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Review of the socioeconomic impacts of coal seam gas in Queensland

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Further information

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Images

Provided by Santos GLNG and Australia Pacific LNG

Foreword

The rapid development of coal seam gas (CSG) in Queensland has not been without issues. The spatial dispersion of the gas means the industry coexists with many more neighbours than a typical resource development, and these neighbours are located in some of Queensland's most diverse agricultural lands. The newness of the industry also led to significant concerns about the potential impact of CSG development on water and the environment.

This review provides a timely synthesis of the socioeconomic impacts of CSG development, defined broadly to encompass both headline economic indicators and other factors which influence wellbeing. The review found that the economic impact of CSG development is akin to other natural resource developments, but the socioeconomic impacts differ as a result of the dispersion of the resource and the need for coexistence with landholders.

While this report examines the Queensland experience, there are valuable lessons learnt for other states and territories. These include the need for effective risk-based regulation of CSG development and its potential physical and environmental impacts, and the importance of early and genuine community consultation.

I highly recommend the *Review of the socioeconomic impacts of coal seam gas in Queensland* to anyone seeking to develop a greater understanding of the CSG industry and its impact on communities.

Mark Cully
Chief Economist
Department of Industry, Innovation and Science
October 2015

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Abbreviations and acronyms

2P	proven and probable (gas reserves)
APLNG	Australia Pacific LNG
APPEA	Australian Petroleum Production and Exploration Association
BTEX	benzene, toluene, ethylbenzene and xylene
CCA	Conduct and Compensation Agreement
CNOOC	China National Offshore Oil Corporation
CSG	coal seam gas
CSIRO	Commonwealth Scientific and Industrial Research Organisation
DNRM	Queensland Department of Natural Resources and Mines
EPBC Act	*Environmental Protection and Biodiversity Conservation Act*
EIS	Environmental Impact Statement
fracking	hydraulic fracturing
GFCQ	GasFields Commission Queensland
GISERA	Gas Industry Social and Environmental Research Alliance
GLNG	Gladstone LNG
GSP	Gross State Product
IESC	Independent Expert Scientific Committee on Coal Seam Gas and Large Mining Development
ILUA	Indigenous Land Use Agreement
KOGAS	Korea Gas Corporation
LNG	liquefied natural gas
LGA	local government area
Mtpa	million tonnes per annum
NICNAS	National Industrial Chemicals Notification and Assessment Scheme
NPA	National Partnership Agreement on Coal Seam Gas and Large Mining Development
OGIA	Office of Groundwater Impact Assessment
PAA	Priority Agricultural Area
PJ	petajoules
QCLNG	Queensland Curtis LNG

QGSO	Queensland Government Statisticians Office
QRC	Queensland Resources Council
RIRDC	Rural Industries Research and Development Corporation
RPI Act	*Regional Planning Interests Act*
SCA Act	*Strategic Cropping Area Act*
UQ-CCSG	University of Queensland Centre for Coal Seam Gas

Executive Summary

Coal seam gas (CSG) development has expanded relatively rapidly in Queensland, with proven and probable reserves increasing more than tenfold over the last decade. CSG is now the dominant source of Queensland's natural gas production, and it is the basis for a growing liquefied natural gas (LNG) export industry from Gladstone.

CSG development has a dispersed geospatial footprint as a result of the broad distribution of the resource, the technologies and the associated infrastructure required to develop it. As a result of these factors, the development of this industry has had a large effect on local communities, including economic impacts and changes to demographics and social structures with flow-on effects evident in measures of community wellbeing.

This review provides a synthesis of the nature and magnitude of various impacts of CSG development on communities in Queensland. It incorporates a literature review, which covers forecasts of impacts, statistical analyses of census and other data. The literature review was supported by a range of interviews and workshops with industry stakeholders. The analysis presents both economic and broader community impacts, as well as drawing a range of insights and conclusions about the experience of CSG development in the state.

Headline economic impacts of CSG development in Queensland to date are found to be net positive, and are attributable to increases in employment, income, output, consumption and government revenue. These changes are broadly consistent with changes experienced as a result of a typical natural resource development.

Impacts on nearby communities — incorporating the distribution of these economic impacts as well as physical and environmental impacts and demographic and social changes — have been more variable, and also differ more from the impacts of typical resource developments. A large part of this is due to CSG's large spatial distribution, and its development alongside existing land uses. As a result of this, a larger number and range of people experience the positive and negative impacts of the development. There is a strong need for sustainable coexistence between the gas industry and the local landholders and communities.

The rapid development of CSG gave rise to concerns about potential impacts on the environment. The evidence to date shows that there have only been negligible impacts on water and air quality, and work is ongoing in order to continue to assess the potential impacts and reduce uncertainties about potential impacts going forward.

This review acknowledges that CSG development is not completely free from risk. It is important to remember that any new activities, resource development or otherwise, come with their own unique set of risks and challenges. In this circumstance, the Queensland Government assessed the level of risk, and put in place rules and regulations to ensure that the risks and potential impacts of CSG development were appropriately managed.

Demographic and social changes also play a large role in how communities experience CSG development. Migration, including an influx of workers, can have a large impact on the social fabric of a community. In

typical resource development this can lead to ‘boomtown’ effects, where the immigration of male workers can be associated with negative consequences of alcohol consumption and violence. Some of these ‘boomtown’ effects have been seen in Queensland, but studies have shown that CSG development has led to the reversing of rural decline in CSG regions, including through increases in female employment and higher youth education levels.

Economic, environmental, and social changes all culminate in changes to the wellbeing of local communities. Wellbeing is influenced by a large range of factors, including access to opportunities to benefit from CSG development as well as individual experiences and perceptions during exploration, construction and operational phases. These impacts are, as one would expect, distributed unevenly between regions, towns and households. CSIRO has found that wellbeing in CSG regions is currently robust. However, there are concerns for future wellbeing as the sector moves from the construction phase to the operations phase.

The review provides a number of ‘lessons learnt’ for other jurisdictions experiencing development of unconventional natural gas resources, or other developments which may have similar impacts on communities. Firstly, the role of government is essential in ensuring that gas development is beneficial for communities. This includes using risk-based regulation to ensure that the development is sustainable and responsible, and any risks of potential environmental or physical outcomes are monitored, assessed and minimised.

Governments also play a role in supporting coexistence between gas companies and local communities. Regulation of the sector should support coexistence, including through ensuring that landholder’s agreement is sought for access to their property, that landholders are fairly compensated, and that prime agricultural land and water resources are not compromised by development activity. Queensland has supported coexistence both through its regulation of the sector and also the creation of the independent GasFields Commission. The Commission has been highly regarded in its role of supporting coexistence, through provision of independent advice and information and facilitating relationships between rural landholders, local communities and the gas industry.

Another lesson is the importance of community engagement. Building trust in the community is essential for the industry having a social licence to operate. Given the spatial dispersion of CSG development activities and the overlap of multiple CSG projects, the social licence for CSG development needs to hold for the entire industry, with high expectations upheld by companies and contractors alike. Investment by companies into local communities is an important part of this engagement, but also essential is the inclusion of community members into decision making processes through genuine engagement and collaboration.

Governments should also be involved in this engagement. There is a strong need for governments, communities and the gas industry to work closely together to ensure that adverse impacts on community wellbeing are minimised and benefits to community wellbeing occur in the long term.

Further lessons include the importance of considering cumulative impacts of CSG development, and the need to consider how the impacts are distributed. Much of this is the focus of research currently underway into the socioeconomic impacts of CSG development, including by the Gas Industry Social and Environmental Research Alliance (GISERA), a partnership between CSIRO, Australia Pacific LNG (APLNG) and QGC; and the Centre for Coal Seam Gas at the University of Queensland (UQ-CCSG), which has funding from Santos, Arrow Energy, QGC and APLNG.

It is also important to note that studies considered in this review mainly cover the lead up to peak construction in the CSG industry in 2014. Assessment of the decline in business post-construction and into the effects of the CSG industry's operations phase is just beginning. The magnitude, locations, and nature of economic and social impacts will continue to change as the CSG industry develops and transitions from the construction phase to the ongoing production and operational phase. As a result, ongoing research into the socioeconomic impacts of CSG will continue to help improve the understanding of this relatively new industry.


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1. Introduction

Queensland has experienced almost 20 years of CSG development. However, it is only within the last decade that the scale of the industry has increased substantially, due to the establishment of a major LNG industry based on CSG. There is a large body of research and information on the environmental, social and economic effects of unconventional gas activities in Queensland, as well as more broadly in Australia and in other countries. This study addresses a significant need for a high level summary of what is known about the main factors underlying the direct economic and broader socioeconomic and environmental consequences on communities arising from the CSG industry.

Queensland's experience provides an opportunity to review what is known about the state-wide, regional and town-level socioeconomic impacts associated with the development of the CSG industry.

1.1 Scope and structure of the review

In addition to reviewing the socioeconomic impacts, this review provides background information and context on the growth of the CSG industry in Queensland and how the development of CSG differs from other natural resource development such as mining or conventional oil and gas. Chapter 1 provides this context, as well as setting out details of the regulatory and policy frameworks in the Australian Government which relate to CSG development.

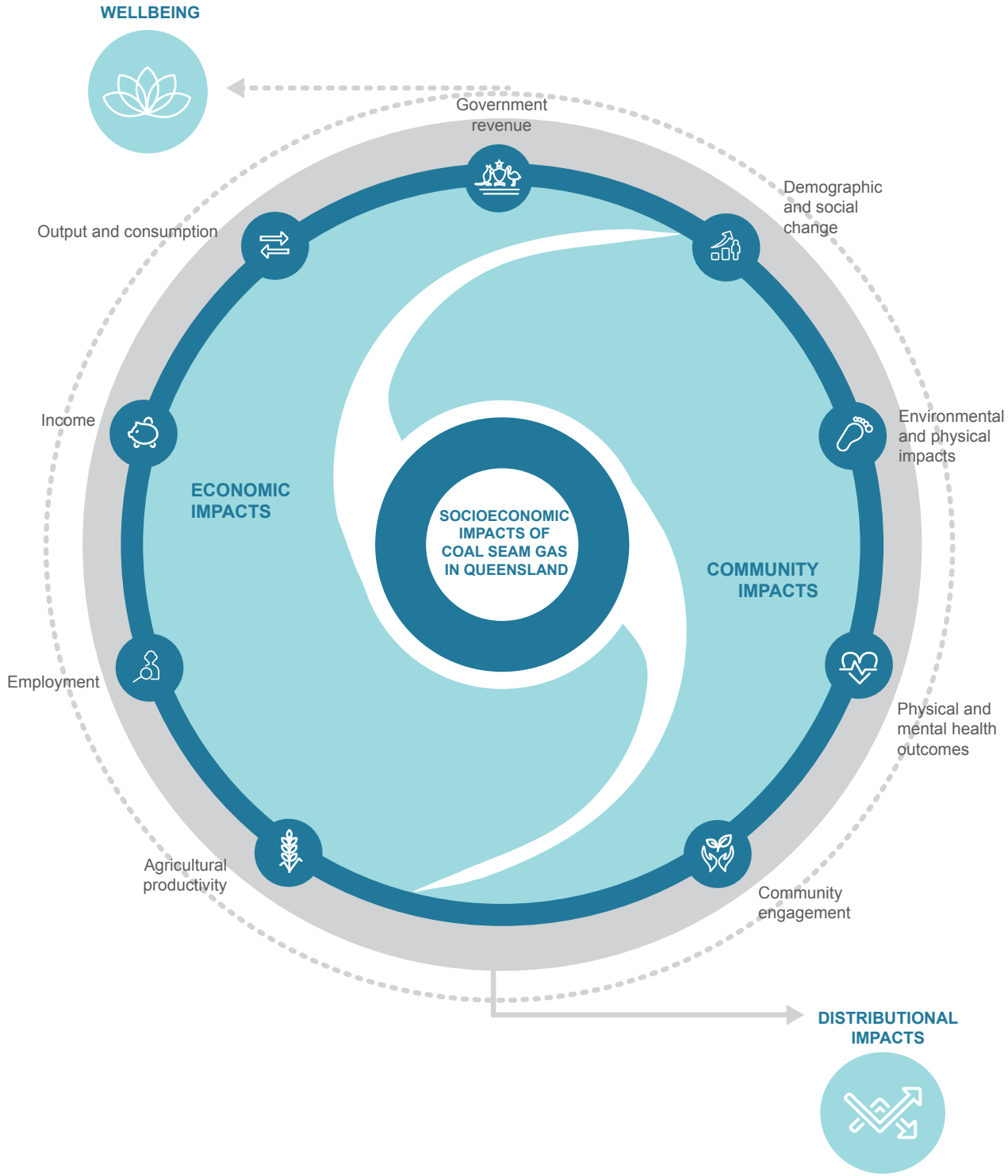
The review adopted a broad definition of socioeconomic impacts. It therefore considers a wide range of aspects of CSG development which are assessed to have potentially significant direct or indirect consequences for a community's economic wellbeing, which are set out in Figure 1.1. The assessment of these impacts is split into two sections covering headline economic impacts, and broader community impacts. Economic impacts of CSG development include changes to employment, income, output and consumption, and government revenue. This part of the review was initially published as a section of the Bureau of Resources and Energy Economics' *Gas Market Report 2014*, and is incorporated as Chapter 2 of this review.

Chapter 3 covers the broader community impacts of CSG development, which include changes to social, demographic, environmental and health outcomes, and findings on wellbeing from interviews and surveys that reflect changes in perceptions and experiences within a community. Community impacts also capture broader factors such as the need for community engagement, which is particularly important given the dispersed footprint of CSG, and the distribution of the economic and broader socioeconomic factors.

The review primarily focusses on economic and broader socioeconomic research on the impacts of CSG development within Queensland. However, where relevant, it also draws upon the literature on impacts of unconventional gas development more generally and the impacts that are more typical of other resource development. This study intentionally does not focus in detail on international experience. The majority of international experience and literature relates to forms of unconventional gas other than CSG, most notably shale gas in the United States. Other unconventional gases, as a result of the differing extraction techniques, can have a range of different impacts on the environment. In addition, different regulatory frameworks in other countries, particularly regarding the ownership of underground resources, can also have a large impact on the economic and community impacts of unconventional gas development. A great deal of care is

therefore required in comparisons between jurisdictions and any generalisations that can be made between experiences in different countries

Figure 1.1: Socioeconomic impacts of CSG development in Queensland



Source: Department of Industry, Innovation and Science (2015)

Literature was identified through an extensive search, drawing upon the annotated bibliography of CSG by Hunter and Taylor.[1] We gave more weight in the review to studies which we assessed to be more rigorous and higher quality. Two of the research organisations undertaking high quality research into the socioeconomic impacts of CSG development are Gas Industry Social and Environmental Research Alliance (GISERA), and the University of Queensland's Centre for Coal Seam Gas (UQ-CCSG). These organisations also helped us identify relevant grey literature to be considered as part of the review.

The review of research was supplemented by a number of meetings with stakeholders in the CSG sector in Queensland to discuss experiences and 'ground-truth' findings from the literature. The stakeholders included:

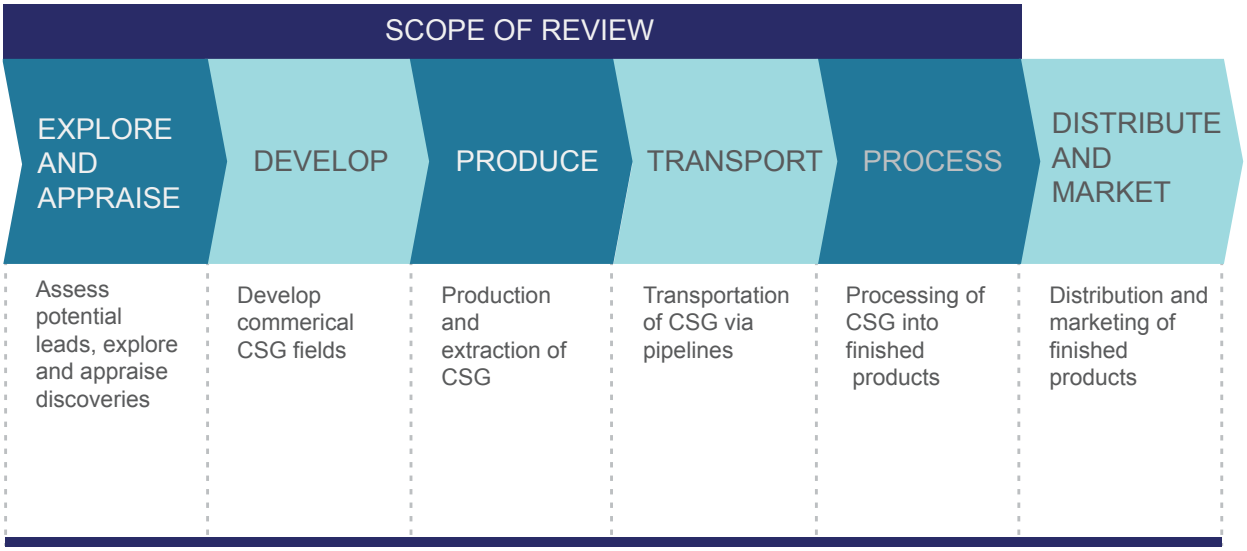
- social science and other researchers, including from the Gas Industry Social and Environmental Research Alliance (GISERA), and the University of Queensland's Centre for Coal Seam Gas (UQ-CCSG)
- Queensland Government representatives, including the Office of Groundwater Impact Assessment (OGIA) and the Department of Natural Resources and Mines (DNRM)
- representatives from the GasFields Commission Queensland (GFCQ)
- industry associations, including the Queensland Resources Council (QRC) and the Australian Petroleum Production and Exploration Association (APPEA)
- representatives from coal seam gas companies and joint ventures operating in Queensland.

We made a conscious decision not to meet with local landholders and community groups. These groups have done extensive consultation with gas companies, governments, and with social science researchers, and there was considered to be a very real risk of research fatigue. Instead, the review has relied on the perspectives of the GasFields Commission and the researchers who have been working very closely with these communities.

This review is limited to the upstream and midstream stages of CSG development, as shown in Figure 1.2. It is often difficult to separate the economic impacts of construction of LNG export facilities from the impact of the upstream CSG development, and to separate the impacts from the various components of the CSG value chain within the upstream stages. Much of the literature does not separate these impacts, and LNG construction activities are incorporated into this study where that is possible.

1 Hunter and Taylor (2013)

Figure 1.2: Stages of the CSG value chain and the scope of the review



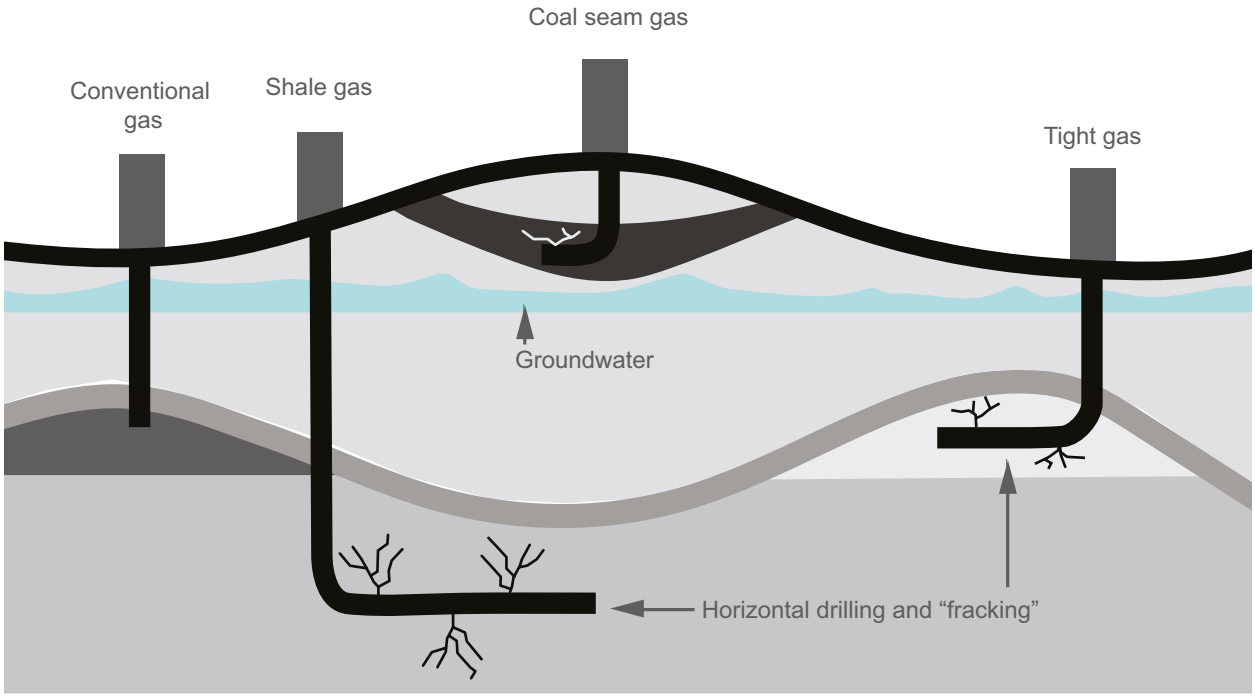
Source: BREE (2014) *Gas Market Report*

1.2 Coal seam gas

CSG is a form of 'unconventional' natural gas contained within coal seams. CSG remains within the source rock (the coal seam) and is held there by water pressure, requiring technological solutions for successful extraction. This is in contrast to conventional extraction of natural gas, where the gas has migrated from a source rock into a reservoir where it is trapped under an impermeable cap-rock, and generally doesn't require pumping for extraction.[2] Figure 1.3 shows a schematic of various types of conventional and unconventional gases.

