

# Process Manufacturing, Recreational Vehicle and Laboratory Industry Reference Committee

## Skills Forecast and Proposed Schedule of Work 2018-2022



# Administrative Information

**Name of Industry Reference Committee (IRC):**

Process Manufacturing, Recreational Vehicle and Laboratory (PMRVL)

**Name of Skills Service Organisation (SSO):**

Innovation and Business Skills Australia (IBSA Manufacturing)

## About the Industry Reference Committee

The **Process Manufacturing, Recreational Vehicle and Laboratory** Industry Reference Committee comprises nine members and was constituted in May 2017.

The 2018 Industry Skills Forecast and Proposed Schedule of Work was reviewed and approved by the membership below.

Mr Keith Monaghan (Chair)

Mr Ian Curry

Mr Stuart Lamont

Ms Leah Simmons

Ms Julie Warren

Mr Nigel Haywood

Ms Ceridwen Jones

Mr Han Michel

Mr Grahame Aston

## Industry Reference Committee Signoff

The 2018 PMA Chemical, Hydrocarbons and Refining Training Package Skills Forecast and Proposed Schedule of Work was approved as the result of a properly constituted IRC decision.

IRC Chair: Mr Keith Monaghan

Date: May 2018

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This IRC Skills Forecast and Proposed Schedule of Work has been prepared on behalf of the PMRVL Industry Reference Committee for submission to the Australian Industry Skills Committee (AISC).

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# Executive Summary

The Process Manufacturing, Recreational Vehicle and Laboratory Industry Reference Committee (IRC) Skills Forecast and Proposed Schedule of Work identify priorities for training package development work to meet the needs of industry. This document is based on research, analysis and consultations with IRC members and other stakeholders and provides evidence of current and emerging industry skills needs.

## What are the Chemical, Hydrocarbons and Refining Industries?

The Chemical, Hydrocarbon and Refining (CHR) industry combines three distinct but related subsectors: Basic Chemical and Chemical Product Manufacturing (chemical), Petroleum and Coal Product Manufacturing (hydrocarbons) and Primary Metal and Metal Product Manufacturing (refining).

The industry is heavily trade exposed and subject to global economic trends, as well as being strongly related to the resources sector (through the Industrial Gas Manufacturing and the Explosives Manufacturing subsector).

Offshore competition and environmental demands play a significant role in the sector, which is heavily government regulated.

## Critical Workforce Challenges and Opportunities

Given the level of overseas competition impacting on the CHR industry and the volatility of the resources sector – the workforce challenges and opportunities in the industry also have a degree of volatility. While some parts of the industry are introducing technology to allow them to compete globally – other (typically smaller) organisations lack the financial resources required for this investment.

In many parts of the CHR industry, environmental standards also play a critical role. Growing demands for gas, from China and as a potential transitional energy source within Australia, are being evaluated against community concerns about onshore gas activity. In addition, Australia's growing reliance on international fuels is raising national security concerns for some in the industry. Collectively these factors, and government responses to them, impact on employment in the CHR sector.

## Forecasting Skills Priorities

In addition to the identified priorities for the PMA Chemical, Hydrocarbons and Refining Training Package (see below), this forecast identifies potential skill changes arising from changing government regulations, the need for a range of generic skills to be introduced to enable businesses to maximise the use of new technologies where these are being introduced, and for stronger business leadership skills. Consumer and government environmental demands are also considered likely to continue to drive skill needs in the sector. A number of industry stakeholders expressed concerns about the level of institutional training available in the sector – with a strong preference for workplace-based training given the nature of the industry.

## Training Package Priorities

There are no items identified for inclusion as a priority for the 2018-2019 schedule of work, as a project is currently underway to review the existing PMA Chemical, Hydrocarbons and Refining qualifications at Certificate II, III and IV level.

However, in 2019-2022 the IRC intends to progress with work to cover the:

- **Processing of coal seam gas** to meet demand due to growth areas in the oil and gas sector; and
- **Review of the diploma and advanced diploma** to better match the qualifications to current job roles in the industry and to enhance articulation opportunities.

The Proposed Schedule of Work 2018-19 to 2021-22 was developed by the IRC, with support from IBSA Manufacturing, based on identified industry trends. The Schedule lists the priorities over the next four years, the rationale and proposed timeframes for these activities.

# Sector Overview

## Industry Snapshot

The chemical, hydrocarbons and refining (CHR) industry is diverse. It covers the production of chemicals, industrial gases and metals, as well as petroleum refining. It is an important industry within Australia's valuable resources sector.

The PMA Chemical, Hydrocarbons and Refining Training Package contains five qualifications that are contextualised by training providers to meet the diversity of the sector. Thirteen skill sets supplement the qualifications to provide specific training in specialised areas, such as 'Offshore crane driver'. The qualifications range from Certificate II to Advanced Diploma and are focused on Process Plant Operations and Technology.

A full list of the qualifications, skill sets and enrolment data can be found in the Training Snapshot on page 9.

A summary of the business landscape for each of these three sectors is included in Table 1.

The CHR industry in Australia is coded within the Australian and New Zealand Standard Industrial Classification (ANZSIC)<sup>1</sup> in Division C Manufacturing:

- Subdivision 17 Petroleum and Coal Product Manufacturing (hydrocarbons)
- Subdivision 18 Basic Chemical and Chemical Product Manufacturing (chemical)
- Subdivision 21 Primary Metal and Metal Product Manufacturing (refining).

Please note that within the above subdivisions, the industry does not include the following groups:

- Group 182 Basic Polymer Manufacturing
- Group 184 Pharmaceutical and Medicinal Product Manufacturing
- Class 1852 Cosmetic and Toiletry Preparation Manufacturing
- Class 2122 Steel Pipe and Tube Manufacturing
- Class 2142 Aluminium Rolling, Drawing, Extruding
- Class 2149 Other Basic Non-Ferrous Metal Product Manufacturing.

<sup>1</sup> ABS publication: 1292.0 - Australian and New Zealand Standard Industrial Classification (ANZSIC), 2006 (Revision 2.0)

Table 1 – Business landscape in key sectors/subsectors

Industry Sector/ Subsector	Number of Businesses at 30 June 2016	% Change from 30 June 2015	Types of Businesses
Chemical	1,167	Less than -1%	46% non-employing 44% small 9% medium 1% large
Hydrocarbons	299	Less than -1%	49% non-employing 41% small 9% medium 1% large
Refining	1,693	-1%	38% non-employing 51% small 10% medium 1% large

ABS, 2017, 8165.0 Counts of Australian Businesses, including Entries and Exits, Jun 2012 to Jun 2016

## Chemical

The Chemical sector comprises the following subsectors:

- Basic Chemical and Chemical Product Manufacturing, nfd (Group 180)
  - Basic Chemical and Chemical Product Manufacturing, nfd (Class 1800)
- Basic Chemical Manufacturing (Group 181)
  - Basic Chemical Manufacturing, nfd (Class 1810)
  - Industrial Gas Manufacturing (Class 1811)
  - Basic Organic Chemical Manufacturing (Class 1812)
  - Basic Inorganic Chemical Manufacturing (Class 1813)
- Fertiliser and Pesticide Manufacturing (Group 183)
  - Fertiliser and Pesticide Manufacturing, nfd (Class 1830)

- Cleaning Compound and Toiletry Preparation Manufacturing (Class 185)
  - Cleaning Compound and Toiletry Preparation Manufacturing, nfd (Class 1850)
  - Cleaning Compound Manufacturing (Class 1851)
- Other Basic Chemical Product Manufacturing (Group 189)
  - Other Basic Chemical Product Manufacturing, nfd (Class 1890)
  - Photographic Chemical Product Manufacturing (Class 1891)
  - Explosive Manufacturing (Class 1892)
  - Other Basic Chemical Product Manufacturing nec (Class 1899).

## Business Landscape

The various sub-components of the Chemical sector are all predicted to experience modest growth (ranging from 0.8% and 11.3%) in the period to 2022. Each subsector is relatively small in size – containing fewer than 300 businesses and generating between \$1.1 billion and \$3.9 billion in revenues in the last financial year.

The subsector predicted to experience the highest rates of growth are the Industrial Gas Manufacturing sector and the Explosives Manufacturing sector. The strong links between the resources sector and the explosives manufacturing sector mean that export growth in mining is likely to see demand for explosives increase modestly in the next five years.

By contrast, while the Industrial Gas Manufacturing industry produces gases for the resources sector, its products are also used in a range of industries including agriculture (feedstock) and health care. In addition to well-known and widely used 'bulk' gases (such as oxygen, nitrogen, carbon dioxide, hydrogen and argon), the industry also produces a range of specialty, medical and refrigerant gases. Some of the industries the Gas Manufacturing sector supplies to are volatile, but modest growth is anticipated in the next five years and a range of technological innovations are impacting this industry.

Offshore competition is squeezing businesses and profits in other parts of the Chemicals sector, and the Pesticides industry is facing ongoing environmental regulations and consumer concerns (as well as climate variability having an ongoing impact on the agriculture sector which it supplies to).

## Key Industry Stakeholders

Most of the sub-industry sectors in the broader Chemical sector have their own industry bodies and associations – including the Australian Explosives Industry Safety Group, the Australian Fertiliser Services Association, the Australia New Zealand Industrial Gas Association, Chemistry Australia and the Plastics and Chemical Industries Association.

