

# Reforming the Eastern Australian gas market

Xunpeng (Roc) Shi<sup>1,2</sup>  | R. Quentin Grafton<sup>3</sup> 

<sup>1</sup> Australia China Relations Institute, University of Technology Sydney, Ultimo, NSW 2007, Australia

<sup>2</sup> Energy Studies Institute, National University of Singapore, 119620, Singapore

<sup>3</sup> Crawford School of Public Policy, The Australian National University, Canberra, Australia

## Correspondence

R. Quentin Grafton, Crawford School of Public Policy, The Australian National University, Building 132 Lennox Crossing, Acton 2601, Canberra, Australia.

Email: [quentin.grafton@anu.edu.au](mailto:quentin.grafton@anu.edu.au)

## Abstract

We analyse the deficiencies behind the Eastern Australian gas market by applying a framework proposed by the International Energy Agency. We show that this gas market has structural weaknesses that include inadequate supplies at hubs; limited pipeline capacity; predominance of long-term gas supply contracts; deficiencies in design; and difficulties with third party access. We provide five policy actions to help remedy these deficiencies and to help establish a functional gas market. Although our study is limited to Australia, it, nevertheless, provides insights for countries in the Asia Pacific region, which may wish to move towards more competitive gas markets, including trading hubs.

## KEYWORDS

competition, hub, LNG, market regulation, prices

*“... a liquid wholesale gas market ... provides market signals for investment and supply, where responses to those signals are facilitated by a supportive investment and regulatory environment, where trade is focused at a point that best serves the needs of participants, where an efficient reference price is established, and producers, consumers and trading markets are connected to infrastructure that enables participants the opportunity to readily trade between locations and arbitrage trading opportunities.” (COAG Energy Council, 2014).*

This is an open access article under the terms of the Creative Commons Attribution-NonCommercial License, which permits use, distribution and reproduction in any medium, provided the original work is properly cited and is not used for commercial purposes.

© 2018 The Authors. *Asia and the Pacific Policy Studies* published by John Wiley & Sons Australia, Ltd and Crawford School of Public Policy at The Australian National University.

## 1 | INTRODUCTION

The Eastern Australian gas market encompasses two paradoxes. First, although Australia is soon to be the largest liquefied natural gas (LNG) exporter in the world, it also has a projected gas shortfall in 2018 and 2019 in its eastern states (ACCC, 2017). Second, in 2017, the Eastern Australian wholesale spot gas prices were at record highs when Asian spot gas prices were at record lows. These paradoxes, in part, are a result of imperfections in the Eastern Australian gas market.

A key problem in Eastern Australia is a lack of meaningful, market-based reference prices for wholesale gas (ACCC, 2016). Although a number of facilitated gas markets have been developed in Eastern Australia, including the declared wholesale gas market (DWGM) in Victoria and the short-term trading market (STTM) hubs in Adelaide, Brisbane, and Sydney, the role of gas trading markets is limited to mainly managing daily imbalances rather than representing long-term market fundamentals (AEMC, 2016a). Although a wholesale gas market was created in Wallumbilla in Queensland at a node for gas pipelines as early as 2014, there are concerns: the prices in this market are higher than they would be in a competitive market.

The lack of a competitive and liquid Eastern Australian gas market is puzzling given that Australia has already established a competitive national electricity market and has a functional competition environment. A stated vision by the Council of Australian Governments Energy Council is to establish an efficient and transparent reference gas price. Two comprehensive reviews on the Eastern Australian gas market by the Australian Energy Market Commission provide a summary of the status, challenges, and possible pathways of Eastern Australian gas market (AEMC, 2016a) and the Victorian DWGM (AEMC, 2016b). These studies, and also reports by Australian Competition and Consumer Commission (ACCC, 2016) and Productivity Commission (2015), offer useful descriptions. Nevertheless, neither of these reports nor the published literature (Hay, 2009; Simshauser & Nelson, 2015) provides an analytical framework or lessons or market insights applicable to other countries.

