Gas Industry Social Environmental Research Alliance

SA Stakeholder Roundtable

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CSIRO ENERGY
www.csiro.au

WWW.GISERA.ORG.AU

CSIRO | Australia Pacific LNG | QGC A BG Group business | AGL Energy in action. | origin | Santos We have the energy. | NSW Government | Australian Government Department of Industry, Innovation and Science

GISERA
Gas Industry Social and Environmental Research Alliance

- CSG: Challenges & opportunities
  - Not distributed evenly in space & time or among stakeholders
  - Uncertainty creates tension and public discontent
  - Science to improve predictions of distribution of challenges & opportunities
  - Inform decision making, inject information into debate & reduce tension

- GISERA seeks to develop
  - Integrated, regional, systems-based research portfolio
  - Provide gas industry/community evidence based knowledge
  - Underpin decision making to maximize benefits & minimize costs

- Benefits
  - New knowledge & reduced uncertainties for relevant stakeholders
  - Foster collaboration by industry, communities, government, universities
  - Synthesize data & knowledge at a regional scale
  - Provide non-exclusive & mutual leverage opportunities

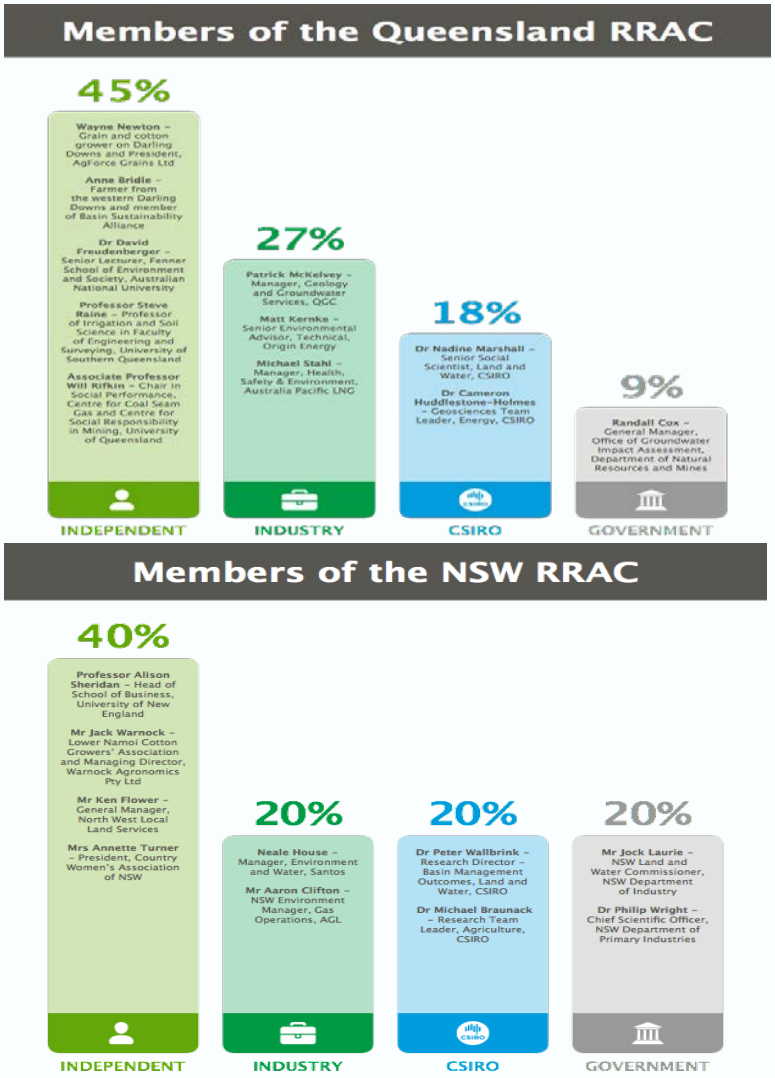
Key environmental & social questions

- Does CSG affect quality/quantity of water?
- What are impacts on farm production, productivity and amenity?
- What is CSG contributing to regional greenhouse gas & global climate change?
- What are costs/benefits for communities?
- What are impacts on regional flora/fauna?
- Does CSG development make people sick or affect ecosystems?
- Decommissioning issues?

