

# On the make

## Gas and manufacturing in Australia

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*The vast bulk of Australian gas production is exported as LNG, 4,519 petajoules in 2018-19. Manufacturing gas use was just 373PJ. Most manufacturing uses little or no gas, and just 1% of Australian gas production is used as a feedstock. Most gas used in manufacturing is used by sectors employing relatively few people. Australian manufacturing jobs declined over decades when Australia had cheap abundant gas. Massive increases in the gas supply over recent years have seen manufacturing jobs continue to fall, not rise. Plans for a 'gas fired recovery' are impractical, and ignore opportunities in cleaner, cheaper energy.*

Discussion paper

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# Summary

Australia's purported 'gas-fired recovery' is based on a claim that increasing Australian gas production will benefit the manufacturing industry and, presumably, jobs in manufacturing. This claim is not supported by data or recent experience - from the mid-1980s to 2013 Australia had abundant, low-cost gas, but saw manufacturing employment steadily declined. Australian fossil gas production tripled from 1990 to 2010, and then almost tripled again to 2019, yet gas prices in eastern Australia tripled and manufacturing jobs declined.

Clearly, more gas does not necessarily lead to more employment in manufacturing.

## KEY POINTS

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- LNG exports dwarf Australian manufacturing gas use. In 2018-19 4,094 petajoules (PJ) were exported and 425PJ used in processing the exports, a total of 4,519PJ. The manufacturing industry used just 373PJ, meaning gas exports use 12 times more gas than all manufacturing.
- The gas consumed for the processing of LNG (425PJ) is greater than the gas use of the manufacturing industry (373PJ), and is more than twice as much as is used by households (169PJ).
- Gas use in manufacturing has declined over the last decade, the only sector to significantly increase its use of gas has been LNG processing.
- The most gas-intensive sectors of manufacturing are non-ferrous metal manufacturing and chemical, polymer and rubber manufacturing. These used 123PJ and 113PJ respectively in 2018-19. In other words, LNG exports used 37 times more gas than the most gas-intensive part of the manufacturing industry.
- Most gas use in manufacturing is for energy. Only 56PJ is used as a feedstock by industries in Australia, or 1% of gas produced in Australia and 4% of gas used domestically.
- Gas use in manufacturing has declined in every state in recent years, even in the big gas producing states of WA and Queensland.
- WA has the most gas-intensive manufacturing industry in Australia. Since 2007 gas production in the state has tripled while manufacturing gas use has declined.
- There is no relationship between increasing gas supply and manufacturing jobs.
  - Australian manufacturing jobs declined throughout the decades of cheap abundant gas from the mid-1980s to 2013.
  - Manufacturing jobs have declined as gas production has tripled over the last six years, including in Western Australia where a gas reservation policy keeps gas prices low.

- Gas-heavy manufacturing industries are the least labour intensive divisions of the manufacturing industry. Three quarters of gas used in manufacturing in Australia is used by industries that employ only 17% of the manufacturing workforce.
- The LNG industry employs 7 workers for every petajoule of gas it consumes and exports, compared to 760 workers per petajoule used in the chemical and mineral processing manufacturing industries.
- Increasing gas production will not reduce gas prices. Gas prices are likely to increase as LNG companies continue to export Australia's more accessible, lower cost gas, leaving only more remote and difficult to extract gas for Australian customers.
- Australia's energy market operator expects gas to decline in importance in Australia's electricity markets. Residential gas use can also be economically reduced by heat pumps. Reducing gas dependency will reduce costs for households and businesses, and free up gas for industries where reducing gas use is more difficult. Many manufacturing processes can also be provided by electricity at a lower cost than gas.

No amount of additional gas production in Australia will reduce prices for Australian manufacturers because as LNG exporters continue to export vast amounts of Australia's relatively low cost gas resources, only increasingly remote and expensive to extract resources remain. While Australian manufacturers remain dependent on gas they will remain locked into ongoing energy cost increases even as electricity prices fall due to an increasing proportion of low cost renewables.

Fortunately, there are many opportunities to reduce gas dependence. There are many lower cost alternatives to gas use in the residential, manufacturing and electricity generation sectors.

# Introduction

Australia's Federal Government has advocated a "gas-fired recovery" from the COVID-19 recession. \$52.9 million has been allocated towards the gas-fired recovery in the 2020-21 Budget, including measures to open five "strategic gas basins," funding for gas research, and a National Gas Infrastructure Plan.<sup>1</sup>

The focus on the gas industry is unusual from an economic perspective, as it is one of the least labour intensive industries in Australia, and supporting virtually any other industry would provide more jobs.<sup>2</sup> Perhaps because of this, the gas-fired recovery has linked subsidies for the gas industry to the more labour-intensive manufacturing industry. As Prime Minister Scott Morrison explained:

An estimated 225,000 Australians work in manufacturing firms that rely heavily on gas as a feedstock or fuel source, according to APPEA - in sectors such as fertilisers, chemicals, metals, bricks, cement and parts of food processing and beverage manufacturing. When Andrew Liveris sat down with me at Kirribilli some time ago, and working with him through the COVID Commission, said you want to change manufacturing in this country, you've got to deal with gas. You've got to deal with gas. And Angus has taken up that challenge along with Keith Pitt and this is what we're talking about today.<sup>3</sup>

While it is true that manufacturing industries use gas, the idea that government subsidies to the gas industry will therefore create jobs in manufacturing is simplistic and not supported by data or recent experience. The Government also points to the use of gas for feedstock for chemical and fertiliser manufacturing, according to Energy Minister Angus Taylor:

Gas is right at the centre of it. We know gas is important for manufacturing, not just because it provides energy, but because it's a feedstock for critical industry.<sup>4</sup>

It is harder to find substitutes for gas feedstock than for the main industrial gas use, which is creating heat. However, government spokespeople fail to mention that a very small portion

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<sup>1</sup> Australian Government (2020) *Budget Paper No.2*, p.116, [https://budget.gov.au/2020-21/content/bp2/download/bp2\\_complete.pdf](https://budget.gov.au/2020-21/content/bp2/download/bp2_complete.pdf)

<sup>2</sup> Ogge and Swann (2020) *Gas Fired Backfire. Why a "gas fired recovery" would increase emissions and energy costs and squander our recovery spending*, <https://www.tai.org.au/sites/default/files/P908%20Gas-fired%20backfire%20%5Bweb%5D.pdf>

<sup>3</sup> Prime Minister of Australia (September 2020) *National Energy Address- Tomago, NSW*, <https://www.pm.gov.au/media/national-energy-address-tomago-nsw>

<sup>4</sup> Sky News (October 2020) *Success of Australia's manufacturing 'rests on affordable, reliable supply of gas'*, [https://www.skynews.com.au/details/\\_6197498170001](https://www.skynews.com.au/details/_6197498170001)

of gas for manufacturing is as a feedstock. In this report we cite estimates of this volume equal to just 1% of gas produced in Australia.

The Government does not explicitly claim that increasing gas production would reduce gas prices or increase manufacturing jobs, perhaps because such a claim is difficult to justify when gas prices in eastern Australia have tripled over the last decade despite gas production tripling. However, key government advisors have made this claim, including the former gas executive and chair of the National COVID-19 Coordination Commission (NCCC), Nev Powers:

We have the opportunity to increase the supply of gas, bring the price down to competitive price levels where they are around the world and to put those manufacturing businesses in place.<sup>5</sup>

The head of the NCCC's manufacturing taskforce, Andrew Liveris, who apparently advises the Prime Minister directly at his Kirribilli home, went further by asserting that gas prices could be reduced to \$4 per gigajoule (GJ).<sup>6</sup>

This claim has been widely criticised, including by gas industry experts.<sup>7</sup> Leading gas market analyst Mark Samter of MST Marquee said Andrew Liveris's claims that gas could be supplied to Australian manufacturers for \$4 per GJ deserved "a gold medal for the most stupid comment ever made publicly".<sup>8</sup>

The idea that increasing gas production reduces gas prices also ignores the reality that Australia's relatively low cost gas resources have largely been either already used, or more recently exported by the LNG industry. The remaining resources are becoming increasingly expensive.

According to independent analysis released by the Australian Energy Market Operator (AEMO) this year, two of the "strategic gas basins" being subsidised in the Government's gas-fired recovery plan, the Galilee and Beetaloo basins, would cost from \$7.30 per GJ to almost \$10 per GJ just to extract the gas.<sup>9</sup> AEMO does not estimate the cost of the North

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<sup>5</sup> Morgan (May 2020) *Coronavirus economic recovery committee looks set to push Australia towards gas-fired future*, <https://www.abc.net.au/news/2020-05-13/coronavirus-recovery-to-push-australia-towards-gas-future/12239978>

<sup>6</sup> McDonald Smith (May 2020) *Gas action plan sets up clash over price*, <https://www.afr.com/companies/energy/gas-action-plan-sets-up-clash-over-price-20200528-p54x69>

<sup>7</sup> McDonald Smith (May 2020) *Gas action plan sets up clash over price*

<sup>8</sup> Williams (September 2020) *'I'll buy your house': Andrew Liveris ridiculed over gas price claims*, <https://www.theaustralian.com.au/business/mining-energy/ill-buy-your-house-andrew-liveris-ridiculed-over-gas-price-claims/news-story/2d683b9765fe9314a76ca617c2c7f928>

<sup>9</sup> AEMO (2020) GSOO 2020, *supporting materials. Core Energy, Reserves and Resources and Cost Estimates*, <https://aemo.com.au/en/energy-systems/gas/gas-forecasting-and-planning/gas-statement-of-opportunities-gsoo>



Bowen gas basin the Government also identified as a “strategic gas basin.” These basins are also very remote and will have high transport costs, meaning that the delivered cost is unlikely to be below \$10 per GJ, and probably well over.

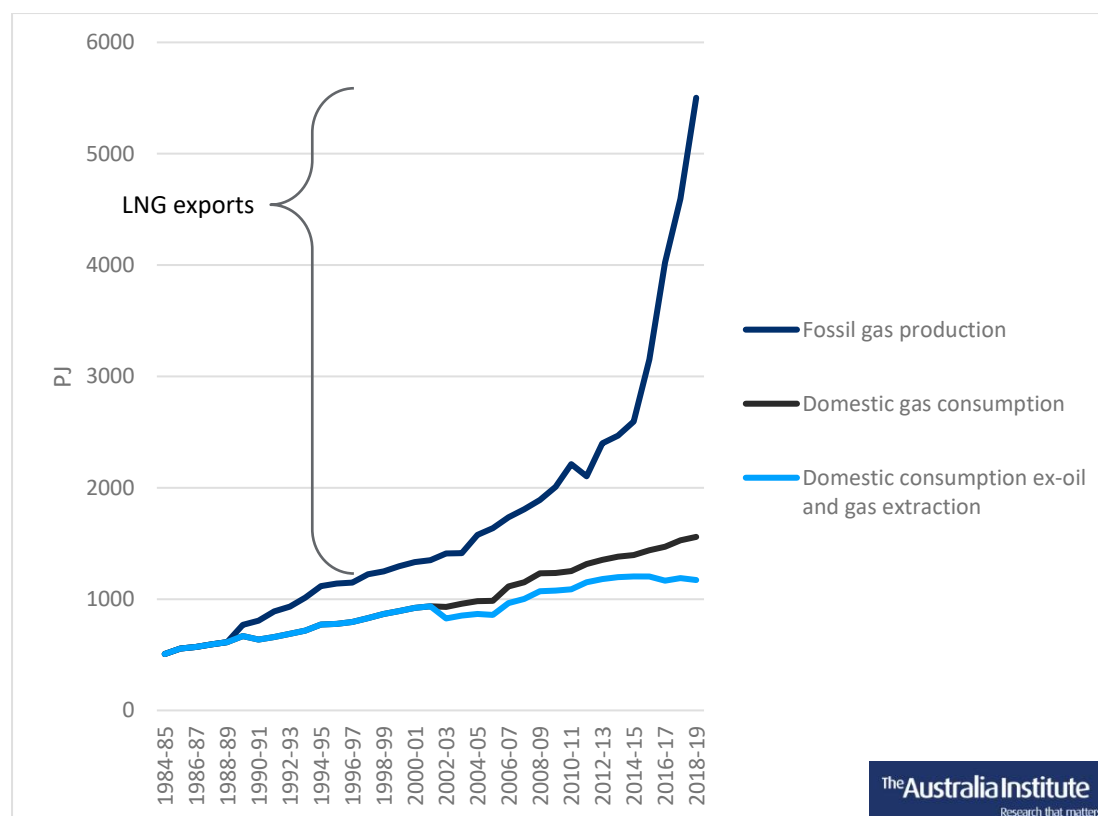
For these reasons, Australian manufacturers who remain heavily dependent on gas will remain locked into high energy costs that will continue to increase regardless of whether the ‘gas fired recovery’ proceeds.

Fortunately there are many opportunities for the manufacturing industry to replace gas with electricity that will also lock in ongoing energy use, energy cost and emissions savings. Additionally, there are even larger opportunities to reduce gas use in electricity generation and households. Gas savings from these sectors could be redirected to those parts of the manufacturing industry that are more difficult to electrify.

