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Narrabri Gas Project
Submission

The economic assessment of the Narrabri Gas Project is misleading and does not comply with NSW assessment guidelines. The benefit cost analysis by consultants GHD is contradicted by the proponents' financial statements and analysis commissioned by the Australian Energy Market Operator.

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Summary

The economic assessment of the Santos Narrabri Gas Project is misleading, heavily understating the costs of the project. This is evident from the fact that both proponents, Santos and CLP Group, have written off the entire value of the project in their financial statements, effectively valuing the project at zero.

In December 2015 Santos was forced to "write down the remaining book value" of its Narrabri stake and in December 2016, classified the project as a 'non-core asset'. This is in stark contrast to the economic assessment written by consultants GHD, that estimates the net present value of the project at $1.54 billion to Australian stakeholders, implying a total value of $2.2 billion.

The main factor behind GHD's optimistic evaluation is assumed capital and operating costs far below published estimates by other analysts. In 2015 the Australian Energy Market Operator (AEMO) commissioned analysis that included estimates of gas production costs in the Gunnedah Basin which includes the Narrabri Gas Project area. AEMO's estimates are between $6.53 and $7.98 per gigajoule (GJ), with a central estimate of $7.25/GJ.

Even without allowing for inflation or any discounting of future costs, GHD's costs per gigajoule are lower than AEMO's most optimistic scenario, $6.25/GJ compared to $6.53/GJ. As soon as any inflation, financing costs, risk and uncertainty are considered through a discount rate, GHD's costs are far lower than those commissioned by AEMO. Exact comparison is difficult without more information on both studies, but GHD's central present value cost per gigajoule is just 34% of AEMO's central value, at $2.48/GJ.

This large difference in costs must be explained by GHD and Santos. In our opinion this is the main factor resulting in the wildly different project values estimated by financial analysts compared to the benefit cost analysis performed by GHD.

GHD note in their report:

> GHD has prepared this report on the basis of information provided by Santos which GHD has not independently verified or checked beyond the agreed scope of work…It was outside the scope of this analysis to independently appraise project parameters such as forecast gas prices, capital and operating costs and gas production estimates.

The *NSW Guidelines for the Economic Assessment of Mining and Coal Seam Gas Proposals* with which this benefit cost analysis should comply require the economic assessment to 'be based on rigorous, transparent and accountable evidence that is open to scrutiny'. Cost and production data in the GHD analysis is not rigorous or transparent and has not been subject to scrutiny even by GHD, contrary to the NSW Guidelines.

Other problems with GHD's analysis include:

- Optimistic gas prices. Santos has a history of making over-optimistic oil and gas price forecasts and this appears present in the gas price forecast it has supplied to GHD.
- No discussion of the pipeline required to facilitate the project.
- Minimal consideration of costs of potential impacts on water resources.
- No consideration of costs of potential impacts on human health.
- Underestimate of greenhouse gas emissions, ignoring fugitive and migratory emissions.

The flaws in GHD's analysis are typical of assessments of 'megaprojects'. Nobel Prize for Economics winner, Daniel Kahneman, and Amos Tversky, have outlined the systematic biases that are common in such assessments, including optimism bias, strategic misrepresentation and principal-agent misalignment of objectives. The world's most cited scholar on megaprojects, Bent Flyvbjerg writes:

> When cost and demand forecasts are combined, for instance in the cost-benefit analyses that are typically used to justify large infrastructure investments, the consequence is inaccuracy to the second degree. Benefit-cost ratios are often wrong, not only by a few percent but by several factors. As a consequence, estimates of viability are often misleading, as are socio-economic and environmental appraisals, the accuracy of which are heavily dependent on demand and cost forecasts. These results point to a significant problem in policy and planning: More often than not the information that promoters and planners use to decide whether to invest in new projects is highly inaccurate and biased making plans and projects very risky.

Recent changes to NSW project assessment guidelines have not improved the quality of assessment provided by proponents such as Santos and consultants such as GHD, which continue to include glaring errors and inconsistency with market evaluations and independent assessments. NSW guidelines must continue to evolve and deal with the biases and strategic misrepresentation of projects that are rife within the planning system.

The Narrabri Gas Project will not affect rising gas prices in eastern Australia. Now that Australia is linked to world gas markets via export terminals in Gladstone, Queensland, Australian prices will largely reflect world market prices.

Benefits to the local area are likely to be minimal. Gas industry-funded research in Queensland finds that local businesses in unconventional gas regions believe that gas development led to deterioration in their finances, local infrastructure, social connections and labour force skills.

The Narrabri Gas Project is financially dubious, with uncertain benefits and costs that have not been properly assessed by GHD. It is likely that its costs outweigh its benefits and it should be rejected by NSW planning authorities on this basis.

Introduction

Santos is proposing to extract coal seam gas in the Gunnedah Basin of New South Wales, southwest of Narrabri. The project is referred to as the Narrabri Gas Project (Project). Santos has lodged an Environmental Impact Statement (EIS) for the Project, which includes a benefit cost analysis prepared by GHD.[1] This document is our submission concerning the benefit cost analysis and other economic aspects of the EIS.

The Project is a large project covering 950 square kilometres and includes the installation of up to 850 new wells, new access tracks, a gas processing facility, a water management facility and various buildings. First production is scheduled for 2019/20, with the Project having an estimated life of 25 years.

The Project area includes a portion of the region known as the Pilliga. Nearly half of the Pilliga is set aside for conservation.[2] The Pilliga has spiritual meaning and cultural significance for the Aboriginal people of the region. Other parts of the Pilliga are State Forest set aside for forestry, recreation and mineral extraction. Much of the Project area is within this State Forest, with the remaining Project area on agricultural land that supports dry land cropping and grazing.

The benefit cost analysis states that the net present value of the Project is $1.54 billion and that the Project is expected to generate approximately 1,300 jobs during construction and 200 jobs during operation. The benefit cost analysis estimates that the Project will generate $293 million in royalties for the NSW Government and $60 million in payroll taxes (in net present value terms). Our view is that the benefits of the Project are heavily overstated, while costs are understated. Many projects in the NSW planning system have suffered from these problems, as is common internationally. International literature on megaproject assessment outlines why these over-optimistic estimations arise again and again.

We confirm that in preparing this submission we have read the Expert Witness Code of Conduct under the *Uniform Civil Procedure Rules 2005* and agree to be bound by it.

[1] GHD (2016) *Narrabri Gas Project – Environment Impact Statement Economic Assessment*
[2] *Ibid*, p3.

Project value in proponent accounts

The net present value (NPV) of the Project estimated by GHD in the EIS is $1.54 billion. This estimate is contradicted by values in the proponents' financial statements.

The Project is 80% owned by Santos and 20% owned by the Hong Kong based CLP Group via its subsidiary EnergyAustralia. Santos itself is 87% domestic owned and 13% foreign owned. The Project is therefore 30% foreign owned.

