HSBC Building
Level 19
580 George Street
Sydney NSW 2000
PO Box R41
Royal Exchange NSW 1225

Phone 61 2 9693 0000
Fax 61 2 9693 0093
www.apa.com.au

APA Group

Australian Pipeline Ltd
ACN 091 344 704

Australian Pipeline Trust
ARSN 091 678 778

APT Investment Trust
ARSN 115 585 441

18 May 2016

Mr John Pierce
Chairman
Australian Energy Market Commission
PO Box A2449
Sydney South NSW 1235

Reference: GPR0002

Dear Mr ~~Pierce~~ John

APA Group further submission to the AEMC Discussion Paper: Review of the Victorian Declared Wholesale Gas Market

In its submission to the AEMC discussion paper on the Review of the Victorian Declared Wholesale Gas Market, APA Group (APA) expressed concern regarding the AEMC's assumption that the role of institutions under the current Victorian DWGM would remain largely unchanged in the transition to an entry-exit model.

APA has engaged Boston Consulting Group, with over 15 years' experience in European gas markets and the European application of the entry-exit system, to advise on the optimal allocation of institutional roles under an entry-exit model. BCG's report is attached to this letter, and we commend it to the AEMC's consideration.

We would be pleased to discuss the content and conclusions of this report at your convenience.

Please call Peter Bolding, General Manager Regulatory and Strategy, on 02 9693 0053, if you would like any further information.

Yours sincerely

Ross Gersbach
Chief Executive Strategy & Development

Design of institutional roles in international gas transmission markets

Prepared for submission to the Australian Energy Market Commission in response to proposed reforms of the Victorian Declared Wholesale Gas Market

17 May 2016

THE BOSTON CONSULTING GROUP

This paper has been prepared by Christophe Brognaux, Balazs Kotnyek, Simon Miller and Lucy Carter of The Boston Consulting Group (BCG). It was commissioned by APA VTS to respond to the Australian Energy Market Commission's Discussion Paper on its Review of the Victorian Declared Wholesale Gas Market.

- **Christophe Brognaux** is a Senior Partner and Managing Director in BCG's Brussels office and has worked on gas transmission since 1997. During that time, he has worked on gas transmission systems in eight countries, as well as with multiple power system operators and regulated distribution companies. He was global head of BCG's regulated energy networks business for five years and has in-depth knowledge of European entry-exit models.

- **Balazs Kotnyek** is an Expert Principal in BCG's Budapest office. Since joining BCG in 2003, Balazs has worked with energy clients globally on topics of regulation and network operations (especially in European entry-exit models), including negotiation support with regulators, tariff setting, developing gas market model options, developing a national gas distribution codes and a range of other energy regulation topics.

- **Simon Miller** is a Partner and Managing Director in BCG's Sydney office. Prior to joining BCG he was Deputy Director-General of Energy and Water in New South Wales, participated as NSW's delegate to the Standing Committee of Officials of the Ministerial Council for Energy and was Chief of Staff to the Treasurer of NSW.

- **Lucy Carter** is a Project Leader in BCG's Melbourne office and has worked with BCG since 2014. Lucy has worked on electricity network transformation, distributed generation, electricity asset privatisation, gas portfolio restructure for a gas retailer, and tariff and pricing strategies for distribution network service providers. Prior to joining BCG, Lucy worked as a Fellow within the Energy Program at a leading Australian think tank, and has a wide range of published papers and articles on gas and electricity.

The views expressed in this paper are BCG's alone and represent independent input into the AEMC's market development process. The information presented has been prepared for discussion purposes only in order to identify issues, reflect basic principles or relationships, and provide particular insight into the opportunities or difficulties which may arise as a result from the proposed structural reforms.

Positions outlined in this paper are based on our industry experience, our work with clients, and public data and should not be used or relied upon without independent investigation and analysis.

This paper is published by The Boston Consulting Group Belgium BVBA/SPRL, Keizerinlaan 13 Boulevard de l'Impératrice, 1000 Brussels, Belgium

This paper may be cited as: Brognaux, C., Kotnyek, B., Miller, S., and Carter, L. 2016, *Design of institutional roles in international gas transmission markets*, Boston Consulting Group

Contents

1. Background

The Australian Energy Market Commission's (AEMC) ongoing review of the Victorian Declared Wholesale Gas Market (DWGM) includes a proposal for an entry–exit gas market model.

In this report, The Boston Consulting Group compares the model proposed by the AEMC with the structure of entry–exit models in similar markets. In particular, it considers the division of market roles in entry–exit models in international markets and compares these cases with the proposed Victorian model.

Current debate about the design of an entry–exit model for the Victorian market is forming the foundations for the evolution of the gas market in Victoria. The outcomes of this debate will have implications for the broader development plans of Australian gas markets. Ensuring that the system is designed in a way that meets the AEMC's objectives is critical to ensuring that markets operate efficiently. Market design will also underpin system security, ensure that efficient investment signals operate during the transition to the new arrangements, and ensure the right balance between incentivising capacity expansion and avoiding inefficient investment.

In an earlier AEMC submission on proposed changes in the Victorian DWGM, APA raised concerns about the market design. In particular, APA was concerned by the AEMC’s assumption that Australian Energy Market Operator (AEMO) should continue in the system operator role. In light of these concerns, APA engaged BCG to provide an expert independent opinion on market design issues to inform the Victorian regulatory design process with an international perspective.

BCG has over 15 years’ experience working on access arrangements for gas transmission systems in Europe and the United States. We have worked with transmission system operators and other market participants and have observed the operating structure and dynamics of the markets as well as the roles of the participants.

The views expressed in this paper are BCG's alone and intended as independent input into the AEMC's market development process.

2. Executive Summary

This paper contributes to the Australian Energy Market Commission's (AEMC) proposed reforms to the Victorian Declared Wholesale Gas Market (DWGM). Specifically, it relates to the design of institutional roles under the proposed changes in the Victorian gas transmission market model. The reforms have two aims: to establish a more liquid market for gas commodity trading; and to introduce an entry-exit model for accessing capacity on the gas transmission system.

