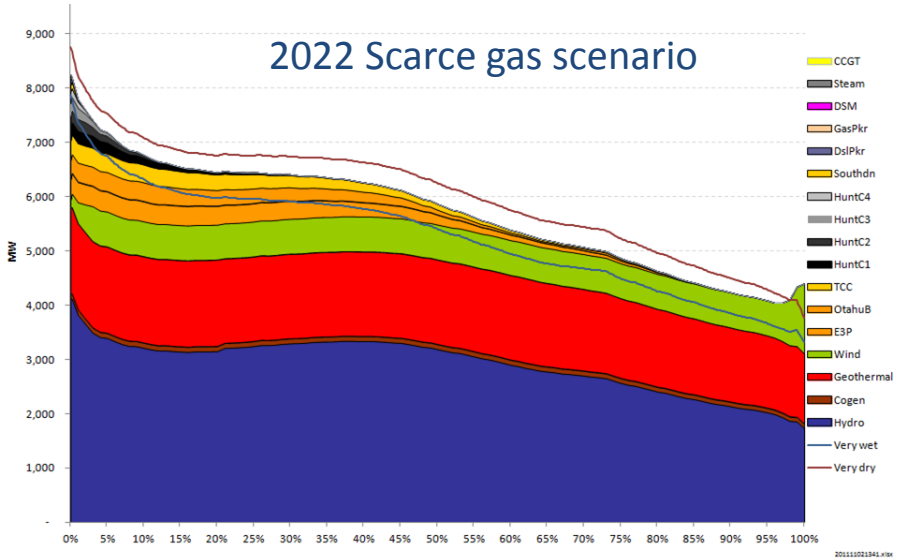
- International gas prices feed back into NZ market via Methanex willingness to pay

... low US gas prices limit Methanex's *willingness* to pay

NZ power generation mix

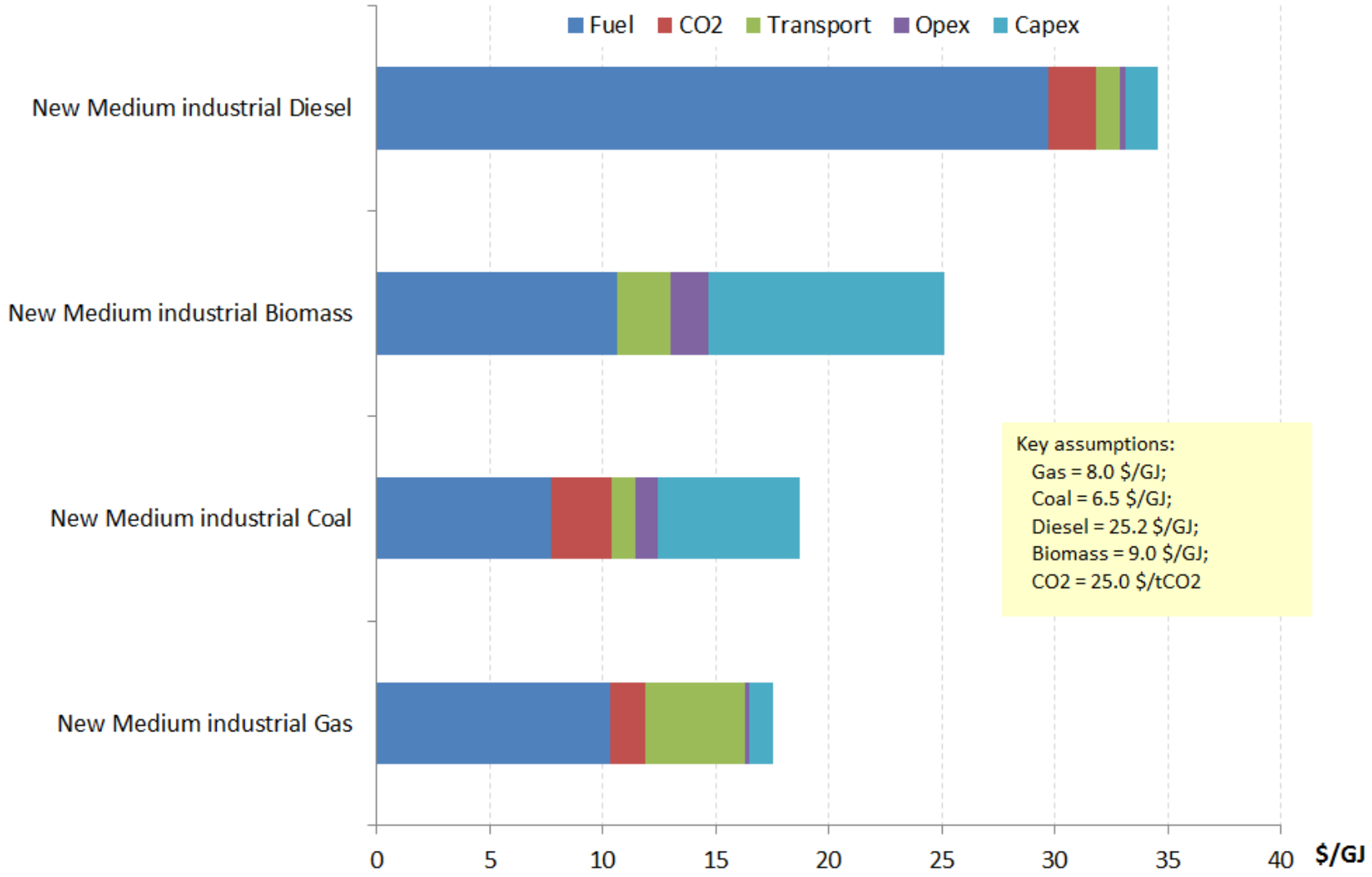
- Abundant (cheaper) gas would expand its use for baseload generation
- Limited (expensive) gas would see it move to premium fuel for swing/peaking duty
- At margin, gas competes with new renewable investment (baseload) and coal/diesel (swing/peaking)





Power generation provides another balancing mechanism

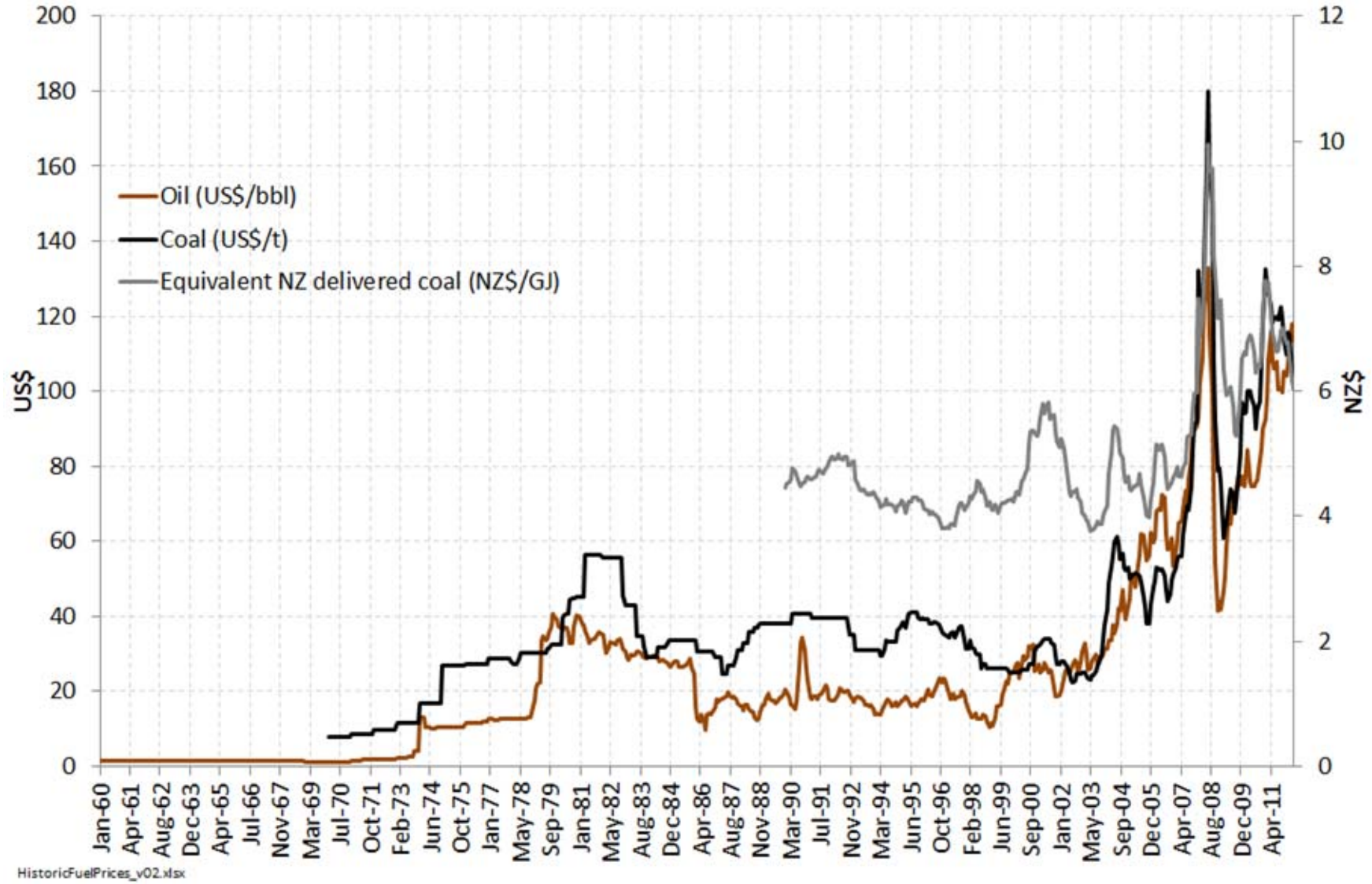
Industrial user demand



Coal and CO2 prices likely to be key issues for industrial gas demand

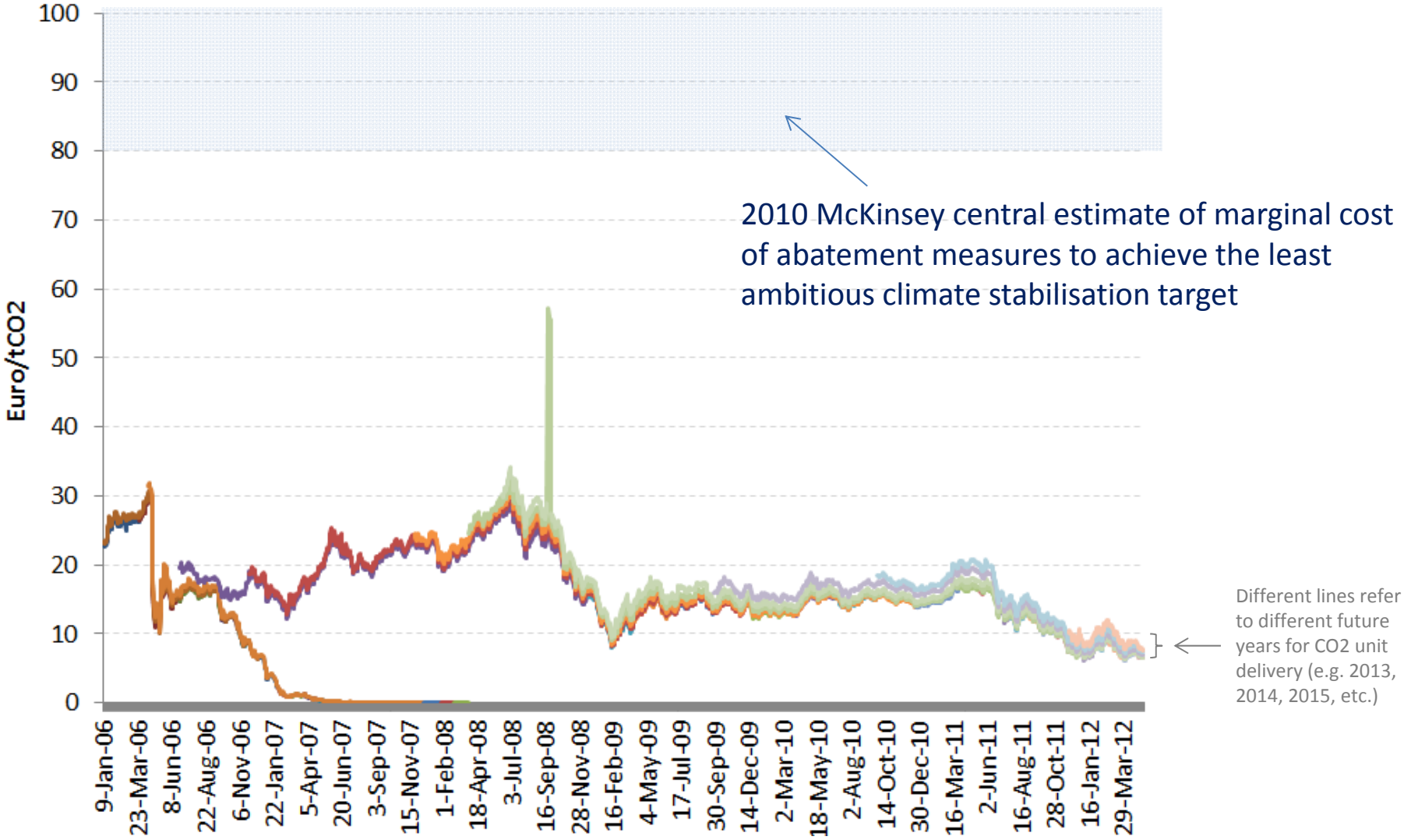
* Delivered gas price in chart assumes some level of swing price above the baseload wholesale price

Coal prices



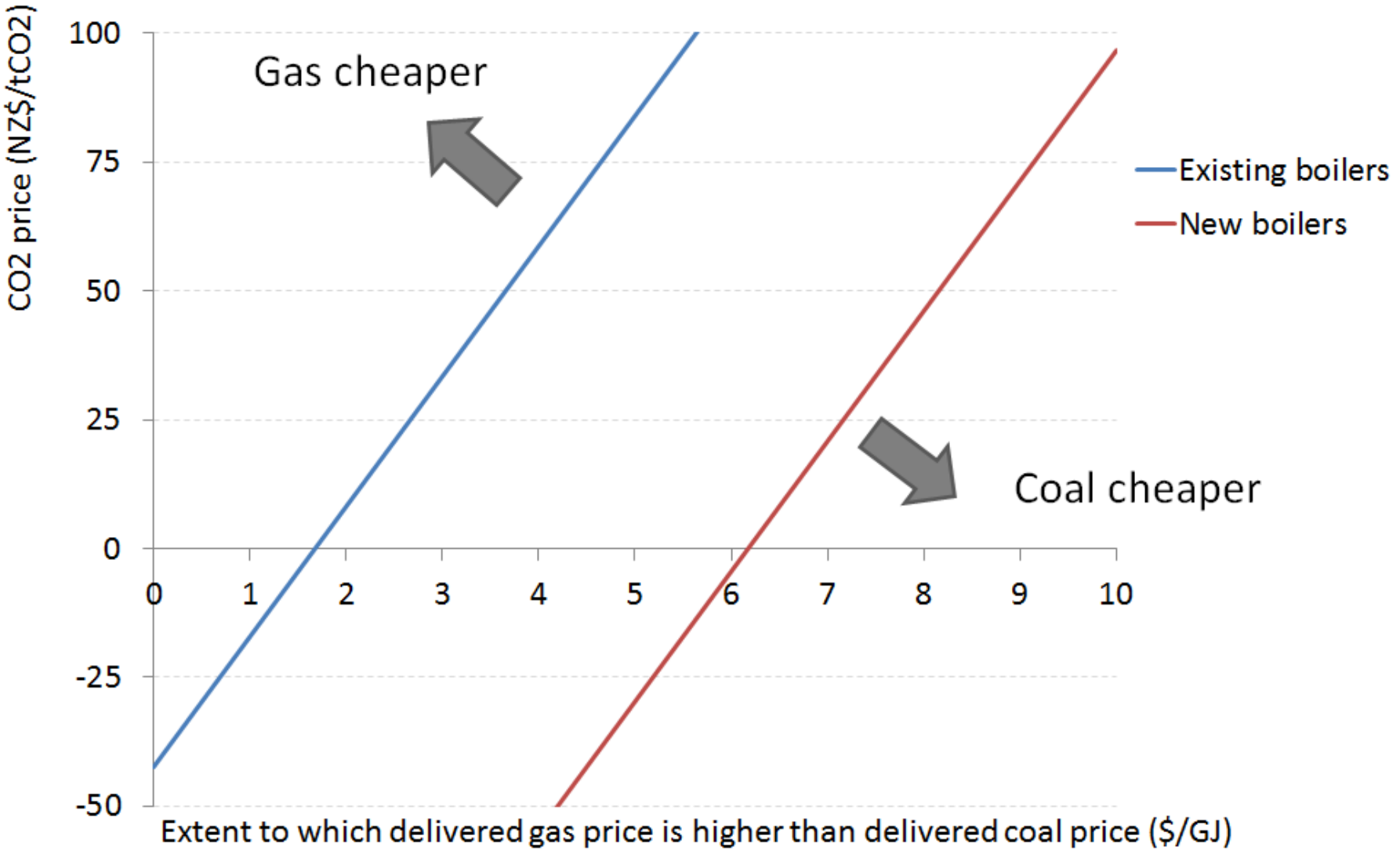
NI coal prices likely to be increasingly linked to international prices

