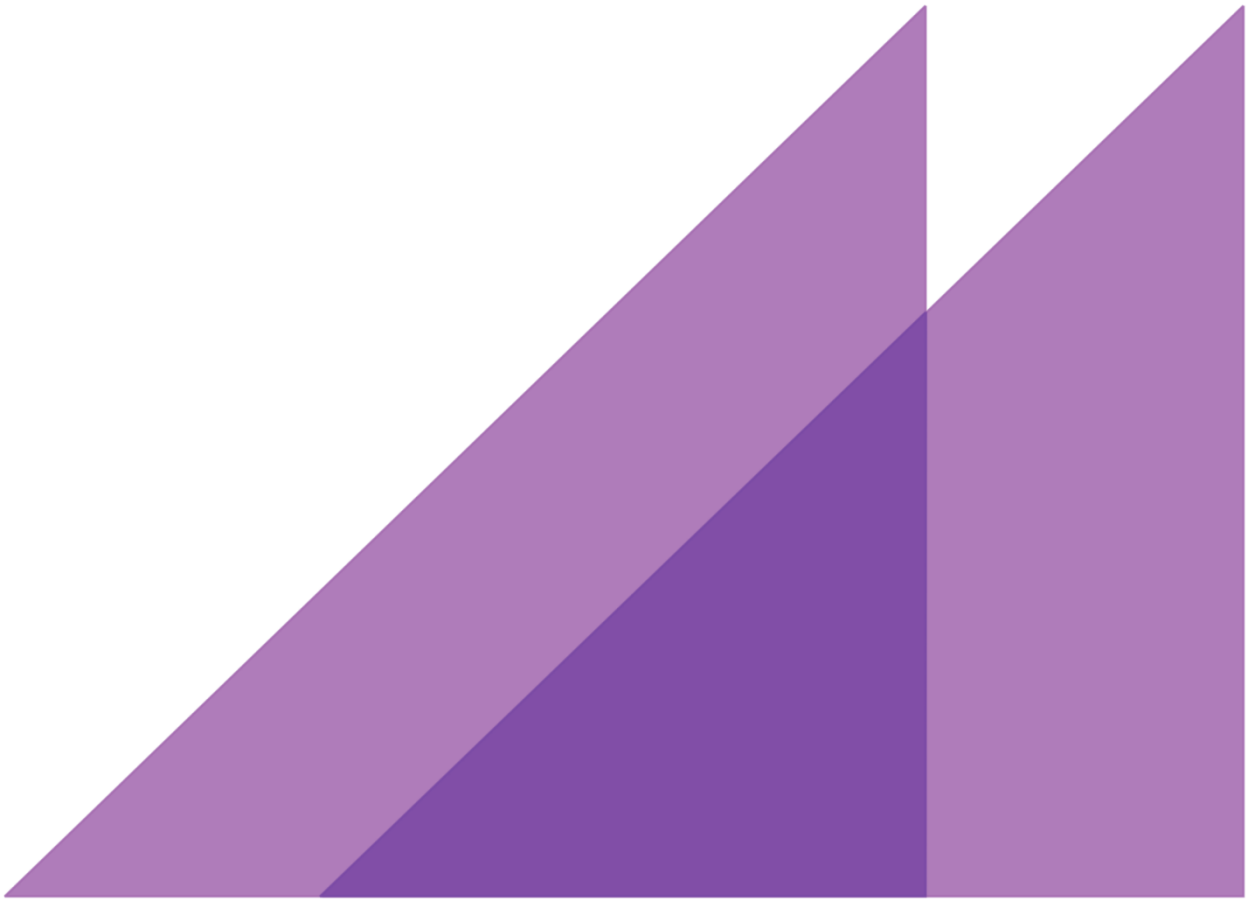
ACIL ALLEN CONSULTING

REPORT TO
THE ECONOMIC REGULATION AUTHORITY OF WESTERN AUSTRALIA

18 MARCH 2014

DOMGAS RESERVATION POLICY

REVIEW OF LITERATURE AND POLICY RECOMMENDATIONS



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Contents

1 Introduction

Following the publication in November 2013 of its Microeconomic Reform Discussion Paper[1], the Economic Regulation Authority (ERA) commissioned ACIL Allen Consulting to provide independent advice on economic issues relevant to Western Australia's domestic gas reservation (DGR) policy.

In an earlier (2010) submission[2] to an inquiry into domestic gas prices conducted by the Economics and Industry Standing Committee (EISC) of the WA Legislative Assembly, ERA expressed the view that the policy may not be in Western Australia's best interests. The EISC took a different position.

ACIL Allen has assessed the various arguments deployed in the debate regarding Western Australia's DGR and similar debates in Australia's eastern states and in the United States. The resulting advice is set out in this report. It comprises six main elements:

- a critical review of the discussion of the DGR policy in Chapter 4 of the EISC's 2011 report on domestic gas prices[3] (Section 2);
- critical reviews of material relating to the DGR policy in submissions received in response to ERA's Microeconomic Reform Discussion Paper (Section 3);
- a critical review of the existing literature (Australian and international) on policies that divert domestically sourced gas from the export market to the domestic market (Sections 4 and 5);
- a discussion of the relationship between the DGR policy and other policies applying to the WA gas market, including taxation and the allocation and management of exploration and extraction tenements (Section 6);
- inferences about the likely quantitative effects of the DGR policy on the WA economy drawn from the existing literature[4] (Section 7); and
- conclusions and policy recommendations (Section 8).

[1] http://www.erawa.com.au/cproot/11785/2/Inquiry%20into%20Microeconomic%20Reform%20in%20Western%20Australia%20-%20Discussion%20Paper.pdf.

[2] http://www.parliament.wa.gov.au/parliament/commit.nsf/(Evidence+Lookup+by+Com+ID)/9A05608448DAA5334825785D0011D4F1/$file/Sub+13+-+Economic+Regulation+Authority+-+20100701.pdf.

[3] http://www.parliament.wa.gov.au/publications/tabledpapers.nsf/displaypaper/3813232af0e096cabecf9c8e4825785e0004c326/$file/3232.pdf.

[4] The terms of reference for the consultancy do not extend to undertaking new modelling or the quantitative effects of the policy.

2 Report of EISC inquiry into domestic gas prices

The DGR policy is discussed at length in Chapter 4 of the EISC report. The EISC favours retention of the DGR policy (see especially findings 19-22) as a means of keeping domestic prices down. It does not provide any detailed case as to why this is economically advantageous for WA. We do not find its treatment of other implications of the policy convincing.

In its Finding 2, the EISC expresses a commonly mentioned concern about the WA gas market, namely that:

> *"In recent years, the production side of the Western Australian domestic gas market has become highly concentrated. Such concentration raises legitimate concerns about the level of competition and effectiveness of this market."*

To support the first part of this finding, the EISC appeals to Figure 6 on page 23 of its report. However, this appears to show that upstream concentration is not a recent feature of the market and that in recent years the market has moved from having a single dominant upstream source (Perth Basin up to about 1983 and North West Shelf gas (NWSG) from the late 1980s until about 1992) to having two major sources (NWSG and Apache) from the mid-late 1990s onwards. Concentration appears to be waning as a result of commencement of domestic supply of gas from BHP Billiton's Macedon project (mainly to its own mining operations), future domestic supply from the Gorgon and Wheatsone LNG projects, and later supply (around 2018) from unconventional sources onshore in the Canning Basin. The trend will be strengthened if the Australian Competition and Consumer Commission (ACCC) decides to withdraw approval for joint marketing arrangements for partners in the NWS and Gorgon joint ventures from 2015.

If the major "legitimate concerns" mentioned in the second part of the finding are about high domestic prices, international market forces that have induced LNG developments are probably the major driver. It is hard to see how having more upstream suppliers would remove this pressure if all of them have export options. Moreover, the EISC itself does not seem to demur from the contention of Apache and NWSG (paragraph 299 of the report) that by reducing domestic prices the DGR policy would "*deter specialist domgas producers from entering the market*". Hence, there do seem to be tensions between the DGR policy and the EISC's desire to "*encourage diversity of supply, multiplicity of participants and greater liquidity in the domgas market*" (paragraph 305 of the report).

If gas producers do have an export option and if WA is a price taker in the export market, then the LNG netback price is the opportunity cost of using gas domestically, both from the producers' point of view and from the State's. Most economists would then regard the market as "well-functioning" if domestic consumers are paying the LNG export price *less* the difference between the cost of processing gas for LNG and the (generally much lower) cost of processing gas for the domestic market.

But this is not the definition of a well-functioning market that is implicit in the EISC report. Instead, the EISC clearly prefers a market in which the domestic price of gas is well below its opportunity cost:

> *"….. the aim should be to foster the supply and competition needed to allow domgas prices to settle at levels substantially below LNG netback values"* (paragraph 311 of the report);
>
> and
>
> *"If the gas reservation policy does not lead to a reduction in domestic gas price beyond LNG netback, the government should consider additional options to create a functioning market for gas-on-gas competition in Western Australia, including a regulated auction or limiting specific fields to domestic use" (Finding 25)*.

The principal weaknesses of the EISC report are that it omits to explain:

- why it is of economic advantage to WA to require gas producers to supply domestic users at prices below the opportunity cost of the gas;
- why the policy package that it favours (including continuation of the DGR policy) would help to promote upstream competition in the gas market; or
- how additional upstream competition in the gas market would help to reduce domestic gas prices.