For a gas transmission system to operate effectively, the roles and responsibilities of market operators in relation to the network owner must be allocated efficiently. The proposed changes will affect the current roles, so ensuring they are well allocated will help the new model to deliver maximum benefits and will reduce transitional risks.

The four key operational roles and their responsibilities are:

- the **network owner** provides financial capital for network assets;
- the **network operator** plans, builds and operates the physical gas network;
- the **system operator** manages system capacity and maintains system balancing; and
- the **market operator** manages gas commodity trading.

Different market models allocate these responsibilities in different ways, and the system of allocation has implications for market efficiency and governance.

Under the current DWGM model, APA is the network owner and network operator. The Australian Energy Market Operator (AEMO) is the system operator and market operator. Under the proposed model, the system operator role will need to include new functions, such as capacity allocation or residual balancing. The role of market operator will also change from matching mandatory injection and withdrawal bids to facilitating voluntary trading deals between market participants.

In the international gas markets that have adopted entry-exit models, some common approaches are apparent. These arise from similarities in policy makers' objectives and in underlying regulatory, economic and governance issues. Commonly, the system operator and network operator roles are combined. This delivers compelling operational and market efficiencies and cost savings by avoiding duplication (for example, in IT costs) and providing economies of scale. While this design is valid in most gas systems, it is particularly relevant in markets that operate under an entry-exit market model. Often the network and system operator roles are also closely aligned with the network owner role. Combining these roles provides a strong alignment between the network owner's financial incentives and regulatory incentives.

In the DWGM, the system operator and market operator roles are combined. This is understandable as pipeline capacity is sold stapled to the gas commodity. Yet, in the vast majority of international gas markets where capacity is traded separately, policy-makers have explicitly separated the system operator and market operator roles; particularly in larger, more liquid markets. Separating the system and market operators is preferable because there is limited overlap between the required skill sets and it can encourage market liquidity and lead to a better alignment of performance incentives. This may be particularly relevant for the DWGM, given that the market operator is a not-for-profit entity and will not face strong incentives to optimise system operations.

Compared with electricity operations, gas system operations tend to rely more on physical network management actions (for example, through operating compressors). Electricity system operations tend to rely on market-based mechanisms (such as ancillary services markets). International experience suggests this can lead gas and electricity markets to develop along different paths; it is more likely that system operators in electricity markets will be separated from network operators and owners.

In gas markets in Europe and the USA, the 'Modern TSO' model is favoured for institutional market roles. In this model, the transmission system operator owns and operates the network and acts as the system operator. The market operator is a separate entity. Grouping the network and system operations, while separating market operations, grew out of an increasing focus on free and transparent gas trading on the exchange hubs.

In Europe, entry-exit markets have strengthened the roles of both the system operator and market operator, but reinforced the need for the physical network and system controls to be jointly operated. The new functions required under the entry-exit model, such as capacity allocation and system balancing, are closely tied to the operation of physical assets.

The case studies in this paper provide several lessons that apply to the Victorian context:

- To align financial and regulatory incentives, the network owner, network operator and system operator roles should merge under a single entity. This entity would have financial responsibility for planning, developing and maintaining the network, balancing the system, and designing and selling capacity products.
- AEMO, as the market operator, should focus its efforts on creating an efficient, liquid gas commodity exchange in Victoria, which is a key policy objective of the gas market reform.
- The AER should retain oversight of APA's performance as the network and system operator and update its regulatory incentive structure to reflect the move to an entry-exit market model. The AER should revise the design of the remuneration model that provides optimal financial incentives to ensure efficiency, while providing a level of investment for system security.
- The AEMC should oversee market development and establish market rules to realise the benefits of market reform.

3. Proposed changes to the Victorian gas transmission market

3.1. The AEMC proposal to move to an entry-exit market model

This paper responds to issues raised by the AEMC in recent reports on reforms to the Victorian Declared Wholesale Gas Market (DWGM). Specifically, it relates to the design of institutional roles under the proposed market model.

In December 2015, the AEMC released a Draft Report on its review of the Victorian DWGM, which set out a package of reforms for gas transport arrangements on the Victorian Declared Transmission System. There were two main changes set out in the Draft Report:

- Move to a voluntary trading model ('exchange based trading'), which would alter the role of the Victorian market operator; from acting as a market-maker, to market administration and residual balancing.
- Move to an entry-exit model for accessing system capacity, which would require separating commodity trading from transport rights, and involve measuring and monitoring system access only at injection and withdrawal points.

In March 2016, the AEMC released a Discussion Paper relating to these recommendations, which outlined a number of design options including capacity allocation and gas balancing regimes. In the model proposed by the AEMC, it was assumed that AEMO would maintain its role as both the system and market operator under an entry-exit model. The AEMC requested comments on whether the existing allocation of functions between market participants under the proposed entry-exit model is appropriate. This response addresses the question of whether the division of institutional roles between market participants is likely to achieve the optimal balance between efficient use and operation of the system.

3.2. Stated objectives of shifting to an entry-exit model

The AEMC has stated a number of objectives for its review of the Victorian DWGM, and for moving to an entry-exit model. First, reforms seek to encourage more efficient and transparent markets. Achieving this will involve establishing an efficient and transparent gas reference price, facilitating trading between hub locations, and establishing the conditions that will allow financial risk-management products to develop.

To help support more efficient markets, the proposed reforms encourage new downstream counterparties to enter the market by, for example, providing greater flexibility for participants such as new entrant retailers and large customers to buy and sell gas in the commodity market.

Finally, the reforms encourage efficient investment in new infrastructure by establishing incentives that make investment decisions responsive to market signals.

At the same time, the proposed market design explicitly aims to preserve key features of the current market. Maintaining competition in the retail gas markets is a priority. Also, the AEMC aims to preserve arrangements where the system operator can buy gas on behalf of shippers who do not make scheduled injections. This will help the system operator to maintain system pressure and the security of supply.

