Australia's National Science Agency

SOCIAL AND ECONOMIC IMPACTS

GISERA | Gas Industry Social and Environmental Research Alliance

Local demographic and economic shifts over 20 years of onshore gas operations in Queensland

This fact sheet presents a summary of research about demographic and economic changes during two decades of onshore gas operations in rural regions of Queensland, Australia.

The research evaluated a 20-year period from 2001 to 2021. During this time, onshore gas operations in some rural regions of Queensland developed rapidly.

The emergence of new energy industries in rural regions continues to be an important community and economic development topic.

While previous studies had analysed the short-term regional impacts of onshore gas operations in Australia, and other parts of the world, there were few evaluations of the medium-to-long term impacts.

This project, conducted through CSIRO's Gas Industry Social and Environmental Research Alliance (GISERA), was an opportunity to evaluate the demographic and economic changes that occur alongside longer-term onshore gas operations.

The research incorporated two separate projects – one that looked at impacts of onshore gas operations from 2001 to 2011 (Project A), and a second that evaluated those same impacts from 2011 to 2021 (Project B). Each of these projects included both demographic and economic analyses.

Project B was designed to replicate the studies in Project A, to enable a comparison of the demographic and economic trends observed for each decade.

Key points

Project A (2001 to 2011, completed 2014)

- **Demographic analysis:** Impacts of unconventional gas development on rural community decline (Measham and Fleming, 2014)
- **Economic analysis:** Local economic impacts of an unconventional energy boom: the coal seam gas industry in Australia (Fleming and Measham, 2014)

Project B (2011 to 2021, completed 2024)

- **Demographic analysis:** Beyond the initial boom: energy transitions and rural change (Felton, Fleming-Muñoz and Measham, working paper)
- **Economic analysis:** Local economic impacts of an unconventional energy boom a long-term evaluation (Fleming-Muñoz and Poruschi, working paper)

The case study: Onshore gas operations in rural Queensland

The Surat Basin is a major geological formation underpinning onshore gas operations in southern Queensland, Australia. This research focused on the communities local to the Surat Basin and primarily located within the Western Downs and Maranoa regions, as shown in Figure 1. These areas had experienced the rapid development of the Surat Basin onshore gas operations, which started in the early 2000's and resulted in the construction of thousands of wells and associated infrastructure over the following two decades.

Data sources

The studies used free, publicly available data from two primary sources.

- The Australian Bureau of Statistics (ABS) Census data provided information about the local economy and population.
- The Geological Survey of Queensland (GSQ) data provided the location of onshore gas wells.

Five economic and demographic indicators were used in analyses of the local economy and demographic changes, and these are summarised below.

Indicators of local economy:

- Employment based on the number of jobs in mining, as a proxy for jobs in onshore gas operations (which is a subcategory of mining).
- Income as median weekly income per person and family.

Indicators of demography:

- Migration of young adults to and from areas.
- Gender representation amongst young adults.
- Educational attainment levels of young adults.

Method

The research method was a long-term case study analysis involving four key steps.

1. Identification of rural regions with onshore gas operations

To identify the rural regions with onshore gas operations, the researchers combined the GSQ data of onshore gas wells, with ABS geographical boundaries for the Surat Basin.

As of 2023,[1] there were 11,134 wells in total (abandoned, active and suspended) across the Surat Basin.

The research used ABS boundaries specifically developed for analysing local communities and economies:

- Project A (2001 to 2011) used statistical local areas (SLAs).
- Project B (2011 to 2021) used statistical area twos (SA2s).

The researchers changed from SLAs to SA2s in line with changes to the Australian Statistical Geography Standard. Although not the same, SLAs and SA2s share similarities, and both represent local communities and economies.[2]

At the time of the 2021 Census, the Queensland population was approximately five million and could be segmented into 539 inhabited SA2s.[3] Figure 1 shows onshore gas operations were identified within eight SA2s of the Surat Basin, with a total population of 54,760. The relatively small population reflected the rural characteristics of the regions.

2. Identification of comparable regions without onshore gas operations

The second step identified comparison regions. These were regions without onshore gas operations that were similar to regions with onshore gas operations based on population density. There were approximately 50 SLAs/SA2s in Queensland with similar population densities to the SLAs/SA2s with onshore gas operations. These were used to compare changes in demographic and economic indicators over the two decades.

