

3rd June 2016

Essential Services Commission
Level 37, 2 Lonsdale Street
Melbourne, Victoria 3000.

Email: DGInquiry@esc.vic.gov.au

Submission to: Submission to Draft Report (Energy Value) of Distributed Generation Inquiry

Dear Sir/Madam,

APA Group is pleased to have an opportunity to provide comments to the Essential Services Commission (ESC) of Victoria with regard to the "The Energy Value of Distributed generation – Distributed Generation Inquiry Stage 1 Draft Report" (the paper).

About APA Group

APA own and/or operate around \$19 billion of energy assets and deliver half the nation's natural gas usage. APA own 15,000 kilometres of natural gas pipelines that connect sources of supply and markets across mainland Australia. APA operate and maintain gas networks connecting 1.3 million Australian homes and businesses and employ over 1600 people. APA also own or have interests in gas storage facilities, gas-fired power stations and wind farms. APA Group (ASX:APA) is listed on the ASX and is included in the S&P ASX 50 Index.

APA's Energy Assets include the 7,500-kilometre East Coast Grid of interconnected gas transmission pipelines. This grid provides the flexibility to customers to move gas around eastern Australia, anywhere from Otway and Longford in the south, to Moomba in the west and Mount Isa and Gladstone in the north. In Western Australia and the Northern Territory, APA's pipelines supply gas to power major cities, towns and remote mining operations. APA also own and operate the Mondarra Gas Storage Facility and the Emu Downs Wind Farm in Western Australia, Diamantina and Leichhardt Power Stations in Queensland, the Dandenong LNG Storage Facility in Victoria and the Central Ranges Gas Distribution Network, servicing Tamworth in New South Wales.

APA also has extensive investment interests in a variety of other energy assets across Australia, such as pipelines; power stations; wind farms; electricity interconnectors; gas processing plants and a gas distribution network.

APA thanks the ESC for the opportunity to comment on the Paper. Please contact either Josh Hankey (07 3215 6632) or myself (08 8113 9197) should you wish to discuss our submission further.

Yours sincerely

Peter Gayen
Manager Networks Commercial

APA's comments in regard to the Paper's recommendations

As per APA's February 2016 submission in relation to the initial paper concerning the True Value of Distributed Generation, APA believes that the key energy policy principle to be applied by the Victorian government as it transitions from a high to low emission energy market is a technology neutrality policy. Such a policy would treat technologies fairly and equally, and would *not* therefore, adversely affect any particular energy source, and indeed would likely provide a more positive operating environment for the emergence of low emissions technologies.

APA noted that the first ESC consultation paper effectively promoted thinking around potential roles for other low emissions technologies which could also be eligible for a FIT payment – on the basis that they provided outcomes similar to those that existing FIT approved technologies provide.

APA is therefore disappointed that the ESC has recommended a limited type and size of technologies eligible for payment under the FIT programme in its paper, i.e. **Draft Recommendation (2) - Eligibility for payments** i.e.

Solar photovoltaic (PV), wind, hydro and biomass remain eligible technologies for receipt of feed-in tariff payments, and eligibility be retained for units up to a generating capacity of 100kW.¹

No new low emissions fuels would be included in the technologies eligible for payment under the FIT under this recommendation. With the inclusion of a 100kW capacity cap reference within the proposal, APA find the recommendation particularly disappointing knowing that a number of other low emission household technologies below 100kW already exist.

These existing technologies can generally perform the same function as those technologies included in Draft Recommendation (2), and as such, APA is concerned that other technologies that also deliver energy, provide low emission outcomes, create other value under Victorian FIT arrangements, are not being provided an opportunity to participate in the FIT scheme. Examples include fuel cells, including micro systems, which can provide heat and power for home, and are typically well within the 100kW cap, ranging in size from 1 to 3kW and 4 to 8kW.²

Although APA generally supports the high level direction of the other (10) recommendations of the paper, in APA's opinion, the principle of technology neutrality is crucial to the development of markets and ensures that winners aren't picked. Even from an emission reduction perspective only, strong argument exists to demonstrate that the costs of emission reduction can vary significantly between schemes and technologies.

As an example, APA is aware the Energy Networks Association has worked with Jacobs, to develop a further understanding of Australia wide, least cost carbon abatement policy options, which support a technology neutral approach to achieving emission reductions.

In particular, Jacobs conducted analysis to understand the least cost abatement path for Australia under three policy scenarios:

1. "Business as usual": a continuation of the diverse range of various State and Federal abatement initiatives (which frequently prescribe specific technologies or scale, such as solar feed-in-tariffs);
2. "Level playing field": replacing current initiatives with technology-neutral programs focussed on the outcome of lower emissions; and
3. "Alternative level playing field": current policies are replaced with a carbon equivalent mechanism.

Importantly, Jacobs found that more cost-effective abatement outcomes can be achieved through a technology neutral policy (i.e. the "Level playing field" option), rather than technology-specific abatement programs that seek to encourage the up-take of renewable energies for example (i.e. "business as usual").³

Additionally, Jacobs developed forecasts of the typical residential bill under each of these three scenarios and as follows:

"Jacobs' analysis shows a typical residential electricity bill in 2030 would be lower under a 45% target scenario with a Level Playing Field, than under the smaller 26-28% abatement target with our current, inefficient policy mix"⁴

¹ The Energy Value of Distributed generation – Distributed Generation Inquiry Stage 1 Draft Report – April 2016 – ESC – page (5)

² "[Reduction of residential carbon dioxide emissions through the use of small cogeneration fuel cell systems – Scenario calculations](#)". IEA Greenhouse Gas R&D Programme (IEAGHG). 11 November 2008. Retrieved 2013-07-01.

³ Energy Networks Association, Response to Climate Authority's "Australia's Climate Policy Options: Special Review" draft report, February 2016.

⁴ Energy Networks Association, "Media Release: Technology neutral policies will deliver lower bills", 10th march 2016, pg 1.

APA encourages the ESC to actively consider the analysis undertaken by Jacobs. As such, APA would be pleased to discuss the Jacob's findings further with the ESC (see Attachments A-C of this submission⁵).

Apart from the Jacobs work, recent work undertaken by the Queensland Productivity Commission (QPC) also raises questions about FITs and selectively chosen technologies, including the costs of their emission reduction performance.

In regard to the costs of emissions reduction achieved, the QPC in the same report makes the following comment:

"Neutrality ensures the focus is on the long-term interests of consumers and not the industry or the development of a specific technology."⁶

Information published by the QPC also suggests that the cost of emissions reduced by certain renewable technologies, is very high compared with alternative approaches:

"Wood, Blower and Chisholm found that the economic cost of emissions to 2030 due to solar PV is more than \$175 per tonne of CO₂."⁷ "ACIL ALLEN produced estimates of the cost of the SRES component of the RET of \$164-\$191 per tonne of CO₂ abatement."⁸

Notably, comparative emission reduction costs also provided in the QPC draft report are much lower than the estimated costs provided above i.e. recent ERF auction rates of \$13.95, \$12.25 and \$10.23 per tonne abated; Australian Treasury modelling rates of \$20-\$24 per tonne (2012-13); etc.

The work of Jacobs and QPC both cast significant doubt on technology approaches that are not focussed on technology neutrality i.e. they cause higher cost emission abatement than a technology-neutral approach to emissions reduction, as well as create adverse market circumstances for other low emission competitor appliances.

"Evidence presented to this inquiry suggests the Queensland Government should ensure:

Future policy design does not provide rooftop solar PV with an unfavourable advantage over other sources of generation including, but not limited to, commercial and large-scale solar/renewables, community solar and other low-emissions technologies, such as gas"⁹

Consistent with the previous section regarding technology neutrality, the above comments from the QPC report effectively summarise APA's views in regard to emissions reduction measures. APA believes that energy policy should be undertaken on a technology neutral basis, where lowest cost of emission reduction is the key driver.

⁵ Note: CEO of the ENA, John Bradley, presented at the Australian Gas Outlook on 10th March 2016. Attachments A-C are copies of his presentation and the ENA's media release regarding Jacob's findings.

⁶ Draft Report – SOLAR FEED-IN PRICING IN QUEENSLAND – Queensland Productivity Commission - page 35

⁷ Ibid – page 79

⁸ Ibid – page 79

⁹ Draft Report – SOLAR FEED-IN PRICING IN QUEENSLAND – Queensland Productivity Commission - page xiii



ENA

THE EVOLUTION OF THE NETWORK

A YEAR IN REVIEW AND KEY ISSUES LOOKING AHEAD TO 2017

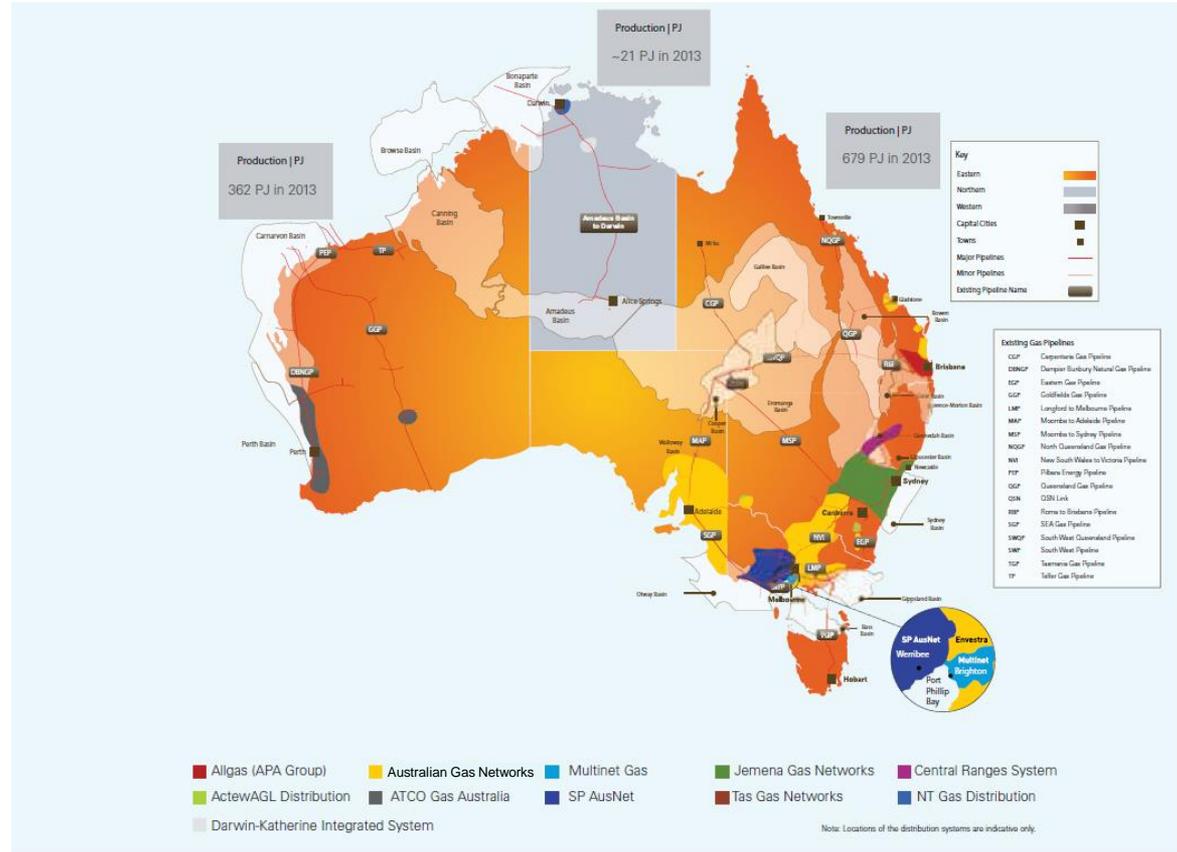
AUSTRALIAN DOMESTIC GAS OUTLOOK

JOHN BRADLEY, CEO, ENA

10 MARCH 2016

ENA & Gas Distribution

- > 74,000 km Distribution pipelines
- > 4.1 million gas customers
- > Gas Penetration:
 - 90% in Victoria
 - 80% in ACT
 - 60% in South Australia
 - 45% in NSW
 - 10% in Queensland
 - 5% in Tasmania



