How low can we go?
Modelling the impact of *Best Available Technologies* and building retrofits on residential energy in Australia

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Energy Efficient Strategies

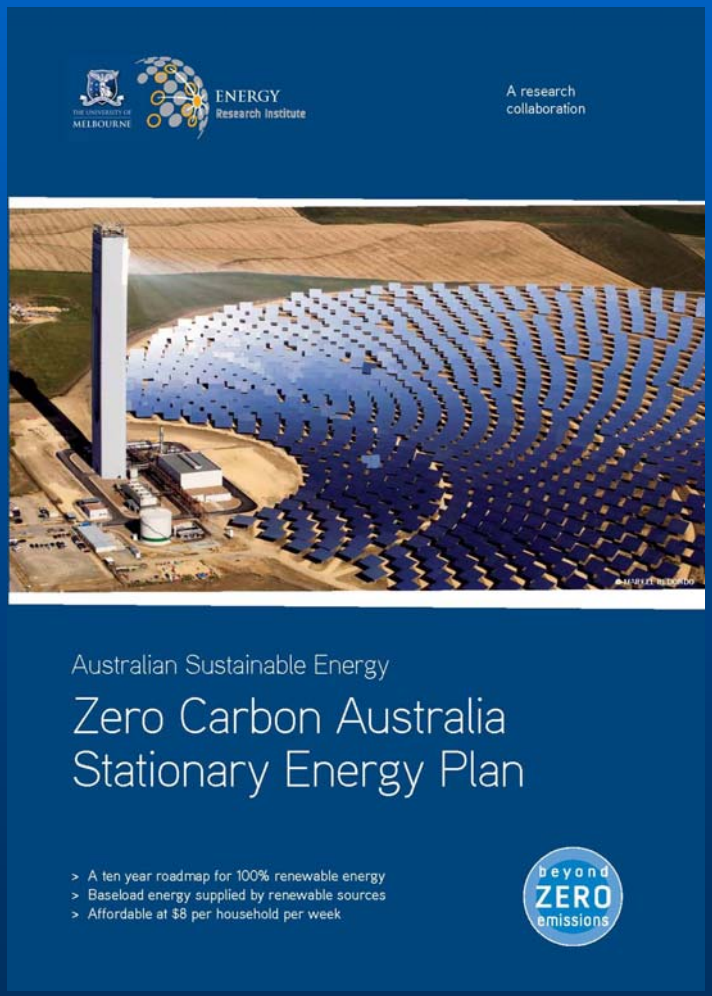
Overview

- About the BZE and the Zero Carbon Plan
- Background to modelling for this project
- Fuel scenarios examined
- Appliance scenarios examined
- Building scenarios examined
- Key results
- Conclusions

Energy Efficient Strategies

BZE and the Zero Carbon Plan

- Beyond Zero Emissions was established in 2006 out of concern about climate change
- The *Zero Carbon Plan* was released in 2010 and set out a practical pathway for a 100% renewable energy supply in Australia within a 10 year period
- The report was released to widespread acclaim in energy circles
- See http://beyondzeroemissions.org