2 GISERA (2014a)

Figure 1.3: Conventional and unconventional gases



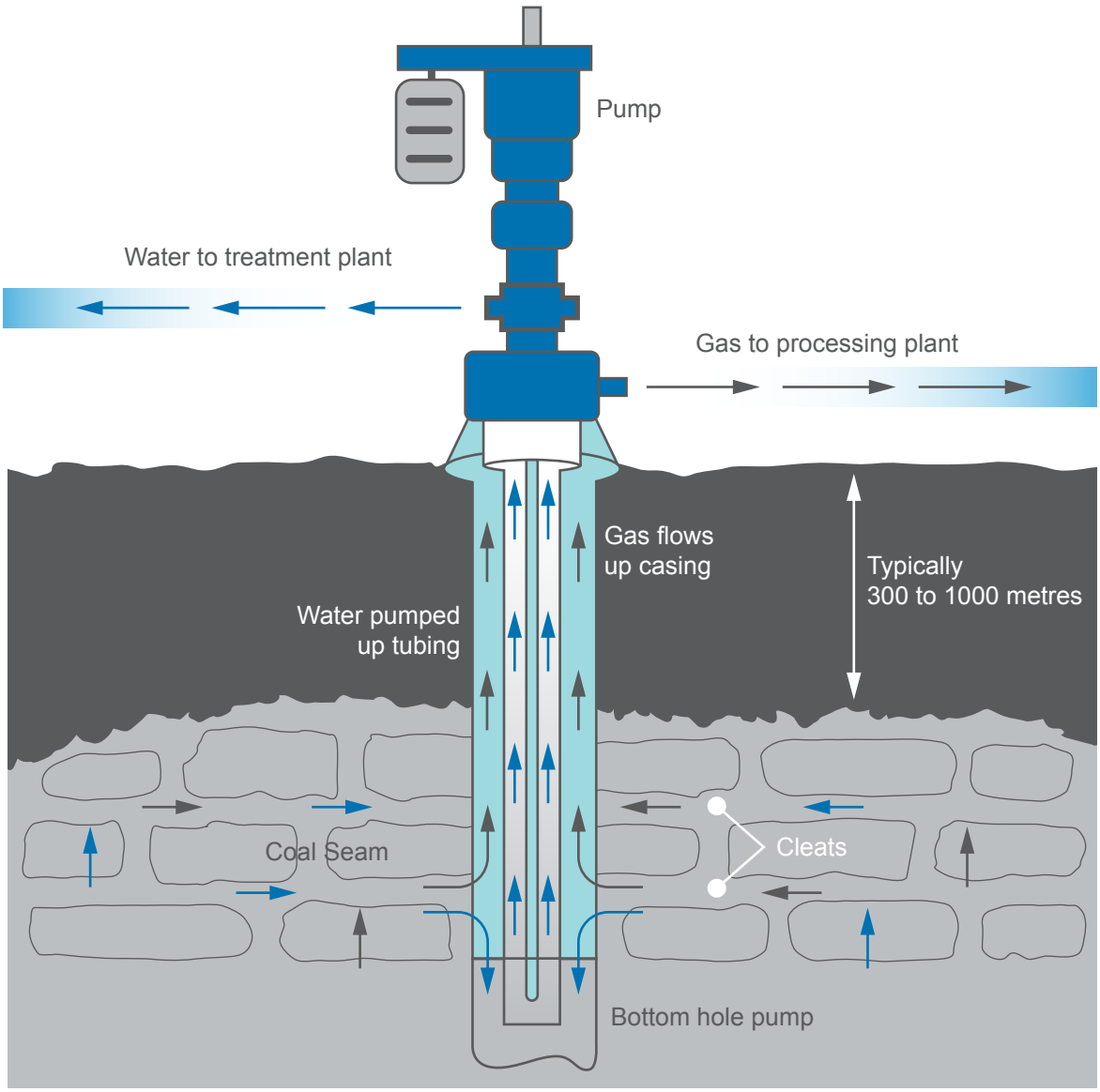
Source: Grattan Institute (2013) *Getting Gas Right: Australia's energy challenge*

CSG extraction requires a larger number of wells than conventional gas production, given CSG remains within the coal seam over a large area and each well can only access a small volume of the gas. However, these wells are generally shallower and cheaper to drill.[3] The CSG wells are depleted of natural gas faster than conventional wells due to relatively low permeability, connectivity and continuity within the coal seams. As a result, to make the development of a CSG field economically viable, wells need to be drilled on a continuing basis to access the gas located in other parts of the coal seam. Figure 1.4 shows a schematic of a CSG well.

This requirement gives CSG development some characteristics consistent with mining, in that there is the need for continuing capital investment over time, which creates a greater sensitivity to changes in gas prices and a greater delivery risk. As such, CSG development can be seen as more risky than the development of conventional oil and gas.

3 Ibid

Figure 1.4: A schematic of a CSG well

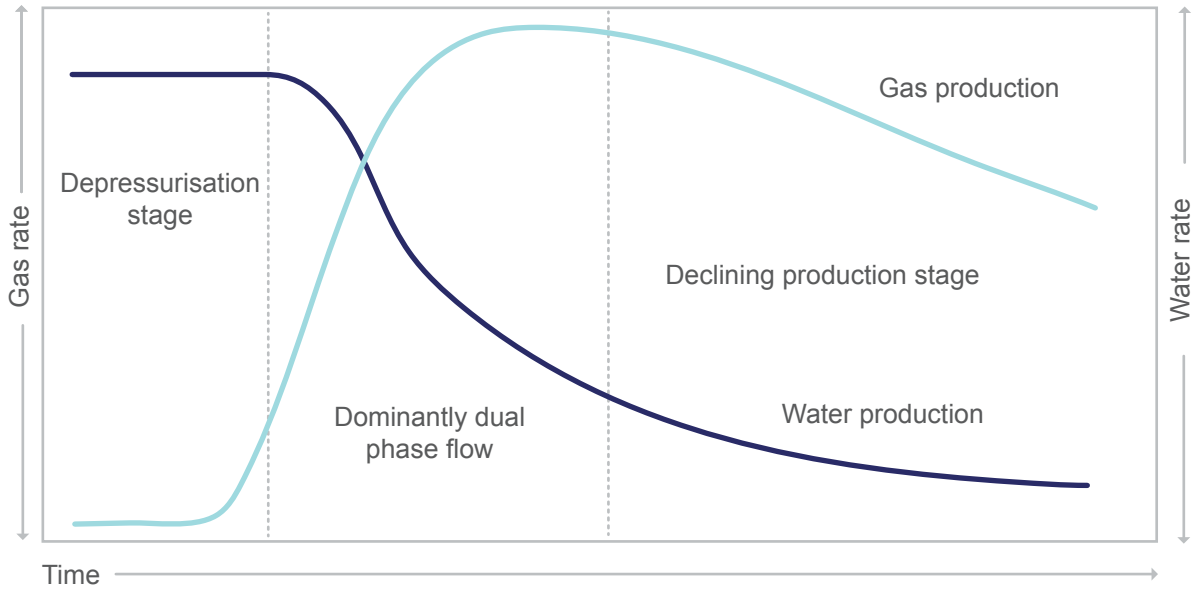


Source: GISERA (2014) *What is coal seam gas?*

CSG is held within the coal seam by water pressure, and the extraction of the gas requires the extraction of water from the coal seam to reduce the pressure and allow the gas to be released, as shown in Figure 1.5. In Australia, this 'associated water' is treated to remove salts and other chemical constituents. What results is called 'produced water', which can then be re-used or disposed of.[4] In other jurisdictions overseas and in conventional oil and gas operations, suitably treated produced water is often reinjected — after the hydrocarbons have been separated.

4 CSIRO (2015)

Figure 1.5: CSG production phases



Source: Queensland Water Commission (2012) *Underground Water Impact Report for the Surat Cumulative Management Area*

Depending on the characteristics of the coal seam, extraction can require further stimulation to increase gas flow, such as hydraulic fracturing, or fracking. Hydraulic fracturing involves pumping water, containing a proppant (such as sand) and chemical additives, at high pressure into the coal seam to either create or open up existing fractures within the coal. These fractures, which are kept open by the proppant, both increase the surface area for gas desorption and allow the gas to flow more freely through the well and to the surface.[5]

1.3 CSG in Queensland

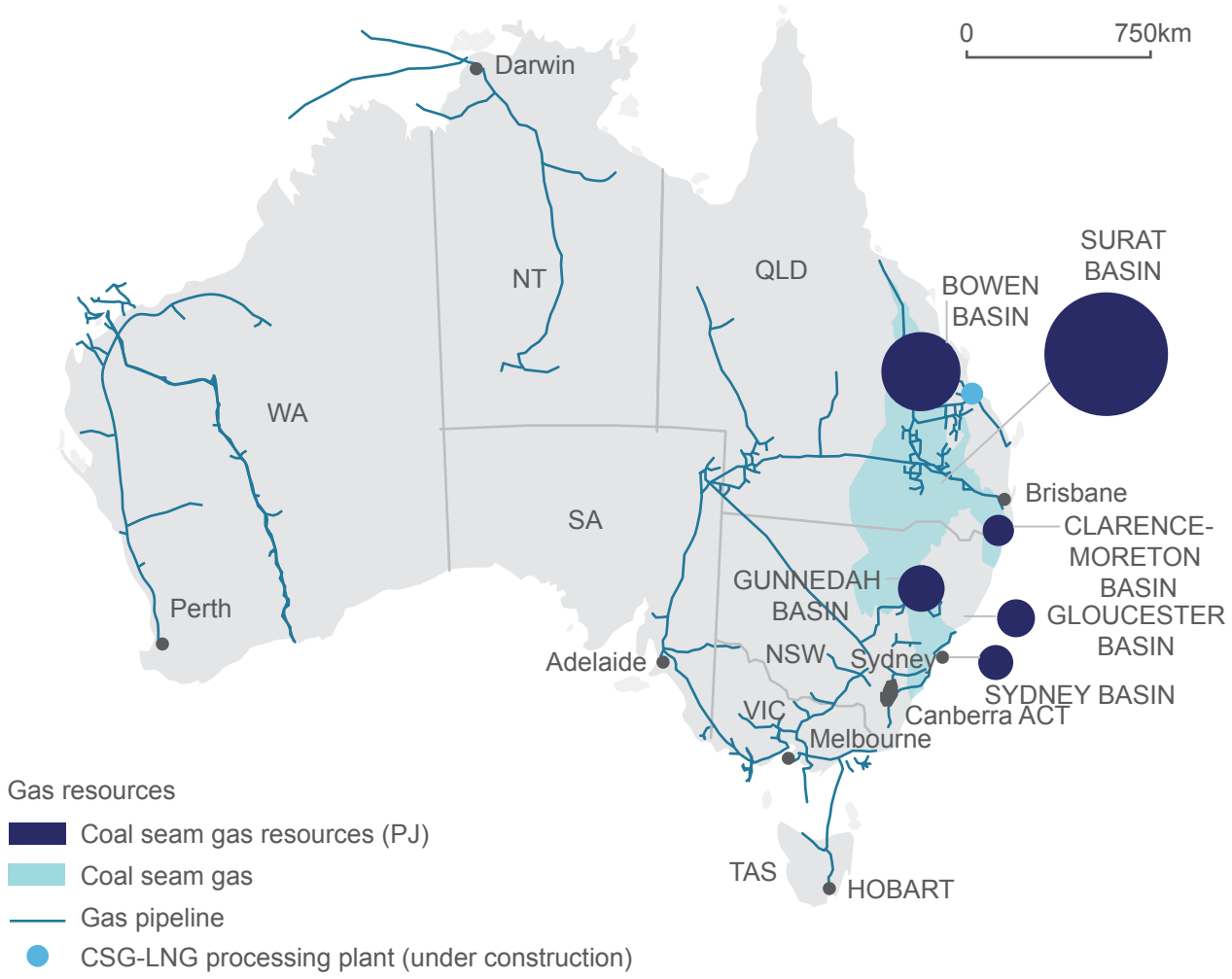
Australia's proved and probable (2P) reserves of CSG are significant, and most recently estimated to be around 45,000 petajoules (PJ).[6] The distribution of reserves is along the east coast as shown in Figure 1.6. Over 90 per cent of Australia's CSG reserves (around 42,000PJ) are located in Queensland's Bowen and Surat basins,[7] while smaller reserves are located in the Clarence-Moreton, Gunnedah, Gloucester and Sydney basins in New South Wales. Figure 1.7 shows the Queensland reserves in more detail.

5 Ibid

6 Geoscience Australia and the Bureau of Resources and Energy Economics (2014)

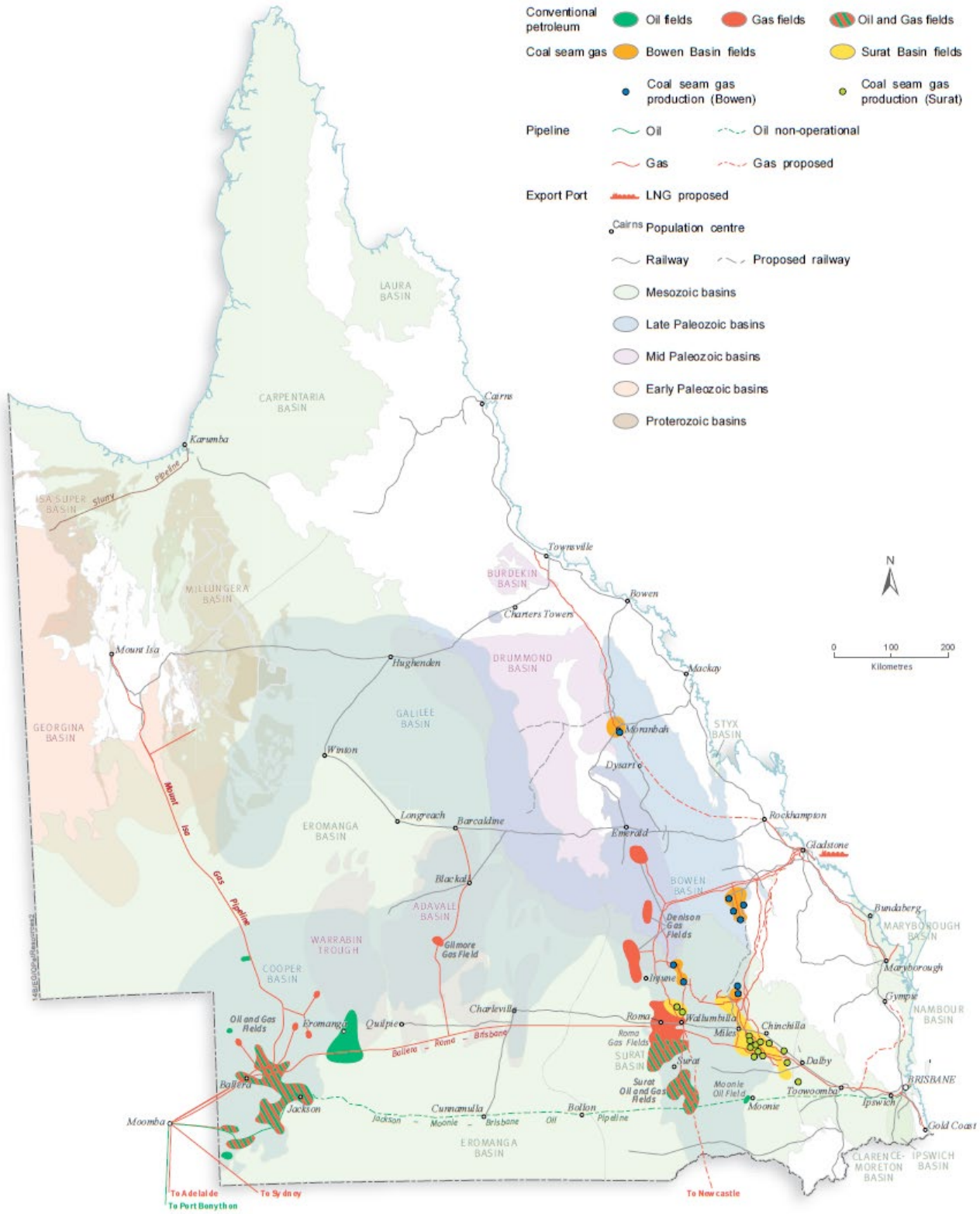
7 DNRM (2015a)

Figure 1.6: Australia's coal seam gas reserves and infrastructure



Source: Geoscience Australia and BREE (2014) *Australian Energy Resource Assessment 2014*

Figure 1.7: Queensland gas reserves and infrastructure



Source: DNRM (2015a), *Queensland's petroleum and coal seam gas 2013–14*

The Bowen and Surat basins have quite different demographic profiles, based on the definitions of these regions by KPMG in its 2013 analysis of census data.[8] The Bowen Basin comprises the Isaac, Central Highlands, Woorabinda and Banana Local Government Areas (LGAs), and the townships of Moranbah, Emerald and Biloela, with a total population of over 85,000 in June 2014.[9] There has been a long history of coal mining in the Bowen Basin prior to CSG development, with mining the largest employer in both 2006 and 2011.[10] Other important industries for employment in the Bowen Basin include agriculture, retail trade and construction.

The Surat Basin comprises the Toowoomba, Western Downs and Maranoa LGAs, including the major township of Toowoomba and townships of Dalby and Roma, with a population of over 200,000 in 2014.[11] Largest employers by industry are health care, retail trade, agriculture and education. The resources sector, including both mining and gas production, represented just 1 per cent of the working population in 2006, and grew by 170 per cent to reach 3 per cent of the population by 2011. This largely relates to a 273 per cent growth in oil and gas employment through the rapid development of CSG in the region.[12] The resources sector is now estimated to be the largest contributor to the Gross Regional Product of the Western Downs LGA, growing by an average of around 16 per cent per annum over the last five years.[13]

Both regions are home to a range of agricultural industries, including livestock and irrigated and dryland cropping. The Surat Basin in particular, where much of Queensland's CSG activity is now occurring, contains some of Queensland's most diverse agricultural lands, including sheep and beef production, horticulture, and broadacre cropping.[14] Coexistence between CSG and agriculture remains a key focus area for research, including at UQ-CCSG and GISERA.

CSG exploration commenced in Queensland in the late 1970s. The growth of CSG in these regions commenced at a time when conventional gas resources supplying gas to the state were starting to deplete. As LNG prices increased in the mid to late 2000s, opportunities emerged to utilise Queensland's CSG reserves for LNG export. This encouraged a wave of exploration activity as a number of gas producers sought to discover and develop CSG reserves. From a large range of proposals under consideration, three LNG projects proceeded to final investment decision. Of these three, two are currently under construction, and one recently started operations.