## Regulation and Licensing

The Chemical sector is heavily regulated. In those sub-sections where the industry itself is not regulated (i.e. businesses do not require a licence to operate) there are licences required for various activities undertaken within the industry. In other parts of the industry, businesses must comply with the statutory National Industrial Chemicals Notification and Assessment Scheme (NICNAS) which involves the assessment of new chemicals prior to their introduction into Australia as well as reporting restrictions on other existing chemicals. Industrial chemical manufacturers are also required to comply with the Chemical Weapons Convention (which aims to restrict the production of chemical weapons).

## Hydrocarbons

Hydrocarbons are organic compounds made of hydrogen and carbon atoms. From an industry perspective, this sector includes businesses engaged in refining heavy and light component crude oil, manufacturing and/or blending materials into petroleum fuels, and manufacturing fuels from the liquefaction of petroleum gases; as well as those engaged in further refining heavy and light oil components into petroleum and coal products, using oil and grease base stocks, as well as synthetic organic compound base stocks. They may also be involved in distilling coal tars and/or manufacturing cyclic organic hydrocarbon intermediate compounds from refined petroleum or natural gas. This sector also includes the use of hydrocarbons as chemical and petrochemical feedstock such as in the manufacture of polymers and ammonia.

The hydrocarbon sector comprises:

- Petroleum and Coal Product Manufacturing (Group 170)
  - Petroleum and Coal Product Manufacturing, nfd (Class 1700)
  - Petroleum Refining and Petroleum Fuel Manufacturing (Class 1701)
  - Other Petroleum and Coal Product Manufacturing (Class 1702).

## Business Landscape

The Petroleum Refining and Fuel Management sector is dominated by four global players which operate in Australia. They are:

- BP Australia
- Caltex Australia
- ExxonMobil Australia
- Viva Energy Holding.

These four companies operate all major petroleum refineries in Australia and supply around 90% of the transport fuel market with bulk petroleum fuels. There are around 28 other major businesses in this subsector that engage in servicing the petroleum industry. The Petroleum Refining and Fuel Management sector has been in decline over the past five years as a result of crude oil prices, significant declines in refinery output in Australia and exchange rate movements. The number of people employed in the hydrocarbon industry declined by 31% in the five years from 2011 to 2016 (down from 6,977 to 4,832).

This scenario is expected to improve slightly in the next five years, with very modest growth of 0.6% anticipated for the 2017-18 financial year, and an overall increase in crude oil prices likely to assist the industry to compete against recently established and highly sophisticated fuel refineries in the Asia Pacific region. Revenue is forecast to increase at an annualised 1.8% over the five-year period to 2022-23, to \$18.1 billion.<sup>2</sup>

The Other Petroleum Products Manufacturing sector produces a range of lubricant, grease, fluid, oil and bituminous goods. In general, these products are used to run vehicles, machinery and equipment, to build roads, and in general manufacturing. The sector has suffered from export declines over the past five years as global production increased and competing imports also decreased.<sup>3</sup>

## Key Industry Stakeholders

The key industry associations related to the hydrocarbon sector are the Australian Institute of Petroleum and the Australian Petroleum Production and Exploration Association (APPEA).

## Regulation and Licensing

The hydrocarbon sector is heavily controlled in relation to matters such as fuel quality, fuel pricing, and other forms of regulation such as domestic energy policy, alternative energy source subsidies, fuel and corporate taxation, industrial relations policy, and environmental issues. Some commentators have also identified national security implications for Australia in our growing reliance on international fuel imports.<sup>4</sup>

## Refining

The Refining sector comprises the following sub-industry sectors:

- Primary Metal and Metal Product Manufacturing, nfd (Group 210)
  - Primary Metal and Metal Product Manufacturing, nfd (Class 2100)
- Basic Ferrous Metal Manufacturing (Group 211)
  - Iron Smelting and Steel Manufacturing (Class 2110)
- Basic Ferrous Metal Product Manufacturing (Group 21)
  - Iron and Steel Casting (Class 2121)

<sup>2</sup> IBIS World Petroleum Refining and Petroleum Fuel Manufacturing in Australia January 2018

<sup>3</sup> IBIS World Lubricants and Other Petroleum Product Manufacturing in Australia January 2017

<sup>4</sup> IBIS World op. cit.

- Basic Non-Ferrous Metal Manufacturing (Group 213)
  - Basic Non-Ferrous Metal Manufacturing, nfd (Class 2130)
  - Alumina Production (Class 2131)
  - Aluminium Smelting (Class 2132)
  - Copper, Silver, Lead and Zinc Smelting and Refining (Class 2133)
  - Other Basic Non-Ferrous Metal Manufacturing (Class 2139)
- Basic Non-Ferrous Metal Product Manufacturing (Group 214)
  - Basic Non-Ferrous Metal Product Manufacturing, nfd (Class 2140)
  - Non-Ferrous Metal Casting (Class 2141).

Refining involves the purification process for an impure metal. It is different from, but related to, the process of smelting whereby a chemical change takes place to the raw materials involved. The refining industry covers both the refining and smelting of metals such as iron, alumina, copper, silver, lead, zinc and other non-ferrous metals.

Iron smelting and steel manufacturing dominate this industry sector. And within this subsector two companies stand out – BlueScope Steel and Arrium. Alumina production by contrast is the smallest subsector of the Australian refining industry.

## Business Landscape

The refining industry in Australia is heavily exposed to global trends – with the strength of the US and Australian dollars being key drivers of revenues and demand in a number of subsectors. Another common factor impacting the profitability of businesses involved in refining has been rising electricity prices. Amongst these, the steel industry has experienced a period of decreasing demand and significant competition from cheap overseas steel. A decline in demand is likely in the five years to 2022 despite some increasing requirements from the construction sector. Aluminium manufacturers have also been impacted by declining demand and high electricity costs. Future growth is expected to be approximately 2.0% by 2022 and greater efficiencies are considered likely in the production process (combined with lower levels of demand for labour).

The refining sector has experienced a 37% decline in employment between 2011 and 2016. It is the largest sector within the Chemicals, Hydrocarbons and Refining industry and in 2016 employed 47,615 people (down from 76,437 in 2011).

## Key Industry Stakeholders

The key industry associations for the refining industry are APPEA, the Australian Mines and Metals Association, Chemistry Australia, the Chamber of Minerals and Energy WA, the Queensland Resources Council and Safer Together (the industry hub for safety in the natural gas sector).

## Regulation and Licensing

Regulations in the refining sector vary according to the nature of the materials being refined or smelted. Lead is subject to the heaviest levels of regulation due to its health risks to the population. Establishing steelmaking or aluminium smelting operations by contrast requires businesses to meet specific environmental and zoning requirements regarding noise, air emissions and the use, handling and disposal of hazardous materials and waste. Businesses in this industry are also required to comply with State and Commonwealth Government occupational health and safety regulations and employee requirements.

## Training Snapshot

### Qualifications Available

The following qualifications and skill sets are contained in the PMA Chemical, Hydrocarbons and Refining Training Package:

- PMA20116 Certificate II in Process Plant Operations
- PMA30116 Certificate III in Process Plant Operations
- PMA40116 Certificate IV in Process Plant Technology
- PMA50116 Diploma of Process Plant Technology
- PMA60116 Advanced Diploma of Process Plant Technology.

There are 162 units of competency in PMA Chemical, Hydrocarbons and Refining qualifications.

### Skill Sets

- PMASS00013 Pipeline liquids transmission
- PMASS00014 Pipeline gas transmission
- PMASS00015 Workplace assessor, trainer, coach
- PMASS00016 Confined space work team
- PMASS00017 Contractor induction
- PMASS00018 Emergency centre team

- PMASS00019 Hot work observer
- PMASS00020 Incident response commander
- PMASS00021 Incident response team leader
- PMASS00022 Incident response team member
- PMASS00023 Offshore crane driver
- PMASS00024 Offshore incident response team member
- PMASS00025 Offshore operator safety induction.

## Learner Training Profile<sup>5</sup>

In 2016, a learner enrolled in a qualification from the PMA Chemical, Hydrocarbons and Refining training package was more likely to be:

- Enrolled in a Certificate III level qualification
- Studying in Victoria or Western Australia or Queensland
- Aged 30 – 49 years of age
- Male
- Not an apprentice or trainee
- Enrolled at a TAFE Institute.

Over the period 2014-2016.

- The total number of enrolments in PMA Chemical, Hydrocarbons and Refining training package qualifications has declined by 45% (from 6,199 down to 3,440).
- The state profile of enrolments changed between 2014 and 2016. Enrolments in Queensland declined by 72% from 3,465 to only 965 enrolments between 2014 and 2016, so that Queensland then comprised 28% of total enrolments. By contrast enrolments have increased in Victoria by 135% to 1,020 in the same period (comprising 30% of all enrolments in 2016). Enrolments remained largely stable in WA (decline of 11% to 1,014 enrolments which makes up 30% of total 2016 enrolments). Enrolments in New South Wales declined by 85% to 77 enrolments which contribute only 2% to total 2016 enrolments).