EU carbon prices



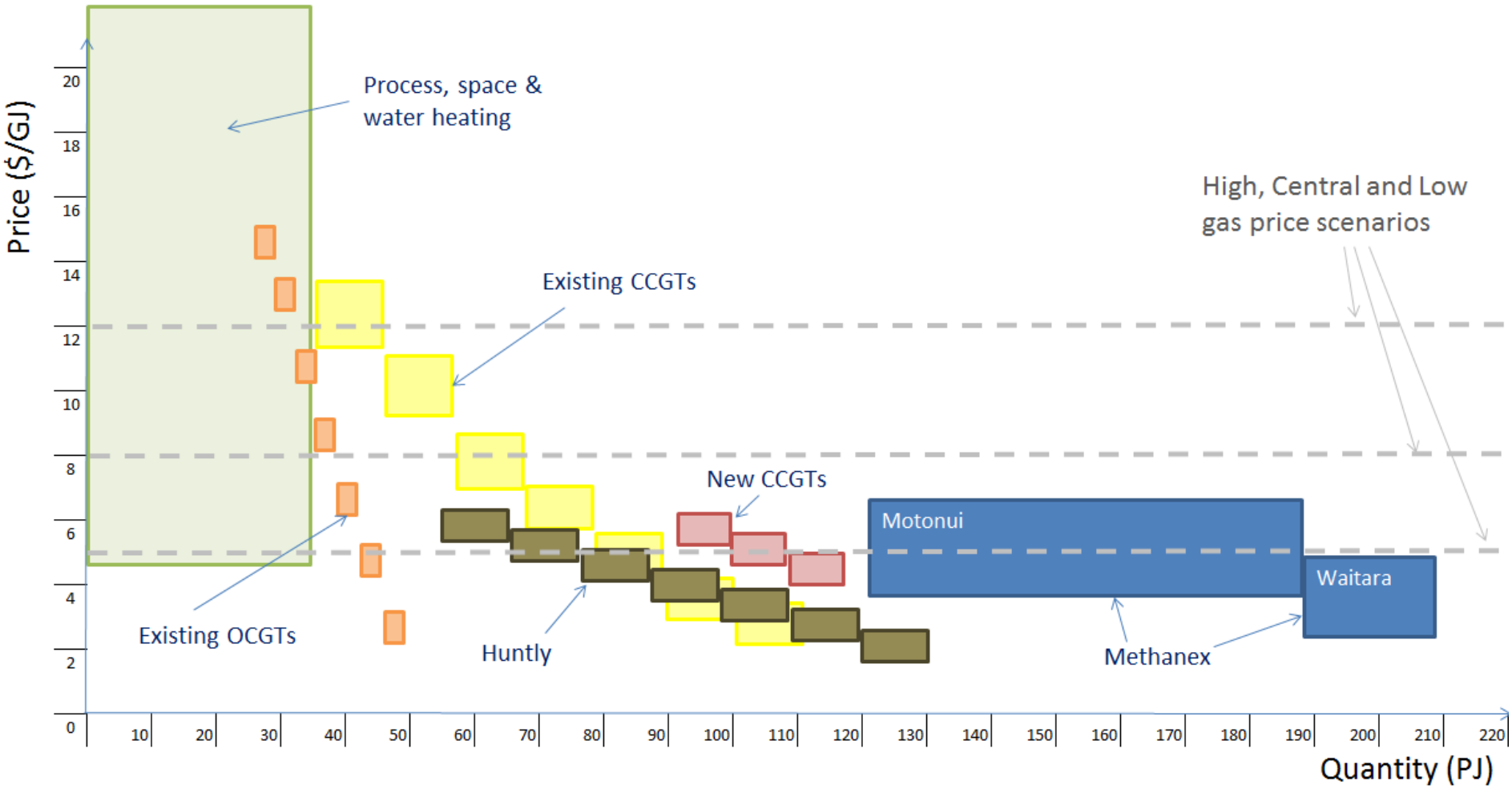
Appears to be upside risk on CO2 prices

‘Break-even’ CO2 prices for different coal vs gas prices



For new boiler investment decisions gas is likely to be more economic

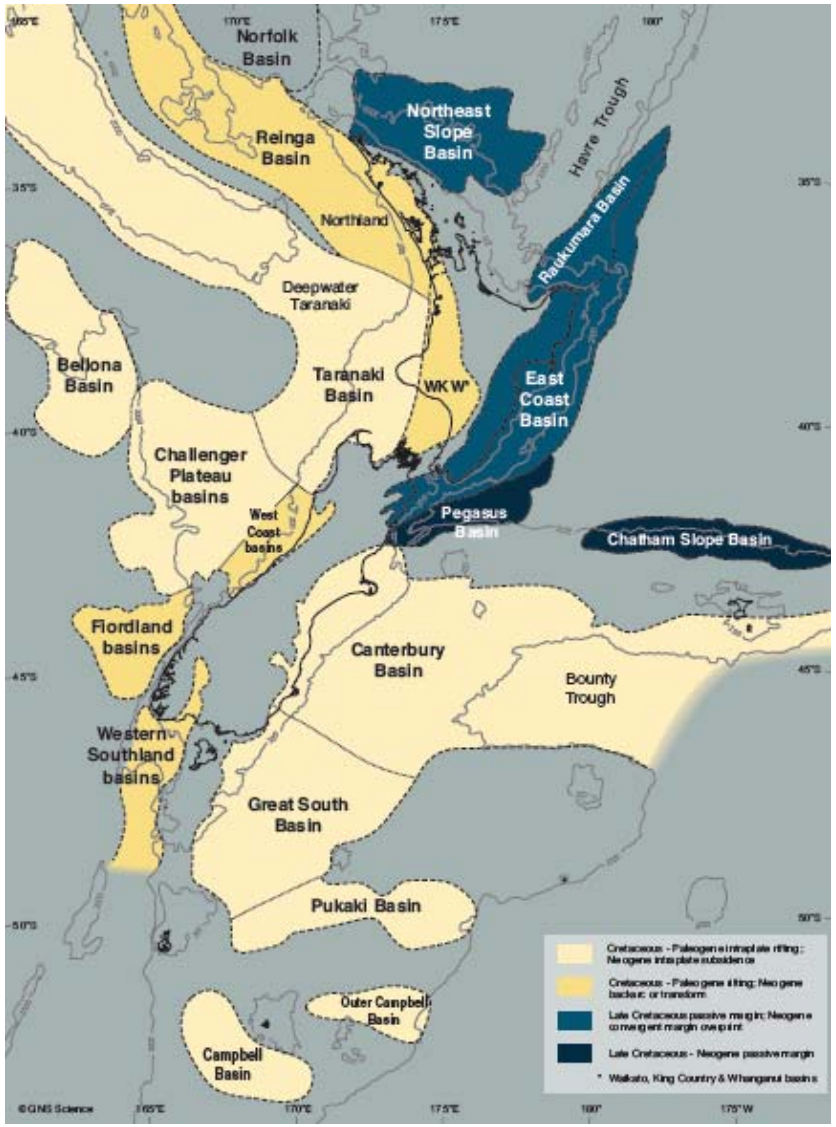
Gas price scenarios – Stylised gas demand curve



Adopt three broad scenarios – low, medium, high gas prices

Location of gas supply in NZ

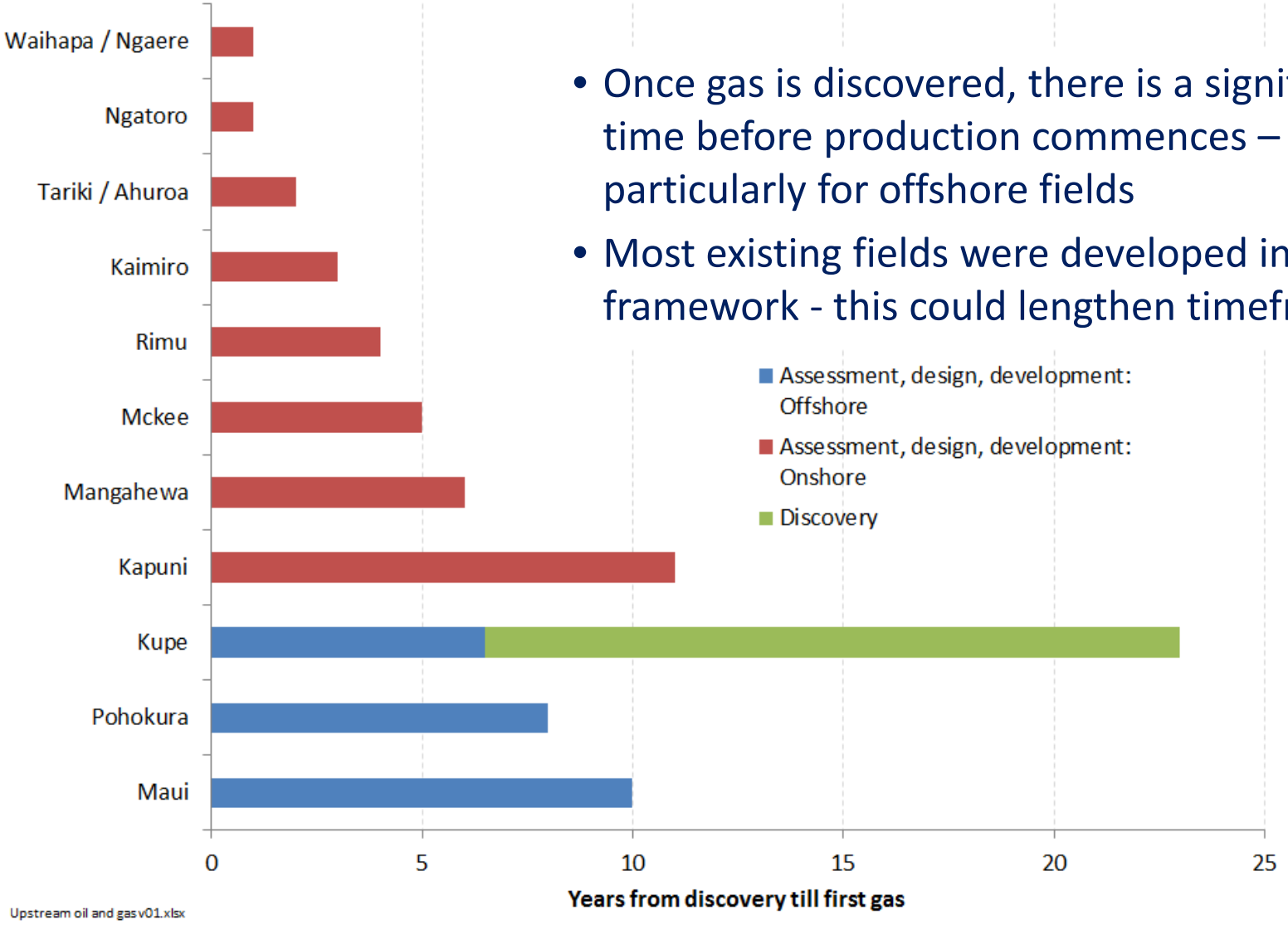
NZ petroleum basins



- New Zealand's sedimentary basins are under-explored by international standards
  - Even Taranaki deep water is relatively under-explored
- There is the potential for significant new gas in non-Taranaki locations
- Could impact on gas demand on transmission network

Non-Taranaki prospects are real

Development timeframes for existing fields

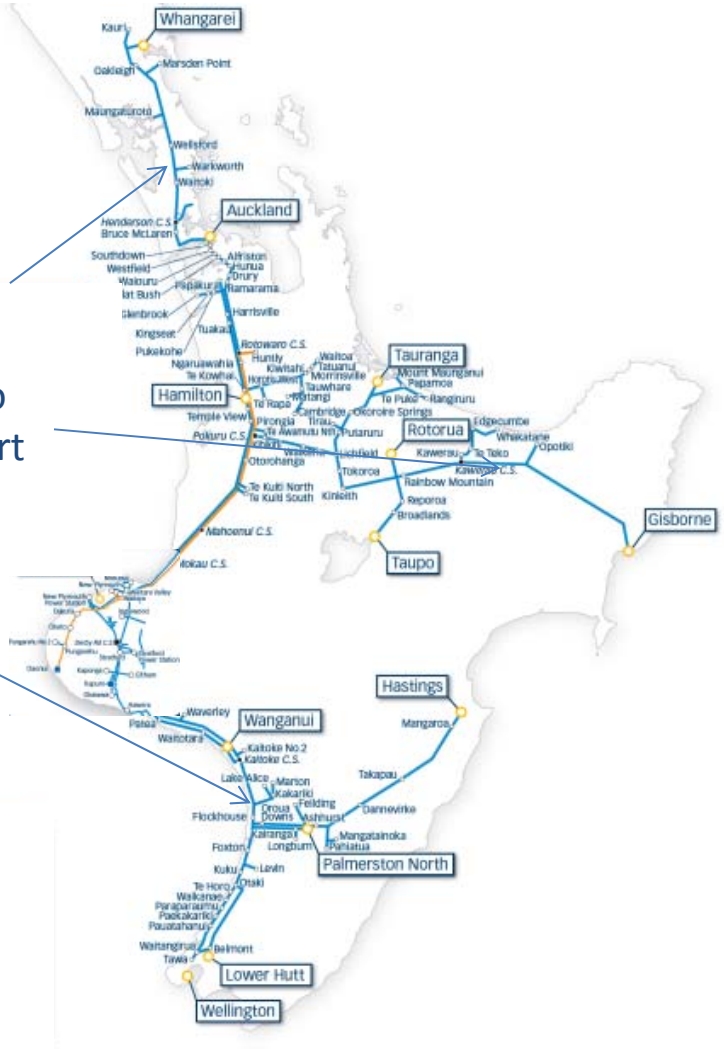


- Once gas is discovered, there is a significant lead time before production commences – particularly for offshore fields
- Most existing fields were developed in pre-RMA framework - this could lengthen timeframes

Even if non-Taranaki gas found – unlikely to alter gas flow <10-15 years

Existing pipeline system

Regional gas transmission pipelines are too small to transport a significant gas find



- For South Island finds, the economics of developing a pipeline to the North Island may not be as favourable as exporting the gas as LNG or methanol
- Similarly, for an East Cape find
- A Northland gas find which required a new pipeline through the Auckland isthmus could take significant time and cost to develop

A significant non-Taranaki gas find is not being 'modelled' as part of this exercise

Part II: Demand projections

Preliminary findings

Future capacity requirement

- Capacity requirement on North system driven by:
  1. Overall trend in annual gas demand over next 15 years
  2. Shape of gas demand at times of peak throughput
  3. Extent to which users can economically interrupt their usage

Overall trend in annual gas demand on North system

- Expect some growth in industrial gas process heat usage and demand for water heating – but tempered by efficiency gains
- Likely to see some decline in gas demand for power generation – including possible closure of Otahuhu B (~38% of current annual demand)

Preliminary findings (cont'd)

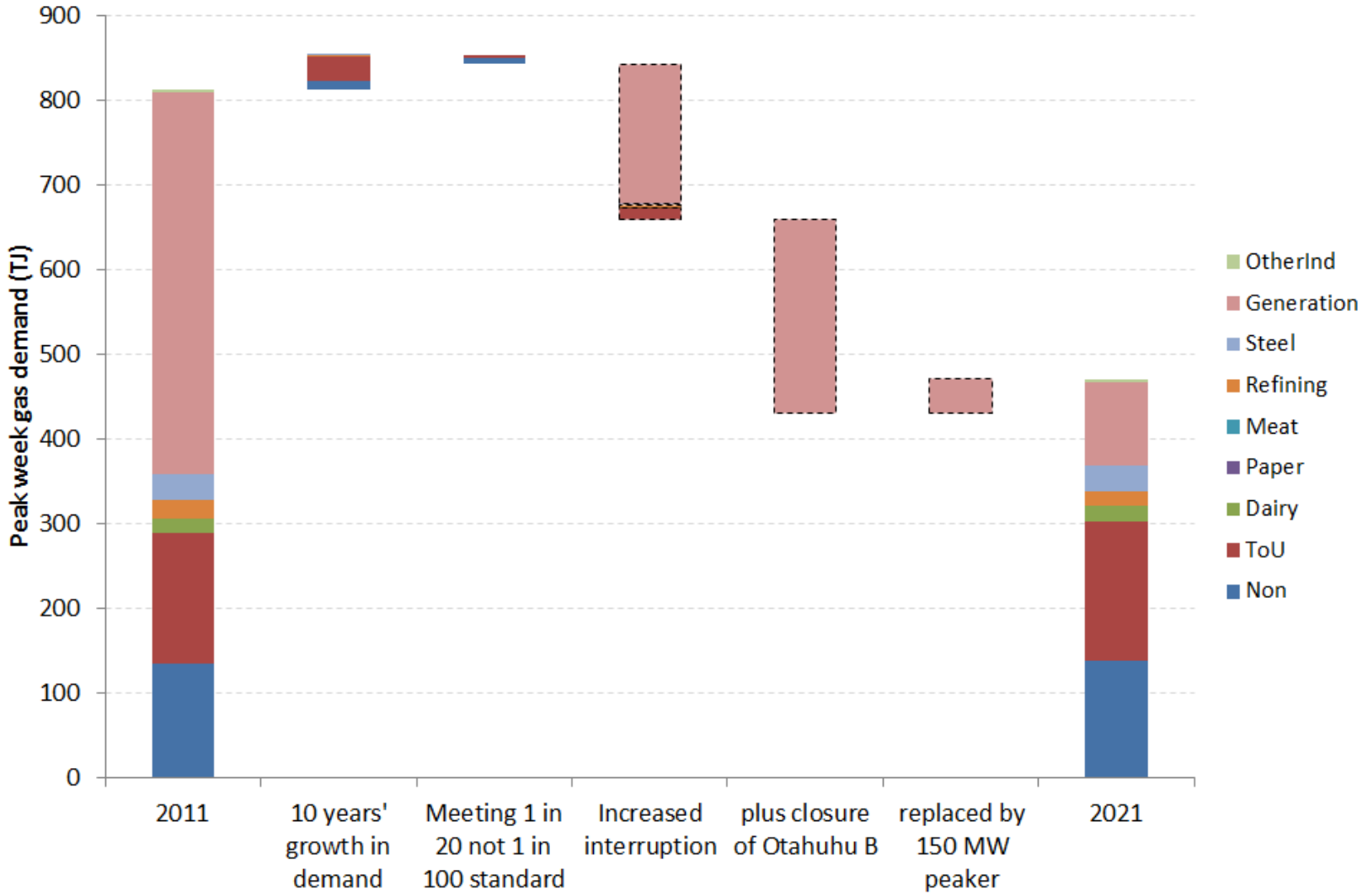
Shape of demand at times of peak throughput