The three projects will have a combined capacity of over 25 Mtpa, slightly larger than the total export capacity of the LNG projects currently operating in Western and Northern Australia, and will use more than double the amount of gas annually consumed in the eastern Australian gas market. The three projects will be the first CSG to LNG projects in the world. They are:

- Queensland Curtis LNG (QCLNG) – operated by BG Group in a venture with China National Offshore Oil Corporation (CNOOC) and Tokyo Gas; QCLNG will have a capacity of 8.5 Mtpa from two trains, which commenced operations in December 2014 and July 2015 respectively;

- Gladstone LNG (GLNG) – operated by Santos in partnership with Petronas, Total and Korea Gas Corporation (KOGAS); GLNG will have a capacity of 7.8 Mtpa from two trains, and it is scheduled for first gas in the third quarter of 2015; and

8 KPMG (2013)
9 QGSO (2014a)
10 KPMG (2013)
11 QGSO (2014b)
12 Ibid
13 Western Downs Regional Council (2015)
14 Queensland Government (2011)

- Australia Pacific LNG (APLNG) – operated by Origin Energy (upstream) and ConocoPhillips (downstream) in a venture with Sinopec; APLNG will have a capacity of 9 Mtpa from two trains, with first gas expected in the last quarter of 2015.

The Queensland Government also encouraged gas exploration, including through the Queensland Gas Scheme, which was introduced in 2005 to boost the industry and reduce greenhouse gas emissions. It required electricity retailers to procure a certain percentage of their electricity from gas-powered generation.[15] The scheme was closed at the end of 2013, at which time gas-powered generation had exceeded the target of 15 per cent and reached almost 20 per cent of Queensland's electricity generation, up from only 2.4 per cent of generation when the scheme was introduced in 2005.[16]

As a result of these factors, Queensland's CSG reserves have grown substantially since December 2004, when 2P reserves (proven and probable) were around 3,650 PJ. Over the nine years to 2014, 2P reserves have increased more than tenfold, predominantly in the Surat Basin (Figure 1.8).

Figure 1.9 shows the rapid growth in CSG production. Commercial production from CSG commenced in 1996 from the Dawson River area near Moura in the Bowen Basin, and the Fairview area near Injune in 1998.[17] Commercial production of CSG from the Surat Basin started in 2006 from the Kogan North area near Dalby and the Berwyndale South area near Chinchilla.[18]

In the late nineties, CSG accounted for only three per cent of Queensland's gas, but with 285 PJ of production in 2013–14 it is now the dominant source of Queensland's gas, at almost 90 per cent.[19]

15 Queensland Government (2014a)

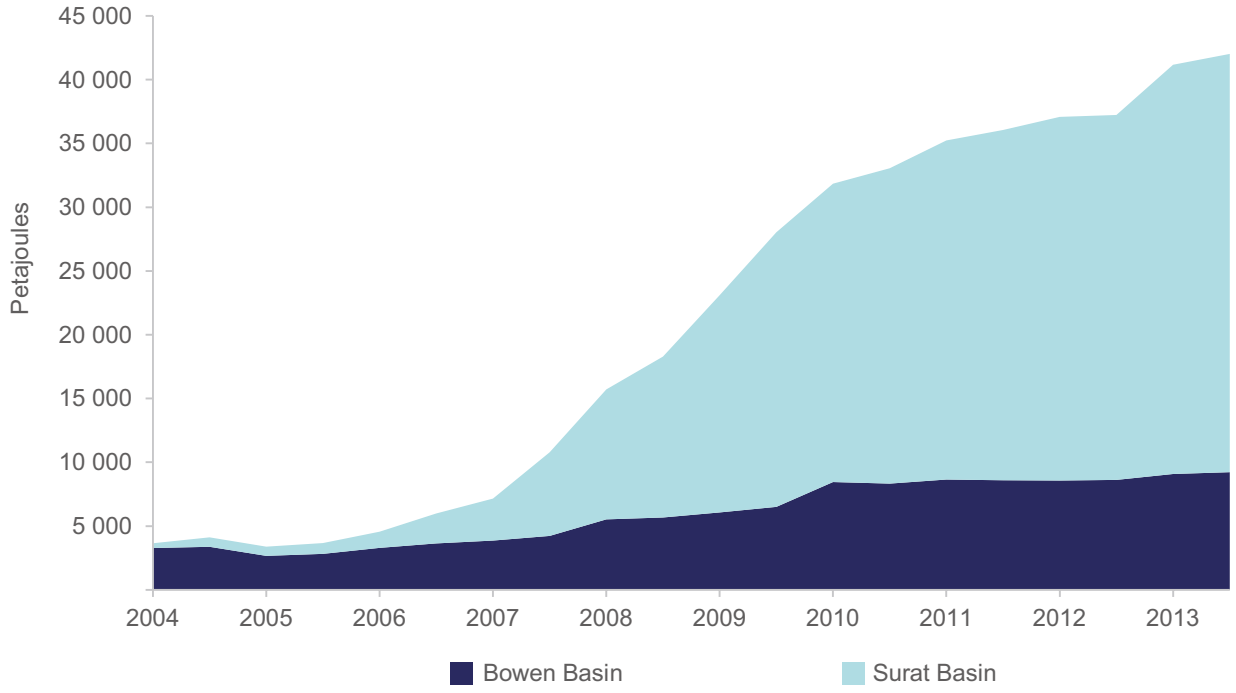
16 Queensland Government (2014b)

17 DNRM (2015a)

18 Ibid

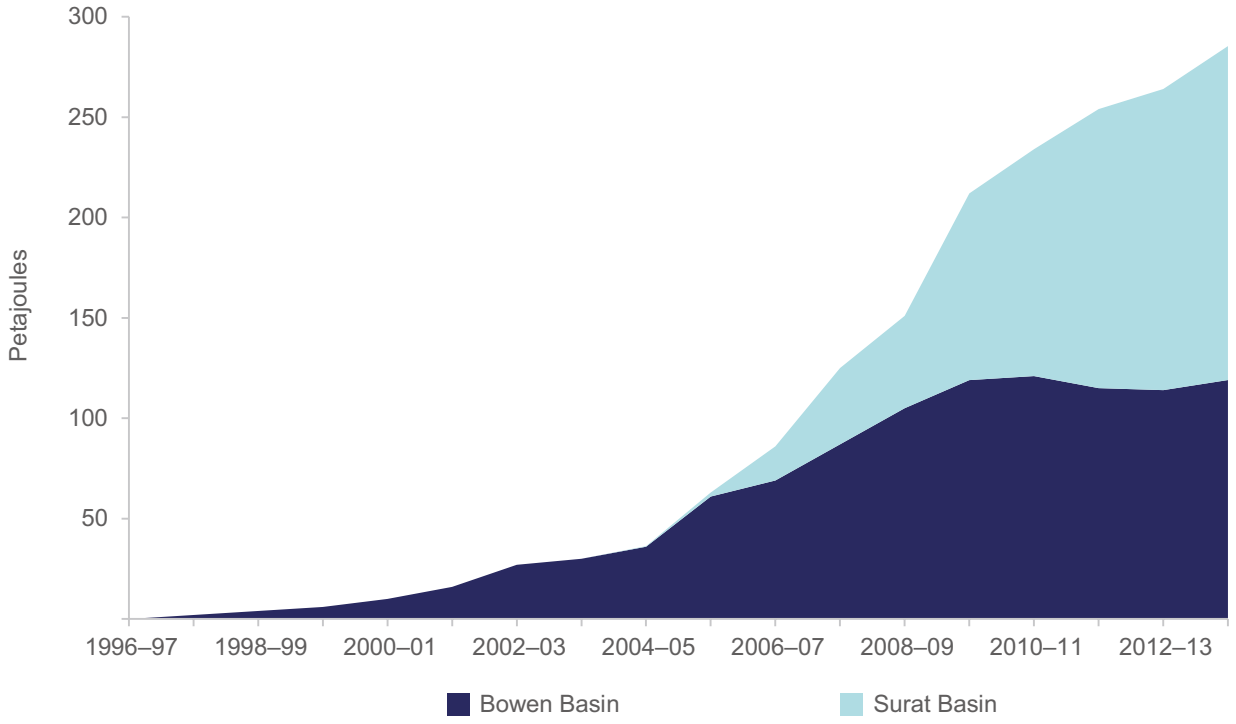
19 Ibid

Figure 1.8: Queensland coal seam gas 2P reserves (proved and probable)



Source: Queensland Government (2015a) *Coal seam gas production and reserve statistics*

Figure 1.9: Queensland coal seam gas production

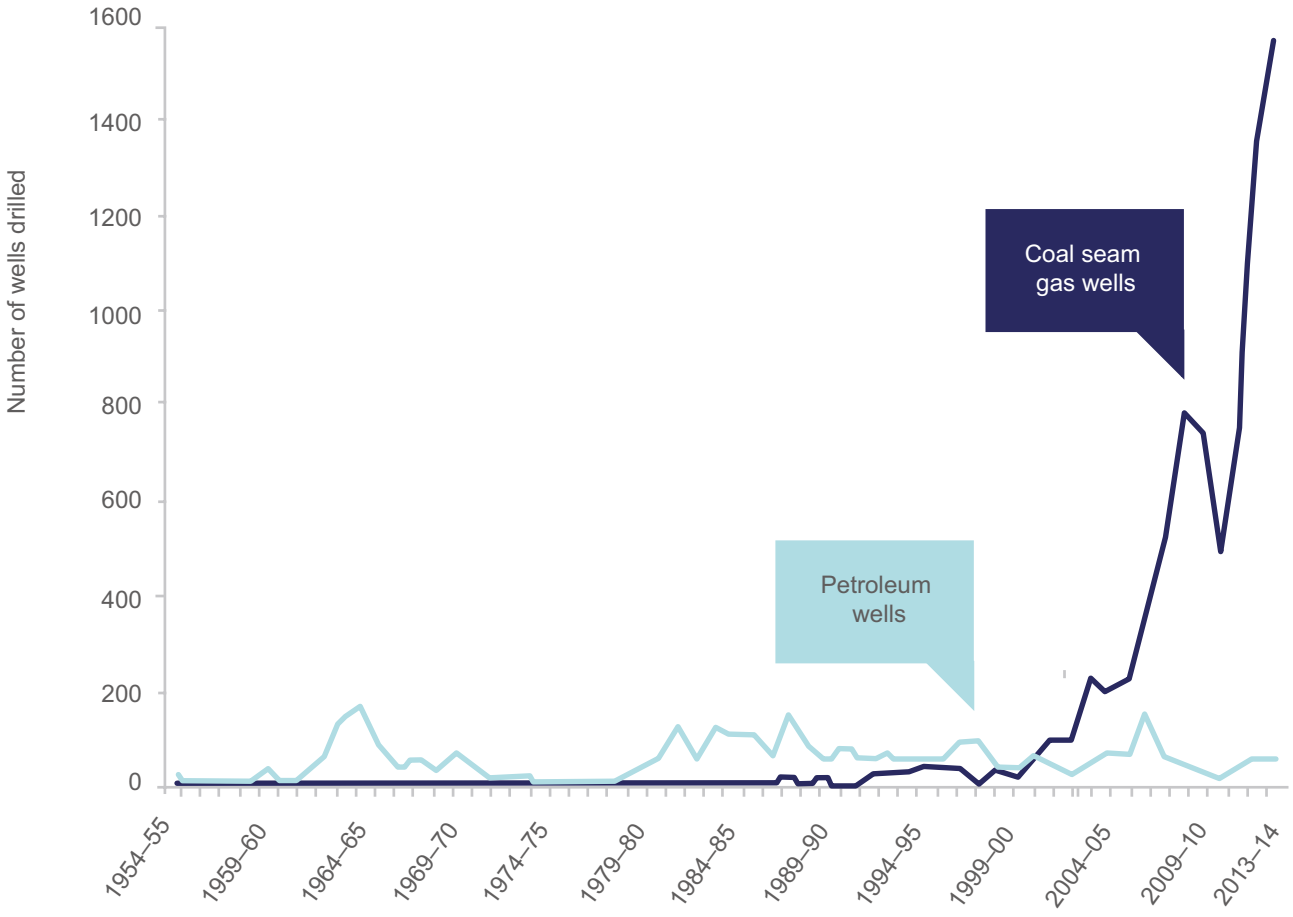


Source: Queensland Government (2015a) *Coal seam gas production and reserve statistics*

This growth in exploration and development has been accompanied by an increased physical presence and impact on the landscape. The number of CSG wells drilled per annum has increased rapidly over the period, from around 200 wells in 2005–06 to around 1,600 wells in 2013–14, as shown in Figure 1.10.[20] This activity is expected to decrease once production has been ramped up for the three LNG projects, and plateau at a lower level.

CSG activities are expected to continue in Queensland for at least several decades, with more than thirty thousand CSG wells expected to be drilled. The impact on the landscape will vary over time as additional exploration and appraisal activity is undertaken and as wells are developed and move into the production phase. In the long term, CSG proponents are required to decommission old wells and remediate CSG wells, ensuring the protection of the groundwater resources and isolation of geological formations, as well as ensuring that surface infrastructure is removed.[21]

Figure 1.10: Annual petroleum wells drilled in Queensland



Source: DNRM (2015a) *Queensland's petroleum and coal seam gas 2013–14*

20 Ibid

21 DNRM (2013)

1.4 How does CSG differ?

There are a number of key differences in the context and technology of development of CSG compared to other resource developments in Queensland. These differences, which primarily relate to the speed of development and the geospatial dispersion of the resource, contribute to differences in the socioeconomic impacts on communities and regions.

'Newness' and rapid development

Although exploration and production of CSG in Queensland started in the 1990s, it was not until the mid 2000s that the pace of development increased and the focus expanded from the Bowen Basin to encompass the Surat Basin. As a result, there was an increase in the area affected by this activity and the associated number of wells and the volume of production. The speed and scale of CSG development and its 'newness' focused attention in local towns and regions on the physical and environmental effects of CSG activities. In some cases, these effects and the related uncertainties are reported to have culminated in increased levels of stress and anxiety for some members of the regional communities.

In addition, although many communities in the Bowen Basin were accustomed to other resource development in the region, CSG development in the Surat Basin affected many communities that had not previously been exposed to significant mineral or petroleum resource development. The adjustment required by residents, businesses, and local government services in a number of these towns to CSG development was therefore quite large.

Geospatial dispersion

CSG development differs considerably from traditional resource development (including conventional gas development) due to the spatial dispersion of the CSG resource and associated activities required for extraction, processing and transport. While modest in total size compared to agriculture, CSG has a dispersed development footprint, not just because the resource occurs across a large subsurface area, but also due to a relatively large scale of the CSG industry's operations, which necessitate a range of infrastructure including gas wells, access roads, pipelines, processing plants and dams.

A complicating factor is that communities and regions are often affected by the cumulative impacts of CSG development from two or three different companies given the existence of multiple projects run by different proponents in the same region.

Land access, land use and community engagement are issues for all resource developments. However, in contrast to coal mining, which takes land out of use by others, existing land uses continue to cohabit over a large area where CSG activities occur. That is, CSG wells are being drilled on active farms and grazing properties. The overlap of activities exposes a larger number of people to the social and economic impacts of the resource development. The 'coexistence' between the CSG industry and communities increases the need for community engagement activities. Given the large number of people who can be directly impacted and the nature of the development, coexistence needs to be maintained for the duration of CSG activities.

The overlap also means that compensation is required for a large number of landholders, rather than simply purchasing an area of land to be mined. Compensation payments can assist with the distributional impacts of CSG development, given that financial benefits are provided to affected landowners. There are more than 5,000 Conduct and Compensation Agreements (CCAs) signed in Queensland in gasfield and pipeline areas.[22]

22 APPEA (2015)

The geospatial footprint of CSG development in Queensland has overlapped with populated areas with pre-existing land uses and industries, including agricultural uses of grazing, cropping and irrigated cultivation. It has been increasingly important for the CSG industry to have a deep understanding of key issues in relation to developing and managing sustainable coexistence with the agricultural industry. Consistent with this goal, the industry is supporting significant research in this area, GISERA and UQ-CCSG.

1.5 Regulatory and policy frameworks

Successful coexistence between CSG and existing landholders and communities is essential for achieving and maintaining a social licence to operate for the industry as a whole. The Australian Government regulatory and policy regime works in concert with state and territory governments, which have primary responsibility for the regulation of CSG in their jurisdiction to ensure responsible development.

The development of the Australian and Queensland governments' policy and regulatory frameworks has been influenced by the National Partnership Agreement on Coal Seam Gas and Large Mining Development (the NPA).[23] The NPA was signed by the Australian, Queensland, New South Wales, Victorian and South Australian governments in February 2012. The purpose of the NPA is to create a more consistent national approach to strengthen the regulation of CSG and large coal mining development by ensuring that future decisions are informed by substantially improved science and independent expert advice. Although the NPA expired in June 2014, arrangements put in place ensure that its objectives and outcomes have enduring effect.

Under the NPA, responsibilities of the Australian Government included establishing the Independent Expert Scientific Committee on Coal Seam Gas and Large Coal Mining Development (IESC), and funding bioregional assessments and other priority research (discussed further below). Responsibilities of state governments included ensuring that processes were put in place to ensure coal seam gas (and coal mining) developments likely to have a significant impact on water resources are referred to the IESC for advice, and that this advice is taken into account in a transparent manner.

Australian Government

The Domestic Gas Strategy sets out the contributions made by the Australian Government to ensure the responsible development of CSG and other unconventional gases, including:

- Improving gas markets to enable better access and price discovery for all market participants, through the Council of Australian Governments (COAG) Energy Council and the Office of the Chief Economist.

- Understanding and responding to potential social impacts to build confidence that community needs and expectations will be considered, including through this study and the work of GISERA.

- Understanding and communicating the science to build confidence in the community that risks and environmental impacts can be managed, through the bioregional assessment of cumulative impacts on water resources, the work of the IESC, and the research done by the National Industrial Chemicals Notification and Assessment Scheme (NICNAS), the Department of Environment, Geoscience Australia, GISERA and CSIRO.

- Attracting investment and encouraging steady and predictable supply through better regulation, including the development of a one-stop shop for environmental approvals and the development of international best practice standards.

23 COAG (2012)

- Tailoring production technologies for Australia to ensure we are making the best of our resources by developing a 'National Strategic Research Initiative for Onshore Gas'.

- Establishing an Oil, Gas and Energy Resources Industry Growth Centre to accelerate advancements within the industry.

- Improving access to geoscientific precompetitive data from Geoscience Australia to understand our resources and attract investment.

- Demonstrating the macroeconomic benefits to build community confidence.

- Learning from mistakes and successes of other jurisdictions through sharing knowledge between states and from international experience.[24]

The Australian Government plays a role in regulating the environmental impacts of CSG development through the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act). The EPBC Act focuses on the protection of matters of national environmental significance. Matters of national environmental significance include 'a water resource, in relation to coal seam gas development and large coal mining development' (known as the 'water trigger') as well as places of world and national heritage, wetlands of international importance and listed threatened species and ecological communities.

The water trigger ensures coal seam gas developments that are likely to have a significant impact on water resources are comprehensively assessed at a national level. As a result of the introduction of the water trigger, the Australian Government Environment Minister can set appropriate conditions as part of the project approval to ensure that any impacts on a water resource are acceptable.

To support regulation under the EPBC Act, the Australian Government is also leading efforts to improve understanding of the water-related impacts of coal seam gas (and large coal mining) development. This includes:

- Providing secretariat and technical support to the IESC, which provides expert scientific advice to Australian government regulators on the water-related impacts of coal seam gas and large coal mining development proposals.

- Managing the Australian Government's programme of targeted bioregional assessments to assess the potential impacts of coal seam gas and large coal mining developments on water resources and water-related assets.

- Managing the Australian Government's research programme to identify and address critical gaps in scientific understanding of the water-related impacts of coal seam gas and large coal mining developments.

The Australian Government also works in partnership with state and territory governments through the COAG Energy Council to develop best practice regulations for CSG. The National Harmonised Regulatory Framework for Natural Gas from Coal Seams is a suite of leading practices with a focus on four key areas of operations: well integrity; water management and monitoring; hydraulic fracturing; and chemical use.[25]

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24 Department of Industry and Science (2015)

25 Standing Council on Energy and Resources (2013)

The Australian Government has also developed the following coexistence principles for the development of coal seam gas, which were featured in the Domestic Gas Strategy[26] and the Agricultural Competitiveness White Paper:[27]

- Access to agricultural land should only be done with the farmer's agreement and farmers should be fairly compensated.
- There must be no long term damage to water resources used for agriculture and local communities.
- Prime agricultural land and quality water resources must not be compromised for future generations.

