

Are we still Cooking with Gas?

An Analysis of Cost
Effective Residential
Energy Options

Report by the
Alternative Technology Association



Who is ATA?



ATA Publications



- 10,000 copies sold per issue
- estimated 65,000 readers
- published since 1980

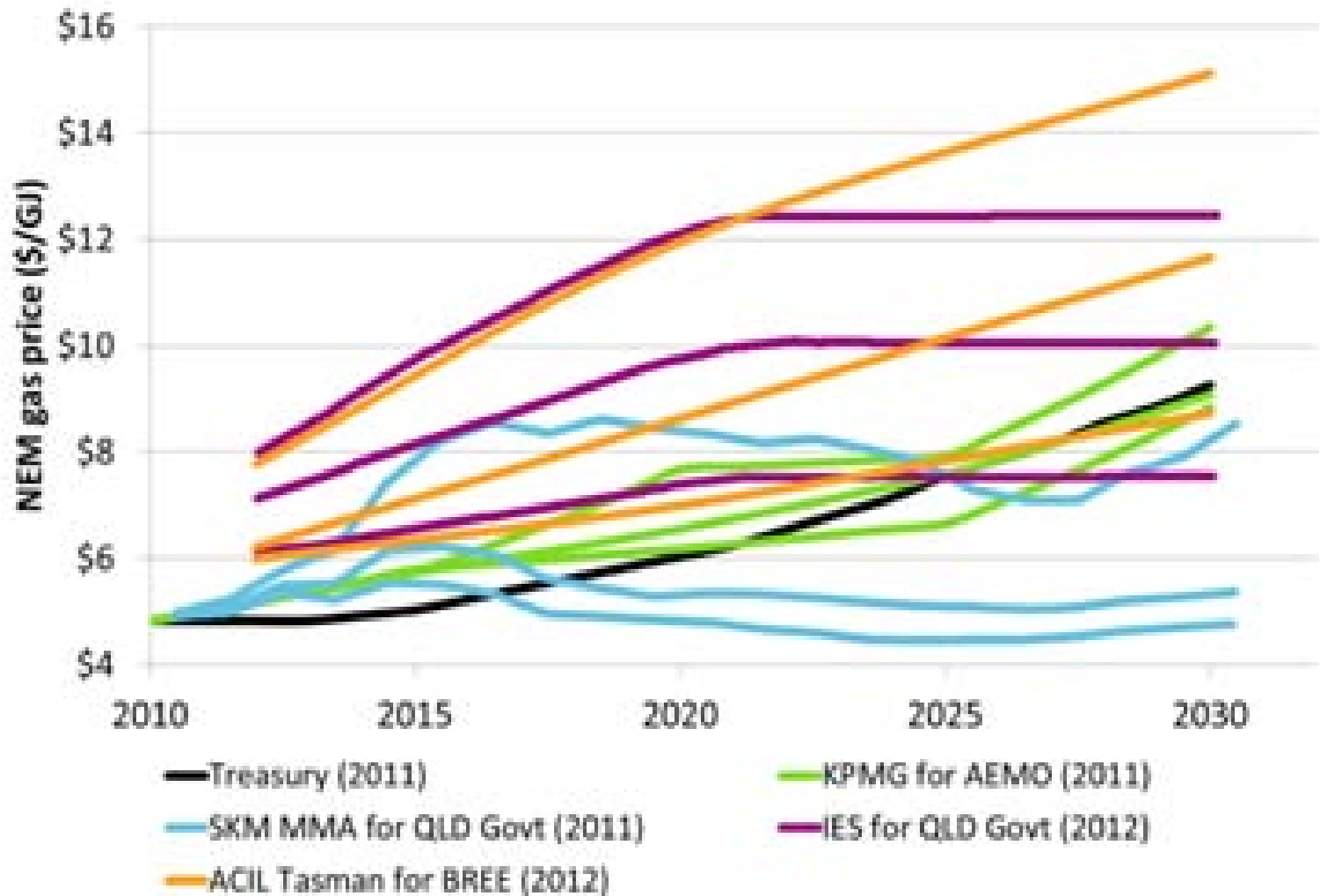
- quarterly – 40,000 readers
 - around 3,000 subscribers
 - 17,000 distributed



International Projects



What's the Problem?



What's the Problem?

*“Household gas prices have **already risen 33 per cent** in real terms since 2008-09, largely unnoticed because all the attention has been on the more rapid growth in electricity prices over the same period (53 per cent).”*

Victorian Council of Social Service

What's the Solution?

“We need both a growing LNG export industry and a diverse industry base with a strong manufacturing sector. We need action on two fronts — get more gas flowing, by replacing blanket bans on gas production with strong but workable regulation; and reform the market that gas is sold in to boost competition and transparency.”