3. Statistical analyses were used to test for differences and changes

The researchers tested for both differences between regions with and without onshore gas operations, and for changes within each decade. In the demographic studies, the researchers identified differences and changes by computing and comparing descriptive statistics. In the economic studies, the researchers used both descriptive statistics and correlational models to identify the differences and changes over time.

4. Comparison of decades

Project B compared the findings from each decade. This involved the researchers undertaking a synthesis of the findings from Project A and B. A synthesis was opted for rather than a direct statistical comparison, due to the change from SLA to SA2 geographical boundaries between Project A and B.

1 Department of Resource (2023). "Queensland Spatial Catalogue – Q Spatial: All bore hole and well locations – Queensland." Retrieved 22 February, 2024, from https://qldspatial.information.qld.gov.au/catalogue/

2 Australian Bureau of Statistics. (2021). "Australian Statistical Geography Standard (ASGS) Edition 3." Retrieved 22 February, 2024, from https://www.abs.gov.au/statistics/standards/australian-statistical-geography-standard-asgs-edition-3/jul2021-jun2026/main-structure-and-greater-capital-city-statistical-areas/statistical-area-level-2

3 Australian Bureau of Statistics. (2021). "Census datapacks." Retrieved 22 February, 2024, from https://www.abs.gov.au/census/find-census-data/datapacks

Figure 1. Map showing the rural regions with onshore gas operations, as SA2s local to the Surat Basin.[1,2] Map produced using ESRI software.

Key findings

The results presented in this fact sheet are key findings for the Surat Basin areas with onshore gas operations.

Local economy shifts

Employment and income of residents were compared for SLAs/SA2s with onshore gas operations to those without onshore gas operations using the jobs in mining category of the ABS Census. Other forms of mining, including coal mining, are also captured in this category. Flow-on effects to other sectors are not included in this measure.

Employment of residents in onshore gas operations

The emergence of energy industries within a region can impact local employment opportunities.

Results showed a 44% increase in mining jobs in the Surat Basin SLA's during the first decade, 2001 to 2011. The increase was consistent with the employment opportunities of the early construction stage of the onshore gas operations.

In the second decade, 2011 to 2021, onshore gas operations in the Surat Basin reached the operational phase and changes in the number of jobs in mining were consistent with this industry shift. The average number of residents with mining jobs in Surat Basin SA2s with onshore gas operations reduced by 32%. Figure 3 demonstrates this change, from 2011 to 2022.

Overall, the changes aligned with more direct employment opportunities during the construction phase of the industry and less employment opportunities as the industry moved into the operational phase. Changes in these areas may also have been affected by any broader fluctuation in other mining activities in the region.

In areas without onshore gas operations, the change in mining jobs was minimal, further suggesting the mining job changes in the Surat Basin mostly reflected changes linked with onshore gas operations.

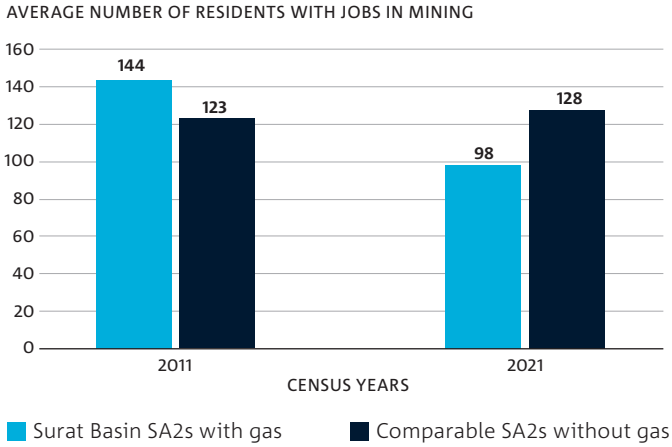

Figure 2. Average number of residents with mining jobs in 2011 and 2021. Averages are for Surat Basin SA2s with onshore gas operations, and comparable SA2s without. Source: Project B, Census data.[3]

KEY FINDING: During the 20 years of onshore gas operations in the Surat Basin, mining jobs – the proxy for onshore gas jobs – increased in the first decade and declined in the second decade:

- 2001 to 2011, the average number of mining jobs of residents increased 44%
- 2011 to 2021, the average number of mining jobs of residents decreased 32%.