Moreover, the report is surprisingly sanguine about the effects of the DGR policy on investment in LNG developments (see paragraph 306). This is surprising because it seems clear that requiring LNG producers to accept less for a proportion of their gas than they could obtain by exporting it must reduce the average rate of return on LNG investment. Moreover, requiring additional production for any given level of exports will increase marginal and average costs because it requires increasing periodic output rates from reservoirs already in production or bringing in additional (relatively high cost) reservoirs or wells. Preserving the incentive to invest in LNG developments is crucial to ensuring that WA's gas reserves will be developed for domestic users as well as exports, as the EISC concedes (see, for example, paragraph 284 of the report).

The EISC also favours attempts to "*obtain a commitment to the domestic gas market … from developments using Floating Liquefied Natural Gas (FLNG) technology*" (Recommendation 7). One of the motivations for FLNG developments is that they allow proponents to avoid State-government impost (including the DGR policy) that apply to onshore gas developments. This is another example in which there may be tensions between EISC's preference for the extension of DGR commitments and its apparent desire to see continuing development of WA's gas reserves.

In Chapter 5 of its report, the EISC proposes a more conventional policy response to concerns about concentration in the domestic gas market. It argues that ACCC approval of joint marketing by partners in the North West Shelf and Gorgon Joint Ventures should be withdrawn. The EISC states:

> *"While arguments can be made in support of the continuation of joint marketing in the current Western Australian domestic gas market, it is plausible to claim that the practice has facilitated a reduction in competitive tension between gas producers."* (Finding 27*)*
>
> *" The government should vigorously pursue the elimination of the joint marketing authority currently granted to the North West Shelf and Gorgon joint venturers when the applications come up for renewal in 2015."* (Recommendation 13)

This view is more solidly grounded in economic principles than the EISC's support for retention of the DGR policy. Prohibition of joint marketing arrangements would directly address the source of market power perceived by the EISC. The DGR policy would not.

3 Submissions in response to ERA's Discussion Paper

In January 2014, ERA received 23 submissions in response to its Discussion Paper[5]. Of these, five address the DGR policy. The subsections below contain discussions of these five.

3.1 Alinta Energy[6]

Alinta favours continuation of the DGR policy. Like the EISC (see Section 2, above), Alinta emphasises the importance of upstream competition in the gas market:

> "*Competition in upstream gas is vital for keeping electricity and gas costs down for residential and business customers.*"

Alinta notes that "*Western Australia now has a reasonable level of upstream and downstream gas competition*" and attributes this in part to the DGR policy.

We are not convinced by Alinta's claims. As noted in Section 2 (above), we regard the option of exporting gas at high prices as the main source of upward pressure on domestic gas prices and do not see how having more upstream competition would alleviate that pressure if all or most upstream producers have the export option. In our view, by depressing domestic prices, the DGR is more likely to deter than to encourage upstream competitors.

Alinta also claims that DGR "*was a policy only implemented to ensure supply to the domestic market not as a policy to deliver supply at below market cost*". But orthodox economics would suggest that increasing domestic supply must reduce domestic prices. Whether or not it reduces them below "*market cost*" is perhaps semantic, but the essence of the DGR policy is that it obliges producers to supply the domestic market at a price lower than they could secure by exporting the gas.

The most interesting point that Alinta makes is the legacy argument that the DGR policy should not be removed because gas users have made investment decisions assuming that it will continue. Against this must be weighed the argument that continuation of the policy will distort future decisions, including future investment decisions. Perhaps the legacy argument is better regarded as a possible justification for a grandfathering arrangement for those who have relied historically on continuation of the DGR policy than as an argument for retention of the policy generally.

[5] http://www.erawa.com.au/economic-inquiries/west-australian-microeconomic-reform/public-submissions.

[6] http://www.erawa.com.au/cproot/11995/2/Alinta%20Energy%20-%20Public%20Submission%20-%20Inquiry%20into%20Microeconomic%20Reform%20Discussion%20Paper.pdf.

3.2 Australian Petroleum Production and Exploration Association (APPEA)[7]

In its submission to the Discussion Paper, APPEA maintains its established position of opposition to the DGR policy. It takes the orthodox economic view that it is appropriate for domestic users to pay the export-parity price for potentially exportable gas. It claims that at such a price there would be no shortage of gas supply in the WA domestic market.

The orthodox economic view to which Alinta subscribes is that the DGR is equivalent to a tax on gas producers and a subsidy to domestic gas users. In the absence of second-best considerations, this will reduce the allocative efficiency of the domestic economy – i.e., it will attract too many resources into the subsidised gas-using sectors at the expense of unsubsidised sectors. It will also discourage investment in gas production. It will reduce domestic economic welfare unless incomes derived from the gas-producing sector (which is disadvantaged by the policy) accrue to foreigners to a greater extent than do incomes derived from the domestic gas-using sectors (which benefit from the policy).

Consistent with our critical view of claims made in the EISC report (Section 2) and the Alinta submission (subsection 2.1), APPEA maintains that policies that keep domestic prices low discourage new domestically-focused gas exploration and development.

To substantiate its opposition to the DGR policy, APPEA relies on a study that it commissioned from Deloitte Access Economics (DAE)[8]. The DAE study uses computable general equilibrium (CGE) techniques to simulate the macroeconomic and structural effects of adopting a DGR policy Australia wide. APPEA's conclusion is that:

> "*Contrary to unsubstantiated claims by proponents of DGR, the DAE analysis highlights the clear negative impacts on jobs, industry competitiveness, investment and living standards from the introduction of a DGR.*"

We evaluate the DAE study in detail in Section 4 (below), along with our evaluations of other recent modelling of the effects of DGR policies.

3.3 Chamber of Commerce and Industry (CCI)[9]

The CCI is opposed to continuation of the DGR policy. Correctly, in our view, it identifies the growth of LNG exports as the major factor exerting upward pressure on domestic gas prices in WA. Consistent with the view taken by the EISC (see Section 2, above), it contends that "*domestic supplies rely on export opportunities to deliver capital investment*".

Like APPEA and again relying on the DAE CGE modelling (subsection 3.2, above), the CCI takes the orthodox economic view that the DGR policy essentially taxes gas production to subsidise domestic gas users, thereby distorting resource allocation and investment incentives. It claims that there "*is no identifiable market failure in relation to the supply of gas to the domestic market*". Supporters of the DGR policy frequently make vague reference to the existence of market failure but we agree with the CCI that in general no convincing case is made. At least this is the case for the other submissions to the Discussion Paper that are reviewed in this section of our report.

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[7] http://www.erawa.com.au/cproot/11998/2/Australian%20Petroleum%20Production%20and%20Exploration%20Association%20Limited%20-%20Public%20Submission%20-%20Inquiry%20into%20Microeconomic%20Reform%20Discussion%20Paper.pdf.

[8] DAE "The economic impacts of domestic gas reservation", October 2013 (Attachment 1 to the APPEA submission).

[9] http://www.erawa.com.au/cproot/12000/2/Chamber%20of%20Commerce%20and%20Industry%20WA%20(CCI%20WA)%20-%20Public%20Submission%20-%20Inquiry%20into%20Microeconomic%20Reform%20Discussion%20Paper.pdf.

3.4 Domgas Alliance (DGA)[10]

The DGA supports retention of the DGR policy. Its submission contains several assertions that we find unconvincing or misleading.

- " *the policy has not led to a loss of exploration and investment in Western Australia. In fact, petroleum and gas exploration expenditure in WA has risen significantly since the domestic gas reservation policy was first raised as a policy option in 2006.*"

  The second sentence quoted does not support the first. It is an example of the post hoc ergo propter hoc fallacy. To support the first sentence, the DGA would need to identify a *counterfactual* case showing how much exploration and investment would have occurred in WA had the DGR policy not been in place through the period since 2006.

- *"… the 2006 policy clearly stated: 'the price of gas sold onto the domestic market will be determined through commercial negotiations between the gas producers and the consumers of that gas.'"*

  This may be an accurate quote but the statement is misleading. It fails to point out that the level at which commercially negotiated domestic prices will be struck will be lower the more gas supply is forced on to the domestic market by measures such as the DGR policy.

- *"… despite Australia's (and particularly Western Australia's) massive gas resources this competitive advantage is being eroded as potential supplies are preferentially directed towards LNG export"*

  The use of the adjective "preferentially" in this statement is misleading. Producers prefer to export gas rather than to supply the domestic market because exporting is more profitable for them, especially if domestic prices are suppressed by measures such as the DGR policy. The orthodox economic view is that economic welfare is maximised by allowing agents to respond to such price/profitability signals.

  " *the community support that has been vital to the development of the LNG industry in Western Australia could be significantly eroded if the community does not see a local benefit being delivered from our State's natural gas resources."*

  This may well be true but it is far from clear that a DGR policy is an appropriate tool for delivering the local benefit. Tax/royalty and tenement policies are also crucial. We discuss this further in Section 6 (below).

- " *the National Institute of Economic and Industry Research … found that … 'each petajoule of natural gas that is shifted away from industrial use towards export … means giving up $255 million in lost industrial output for a $12 million gain in export output. That is, for every dollar gained $21 is lost. This increases to $24 when economy-wide impacts are taken into account.'*

  We discuss the NIEIR report in detail in Section 4 (below). The passage quoted is an accurate statement of the "headline" result that was picked up by the press following publication of the NIEIR report but it is not a fair representation of the report's findings overall. As we explain in Section 4, NIEIR in fact examine the effects of diversion of gas from the domestic market to exports under a number of different assumptions about how the domestic economy might adjust to the diversion. Under assumptions that might

[10] http://www.erawa.com.au/cproot/12028/2/DomGas%20Alliance%20-%20Public%20Submission%20-%20Inquiry%20into%20Microeconomic%20Reform%20Discussion%20Paper.pdf.

be regarded as more plausible than those underlying the "headline" result, the diversion does not have the extreme "headline" negative effects on the economy.