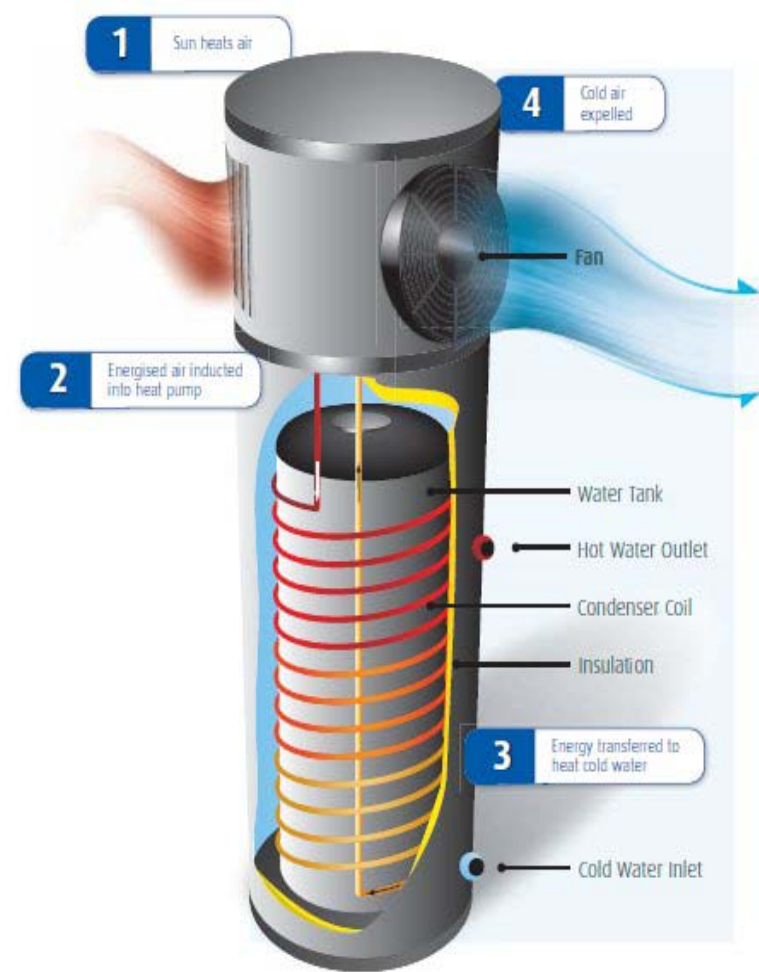
Chief Executive, Ai Group

What's the Solution?

*“We need both a growing LNG export industry and a diverse industry base with a strong manufacturing sector. We need action on two fronts — **get more gas flowing**, by replacing blanket bans on gas production with strong but workable regulation; and reform the market that gas is sold in to **boost competition** and transparency.”*

Chief Executive, Ai Group

At the same time....



**...electric technologies
are becoming more and
more efficient**

***...so what about
the demand-side?***



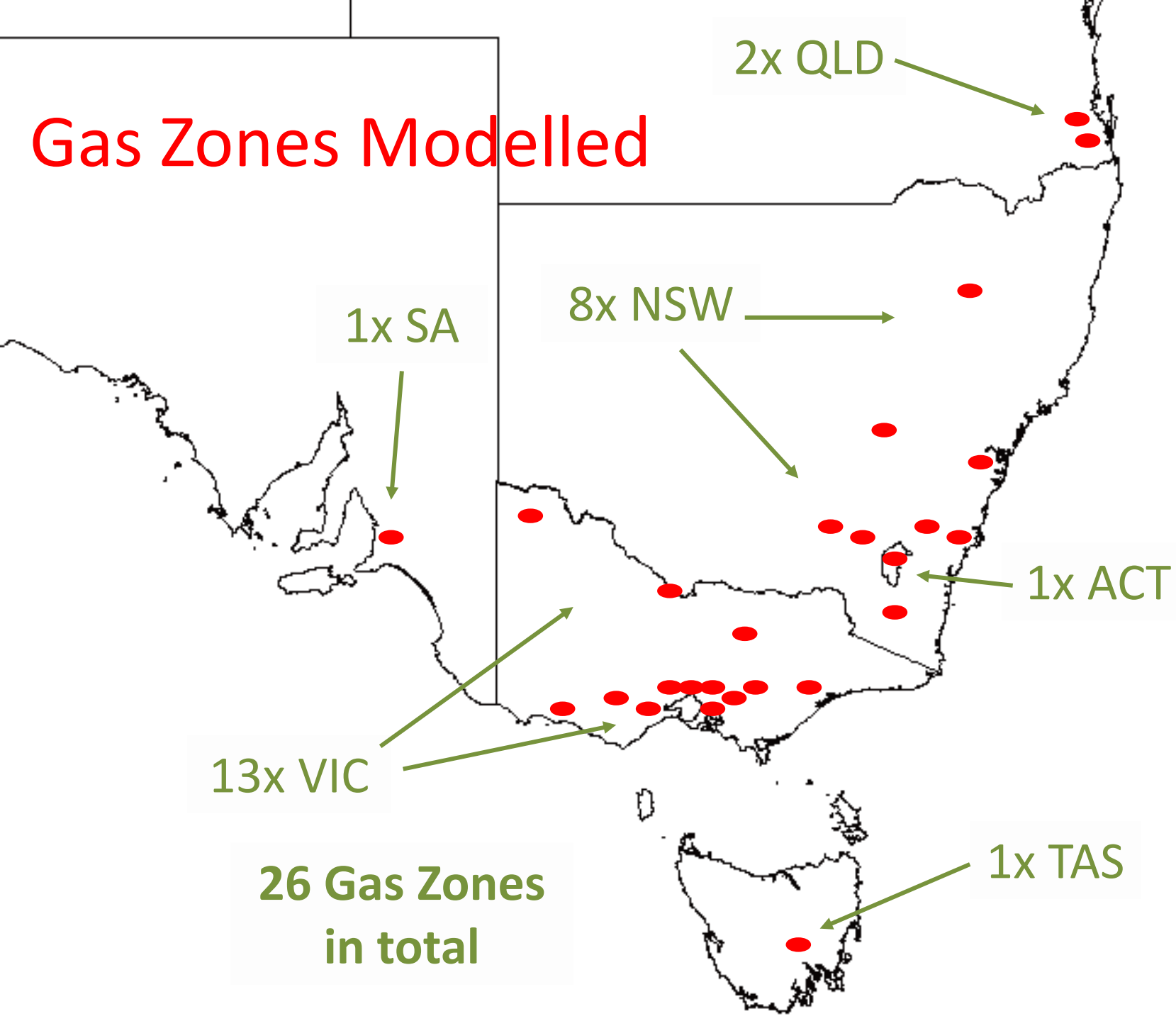
**Little substantial
analysis has been done
that considers the
economics for small
energy consumers**

ATA Report:

Are we still Cooking with Gas?

