



Servicing and Maintenance of New Generation Light Passenger Diesel Vehicles in Australia



Tony Harding

National ISS Institute Overseas Fellowship

Fellowship supported by the Department
of Education, Employment and Workplace
Relations, Australian Government

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Executive Summary

The purpose of this Fellowship was to address skill deficiencies and to advise the Federal Government, the Automotive Industry and automotive training providers on the need to implement training modules into the Automotive Training Package that will address the technical needs of apprentices and technicians in the repair and maintenance of Common Rail Diesel engines.

This report covers the issues raised in the repair and maintenance of Common Rail Diesel as experienced by manufacturers, training providers, repair outlets and technicians in Britain and how those issues can be addressed here in Australia, through the up-skilling of apprentices and technicians. The scope of the report is focused on the identification of the needs to up-skill light vehicle technicians and apprentices, in one of the new technologies that are becoming mainstream in light vehicle propulsion systems.

With more similarities to petrol fuel injection systems than the usual mechanical diesel fuel system, Common Rail Diesel needs a new skills set to deal with extreme injection pressures, multi injection cycles and multiple ancillary emissions systems.

The rapid growth of diesel powered light passenger vehicles in Australia associated with a lack of dedicated training pathways has resulted in a significant skills deficiency. If Australia fails to enhance skills and refine processes and procedures, substantial damage could be caused to power plants and in some cases total destruction of the engine.

This training deficiency is already leading to vehicle dealers sending diesel related problems to 'diesel specialists'. With the Automotive Repair Industry struggling to retain staff and vehicle electronic technologies increasing with every new model release, this new light vehicle technology just adds more pressure to an already struggling repair industry.

During Harding's Fellowship study tour of Britain, the information that was highlighted included the following:

- Common Rail Diesel (CRD) powered vehicles comprise a major proportion of new car sales in Europe.
- Common Rail Diesel (CRD) requires a special set of skills to carry out repairs and maintenance.
- Common Rail Diesel (CRD) has unique problems that require methodical diagnosis for cost effective repairs.
- Fuel contamination is a common problem and can cause thousands of dollars worth of damage.
- Automotive training delivery needs more support from Government and industry to keep up with the rapid change of technology now being fitted to vehicles.

Another area that also needs addressing is customer awareness of how 'high-tech' vehicles have become and that the humble motor car is no longer a purely mechanical vehicle, but a sophisticated multi-computer control device, with anything up to sixty on-board computers. These computers control every aspect of the car from the engine and transmission, through to brakes and steering, and even the glove box light.

Executive Summary

The need for all this computer technology has arisen due to increased safety requirements and a global need to reduce vehicle emissions. Cars have not only increased in technology, but also in weight and power output and with little or no increase in fuel consumption. Even the cheapest car on the market has electric windows, central locking, air bags and anti-locking brakes.

Harding has been involved in the Automotive Repair Industry for the last thirty years and has been actively involved in automotive training for the last seven years. Harding still observes apprentices coming into the trade believing that they will be rebuilding engines, gearboxes and axles, when in reality the job consists of servicing, parts replacement, diagnosis and electrical related problems.

Automotive technology is changing so fast that unless there is active support from the Federal Government, the Automotive Industry and training providers ability to address these skill deficiencies will diminish and the general public will lose confidence in high-tech, low emission vehicles.

Passenger diesel vehicles are gaining popularity in Europe with their ability to deliver drivability and performance equal to their petrol counterparts, but with significantly lower emissions and fuel consumption. It is currently estimated that approximately half of new cars sold in Europe are diesel powered, with diesel sales exceeding 70% of new car sales in some countries.

Significant advances in diesel performance and rising fuel costs has prompted most Australian automotive suppliers to introduce diesel variants into the Australian market. These new generational diesel motors require particular skill sets and resources to service and maintain.

This report urges a unilateral approach by Government, industry and educational bodies to invest in the training of apprentices in these new diesel technologies and to prepare for the introduction of future vehicles powered by petrol alternatives into the Australian market.

Strong market demands in Australia for diesel cars are clearly indicating consumer driven demand for these vehicles. Urgent changes to the training programs of apprentices need to prepare future technicians who may be servicing and maintaining a high proportion of diesel cars in their future roles. Within today's context of environmental and sustainability concerns, it is essential that Australia address this issue and ensure that we become not only proficient, but leaders in this field.

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Abbreviations and Acronyms

AADS	Association of Australasian Diesel Specialists
CRD	Common Rail Diesel
DDE	Digital Diesel Electronics
DEEWR	Department of Education, Employment and Workplace Relations
ISS Institute	International Specialised Skills Institute
RPM	Revolutions per minute
TAFE	Technical and Further Education

Acknowledgments

Tony Harding would like to thank the following individuals and organisations who gave generously of their time and their expertise to assist, advise and guide him throughout the Fellowship program.

Awarding Body - International Specialised Skills Institute (ISS Institute)

We know that Australia's economic future is reliant upon high level skills and knowledge, underpinned by design and innovation.

The International Specialised Skills Institute Inc (ISS Institute) is an independent, national organisation, which has a record of nearly twenty years of working with Australian industry and commerce to gain best-in-the-world skills and experience in traditional and leading-edge technology, design, innovation and management. The Institute has worked extensively with Government and non-Government organisations, firms, industry bodies, professional associations and education and training institutions.

The Patron in Chief is Sir James Gobbo AC, CVO. The ISS Institute Board of Management is Chaired by Noel Waite AO. The Board comprises Franco Fiorentini, John Iacovangelo, Lady Primrose Potter AC and David Wittner.

Through its CEO, Carolynne Bourne AM, the ISS Institute identifies and researches skill deficiencies and then meets the deficiency needs through its *Overseas Skill Acquisition Plan (Fellowship Program)*, its education and training activities, professional development events and consultancy services.

Under the Overseas Skill Acquisition Plan (Fellowship Program) Australians travel overseas or international experts travel to Australia. Participants then pass on what they have learnt through reports, education and training activities such as workshops, conferences, lectures, forums, seminars and events, therein ensuring that for each Fellowship undertaken many benefit.

As an outcome of its work, ISS Institute has gained a deep understanding of the nature and scope of a number of issues. Four clearly defined economic forces have emerged out of our nearly twenty years of research. The drivers have arisen out of research that has been induced rather than deduced and innovative, practical solutions created - it is about thinking and working differently.

A Global Perspective. 'Skills Deficiencies' + 'Skills Shortages'

Skill deficiencies address future needs. Skill shortages replicate the past and are focused on immediate needs.

Skill deficiency is where a demand for labour has not been recognised and where accredited courses are not available through Australian higher education institutions. This demand is met where skills and knowledge are acquired on-the-job, gleaned from published material, or from working and/or study overseas. This is the focus of the work of ISS Institute.

There may be individuals or firms that have these capabilities. However, individuals in the main do not share their capabilities, but rather keep the IP to themselves; and over time they retire and pass way. Firms likewise come and go. If Australia is to create, build and sustain Industries, knowledge/skills/understandings must be accessible trans-generationally through nationally accredited courses and not be reliant on individuals.

Our international competitors have these capabilities as well as the education and training infrastructure to underpin them.

Addressing skill shortages, however, is merely delivering more of what we already know and can do to meet current market demands. Australia needs to address the **dual** challenge – skill deficiencies and skill shortages.

Acknowledgments

Identifying and closing skills deficiencies is vital to long-term economic prospects in order to sustain sectors that are at risk of disappearing, not being developed or leaving our shores to be taken up by our competitors. The only prudent option is to achieve a high skill, high value-added economy in order to build a significant future in the local and international marketplace.

The Trades

The ISS Institute views the trades as the backbone of our economy. Yet, they are often unseen and, in the main, have no direct voice as to issues which are in their domain of expertise. The trades are equal, but different to professions.

The ISS Institute has the way forward through its 'Master Artisan Framework for Excellence. A New Model for Skilling the Trades', December 2004. The Federal Government, DEEWR commissioned ISS Institute to write an Australian Master Artisan School, Feasibility Plan.

In 2006, ISS Institute Inc. set up a new ISS advisory body, the **Trades Advisory Council**. Members are Ivan Deveson AO; Martin Ferguson AM, MP, Federal Labor Member for Batman; Geoff Masters, CEO, Australian Council of Educational Research; Simon McKeon, Executive Chairman, Macquarie Bank, Melbourne Office; Richard Pratt, Chairman, Visy Industries and Julius Roe, National President Australian Manufacturing Workers' Union.

Think and Work in an Holistic Approach along the Supply Chain - Collaboration and Communication

Our experience has shown that most perceive that lack of skills is the principal factor related to quality and productivity. We believe that attitudes are often the constraint to turning ideas into product and a successful business; the ability to think laterally, to work and communicate across disciplines and industry sectors, to be able to take risks and think outside the familiar, to share – to turn competitors into partners.

Australia needs to change to thinking and working holistically along the entire Supply Chain; to collaborate and communicate across industries and occupations - designers with master artisans, trades men and women, Government agencies, manufacturers, engineers, farmers, retailers, suppliers to name a few in the Chain.

'Design' has to be seen as more than 'Art' discipline – it is a fundamental economic and business tool for the 21st Century

Design is crucial to the economic future of our nation. Australia needs to understand and learn the value of design, the benefits of good design and for it to become part of everyday language, decision making and choice.

Design is as important to the child exploring the possibilities of the world, as it is to the architect developing new concepts, and as it is to the electrician placing power points or the furniture designer working with a cabinet-maker and manufacturer. As such, design is vested in every member of our community and touches every aspect of our lives.

Our holistic approach takes us to working across occupations and industry sectors and building bridges along the way. The result has been highly effective in the creation of new business, the development of existing business and the return of lost skills and knowledge to our workforce, thus creating jobs - whereby individuals gain; industry and business gain; the Australian community gains economically, educationally and culturally.