These objectives informed our comparisons between the entry-exit model proposed by the AEMC and systems that operate in other markets. In particular, the sections that follow detail how the choice of particular institutional roles can be important in facilitating the development of market competition and efficient investment signals.

3.3. The case for a new market model

An important guiding principle for regulators is to ensure that benefits from any change should outweigh the cost of implementation. In reviewing the AEMC's Draft Report and Discussion Paper on market reform, it is not clear that the benefits from changing Victoria's gas market arrangements to an entry-exit model will outweigh the associated costs and risks.

Yet, if the AEMC decides to proceed with the changes, the assignment of new institutional roles will be critical to ensuring that market roles, responsibilities and incentives are appropriately aligned. This will deliver maximum benefits and reduce transitional risks.

Realigning institutional roles and responsibilities to support a new market model may add complexity to the transition. Yet, aligning decisions about the physical network and system operations will achieve an efficient allocation of capacity rights and deliver market-based investment signals. This latter point is particularly the case where points in the network that are not defined as entry or exit points need investment. Furthermore, it is essential to delineate each party’s responsibilities towards achieving the stated aims of the reforms and to create a liquid and transparent gas hub.

Given the complexities involved in determining institutional roles, we believe it is prudent that the AEMC has requested comments from interested parties specifically in relation to this issue. In our experience, appropriate institutional support has been a critical determinant of success in gas markets around the world that have adopted entry-exit systems.

4. Roles of market participants in gas transmission markets

4.1. The four key institutional roles

For a gas transmission system to operate effectively, a number of participants need to perform a range of tasks. These tasks are commonly classified into four key operational roles – network ownership, network operations, system operations and market operations. Different market models are characterised by how these tasks are broken up among market participants. The division has important implications for market efficiency and for ensuring good governance.

Exhibit 1 illustrates these four key roles and the functions associated with them. To allow comparison across international markets, we have used international naming conventions for describing the system roles, which may differ somewhat from terms more commonly used in the Australian market.

Exhibit 1: Gas transmission market functions are performed through four key market roles

	Network owner	Network operator	System operator	Market operator
Key roles and responsibilities	• Financial steering through equity ownership	• Planning, building and operating the physical network	• Managing network capacity • Maintaining system balance	• Managing commodity trades through forward and spot market • Ensuring liquidity in commodity markets
Type of regulation	• Typically faces financial incentives to respond to energy regulation	• Ex-ante energy market regulation of system availability, costs, revenues and pricing	• Ex-ante energy market regulation of system access, allowed costs, revenues and prices • Ex-post competition regulation	• Financial market regulation
Key performance indicators	• Returns to shareholders • Outperforming the regulated rate of return	• Adequacy of system capacity • Efficiency of capital and operational expenditure	• Security of system supply • Level of competition in the capacity market • Efficiency of operating expenditure	• Market liquidity and competition
Revenue model	• Company dividends	• Earns regulated tariffs paid by pipeline users	• Earns regulated tariffs paid by gas shippers, often through stamp fees	• Earns fees from market participants

4.1.1. The network owner

The role of the network owner is to provide financial capital, determine business strategy and provide high-level financial oversight of network assets. Importantly, the network owner ultimately bears the financial risk associated with network performance.

While the network owner will be subject to relevant local financial regulations, it is not directly regulated by the energy regulator. However, given that the network owner's financial interests are closely tied to regulatory outcomes, network owners typically seek to maintain strong regulatory relationships.

Based on the financial performance of the pipeline company, the network owner earns a return on its invested capital. The network owner aims to earn above its risk-adjusted cost of capital, which is part of the allowed regulated rate of return on network assets. It can achieve this by implementing efficiency measures that enable it to spend less than the regulated allowance, by avoiding penalties related to system reliability, and by undertaking non-regulated projects in addition to its regulated activities.

The network owner is typically the entity that is best able to respond to financial and operational performance incentives. This is because it has the authority to make capital allocation and business strategy decisions, and because its financial returns are closely tied to the operational performance of the network. Such incentives are put in place by regulators to ensure the system operator is efficient, and are critical to ensure that the benefits of these efficiency improvements are ultimately passed on to gas users.

4.1.2. The network operator

The network operator is responsible for planning, building and operating the physical gas network over a medium to long-term horizon (from one week to many years ahead) to provide transport capacity to gas shippers.

The financial returns of the network owner are critically dependent on actions taken by the network operator. Hence, there is a strong need for the two parties to have their incentives closely aligned. This is typically achieved either directly, though a shared ownership structure, or indirectly, through contractual arrangements or performance indicators linked to financial incentives.

The network operator acts as a natural monopoly; each pipeline system is operated by a single operator. Hence, the network operator functions as a regulated business, supervised by an energy market regulator responsible for licensing issues, system availability and economic regulation of costs, revenues and pricing.

Key tasks for the network operator are network planning, asset management, developing maintenance strategy, and field operations. In exchange, the network operator earns income through regulated tariffs paid by pipeline system users.

The most important performance indicators for a network operator are the efficient provision of adequate system capacity to meet demand (that is, ensuring that the network is not under- or overbuilt), and whether system requirements have been maintained through efficient levels of capital and operating expenditure.

4.1.3. The system operator

The core role for the system operator is managing network capacity made available by the network operator. Other roles include short-term (intra-day) system monitoring, maintaining system security, and managing capacity allocation and system balancing.

To maintain system integrity, there is a single system operator in each interconnected gas transportation system, independent of the number of other market participants. As a monopoly, the system operator is subject to ex-ante energy regulation, focussed on system access conditions and economic regulation of allowable costs, revenues and prices. The system operator may also be subject to ex-post competition regulation by a competition authority, focussed on ensuring that the allocation of capacity rights is non-discriminatory.