GHD's benefit cost analysis calculates the net present value of this project to the *Australian community*. Taking into account the 30% foreign owned stake, the estimated net present value of the Project to *all* stakeholders would be $2.2 billion.[3]

In contrast, Santos values the Project at zero in its financial accounts. In December 2015 Santos was forced to "write down the remaining book value" of its stake in the Project due to the "low oil price environment and the fact that the rate of investment in the Narrabri Gas Project will be slowed".[4] In December 2016, Santos classified its stake in the Project as a 'non-core asset stoking speculation that it would sell the venture'.[5] CLP Group also values the Project at zero. [6] [7]

There are significant differences between economic benefit cost analysis and financial analysis. However, the contrast of zero book value with $2.2 billion NPV points to over-optimism and strategic misrepresentation in the benefit cost analysis.

Benefit cost analysis includes more items in its calculations than financial accounts, such as social and environmental costs – the GHD analysis includes for example a social

[3] The benefit cost analysis estimate of $1.5 billion in net present value to Australian shareholders divided by 70% (1-30%).

[4] Santos (2016), *Statement on Santos NSW assets*, https://narrabrigasproject.com.au/2016/02/statement-on-santos-nsw-assets/

[5] Hannam (2016) *Santos signals possible NSW CSG exit, raising doubts about government gas plan*, Newcastle Herald, 8 December 2016, http://www.theherald.com.au/story/4345321/santos-signals-possible-nsw-csg-exit-raising-doubts-about-government-gas-plan/?cs=12

[6] CLP Group (2015) CLP Group (2015) *Annual Report 2014*, p224, https://www.clpgroup.com/en/Investors-Information-site/Documents/Financial%20Report%20PDF/e_Annual%20Report%202014%20(full%20version).pdf

[7] Chambers (2015) *CLP writes off stake in Santos project.* The Australian, 28 February 2015, http://www.theaustralian.com.au/business/mining-energy/clp-writes-off-stake-in-santos-project/news-story/2619e923515725685b4b4fb0222af101

cost of carbon. Company financial accounts do not include such costs. These items should lower the NPV compared to the value in the financial accounts. However the reverse is the case here, the NPV is much higher.

Financial analysis and benefit cost analysis also approach discounting differently. However, in the sensitivity analysis GHD's benefit cost analysis calculates the value of the Project under the alternative assumption of a 10% discount rate which would be closer to the discount rate used in the financial accounts. This 10% discount rate implies that the NPV of the Project to all shareholders is $1.1 billion, which far from explains this difference.[8]

CLP Group wrote down the value of the Project to zero in December 2014. In doing so, it valued its stake in the Project using a discount rate of 13% and assumed 2.5% inflation.[9] This implies a real maximum discount rate of 10.5% which is very close to the 10% (real) discount rate used in the benefit cost analysis. In other words when CLP used a discount rate similar to that used in GHD's analysis (10.5% vs 10%), CLP valued the Project at zero compared to the benefit cost analysis estimate of $1.1 billion.[10]

Santos has been more optimistic than its partner CLP Group in valuing the Project over time. Both Santos and CLP Group reduced their valuation of the Project in December 2014. However while CLP Group wrote down its stake to zero, Santos only wrote down its Narrabri stake to $543 million.[11] It was not until a year later in December 2015 that Santos wrote down its stake in the Project to zero stating it was due to the 'low oil price environment and the fact that the rate of investment in the Narrabri Gas Project will be slowed'.[12]

Santos' optimism compared to its partner, CLP Group, raises concern that this benefit cost analysis, which is based on Santos assumptions, is subject to optimism bias.

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[8] The alternative scenario of a 10% discount rate results in NPV of $770 million to Australian shareholders. $770 million divided by 70% (domestic ownership of the Project) equals $1.1 billion.

[9] CLP Group (2015) *Annual Report 2014*, pp224, 204, https://www.clpgroup.com/en/Investors-Information-site/Documents/Financial%20Report%20PDF/e_Annual%20Report%202014%20(full%20version).pdf

[10] The assumptions used to calculate this NPV calculation may have moved favourably since December 2014 when CLP Group's valuation was done, but this is unlikely. Oil and gas prices have halved (see below). Neither Santos nor EnergyAustralia have revised upwards their estimation of the Narrabri gas reserves and forecast costs are unlikely to have decreased much, if at all.

[11] Chambers (2015) *CLP writes off stake in Santos project.* The Australian, 28 February 2015, http://www.theaustralian.com.au/business/mining-energy/clp-writes-off-stake-in-santos-project/news-story/2619e923515725685b4b4fb0222af101

[12] Santos (2016), *Statement on Santos NSW assets*, https://narrabrigasproject.com.au/2016/02/statement-on-santos-nsw-assets/

Cost assumptions

Capital and operating costs used in the GHD benefit cost analysis appear unrealistic when compared to estimates of these costs in research commissioned by the Australian Energy Market Operator (AEMO). In February 2015 AEMO commissioned Core Energy Group to analyse gas production costs for the Eastern Australian market, including the Gunnedah Basin (i.e. the Project).

Core Energy estimated costs in the Gunnedah Basin under three scenarios relating to the gas production, low, reference and high, as shown in Table 4 below:

Table 4: Core Energy estimates of Gunnedah Basin supply costs, AUD/GJ

Low production	Reference	High production
7.98	7.25	6.53

These costs estimated by Core Energy are far higher than those estimated by Santos and provided to GHD. As discussed above, GHD made no effort to verify Santos' estimates. Exact comparison between Core Energy's cost estimates and GHD's cost estimates are difficult due to the way information is presented in the EIS. Core's estimates represent:

> *Breakeven price of gas (expressed as AUD/GJ) required to cover the net present value of full lifecycle costs of producing reserves for a defined supply area and to resource owner with a 10% real return on capital.*[13]

GHD provide several estimates of nominal and real capital and operating costs at different discount rates (GHD pp 19, 23 and 25), and an incomplete production schedule from 2019 to 2041 (p 19). Assuming production between 2026 and 2041 tapers in a linear manner, total production would be 1,447 GJ of gas. In terms of costs per gigajoule of production, costs used by GHD are far lower than those estimated by Core Energy for AEMO, as shown in the table below:

[13] Core Energy Group (2015) *Gas Production and Transmission Costs: Eastern and South Eastern Australia,* p9, https://aemo.com.au/-/media/Files/Gas/National_Planning_and_Forecasting/GSOO/2015/Core--Gas-Production-and-Transmission-Costs.ashx page III

Table 5: GHD costs per gigajoule of production

	Undiscounted nominal	Undiscounted real	Discount rate 4%	Discount rate 7%	Discount rate 10%
Capital costs (AUD$m)	3,570.0	2,980.0	2,333.7	2,004.3	1,757.4
Operating costs (AUD$m)	5,470.0	3,790.0	2,229.7	1,578.0	1,161.5
Production (GJ)	1,447	1,447	1,447	1,447	1,447
Break-even price per GJ	$6.25	$4.68	$3.15	$2.48	$2.02

As shown in the table above, even without allowing for inflation or any discounting of future costs, GHD's costs per gigajoule are lower than Core Energy's most optimistic scenario, $6.25/GJ to $6.53. As soon as any inflation, financing costs, risk and uncertainty are considered through a discount rate, GHD's estimated costs are far lower than those published by AEMO. Exact comparison is difficult without more information on both studies, but GHD's central present value cost per gigajoule is just 34% of AEMO's central value. This major difference in assumed costs must be explained by GHD and Santos. In our opinion this is likely to be the main factor in the wildly different Project values estimated by financial analysts compared to the benefit cost analysis performed by GHD.