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Fellowship Supporter

This Fellowship has been supported by the Department of Education, Employment and Workplace Relations (DEEWR), Australian Government.

The Australian Government's Department of Education, Employment and Workplace Relations (DEEWR) implements Government policies and programs to provide education and training opportunities for all Australians, to increase employment participation and to ensure fair and productive workplaces. Education, training and workforce participation are central to our goal of building a productive and socially inclusive nation, one which values diversity and provides opportunities for all Australians to build rewarding social and economic lives.

Tony Harding would like to thank DEEWR for funding and supporting this Fellowship, and the initial support given to the ISS Institute to help them enhance the skills and knowledge and to inspire our nation's talented artisans and tradespeople through the Overseas Skills Acquisition Plan.

Employer Support

Tony Harding would like to thank Charles Darwin University, Northern Territory, for their encouragement and support.

Supporters

Tony Harding would like to thank the following supporters.

Association of Australasian Diesel Specialist (AADS)

Donald Blanksby, then Executive Officer, for support and contacts.

BMW Australia

James Harper, Training and Development Manager and Phil Austin, Apprentice Program Manager, for the opportunity to attend the BMW factory training and the connections with BMW Germany.

Charles Darwin University

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Delphi, England

Claire Green, Export Sales Manager, Delphi Diesel Aftermarket, for her support and network contacts and allowing Harding to attend the diesel training courses.

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Kingston University, England

Denis Marchant, Principal Lecturer, Faculty of Engineering, for his knowledge, support and help in setting up the visit to the university.

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Nic Green, Program Coordinator, Automotive Section, in helping set up a placement with the college.

Iain Hatt, Automotive Section Head, for allowing Harding the freedom to meet staff and learn from them.

Individuals and Organisations Involved in the Fellowship Application

BMW Australia

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Peter Kittle Motor Company

Geoff Bates, General Manger, for his letter of support.

Transport, Engineering and Automotive Training Advisory Council (NT) Inc

Barry Cramond, Chief Executive Officer, for his letter of support.

Association of Australasian Diesel Specialists

AADS is an association of fuel injection and turbocharger specialists here in Australia as well as New Zealand, Fiji and Papua New Guinea. The association is for people connected with all facets of the diesel industry, from repairers to suppliers, manufacturers and educational institutions. Website: www.aads.com.au

Acknowledgments

Australian Organisations Impacted by the Fellowship

Government

- Employment and Workplace Relations Services for Australians
<http://www.workplace.gov.au/>
- Department of Education, Employment and Workplace Relations
<http://www.deewr.gov.au/>
- Australian Apprenticeships
<http://www.australianapprenticeships.gov.au/default.asp>
- Group Training Australia
<http://www.gtald.com.au/>
- Environment Protection and Heritage Council
http://www.ephc.gov.au/nepms/diesel/diesel_intro.html

Local Automotive Manufacturing Companies

- Ford Motor Company of Australia Limited
- General Motors Holden Limited
- Toyota Motor Corporation Australia Limited
- Mitsubishi Motors Australia Limited

Automotive Parts Manufacturers

- Over two hundred specialist automotive component firms – the Federation of Automotive Products Manufacturers: <http://www.fapm.com.au/site.php?id=112>

Automotive Parts Suppliers

- Both Original Equipment and Aftermarket Equipment suppliers
<http://www.fapm.com.au/site.php?id=115>

Automotive Service, Repair and Related Industries

- Motor Trades Association of Australia – over one hundred thousand traders
<http://www.mtaa.com.au/documents/MotorFacts2006.pdf>

Education

- Technical and Further Education institutions (TAFE)
- Automotive Training Australia
- Australian Technical Colleges
- Registered Training Organisations
- National Training Information Service and Training Support Network

Acknowledgments

Associations

- Association of Australasian Diesel Specialists
- Australian Automotive Aftermarket Association
- Automotive Training Board NSW
- Automotive Training Australia WA
- Automotive Training Victoria
- Federal Chamber of Automotive Industries
- Federation of Automotive Products Manufacturers
- Manufacturing Industry Skills Advisory Council
- Motor Trades Association of Australia
- Society of Automotive Engineers
- Transport, Engineering, Automotive Training Advisory Council NT
- Victorian Automotive Chamber of Commerce

Petroleum Industry

- BP Australia
- BHP Billiton Petroleum
- Caltex Australia Pty Limited
- Mobil Oil Australia Limited
- Shell Company of Australia
- Woodside Petroleum Limited

Car Clubs

- 225 cars clubs in Australia
<http://www.autopages.com.au/ap.php?u=ap-sql&svalue=%&state=%&category=club&limit=0,20&onpage=1>

About the Fellow

Name: Tony Harding

Current Position: Automotive Lecturer

Qualifications

- City and Guilds (England 1981)
- BSZ 40198 Certificate IV, Workplace Training and Assessment (Charles Darwin University 2006)
- MEM20198 Certificate II, Engineering Production (Charles Darwin University 2006)

Awards

- BMW Master Technician, 1991
- ISS Institute Fellowship, 2006

Memberships

- Association of Australasian Diesel Specialists
- Toastmaster Alice Springs

Career

Tony Harding is an automotive lecturer with thirty years industry experience working in numerous franchised and non-franchised automotive workshops both in England and Australia. He has experience with Ford, General Motors, Toyota and BMW, reaching the position of Master Technician with BMW Australia.

Harding has been working within the training profession for the last six years and has delivered automotive training and assessment to apprentices and trainees both on-campus and in remote locations throughout the Northern Territory.

A summary of Harding's thirty year career in the automotive trade and other industries is listed as follows.

- Apprenticeship, Ford Main Dealer, Torbay, England
 - Commenced apprenticeship September 1977
 - Automotive Apprentice of the Year at South Devon Technical College
 - Team member of inter-college automotive quiz competition
- Technician, Ford Main Dealer, Torbay England
 - Attended Ford technical training courses
 - Carried out a wide variety of technical tasks
- Workshop Leading Hand in the family garage, Kingskerswell, England
 - Wide variety of mechanical tasks plus paint and panel repairs
- Technician and Customer Service Adviser, General Motors Main Dealer, Torbay, England
 - Started as a technician on the 'shop floor', carried out a wide variety of technical tasks
 - Attended General Motors technical training courses
 - Promoted to Customer Service Adviser, dealing with customers and General Motors on a variety of technical issues

About the Fellow

- Technician, BMW Main Dealer, Torbay, England
 - Carried out a wide variety of technical tasks
 - Attended BMW technical training courses
 - Developed a greater understanding of electrical controlled components
- Technician and Workshop Controller, BMW Main Dealer, Parramatta (Migrated to Australia 1990)
 - Carried out a wide variety of technical tasks
 - Attended BMW technical training courses
 - Became a BMW Master Technician 1991
 - Promoted to Workshop Controller – 12 Technicians and Apprentices
- Customer Service Adviser, BMW Main Dealer, Gordon, Sydney
 - Customer Service Adviser, dealing with customers and BMW on a variety of technical issues and planning workshop loading
 - Attended BMW technical training courses
- Workshop Controller, BMW Dealer, Artarmon, Sydney
 - Managed workshop productivity – 18 Technicians and Apprentices
 - Customer liaison
 - Quality control of workshop output
 - Training requirements for Technicians and Apprentices
 - Delivered in-house training
 - Liaised with inter-departmental staff and BMW technical department
 - Attended BMW technical training courses
- Department of Employment, Education and Training (DEET), Training Officer in welding and fabrication, Laramba Aboriginal Community, NT
 - Lifestyle change from city to a remote Aboriginal community
 - Taught welding and fabrication to meet the needs of the community
 - Projects included beds, grandstand, tables, locks and hinges
- Maintenance Officer at Urapuntja Health Service, Utopia, NT
 - Maintained six vehicles and infrastructure, for the delivery of primary health care to 1000 Aboriginals living a semi-traditional life, living in 20 outstations spread over 5000 square kms of homeland
- Health Administrator for Urapuntja Health Service, Utopia, NT
 - Stepped into this position during staff changeovers, eventually taking on the position in 1999, managing a \$1million budget
- Health Administrator for Ltyentye Apurte Community, NT
 - Undertook this position as the health service was having financial and staffing issues
 - Carried out recruitment for new staff including new position for the General Practitioner
 - Bought excess spending under control
 - Cleared outstanding debts
- Automotive Training Coordinator/Technical Studies Officer and Records Officer for the Centre for Appropriate Technology, Alice Springs.
 - Technical training delivery to Aboriginal people, both in-house and remote locations in the Northern Territory.

About the Fellow

- Automotive Lecturer, Charles Darwin University, Alice Springs
 - Technical training delivery to Aboriginal people, apprentices and school children, both in-house and remote locations throughout the Northern Territory
 - Attended in-house training programs
 - Attended training at BMW Australia
 - Attended training at Delphi, England

Aims of the Fellowship Program

The purpose of the Fellowship was to complete an overseas study program to gain a comprehensive understanding of the training, technology, and market forces behind light diesel passenger vehicles in the United Kingdom.

Specific Fellowship aims included:

- Summarising present light vehicle automotive skills deficiencies in Australia, relating to the service, maintenance and repair of Common Rail Diesel, as fitted to light vehicle passenger vehicles.
- Investigating and documenting how up-skilling is implemented in the United Kingdom.
- Acquiring information on best practice training delivery methods as used by a technical college, university and industry.
- Developing and maintaining networks with international training providers.
- Working in overcoming the current deficiencies in knowledge and skills of Common Rail Diesels.
- Developing training material to assist in the passing on of knowledge.

The Australian Context

Diesel engines have truly 'come of age' in the last ten years and are now on par with their petrol counterparts.

