Grid Planning Assumptions workshop

Demand forecasting

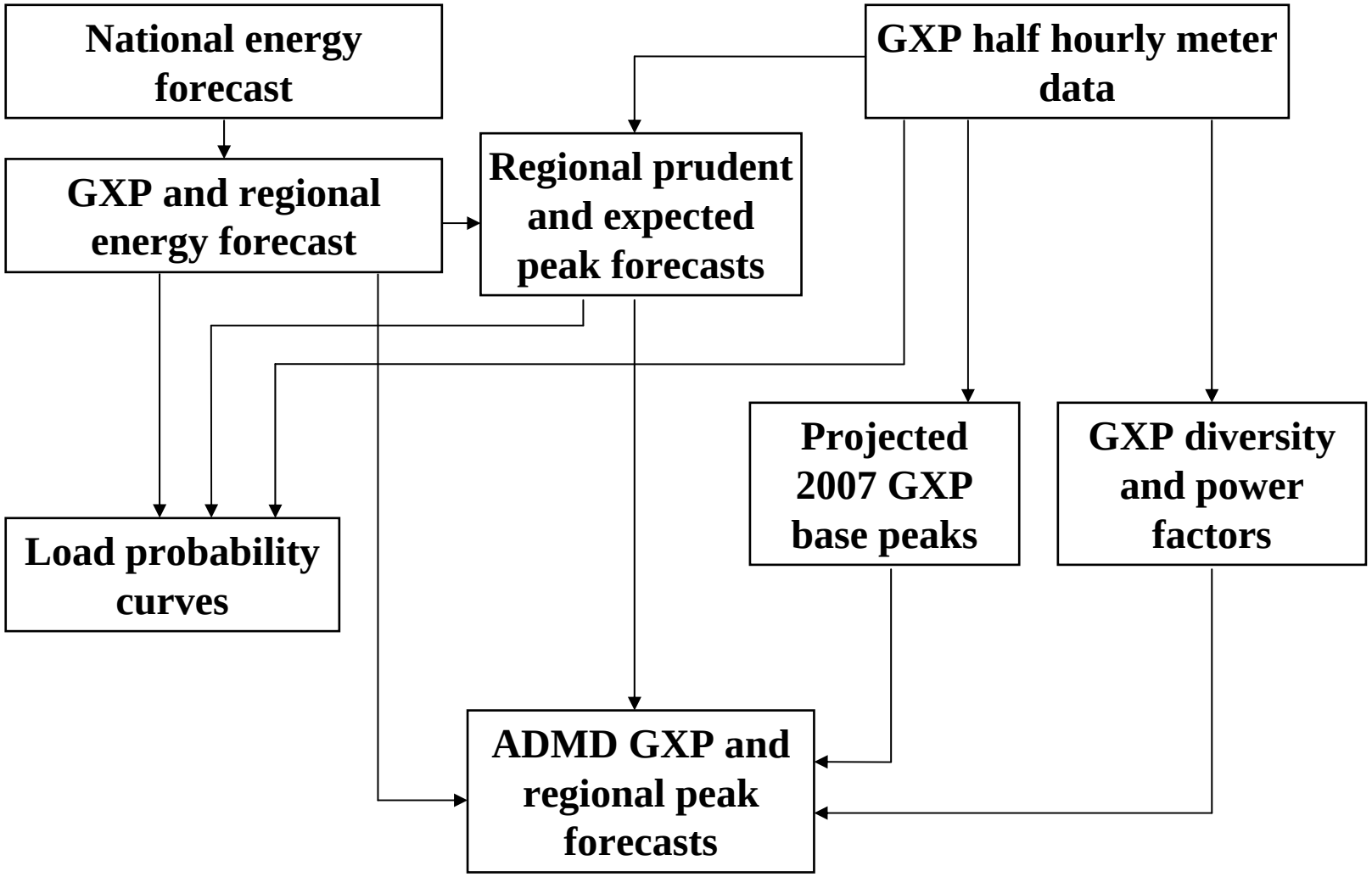
Brian Kirtlan and Brian Bull

29 February 2008

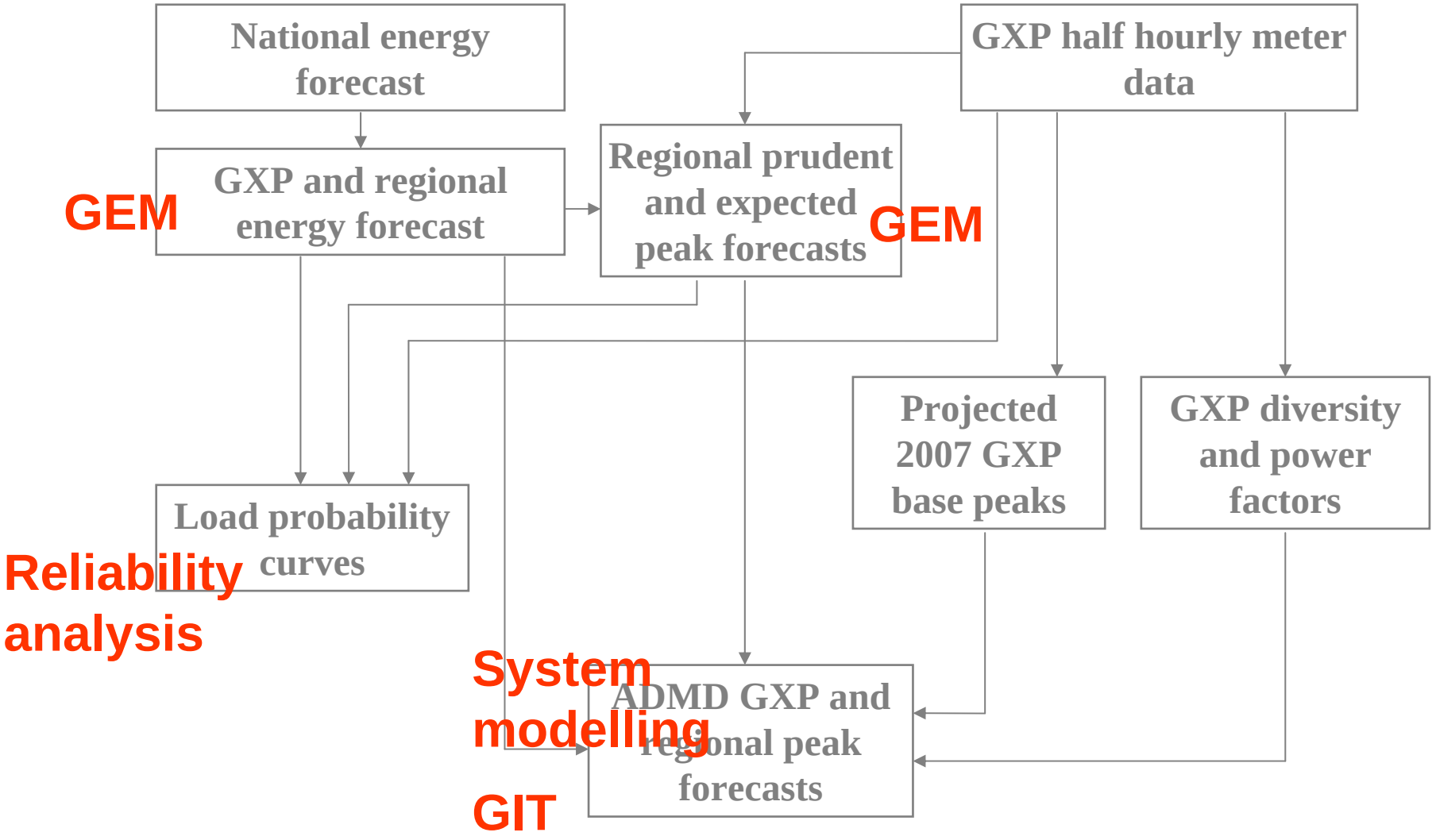
Current status

- Demand forecasts were prepared as part of the grid planning assumptions in 2006 and published as a draft in May 2007
- Forecasts reviewed late 2007 which resulted in some minor changes to the forecasting methodology
- Revised forecasts released for consultation with the intention of publishing them in the 2008 Statement of Opportunities

Forecasting process overview



Application of forecast components



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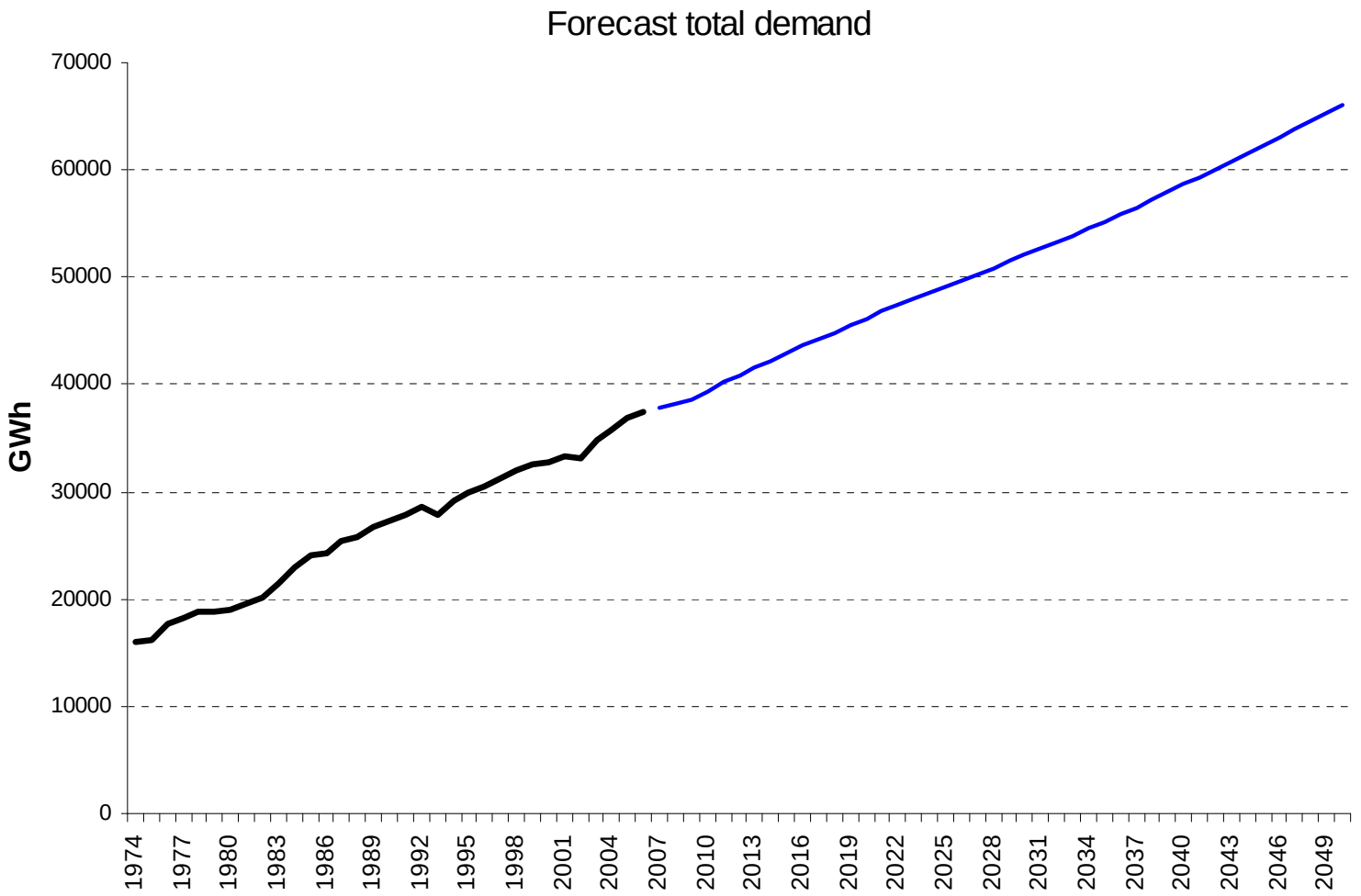
Key points