GHD assumes a gas price received of $8.70 per GJ. There is little margin between this price and a cost of $7.25 per GJ. Only a small deviation in gas prices, gas production and/or costs is required to render the Project unviable in this case. As discussed earlier, the GHD assumed price of $8.70 per GJ is optimistic compared to current world gas prices. If we assume the price received is the current Japanese gas price (net of export costs) of approximately $A7.16 per GJ[14] then the Project is uneconomic compared to the Core Energy production cost estimate of $7.25 per GJ.

Santos' massive asset write-downs have caused it to use funds to repay debt instead of making investments. This raises the question of whether Santos could proceed with the Project if it was approved and whether Santos has the ability to continue with the Project if/when forecasts prove to be overly-optimistic.[15]

[14] See Table 3 above.

[15] Santos (2016), *Santos announces a new strategy to drive shareholder value*, 8 December 2016, https://www.santos.com/media/3476/2016-investor-day-asx-presentation-final.pdf

Analysis relies on data from proponent

In considering the potential biases in the data used by GHD, we note that their analysis is very largely based on assumptions which Santos has given to GHD. These assumptions include capital and operating cost estimates, discussed above, as well as production, gas price, tax and royalty estimates considered later in this submission.

GHD notes "it was outside the scope of this analysis to independently appraise project parameters such as forecast gas prices, capital and operating costs and gas production costs," and "GHD does not accept liability in connection with such unverified information".[16]

The *NSW Guidelines for the Economic Assessment of Mining and Coal Seam Gas Proposals* (**NSW Guidelines**), with which this benefit cost analysis should comply, require the economic assessment to 'be based on rigorous, transparent and accountable evidence that is open to scrutiny'.[17] However this benefit cost analysis does not contain evidence to support the assumptions supplied by Santos, and GHD has not independently appraised them.

[16] GHD (2017) Narrabri Gas Project Benefit Cost Analysis, p6

[17] NSW Government (2015) *NSW Guidelines for the Economic Assessment of Mining and Coal Seam Gas Proposals, p3,* http://www.planning.nsw.gov.au/Policy-and-Legislation/Mining-and-Resources/~/media/C34250AF72674275836541CD48CBEC49.ashx

Megaprojects - over cost, over time, over and over again

The flaws and biases that appear to be present in the GHD assessment are often seen in megaproject assessment. These systematic biases have become well documented and well known, particularly due to the work of Bent Flyvbjerg, but also due to the work of Nobel Prize Winner for Economics, Daniel Kahneman, together with Amos Tversky. These biases include:

- optimism bias;
- the planning fallacy;
- strategic misrepresentation; and
- principal agent theory.

Kahneman and Tversky are credited with demonstrating the over-optimistic bias of humans. People underestimate the costs, completion times and risk of planned actions, whereas they overestimate the benefits of the same actions.[18] Kahneman and Tversky also highlighted the planning fallacy which is the tendency for people involved in a project to underestimate the costs and risks of a project simply because they do not foresee what can go wrong. They base their forecasts of the future on the best case rather than the likely case. Kahneman and Tversky say those involved with a project take *the inside view*. People who take the inside view:

- make forecasts by focusing tightly on the project at hand, considering its objective, the resources they brought to it, and the obstacles to its completion; and
- construct in their minds scenarios of their coming progress and extrapolate current trends into the future.

This results in overly optimistic forecasts.[19]

[18] Kahneman, D. & Tversky, A. (1979a) *Prospect theory: An analysis of decisions under risk*, Econometrica, 47, pp. 313–327. Kahneman, D. & Tversky, A. (1979b) *Intuitive prediction: Biases and corrective procedures,* in: S. Makridakis & S. C. Wheelwright (Eds) Studies in the Management Sciences: Forecasting, vol. 12 (Amsterdam: North Holland).

[19] Flyvbjerg (2008) *Curbing Optimism Bias and Strategic Misrepresentation in Planning: Reference Class Forecasting in Practice*, European Planning Studies 16:3-21, p9

Kahneman and Tversky contrast the inside view with taking the much more accurate *outside view*. The outside view examines the experiences of a class of similar projects, lays out a rough distribution of outcomes for this reference class, and then positions the current project in that distribution.[20]

Flyvbjerg also highlights strategic misrepresentation and the principal agent theory.[21] These theories suggest that there are strong incentives that cause project proponents to deliberately overstate the benefits and underestimate the costs and risks of projects. For example, politicians may want to have projects built to meet policy objectives. Managers may want to have projects built because there are tangible and intangible rewards for getting them underway and for running a bigger company than a smaller company. If senior managers are keen on a project, company employees may also reap the benefits of supporting the project progressing. Employees' ownership of a company (for example, ownership of company shares) is often small compared to their salary and potential bonus, consequently their losses if a project fails are small but their rewards for success are much greater. Managers and employees may also rightly reason that they will have another job elsewhere by the time a project fails and that the blame for the failure will be diffused.

Many of these theoretical issues may be influencing this estimation of net present value of the Project. The Project is strongly opposed by many people. Therefore the Project proponents have stronger reasons to overestimate the benefits and underestimate the costs of the Project compared to if the Project had little opposition. These overestimations or underestimations may be difficult to detect at the proposal phase, and if the Project goes ahead, it will be some years before the forecasts would be shown to be wrong.

Flyvbjerg has collected statistics on megaprojects from around the world. He summarises:

> "Success in megaproject management is typically defined as projects being delivered on budget, on time, and with the promised benefits. If, as the evidence indicates, approximately one out of ten megaprojects is on budget, one out of ten is on schedule, and one out of ten delivers the promised benefits, then approximately ***one in one thousand projects is a success***, defined as "on target" for all three. Even if the numbers were wrong by a factor of

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https://www.researchgate.net/publication/233258056_Curbing_Optimism_Bias_and_Strategic_Misrepresentation_in_Planning_Reference_Class_Forecasting_in_Practice

[20] Paraphrasing Flyvbjerg (2008) *Curbing Optimism Bias and Strategic Misrepresentation in Planning …*, p9.

