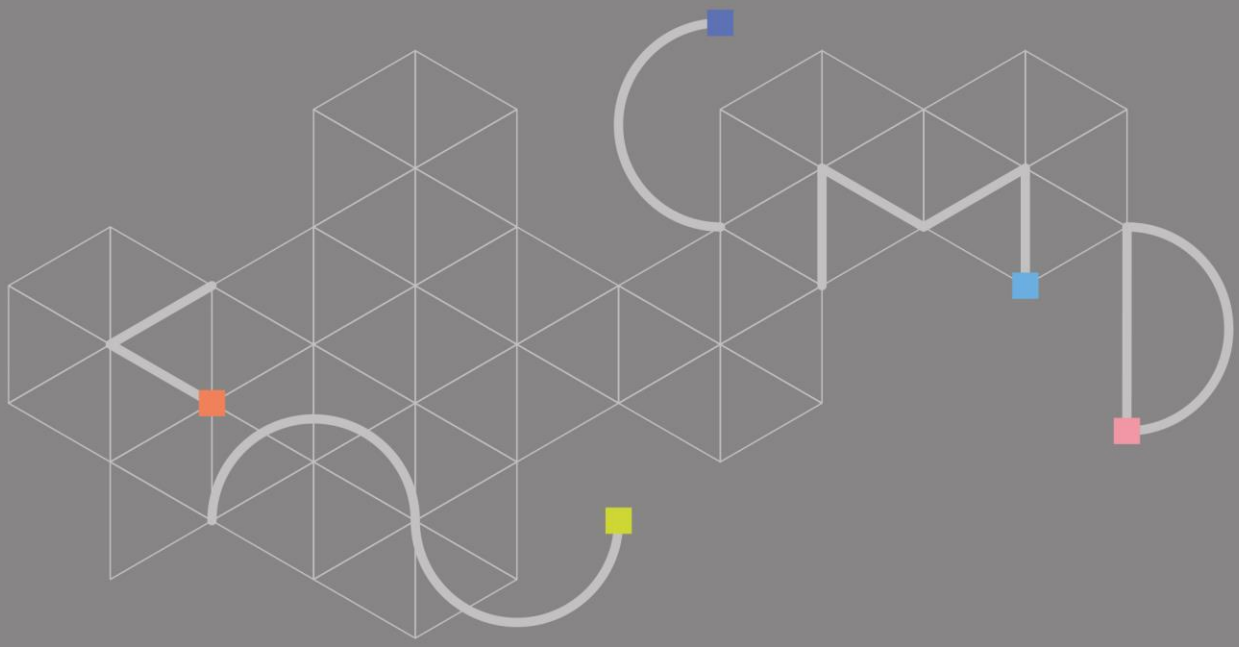
CENTRE FOR MARKET DESIGN

THE UNIVERSITY OF MELBOURNE



PROCUREMENT CASE STUDIES: VICTORIA

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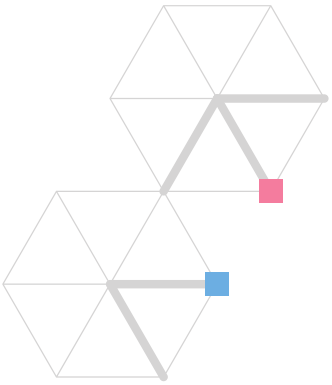
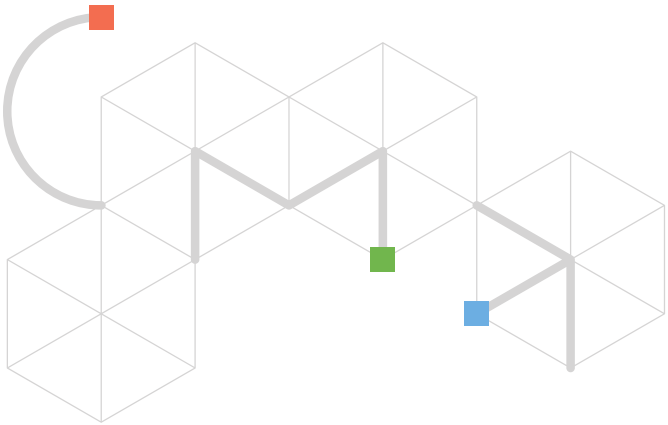




Summary

Developments in microeconomic theory, experimental economics, and information and communications technologies will have a significant impact on the way governments procure goods and services. We report on four case studies in this paper to illustrate how the Centre for Market Design has applied economic design to improve government procurement outcomes.

Where markets are efficient, competition determines the allocation and price of goods and services. Under these conditions, the best procurement strategy is to purchase from the market at prevailing market prices. Where markets are inefficient owing to a lack of competition, public goods, thin markets, or other transaction complexities, it is now possible to design fit-for-purpose mechanisms that improve the procurement outcomes for government. Modern microeconomic theory, laboratory test-bed processes, real world pilots, modern evaluation techniques, and information and communication technologies (ICT) are all important elements of progressive procurement design. This package of ideas, processes and technologies can deliver cost savings, reduced transaction costs, and reduce the scope for corrupt behaviour when compared with standard procurement processes.