- Long term energy and peak forecasts – separate from short-medium term forecasts used for security of supply
- Econometric national energy model based on key drivers – GDP, population, housing
- Split into major sectors – residential and commercial / industrial + Tiwai smelter
- National energy forecasts are allocated to regions and grid exits points
- Used to create prudent and expected peak forecasts

Projected national energy demand



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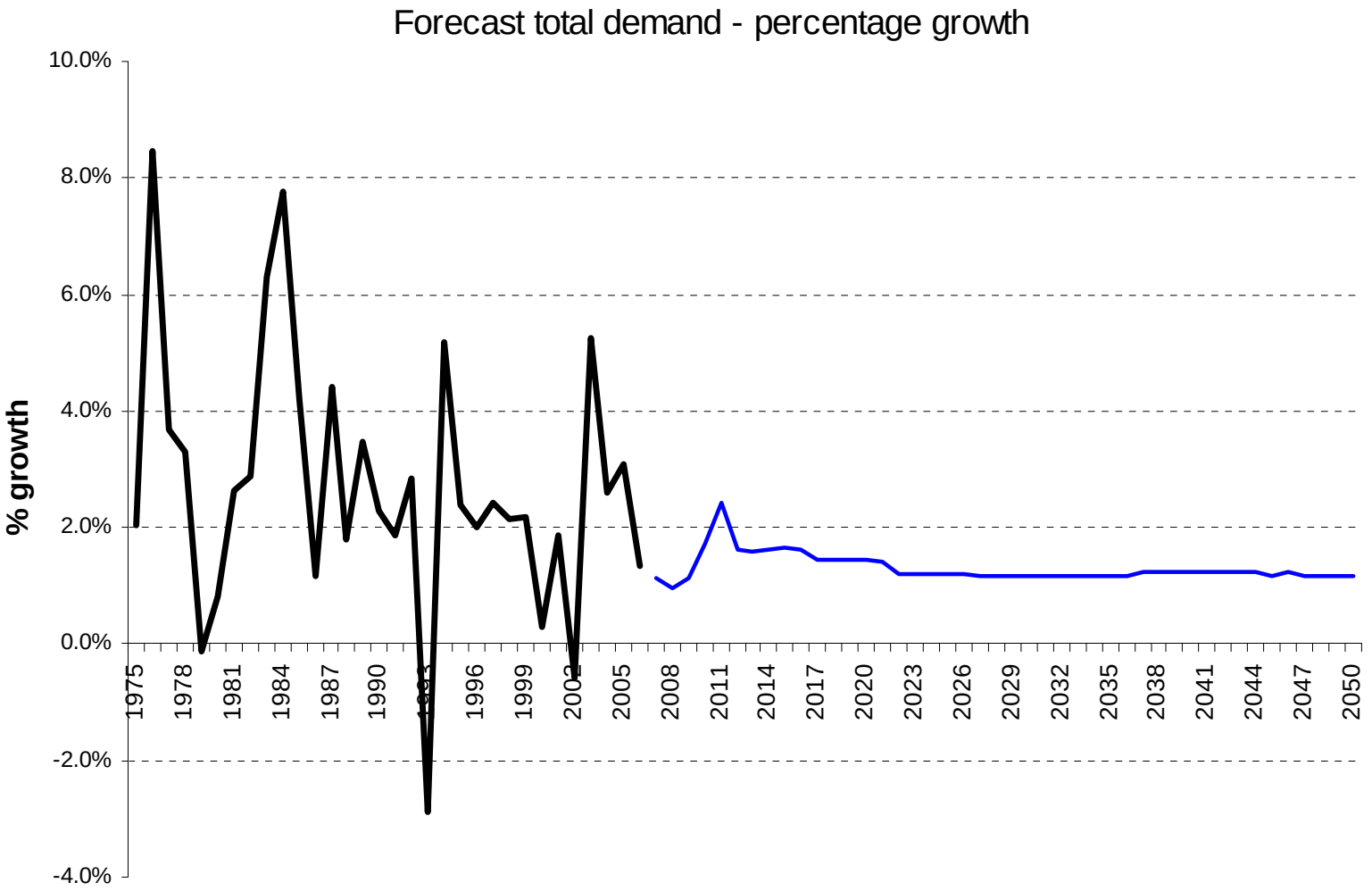
Projected national energy demand - % growth



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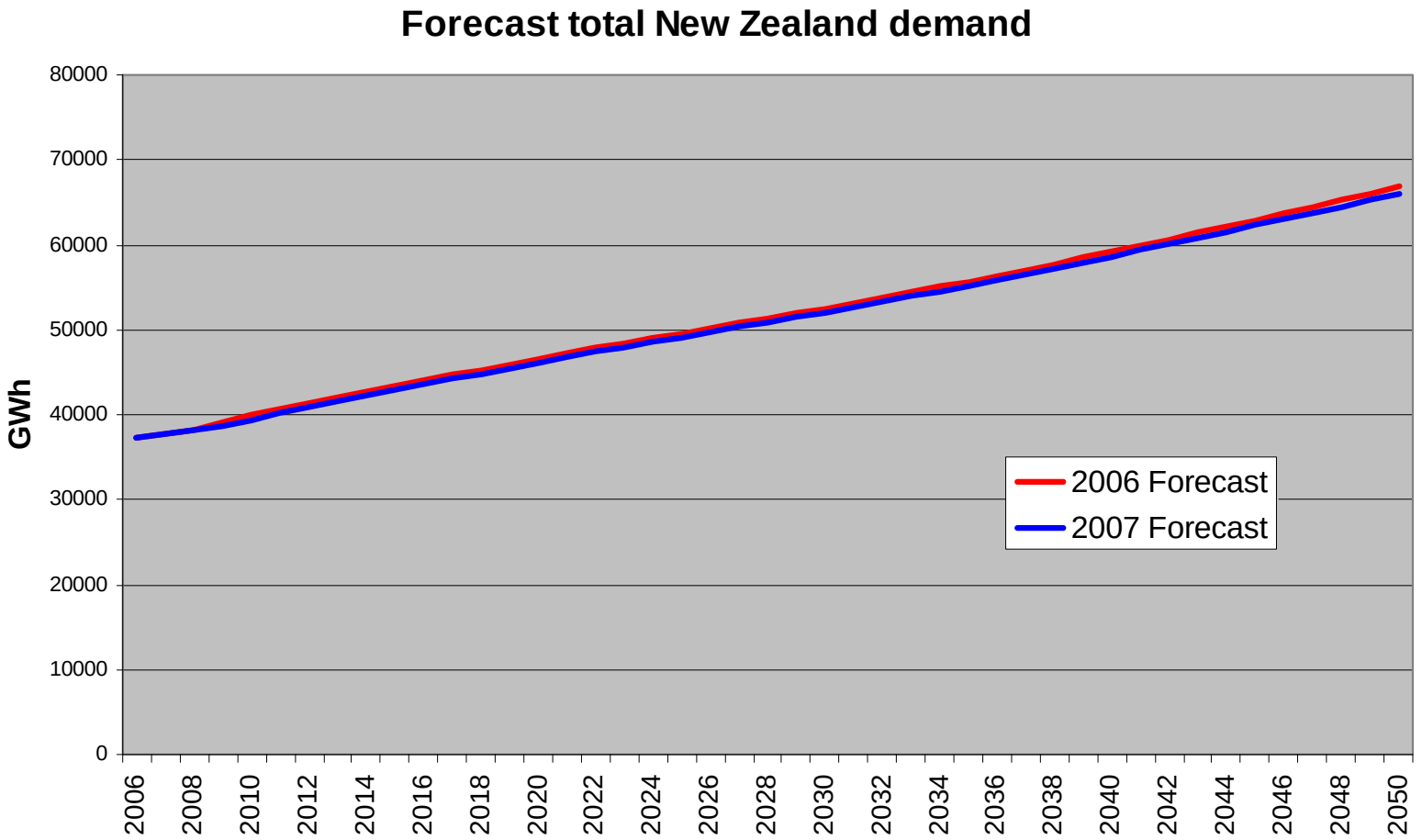
2007 energy forecast compared to 2006