- " *Australia is the only country in the world that allows international oil companies to access and export natural gas without prioritizing local supply*."

  It is beyond the scope of our brief to research this claim in detail but we note that it is in conflict with claims made in the APPEA submission (subsection 3.2, above) that "*of the major OECD gas producing countries (Canada, Netherlands, Norway, UK and U.S.) none have government intervention to subsidise gas for local industry", although "Most of the non-OECD major gas producing countries have government interventions aimed at reducing wholesale gas prices."* .

  We note further that until recently there was a ban on gas exports from the US, with the effect that the supply of gas to domestic users was bolstered. This policy is now breaking down. As at 5 March 2014, the US Government had approved six applications to export gas to any country, and 29 applications to export to free trade agreement countries (effectively only South Korea). Another 22 applications to export gas anywhere were under review by the Department of Energy.[11]

3.5 Energy Supply Association of Australia (ESAA)[12]

In its submission in response to the Discussion Paper the ESAA offers no clear view as to whether or not the DGR policy should be retained. It observes that in the WA context

> " *domestic gas users have concerns as to whether or not LNG producers would commit to providing domestic gas supply at volumes and prices more consistent with a well-functioning market in the absence of a gas reservation policy*."

It fails to specify what it regards as a "*well-functioning market*"; in particular it offers no opinion about whether the orthodox economic view underlying the opposition of APPEA and the CCI to the DGR policy is appropriate. ESSA confines itself to offering support for measures that, in the event that the policy is retained, "*ensure it is applied in a manner that promotes certainty and allows predictability of new supply in the domestic market*."

[11] Balfe, P., *The investment pipeline for oil and gas in Australia*, conference on Excellence in Oil & Gas 2014, ACIL Allen, Sydney 12 March 2014.

[12] http://www.erawa.com.au/cproot/12029/2/Energy%20Supply%20Association%20of%20Australia%20-%20Public%20Submission%20-%20Inquiry%20into%20Microeconomic%20Reform%20Discussion%20Paper.pdf.

4 Recent Australian studies

This section reviews recent quantitative and qualitative analyses of application of DGR regimes in Australia. The discussion of recent Australian studies that include modelling results relevant to the measurement of the macroeconomic and structural effects of domestic gas reservation draws heavily on earlier work undertaken by ACIL Tasman Consulting for APPEA[13]

Two of the studies are widely cited in support of gas reservation policies. They rely heavily on input-output (IO) models and conclude (directly or by implication) that it would be in the national interest for the government to restrict LNG exports in order to ensure that gas remains available on the domestic market at prices that the domestic users regard as viable for the continuation of their operations (or perhaps just for the maintenance of the returns that their shareholders expect).These studies are:

- an October 2012 report prepared by NIEIR for the Australian Industry Group and the Plastics and Chemicals Industries Association[14]. This is the report relied on by the DGA in its submission in response to the ERA Discussion Paper (see subsection 3.4, above).
- a November 2012 report prepared by the AEC Group for the Queensland Large Industrial Gas Customers[15].

We also review studies by SKM MMA[16] and ACIL Tasman[17] that were prepared in 2011 for the WA Office of Energy in support of the WA Strategic Energy Initiative project. These do not analyse the effects of the DGR policy directly, but relevant inferences can be drawn from them, especially from the ACIL Tasman study, which uses computable general equilibrium (CGE) analysis.

There are two quantitative studies that are widely cited by opponents of gas reservation policies. They use CGE models and conclude that if gas can be exported in the form of LNG at prices that exceed those that domestic users pay, then the national interest is best served by allowing LNG exports even though this has detrimental consequences for domestic gas users. These studies are:

- the October 2013 report prepared by DAE for APPEA[18]. This is the report relied on by the APPEA and the CCI in their submissions in response to the ERA Discussion Paper (see subsections 3.2 and 3.4, above).

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[13] *Modelling the economy-wide effects of LNG exports: A review of four recent reports*, ACIL Tasman report for APPEA, February 2013.

[14] *Large scale export of East Coast Australia natural gas: Unintended consequences*, National Institute of Economic and Industry Research (NIEIR) for the Australian Industry Group and the Plastics and Chemicals Industries Association, October 2012.

[15] *Economic Significance of Queensland's Large Gas Using Industries*, AEC Group report for the Queensland Large Industrial Gas Customers, November 2012.

[16] *WA Domestic Gas Market Analysis for the Strategic Energy Initiative,* SKM MMA report for WA Office of Energy, May 2011.

[17] *Energy Futures for Western Australia*: *Scenario development and modelling outcomes,* ACIL Tasman report for WA Office of Energy, September 2011.

[18] *The economic impacts of gas reservation*, Deloitte Access Economics report for APPEA, October 2013.

- a 2008 report by McLennan Magasanik Associates for the Queensland Department of Infrastructure and Planning.[19]

Qualitative discussions of gas reservation regimes by the Bureau of Resources and Energy Economics (BREE)[20] and the Grattan Institute[21] oppose such policies. However, the Grattan Institute made the important point that economic arguments opposing DGR policies implicitly assume that governments have in place tax/royalty regimes that capture a high proportion of resource rent (i.e., of the net imputed value of resources in situ).

All the reports recognise that the development of LNG exports is likely to affect the supply of natural gas to domestic users – raising its price. Some even suggest that it could restrict the amount that domestic users can obtain. Further, all the reports recognise that these domestic-market effects are likely to reduce output and employment levels of domestic gas-using industries. The crux of the disagreement between the different studies is whether the economic benefits of additional LNG exports are sufficient to outweigh the costs imposed on domestic gas users. If the costs outweigh the benefits, then DGR could be justified. If not, its economic effects will be negative on balance.

Economic theory suggests that a DGR policy will have effects of two sorts. First, it imposes deadweight losses – reductions in consumer or producer surplus that are not matched by gains elsewhere. Second, it transfers income from gas producers to domestic gas users. Effects of the first type are unambiguous reductions in domestic economic welfare but the domestic-welfare implications of effects of the second type depend on the identity of the winners and losers. For example, if the winners (i.e., those deriving income from the activities of domestic gas users) are domestic residents and the losers (i.e., those deriving income from gas production) are foreigners, then the transfer aspect of the DGR policy might increase domestic economic welfare. Hence, the assumptions that the modelling makes about the ownership of firms in different industries will be important determinants of the welfare results. Also relevant will be the royalty and taxation regimes applying to foreign-owned income. We address this issue in more detail in section 6 of this report.

4.1 Studies supporting DGR: NIEIR and AEC

4.1.1 Indicators of the social value of gas usage

The NIEIR and AEC reports both give great weight to *value added generated per PJ of gas used (VA/PJ)* as an indicator of the relative social value of alternative uses of a country's endowments of natural gas. This indicator is the basis for the headline conclusion of the NIEIR report:

> *"if 1 PJ is instead shifted from local use by gas-dependent industries to export, the result is a direct loss of gross output .... of $255 million compared to $12 million gain from export revenues. The direct net loss in Australian value added is $243 million, or a loss/benefit ratio of 21 to 1."* (NIEIR Report, p. 20).

It is also explicit in the AEC Report's conclusion that:

> *"large industrial gas users are estimated to contribute: between 5.5 and 70 times more GSP per PJ of gas consumed than LNG production."* (AEC Report, p. ii)

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[19] *Queensland LNG Industry Viability and Economic Impact Study*, McLennan Magasanik Associates report for the Queensland Department of Infrastructure and Planning, February 2008.

[20] *Eastern Australian Domestic Gas Market Study*, Bureau of Resources and Energy Economics, December 2013.

[21] *Getting Gas Right: Australia's Energy Challenge*, T. Wood and L. Carter, Grattan Institute, June 2013.

Of the two reports, the AEC's is the clearer about the focus on the *VA/PJ* indicator. The essence of what the AEC has to say is well summarised in the following paragraph from its report's executive summary.

> *"The large industrial gas using industry is a higher value adding industry than LNG per PJ of gas used. This is unsurprising given the large industrial gas users consume gas as either an energy input or as an intermediate good in value adding processing and production of final outputs. The LNG industry, on the other hand, provides an avenue for gas producers to enter* ***more lucrative gas markets*** *by altering the gas state for transport to export markets. While this provides a* ***considerable increase in the net value of the gas extracted****, it provides lower value adding activity per PJ of gas than productive uses of the large gas using sector."* (AEC Report, p. iii, emphasis added)

This summary is uncontentious but it seems unlikely to constitute a valid justification for a DGR policy. How could it be to an economy's advantage to provide gas that could be sold to foreigners for a high price to domestic users who place on it a lower value than the foreigners are prepared to pay? Unsurprisingly, gas producers prefer to sell at the highest price available. If the price that they could obtain on the domestic market (net of processing costs) were the same as the netback export price, they would be indifferent between exporting and selling locally.