A coal seam gas well head.

Incomes of residents

Energy industries that change the employment opportunities for local residents can also impact their incomes. The researchers tested for changes in incomes, both per person and per family.

For the first decade, the researchers found that median weekly incomes increased in Surat Basin SLAs with onshore gas operations by 16% per person and 11% per family.

These changes indicated that the industry's early construction phase employment opportunities were a likely boost for local incomes.

For the second decade, the researchers found:

- Median incomes were similar between Surat Basin SA2s with gas and SA2s without, see Figure 3.
- The growth in local incomes in areas with onshore gas operations eased compared to the previous decade.

The easing in income may have been linked to less availability of higher salary opportunities from the initial onshore gas jobs in the Surat Basin.

Given the different income trends for each decade, future research could seek to understand how local communities adapt to changes in income over the life cycle of energy industries.

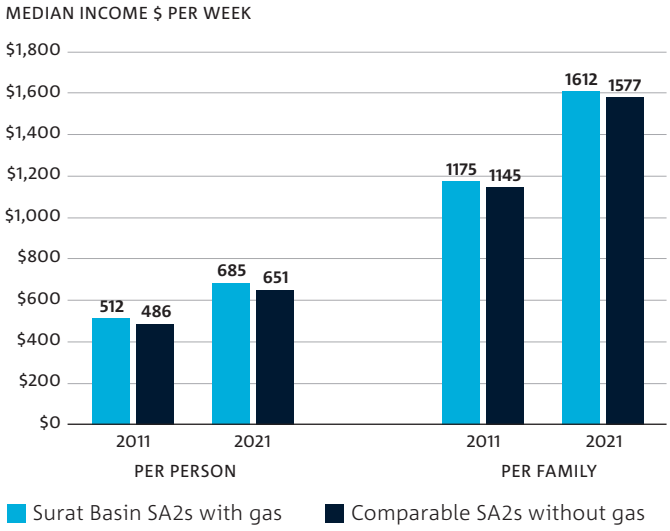

Figure 3. Median weekly income of residents in 2011 and 2021. Medians are for Surat Basin SA2s with onshore gas operations, and comparable SA2s without. Source: Project B, Census data.[3]

> **KEY FINDING:** Similar to employment, income growth initially increased in Surat Basin SA2s with onshore gas operations, and relative to the SA2s without such operations. Then, in the second decade, this trend eased – incomes of SA2s with and without onshore gas operations were similar.

Streetscape of Chinchilla in Queensland, Australia. Chinchilla is a major township within the Surat Basin.

Local demography shifts

The migration and retention of young adults and their formal education levels were analysed as part of the demographic analysis for both Project A (2001 to 2011) and Project B (2011 to 2021).

Migration of young adults

The migration of young adults to and from the areas with onshore gas operations was used to inform about the human capital being retained, maintained or lost over the life of industry operations.

The researchers used Australian Census data from 2011, 2016 and 2021 to understand changes in the young adult population, including gender representation, as mining is often linked with employment opportunities for males.

Overall, the studies found the inward migration of young adults to areas with onshore gas operations was greater during 2001 to 2011 than 2011 to 2021, although migration did continue in the second decade. Consistent between decades was the finding that areas with onshore gas operations generally observed greater growth or less decline in young adults than areas without onshore gas.

Greater growth in the first decade was consistent with the industry's initial construction phase and increased employment opportunities.

The second decade trends, as observed at the 2016 and 2021 Census, for the young adult cohort of 20- to 24-year-olds and 25- to 29 -year-olds are shown in Figure 5.

For Surat Basin SA2s with onshore gas operations, more out-migration was recorded for 20- to 24-year-olds, which consisted of more males than females. More in-migration was recorded for 25- to 29-year-olds, which consisted of more females than males.

To understand the motivations for these migration patterns, including the age and gender differences, more research is required.

> **KEY FINDING:** In both decades, arrival and retainment of young adults were greater in Surat Basin areas with onshore gas operations (compared to areas without such operations). When the shifts of each decade were compared, the first decade was found to have greater arrivals.