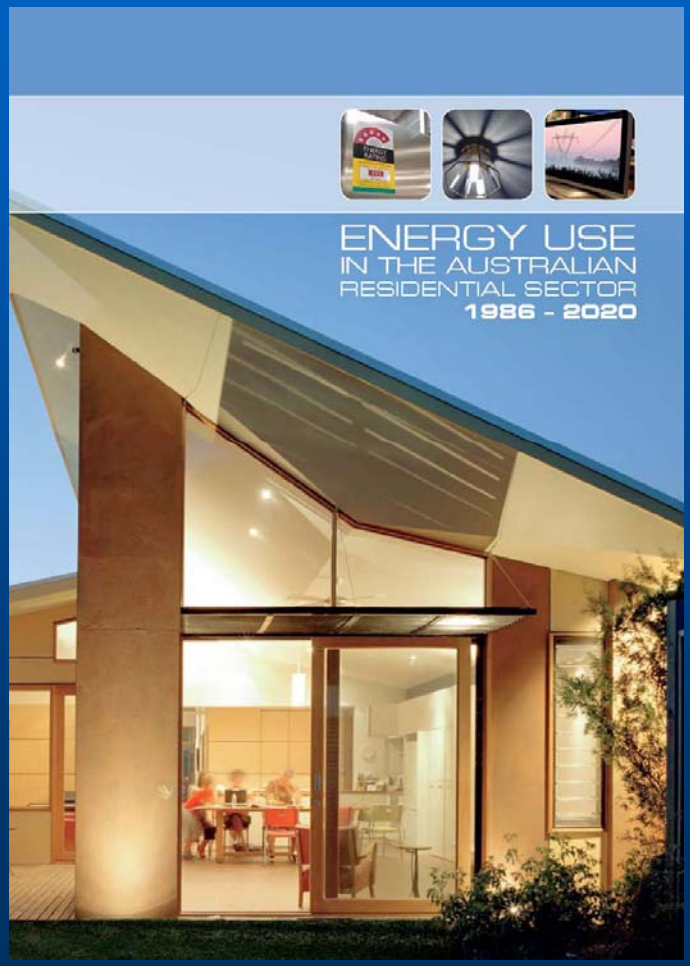


Zero Carbon Australia

- The *Zero Carbon Australia Stationary Energy Plan* sets out a detailed plan on how to achieve 100% renewable energy supply
- An additional 5 specialised reports cover additional topics in detail as follows:
  - Report 2 – Buildings Plan
  - Report 3 – Transport Plan
  - Report 4 – Industrial Processes Plan
  - Report 5 – Land Use Plan
  - Report 6 - Plan for Replacing Coal Export Revenue
- The analysis described in this presentation has contributed to **Report 2 – Buildings Plan**
- Improved energy efficiency in buildings is a key element of the overall plan to switch to 100% renewables

Modelling Approach

- A residential end use model was prepared by EES for DEWHA, published in 2008
- Covered 65 appliance end uses and a comprehensive building shell model
- For the BZE project, appliance attributes were updated and ownership data from ABS4602 in 2008 and 2011 included, with updated ABS household projections



Fuel scenarios

- Business as usual ownership for electricity, gas, LPG and wood was the base case – on trend as per ABS4602
- A second scenario had all fossil fuel appliances retired within a 10 year time frame and replaced with high efficiency electricity
- Replaced fossil fuel appliances included:
  - induction cooktops to replace gas cookers
  - heat pump water heaters to replace gas WH
  - reverse cycle AC to replace gas space heaters

Appliance scenarios

- Business as usual scenario included the impact of all appliance regulatory programs up to 2012
- Did not, for example, include future MEPS for air conditioners or refrigerators
- A scenario for **Best Available Technology** based on the most efficient products on the market in 2012 was modelled for major end uses:
  - refrigerators, freezers, air conditioners, clothes washers, dishwashers, clothes dryers, space heaters (heat pump), televisions and lighting
  - High end solar thermal system based on evacuated tubes optimised for winter solar contribution with heat pump boost