- ✿ Economic modelling & research
- ✿ Funded by the *Consumer Advocacy Panel*
- ✿ Project Objective:
 - *To understand the impact of retail gas price rises on small consumers and to identify cost effective alternatives, where they may exist.*

Gas Zones Modelled



	Scenario 1 Reference Home		Scenario 2 Small Home		Scenario 3 Large Home		Scenario 4 Public Housing		Scenario 5 LPG Home		Scenario 6 New Build	
Description	Typical of current housing stock		Typical small detached/semi-d		Typical 10+ year old (3 star)		Concession eligible				6 star build	
Gas usage	Med		Small		High		Med		Med		High	
Gas services	BAU Case NG	All Elec	BAU Case NG	All Elec	BAU Case NG	All Elec	BAU Case NG	All Elec	BAU Case	Mainly Elec	Gas Option	Elec Alt
Space heating	Ducted gas - Replace furnace. Sized to house	Multiple RC/ACs. Sized to house	Ducted gas - Replace furnace. Sized to house	Multiple RC/ACs. Sized to house	Ducted gas Replace furnace .Sized to house	Multiple RC/ACs. Sized to house	Two flued gas wall heaters. Sized to rooms	Two RC/ACs. Sized to rooms	LPG Heater for living room	RC/AC sized to room	Ducted gas. Sized to house	Multiple RC/Acs. Sized to house
Hot water	Gas storage - High efficiency med sized unit	Heat pump med	Gas instant. - high efficiency unit	Heat pump small	Gas storage - high efficiency large unit	Heat pump large	Gas instant. - high efficiency unit	Heat pump med	Instant. LPG - high efficiency medium unit	Heat pump med	Large gas storage - high efficiency unit	Heat pump large
Cooking	Gas oven, cooktop 500MJ/Qtr	Elec oven, Induction cooktop	Gas oven, cooktop 250MJ/Qtr	Elec oven, Induction cooktop	Gas oven, cooktop 750MJ/Qtr	Elec oven, Induction cooktop	Gas oven, cooktop 500MJ/Qtr	Elec oven, Induction cooktop	LPG oven, cooktop 500MJ/Qtr	No change	Gas oven, cooktop 750MJ/Qtr	Elec oven, Induction cooktop

No. Replacement Cases

Capital Cost Assumptions

1	Switching a gas appliance, within 5 years of end of life, staying on gas network	Gas & Electric
2	Switching a gas appliance, not within 5 years of end of life, staying on gas network	Electric Only
3	Switching one gas appliance, of any age, disconnecting from gas network	Electric Only
4	Switching two gas appliances, at least one is within 5 years of end of life, disconnecting from gas network	1 Gas & 2 Electric
5	New & existing homes, not currently gas connected, choosing efficient electric instead of gas	3 Gas & 3 Electric
6	All gas appliances switched: one is within 5 years of end of asset life, avoiding \$2,000 replacement capex	1 Gas & 3 Electric

Model Outputs:

Gas Zone: Envestra Mildura				Electricity Zone: Powercor		
Example Location: Mildura, 3500, VIC				Climate Zone: Balanced Moderate Demand		
Household Scenario	Ref home	Small home	Large home	Public housing	LPG home	New build
Switching a gas appliance, within 5 years of end of life, staying on gas network						
Space Heating	\$3,831	\$3,179	\$4,769	\$2,681	\$2,188	\$4,046
Hot Water	-\$23	-\$803	\$105	-\$264	\$1,820	\$477
Cooking	-\$161	-\$122	-\$330	-\$103	n/a	-\$330
Switching a gas appliance, not within 5 years of end of life, staying on gas network						
Space Heating	\$1,031	\$979	\$1,369	-\$319	\$688	n/a
Hot Water	-\$1,523	-\$2,003	-\$1,695	-\$1,464	\$620	n/a
Cooking	-\$1,961	-\$1,922	-\$2,130	-\$1,903	n/a	n/a
Switching one gas appliance, of any age, disconnecting from gas network						
Space Heating	\$4,697	\$3,926	\$5,610	\$2,426	n/a	n/a
Hot Water	\$2,032	\$925	\$2,603	\$1,301	n/a	n/a
Cooking	\$533	\$517	\$549	\$198	n/a	n/a
Switching two gas appliances, at least one is within 5 years of end of life, disconnecting from gas network						
Space Heating + Cooking	\$5,647	\$4,259	\$7,176	\$3,624	n/a	n/a
Hot Water+ Cooking	\$1,681	\$258	\$2,569	\$699	n/a	n/a
New & existing homes, not currently gas connected, choosing efficient electric instead of gas*						
All Heating & Cooking	\$7,179	\$4,655	\$9,231	\$4,854	\$6,376	\$8,169

* Assumes full CAPEX on both electric and gas sides.

Ahh, how did you arrive at that?



Cooking



Cooking – Energy Loads

- ✱ CUAC (2013) reported average is 500MJ/Qtr.
 - ✱ High, medium and low: +/- 50%
 - ✱ Assumed 60% used on cooktop / 40% oven
- ✱ Energy input * efficiency at point of use = energy output
- ✱ Efficiency at point of use:

Gas

Electric

✱ Gas ring 40%

Induction 80%

✱ Oven 7%

Oven 14%

Sources: Choice, BZE, US Dept of Energy....

Cooking – Installed CAPEX and OPEX

- ✱CAPEX: gas cooktops and ovens – sample of 34; electric cooktops and ovens – sample of 32.

- ✱Added installation cost.