Key tasks for the system operator are demand forecasting, system dispatch, system balancing, and selling system capacity (in particular, selling short-term capacity to support system balancing). The system operator earns income through regulated tariffs, which are paid by gas shippers. System operators' tariffs are often charged as stamp fees; users pay a fixed fee that is not strongly related to actual usage. This pricing approach reflects that the role of the system operator is to provide equal access to all shippers, regardless of their size. System operators' fees usually constitute only a small part of total regulated network fees paid by shippers.

Performance indicators for the system operator are security of system supply, the level of competition in the traded capacity market, and operating expenditure efficiency.

In traditional point-to-point contract carriage markets the role of the system operator is essentially merged with the role of the network operator. This occurs because network usage and capacity rights are bundled, so gas shippers are responsible for balancing their loads and any residual balancing is closely linked to the operation of the physical network.

4.1.4. The market operator

The core role for the market operator is managing commodity trades on the network. The role of the market operator mostly involves activities that occur over the medium term (on forward markets) and in real time (daily or on spot markets).

Unlike the network operator and system operator, the market operator functions in a competitive market. However, many markets feature a dominant market operator that plays a de facto monopoly role. The market operator is not subject to ex-ante regulation by the energy regulator, but its role as a market maker means it is subject to financial market regulation.

Whereas the key objectives of economic energy regulation are to incentivise operational efficiency and system adequacy, financial regulation has aims like encouraging effective risk management and adequate capital reserves. Given this incentive, their skill sets and their priorities, market operators often play a role across different financial, product or commodity markets. For example, the market operator for Henry Hub in the USA is the same firm that operates the New York Stock Exchange.

Key tasks for the market operator are creating and maintaining a platform for forward and spot commodity trading, designing products that meet market participant’s needs, transferring market information and managing contract settlements. The market operator earns income through fees from market participants.

From a system perspective, the key performance indicators for the market operator are market liquidity and the level of competition in commodity markets (as distinct from capacity markets).

4.2. Institutional roles in the Victorian gas market

The remainder of this paper examines the potential governance configurations for these institutional roles under entry-exit market models. The AEMC's Discussion Paper on the Victorian DWGM proposes a division of the required roles under a new entry-exit market model. In particular, the AEMC highlights the proposed roles of two key participants; APA and the Australian Energy Market Operator (AEMO).

Under the current model, the role of APA in the Victoria Transmission System encompasses network ownership and network operations, while AEMO's primary role is as the system and market operator. The combination of the system operator and market operator roles in understandable in the unique circumstances of the DWGM, in which access to pipeline capacity is stapled to gas commodity purchases. However, where capacity is traded separately from the gas commodity, as in an entry-exit market, there are logical reasons for separating these roles.

Under the proposed entry-exit model, the system operator will assume new functions such as capacity allocation and residual balancing. The role of market operator will also change significantly, from matching mandatory injection and withdrawal bids to facilitating voluntary trading deals between market participants.

We view the key institutional design question for the Victorian market as being how the system operator will be aligned with the network owner/operator and market operator to best meet the AEMC's market development goals. In our experience, this is a similar challenge to that faced by European markets and these choices will have a material impact on market development.

5. Design choices for network, system and market operations

In gas markets that have adopted entry-exit models, the network, system and market operator roles tend to be configured in similar ways. While many international markets adopt similar approaches, some variations also tend to emerge in response to different market conditions or design priorities.

The key design choices concern the level of alignment between the network and system operator, and alignment between the system and market operators.

5.1. Reasons to combine network and system operators

One of the features most commonly seen in international gas markets is the combination of the network operator and system operator roles. This design choice is seen frequently because combining the network operator and system operator roles delivers a strong alignment with regulatory incentives, a number of compelling operational and market efficiency benefits, and cost savings. While these reasons are valid in all gas systems, they are particularly relevant in markets that operate under an entry-exit market model.

5.1.1. Strong regulatory incentives

Network owners with the right regulatory incentives are strongly motivated to ensure that pipeline systems operate as efficiently as possible. Strong operational performance is one of a limited number of ways network owners can earn returns in excess of the rate of return allowed by the energy regulator. Efficient operation of the transmission network is a joint responsibility of the network and system operators, so having control of both is an important tool for a network owner to manage financial risks.

From a regulatory perspective, combining the roles of network owner, network operator and system operator is a powerful measure to incentivise efficient operation of the overall gas transmission system. It allows the regulator to apply a simpler and more consistent system of economic incentives to encourage efficient operation of the system. For example, when dealing with a combined network and system operator, the regulator does not need to consider the potentially conflicting impact of regulatory settings on separate network and system operations, or to facilitate the exchange of information between different regulated businesses. Instead, these issues are managed internally by the regulated company.

The benefit of having a joint network and system operator are even greater when compared with an arrangement where the system operator is a not-for-profit company, which cannot fully respond to appropriate financial incentives for efficient operation. Extending the strong efficiency focus of a well-regulated network owner/operator to system operation provides the simplest and most effective tool for the regulator to keep overall cost of network usage – and thus the prices for end-users – as low as possible.

5.1.2. Operational and investment efficiency

A combined network and system operator has better access to the physical assets and system tools required to respond to network faults quickly and optimise system performance. For example, in case of an unforeseen equipment failure in the network, the fault recovery process and the reallocation of network flows requires close cooperation between the network and system operators. The standard international practice in such situations is that the system operator (more specifically, the dispatch centre) directly commands the field service staff dealing with fault recovery. This fast and coordinated reaction is especially important in systems that suffer from frequent load imbalances, and thus have a greater need for alignment between parties.

Another example of the need for close cooperation between network and system operators is the example of intra-day line-pack management described in the AEMC Discussion Paper (p63). On days of high demand, the system operator may find it optimal to boost line-pack by injecting more gas into the pipeline earlier the day to deal with high demand later the day. The higher injection rate may affect the contracted firm capacity of the shippers, and thus require cooperation with the network operator to manage settlements.

Furthermore, combining the network and system operators helps to ensure that efficient decisions are made to balance long-term capacity investments against short-term approaches for managing constraints. A key role of the system operator is to ensure high levels of reliability and system security. Yet, there are a number of ways the system operator can achieve this objective. One approach is building enough network capacity into the physical pipeline system to meet all gas demand, even on days when demand is extremely high. This approach is effective, but extremely expensive as it can involve large investments in infrastructure that is used only rarely.