- Defining 'peak' period is not straightforward – likely to be between 1-5 days
- Temperature variation important driver for non-TOU demand – raises issue of appropriate economic 'standard'
- Power generation also major contributor to peak demand

Potential for increased voluntary interruption at peak

- Indicative analysis suggests potential for more demand interruption to be economically viable – especially for power generation
- Industrial users may also have some unused potential
- Design of incentives will be important – limited reward at present

Relative scale of issues

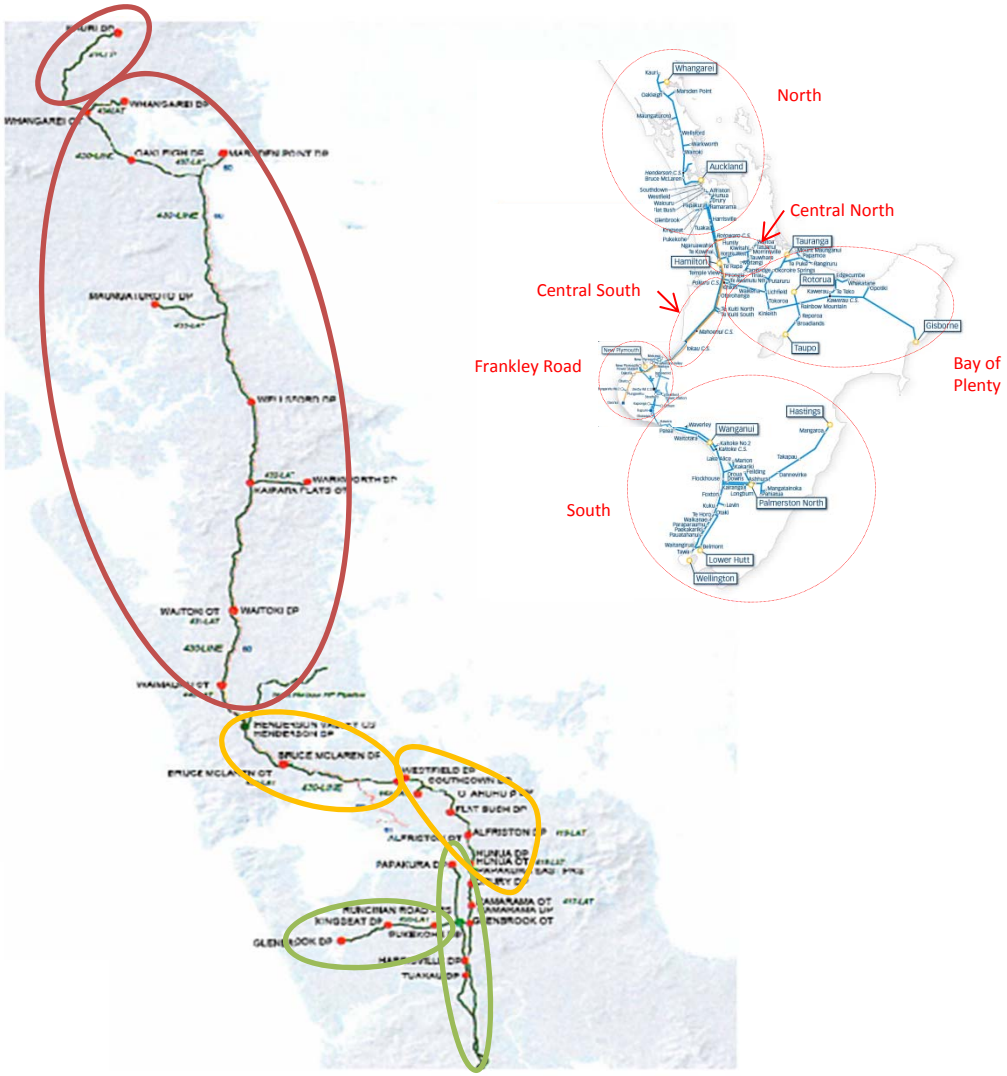


Interruptibility & Otahuhu B future dominate picture for North system

Annual gas demand

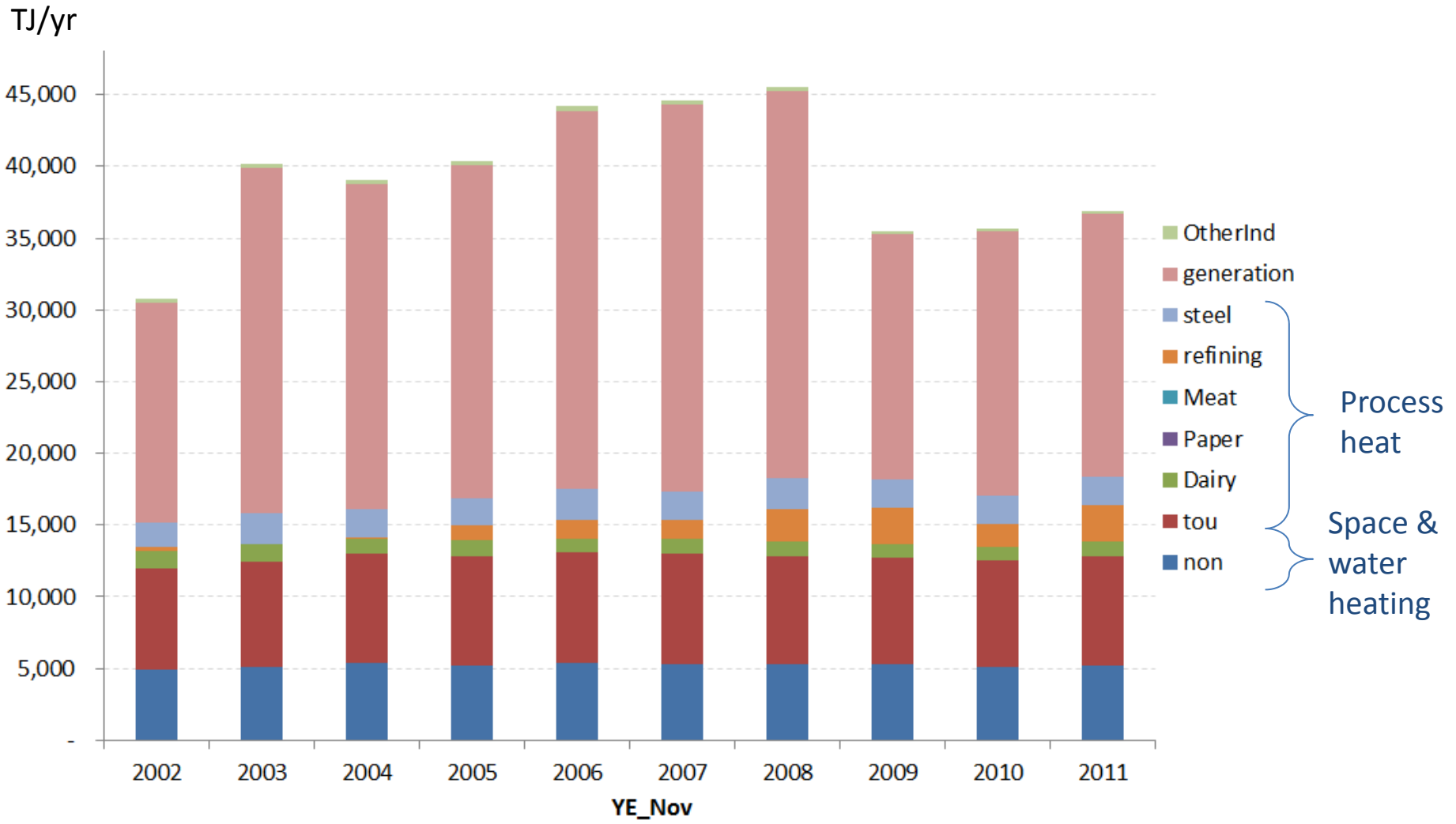
North gas system

- Today's session focuses on North system as capacity concerns largely centre on Rotowaro → Auckland
- But this is not sole area of capacity concern over next 15 years
- Toolset allows demand to be analysed at higher and lower levels
- Most of issues generic to whole North Island network



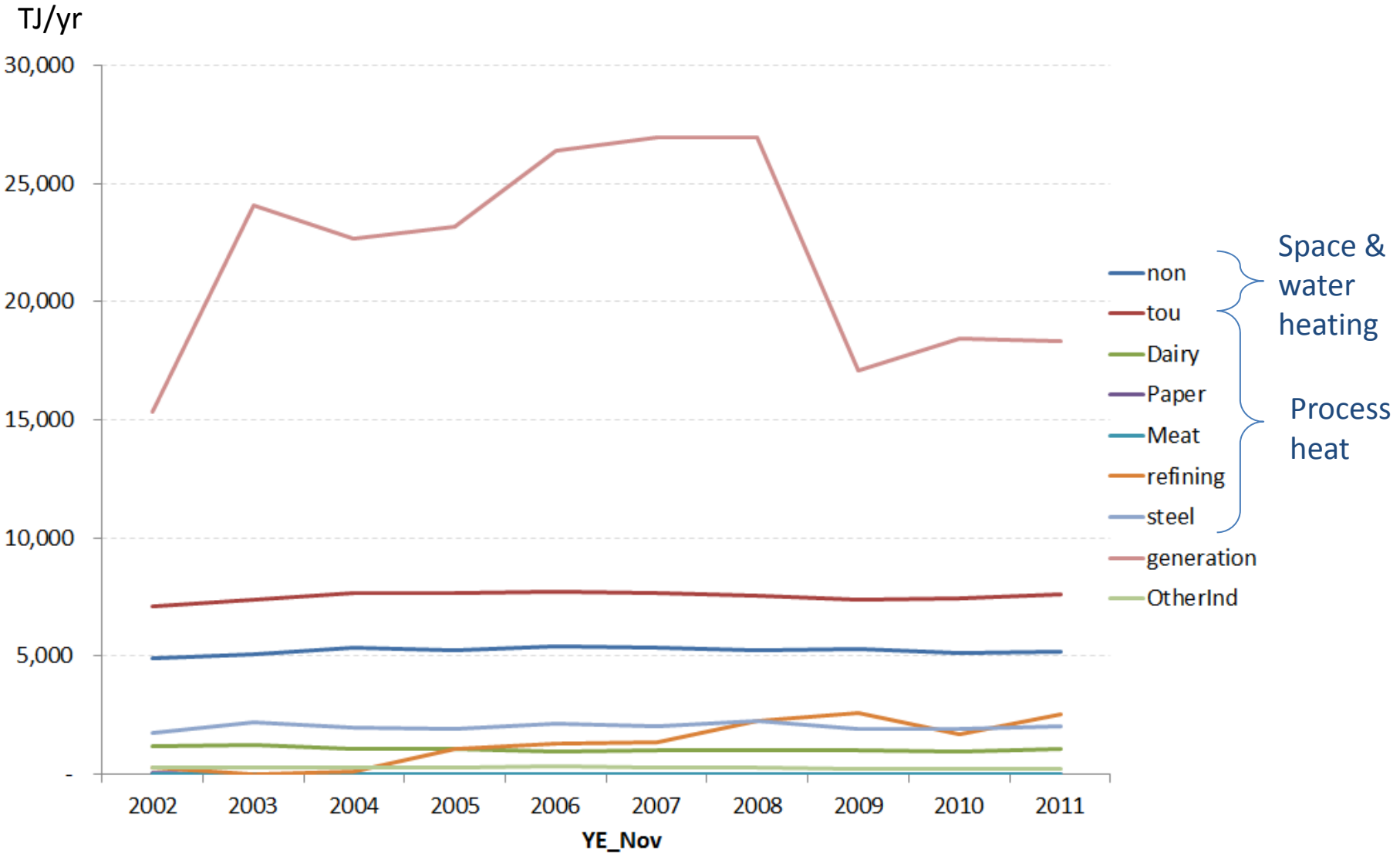
Analysis is multi-layered – with main focus on North system as a whole

North system – total annual gas throughput



Total annual gas throughput on North system has fallen by ~20% since 2008

North system – annual gas throughput by segment



Power generation demand has fallen by >30% - most other segments stable

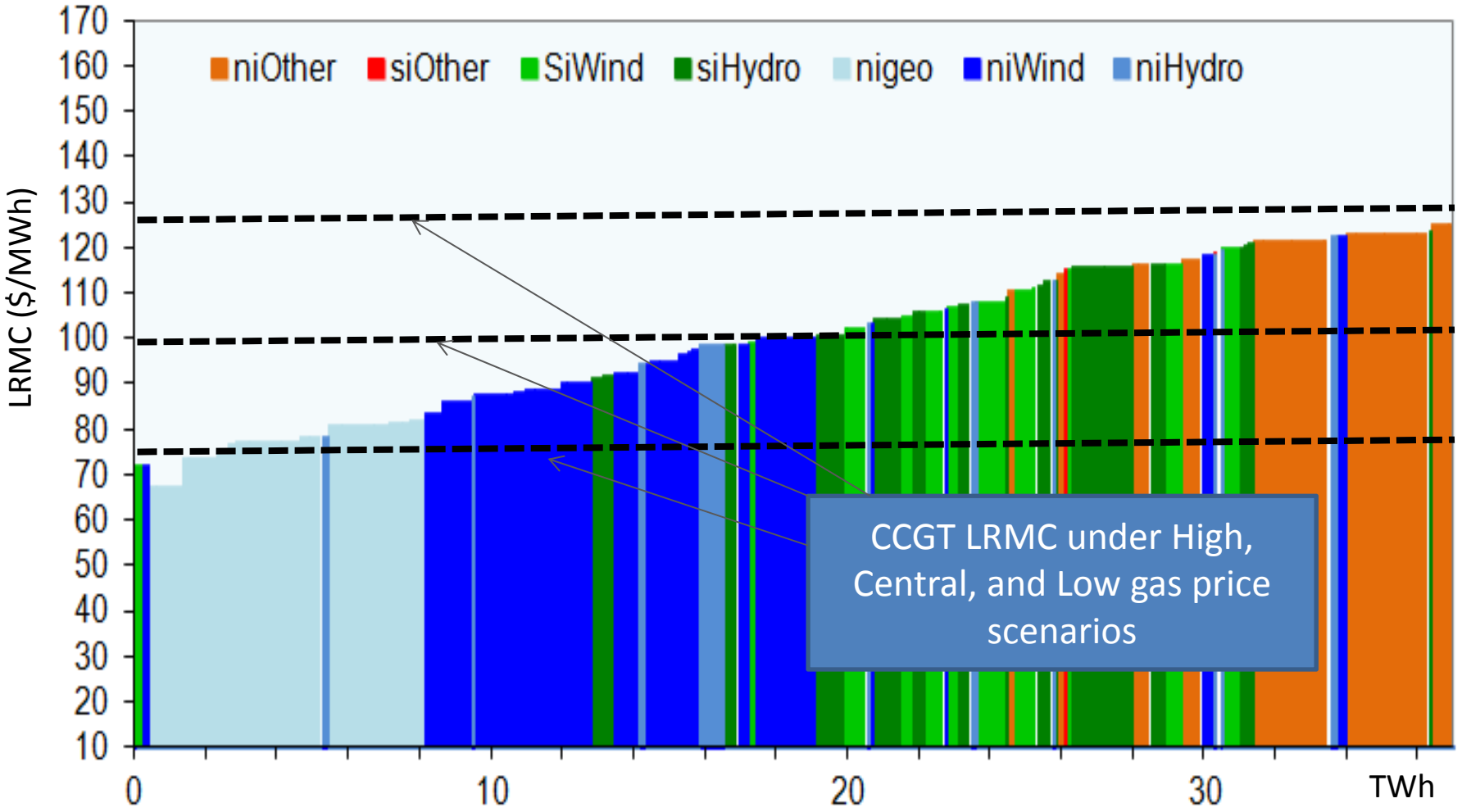
Annual gas demand

Electricity generation

North system – annual gas demand for generation

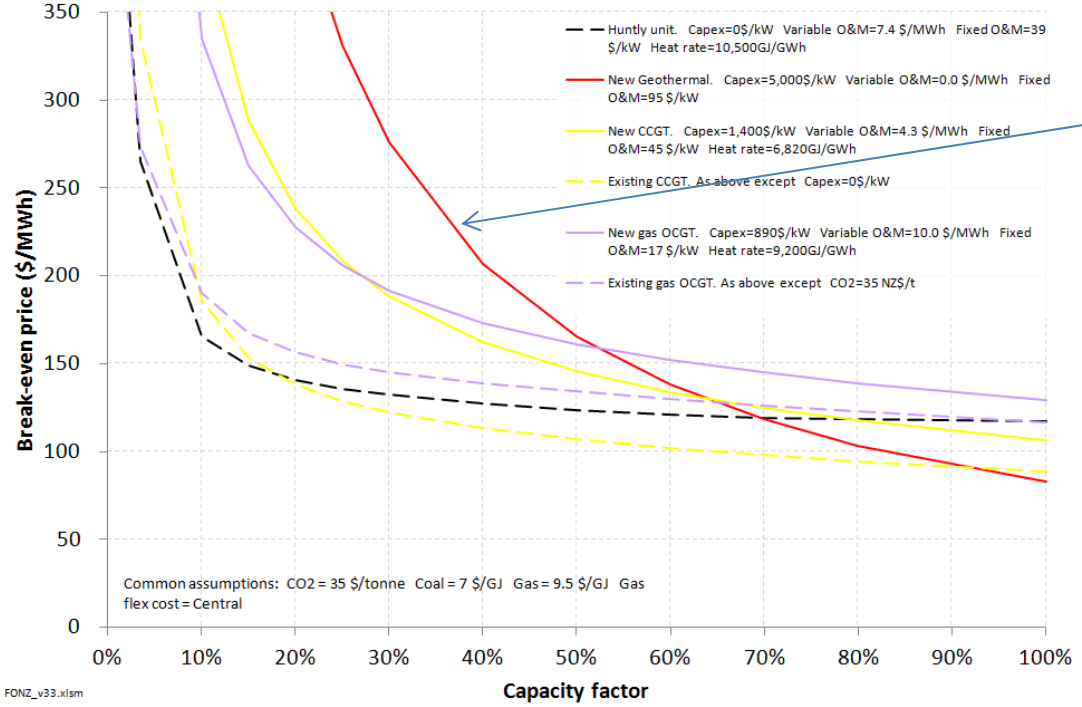
'Fall off' of take-or-pay contracts post 2013 could further reduce gas usage