Brief History of Diesel Development

- **1892** The diesel engine was named after German engineer Rudolf Diesel.
- **1927** The volume pump appears and enables higher engine speeds than before.
- **1962** New design of the injection pump appears, giving the engine additional control and power.
- **1983** Bosch electronic controlled diesel engine DDE.
- **1997** First generation Common Rail Diesel (CRD) appears on passenger cars.
- **2001** Second generation CRD appears with increased fuel pressure to make the diesel engine even more economical with less emissions, quieter and more powerful.
- **2003** Third generation appears with another increase in performance and economy.
- **2007** Fourth generation system with pressures up to 2,500 bar pressure.

Diesel engines have proved massively popular in the European Union, with the 2006 market share of new passenger diesel cars sales being 51.2%, with Luxemburg's market share a staggering 77.4%, Belgium 74.5% and the UK 38.3%. Compare this to Australia's 2006 passenger diesel sales of 14,845 units and a market share of 4.6% – not a large percentage, but two years before, this was only 0.3% and 1,885 units. If this growth continues in a similar pattern to Europe, Australia's diesel passenger share could be 50% of national sales within the next 15 years.¹

Diesel is now an integral part of the European passenger car market, with the commercial market at over 95% diesel.¹ European consumers have had a longer exposure to diesel powered vehicles and therefore, a greater acceptance to new advancements in engine technology, hence the high level of vehicle sales. With the introduction of these new technologies and revised fuel the Australian Automotive Industry has launched many new European models, with diesel as a power plant. Australian consumers familiar with petrol cars are now considering diesel passenger vehicles because of the significant improvements in their refinement and driveability.

Light vehicle diesels have been a limited part of Australia's industry for the last 70 years, with Mercedes Benz releasing the first diesel passenger car back in 1936, Volkswagen launching their first Golf diesel model in 1976 and Holden launching the Isuzu sourced Holden Gemini TE diesel in 1981. Even with minimal volume of new vehicle diesels coming onto Australian roads, skills deficiencies are already starting to become evident, with problem vehicles being sent to diesel specialists from main dealers for repair. This is mainly due to technicians lacking training, experience and/or test equipment.

The Australian Context

With the introduction of the latest European light vehicle diesels onto the Australian car market, generic light diesel training is fast becoming a necessity as consumers appreciate their greatly improved drivability, efficiency and general refinement.

A comparison of petrol to diesel, from the perspective of the consumer:

- Due to high fuel prices consumers are looking for better fuel consumption
 - Compared to similar kW output petrol engines, CRD will give around a 20% saving on fuel consumption.
- Driveability/performance, 'pulling power', 'that acceleration feeling'
 - To get the similar torque output of a 2.0 litre CRD engine it would have to be a petrol equivalent of 3.6 litre petrol engine.
 - For similar kW output the equivalent is a 2.5 litre petrol engine.
- Servicing intervals are now up to 30,000km on some CRDs, compared to the older diesels being every 5,000 km.
- Noise levels are similar to petrol engines.
- New models have instant start up from cold. Gone are the days of waiting for the heater plugs to warm up.
- Exhaust emissions are no longer big clouds of black smoke. With better fuel burning characteristics and the use of exhaust filters, the exhaust is clear and almost odourless.

Diesel engines are now complex pieces of engineering, having developed well beyond those associated with Australia's rail networks. Complex systems work together to provide optimum performance and economy. Low emissions are ensured through turbochargers, exhaust particle filters and exhaust gas recirculation systems.

The turbocharger has undergone dramatic change and is now able to provide boost pressure at low engine RPM almost eliminating 'turbo lag' ('turbo lag' is the delay between the instant a car's accelerator is depressed and the time the turbocharged engine develops power). The exhaust particle filter removes all soot particles from the exhaust gases, holding onto them until the filter is full and then burning them off. The exhaust gas recirculation system helps reduce the release of oxides of nitrogen, a toxic and greenhouse gas, by allowing cooled exhaust gases back into the engine and cooling the combustion process.

The CRD is a very complicated engine system, with many systems dependent on each other to provide the performance, economy and low emissions required of today's engines. The repair and maintenance of light vehicle diesels has over the years either been carried out by 'factory trained' technicians, or by specialised diesel repair shops. As the number of diesels increase, a comparable increase will occur in the need for 'front line' workshops to maintain and repair these engines. So comes the need for highly skilled technicians that are not only able to service them, but able to diagnose both mechanical and electronic problems quickly and efficiently.

The Australian Context

A significant issue for the Australian industry is that there are currently no training pathways devoted to providing qualifications in light vehicle diesel servicing and maintenance within the nationally endorsed Automotive Training Package.

Although there has never been a specific pathway for light vehicle diesel training, the Training Package does include elective modules that can be used (and are used) within heavy diesel training pathways that are already established. The majority of training still comes from individual TAFE colleges and universities and, therein, there may not be transferability from state-to-state and variability of the standard of the course content.

At this point in time the relevant diesel modules are mainly taught as electives as part of the heavy vehicle stream of the auto apprenticeship program. The Australian automotive and training industries must prepare apprentices for the predicted ongoing development and increasing number of diesel cars which require particular skill sets.

A SWOT (strengths, weaknesses, opportunities and threats) analysis provides a useful avenue for summarising the current situation and the implications of addressing, or not addressing, the need for ongoing skills associated with light vehicle diesel passenger vehicles and ongoing training.

SWOT of Light Vehicle Diesel Passenger Vehicles

Strengths	Weaknesses
<ul style="list-style-type: none"> • Lower fuel consumption compared to equivalent sized petrol engine • Higher engine torque output compared to equivalent sized petrol engine • More environmentally friendly – reduced exhaust pollutants 	<ul style="list-style-type: none"> • Oxides of nitrogen an exhaust emission and a pollutant • Higher repair costs • Up-skilling required for light vehicle automotive industry • Service/repair centres uncommon
Opportunities	Threats
<ul style="list-style-type: none"> • Use of bio-diesel • New automotive training pathways 	<ul style="list-style-type: none"> • Petroleum based fuel supplies • Non-acceptance of diesel by the general public

The Australian Context

SWOT of Light Vehicle Diesel Training

Strengths	Weaknesses
<ul style="list-style-type: none"> • Opportunity to investigate alternative training delivery methods • Up-skilling lecturers with the latest passenger vehicle technology • Demonstrating to industry that training providers are pro-active and are foreseeing technology changes 	<ul style="list-style-type: none"> • Not up-skilling apprentices/ technicians before diesel market gets too large • Ignoring technological advances in automotive and not training to meet those needs • Not having enough trained training providers
Opportunities	Threats
<ul style="list-style-type: none"> • Learning from overseas training providers about what worked and what didn't work • A chance to be 'ahead of the game' and meet the needs of a new generation of passenger powered vehicles. • To implement a higher education stream into the diesel repair industry 	<ul style="list-style-type: none"> • Non-acceptance of diesel by the general public • Downturn in vehicle sales in general • Funding reduced to training organisations • Support, training and resources not given by industry • Shortage of skilled apprentices/ technicians

Identifying the Skills Gaps

Shortages in Diesel Servicing Skills

Australia's Automotive Industry, like most trades, is struggling to attract and retain skilled workers. This is particularly evident in rural and remote areas where businesses are forced to provide increased incentives and in many cases improvise with short term or contract staff.

The rapid adoption of electronics and computers in the design, running and diagnosis of modern vehicles has already seen a shift towards new skill sets in this area. The traditional mechanic is being replaced by service technicians who use computer technology to diagnose issues with modern vehicles.

A limited pool of diesel-savvy technicians exist in Australia, but with a predicted increase in diesel cars, current apprentices must be taught about diesel technologies to meet current and future market demands.

This report addresses skill deficiencies and skill shortages. As already established, based on ISS Institute's research in 1990, an important category emerged, that of **skill deficiency**. 'Skill deficiency' is where a demand for labour has not been recognised and training is unavailable in nationally accredited higher Australian education institutions. These are only filled where skills are acquired on-the-job, gleaned from published material or from working and/or study overseas.

There may be individuals or individual firms that have these capabilities. However, individuals in the main do not share their capabilities, but rather keep the IP to themselves; and over time they retire and pass way; firms likewise come and go. If Australia is to create, build and sustain 'Industries', knowledge/skills/understandings must be accessible across the generations through nationally accredited courses and not reliant on individuals.

Source: Sustainable Policies for a Dynamic Future. Policy Statement, ISS Institute 2007

Skill shortages exist when employers are unable to fill or have considerable difficulty filling vacancies for an occupation, or significant specialised skill needs within that occupation, at current levels of remuneration and conditions of employment, and in reasonably accessible locations.

Source: see 'Attachment 1' or go to:

http://www.workplace.gov.au/NR/rdonlyres/FFefd237-B1A5-4592-B3B6-814183C83B5D/0/Skillsindemand_MethodologyPaper07.pdf

Skills and Knowledge Gaps

A survey of employers who had recently advertised for motor mechanics was undertaken for this report. Less than half (46 per cent) of the advertised vacancies were filled within 4 weeks of advertising. About one third of surveyed vacancies were for diesel mechanics, and the fill rate for these positions (32 per cent) was lower than for other vacancies.

Almost 60 per cent of applicants were considered by employers to be suitable for their vacancies. Applicants who were considered unsuitable were either unqualified, or were tradespeople who lacked recent relevant experience or

Identifying the Skills Gaps

particular specialist skills. A number of employers had vacancies which remained unfilled despite receiving applications from suitably qualified mechanics. In most cases these vacancies were unfilled because applicants were unwilling to work for the offered wages or in a particular location.

Source: see 'Attachment 2' or go to:

<http://www.workplace.gov.au/NR/rdonlyres/B671F26A-1116-48ED-ACC7-161135CD3F90/0/421111AUSMotorMechanicchkd1.pdf>

Tasks performed in the workshop within the Automotive Service and Repair Industry have changed dramatically over the last decade. With the introduction of micro-processors into just about every aspect of the vehicle's operation, they have moved away from the mechanical servicing, repairing and overhauling, and more into electronic diagnostics and parts replacement.