An alternative is to build enough physical capacity into the system to meet demand at most times and on most days, but to meet rare, peak-day events, through other approaches such as using line-pack, injecting LNG into the system (where available) or employing voluntary demand curtailment. This can be a more efficient way to manage capacity, but may only be possible under a combined network and system operator model, which provides the system operator with a broader suite of system management tools. It is not clear that a not-for-profit system operator would respond to the incentives to avail itself of these tools.

In some cases, it may also be efficient to accept a slightly higher risk to system reliability to achieve substantial savings in network costs. Under a sound regulatory regime, the network operator is incentivised to make efficient investments in network capacity only up to the level that provides a minimum sufficient level of system reliability. Investing more would mean delivering a level of system reliability that costs more that it delivers in value to customers, which reduces the net welfare of system users.

Companies that perform both the network and system operator roles naturally consider trade-offs between reliability and costs in their business decisions. While energy regulators both can and should also balance these factors when approving network investment plans, with a merged network and system operator the regulator has more scope to define high level performance targets (the rate of return on capital expenditure, system security level, or operational KPIs) and let the regulated company find the best solution to optimise these factors.

For many asset management tasks, there are close linkages between the roles of network and system operators. For example, designing maintenance strategy is the responsibility of the network operator, while it is the system operator that runs the compressors to maintain system pressure. The asset and maintenance strategy for compressors (which includes decisions such as the asset inspection frequency, repair vs. replacement, etc.) assumes standard asset operation schedules. However, compressors may be run more often to help manage imbalances, which eventually leads to more wear and reduces their expected life. This long-term impact on costs is not passed on to a separated system operator, which could lead to practices that are optimal from the system operator's standpoint, but suboptimal for the gas system at large.

5.1.3. Market efficiency benefits

Combining the network and system operator roles can deliver benefits for market efficiency because the combined operator may have a greater incentive to offer more innovative capacity products, such as products with different terms or bundled products including firm and interruptible capacity. A system operator charging stamp fees from shippers has much less incentive to innovate. Currently in the DWGM, only a single 'vanilla' gas transportation product is available.

Combining the network and system operator roles is also a better arrangement for shippers, as it allows them to trade with a single counterparty to purchase both firm and interruptible pipeline capacity. Shippers are also able to settle their accounts under a single bill, rather than having to trade with two separate counterparties. The model being proposed by the AEMC would require a shipper to sign a contract for long-term firm capacity with one entity, and then purchase short-term capacity through a different entity. This imposes transaction costs on the shipper and also reduces the shipper's ability to negotiating a deal for their whole capacity portfolio to optimise the price.

5.1.4. Savings on overhead costs

Many of the corporate overhead costs associated with a system operator are similar to those required for the network operator, so combining the two has the potential to avoid duplication and provide economies of scale. Information technology is a key example of where combining the network and system operator roles has the potential to deliver meaningful savings. An integrated operator avoids the need to install, monitor and manage two separate IT systems, removes the need for interfaces between these systems and reduces the number of IT interfaces with other market participants.

Merging the system operator and network operator also has the potential to lead to savings in central function costs, such as human resources and finance.

5.1.5. Efficient allocation of roles under an entry-exit model

While combined network and system operators are seen in most market models, the combined role is even more critical under an entry-exit model. In Europe, as more markets have transitioned to an entry-exit model, network and system operator roles have become more closely linked. This is because entry-exit models expand the complexity of the system operator role, which increases the benefits from aligning roles to the network operations. In some European transmission system operators the dispatch centre, traditionally a systems operations function, has been fully integrated into network operations.

There are two main reasons why a combined operator role is more important under an entry-exit model. In the short term, introducing an entry-exit model typically means that operational decisions become a critical component of intra-day system planning. This includes choices such as how to run compressors, or whether to manage constraints using physical methods such as contractual voluntary curtailment, LNG injections or line-pack.

In the longer term, an entry-exit model will create trade-offs between managing constraints through system planning approaches, or building network infrastructure. While there is a clear market signal for investment decisions at entry and exit points, the internal interfaces within the network are not seen by market participants other than the network and system operator. A combined network and system operator has stronger incentives and greater flexibility to make optimal investment decisions at these internal interfaces.

5.2. Reasons why the system and market operators are often separated

Another feature of international gas markets is that larger, more liquid markets tend to favour separation between the system operator and market operator roles. This decision is related to the difference in the skill sets between system and market operators, encouraging market efficiency and aligning performance incentives. A separation of the system and market operator roles would be appropriate for the Victorian gas market.

5.2.1. Leverage specialist skills

One clear reason for the separation is that the system and market operator roles often require different skill sets; system operators work with energy regulators to optimise system performance, whereas market operators work with financial regulators to manage market risks. In larger markets, this often means that a specialist market operator assumes the role. For example, Intercontinental Exchange Group (ICE) is the market operator for TTF gas market in the Netherlands and Henry Hub in the USA, as well as for the New York Stock Exchange and other financial and commodity markets.

5.2.2. Encourage market liquidity

Separation of the system and market operator roles may also encourage more participants to enter the market by avoiding real or perceived conflicts of interest. For example, traders who do not own the physical commodity may be concerned about entering a market run by the system operator due to concerns that the market operator may distort the market through system balancing activities. Discouraging these traders will reduce market liquidity.

Similarly, combining the market and system operator roles may limit competition between market operators. While it is typical for a single dominant market operator to emerge in each market, it is possible for the incumbent operator to be displaced if it is charging high fees or not operating the market efficiently. However, if the system operator and market operator roles were combined, this would act as large barrier to entry for a new market operator and may potentially create a need to regulate market operator fees due to the lack of competition.