Source: AER State of the Energy Market 2015

Source: Core Energy

Outline

- > Domestic gas challenges
- > *Australia's Bright Gas Future*
- > The role of gas in climate policy options

Domestic Gas Challenges

- > Impact of export LNG markets on domestic prices and availability

Figure 2.3: Gas demand by sector, by state, 2014 and 2024



Source: AEMO (2015) National Gas Forecasting Report

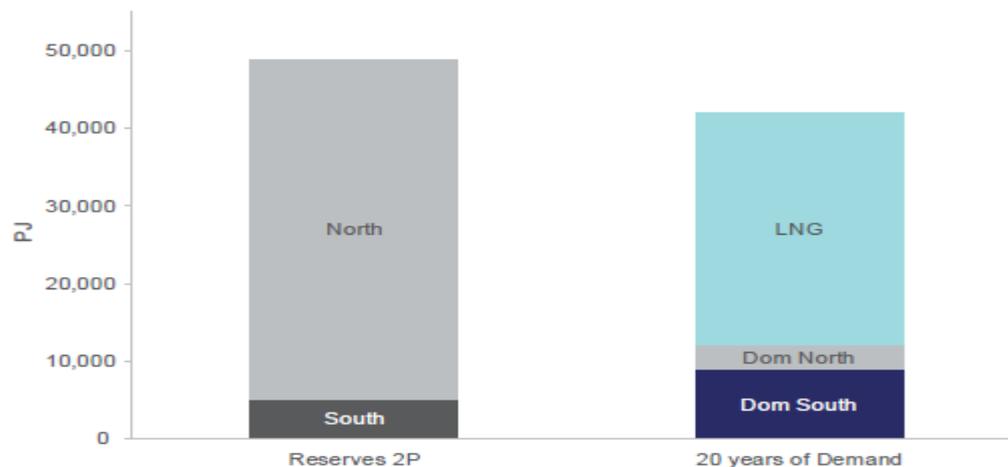
Source: Australian Government, Office of the Chief Economist (2016), *Gas Market Report 2015*, Figure 3.2



Source: Woodside Energy Ltd.

Domestic Gas Challenges

> *Regional Mismatch of Supply & Demand*

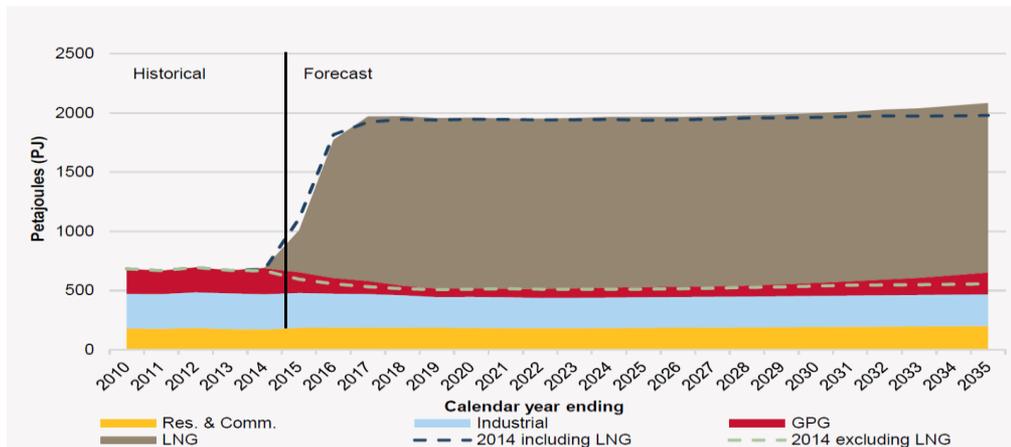


Source: Australian Government, Office of the Chief Economist (2016), *Gas Market Report 2015*, Figure 3.2

Domestic Gas Challenges

> *Technology-specific policies leading impacting least cost abatement*

Total annual gas consumption



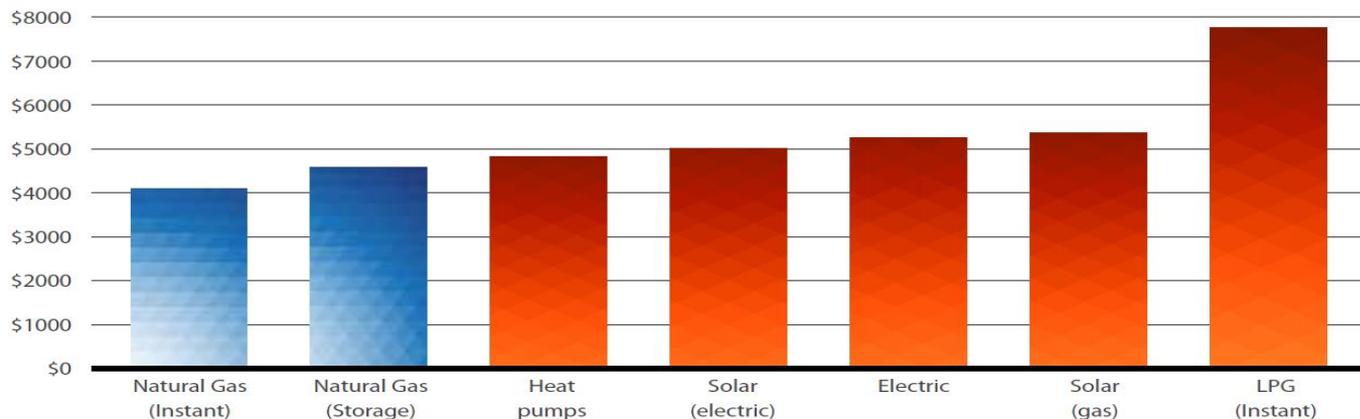
“In an oversupplied market, new renewable generation displaces GPG from the electricity dispatch merit order ...”(AEMO, 2015)

“Electricity generation from renewables and black and brown coal increased over 2014-15, while generation from gas and hydro fell...” (DoE, 2015)

Domestic Gas Challenges

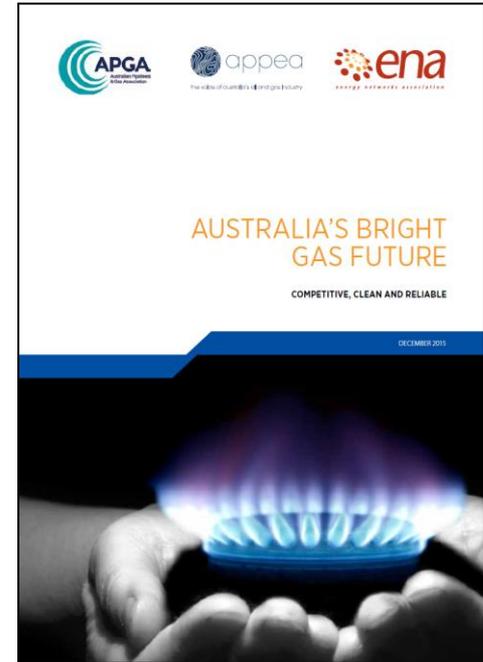
- > *Technology-specific policies leading impacting least cost abatement*

Comparison of Water Heating Lifecycle Cost



A strong value proposition for households....

- > Gas is a **low cost, low carbon** and **convenient** fuel of choice for Australian consumers when it comes to cooking, hot water and winter heating.
- > Natural gas from a distribution network delivers energy which is **1/4 to 1/6 of the carbon intensity of mains electricity.**
- > Can deliver a **hot water system that never goes cold** and **up to 83% less emissions** than a electric resistance HWS.
- > **Control for home chef, amenity and warmth**



...and innovative applications

WHAT'S NEXT?

Australians are enjoying innovative new uses for household gas appliances

GAS REVERSE CYCLE AIR CONDITIONING

For the larger homes, ducted gas reverse cycle air conditioning is now an option. This is even lower emissions and running cost than electric air conditioning and performs better at low temperatures. If you need to manage your peak electricity demand, gas fired air conditioning is a great option.



GAS BARBEQUES AND PATIO HEATERS⁵

Natural gas barbecues and patio heaters allow warm outdoor entertaining all year round. A networked natural gas patio heater provides substantial warmth, requires no lifting of heavy cylinders and can save you money. Networked natural gas costs about one quarter to one-third of the cost of LPG cylinders, without the inconvenience or transport emissions of refueling.

GAS MICRO GENERATION

Gas microgenerators are being developed in Europe, North America and Asia to assist balancing residential electricity demand. These can provide hot water and cooling as useful by-products, and being onsite, gas-fired micro generation can help to avoid electricity losses and lower carbon emissions.

GAS DRYERS⁴

Comparisons show that that the 54% of Victorians who have clothes dryers will add \$123 a year to their electricity bill to run a large electric dryer 1.5 times a week. For the same load, gas dryers are more efficient and will save a customer \$87 annually whilst reducing drying times and greenhouse gas emissions.



⁴ Washer and Dryer, Sustainability Victoria, April 2014
⁵ natural-gas.com.au - Natural Gas your questions answered, p.2

A vital input to Business and Industry

Gas in Business and Industry



Onsite Electricity Generation and Space heating and cooling

eg. swimming pools, leisure centres, shopping centres, hospitals, public buildings



Heat and Steam raising activities

eg: cement and lime production, alumina and non-ferrous metals refining, bricks, tiles and masonry, ethanol production, glass production, food production



Feedstock

eg: Ammonia synthesis, fertiliser production, methanol production, explosives, polymers for plastics, chemical production, hydrogen production

... new commercial opportunities

GPAC



CASE STUDY: GPAC

The ATCO Gas site in Jandakot, WA utilises clean, reliable and safe natural gas for cooling through Gas Powered Air Conditioning. The building uses four, 85kW gas powered air conditioning units to cool a total of 3,127 m². Using GPAC has saved the business 40% on the running cost of an equivalent electricity system. It has improved environmental performance also, adding an extra star under the Green Star building rating scheme.