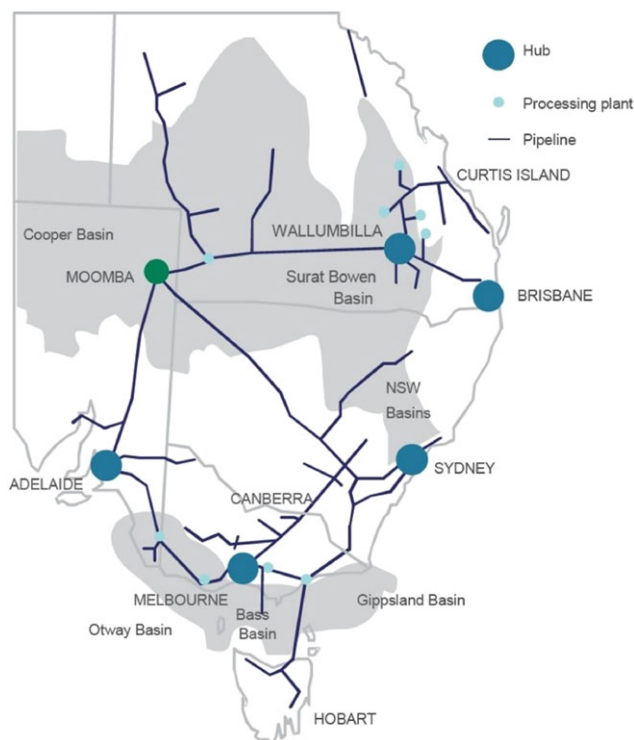
Here, we investigate possible reasons why the establishment of a competitive and liquid gas market in the Australian eastern coast remains elusive. To this end, a framework for assessing gas markets proposed by the International Energy Agency (IEA) is applied. This framework provides a means to connect the assessment of the Eastern Australian gas market to other locations.

Our study of the Eastern Australian gas market is important because several Asia and Pacific countries are seeking to establish gas markets where prices are determined by local supply and demand fundamentals. Indeed, efforts are underway to both liberalise markets and establish gas trading hubs (IEA, 2013; EIA, 2017; Shi & Variam, 2016). Here, we show the formidable challenges of establishing a competitive gas market even in an established market economy with open and competitive energy markets, such as Australia.

Section 2 provides an overview of the Eastern Australian gas market. Section 3 explains the causes for its deficiencies. Section 4 offers possible measures to establish a functioning gas markets in Eastern Australia, whereas Section 5 provides concluding remarks.

## 2 | EASTERN AUSTRALIAN GAS MARKET

The Eastern Australian gas market comprises five states (Queensland, New South Wales, Victoria, South Australia, and Tasmania) and the Australian Capital Territory (Figure 1). The market has three different wholesale gas market trading designs, which are operated by the



**FIGURE 1** Eastern Australian gas network.

Source: Modified from Department of Industry (2015, p. 25)

Australian Energy Market Operator (AEMO). STTM is located in Adelaide, Brisbane, and Sydney, the DWGM is located in Victoria, and the gas supply hubs (GSHs) are based at Wallumbilla in Queensland and Moomba in South Australia.

The DWGM is a virtual hub that covers the Victoria declared transmission system (DTS) and includes a network of pipelines established in 1999 that transports gas from the fields near Victoria to meet demand in that area. In the DWGM, capacity is implicitly allocated by AEMO based on the scheduled quantities, and, thus, gas shippers do not explicitly book capacity to transport gas within the DTS (AEMC, 2016b). By contrast, in other Australian gas markets, pipeline capacity is allocated via bilateral arrangements.

The STTM, established in November 2010, is a market for the trading of natural gas at the wholesale level at defined hubs in Sydney, Adelaide, and Brisbane between pipelines and distribution systems. It is a market-based wholesale gas balancing mechanism that facilitates the short-term trading of gas and supports retail competition (AEMC, 2016a). Although each of the three STTM hubs is scheduled and settled separately, all hubs operate under the same rules. Unlike the DWGM that has intra-day trades, the STTM market runs once per day, on the day ahead, and a market price is set each day at each hub. This day-ahead price (“ex ante market price”) is applied to all gas that is supplied according to the market schedules through the hub on the gas day.