Queensland Government

In response to the scale, speed, the potential risks and inherent uncertainties of CSG development, the Queensland Government put in place an 'adaptive management' process for imposing appropriate regulation on the industry that allowed for flexibility in dealing with unforeseen outcomes or risks and addressed community and environmental concerns.[28] This ensures that the potential risks of adverse physical outcomes from CSG development are identified and appropriately managed. In addition to the standard legislation that applies to the gas industry with regard to exploration and production activities, safety, water and environmental impacts, a range of regulatory instruments were introduced specific to the CSG industry with regard to water management, gas gathering, construction and abandonment of wells, and emissions detection and reporting.

The Queensland Government created the GFCQ in 2013 to manage and improve sustainable coexistence among rural landholders, regional communities and the onshore gas industry. As an independent statutory organisation, the GFCQ has played a critical role as a key reference point for both CSG and the agricultural industry. It not only facilitates relationships between landholders and CSG companies, but also provides impartial advice, information and tools throughout negotiations about land access and compensation. The GFCQ is also responsible for reviewing the effectiveness of legislation and regulation and for making recommendations to government and industry.[29]

The previous Queensland government also created a 'Royalties for Regions' program in order to channel resource royalties toward regional infrastructure projects. This program has been superseded by the 'Building our Regions' program, with $200 million available over two years as a 'targeted infrastructure' program.[30]

The Queensland regulatory framework is consistent with the Australian Government principles of supporting coexistence, the key components of which are outlined below.

26 Department of Industry and Science (2015)

27 Australian Government (2015)

28 Queensland Government (2015b)

29 GFCQ (nd)

30 DoSD (2015)

Land access

A major component of the coexistence between CSG and communities is land access. The Queensland Government's land access laws have been updated to ensure that:

- landholders are fairly compensated for activities on their land
- resource companies minimise the impact on existing land and business operations.[31]

The Queensland Government's land access regulatory framework sets out consistent legislation and processes relating to land access and compensation, including obligations for each party and expectations for CCAs between resource companies and landholders.[32] The Land Access Code was established in 2010 under the *Petroleum and Gas (Production and Safety) Act 2004*, which aims to promote co-operation and improved relationships between the agriculture and resources/CSG sectors.

The Queensland Government has also been working closely with other organisations to promote improved stakeholder relationships and ensure that quality information and education on land access rules and CCA negotiations is provided to communities. There are checklists and guidelines on CCA negotiations and compensation arrangements available from peak body and Government organisations, including AgForce, Basin Sustainability Alliance, GFCQ, and the Queensland Government. All of these factors have positively contributed to completion of a significant number of negotiations between landholders and CSG companies, reflected in substantial increase in signed CCAs, from around 1,800 in July 2011 to 5,107 in March 2015.[33]

As a further innovation, the Queensland Government also established the CSG Compliance Unit within the DNRM to increase the resource available to landholders. The aim of the Unit is to engage and respond to landholders' concerns, to monitor compliance of CSG activities with government requirements, and to coordinate groundwater monitoring by the landholders themselves through 'CSG Net'.[34]

Water resources

The protection of water resources is a key issue for the successful coexistence of agriculture and CSG, given the importance of ongoing access to safe water for the maintenance of agricultural livelihoods. The Queensland Government has put in place a range of measures to address water management issues, including controlling the water quality and prohibiting the use of potentially harmful chemicals, such as benzene, toluene, ethylbenzene and xylene (BTEX) in hydraulic fracturing fluids.[35]

The OGIA was established under the *Water Act 2000* to oversee the groundwater impacts of the CSG industry.[36] A cumulative management area has been declared over the Surat Basin. As a result, gas companies are mandated to report water production and monitoring data and OGIA prepares an Underground Water Impact Report (UWIR), which is updated every two years. The UWIR includes a cumulative assessment of groundwater impacts of CSG extraction activities and an overview of integrated regional management arrangements. Any necessary 'make good' arrangements, including the provision of water to landholders whose bore levels drop by 5 metres or more following initiation of CSG development, remain the responsibility of the companies.

31 Queensland Government (2010)
32 Ibid
33 APPEA (2015), Queensland Government (2013)
34 DNRM (2015c)
35 Ibid
36 DNRM (2015d)

In addition to OGIA's public reports and forecasts, and landholder groundwater engagement through CSG Net, the Queensland Government have also created an online data map, the 'CSG Globe', to enable the public to view activity and water data related to the industry.[37] CSG Globe plots on a Google Earth map the location of and data from bores that are required to be registered with the Queensland Government.

Resource protection

The Queensland Government's regulatory framework identifies and protects areas that are considered to be 'of regional interest' to ensure a balance between protecting 'priority land uses' (such as farming on highly fertile land) and supporting diverse economic development. The *Strategic Cropping Land Act* (SCL Act) was introduced in 2011, which was replaced by the *Regional Planning Interests Act* (RPI Act) and associated guidelines in 2014.[38]

The RPI Act defines Priority Agricultural Areas (PAAs), which are strategically significant and high value agricultural areas within a region. PAAs include the major dryland and irrigated cropping areas of the Darling Downs. Proposed activity must not result in a material impact on a priority agricultural land use. Strategic Cropping Areas (SCAs) are areas defined as being of regional interest under the RPI Act, which incorporate all the former protections for land previously identified under the SCL Act. In order for CSG to be approved in SCAs, the activity needs to demonstrate to have an impact for less than 50 years except under exceptional circumstances. The RPI Act also provides protection for Priority Living Areas and Strategic Environmental Areas.

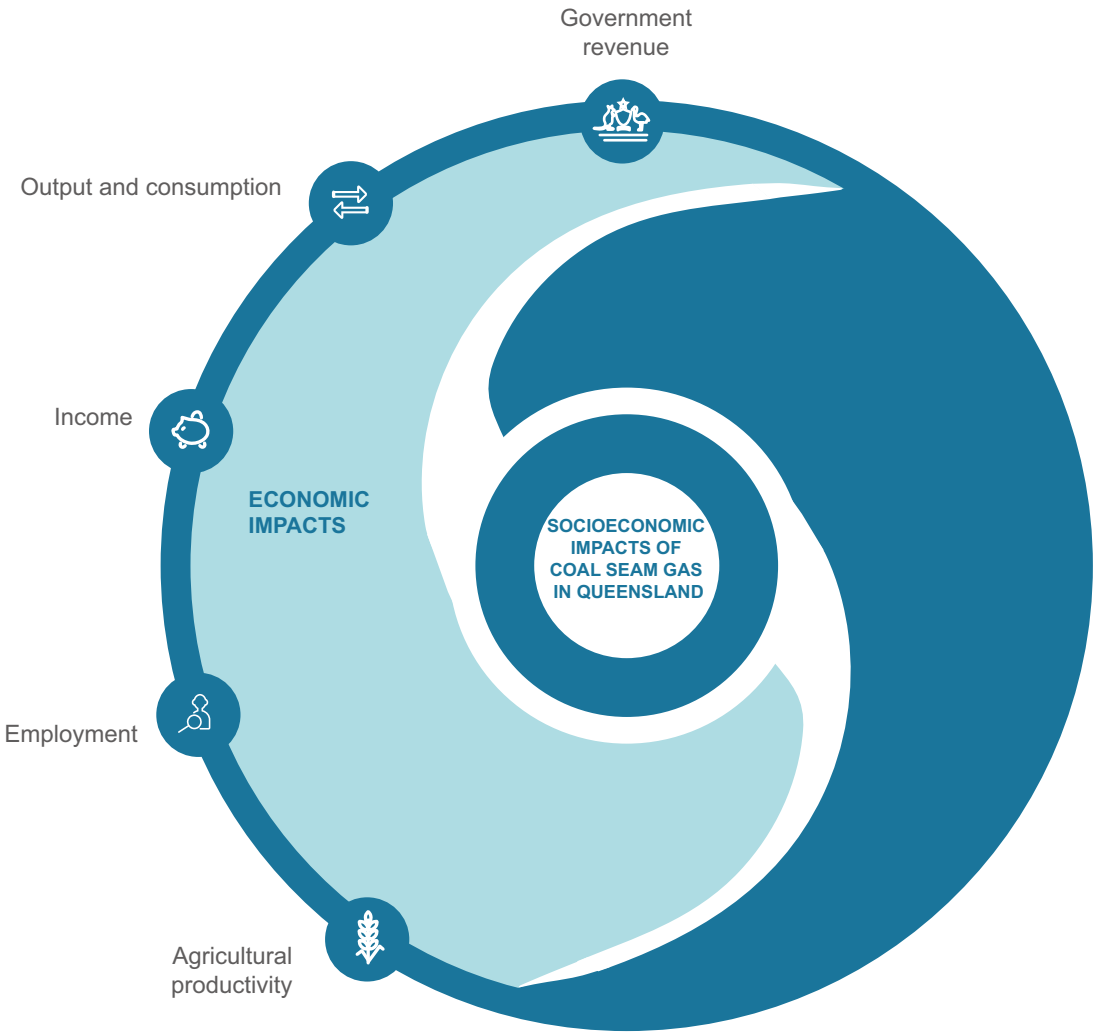
37 Queensland Government (2015c)

38 DILGP (2015), DNRM (2015b)

2. Direct economic impacts of CSG

This chapter assesses the direct economic impacts of CSG development in Queensland. It finds that the headline economic impacts are consistent with those of a typical natural resource development, with increases in employment, income, labour, output, consumption, and government revenue as shown in Figure 2.1.

Figure 2.1: Structure of economic impacts of the resources sector



Source: Department of Industry, Innovation and Science (2015)

Given the overlap of CSG development with agricultural activities, the chapter also considers the impact of CSG development on agricultural productivity. There are a large range of factors which have the potential to reduce productivity, including time spent in negotiations, land use, and competition for labour. However, these can be offset by positive factors, including compensation and access to treated water.

2.1 Typical impacts of natural resource development

The typical economic impacts of natural resource development set an important context for considering the impacts of CSG development. Given this array of impacts, it is easy to recognise that resource development has both positive and negative economic consequences.

Common in the resources literature is the idea of a 'resources curse', in which the economies of countries with significant natural resources often grow more slowly than those without. The decline in economic growth is attributed a number of factors including to the resource development crowding out other forms of industrial development, as the workforce and skill sets are tailored to the one industry. The existence of a resource curse is not universally accepted but for those who subscribe to it at a national level, it is often seen as more of an issue for developing and non-democratic countries. Hajkowicz et al found no evidence of a resource curse at a local government level in Australia's mining regions,[39] but Fleming et al did find some adverse effect in eastern regions.[40]

The key change caused by any resource development is effectively a labour demand shock. The labour demand generated as a result of resource development increases employment and salaries in the region, contributing to economic growth. Fleming et al found that a doubling of the number of miners in a region is expected to lead to 2 per cent growth in family income in that region.[41] The demand for labour generally cannot be filled by the local population. As a result, the regional population increases, although some of this increase can be temporary, non-resident workers.

The ways in which changes in employment impact on the economy can vary. Job spillovers (or multipliers) are created through employment opportunities that develop in other sectors, while crowding out of local employment results from people moving from other industries into the resource development sector. How these changes to employment flow through the economy has a major impact on whether the development results in long-term positive or negative economic outcomes. If job spillovers outweigh crowding out, medium term employment growth can be favourable, whereas if job spillovers are negligible, non-mining sectors will be negatively affected, with employment growth reduced in the medium term.[42]

Resource development also has consumption effects. There is increased spending from the resource sector itself to direct business suppliers, which will flow through to indirect effects on other suppliers.[43] In addition, increased disposable income of workers in the region leads to increased demand, consumption and investment. Although a larger share of consumption effects are estimated to flow through to capital cities and regional centres, a portion will generally stay in the region. In addition, resource development will lead to increased government revenue, both directly from the project and from the economic growth more broadly. However, the rise in government revenue from royalties would only start once the resource project begins operations and sales, after an initial construction boom.

39 Hajkowicz et al (2011)

40 Fleming et al (2015)

41 Ibid

42 Fleming and Measham (2014)

43 Rolfe et al (2011)

Although one can determine a general pattern of impacts of natural resource developments, it is important to note that these impacts vary considerably as a result of the initial state of the hosting community, as well as external factors regarding the resource itself, the broader community, and the communities' existing industries or commodities. Regional factors include the type of economic activities, existing skillsets, the nature of the housing market, and the integration of the regional economy into the national economy. In agricultural areas, rainfall patterns can be a critical issue. External factors include the type and location of the resource, the life cycle of its extraction, and the price volatility of the commodity.[44] Given the spatial dispersion of the CSG industry, these factors can also impact on how different communities have experienced CSG development.

The economic impacts of CSG, although varying between regions and towns, are broadly consistent with the economic impacts of typical resource developments. The rest of this chapter considers the impacts of CSG development against the following metrics:

- employment, both in terms of direct employment by CSG companies and indirect impacts on broader employment in the state
- household income, including the combined income for people sharing a household
- increases to output and consumption through changes to Queensland's Gross State Product (GSP)
- increased royalties and other government revenues.

2.2 Employment

Prior to the commencement of LNG project construction, CSG development in Queensland was projected to have a large impact on employment, leading to strong employment growth, both in terms of direct employment and indirect effects.

Consistent with predictions, a range of studies find strong evidence that the growth of the CSG industry has provided increases in both direct and indirect employment, particularly in the construction and professional services sectors.[45] However, these empirical studies have generally covered periods only leading up to 'peak construction' for the CSG industry, which occurred during 2014. More recent research at UQ-CCSG indicates that employment in the CSG industry began to fall, in line with project plans, from this point.[46]

Economic data from the Queensland Government Statistician's Office (QGSO) shows a strong growth in employment in the CSG resource regions. [47] Although this growth cannot be attributed purely to the growth in the CSG sector, the unemployment rate in the Surat Basin decreased from 5.9 to 3.1 per cent between the 2001 and 2011 census, and in the Bowen Basin from 4.3 to 2.2 per cent over the same period.

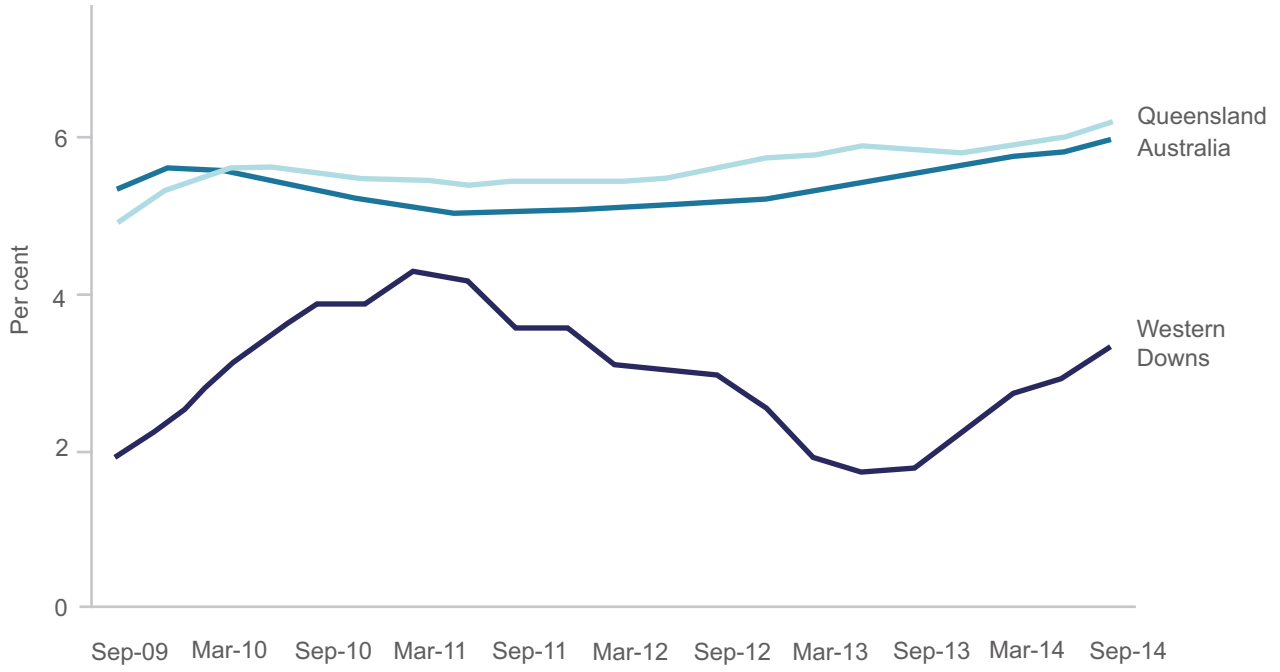
44 Fleming and Measham (2013)

45 Fleming and Measham (2015a)

46 Will Rifkin, UQ, personal communication

47 QGSO (2015)

Figure 2.2: Unemployment rate in the Western Downs



Source: Western Downs Regional Council (2015) *Western Downs Economic Annual*

Figure 2.2 shows the change in unemployment in the Western Downs region, which was 3.3 per cent in the September quarter of 2013, significantly lower than the rates for Queensland and Australia.[48]

Unemployment figures for agricultural areas need to be viewed carefully, as there is often an amount of unpaid work on farms provided by family members. As a result, there may be people who are active in the workforce who are not counted as 'participating' in the measured workforce. Nonetheless, the peaks and troughs in unemployment in relation to resource development show strong changes in levels of employment. For individual towns, the UQ-CCSG town-by-town profiles for the heart of the CSG region show unemployment dropping during peak construction in the CSG industry in 2013.[49]

The growth in employment as CSG development increased was even stronger when considering purely the change in mining sector employment. Over the same period, mining employment grew by 121.6 per cent in the Bowen Basin (from 20.8 to 31.8 per cent of the workforce), and by 574.5 per cent in the Surat Basin (from a lower base – from 1.3 to 7.2 per cent of the workforce), although this data encompasses the broader mining sector and not just CSG.[50] KPMG analysis of the census found that the percentage of people working in the oil and gas sector in the Surat increased by 273 per cent between the 2006 and 2011 census.[51]

An analysis of census data between 2001 and 2011 by Fleming and Measham found that employment in the mining/resources sector showed higher growth in areas with CSG development compared to the rest of Queensland, as has non-mining employment in some areas.[52] Employment in the Surat Basin grew more

48 Western Downs Regional Council (2015)

49 Rifkin et al (2015)

50 QGSO (2015)

51 KPMG (2013)

52 Fleming and Measham (2015a)

than in the Bowen, signalling that the positive employment effects were stronger in areas such as the Surat Basin that did not have a history of mining.[53]

From a closer examination of the Surat Basin, there was mixed evidence of spillover effects of employment into other industries. The expected positive job multipliers across a broad range were evident only in the construction and professional services industries, with 1.4 new construction sector jobs and 0.4 new professional services jobs for each additional CSG job, but no impact on jobs in retail trade or other local services.[54]

The growth in employment in the CSG industry occurred during a period of large resources investment in Australia. Over the period 2003 to 2014, more than $400 billion of resource projects were initiated in Australia, around half of this investment in the development of LNG projects, predominantly onshore in Queensland or on the northwest shelf and in Darwin. This large peak of investment activity led to high levels of employment and competition for skilled labour.

There is evidence that some of the employment in the CSG sector has been drawn from other industries, as the growth in employment in CSG has been associated with a reduction in agricultural employment. However, the latter decline could also be attributed to drought, increased mechanisation, and a trend toward consolidation of farm ownership. Fleming and Measham found evidence that agricultural jobs have been affected negatively: 1.8 agricultural jobs lost correlating with every CSG job created.[55] Those shifts could be direct moves into mining jobs or could be due to high labour costs encouraging a move toward less labour-intensive agriculture. Farming communities can experience limited availability and increasing cost of rural labour as a result of competition between CSG companies, especially at peak times such as planting and harvest.[56]

Contrary to expectations, there was no significant loss of jobs in the manufacturing sector as a result of the growth of CSG in the period covered by the data. Local businesses owners have reported skills shortages, difficulties in hiring and retaining suitable staff for service industries, such as food, accommodation, and certain trades such as electricians.[57] They attribute that to attractive wages in the resources sector and a significant spike in weekly rents in towns central to the CSG development.

With moderating consumption growth and lower commodity prices, resources companies now have a renewed focus on reducing costs and improving productivity. A casualty of this could be employment numbers, combined with the fact that employment requirements change as projects move from the construction phase to the production phase.