This new era in motor vehicle technology and the skills required to look after the modern vehicle has led to the creation of numerous pathways that a motor vehicle technician can choose from. Positions such as Exhaust Fitter, Cooling Systems Fitter, through to specialists in Transmissions and Engine Reconditioning exist.

These are specialised fields of their own and transferring from one area to another requires up-skilling. One of the new field that has been growing over the last five years is the Common Rail Diesel (CRD) engine, which is being fitted to passenger vehicles. The first example of a passenger vehicle fitted with this of type of fuel injection system was the Alfa Romeo 156, back in 1997.

In Australia, due to the non-availability of low-sulphur diesel fuel, Common Rail Diesel was uncommon before 2002. With this late entry into the Australian automotive arena, the CRD is starting to gain acceptance as a viable alternative to its petrol powered cousin.

With this growth in acceptance, the need for skilled technicians to service and repair CRD is a growing one. As most light vehicle technicians are brought up on petrol powered vehicles, the CRD diesel still has a 'fear of the unknown' about it. This knowledge void needs to be up-skilled now, before the general public lose faith in this next generation of power trains which includes cars.

A similar issue arose when electronic petrol injection systems became a standard fitment. The older technician's tried to avoid working on them whenever possible, mainly due to the fear of not being able to see what was going on inside the system.

The International Experience

Within the context of the aims of the Fellowship, Harding was motivated to learn how the UK's education and automotive industries adapted to the significant technological advances in diesel technology.

Site Visits

The most valuable site visits were at the following institutions.

South Devon College Paignton

One of the most modern colleges in England and having praise given to it by the Inspector from the Office for Standards in Education (Ofsted), for its excellent facilities and resources to support automotive courses. The high success rate of students from most of the automotive courses especially impressed.

Delphi Diesel Warwick, United Kingdom

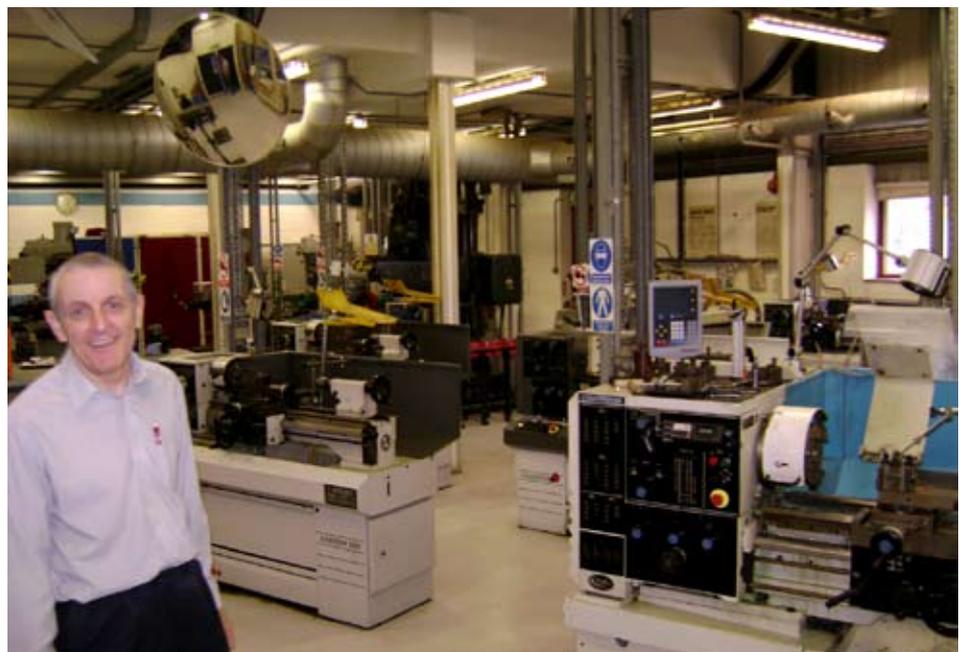
One of the world's leading diesel suppliers, who provide a comprehensive range of diesel repair parts, test equipment and diagnostic tools to service on and off highway, marine, construction, agriculture, and industrial applications, with 3000 service centres worldwide.

Contact: Tim Roberts AMIRTE MSOE, Senior Technical Instructor

Kingston University Kingston-upon-Thames, London, England

Kingston University's School of Engineering is an acknowledged leader in its field, its foundation Degree courses are well established and recognised for excellence by the UK Government. The foundation Degree was created in conjunction with Delphi, to meet the market need to produce highly qualified Diesel Technicians.

Contact: Denis Marchant, Principle Lecturer, Faculty of Engineering



Denis Marchant, Principle Lecturer, Faculty of Engineering, Kingston University

The International Experience

South Devon College

Providers of further and higher education courses for South Devon.

Contacts: Nic Green, Program Coordinator; Iain Hatt, Automotive Section Head and Andy Hobbs, Assessor

Electro-Diesel Ltd

Auto-electrical and diesel repair centre, with three outlets throughout the South West of England.

Contact: Bosch Diesel Centre, Exeter, Devon, England

Chelston Electrical Torquay, England

Diesel and Electrical Workshop

CJ Diesel Isleworth, Middlesex, England

Exporters of used diesel test equipment and diesel engine repairer.

Contact: John Lucas, Manager

RLH Services Leamington Spa, England

Maintenance and repair of motor vehicles.

GRW Autos Leamington Spa, England

Maintenance and repair of motor vehicles.

Contact: Garry Ward

Leam Auto Leamington Spa, England

Maintenance and repair of motor vehicles.

Ocean BMW Paignton, Devon, England

BMW Main Dealer for the South Devon region.

Contacts: Nigel Staddon, BMW Master Technician and Graham Hunt, After Sales Manager

Newton Abbot Vauxhall Newton Abbot, Devon, England

Vauxhall Main Dealer

Contact: Jim Bailey, After Sales Manager

Gliddon Ford Churston Ferrers, Brixham, Devon, England

Service and Sales for Ford Motor Company

Contact: Gerry Norsworthy, After Sales Manager

Trident Technology and Business College

One of the most modern and well equipped technology centres in the central region of England

Snap-On Tools

Suppliers of tools and equipment to the automotive trade.

The International Experience

Findings

Before proceeding with the findings of the study tour, it needs to be noted that with regard to many site visits, use of a camera was prohibited.

Diesel Training

Generally speaking, the UK Automotive Industry shares similar concerns to its Australian counterparts.

These include:

- The calibre and skills of vocational and university graduates are generally not meeting the needs of industry.
- A rapid movement towards electronic diagnostic skills is not being followed by many non-industry training centres that are still emphasising mechanical skill sets.
- Internal training by vehicle manufacturers is considered high quality, however like most industries they are struggling to find and retain quality staff.
- A large number of mechanics are reluctant to up-skill to the electronic and computer based skill sets and choosing to focus on the maintenance and servicing of older cars.

The knowledge and ideas gained from this Fellowship have equipped Harding with the skills to advise the Australian automotive and training industries on possible training pathways to meet the upcoming diesel revolution in light passenger vehicles in Australia.

- The general public in the UK has taken on board the diesel powered passenger vehicles and it is now accepted as a mainstream automotive product. Customers have shown concern at the cost of repairs especially after fuel contamination. It can require the repair or replacement of the whole fuel injection system and can run into many thousands of dollars worth of repair costs. These are sometimes covered by insurance claims.
- The motor vehicle repair industry/main dealers are having problems recruiting and re-training qualified staff which is leading to vehicles spending extended periods in the workshops waiting for repairs.
- The main areas of weaknesses with the modern diesel are:
 - Fuel contamination by petrol.
 - Incorrect lubricants used in the engine, causing premature engine wear.
 - Early failure of turbo due to incorrect use of lubricants and driving technique.
 - Air mass meter contamination causing poor engine running.
 - Exhaust gas recirculation system contaminated with exhaust particulate matter causing the engine to run poorly.
- Diesel training still not being included as part of a mainstream course of the UK Automotive Training Package.
- Change in attitude towards training styles moving from 'Victorian style' classroom teaching to a more engaging, self paced and interactive learning approach. But with this approach, interactive training resources come at a very high price.

The International Experience

- South Devon College example uses one of the Degem electronic Training Packages that was put in for a cost of 250,000 pounds (\$600,000). This was only able to be done with a funding grant from the European Union (www.degem.com).
- Trident college in Warwickshire has a good rapport with industry which now provides 60% of funding via vehicles, equipment, etc.
- Kingston University has a unique partnership with Delphi Diesel in having developed a tertiary course in diesel technology. They also work closely with Delphi in the development stages of new equipment and new technology.
- Industry training both by the diesel equipment manufacturers and vehicle manufacturers appears to be very supportive.

Use of Technology

Trade

Automotive main dealers utilise latest equipment supplied by vehicle manufacturers and they appeared to be very well resourced. This includes a modern intranet/internet system for vehicle diagnosis which includes the ability for manufacturers to access raw data of a vehicle with issues that can't be solved on a local level.

Non Franchised Dealers and Retail Workshops

Most had aftermarket testing equipment but generally avoided investing in high-end equipment, preferring to focus on low technical maintenance and basic servicing of vehicles. Many outsourced more complex repairs to local dealers or specialist repairers.

Component Manufacturers

Component manufacture Delphi Diesels was well resourced with staff having access to latest training equipment and support from their own technical centres based at Warwick, England and elsewhere overseas.

Education Centres

There was a large variance in the resources of training centres. Those close to manufacturing centres such as Trident College in Warwick were well resourced due to their close proximity to an automotive manufacturing centre.