The GSHs, which are recent initiatives, are exchanges for the wholesale trading of natural gas. They provide market participants with an electronic platform to continuously trade standardised and short-term physical gas products. The first GSH was inaugurated in May 2014 in Wallumbilla in Queensland, which is close to the gas production centres and facilitates the marketing of gas to Australia’s southern domestic markets and its east coast LNG export

facilities. As a pipeline interconnection point for the Surat–Bowen Basin, Wallumbilla links gas markets in Queensland, South Australia, New South Wales, and Victoria. It services industrial gas customers, LNG export facilities, and gas powered generators, thus making it a natural point of trade and an ideal location for a gas trading exchange (AER, 2017). As a result of AEMO's optional hub services model in March 2017, the three trading locations at Wallumbilla were replaced with a single Wallumbilla location. The consolidated single trading location should improve market liquidity by enabling trading participants across different pipelines to more easily trade with each other (AEMO, 2017).

The second GSH at Moomba began in June 2016 under the same market framework and rules as the Wallumbilla GSH (AEMO, 2017). It is a dedicated transit point for gas flowing between the east coast markets. The Moomba hub is considered an appropriate transitional measure to provide additional flexibility until trading at the Northern (Wallumbilla) and Southern (DWGM) hubs, and also pipeline capacity trading, mature. A concern is that the Moomba hub may dilute the limited trading in the Eastern Australian gas market (AEMC, 2016a) and, thus, may make price discovery more rather than less of a challenge.

Past reports (AEMC, 2016a, 2016b) have concluded that the STTM and DWGM hubs, despite providing effective and competitive gas balancing services, have not produced competitive benchmark prices. STTM's balancing function and relative small trading volume make them unable to represent long-term market fundamentals of gas supply and demand. Indeed, as of August 2016, these balancing volumes represented just 5% of Sydney flows, 2% of Brisbane flows, and 6% of Adelaide flows (Energy Quest, 2016). For the Victoria DWGM, the mandatory usage of it causes a large proportion of gas (which has been locked in long-term contracts) to be bid at a zero price (\$0/GJ) to ensure guarantee of delivery (AEMC, 2016b). This is because sellers are required to offer gas according to their long-term contracts, whereas the DWGM requires the delivery to be determined by market trading. Thus, bidding in the lowest allowable (zero) price to guarantee the delivery is practiced by the DWGM market.

The GSHs do not have representation from important market players, and, thus, their prices are not necessarily representative of prices paid for gas contracted in large volumes and over multiple years (AEMC, 2016a). Additionally, the derivatives market that generates forward curves for price discovery is not yet functional despite of the launching of Wallumbilla Natural Gas Futures contracts in April 2015. Thus, it uses the Wallumbilla End of Day Benchmark Price as the reference price (ASX, 2017).

### 3 | DYSFUNCTION IN GAS MARKETS: A CRITICAL ASSESSMENT

Our definition of a functional gas market is one in which there is "... a single price zone accessible to incumbents and new entrants on equal terms and where trading is liquid, so that it creates a reliable price signal in the forward and spot markets which are not distorted" (IEA, 2013, p. 32). A critical feature of such a market is an exchange with both a spot and futures market that provide a reliable price signal of market fundamentals. A platform for such an exchange is commonly referred to as a "hub" where the title or ownership of natural gas is exchanged between a number of market participants (IEA, 2013).

Here, we apply a framework for assessing a gas market proposed by the IEA. The key factors in this framework include institutions, structure, and market design (Table 1).

**TABLE 1** Features of a functioning wholesale gas market

	IEA requirements	Eastern Australia's status	Responsible agency
Institutional factors	A hands-off government approach Wholesale price deregulation Separation of transport and commercial activities	Existing Existing Not fully functional	Government
Structural factors	Sufficient network capacity and non-discriminatory access to networks (TPA) Competitive number of market participants Involvement of financial institutions	Both the capacity and TPA need to be improved Not present Yet to happen	Regulator
Market design	Spot market Futures market	Existing Yet to be developed	Competitive authority

*Note.* Authors' own classification based on the understanding that this is a basic foundation.

IEA = International Energy Agency; TPA = third party access.

*Source:* Authors' summary based on IEA, (2013).

### 3.1 | Tight markets

One of the key market conditions that support sport trading and, thus, wholesale market competition is that supply be sufficiently available such that a market price can be established on the basis of marginal costs. One of the key reasons why European gas markets transition from oil indexation to hub indexation was because of adequate gas supplies (Heather, 2015; Shi, 2016; Stern & Rogers, 2011). By contrast, the recent ACCC inquiry projected an Eastern Australian gas market shortfall of between 55 and 108 PJ in 2018 and between 48 and 102 PJ in 2019 (ACCC, 2017). This suggests that the required supply conditions may not be present in the Eastern Australia market hubs.