[21] Flyvbjerg (2008) *Curbing Optimism Bias and Strategic Misrepresentation in Planning…*

> two—so that two, instead of one out of ten projects were on target for cost, schedule, and benefits, respectively— the success rate would still be dismal, now eight in one thousand. This serves to illustrate what may be called the "iron law of megaprojects": ***Over budget, over time, over and over again***. ***Best practice is an outlier, average practice a disaster*** in this interesting and very costly area of management."[22]

In reference to benefit cost analyses, Flyvbjerg further writes that:

> "When cost and demand forecasts are combined, for instance in the cost-benefit analyses that are typically used to justify large infrastructure investments, the consequence is inaccuracy to the second degree***. Benefit-cost ratios are often wrong, not only by a few percent but by several factors***. As a consequence, estimates of viability are often misleading, as are socio-economic and environmental appraisals, the accuracy of which are heavily dependent on demand and cost forecasts. These results point to a significant problem in policy and planning: ***More often than not the information that promoters and planners use to decide whether to invest in new projects is highly inaccurate and biased making plans and projects very risky***."[23]

The oil and gas sector is not immune from the problem. Westney is a Houston-based engineering and risk consultant to the oil and gas industry. They estimate that the probability of oil and gas projects running on time and on cost is only between 5% and 25%.[24] Westney also quote Independent Project Analysis who found only 22% of large oil and gas projects were on time and on budget.[25] Both these estimations leave aside the question of whether the projects also achieved their stated benefits (i.e. revenue). To help answer this question Westney quote a PricewaterhouseCoopers study that found only 2.5% of megaprojects met their objectives of scope, cost, schedule *and* benefits.[26]

Worldwide consulting firm EY analysed 365 oil and gas megaprojects and found 65% were over-budget and 73% over schedule. The budget overruns were not small – current project estimated costs were, on average, 59% above the initial estimate. EY

[22] Flyvbjerg (2014) *What you should know about megaprojects and why….,* p11, emphasis added.

[23] Flyvbjerg (2008) *Curbing Optimism Bias and Strategic Misrepresentation in Planning…*, p5, emphasis added.

[24] Briel, Luan and Westney (2014) *Built-in Bias Jeopardises Project Success, p2,* http://www.westney.com/wp-content/uploads/2014/04/Built-in-Bias-article-SPE-as-published.pdf

[25] Boschee (2012) *Panel Session Looks at Lessons Learned from Megaprojects*. SPE Today, 10 October 2012. Quoted in Briel, Luan and Westney (2012).

[26] PricewaterhouseCoopers (PwC) (2009) *Need to know: Delivering capital project value in the downturn*. Quoted in Briel, Luan and Westney (2012). Note this study refers to all megaprojects, not just oil and gas megaprojects.

noted these estimates were likely to understate poor performance as a substantial amount of the projects were still underway. Once again, EY only looked at cost performance and did not cover revenue performance.[27]

Closer to home is the building of Australia's eight newest Liquid Natural Gas (LNG) plants (including Santos's Gladstone LNG plant) which have totalled up $45 billion in cost overruns.[28]

Revenue forecasts are subject to the same biases that make cost forecasts so optimistic. Flyvbjerg estimates 84% of rail projects overestimate demand by more than 20%, and 72% of projects overestimate demand by more than 40%. For roads, 50% of projects overestimate demand by more than 20%, and 25% by more than 40%.[29] For oil and gas projects, revenue projection is made doubly difficult because of the difficulty of forecasting both reserves under the ground *and* also forecasting oil and gas prices which can fluctuate wildly from year to year. Recently Santos' Gladstone LNG plant has had to buy gas to meet contracts because Santos overestimated its gas reserves.[30]

As Flyvbjerg writes, when optimistic forecasts of cost are combined with optimistic forecasts of demand, it is very risky to place much weight on the resulting estimation of net benefit. Take a generous estimate of the likelihood of oil and gas projects running on cost: say 1/3 of projects run on budget or better as opposed to the 1 in 10 figure quoted by Flyvbjerg, the 5-25% quoted by Westney and the 22% quoted by Independent Economic Analysis. Combine it with a generous estimate of the probability of revenue running as forecast: say 1/3 of projects deliver their estimated revenue. The result is still only a 1 in 9 chance that a project will meet both its cost and revenue projections. Moreover as Flyvberg notes, there is also a good likelihood that if a project fails to meet its projections, it will not be off by just 10 or 20 per cent, but much more, possibly hundreds of per cent.

[27] EY (n.d.) *Spotlight on oil and gas projects*, p4-5, http://www.ey.com/Publication/vwLUAssets/EY-spotlight-on-oil-and-gas-megaprojects/$FILE/EY-spotlight-on-oil-and-gas-megaprojects.pdf

[28] Fickling (2017) *Devil's bargain on gas means nobody is winning*, Sydney Morning Herald, 27 March 2017, http://www.smh.com.au/business/energy/devils-bargain-on-gas-means-nobody-is-winning-20170326-gv6za7.html

[29] Flyvbjerg (2008) *Curbing Optimism Bias and Strategic Misrepresentation in Planning…*, p5.

[30] McDonald-Smith (2016) *Santos under pressure as GLNG performance questioned,* Australian Financial Reivew, 12 October 2016, http://www.afr.com/business/energy/gas/santos-under-pressure-as-glng-performance-questioned-20161012-gs0ddd

While GHD estimates that the Project will provide a net benefit to Australia of $1.54 billion in net present value terms, based on analysis of other projects, there is at least a 90% probability that the net present value will be less than this and a high likelihood that the net present value will be *much* less than this and may be negative.

NSW legislation and guidelines largely ignore the systemic biases that cause projections for projects, particularly megaprojects, to overestimate their benefits and underestimate their costs. With a capital cost of over $2 billion and operating costs of over $1.5 billion, the Project can be defined as a megaproject.[31] Bent Flyvbjerg is the world's most cited scholar on megaprojects. He has advised the UK Government on its "Green Book" used to evaluate projects, the US Government and several corporations.[32] Systemic biases have caused Flyvbjerg to propose the *iron law of megaprojects: over cost, over time, over and over again.*