5.2.3. Align performance incentives

From the perspective of market design, aligning the system operator to the network operator, rather than the market operator, creates a better alignment of performance incentives. As noted previously, the network owner has a strong financial motivation to respond (and ensure that the network operator responds) to performance incentives set by the energy regulator. The incentives for the market operator are weaker.

The misalignment of incentives between the market operator and the system operator is a particularly acute in the case of the Victorian market, where AEMO is the market operator. AEMO's role as a not-for-profit entity that recovers fees from market participants means that it will not be directly impacted by the rewards or penalties linked to system performance, so will not have incentives to drive high standards of system performance.

Box 1: The challenge of implementing financial incentives for a not-for-profit business

In its recent discussion paper, the AEMC suggested that AEMO would assume the role of the system operator under a proposed entry-exit model. Yet, the AEMC raised the concern that "the ability to use financial incentives to encourage efficient decisions will be limited by AEMO’s status as a not-for-profit entity".

Financial incentives play a critical role in ensuring that a system operator acts in an optimal way to achieve the desired policy outcomes. One of the key motivations for linking network owners, network operators and system operators in many markets around the world has been driving operational performance, as energy regulators recognise that performing well against regulatory incentives is a critically important part of how network owners make money. In the absence of this structure, not-for-profit operators face weaker incentives to achieve incentive targets set by the energy regulator and may be more inclined to take a conservative approach to meeting operational targets.

Moreover, there is a risk that having a system operator with a substantial government shareholder may result in implicit or explicit pressure to drive extremely high standards of system reliability that are not economically justified. This has the potential to lead inefficient levels of system investment.

5.3. Differences in gas and electricity markets

When facing market design questions, it may sometimes be appropriate for decision makers to consider the approaches adopted in similar markets. For the gas transmission market, the most common comparison drawn is to electricity transmission markets, and there is evidence to suggest that the current Victorian gas market design was modelled on electricity market counterparts. Yet, there are distinct physical differences between the two markets that can justify quite different approaches to assigning market roles among participants.

5.3.1. Key differences between gas and electricity transmission markets

The major physical difference between gas and electricity markets is that electricity is transmitted almost instantaneously, while gas transport takes considerably longer. The implication of this physical difference is that it can make sense to align a system operator with a market operator in electricity markets, while in gas markets the system and network operators are more closely linked.

In electricity markets, instantaneous transport means that system balancing can be carried out in real time, and is typically conducted through market-based mechanisms, such as the ancillary services market. As the system balancing role is conducted through a market-based mechanism, there is a much stronger alignment between the system operator and market operator roles. In gas markets, transport takes much longer and system balancing relies on physical network infrastructure like compressors, LNG injections and line-pack. This means that the system operator role is much more closely aligned to the network operator.

At points where different systems meet, electricity networks require more real-time coordination between different system operators to manage the uncontrolled flow of electric current over system interconnections. Gas flow at interconnection points is easier to limit or control through systems of compressors and valves. This means that the communication between gas system operators can be limited to information exchanges and the joint management of the interconnector capacity. Again, the impact is that system operations are more closely tied to network operations in gas than electricity markets.

5.3.2. Differences are enhanced under an entry-exit market model

In some ways, the current gas market model in Victoria resembles the structure of the electricity market model; allocation of transmission system capacity is managed through the commodity market, and injections and withdrawals are balanced at frequent intervals through the market operator. As such, AEMO's dual role as both market and system operator do not impose major barriers to market efficiency under the current DWGM market structure.

Yet, an entry-exit model operates quite differently; trading is voluntary and performed through a market hub, and pipeline capacity and the underlying gas commodity are traded separately. This enhances the need to separate the market operator and system operator roles.

5.3.3. International markets reflect these differences

Looking at the arrangements in international gas and electricity transmission markets provides evidence to support the view that system operator roles need to be treated differently in gas and electricity markets. In electricity markets, there are some examples of independent system operators that do not have a role in network operation, reflecting that system balancing in the electricity market is less dependent on controlling the physical network. For example, the New York State ISO (NYISO) operates as an independent system operator for an electricity system that spans several utility companies with different owners and network operators.

In Europe, the separation of network ownership from system operations in electricity transmission markets is a topic of ongoing discussion. There are different motivations among policy makers, ranging from attempts to encourage an integrated European energy market to retaining nationalised control of system operations. Yet, even where there debates are taking place within electricity markets, there has not been an equivalent attempt to separate the network and system operators in gas markets.

6. Lessons from international markets

6.1. Market functions are closely linked to the market model

The development of entry-exit gas markets requires market designers to reconsider institutional roles within the gas transmission market.

Point-to-point contract carriage models were widely used in Europe before entry-exit systems were adopted, and remain the norm in US markets. Under a point-to-point system, the role of system operator is limited. This is because usage and capacity rights are bundled, so all required capacity is allocated before gas is dispatched, which avoids problems with system congestion. The point-to-point model ensures equal access rights by obliging the network operator to negotiate with all shippers, and also makes shippers responsible for balancing their own loads at each entry and exit pathway within the network.