- ✱Maintenance costs from survey: no results for induction. Assume it would prove to be the same as gas

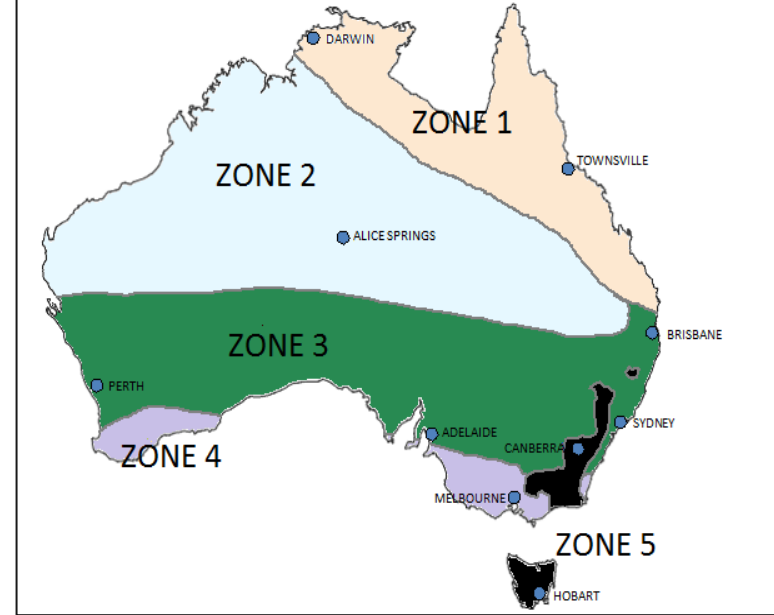


Water Heating

Water Heating Loads

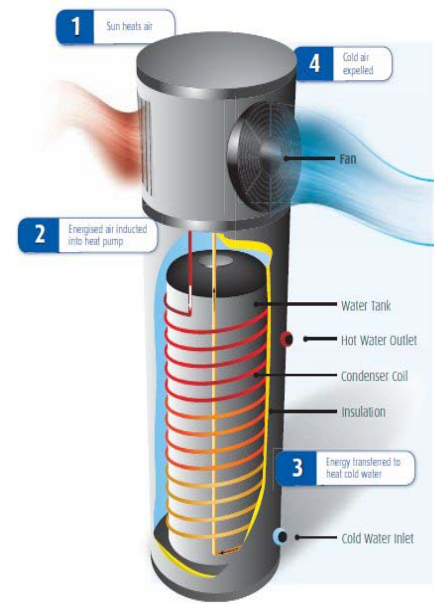
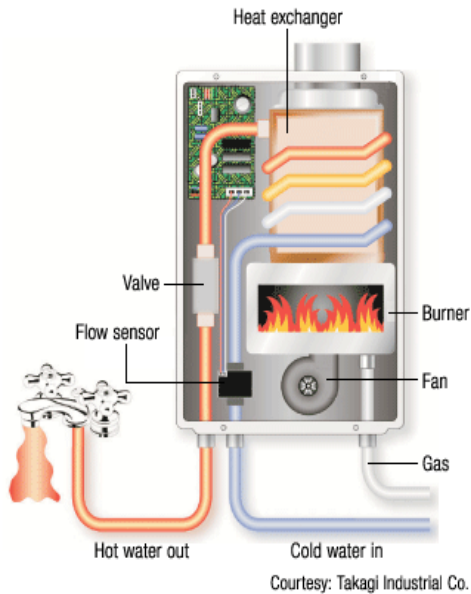
☼ Energy loads drawn from published data/modelling:

- Gas HW: EnergyConsult for SV (2009)
 - ✓ Gas storage (5 Stars) / Instantaneous (5 Stars)
 - ✓ Zones 3 & 4
- Heat Pump HW: Pitt & Sherry (2012)
 - ✓ modelled small/medium/large HPWH systems across 10 locations (Zones 1 – 5)



Aust Water Heating Climate Zones

HW Capex & Opex



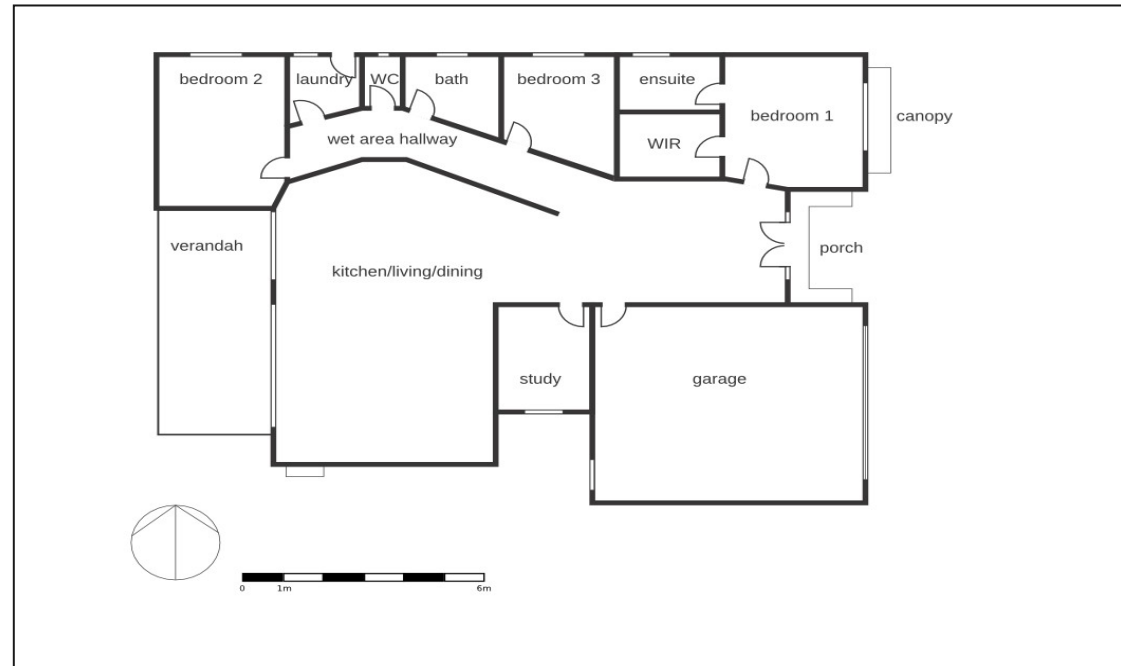
- ✿ Gas capex taken from a sample of 28 available models
- ✿ HPHW capex taken from sample of 16 available models
 - maintenance costs taken from manufacturer/other industry data
- ✿ Solar hot water was considered:
 - difficult to compete (\$) with HPHW – additional capital cost
- ✿ Small Electric Resistance HW also modelled:
 - 15c/kWh off-peak tariff; apartment blocks etc



Space
Heating

How to Model Space Heating?