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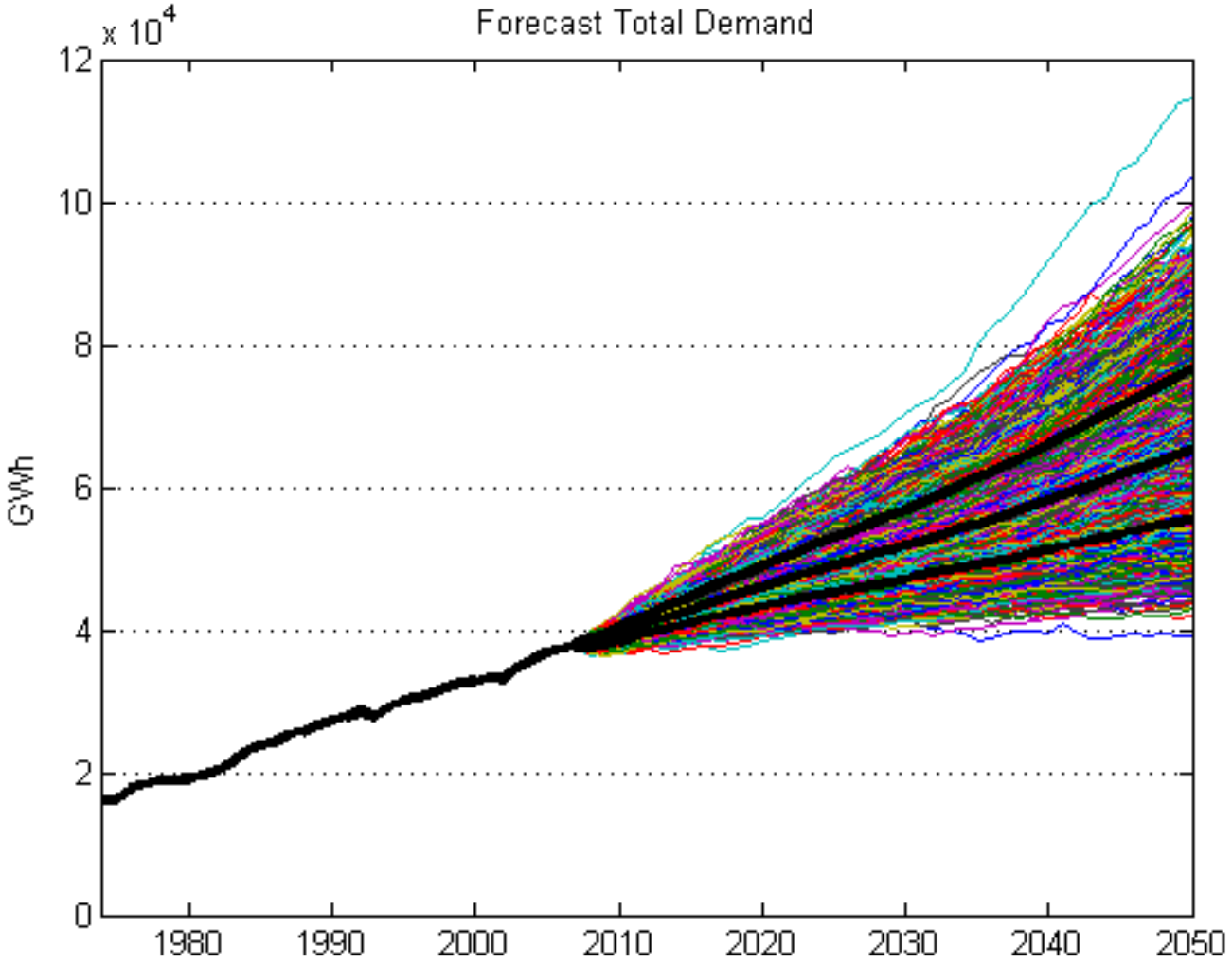
Energy forecast uncertainty

- There is uncertainty in both the historical data series (resulting in modelling uncertainty) and the forecasts of the key drivers (GDP, population etc)
- Use Monte Carlo modelling to estimate the resulting uncertainty in forecast demand
- Establish distributions for the input series and for the forecast drivers
- Run the model many times, drawing randomly from the defined distributions and re-estimating the model and forecasts

Energy forecast confidence limits



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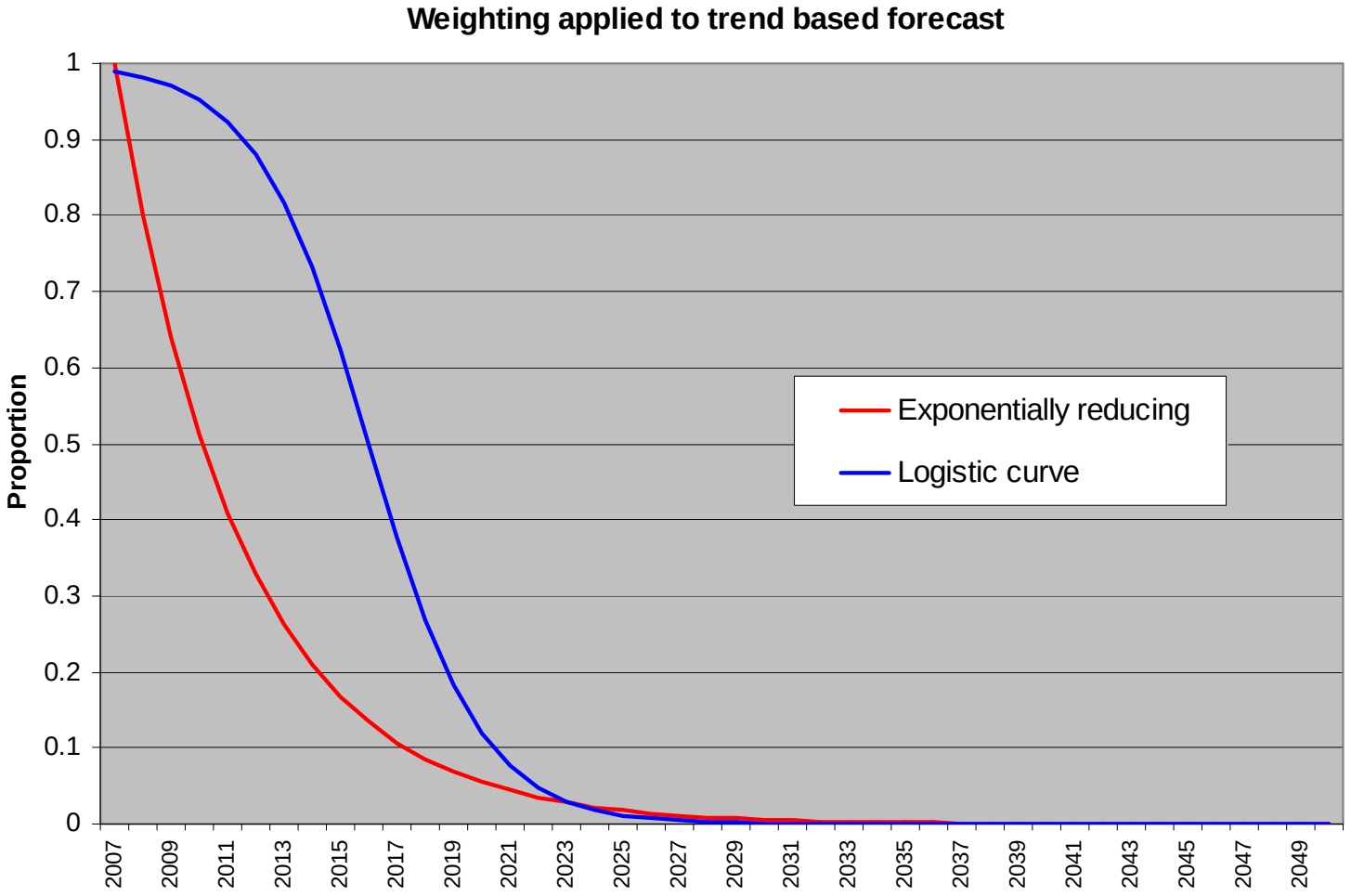
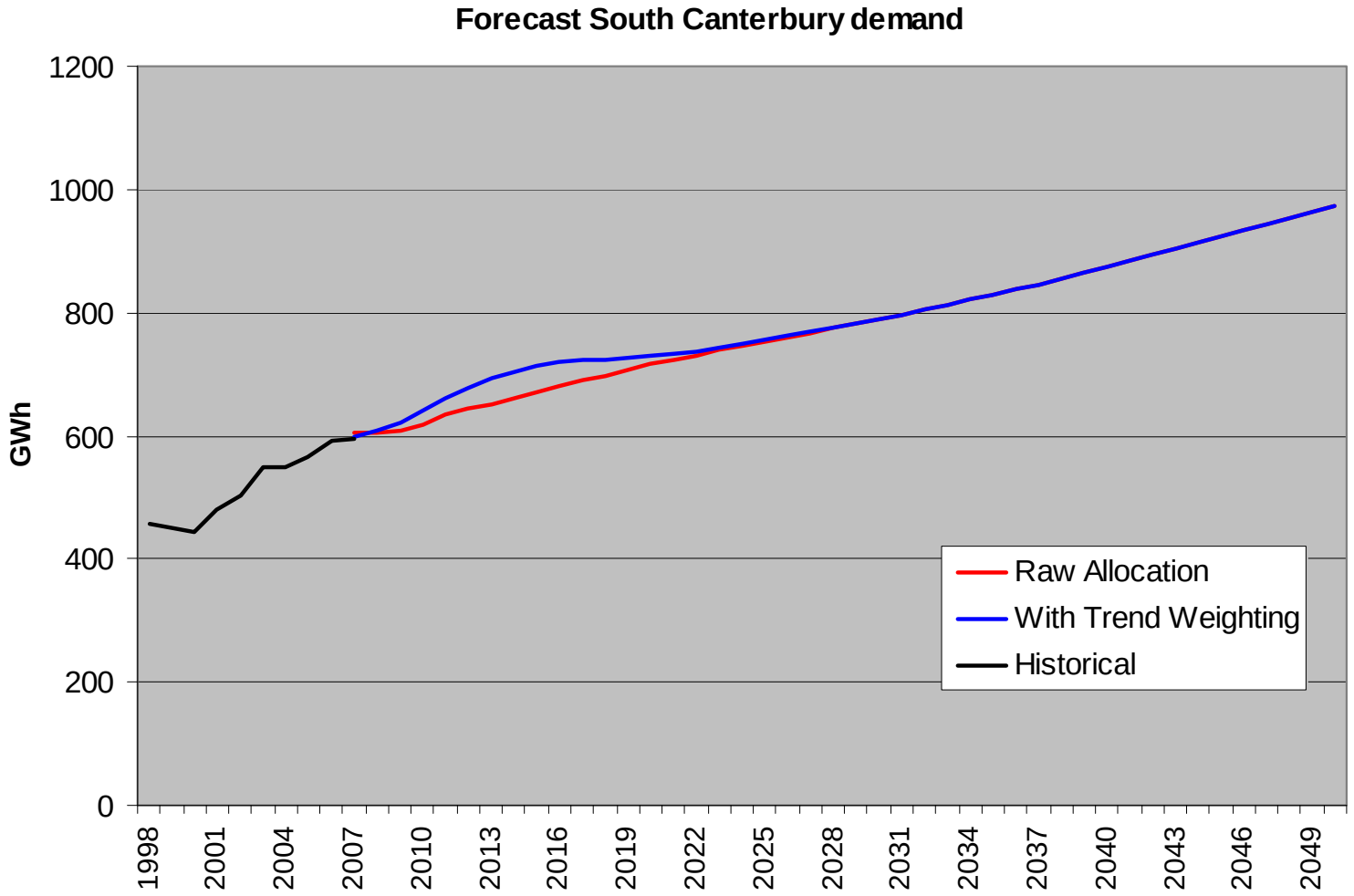
Regional energy forecasts