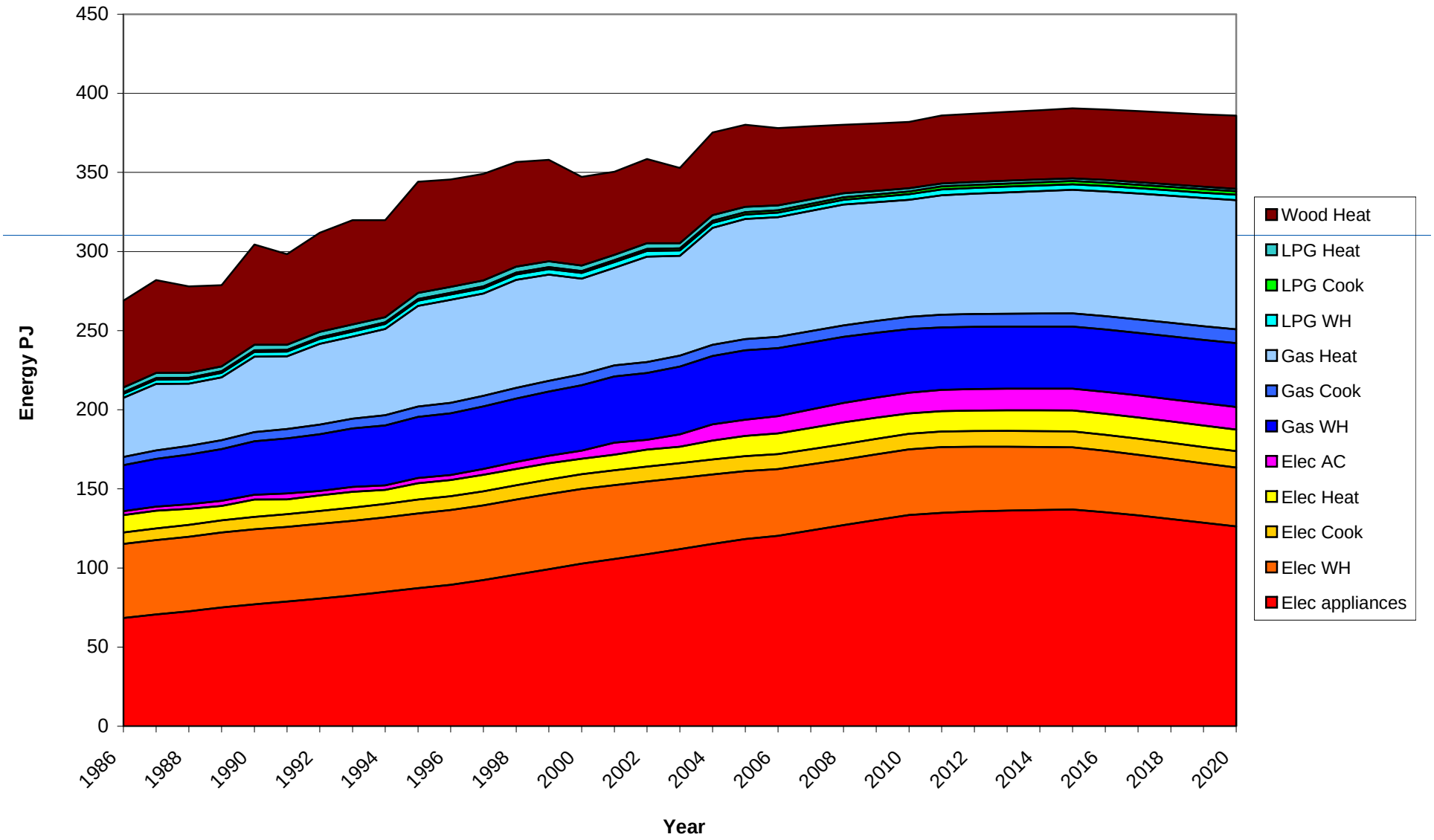
Building scenarios

- 5 building scenarios were examined and costed
- Upgrade Level 4 is approximately 2 star improvement to an existing dwelling
  - Level 1: all new 6 star from 2011, no retrofit of existing dwellings
  - Level 2: all new 6 star from 2011, with BZE upgrade level 1 to all existing dwellings by 2020
  - Level 3: all new 6 star from 2011, with BZE upgrade level 2 to all existing dwellings by 2020
  - Level 4: all new 6 star from 2011, with BZE upgrade level 3 to all existing dwellings by 2020
  - Level 5: all new 6 star from 2011, with BZE upgrade level 4 to all existing dwellings by 2020

Results

- Two ownership scenarios
- Two appliance efficiency scenarios
- Five building shell scenarios
- 20 scenarios modelled (with some additional variants)
- Only selected outputs are examined to illustrate where we are currently going and where we could be by 2020