GISERA Research Program

- **Agriculture**: identifying landscape/development configurations that maximise co-benefits
- **Water**: understanding risks associated with extraction & use of groundwater
- **Biodiversity**: understanding & minimising impacts of development on regional ecological function
- **Marine**: understanding vulnerable components of the marine ecosystem to minimise or offset impacts
- **Socio-economic**: informing & supporting change to enhance regional & community benefit
- **Greenhouse footprint**: identifying sources and profiling the region
- **Health:** understanding exposure pathways and associated risks

GISERA governance



- GISERA NSW Research Advisory Committee
  - Contains 2/10 industry members
  - Identify, develop, approve or stop projects
  - Ensures research priorities are independent
  - Ensure research is transparent
  - Oversees conduct
  - Internal documentation completely visible (www.gisera.org.au)
  - Reports publicly available
  - CSIRO peer-review

- GISERA Research Management Committee
  - Composition: CSIRO, APLNG, QGC
  - Oversees day-to-day operations
  - Financial governance
  - Milestone sign-off

CSIRO Methane Fugitive Emissions Fact Sheet

www.csiro.au

What does science tell us about fugitive methane emissions from unconventional gas?

This factsheet sets out what the science tells us about methane emission sources from coal seam gas (CSG) wells, pipelines, compressors and other infrastructure associated with CSG production; and their importance in contributing to warming of the earth's climate.

KEY POINTS

- Fugitive emissions are losses, leaks and other releases of methane to the atmosphere that are associated with industries producing natural gas, oil and coal.
- In Australia, fugitive emissions from gas production are estimated to account for about 2.5% of greenhouse gas emissions.
- To accurately measure fugitive emissions, natural background biological and geological sources must be separated from human sources. CSIRO studies aim to separate these sources.
- CSIRO has a range of research programs underway in Queensland, New South Wales and Western Australia using measuring and monitoring techniques and lifecycle analysis methods in an attempt to build a comprehensive picture of natural and fugitive emissions in Australia.
- Unconventional gas issues in the United States differ from those in Australia. Only Australian specific studies provide an accurate picture of CSG industry fugitive emissions.
- The median fugitive emissions from measurements of CSG wells in Queensland and NSW is less than 1kg/day with 1% of wells releasing 63 kg/day. Well completion and workover measurements show releases of 200 kg/day and 20 t/day, respectively. Measurements made at a CSG water treatment plant were between 18 and 32 kg/day and from a CSG compression plant, emissions were 780 kg/day. To put these measurements into context, methane fluxes measured from an urban sewerage treatment plant were 45 kg/day, a medium sized waste land fill were 400 kg/day and from a cattle feed lot were 2,600 kg/day.
- CSIRO is actively researching fugitive emissions and this fact sheet will be updated as new data are received.

What is methane and where does it come from?

Methane, a colourless, odourless, non-toxic gas, originates from two sources:

- the decomposition of organic matter, such as in lakes, rivers, wetlands and soils, or
- from deep beneath the earth's surface where gaseous methane has formed geochemically under elevated temperature and pressure conditions.

Globally, it is estimated that more than 300 million tonnes (Mt) of methane is emitted each year from natural sources such as wetlands, soils, biomass burning and geological sources and another 330 million tonnes (Mt) of methane is produced by human activities such as agriculture; mainly rice and beef production (Kirschke et al., 2013). However, large uncertainties remain in these estimates (Schaefer et al., 2016). Of the natural sources, about 16% is seeping naturally from sedimentary basins such as from coal seams and shale basins, rising from geological structures beneath the earth's surface. About 29% of human sources of methane emitted to the atmosphere arise from fossil fuel combustion (Kirschke et al., 2013). However, these estimates are still subject to significant uncertainty. The Commonwealth Government estimates that fugitive emissions from natural gas production are about 2.5% (Commonwealth Government, 2014).

How much does methane warm the atmosphere?