Australian vocational education centres appear to have greater access to physical resources that have been donated by automotive manufacturing centres.

Education

Dealerships

Training is increasingly recognised as a core requirement to retain quality staff in dealerships. Master technicians are given responsibilities to share their knowledge with other staff and are given official recognition of their skills.

Vocational Training

'Hands on' training was a clear priority at UK colleges with strong literacy and numeracy support given in conjunction with the delivery of the local Automotive Training Package.

The International Experience

South Devon Training College

A culture of high expectations exists at South Devon Vocational Training College which extended to the attitude, expectations, presentation and engagement of students and staff. An example included the students being asked to be clean and presentable at all times – as if they were working for a dealership. Access to classrooms and workshops was not allowed outside teaching hours.

Online learning is equally important, with South Devon College using the MOODLE software package allowing students to report absenteeism using mobile phones and the internet. Online testing and resources assisted students further.

Teacher to student ratios were approximately one lecturer to around 15 students, with technicians available to lend further support. Thus the college provides students with almost immediate technical knowledge and support. The workshop teaching areas are set up by the technicians prior to the commencement of each class.

Overall they offer an efficient, structured and measured learning approach. A typical team structure included a Team Manager, Program Coordinators, Lecturers, Assessors and support staff. South Devon College offered about 26 automotive staff to support 280 students annually.



South Devon Technical College auto workshop/classroom



South Devon Technical College vehicle electronics workshop/classroom. Lecturer Nic Green (left) and Iain Hatt, Head of Section Automotive (right).

Trident College

This college enjoyed stronger industry support from local manufacturers and equipment providers across the UK. They indicated around 60% of funding was acquired from these sources. The college as a whole was proactive in offering advertising space and promotion to industry partners willing to support the college.

Their community engagement included offering a dyno testing facility (power output testing) to local automotive businesses to assist in the diagnosis and setting up of engines.

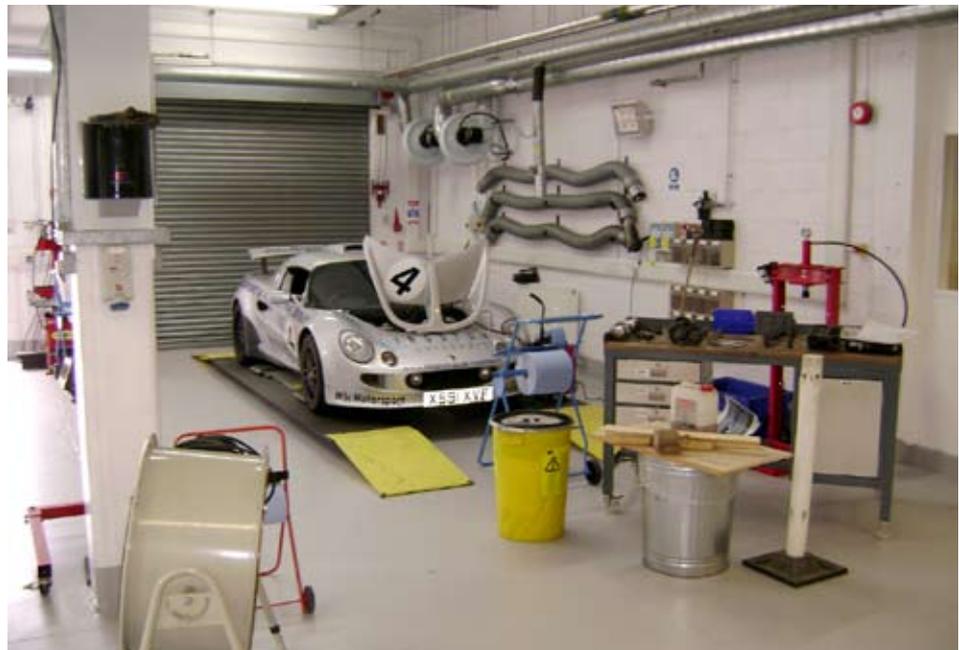
Kingston University

This tertiary institution leads the UK in diesel specific course work offering automotive engineering degrees with a focus on latest engine technologies. It also franchises units to other universities in the world. No Australian institution is involved with this program.

The International Experience

The university enjoys close partnerships with Delphi Diesel and both parties work together on research and development of next generation diesel injection systems.

Their degree initially covers basics in automotive engineering then specialising in new diesel technologies. Students are exposed to a mix of academic study, work experience and technology training and well performing students are offered an honours year. Further information about the automotive engineering degree (diesel technology) is available at www.kingston.ac.uk/autofd.



Kingston University Faculty of Engineering workshop

Environment

Harding found a significant drop in air pollution since his last visits to London and it was noted that this was directly attributed to improved emissions from all vehicles, especially diesels. London's double-decker buses for example are now emitting almost odourless exhaust gases from their exhausts, not clouds of black soot.

Highly engineered diesel motors must run on clean fuels, which are not tainted at any stage of the refinement and supply process. Due to the minute tolerances within the main fuel pressure pump, typically four microns can see engines destroyed through any contaminants entering the fuel system. This need extends to having an ultra clean servicing and repair methodology and environment within the workshop.

European Union directives, as laid down in the EURO exhaust emission laws, have seen a massive drop in harmful exhaust emissions of noxious gasses and particulate matter; however this all depends on the use of correct lubricants, quality fuels and correct servicing and repair schedules.

The International Experience



Instant fuel consumption figure which is equal to 5 litres per 100kms at 110km/h Vauxhall Vectra 1900cc Common Rail Diesel

The reduction in exhaust emissions has been attained through the use of multi stage fuel injections at high pressure, exhaust filters and other technologies.

In regard to sustainability and environmental matters, it is recommended that this report be read in conjunction with Nova McNamara's report which will be published in early 2009.²

A Cautionary Note: Occupational Health and Safety (OHS)

A core concern of the industry believes OHS matters need to be understood and that the general public be made aware of the significant harm that can arise out of a non-trained person 'tinkering' on their diesel motors.

For example, a new generation diesel motor fuel supply systems run at extreme pressures, around 30,000 psi (2000 bar). This pressure is equal to the weight of a large family sedan pushing down on an area the size of a thumbnail. At this pressure a stream of diesel fuel would cut through a human hand and degradation of human flesh by diesel is life threatening.

² In 2008, Nova McNamara, Recycling Engineer, Ford Australia Ltd was awarded 'The Pratt Foundation/ISS Institute Fellowship' sponsored by The Pratt Foundation to travel to Germany and the UK in skill deficiencies related to • Vehicle recycling • Design and recyclability requirements, substance use restrictions and parts marking conformance for end of life recycling and environmental measures • Understanding the impending CO₂ legislation and the strategies to reduce fleet CO₂ • EU legislations requirements and processes.

The International Experience

Marketability of Diesel Cars

Diesel car technology is finally delivering cars which are as responsive, lively, and powerful as their petrol counterparts, whilst offering lower exhaust emission and using significantly less fuel.

Each automotive category including economy, performance and luxury are now catered for with diesel motors and nearly half of all new car sales in Europe are diesel.¹

Rising fuel costs, registration incentives for low emission cars and refinement of these cars are convincing more UK customers to purchase them.



Vauxhall Vectra 1900cc Common Rail Diesel – under the bonnet (cover removed)

Auto Industry Careers and Employment Issues

- Recruiting and retaining quality staff is an ongoing challenge in the UK. The general public still consider automotive technicians as ‘grubby’ mechanics working in oil stained workshops.
- The reality of this career is very different with a strong focus on computer and electronic skills and methodical, exact approaches to car maintenance, repairs and servicing.
- Automotive technicians are offered diverse working environments with ongoing training and opportunities to specialise in technical or management areas.
- Diesel technicians are in high demand across all areas of the automotive industry from light vehicles through to trucks and heavy vehicle equipment. There is a clear demand for more ‘diesel savvy’ technicians as the market for these cars increases.

The International Experience

- UK colleagues, training centres and the industry in general are still reacting to skills needs rather than proactively targeting youth with a range of marketing programs and including diesel training as core components.

Culture

- New car diesel owners are educated about the unique traits of diesel motors, usually prefer to have their cars serviced at automotive dealerships and are prepared to pay premium costs for 'peace of mind'.
- They also expect a fast turnaround of their vehicles at a dealership that operates a quality customer service culture.
- Second and third owners are generally less discerning about servicing options, however, the engineering of these new diesel motors still requires sterile workshops and quality lubricants.
- The fine tolerances of these motors makes them more susceptible to damage through incorrect servicing, lubricants and filters.

Knowledge Transfer

As identified in the Fellowship aims and objectives, Harding believes that it is essential that knowledge transfer occur regarding Fellowship findings. The knowledge acquired as a result of the overseas Fellowship study contributes to addressing the skill gaps and broader contextual issues that surround it. Key knowledge transfer activities included the following.

Communication Activities

- Interviews with ABC Rural Radio, which have been broadcast around Australia.
- Television interview with Imparja, which was broadcast through Queensland, the Northern Territory, outback New South Wales and South Australia.
- Interviews with Centralian Advocate. This story was also picked up by the Sydney Morning Herald.
- Two speeches have been given to Alice Springs Rotary Club.
- Interviews and updates on the Charles Darwin University website.

Capacity-Building Activities

- The Fellowship findings are now included in delivery of training to Apprentices as part of servicing and repairing diesel fuel systems at Charles Darwin University.
- Fellow work colleagues have been provided with information sessions.

Extension and Education Activities

- Information included in delivery to apprentices as part of servicing and repairing diesel fuel systems at Charles Darwin University.

Knowledge Production

Academic Publication Activities

- Training module for 'Learnline', a Charles Darwin University web-based information podcast.
- To produce training resource material/workbook to be made available to all training institutions (future).

Knowledge Engagement

- Participation in non-academic community and economic activities.
- Two speeches have been given to a Rotary Club.