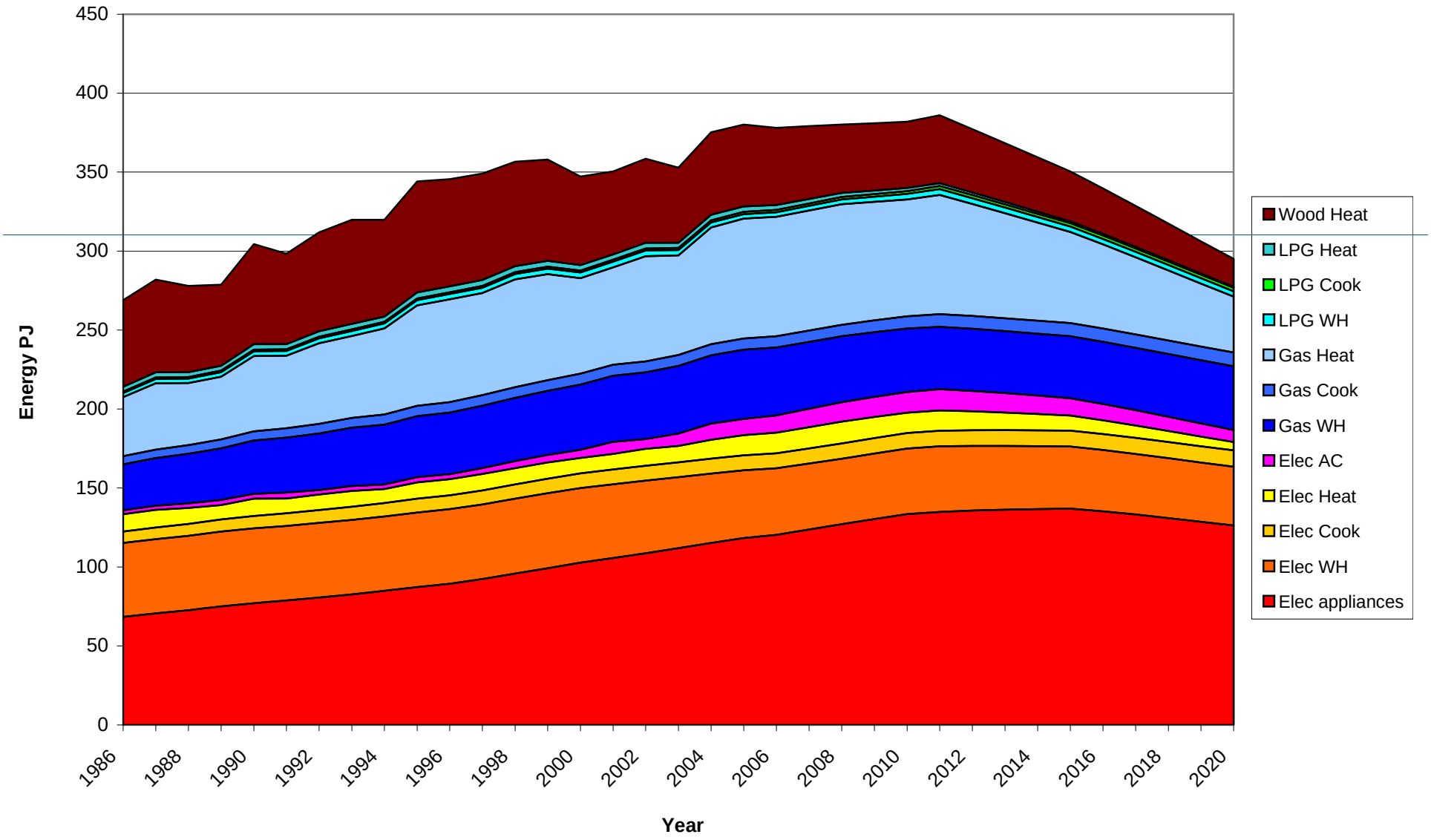
Results - base case



Observations – base case

- Electricity likely to peak in 2012-2013 at around 215 to 220 PJ/year as a result of existing efficiency programs, despite ongoing household formation
- This **EXCLUDES** the impact of PV (10.5PJ 2012)
- Gas will continue to grow strongly
- LPG is stable and small
- Wood as a space heating fuel is in slow decline
- Electricity in 2020 = 207 PJ/y
- Gas in 2020 = 134 PJ/y