Like all greenhouse gases, methane absorbs infra-red radiation from the earth and then radiates this heat back into the surrounding atmosphere, warming it. However, methane is a more potent greenhouse gas than carbon dioxide. About 20% of the total warming of the atmosphere since 1750 is due to methane emissions from human activities, which has increased global average temperatures by about 1 degree Celsius (Kirschke et al., 2013).

The relative capacity of different gases to warm the atmosphere, taking into account their 'lifetimes', is called the global warming potential. Methane remains in the atmosphere on average for between eight and twelve years (Lassey et al., 2007), whereas 50% of carbon dioxide emitted to the atmosphere is lost in about 30 years (Inman 2008). The global warming potential of methane, when compared to carbon dioxide over a 100-year lifetime, is about 25 times greater (Saunois et al., 2016; Commonwealth Government 2017).

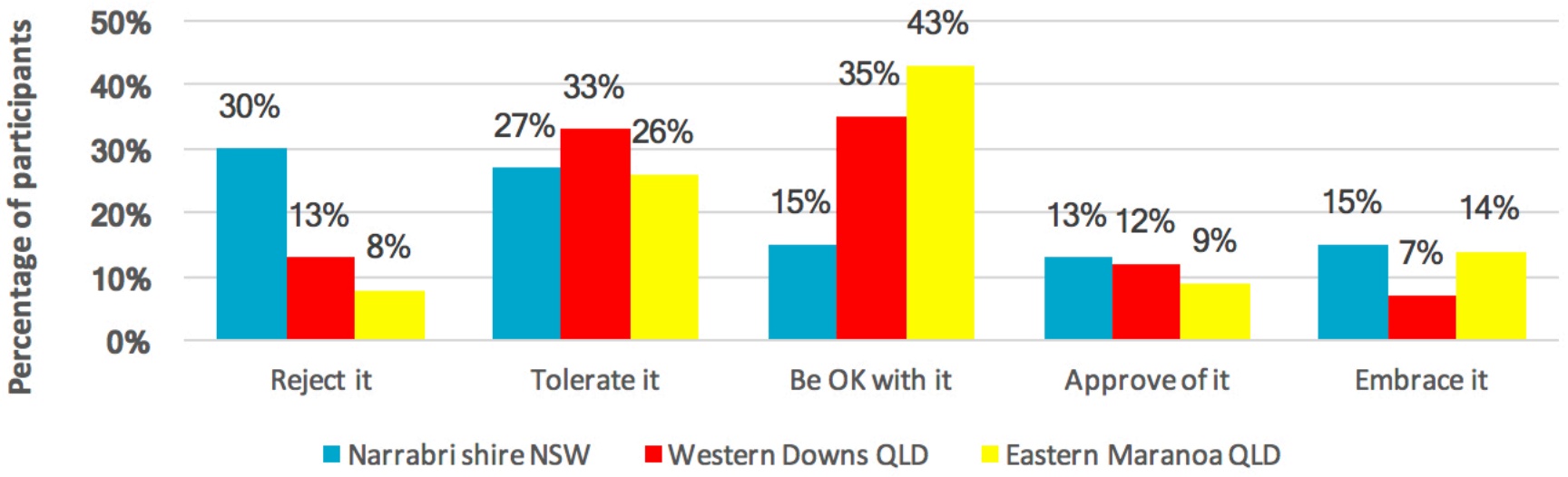
Process/component	Methane emissions
Well completions	200 kg in 1 hour
Workovers	20 t in 1 day
Compression plants	780 kg/d
Water treatment facilities	32 kg/d
Coal exploration bores	1000 kg/d
Urban sewerage plant	40 kg/d
Urban Land fill	400 kg/d
Feed lot	~2100 kg/d
Natural fissures	~100 kg/d

Regional Economics - NSW

- Econometric analysis
- Income and sectoral employment
- 24 NSW rural regions (> 2 CSG wells)
- 114 NSW rural regions (0 CSG)
- Paired for similar average socioeconomic/ environmental characteristics
- Removed factors influence farm income, human capital productivity, non-CSG revenue
- 6.47% & 6.31% higher median personal and family income independent of other factors
- Increased indirect employment
  - rental, hiring & real estate services
  - professional/technical services
- Not statistically significant

Marcos-Martinez et al (2014) Assessing linkages between regional economic indicators and CSG industry activity in NSW 2001-2011. CSIRO Report. 33 p.