<sup>5</sup> VOCSTATS VET Provider Collection, extracted on September 2017

- While learners aged between 30 and 39 years are still the largest cohort enrolled in PMA Chemical, Hydrocarbons and Refining qualifications (900 or 26% in 2016), they declined by almost half (48%) between 2014 and 2016. There were slightly fewer (892) learners aged 40-49 in 2016. Enrolments by 40- to 49-year olds declined by 45% in the same time period.
- Males dominate employment in the industry and enrolments in PMA Chemical, Hydrocarbons and Refining qualifications. The male share of enrolments dropped from 93% to 81% between 2014 and 2016 as overall employment in the industry has declined. Female enrolments in PMA Chemical, Hydrocarbons and Refining qualifications has increased in the same period (384 enrolments in 2014 and 549 in 2016).

Apprenticeships and traineeships within the Chemical, Hydrocarbons and Refining industry relate to PMA30116 Certificate III in Process Plant Operations and PMA40116 Certificate IV in Process Plant Technology. Overall apprentice/trainee program enrolments are provided in Appendix A and indicate a spike in enrolments in 2015 to 774 enrolments and a decline (to 496 enrolments) in 2016.

**Appendix A** presents a graphical snapshot of enrolment data from the PMA Chemical, Hydrocarbons and Refining Training Package.

## Training Delivery

As illustrated in Table 2 below, delivery by TAFE Institutes accounts for approximately half of all enrolments in PMA Chemical, Hydrocarbons and Refining qualifications. In addition, just over half of all training was government funded in 2016, up by 10% on 2015 data.

**Table 2 – Program Vocational Education and Training (VET) enrolments in PMA Chemical, Hydrocarbons and Refining qualifications by Training Organisation type**

Training Organisation Type	Total VET Enrolments		Proportion of enrolments that were Government Funded	
	2015	2016	2015	2016
TAFE	2,031	1,928	36%	62%
University	50	65	74%	88%
Enterprise provider	93	180	0%	0%
Private training provider	1,877	1,251	52%	46%
School	-	-		
Community education provider	-	-		
Totals	4,051	3,424	43%	53%

VOCSTATS VET Provider Collection, extracted on September 2017

In February 2018, there were 213 Registered Training Organisations (RTOs) approved to deliver units, skill sets or qualifications from the PMA Chemical, Hydrocarbons and Refining training package. A much smaller number (around 33) were approved to deliver one or more of the individual qualifications from the package.<sup>6</sup>

- There were 31 registered providers of the Certificate III in Process Plant Operations. Thirteen are TAFE Institutes and public universities. Every state and territory had at 15 least providers with scope to deliver the qualification.

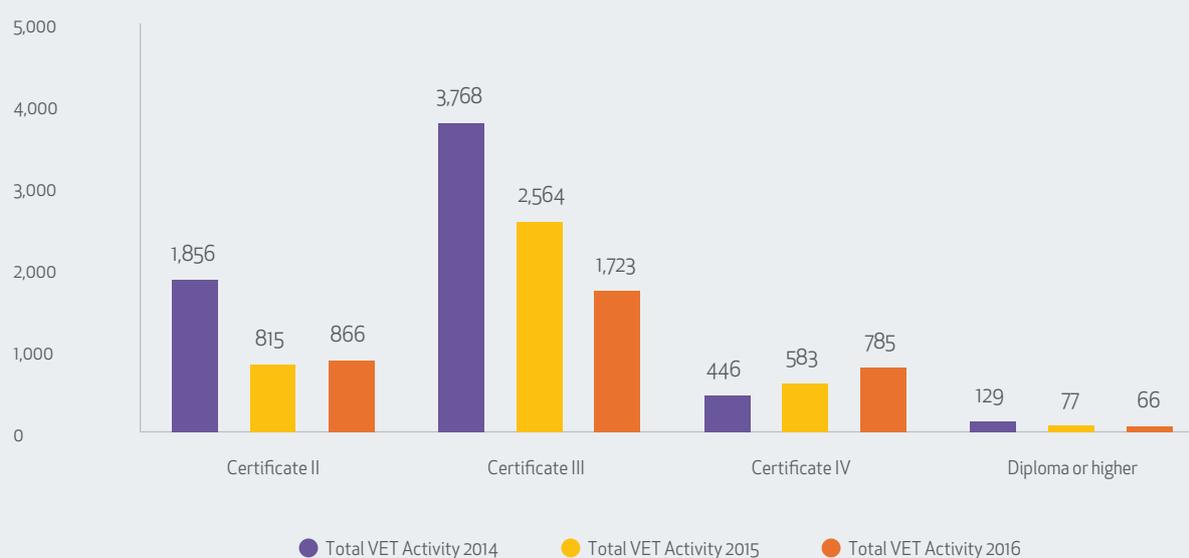
<sup>6</sup> Data accessed from <https://training.gov.au/> on 12 February 2018

- The remaining Chemical, Hydrocarbons and Refining qualifications had between 5 and 20 registered providers, mostly TAFE Institutes. For the Certificate IV in Process Plant Technology nearly half of the registered providers were non-TAFE Institutes.
  - Certificate II in Process Plant Operations (18 RTOs approved to deliver)
  - Certificate IV in Process Plant Technology (20 RTOs)
    - Diploma of Process Plant Technology (12 RTOs)
    - Advanced Diploma of Process Plant Technology (5 RTOs).

## Qualification Uptake

The uptake of qualifications in the PMA Chemical, Hydrocarbons and Refining training package is illustrated in Figure 1 below.

Figure 1 – Total enrolments in Chemical, Hydrocarbons and Refining qualifications

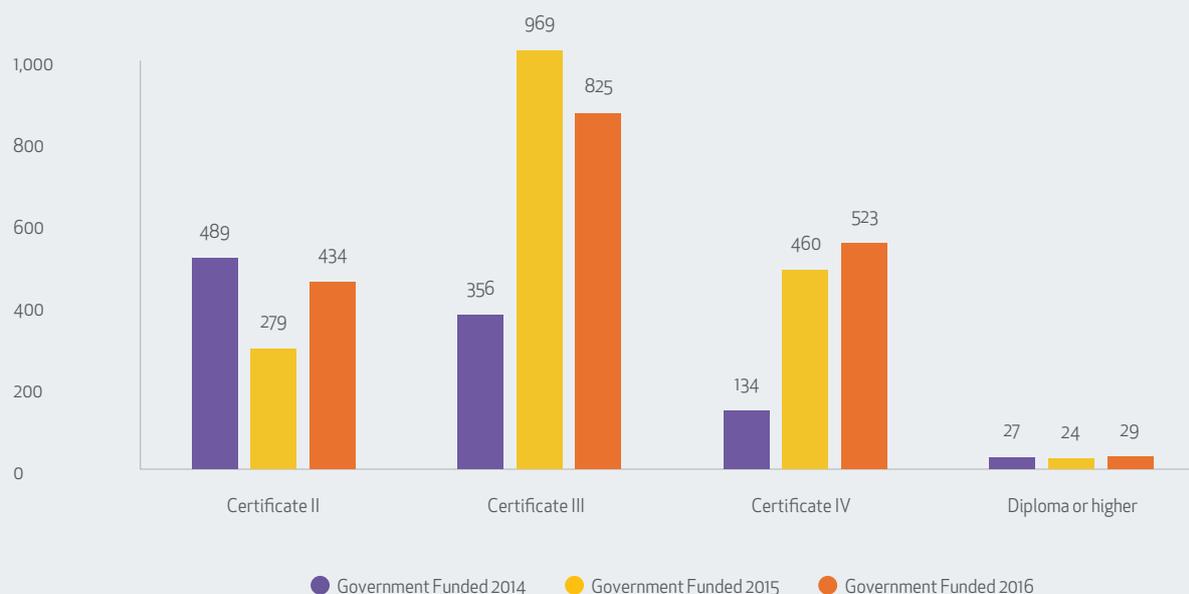


VOCSTATS VET Provider Collection, extracted on September 2017

The majority of enrolments in the PMA Chemical, Hydrocarbons and Refining Training Package are in the Certificate III qualification, accounting for 50% of all enrolments in 2016. The Certificate II remains the next most popular qualification, but enrolments are in decline (25% of all enrolments in 2016), compared with growth in enrolments in the Certificate IV (23%).

While enrolments across all qualifications have declined by 42% over the period of 2014-2016 (despite the increase in enrolments in the Certificate IV in Process Plant Technology), the trend in government funded enrolments has been one of overall growth. Total government funded enrolments increased by 80% between 2014 and 2016. Once again there was steady growth in Certificate IV enrolments, and more variability in enrolments in Certificate II and III (see Figure 2).

Figure 2 – Government funded enrolments in Chemical, Hydrocarbons and Refining qualifications



VOCSTATS VET Provider Collection, extracted on September 2017

# Challenges and Opportunities

Megatrends affecting all of the sectors covered by the PMRVL IRC were identified by IRC members in a future skills workshop conducted in 2017. A summary of the outcomes of this workshop can be found in **Appendix B**.

More specific challenges and opportunities for the sectors related to the PMA Chemical, Hydrocarbons and Refining Training Package are discussed below.

## For Industry and Employers

The CHR industry is diverse – albeit one impacted heavily by global trade and with strong links to other parts of the manufacturing sectors as well as the construction industry. The skills required in the different subsectors are generalisable and hence the training package contains a defined and relatively small set of qualifications, supplemented by additional skill sets.