Potential for new baseload gas-fired generation



New baseload gas-fired generation unlikely in medium and high gas price scenarios

New ‘peaking’ gas-fired generation



- Capital intensity of renewables makes them uneconomic for low capacity factor operations
- Key drivers on extent of new gas-fired peaking generation include
  - Cost of gas swing
  - Economics of diesel peakers and Huntly
  - Extent of new wind development

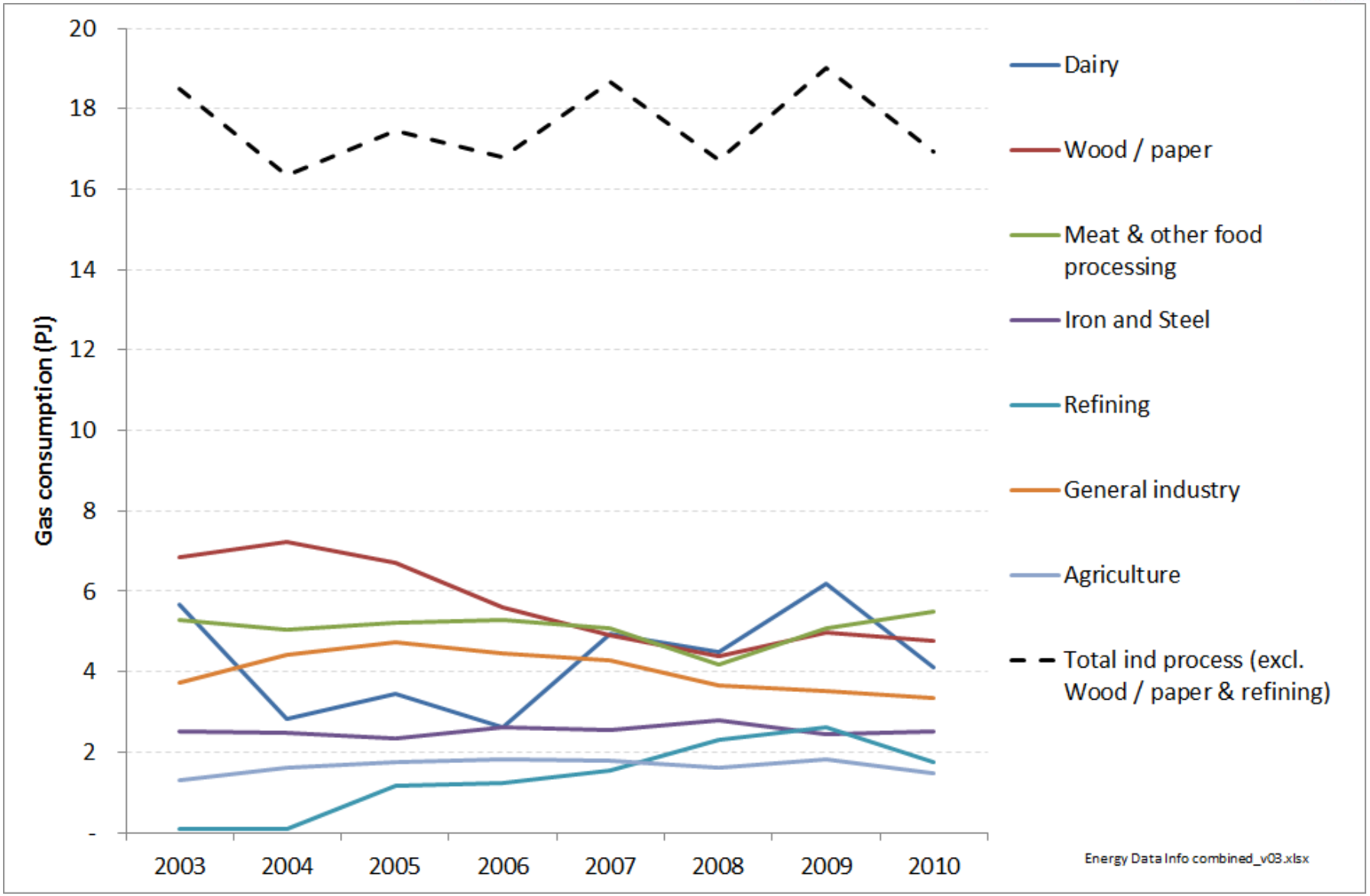
- New peakers more likely to locate in Taranaki or Waikato due to relative cost of electricity and gas transmission
- That said, closure of Otahuhu B could result in a new peaker in Auckland region

New gas-fired ‘peakers’ likely - but probably not in North system

Annual gas demand

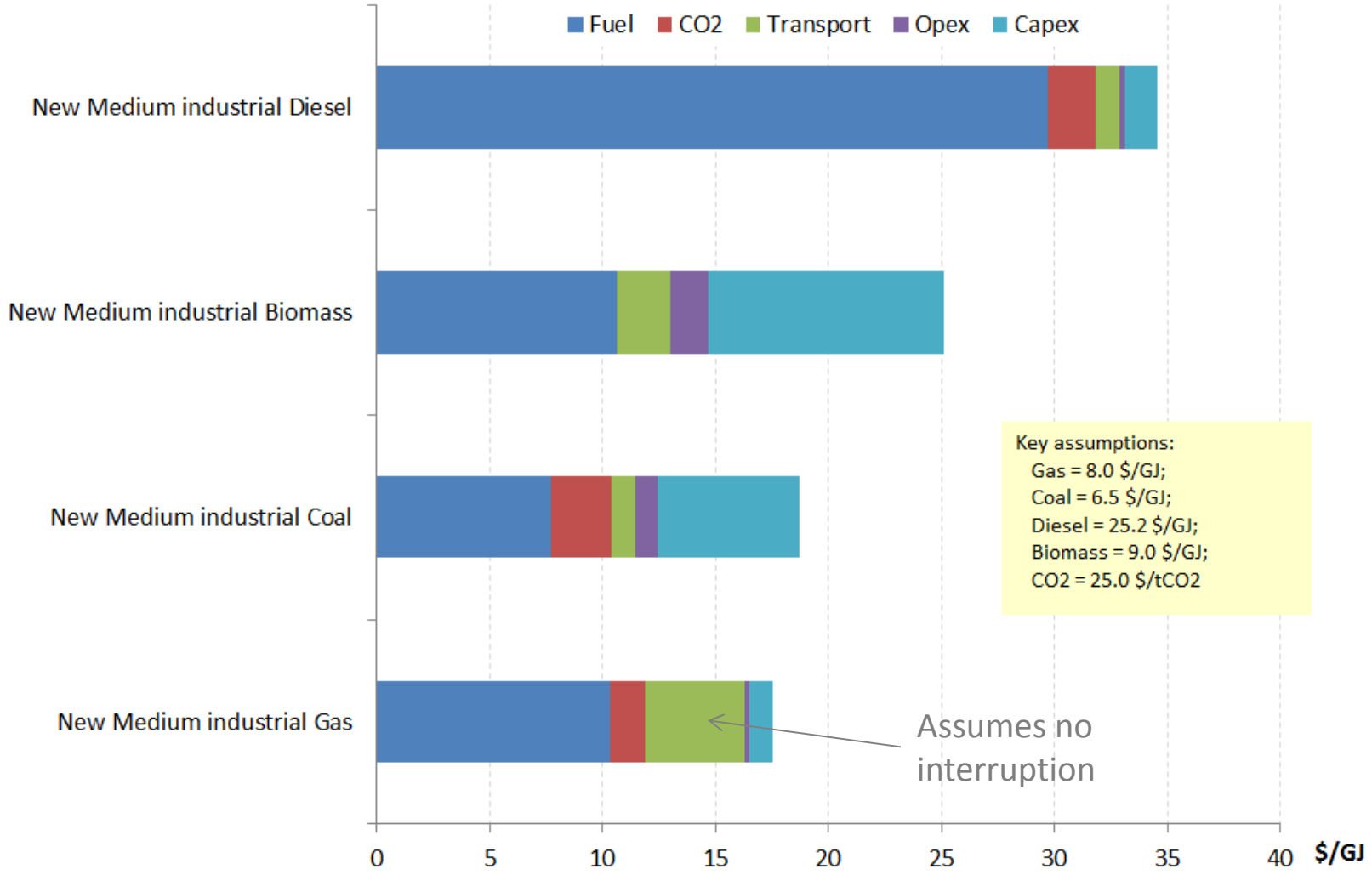
Industrial process heat

Total NZ gas demand for industrial process heat



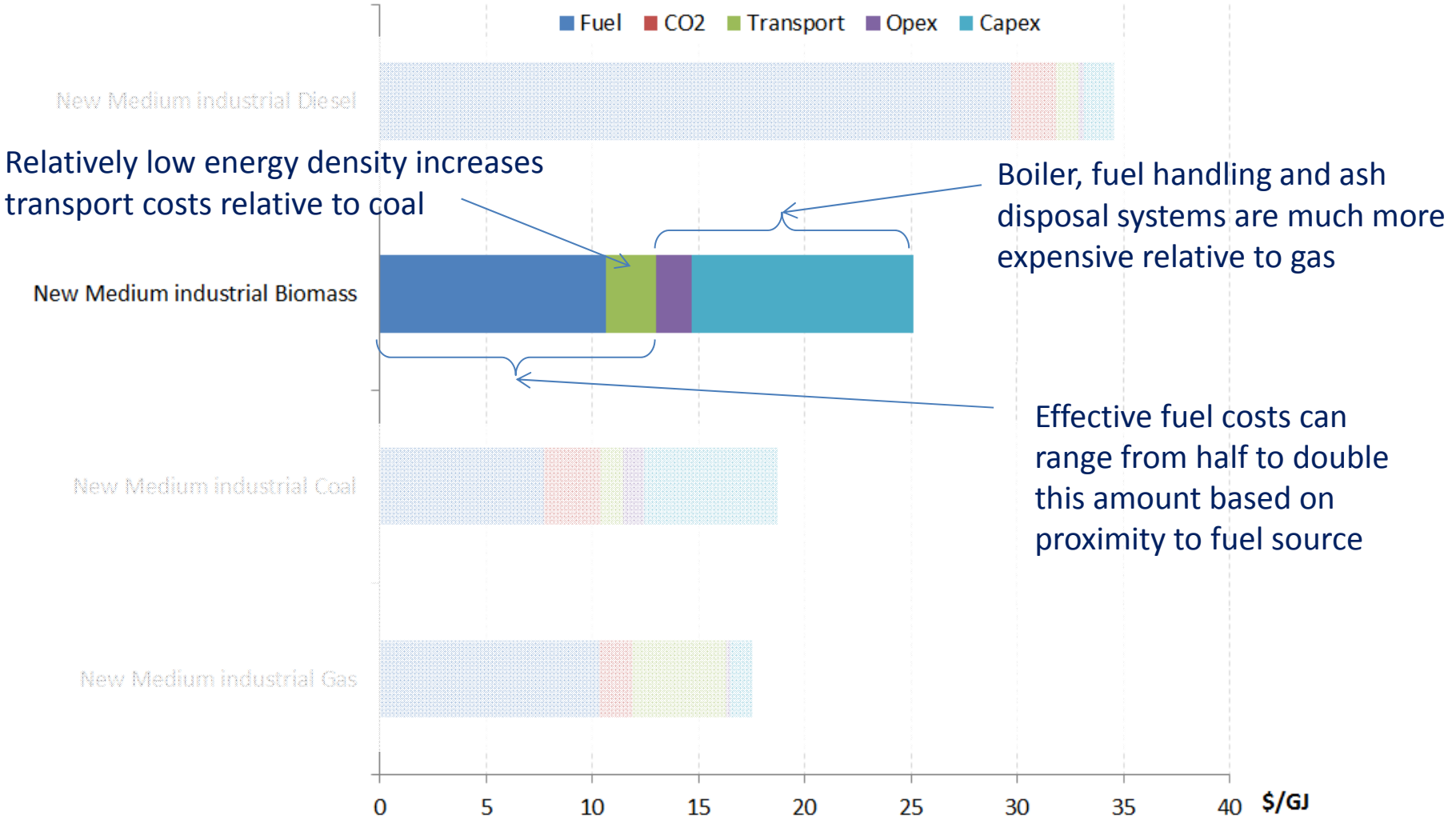
Demand growth for industrial process heat has been relatively flat

Key drivers of future annual demand - industrial



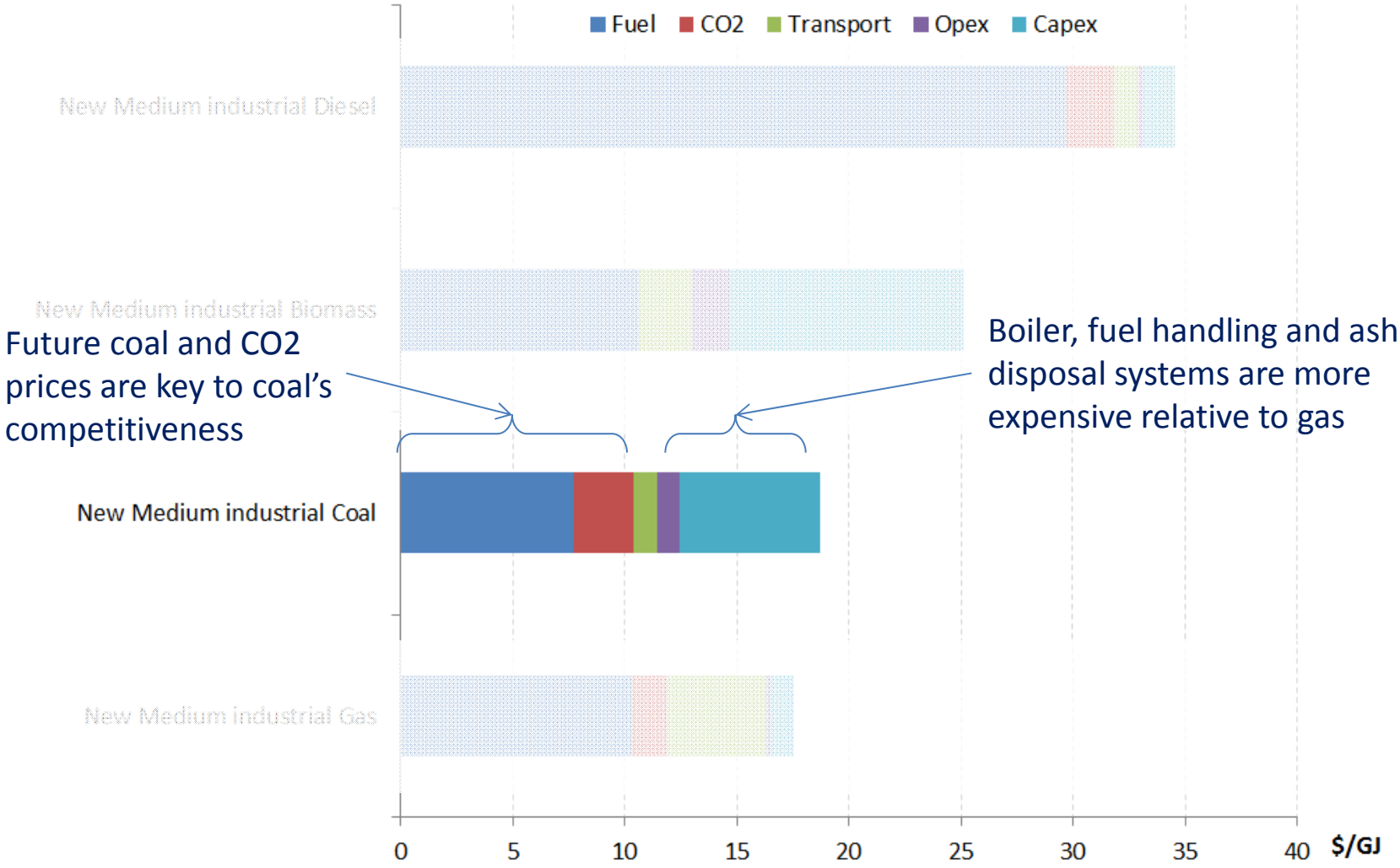
Gas expected to be competitive when new boiler investment required

Biomass considerations



Biomass is only likely to compete with gas in for situations where biomass fuel is effectively 'on-site' – e.g. wood / paper sector

Coal considerations



Gas expected to be competitive when new boiler investment required

Summary considerations for industrial demand

- Underlying demand expected to grow over next 15 years - but partly offset by continuing energy efficiency improvements
  - There appears to be some suppressed demand at present