- ✿ Drew upon BZE¹ heat load modelling
- ✿ Included a single 'Reference Home'
 - 3-bed, single storey, detached dwelling
- ✿ Variations based on orientation & building construction
- ✿ Common floor plan:



¹ZCA Buildings Plan

How to Model Space Heating?

- ✿ Representative construction types chosen by location
- ✿ Home Modification levels modelled by BZE:
 - ‘Level 2’ used for ATA Existing Home Scenarios:
(R2.5 ceiling insulation, representative of **2 Star** building stock)
 - ‘Level 4’ or NatHERS **6 Star** used for ATA New Home Scenarios

House Type	Wall Construction	Floor Construction
1	Weatherboard	Timber
2	Weatherboard	Concrete Slab
3	Brick Veneer	Timber
4	Brick Veneer	Concrete Slab
5	Cavity Brick	Timber
6	Cavity Brick	Concrete Slab

*NatHERS energy loads
combine heating & cooling
requirements

*BZE just defined heating

Heat Load by Climate/Location

(MJ/m2/annum)

Climate Type	City	Scenario 1-5	Scenario 6: New Build
Balanced Moderate Demand	Adelaide	112.8	56.8
Balanced Moderate Demand	Sydney	78.3	35.9
Heating Dominated	Tullamarine	268.8	197.0
Heating Dominated	Melbourne	242.4	114.0
Heating Dominated High Demand	Canberra	321.0	165.0
Heating Dominated High Demand	Orange	438.4	219.0
Low Demand	Brisbane	38.9	15.2

RCAC Capex & Efficiency

☼ Reviewed 35 small-med & 28 large RCACs:

- average price of 6 cheapest/CoP models
- Large Unit: CoP 4.0; Capex \$2,600
- Small/Medium Unit: CoP 4.5; Capex \$1,850
- Maintenance costs drawn from ATA

member/public survey

- CoP penalties (0.5) for 'Heating Dominated', 'High Demand' climate zones

Heated Rooms/Area + RCACs

(per Household Scenario)

	Scenario 1: Reference Home	Scenario 2: Small House	Scenario 3: Large House	Scenario 4: Public Housing	Scenario 5: LPG House	Scenario 6: New Build (6 Star)
Total Heated Area (m ²)	120	70	160	70	40	160
No. Rooms to be Heated	Up to 6	Up to 4	Up to 8	Up to 4	Up to 2	Up to 8
No. 7.0kW Systems	1	1	2	1	1	2
No. 3.0kW Systems	2	1	2	1	-	2

✿ Zoning assumptions:

- primary RCAC on 100% of heating hours
- second RCAC on 90% of heating hours
- third & subsequent RCAC on 50% of heating hours

RCAC Annual Energy Use

(by Climate Zone and by Household Scenario)

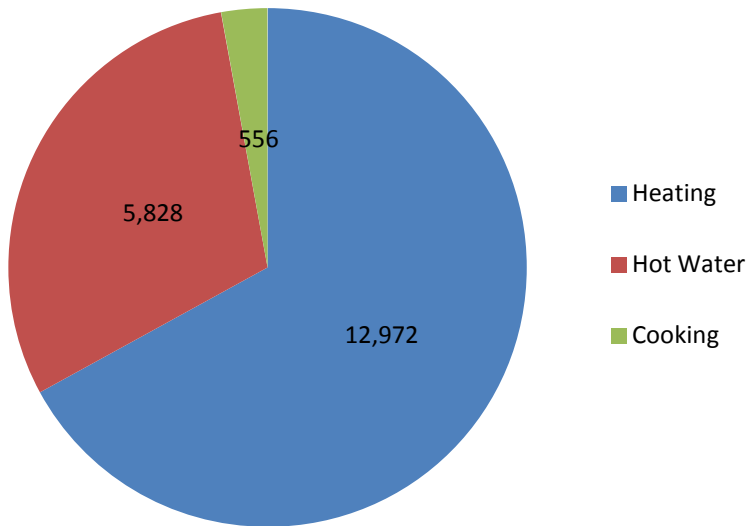
Climate	Location	Scenario 1: Reference Home	Scenario 2: Small House	Scenario 3: Large House	Scenario 4: Public Housing	Scenario 5: LPG House	Scenario 6: New Build (6 Star)
Balanced Moderate Demand	Adelaide	703	418	873	418	313	440
Balanced Moderate Demand	Sydney	488	290	607	290	218	278
Heating Dominated	Melbourne	1,512	898	1,878	898	673	883
Heating Dominated	Tullamarine	1,899	1,133	2,368	1,133	853	1,735
Heating dominated High Demand	Canberra	2,267	1,353	2,828	1,353	1,019	1,454
Heating dominated High Demand	Orange	3,096	1,848	3,862	1,848	1,392	1,929
Low Demand	Brisbane	242	144	301	144	108	117

Gas Energy Loads – Space Heating

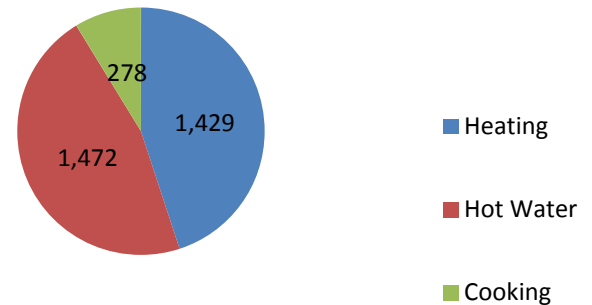
- ✿ Utilised same MJ/m² heating loads
- ✿ Burner efficiencies applied for ducted/wall furnace systems (EnergyConsult, BZE data)
 - Ducting system losses
 - Industry sales data (representative burner size)
- ✿ Electricity usage of fans included
- ✿ Excluded thermostat & controller loads (immaterial)
- ✿ Capital costs taken from a sample of 22 available models
 - maintenance costs taken from ATA/public survey