## Society and Culture

The main societal factors impacting on the CHR sector are driven by environmental concerns – as consumers and the public seek reassurance about the environmental impacts of various manufacturing processes in the sector. Some businesses are seeking to innovate and meet consumer demand by establishing greener production methods and improving recycling.

In terms of training provision, the industry is ageing, with the proportion of employees aged 50 years and over rising from 26% in 2006 to 36% of the workforce by 2016. Older workers are less likely to participate in training. The large proportion of businesses in the CHR industry which are small or micro (ie five employees or fewer) is also likely to impact on levels of participation in training.

## Business and Economics

The large proportion of businesses in the CHR industry which are small or micro (i.e. five employees or fewer) impacts on levels of participation in training as well as on the firms' ability to compete with global businesses and withstand competition. As larger businesses and global competitors innovate with improved processes, increased technological innovation and new products, the challenges on smaller CHR businesses will grow. Other factors beyond the control of the sector, particularly high energy costs and the exchange rate fluctuations of the US and Australian dollars, all have a significant impact on costs and prices.

Regarding the hydrocarbon sector, supply and demand dynamics are expected to continue to exert their influence. For example, the demand for, and the price of, oil will affect production levels in the oil and gas industry. Regarding the domestic Coal Seam Gas (CSG) market: the New South Wales government does not currently support further CSG exploration (in fact, AGL withdrew from this market in 2016),<sup>7</sup> but the Queensland government is forecasting significant growth in employment; most of these workers will be new to the sector.

In the last five years, there has been unprecedented growth in the oil and gas sector of the industry, with Australia predicted to become the world's largest gas producer by 2021<sup>8</sup>. The construction of new gas processing plants (trains) across Australia is almost complete and the industry is transitioning to the production phase. This will lead to increasing demand for skilled process workers and technologists in this important sector.

Further, regarding the global hydrocarbon sector, the International Energy Agency (IEA)<sup>9</sup> sees energy consumption growing well into the foreseeable future with non-OECD Asian countries consuming more than OECD nations by 2030. Despite renewables growing at the fastest rate of all energy sources, the IEA forecasts demand for liquid fuels and natural gas to continue to increase.

## Resources and Environment

The demand for more environmentally sustainable products and practices, (including in response to regulation), is driving changes to business practices across the CHR industry. Environmental concerns are also having an impact. This is being felt particularly in subsectors such as pesticides. In response to these concerns, Australian products are being squeezed out by imports with better environmental credentials.

Some firms are changing the raw materials they use, and others are innovating through the development of new products in order to address these environmental concerns.

Industry sources highlighted the growing demand for liquid natural gas from China as it diversifies its economy away from coal. This shift has been a positive for Australian suppliers. The use of gas as a transition fuel in the move to a low carbon economy in Australia is debated within the industry – with some players foreseeing a role for gas as a key transition fuel and others predicting a move to renewables which will bypass the need for significant additional baseload gas.

Environmental concerns have also been raised in parts of the gas sector. Examples include drilling in the Great Australian Bight and the onshore gas moratoria which are in place in a number of states and territories. At this stage these concerns have not yet resulted in changes to training standards but future changes are possible as governments and companies balance the industry's 'social licence' to operate with the challenge of meeting Australia's energy needs.

7 'AGL exits NSW, Queensland coal seam gas in major win for opponents', <http://www.smh.com.au/environment/agl-exits-nsw-queensland-coal-seam-gas-in-major-win-for-opponents-20160203-gml6qs.html> accessed January 2018

8 International Energy Agency, 2016, IEA sees major shifts in global gas trade over next five years, IEA, Brussels, 8 June 2016

9 'International Energy Outlook 2017', [https://www.eia.gov/outlooks/ieo/exec\\_summ.php](https://www.eia.gov/outlooks/ieo/exec_summ.php) accessed January 2018

## Technology

Advances in technology are having a differential impact on businesses within the CHR sector. For example, the soap and cleaning manufacturing subsector is not expected to experience a rapid rate of technological change in the foreseeable future. Aluminium casting has also established technological processes and these are not predicted to change in the short term. However, continuous product innovation is becoming increasingly important as businesses seek an advantage in a highly competitive sector. IBISWorld reports that some consumer product companies are turning to specialty chemical manufacturers, in their efforts to develop innovative and more environmentally friendly products.

In the Petroleum Refining and Petroleum Fuel Manufacturing sector, much of the technological innovation in the industry has occurred offshore (and assisted countries like the US to now be energy self-sufficient as well as an energy exporter in competition with countries like Australia).

## Political and Institutional

Activities in offshore petroleum facilities, that fall in within Commonwealth waters, are legislated by the Australian Government through the National Offshore Petroleum Safety and Environmental Management Authority (NOPSEMA). Most other regulation in the CHR industry is set at the state and local government level – relating to environmental concerns and land planning and business use regulations.

## Supply-side Challenges and Opportunities

While enrolments in most qualifications (and particularly the Certificate III in Process Plant Technology) have declined in recent years this is not due to a lack of government funding. Government funded enrolment trends have shown growth between 2014 and 2016, particularly in the Certificate III and IV qualifications as illustrated in Figure 2 on page 13.

Industry figures noted concerns that the supply of VET qualifications was being dominated by graduates with institutional qualifications – giving them little chance of securing employment in the oil and gas industry where, due to the stringent standards and health and safety risks, workplace based training is of much greater value.

## For Learners and Training Package Development

During the consultations undertaken in the development of this Industry Skills Forecast, industry representatives identified issues in relation to formal, accredited training, including:

- some prospective employees that have completed one of the lower level PMA Chemical, Hydrocarbons and Refining Training Package qualification are presenting without any 'hands-on' training with industry processes; and
- a gradual reduction in materials science knowledge over time.

### Training

CHR companies typically have a high commitment to the education and training of the workforce because of the nature of the work involved and the potential hazards. The primary consideration for most employers is to make sure their employees are well trained in company-specific procedures and can operate safely.

Despite this overall commitment to training within the industry, enrolments in qualifications from the PMA Chemical, Hydrocarbons and Refining Training Package have been reducing over the last three years. In 2016 there were only 3,424 enrolments in PMA Chemical, Hydrocarbons and Refining qualifications, a 45% reduction since 2014.

At face value it does not appear to be a lack of training providers which has caused the decline in training. There are around 213 Registered Training Organisations (RTOs) approved to deliver one or more of the 162 units of competency within the PMA Chemical, Hydrocarbons and Refining Training Package.<sup>10</sup> Eighteen have the Certificate II qualification on their scope, 31 have the Certificate III, 20 the Certificate IV, 12 the Diploma and 5 the Advanced Diploma.

The RTOs delivering the PMA Chemical, Hydrocarbons and Refining qualifications are a mix of public and private providers and are both located and approved to deliver across Australia.

### Cross-industry Challenges and Opportunities

The CHR industry, like others involved in manufacturing, is experiencing challenges related to the introduction of new technology. As businesses invest in technology to retain their competitiveness, they face challenges in relation to upskilling and reskilling their existing workforce, as well as significant capital costs. Changing job roles (often as a result of technological change) are also triggering a demand for hybrid skills.

In addition, like other heavily regulated and environmentally sensitive industries, the CHR industry is balancing its social licence to operate with increased demand for its products, and with government restrictions on its activities. It is simultaneously looking for opportunities to demonstrate its environmental credentials (for example, to attract future investment through the ability to demonstrate 'best in class' asset operation and maintenance approaches).

<sup>10</sup> Data sourced from a count of RTO's listed at <http://training.gov.au> accessed February 2018

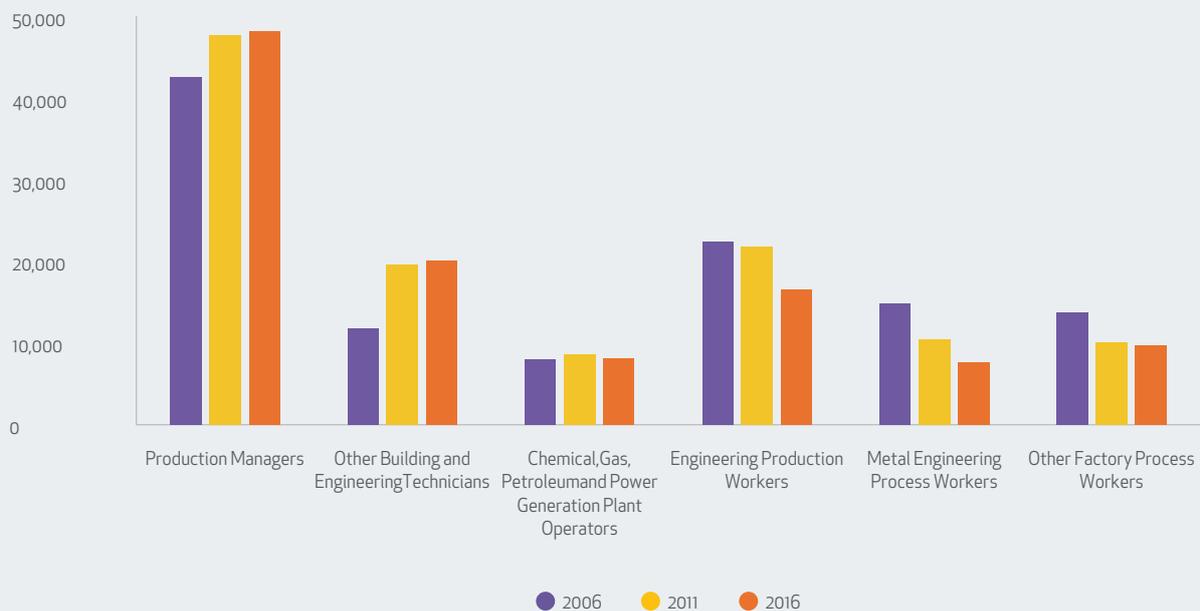
# Employment and Skills Outlook

## Employment Outlook

Data on employment trends and projections of the occupations and industries to which PMA Chemical, Hydrocarbons and Refining qualifications relate are illustrated in Figure 3 and Table 2 below. Other trends indicate:

- Employment across the industry is male dominated (87% male in 2016)<sup>11</sup>
- Employment projections for the sector for the period to 2022 are predicted to be almost stable with a decline of only 1,600 jobs predicted or a loss of 1.7% of all jobs in the industry<sup>12</sup>
- In the past decade there has been growth in Production Managers (13% increase) and Other Building and Engineering Technicians (71% increase).