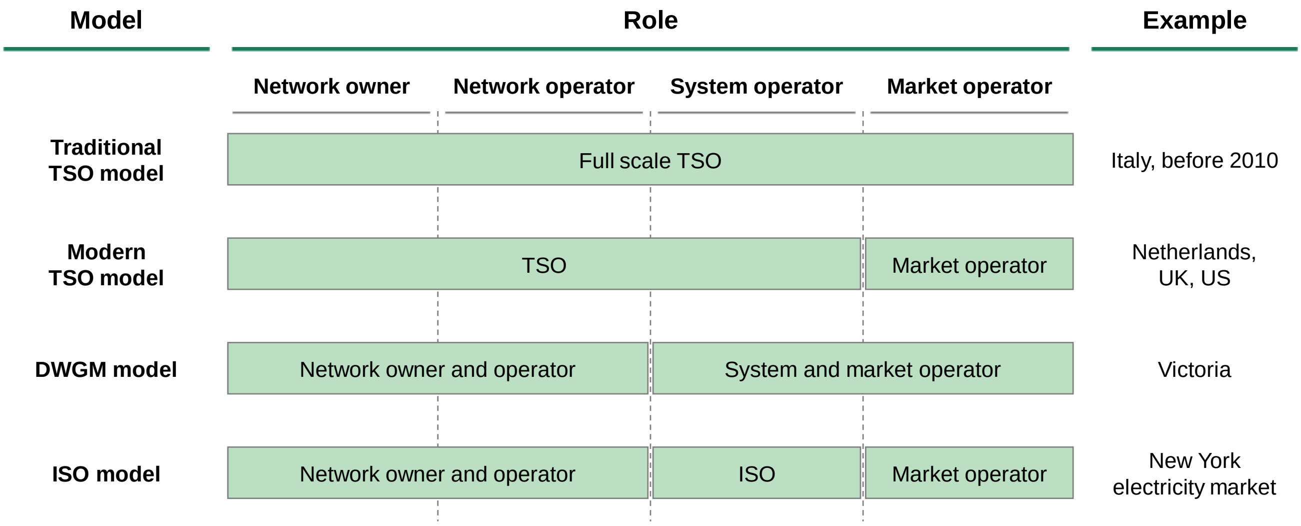
The move to an entry-exit system reinforced the need for the physical network and system controls to be jointly operated. New functions required under the entry-exit model, such as capacity allocation and system balancing, are closely tied to the operation of physical assets. The system operator role under the entry-exit model also requires much closer coordination between long-term and short-term system planning, and maintaining an efficient balance between the physical condition of the network and the system reliability.

The market operator role was created in parallel with the move to entry-exit models in many markets, and with the evolution of market hubs. Before this, capacity access and commodity transfer products were typically bundled by the transmission system operators and offered to the relatively small number of physical shippers.

The market operator role was created because market operations need to be managed separately from the physical network or network capacity transactions to effectively operate a modern commodity trading platform, where gas can change hands multiple times before physical delivery. Separating the market operator role also delivers other benefits such as allowing system and market operators to develop different specialist skill sets and encouraging market efficiency.

Exhibit 2 illustrates four distinct models for the separation of institutional roles across transmission systems in different jurisdictions.

Exhibit 2: International models for organising key market roles



Under the 'Traditional TSO' model, network ownership and each of the network, system and market operator roles are combined under a single entity. This model is rarely seen in markets with an entry-exit design, but was used in Italy by the full-scale TSO, SNAM, up until 2010. After SNAM failed to deliver a significant improvement in market liquidity in the Italian gas hub, regulators intervened in 2010 to separate the market operator role from SNAM's operations, driven by the view that an independent operator could deliver more efficient market operations. The Italian market now more closely resembles a 'Modern TSO' model.

The 'Modern TSO' model includes a combined network owner, network operator and system operator, and a separate market operator. It is widely regarded as the 'best practice' model for gas transmission system design. The choice to group network and system operations while separating system and market operations was driven by an increasing focus on the importance of free and transparent gas trading on the exchange hubs. This model is used in major European gas markets, like the Netherlands and UK, and in the USA.

The Declared Wholesale Gas Market model is a model that is unique to the Victorian market. The key drawbacks of the model are that the not-for-profit system operator has less financial motivation to respond to regulatory incentives, it inhibits the ability of the system and network operators to work together to manage constraints, and it limits innovation and competition in the market operator role.

The independent system operator ('ISO') model involves separate network, system and market operators. It is a model that is sometimes seen in electricity markets. For example, the New York State electricity market in the USA has adopted an ISO model and the model is under consideration in a number of European electricity markets. However, this is not a model seen in gas markets due to closer relationship between the network and system operators that is required to efficiently manage system balancing.

6.2. Combining the system and network operators

Our experience in international gas markets is that network and system operator roles are normally combined within the same entity.

6.2.1. Gas markets in Europe

In Europe, network operator and system operator roles are typically closely integrated under the gas transportation system operators (TSOs). In each country in Europe, the system operator also operates the physical network.

There are some European examples where network operators are not combined with the transmission system operators. This happens where there are multiple network owners in one interconnected gas transportation system; for example, in Germany or Austria. In these cases, the largest network operator acts as the system operator for the entire transportation system.

Interconnector pipelines linking different transportation systems are often owned and operated by individual project companies, which do not have a system operations role. For example, this is the case for the Bacton-Zeebrugge interconnector, which links the UK and Belgium. Such interconnectors, which make up the majority of recent private investment in European pipelines, are typically exempt from the entry-exit market rules.

The introduction of entry-exit system changed the roles and responsibilities of transmission system operators, but did not change the fact that they are responsible for operating both the physical network and the transportation system.

The European Commission (EC) intends to empower the common European energy markets and gradually eliminate differences between the regulations of individual member states. Yet, the EC has not challenged the idea that different system operator arrangements can operate in different local gas markets. Rather, it has focussed on strengthening the common, European-level regulation of energy markets.

6.2.2. Gas markets in the USA

In the USA, interstate and intrastate pipeline owners act as integrated network and system operators. The entry-exit market model for access and tariff regulation is rare; most markets still use contract-carriage or common-carriage systems, and it is typical for interstate pipelines to function under bilateral, point-to-point models. Some of the larger gas systems that operate within state borders (e.g. in Texas) have adopted models that are similar to the entry-exit approaches used in Europe.

Separation of the network operator and system operator roles is not prevalent in the USA. The Federal Energy Regulatory Commission (FERC) has jurisdiction over interstate pipelines, but does not distinguish between the network operator and system operator roles.

6.3. Separating system and market operations

In our experience both in Europe and in the USA, it is more common for the system operator and market operator roles to be separated in more developed markets. That is, the physical gas transfer or gas title transfer (the virtual transfer of the gas rights) is managed by the transmission system operator, but commodity contracts are processed by a market operator.

Typically, the transmission system operator establishes a physical or virtual hub. In terms of capacity management, hubs are treated as entry and exit points within the pipeline system. The TTF (Title Transfer Facility) in the Netherlands is an example of a virtual hub operated by the Dutch transmission system operator, Gasunie. Henry Hub in the USA is a physical hub operated by Sabine, a pipeline company.