Co-gen & Tri-gen



CASE STUDY: Co-Generation⁹

A year after the installation of a 229kW Cogeneration System at the Oasis Regional Aquatic Centre in Wagga Wagga NSW, the Centre has reduced its electricity bill by over \$20,000 a month and its greenhouse gas emissions by 945 tonnes.

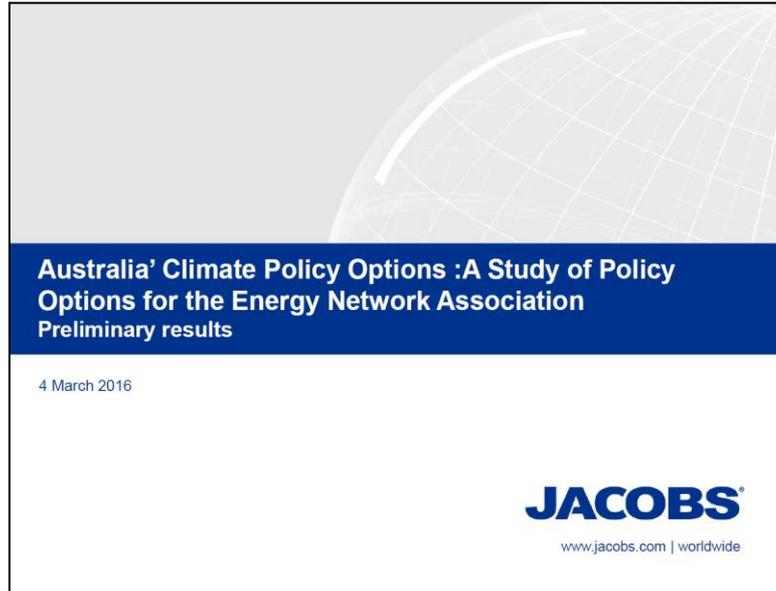
The Cogeneration System is fuelled by Natural Gas but supplements the existing gas fired hot water boilers. With the total investment of the system including installation of \$373,636 and factoring in maintenance costs, an estimated payback of just over 2 years has been achieved.

Natural Gas Vehicles

TABLE 1. Payback periods based on 40c/litre/equivalent price spread between CNG, NGV and petrol/diesel. Figures include fuel excise.¹⁰

	Km/yr	Fuel use l/yr	CNG premium	Annual saving	Payback period years
Car 2.5l	30000	3000	\$4,500	\$1,200	3.75
	60000	6000	\$4,500	\$2,400	2.5
Taxi	150000	20000	\$4,500	\$6,000	0.75
Light duty van	30000	3600	\$7,000	\$1,440	4.86
	75000	9000	\$7,000	\$3,600	1.94
Light duty truck	30000	7500	\$13,000	\$3,000	4.33
	75000	18750	\$13,000	\$7,500	1.73
Medium duty truck	30000	9000	\$18,000	\$3,600	5
	75000	22,500	\$18,000	\$9,000	2

Climate Policy & the Role of Gas



Two targets – Three Policy Scenarios...

- > **Objective:** Quantify the impacts of alternative policy approaches to achieve the stated national emission reduction target in 2030.

	26-28% Target	45% Target
Business as usual	✓	✓
Level playing field	✓	✓
Explicit carbon price	✓	✓

Scenarios:

1. Business as usual:

- Continue diverse State and Federal abatement initiatives which prescribe **specific technologies** (e.g. renewables) or **scale** (e.g. SRES, FiT).
- Extend use of a binding **Safeguards Mechanism** that limits sectoral emissions without trading.
- *PLUS in the 45% target scenario a carbon price and 50% RET is assumed).*

2. Level playing field scenario:

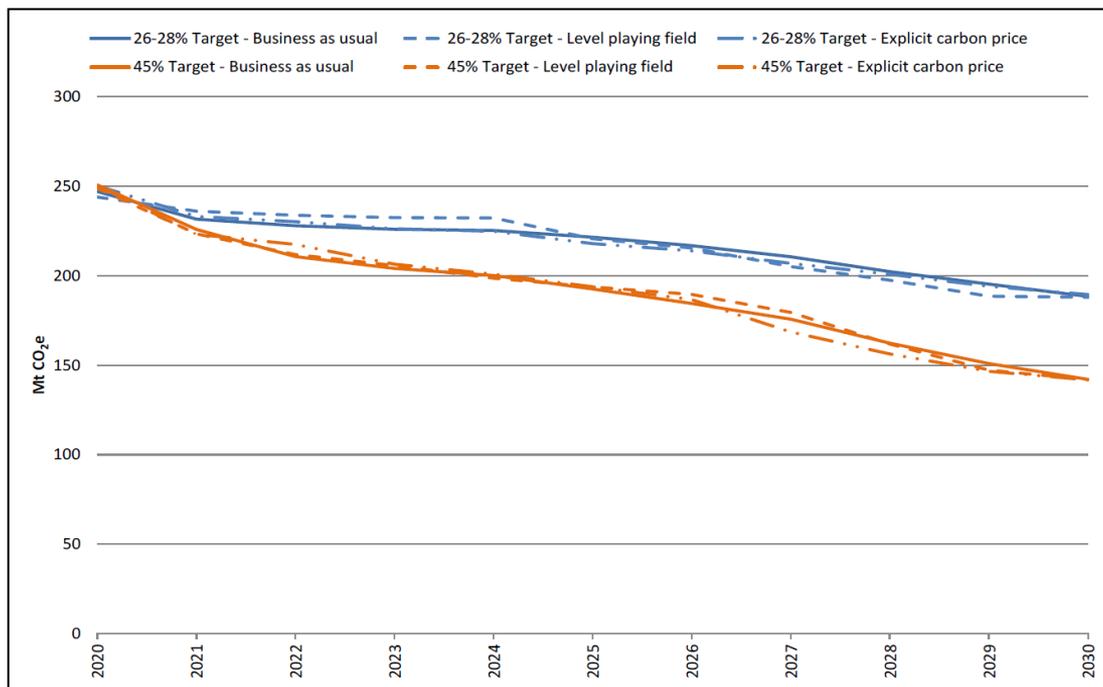
- Abatement initiatives maintained but made **technology neutral** (eg. via a low emissions target scheme) and indifferent to scale.
- In the 26-28% target scenario, the Safeguards Mechanism evolves to a **baseline & credit mechanism** permitting trading among participants.
- *PLUS in the 45% target scenario, a carbon price and 50% LET is assumed.*

3. Explicit carbon price scenario:

- This scenario assumes that an explicit carbon price is established through a mechanism equivalent to a whole of economy carbon tax or emissions trading scheme.
- All other abatement policies (eg RET, SRES) are removed.

Key Findings

- Carbon reduction targets for 2030 for the stationary energy sector can be met using all of the different policy approaches.**



Key Findings

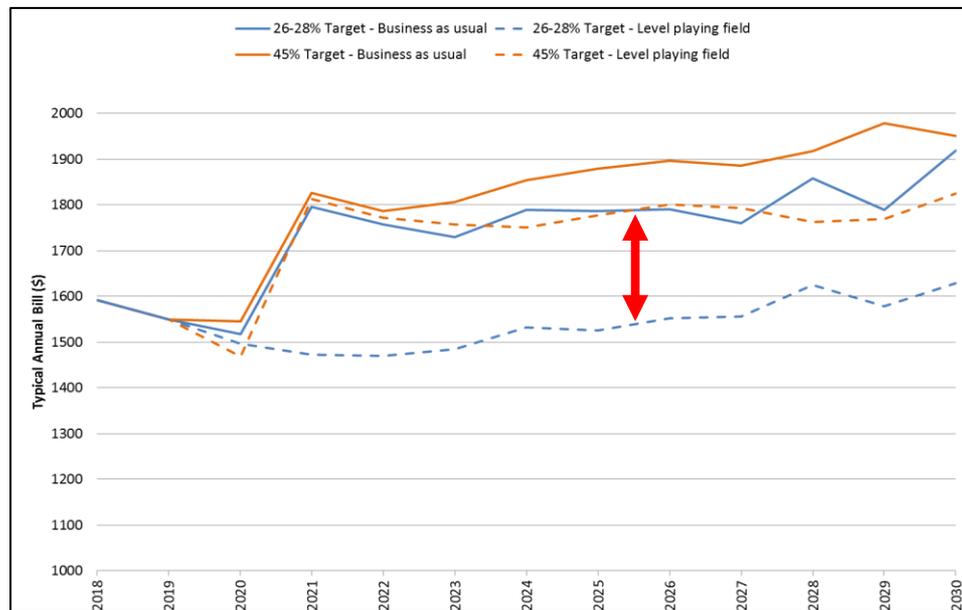
2. **Technology neutral policies would achieve Australia's carbon abatement targets at lower costs in the stationary energy sector.**

	Abatement Target			
	26 to 28%		45%	
Policy Settings	<i>Total Cost</i>	<i>Savings</i>	<i>Total Cost</i>	<i>Savings</i>
Business as usual	\$129.2 bn	-	\$152.5 bn	-
Level playing field	\$128.6 bn	\$600 m	\$150.9 bn	\$1.5 bn
Explicit carbon price	\$128.5 bn	\$700 m	\$144.3 bn	\$8.2 bn

Key Findings

3. The technology neutral framework provides the lowest residential electricity bills from 2020-30.

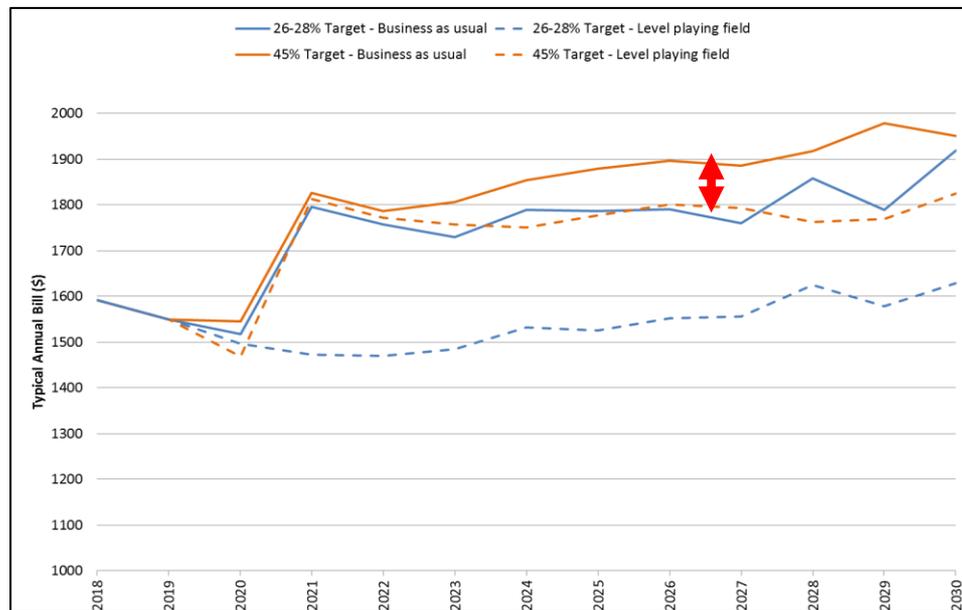
- Savings from a 'level playing field' compared to "BAU" in 26-28% target:
 - Typical residential bills average **\$234 pa lower** in period 2020-30.
 - Cumulative savings up to **\$2,570**.