The NIEIR Report includes a methodological statement that is similar to AEC's:

> *"Natural gas dependent industries are industries where a large part of total output depends on the availability of natural gas at relatively low prices. These industries are the chemical sector and the non-ferrous basic metals industries (particularly alumina production).*
>
> *To calculate the net value trade off for a given quantity of natural gas we estimate the value of current output of these industries that, in the long-term, would be curtailed if the supply of natural gas to these industries ended, or alternatively if supply was available only at such prohibitive prices that the industries became uncompetitive and retreated offshore."* (NIEIR Report, p.17.)

The policy criterion that AEC (and NIEIR) appear to favour by focussing on the *VA/PJ* indicator is that gas should be allocated not to uses in which it commands the highest price, but instead to uses in which it generates the highest domestic value added per PJ of gas. They appear to think that the fact that other factors of production employed in domestic gas-using processes earn income when the gas is used domestically is adequate compensation for the fact that the returns accruing to the gas itself are lower than when it is exported. This might be reasonable if those ancillary factors of production would be unable to earn incomes at all if they were not employed in the gas-using processes – i.e., if the ancillary factors had no opportunity cost. But to assume this is implausible.

The assumption that non-gas factors of production employed in domestic gas-using processes have no alternative uses is exactly the assumption that underlies the IO calculations on which the AEC and NIEIR reports rely in evaluating the economic significance of large domestic industrial gas users.

4.1.2 Comments on the AEC report

AEC's "economic significance" analysis is a description of the economy as at 2010-11. It observes the values of the produced inputs, labour and capital that the domestic gas-using

industries used in 2010-11 to support their operations (*direct impacts*) and then observes that:

- suppliers of the gas-using industries must themselves have used produced inputs, labour and capital in order to be able to produce the goods or services that they supply to the gas users, and that the suppliers of the suppliers of the gas users must have done likewise etc. (indirect impacts); and
- workers and owners of capital employed in the gas-using industries and in their suppliers and their suppliers' suppliers etc. will have earned and spent incomes, thus inducing additional chains of production to service those expenditures (induced impacts).

All three of these impacts are summed and interpreted as the economic impacts of the large domestic gas-using industries. Although not claimed explicitly by the authors of the AEC report, this invites the interpretation that what is being claimed is that had those industries not existed, the economy would have been smaller by the full extent of the estimated direct, indirect and induced impacts. This is an invalid interpretation because, as explained earlier, it implicitly assumes that the labour, capital and natural resources used directly and indirectly by the gas-using industries would have found no alternative uses in their absence, and that consequently their owners would have received no income and made no consumption expenditures.

Additionally, the analysis ignores the extent to which gas users can substitute other inputs for gas. The LNG industry has no such opportunities but many other gas users have. According to ACIL Allen's data, *Trade services* is among the industries generating the most value added per PJ of gas consumed. It uses a small amount of gas – presumably as fuel for heating or cooking. It could easily replace gas with electricity. Rather than disappear, it presumably would simply switch energy sources if gas prices were to rise too high.

In any case, AEC's economic-significance analysis is an extremely obscure way in which to approach the underlying policy issue: is it economically beneficial for a state to divert natural gas from high-value exports to lower-value domestic uses? AEC exacerbates the obscurity by comparing the results of its IO analysis of the economic significance of large domestic industrial users of natural gas with more soundly based CGE estimates of the economic effects of the development of the LNG export industry, including in estimates from a 2012 report by ACIL Tasman for APPEA.

The CGE estimates make more appropriate assumptions about the operation of Australia's capital, labour and natural-resource markets, including recognition of the opportunity cost of factors of production that would be used in processing gas for export. They also account for input-substitution possibilities available to gas users. Because IO methods exaggerate industries' economic significance relative to CGE analysis, the AEC's comparisons are illegitimate. The authors of the AEC report do allude to this problem, but they make the comparison anyway. The report gives the strong impression that its authors understand much more about the defects of their methodology than they think it politic to emphasise.

4.1.3 Comments on the NIEIR report

The primary shortcomings of the NIEIR Report relate, as explained above, to its focus on the VA/PJ indicator of economic significance and its use of IO analysis. Several aspects of the details of the methodology used are not clearly explained in the report. The main ambiguities are outlined below.

Role of the terms of trade

The NIEIR Report seems confused about the crucial role of the terms of trade with respect to LNG developments. Page 13 of the report states:

> *"At the macroeconomic level the different drivers of the resource extraction industry versus manufacturing expansion can lead to a conflict between manufacturing expansion and equivalent resource extraction industry expansion that is unrelated to issues of national resource availability. This is because the higher terms of trade effect associated with resource extraction industry expansion crowds out manufacturing activity through exchange rate impacts. The converse negative impact on the resource extraction industry from manufacturing expansion is much weaker because manufacturing expansion does not influence the terms of trade."*

The development of export demand for LNG represents a terms-of-trade improvement for Australia, which increases Australians' aggregate real incomes. But it is this terms-of-trade increase that is driving the increase in the LNG industry, not the other way round. It is true that the terms-of-trade improvement reflected in this way requires structural adjustment from which there are some losers. But the contrast between this and the structural adjustment that is required to accommodate protectionist policies to promote domestic manufacturing is that the latter is accompanied by no significant increase in aggregate real incomes. This is one of the important reasons for resisting the attempts that NIEIR favours to protect manufacturing from the effects of LNG expansion driven by developments in world energy markets that are favourable to Australia's terms of trade. But similarly, were manufacturing to be stimulated by increases in the world prices of Australia's manufactured outputs or by improvements in manufacturing productivity, then this should not be resisted by government policy despite the fact that it would impose adjustment pressures on resource industries.

Assumptions about gas-using industries

NIEIR assumes that the bulk of the non-ferrous-metals and basic-chemicals industries would cease to exist without the availability of low-cost natural gas. In addition it assumes that activity in downstream chemical industries would be severely curtailed. The latter assumption is essentially that imported feedstock of basic chemicals could not replace domestic supplies. The details of how NIEIR implements these assumptions are, however, far from clear. In particular, we are unable to reproduce the calculations reported in Table 4.1 (p. 19 of the NIEIR Report).

NIEIR recognises that:

> *"The basic chemical industry was established in Australia before adequate supplies of natural gas became available. However, this was driven by factors including security objectives arising during and from World War II and high levels of tariff protection and subsidies.* ***These no longer exist****." (NIEIR Report, p.18, emphasis added.)*

Ironically, it does not seem to recognise that the policies that it advocates for insulating gas-using industries from the effects of LNG developments amount to reintroducing the protectionist measures.

Scenarios on adjustment to restriction of domestic gas supplies

Among the more interesting features of the NIEIR Report, are its scenarios on possible adjustments of the domestic economy to diversions of natural-gas supplies to service LNG export. Unlike the AEC Report, NIEIR does not confine itself to the case in which LNG

exports just crowd out activity in domestic gas-using industries. NIEIR also considers cases in which the diversion of gas to LNG exports is met:

- by domestic industrial users substituting electricity for gas;
- partly by reduced activity in the domestic gas-using industries and partly by reductions in household consumption; and
- by replacing gas-fired electricity generation with generation using renewable technologies.

The components of the scenarios that are based on gas users substituting other power sources for gas are calibrated using econometric estimation of the average elasticity of substitution between gas and electricity in the Australian economy (see section 5.1 of the NIEIR Report). A well-specified CGE analysis would include all these adjustment mechanisms. Results for these NIEIR scenarios are reported in the Report's Appendix A.

Unsurprisingly, the case in which the expansion of LNG exports is assumed just to crowd out activity in domestic gas-using industries and in their downstream customers involves the most adverse net effect on the domestic economy. This is the case underlying what was described earlier as NIEIR's "headline" conclusion. It was this result that was picked up in the press immediately following publication of the Report.

Cases in which adjustment mechanisms based on fuel substitution are included involve much more favourable macroeconomic effects. For example, the estimated annual reduction in net national product (a good measure of net welfare) in the "headline" case is almost $8,757 million (NIEIR Report, final column of Table A.1.). In the case in which gas is released for export by domestic industrial users substituting electricity for gas, there is an estimated increase in net national product of $352 million (NIEIR Report, third column of Table A.4.).

4.2 Studies prepared for WA Office of Energy in support of the Strategic Energy Initiative

4.2.1 SKM MMA

This is a descriptive study of the WA gas market. Among other things, it proposes assumptions that could be used in future modelling. It contains a brief description (Section 6.1) of the operation of the DGR policy and notes that:

> *"In our assessment of potential domestic gas supply from export projects over which the WA Government is expected to have influence, we have assumed that a minimum of 15% of production would be available domestically, with production based on project estimates of exports. For projects with sufficient resources additional domgas could be made available."* (SKM MMA Report, p. 130)

The report seems to assume that there is segmentation between the supply of gas to the domestic market and the supply of gas for export. One of the effects of the DGR policy is to promote such segmentation. In addition, the report assumes that there is monopoly price setting in the domestic market and: "*that profit maximising prices are in the range $9/GJ to $13/GJ (for $0/t to $60/t carbon prices) in the short term*." (SKM MMA Report, p. 16). It also points out that: "*The export price would be irrelevant if it were lower but may push this up if it were higher and export and domestic supply were readily substitutable.*" (p.18). This last statement ignores the probability that if the export price were lower than the domestic price, producers would divert gas from exports to the domestic market, putting downward pressure on the domestic price. The key point is that the DGR policy puts a floor under domestic supply, not a ceiling over it.