Figure 3 – Employment in Australian and New Zealand Standard Classification of Occupations (ANZSCO) groupings related to PMA Chemical, Hydrocarbons and Refining qualifications



ABS 2006, 2011 and 2016 Census Data

<sup>11</sup> ABS Census of Population and Housing; 2006, 2011 and 2016

<sup>12</sup> Department of Jobs and Small Business Labour Market Information Portal (LMIP) Industry Employment Projections May 2017 – May 2022

Table 3 – Employment growth and projections

ANZSIC Code	Industry	Employment	Projected employment growth	
		level – May 2017 (’000)	– five years to May 2022 (’000)	(%)
17	Petroleum and Coal Product Manufacturing	6.1	-1.2	-19.4
18	Basic Chemical and Chemical Product Manufacturing	52.8	2.6	4.9
21	Primary Metal and Metal Product Manufacturing	47.6	-3.6	-5.7

Department of Innovation and Jobs, Labour Market Information Portal

Details of the alignment between PMA Chemical, Hydrocarbons and Refining qualifications and the ANZSCO occupation classifications can be found in **Appendix C**.

## Workforce Supply Challenges and Opportunities

The Chemical, Hydrocarbons and Refining industry invests heavily in initial training to ensure it can meet its workforce supply challenges. Industry stakeholders noted that most employers provide substantial training (typically up to three or four years) in simulated work environments to ensure that newly recruited workers are job ready well before new projects come on-line. Within the oil and gas industry, institutional VET pathways are typically not valued by the industry (with a much stronger preference for on-the-job training) but a network of training providers working through the Australia Centre for Energy and Process Training (ACEPT) is delivering skills recognition and initial training to assist employers with their workforce supply issues.

With overall employment numbers in the industry in decline (due to technological change), workforce supply issues are being met by employers recruiting experienced staff from other projects and through the heavy investment in simulated training to prepare new recruits for the workplace.

## Skills Outlook

Employment in the CHR industry is linked to broader global economic trends. The strong relationship with the resources sector, and fluctuating demand in that industry, has an impact on the CHR sector. The smaller size of many CHR businesses makes it difficult to respond to technological change at a time when it is increasingly required to remain competitive. Those organisations which are introducing new technologies, such as remote apps for permit to work, equipment identification, business improvement, etc. are looking for different skills – hybrid skills to accommodate changing job roles and the skills to maximise the use of the new technology.

In the onshore gas sector, industry stakeholders identified that changes may be made to remove Northern Territory's moratorium to allow the opening up of the Beetaloo Basin. This will in turn drive demand for a range of skills.

Work is underway within the industry to explore if and how training for onshore and offshore workers in the gas industry can be encapsulated in common qualifications – with the capacity to add on additional specialist units where required. This work is not sufficiently advanced to be included in more detail in this Skills Forecast but a working group has been established with representation from significant industry/employers and training providers and detailed discussions are in progress.

As with all industry sectors, there is also an increasing demand for generic skills to complement and support industry-specific technical skills and knowledge.

IRC members have ranked the importance of key generic workforce skills as indicated in Table 3 below. In several cases, only particular aspects of the generic skill area were identified as important, and these have been highlighted within the text in the table.

The impact of technological change in the manufacturing sector is evident in the ranking of the five most important generic skills, all relating to the introduction of new technology and/or having the skills (e.g. design thinking, problem solving, Science, Technology, Engineering and Mathematics (STEM), etc.) to maximise the use of technology.

IRC members observed that although they would expect that learners would already possess the necessary underpinning Language, Literacy and Numeracy (LLN) and STEM skills when enrolling in qualifications, this is often not the case. Therefore, it is important that qualifications specify the required underpinning skills within the standards.

It was also suggested that workplace health and safety should be added to the list of generic skills, as its high level of importance is evident across all of the industry sectors under the remit of this IRC.

For the PMRVL IRC members, leadership and LLN were ranked more highly than across other areas of the manufacturing sector.

Table 4 - Key Generic Workforce Skills

Combined Manufacturing IRCs	Process Manufacturing, Recreational Vehicle and Laboratory IRC
1 Design mindset/Thinking critically/Systems thinking/Solving problems skills	1 Technology use and application skills
2 Technology use and application skills	2 Design mindset/Thinking critically/Systems thinking/ <b>Solving problems skills</b>
3 Learning agility/Information literacy/Intellectual autonomy and self-management skills	3 Managerial/ <b>Leadership skills</b>
4 Communication/Collaborations including virtual collaboration/Social intelligence skills	4 Language, Literacy and Numeracy (LLN) skills
5 Science, Technology, Engineering and Mathematics (STEM) skills	5 Science, Technology, Engineering and Mathematics (STEM) skills
6 Language, Literacy and Numeracy (LLN) skills	6 <b>Learning agility/Information literacy/Intellectual autonomy and self-management skills</b>
7 Data analysis skills	7 <b>Customer service/Marketing skills</b>
8 Managerial/Leadership skills	8 <b>Communication/Collaboration</b> including virtual collaboration/Social intelligence skills
9 Customer service/Marketing skills	9 Data analysis skills
10 Environmental and Sustainability skills	10 Environmental and Sustainability skills
11 Entrepreneurial skills	11 Financial skills
12 Financial skills	12 Entrepreneurial skills

# Key Drivers for Change and Proposed Responses

The challenges and opportunities and the employment and skills outlook described in this report, indicate the need for skill development solutions in a number of priority areas. These are outlined in Table 5 below.

Table 5. Priority skills and key drivers for change

Priority Skills	Key Driver for Change	Proposed Response
<b>Regulatory/Legislative</b>		
Additional environmental regulations	No specific changes are identified but given responsibility occurs at the state and Commonwealth level and there are a number of elections planned for 2018-19, changes may be introduced.	Monitor government policies at the state and Commonwealth level for changes to environmental regulations.
<b>Industry Specific</b>		
Increased global competition	Ongoing competition will drive product innovation in those companies which successfully compete.	Review current units of competency as businesses innovate.
<b>Business skills</b>		
Business skills	Lack of business management capability across the SMEs in the sector.	Leadership skills were identified as the third most significant generic skill required by the IRC. Identification of relevant business management/leadership skills for delivery as skill sets to the CHR industry and/or for incorporation into existing qualifications should be undertaken.
<b>Technology</b>		
Technological innovation	Unlike other elements of the manufacturing sector, little technological innovation is foreseen for workforce covered by PMA Chemical, Hydrocarbons and Refining in the next five years, although new machines and processes are being introduced into some larger businesses.	While technological change is being unevenly introduced into the CHR industry, beyond the next five years it is likely to have a much greater impact and a watching brief should be maintained.

# Training Product Review - Current Activities

## 2016-17 Activities

In February 2017 IBSA Manufacturing was commissioned to undertake training package development work on behalf of the Process Manufacturing, Recreational Vehicle and Laboratory IRC on the PMA Chemicals, Hydrocarbons and Refining Training Package.

The project involves the review and update of four existing qualifications to meet industry requirements and reflect current job roles, and 162 existing units of competency:

- PMA30116 Certificate III in Process Plant Operations
- PMA40116 Certificate IV in Process Plant Technology
- PMA50116 Diploma of Process Plant Technology
- PMA60116 Advanced Diploma of Process Plant Technology.

The project also allows for the development of 5 new units of competency and 1 new skill set. Initially it was proposed to focus on drone technology/remote monitoring, however preliminary industry feedback suggested drone technology/remote monitoring may be a marginal imperative. IBSA Manufacturing will continue to work with industry to define the focus of new components in terms of critical skill gaps to ensure they deliver value.

This work strongly supports the CISC-AISC priorities, including:

- removing superfluous information from units of competency and deleting units that are obsolete
- improving qualification design to align with industry skill needs, current work practices and equipment (the grouping of electives into streams will be considered)
- revising training products to improve industry's expectations in assessments.

This project is due to be submitted to the AISC in September 2018.

## AISC Cross-Sector Projects

The AISC identified a number of emerging cross-sectoral themes in previous IRC skills forecasts. The AISC sought to strategically address these common skills issues and commissioned nine cross-sector projects. The aim of the projects is to address changing skills needs across industries in a coordinated and efficient way and, where opportunities exist, to create flexible and transferable training package components that will benefit industry, learners and the broader VET sector.