Key Findings

3. The technology neutral framework provides the lowest residential electricity bills from 2020-30.

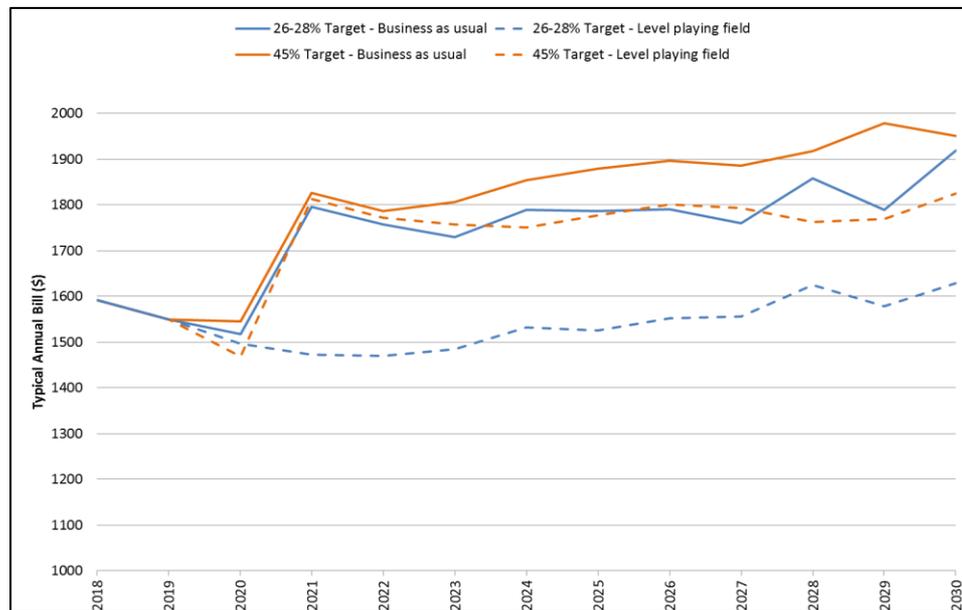
- Savings from a ‘level playing field’ compared to “BAU” in 45% target:
 - Typical residential bills average **\$94 pa lower** in period 2020-30.
 - Cumulative savings up to **\$1,033**



Key Findings

3. The technology neutral framework provides the lowest residential electricity bills from 2020-30.

- Efficiency benefits of technology neutral policy settings are enough to offset impacts of a higher target (45% vs 26-28%).



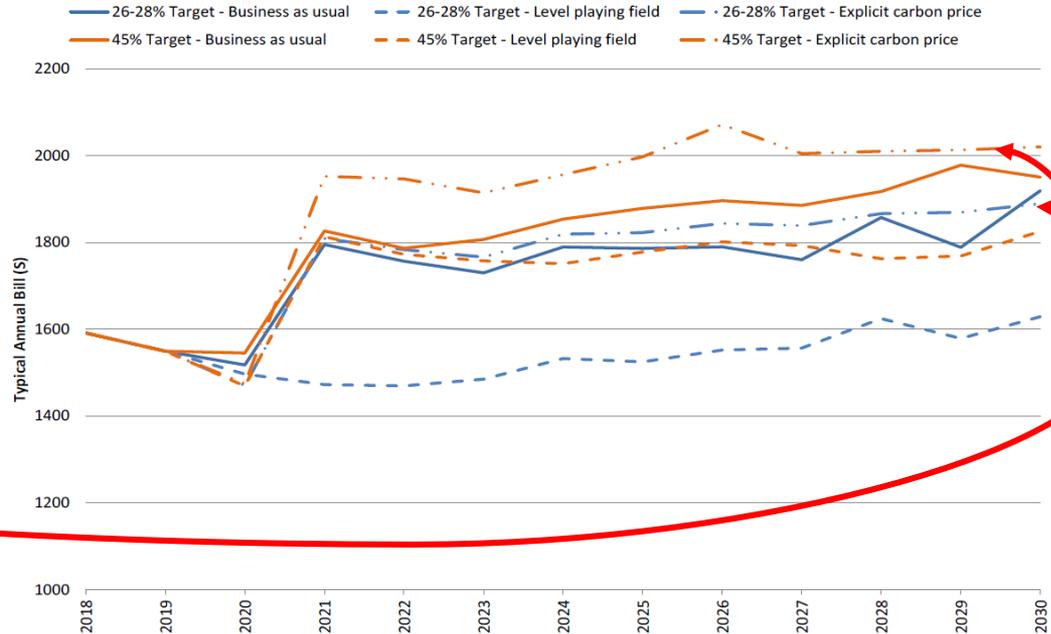
Key Findings

4. Residential outcomes of Carbon Price Scenario depend on approach to household transfers.

NOTE:

Explicit Carbon Price scenario bill outcomes do not reflect the final household financial outcome.

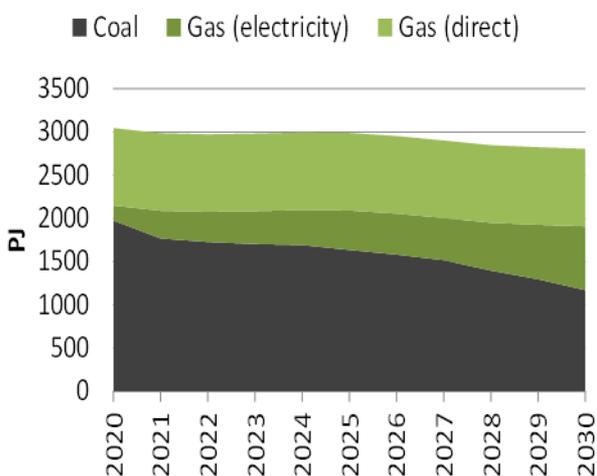
No adjustment has been made for any offsetting household payment/relief which would be possible from scheme revenue.



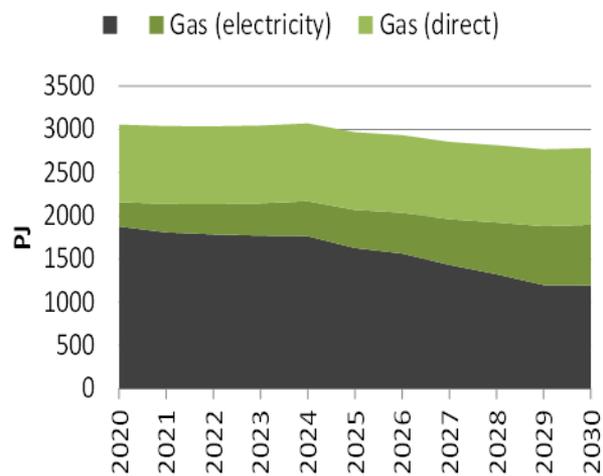
The Role of Gas in Climate Policy Options

> Key Results – gas usage in the 26-28% scenario

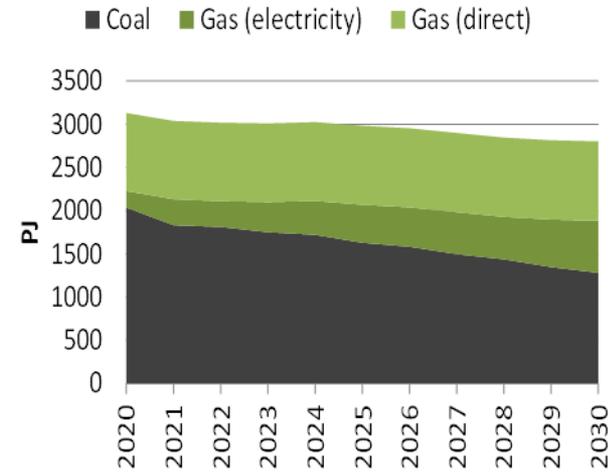
Business as usual



Level playing field



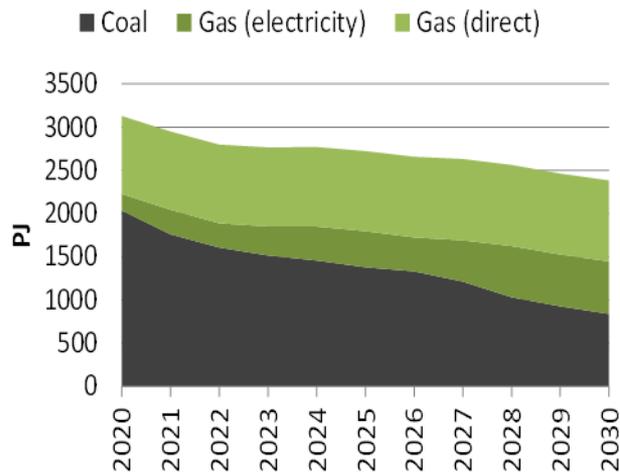
Explicit carbon price



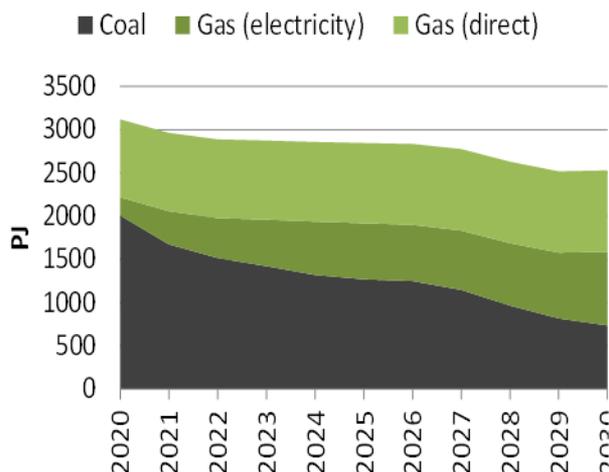
The Role of Gas in Climate Policy Options

> Key Results – gas usage in the 45% scenario

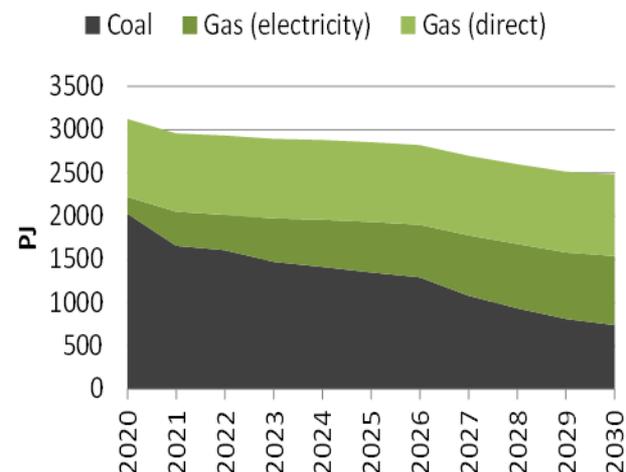
Business as usual



Level playing field



Explicit carbon price



Key Findings

- > The achievement of Australia's abatement targets does not require technology-specific abatement programs.