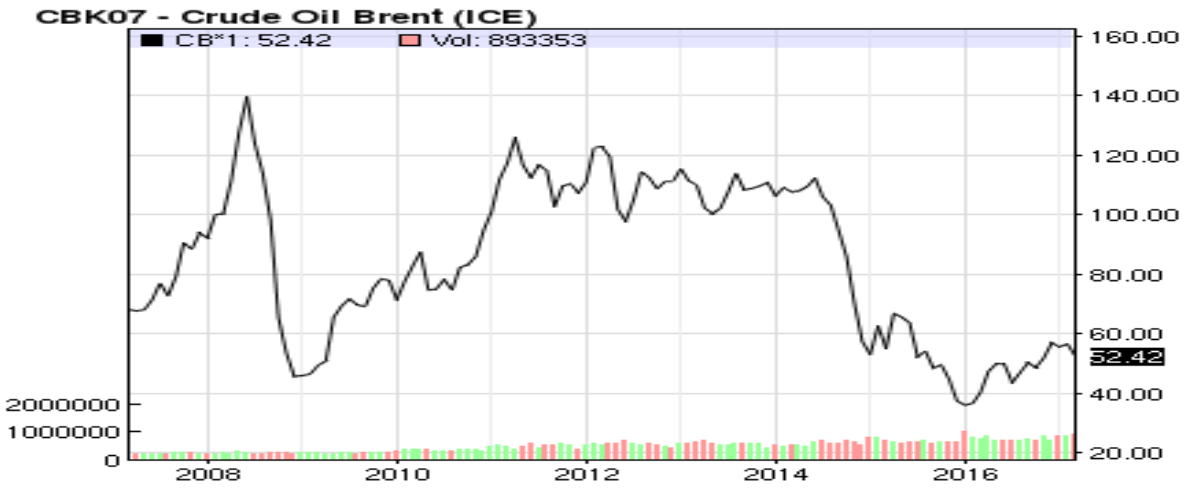
[31] Flyvbjerg defines a megaproject as a project with cost of over US$1 billion. Flyvbjerg (2014) *What you should know about megaprojects and why: an Overview,* p1, https://papers.ssrn.com/sol3/papers.cfm?abstract_id=2424835

[32] Said Business School (2017) *Bent Flyvbjerg* http://www.sbs.ox.ac.uk/community/people/bent-flyvbjerg

Oil and gas price assumptions

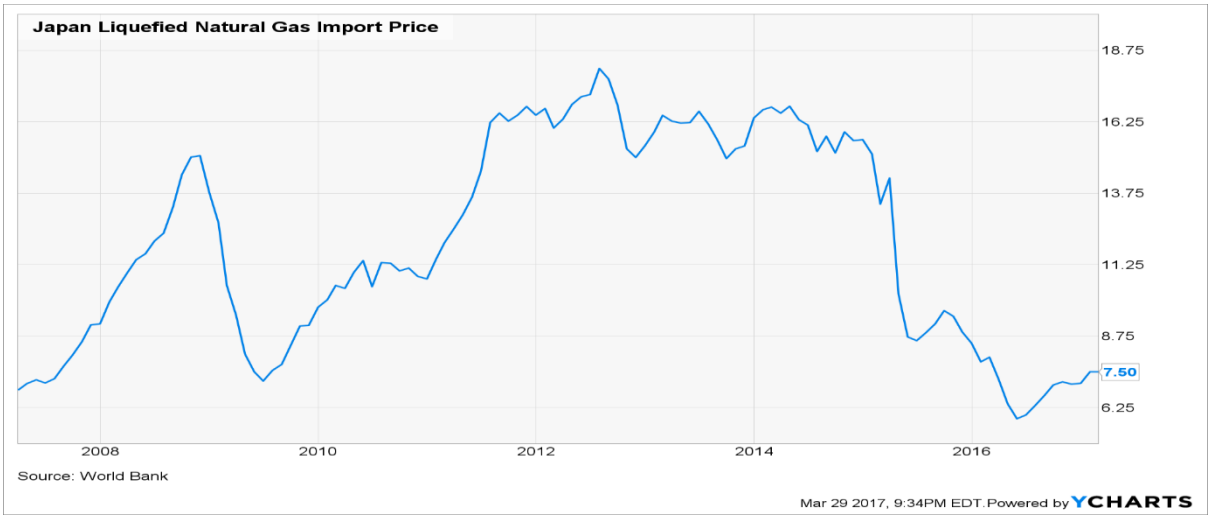
The discussion above indicates the difficulties in making forecasts in order to value projects. The further into the future those predictions are made, the more precarious those forecasts become. Only three years ago, Santos valued its Narrabri holding at $1,351 million. Its financial accounts now value it as worthless. The energy market is undergoing what has been regarded as an energy revolution. This makes oil and gas price forecasts very uncertain. The US shale oil boom has caused a halving of the oil and gas prices, which oil and gas companies did not forecast, and has caused them to make massive asset write-downs (see Figures 1 and 2 below).

Figure 1 Brent Crude Oil Price (US$ per barrel)



Source: http://www.nasdaq.com/markets/crude-oil-brent.aspx?timeframe=10y

Figure 2 Japan Liquefied LNG Natural Gas Import Chart (US$/mmBTu)



Source: https://ycharts.com/indicators/japan_liquefied_natural_gas_import_price

Figures 1 and 2 show the impact of the US shale oil boom, which oil companies failed to consider. This is an example of the limitations of the insider view highlighted by Kahneman and Tversky, discussed above. In this case, oil and gas companies took prices over recent years as a given and failed to foresee the competition from the US shale oil boom.

The long term outlook for energy continues to be for downward pressure on prices as renewable energy decreases in cost and increases in availability. While it is easy to be sceptical of the impact of renewable energy - "renewable energy has always been coming" – the train is clearly pulling into the station now. In October 2016, International Energy Agency (IEA) reported that for the first time renewable energy passed coal as the world's biggest source of power-generating capacity. In China, in the first half of 2016, more grid-connected solar energy was installed than in the whole of 2015.[33] In April 2017, Great Britain went a full day without burning coal for electricity for the first time since the 1800s.[34]

Renewable energy can be produced at very little marginal cost making it hard for other energy sources to compete. The EIS forecasts a revenue stream from the Project based on a constant gas price of $A8.70 per GJ received over the 25 year life of the Project. Making such a prediction so far into the future given the likely downward pressure on energy prices from renewable energy appears optimistic at best.

The important assumptions in the benefit cost analysis are sourced from Santos however Santos does not have a good record as a forecaster. Its assumptions about oil and gas prices have proven to be overly-optimistic, and still appear overly-optimistic. These overly-optimistic price assumptions have caused Santos to make massive asset write-downs.

Over the last three years Santos incurred $8.4 billion in asset write-offs, as shown in Table 1 below. This is thirteen times the underlying profits it has reported over those three years.

[33] The Economist (2016) *Wind and solar advance in the power war against coal*, 27 October 2016 , https://www.economist.com/news/finance-and-economics/21709355-clean-energy-surges-so-does-price-coal-wind-and-solar-advance-power

[34] Bennhold (2017*) For first time since 1800s, Britain goes a day without burning coal for electricity, Sydney Morning Herald*, http://www.smh.com.au/environment/global-warming/for-first-time-since-1800s-britain-goes-a-day-without-burning-coal-for-electricity-20170422-gvqamv.html

Table 1: Santos asset write-downs

Santos financial year	Asset write-down A$m	Underlying profit A$m
2014	2,356	533
2015	3,924	50
2016	2,156	63
Total 2014-2016	**8,436**	**646**

Sources: Santos Annual Reports 2014-2016. Santos (2015), p7. Santos (2016), pp5,82. Santos (2017), p4,78,59. https://www.santos.com/investors/company-reporting/

Part of the reason for the write-downs shown in Table 1 is that Santos writes contracts for its gas sales in which the prices paid are linked to the oil price. As such, Santos makes predictions about future oil prices to value its assets. For 2015 and 2016 these forecasts have proven to be reasonably accurate for the coming year, but beyond that its forecasts have been overly-optimistic and Santos has had to revise them downwards as time has passed. They still appear overly-optimistic. Santos' 2016 Annual Report, released in February 2017, forecasts gas prices of $US75/barrel for 2019 and onwards. This is 30% more than the futures market, which forecasts a price of only $US54-58/barrel for the years out to 2025. This raises questions about whether the price assumptions from Santos are similarly optimistic.