4.2.2 ACIL Tasman

The ACIL Tasman study simulates the economic effects of different scenarios on the development of the WA energy market. It uses a suite of models including ACIL's proprietary *GasMark* model of the gas market, its *PowerMark* model of the electricity market and its *Tasman Global* CGE model. In its base-case simulation, the supply of gas to the domestic WA market is constrained, but it also simulates a "*High Gas Supply*" scenario that assumes an unlimited supply of gas to the domestic market at a price equal to estimated long-run marginal cost of supply, which is lower than the domestic price in the base case.

Unsurprisingly, the WA economy fares better under the "*High Gas Supply*" scenario than in the base case. This could be taken to suggest that increasing domestic supply by a DGR policy would have favourable economic effects on WA. But this interpretation would not be warranted. The key point is that the additional gas supplied to the domestic market in the "*High Gas Supply*" scenario is assumed not to come at the expense of gas exports. Instead it is assumed that the additional gas that is used domestically would not have been used at all in the base case. In other words, no account is taken of the opportunity cost of the additional gas.

4.3 Quantitative studies opposing DGR

4.3.1 The CGE approach

The CGE-based studies on which opponents of DGR policies rely make assumptions about the operation of Australia's capital, labour and natural-resource markets that are more appropriate than the IO assumptions. In particular, they include recognition of the opportunity costs of factors of production that would be used in processing gas for export. They also account for input-substitution possibilities available to gas users.

The CGE-based studies model the policy problem directly, with the LNG industry and the large domestic industrial users of gas treated consistently within a modelling framework that makes plausible assumptions about how the economy works.

First it is necessary to define a base case – a projection of the evolution of the economy under whatever one chooses to regard as business-as-usual assumptions. Next it is necessary to define a case in which a policy shock has been applied. Finally, the effects of the policy shock are defined as the differences between the values of economic variables in the shocked case and their values in the base case.

These calculations require assumptions about how labour markets, capital markets and natural-resource markets work in the economies of interest. The approach adopted by ACIL Allen in its modelling of DGR issues typically assumes the following:

- Shocks to labour demand don't have much effect on unemployment rates in the long run. Instead they affect wage rates – an increase in demand bids up wages and a fall means that wages will rise less strongly than would have been the case in the absence of the shock. These wage changes are assumed to change the labour force – at the national level they drive participation rates, and changes in wage relativities between regions induce inter-regional migration of labour.
- Australia's draw on global stocks of investment funds is positively related to the strength of Australia's GDP growth relative to global growth. On top of that, it recognises that if LNG exports are restricted, investment in the LNG industry and in gas extraction will be lower than it otherwise would have been.

- If gas producers are forced to accept a lower average gas price on account of the LNG restriction, there will be less gas exploration and less of Australia's natural gas will be extracted – more will be left in the ground, at least temporarily.

The ACIL Allen approach takes as its primary policy criterion the effects of diverting gas from LNG exports to the domestic market on measures of real income (economic welfare)[22] in the relevant jurisdictions (Australia as a whole or a particular State, say). It also examines the effects on Australia's gross domestic product and the State's gross regional product, on employment and on the output levels of large domestic users of gas and other indirectly affected industries. In making the relevant calculations, ACIL Allen makes some attempt to account for foreign ownership and the taxation of foreign-owned income, although the data needed to do so are far from complete. For example, in studies relating to the Queensland LNG industry we assumed that 45% of post-tax profits in the LNG sector accrue to foreigners. This implies a high level of foreign ownership.

The CGE method allows us to examine the distributional effects of policy across regions, industries and household groups, as well as the aggregate effects. A policy that has a small aggregate effect may do so by making some regions, industries or households much better off but at the expense of others who are made much worse off. These distributional effects matter to policy makers.

ACIL Allen's analysis has found that the effect on Australia's real income of restricting LNG exports from a gas-producing State would be negative, but small as a percentage of base-case income. The negative effects are felt almost entirely in the gas-producing State.

The analysis does confirm that restricting LNG exports would have favourable effects on other trade-exposed industries, especially the large gas users. This is for two reasons. First, the reduction in LNG exports lowers the price at which producers supply gas to the domestic market relative to the price that they receive in the base case. Second, the loss of LNG export revenue puts downward pressure on Australia's real exchange rate. The favourable effects of these two factors on non-gas trade-exposed industries stimulates gross product in regions that are not directly exposed to the LNG industry.

With respect to gas-using industries that are not yet established or that are contemplating expansion, application of the policy criterion based on the VA/PJ indicator makes no sense at all – we should certainly not be encouraging new investment in industries that are viable only if the price they pay for gas is subsidised relative to its export value.

Some firms in gas-using industries may have already sunk capital into operations predicated on domestic gas prices lower than those that will prevail if the LNG industry develops unrestricted by government policy. It is likely that the development of the LNG industry will reduce the returns earned by such firms relative to the returns that they anticipated when they made their investments. But this is just a commercial risk of the sort that investors know they face when they make their investments and for which shareholders are rewarded by the excess of equity returns over the returns to holding risk-free assets.

There may even be cases in which LNG developments completely strand the assets of some investors that failed to anticipate the developments. This will be the case if the domestic gas price rises to the level at which the domestic gas user can no longer cover its avoidable costs – that is, when it is unable to make any contribution at all towards recovery of its sunk costs. Such an industry presumably might shut down, depending on its expectations about future gas prices and other aspects of the future economic environment.

[22] We note in passing that, despite the dependence of its headline conclusions on the VA/PJ indicator, the NIEIR Report recognises that this is the appropriate criterion. See NIEIR Report, final paragraph of section 2.2 (p. 9).

If it did close, the labour and other non-sunk resources released by its closure would probably find other uses. That is structural adjustment, a process that represents a redistribution of income, not a welfare loss. There is no convincing case for the government to waste income that could be earned from LNG exports to avoid structural adjustment by bailing shareholders out of failed investments.

4.3.2 The DAE report

The DAE report simulates the effects of the introduction of a DGR policy in Eastern Australia using its DAE-RGEM model. DAE-RGEM is a derivative of the well-known GTAP model following lines of adaptation similar to those used by ABARES in the specification of its GTEM models. The DAE-RGEM results apply to the Australia-wide effects – there is no intra-Australia regional disaggregation in the model. But the DAE's calibration of the model for this report draws on project-specific data for the eastern Australian gas market. DAE makes a bottom-up (project-specific) calibration of the "*sensitivity of investment in gas projects to the price and quantity of gas sold in the domestic market*" using information from industry consultation and AEMO data. Being based on project-specific cost data, the resulting supply curve exhibits real-world lumpiness. Domestic demand for gas is assumed to be inelastic, based on econometric studies using historical data.

DAE's base (business-as-usual) case assumes that the eastern Australian LNG industry develops in line with growing overseas demand and unhindered by DGR restrictions. The base-case assumptions include an export-driven spike in domestic gas prices and a long-run netback price of $9/Gj.

In DAE's policy case, which DAE compares to its base case in estimating the effects of domestic gas reservation, the DGR policy is represented as a tax on gas production and a subsidy to domestic gas users. This representation conforms to orthodox economic theory. The responses of gas supply and investment to the tax and of domestic demand to the subsidy depend on the gas-market calibration outlined in the first paragraph of this sub-section.

DAE finds that the DGR policy has adverse effects on GDP, aggregate employment and aggregate domestic consumption. The level of detail in the report is insufficient to allow full understanding of some details of the results. There are two particular problems.

- There is no discussion of foreign ownership of the gas-producing or domestic gas-using industries or of assumptions about taxation of foreign-owned income. This makes it hard to know whether or not the relationship between the GDP and consumption results is appropriate.
- There is no discussion of labour-market assumptions. An orthodox approach would have longer-run wage adjustments offsetting the short-run employment effects of the policy. In the DAE results, negative employment effects seem to persist.

Consistent with economic theory, the DGR policy leads to output reductions in the gas sector and by its suppliers, but to output gains in domestic gas-using industries and in trade-exposed industries that are not directly related to the gas sector – agriculture, for example. The latter effects are due to a real depreciation of the Australian dollar caused by the reduction in LNG exports induced by the policy.

4.3.3 The MMA report

The MMA report relates to the development of the gas market in Queensland. It does not simulate the effects of a DGR policy directly. Instead it simulates the effects of expansions of the LNG industry, one of the effects of which is to increase domestic gas prices. MMA

concludes that expansion of the LNG industry would have positive effects on national real GDP, Queensland's real GSP and real gross product in the sub-state regions in which the LNG industry is located. We can infer from these results that restricting the growth of the LNG industry and suppressing the increase in domestic gas prices, which a DGR policy would do, would have negative macroeconomic consequences.

MMA's methodology is to first use its proprietary gas market model (MMAGas) to project volumes and prices in the gas market under its LNG-growth assumptions. These gas-market projections are then fed into Econtech's MM600+ and MM2 models to project the wider economic consequences.[23]

MM600+ (at least in the configuration adopted for the MMA study) is a detailed long-run equilibrium model in which markets are assumed to adjust so that shocks (in this case growth of the LNG sector) have no permanent effects on aggregate employment, the trade balance or government budget balances. MM2 is a less detailed dynamic macro-CGE model – in the MMA study, it is used to estimate a nine-year time profile of the economy's adjustment towards long-run equilibrium.

The results of the MMA study are broadly consistent with those of the DEA study and of ACIL Allen's own gas-market research.