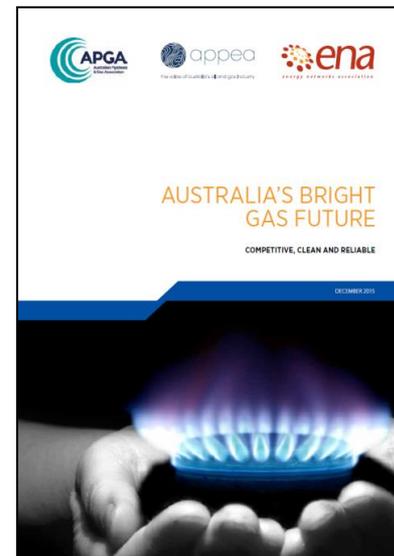
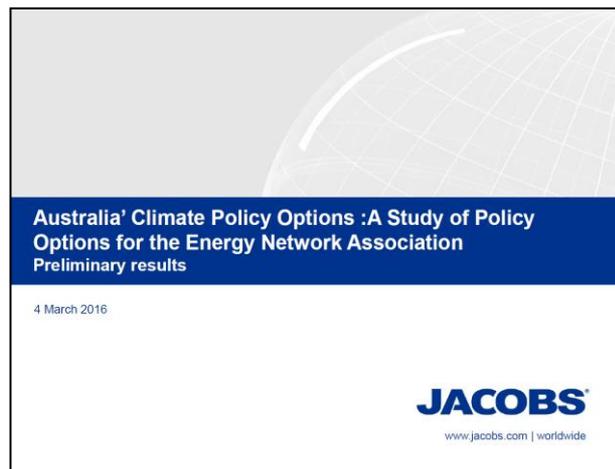
- > The lowest economic cost is associated with:
 - Market based mechanisms applied broadly across the energy sector that allow for the lowest cost options to be adopted
 - Technology neutral policies

- > The lowest residential electricity bills occur with:
 - Level playing field for technologies to participate in mitigation
 - Where trading around liabilities is allowed

- > In the period under study, Australia's domestic gas usage needs to increase in all scenarios from 2020 to 2030 due to the need to deploy low emission technologies

More information....

www.ena.asn.au





EMBARGOED: 10 March 2016

Technology neutral policies will deliver lower bills

A move to “technology neutral” carbon policy could save a typical residential electricity customer \$234 per year while still meeting Australia’s emission reduction targets.

Speaking at *Australian Domestic Gas Outlook 2016*, Energy Networks Association (ENA) CEO, John Bradley, released analysis from a forthcoming Jacobs report on carbon abatement policy options and the outcomes for consumers.

“Australia’s carbon policy is at a crossroads and the next Federal Government will determine how efficiently we meet the 2030 carbon abatement commitments from Paris,” Mr Bradley said.

“Governments can save the Australian economy over \$600 million and electricity customers \$234 per year by allowing all low emission technologies to play their role in meeting current targets.

“Left as they are, Australia’s abatement programs will see residential electricity bills 15% higher than they need to be to achieve our emission reduction targets.”

The Jacobs analysis compared a *Business as Usual* scenario (where current State and Federal policies continue to focus on renewables) with a *Level Playing Field* scenario (using a Low Emission Target and subsidies based on abatement not technology) and an *Explicit Carbon Price* scenario.

“Our current policy settings squeeze out low emission fuels like gas that can have one-quarter to one-sixth the carbon intensity of mains electricity,” Mr Bradley said.

“The analysis shows, if policies focus on least cost abatement, Australia will still see a surge in renewable generation, but will also make efficient use of high quality gas resources and save customers over \$2500 by 2030.”

Mr Bradley said the savings from technology neutral policy settings could be enough to offset an increase in the abatement target from 26-28% below 2005 levels by 2030, to 45%.

“Jacobs analysis shows a typical residential electricity bill in 2030 would be lower under a 45% target scenario with a Level Playing Field, than under the smaller 26-28% abatement target with our current, inefficient policy mix.

“The lowest residential electricity bills were achieved with a Level Playing Field, where the Renewable Energy Target evolves to a low emissions target and today’s Safeguard Mechanism becomes a ‘baseline and credit’ scheme allowing some trading.”

Mr Bradley said the Jacobs analysis indicated an explicit carbon price delivered the lowest cost to the Australian economy, with savings of up to \$8.2 bn under a 45% target, when compared to current policy settings.

However, in this scenario, residential electricity bills were higher and the household financial outcome would depend on how any offsetting payments were made from scheme revenue.

“Australian energy ministers rightly recognise the need for better integration of carbon and energy policy,” Mr Bradley said.

“Australia can achieve its current and future carbon targets efficiently and minimise the impacts on electricity customers, but this will require a level playing field from government policy.”

-Ends-

See attached Fact Sheet.

Media Contact:

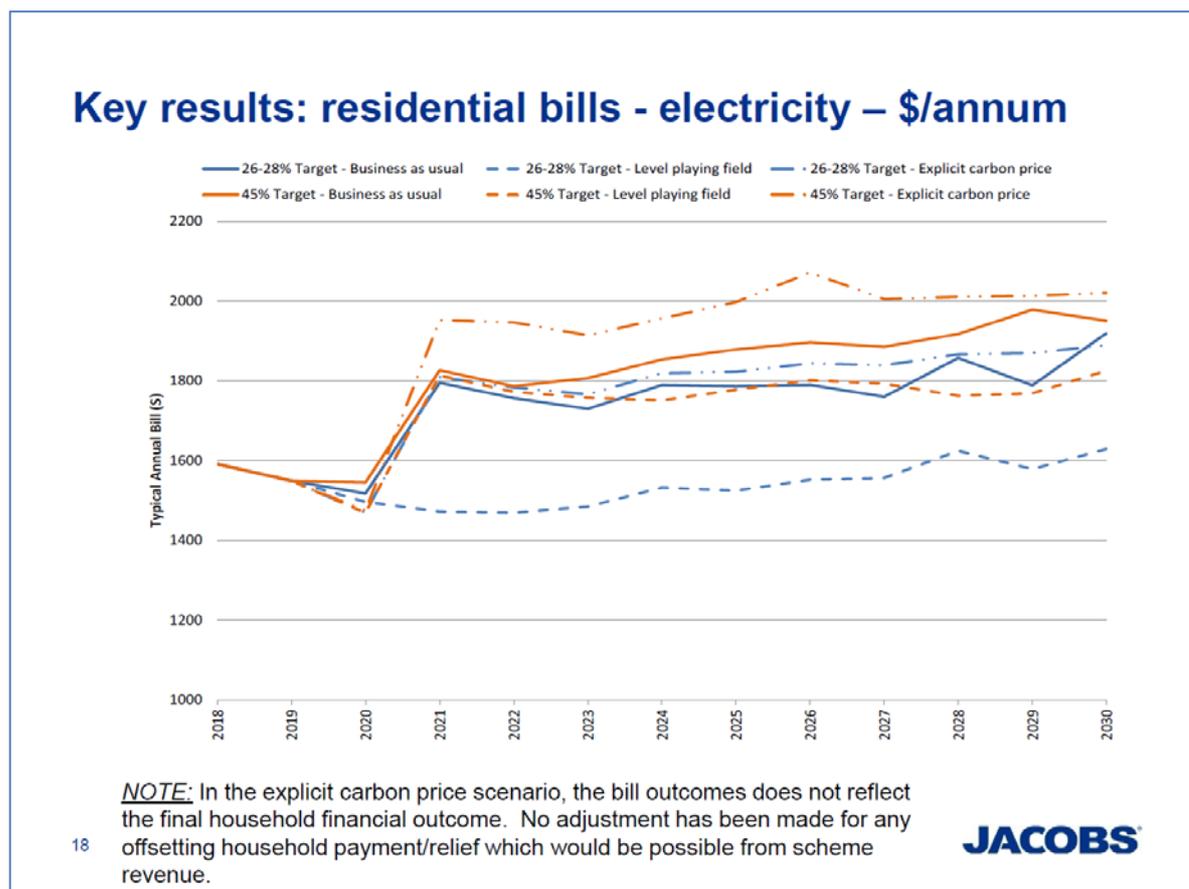
Simone Reading

02 6272 1524 or 0447 569 029

The Energy Networks Association is the peak national body representing Australia’s electricity transmission and distribution networks and gas distribution networks on economic, technical, environmental and safety regulation, and national energy policy issues. ENA members provide energy to virtually every household and business in Australia.