Energy usage by the Reference home in Richmond, Melbourne

Gas Appliances: 19,356 kWh pa



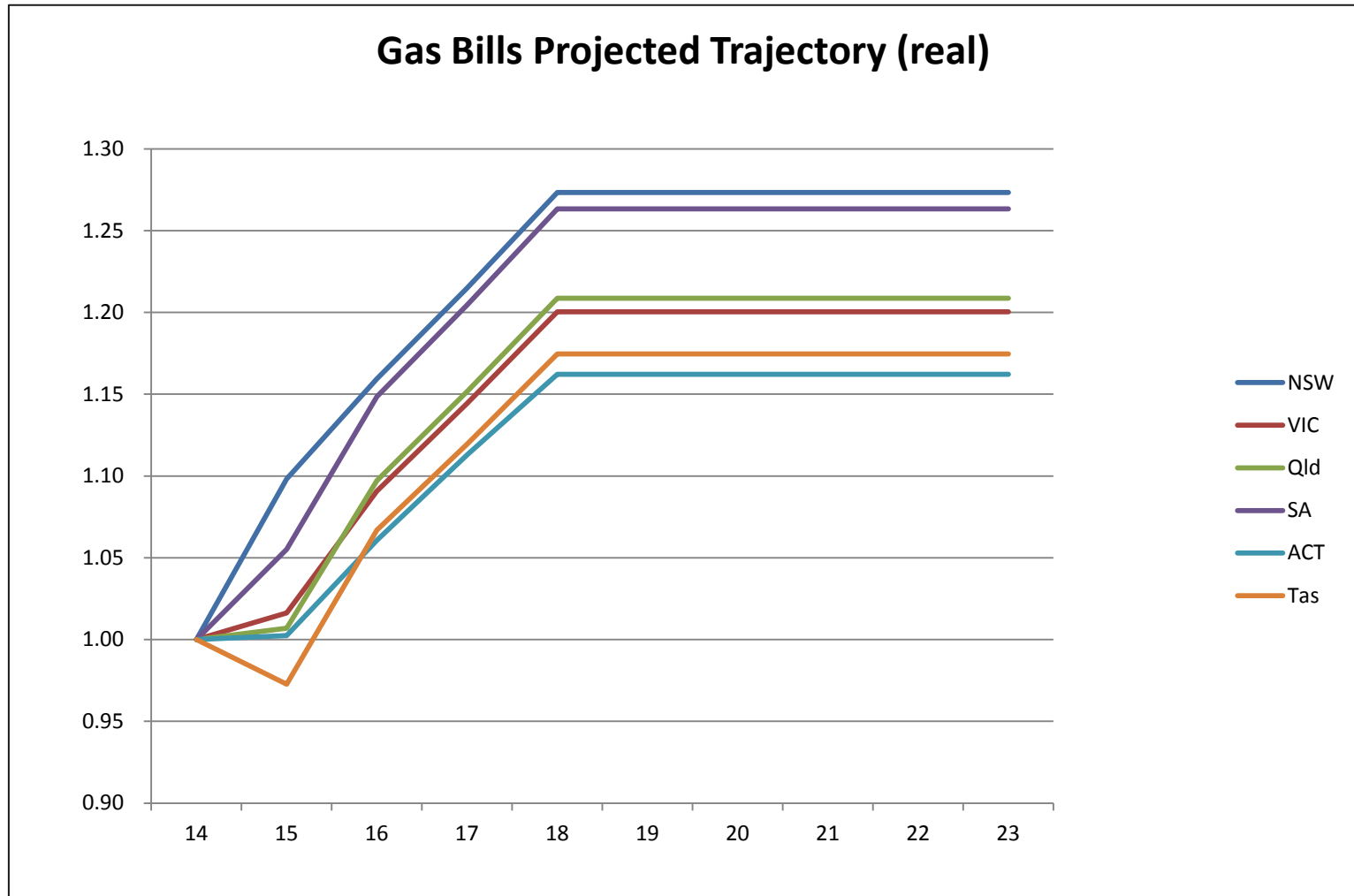
Efficient Elec. Appliances: 3,179 kWh pa



Energy Prices



Gas Price Trajectory: Base (Medium) Case



Gas Prices & Price Trajectory

✿ Gas prices selected as at 1 Jan 2014

✿ VIC: gazetted 'Standing Offers'

- competitive tariffs found using 'tertiles of gas usage' (AGL)
- applied in the St Vinnies 'Tariff Tracker' tool

✿ NSW: St Vinnies 'Tariff Tracker' tool

✿ SA: only Origin has Standing Offers (little variation across gas zones)

✿ QLD: average of the only 2 gas retailers

✿ ACT: only 1 gas retailer with Standing Offer

✿ TAS: 2 retailers, 50/50 market share – Tariff 31 used

✿ All Adjusted for Carbon Tax Repeal (July, 2014)