Table 2: Santos oil price forecasts

	Brent oil price: $US/barrel					
	2015	2016	2017	2018	2019	2020 onwards
Santos oil price forecast Dec 2014	$55	$70	$80	$90	$90	$90
Santos oil price forecast Dec 2015		$40	$60	$0	$75	$75
Santos oil price forecast Dec 2016			$60	$70	$75	$75
Actual average price for the year	$52	$44				
Brent Oil Financial Futures April 2017			$53	$54	$54	$57

Sources: Santos (2015) Santos Annual Report 2014, p52, Santos (2016) Santos Annual Report 2015, p60. Santos (2017) Santos Annual Report 2016, p77. Statisita (2017) UK Brent Oil Price Changes since 1976 https://www.statista.com/statistics/262860/uk-brent-crude-oil-price-changes-since-1976/. CME Group (2017) Brent Last Day Financial Futures Quotes. Price quoted for June each year. 2020 onwards is an average of the forecast June price for years 2020-2025. http://www.cmegroup.com/trading/energy/crude-oil/brent-crude-oil-last-day.html.

The over-optimism that Santos has displayed in its financial accounts appears present in the price assumption it has provided to the benefit cost analysis. Santos estimates that the Project will receive $8.70 per GJ.

With the building of LNG plants at Gladstone the Australian gas price will, over time, equal the world gas price (net of the costs of export).[35] At 30 April 2017 the imported LNG price into Japan was US$7.75/mmBTu. We calculate this equates to around $7.16 per GJ (see Table 3), which is 18% less than the $8.70 price assumed by Santos. Once again, Santos appears over-optimistic in its price forecasts.

Table 3: Estimate of gas price received by Australian producer in $A/GJ

Japan 30 April 2017 imported LNG price	**USD /mmBTu**	**$7.75**
Convert to GJ (divide by .9478)		
Japan current imported LNG price /GJ	USD/GJ	$8.18
Cost to transport from Australia to Japan	USD/GJ	-$0.75
Cost to liquefy	USD/GJ	-$1.50
Cost to transport in Australia	USD/GJ	-$0.56
Price received by Australian producer	**USD/GJ**	**$5.37**
AUD/USD exchange rate end April = 0.75		
Price received by Australian producer	**AUD/GJ**	**$7.16**
Price assumed in benefit cost analysis	**AUD/GJ**	**$8.70**

Sources: Ycharts (2017) *Japan Liquefied Natural Gas Import Price*, https://ycharts.com/indicators/japan_liquefied_natural_gas_import_price Accessed 10 May 2017. Costs to transport gas to Japan and cost to liquefy from Robertson and West (2016) *It's a gas! Australian gas is a bargain … if you're Japanese, https://www.michaelwest.com.au/its-a-gas-australian-gas-prices-are-a-bargain-in-japan/* Cost to transport in Australia estimated based on assumption of cost of transport gas from Narrabri to Sydney of $A0.75 per GJ from Buckley (2014) *Briefing Note: The Narrabri Gas Project*, December 2014, Institute for Energy Economics and Financial Analysis, p13, http://www.ieefa.org/wp-content/uploads/2014/12/IEEFANarrabriCSGproject.pdf. AUD/USD exchange rate from http://www.rba.gov.au/statistics/historical-data.html

If approval for the Project is granted, gas production is not scheduled to start until 2020 at 12.8 million GJ per annum, and not reach full production of 74.1 million GJ per annum until 2025.[36] This is a considerable number of years away and, as discussed above, megaprojects like this one rarely run on schedule. The downward impact of renewable energy on energy prices will only increase over time. These time lags make predicting the future oil price even more precarious than if production was to start immediately.

[35] For more discussion of this see 'Énergy context' later in this submission.

[36] GHD (2016) *Narrabri Gas Project – Environment Impact Statement Economic Assessment, p13.*

Market access - pipeline

The benefit cost analysis focusses on the Project itself. However, the Project also requires a $450 million, 450 kilometre gas pipeline to be built so that the gas can be sold. This requires government approvals, negotiation with landholders and communities in seven local government areas, negotiations with APA Group, who will build the pipeline, and the actual building of the pipeline itself, which will cross rivers, wetlands, highways and major roads. These are all potential sources of delay and increased costs, which would reduce the NPV of the Project.[37]

[37] Ferguson and Clift (2017) *Pipeline worth $450m proposed to support controversial Narrabri Gas Project in NSW,* 31 March 2017, http://www.abc.net.au/news/2017-03-31/pipeline-proposed-for-narrabri-gas-project/8404188

External costs

There are major concerns about groundwater contamination with the Project. Groundwater contamination could be regarded as a low probability high impact event. It would have a devastating impact on neighbouring farms. It is difficult to predict the probability of a low probability event precisely because these events occur infrequently and we have difficulty appreciating their magnitude. With such events, we also reach the limit of our knowledge, we simply do not know what can go wrong and how serious it could be, i.e. so-called 'unknown unknowns'. As Taleb wrote in his book, *The Black Swan,* 'Left to our own devices we tend to think what happens every decade in fact only happens every century and, furthermore, that we know what's going on'.[38] The risk of groundwater contamination is simply considered low and ignored in this benefit cost analysis.[39] It should not be. Just because something cannot be measured easily, does not mean it is unimportant or that it should be ignored.

There are similar concerns about the disposal of waste water, health impacts and possible drawdown of the Great Artesian Basin.[40] These are also low probability, high impact events where the effects are uncertain because of the limitations of our knowledge. They are also ignored in this benefit cost analysis.

Concerns about coal seam gas were important enough for the Australian Medical Association to pass a resolution saying:

"*… all future proposals for coal seam gas mining are subject to rigorous and independent health risk assessments, which take into account the potential for exposure to pollutants through air and groundwater and any likely associated health risks. In circumstances where there is insufficient evidence to ensure safety,* ***the precautionary principle should apply***.[41]

[38] Taleb (2010), *The Black Swan,* Random House, p141.