Fact Sheet: Jacobs analysis of carbon policy options

Scenario	Key Features
Business As Usual	Assumes the continuation of the diverse range of various State and Federal abatement initiatives which prescribe specific technologies (e.g. renewables) or scale (e.g. SRES, FiT) and the extended use of a binding Safeguards Mechanism which limits sectoral emissions without trading. In addition, in the 45% target scenario a carbon price and 50% RET is assumed.
Level Playing Field	Assumes the current abatement initiatives are made technology neutral (eg. via a low emissions target scheme) and indifferent to scale. In the 26-28% target, it assumes that the Safeguards Mechanism evolves to a baseline & credit mechanism permitting trading among participants. In addition, in the 45% target scenario a carbon price and 50% LET is assumed.
Explicit Carbon Price (only)	This scenario assumes that an explicit carbon price is established through a mechanism equivalent to a whole of economy carbon tax or emissions trading scheme. All other abatement policies (eg RET, SRES) are removed





Australia's Climate Policy Options: A Study of Policy Options for the Energy Networks Association

Preliminary results

4 March 2016

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Key Findings

- Carbon reduction targets for 2030 for the stationary energy sector can be met using the different policy approaches modelled.
 - The greater the target reduction the higher the contribution from electricity generation compared to direct combustion in meeting the target
- The lowest economic cost is associated with:
 - Market based mechanisms applied broadly across the energy sector that allow for the lowest cost options to be adopted
 - Technology neutral policies
- The lowest residential electricity bills occur with:
 - Level playing field for technologies to participate in mitigation
 - Where trading around liabilities is allowed
- In the period under study, Australia's domestic gas usage needs to increase in all scenarios from 2020 to 2030 due to the need to deploy low emission technologies

Objective

- Quantify the impacts of alternative policy approaches to achieve the stated national emission reduction target in 2030.
- The analysis focuses on achieving this target in stationary energy activities through 3 alternative means:
 - *Business as usual*: Assumes the continuation of the diverse range of various State and Federal abatement initiatives which prescribe specific technologies (e.g. renewables) or scale (e.g. SRES, FiT) and the extended use of a binding Safeguards Mechanism which limits sectoral emissions without trading. *In addition, in the 45% target scenario a carbon price and 50% RET is assumed.*
 - *Level playing field scenario*: Assumes the current abatement initiatives are made technology neutral (eg. via a low emissions target scheme) and indifferent to scale. In the 26-28% target, it assumes that the Safeguards Mechanism evolves to a baseline & credit mechanism permitting trading among participants. *In addition, in the 45% target scenario a carbon price and 50% LET is assumed.*
 - *Explicit carbon price scenario*: This scenario assumes that an explicit carbon price is established through a mechanism equivalent to a whole of economy carbon tax or emissions trading scheme. All other abatement policies (eg RET, SRES) are removed.

Objective

- There are two targets in 2030 to be covered under the analysis:
 - a 26 to 28% reduction on 2005 levels and
 - a 45% reduction on 2005 levels.
- The relevant target is met in each of the six scenarios using 3 different policy frameworks

	26-28% Target	45% Target
Business as usual	✓	✓
Level playing field	✓	✓
Explicit carbon price only	✓	✓

- Note: all 45% target scenarios include a carbon price mechanism

Method

- Integrated modelling approach.
- The models used:
 - *DEAM (part of the SEAM suite of modules covering the direct combustion sector): provided insights on abatement options and costs for the direct combustion sector).*
 - *DOGMMA: provides projections of uptake of small scale generation and electricity displacement systems.*
 - *Strategist: Model of electricity markets: determines dispatch of plant and investment in new plant using least cost programming methods.*
- Study period: 2015 to 2035
 - Study went beyond 2030 as investment choice to 2030 are affected by what happens after 2030 given the long life of energy assets.
 - Policies announced assume a 2020 start.

Method

- Abatement policies modelled:
 - RET/LET: determine uptake of eligible options to meet cumulative target to 2030.
 - Under RET, only renewable energy options allowed.
 - Under LET, all low emission options with an emission intensity below a benchmark of 0.6 t/MWh earn certificates with the proportion of certificates earned based on their emission intensity relative to the benchmark.
 - Based on least cost choice of options.
 - Certificate price determined by LRMC of last plant required to meet the target.
 - SRES: projections of uptake of small scale generation and electricity displacement systems (extending eligibility in level playing field scenarios to microgeneration, trigeneration and efficient gas heating).
 - Safeguarding mechanism: Gradually reducing the absolute baselines for facilities operating at emissions above sectoral baselines. For the 26 to 28% target current policy scenarios, this was the main mechanism to meet long term targets.
 - Baseline and credit: Used in the level playing field 28% target scenario. Sectoral baselines were established reducing from 2020 to 2030 to meet the emission target. Generators with emission intensity above the baselines can trade with generators with emission intensities below the baseline to cover their emission liabilities.
 - Carbon pricing: applying a carbon price to fuel combustion emissions. Gradually increased starting price to achieve 2030 target. Used only in 45% target scenarios and in the 28% Explicit carbon pricing scenario.

Method

- Iterative process:
 - First determine level of emissions from technology pull policies
 - Then meet target by adjusting residual policy (absolute baselines, sectoral baselines, carbon prices)

Policy assumptions

	Carbon	RET	ERF & AB	SRES	LET	State and territory EE and RE policies
G1	N/A	33,000 GWh renewable generation	Set to achieve the 26-28% target	Extended to 2030	N/A	Extended to 2030
G2	N/A	N/A	Set to achieve the 26-28% target	Expanded to low emission technologies and extended to 2030	Higher RET type target but extended to cover all low emission technologies	Expanded to low emission technologies and extended to 2030
G3	Carbon price path to achieve 26-28% target	N/A	N/A	N/A	N/A	N/A
O1	Carbon price commences in 2020 to assist in achieving 45 % reduction by 2030	Higher GWh target to achieve 50% of electricity demand and scheme extended to 2040	N/A	Extended to 2040	N/A	Extended to 2030
O2	Carbon price commences in 2020 to assist in achieving 45 % reduction by 2030	N/A	N/A	Expanded to low emission technologies and extended to 2040	Higher GWh target extended to all low emission technologies	Expanded to low emission technologies and extended to 2030
O3	Carbon price path only measure to achieve 45% target	N/A	N/A	N/A	N/A	N/A

Assumptions

	Energy Sector Emissions (Mt CO ₂ -e pa)		
	<i>Electricity</i>	<i>Gas (direct combustion)</i>	<i>Total</i>
2005 Emissions (DoE)	197	61	258
26-28% Target	144	45	188
45 % Target	108	34	142
2013 Emissions	187	70	257

Key results

- If emission targets are higher (i.e. 45%), the electricity sector does proportionally more to meet emission targets
 - Direct combustion sector has already done the fuel switching (to gas) so limited opportunities for further fuel switching from high emission fuels to low emission fuels. Opportunity is switching end use from electricity to gas.
 - For electricity: abatement comes mainly from a switch to gas and renewable energy generation with the proportion determined by policy mix
 - For direct combustion: abatement comes from energy efficiency (including cogeneration in industrial sector), and fuel switching, mainly to gas.

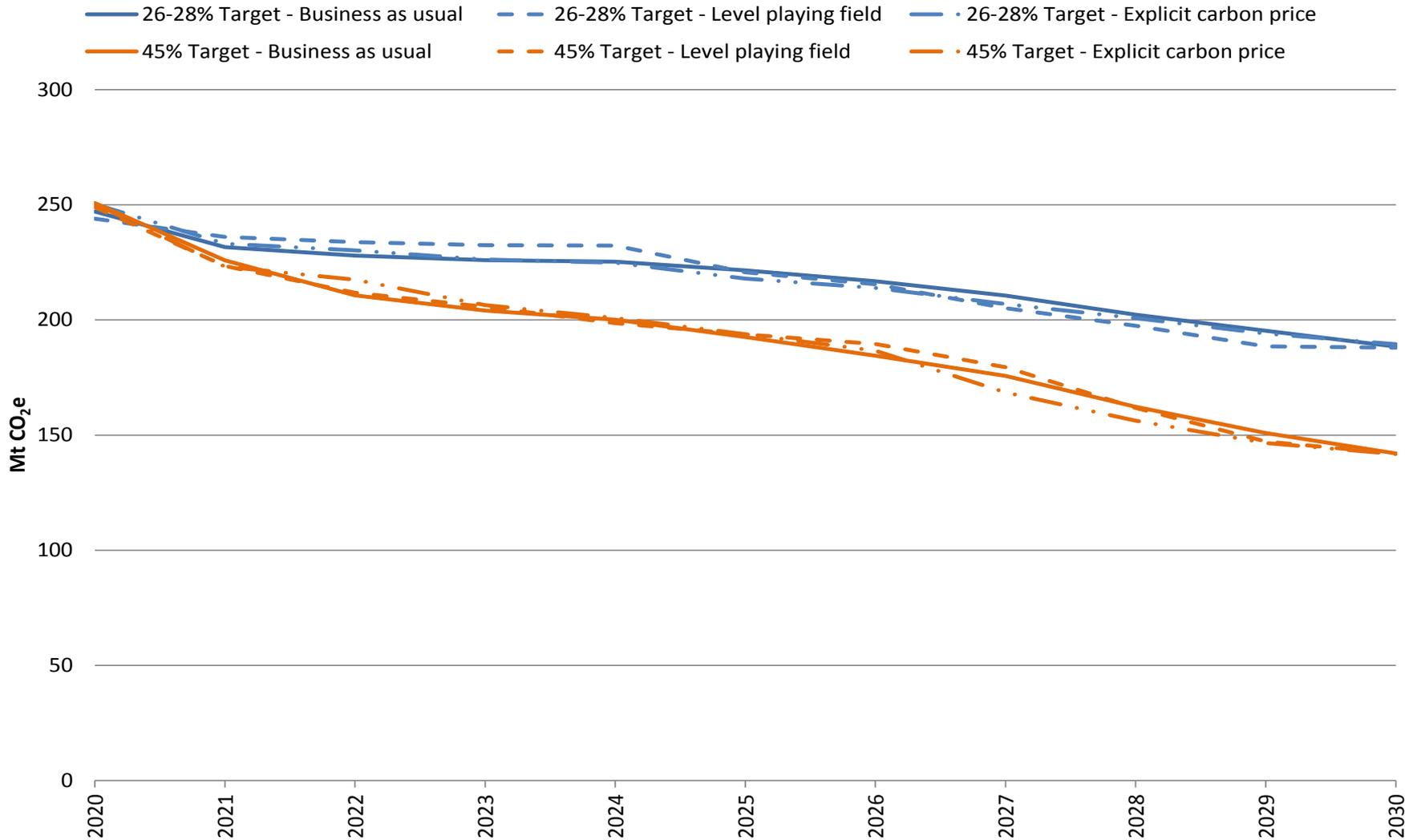
Key results

- Fuel/technology mix results:
 - Overall fuel usage over the period declines because overall energy demand declines and because of higher renewable energy generation in some scenarios.
 - Gas usage needs to increase in all scenarios from 2020 levels by between 35 and 61%.
 - Usage is highest in the technology neutral scenarios
 - Mixed results for coal usage particularly from electricity generation
 - Overall coal reduces in all scenarios by between 36 & 64%.
 - In some scenarios there is a switch from brown coal generation to black coal generation as that produces a lower emission option.
 - Increase in renewable electricity generation in all scenarios (from 45 to 202%)