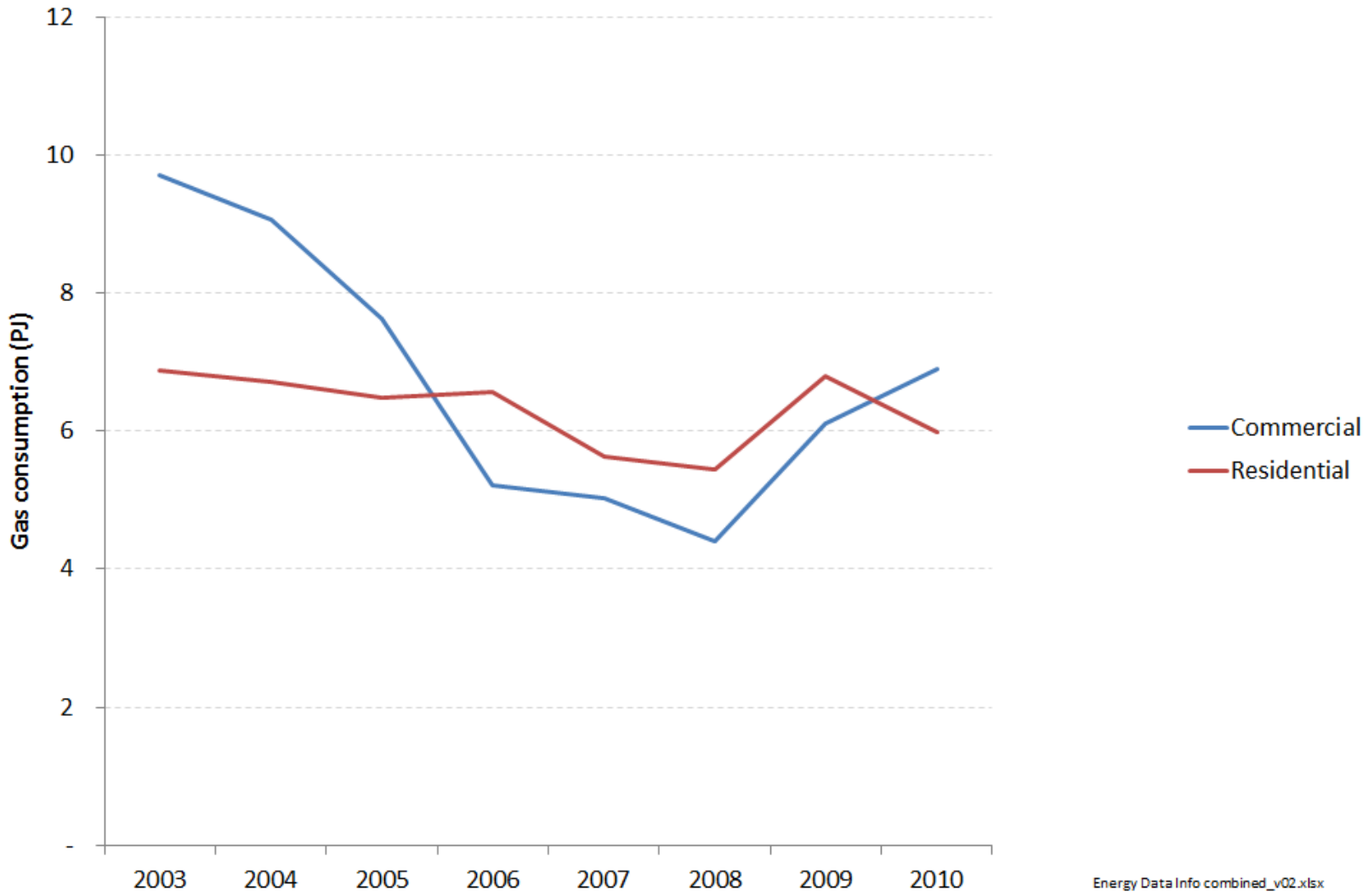
- Alternatives to gas are:
  - Biomass: limited by transport costs – but potentially viable for some niches, e.g. wood processing in Northland
  - Geothermal: limited within North system region
  - Diesel: limited by cost
  - Coal: prime competition to gas, but hindered by capex & CO2

Continuing industrial demand growth expected to be met predominantly from gas

Annual gas demand

Space & water heating

National commercial and residential gas demand



Commercial and residential gas demand has fallen but may be recovering

Key drivers of future annual demand – S&W heating

- Underlying demand for space and water heating expected to grow over next 15 years with population - but again partly offset by efficiency improvements

- Space heating - relatively flat demand for gas due to economics of heat pumps versus gas burners - possible decline in some scenarios

- Water heating – further growth in gas for water heating likely due to superior economics of instant gas water heating and other utility benefits (e.g. never running out)

Demand for S&W heating likely to be relatively modest

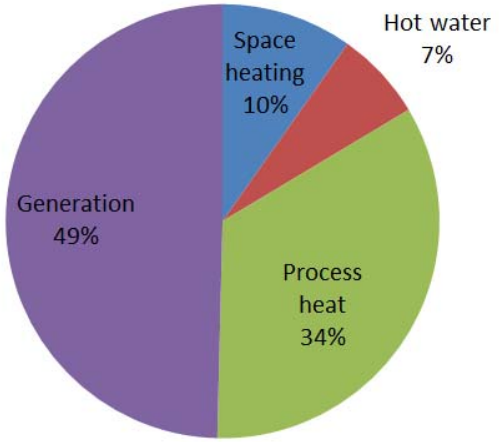
Annual gas demand

Summary implications

Annual gas demand outlook over 15 years

- Power generation – further decline likely but speed is uncertain
- Industrial demand – modest rate of growth likely
- Space and water heating – slow growth likely

Estimated 2011 North system annual consumption by category



A decline in gas demand for power generation will dominate other influences because of its relative size

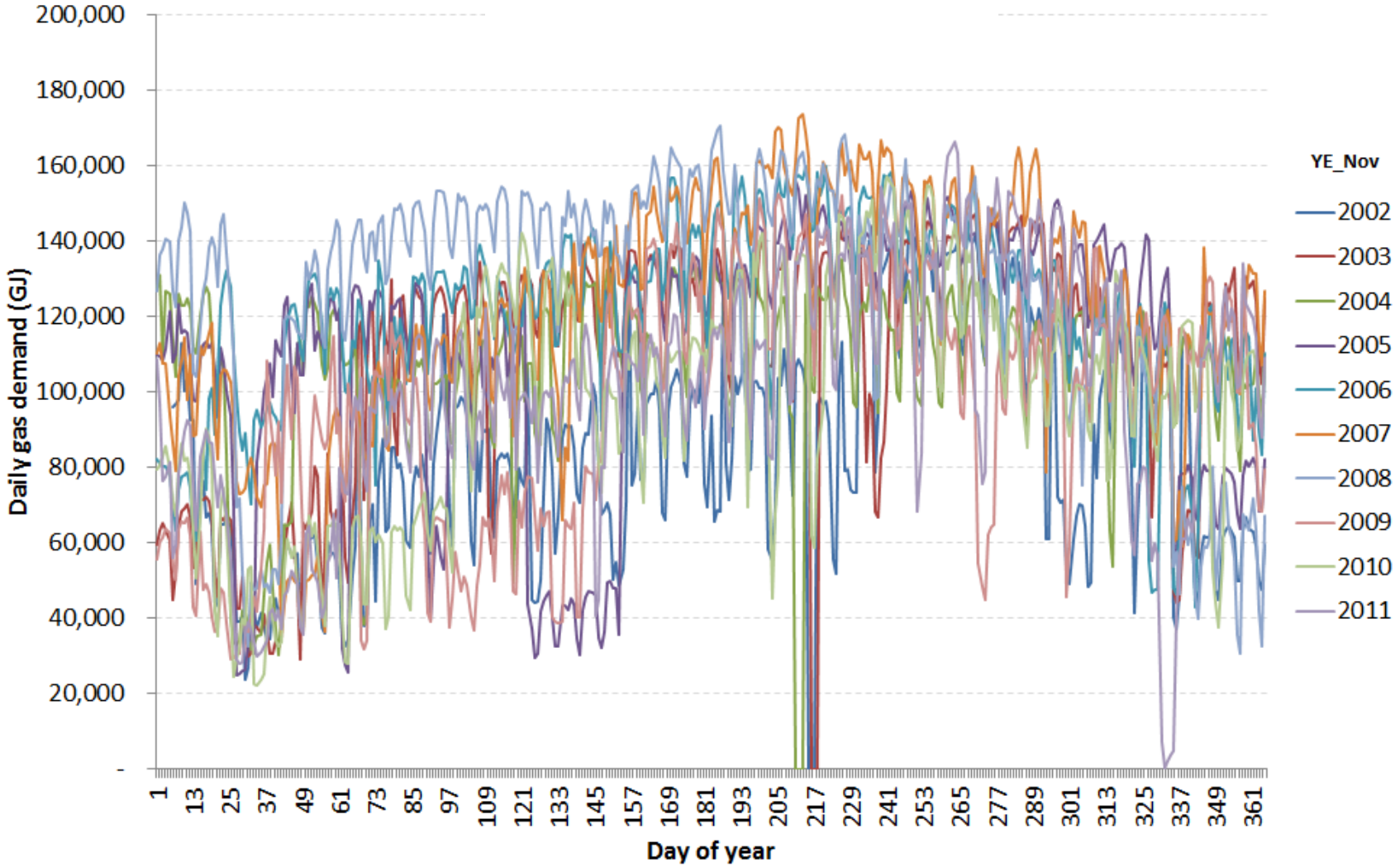
Peak gas demand – North system

North system – projecting peak demand

Four step process

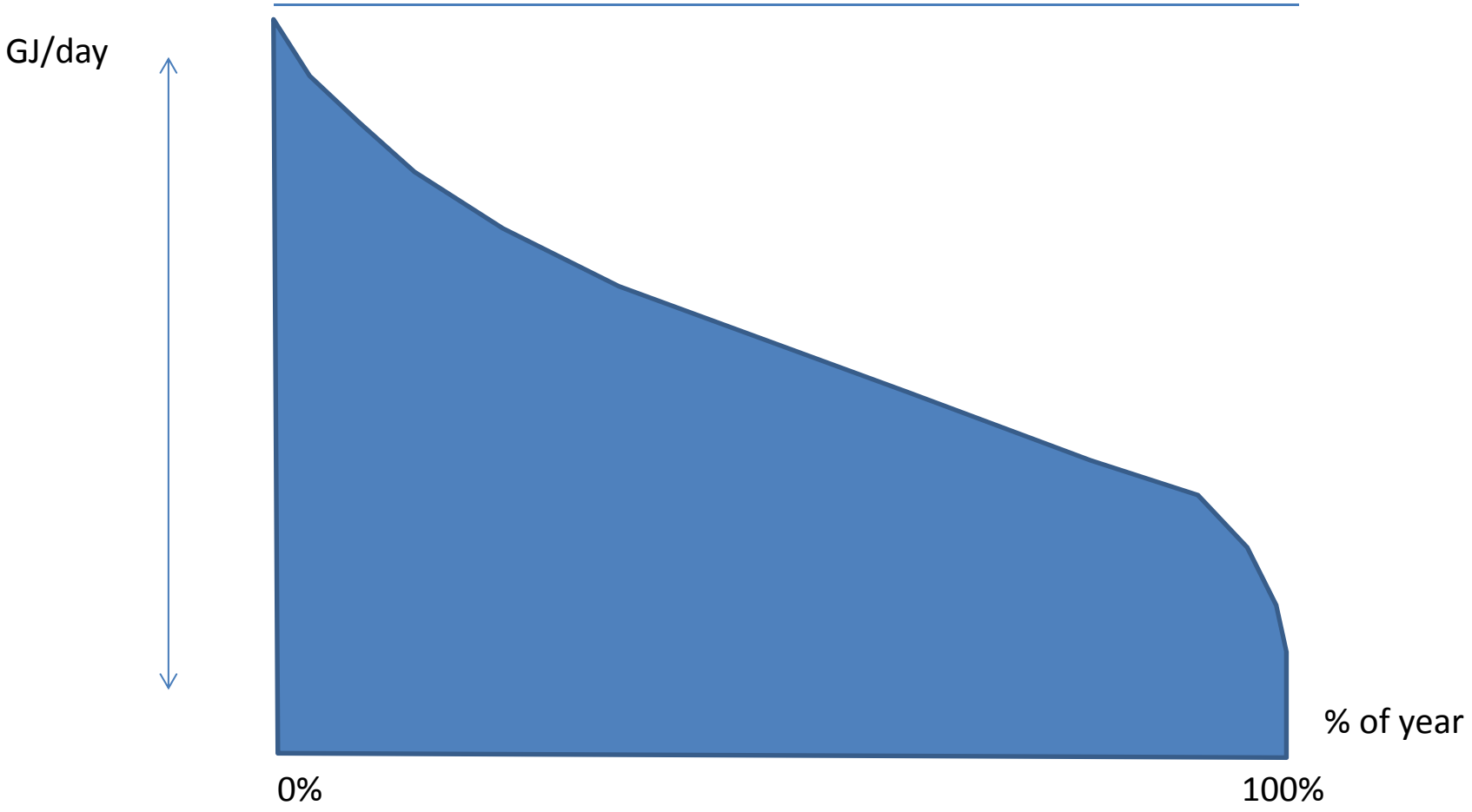
1. Project underlying annual gas demand
2. Adjust some segments for temperature dependency
3. Adjust for some segments for seasonal factors
4. Consider scope for interruptibility

North system – total daily gas throughput



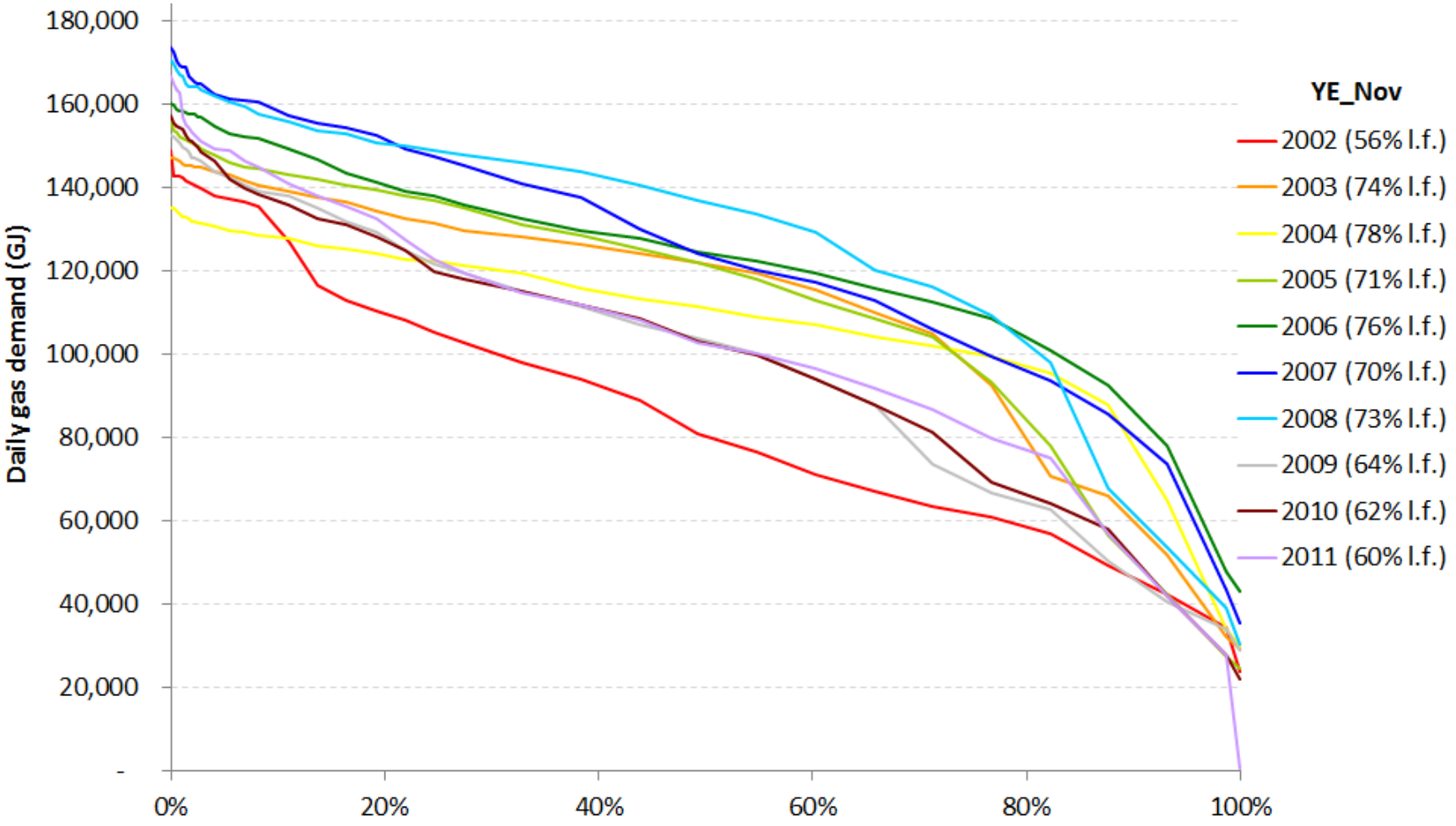
For capacity decisions, peak rather than annual throughput is relevant