- Allocation to regions based on population and GDP projections
- Use recent trends in shorter term then transition to long term driver driven forecasts
- Altered transitional weighting so that short term trend given more emphasis for an increased number of years
- Introduced inter-regional population uncertainty modelling – had little impact

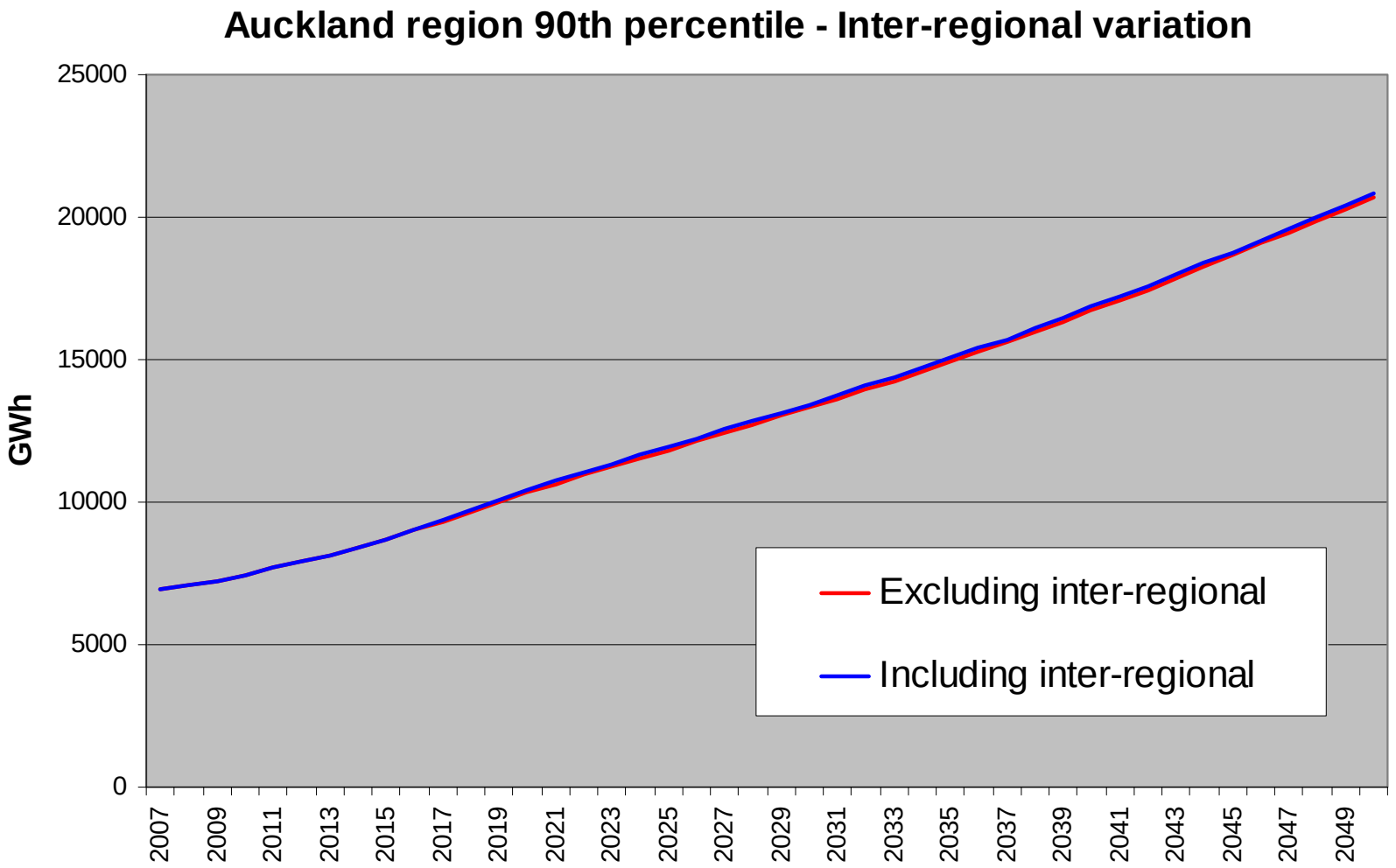
Regional energy forecasts – exponential v.s. logistic transition



Regional forecast example – transition from short term trend to long term forecast



Inter-regional population variation example



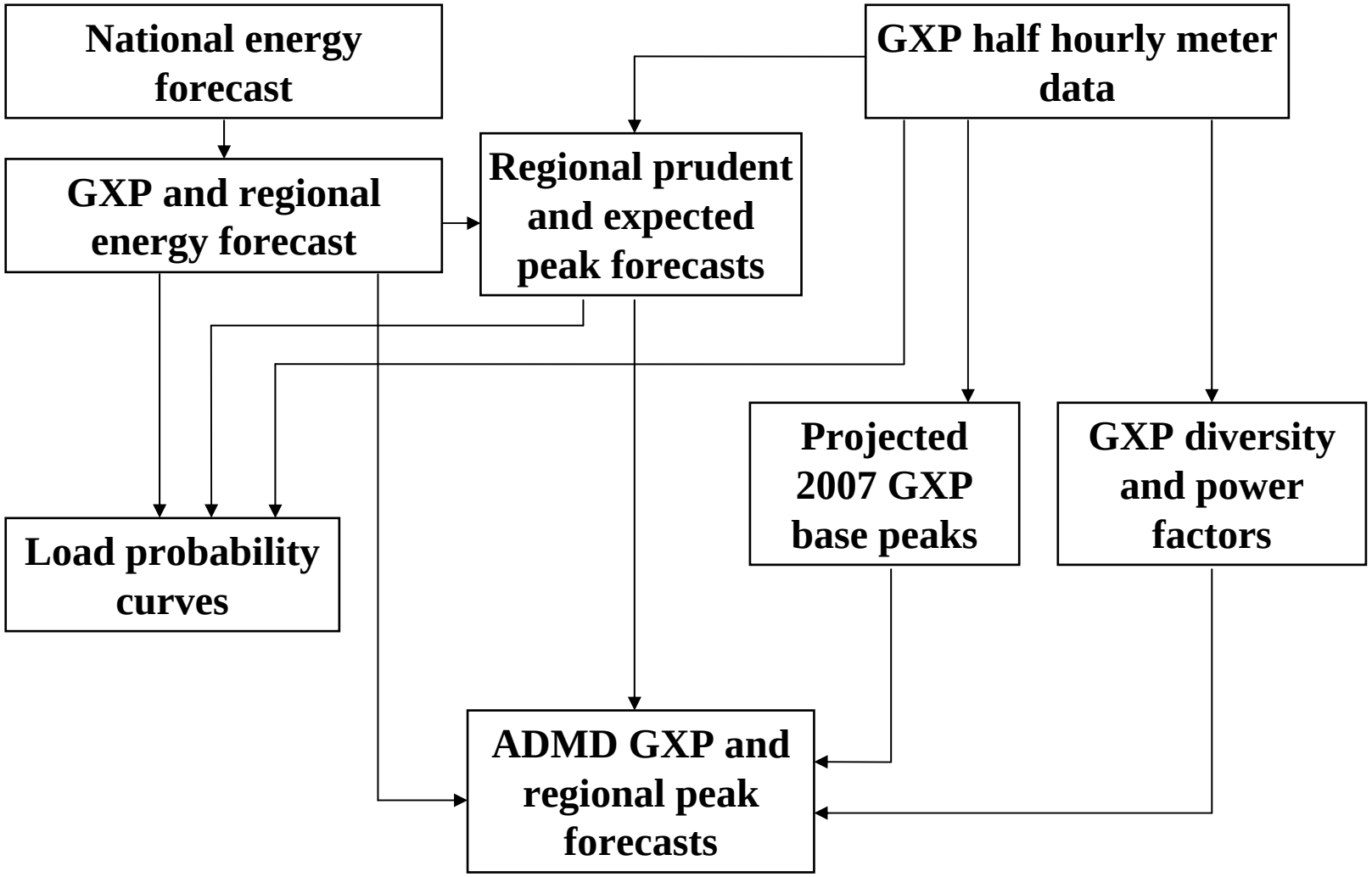
Island energy balance

	Av. Ann. Growth Gwh			% of total NZ growth	
	South	North	NZ	South	North
Past 8 yrs	238	358	596	40%	60%
Past 5 yrs	260	368	628	41%	59%
Revised Forecasts					
Next 5 yrs	229	334	564	41%	59%
Next 10 yrs	198	419	616	32%	68%
Next 20 yrs	137	478	615	22%	78%
Draft 2007 Forecasts					
Next 5 yrs	169	484	653	26%	74%
Next 10 yrs	148	514	661	22%	78%
Next 20 yrs	127	511	638	20%	80%

Raw GXP peak forecasting

- GXP peaks used as a base to forecast from are estimated using recent trends in metered demand
- Focus is to produce an expected peak with ‘normal’ diversity and power factor characteristics (uses 50 highest peaks)
- Raw GXP mean forecasts use energy growth rates for each GXP with adjustments for embedded generation