# Where Australian gas goes

Australian fossil gas production tripled from 1990 to 2010, and has since tripled again, as shown in Figure 1 below:

**Figure 1: Gas production vs consumption, including consumption by oil and gas industry**



Source: Department of Industry, Science, Energy and Resources (2020) *Australian Energy Update 2020*, <https://www.energy.gov.au/publications/australian-energy-update-2020>, Note: pre 2002-03, gas use by oil and gas mining is 'mining' as subsectors not given separately; subsequent data shows almost all mining gas consumption is by oil and gas, and most of this for LNG.

Figure 1 shows a huge difference between Australian fossil gas production and domestic consumption. The dark blue line shows the enormous increase in fossil gas production over the last decade in particular.

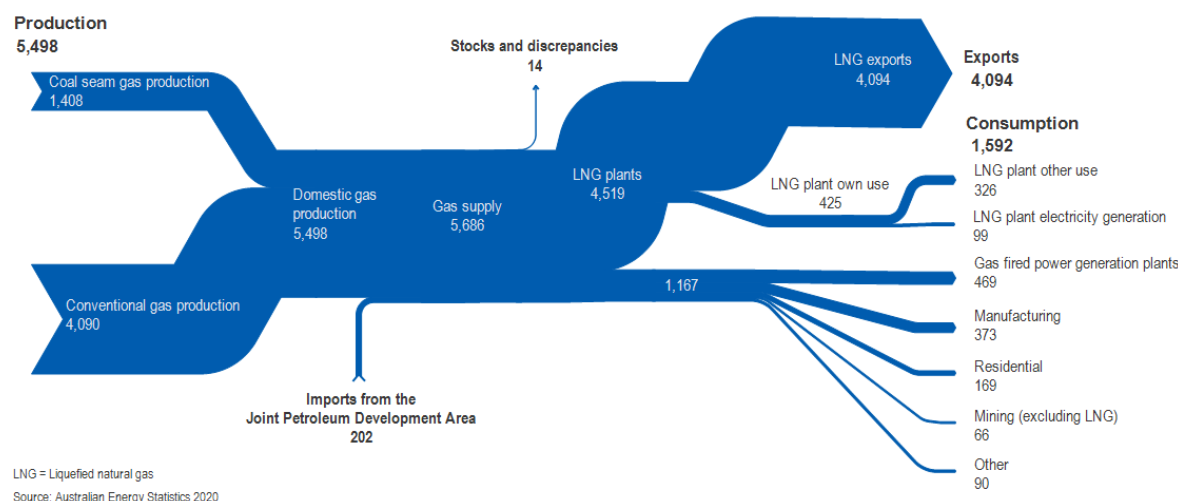
The black line below it shows the amount of that gas used in Australia. However, a significant proportion of that gas is used in the LNG terminals to process the gas for export. The bracket indicates the proportion that is exported as LNG or used in the process of exporting LNG. The lighter blue line represents the amount of gas remaining for (non-LNG) Australian customers, only around 21% of gas produced in Australia.

In other words, nearly all of the increase in Australian gas production over the last 15 years has gone to exports. Almost four fifths of Australian gas production is either exported as LNG or used in the process of doing so. While the amount of gas used in LNG production has been steadily increasing, the amount of gas used by Australian customers other than the LNG industry has been falling.

This is also shown in

Figure 2 below, reproduced from the Australian Energy Statistics published by the Australian Government. Figure 2 shows that the LNG industry exported 4,094PJ of gas in 2018-19, and also consumed 425 petajoules in processing the gas for export. This total of 4,519PJ is 12 times the 373PJ used across the entire manufacturing sector:

**Figure 2: Australian gas flows in 2018-19 (PJ)**



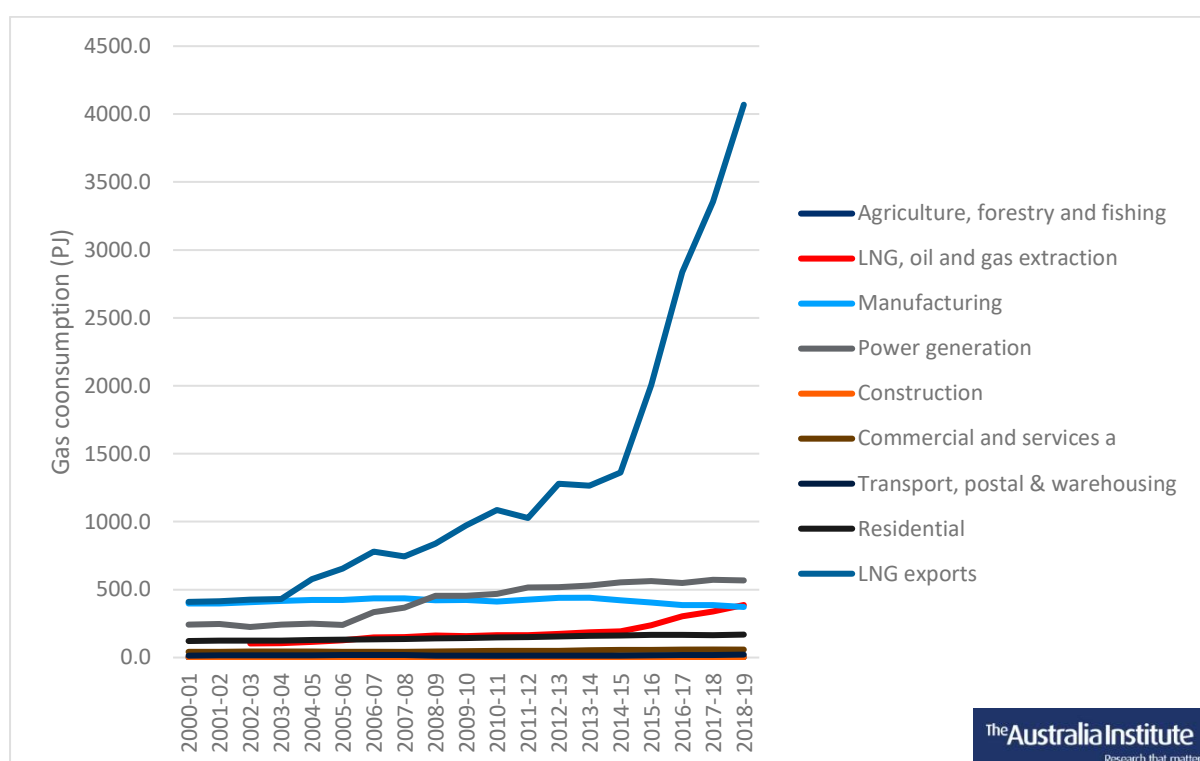
Source: Department of Industry, Science, Energy and Resources (2020) *Australian Energy Update 2020*, p. 10, <https://www.energy.gov.au/publications/australian-energy-update-2020>

Figure 2 shows that LNG processing used a total of 425PJ of gas directly (326PJ) and for electricity generation in LNG plants (99PJ). This is more than twice as much gas as is burned in Australian households (169PJ) and more than the entire Australian manufacturing industry (373PJ).

Figure 2 also shows that LNG facilities use 17 percent of all the gas used in electricity generation in Australia.

As shown in the Figure 3 below, gas exports by the LNG industry dwarf gas use in all other sectors of the economy.

**Figure 3: Fossil gas consumption in Australia by major sector, since 2000**



Source: Department of Industry, Science, Energy and Resources (2019) *Australian Energy Update 2020* Tables F and N, <https://www.energy.gov.au/publications/australian-energy-update-2020>

Figure 3 also shows that outside of exports, the single largest source of gas demand is for power generation, which makes up a third of Australian domestic gas consumption. Despite its large share of gas use, gas powered electricity generation makes up only 20% of overall power generation in Australia: 11% in the NEM and currently around 60% in the smaller WA market.<sup>10</sup>

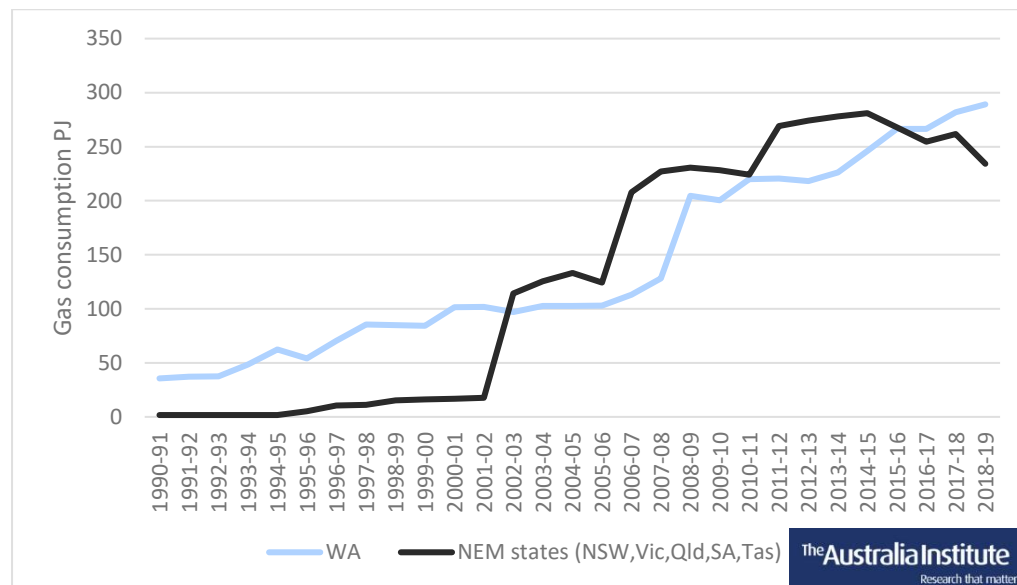
Virtually all the growth in gas use within Australia has been that used by the LNG industry to process gas for export, shown in the red line in Figure 3. A substantial proportion of the growth in electricity generation is for electricity used for gas processing in LNG facilities. By contrast, manufacturing gas demand has declined since the Global Financial Crisis, coinciding with the period of greatest gas export growth.

Although difficult to see in Figure 3 due to its minimal size compared to exports, residential gas has stopped its slow long-term growth trend, likely because it is more expensive than electricity for space and hot water heating. Commercial and public services – which cover the vast majority of the economy by GDP and by employment – use a tiny amount of the total consumption.

<sup>10</sup> Department of Industry, Science, Energy and Resources (2020) *Australian Energy Statistics, Table O Electricity generation by fuel type 2018-19 and 2019*, <https://www.energy.gov.au/publications/australian-energy-statistics-table-o-electricity-generation-fuel-type-2018-19-and-2019>

WA is currently dependent on gas for its electricity generation. Figure 4 below shows that despite WA making up only 9% of Australian electricity generation, power generators burn as much gas in WA as all of the eastern states linked to the National Electricity Market (NEM) combined which make up 84% of national power generation.<sup>11</sup>

**Figure 4: Gas burned to generate electricity, WA vs NEM states**



Source: Department of Industry, Science, Energy and Resources (2019) *Australian Energy Update 2020* Tables 0, <https://www.energy.gov.au/publications/australian-energy-update-2020>

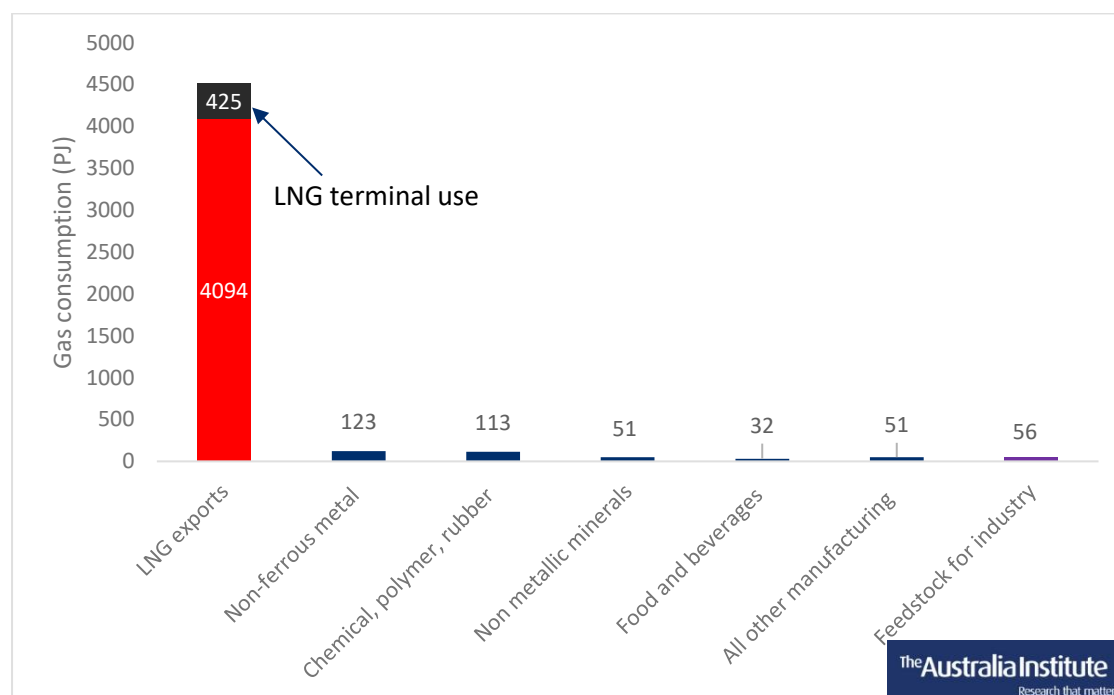
When looking at Figure 4, it is important to bear in mind that 17% of gas used by for electricity generation in Australia is used by the gas industry itself processing LNG for export, as noted above.