This paper summarises the work that the Centre for Market Design has undertaken in applying modern procurement techniques to common government procurement problems. We use four case studies to illustrate a generally applicable methodology, the breadth of procurement problems it may be applied to, and the policy outcomes that have been realised from implementation involving the CMD. The case studies discuss procuring: electricity for small government establishments, fuel for the government vehicle fleet, medical expertise for medical panels, and environmental goods and services from private land.

Electricity

A significant problem with standard procurement practices is that the lengthy and iterative process does not align well with the dynamism and price volatility of the wholesale electricity market. In practice, energy retailers are forced to bear increased price risk as a consequence of the procurement process, which is then priced into their tenders. By separating price risk from other network and retail services, the procurement problem resolves to a simple competition over retail margins. The CMD anticipates a further procurement savings under this model because government is able to bear electricity price risk at lower cost than electricity retailers.

Key attributes

- Proposed method to replace a sealed-bid tender and negotiation process
- Procurement auction used to select a retailer to provide only customer and billing services
- Price risk borne by the government rather than the electricity retailer
- Benefits arise from heighted competition over retail service margins, and reduced cost of managing price risk
- Procurement model finalised and available to be implemented

Fuel

Fuel is a commodity for which there is an established market suggesting that there is limited scope to improve on market outcomes. The first, somewhat surprising result from the implementation of a re-designed fuel procurement auction is the extent of the cost savings achieved. Improvements to the structure of the property rights offered to participants (i.e. the introduction of a primary supplier and two secondary suppliers) and the use of a sealed-bid

auction with no negotiation yielded a 100% increase in the fuel discount for the primary fuel card. This will give rise to a significant cost saving when applied to the 50 million litres (per year) of fuel purchased by the Victorian Government.

Key procurement model outcomes

- Method replaced a sealed-bid tender and negotiation process
- Method used an improved property rights structure including differentiation between a primary supplier and secondary suppliers
- Procurement benefits arise from focussing competition on well-articulated competitive margins and using a procurement mechanism that mitigates scope for collusion.
- Truncated version of the model yielded a 100 per cent increase in discount from the primary supplier

Medical panels

Research into the design of a procurement process for Medical Panels has resulted in a mechanism that appears to have relevance to a wide range of professional and other services that are currently procured through a panel process. The objective of this procurement program is to discover the remuneration needed to enrol the various types of private sector medical experts required to assess claims for injury referred through the court system and Worksafe processes. The mechanism proposed will enable competition to be introduced into the panel formation stage for any ad-hoc panel of services required by government. This means that the purchaser of services can select providers from a panel based on expertise and required remuneration. Competitive revelation of this information in the panel process will reduce administration costs for government and improve and economic efficiency some of which will be appropriated by government.

Key procurement model outcomes

- Method anticipated to replace an administered price scheme
- Method uses an auction to select medical experts and determine remuneration rates
- Procurement benefits arise from efficient pricing of medical experts' time, and associated dynamic effects anticipated to increase supply
- Method scheduled to be piloted in 2016

Environment

The application of economic design and incentive theories to environmental procurement programs achieved an estimated 30% improvement in economic efficiency. Some (unknown) proportion of this gain will be appropriated by government as a cost reduction and some will be appropriated by landholders in the auction as a payment (rent) for revealing information. Other important results include the importance of linking different policy programs (mechanisms) where there is joint-supply of environmental goods and services (e.g. increases in habitat stock increase carbon sequestration). Analysis of the pilot data suggests that linking biodiversity conservation with a tradable permit market for carbon would reduce the cost of biodiversity conservation programs and that the savings rise as the price of carbon increases.

Key procurement model outcomes

- Method replaced a fixed price grant
- Auction of conservation contracts between private landholders
- Procurement benefits arise from introduction of competition to select least cost suppliers of environmental goods and services, and improved contract incentives to deal with moral hazard
- Method yielded a 30 per cent efficiency gain, part of which manifests as a cost saving to government

Background

Government makes some of the goods and services needed to deliver public services but purchases a substantial proportion of these from the market. The Victorian Government, for example, purchases around $5bn of goods and services each year including commodities such as: fuel, electricity, stationery, cars etc.; professional services, such as training, policy advice, legal services; though to highly specific services that assist those with disadvantage or disability. Procurement represents one of the important public sector applications of the economic ideas and design methodology collectively referred to as economic design. These ideas open-up the prospect of harnessing competition and incentives more effectively to achieve cost savings for government. The use of experimental economics to test and refine the procurement mechanism before implementation is also an important innovation relevant to government.