The market operator sets up a platform to buy and sell gas trading products (daily contracts, forwards, etc.) between physical shippers and non-physical traders on the hub. For example, Intercontinental Exchange (ICE) handles contracts for TTF in the Netherlands and Henry Hub in the United States of America. There can be more than one market operator on a single hub. For example, the European Energy Exchange (EEX), a leading European energy exchange company also provides a platform for TTF.

Box 2: Gas hub regulation in the USA

In the USA in the 1980s, a number of market hubs emerged, operated by interstate gas pipeline companies. These hubs developed to facilitate growing gas trading across states. In 1992, in response to this development, FERC issued an official Order mandating that the interstate pipeline companies (only interstate pipelines fall within FERC's jurisdiction) refrain from commercial activities and focus strictly on gas transportation.

As a consequence, market centres were set up by gas companies to provide transparent transfer services to gas shippers at the main physical hubs. The key services provided at these market centres are physical transfers between interconnecting pipelines, and physical balancing. The market centres also provide commercial services, such as access to trading platforms or capacity markets, and most also provide virtual title transfers for shippers.

Over time, commercial platform services have gradually been consolidated and acquired by professional exchange operators. For example, one of the largest commodity exchange operators, Intercontinental Exchange Groups (ICE) now operates more than 10 regulated exchanges in US, Canada, Europe and Asia, (including Henry Hub in US, and TTF in Europe), and the New York Stock Exchange.

Box 3: A comparison of TTF and PSV: how a separate market operator can help to increase liquidity

In Europe, the largest gas exchange is TTF, a virtual hub in the Dutch gas transportation system. Since its creation in 2003 by the Dutch gas transmission system operator, Gasunie, TTF has evolved into a reference price point for all European gas market trading. It has assumed this role because it is a highly liquid, transparent market, which has developed innovative products, and offers good connectivity to important supply and demand regions.

International energy exchange operators like APX-Endex have operated a commercial platform on TTF from very early on. Recently, ICE, the largest global gas exchange operator, acquired the gas market operation business from APX-Endex and set up a joint initiative with Gasunie to operate a TTF platform. Now, gas traders can use the ICE platform to make deals on both the largest (TTF) and second largest (NBP) gas exchanges in Europe and on Henry Hub, the largest gas hub and reference point in USA.

On the other hand, the Italian gas hub, PSV, was operated by SNAM, the gas transmission system operator, from its creation in 2003 until 2010. While Italy is the third-largest gas market in Europe after Germany and the United Kingdom, and has interconnection to the supply regions in the South, North and East, PSV failed to significantly increase market liquidity and to become a real international trading platform. Market participants blamed the failure on pipeline bottlenecks, a lack of market transparency, and the misalignment of incentives for SNAM and of its vertically integrated owner, ENI.

Regulators reacted to the apparent underperformance by changing the market structure and entrusting GME, a state-owned power market operator, to organise and manage the gas market and associated services on PSV. In 2015, GME and SNAM signed a cooperation agreement with ICE Endex to introduce physical gas contracts on PSV.

7. An optimal structure for Victoria

The international case studies and economic arguments presented in this paper provide a number of lessons that can be usefully applied to the Victorian context.

Of the four market models presented in Exhibit 2, the model that is most appropriate to support an entry-exit gas transmission market in Victoria is the 'Modern TSO' model. Internationally, this model has been widely adopted because it results in a system operator that has a strong financial motivation to respond to regulatory incentives, allows the system and network operator to work jointly to manage constraints, and encourages innovation and competition in market operations.

Moving to a 'Modern TSO' model in the Victorian market would require two key steps:

1. Merging the network owner, network operator and system operator roles under a single entity. This entity would be assigned full responsibility for planning, developing and maintaining the network, for system balancing, and for designing and selling baseline (firm) and additional (interruptible) capacity products.
2. Create a separate market operator role, with responsibility for developing the gas exchange platform, designing spot and forward commodity products, developing risk management solutions, and providing reference price information to all market participants.

In practice, this would involve making changes to the current DWGM roles of some market participants. Aligning the system operator with the network owner and operator would involve transferring a number of functions from AEMO to APA. This would include functions like managing gas flows, operating compressors, system dispatch, balancing and managing pipeline capacity. As the system operator, APA would also take on the role of developing new capacity allocation mechanisms and capacity trading platforms, and creating innovative solutions for system balancing.

In other Australian gas markets, APA has experience in functions that extend beyond its network operations role in Victoria. Hence, we expect that transferring the systems operator role to APA would not represent a major operational risk through the transition period to an entry-exit model, or require a major expansion of capabilities beyond what would already be required as a result of changing the market design.

Under the revised model, AEMO would remain the market operator and would focus its efforts on creating an efficient, liquid gas commodity exchange in Victoria. The market operator will play a larger role under an entry-exit market model; it will be critical to ensuring efficient commodity market operations and will likely need to develop its increasingly specialised capabilities.

The AER should retain its oversight of APA’s network and system operator performance and update its regulatory incentive structure to reflect the move to an entry-exit market model. Examples of AER functions under the entry-exit model include providing oversight for system development plans, and approving the revenue allowance for APA’s regulated activities. The AER will play a critical role in designing a remuneration model that provides optimal financial incentives to ensure efficient operations, while at the same time providing for an efficient level of investment to provide sufficient system security.

The AEMC would oversee market development under the new Victorian market model, and be responsible for establishing market rules to ensure that benefits from market reform are realised. Examples of new requirements under the entry-exit system may include amendments to the National Gas Rules to reflect the significant changes arising from implementing a new market model.

The evolution of the Victorian gas market will be shaped by the current debate about the design of a new entry–exit market model. Ensuring that the system is designed in a way that meets the AEMC's objectives is critical to ensuring that markets operate efficiently, the system operates securely, and that capacity investment signals are efficient.