<sup>11</sup> Department of Industry, Science, Energy and Resources (2019) *Australian Energy Update 2020* Tables 0, <https://www.energy.gov.au/publications/australian-energy-update-2020>

# Manufacturing and LNG gas use compared

As noted above, most Australian gas is exported and a large amount is used by LNG export terminals themselves. In total, the LNG industry exports and consumes twelve times the amount of gas used by the entire Australian manufacturing industry, as shown in Figure 5 and Table 1 below. Gas used for feedstock is part of gas consumption in the chemical, polymer and rubber industry sector. It is shown separately in this chart for purposes of comparison.

**Figure 5: Gas exports and manufacturing by sector**



Source: Department of Industry, Science, Energy and Resources (2020) *Australian Energy Update 2019*, Table F and Table N; 2020, <https://www.energy.gov.au/publications/australian-energy-update-2020>, IEA (2018) *Australia Energy Balance*, <https://www.iea.org/sankey/#?c=Australia&s=Balance>  
\*Feedstock refers to non-energy use gas from IEA 2018, 1.34 Mtoe, 61 PJ. Feedstock is included in this chart for the purposes of comparison, but is part of the chemical, polymer and rubber industry sector.

**Table 1: Gas consumption, LNG compared to manufacturing, 2019\***

Gas use	Gas consumption (PJ)
LNG exports	4,094.0
LNG processing	425.0
Basic non-ferrous metals	123.3
Chemical, polymer, rubber	113.5
Non-metallic mineral products	51.3
Food, beverages and tobacco	32.8
Petroleum refining etc.	16.9
Iron and steel	13.8
Wood, paper and printing	13.1
Textile, clothing, footwear and leather	5.1
Fabricated metal products	1.7
Machinery and equipment	0.6
Furniture and other manufacturing	0.1
Feedstock	56.0

Source: Department of Industry, Science, Energy and Resources (2020) *Australian Energy Update 2019*, Table F and Table N; 2020, <https://www.energy.gov.au/publications/australian-energy-update-2020>, IEA (2018) *Australia Energy Balance*, <https://www.iea.org/sankey/#?c=Australia&s=Balance>  
 Note: Feedstock refers to non-energy use gas, converted from 1.34 Mtoe to 56 PJ

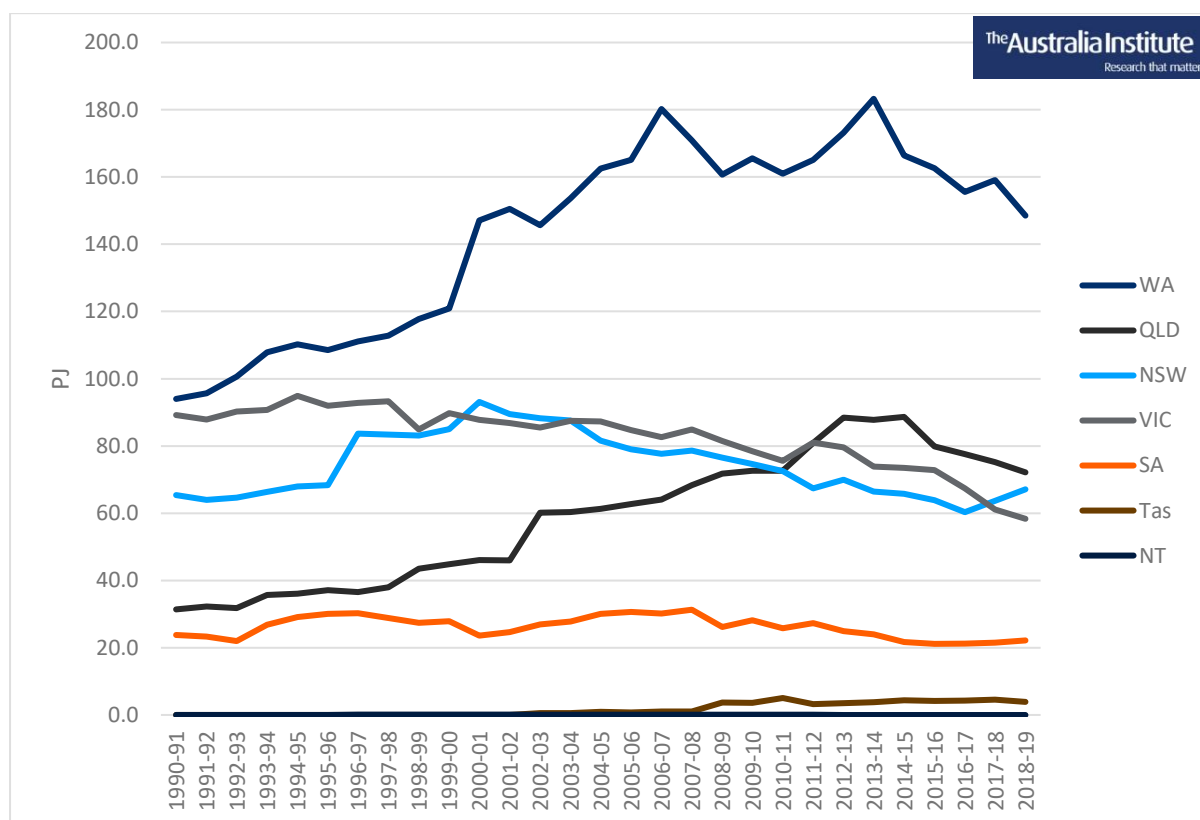
Figure 5 and Table 1 show that LNG companies consume thirty six times the amount of gas used by the most gas-intensive sector of the Australian manufacturing industry, non-ferrous metal manufacturing and almost forty times the amount used by the next biggest gas-using sector, chemical, polymer and rubber industries. They also consume and export around eighty times the amount of gas used for chemical feedstock by the Australian manufacturing industry.

# Gas use in manufacturing

As shown in Figure 7 below, since the opening of LNG exports, gas use in manufacturing has declined not only across the country, but in all states, including those where gas is extracted.

For some states including NSW and Victoria, the decline began when there was a cheap abundant gas supply, long before the export terminals opened. The decline in Western Australia began around 2007 and has continued even as gas consumption in the state has tripled, while in Queensland the decline began when the Gladstone export terminals opened, and continued as gas production in that state has near tripled. Figure 8 shows the same data as figure 7, but on the same axis to highlight the relative size of manufacturing gas use in the various states compared to the total amount of gas produced in Australia.

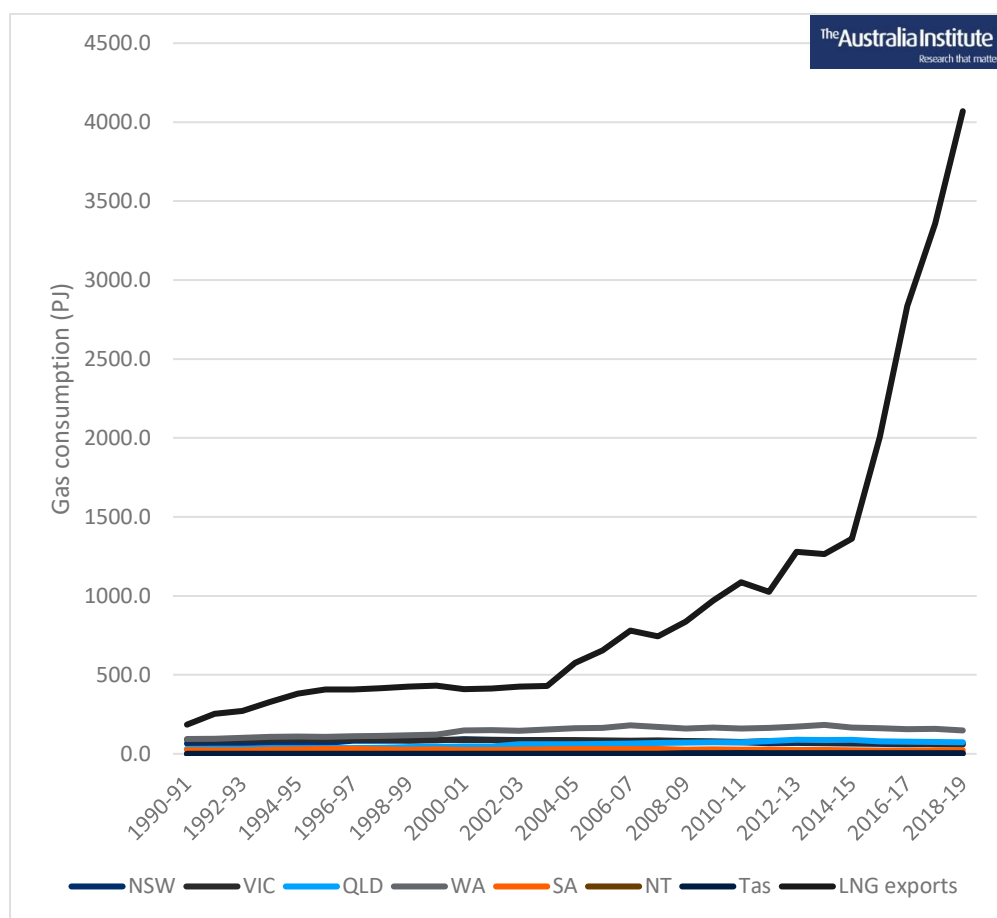
**Figure 6: Manufacturing gas consumption, by state**



Source: Department of Industry, Science, Energy and Resources (2019) *Australian Energy Update 2020*, Table F, <https://www.energy.gov.au/publications/australian-petroleum-statistics-2020>



**Figure 7: Manufacturing gas consumption by state compared to LNG exports.**



Source: Department of Industry, Science, Energy and Resources (2019) *Australian Energy Update 2020*, Table F, <https://www.energy.gov.au/publications/australian-petroleum-statistics-2020>

## MANUFACTURING GAS USE IN WESTERN AUSTRALIA

Western Australia is the largest gas producer of all Australian states and territories, and uses by far the most gas manufacturing of any state or territory.

Unfortunately, the Australian Energy Statistics do not provide a breakdown of gas use for the most gas intensive manufacturing sectors in Western Australia. However, Western Australia's high use of gas for manufacturing relative to other states and territories is due to a number of very gas-intensive industrial facilities located there, particularly alumina refineries and ammonia plants.

Alumina refineries are particularly energy-intensive and dominate gas use in the non-ferrous metals manufacturing industry. The Bayer process used to produce alumina involves two energy intensive steps, requiring large amounts of industrial process heat. The first, producing alumina hydroxide from bauxite requires steam for producing lower

temperatures (around 200 degrees), but uses two thirds of the thermal energy. The second, calcination of aluminium hydroxide to produce alumina requires higher temperatures of around 800 degrees, and uses the remaining third of the energy. Gas and coal are used in these processes in various combinations.

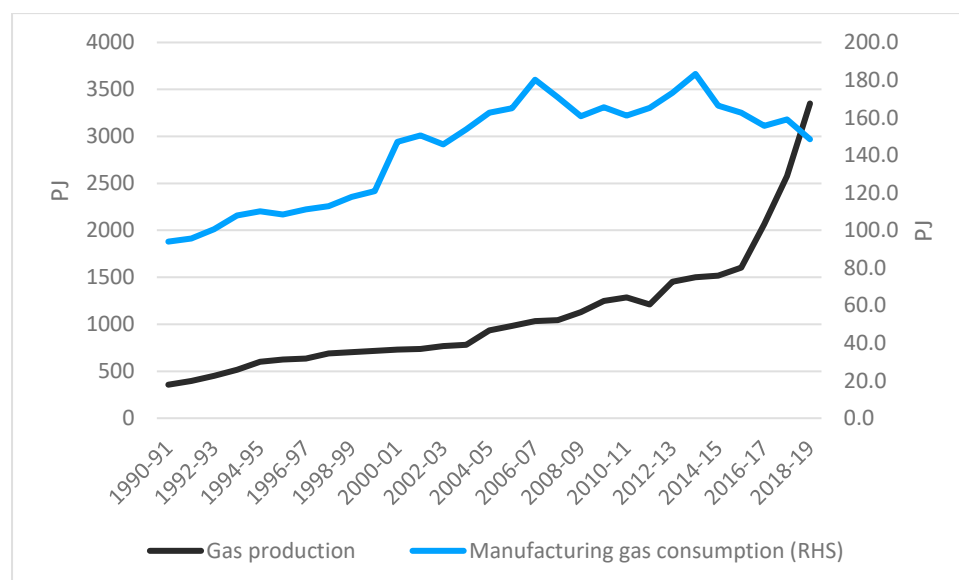
Four of Australia's six alumina refineries are located in Western Australia, supplying 45% of Australia's alumina.<sup>12</sup> Three of them, Kwinara, Pinjarra, and Wagerup use gas for all their processes, and the remaining facility Worsley uses a combination of coal and gas.<sup>13</sup>

Ammonia is used to produce fertiliser and explosives for the mining industry and is by far the largest user of gas in the whole chemicals sector. Two of Australia's seven ammonia plants are also located in Western Australia. The Yara Barrup plant in the Pilbarra is one of the largest ammonia plants in Australia.<sup>14</sup>

There is no relationship between increasing gas production and manufacturing gas use in Western Australia. As shown in Figure 9 below in Western Australian manufacturing gas has fallen since 2007 as gas production in Western Australia has tripled. Figure 10 shows the same data on one axis to demonstrate how small the amount of gas used for manufacturing in Western Australia is compared to the amount produced (overwhelmingly for export).