### 3.2 | Pipeline capacity, allocation, and third party access

Given that most pipelines in East Australian gas market are connecting different routes, there is only limited pipeline-to-pipeline competition in the physical hubs. By contrast, as shown in the United States, the ability to compete and deliver gas through multiple hubs is a critical factor in their successful market price discovery (EIA, 2017).

An issue also exists in terms of how pipeline capacities are allocated. Other than the DTS, the Eastern Australian gas market operates under a contract carriage model in which pipeline users need to purchase primary pipeline capacity rights from pipeline owners through long-term contracts. This individual, bilateral negotiation of pipeline capacity raises the barrier for new producers or gas users to enter the pipeline capacity market, as they may not have the resources to negotiate on an equal basis with incumbents (AEMC, 2016a).

In addition to a less than effective primary pipeline capacity market, a secondary pipeline capacity market is not sufficiently advanced to support further gas trades. In other words, because there is no mandatory relinquishment of unused pipeline capacity, users with firm capacity rights may have an ability and incentive to "hoard" their capacity in order to limit

competition in their downstream markets (K Lowe Consulting, 2013; The Brattle Group, 2013). This causes “contractual congestion,” a situation whereby market participants cannot gain access to contracted but unused pipeline capacity.

Even if contract holders have an incentive to sell capacity in secondary pipeline capacity markets, there are barriers to the capacity trades, including higher transaction cost and small size. Due to the small size of Eastern Australia's gas markets (EnergyAustralia, 2013), or a lack of common delivery points (AGL Energy, 2014), there are very few trades in secondary pipeline capacity markets.

Third party access (TPA) to pipeline networks has been permitted since the Gas Supply Act 1996 and first implemented by AGL in August 1997 (Abbott & Ma, 2017). Nevertheless, TPA is not universally applied, and the level of regulation is uneven. Indeed, less than 20% of the transmission pipelines on the east coast are currently subject to any form of regulation (Productivity Commission, 2015).

Earlier gas market reviews have identified other major challenges that include a lack of transparent information on the identity of pipeline capacity contract holders, pipeline usage rates, and the availability and price of capacity in secondary pipeline capacity markets (Grattan Institute, 2013; Victorian Gas Market Taskforce, 2013). A lack of transparency impedes the entry of new suppliers, particularly, smaller shippers, into retail markets (ESAA, 2014).

### 3.3 | Market players and price regulation

As the U.S. gas markets illustrates, a successful physical gas hub requires a large number of buyers and sellers willing to trade and competition between pipeline owners and operators to provide hub services (FTI Consulting, 2015). By contrast, a small number of large producers (often in the form of consortia) account for the bulk of gas production and reserves in Eastern Australia (Productivity Commission, 2015). In the gas transmission sector, ownership in Eastern Australia is highly concentrated with only two major players (AER, 2013).

A related issue is that a large number of existing pipeline owners have been engaging in monopolistic pricing, and the ability and incentive to undertake such pricing has not been effectively constrained by competition (FTI Consulting, 2015). Thus, market power by pipeline owners has contributed to higher domestic wholesale gas prices than if the market were more open and competitive (ACCC, 2016). This market contraction and the associated market power are strengthened by joint venture marketing arrangements and vertical integration (Productivity Commission, 2015).

### 3.4 | Market designs

The multiple spot markets in the Eastern Australian gas market create complexity, costs, and inefficiencies, which appear to discourage greater participation of market participants (AEMC, 2016a, 2016b). Indeed, the market currently has three different facilitated market designs and six different pricing points (hubs). This fragmentation may deter participants in one market entering another, and registration by participants at only one of the hubs limits their ability to trade elsewhere (AEMC, 2016a). This fragmentation, coupled with relatively small gas supplies per market, undermines the ability to establish competitive and benchmark hub prices (AEMC, 2016b). Another problem is that the short-term trading of gas is limited by a design framework to procure pipeline capacity at short notice in response to price signals at the hubs (ACCC, 2016).



The market framework challenges continue because the location of STTM, at the end of pipeline, prevents liquidity growth because it is not easy to purchase gas from the STTM market and transfer to other markets due to capacity access and cost of pipeline transportation (AEMC, 2016a). Further, the physical hub design makes the participation of financial participants difficult and, thus, does not support the development of risk management products (AEMC, 2016a; Shi, 2016).