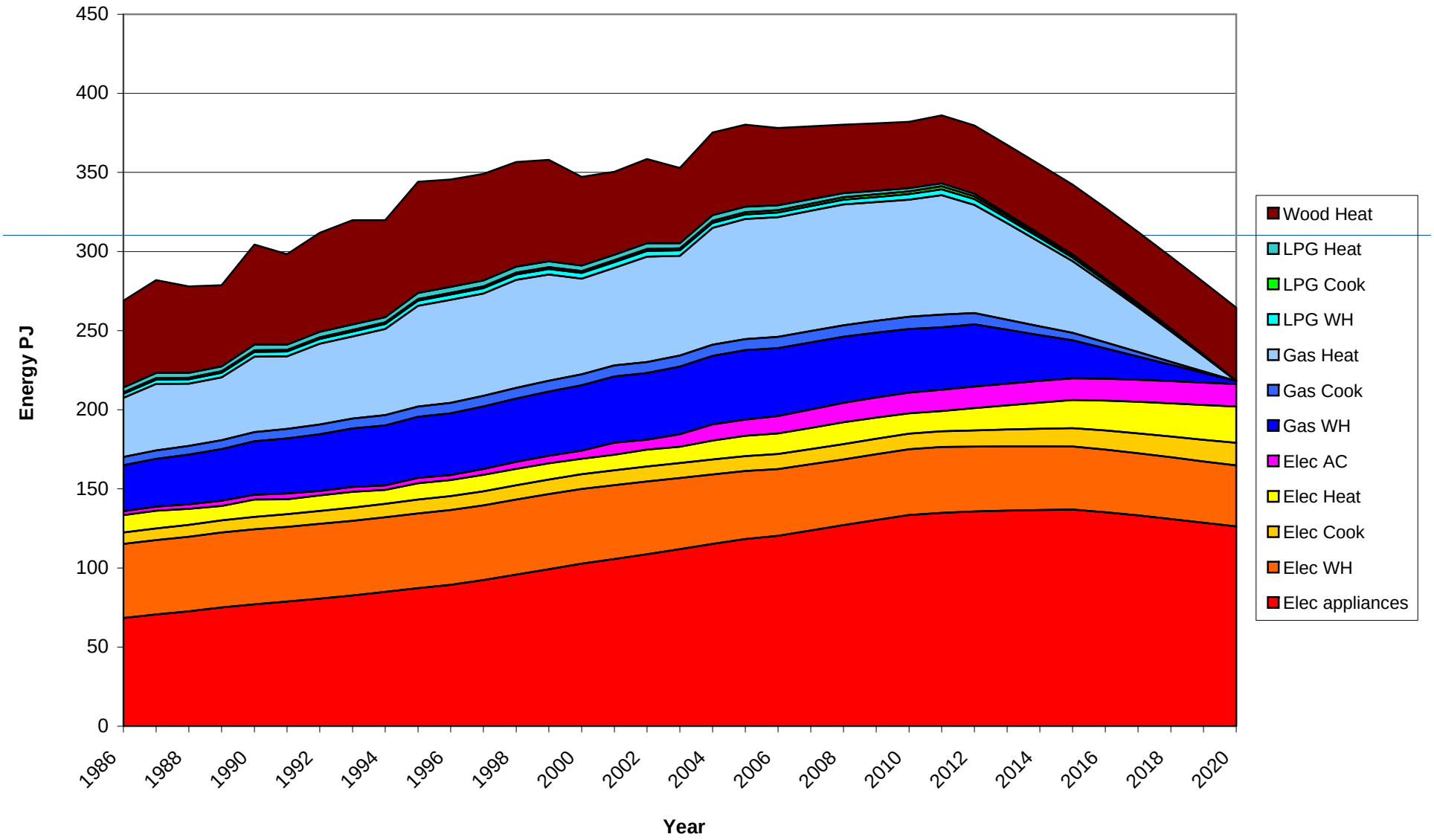
Results – BAU fuel and efficiency, Level 5 building retrofit



Observations – BAU fuel and efficiency, Level 5 building retrofit

- Modest impact on electricity as contribution to total space heating still small
- Impact on Gas is significant
- Wood will also be reduced
- Electricity in 2020 = 187 PJ/y
- Gas in 2020 = 88 PJ/y