This is despite Western Australia having a gas reservation policy that avoided the export linked gas price increases experienced on the east coast since 2014.

**Figure 8: Western Australian gas production vs manufacturing gas consumption**



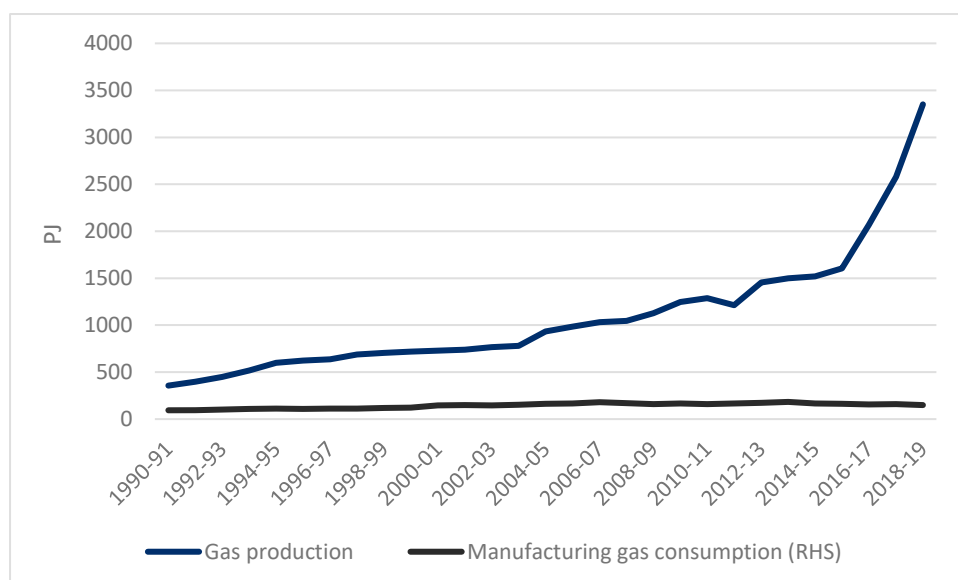
<sup>12</sup> Geoscience Australia, *Alumina*, <https://www.ga.gov.au/education/classroom-resources/minerals-energy/australian-mineral-facts/aluminium>

<sup>13</sup> ARENA (November 2019) Renewable energy options for process heat, <https://arena.gov.au/assets/2019/11/renewable-energy-options-for-industrial-process-heat.pdf>

<sup>14</sup> ARENA (November 2020) Ibid.

Source: Department of Industry, Science, Energy and Resources (2019) *Australian Energy Update 2020*, Tables F and Q, <https://www.energy.gov.au/publications/australian-petroleum-statistics-2020>

**Figure 9: Western Australian gas production vs manufacturing gas consumption**

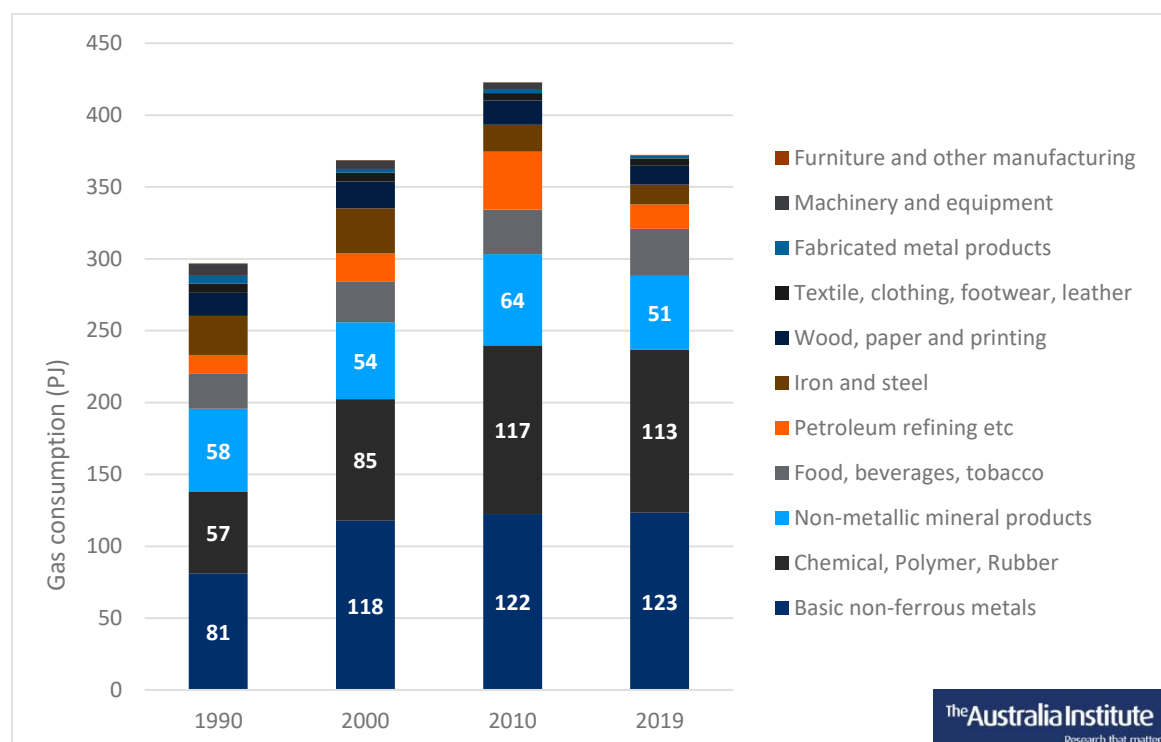


Source: Department of Industry, Science, Energy and Resources (2019) *Australian Energy Update 2020*, Tables F and Q, <https://www.energy.gov.au/publications/australian-petroleum-statistics-2020>

## GAS USE WITHIN MANUFACTURING

Figure 8 shows the breakdown of gas consumption by subcategory of manufacturing. Manufacturing gas consumption is dominated by certain parts of the manufacturing sector: chemicals, polymer and rubber products, and non-ferrous metals. These together constitute most of the gas consumption in manufacturing. Gas consumption in both grew to 2010 but since then has levelled out.

**Figure 10: Manufacturing gas use by industry subdivision**

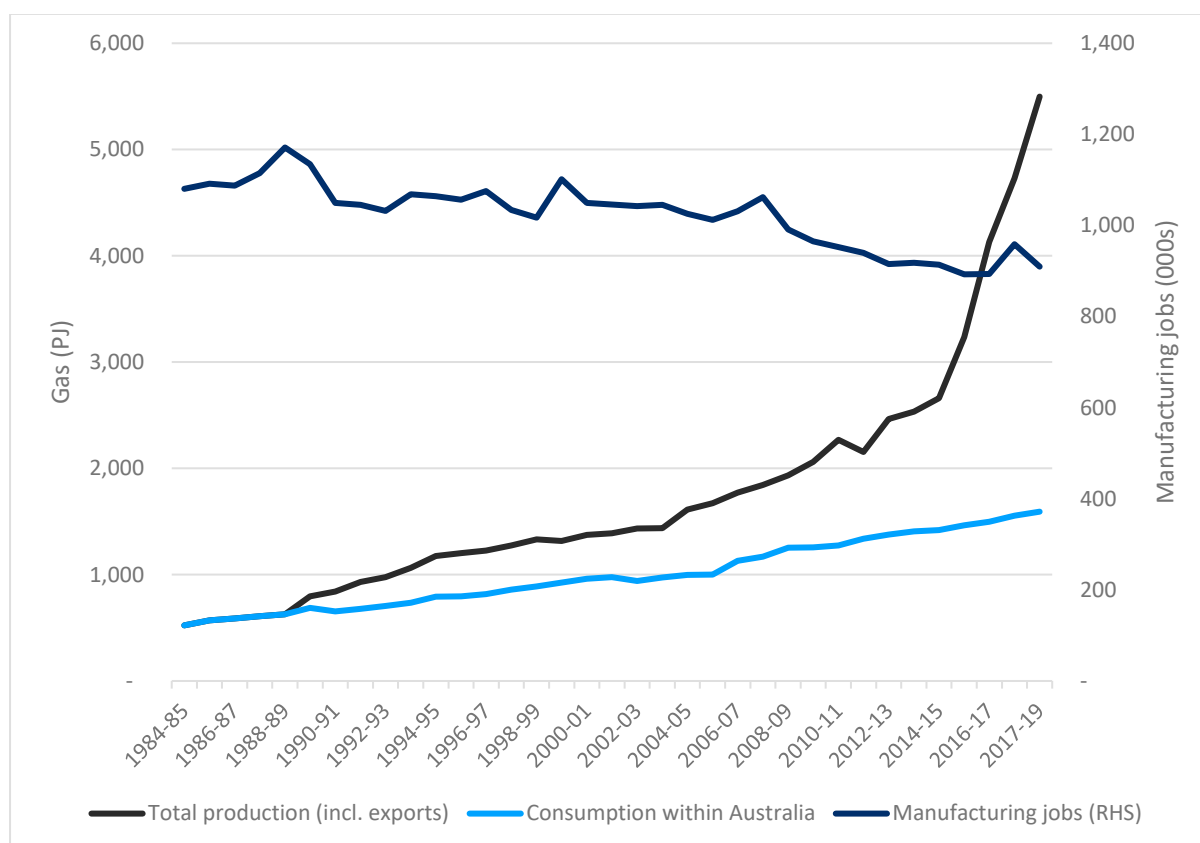


Source: Department of Industry, Science, Energy and Resources (2020) *Australian Energy Update 2020*, <https://www.energy.gov.au/publications/australian-energy-update-2020>

# Gas and manufacturing jobs

The amount of gas produced or consumed in Australia bears no relationship to the number of Australians employed in manufacturing. As shown in Figure 9 below, manufacturing jobs have declined since late 1980s while gas production has increased nine times over and gas consumption within Australia more than doubled.

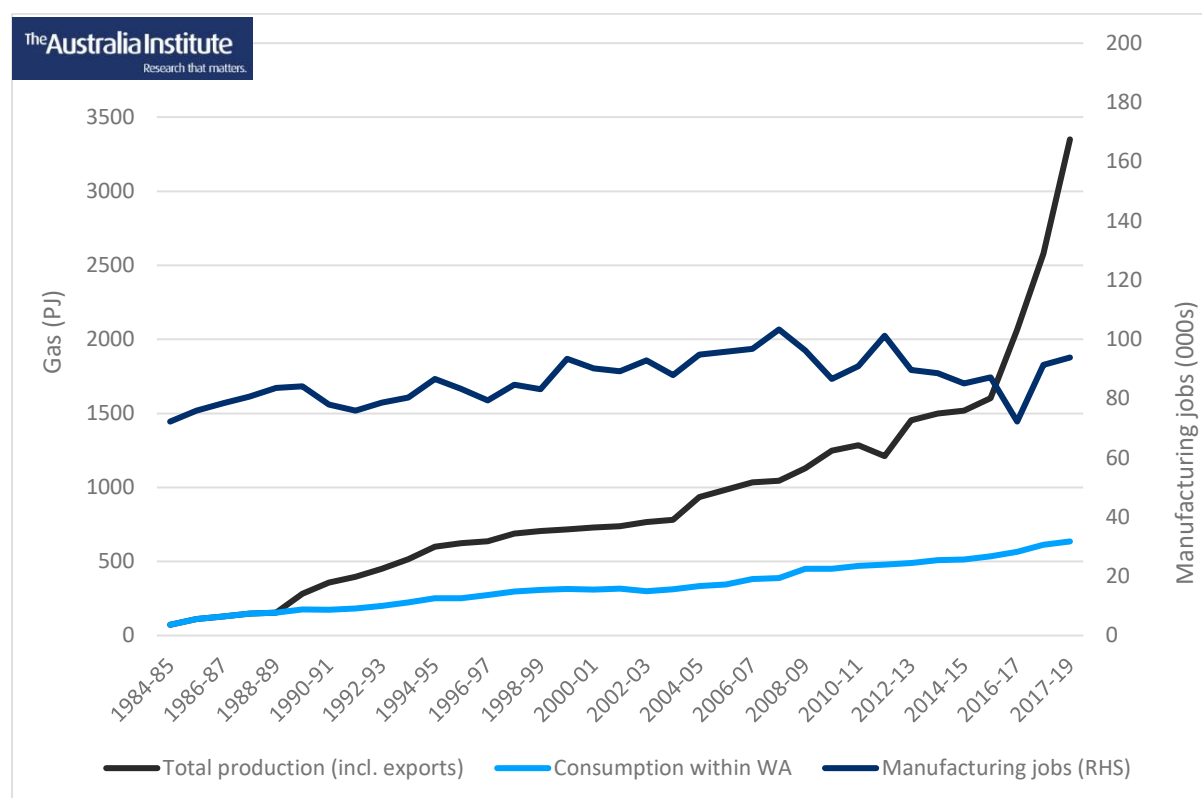
**Figure 11: Australian gas supply and consumption vs manufacturing jobs**