There are a number of cross-sector projects that will potentially directly impact upon the Chemicals, Hydrocarbons and Refining training package.

- The **Digital Skills** Cross-Sector Project, while initially focused on the need for coding skills in manufacturing and related training packages, was expanded to focus on a broader set of skills related to coding and programming, CAD/CAM/CAE, and additive manufacturing/3D printing, as well as the digital analytical/diagnostic skills needed to analyse and respond to data provided by machines in the workplace. Outcomes of the project may result in recommendations for updated content for at least one unit of competency in the PMA Chemical, Hydrocarbons and Refining Training Package.
- The **Automation Skills** Cross-Sector Project focused on current and emerging developments in automated processes which were reviewed as part of this project to determine the cross-sector skills required to use robotics, drones and remote operation systems. Outcomes of the project may result in recommendations for updated content for at least one unit of competency in the PMA Chemical, Hydrocarbons and Refining Training Package.
- The **Environmental Sustainability Skills** Cross-Sector Project focused on identifying environmental sustainability skills that are shared by multiple industry sectors and recommend training package developments and modifications that will enable the use of training products across multiple industries, thus reducing duplication and enhancing skill transferability. Outcomes of the project may result in recommendations that at least two units of competency from the PMA Chemical, Hydrocarbons and Refining Training Package be reviewed, with potential for replacement by a cross-industry unit.

# Training Product Review – Priorities 2018-2022

Following consideration and analysis of the industry challenges and opportunities, current and emerging skills needs and the key drivers for change, the Process Manufacturing, Recreational Vehicle and Laboratory IRC have identified a number of areas for training product development. These training priorities are outlined in the IRC Skills Forecast and Proposed Schedule of Work 2018-19 to 2021-2022 table which lists the priorities for the next four years. This table also provides a rationale for the priorities, proposed scope and timeframes for these activities.

As outlined in the Training Product Review - Current Activities section above, work has been approved to review four existing PMA Chemical, Hydrocarbons and Refining Training Package qualifications, and update these to meet industry requirements.

Additionally, some of the priorities previously identified by the Process Manufacturing, Recreational Vehicle and Laboratory IRC 2017 Skills Forecast cycle, for example, virtual reality (VR) technology and data analytics, also align with the cross-sector projects which are presently underway.

## Items Identified as Important and to be Included in the Priorities for 2018-19

There are no items that have been identified as priorities for the 2018-2019 schedule of work.

## Items Identified as Priorities Over the Next Three Years

The IRC identified the following training priorities to be considered over the next three years:

- **Processing of coal seam gas** to meet demand due to growth areas in the oil and gas sector
- **Review of the Diploma and Advanced Diploma** to better match the qualifications to current job roles in the industry and to enhance articulation opportunities.

## Future Priorities 2023 Onwards

In their analysis of the industry challenges and opportunities, current and emerging skills needs and the key drivers for change, the PMRVL IRC identified that the current rate of technological change within the industry makes it too difficult to predict skill needs five years out. As further details on new plant design and new operational processes within the Chemical, Hydrocarbons and Refining industry become apparent, the PMRVL IRC will be better able to assess the sector's skill needs for 2023 and beyond.

# Proposed Schedule of Work 2018-19 to 2021-22

## Process Manufacturing, Recreational Vehicle and Laboratory Industry Reference Committee

### PMA Chemical, Hydrocarbons and Refining

**Contact details:** Keith Monaghan, IRC Chair

**Date submitted to Department of Education and Training:** May 2018

Year	Items to be included in National Schedule of work
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2019-2020	<b>Coal Seam Gas</b>
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Processing of coal seam gas to meet demand due to growth areas in the oil and gas sector

**Rationale**

As exploration of coal seam gas broadens, it will likely become a key significant supplier in Australia, especially considering Australia is predicted to become the world's largest gas producer by 2021. Some jurisdictions, such as the Queensland government, are forecasting significant growth in employment, most of whom will be new to the sector. This will lead to increasing demand for skilled process workers and technologists. Qualifications need to ensure they are catering to the needs of this growing industry.

**Training products impacted:**

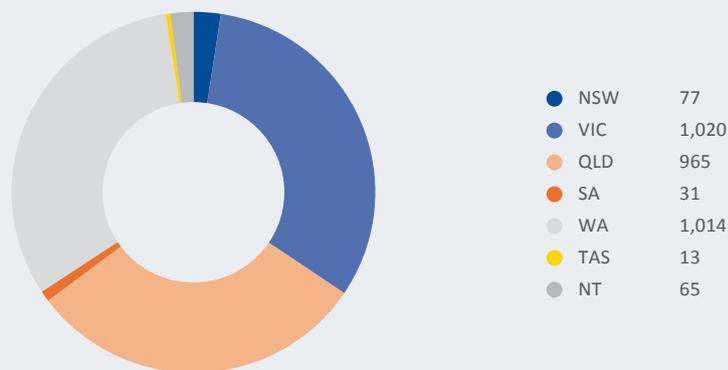
- Certificate III in Process Plant Operations
- Certificate IV in Process Plant Operations

Year	Items to be included in National Schedule of work
2020-2021	<p data-bbox="328 376 1198 450"><b>Review of higher level PMA Chemical, Hydrocarbons and Refining qualifications</b></p> <p data-bbox="328 465 1342 524">Review of the Diploma and Advanced Diploma to better match the qualifications to current job roles in the industry and to enhance articulation opportunities</p> <p data-bbox="328 544 416 573"><b>Rationale</b></p> <p data-bbox="328 593 1362 745">Higher level PMA Chemical, Hydrocarbons and Refining qualifications are Engineers Australia approved, and there is a prescribed footprint for international and mainstream VET students/or those in the industry, who wish to articulate to university and seek careers overseas. However, industry feedback suggests the Diploma and Advanced Diploma are not widely used by industry as there is a disconnect between the qualification outcome and the job role. Review of these qualifications is required to ensure they remain current, and relevant for the sector.</p> <p data-bbox="328 766 584 795"><b>Training products impacted:</b></p> <ul data-bbox="328 815 788 889" style="list-style-type: none"><li data-bbox="328 815 695 844">• Diploma of Process Plant Technology</li><li data-bbox="328 860 788 889">• Advanced Diploma of Process Plant Technology</li></ul>

# Appendix A: Training Package Enrolment Snapshot

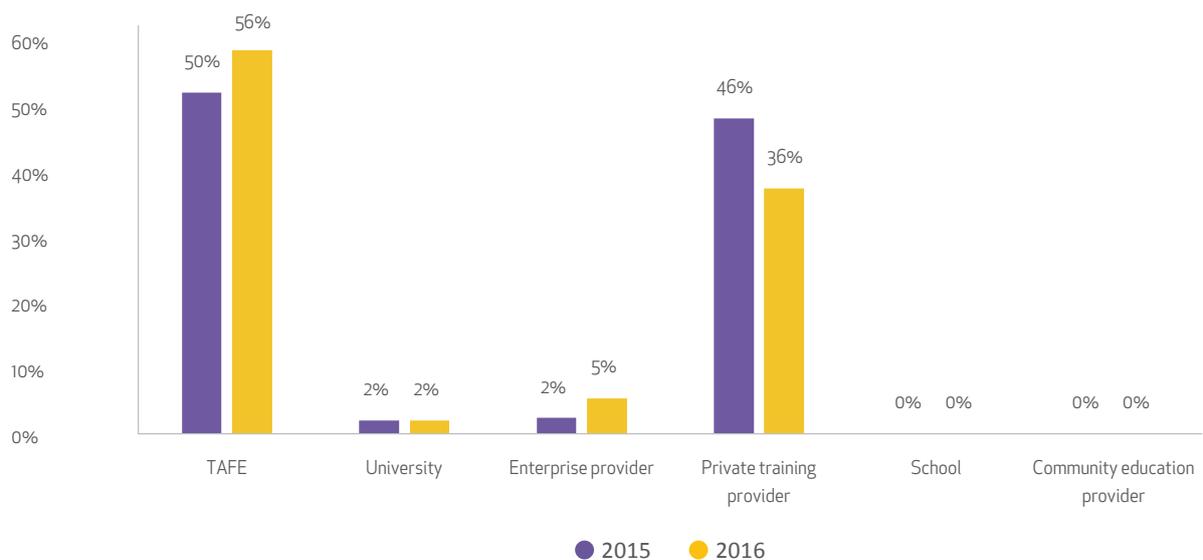
## Program enrolments in PMA Chemical, Hydrocarbons and Refining qualifications by State/Territory of student residence