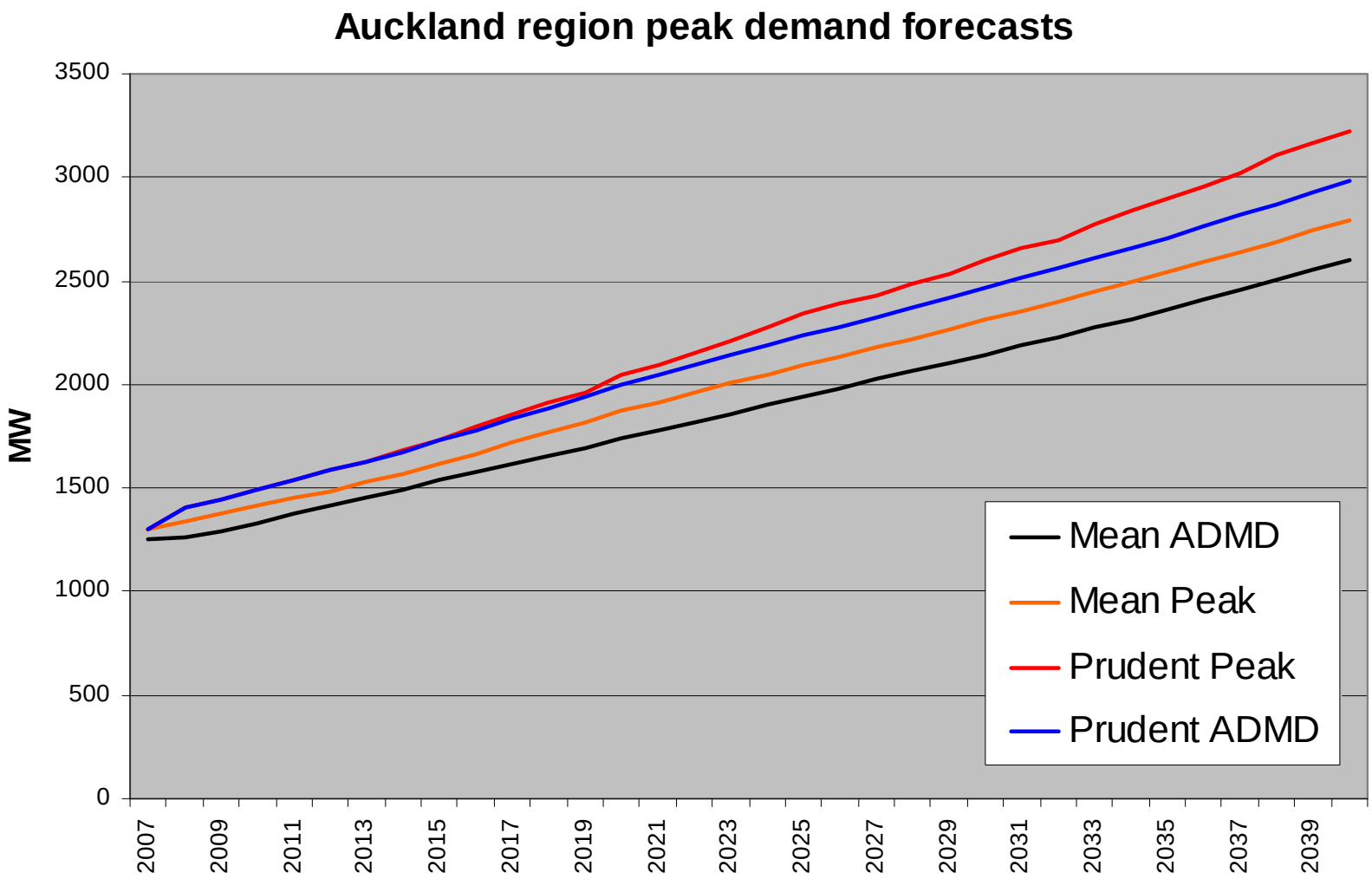
Forecasting process overview



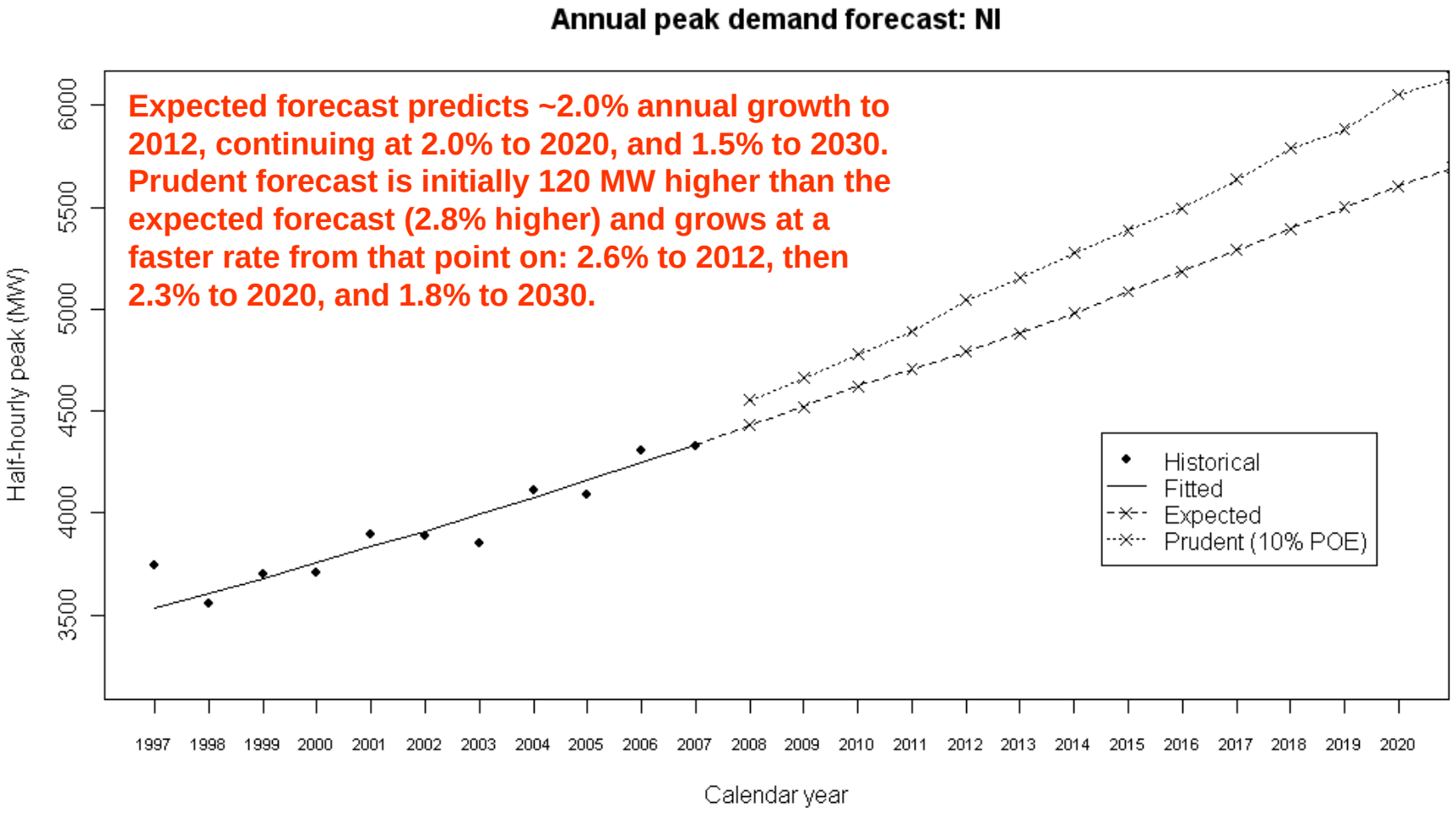
Prudent and expected peak forecasting

- Expected regional peak forecasts are calculated using metered data and the energy forecasts
  - Single highest peak
  - Historical trend merges gradually into projected growth rate from energy forecasts
  - Includes adjustments for committed new load
- Prudent regional peak forecasts incorporate:
  - Uncertainty about energy growth
  - Risk of short-term surge in peak demand
  - Year-to-year variation in peak demand (weather, etc)
- Raw GXP forecasts are then scaled so that they sum to match the prudent peak forecasts then transition to mean forecast growth

Regional forecast types



North Island peak growth



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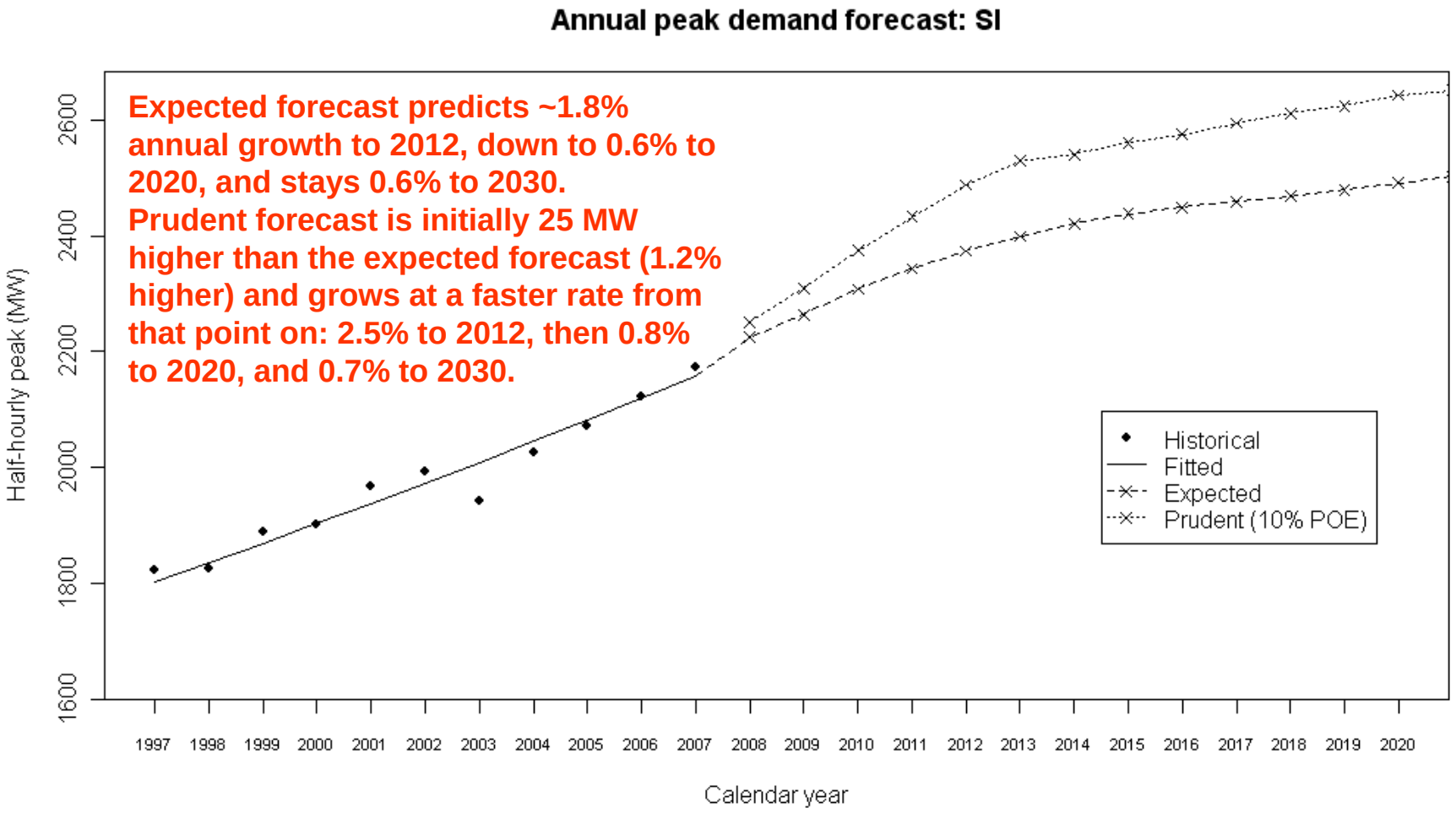
South Island peak growth