In terms of DWGM design, multiple pricing schedules (intra-day pricing), ancillary payments, and uplift charges mean that not all of the trading risk is captured in a single commodity price. For example, the intra-day rescheduling process in DWGM exposes participants to a number of different prices across their daily volumes. Further, because the ASX futures contract is settled daily on the 6 a.m. price, residual risk remains in the form of exposure to the intra-day prices if participants change their bids/offers or deviate from their schedule during the day. In addition, market participants are also exposed to volume risk, which cannot be fully hedged (AEMC, 2016a). Due to this limitation, it is problematic to develop physical trading and financial risk management products based on the existing design of the Victorian DWGM.

For the GSHs, the uncertainty for delivery makes the hub less attractive than the STTM hubs. In the GSHs, the hub operator, AEMO, matches the trades and centrally settles transactions, but unlike the DWGM or STTMs, it does not schedule and manage gas flows or balance inputs and offtakes on the gas pipelines (AEMC, 2016a).

### 3.5 | Long-term gas contracts

Australia buyers and sellers appear to prefer long-term gas contracts rather than hub trading because, at the wholesale level, the vast majority of trades occur through long-term bilateral contracts, with the terms and price kept confidential (ACCC, 2016). In 2016, approximately 80% of gas trading occurred outside of the trading market and were in the form of gas supply agreements (AEMC, 2016a). Even in the DWGM where usage of the hub is mandatory, market participants still manage price risk by entering into GSAs outside of the market, and bidding this gas into the hub to ensure that their short-term injections and withdrawals match (AEMC, 2016b).

## 4 | TOWARDS A FUNCTIONAL EAST AUSTRALIAN GAS MARKET

On the basis of the IEA framework, Australia appears to be well positioned towards having a functional gas market in terms with government leadership in relation to markets, price deregulation, and spot markets. Progress has also recently been made in terms of gas networks. Nevertheless, deficiencies remain, as highlighted in Table 1.

Recognising the challenges in establishing a functioning Eastern Australian gas market, the Australian federal government has undertaken several actions. Plans include improving market transparency; a Northern Gas Pipeline to transport gas from the Northern Territory to Queensland; an assessment of further gas pipelines to link Northern and Western Australia to Eastern Australia; an ACCC inquiry into gas prices, transport, and supply; and a program to increase community acceptance of gas projects (Grafton, Shi, & Cronshaw, 2018).

The Australian Energy Market Commission is also proposing the establishment of two reference gas prices, based on a Northern and Southern hub, respectively (AEMC, 2016a). The

proposed Northern Hub would be based on the GSH at Wallumbilla, which is supported by the recent introduction of hub services that allow participants to trade compression capacity (AEMC, 2016a). The proposed Southern Hub would be developed from the existing DWGM by replacing its current gross pool design with continuous exchange-based trading, supported by a system of firm capacity rights (AEMC, 2016b).

Beyond these existing initiatives, additional actions should be considered. First, and foremost, an increase in the effective supply for domestic market. The “surplus of supply” condition was a key catalyst that facilitated the transition from oil indexation to hub competition pricing in Europe (Heather, 2015; Shi, 2016; Stern & Rogers, 2011). Given there are potentially large volumes of gas in the Northern Territory and in Western Australia that could be directed to Eastern Australia, additional pipeline connections would augment supply and reduce the market power of existing gas suppliers in Eastern Australia. Additional supply competition could also be enhanced by construction of LNG regasification terminals as is also planned by two different operators (Grafton et al., 2018).

Second, develop an efficient and transparent *secondary* pipeline market. Easier access to secondary pipeline capacity for market participants could encourage more efficient responses to demand and supply imbalances in different parts of the Eastern Australian gas market and also assist the development of wholesale spot markets (Productivity Commission, 2015). This might be achieved through regulatory changes such as mandatory relinquishment of unused pipeline capacity, as well as measures to reduce transaction costs.

Third, promote transparent and efficient TPA. The current regulatory approach should be strengthened towards a more complete regulation. As for those pipelines under full regulation, measures need to be taken to prevent some pipeline owners from exercising their market power (ACCC, 2016). The mandatory and timely reporting of all significant market data can also increase market transparency. A daily and day-ahead market for contracted, but un-nominated pipeline capacity and hub services, also needs to be developed and introduced into the market design (AEMC, 2016a).