[39] GHD (2016) *Narrabri Gas Project – Environment Impact Statement Economic Assessment, p10.*

[40] Thomas and Reading (2017) *Experts to assist with Narrabri Gas Project assessment,* Australian Broadcasting Commission, http://www.abc.net.au/news/2017-02-21/experts-to-assist-with-narrabri-gas-project-assessment/8290146 . See also Grudnoff (2014) *Fracking the Future*, The Australia Institute, p43-49, http://www.tai.org.au/sites/defualt/files/IP%2016%20Fracking%20the%20future%20-%20amended_0.pdf

[41] AMA (2013) *AMA calls for coal seam gas health check.* Emphasis added *https://ama.com.au/media/ama-calls-coal-seam-gas-health-checks*

Greenhouse gas emissions are likely to be underestimated

There is increasing concern about carbon emissions from coal seam gas with research from overseas and by University of Melbourne researchers finding that emissions which occur as part of the coal seam gas production process (termed 'fugitive emissions') may be significantly underestimated. This is particularly due to methane which is emitted as part of the production process. Methane is a powerful contributor to greenhouse gas emissions. University of Melbourne research found that:

- Several major potential sources of methane emissions are assumed to be zero under Australia's accounting and reporting of unconventional gas.
- Methane measurements at US unconventional gas fields have found leakage rates in the order of 10-25 times higher than the Australian Government reports to the United Nations, and up to 170 times those claimed by the gas industry.
- If leakage rates comparable to those found in the US are found at Australian unconventional gas fields it will have serious implications for Australia meeting its emission reduction commitments under the Paris Agreement.[42]

Other research by the University of Melbourne has found that coal seam gas extraction in Queensland's Surat Basin could be significantly increasing methane emissions from underground gas deposits.[43]

Given these findings, this benefit cost analysis research is likely to be underestimating carbon gas emissions and thereby underestimating the carbon costs of this project.

[42] Lafleur, Forcey, Saddler and Sandiford (2016) *A review of current and future methane emissions from Australian unconventional oil and gas production,* The University of Melbourne – Melbourne Energy Institute. Research was funded by the Australia Institute.

[43] Lafleur and Sandiford (2016) *The risk of migratory methane emissions resulting from the development of Queensland coal seam gas,* The University of Melbourne – Melbourne Energy Institute. Research was funded by the Australia Institute.

Sensitivity analysis

The analysis above indicates that there are strong grounds to believe that the forecasts in this benefit cost analysis are over-optimistic, and quite possibly very over-optimistic. Even with this likely over-optimism, only small changes in the benefit cost analysis forecasts are required to make the Project marginal. Roughly speaking a cumulative detrimental change of only approximately 30% in a combination of the price, production and cost forecasts will make the Project marginal. For example: a 30% decline in the gas price; or a 20% decline in the gas price combined with 10% decline in gas production; or a 10% decline in the gas price, a 10% decline in production and a 10% increase in cost would all make the Project marginal. As Flyvbjerg noted, benefit cost ratios for megaprojects 'are often wrong, not only by a few percent but by several factors'. A cumulative detrimental change of more than 30% is quite likely.

As discussed above, Core Energy Group forecasts the cost of production of the Project at $7.25 per GJ. There is even less margin for error between this cost and the $8.70 gas price assumed in the benefit cost analysis. It only takes roughly a 20% cumulative negative change in forecasts to make the Project marginal. And if we assume the gas price is the current Japanese imported LNG price (net of export costs) of $7.16 per GJ, as per Table 3, then the Project is uneconomic.

Benefits to New South Wales are required to be assessed

The NSW Guidelines require project proposals to estimate their benefit to NSW.[44] However, the benefit cost analysis for the Project estimates a benefit to Australia of $1.5 billion in NPV terms. The benefit cost analysis explains why this was done.[45] The NSW Guidelines recommend using 32% as the proportion of the NSW population to the Australian population to estimate benefits to NSW.[46] On this basis the NPV to NSW is $490 million. This is the figure that should be of most concern to NSW decision makers under the Guidelines.

[44] NSW Government (2015) *NSW Guidelines for the Economic Assessment of Mining and Coal Seam Gas Proposals, p1,* http://www.planning.nsw.gov.au/Policy-and-Legislation/Mining-and-Resources/~/media/C34250AF72674275836541CD48CBEC49.ashx

[45] GHD (2016) *Narrabri Gas Project – Environment Impact Statement Economic Assessment, p8.*

[46] NSW Government (2015) *NSW Guidelines …, p10,*

Energy context

There is currently extensive commentary about increases in gas prices in Australia. Unfortunately the Project will be of little use in addressing this issue.

For many years Australian gas prices were substantially lower than the world gas prices because Australian gas producers could not easily export gas to the world. However the construction of LNG plants has meant that Australian gas producers can now sell to the world and receive the world gas price. Consequently, Australian gas prices have more than doubled to match world gas price parity.[47] Increased gas from the Project will not lower gas prices, as Australian producers (e.g. Santos) will sell to the world market if they can receive a higher price there. Matt Grudnoff, of The Australia Institute, examined this issue four years ago and forecast the substantial rises in Australian gas prices that have since occurred.[48]

While the gas price rise was predicted, as the transition to Australia being the world's largest gas exporter takes place, spot gas prices in particular, have spiked as industrial users' gas contracts set at lower prices expire and LNG plants source gas in the domestic market to meet their export contracts, because their own gas fields have not produced as much gas as forecast.[49] Unfortunately the genie cannot be put back in the bottle, now that producers have the option of selling at the world price the Australian gas price will not fall back below the world gas price parity. The Project cannot change this.

Nor can the Project help to ease the price spikes during the current transition period because it will be at least some five or six years before the Project could add to Australia's gas supply in a meaningful way. The Project is not forecast to start production until at least 2020, production takes five years to ramp up and, as discussed previously, there is a high likelihood that the Project will run over-schedule. In those five or six years or more, the current transitory price spike will have passed due to a combination of one or all of the following:

[47] Oakley Greenwood (2016*) Gas Price Trends Review*, https://industry.gov.au/Energy/Energy-information/Documents/Gas-Price-Trends-Report.pdf

[48] Grudnoff (2013) *Cooking up a price rise*, The Australia Institute, http://www.tai.org.au/sites/defualt/files/PB%2053%20Cooking%20up%20a%20price%20rise.pdf

[49] Macrobusiness (2017) *Credit Suisse: Gas solutions do not convince a 5-year old*, https://www.macrobusiness.com.au/2017/04/credit-suisse-gas-solutions-not-convince-5-year-old/

- The higher gas price will cause users to reduce demand, either by using gas more efficiently, using other energy sources or deciding they can make more money by selling their contracted gas supply to another gas user. As discussed above, falling renewable energy and battery prices make these energy sources more and more attractive. Higher gas prices also make it more attractive for alternative energy sources to supply the market;
- LNG producers who currently export gas instead choosing to supply the domestic market;
- Government action requiring LNG producers to supply/reserve gas for the domestic market. Credit Suisse has proposed that the third party gas currently used in the Santos Gladtsone LNG plant should be directed to the domestic market.[50] Professor Ross Garnaut has suggested similarly;[51] and
- Changes in government regulation. For instance changing electricity market rules and regulations could reduce the need for gas-fired electricity plants by making it more attractive for other energy sources to supply the market.[52] Similarly the Australian Competition and Consumer Commission has raised the issue of monopoly pricing by gas pipelines and argued for better regulation of gas pipelines to reduce gas prices.[53]

The EIS claims that the Project will add substantially to the NSW gas supply.[54] However this makes little sense as the existence of gas pipelines across Eastern Australia means that there is really no isolated NSW market. Instead, there is an East Australian gas market and the price of gas in this market depends on the world gas price. There is simply no shortage of gas in Australia, just a shortage of gas at prices Australians are accustomed to.