In the long run, expansion of LNG exports increases real GDP, capital formation and real consumption (a better measure of domestic economic welfare than real GDP). It also strengthens the Australian exchange rate, increasing imports and reducing non-gas exports. The report includes no details of the assumptions adopted about foreign ownership of firms in the advantaged and disadvantaged sectors or about the taxation of foreign owned incomes. As noted above, these would be relevant to the relationship between the output results of the modelling (including the GDP and GSP results) and the economic-welfare results (including the aggregate-consumption result).

At the broad sector level, the increase in LNG exports stimulates output and employment in the mining sector (which includes gas mining) but reduces output and employment in gas-using sectors (e.g., manufacturing and electricity) and in non-gas export industries (e.g., agriculture), which are adversely affected by the strengthening of the exchange rate.

At the regional level, the results indicate that the LNG expansion would benefit the regions in which the LNG industry is located, but partly at the expense of other regions.

4.4 Qualitative analyses opposing DGR

4.4.1 BREE report

BREE opposed DGR regimes. It presented an orthodox economic critique of such regimes in qualitative terms.

> *"In its most pure form, a domestic gas reservation policy implemented in response to a relatively large demand for export gas will reduce the amount of gas that producers have available to sell for export and increase the amount of gas they supply to the domestic market. This additional domestic supply then has the potential to reduce the domestic price relative to the export price from that which would have prevailed in the absence of the policy. Hence, in the short term, domestic gas consumers receive a gain from the lower gas price while the benefits to producers are reduced.*

[23] In its gas-market analysis, ACIL Allen follows a similar approach, using its GasMark gas-market model and its Tasman-Global CGE model.

> *This creates an economy-wide trade-off: the economic cost from introducing a domestic reservation policy is determined by netting off the resulting gains for domestic consumers against the losses for both producers and government revenue, and efficiency losses as the gas market adjusts to the new conditions. The overall net economic impact is likely to see a reduction in economic welfare if Australia foregoes export earnings (and tax revenues) in favour of (presumably lower value) domestic production, and lower future exploration and gas development activity.*
>
> *The diversion of gas to the domestic market under a reservation policy could, therefore, have both short- and long-term effects on the price and availability of gas domestically. Where the supply side is already tight, the importance of incentivising the supply response grows, and the chances of such policies causing net losses dramatically increase.*
>
> *The desired market response to a tightening in supply and the associated higher gas price is an increase in gas exploration, development and production. A reservation policy acts contrary to this goal by creating a perverse signal to the upstream sector, which diminishes incentives for bringing on new supply and potentially creates conditions for tightness in the gas market to persist."* (p. 107 of BREE report)

BREE's depiction of gas supply responses to DGR policy ignores the possibility that, rather than gas being shifted from the export market to the domestic market without any change in total gas production, gas production could be increased by bringing forward production of gas, accompanied by higher marginal costs of production. LNG profits would be reduced to cross-subsidise domestic supply. At the margin, additional investment to supply both export and domestic markets would be discouraged by DGR.

4.4.2 Grattan Institute

The Grattan Institute argued that there is no clear evidence that the gas reservation policy applied in WA had delivered low gas prices for domestic gas users. It observed that WA gas prices are currently higher than those on the east coast, where reservation policies have not been implemented.

The Grattan Institute was critical of assertions that domestic gas reservation requirements could be justified by market failure. It explained that the dynamics of the gas market should not be confused with market failure.

> *"High demand for gas has shifted the balance of market power towards the gas producers and away from the wholesalers and large industrial gas users who buy gas from them. If buyers are unwilling to pay higher prices to sign long-term contracts, they may have to sign shorter contracts and accept the risk that prices will move in coming years. Yet, these conditions reflect the dynamics of the underlying market; not a market failure. Our analysis found limited evidence that gas will not be available to users who are willing to accept higher prices and be flexible with contract terms. In the absence of a genuine market failure, it is in the interests of the Australian economy to allow gas to flow to the users who value it most highly."* (p. 15 of Grattan Institute report)

Nevertheless, the Grattan Institute warned that joint gas marketing arrangements in WA that have been permitted by the ACCC have reduced competition by reducing the number of sellers in the market. While this is a potential market failure, the Grattan Institute did not consider that a DGR policy was an appropriate response. Instead, it argued that as markets grow in depth and breadth, the ACCC should ultimately eliminate joint gas marketing arrangements.

An important contribution to the debate on domestic gas reservation regimes was the Grattan Institute's point that economic arguments opposing gas reservation policies implicitly assumed that governments have in place tax/royalty regimes that capture a high proportion of resource rent (net imputed value of resources *in situ*). It explained:

> *"….. the argument that Australians have more to gain from trading LNG than they have to lose from higher prices assumes that appropriate tax and transfer systems are in place. Governments should ensure that this is the case. Protectionist (domestic gas reservation) policies impose an implicit tax on gas producers by forcing them to sell gas at prices lower than those they could achieve by an unconstrained market. An explicit tax regime is a more efficient means of collecting revenue. It also allows more flexibility for governments to decide how to spend that revenue, whereas protectionist policies confer all of the benefits on gas users."* (p. 22 of Grattan Institute report)

The implications of this point for policy formulation have been overlooked by some other participants in the debate on DGR policy. Proponents of such a policy have failed to recognise that there is a superior first-best policy response available. Opponents of domestic gas reservation have neglected the absence of the first-best response and have not considered and any possible second-best justification of DGR policies.

4.5 Overall assessment

Orthodox economic theory implies that restricting LNG exports imposes net economic costs on the potential exporting country if the export price (net of the costs of LNG processing) is substantially higher than the price that domestic users are prepared to pay for gas. Unsurprisingly, economic models based on that orthodox theory – DAE's *DAE-RGEM* model, the *MM6000+* and MM2 models used by MMA and ACIL's *Tasman Global* model, for example, yield this result. The BREE and Grattan Institute reports make the same point in qualitative terms.

But economic orthodoxy also confirms that the development of LNG exports would impose costs on domestic gas users, although these costs are outweighed by the benefits that the exporting country enjoys in the form of export revenue.

The headline conclusions of the NIEIR and AEC reports are that LNG exports would reduce economic welfare in the exporting economy. In the modelling underlying these conclusions, NIEIR and AEC do not allow for adjustment mechanisms in goods and factor markets that are fundamental to the orthodox economic view. Nevertheless, NIEIR does consider scenarios in which at least some of these adjustment mechanisms are included. When it does so, its conclusions are much closer to those obtained by DAE, MMA and ACIL Tasman.

The headline conclusions of the NIEIR and AEC reports depend on the following three implausible assumptions.

a) There are no substitutes for gas in domestic gas-using industries.

b) Downstream users of truly gas-dependent products (e.g., basic chemicals) could not substitute imports for domestic supplies.

c) Labour and capital employed in domestic gas-using industries and by their suppliers have no alternative uses.

Moreover:

- the AEC conclusion is based on an illegitimate comparison between estimates of the economic significance of domestic gas-using industries that adopt these

implausible assumptions and an estimate of the significance of the LNG industry that does not adopt them; and

- despite its headline conclusions, the NIEIR Report includes analysis of cases in which the demand for gas to service LNG exports is accommodated by domestic users substituting other fuels for gas, rather than just by crowding out domestic gas-using activities. In these cases, the development of LNG exports poses no macroeconomic threat to the domestic economy.

Our overall assessment is that the Australian studies using modern CGE models tell a broadly consistent story that is well supported by orthodox economic theory. The story is that the development of LNG exports has favourable economic effects and that restricting those developments by diverting gas from export to domestic uses would have negative effects.

The main caveat relating to the studies included in our review is that it is not clear that due attention has been given to issues of foreign ownership and the taxation of foreign income. These issues are not very important as determinants of the effects of LNG developments (or of the restriction of those developments by DGR policies) on output and employment in the national or regional economies, but they may have important implications for domestic economic welfare. Even where these issues are treated explicitly, the empirical underpinnings of the treatment are tenuous.

On the other hand, the studies purporting to show that diverting gas from exports to the domestic market would have beneficial economic effects are based on implausible assumptions about the working of modern market economies. Moreover, there are problems with the way in which the analysis they do prefer has been applied. The approach that the AEC report uses to evaluate the benefits of the DGR policy is inconsistent with the approach used to evaluate the costs. Taken overall, the analysis presented in the NIEIR report does not really support its headline results.

5 The US literature

There is a burgeoning literature on gas policy in the US following shale gas developments and the prospect that the US could develop a significant LNG export industry. An interesting survey that contains a qualitative discussion of the issues and some quantification, but no detailed modelling is the 2012 discussion paper produced by Michael Levi under the auspices of the Hamilton Project at the Brookings Institution[24].

Like the Australian studies discussed in Sections4.2 and 4.4 (above), Levi concludes that the macroeconomic consequences of developing LNG exports would be positive for the US, notwithstanding that it would increase domestic gas prices to the detriment of domestic gas-using industries (principally, manufacturing and electricity generation). But he notes (see especially Table 1 on page 20 of Levi's paper) that there would be regressive distributional effects and environmental costs associated with shale gas activity that should be weighed against the macroeconomic benefits in making policy decisions about LNG exports.

5.1 The NERA report[25]

In December 2012, NERA Economic Consulting completed a major study for the US Department of Energy on the macroeconomic impacts of LNG exports from the United States. NERA constructed several scenarios reflecting different assumptions about levels of exports, global market conditions, and the cost of producing natural gas in the U.S. For each scenario, it used its dynamic CGE model of the United States (*NewERA*) to project the economic impacts of different limits on LNG exports. The *NewERA* model is closely analogous to the CGE models used in the Australian studies discussed in Section 4.2 (above), especially *DAE-RGEM,* and *Tasman Global* model of the Australian economy that ACIL Allen has used in its analysis of possible restrictions on Australia's LNG exports.