53 Fleming and Measham (2015a)

54 Fleming and Measham (2015a)

55 Ibid

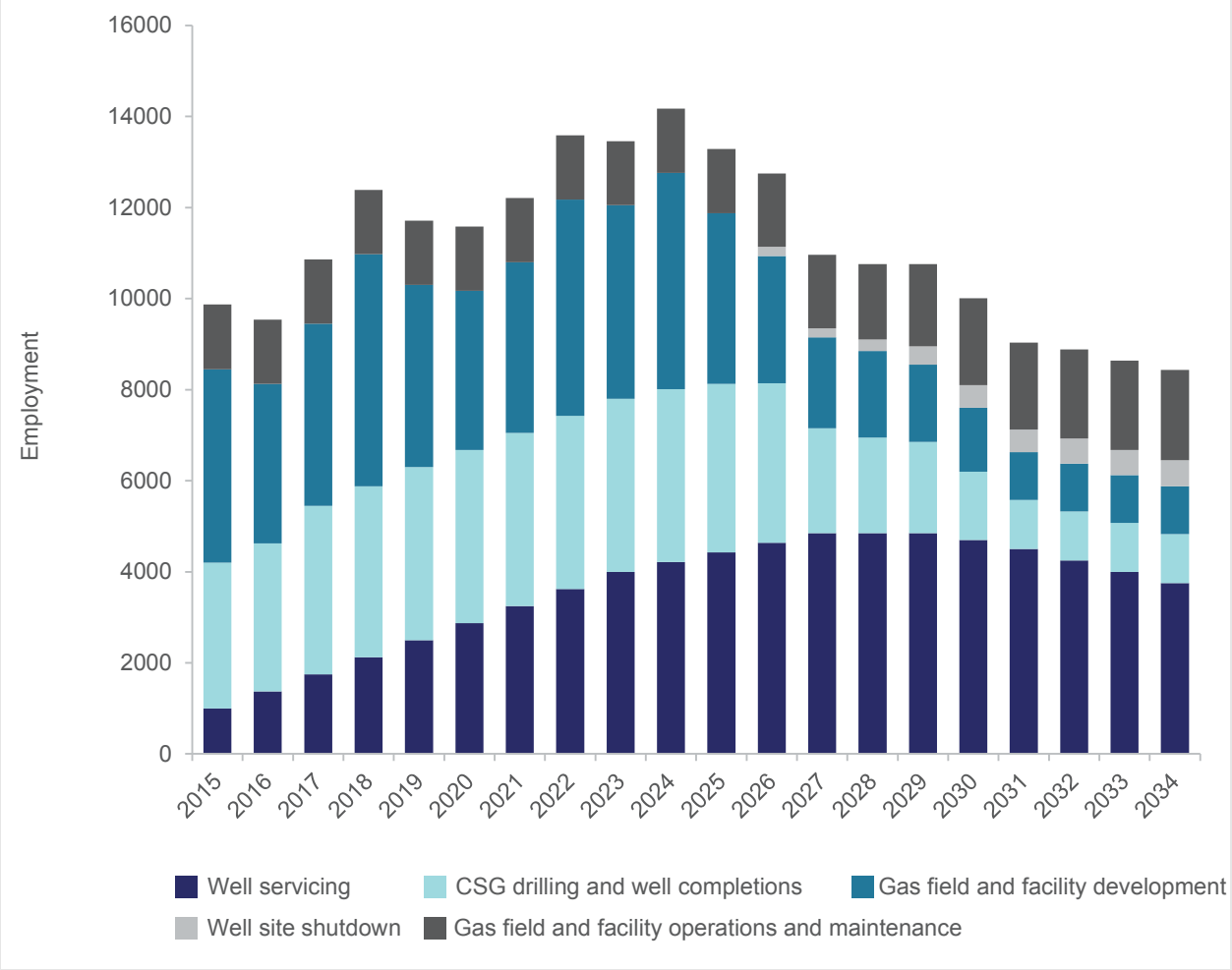
56 Cavaye J and Kelly L (2015), Hossain et al (2008)

57 Rifkin et al (2015)

Box 2.1: Employment in the upstream CSG industry

Although employment for LNG project construction is now tapering, Energy Skills Queensland forecast that the upstream CSG workforce would not peak until 2024 (based on a scenario of 45,000 wells and six LNG trains). Upstream activities consist of CSG well drilling, well servicing, well shutdown, and gas field and facility development, operations and maintenance, and the balance between the roles changes over time, with well servicing becoming the largest employer after drilling and gas field development pass their peaks, as shown in the figure below.

Box 2.1 Figure 1: Forecast employment in the upstream CSG industry



Source: Department of Industry, Innovation and Science (2015), based on Energy Skills Queensland (2013) *Queensland CSG to LNG Industry Workforce Plan*

2.3 Income

The CSG sector, like other resource sectors, tends to pay higher wages than many other jobs in regional economies. While wage increases are good for workers (both those directly employed by CSG companies and those in other industries where increased demand pushes wages up), there is concern for other regional businesses who can struggle to compete with the resources industry for labour.

The growth of the CSG industry in Queensland has led to increases in the number of high income residents in CSG regions.[58] Fleming and Measham's investigation of economic outcomes related to the CSG industry across southern Queensland found that between 2001 and 2011, areas with CSG development showed higher income growth than those without. Over this period, family income grew by 12 to 15 per cent more in areas impacted by CSG than the rest of Queensland.[59] Analysis of business income in certain towns showed a five-fold increase in one year.[60]

It is not clear the extent to which income growth can be attributed strictly to increased wages from the resource industry or whether it can also be attributed to non existent on-farm wages (such as a family member working unpaid on the farm), or artificially low declared income for a small business owner (through reinvesting profit in the business) being replaced by full-time paid employment in the sector.

Although it is difficult to identify precise figures for agricultural income, the data suggest that CSG development was associated with income growth, but also that the growth was not restricted to workers residing temporarily in CSG regions (and declaring their income in other regions). The income growth could therefore be seen to be of potential benefit to the region (additional if it was spent in the region), as the income effect applied to locally-residing families as well as non-resident workers.

Compensation payments negotiated as part of land access arrangements, including both up-front and ongoing components, can be an important income source for farmers. They can not only buffer against the variable nature of agriculture income, including through periods of drought, but also provide greater certainty in financing agricultural businesses. There is a question about the extent to which lending institutions recognise this income stream in providing loans to enable expanding farm businesses.[61]

Offsetting this increase in household income is a potential increase in the cost of living. The costs of services and some goods may increase as a result of increasing demand and pressures on labour costs for businesses. The Rural Industries Research and Development Corporation (RIRDC) reported a substantial increase in the cost of fencing (from $200 per day to $600), mainly due to shortages in good quality skilled labour.[62] These factors together can create distributional issues, which are considered further in the following section.

The distribution of income and other impacts of CSG development will be considered further in section 3.2.

58 KPMG (2013)

59 Fleming and Measham (2015a)

60 Katherine Witt, UQ, personal communication (based on analysis of ATO data)

61 Lisa Kelly, UQ, personal communication

62 RIRDC (2013)

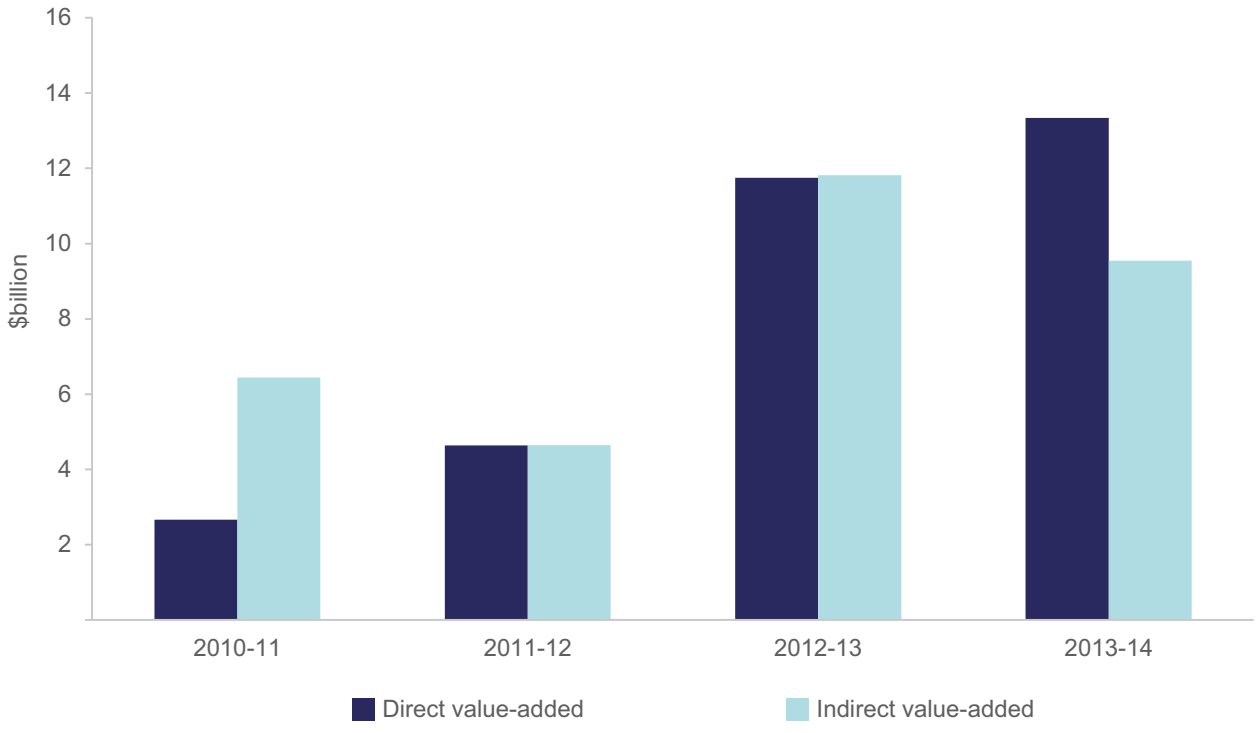
2.4 Output and consumption

Forecasts of the impact of CSG development on Queensland's GSP were consistently positive, both in terms of direct effects and indirect effects of the flow-on impacts of the CSG industry to other sectors. Much of the GSP growth was forecast to come from industries that supply the oil and gas sector and whose output is non-tradable, including construction, other mining, transport and hospitality. Offsetting the benefits to some extent were industries forecast to suffer losses as a result of the growth in CSG, including tradable sectors where there is competition from international suppliers, such as manufacturing and agriculture. ACIL Tasman forecast that the cumulative impact of a six-train LNG export industry on Queensland's GSP would peak at around $25 billion in 2035.[63]

A review of the Lawrence Consulting analysis of data collected by the Queensland Resource Council since 2010–11 illustrates that the forecast growth in the contribution of the CSG sector to Queensland's GSP has commenced. In 2013–14, direct value added (including salaries to direct full-time employees, purchases of goods and services and community contributions), was $13.3 billion and second round value added (supply chain and consumption effects) from the CSG sector was $9.5 billion, providing a total contribution to GSP of $22.9 billion,[64] as shown in Figure 2.3.

The Queensland Government expects that state GSP will strengthen by 4.5 per cent in 2015–16 and 2016–17, as a result of the surge in LNG exports.[65]

Figure 2.3: **Modelled nominal contribution of the coal seam gas sector to Queensland's Gross State Product**



Source: Lawrence Consulting (2014) *Economic contribution of the Minerals and Energy Sector to the Queensland Economy*

63 ACIL Tasman (2012)

64 Queensland Resources Council (2014)

65 Queensland Government (2015d)

2.5 Government revenue

State and Commonwealth government revenue are both expected to see a boost from increased CSG production and have positive flow on effects throughout the regional and state economy. The average annual cumulative impact of six trains, from the CSG and LNG activities, were estimated in 2012 at around $900 million each year to the Queensland Government. That figure consists of royalties, taxes, excise and charges. Another $2.4 billion each year was forecast to go to the Australian Government in company and personal income taxes.[66]

This figure is likely to be smaller given the reduction in oil prices since 2012, however CSG development is still expected to drive increases in government revenue. At this stage, the Queensland Government has collected a small increase in royalties and other Queensland Government revenue from the growing CSG production for the domestic gas market. This is consistent with the expectation in the 2014–15 State Budget that the growth in government revenue as a result of CSG exports would be strongest in 2015–16. The 2015–16 Budget acknowledges that lower LNG prices, driven by lower oil prices, are reducing Queensland's CSG royalty revenue.[67]

Queensland's economic growth is still supported by LNG exports. Any flow through impacts on communities from increased CSG revenue will take some time, although the Queensland Government has already committed to invest royalty earnings into infrastructure projects for communities through the Royalties for Regions program which has been superseded by the new government's Building our Regions program.[68]

66 ACIL Tasman (2012)

67 Queensland Government (2015d)

68 DoSD (2015)

2.6 Agricultural productivity

There is a range of aspects of CSG development that can impact on the productivity and profitability of agricultural activities. A key component is the reduced access to productive agricultural land as a result of CSG operations, which may have broad implications for operations/production, management, and long-term development of agricultural businesses. While concerns around land access have reduced over time,[69] agricultural communities have raised concerns about reduced farm profitability as a result of possible additional costs and time and efficiency and productivity loss arising from the CSG infrastructure.

Research is being undertaken at the UQ-CCSG to investigate the relationship between CSG development and farm profitability by developing quantifiable measures of productivity and profitability.[70] The research covers an extensive range of potentially significant impacts of CSG development on agricultural business, including farm operations and production, biosecurity, farm economics and management, and social and human issues. Ongoing monitoring and evaluation of the potential impacts and long-term implications on the agriculture sector will be particularly important given the current shift to an operational stage for CSG activities in some areas.

With respect to CSG and farm operations and production, CSG infrastructure can potentially change cultivation, cropping and irrigation patterns due to soil compaction and disturbance, changes to controlled traffic lines, alteration of surface water flow and erosion, and disruption to the overland flow of surface water to irrigation storage.[71] These factors, and subsequent changes in farming practices, can potentially increase production costs and reduce efficiency, productivity and profitability. CSG companies have responded by developing a framework of minimising CSG impacts on farm operations, such as reducing the need to place wells in cultivated portions of agricultural land and careful configuration of CSG infrastructure, including the use of directional drilling.

Many of the impacts explored in previous sections can also have impacts on agricultural productivity, including change to regional employment. Although CSG development in a region can increase labour costs and reduce availability, the development also provides off-farm employment opportunities and subsequently additional income to the agriculture communities. The local content code of practice endorsed by the Queensland Government can encourage the upgrade of skills in agricultural communities.[72]

Community impacts explored in the following section, including water management, biosecurity and other environmental changes can also impact on agricultural productivity. Compensation agreements with affected landholders are designed to ensure that they are compensated for any physical impacts, as well as for impacts on the productivity and profitability of the land. There is also a range of potential benefits from CSG development to the agriculture industry, including irrigation, infrastructure, community support funding and employment opportunities.

Irrigation and grazing with treated co-produced CSG water can substantially benefit the agricultural businesses in Queensland where drought has been a serious issue, as well as further opening up the possibility of growing high value crops.[73]

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69 Jim Cavaye, UQ, personal communication

70 Cavaye and Kelly (2015)

71 RIRDC (2013)

72 RIRDC (2013)

73 Cavaye and Kelly (2015)

Improvement in both on and off farm infrastructure and associated farm management and operations is another potential benefit from coexistence with the CSG industry. Such benefits include improved roads, gates and grids, upgrading of road networks and sealing of local roads, and improved telecommunication.[74] In addition to improved infrastructure, the community support funding offered by the CSG industry can provide improved services at a community level. The improvements in both infrastructure and services, however, require adequate planning and provision of social infrastructure, such as police, teachers and medical practitioners. The community investment requires qualified local partners to follow through with implementation, and anecdotal evidence indicates that can be a challenge.[75]

Both the positive and negative impacts are likely to be most pronounced during the construction phase of CSG projects. In terms of direct impacts on farm operations, it has been estimated that each CSG well could require about 1 hectare of land for approximately one year initially, gradually decreasing for the rest of the well's economic life of approximately 20 years.[76]

The spatial impact coincides in time with the maximum level of activity during the construction and development stage. As such, physical and environmental impacts, such as transport nuisance, as well as economic impacts, such as labour demand, is expected to peak at the same time. Nevertheless, given the long-term nature of CSG operations, there will be ongoing impacts on the affected agricultural businesses and communities. However, as technologies and CSG development practices improve, the size of the footprint per well is likely to continue to reduce.

74 Cavaye et al (2015)

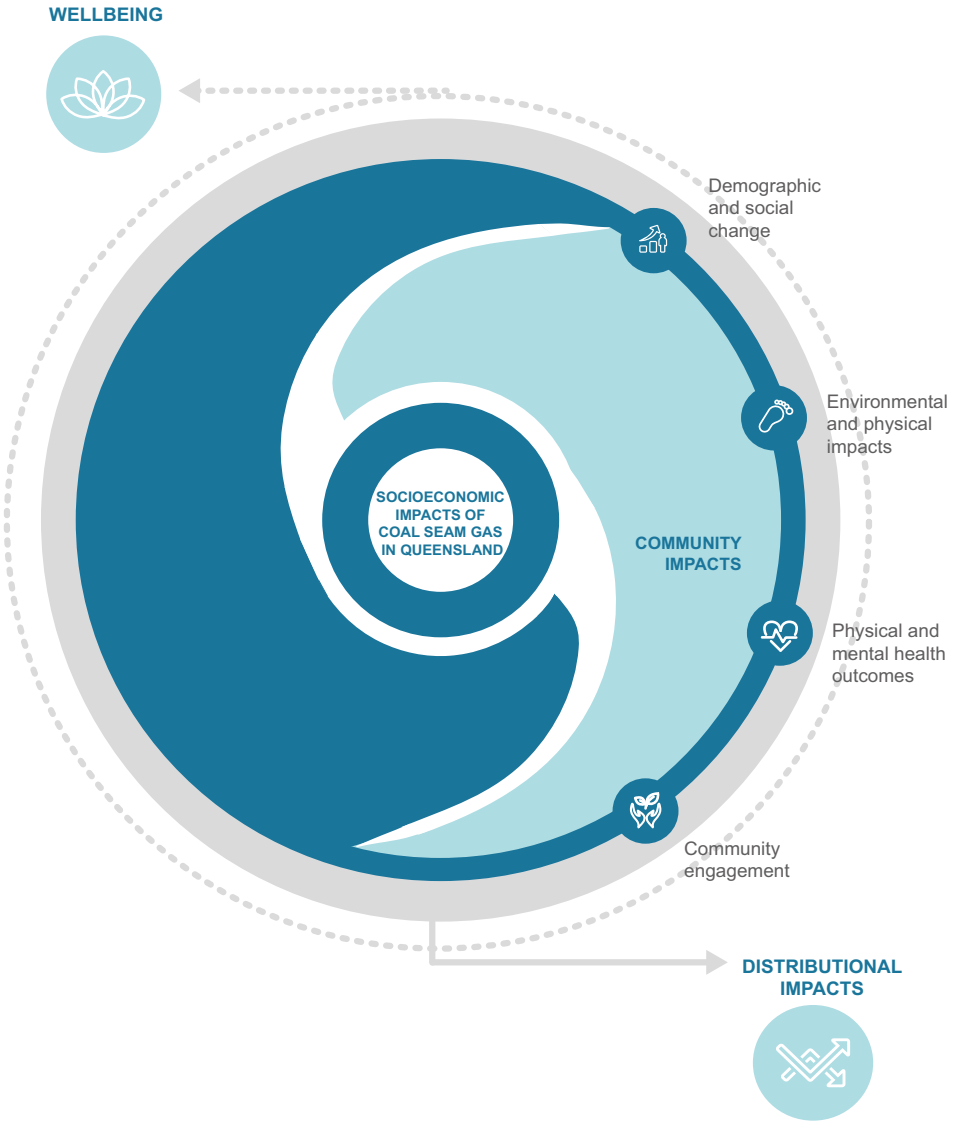
75 Will Rifkin, UQ, personal communication

76 Queensland Department of Environment and Heritage Protection (2012)

3. Community impacts of CSG

The headline direct economic indicators demonstrate only a small fraction of the potential impacts of CSG on regional communities. Broader community impacts as shown in Figure 3.1 may, in the long run, have a greater influence on welfare than changes to employment and income.