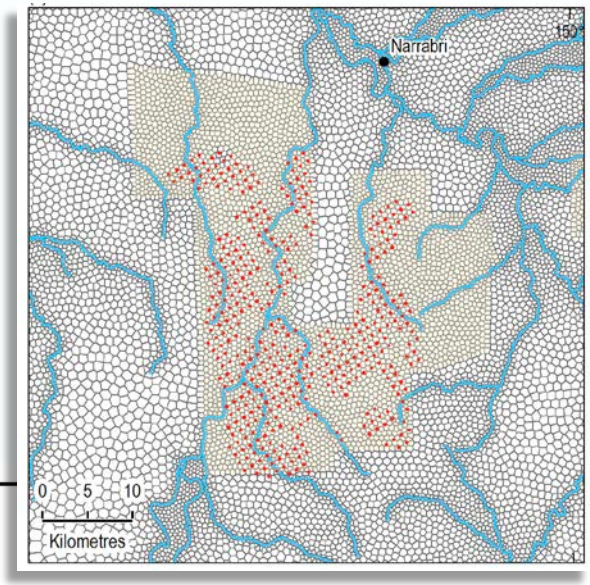
Community Wellbeing – NSW & Qld

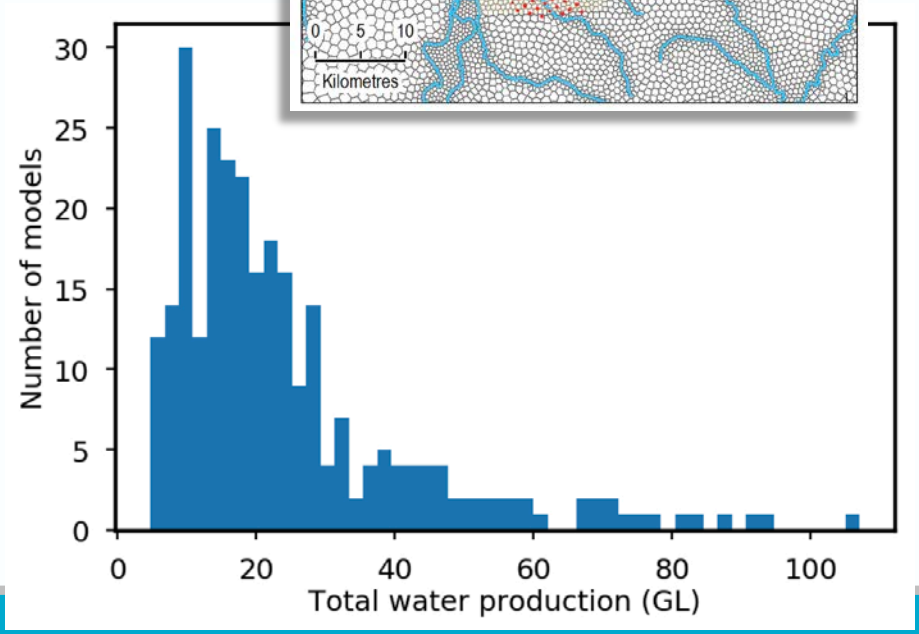


- Factors → Community acceptance
  - Existing community resilience
  - Environmental management
  - Job/business opportunities
  - Services and facilities
  - Community trust

- Current wellbeing robust…
- But concerns for future
- Adaptation varies across region
- Opportunities to invest in wellbeing

Water impacts on GAB fluxes - NSW





- Depressurisation of Hoskisson and Maul's Ck measures
- Impacts on Piliga Sandstone and Namoi Alluvium
- 3500 parameters sets
- 500 'best' model runs c.f. obs
- Median: 84.52 ML/y
- Range: 0.28 to 2299.21 ML/y
- 0.29% of LTAAEL
- Similar GIA 'base case' 60ML/y
- Alluvium: 0.89 ML/y

Thank you

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