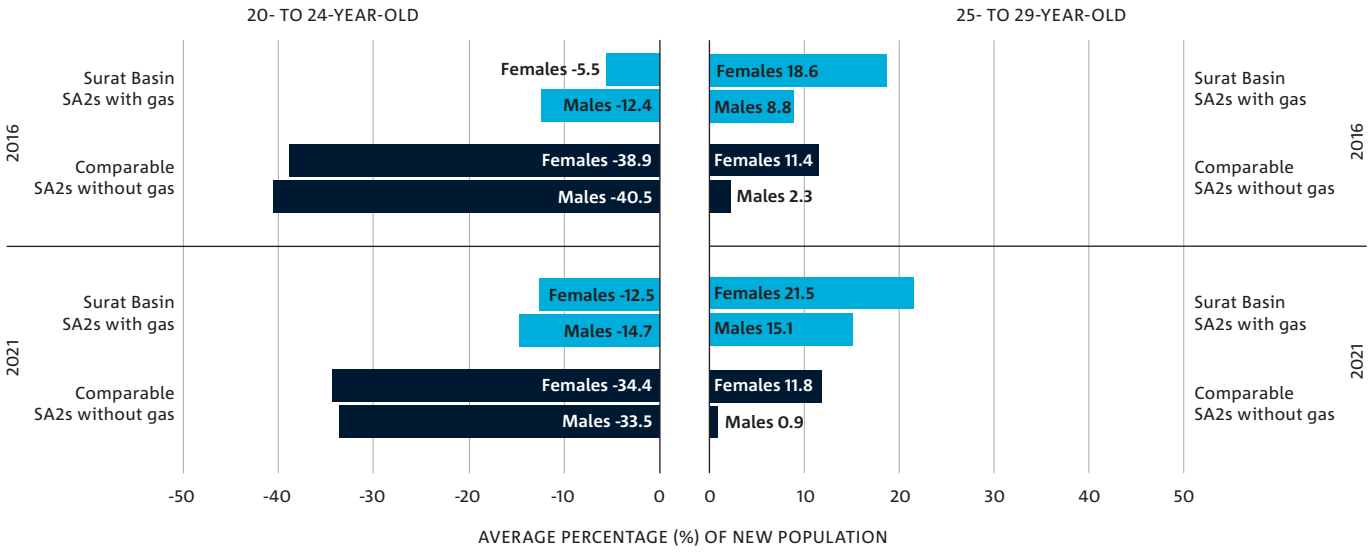

Figure 4. Average percentage (%) of young adults (20- to 29-year-old) new to SA2s since Census. Showing females and males for Surat Basin SA2s with onshore gas operations and comparable SA2s without. Source: Project B, Census data.[3]

Formal education levels of young adults

Worldwide, there has been research into the relationship between mining development and educational attainment, though findings have been mixed. Some studies have found that in mining communities, educational attainment can be reduced due to the increased availability of high paying, low-skilled jobs. Other studies have observed increased participation in education and training.

In the demographic studies of Projects A and B, the researchers analysed the post-school levels of educational attainment of young adults (15- to 24-year-old and 25- to 34-year-old). Focusing on the Surat Basin where most of the onshore gas operations were, the researchers found:

- In 2011, educational attainment was higher in SA2s with onshore gas operations. That is, more young adults of both age cohorts, female and male, living in SA2s with onshore gas operations – had attained a Certificate III or IV, compared to SA2s without onshore gas operations.
- In 2021, again, educational attainment was higher in SA2s with onshore gas operations. However, when detailed by age cohort and gender there were interesting changes. As shown in Figure 6, within the 15- to 24-year-old cohort:
  - a similar percentage of males and females had Certificate III or IV
  - a similar percentage of males and females had bachelor degrees.
- Whereas within the 25- to 34-year-old cohort:
  - a greater percentage of males compared to females had attained Certificate III or IV
  - a greater percentage of females compared to males had attained bachelor degrees
  - the percentage of females with bachelor degrees was the same as females with Certificate III or IV.

Higher education levels may indicate that skilled employment opportunities were a key factor in attracting and retaining young adults to areas with onshore gas operations. Future research could explore in more detail the motivations for these trends, especially for different age cohorts and genders.

> **KEY FINDING:** In both decades, the education levels of residents were higher in Surat Basin areas with onshore gas operations, compared to areas without such operations. Specific to the end of the second decade, in 2021, more females (compared to males) were observed to have bachelor degrees.