Source: AES (2020) *Australian Energy Update 2020*, Table Q; Australian production of gas, by state and territory, ABS (2020) 6291.0.55.003. ABS (2020) *Labour Force, Australia, Detailed, Quarterly*: Table 05. Employed persons by State, Territory and Industry division of main job (ANZSIC)

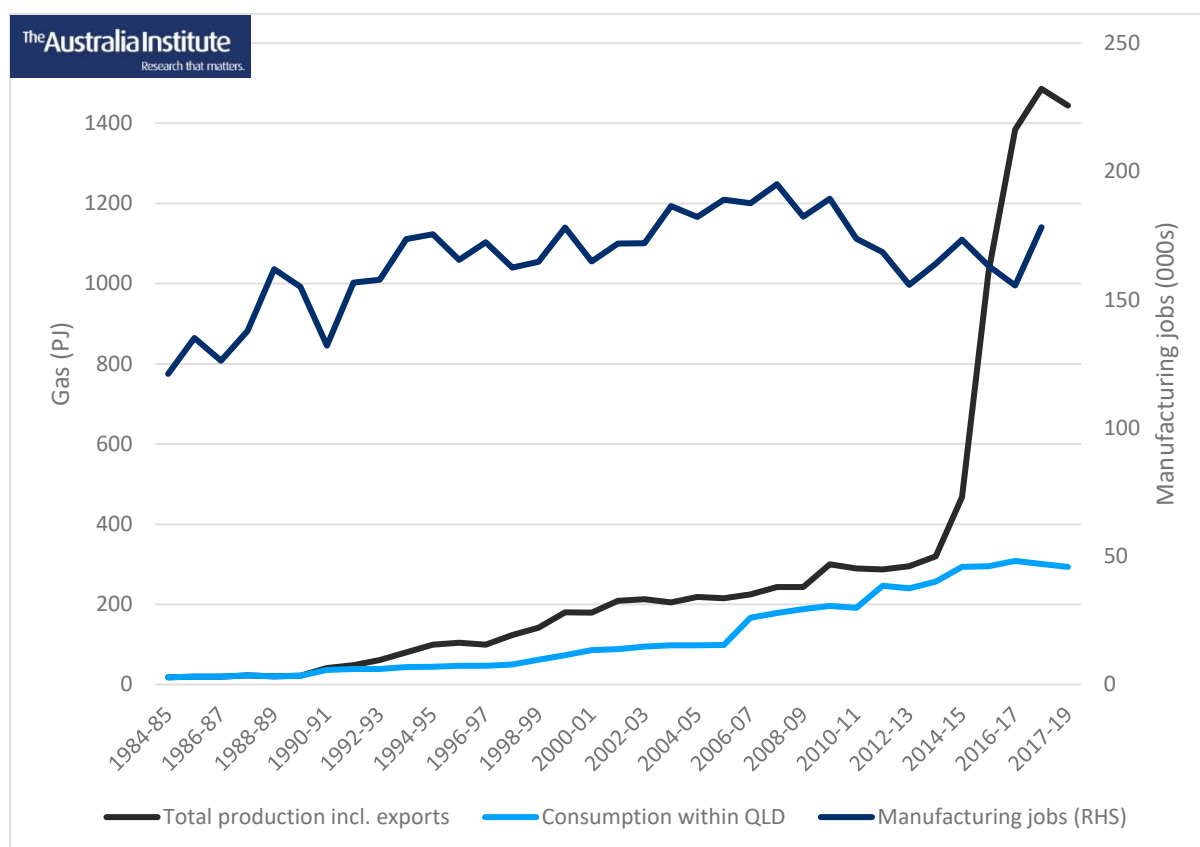
Figures 13 and 14 below consider WA and Queensland, the states responsible for most Australian gas production. Both states have seen sustained growth in gas production, most dramatically in the last decade, yet in this period of the greatest growth in gas supply, manufacturing jobs declined.

**Figure 12: WA gas production and consumption vs WA manufacturing jobs**



Source: Source: AES (2020) *Australian Energy Update 2020*, Table Q; Australian production of gas, by state and territory, ABS (2020) 6291.0.55.003 *Labour Force, Australia, Detailed, Quarterly*: Table 05. Employed persons by State, Territory and Industry division of main job (ANZSIC)

**Figure 13: Queensland gas production and consumption vs Qld manufacturing jobs**



Source: Source: AES (2020) *Australian Energy Update 2020*, Table Q; Australian production of gas, by state and territory, ABS (2020) 6291.0.55.003 *Labour Force, Australia, Detailed, Quarterly*: Table 05. Employed persons by State, Territory and Industry division of main job (ANZSIC)

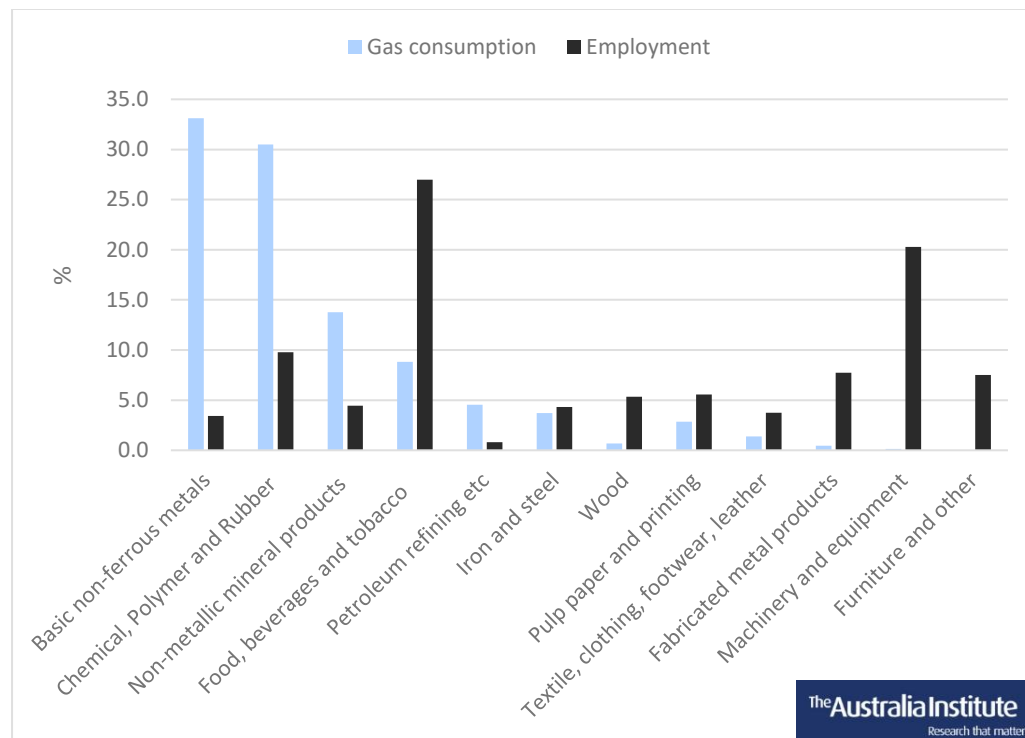
Despite the much higher levels of gas production in WA over a much longer period, there are significantly fewer manufacturing jobs than in Queensland. Both states saw manufacturing employment increase moderately or remain flat through to the mid-2000s. From then on, post GFC, manufacturing employment has generally declined. This occurred during periods of very large increases in gas production in both states.

A simple reading of these data might suggest that more gas reduces manufacturing employment. The reality is that gas does not have a major effect on manufacturing, compared to major economic trends and policy decisions including international competition, pro-manufacturing policy in other countries and lack of policy in Australia, free trade agreements and removal of tariffs, and the mining boom pushing up interest rates and exchange rates to the detriment of other industries.

Moreover, most gas is not used by manufacturing. Gas is only one of many inputs into manufacturing, and crucially, most manufacturing uses little or no gas.

As shown in Figures 15 and 16 below, the two manufacturing sub-sectors that each use more than 30 percent of total manufacturing gas use, each employ less than ten percent of the manufacturing workforce.

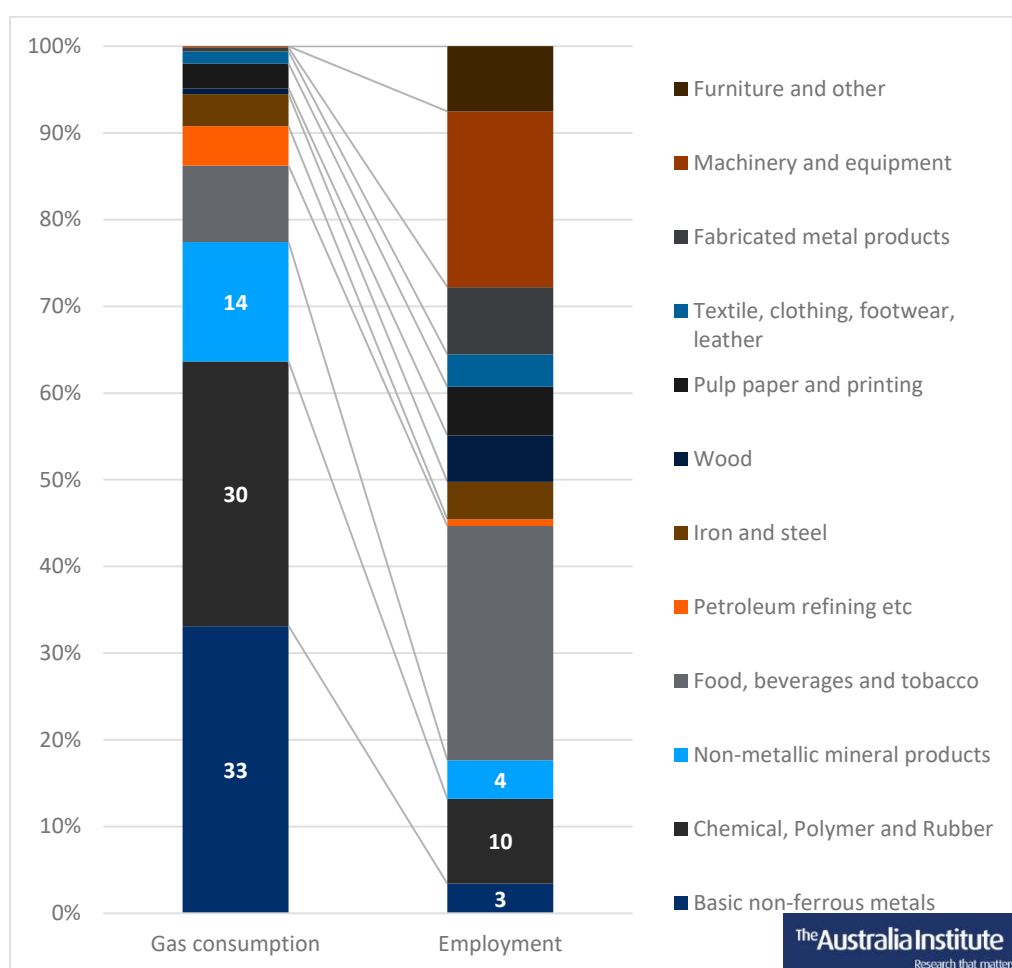
**Figure 14: Australian manufacturing: share of gas consumption vs share of jobs, FY2019**



Source: ABS (2020) Labour Force, Australia, Detailed, Quarterly: Table 05. Employed persons by State, Territory and Industry division of main job (ANZSIC), AES (2020) 2020 Update, Table F



**Figure 15: Australian manufacturing: share of gas consumption vs share of jobs, FY2018**



Source: ABS (2020) Labour Force, Australia, Detailed, Quarterly: Table 05. Employed persons by State, Territory and Industry division of main job (ANZSIC), AES (2020) 2020 Update, Table F.