Key results

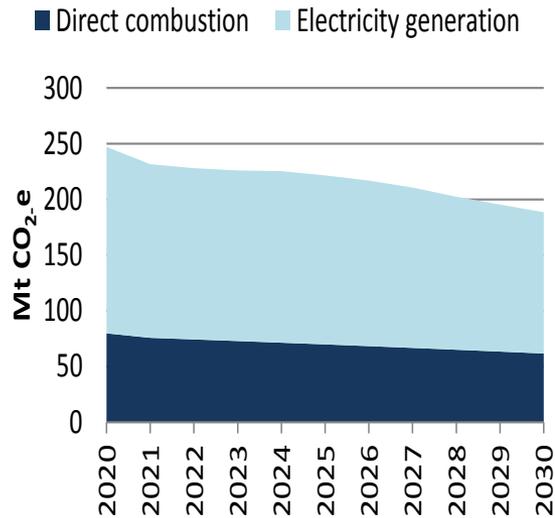
- Costs:
 - Lowest economic cost for explicit carbon pricing scenarios
 - The cost difference is higher under the higher carbon reduction target scenarios (45%)
 - The level playing field has lower economic cost than business as usual
 - Increase in investment is required in new gas and renewable generation plant under all scenarios
 - Gas plant investment ranges from 6,600 MW to 7,500 MW in the 28% target scenarios, and 8,200 MW to 10,000 MW in the 45% target scenarios
 - Renewable plant investment ranges from 4,800 MW to 8,400 MW in the 28% target scenarios and 13,000 MW to 22,000 MW in the 45% target scenarios

Key results: emissions

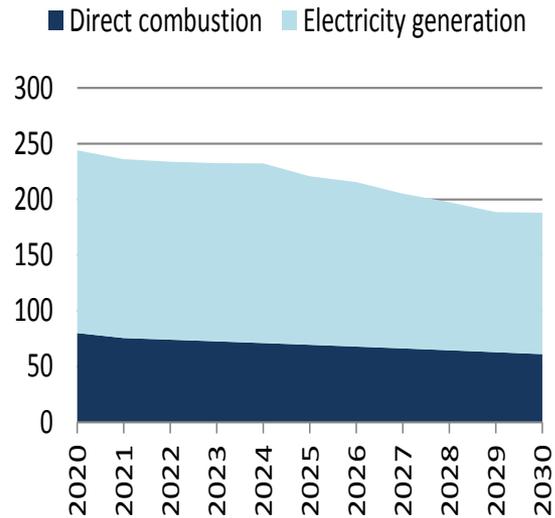


Key results: emissions

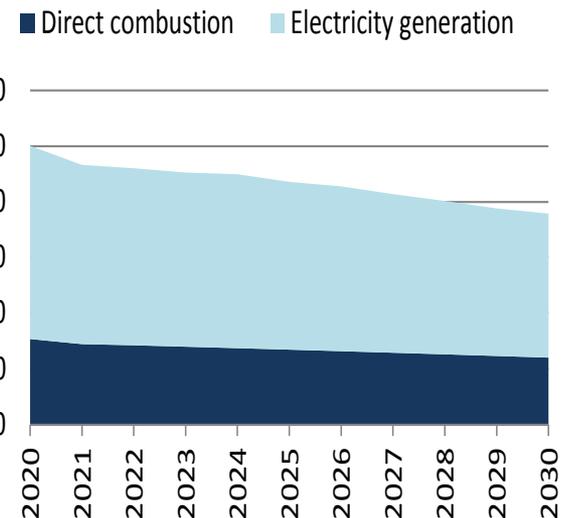
26-28% Target - Business as usual



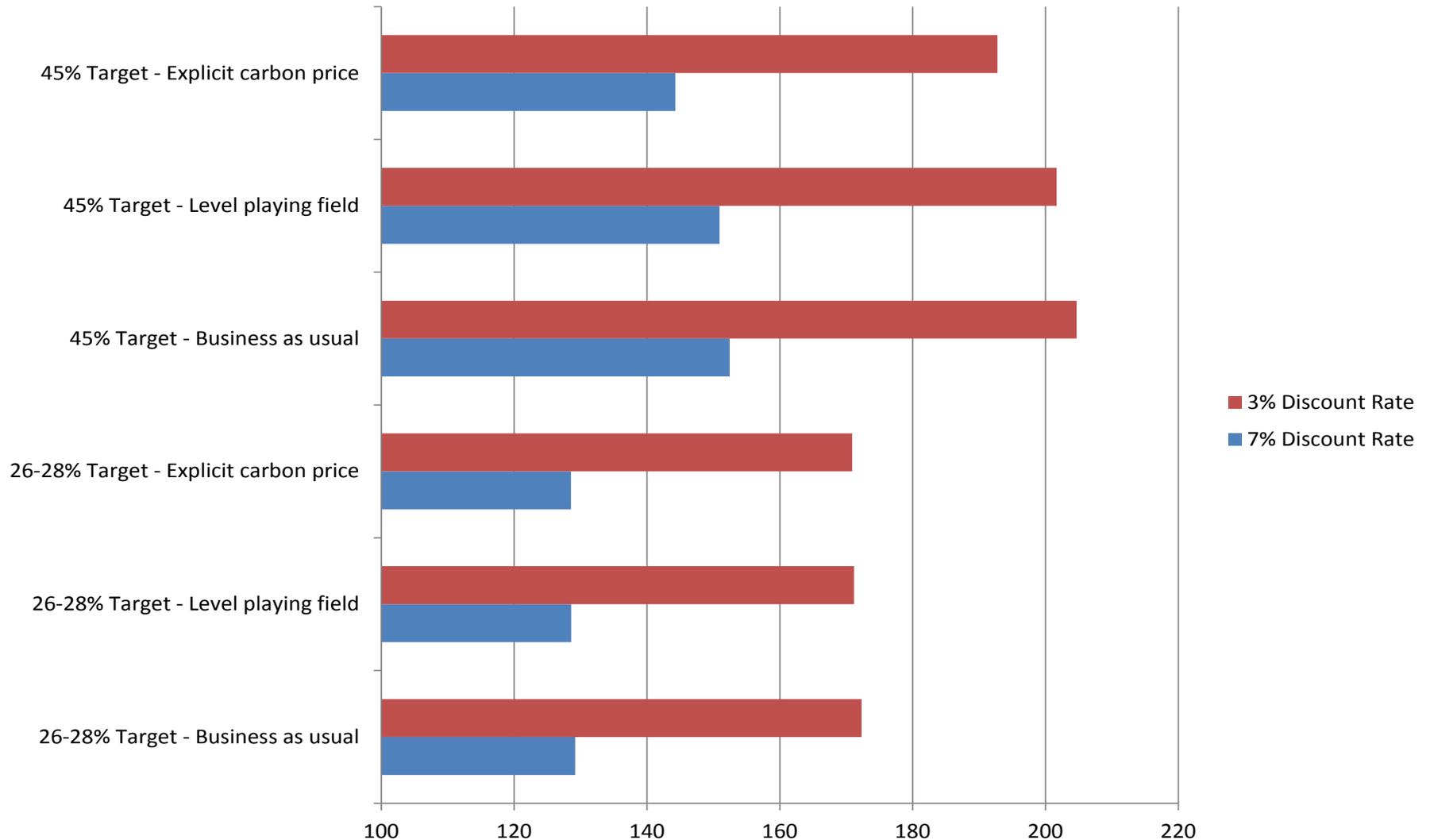
26-28% Target - Level playing field



26-28% Target - Explicit carbon price



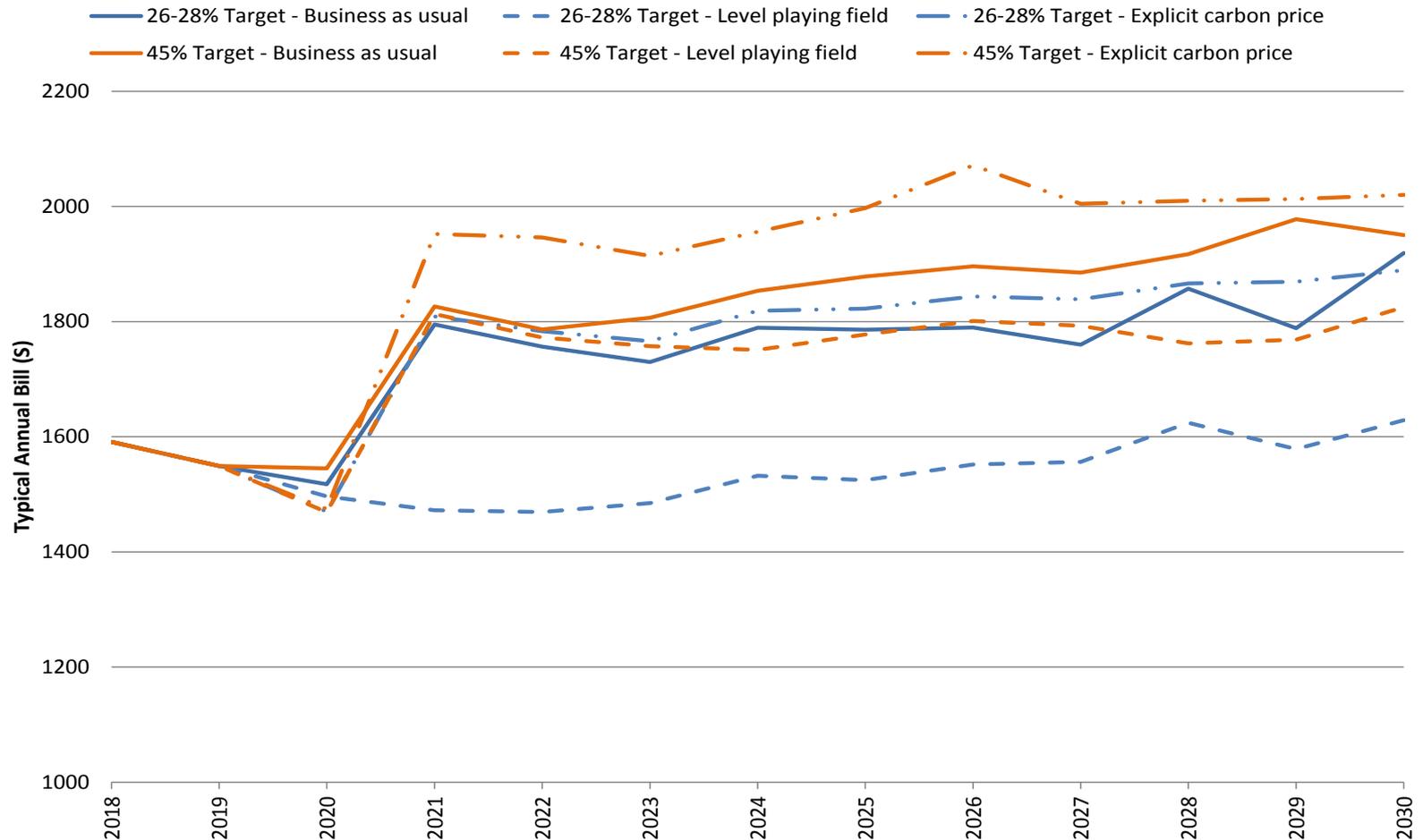
Key results: resource costs - electricity – \$ billion