Proposed Further Activities

University-organised events for community and regional economic and social benefit (workshops, seminars etc.) such as:

- Deliver a seminar at Charles Darwin University, Alice Springs.
- Training sessions for local automotive repair shops.
- Deliver a seminar for BMW Australia.
- Deliver a seminar for the Association of Australasian Diesel Specialists.
- Contribute to University facilities available for non-academic purposes (for example libraries, cultural centres, sportsgrounds).

Knowledge Transfer

Other activities as identified by ISS Institute including discussing Harding's findings with Manufacturing Skills Australia (MSA) in regard to the Automotive Training Package and Transport, Engineering and Automotive Training Advisory Council (NT) Inc through Barry Cramond, Executive Officer.

Recommendations

Training

- Technology is changing faster than training institutions can adapt, both in keeping staff up-skilled and relevant resources.
- Learning styles have changed to a more interactive, self-paced learning, requiring more creative teaching styles to be used. Again this requires up-skilling of staff.
- The current Automotive Training Package is too inflexible, being very much compartmentalised in its layout. A more holistic style of training is needed to develop fundamental skills sets that can be more easily transferred from task to task. This is particularly relevant due to the many variables between manufacturers' vehicle models and production years. Holistic skills help technicians prepare for the variance in diesel maintenance and servicing, as what is correct for one vehicle is not necessarily correct for another.
- Relevant numeracy and literacy skills need to be improved to help in the reading of, and interpretation of, technical information.
- Improving communication skills will assist in retrieving information for customers and technical support staff, etc.
- A well grounded understanding of electronics and diagnostic skills will assist students to use and interpret readings from multimeters, oscilloscopes and computerised diagnostic equipment.
- It is essential that a good understanding of the underpinning knowledge of vehicle operating systems and their interaction with other operating systems on and off the car be developed.
- An interactive computer game approach to learning could be developed that encourages a problem solving and analysis skills method of training with an instant style of feedback.
- Ongoing training pathways should be developed and promoted beyond the apprenticeship, covering items such as technical up-skilling, workplace training and assessing skills, administration skills, team and management skills and higher education.
- With less Federal and Local Government funding being allocated to the delivery and maintenance of automotive training, more connections with the automotive industry need to be created, to assist in the sharing of knowledge and resources.
- The Fellow can be made available to discuss his findings with Manufacturing Skills Australia (MSA) in regard to the Automotive Training Package should the MSA require him to do so.
- ISS Institute, through its links with TAFE and the Industry Skills Councils, could facilitate the development and introduction of new training pathways.

Automotive Industry

- The retail arm of the Automotive Industry needs an image makeover. It is essential to move away from the 'grease monkey' image and to demonstrate that the industry is highly technical with almost no comparison to the cars of yesteryear. Today's workshop offers a blend of modern electronics coupled with finely machined mechanical units.

Recommendations

- Workshops need to be proactive in attracting apprentices and have a clear understanding of what the Automotive Industry is and where it is going.
- To change workshop culture to meet the needs of generation 'Y' the following issues need to be addressed:
 - What's in it for me?
 - Flexibility
 - Diversity in roles
 - Progression
 - Instant reward and gratification
 - Recognition
 - Rewards – financial and personal
 - Clear and continuing pathways of education
- Wage salaries for apprentices needs to be re-evaluated.

ISS Institute recommends that a collaborative partnership be established and funded by the Australian Government and the Automotive Industry to implement a national marketing campaign to attract young people and retrain others into apprenticeships within the industry.

A key focus is to change the perception of the 'grease monkey' image of yesteryear to the current reality of careers arising out of apprenticeships that are highly technical with lifelong learning as technologies evolve.

This recommendation arises out of ISS Institute's work with the industry including the 'Automotive Industry: Really Creative. Really Fast. Think Bank', 17th September 2008.

Government

The Federal and State Governments have enormous leverage to influence car manufacturers and Australian consumers in their choice of vehicles. Whilst the drivability and fuel efficiency of diesel cars are driving market demand, Government can boost this with further incentives.

This is particularly relevant considering the Australian Government's recent commitment to the Kyoto agreement for emission reductions, of which vehicles are a major contributor in Australia.

Australia's failure to meet these targets will result in millions of dollars in fines which could otherwise be spent on the investment in diesel and other alternative fuel vehicles.

Suggestions include:

- Using financial incentives to further boost the sale of diesel motors as they have a smaller pollution footprint than comparative petrol motors.
- Registration rates could be based upon CO₂ emissions of cars, effectively allowing customers to save on fuel and registration based upon their choice of diesel cars.

Recommendations

- Financial incentives to encourage local manufacturers to consider diesel options could be introduced. This is particularly relevant to Australian car manufacturers who are still producing large six cylinder petrol motors, whilst the local consumers are turning to smaller cars including the Toyota Corolla.

Whilst many alternative fuel options are becoming available in the Australia market, diesel technology has already proven to be a viable fuel option in Europe and will remain a market leader for the foreseeable future.

Market forces are seeing diesel car sales grow in many developed markets around the world, including the USA. The development of a nationally accredited diesel training program should be urgently implemented for current and future technicians of light passenger vehicles.

Consumers may avoid purchasing diesel cars if they believe service levels, or associated costs are compromised.

Conclusion

Common light passenger vehicle technology is providing consumers with quality alternatives to petrol power cars, offering similar driveability, refinement and lower fuel consumption.

Diesel car sales are increasing in Australia as consumers demand more fuel efficient modes of transport that have similar refinement and drivability to their petrol counterparts.

The automotive and training industries must prepare future graduates with the skills to service and maintain diesel cars. A failure to do so could see diesel sales stifled either through consumer reluctance due to foreseen service delays, or manufacturer reluctance if high service standards cannot be delivered.

Diesel represents the next logical step in the automotive industries offering of alternative fuel cars that cause less damage to the environment through less emissions and consumption. It is essential that the Australian Government, training organisations and automotive manufacturers work together to ensure consumers are encouraged to purchase more environmentally friendly cars. Pivotal to this is the provision of the necessary resources to ensure all service technician apprentices are comprehensively trained in this technology.

References

- ¹ Joanna Smolinska, *EU Economic Report*, ACEA (European Automobile Manufacturers Association), Brussels, February 2008
http://www.acea.be/images/uploads/files/20080219_ER%200802%20CONSOLIDATED%20-%20website.pdf

Attachments

Attachment 1



Australian Government
**Department of Employment and
 Workplace Relations**

SKILLS IN DEMAND RESEARCH METHODOLOGY 2006-07

PURPOSE

The Department of Employment and Workplace Relations (DEWR) undertakes skills in demand research on an ongoing basis. This work forms the basis of the Migration Occupations in Demand List (MODL) which is gazetted by the Department of Immigration and Citizenship (DIAC). Its purpose is to target the General Skilled Migration categories of the Migration Program to the entry of migrants with skills, qualifications, work experience and English language proficiency appropriate to employment in skilled occupations. MODL is focused on professional, associate professional and trade occupations.

Skills in demand research also addresses a need for information about skill needs in each State and Territory to underpin policy, planning and resource allocation. State and Territory Skills in Demand Lists which incorporate the results of the research are publicly available and are posted on www.workplace.gov.au/skillsindemand.

The DEWR methodology provides qualitative, indicative information on skills in demand. It delivers useful, relevant information about employers' experiences recruiting skilled workers and allows DEWR to explore labour market issues impacting on the supply and demand for particular skills through discussions with individual employers. While the DEWR methodology is cost effective and targeted, it is not based on a statistically valid sample and does not enable the compilation of quantitative estimates. The Australian Bureau of Statistics reviewed the methodology in 2006 and found it was appropriate for what it seeks to do.

1. SURVEY OF EMPLOYERS WHO HAVE RECENTLY ADVERTISED (SERA)

The SERA is a survey of employers who have recently advertised vacancies in selected skilled occupations ([List of occupations assessed](#)). It is an important element of the research into skills in demand conducted by DEWR through its State and Territory Labour Economics Offices (LEOs) and National Office. The aims of the SERA are to

- Better target telephone contact work by focusing on employers who have recently advertised and therefore are in a good position to comment on current recruitment issues for target occupations
- Provide information on employer recruitment experience
- Provide a consistent methodology for information across States/Territories and occupations which could be analysed over time to determine broad trends in skilled labour markets.

2. MAIN ELEMENTS OF THE SERA

DEWR staff contact employers who have recently advertised vacancies in the occupations included in the skills in demand research programme. Vacancies are collected from available sources, including major metropolitan and regional newspapers, general employment and specialist industry/occupational Internet sites as well as professional associations.

- Where there are sufficient vacancy numbers, vacancies for follow-up are randomly selected
- For some occupations, adequate numbers of vacancies are not identified, and in these cases all vacancies found with appropriate contact information in the survey period are followed up and other employers are cold canvassed to ensure assessments are based on a sufficient number and range of contacts.
- The minimum information sought from employers is the number of vacancies, whether vacancies were filled, the total number of applicants and the number of suitable applicants. However, supplementary information is collected where practical, through the [standard questionnaire](#). The research aims to collect information about why vacancies are unfilled as this is important for making a decision about the rating for each occupation.
- Survey results are recorded and summary information included in a one-page report.

3. METHODOLOGY

3.1 Sample size and selection of sample

The number of employers contacted varies based on the number of people employed in the occupation and the number of vacancies advertised. In a small number of cases, the limited number of employers makes it impractical to contact the target number of employers who have recently advertised. In these cases judgment is used regarding the number of employers surveyed to produce a reliable result. There is a minimum number of contacts made for each occupation. In the first instance, this comprises employers who have advertised vacancies over the past six months. However, where vacancy numbers are low and sufficient vacancies cannot be identified “cold canvassing” of major employers and industry bodies is undertaken.