Consistent with those Australian studies, the NERA study finds that, under all scenarios, the U.S. would experience net economic benefits from increased LNG exports. NERA emphasises the orthodoxy of this result:

> *"… benefits that come from export expansion more than outweigh the losses from reduced capital and wage income to U.S. consumers, and hence* ***LNG exports have net economic benefits in spite of higher domestic natural gas prices. This is exactly the outcome that economic theory describes when barriers to trade are removed****." (NERA Report, p.1, emphasis added).*

Of particular interest in the context of the current debate in Australia, the NERA report found that:

> *"… U.S. economic welfare consistently increases as the volume of natural gas exports increased. This includes scenarios in which there are unlimited exports. The reason for this is that even though domestic natural gas prices are pulled up by LNG exports, the value of those exports also rises so that there is a net gain for the U.S.*

[24] Michael Levi, "A Strategy for U.S. Natural Gas Exports" *Discussion Paper 2012-04*, The Hamilton Project, Brookings, June 2012

[25] *Macroeconomic Impacts of LNG Exports from the United State,* NERA Consulting for the US Department of Energy, December 2012.

economy measured by a broad metric of economic welfare or by more common measures such as real household income or real GDP. Although there are costs to consumers of higher energy prices and lower consumption and producers incur higher costs to supply the additional natural gas for export, these costs are more than offset by increases in export revenues along with a wealth transfer from overseas received in the form of payments for liquefaction services. The net result is an increase in U.S. households' real income and welfare." (NERA Report, p.6).

The NERA report (pp. 21 and 211) acknowledges the potential importance of foreign ownership of firms in the gas-producing, gas-processing and gas-using industries to the economic-welfare implications of gas-market policy. However, like most of the Australian studies, it includes no details of the particular assumptions adopted in generating the results presented in the report. Our expectation is that these issues would be less important for the US than they would be for WA.

6 Retention leases and taxation

Various parties have suggested that, as a complement or alternative to DGR regimes, retention lease arrangements should be changed to induce faster development of gas resources.[26] Proponents envisaged that this would reduce domestic gas prices and bring forward the benefits of development.

This policy proposal has important deficiencies.[27]

- The retention lease system was conceived to alleviate the problem that exploration tenement conditions and allocation systems tend to induce too much exploration too soon, and thereby dissipate *ex ante* resource rent. However, they tend to reinforce the problem by providing a higher degree of post-discovery security of tenure and by imposing work requirements within specified time-frames. Changing the retention lease system in an attempt to force much earlier development will weaken the economically adverse effect of exploration tenement regimes, in future. However, forcing earlier development of already discovered resources will tend to dissipate resource rent by causing departure from the optimal timing of development and resource extraction.
- Undermining the retention lease system will create a time inconsistency or sovereign risk problem that will tend to discourage future exploration activity.
- The "first-best" tenement policy would replace existing exploration tenement arrangements with cash bidding for exploration tenements involving relatively unconditional tenure. Alternatively there could be a combination of less conditional tenure and a greater focus of government funded very early-stage exploration activity on identifying areas for release for bidding that have early commercial and economic potential, rather than scientific interest only. In a "first-best" tenement regime, retention leases would not involve the work requirements of present arrangements, which tend to cause too much exploration, too soon. Indeed, under extended exploration tenure and cash bidding, retention leases could be become largely redundant.
- Any increase in the supply of Australian gas as a result of tightening of conditions for retention leases to speed up development will not necessarily reduce domestic gas prices, as long as producers have the option of exporting the gas as LNG, and are price takers in international markets. In the longer term, such tightening of retention lease conditions could result in less exploration and reduced supply of gas to all markets.

Existing exploration tenement and retention lease regimes have important adverse implications for taxation/royalty revenue from mineable resources. Because these tenement regimes tend to dissipate resource rent, they undermine the tax/royalty base of petroleum

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[26] For example, see *Australia's Domestic Gas Security*, Domgas Alliance, November 2012; *Review of Policy Relating to the Grant and Renewal of Retention Leases: Options Paper*, Commonwealth Department of Resources, Energy and Tourism, 12 June 2009; *Inquiry into Domestic Gas Prices*, Economics and Industry Standing Committee of Parliament of WA, 2011; "Use it or lose it, miners warned" report on comments by incoming Minister, Ian Macfarlane, *The Australian*, 18 September 2013, p. 1.

[27] For a detailed discussion of issues outlined in this section, see *Review of Offshore Petroleum Exploration Policy*, report to Department of Resources, Energy and Tourism, ACIL Allen, January 2012.

resource rent tax (or other economic profits-based royalty or tax systems) and accounting profits-based systems. This results in reduced government capture of resource rent by these regimes and by local and overseas shareholders of extraction enterprises. While ad valorem royalty systems tend to partly offset the rent dissipation effects of exploration tenement and retention lease regimes, they destroy resource rent in other ways. In particular, they discourage extraction of higher cost resources and discourage exploration by treating revenues/gains and costs/losses highly asymmetrically. They cannot be levied at high rates to capture resource rent, because they tend to destroy it.

The problems of resource rent dissipation and destruction can be overcome and resource rent capture can be increased by a combination of tenement reform and royalty/tax reform. The tenement reform would be as described above. The tax/royalty reform would involve moving to taxes/royalties on economic profits or resource rents. The cash bidding system would capture *ex ante* resource rent. Reformed taxes/royalties would capture a share of *ex post* resource rent. The former would allow tax/royalty rates to be kept low enough to avoid disincentives to realise resource rent. The latter would avoid sovereign risk or time inconsistency issues associated with cash bidding as the sole source of revenue.

The petroleum resource rent tax falls short of what can be designed for practical application. The company income tax system (an accounting profits-based system falls) far short of that standard. Ad valorem royalty regimes are highly flawed.

If governments want to capture more benefits for the community from gas extraction, the combined tenement and tax/royalty reform described above is the “first-best” policy package.

7 Quantification of the costs and benefits of the DGR policy

The quantitative studies discussed in Section 4.2 (above) refer to the eastern Australian gas market, not to the WA market. A strong implication of our discussion in Sub-sections 4.3.1 and 4.5 is that any attempt to quantify the impact of WA's DGR policy on the WA economy and the economy of Australia as a whole would be best conducted using a dynamic CGE model that includes a facility for distinguishing intra-national regional effects as well as national macroeconomic and industry-structure effects. Several such models are available, including ACIL Allen's *Tasman Global* model, the MMRF model maintained by the Centre of Policy Studies at Victoria University and the Econtech models that were used in the MMA study (subsection 4.3.3, above). Our preferred approach would be to link the CGE model with a detailed bottom-up model of the gas market such as ACIL Allen's *GasMark* model.

Conducting a new study focussing specifically on the WA economy and the WA gas market is beyond the scope of the current project. In its absence, all that can be done is to infer broad orders of magnitude from the existing studies and to identify key differences between the WA situation and that pertaining in the eastern Australian market.

The DAE report is the most recent Australian CGE-based study and the one most directly focussed on the DGR policy. It estimates that the effect of imposing a DGR policy in eastern Australia would be to reduce Australian real GDP in 2020 by $5.925 billion (2011-12 prices)[28]. We begin our discussion of the quantitative significance of DGR policies by considering the significance of this result.

Adams and Parmenter[29] discuss four different methods of reporting policy deviations from dynamic CGE models. Using these four methods, the DAE result is[30]:

- absolute effect at 2025 = -$5.81 billion (2010-11 prices)[31]
- percentage effect at 2025 = -0.27%
- effect on average annual percentage growth rate 2013 to 2025 = -0.05 percentage points (i.e., the GDP growth rate falls from 3.17% to 3.12%)
- number of months of base period growth lost by 2020 = 1.01 (i.e., the GDP level attained at the beginning of January 2025 in the base case would not be attained until early February 2025 if the DGR policy is imposed).

A reasonable interpretation considering all these methods would be that the effects of the DGR policy on GDP are modest.

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[28] See Chart 4.1 in the DAE Report.

[29] Adams, P.D. and B. R. Parmenter, "Computable General Equilibrium Modeling of Environmental Issues in Australia: Economic Impacts of an Emissions Trading Scheme", Chapter 9 in Volume 1A of Dixon and Jorgenson (eds), *Handbook of Computable General Equilibrium Modeling*, Elsevier B.V., 2013. (see pp. 609-612.)

[30] In making these calculations, we constructed base-case data from DAE's July 2013 *Investment and GDP profile study*: (http://www.deloitte.com/assets/Dcom-Australia/Local%20Assets/Documents/Services/Corporate%20Finance/Access%20Economics/Deloitte_Access_Economis_Investment_GDP_profile_report_08.08.2013.pdf).

[31] This is broadly similar (probably slightly larger) than the costs of restricting LNG exports estimated in CGE modelling conducted by ACIL Allen.

GDP is a measure of real factor income generated in an economy, not a measure of the real income accruing to domestic residents. It is the latter that determines domestic residents' consumption possibilities (i.e., their economic welfare). To derive a measure of the policy-induced change in real income accruing to domestic residents, we must subtract from the change in real GDP the change in domestically generated income that is owned by foreigners and add the change in income generated overseas that is owned by domestic residents. We must also account for changes in the terms of trade – an improvement increases the amount of consumption that an economy's residents can secure in exchange for any given level of its output.