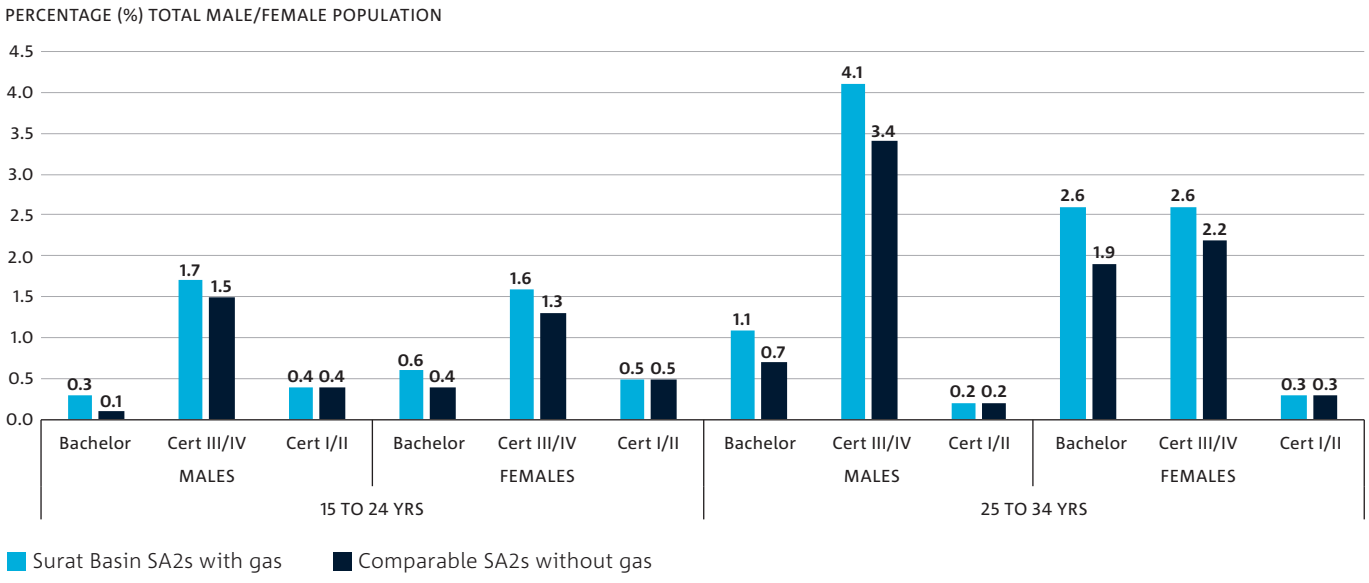

Figure 5. Average percentage (%) of educational attainment for young adults in 2021. Showing males and females, for Surat Basin SA2s with onshore gas operations and comparable SA2s without. Source: Project B, Census data.[3]

Conclusion

Combined, Projects A and B demonstrated that a longer-term case study of industry, demographic and economic indicators can provide an evidence base to identify the impacts of energy and mining transitions.

This long-term case study approach, using public data, could be applied to other regions where energy infrastructure – including gas, wind and solar – are being developed. Evaluations can be undertaken as data become available, allowing analyses to be timely and transparent inputs for decision-makers and communities about changes in financial, human and social capital.

Road sign for towns in the Surat Basin of Queensland, Australia.

Summary of key findings

Evaluation of the changes that local economies and populations experience when industrial operations commence in a region are generally short-term. This project has allowed a longer-term view and identified important trends:

- **Local employment and incomes**: The gains in local employment and incomes of the first decade steadied in the second decade. This was consistent with the industry moving to a less labour-intensive operations phase. However, more nuanced understanding of sub-categories of mining employment were not identified, nor was the impact of flow-on effects to other sectors associated with the industry.
- **Local young adult population**: The migration of young adults during the first decade also steadied, although areas with onshore gas continued to have greater retainment and arrival of young adults. Educational Certificates III or IV continued to be common amongst young adults, especially in areas with onshore gas operations. Females in the 25 to 34 age cohort in areas with gas operations were commonly found to have bachelor degrees in the second decade study.

Overall, the initial local economic gains of jobs and incomes steadied, but regions with onshore gas operations continued to attract and retain more skilled young adults.

More information

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