Fourth, stimulate demand for hub price benchmarks. One possible measure is to provide additional support for gas spot trading and to create a price benchmark based on hub prices. The European experience shows that abolishing long-term contracts create demand for trade that sustains hub development (Shi, 2016). Such an approach could be supported in Eastern Australia by regulations that prevent new long-term contracts.

Fifth, help transform physical hubs to virtual hubs to attract market players. Physical hubs require large numbers of market players through pipeline-to-pipeline competition in the gas network, which is not yet present in the Eastern Australian market. Consequently, optional hub services may not be sufficient to produce the expected levels of trading liquidity (AEMC, 2016a). Over the longer term, the Wallumbilla GSH as well as the Moomba GSH, combined or independently, may need to be further transitioned from a physical hub to a small virtual hub with a market-based balancing mechanism consistent in design to recommendations for the Southern Hub (AEMC, 2016a).

## 5 | CONCLUDING REMARKS

The Eastern Australian gas market is in a state of flux. Wholesale prices are at or close to historical highs, yet there is an inadequate supply and a projected domestic gas shortfall in 2018 and 2019. Much of this turmoil arises from the lack of functioning wholesale gas market to



generate wholesale gas price benchmark. This is despite the stated intent and focus of the Australian governments to create such a market.

By applying the IEA framework for hub development, we identify a number of reasons why a competitive and functional gas market in Eastern Australia has failed to materialise. The key barriers to a functioning market include insufficient pipeline connections; an inability to allocate or reallocate pipeline capacity; an inadequate number of market players that has, in turn, allowed for the exercise of market power; and a lack of liquidity in terms of gas volumes because most domestic demand is supplied via opaque and long-term gas supply agreements.

We propose that, in addition to existing or planned initiatives, further efforts be undertaken to increase the effective gas supply; to support an efficient and transparent secondary pipeline market; to promote transparent and efficient TPA; and to stimulate participation in gas market hubs to ensure benchmark gas prices that reflect market fundamentals. These initiatives, with suitable adaptation, may also assist other countries in the Asia and Pacific region who wish to establish functioning and competitive gas markets.

## ORCID

Xunpeng (Roc) Shi  <http://orcid.org/0000-0001-9653-7395>

R. Quentin Grafton  <http://orcid.org/0000-0002-0048-9083>

## REFERENCES

- Abbott, M., & Ma, X. (2017). Economic regulation in Australia: The case of the New South Wales gas. *Economic Papers-A Journal of Applied Economics and Policy*, 36(3), 250–265.
- ACCC, (2016). Inquiry into the east coast gas market. Canberra: Australian Competition and Consumer Commission (ACCC). [https://www.accc.gov.au/system/files/1074\\_Gas enquiry report\\_FA\\_21April.pdf](https://www.accc.gov.au/system/files/1074_Gas%20enquiry%20report_FA_21April.pdf)
- ACCC, (2017). Gas inquiry 2017–2020 interim report. Canberra. <https://www.accc.gov.au/publications/serial-publications/gas-inquiry-2017-2020/gas-inquiry-september-2017-interim-report>
- AEMC, (2016a). East coast wholesale gas markets and pipeline frameworks review: Stage 2 final report. Sydney: Australian Energy Market Commission. <http://www.aemc.gov.au/getattachment/576299ec-c361-4a2c-a6cd-bb45fb834741/Stage-2-Final-Report.aspx>
- AEMC, (2016b). Review of the Victorian declared wholesale gas market: Draft final report. Sydney: Australian Energy Market Commission. <http://www.aemc.gov.au/getattachment/576299ec-c361-4a2c-a6cd-bb45fb834741/Stage-2-Final-Report.aspx>
- AEMO, (2017). Gas supply hubs. <https://www.aemo.com.au/Gas/Gas-Supply-Hubs>
- AER, (2013). State of the energy market 2013. Melbourne. <http://www.aer.gov.au/node/23147>
- AER, (2017). Wallumbilla gas supply hub – On and off market trades. <https://www.aer.gov.au/wholesale-markets/wholesale-statistics/wallumbilla-gas-supply-hub-on-and-off-market-trades>
- AGL Energy, (2014). COAG energy council consultation: Enhanced pipeline capacity information. Sydney.
- ASX, (2017). Energy derivatives: Natural gas. <http://www.asx.com.au/products/energy-derivatives/natural-gas.htm>
- COAG Energy Council, (2014). Australian gas market vision.
- Department of Industry, (2015). Gas market report 2015. Canberra: Department of Industry, Innovation and Science. <https://industry.gov.au/Office-of-the-Chief-Economist/Publications/Pages/Gas-market-report.aspx#>
- EIA, (2017). Perspectives on the development of LNG market hubs in the Asia Pacific region. Washington D.C.: U.S. Energy Information Administration. <https://www.eia.gov/analysis/studies/lng/asia/>
- Energy Quest, (2016). Energy quarterly August 2016 report.