Results – No gas fuel, BAU efficiency, Level 1 blding retrofit

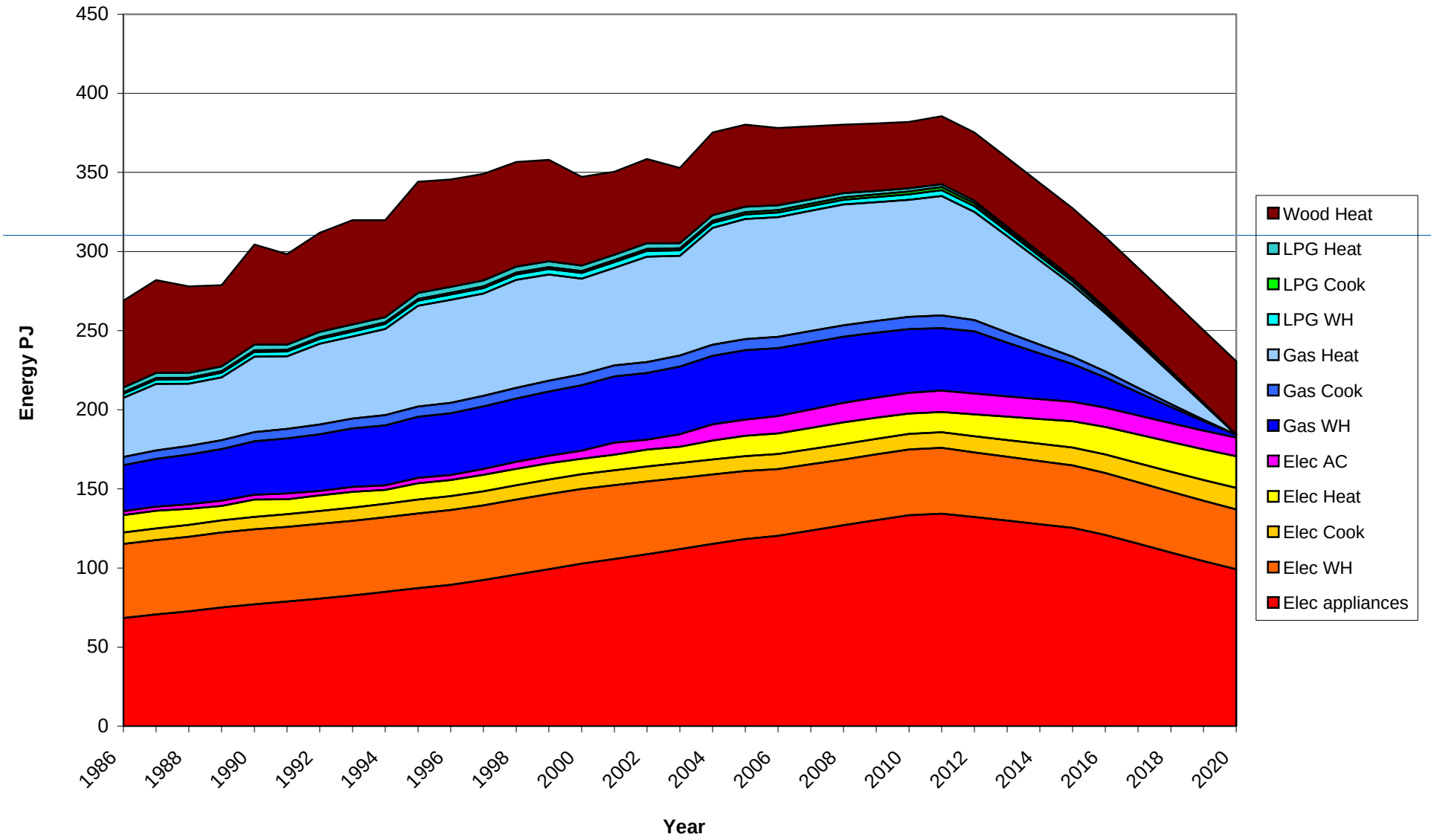


Observations – No gas fuel
BAU efficiency, Level 1 building retrofit

Energy Efficient Strategies

- All gas eliminated
- Electricity consumption steady (small increase) as gas substituted with high efficiency electric replacements
- Wood is unaffected
- Electricity in 2020 = 216 PJ/y
- Gas in 2020 = 0 PJ/y