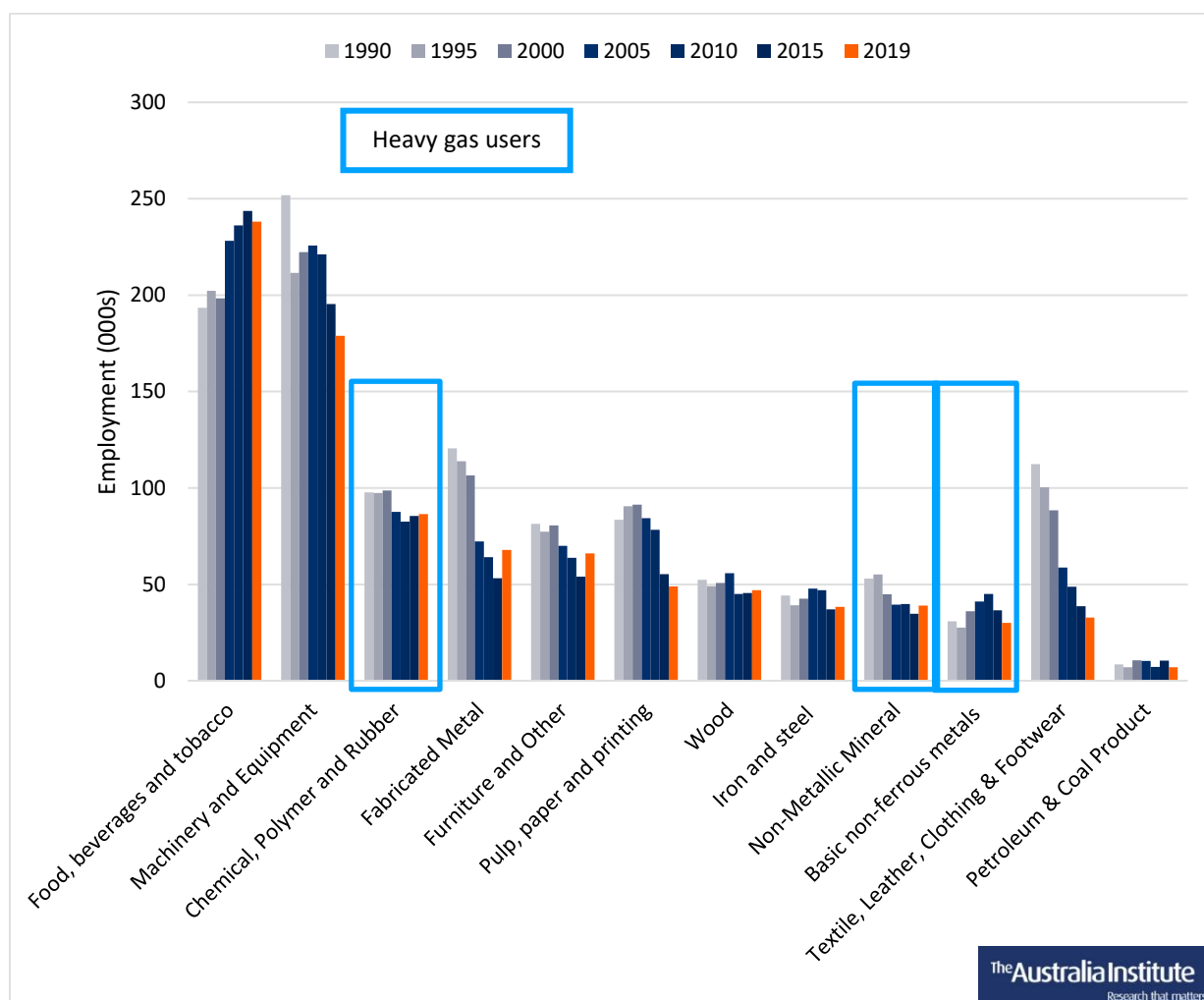
The manufacturing of non-ferrous metals, including aluminium, is the largest user of gas in manufacturing, making up around 33% of all manufacturing gas consumption, but it employs only 3% of the manufacturing workforce. Chemicals, polymer and rubber manufacturing are the next largest gas user, consuming 30% of all manufacturing gas consumption, and employing around 10% of the manufacturing workforce.

In other words, the manufacturing divisions that consume two thirds of the manufacturing gas consumption employed only 13% of all manufacturing workers.

Divisions that used only 13 percent of manufacturing gas employ 57 percent of manufacturing workers.

Figure 15 below shows trends in employment over time in different parts of manufacturing, highlighting the three main gas consuming parts of the industry.

**Figure 16: Australian manufacturing employment by subdivision**



Source: ABS (2020) Labour Force, Australia, Detailed, Quarterly: Table 05. Employed persons by State, Territory and Industry division of main job (ANZSIC). Annual averages, Manufacturing nfd (not further defined) allocated to other sectors pro rata.

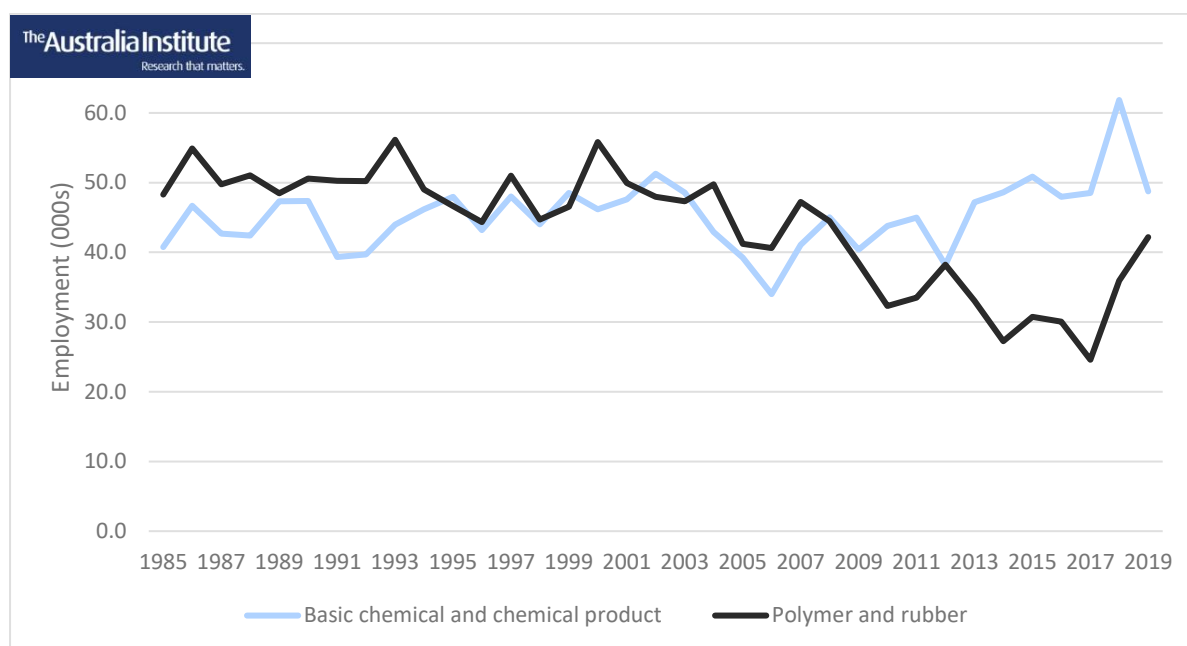
The large increase in gas supply did not lead to a large increase in jobs in manufacturing jobs, even in the parts of manufacturing that use the most gas.

The biggest current employer and the manufacturing sector with the most growth since 1990 – food, beverages and tobacco – uses relatively little gas. It employs 27% of the sector but uses only 9% of the gas.

The biggest falls in employment were in machinery and equipment – largely reflecting the end of complete car manufacturing – and textiles, clothing and footwear. These sectors use almost no gas.

The data above combine chemical and polymer products into one category, as given in the Australian Energy Statistics. Figure 18 below shows employment over time separately for chemical manufacturing and polymer manufacturing.

**Figure 17: Australian employment in chemical vs polymer manufacturing**



Source: ABS (2020) Labour Force, Australia, Detailed, Quarterly: Table 05. Employed persons by State, Territory and Industry division of main job (ANZSIC)

Again, the staggering increase in gas production is not associated with an increase in employment in these sectors. Polymer product employment decreased, while the chemical industries are at levels seen more than a decade ago.

## JOB INTENSITY IN MANUFACTURING AND LNG

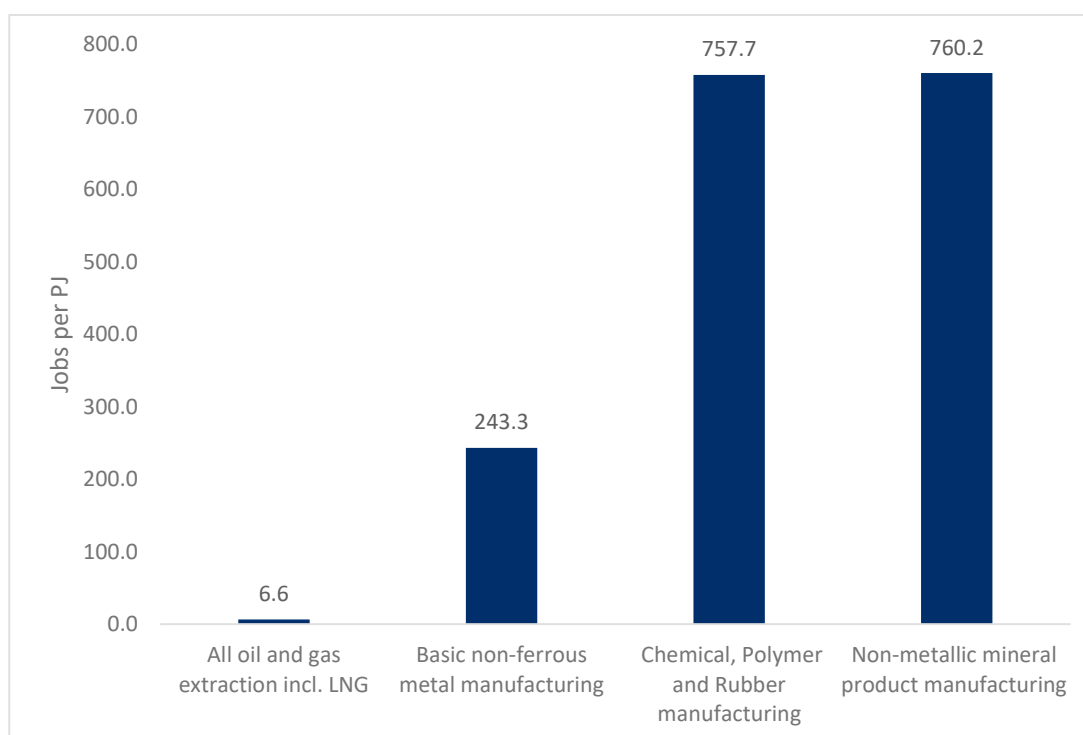
One way of evaluating whether Australia's finite gas resources are being used in the interests of Australians is to compare how many jobs an industry creates relative to the amount of gas it uses.

The LNG and manufacturing industries both consume gas, but their employment outcomes are very different. Although gas-intensive manufacturing is far less labour intensive than other forms of manufacturing, even gas-intensive manufacturing is far more labour intensive than the LNG industry.

Figure 16 and Table 2 below compare the amount of people employed per unit of gas consumed for Australia's three most gas intensive manufacturing industries and workers employed per unit of gas used and exported by the LNG industry.

Around 760 people are employed for every petajoule (PJ) of gas used in the chemical and non-metallic mineral product manufacturing sectors, and around 240 in the manufacturing of non-ferrous metals like aluminium. In contrast, the LNG industry employs only around 7 people in Australia per petajoule it uses and exports.

**Figure 18: Employment per petajoule of gas consumption of LNG and gas intensive manufacturing 2019**



Source: ABS (2020) *Labour Force, Australia, Detailed, Quarterly: Table 05. Employed persons by State, Territory and Industry division of main job (ANZSIC)*, <https://www.abs.gov.au/statistics/labour/employment-and-unemployment/labour-force-australia-detailed-quarterly/latest-release>, AES (2020) *Australian Energy Update 2020*, Table F and N, <https://www.energy.gov.au/publications/australian-energy-update-2020>, McKinsey Australia (2016)

**Table 2: Employment per petajoule of gas consumption of LNG and gas intensive manufacturing 2019**

	Gas consumption (PJ)	Jobs (000)	Jobs per PJ
<b>LNG</b>	4,519.0	29.9	7
<b>Basic non-ferrous metals</b>	123.3	30	243
<b>Chemical, polymer, rubber</b>	113.5	86	758
<b>Non-metallic mineral products</b>	51.3	39	760

Source: ABS (2020) *Labour Force, Australia, Detailed, Quarterly: Table 06. 6291.0.55.003 Employed persons by State, Territory and Industry division of main job, Labour Force, Australia, Detailed, Quarterly (ANZSIC)*, <https://www.abs.gov.au/statistics/labour/employment-and-unemployment/labour-force-australia-detailed-quarterly/latest-release>, AES (2020) *Australian Energy Update 2020*, Table F and N, <https://www.energy.gov.au/publications/australian-energy-update-2020>

## JOB'S USING GAS AS FEEDSTOCK

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The Australian Energy Statistics (AES) include all fuel consumption, including when used as a feedstock, but do not provide separate data on such 'non-energy' consumption.<sup>15</sup> However separate data is provided by the IEA, showing non-energy gas consumption in Australia in 2017-18 was around 1% of total production and 4% of Australian domestic gas consumption.<sup>16</sup> As such, 96% of gas consumed in Australia is not used as feedstock.