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2008 step load adjustments

Project	Date	MW	GWh	GXP	Region
Pike River coal mine Stage 1	2008	7	61	ATU1101	West Coast
Pike River coal mine Stage 2	2009	7	61	ATU1101	West Coast
Blackpoint irrigation Stage 1	2007	6	19	BPT1101	Otago/Southland
Blackpoint irrigation Stage 2	2008	4	18	BPT1101	Otago/Southland
Westland Dairy powder plant	2008	4	18	HKK0661	West Coast
Globe Progress gold mine	2008	4	35	RFT1101	West Coast
Hawera gas processing plant	2008	12	80	HWA0331	Taranaki

ADMD prudent peak forecasts

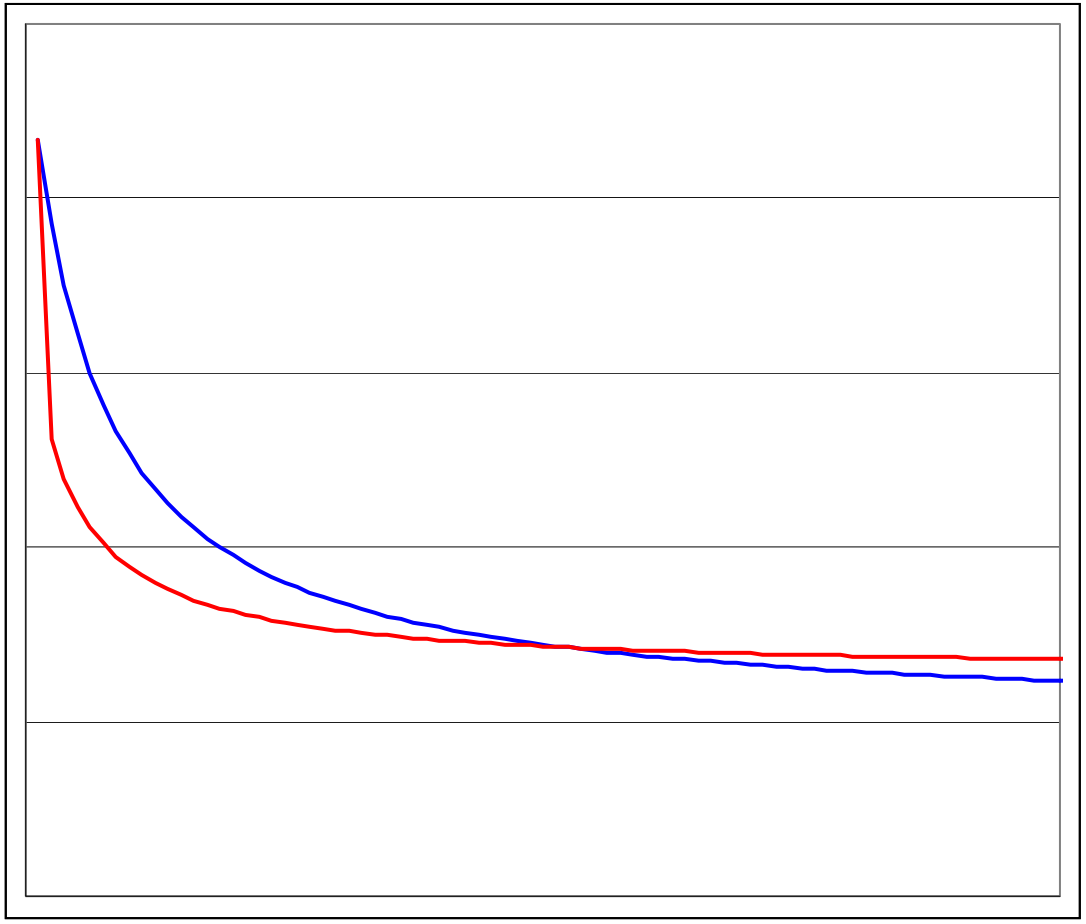
- Some significant changes to regional peak forecast compared to the draft May 2007 forecasts
- GXP forecasts may be changed for specific analyses if additional information becomes available

Load probability curves

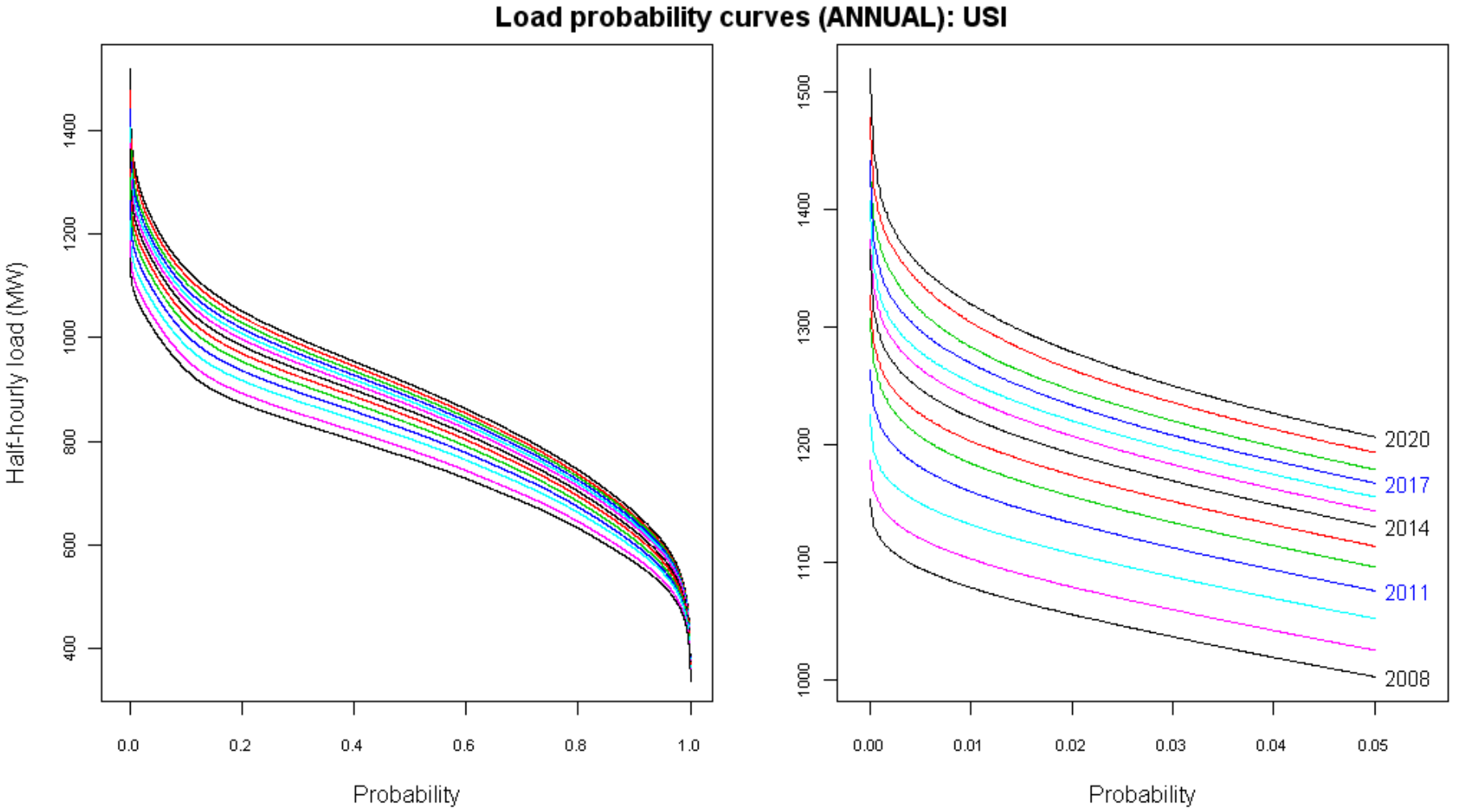
- Demand forecasts now also include regional load probability curve (LPC) forecasts
- Definition of LPC – “curve that shows the probability that each given demand level will be exceeded in a randomly chosen trading period”
- Can be used for reliability analysis (e.g. in GIT)
- Forecasting methodology not particularly sophisticated. LPC forecast should:
  - Be consistent with energy forecast
  - Be consistent with peak forecast
  - Reflect the historical variability in load shapes

Motivation for LPC forecasts

It's all very well to have a forecast of annual peak, but *how much of the time do we expect to be close to that peak?*