- EnergyAustralia, (2013). Submission to standing council on energy and resources regulation impact statement – Gas transmission pipeline capacity trading consultation paper. Melbourne.
- ESAA, (2014). Submission to consultation paper on enhanced pipeline capacity information. Melbourne.
- FTI Consulting, (2015). Conceptual design for a virtual gas hub(s) for the east coast of Australia. London. <http://www.aemc.gov.au/getattachment/98035b44-a513-4d34-a5a0-9048b7166db3/FTI-Consulting-%E2%80%93-Conceptual-design-for-a-virtual-g.aspx>
- Grafton, R. Q., Shi, X., & Cronshaw, I. (2018). 'Making cents' of the Eastern Australian gas market. *Economic Papers: A Journal of Applied Economics and Policy*, 37(1), 42–54. <https://doi.org/10.1111/1759-3441.12194>
- Grattan Institute, (2013). Getting gas right: Australia's energy challenge. Melbourne.
- Hay, J. L. (2009). Challenges to liberalism: The case of Australian energy policy. *Resources Policy*, 34(3), 142–149. <https://doi.org/10.1016/j.resourpol.2008.05.001>
- Heather, P. (2015). *The evolution of European traded gas hubs*. Oxford: OIES. <http://www.oxfordenergy.org/wpcms/wp-content/uploads/2015/12/NG-104.pdf>
- IEA, (2013). Developing a natural gas trading hub in Asia: Obstacles and opportunities. Paris: International Energy Agency. [https://www.iea.org/publications/freepublications/publication/AsianGasHub\\_FINAL\\_WEB.pdf](https://www.iea.org/publications/freepublications/publication/AsianGasHub_FINAL_WEB.pdf)
- K Lowe Consulting, (2013). Gas market scoping study: A report for the AEMC. Melbourne. <http://www.aemc.gov.au/media/docs/Gas-Market-Scoping-Study---K-Lowe-Consulting-Report-7332de0b-5c04-46c5-82ad-11bde42a824e-0.PDF>
- Productivity Commission, (2015). Examining barriers to more efficient gas markets. Canberra. Commission Research Paper. <http://www.pc.gov.au/research/completed/gas-markets>
- Shi, X. (2016). Development of Europe's gas hubs: Implications for East Asia. *Natural Gas Industry B*, 3(4), 357–366. <https://doi.org/10.1016/j.ngib.2016.11.001>
- Shi, X., & Variam, H. M. P. (2016). Gas and LNG trading hubs, hub indexation and destination flexibility in East Asia. *Energy Policy*, 96, 587–596. <https://doi.org/10.1016/j.enpol.2016.06.032>
- Simshauser, P., & Nelson, T. (2015). The Australian east coast gas supply cliff. *Economic Analysis and Policy*, 45, 69–88. <https://doi.org/10.1016/j.eap.2015.01.002>
- Stern, J., & Rogers, H. (2011). *The transition to hub-based gas pricing in continental Europe*. Oxford: OIES. <http://www.oxfordenergy.org/wpcms/wp-content/uploads/2011/03/NG49.pdf>
- The Brattle Group, (2013). International experience in pipeline capacity trading, prepared for AEMO. Rome.
- Victorian Gas Market Taskforce, (2013). Gas market taskforce: Final report and recommendations. Melbourne.

*The opinions expressed in the Policy Forum are those of the author(s) alone and do not necessarily reflect those of the Journal's Editors and partners.*

**How to cite this article:** Shi X(R), Grafton RQ. Reforming the Eastern Australian gas market. *Asia Pac Policy Stud*. 2018;5:641–650. <https://doi.org/10.1002/app5.244>