Comparing with the AES data, non-energy gas consumption was 15% of total manufacturing gas consumption in that year.

Chemistry Australia, the peak group for chemical manufacturers in Australia, commissioned a report from ACIL Allen in 2019 to examine and promote the "economic contribution" of their industry. This report singles out certain manufacturing subsectors as the "Gas feedstock chemical sector":

- Industrial gas manufacturing (including micro-LNG for domestic use)
- other basic polymer manufacturing
- Fertiliser manufacturing
- Explosive manufacturing

The report found the "direct economic contribution" was very small:

The direct economic contribution of this component of the chemical industry accounted for 0.18 per cent of Australia's 2017-18 GDP. The estimated direct FTE employment in this part of the chemical industry in 2017-18 was 9,232<sup>17</sup>

9,000 jobs across the entire country is around 0.07% of all employment at the time, and 1.1% of manufacturing employment. Even in these industries around 45% of gas consumed is burned for energy, not used as feedstock.<sup>18</sup>

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<sup>15</sup> Confirmed in correspondence from the Energy Statistics team at the Department of Industry, Science, Energy and Resources. 15 June 2020.

<sup>16</sup> Domestic consumption is here total supply less exports. Non energy gas consumption was 1.34 Mtoe, around 56 PJ. International Energy Agency (2018) *IEA Sankey Diagram*, <https://www.iea.org/sankey/>

<sup>17</sup> ACIL Allen (2019) *Chemical Industry Economic Contribution Analysis 2017-18*, [http://www.chemistryaustralia.org.au/docs\\_mgr/ACILAllenChemistry2017-2018%20FINAL.pdf](http://www.chemistryaustralia.org.au/docs_mgr/ACILAllenChemistry2017-2018%20FINAL.pdf)

<sup>18</sup> Acil Allen (2019) Report to Chemistry Australia: Chemical industry economic contribution analysis, Fig.3.9 p.30, [https://www.acilallen.com.au/uploads/files/projects/254/ACILAllen\\_ChemicalIndustry2019-1565671864.pdf](https://www.acilallen.com.au/uploads/files/projects/254/ACILAllen_ChemicalIndustry2019-1565671864.pdf)

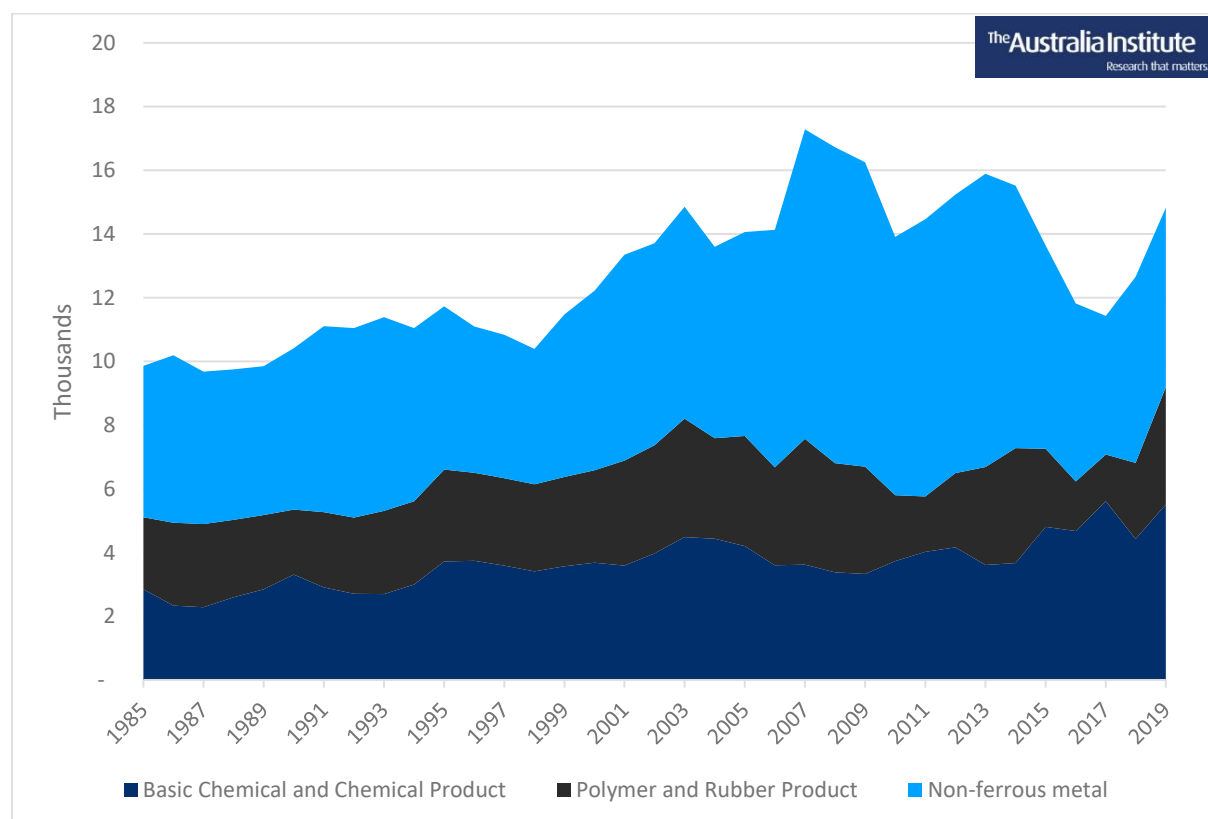
## MANUFACTURING GAS EMPLOYMENT IN WESTERN AUSTRALIA

As discussed above, WA produces and consumes more gas than any other state or territory. WA is the only state with a gas reservation policy, which requires a share of most gas extracted to be sold within WA. This results in lower gas prices in WA.

Even with this reservation policy, overall manufacturing gas consumption and employment have both declined during the last decade, while gas production increased significantly.

The gas-heavy parts of manufacturing – chemicals, polymer and non-ferrous metals – are small employers even in WA. As shown in Figure 17 below, total employment in gas-heavy manufacturing grew by around 5,000 since the beginning of the century, mostly in metals. Note the volatility in the data, the result of the numbers being so small and therefore difficult for the ABS to estimate.

**Figure 19: Employment in gas-heavy manufacturing in Western Australia**

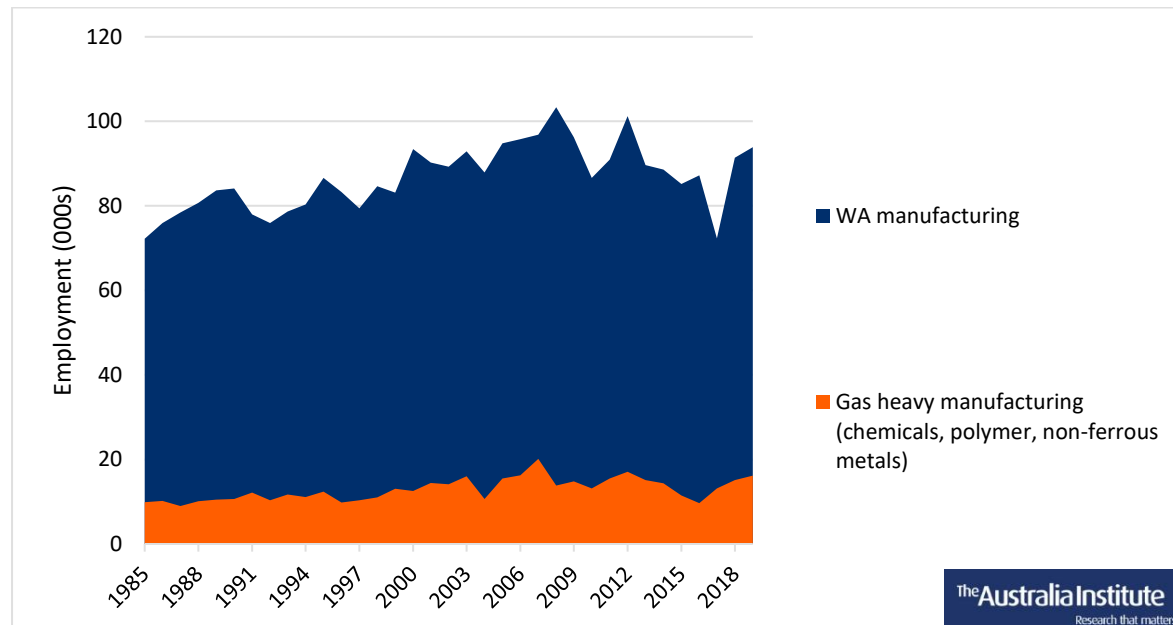


Source: ABS (2020) *Labour Force, Australia, Detailed, Quarterly*: Table 05. Employed persons by State, Territory and Industry division of main job (ANZSIC)

However the growth in gas-heavy employment in WA is slower than growth in Western Australia's overall employment, of which it is a tiny proportion. While gas-heavy manufacturing in WA has increased its share of modestly falling manufacturing employment

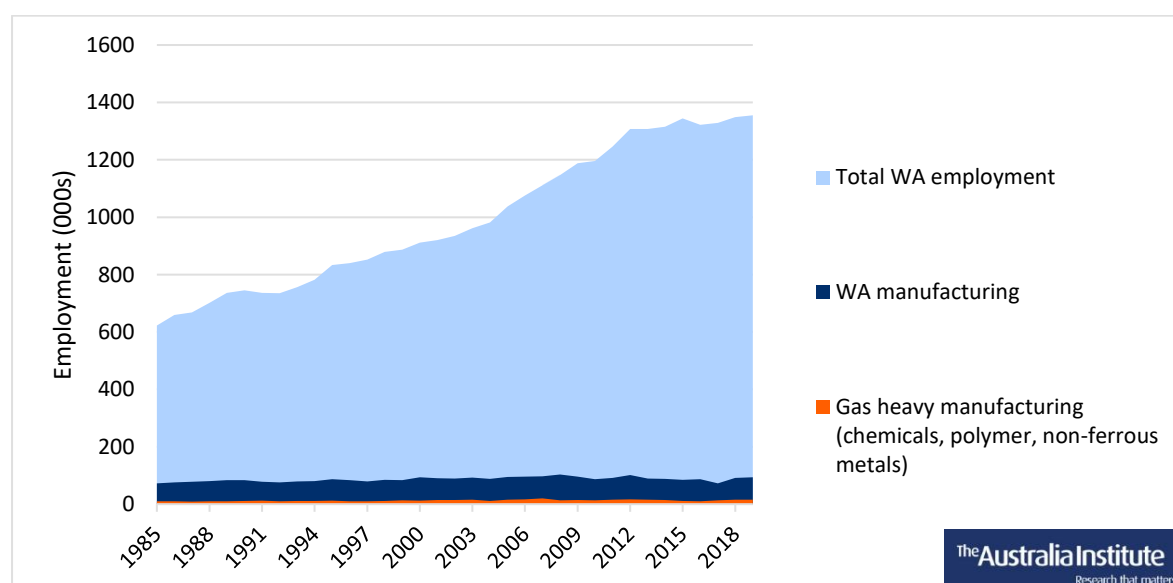
over decades to 2018 by a few percent to around 15% (Figure 21), it has fallen as a share of overall WA employment, from 1.5% in 1985 to 1.2% in 2018 (Figure 22).

**Figure 20: Employment in gas-heavy manufacturing sectors compared to total manufacturing employment in Western Australia**



Source: ABS (2020) *Labour Force, Australia, Detailed, Quarterly*: Table 05. Employed persons by State, Territory and Industry division of main job (ANZSIC)

**Figure 21: Manufacturing employment compared to total employment in Western Australia**



Source: ABS (2020) *Labour Force, Australia, Detailed, Quarterly*: Table 05. Employed persons by State, Territory and Industry division of main job (ANZSIC)

# Reducing gas dependence

Gas prices will inevitably increase as LNG companies continue to export vast quantities of Australia's more accessible lower cost gas, leaving only more remote and difficult to extract gas for Australian customers.

The only way for manufacturing businesses to get off this upward energy cost spiral is to reduce their dependence on gas.

Most manufacturing processes don't require gas per se, but energy, predominantly for heat. Fortunately, this can often be provided by electricity, often at a far lower cost than gas.

There are also significant opportunities to reduce gas consumption in electricity generation and through fuel switching in the residential sector. If LNG exports are capped, this gas could add to the supply of domestic gas available to Australian manufacturers.