2016 Total VET Activity



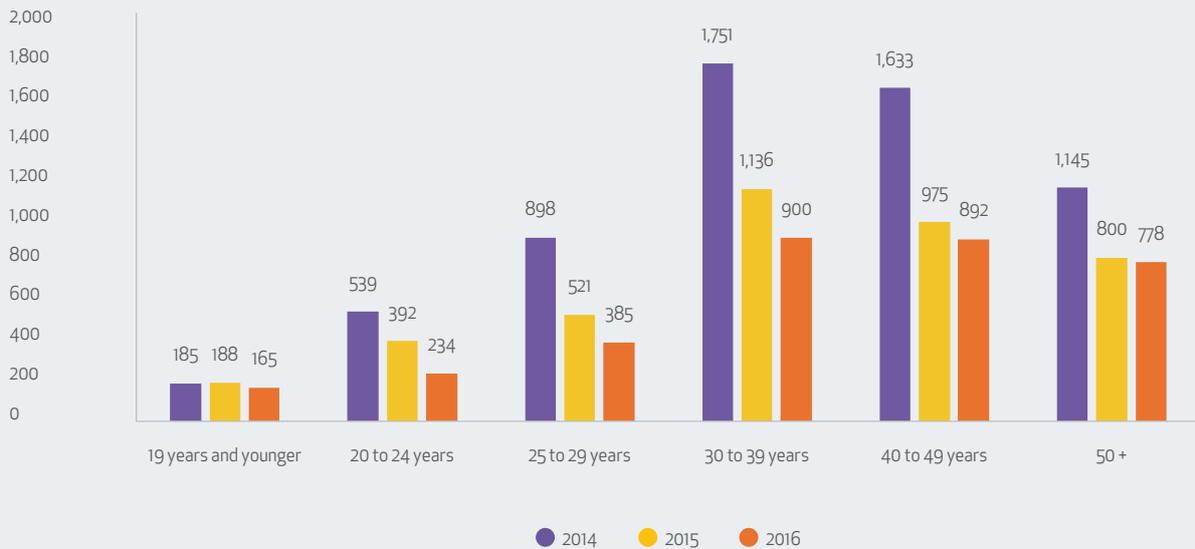
## Program enrolments in PMA Chemical, Hydrocarbons and Refining qualifications by Training Organisation Type

Percentage of 2015 - 2016 Total VET Activity



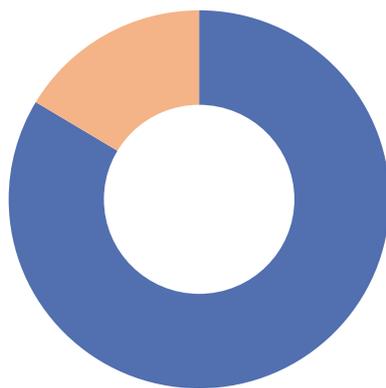
## Program enrolments in PMA Chemical, Hydrocarbons and Refining qualifications by Age Group

2014 - 2016 Total VET Activity



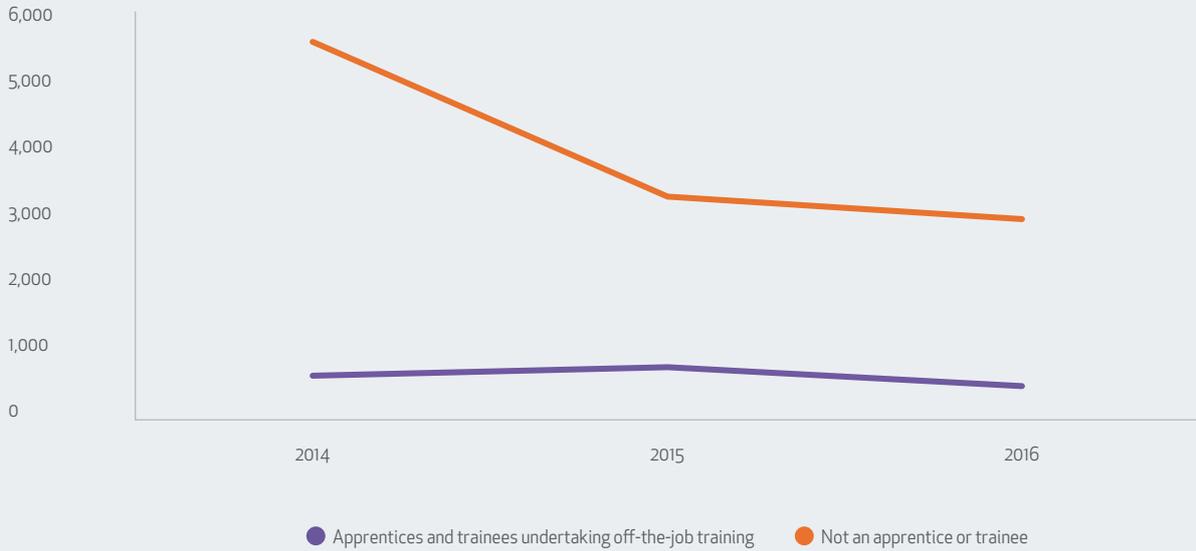
## Program enrolments in PMA Chemical, Hydrocarbons and Refining qualifications by Sex

2016 Total VET Activity



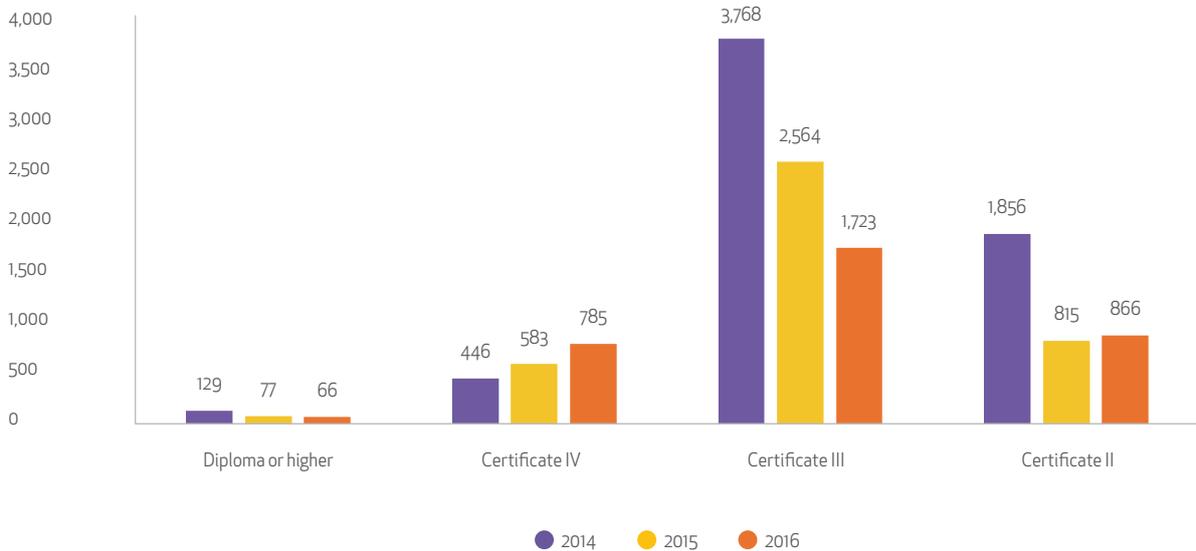
## Program enrolments in PMA Chemical, Hydrocarbons and Refining qualifications by Apprentice/Trainee undertaking off-the-job training

Total VET Activity 2014-2016



## Program enrolments by qualification level in PMA Chemical, Hydrocarbons and Refining qualifications

2014 - 2016 Total VET Activity



All data in this Appendix is sourced from the VOCSTATS VET Provider Collection. 2016 Government Funded and Total VET Activity Program enrolments extracted September 2017

VOCSTATS data are 'randomly' adjusted by small amounts by a data perturbation tool to avoid the release of confidential data. Hence numbers are only approximate. The perturbation impact is negligible for most practical purposes. The effect can be significant and must be considered when interpreting small numbers

# Appendix B: Future Skills Outcomes

The Australian Industry and Skills Committee (AISC) commissioned the Future Skills and Training Resource which summarises data on current and future Australian and international megatrends, to support Industry Reference Committees (IRCs) in developing their Industry Skills Forecasts and Proposed Schedules of Work.

The following trends and considerations are based on Process Manufacturing, Recreational Vehicle and Laboratory IRC discussions. This appendix presents the preliminary thinking of IRC members in order to stimulate broad discussion in industry.

## Trends



### Technology

Technology will have an extreme impact on the Process Manufacturing, Recreational Vehicle and Laboratory sectors and will change the industry sectors as they're currently known, as well as have an effect on learning and creating knowledge.

The key trends affecting the sectors are:

**Artificial Intelligence (AI) and Machine Learning:** AI technologies are an established trend and have been implemented across the sectors in various ways. A significant challenge is for policy and regulation to keep up with the pace of change and implementation. Industry also needs to be better at promoting the employment and skilling opportunities of technology adoption.

**Cross-Disciplinary Science:** This is an emerging trend requiring people and teams to have a functional knowledge across a number of disciplines.



### Society and Culture

The key trends affecting the Process Manufacturing, Recreational Vehicle and Laboratory sectors are:

**Changing Work and Career Values:** This is an emerging trend which will become more prevalent in workplaces, particularly with technology expansion and the acceptance of automation. Workers will have the flexibility to undertake roles which interest them, and employers can also benefit from the broader perspectives gained from employees' experience in other areas. However, if workplace changes are imposed on workers, the benefits for individuals are not always positive.

**Global (and Social) Mobility:** Higher level skills and industry knowledge are leaving Australia to follow industry jobs moving offshore. Lower level, technical skills are required and increasingly filled by migrants, and this poses language, literacy and numeracy challenges to workplaces. Social mobility, fuelled by social media and the internet, is having a significant impact on the industry, particularly on how people are learning, and on their career and work choices.