When employers are cold canvassed, they are asked whether they have advertised vacancies in the target occupation in the last six months. (Vacancies older than six months are not considered as they may not be a reliable guide to current labour market conditions.) Employers are then asked whether they filled the vacancy and, if so, approximately how long it took them to do so. See comments under “cold canvassing”.

If cold canvassed employers have not advertised recently, discussions focus on the employer’s perceptions about the labour market for the occupation and issues impacting on the labour market.

Regional vacancies

DEWR attempts to survey an appropriate number of employers from regional areas for each occupation taking into account the significance of regional employment in the particular occupation. Regional areas are those outside the major capital cities in each State and Territory.

Smaller States/Occupations

In the smaller States particularly (South Australia, the Northern Territory, Tasmania and Australian Capital Territory) and for occupations (such as apparel cutter) which have small employer/vacancy numbers, the minimum number of employer contacts is not always

Attachments

achievable for some occupations. In these cases, DEWR aims to collect as many vacancies for follow-up as possible, with “cold canvassing” of employers when vacancy numbers are low.

Cold Canvassing for occupations with low vacancy numbers

Where possible, contact is made with a range of large employers as well as some smaller employers to ensure that any differences in recruitment experiences are captured. Discussion with “cold canvassed” employers is as close as possible to the SERA methodology:

- 1) Have you recently tried to recruit for occupation X?
- 2) How long ago was this? [don't consider those more than 6 months old]
- 3) Did you fill the vacancy?
- 4) [If yes] How long did it take to fill?

Discussion then continues as per the SERA questionnaire.

- If the employer has not recruited, questioning may include: the likelihood of them recruiting in the next six months; their expectations of difficulty filling vacancies; whether they have potential employees in the target occupation knocking them; their experience with staff turnover in the target occupation; and how they generally recruit.

3.2 Collection and presentation of results

Demand analysis

Researchers undertaking State or Territory based assessments take account of a range of data (such as that outlined below) in conjunction with the results of the SERA which underpins their assessments of occupational labour markets¹. However, comment on these data sets is included in the Skills in Demand Research Programme reports only where it presents relevant information about the labour market for that occupation or where it adds evidence for the rating for the occupation. Comment is included about how changes in industry activity levels impact on demand for the occupation (for example, falling housing starts may impact more quickly on commencing trades such as bricklaying and demand for tilers and painters may hold up longer as work in progress is completed). Additionally, the labour market for trades which has stronger demand from maintenance work such as plumbers may be less affected by a decline in housing commencements.

Demand data could include

- Examination of key determinants of demand (that is, the variables affecting the level of demand for these skills)
- Relevant industry activity statistics and projections
- Employment levels where reliable and current
- Vacancy levels (only where reliable data are available)
- Anecdotal information on demand from employers and industry contacts
- A conclusion on whether demand is increasing/decreasing
- The likely outlook for demand over the following six months.

Supply analysis

Analysis of supply to the occupation is important, although available data do not always allow a precise estimate of numbers entering an occupation. Supply trends are included in occupational reports with comment about anticipated changes to supply, (for example the closure of a training

¹ Occupational research undertaken at the national level are based only on the results of the SERA and discussion with employers.

course or establishment of new courses). Where there are no well defined supply paths (for example for some management and associate professional occupations) reports may include information about the diversity of supply sources).

Consideration is given to the following supply issues

- Training completions and commencements where available
- Wastage (people leaving the occupation), although estimates based on 2001 Census data are now dated, comments about wastage are nonetheless included if there is significant anecdotal evidence
- Net migration figures if relevant and available
- Comment on informal supply if significant.
- Conclusion on whether overall supply to the occupation is increasing or decreasing.

SERA results

SERA results are not intended as a measure of the degree of shortage and are not statistically accurate. Reflecting this, figures are quoted in the relevant skills in demand report in broad terms, but may be compared with previous results when available. The SERA is only one piece of evidence for the state of the labour market for a particular occupation. While it may vary from occupation to occupation, other relevant information including that outlined under 'demand analysis' and 'supply analysis', and SERA results are interpreted in light of other available information such as employment growth, vacancy trends (where reliable) and the comments of employers, industry contacts, educational institutions and labour market intermediaries.

A low vacancies filled rate may not necessarily be indicative of a skill shortage in the occupation. DEWR examines the reasons for vacancies remaining unfilled and there are often a number of causes which are not related to overall shortage. These include employers having specialist requirements, the position involving the operation of machinery or equipment which are not generally used and with which most qualified and skilled workers may not have experience, pay or conditions offered being below market rates, particular working arrangements and expectations of employers or employees which are unrealistic. Additionally, the working arrangements sought by workers may not match those offered by employers, for instance workers seeking full-time work but employers offering part-time hours, employers seeking salary and wage employment but workers wanting contract work.

Release of reports

Skills in demand reports will, starting from the 2006-07 skills in demand research programme, be posted on the Australian Workplace site. The publication of these reports will coincide with the updating of the State and Territory Skills in Demand Lists, which is done on a six monthly basis. Trades occupations are generally researched in detail in the first half of the financial year (July to December) and professions and other occupations from January to June. Results for Trades reports will be published on the Internet around the end of March each year with other reports released around the end of September.

3.3 Ratings

Taking account of all available information, including the results of the SERA and the reasons for employers being unable to fill vacancies, researchers decide on an appropriate rating. Options for ratings are:

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Shortage

Skill shortages exist when employers are unable to fill or have considerable difficulty filling vacancies for an occupation, or significant specialised skill needs within that occupation, at current levels of remuneration and conditions of employment, and in reasonably accessible locations.

Recruitment difficulty

Recruitment difficulties occur when some employers have difficulty filling vacancies for an occupation. There may be an adequate supply of skilled workers but some employers are unable to attract and recruit sufficient, suitable workers for reasons which include: specific experience or specialist skill requirements of the vacancy; differences in hours of work required by the employer and those sought by applicants; or particular location or transport issues.

No shortage

Research has not identified any significant difficulty filling vacancies.

3.4 Standard employer questions

Although the minimum information required for the SERA is whether a vacancy was filled within the four to six week period, other information is important in determining whether skills shortages exist and the reasons for these shortages. [Recommended questions](#) for employer contact work are provided to researchers. It must be emphasised, however, that researchers use their discretion regarding the questions which are appropriate in relation to the occupation and the attitude of the contact.

3.5 Timing of contact work

To reduce the influence of seasonal factors, as far as possible, DEWR conducts SERA contact work for a group of occupations (for example Construction) at approximately the same time of the year in each State and Territory.

Identifying whether a vacancy is filled or not is measured four weeks after advertising (six weeks for professional vacancies). Therefore, contact with employers is generally attempted four weeks (or in the case of professional vacancies, six weeks) after the surveyed advertisement appeared. However, where this is not possible, the questions seek information about whether the position was filled within four (or six) weeks. If a vacancy is filled but the employer states they had advertised for several weeks before the vacancy which was surveyed, the concern is whether the *surveyed* vacancy was filled within the four weeks. The focus is on the employer's most recent recruitment experience.

3.6 Specialisations

To achieve a reasonable sample size the SERA is conducted on occupations at the six digit ASCO level (although some six digit occupations have been combined). Assessments of shortages in specialisations are usually based on qualitative information drawn from a smaller number of employer and industry contacts.

3.7 What is a vacancy?

The definition of a vacancy used in DEWR's [Skilled Vacancies Index \(SVI\)](#) is generally followed. That is, a vacancy is for a definite position offered by the direct employer for a paid employee. Part-time positions are surveyed if the hours of work are 16 or more per week and

temporary/casual positions are surveyed if they are for three months or longer. Advertisements for self-employment or partnerships are generally excluded. However, in industries where there is significant sub-contracting (eg construction) and the advertisement offers specific paid employment which meets the criteria, the position is surveyed. Vacancies advertised by recruitment agencies are included in the SERA if they are for an actual vacancy with a particular employer rather than a general “canvassing” advertisement. However, recruitment agencies are often contacted for qualitative information.

Multiple vacancies

Employers sometimes advertise multiple vacancies without having a definite number in mind. In such cases, researchers attempt to seek from employers their best estimate of the number of vacancies involved. Employers may be asked how many people they would immediately employ and could afford to employ if a large number of very good candidates applied.

3.8 When is a vacancy filled?

A vacancy is considered to be filled if the employer recruited a suitable applicant within four weeks of advertising the surveyed vacancy (six weeks in the case of professions), the successful applicant stayed more than two weeks in the position and left voluntarily, and there were no performance issues.

Incomplete recruitment exercises

In some cases, an employer will not have completed a recruitment exercise within four to six weeks for administrative reasons; for example, they have not finalised formal interviews or have called several promising applicants for a second round of interviews. In this case, the researcher makes arrangements to recontact the employer when the result of the interview process is known. If this is not practicable, the researcher records the vacancy as filled if the employer is highly confident of filling the vacancy from that recruitment round. If the employer is unsure of the likely result, the vacancy is excluded from the SERA.

3.9 Time period

The period after which a vacancy is assessed (six weeks for professionals, four weeks for other occupations) is to some extent arbitrary, although it is reasonable to expect that employers would have, in most cases, completed the recruitment process in that time. Setting a defined time for vacancy filling gives the advantage of simple and consistent benchmark of measuring whether a vacancy is filled so that SERA data are consistent across States and National Office, and over time.

Advertisements often state a cut-off date for applications. In this case the vacancy is surveyed four to six weeks after the cut-off date if practical.

3.10 Consultation

Consultation with key industry and professional associations is undertaken to confirm the findings of the research and discuss the labour market and factors impacting on skill needs prior to finalisation of reports and skills in demand lists.