LPC examples



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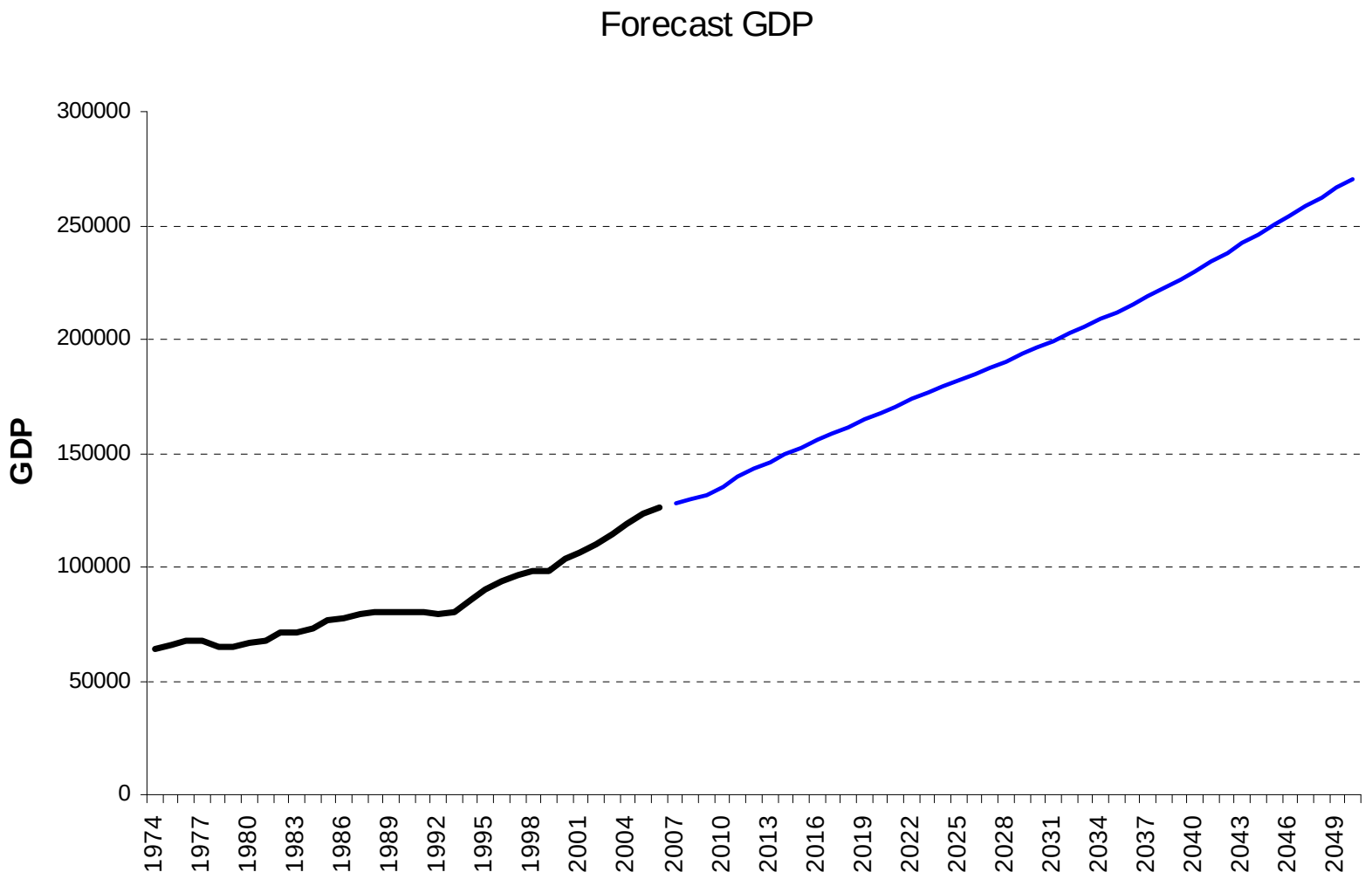
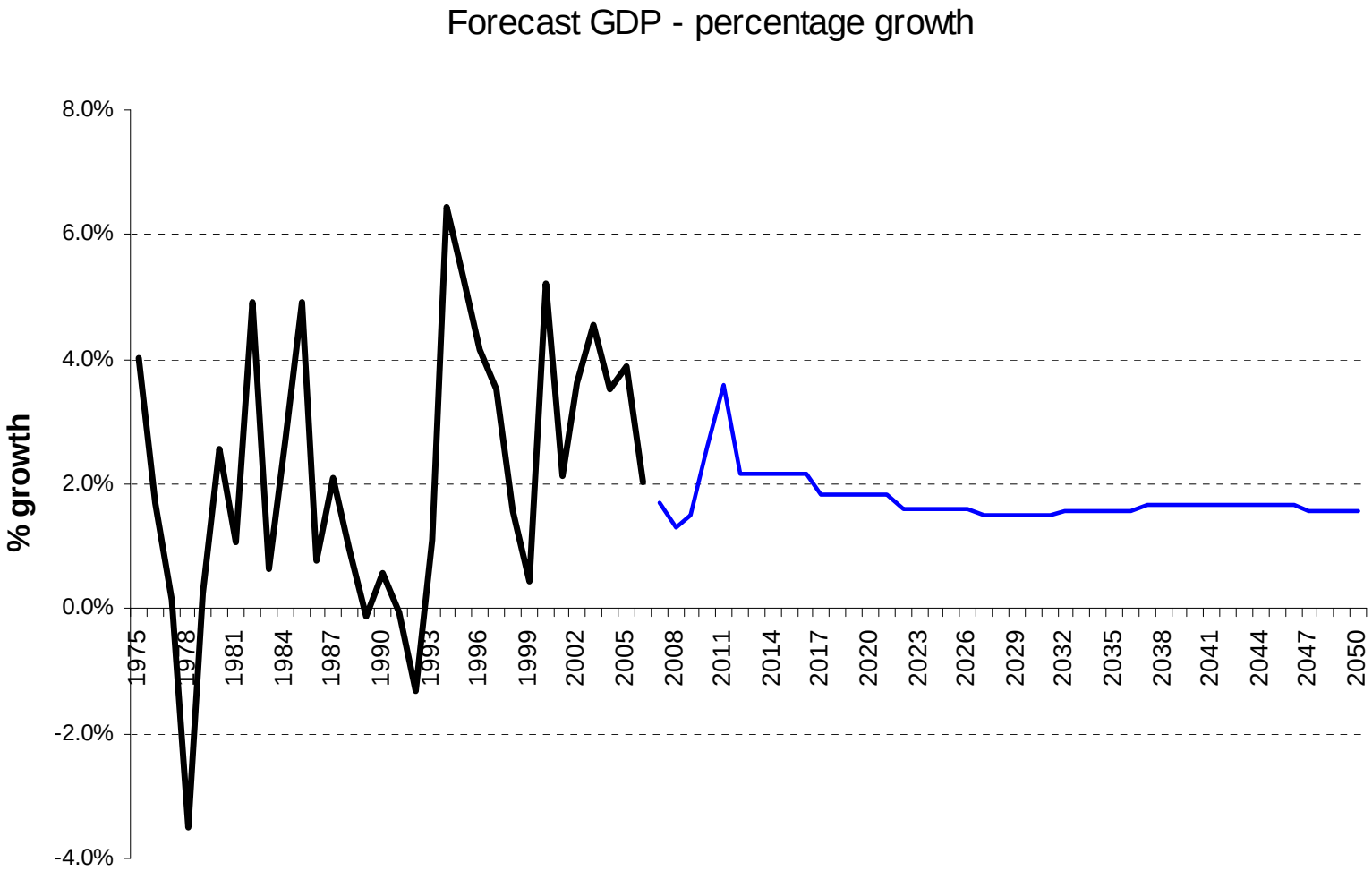
Supplementary slides

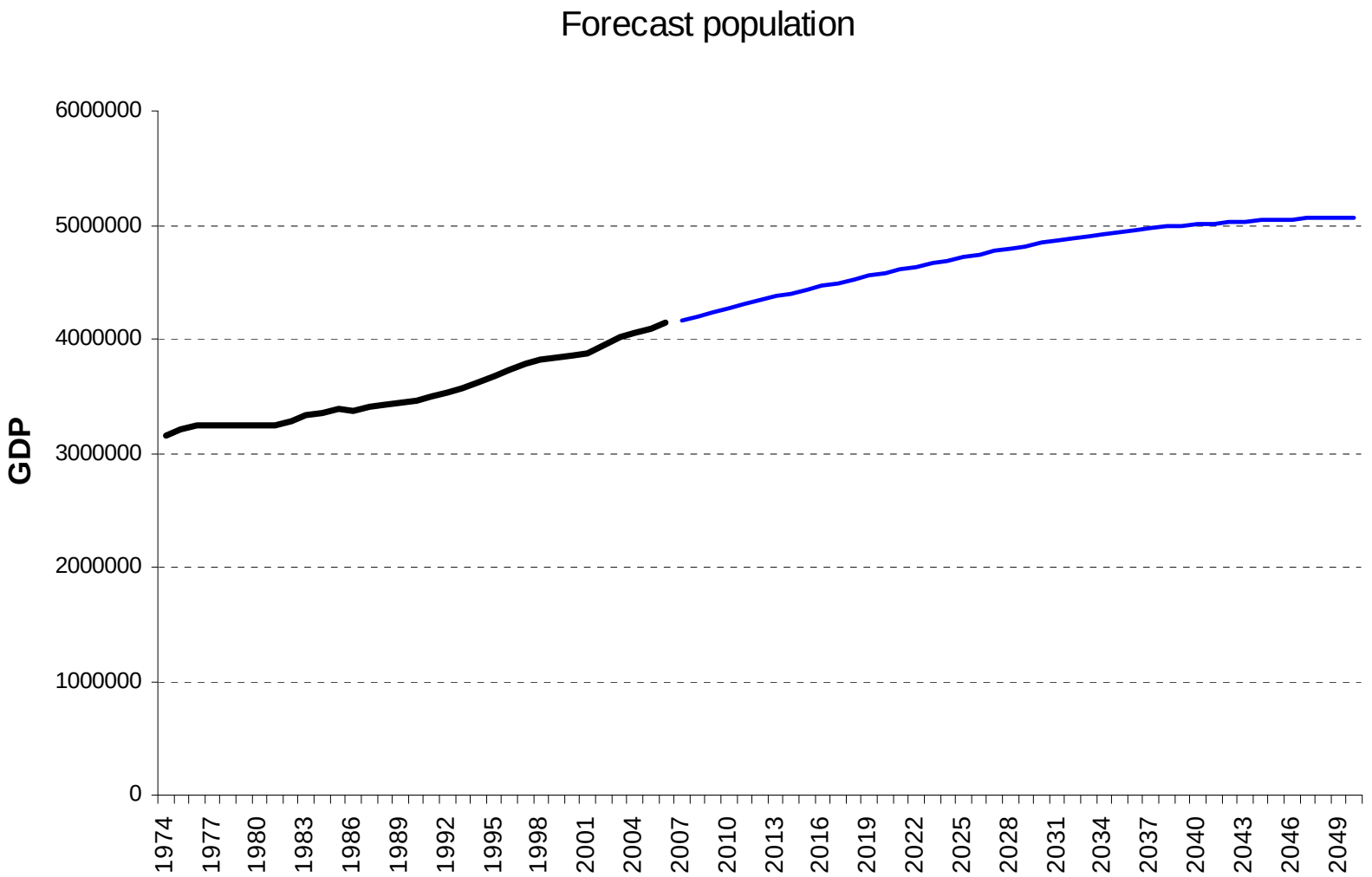
Drivers - GDP


Forecast GDP
GDP
300000
250000
200000
150000
100000
50000
0
1974
1977
1980
1983
1986
1989
1992
1995
1998
2001
2004
2007
2010
2013
2016
2019
2022
2025
2028
2031
2034
2037
2040
2043
2046
2049