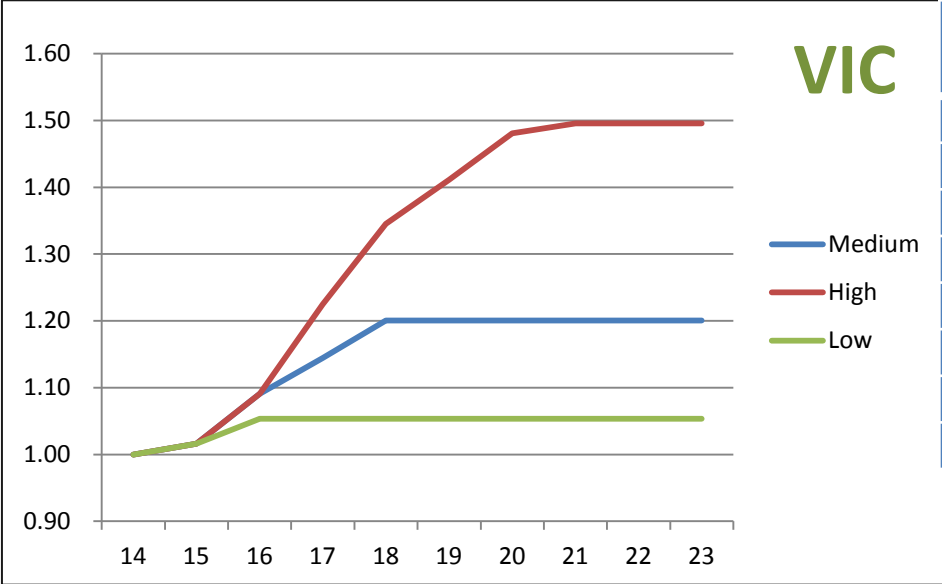
✿ Scheduled Price Rises included:

- e.g. NSW IPART 17% increase July 2014

✿ Trajectory – CUAC 'Making the Gas Connection'

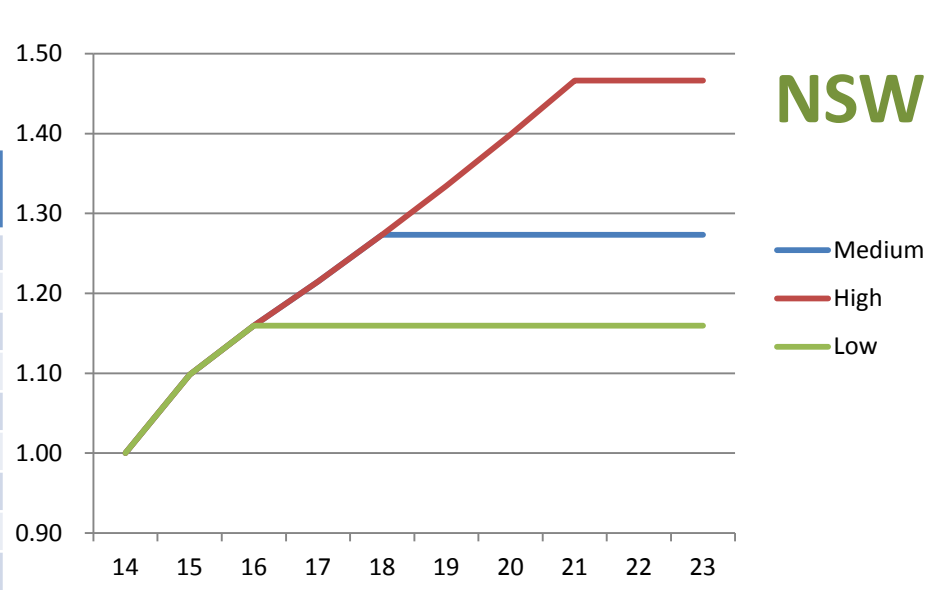
- doubling wholesale price; 20-25% retail increase by 2020

Gas Price Trajectories: Sensitivity (VIC & NSW)



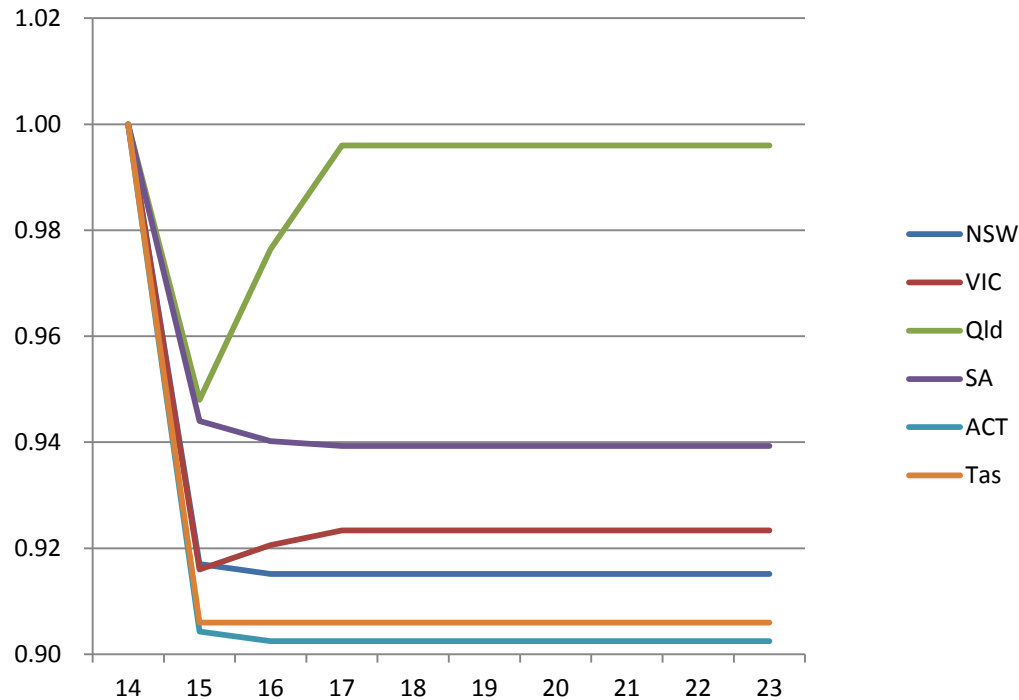
Year	Medium	High	Low
2014	1.00	1.00	1.00
2015	1.02	1.02	1.02
2016	1.09	1.09	1.05
2017	1.14	1.22	1.05
2018	1.20	1.35	1.05
2019	1.20	1.41	1.05
2020	1.20	1.48	1.05
By 2020	20%	48%	5%

Year	Medium	High	Low
2014	1.00	1.00	1.00
2015	1.10	1.10	1.10
2016	1.16	1.16	1.16
2017	1.21	1.21	1.16
2018	1.27	1.27	1.16
2019	1.27	1.33	1.16
2020	1.27	1.40	1.16
2021	1.27	1.47	1.16
By 2021	27%	47%	16%