Results – No gas fuel, BAT efficiency, Level 1 blding retrofit

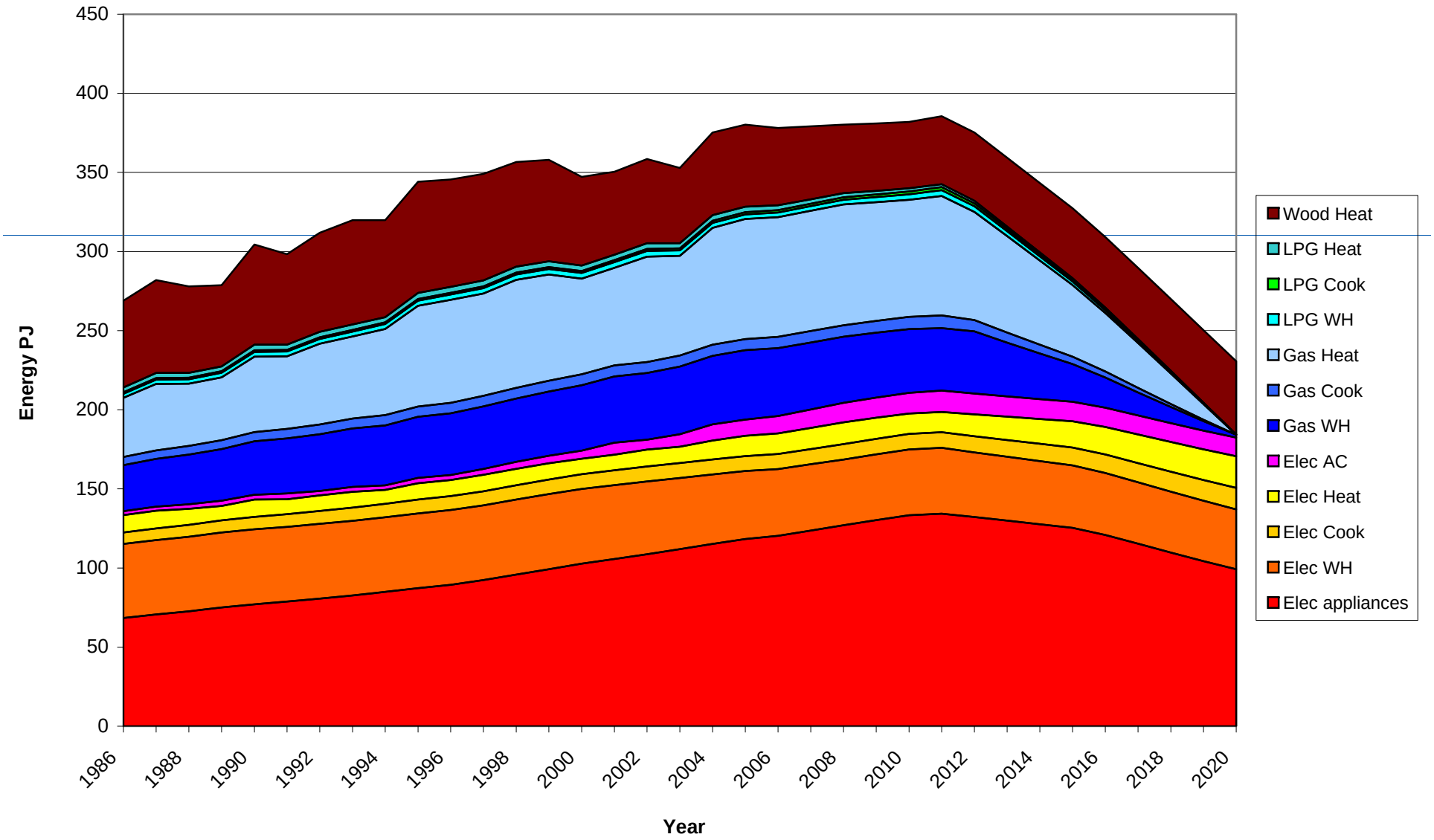


Observations – No gas fuel, BAT efficiency, Level 1 building retrofit

Energy Efficient Strategies

- All gas eliminated
- Electricity consumption falls significantly
- BAT scenario only assumes natural replacement of target appliances, strong downward trend continues past 2020
- Wood is unaffected
- Electricity in 2020 = 182 PJ/y
- Gas in 2020 = 0 PJ/y

Results – No gas fuel, BAT efficiency, Level 5 blding retrofit



Observations – No gas fuel, BAT efficiency, Level 5 building retrofit

Energy Efficient Strategies

- All gas eliminated
- Electricity consumption falls substantially with ongoing downward trend beyond 2020
- Wood is reduced
- Electricity in 2020 = 164 PJ/y
- PV at current rate could make 45 PJ lower
- Gas in 2020 = 0 PJ/y

Conclusions

- Aggressive efficiency can reduce energy consumption from 340 PJ/year (gas+elec) in 2020 to just 164 PJ/year (elec only)
- Changes in ownership, BAT appliances and building shell retrofits can all make substantial contributions (similar magnitude)
- BAT appliance scenario will continue to reduce energy significantly until 2030 through natural replacements
- More efficiency will be even more cost effective under higher electricity price scenarios

Conclusions

- By any measure, these results show that efficiency can deliver large demand side energy reductions at low cost
- This will help to minimise investment in supply side renewables to reduce the total cost of supply and demand in a fully renewable system
- While these scenarios are relatively conservative (in terms of feasibility), there are many elements that need to be implemented
- This will take courage and vision to enact

The End

- thank you