Figure 3.1: Structure of community impacts of the resources sector



Source: Department of Industry and Science (2015)

This chapter draws on relevant literature and ongoing research to explore how socioeconomic indicators have changed with the development of CSG in Queensland, and how communities have experienced these changes. It also considers how the economic and the community effects are distributed among and within communities. The distribution of impacts is very important, but the study finds that income inequality has increased less in CSG regions than elsewhere.

Community impacts include demographic and social change, environmental and physical impacts and health outcomes. Demographic and social changes can be mixed, with population changes leading to decreased housing affordability and negative social impacts, but supporting a reversal of rural decline in some regions. Environmental and physical impacts have caused concern for a number of residents, but the review finds that actual impacts have been minimal, and continued work is being done to ensure risks are managed appropriately.

Given the broad definition of community impacts used in this review, this chapter also reviews the literature on the importance of early and genuine community engagement, and on how CSG development has contributed to changes in wellbeing in local communities. Wellbeing is found to be currently robust, but with concerns for the future as CSG development moves from the construction to the operations phase.

To set the context, we first set out community impacts of natural resource development that are recognised as typical.

3.1 Typical impacts of natural resource development

Economic impacts of a natural resource development can have significant effects on broader socioeconomic aspects of a town or region. These effects follow through the distribution of costs and benefits attributable to the activity and the way that the changes interact with the broader economy of the hosting region.

Hajkowicz et al examined the relationship between socioeconomic wellbeing (measured through quality of life indicators) and the gross value of minerals production from Australian regions.[77] The study found no evidence of systematic negative associations between quality of life and minerals production for mining regions across Australia. Mining activity was significantly positively correlated at a regional level with socioeconomic indicators, such as communication access, education level and housing affordability. It was also positively correlated with the more traditional economic indicators of improved employment and income. In aggregate across local government areas, those with more mining activities were assessed to perform better on social welfare indicators; however it was noted that this assessment may overlook income inequality and intra-regional and demographic-specific trends.

The construction peak of a large mining or infrastructure project can put pressures on housing affordability and rent, due to the need to accommodate a large temporary workforce. Although this problem should be minimised by the provision of temporary accommodation by project proponents, workers in other sectors boosted by the development (such as hospitality) need housing, and increased demand will push up prices. Such rises create difficulties for renters in the community who do not benefit from increased wages in the resources sector, which can range from dishwashers and hotel cleaners to teachers, police officers, and state government staff. Lower income households are pressured by increases in the cost of living in the region due to increased demand for goods and services, potentially leading to the outmigration of these households, something that has been reported in the Darling Downs.[78]

77 Hajkowicz et al (2011)

78 Rifkin et al (2015)

Any resources boom will lead to a range of demographic and social changes in the hosting community. A common regional trend as a result of mining is known as the 'boomtown effect', which includes social disruption resulting from large scale immigration of males into a region, and has been associated historically with negative outcomes of alcoholism, drug abuse and violence.[79]

3.2 Distribution of impacts

The first part of the study identified that although CSG has a net positive economic benefit to Australia, Queensland and affected regions, the distribution of these benefits and costs are very different. Both benefits and costs can be unevenly distributed between regions, given that many goods and services may be procured from regional centres or capital cities rather than hosting regions. Additionally, many workers reside outside the resource region and can take a large part of their incomes back to their place of residence. It is also evident that investors in new housing developments and businesses come from outside the region during the peak construction period.[80]

Distribution effects can be a concern within communities amongst those involved in the industry and those outside it. For example, compensation payments flow to a minority of the population, and job opportunities are only available to those with skills sets appropriate to resource industry employment. The bottom line is that some individuals and groups are able to capture more of the financial benefits through employment and business opportunities, whereas others may bear more of the costs.

Income inequality could be a problem in areas impacted by a natural resources boom, given the mining sector generally pays higher wages than other regional industries. However, any concern over growing inequality in resource regions may be misplaced. An analysis of census data by Fleming and Measham has found that income inequality, measured by the Gini coefficient, has increased on average less in mining regions than non-mining regions between 2001 and 2011.[81] The study showed that income inequality increased by an average of 8.7 per cent in non-mining regions, but by around 4.8 per cent in mining regions. Growth in inequality in the Bowen and Surat Basins was even smaller, 1.3 per cent and 3.3 per cent respectively; although it is worth noting the last census was prior to the peak of the CSG construction phase. Additionally, any measure of income in an agricultural region can be confounded by the income reporting strategies of farm businesses and small businesses, as discussed earlier.

Some literature suggests that wealth inequalities are the cause of social hardship and that geographically concentrated, or 'point' resources, lead to worse outcomes.[82] As such, resources that are concentrated in a small location, such as an underground mine, lead to poorer institutional structures, given access to the resource is very limited and few people are able to benefit from its development. Given that CSG is a regionally dispersed resource, one would expect a broader range of stakeholders to benefit from the resource extraction, including through landholder compensation. However, another contributing factor that can reduce growth in inequality could be the outmigration of lower income residents from CSG regions, due, for example, to higher rents and other aspects of localised inflation.

Distributional effects are important to consider across the spectrum of socioeconomic impacts of CSG development and not just in terms of income. Some landholders benefit more from compensation agreements purely due to geography, some businesses are better placed to capture opportunities from CSG development, and others will only see the costs of increased wages in order to maintain staff. Other

79 Fleming and Measham (2013), Carrington et al (2013)

80 Rifkin et al (2015)

81 Fleming and Measham (2015b)

82 Hajkowicz et al (2011)

impacts explored in this section, including physical and health impacts and changes to wellbeing, will also be distributed differently between individuals and communities.

3.3 Demographic and social change

Population change

Project proponents did not envisage a large increase in permanent populations in the areas affected by CSG and LNG developments. They anticipated instead that the parts of the workforce requirements not met by local residents lead to commuting into the region by 'non-resident workers', who would be accommodated in work camps.

Actual observations of changes to population are consistent with these forecasts. Data from the QGSO show that growth in the resident population (excluding workers who commute to and from the region) of the Bowen Basin has grown by an average rate of 1.6 per cent per year between 2001 and 2013, and by 1.2 per cent per year in the Surat Basin.[83] These figures are lower than the population growth across the whole of Queensland of 2.2 per cent per year over the same period. However, the growth in the Bowen and Surat basins has sped up relatively in the past few years, at 2.3 and 1.5 per cent per year, respectively. These figures are relative to a growth rate of 2.0 per cent per year across Queensland as a whole.

Regional figures can mask town-by-town differences. The CSG hub of Chinchilla saw a rise in its district population of 13 per cent between 2001 and 2013 from 6,000 to 6,800, while the district of the nearby town of Miles had its population increase negligibly during the same period, staying around 1,200.[84]

Rolfe found that positive impacts of resource projects on economic growth in the Surat Basin are very sensitive to the extent that the existing workforce can be utilised and the level of non-resident workforce based outside the region. If workers commute, the positive impacts will be much smaller.[85] Like many other large resource development projects, the scale and nature of these projects makes it impractical to use an entirely resident workforce, and some combination of both is required.

Although an increase in regional population can be seen as economically beneficial, it can also have negative impacts, including on housing affordability and social capital, which will be considered in more detail below.

Housing affordability

Increases in population, combined with increases in income and consumption can have a large impact on housing affordability, particularly during the peak of the construction period. Both rents and house prices increased in the Western Downs towns during the construction phase. In 2013, housing rents in Miles were roughly $200 higher than the Queensland median, and median house prices peaked around 2013.[86] This University of Queensland study also found that the size of the town made a large difference to the scale of the impact, with smaller towns experiencing much higher pressures on affordability than larger towns, as the size of the non-resident workforce accommodated and working nearby was much greater in proportion to the population of the town centre.

83 Rifkin et al (2015)

84 Rifkin et al (2015)

85 Rolfe (2013)

86 Witt et al (2014)

This pressure is likely continue, as worker accommodation villages are being located closer to gas fields rather than in town centres.[87] As at June 2014, around 95 per cent of non-resident workers are housed in these villages rather than other forms of accommodation, including hotels and caravan parks.[88]

Across the Western Downs, rents and prices have now dropped significantly, with some residents noting that housing is now returning to 'affordable' levels, with some concerns that rental vacancies are now too low.[89] Resolving the pressure on housing is clearly a matter of balance when a temporary workforce is involved. Communities will be keen to maximise the benefits that can accrue from resident workers rather than non-resident workers. This shift, though, will increase pressure on the existing stock of housing and require new residences to be built. However, once the workforce peaks and employment opportunities are reduced, excess housing supply can also cause problems, as noted by local real estate agents.[90]

Rural decline

An advantage of an increased population is that it can help to combat rural decline, which is being experienced in many rural communities across Australia, including those in which CSG has been subsequently developed. Rural decline can result from the loss of rural youth, reductions in human capital (the skill sets in the population), and an increase in rural poverty.[91] A range of demographic changes experienced in CSG communities have contributed to the mitigation and potential reversing of rural decline, at least during the CSG exploration, development, and construction phases.

Change in the gender balance can be a very important component of demographic change from resource development, given that the influx of male labour can lead to social disruption. However, compared to similar regions where gas development had not occurred, regions with CSG development have experienced a growing youth share of the population, leading up toward the peak in CSG production, with equal increases in male and female youth.[92] Female employment was found to have increased in CSG regions, in the construction, mining, and accommodation/food services sectors. However, anecdotal evidence suggests that retention of youth in the region has declined as CSG jobs have evaporated following peak construction in 2014.[93]

Education is another important aspect of this change. There is evidence in CSG areas of education levels higher at younger ages than the broader population, including completion of secondary school, university degrees and advanced technical training.[94] These changes in education and gender patterns were part of a broader positive impact of CSG activity on areas subject to rural decline.

It is important to note that higher mean levels of education may result from migration and are likely not to be merely due to long-term residents gaining higher qualifications. In fact, CSG development has resulted in older residents selling their homes for higher prices and moving to the coast, and there are reports that residents with lower socioeconomic status have moved to avoid high rents.[95] Both shifts suggest that those who may have lower education levels are leaving the area.

87 QGSO (2014a)
88 Ibid
89 Witt et al (2014)
90 Ibid
91 Measham and Fleming (2014a)
92 Ibid
93 Will Rifkin, UQ, personal communication
94 Measham and Fleming (2014a), QGSO (2015), KPMG (2013)
95 Witt et al (2014)

Such migration plays a role in the ability of CSG activity, partially as a result of its large spatial footprint, in mitigating and reversing rural decline. There has been at least a temporary growth in the youth share of population, including a growing female youth share, as well as a reduction in the number of poor people in some specific CSG regions. These changes represent a key divergence in the social impact between CSG development and other mining booms.

Social impacts

Although the 'boomtown' impact for the construction phase of CSG development in Queensland has differences compared to traditional resource development, it does not mean that CSG and the associated demographic changes have had no social impact. A study funded by the UQ-CCSG found that the movement of people in and out of the Western Downs region can be seen to lead to a decline in 'social capital' through a reduction in social bonds and networks.[96]

Some boomtown social impacts have been experienced in the region, including impacts on crime and safety. Since 2011, there has been an increase in reported offences in the Western Downs, primarily good order offences and traffic offences, but also drug offences and theft.[97] Actions have been taken to mitigate the increase in offenses, including changing police strategies, community responses, such as implementing a local liquor accord, and company responses, such as computerised vehicle monitoring.[98]

Despite these social issues, a CSIRO survey on wellbeing in the Western Downs found that community spirit was one of the most positively perceived aspects of wellbeing. Survey respondents reported that they felt that they could rely on others in the community to help, they could work together, and that relationships within the community were friendly.[99] Community spirit was also found to have a strong contribution to the overall sense of wellbeing. Changes to wellbeing will be considered further in section 3.6.

3.4 Environmental and physical impacts

As CSG development increased and expanded into new regions, local communities were often uncertain about how CSG activities in their region would affect them, their properties, and future generations. There are a number of potential physical impacts of CSG that can impact on individuals and communities, including water, air quality, and human health, as well as concerns about geological and transport impacts and broader environmental impacts. This section considers these key impacts, and the current status of work on how they are understood and managed.

Water management

Given the overlap of CSG development with a range of other land uses, particularly agriculture, one of the key concerns of local communities was the actual and forecast or potential impacts of CSG development, including:

- groundwater issues, including the impacts of water pressure changes on freshwater aquifers and the replacement of extracted water

- pollution issues, such as the disposal of the extracted water (including salt and other chemicals from coal seams) and the management and disposal of fracking fluids.

96 Rifkin et al (2015)

97 Ibid

98 Ibid

99 Walton et al (2014)

A CSIRO study on wellbeing in the Western Downs in 2014 found that the management of underground water quality was one of the biggest concerns in the community.[100] Community members who responded more positively about CSG development in their area reported that they felt that the natural environment (including water quality and sustainability of local farming land) was being managed well.

Many of the concerns about both groundwater and pollution relate to the use of hydraulic fracturing, or 'fracking' to help extract the gas from the coal seam. Hydraulic fracturing in Australia is currently used in 9 per cent of CSG wells though it may eventually be used in 30 to 40 per cent of wells.[101] Numerous in-depth reviews by experts in other countries have found that, subject to the implementation of appropriate controls and standards, the use of hydraulic fracturing does not pose a significant risk to the environment.[102]

In Queensland between 2010 and March 2015, 6,734 wells were drilled. No sub-surface equipment leaks have been reported to the Petroleum and Gas Inspectorate.[103]

Air quality

Well-head and other equipment leaks are inherently limited in size and duration. However, there is the potential for fugitive emissions from CSG wells as well as other infrastructure. In contrast to shale-gas developments in the US where volatile hydrocarbons may be emitted, in CSG such leaks are predominantly methane, a non-toxic gas which is flammable in air between well-known upper and lower limits.

Queensland has adopted stringent reporting standards based on those normally used in more sensitive urban environments, leading to a very conservative approach to reporting leaks. As at the end of 2014, there were 3,500 producing gas wells. From 2010 to the end of 2014, there were 199 'reportable' leaks notified to the petroleum and gas inspectorate, all of which were subsequently fixed, and there were no reports of sub surface leakage.[104]

These experiences are in line with a scientific study undertaken by CSIRO of 43 wells in Queensland and New South Wales.[105] The study found that emissions were generally very low, especially when compared to the volume of gas produced. The sources of emissions were found to be equipment leaks, venting, pneumatic device operation and engine exhaust (areas that are often easy to repair), with none showing evidence of sub surface methane migration outside the well casing.

The rates of emissions found in the study were much lower than those reported for US unconventional gas production. The report noted that emissions may vary over time, and in cases of maintenance and repairs, there may be higher emissions of limited duration. CSIRO is currently in the process of undertaking further work on the level of emissions in the Surat Basin, including from water infrastructure and other potential sources. Furthermore, research recently undertaken by UQ-CCSG shows evidence of a variety non-fugitive, natural background and anthropogenically stimulated methane and other hydrocarbon sources.[106] That is, gas has been historically emitted in the region via a range of other avenues.

100 Ibid
101 APPEA (2015)
102 Andrew Garnett, UQ, personal communication
103 Ibid
104 GFCQ (2015)
105 Day et al (2014)
106 Underschultz et al (2015)

Geological impacts

Geological impacts from CSG development have thus far been minimal, in terms of both induced seismicity and subsidence. The key cause of concern is again the use of hydraulic fracturing. However, the potential for induced seismicity as a result of CSG development in Queensland is small, given the shallow depths at which CSG extraction occurs.[107]

While the fields are not yet at full production, and some minor subsidence might reasonably be expected over a long period of time, there is no confirmed subsidence as a result of CSG development in Australia,[108] and the maximum predicted is 280mm.[109] Nevertheless, particularly in the Surat Basin, companies pursuing CSG development are developing extensive monitoring networks including tiltmeters, extensometers, InSAR analysis, and geodetic survey monitoring.[110] Furthermore, the Queensland Government regulation requires an evaluation and sets trigger levels for the potential for subsidence in the groundwater impact assessments undertaken by project proponents.

Transport impacts

CSG activity generates a large number of truck and vehicle movements associated with the transport of workers and drilling infrastructure, which can lead to concerns within the community regarding road safety, particularly in towns and near schools. It can also contribute to degradation of infrastructure and the spreading of weeds.

Biosecurity can be an area of concern for agriculture producers, especially organic certified producers. A number of these impacts are managed through regulation, such as the requirement to wash vehicles to minimise the spread of weeds. Other impacts are minimised through company contributions to road infrastructure and changes to driving practices.

Traffic offences have increased in a number of towns in the Western Downs region,[111] although it is unclear how much of this increase is a result of the increased number of vehicles on the road, poor driving behaviour, or from changes to policing strategies. For example, towns such as Miles changed their policing strategy as a result of expectations of CSG impacts.[112] Traffic infractions are being attributed by local residents and police to contractors rather than company staff, which may reflect the effectiveness of extensive computer monitoring of CSG company vehicles.[113]

107 Gibson and Sandiford (2013)
108 Andrew Garnett, UQ, personal communication
109 Australian Government (2014b)
110 Andrew Garnett, UQ, personal communication
111 Witt et al (2014)
112 Ibid
113 Rifkin et al (2015)

Overall risks and impacts

Like any other industry, including agriculture, mining and forestry, CSG faces uncertainties, risks and challenges. However, the rapid development of CSG led to a level of uncertainty around these potential adverse physical effects on communities and future generations. As the CSG industry continues to grow and the industry and the regulation adapts, these uncertainties and risks will continue to be minimised. The NSW Chief Scientist and Engineer found that the industry is 'not significantly more likely to be more damaging or dangerous than other extractive industries'.[114]

Consistent with economic impacts, the physical and environmental impacts associated with CSG development change through the value chain. The peak of socioeconomic impacts coincides with the peak of construction and associated activities in the development phase. As wells in an area move into the production phase, the physical and environmental impacts of the development in that locality are likely to change.

Considering the cumulative nature of physical and environmental impacts is important. This includes not just taking into account the multiple CSG projects being developed at the same time over a similar area but also other developments and existing land uses, and their impact on various factors, including water use.

Companies are now required to address cumulative impacts of projects in their Environmental Impact Statements (EIS, with a social impact assessment being a component); however, they may not be best placed to understand the full details and consequences of other proponents' projects. The Australian Government's programme of bioregional assessments will also increase knowledge about regional and cumulative impacts of coal resource development, including coal seam gas, in the bioregions being assessed.[115]

3.5 Physical and mental health outcomes

Many reports and commentators have noted concerns about potential health impacts of CSG development as a result of the physical impacts listed above, including water quality, air quality and noise pollution. Adverse health impacts would have a negative economic impact on individuals and communities, and they would also have a large impact on perceptions of CSG as an industry. However, there are very few studies that demonstrate a correlation between CSG activities and adverse health outcomes, much less a causal relationship.

A recent literature review by Werner et al found the strength of epidemiological evidence to be 'tenuous', with only seven highly relevant studies providing evidence about direct associations between environmental health hazards related to unconventional natural gas activities (not just CSG) and health outcomes.[116] The review recommended that further research be undertaken to credibly assess the extent of the risk posed to the public.

Focussing specifically on CSG, the Queensland Department of Health found no clear link between CSG activities in Tara and reported health complaints. This finding is based on an assessment of both clinical and environmental monitoring data. In terms of air quality, data was insufficient to assess the impact in the region. Low frequency noise was found to exist at levels that could be annoying, although levels were below relevant

114 NSW Government Chief Scientist and Engineer (2014), p. 8

115 More information is available at bioregionalassessments.gov.au.

116 Werner et al (2015)

regulatory thresholds. The review also found evidence of solastalgia, or distress caused by environmental change and a perceived lack of control over these changes.[117]

Solastalgia and other potential mental health impacts may be an important aspect of the health impacts of CSG development, and have been explored in a number of studies. CSG activities, and concerns about their on- and off-farm effects, can be a significant source of stress for farmers.[118]

The levels of stress experienced by some landholders may not be reflected across communities more broadly, potentially as a result of community engagement by the CSG industry, the GFCQ, and organisations such as the farming peak body AgForce, as well as improvements in understanding and processes. A recent survey by CSIRO on perceptions of community wellbeing across the Western Downs found that health, including physical and mental health, was one of the dimensions of wellbeing that was most positively perceived by participants.[119]

It has long been known that uncertainty about impacts of any significant change can play a role in the level of stress and anxiety experienced in the community.[120] CSG development in a region can represent a significant change. In a study of potential harms from CSG activities, Fibbens et al found that the impacts of CSG could differ from the typical impacts of large mining or infrastructure projects, as there was uncertainty about the extent and timing of the impact over the different stages of the CSG development activities.[121] Given the CSG industry needs to work closely with local residents including farmers to gain access to their land, this uncertainty regarding short and long term impacts can lead to challenges for the CSG and agricultural industries in achieving successful coexistence.