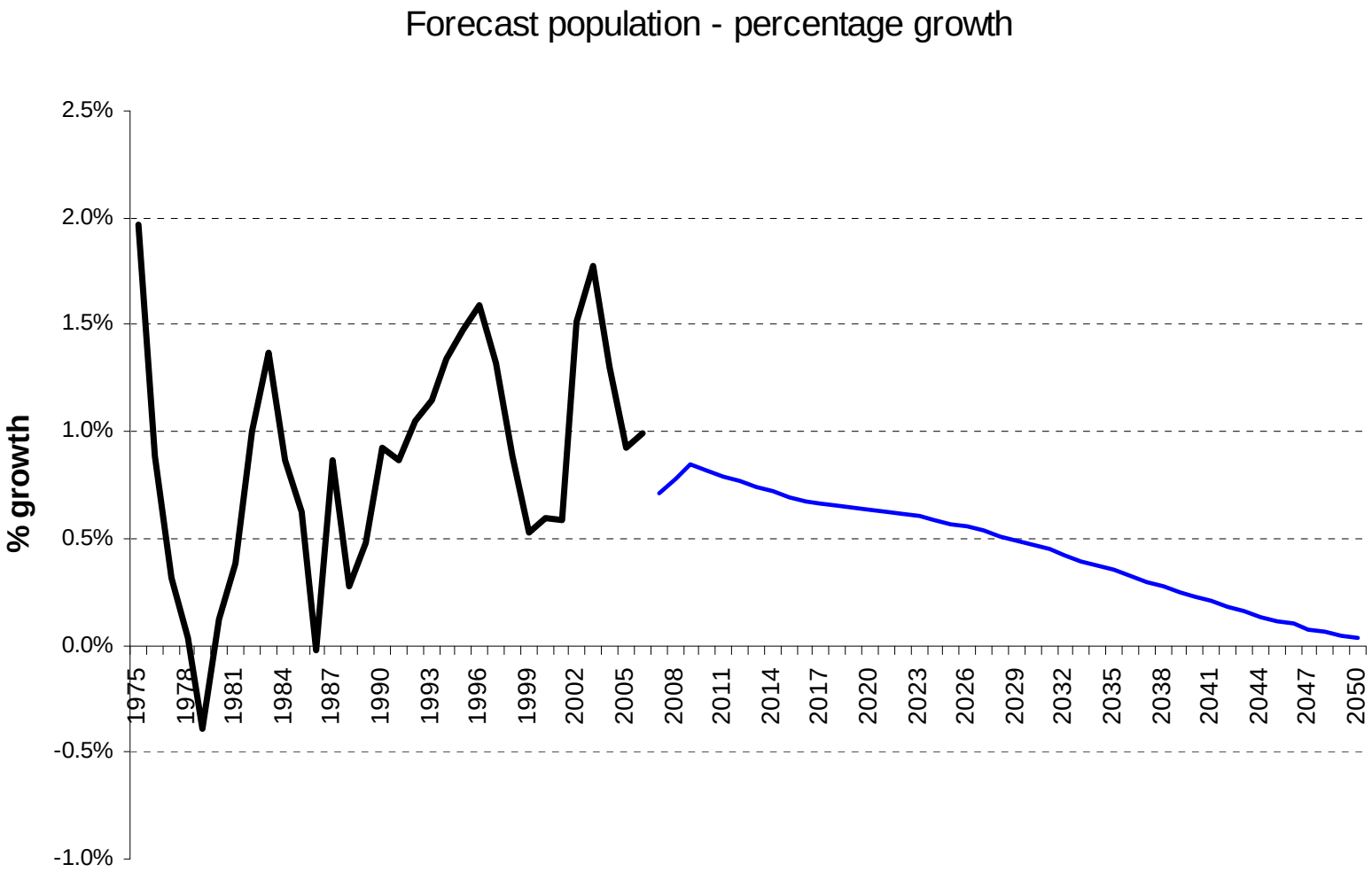
Drivers – GDP %


Forecast GDP - percentage growth
% growth
8.0%
6.0%
4.0%
2.0%
0.0%
-2.0%
-4.0%
1975
1978
1981
1984
1987
1990
1993
1996
1999
2002
2005
2008
2011
2014
2017
2020
2023
2026
2029
2032
2035
2038
2041
2044
2047
2050

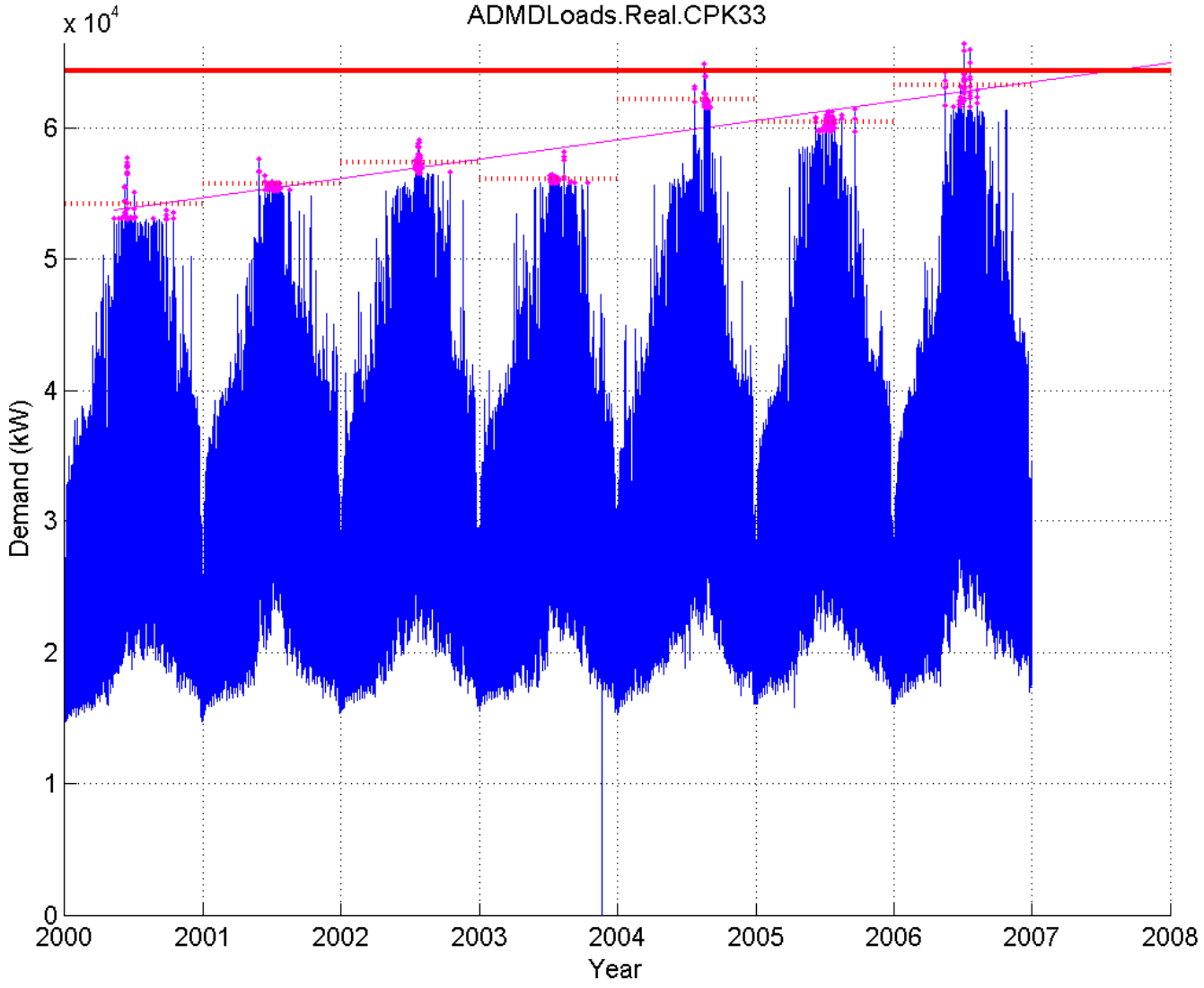
Drivers - population



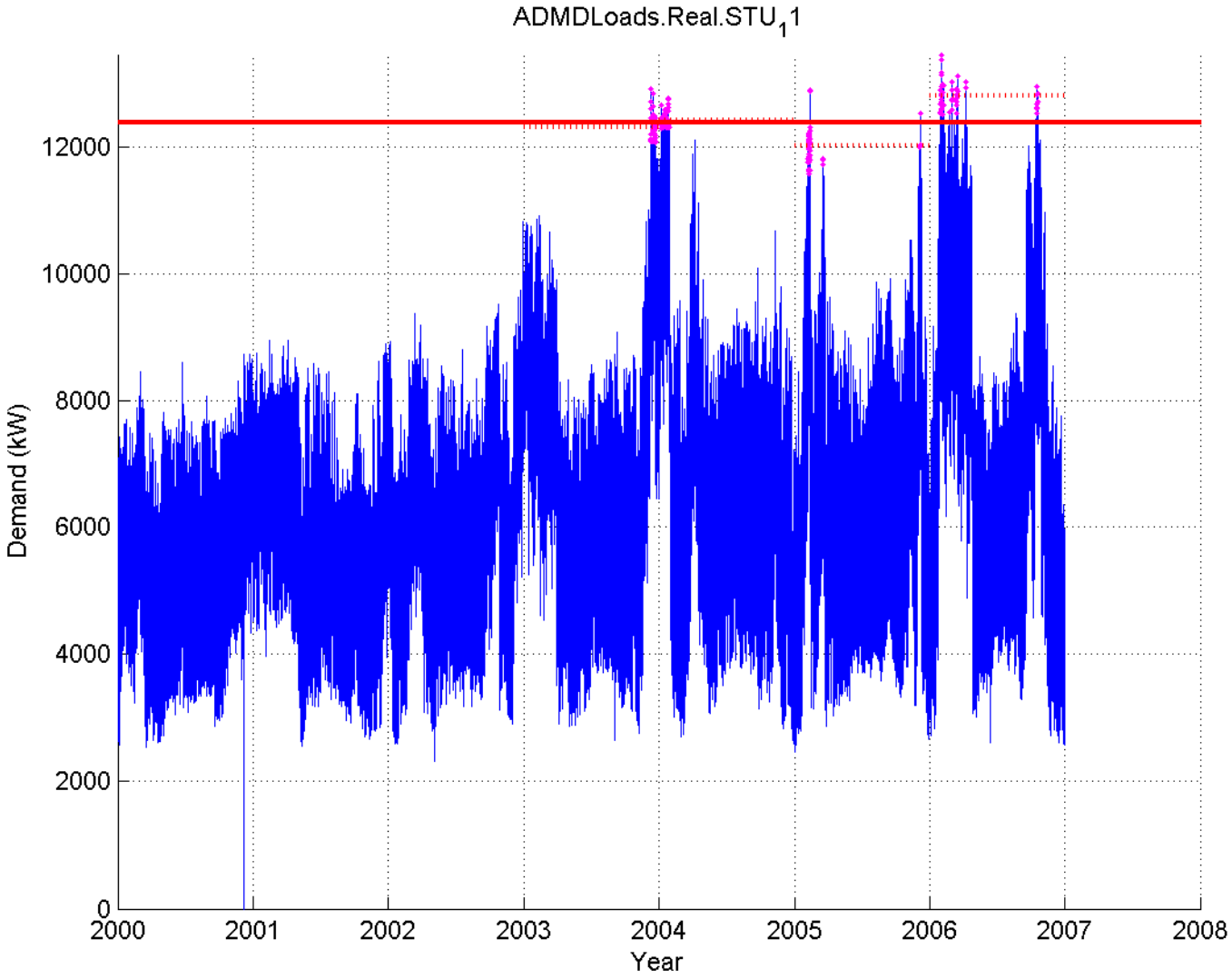
Drivers – population %



Base GXP peak selection example 1



Base GXP peak selection example 2



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Errata – Truncated residential model forecast