Duration curve approach



Duration curves facilitate the analysis of the shape of demand

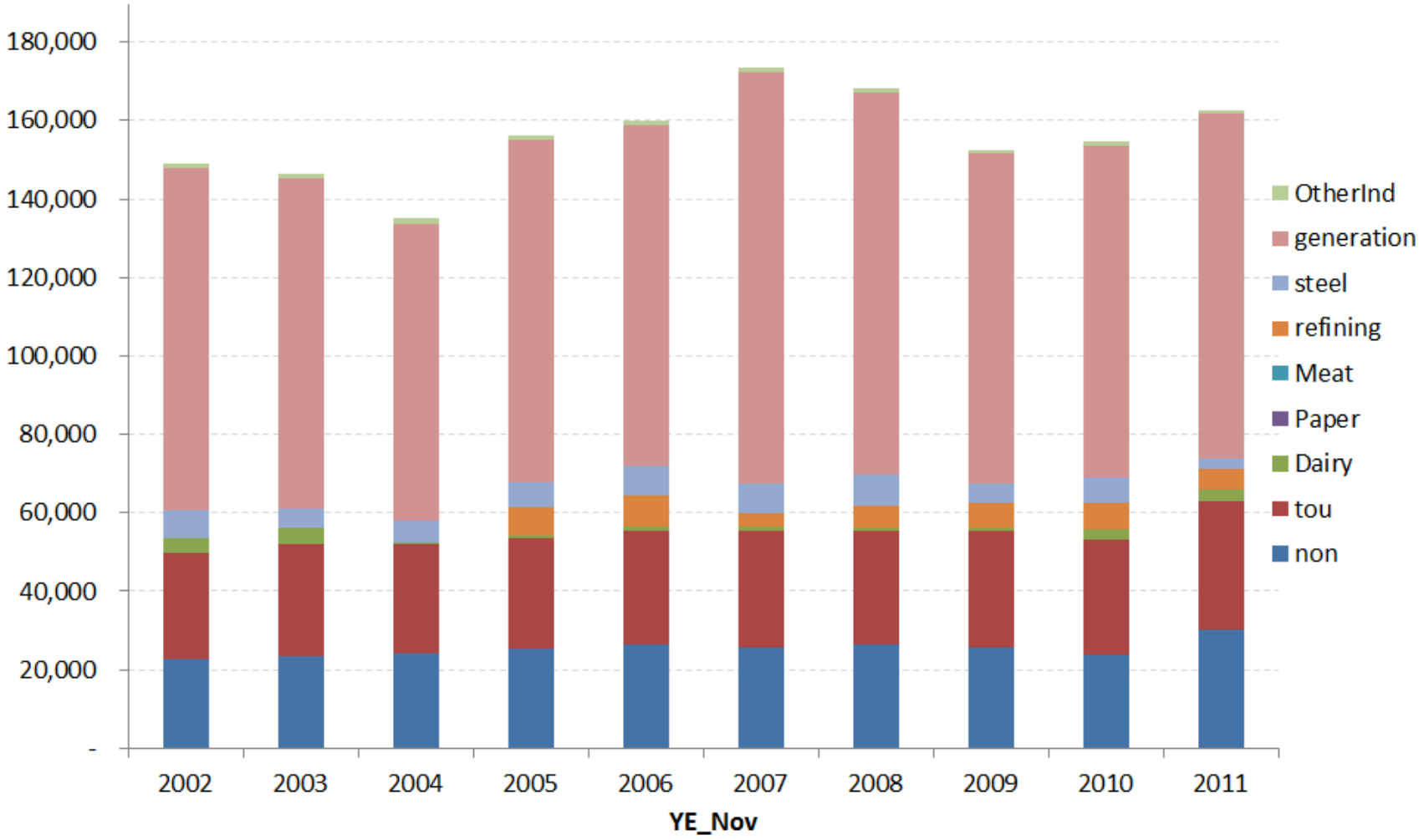
North system – load duration curves



Load factor has been falling on the North system

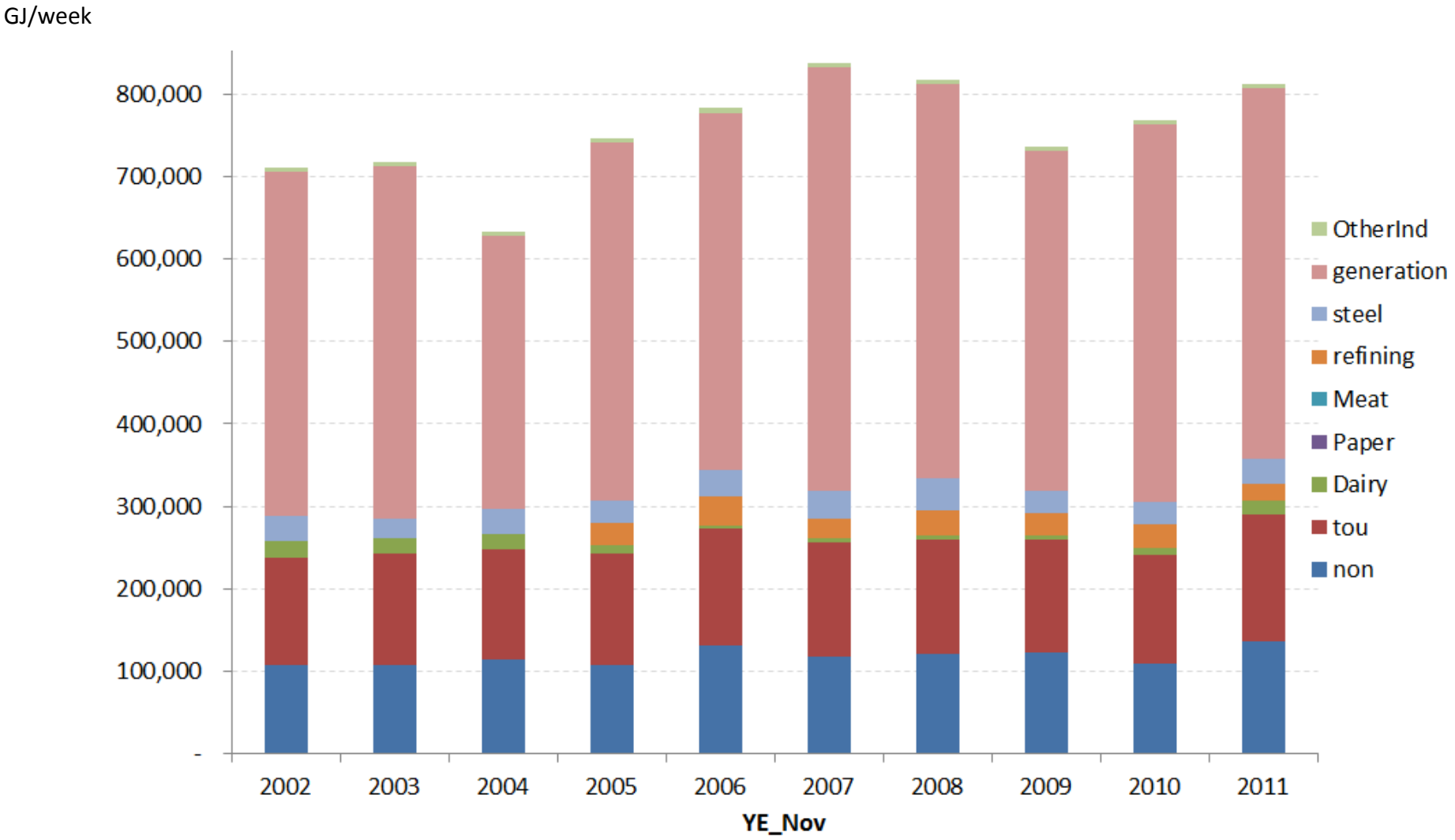
North system – peak day gas throughput

GJ/day



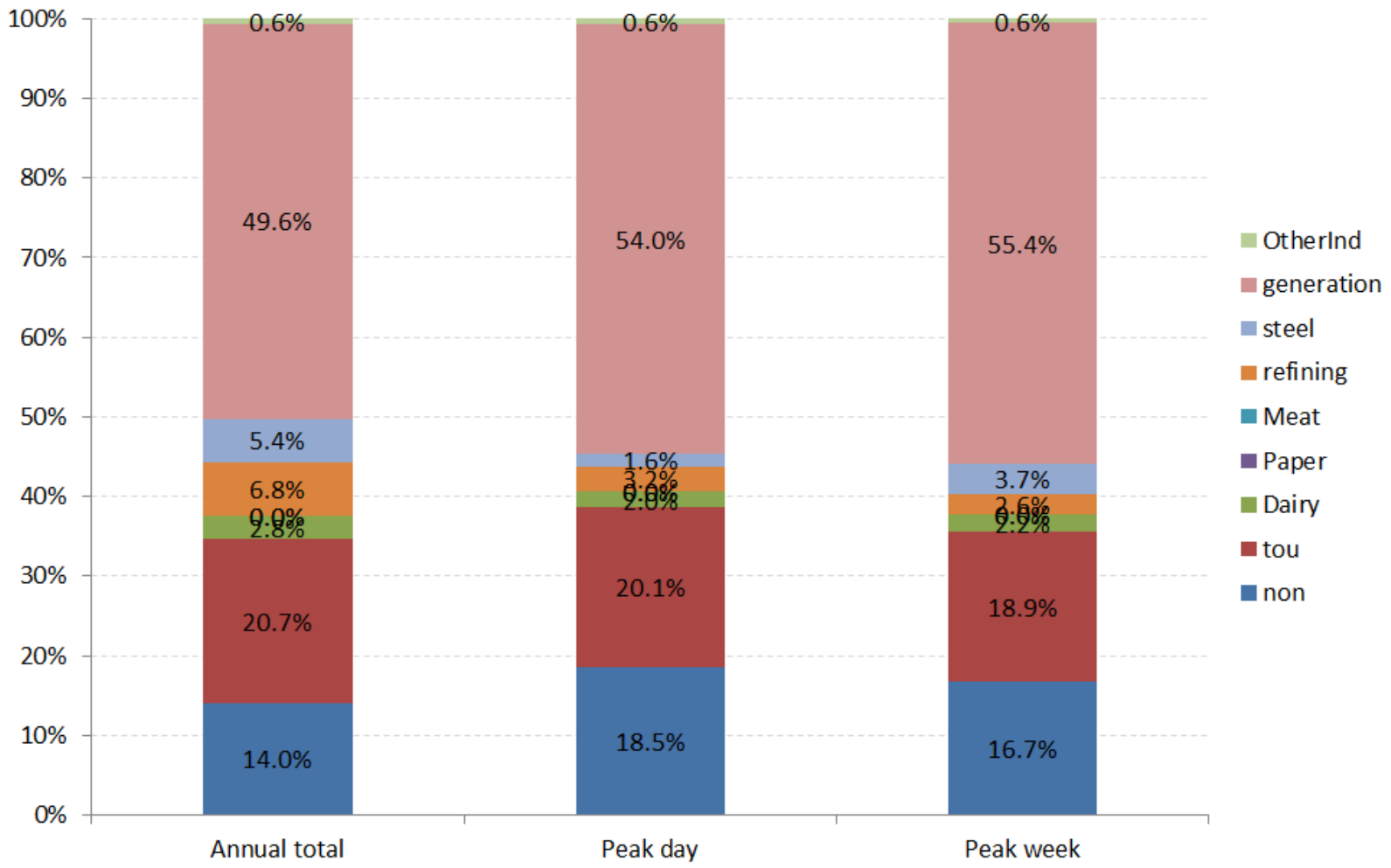
Change in peak demand has not been as great as change in annual demand

North system – peak week gas throughput



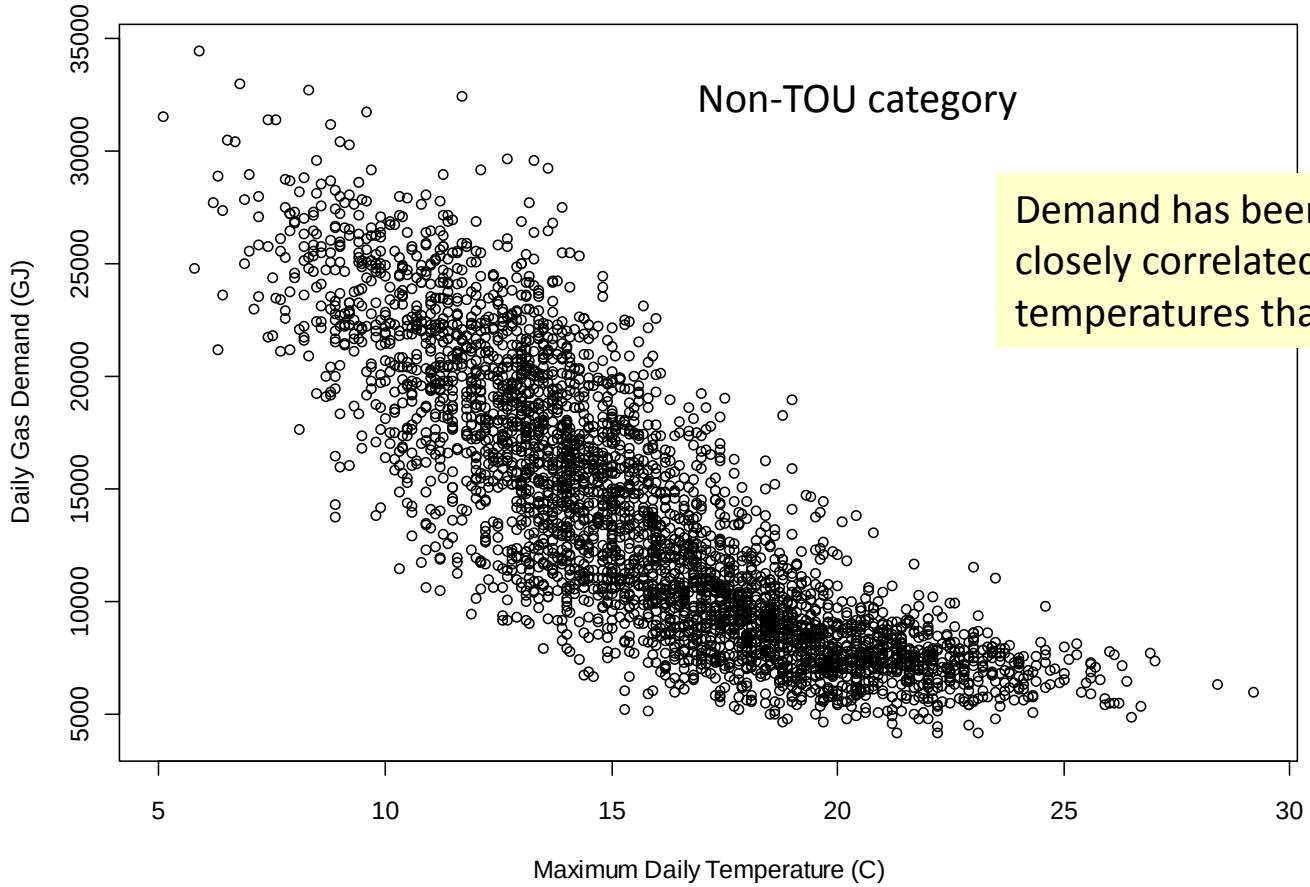
Change in peak demand has not been as great as change in annual demand

North system – demand shares 2011



Sectoral shares of annual, peak day and peak week demand are different

Temperature effects

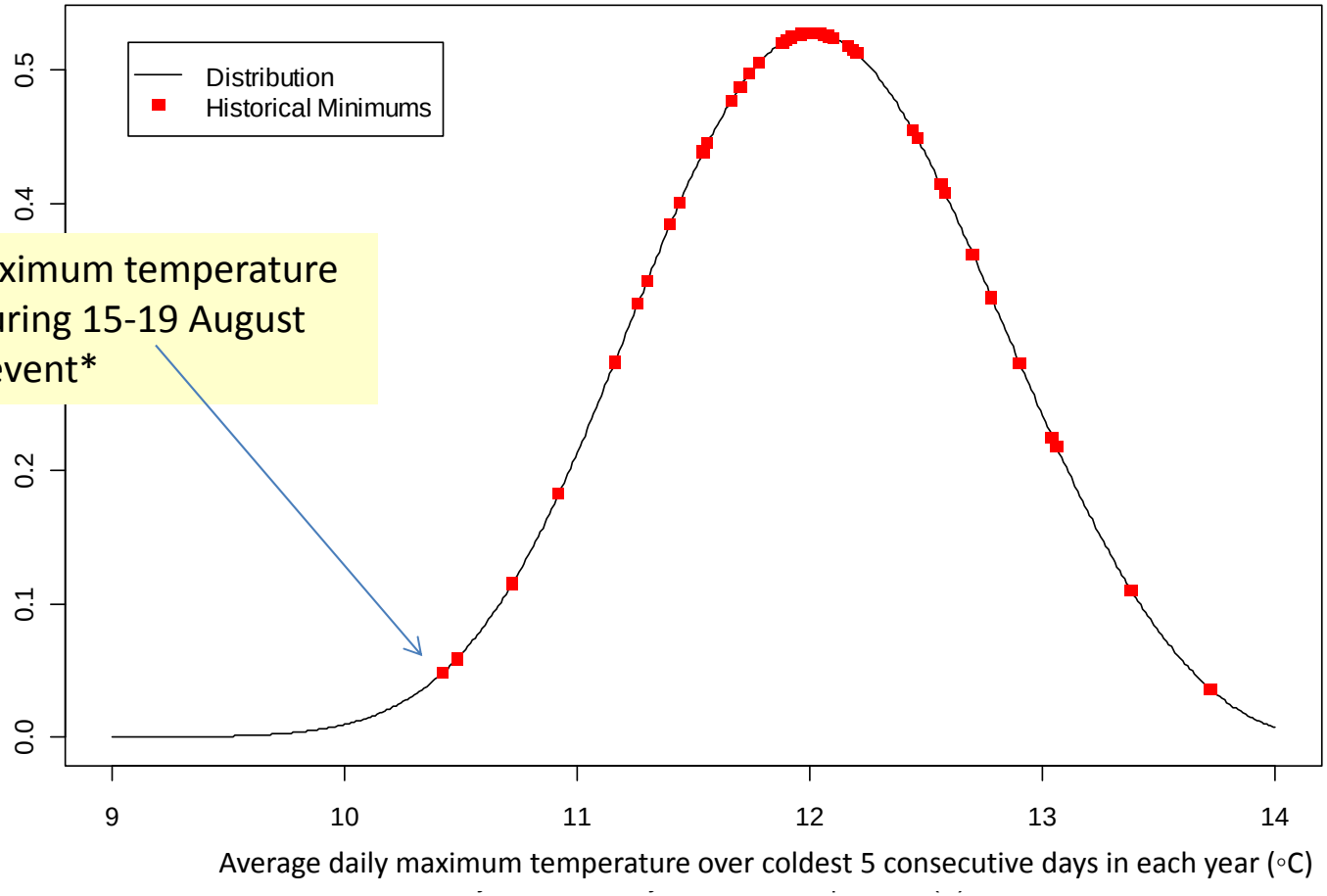


Demand has been observed to be more closely correlated with maximum daily temperatures than minimum.