Key results: resource costs - electricity – \$ billion

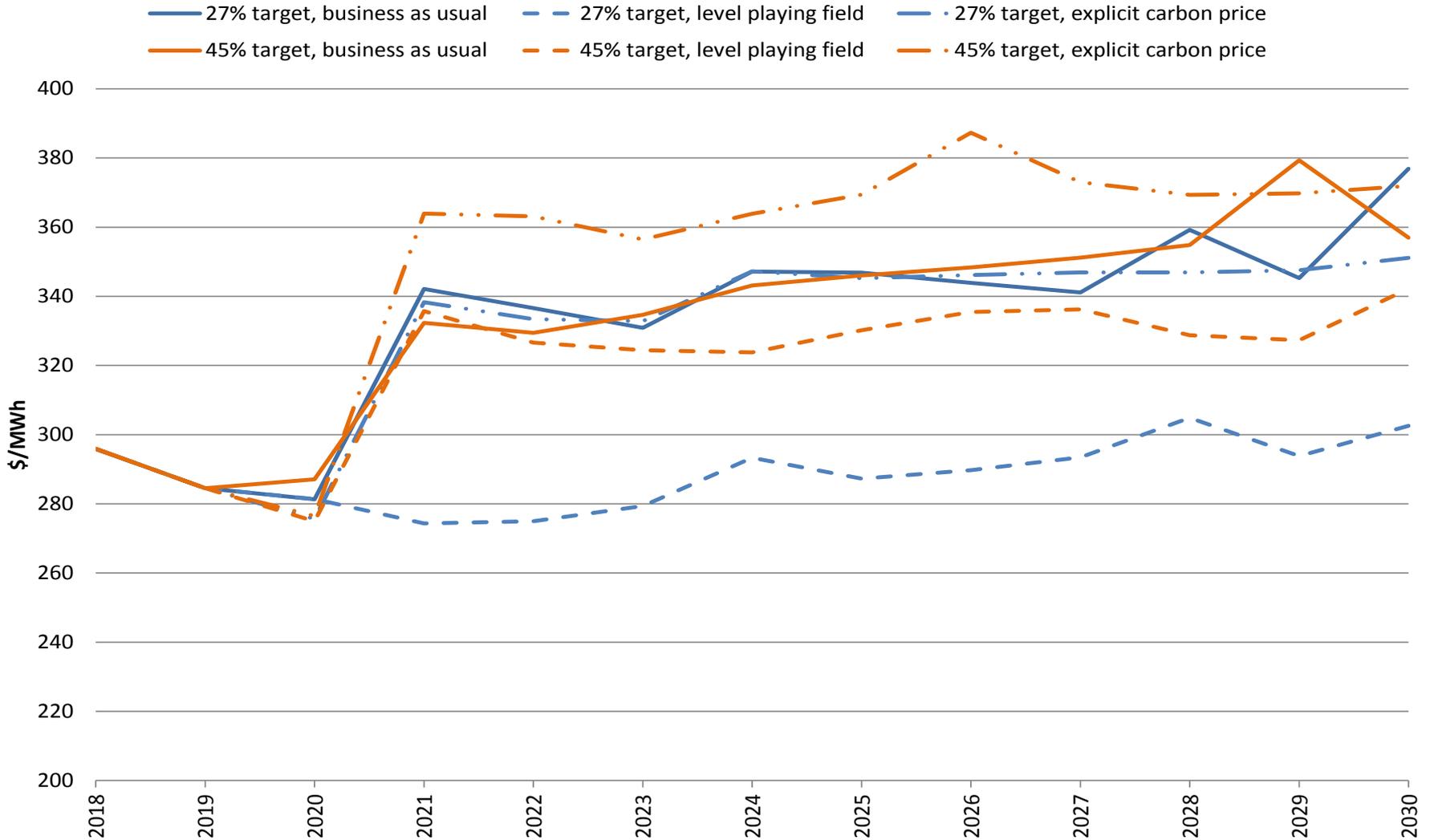
	Abatement Target			
	26 to 28%		45%	
Policy Settings	<i>Total Cost</i>	<i>Savings</i>	<i>Total Cost</i>	<i>Savings</i>
Business as usual	\$129.2 bn	-	\$152.5 bn	-
Level playing field	\$128.6 bn	\$600 m	\$150.9 bn	\$1.5 bn
Explicit carbon price	\$128.5 bn	\$700 m	\$144.3 bn	\$8.2 bn

Key results: residential bills - electricity – \$/annum



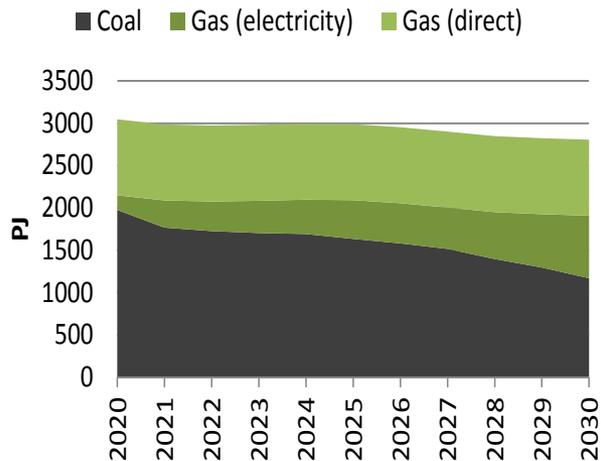
NOTE: In the explicit carbon price scenario, the bill outcomes does not reflect the final household financial outcome. No adjustment has been made for any offsetting household payment/relief which would be possible from scheme revenue.

Key results: residential prices - electricity – \$/MWh

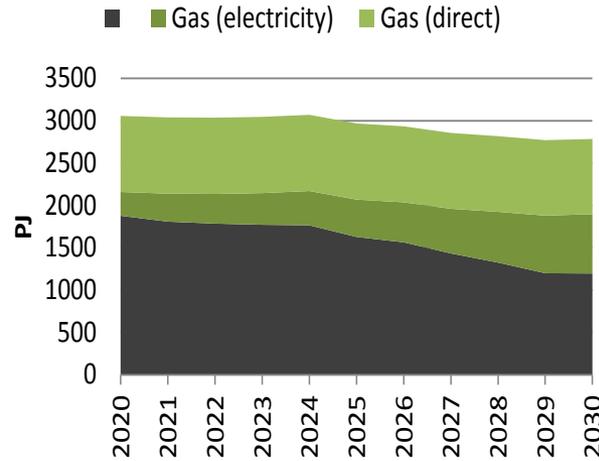


Key results: fuel usage – 26 to 28% target

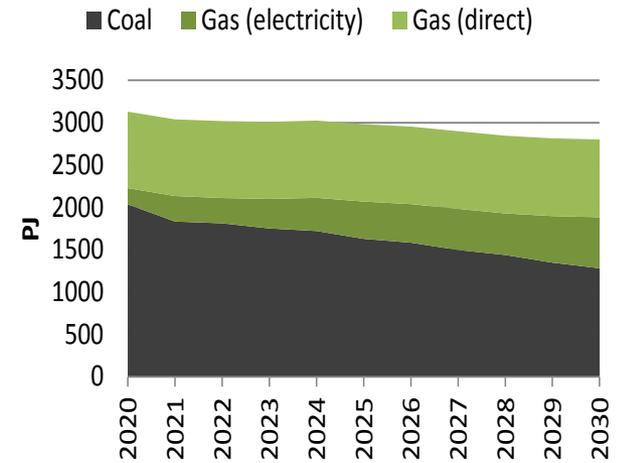
Business as usual



Level playing field

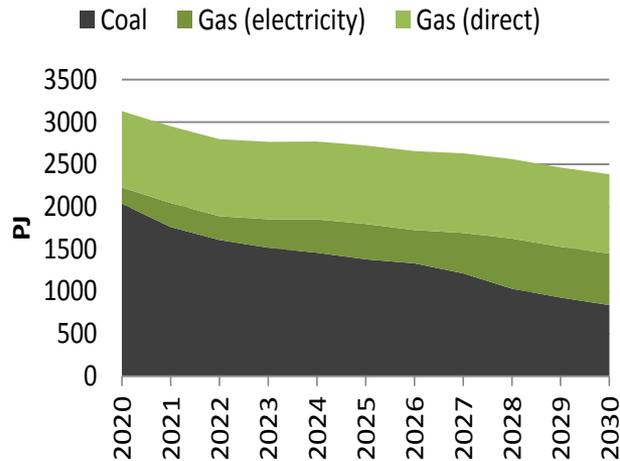


Explicit carbon price

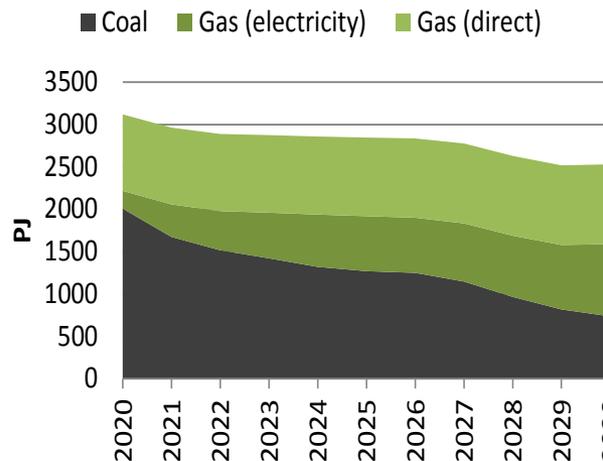


Key results: fuel usage – 45% target

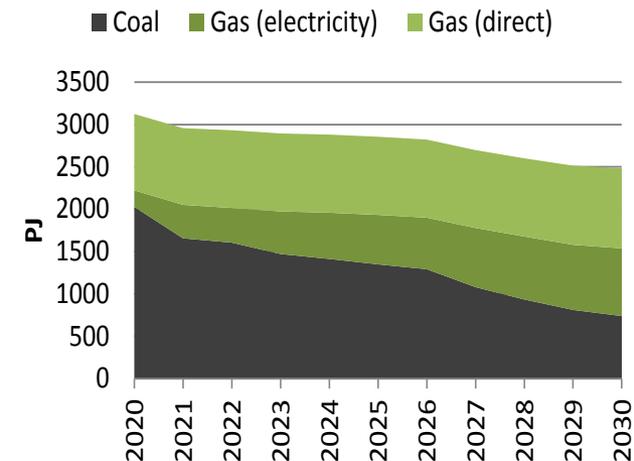
Business as usual



Level playing field



Explicit carbon price



Limitations

- The energy mix will be affected by post 2030 targets.
- Potential industrial plant closures (and subsequent net reduction in energy demand) not included in modelling
- Abatement options for direct combustion sector limited to energy efficiency and fuel switching

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