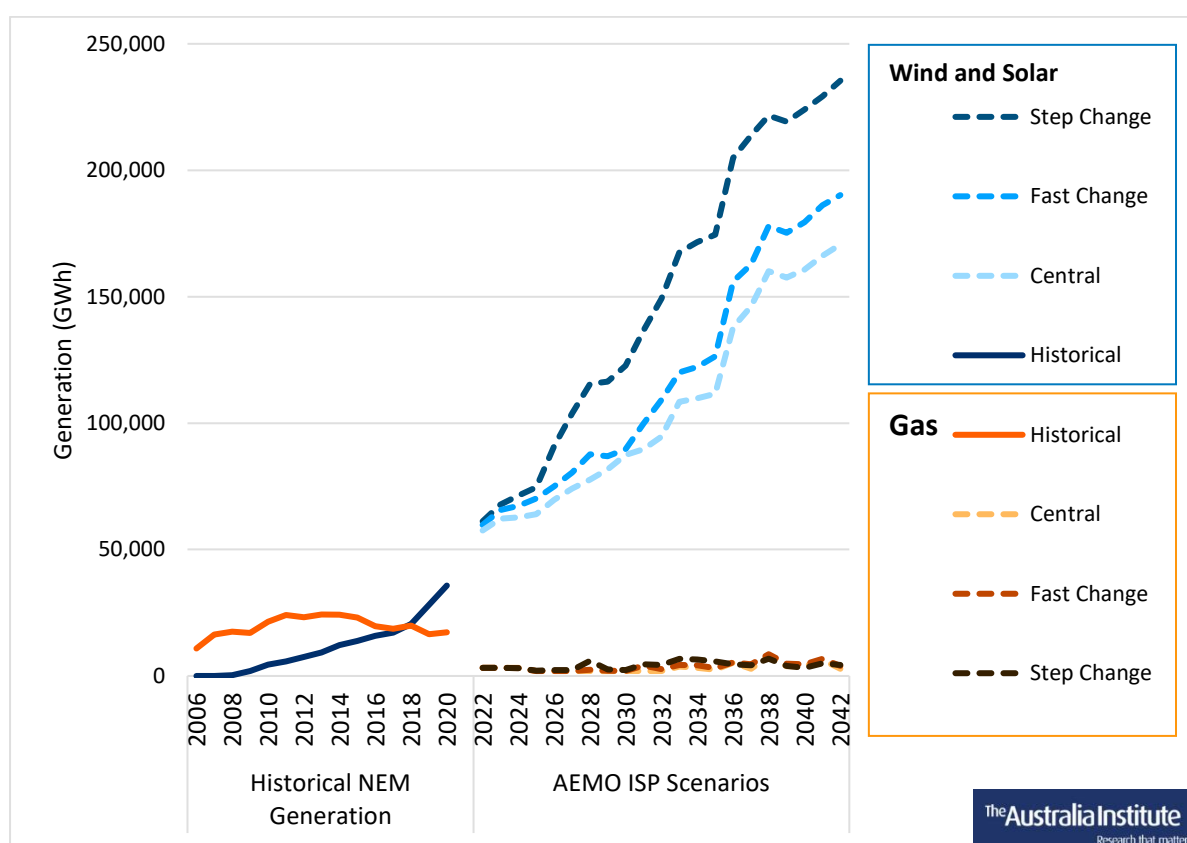
## ELECTRICITY GENERATION

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The Australian Energy Market Operator's Integrated System Plan (AEMO ISP) examines lowest cost development of the NEM over coming decades. In the key scenarios, shown in Figure 20, gas-fired electricity collapses and remains low over coming decades, while renewable energy generation grows very strongly.



**Figure 22: Gas vs renewables in the NEM – historical & AEMO ISP optimal scenarios**



Source: OpenNEM (2020) OpenNEM: An Open Platform for National Electricity Market Data, AEMO (2020) *2020 Integrated System Plan (ISP)*, 2020 ISP Generation Outlooks, Scenario 2 for “optimal path” in each case, optimal development pathway for each scenario, as per Table 10 in ISP report.

The AEMO scenarios are “derived by minimising total system cost”. AEMO notes that “in practice” gas use may be higher for a range of reasons, like emergency events and “contract positions and strategic bidding by generators”, but adds where these factors increase gas generation they also “increase costs to consumers”.<sup>19</sup> The immediate reduction of gas use in the ISP modelling indicates gas consumption is associated with higher system costs.

## HEAT

Most gas is used to create heat. It is used in our homes for space heating, hot water and cooking, and in industry to create heat for industrial processes.

Fortunately there are now there are many efficient electrical alternatives for creating heat in our homes, businesses and industry that also cost less than gas.

<sup>19</sup> AEMO (2020) *2020 Integrated System Plan (ISP)*, p.56, <https://aemo.com.au/en/energy-systems/major-publications/integrated-system-plan-isp/2020-integrated-system-plan-isp>

## Residential

Victoria is the largest consumer of gas in the residential sector, consuming almost half the amount of gas in 2019 (168 PJ) as used in manufacturing across Australia (372 PJ).<sup>20</sup> Almost all of this is used for heating houses and hot water, with a small proportion used for cooking.

Because heating is seasonal, Victorian residential gas use creates large peaks in winter demand for gas. Reducing those peaks alleviates potential shortfalls that result largely from gas pipeline constraints.

Ducted gas heating makes up around 70% of Victorian residential gas use and is extremely inefficient. Efficient electrical heat pumps with a Coefficient of Performance (COP) of between 4 and 6 can deliver the same amount of heat as ducted gas heating using around one tenth of the energy. Heat pumps can also be used to heat hot water, requiring at least 50% less energy than gas hot water systems. Electrical induction cooktops use around 50% of the energy of gas cooktops.<sup>21</sup>

All of these efficient electrical appliances cost far less to run than gas, and modelling has shown switching from gas to electricity can save many households hundreds of dollars each year.<sup>22</sup> The cost of buying new appliances are a barrier to switching from gas, however many gas appliances are old, and customers are increasingly replacing them with electrical systems. This processes that can be accelerated by appropriate policies including replacing gas heating with efficient reverse cycle air-conditioners in public housing, as well as providing incentives to other households switch.

Northmore Gordon estimate that gas demand in Victoria can be reduced by up to 113 PJ/year through measures with a zero to moderate cost.<sup>23</sup> Coincidentally, this is the same amount of gas used by the entire Australian chemical, polymer and rubber manufacturing sector in 2019.

University of Melbourne research recommends switching 50% of the Victorian gas heating load to heat pumps.

They estimate this would free up 180 TJ/day (70 PJ/year), the equivalent amount of gas that would be provided by the controversial Narrabri Gas Project if it goes ahead.<sup>24</sup> If LNG

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<sup>20</sup> AES (2020) *Australian Energy Update 2020*, Table F, <https://www.energy.gov.au/publications/australian-energy-update-2020>

<sup>21</sup> Northmore Gordon (2020) *Victorian Gas Market – Demand Side Measures to Avoid Forecast Supply Shortfall*, pp 20-22, <http://environmentvictoria.org.au/wp-content/uploads/2020/06/Vic-Gas-Market-Demand-Side-Study-Final-Report-1.pdf>

<sup>22</sup> Moyse et al (2014) *Are we still Cooking with Gas? Report for the Consumer Advocacy Panel*, [https://renew.org.au/wp-content/projects/CAP\\_Gas\\_Research\\_Final\\_Report\\_251114\\_v2.0.pdf](https://renew.org.au/wp-content/projects/CAP_Gas_Research_Final_Report_251114_v2.0.pdf)

<sup>23</sup> Northmore Gordon (2020) Op. Cit. p.4

<sup>24</sup> Sandiford and McConnell (2020), Op. Cit p.1

exports were capped, preventing gas savings from being exported, this gas would add to the domestic gas supply available to manufacturing.

This research also estimates switching 50 percent of the Victorian gas heating load to heat pumps will add around 2 GW to Victorian peak winter electricity demand with the total annual demand requirement equivalent to the output of about 1.5 GW of installed wind power.<sup>25</sup>

Australian Energy Regulator (AER) data on state peak electricity demand in Victoria shows over the last 3 years summer peak demand has been between 1.6-2 GW higher than winter peak demand in winter, suggesting there is significant winter redundancy to absorb much of the additional electricity load.<sup>26</sup>

The University of Melbourne research also recommends reserving a minimum of 550 TJ/day of Queensland CSG to restore the allocation of Queensland CSG to the domestic prior to the opening up of LNG exports in 2015.

## Manufacturing

There are also significant opportunities to reduce gas dependency in the manufacturing industry itself. Almost all the gas used in manufacturing is used to create heat. Just as domestic heat pumps can create heat for homes, industrial scale heat pumps can replace gas to create heat for temperatures up to 150 degrees.<sup>27</sup> While electrification delivers ongoing energy cost savings for manufacturers, the initial capital outlay is still a barrier.

In its 2020-21 budget submission, the manufacturing industry body Ai Group recommended the Commonwealth Government establish a \$500 million industry energy transformation fund.

The fund would should allocate \$500 million over two years for capital grants to rapidly scale up the penetration of existing technologies that are widely used overseas but uncommon in the Australian market. These include electrification of industrial processes with industrial scale heat pumps and electric induction furnaces, as well as energy management systems to enable demand response.

Ai Group estimate this funding with a matching rate of 1:1 “would deliver \$1 billion of manufacturing investment, equivalent to between 150 and 1,000 electrification projects”

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<sup>25</sup> Sandiford and McConnell (2020) *The gas-fired recovery - new supply v. fuel switching with reservation*, [https://melbourne.figshare.com/articles/online\\_resource/The\\_gas-fired\\_recovery\\_-\\_new\\_supply\\_v\\_fuel\\_switching\\_with\\_reservation/13133477](https://melbourne.figshare.com/articles/online_resource/The_gas-fired_recovery_-_new_supply_v_fuel_switching_with_reservation/13133477)

<sup>26</sup> AER (2020) *Seasonal peak demand – regions*, <https://www.aer.gov.au/wholesale-markets/wholesale-statistics/seasonal-peak-demand-regions>

<sup>27</sup> 2XEP (2017) *High Temperature heat pumps for the Australian food industry*, [https://022fdef7-26ea-4db0-a396-ec438d3c7851.filesusr.com/ugd/c1ceb4\\_9b0221a90abf44d18fdc8f393afd9b31.pdf?index=true](https://022fdef7-26ea-4db0-a396-ec438d3c7851.filesusr.com/ugd/c1ceb4_9b0221a90abf44d18fdc8f393afd9b31.pdf?index=true)

enabling facilities to reduce their energy bills by between 5-50% and create “7,000 job-years of employment.”<sup>28</sup>

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<sup>28</sup> AI Group (2020) *AI Group 2020-21 Budget Submission*, p.23,  
[https://cdn.aigroup.com.au/Submissions/Budget/2020/Ai\\_Group\\_BUDGET\\_SUBMISSION\\_24\\_August\\_2020.pdf](https://cdn.aigroup.com.au/Submissions/Budget/2020/Ai_Group_BUDGET_SUBMISSION_24_August_2020.pdf)

# Conclusion

There is no shortage of gas in Australia. Gas production has tripled in the last decade and Australia is permitting the export of vast quantities of gas every year that dwarf the amount used by manufacturing.

This has the effect of permanently raising the price of gas for Australian manufacturing because the extraction of more affordable gas is prioritised by oil and gas companies, leaving only more remote and higher cost gas for Australian customers.

As a result, no amount of increased production will reduce gas prices for Australia's manufacturers, and in its official releases relating to the Gas-fired Recovery JobMaker Plan, the Government does not claim that it will. Even if gas prices could be reduced, there is no reason to believe it would increase manufacturing jobs. When Australia had cheap abundant gas over several decades, manufacturing jobs did not increase, in fact they declined steadily.

As such, the Government's gas-fired recovery as part of its JobMaker Plan will not significantly increase jobs in Australia's manufacturing industry or elsewhere.

Fortunately most of Australia's manufacturing industry uses very little if any gas, and the parts of the industry that are heavily dependent on gas are also the least labour intensive.

Although these industries employ relatively few people, those jobs are still important. Fortunately there are ample opportunities to reduce the gas dependence of those industries through electrification. Almost all gas used in manufacturing is used to provide heat, and heat can be provided by electricity at far lower cost than gas in many cases. If manufacturers are able to electrify, they will lock in permanent ongoing energy cost reductions.

The barrier for many manufacturing businesses the capital cost of replacing equipment designed to use gas. However, in many cases this could be overcome by government assistance. Stimulatory spending for the COVID-19 recovery provides a unique opportunity to assist industry to take these steps. The manufacturing industry representative AI Group itself advocated for this in its 2020-21 Federal Budget submission.

There are also large opportunities to reduce gas use in electricity generation and household use. Renewable energy with storage is already cheaper than gas for electricity generation. Heating, hot water and cooking are far cheaper using efficient electrical systems. If households and businesses can switch from gas to electricity, it would not only lock in ongoing savings, but can save ample amounts of gas that can be redirected to those parts of the manufacturing industry where electrification is more difficult.

The argument that gas is needed by the manufacturing industry for feedstock is a furphy. There is no shortage of gas for feedstock as only around 1 percent of the gas produced in Australia is used for feedstock.