- Non-TOU demand has strong temperature correlation
- 'TOU' demand also has some correlation
- Other sectors show relatively little correlation other than generation

Historical temperature data

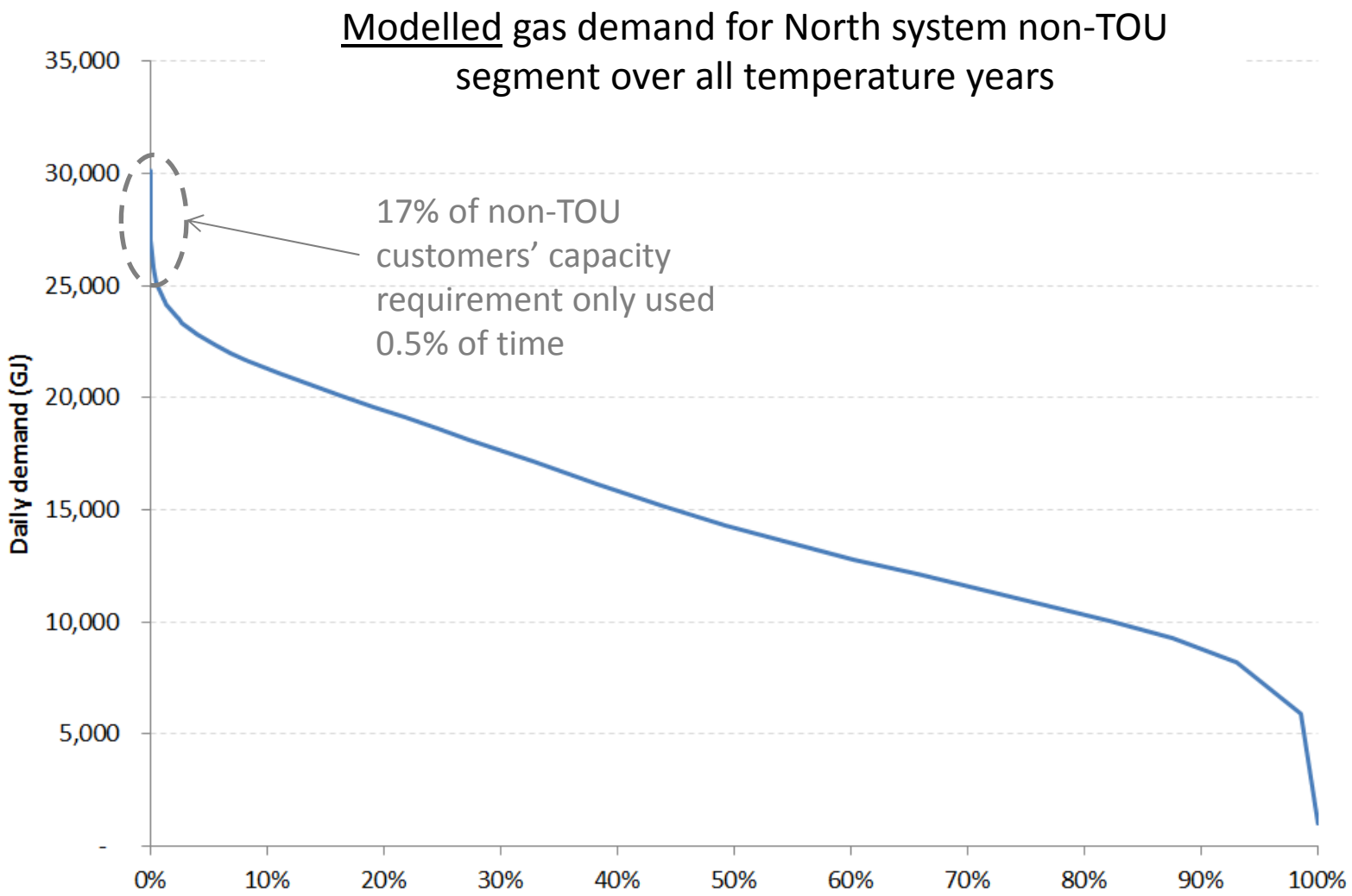
On a rolling 5 day maximum temperature basis, the weather during 15-19 August was ≈ a 1 in 95 year event*



* Using 46 years worth of temperature data, and a Generalised Extreme Value (GEV) probability distribution approach.

15-19 August 2011 appears to have been particularly extreme event

Margin required for temperature uncertainty



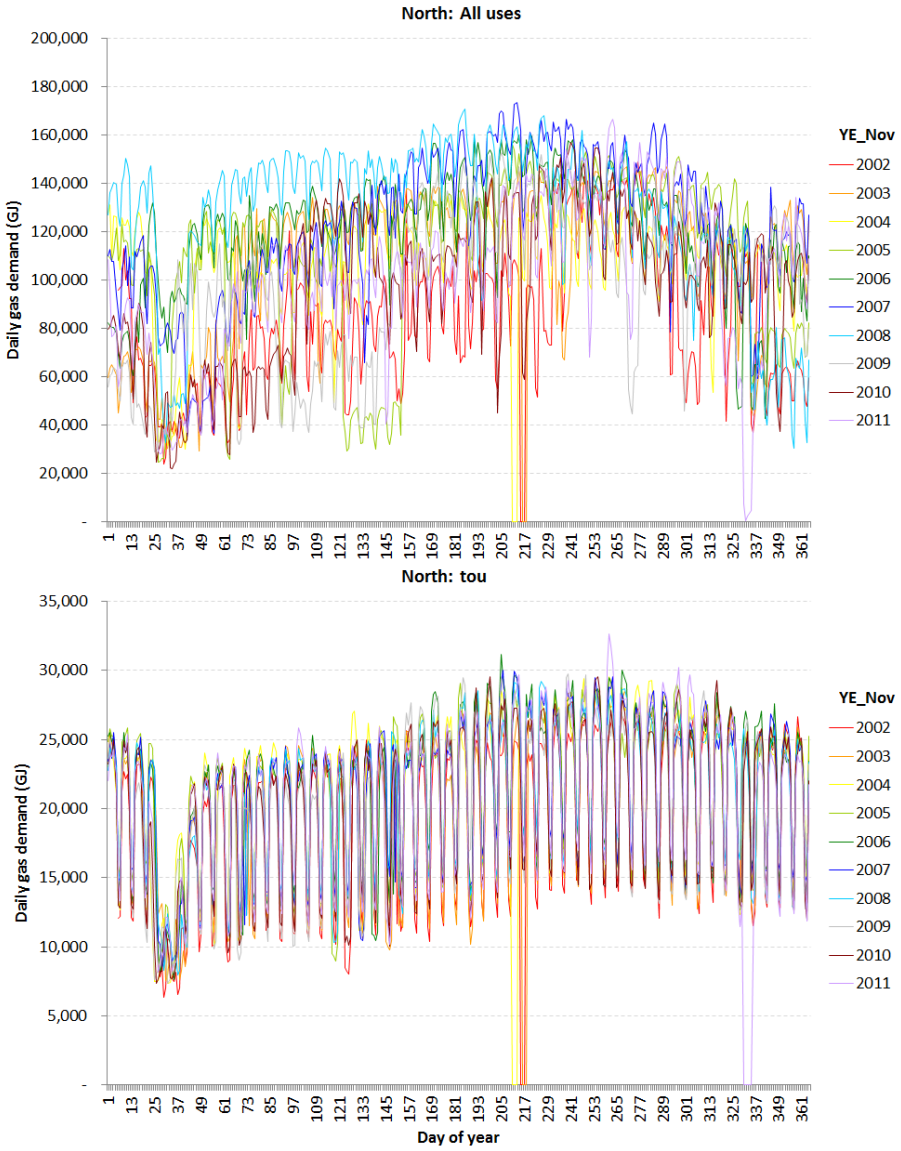
How much capacity should be reserved for temperature uncertainty?

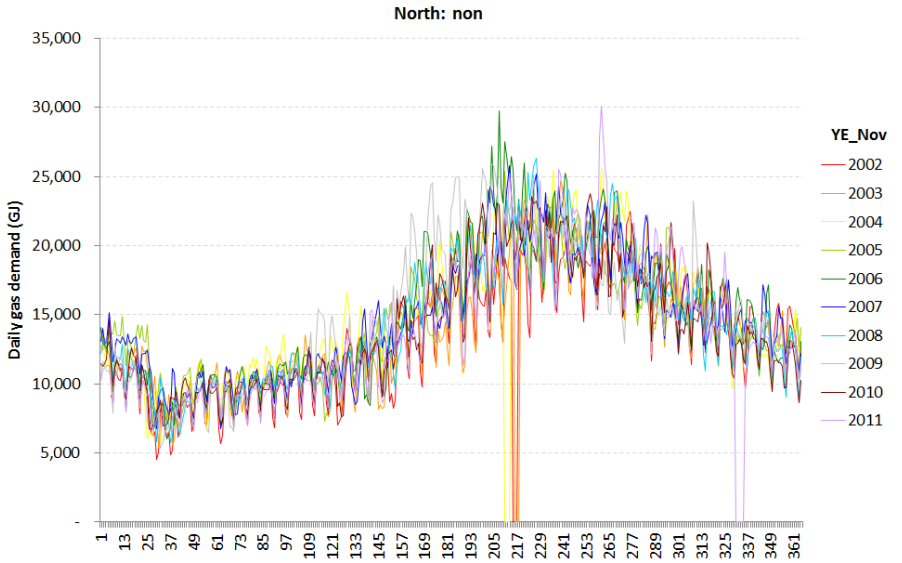
Variability in maximum demand

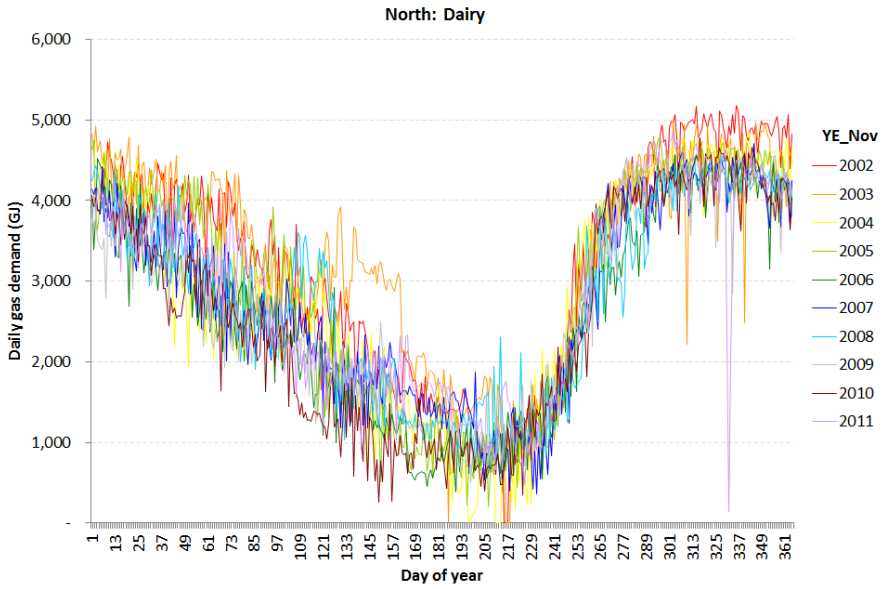
	Extent max demand greater than max demand in mean year			
	Max	***1 in 99***	***1 in 20***	***1 in 10***
Max daily	17%	16%	10%	8%
Max week	15%	11%	8%	6%

There is significant temperature-driven variability in range of possible maximum demands experienced in a year

Seasonal issues







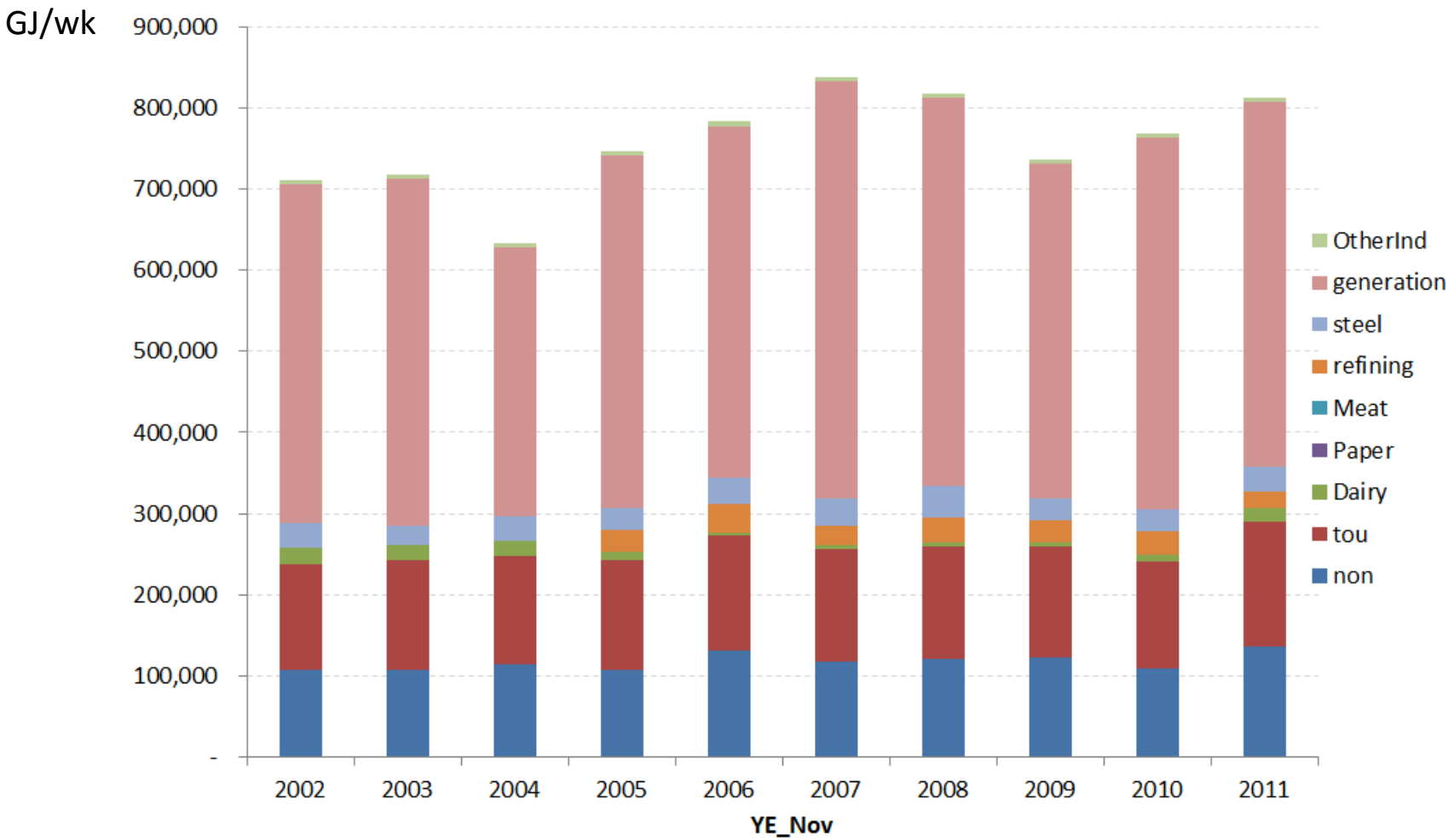
There are significant seasonal and diurnal variations among the different uses

Interruptible demand

- Currently, refinery only large customer with interruptible contract
  - ≈3% of peak daily demand
  - Ability to switch to alternative fuel (from own feedstock)

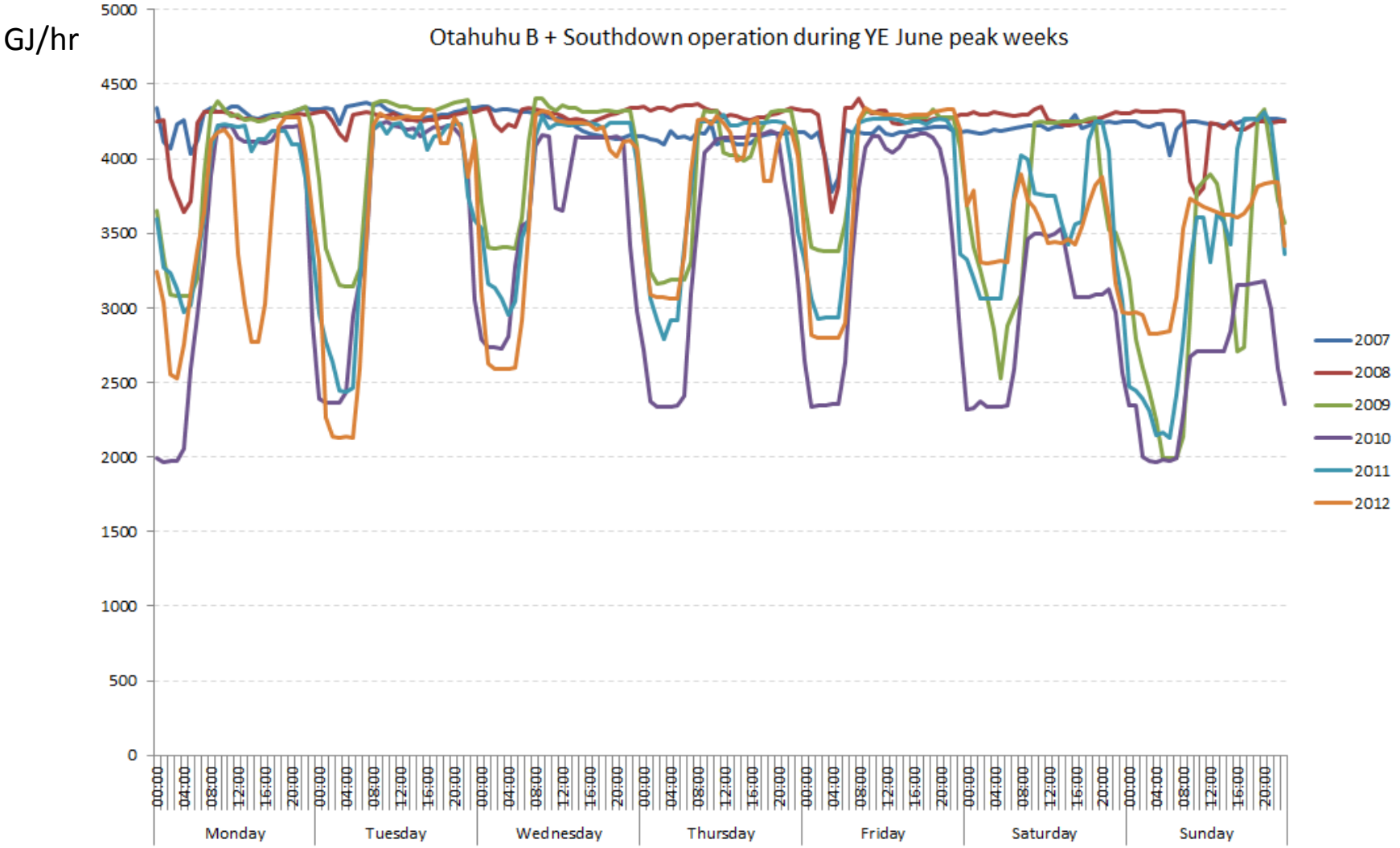
- Other potentially interruptible load may exist
  - Generation – via substitution to other stations
  - Industrial process heat
    - Curtailing/reducing usage for relatively low-value loads
    - Switching to back-up fuel