[50] Stevens (2017) *GLNG partners clash over gas plan*, Australian Financial Review, 24 April 2017, http://www.afr.com/business/glng-partners-clash-over-domestic-gas-plan-20170421-gvpw04

[51] Stevens (2017) *Ross Garnaut says LNG cutbacks only answer to gas crisis*, Australian Financial Review, 21 April 2017, http://www.afr.com/business/energy/gas/ross-garnaut-says-lng-export-cutbacks-only-answer-to-gas-crisis-20170420-gvp7gb#ixzz4f0dh3BgJ

[52] For instance changing electricity pricing to the five minute rule as recommended by the Australian Energy Market Operator. The Australia Institute (2017) *Open Letter calls for straightforward changes to fix 'energy trilemma'* *http://www.tai.org.au/content/open-letter-calls-straightforward-changes-fix-%E2%80%98energy-trilemma%E2%80%99-0*

[53] Stevens (2017) *Sims excited by gas watchdog invitation*, Australian Financial Review, 20 April 2017, http://www.afr.com/business/energy/rod-sims-excited-by-pms-gas-watchdog-invitation-20170420-gvoqeq

Robinson (2016) *It's a gas, Australian gas prices are a bargain in Japan,* http://www.michaelwest.com.au/its-a-gas-australian-gas-prices-are-a-bargain-in-japan/

[54] Santos (2016) Narrabri Gas Project – Environmental Impact Statement, 32-3.

Benefits to the Narrabri community are uncertain

The benefit cost analysis highlights the benefits of the Project to the local community.[55] In contrast, a report by The Australia Institute based mostly on gas industry-funded research found that local businesses in unconventional gas regions in Queensland believe that gas development led to deterioration in their finances, local infrastructure, social connections and labour force skills.[56] Key findings of the report:

- Local business stakeholders reported a deterioration in:
    - Financial capital;
    - Local Infrastructure;
    - Local skills;
    - Social cohesion; and
    - The local environment.
- Unconventional gas reduced community wellbeing:
    - Fewer than one in four local people approved of the unconventional gas industry, with less than 6% believing it would "lead to something better".
- Unconventional gas created few additional jobs:
    - There were virtually no spillover jobs created in local retail or manufacturing; and
    - Gas jobs will be reduced by 80% at the end of the construction period.
- For every 10 unconventional gas jobs created, 7 service sector jobs were lost.

When regional towns become service centres for the gas industry, existing businesses often lose their skilled staff, have to compete with inflated gas industry wages and face higher costs for rent and services. Workers work long shifts in self-contained camps and have little opportunity to spend money locally, and companies often bypass local suppliers.

[55] GHD (2016) *Narrabri Gas Project – Environment Impact Statement Economic Assessment, p21-22.*
[56] Ogge (2015) *Be careful of what you wish for,* The Australia Institute.

Recommendations

The benefits and costs of the Project have been misrepresented in the GHD assessment. Proponent financial statements and research published by AEMO suggest the project is economically marginal. Considering the likelihood of significant external costs, the project should be rejected on this basis.

The NSW Guidelines which prescribe this benefit cost analysis do not appear to have incorporated the work of Kahneman and Tversky, and also of Flyvbjerg, that highlights the very high likelihood of over-optimism and strategic misrepresentation in benefit cost analysis. This is disturbing given that these biases are well known. The UK Government has considered these biases in their project guidelines since 2003.[57] The Victorian Parliament considered them in a 2012 Parliamentary Inquiry.[58] Switzerland, Denmark and The Netherlands have also considered them.[59]

Beyond the inadequacies of the benefit cost analysis for the Project discussed above, we make three general recommendations to improve the use of benefit cost analysis in assessing mining and coal seam gas projects:

1. **Revise the NSW Guidelines**
   The NSW Guidelines need to be urgently revised to consider over-optimism and strategic misrepresentation.

2. **Incorporate reference class forecasting**
   Kahneman and Flyvbjerg urge the use of reference class forecasting to better estimate the benefits and costs of projects. This is done by comparing the costs and benefits to what similar projects have achieved rather than relying on assessments by the project proponents, that is, taking the *outside view* rather than the *inside view*. Terrell also recommends that Australian Governments do this when assessing infrastructure projects.[60] We also recommend that reference class forecasting be used to evaluate mining and coal seam gas

[57] Flyvbjerg (2008) *Curbing optimism bias and Strategic Misrepresentation in Planning, p11.*

[58] Parliament of Victoria (2012) *Inquiry into Effective Decision Making for the Successful Delivery of Significant Infrastructure Projects,* http://www.parliament.vic.gov.au/images/stories/committees/paec/reports/PAEC_InfrastructureInquiry_FINAL-Report.pdf

[59] Flyvbjerg (2014) *What you should know about megaprojects and why….,* p16.

[60] Terrill (2016) *Cost overruns in transport infrastructure,* Grattan Institute, p22, https://grattan.edu.au/wp-content/uploads/2016/10/878-Cost-overruns-on-transport-infrastructure.pdf

proposals.

3. **Develop a database of projects for use in reference forecasting**
   Terrell recommends that, 'The Commonwealth Department of Infrastructure should be required to publish to data.gov.au the post-completion report it already requires from state governments as a condition of providing final milestone payments for transport infrastructure projects. Reports should detail any scope changes and their justification, agreed and actual construction start and finish dates, actual project costs, reasons for overruns or under-runs, and progress against performance indicators.'[61] In addition, Flyvbjerg has developed a database of transport projects for the UK Treasury to use in reference forecasting of new transport proposals.[62]

   Mining and gas proposals, such as the Project, are becoming increasingly controversial as communities grow concerned about risks to their community and the environment. Similar to infrastructure projects, we recommend that the NSW Government work with other state governments and the federal government to develop a database of approved mining and coal seam gas proposals, which highlights their outcomes versus their forecast benefits and costs. This can then be used to carry out reference class forecasting so that project appraisals are much less vulnerable to the optimism bias and strategic misrepresentation that occurs when the project proponents provide their own benefit cost analysis.

[61] ibid, p24.
[62] Flyvbjerg (2008) *Curbing optimism bias and strategic misrepresentation in planning*, p11.