117 Queensland Health (2013)

118 Morgan et al (2015)

119 Walton et al (2014)

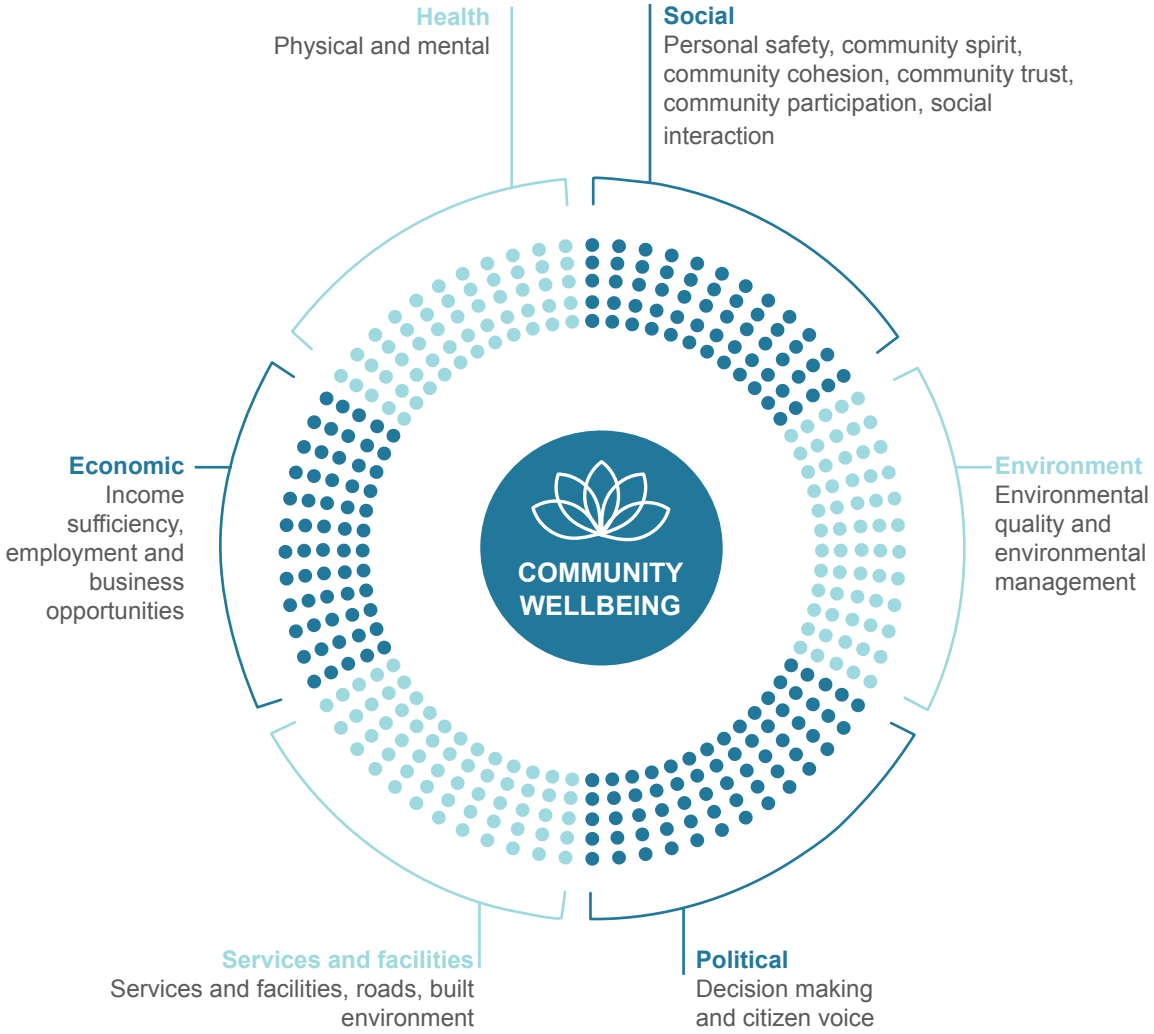
120 Colson (1973)

121 Fibbens and Mak (2014)

3.6 Wellbeing

The level of wellbeing experienced by community residents reflects the economic impacts of CSG as well as many of the community factors considered in this section. These include health outcomes, social and environmental impacts. In a survey of community wellbeing and responses to change in the Western Downs region, Walton et al divided aspects of wellbeing into six dimensions, as set out in Figure 3.2.[122]

Figure 3.2: Dimensions of community wellbeing



Source: Walton et al (2014) *CSIRO survey of community wellbeing and responding to change*

This depiction of wellbeing also incorporates political impacts and adequacy of services and facilities. Political impacts, incorporating decision making and political voice, were negatively perceived, indicating that community members in the Western Downs were concerned with how decisions were made. Perceptions of services and facilities were mixed, with moderate responses on services and facilities and the built environment, but negative perceptions regarding roads. Although the quality of road infrastructure may have increased in many areas, residents were still concerned about the condition, safety and the volume of traffic on roads.[123]

122 Walton et al (2014)

123 Ibid

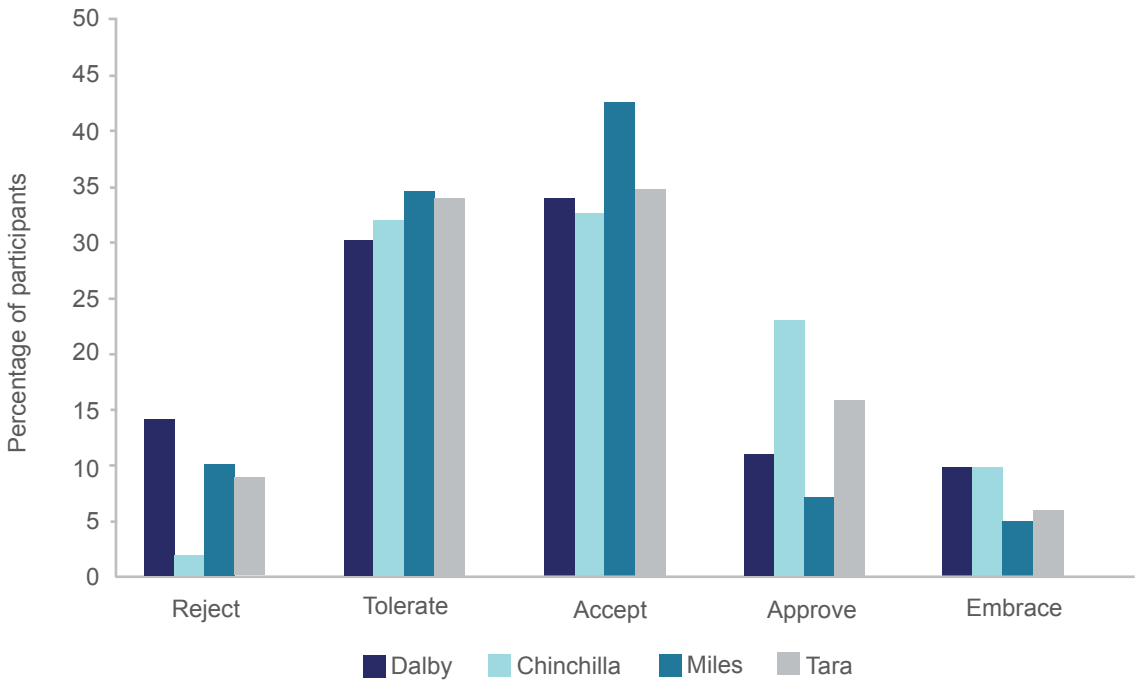
The survey found that the most important dimensions contributing to an overall sense of community wellbeing in the Western Downs region were: services and facilities; community spirit and cohesion; personal safety; and environmental quality. It also found that wellbeing is currently robust in Western Downs communities, but there are concerns of a downward trajectory in wellbeing as the construction peak passes, with communities expecting their wellbeing to be reduced in the future.[124]

That result corresponds with recent anecdotal evidence and public forums, where business owners have expressed concern, frustration, and distress at the strong downturn in business following the end of the peak construction period for CSG.[125] This anecdotal evidence indicates that some businesses are closing and owners leaving the area without settling their accounts with local suppliers who are remaining in the area.

Walton et al provide a number of suggestions on investments to be made into wellbeing and resilience, based on key areas of dissatisfaction in the Western Downs – improvements to roads, further community participation in decision making, and management of the environment over the long term.[126] Working together within a community to resolve these issues has benefits for wellbeing, for resilience, and for perceptions of the CSG industry.

The perception of the CSG industry and its social licence to operate are very important for wellbeing and for the ongoing success of the industry. Walton et al found mixed attitudes toward CSG development in the Western Downs region, as shown in Figure 3.3.[127] Over 80 per cent of participants had moderate attitudes toward CSG, tolerating, accepting or approving CSG, while less than 10 per cent had extreme views in either direction – rejecting or embracing CSG.

Figure 3.3: Attitudes towards CSG in the Western Downs



Source: Walton et al (2014) *CSIRO survey of community wellbeing and responding to change*

124 Ibid

125 Will Rifkin, UQ, personal communication

126 Walton et al (2014)

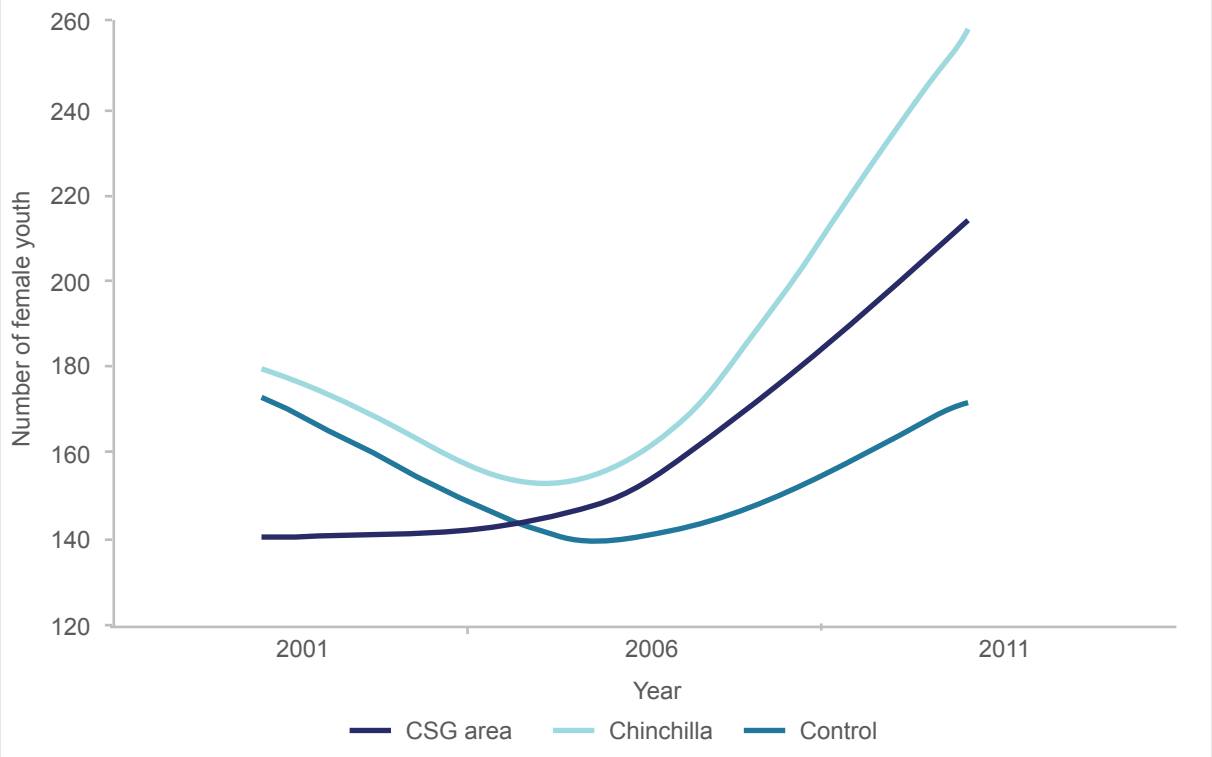
127 Ibid

Box 3.1: A case study: Chinchilla

The town of Chinchilla has experienced a significant change as a result of CSG development, with the population growing almost 20 per cent between 2008 and 2012. This brought about increasing diversity in the town, but also a reduction in connectivity, which has been missed.[128]

Chinchilla has been an example of where CSG development has mitigated rural decline, with the population of young people increasing by about 46 per cent between 2006 and 2011.[129] This occurred across both males and females, contrary to typical male migration in typical resource 'boom towns', as shown below (where control represents other comparable rural Queensland regions). Some 'boom town' social issues emerged, with increases in good order offences, and initial reports of women initially feeling unsafe.[130]

Box 3.1 Figure 1: Change in female youth in Queensland



Source: Measham TG and Fleming DA (2014b) *How coal seam gas is changing the face of rural Queensland*

128 Witt et al (2014)

129 Measham and Fleming (2014b)

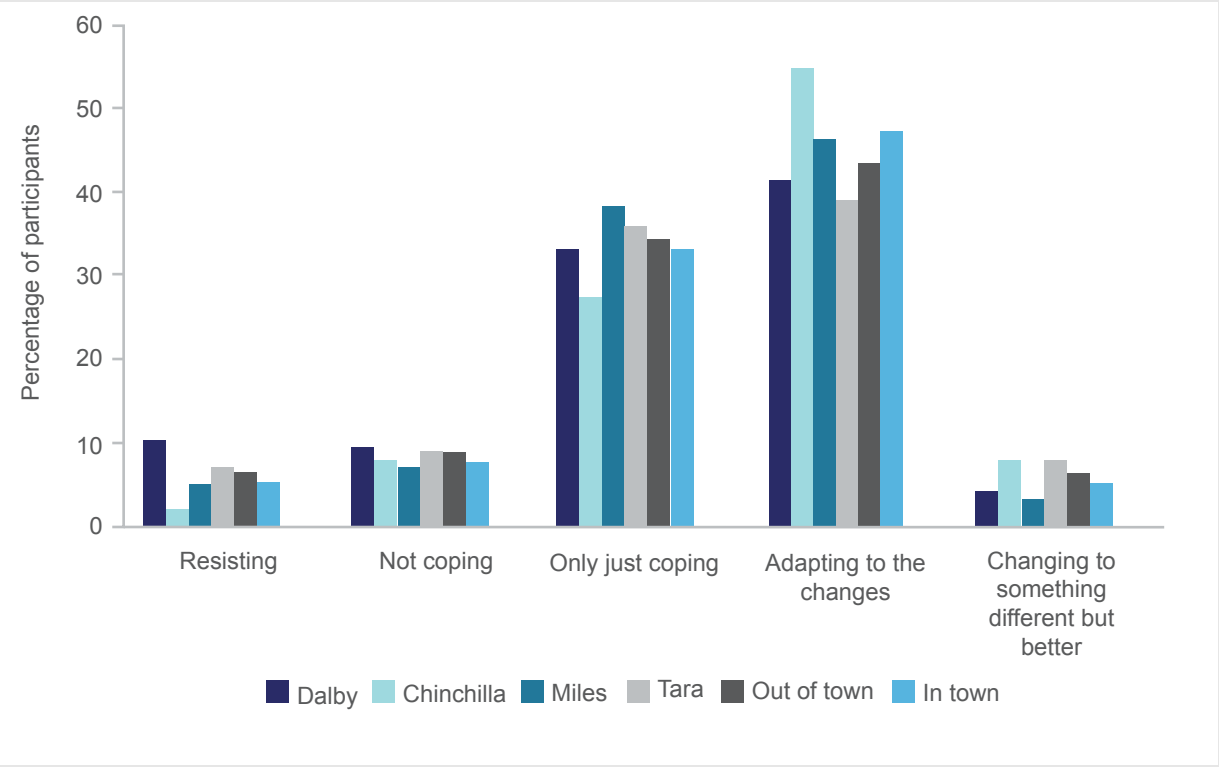
130 Witt et al (2014)

Poverty reduction in CSG regions has been concentrated particularly in Chinchilla, although this does need to be balanced against higher housing costs.[131] House prices and rents in Chinchilla, which were traditionally lower than Queensland's median, both grew rapidly as a result of CSG development, with rent higher than the state median in 2013.[132]

Walton et al found that overall wellbeing in Chinchilla was relatively high.[133] Dimensions of wellbeing which were higher than other towns in the Western Downs were perceptions of community spirit, income sufficiency, community cohesion, services and facilities, and employment and business opportunities. Chinchilla reported dissatisfaction with levels of environmental management, decision making, and roads.

Within the region, residents of Chinchilla had the most positive attitudes towards CSG (as shown in Figure 3.3), and most positive perceptions of the way their community was responding to CSG development, with only 2 per cent resisting, and over 60 per cent with favourable perceptions, as shown below.[134]

Box 3.1 Figure 2: Attitudes towards CSG in the Western Downs



Source: Walton et al (2014) *CSIRO survey of community wellbeing and responding to change*

131 Measham and Fleming (2014b)

132 Witt et al (2014)

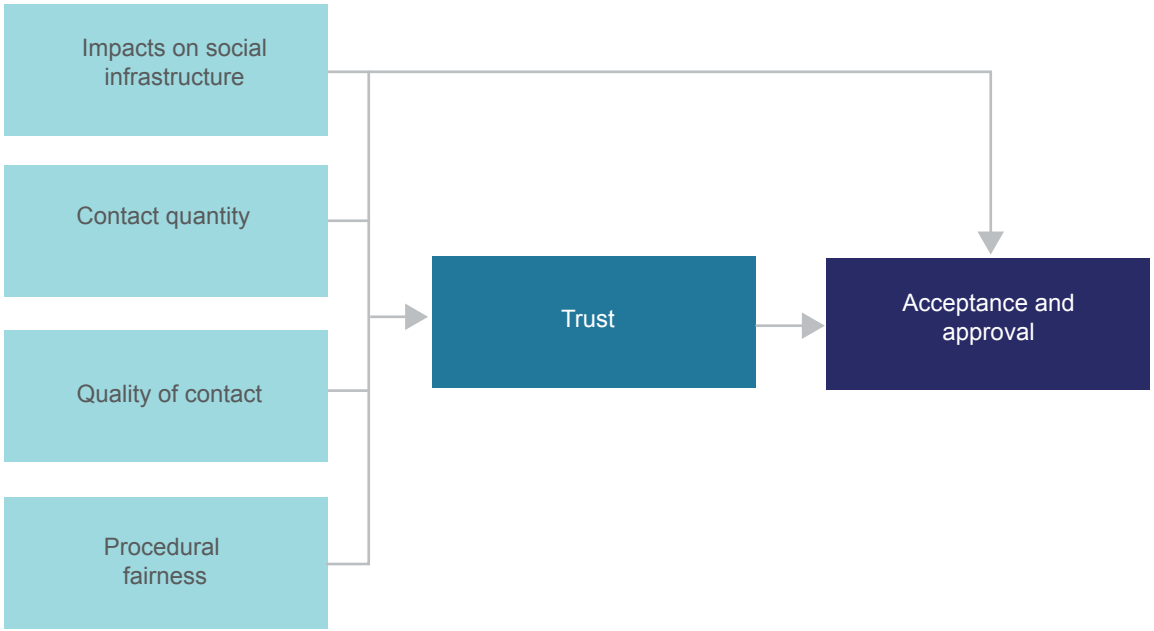
133 Walton et al (2014)

134 Walton et al (2014)

3.7 Community engagement

Given the scale and the overlap of CSG activities by multiple companies, studies have found that the social licence to operate for CSG development needs to hold for the entire industry rather than for individual operators.[135] Building and maintaining landholder/community trust is essential for a social licence to operate and a key factor in building mutually-beneficial coexistence between the CSG industry and the agriculture sector.[136] Moffatt and Zhang developed a model of social licence to operate, with trust as the central element.[137] Impacts on social infrastructure, including employment, training, and physical infrastructure, are very important for trust and community acceptance. Other factors influencing the level of trust are contact quantity and quality, and procedural fairness. Moffatt and Zhang's model is set out in Figure 3.4.