North system – peak weekly gas throughput



Power generation is the major contributor to peak weekly demand

North system – hourly generation in peak weeks



Otahuhu B & Southdown have been cycling during peak gas weeks

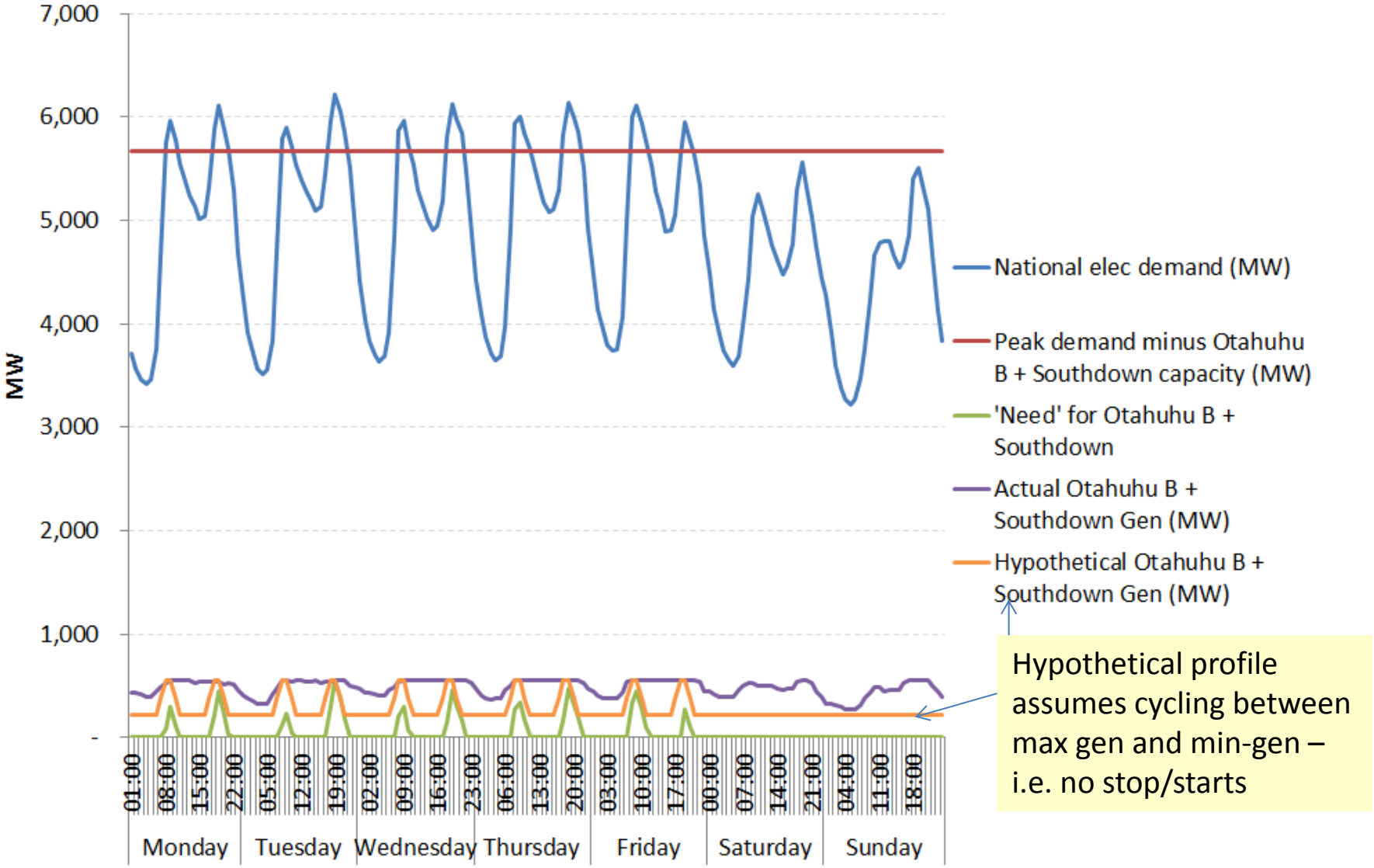
Potential for increased generation cycling

- While Otahuhu B and Southdown are doing some cycling during peak weeks, additional potential appears to exist to reduce output overnight and during the middle of the day

- Key issues to consider are:
  - more aggressive cycling imposes wear and tear costs
  - stop/start costs likely to be significant for Otahuhu B
  - need to serve electricity demand from other sources if Otahuhu B/Southdown reduce output

- Indicative analysis of unused potential can be performed based on 'static' view of current generation system

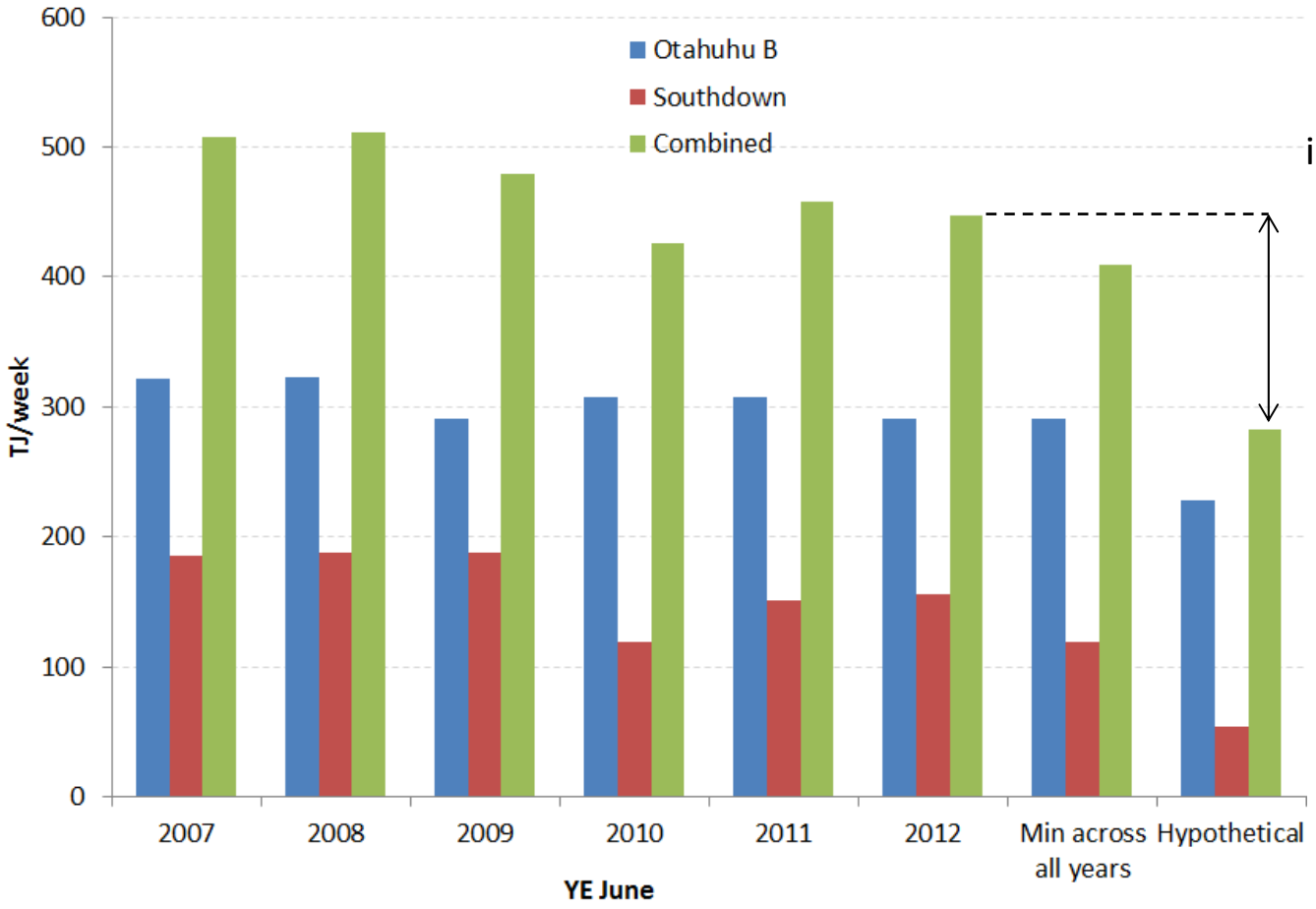
Potential for additional cycling in peak gas weeks



Hypothetical profile assumes cycling between max gen and min-gen – i.e. no stop/starts

There is daylight between actual and 'needed' generation on North system

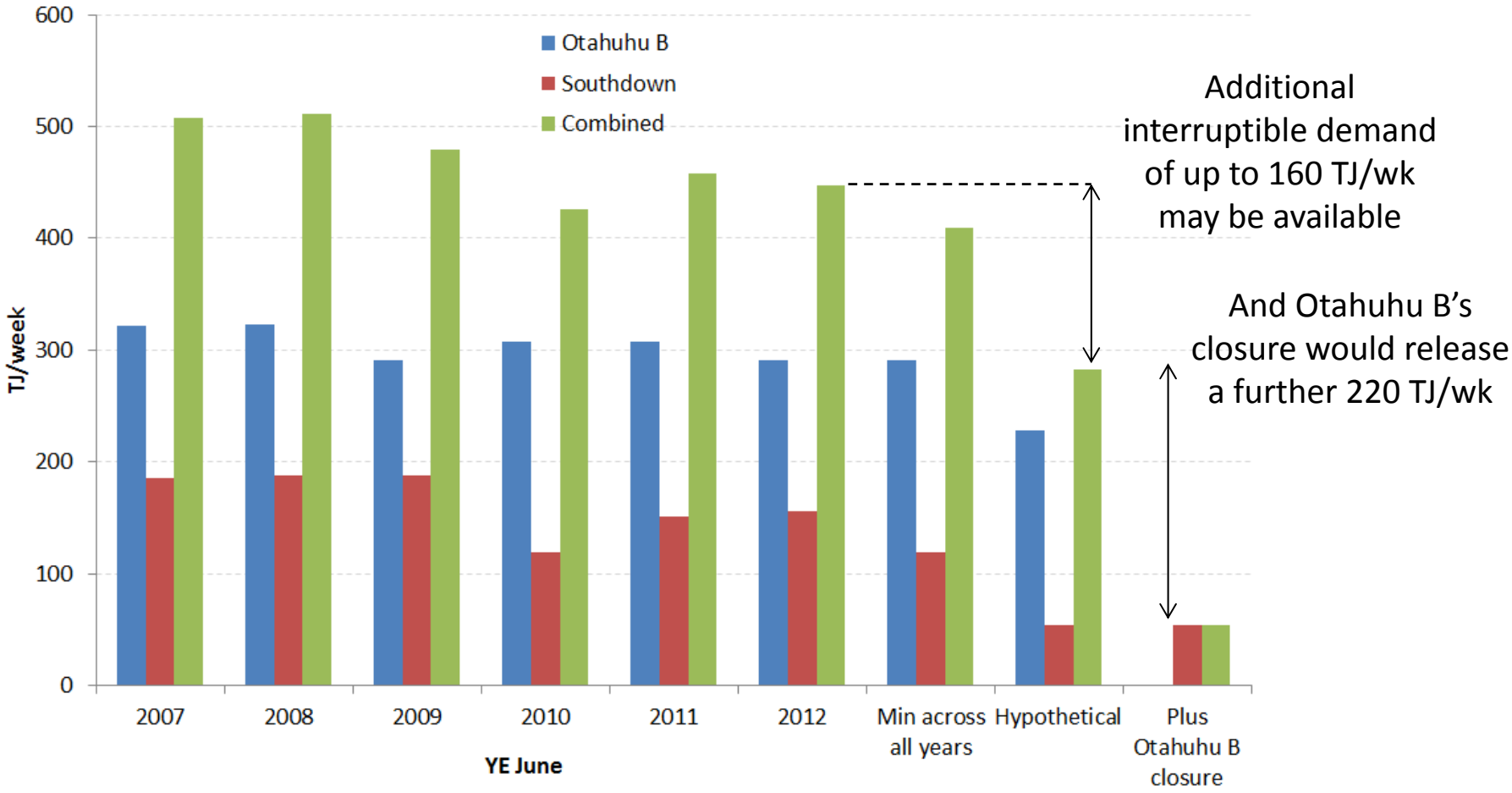
Power station interruptible demand



Additional interruptible demand of up to 160 TJ/wk may be available ≈ 20% of system capacity

Indicative analysis suggests up to 160TJ/wk of interruptible demand available

Otahuhu B closure scenario



Closure of Otahuhu B would release a further 200 TJ/wk

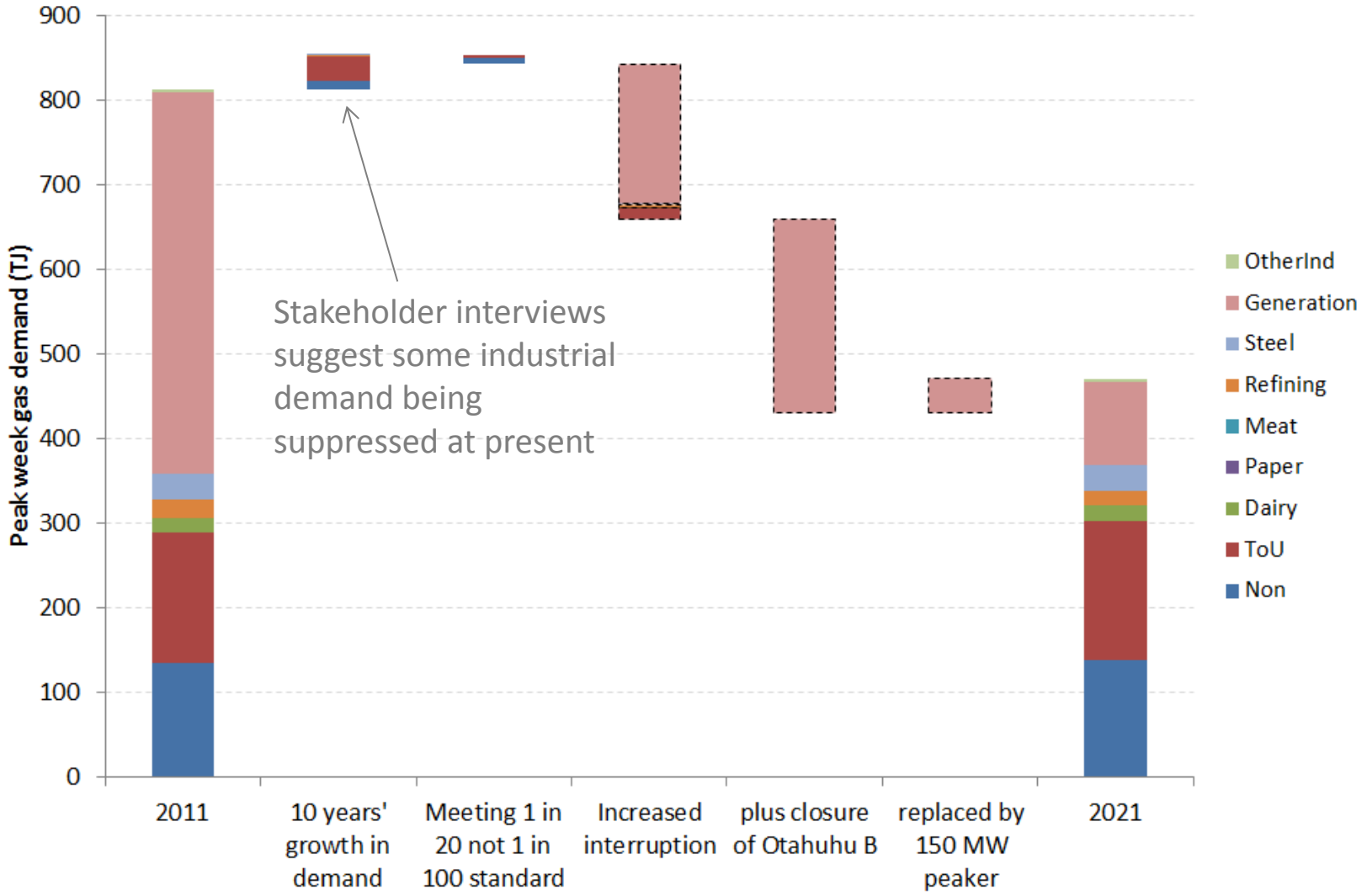
Interruptible demand - viability

- If more demand interruption is physically feasible, will it emerge in practice?

- Preliminary analysis suggests that additional demand response would be economic for much of the time (i.e. inferred value of capacity > opportunity cost of interruption)

- Suggests incentives likely to be the key issue:
  - short term signals (to facilitate efficient capacity usage at peak)
  - durability of regime (to provide confidence for any necessary longer term decisions)

Summary of issues



Power generation issues – interruptibility and Otahuhu B future dominate considerations

Next steps

- **Stakeholder input**
  - Welcome input from industry stakeholders on scenarios and approach

- **Supply and cost scenarios**
  - Complete supply and cost scenarios

- **Demand scenarios**
  - Complete demand projections by sector and region and run in combination with peak demand scenario distributions