## Political and Institutional

The Process Manufacturing, Recreational Vehicle and Laboratory sectors operate in highly regulated environments, with workplaces required to adhere to stringent workplace, health and safety requirements and many workers requiring licences to undertake their job roles.

The key trends affecting the sectors are:

**Political Instability and Polarisation/Political Appetite for Reform:** Frequent changes in governments impact the implementation of reform agendas that are important for industry sustainability.

Governments also need to ensure funding for training is funnelled to the right skill areas so that workers can access training, particularly to meet regulatory requirements.

## Resources and Environment

The key trend affecting the Process Manufacturing, Recreational Vehicle and Laboratory sectors is:

**International Sustainability Action:** International regulations are emerging as a key driver of change, with Australia looking to harmonise to international standards, such as those around emission targets.

More generally, resources are more widely understood and accepted as finite challenges faced by the industry, related to disposal of process waste, cost of energy use and access to ICT-related infrastructure. Younger generations are also more concerned about environmental issues, leading business and society to give more value to sustainability and the environment.

## Business and Economics

The key trends affecting the Process Manufacturing, Recreational Vehicle and Laboratory sectors are:

**Empowered (Informed and Demanding) Customers:** Business is guided by social and cultural dynamics. Changes in consumer demands are being driven by social media movements, which will impact not only product design, but also job design.

**Changing Workplace Dynamics:** There is an emerging trend with teams becoming increasingly fluid in terms of sizes, interactions and tasks. The relational aspect of working together will matter more than technical aspects. A tension exists between the drive toward innovation and the need for standardisation in the manufacturing environment. 'Structured flexibility' will become prevalent in the industry.

**Start Up Thinking:** Australian manufacturers have a 'can do' attitude and are innovators, often requiring 'outside the box' solutions, but current systems do not always support this. Hyper-competition is driving faster product development and business cycles. Innovation is sometimes hampered by bureaucracy as well as management within organisations. Employees need to be provided with conscious opportunities to innovate, generate ideas and test designs in supportive environments.

**Access to Quality Internet:** This is an important requirement for every business, particularly as workforces are increasingly spread across different geographical locations.

**Financial Viability:** While impacted by access to and cost of resources, the key challenge for businesses in the industry sectors is to remain financially viable in order to stay competitive and continue to employ and train people.

# Considerations for Training

## Employers / Industry

Skills mismatch is a huge problem, and industries are running their own workshops and campaign to attract industry entrants. However, the gap is too large for industry to address alone.

SMEs' engagement with workforce development and training remains a challenge due to market pressures.

The VET system must become more flexible to respond to industry needs; otherwise industry will go around the system.

## Learners / Workers

The flexibility that now exists in mobility, social media, and connectivity needs to translate to new training models and approaches. Flexibility and higher order 'soft skills' are essential attributes now and in the future.

Learners and workers will seek to demonstrate to employers their capacity to think, try new things, and take risks. These abilities will need to be part of the training approach.

Learners and workers will combine VET and higher education alongside independent learning to gain employment or pursue entrepreneurial paths.

## Government

Regulation will be a pivotal challenge to technology adoption and filling of skills gaps. Ways of evaluating progress, impact and achievement need to be reviewed.

Government involvement in all areas and aspects of the VET system will need to continue. The barriers in relation to industry having and accessing appropriate training to meet their needs requires management. This includes ensuring national and state funding skills lists accurately represent industry demand and that appropriate funding mechanisms, which reduce the cost burden on learners, are in place to enable training for these key skills.

Industry needs an active role in VET to ensure system-wide engagement.

## Education and Training

Inflexibility in cross-industry training is a key issue to be addressed. Society and industry expect the VET system to focus more on industry value chains and lifecycles, and align training with new/expanding industries.

Educators' and trainers' roles are under pressure to be reconceptualised. Greater industry demand for skill sets and 'just in time' learning means these are increasingly used instead of the traditional training package model. Full qualifications as we know them have reduced relevance for employers and employees; continued support for a skills-driven training model is evident.

Registered training organisations are also impacted by financial viability and are grappling with how to deliver flexible, customised training at competitive rates to industry.

# Appendix C: Occupation classifications

For the purposes of analysing employment trends, the following Australian and New Zealand Standard Classification of Occupations (ANZSCO) occupation classifications have been used.

ANZSCO Unit Group	ANZSCO Unit Group and Name	ANZSCO Occupation	ANZSCO Occupation Title
1335	1335 Production Managers	133512	133512 Production Manager (Manufacturing)
3129	3129 Other Building and Engineering Technicians	312911	312911 Maintenance Planner
3129	3129 Other Building and Engineering Technicians	312912	312912 Metallurgical or Materials Technician
3129	3129 Other Building and Engineering Technicians	312913	312913 Mine Deputy
3129	3129 Other Building and Engineering Technicians	312999	312999 Building and Engineering Technicians nec
3992	3992 Chemical, Gas, Petroleum and Power Generation Plant Operators	399211	399211 Chemical Plant Operator
3992	3992 Chemical, Gas, Petroleum and Power Generation Plant Operators	399212	399212 Gas or Petroleum Operator
3992	3992 Chemical, Gas, Petroleum and Power Generation Plant Operators	399213	399213 Power Generation Plant Operator
7123	7123 Engineering Production Workers	712311	712311 Engineering Production Worker
8391	8391 Metal Engineering Process Workers	839111	839111 Metal Engineering Process Worker
8399	8399 Other Factory Process Workers	839911	839911 Cement and Concrete Plant Worker
8399	8399 Other Factory Process Workers	839912	839912 Chemical Plant Worker
8399	8399 Other Factory Process Workers	839913	839913 Clay Processing Factory Worker
8399	8399 Other Factory Process Workers	839914	839914 Fabric and Textile Factory Worker
8399	8399 Other Factory Process Workers	839915	839915 Footwear Factory Worker
8399	8399 Other Factory Process Workers	839916	839916 Glass Processing Worker
8399	8399 Other Factory Process Workers	839917	839917 Hide and Skin Processing Worker
8399	8399 Other Factory Process Workers	839918	839918 Recycling Worker
8399	8399 Other Factory Process Workers	839999	839999 Factory Process Workers nec

ABS publication 1220.0 - ANZSCO -- Australian and New Zealand Standard Classification of Occupations, 2013, Version 1.2

# Appendix D: Industry classifications

For the purposes of analysing the business landscape, the following Australian and New Zealand Standard Industrial Classification (ANZSIC) industry classifications have been used.

The Chemical sector comprises the following ANZSIC Classes:

- Basic Chemical and Chemical Product Manufacturing, nfd (Group 180)
  - Basic Chemical and Chemical Product Manufacturing, nfd (Class 1800)
- Basic Chemical Manufacturing (Group 181)
  - Basic Chemical Manufacturing, nfd (Class 1810)
  - Industrial Gas Manufacturing (Class 1811)
  - Basic Organic Chemical Manufacturing (Class 1812)
  - Basic Inorganic Chemical Manufacturing (Class 1813)
- Fertiliser and Pesticide Manufacturing (Group 183)
  - Fertiliser and Pesticide Manufacturing, nfd (Class 1830)
- Cleaning Compound and Toiletry Preparation Manufacturing (Group 185)
  - Cleaning Compound and Toiletry Preparation Manufacturing, nfd (Class 1850)
  - Cleaning Compound Manufacturing (Class 1851)
- Other Basic Chemical Product Manufacturing (Group 189)
  - Other Basic Chemical Product Manufacturing, nfd (Class 1890)
  - Photographic Chemical Product Manufacturing (Class 1891)
  - Explosive Manufacturing (Class 1892)
  - Other Basic Chemical Product Manufacturing nec (Class 1899)

The Hydrocarbon sector comprises the following ANZSIC Classes:

- Petroleum and Coal Product Manufacturing (Group 170)
  - Petroleum and Coal Product Manufacturing, nfd (Class 1700)
  - Petroleum Refining and Petroleum Fuel Manufacturing (Class 1701)
  - Other Petroleum and Coal Product Manufacturing (Class 1702)

The Refining sector comprises the following ANZSIC Classes:

- Primary Metal and Metal Product Manufacturing, nfd (Group 210)
  - Primary Metal and Metal Product Manufacturing, nfd (Class 2100)
- Basic Ferrous Metal Manufacturing (Group 211)
  - Iron Smelting and Steel Manufacturing (Class 2110)
- Basic Ferrous Metal Product Manufacturing (Group 21)
  - Iron and Steel Casting (Class 2121)
- Basic Non-Ferrous Metal Manufacturing (Group 213)
  - Basic Non-Ferrous Metal Manufacturing, nfd (Class 2130)
  - Alumina Production (Class 2131)
  - Aluminium Smelting (Class 2132)
  - Copper, Silver, Lead and Zinc Smelting and Refining (Class 2133)
  - Other Basic Non-Ferrous Metal Manufacturing (Class 2139)
- Basic Non-Ferrous Metal Product Manufacturing (Group 214)
  - Basic Non-Ferrous Metal Product Manufacturing, nfd (Class 2140)
  - Non-Ferrous Metal Casting (Class 2141).

ABS publication: 1292.0 - Australian and New Zealand Standard Industrial Classification (ANZSIC), 2006 (Revision 2.0)