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ATTACHMENT 1

List of occupations to be assessed in 2006-07 Skills in Demand research

ASCO code	Occupation title
121111	Finance Manager
121311	Human Resource Manager
122111	Engineering Manager
122211	Production Manager (Manufacturing)
122213	Production Manager (Mining)
122411	Information Technology Manager
123111	Sales and Marketing Manager
129211	Director of Nursing
129213	Medical Administrator
129511	Child Care Co-ordinator
129611	Media Producer
211111	Chemist
211211	Geologist
211411	Environmental Research Scientist
211413	Forester
211415	Park Ranger
21141921	Agricultural Scientist/Adviser
211511	Medical Scientist
212111	Architect
212113	Landscape Architect
212211	Quantity Surveyor
212313	Surveyor
212411	Civil Engineer
212511	Electrical Engineer
212513	Electronics Engineer
212611	Mechanical Engineer
212613	Production or Plant Engineer
212711	Mining Engineer (excluding Petroleum)
212917	Chemical Engineer
221111	Accountant
221211	External Auditor
222111	Public Relations Officer
222113	Marketing Specialist
222115	Market Research Analyst
222117	Advertising Specialist
2231	ICT Professions
229111	Personnel Officer
229113	Personnel Consultant
229115	Industrial Relations Officer
229117	Training Officer
229211	Librarian
229313	Statistician
229415	Quality Assurance Manager

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229511	Valuer
232111	Nurse Manager
232211	Nurse Educator
232311	Registered Nurse
232411	Registered Midwife
232511	Registered Mental Health Nurse
23811113	Dentist/Dental Specialist
23821315	Retail/Hospital Pharmacist
238311	Occupational Therapist
238411	Optometrist
238511	Physiotherapist
238611	Speech Pathologist
238711	Chiropractor
238811	Podiatrist
239111	Medical Diagnostic Radiographer
239113	Radiation Therapist
239115	Nuclear Medicine Technologist
239117	Sonographer
239211	Veterinarian
239311	Dietitian
239411	Naturopath
239911	Audiologist
241111	Pre-Primary School Teacher
241211	Primary School Teacher
241311	Secondary School Teacher
241411	Special Needs Teacher
251111	Social Worker
251211	Welfare Worker
251213	Community Worker
251311	Rehabilitation Counsellor
251319	Student Counsellor
251411	Clinical Psychologist
2521	Legal Professionals
252211	Economist
252311	Urban and Regional Planner
25291315	Translator/Interpreter
253313	Graphic Designer
253317	Interior Designer
2534131517	Journalist
254111	Aircraft Pilot
254211	Ship's Master
254215	Ship's Engineer
254311	Occupational Health and Safety Officer
254313	Environmental Health Officer
254919	Recreation Officer
3111	Medical Technical Officers

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311211	Chemistry Technical Officer
311213	Earth Science Technical Officer
311215	Life Science Technical Officer
311217	Agricultural Technical Officer
312111	Building Associate
312113	Architectural Associate
312115	Surveying and Cartographic Associate
3122	Civil Engineering Associates
3123	Electrical Engineering Associates
3124	Electronic Engineering Associates
3125	Mechanical Engineering Associates
312915	Mine Deputy
329411	Computing Support Technician
332211	Chef (includes Cook)
332311	Hotel and Motel Manager
341111	Enrolled Nurse
342113	Youth Worker
3492111315	Dental Therapist, Hygienist and Technician
399111	Primary Products Inspector
411211	Fitter
411213	Metal Machinist (First Class)
411311	Toolmaker
41141115	Aircraft Maintenance Engineer (Mechanical. Avionics)
411511	Precision Instrument Maker and Repairer
411515	Locksmith
412211	Metal Fabricator
412215	Welder (First Class)
412411	Sheetmetal Worker (First Class)
421111	Motor Mechanic
421211	Automotive Electrician
421311	Panel Beater
421411	Vehicle Painter
421511	Vehicle Body Maker
421611	Vehicle Trimmer
431111	General Electrician
431115	Lift Mechanic
431211	Refrigeration and Airconditioning Mechanic
431311	Electrical Powerline Tradespersons
43141113	Electronic Instrument Trades
431511	Electronic Equipment Tradesperson
431513	Business Machine Mechanic
431611	General Communications Tradesperson
431613	Communications Linesperson
4411111315	Carpenter and Joiner
441211	Fibrous Plasterer
441311	Roof Slater and Tiler

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441411	Bricklayer
441511	Solid Plasterer
441611	Wall and Floor Tiler
441613	Stonemason
442111	Painter and Decorator
4422-11	Signwriter
442311	Floor Finisher
443111131517	Plumber and Gasfitter
451111	Butcher
451211	Baker
451213	Pastrycook
451311	Cook (includes Chef)
461211	Shearer
462111	Nurseryperson
462211	Greenkeeper
462311	General Gardener
462313	Landscape Gardener
462315	Tree Surgeon
491111	Graphic Pre-Press Tradesperson
491211	Printing Machinist
491213	Small Offset Printer
491311	Binder and Finisher
491411	Screen Printer
492111	Wood Machinist (A-Grade)
492211	Cabinetmaker
492911	Picture Framer
492913	Furniture Finisher
493111	Hairdresser
49411315	Tailor/Dressmaker
494117	Apparel Cutter
494211	Furniture Upholsterer
494311	Shoemaker
498113	Boat Builder and Repairer
498211	Flat Glass Tradesperson
498311	Jeweller
498611	Driller
498711	Chemical Plant Operator
498713	Petroleum and Gas Plant Operator
4999-11	Optical Mechanic
6312-11	Child Care Worker

ATTACHMENT 2**STANDARD QUESTIONS**

The following is a list of recommended questions when contacting employers and industry contacts. The list is not exhaustive. Depending on how the interview flows, there may well be other relevant questions. It is also not recommended that all these questions should be asked of all contacts or necessarily in this particular order. Rather, it is up to the judgement of the researcher to determine the most appropriate questions to ask a particular contact based on the employer's circumstances and their willingness to be involved. If an employer was selected for interview because he/she had advertised for recent graduates, the questions should reflect this.

Questions marked with an asterisk are considered the minimum *core questions* to be asked in relation to the *Survey of Employers Who Have Recently Advertised (SERA)*.

1. Hello, my name is **X** from the Department of Employment and Workplace Relations. We are conducting research into shortages in occupation **X**. I understand that you have recently advertised for **occupation x** (give detail of advertisement). Is this correct? (Ask to speak to the appropriate person.)*
2. *How many vacancies did you have for this occupation?**
3. For how long has the position(s) been vacant?*
4. Have you *filled the vacancy*, or expect to shortly, from the current recruitment exercise?*
5. How many applicants did you get?*
6. Approximately how many (or what proportion) of applicants were suitable?*
7. What were the main reasons why applicants were considered unsuitable?* Issues such as the following should be canvassed, although **this is not to be used as a prompt as we do not want to lead employers**.
 - i Not suited to type of work
 - ii Too young
 - iii Too old
 - iv Poor attitude or presentation
 - v Lack of relevant skills
 - vi Lack of experience
 - vii Inadequate qualifications
 - viii Other (specify)
8. Were you seeking specialised skills or experience? (Please specify)
9. Were there any other factors which made the position difficult to fill (eg, location, lack of public transport)
10. How would you rate turnover in this occupation? Why?

a) High b) Moderate c) Low
11. Have changes to training arrangements or other supply issues such as licensing affected this occupation? OR (for occupations like managers or associate professionals) what background/training are you seeking in the ideal candidate?
12. Are there any factors currently affecting demand for this occupation?
13. Have you attempted to recruit a New Apprentice in the past 12 months? If so, did you have difficulty filling the position?
- 13a) Do you have any general comments on your experience in recruiting new apprentices.
14. Do you have any other comments in relation to skill shortages?

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Other organisations

Contacts with other organisations such as employee associations, industry bodies, training institutions may also be necessary or desirable. No attempt will be made to develop standard questions for these contacts as this will vary on a case by case basis depending on the purpose of the interview. Key issues of course will be evidence of shortages, factors influencing the labour market.

The contact with key employer/industry or professional groups is not just for verification of SERA results but should be seen as a key data source to be taken into account in determining the occupational labour market. For example, information about whether the industry is instigating actions such as negotiation of labour agreements, or considering other initiatives to improve labour supply to the occupation can be useful. This information source can also provide insight into future demand.

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Attachment 2

Motor Mechanic	Australia
ASCO Code: 4211-11	July 2006
Labour market rating	Shortage
Comment	

Employer and industry comments/current labour market

A survey of employers who had recently advertised for motor mechanics was undertaken for this report. Less than half (46 per cent) of the advertised vacancies were filled within 4 weeks of advertising. About one third of surveyed vacancies were for diesel mechanics, and the fill rate for these positions (32 per cent) was lower than for other vacancies.

Most employers reported similar experience recruiting qualified mechanics, although employers in Queensland and Western Australia had the most difficulty, and vacancies in regional and rural areas were slightly harder to fill than those in metropolitan areas. This was especially evident in South Australia where all metropolitan vacancies were filled within a few days of advertising but none of the vacancies in regional/rural areas were filled within four weeks.

Almost 60 per cent of applicants were considered by employers to be suitable for their vacancies. Applicants who were considered unsuitable were either unqualified, or were tradespeople who lacked recent relevant experience or particular specialist skills. A number of employers had vacancies which remained unfilled despite receiving applications from suitably qualified mechanics. In most cases these vacancies were unfilled because applicants were unwilling to work for the offered wages or in a particular location.

The main reason suggested by employers for the lack of motor mechanics was relatively low wages offered for the type of work and skills required. Employers in Queensland and Western Australia commented that they could not compete with wages offered to tradespeople by the mining and resource industry.

A number of employers commented on the need for mechanics to keep informed of new technology in all types of vehicles.

Labour market outlook

There is no evidence of significant changes in the level of demand or supply to this trade over the next six months, and shortages are expected to persist.