Figure 3.4: A model of community acceptance of mining



Source: Moffatt and Zhang (2014) *The paths to social licence to operate*

Research findings on the level of trust in CSG companies tend to vary. CSIRO's research on community wellbeing (undertaken in February 2014) showed a low level of trust for CSG companies.[138] However, the overall picture of trust appears to be more nuanced when considering different types and drivers of trust within different stakeholder groups. An interview study of a broad range of CSG stakeholders (including community, regulators and employees), conducted by UQ Business School between May and October 2014, found that most participants had moderate to high levels of trust that companies would conduct their operations competently and effectively (though levels varied across companies).[139] However, at that time, only around half of the participants had moderate to high trust that the CSG operations would have an overall beneficial impact.

135 Paragreen and Woodley (2013)

136 Gillespie and Bond (2015), Williams and Walton (2013)

137 Moffat and Zhang (2014)

138 Walton et al (2014)

139 Gillespie and Bond (2015)

Broader sampling and deeper analyses is needed to better understand drivers and distribution of feelings of trust. Given the long-term nature of the operational stage of CSG in Queensland, these findings emphasise the importance of ongoing monitoring and assessment of CSG activities. That result suggests a need to promote long-term sustainability and coexistence with the agricultural sector.

Early engagement is one of the major factors building landholder and community trust, with consequences for the social licence to operate.[140] There are incentives for companies to undertake early engagement and build sustainable relationships with communities in order to reduce the costs of conflict. Davis and Franks found that many extractive companies don't identify and aggregate the full costs of conflict with local communities. The study concluded that in terms of investment into communities – the more that can be done early, the better.[141] Moffatt and Zhang identified that the divergence of impacts between expectations and reality as a major factor in community acceptance, stressing the importance of early engagement to clearly explain likely impacts of the project well in advance.[142]

The quality of the relationship and ongoing engagement with communities are also crucial for maintaining and enhancing this trust.[143] An important factor for driving quality engagement can be a deep understanding of and responding to diverse perspectives and concerns held in agricultural communities. Moffatt and Zhang found that social investments are important, but more helpful for community acceptance is the inclusion of community members into decision making processes through genuine engagement and collaboration.[144]

An important aspect of community engagement is the negotiation of compensation agreements. These negotiations, which can be lengthy, complex and require significant legal input, can cause anxiety and stress especially for time-poor farmers. Farmers may have to spend up to 500 hours negotiating with CSG company representatives to reach a CCA for a single property, with over a quarter of the time spent during the first six months of interaction.[145] Ongoing reviews of compensation agreements can be an additional factor in causing stress.

With significantly more experience in successful CCA negotiations over the years, these burdens are reported to have been substantially reduced for both CSG companies and landholders. For instance, CSG industry representatives note an improved understanding of agricultural land uses, and as a result, they see that they can better plan and design resource activities to minimise potential negative impacts on the agriculture industry. For landholders, the differences between exploration and production activities and their impacts are better understood.[146]

Nevertheless, perceived lack of fairness and transparency associated with compensation agreements may still be areas of concerns for landholders. The confidential nature of the CCA negotiated at an individual level can create community perception that the outcome is a result of negotiation skills instead of the true value of the economic loss. Additionally, time spent in negotiations, and the associated productivity loss, are generally not included in compensation.[147]

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140 Queensland Government (2012), RIRDC (2013)

141 Davis and Franks (2014)

142 Moffat and Zhang (2014)

143 Department of Industry and Science (2015)

144 Moffat and Zhang (2014)

145 RIRDC (2013)

146 Queensland Government (2013)

147 Cavaye and Kelly (2015)

Williams and Walton note that inclusive engagement strategies need to incorporate the fact that values, expectations and aspirations are diverse within each community.[148] Engagement needs to ensure that all community members have an opportunity to be involved, including marginalised community members, not just those most vocal or those already significantly engaged in community activities.

Other potential factors that contribute to quality engagement can be provision of more detailed information on resource development activities, as well as thorough planning and consultation on work programs with agricultural communities.[149] Other important elements include open and effective communication, as well as focusing on building long-term relationships based on shared values and visions. Such measures would not only help communities to assess the potential impacts of CSG activities, but they could also help to create a mutually beneficial coexistence.

Box 3.2: Engagement with Aboriginal and Torres Strait Islander peoples

Another important aspect of land access and community engagement for any natural resource development is the engagement with Indigenous Australians. A study by Trigger et al, looking at both Indigenous Australian and practitioner viewpoints, found that the geospatial dispersion of CSG development and the rapid development of the sector created additional challenges for the negotiation of Indigenous Land Use Agreements (ILUAs).[150]

Trigger et al noted that there have been 35 ILUAs negotiated for CSG development in Queensland, which necessitated the rapid development of corporate systems, processes and cultural proficiency in engagement with Indigenous Australians. The study found that access to economic benefits through employment, training and business development commitments are an important component of ILUAs, as is a commitment to youth opportunity.[151]

A review of QGC's Indigenous employment, training and business development initiatives by UQ's Centre for Social Responsibility in Mining found that QGC had achieved a significant increase in employment of Indigenous Australians, up from 63 jobs in 2011 to 251 in 2013.[152] It noted that a methodological limitation of the study was that only a small proportion of traditional owner groups participated in the research. The study also found that it will be necessary to observe outcomes as the work continues to mature in order to fully judge the effectiveness of the initiatives.

148 Williams and Walton (2013)

149 Queensland Government (2012)

150 Trigger et al (2014)

151 Ibid

152 Arbelaez-Ruiz et al (2014)

4. Insights

This chapter distils from the literature review, as well as our own experience and analysis of key issues, a range of insights on CSG development in Queensland and the lessons learned. These insights are likely to be relevant to other jurisdictions.

4.1 Cumulative impacts

It is important for each company to consider the impact of its own project on the environment and the community. Given that there are a number of overlapping large projects, it is also important to have a comprehensive understanding of the cumulative impacts of CSG development across environmental, economic, social and other indicators.

In advance of the CSG industry's expansion, there was a lack of robust sensitivity analysis of the cumulative economy wide effects of the CSG industry and associated LNG projects. Each of the LNG project proponents used computable general equilibrium modelling to assess the impact of their project, and some of the project proponents included sensitivities in their analysis in relation to price assumptions, cost assumptions, and greenhouse gas emission policies and associated permit prices.[153] Other analyses noted some of the risks to their forecasts, including potential downside risks on CSG reserves or production rates. In addition to these studies, an independent analysis of the cumulative impacts of multiple CSG-LNG projects would have been informative for planning and regulatory purposes.

The consideration of cumulative impacts is now an important feature of the Australian and Queensland governments' regulatory frameworks. The EISs undertaken by proponents are required to consider the cumulative effects of developments in a region, and Queensland has created a number of institutions whose role is to consider and minimise the cumulative impacts of CSG development in the state. Additionally, the University of Queensland has developed a methodology, in consultation with the four major CSG proponents, the state and local governments, and community representatives, for assessment and ongoing monitoring of cumulative socioeconomic impacts at the town and regional levels.[154]

4.2 Distribution of impacts

Impacts on economic welfare can vary significantly between regions, between community groups, and between individual households. In particular, communities in the Bowen Basin have had more experience in adapting to previous mining experiences, which has not been the case in the Surat Basin region, making their adaption to CSG development more challenging for local communities.

As with any economic shock, CSG development affects the distribution of income and other economic costs and benefits within the community. The economic and community impacts of CSG development are not always jointly beneficial. Economic impacts can be experienced differently by different members of the community depending on individual circumstances, location (of households and industry) and their capacity to adapt. Individual circumstances play a large role in determining whether individuals are able to capture the benefits of the CSG development and their acceptance of CSG in their community.

153 QGC (2009), Santos (2009). APLNG (2010)

154 Rifkin et al (2015)

The effects of CSG development on a community are not static but rather change over time. That is a result of the nature and scale of the activities changing as the CSG process moves through the value chain. Effects of CSG activities tend to peak as the CSG value chain progresses from exploration into development, and then it tapers off once the gas pipeline network is mostly in place and the initial tranche of wells moves fully into production. Key factors contributing to the extent and duration of associated impacts in a particular area are the intensity and amount of drilling activity required each year to deliver the contracted gas.

Both economic and community impacts will change as the CSG industry moves further beyond the construction peak for the three LNG projects. However, the activity and the impact on communities will not reduce to nothing. Given the nature of CSG development, continued work will be required to explore, appraise and develop new CSG wells over the coming two or more decades. This continual work ensures that the production workforce will be required, but it will be a smaller regional workforce providing economic benefits to local communities. The adjustment of communities to the operations phase requires impacts being absorbed and minimised.

The change in impacts over time is also a result of companies gaining experience with the activities involved in CSG development. As a result, they develop significant capabilities in the relevant technologies, including water management. The experiences arising from CSG activities provide regulators with the opportunities to learn, adapt, and respond in ways that satisfy both commercial objectives and community expectations.

4.3 Role of government

Considering the regulatory and policy frameworks set out in section 1.5, the role of government in CSG development is very important. Governments need to provide appropriate regulation to balance the need to encourage investment whilst ensuring best practice, sustainable and environmentally responsible resource extraction. Developing such regulation can be particularly challenging in an emerging industry, where unforeseen problems can emerge that are outside the regulatory framework, and which warrant the attention of governments.

The Australian Government's role in the development of the CSG industry has included its regulatory role under the water trigger provisions of the EPBC Act. By undertaking these roles, the Australian Government has both improved the scientific knowledge underpinning regulatory decisions and strengthened the regulation of the water-related impacts of CSG development.

An important feature of Queensland's regulatory and monitoring framework has been the creation of strong institutions. In particular, the GFCQ has played a useful role in managing and improving sustainable coexistence, including in terms of providing information and tools for land access agreements. OGIA has also been essential to assure landholders and communities that potential groundwater impacts are being assessed and managed at a cumulative level. Both of these institutions are highly regarded and seen as effective by community, industry, and academia alike in their respective roles given their legislated independence and certainty in their roles and ongoing funding.

These institutions have also been well regarded in terms of their provision of information. Another useful institution in this space has been GISERA, the research alliance between CSIRO, APLNG and QGC, involved in researching the environmental, social and economic impacts of the natural gas industry. The CSG industry has also engaged significantly in supporting independent research in leading institutions, such as the UQ-CCSG with UQ, Santos, Arrow Energy, QGC and APLNG. The UQ-CCSG is engaged in researching socioeconomic impacts, agricultural coexistence and ground water impacts.

The strength of institutions is important in terms of ensuring positive impacts of CSG development through government allocation of the future revenue from the growth of the LNG sector. Sustainable government spending decisions can help to mitigate distributional effects and other potential costs to communities in these resource corridors.

It is important that Queensland's regulatory framework be frequently reviewed to ensure that regulatory requirements are risk based and that an appropriate balance between objective-based and prescriptive requirements are in place to engender efficiency and innovation. There are a number of formal reviews of CSG regulation from which to draw for best practice recommendations. The Queensland Competition Authority made a series of recommendations to reduce duplication and unnecessarily prescriptive regulation.[155] Other examples include suggestions of the Productivity Commission to develop a register of land access agreements to increase the transparency of compensation outcomes and to develop a uniform voluntary code of practice for community engagement in the gas industry.[156]

In addition to regulation and information provision, various levels of government play an important role in the planning process, with respect to the provision of housing, water, other infrastructure and town planning. With respect to CSG, much of the development occurred in regions with small communities and insufficient infrastructure to be able to support CSG activities and the associated large increases in temporary and ongoing population.

There were definitely challenges in responding to the planning demands of a fast growing industry. In Queensland, a number of regions were experiencing rural decline, and local regional councils that had gone through significant disruptions through an amalgamation process. These events were also occurring during a period of extended drought that was having severe impacts on the local agricultural industry. Particularly in this context, it can be very difficult to accurately forecast industry impacts and infrastructure needs. Therefore, it is important that governments work closely with communities and companies to better understand how parties can work together and enhance the value that can be obtained by the community.

The important lesson here is having in place high quality planning institutions and mechanisms by which coordinated decisions are made initially and then adaptively as development progresses. It is essential that these institutions foster productive three-way discussions among communities, companies and governments to ensure that planning and implementation processes are as successful as possible. Lessons from Queensland's experience, such as captured in the UQ Cumulative Impacts Tool Kit developed by Rifkin et al, will be useful for other jurisdictions where there are multiple large projects occurring.[157]

4.4 Transitioning to operations phase

The realisation of economic benefits is a key factor that has influenced the perception of the industry by local communities. Linking in with the negative impact of uncertainty on stress and wellbeing, areas where CSG is progressing and where economic benefits have been realised have more positive perspectives on CSG than areas in which there is still uncertainty regarding whether and when CSG development will occur.

These economic benefits are maximised when CSG activity reaches its peak. They reduce as CSG development moves into the production phase of the value chain. Although many of these economic benefits are maintained through the operational phase, there are reductions in employment and business opportunities for local communities. It will be important that this transition is managed well by relevant stakeholders. Research work currently underway, including by GISERA and UQ-CCSG, to model and assess

155 Queensland Competition Authority (2014)

156 Productivity Commission (2015)

157 Rifkin et al (2015)

these impacts from the scale of individual businesses through to regional and state levels, will be helpful in this regard.

It is also important to note that this transition will be occurring as the oil and gas industry is adjusting to the current low international price environment, a time when there are huge pressures to increase productivity and reduce costs. Social licence to operate, through best practice activities and continued community engagement, will be very important to ensure continued net benefits to communities, the region, and the state. Although there may not be as much funding available to be allocated to these activities, a very important factor is the quality rather than the dollar value of the spend, including the quality of engagement with communities and stakeholders.

4.5 Future research priorities

Research is continuing into the economic, socioeconomic, physical and environmental impacts of CSG. The review has identified a number of key areas for future study.

Looking ahead

Given the current transition from the construction phase to the operation phase, continued work on how this transition will be experienced by regions, communities and individuals is useful. GISERA has commenced a study to consider the likely impact of the transition to the operation phase of the CSG industry in Queensland, to help with preparation for likely economic effects. The project will utilise both economic modelling to forecast these effects, and interviews with local businesses to understand how they are experiencing the change and how they can respond positively and remain resilient.

In addition, a team from UQ-CCSG is analysing how small to medium sized enterprises are responding to the shift, and identifying effective strategies. Another team from the UQ-CCSG is extending the effort to monitor indicators of cumulative socioeconomic impacts during this transition. The monitoring will be undertaken until 2017 and covers a greater proportion of the industry footprint – extending beyond the Western Downs to Maranoa, Toowoomba, and the newer developments in the Bowen Basin.

Ongoing monitoring of the impacts through transition, and comparison to forecasts, will be helpful to provide lessons learned for other communities facing such a transition.

Water

The Department of the Environment is supporting targeted bioregional assessments to assess the potential impacts of coal seam gas and large coal mining developments on water resources and water-related assets, as well as managing the Australian Government's research programme to identify and address critical gaps in scientific understanding of the water-related impacts of coal seam gas and large coal mining developments.

The UQ-CCSG is working with OGIA to address fundamental challenges in ground water impact prediction and monitoring. This focus includes fundamental geological and mathematical research needed to improve the impact of connectivity, as well as new ground water field measurements (recharge rates and in-field movements) and better estimating methods. These efforts are oriented to improve predictive modelling and visualisation focussing on improved understanding of Great Artesian Basin dynamics and risks. UQ-CCSG is also investigating alternative uses for brines and salt residues.

Well integrity and emissions

Further work is also being undertaken into well integrity and emissions, including GISERA's ongoing research comprehensively examining sources and fluxes of emissions to the atmosphere, both natural and anthropogenic. UQ-CCSG is working on materials to replace and improve on the performance of than conventional cements when wells are decommissioned. These materials could also be used to remediate legacy bores in the context of unofficial estimates of more than 10,000 coal exploration wells in the region.

Workforce composition and housing

There were concerns within communities during the construction phase regarding the appropriate balance of workforce composition between resident workers and non-resident workers (fly-in-fly-out or other arrangements). The balance between the two needs to take into account the size of the workforce, the skills and capabilities in the region, the level of existing infrastructure and the infrastructure required, the costs of the workforce as well as the costs of the infrastructure, and the long-term impact on the wellbeing of the community.

Further study into an optimal balance in workforce composition could be beneficial in addressing and alleviating these concerns and optimising the balance. Organisations such as Energy Skills Queensland, with members from industry, training organisations and the Government have in the past helped to identify in various stages of CSG projects where skills gaps are likely to exist and what training will be required. A role for such organisations in the future could be to assist workers to transition from their roles in the construction phase to other projects or opportunities.

It is important that all relevant parties are aware of the scale and type of workforce involved in these projects. Communities, governments and companies need to work together to ensure that all relevant parties have a clear understanding of the scale of the permanent and temporary workforce, and to ensure that housing is managed as well as possible to accommodate workers in an appropriate balance of permanent and temporary housing.

Land value

A better understanding is needed of the impact of CSG on land values, including how this impacts on the ability of farmers to gain financing to improve their businesses. Land values are a key indicator of wellbeing and perceptions – if there is a significant change in a region, a comparison of local land values against a control region will illustrate how that change is perceived and valued within the region, controlling for external factors, such as drought. Unfortunately such tracking and comparison is difficult to assess given the range of factors at play, including short-term housing demand throughout the construction period, and the fact that the market for larger properties is much less liquid, with larger properties bought and sold less frequently. These parameters make farm to farm (and region to region) comparison difficult.

The Queensland Valuer General found that land values increased over recent years in the Western Downs as construction peaked, but that the property market in these areas has since slowed somewhat.[158] Once the construction peak has passed and further data can be collected, consideration of long term changes in land values in CSG areas compared with similar regions without CSG development would be a useful indicator of changes in community wellbeing and perceptions.

More work on this issue is warranted. Consideration of impacts on migration would also be useful, including the extent to which CSG growth and the associated wage and population increase has led to the outmigration of low income residents from CSG areas. As well as land value, further analysis of the impacts on housing affordability would also be useful, including impacts on rental prices and the distribution of these effects within a community.

4.6 Conclusion

There is a broad range of research and live experiences relating to CSG development, which illustrate the various ways in which CSG can impact on the net benefit of the hosting regions. The direct economic impacts of CSG development appear to be consistent with other resource developments, leading to increases in employment, output, income, government revenue and regional populations.

Other factors including demographic and social change, and real and perceived physical and environmental impacts, also play a large role in how communities experience CSG development and how that experience, and their perception of it, changes over time. These community impacts can have a material impact on the net benefit of the CSG industry to Queensland and the regions and communities within it, and how the benefits are distributed between — and experienced by — individual households. CSG, as a dispersed resource that was developed rapidly in Queensland, has a socioeconomic impact that differs clearly from other resource development.

CSG has a larger number of neighbours than a typical mining development, and its ongoing development overlaps with other land uses. As a result, additional effort is required for coexistence with a large number of landholders, and more members of the community are exposed to potential negative impacts of the development. Conversely, it also means that a large number of stakeholders are able to realise economic benefits from the development through employment and business opportunities and landholder compensation.

To ensure these benefits are able to be realised, it is essential that companies engage with communities early, and in a genuine and consultative way. Various levels of government also need to be closely engaged in the engagement process to inform their planning processes, and also to ensure the regulatory framework is clear, appropriate and understood.

158 DNRM (2015d)

Regulatory adaptation and innovation has an important role. The impact of the CSG industry has changed over time, as processes and regulations have improved. There have been changes through the different stages of the value chain, with the peak of both economic and socioeconomic impacts coinciding with the peak of drilling and other activities in the development phase. The impacts of the CSG industry will continue to change as the sector transitions into the ongoing, operational phase from the peak activity in 2014 during development and construction.

Ongoing research into both the cumulative and the distributional effects of the CSG industry over time is bringing together the economic and social impacts of the development of the industry and how they change over time. Results of such research will provide a greater depth of understanding of the impacts of these developments. It is important that the quantitative data on economic indicators be integrated with the qualitative analysis on how the development of the CSG sector is experienced by communities, households, and individuals. It would also ensure that government, industry and the community have the information available to best manage the overall impacts of the CSG industry.

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