A potentially important determinant of the size of the change in domestic real income that any policy induces relative to the size of the induced change in real GDP is the ownership structure of firms in the industries affected by the policy. As illustrated in Figure 4.2 of the DAE report, the DGR policy has effects of two different kinds: it imposes deadweight losses (the red triangles in the figure) and it transfers income from gas producers (who are required to supply gas to the domestic market at a price lower than they could secure on the export market) to domestic gas users (who pay lower prices for gas than they would in the absence of the policy). Typically, the transfers (measured by rectangles in the diagrams) are large relative to the deadweight losses (measured by triangles).

If equal weight is applied to the interests of the recipients and providers of the transfers, they are irrelevant to the overall welfare effect. However, if gas-producing firms are predominantly foreign owned and firms in domestic gas-using sectors are predominantly owned by domestic residents, the transfer might represent an increase in domestic economic welfare. Because the transfers are typically large relative to the deadweight losses, the weight attached to the transfer recipients might not have to be much larger than the weight attached to the transfer providers for the transfer effect to be significant in the overall welfare calculus.

As noted above, it is not clear how well (if at all) the ownership issue has been handled in the studies that we have reviewed. In addition, there might well be material differences between the ownership structures of the relevant industries in WA and the eastern states. For these reasons, it is hard to be confident about drawing inferences about the economic-welfare effects of the DGR policy in WA from the available studies of gas policy in eastern Australia. New modelling that pays serious attention to data on the WA gas market, including ownership structures, would be required to make a more reliable estimate of the welfare effects of the policy.

Even if research regarding foreign ownership of winners and losers from a DGR policy and subsequent CGE modelling demonstrated net transfers to locals that were considered sufficiently large relative to deadweight losses to indicate this policy instrument had positive social value in its current form or a modified form, DGR still would not necessarily be justified. It would have to be shown that the policy was superior to alternatives. If not, it could only be a "second-best" or lower ranking policy.

A potential "first-best" policy would involve a package of policy instruments, because multiple interacting policy issues require attention. This package is outlined in Section 6 and reiterated in Section 8.

8 Conclusions and policy recommendations

The studies that we have surveyed and that we regard as reliable demonstrate that the DGR policy transfers income from those who derive income from gas production to those who earn income from domestic gas-using industries and non-gas-using trade-exposed industries. Gas-using households also benefit. In making these transfers, the DGR policy imposes a modest net loss of income through resource misallocation.

As evidenced by the literature that we have reviewed, proponents of the DGR policy favour it essentially for two reasons:

- because it stimulates activity in the WA economy; and
- because it allows Western Australians to capture a higher share of rents accruing to local gas reserves.

To the extent that the DGR policy stimulates activity in the WA economy, it does so by protecting domestic gas-using industries at the expense of other sectors – principally gas producers. Orthodox economics does not generally support such protectionist policies. For the particular case of the DGR policy, quantitative studies based on orthodox economics find that the costs in terms of foregone export revenue outweigh the benefits of increased activity in gas-using industries, once plausible assumptions are made about alternative uses available to the non-gas resources that would be absorbed by the protected gas-using industries.

The studies that we have reviewed do not demonstrate that the DGR policy would increase the extent to which gas rents are captured by West Australians. The reason is that the studies do not include sufficient detail on the ownership issues that determine how reallocation of activity between sectors affects the distribution of income between Western Australians and non-residents. Nevertheless, it is likely that the effect on domestic economic welfare will depend as much on the welfare weights attached to the winners in the income transfer relative to the weights attached to the losers as it does on the net income loss. Foreign ownership is a prominent feature of the gas-mining industry in WA. The extent to which transferring profits from foreign-owned gas companies to domestically-owned gas users promotes domestic welfare depends upon the extent to which the profit extracted from the gas companies is rent as opposed to the reward required to attract foreign capital.

Even if the DGR policy is effective in increasing the share of gas rents captured by West Australians, it is unlikely that it is the first-best way to do so. The key insight is that allowing rents to accrue in the first instance to foreigners would not be a problem for Western Australia if the regime for taxing income accruing to foreigners were optimal. Improving the regime for allocating and managing tenements and taxing foreign income is a more appropriate for promoting local rent capture than is the DGR policy.

The DGR policy has not been convincingly justified by a market failure argument. The policy's proponents have not shown that gas producers have exercised excessive market power. Moreover, it has not been demonstrated that the DGR policy would be the appropriate policy instrument to target a market-power problem. If there is concern that ACCC's approval of joint marketing arrangements has provided producers with potential market power, this could be addressed by prohibiting such arrangements. It seems clear

that the dominant influence on domestic prices is the LNG price obtainable in the Asian market, rather than the exercise of market power locally.

As noted above, it has been suggested that the DGR policy could be a means of redistributing gas resource rent in favour of Western Australians. Whether or not this would occur depends on the extent of foreign ownership of gas-producing and gas-using entities. A resolution to this question will require additional research on the foreign ownership question and CGE modelling that explicitly takes into account foreign ownership patterns.

In any event, the DGR policy is far from being the best policy to address inadequate capture of gas resource rent by Western Australians and to distribute it equitably and efficiently. There are two reasons for this.

- First, the policy will reallocate resource rent from gas producers to gas users. but it is not obvious that Western Australians *gas users* are the most worthy recipients of the reallocated resource rents.
- Second, the DGR policy mechanism misallocates resources (causes deadweight losses) as demonstrated by the various quantitative and qualitative economic analyses that ACIL Allen has reviewed and regards as reliable. These adverse economic effects include some dissipation or destruction of resource rent to the detriment of Western Australians and foreign investors, through encouraging economically premature extraction and discouraging future exploration and consequent development activity.

If the aim is to increase domestic capture of resource rent, it is not clear why gas has been singled out for particular attention. One possible reason is that the Commonwealth owns offshore resources, including gas, and has the right to capture resource rents through royalty and *de facto* royalty policy instruments. However, it is noted that the State has received a share of royalty revenue from the operations of the North West Shelf joint venture, as a result of an agreement with the Commonwealth Government in the 1980s. The WA Government has a constitutional right to impose *ex ante* and *ex post* royalties in respect of onshore resources. But, the State government has chosen not to increase its share of resource rents from onshore resources, such as iron ore, gold, base metals, bauxite, and petroleum.

Tightening-up retention lease conditions in an attempt to force the pace of development of gas resources has been suggested as an alternative or complement to the DGR policy. However, these policy measures have similar deficiencies from economic and distributional perspectives.

The best policy package excludes the DGR policy and tighter retention-lease conditions. This package, which is recommended, comprises the following elements.

- Prohibit joint domestic marketing arrangements by producers, including joint venture partners.
- Replace existing WA royalty arrangements with a two-part royalty regime that directly charges for the right to extract resources on the basis of resource rents or economic profits. The new regime would target *ex ante* resource rents through a cash bidding system for allocating exploration licences, and *ex post* or realised resource rents through a base that could be either "real" cash flow or an allowance for corporate capital concept. These systems effectively provide full loss offsets, treating exploration and other gains and losses fully symmetrically.
- Adopt royalty rates on realised resource rents, that in combination with cash bidding capture a high proportion of resource rents, while avoiding high rates on realised

outcomes. This combination would avoid undue reliance on cash bidding, which could lead to sovereign risk or time inconsistency issues. It would also avoid undue reliance on high rates of royalty on realised resource rent, which could be self-defeating because of a disincentive to realise rent.

- Complement these royalty arrangements with a stabilisation fund to address revenue volatility. An allowance for corporate capital base for royalty would present less revenue volatility issues than a "real" cash flow base.
- The cash bidding system for allocation of exploration licences would double as an *ex ante* royalty system and as a system for allocating exploration licences. It would replace the existing tenement allocation system.
- Replace highly conditional exploration tenure arrangements with tenure that is relatively unconditional, or release ground for exploration only after very early-stage exploration by the government geological survey has shown that early exploration is is likely to be economically attractive, or adopt some compromise between these concepts. The latter approach is favoured for pragmatic reasons.
- Adopt retention lease arrangements to allow for the possibility that discoveries may not be ripe for immediate development, but without short lease periods and without work programmes specified as a condition of tenure.

The revised royalty arrangements would eliminate an important problem with current royalty systems. These systems cannot capture a substantial share of resource rent without substantial destruction of resource rent through disincentives to explore for, and extract, sub-surface resources; the higher the rate the greater the destruction.

The proposed tenement regime would eliminate the tendency of current arrangements to dissipate resource rent and undermine revenue from a royalty regime with a resource rent or economic profits base, or from a royalty or income tax based on accounting profits.

The systems proposed above are superior to those adopted by the Commonwealth Government in offshore areas. The petroleum resource rent tax and income tax do not provide full loss offsets. The former tends to favour development activity over exploration. The latter tends to favour exploration over development. Both tax systems tend to favour large over small companies and existing operators over new entrants. The Commonwealth Government announced in late-2012 that it would deploy cash bidding in highly prospective areas, but retained work programme bidding for highly conditional tenure in other areas.

Western Australia gains from Commonwealth spending in the state that is funded by the petroleum resource rent tax, but other states share that spending. The state government has limited ability to influence the share of revenue allocated to people and activities in Western Australia. However, it could pre-empt petroleum resource rent tax revenue from onshore activities in Western Australia by implementing the two-part royalty regime (including cash bidding for exploration licences) recommended above.