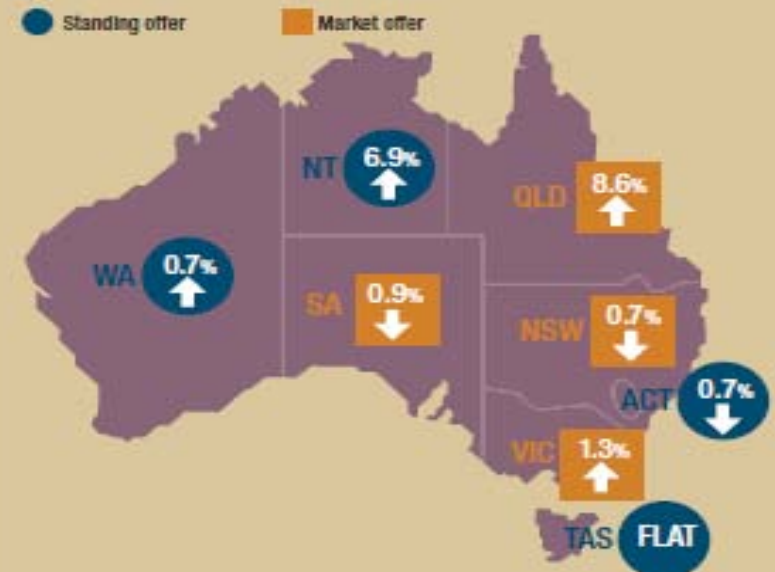


Electricity Price Trajectory: Base (Medium) Case

Electricity Price Trajectory (real)

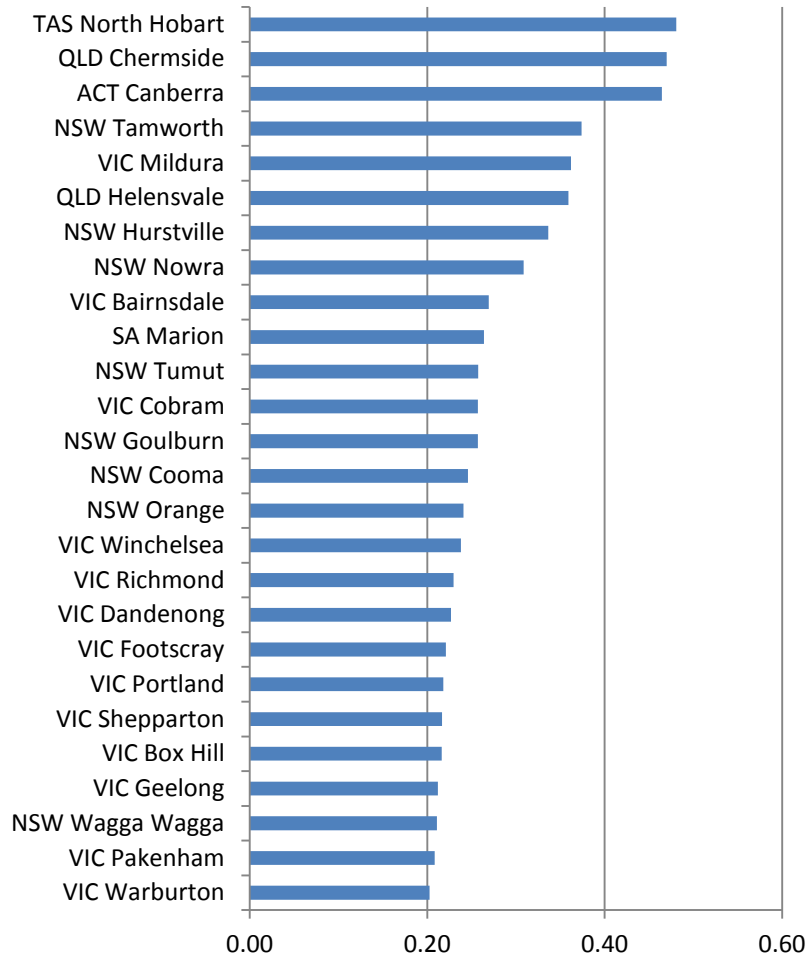


PRICE MOVEMENTS
ANNUAL AVERAGE FY13 – FY16



Relative Cost of Gas v Electricity

Cost of gas v/s electricity, 2014



Variable cost of gas c/MJ * 3.6 (to kWh) / Variable cost of electricity c/kWh

The relative cost of gas v electricity in each gas zone was important to the overall economics of the case for switching



Findings

Findings – New & All-Electric Homes



- 1. It is not cost effective to connect a new home / existing all-electric home to mains gas when efficient electric appliances are an option (all gas zones)**
- 2. Connecting an existing all-electric home to mains gas may be cost effective when the cost of new appliances is subsidised**

Findings – Dual Fuel Homes



The case for dual-fuel homes to replace some / all their appliances with efficient electric is dependent on multiple factors:

- **Age or condition of the existing gas appliance**
- **Whether the replacement allows the customer to disconnect from the gas**
- **Whether the household is able to install efficient electric appliances**
- **Whether the existing gas supply is mains or bottled gas**
- **The marginal cost of gas on a declining block tariff**
- **Climate**
- **Ratio of gas to electricity price**

Findings – Dual Fuel Homes



- 1. Cost effective to replace gas heaters with multiple RCACs**
- 2. In warmer climates (SA, QLD & parts NSW), switching all gas appliances to electric and disconnecting offers better economic returns than cooler climates**
- 3. Heat pump HW only cost effective where the relative price of gas (versus electricity) is higher; or where the climate is warmer**
- 4. Switching from gas to induction cook tops/electric ovens is only cost effective (on its own) when avoiding high fixed charges**
- 5. Customers in new gas zones pay more for gas**

Questions?