This report summarises the CMD's experience in applying economic design to procurement. It includes a brief overview of the key economic design ideas relevant to government procurement and the processes used to test and refine procurement mechanisms before they are implemented. Four case studies are then used to illustrate the types of institutions that arise from a designed approach to procurement. The case studies refer to procurement of: electricity for small government establishments; fuel needed for the government fleet; procurement of medical expertise needed to assess the extent and severity of injury referred under the Wrongs Act; and environmental procurement. Each of these goods or services has very different characteristics and complexities leading to unique procurement solutions. The final section of the report notes the outcomes and insights that have been achieved through the experimental test-bed process or pilots completed for these goods and services.

Economic design and procurement

The economic design process (see Roth 2002) involves the application of modern microeconomics to design fit-for-purpose institutions/policy mechanisms. Because many designed policy mechanisms can have unique characteristic, a complementary process has emerged that allows these mechanisms to be tested, refined and rehearsed in the economics laboratory. This is referred to as experimental economics (see Smith 1982 and Plott 1979). Economic theory and experimental economics are used by the CMD to design and test-bed procurement processes for government.

When governments procure goods and services, they are faced with two important information problems: they must firstly discover which firm can supply the goods and services needed at low cost; and they must also ensure that the provider of goods and services does not skimp on inputs (leading to poor quality outcomes). These two problems occur widely in other domains of the economy because information is decentralised and the incentives of the government (the principal) differ from the incentives faced by private firms (the agent). Fortunately, there are ways to address, or partially address, these problems through the application of auction theory and incentive theory that can improve the efficiency and effectiveness of government procurement processes.

Auction theory provides an understanding of the problems of bargaining and negotiation under asymmetric information. One of the most important lessons from this area of economic theory is that bilateral bargaining between a well-informed supplier (firms and organisations they know their costs of production) and a poorly informed buyer (government does not have information about these costs) is that the uninformed party will come off second best in negotiated outcomes. In procurement, this translates to the government paying too much for the goods and services it needs to supply public services. Government's response to this should be to firstly avoid bilateral procurement processes by designing procurement auctions in which the price of goods and services is revealed through competition between suppliers. If well-designed, this strategy will dissipate excess profit margins that could be earned by service providers. Each procurement auction represents a unique economic design problem with different objectives (e.g., cost minimisation, efficiency); different constraints imposed by government (e.g. local content); different characteristics (e.g. single, multi-units) and a range of complexities (e.g. information, strategic and policy) that together influence the design

of the procurement auction. The use of sealed-bid tenders for all procurement activities is not supported by auction theory. Procurement auctions need to be designed on a case-by-case basis. To accommodate these factors, governments will benefit from access to a wide range of auction formats including: sealed-bid, first price formats; a broad suite of open auction formats where there are common value information structures; through to highly specialised auction formats capable of dealing with package problems. Furthermore, when governments require procurement to reflect other government policy objectives, such as local content plans, preference for small firms etc. these objectives will need to be achieved in the most cost-effective way. Under these circumstances, a systematic, designed approach to procurement will be needed.

The second important influence on procurement is the incentive structures embodied in the contract for goods or services required. The role of these incentives is to align the actions of the supplier with the objectives of government (the buyer). Alignment can be improved by delegating some risk to the provider of the good or service even though this may increase the price of risk bearing overall. In some procurement situations, these two problems, referred to as adverse selection and moral hazard) occur simultaneously creating additional design complexity. See Laffont and Martimort (2002).

Many of the auction formats that governments will want to use cannot be operationalized through paper-based systems. Open auction formats, for example, rely on information and messaging between participants in the auction, other auctions, such as combinatorial auctions used to procure packages of goods and services, need to be supported by algorithms that process information required to facilitate competitive bidding. These classes of auction will need to be hosted on web-based electronic platforms that are accessed through the internet. Besides improved flexibility, with respect to auction format, electronic auctions have other important benefits. These include:

- improved flexibility and functionality - electronic auctions provide the flexibility needed to host a wider variety of designed procurement auction formats;
- improved participation - increased participation facilitated through the internet will promote the achievement of government objectives with respect to procurement;
- mitigation of corrupt behaviour - electronic auctions provide a structural separation between government representatives and market participants; and
- reduced red tape - electronic auctions can be reused or modified at low cost for repeat or similar procurement activities and have been demonstrated to significantly reduce the procurement life cycle.

These advantages have been argued to have improved cost effectiveness in countries that have introduced web-based procurement auctions.

Test-bed methodology

The CMD uses a structured test-bed methodology to evaluate and refine policy options during the development phase in order to reduce implementation risks and increase the likelihood of a policy achieving its objectives. The test-bed methodology develops an evidence base that is able to quantitatively inform the performance of a policy, and uses a feedback loop to iteratively test and improve elements of a policy, based on economic theory. The policy approaches that emerge from the CMD test-bed methodology have been subject to a rigorous examination of their ability to deliver economically efficient outcomes so decision-makers are in a position to move to implementation with the confidence that policies will perform as expected.

Integral to the CMD test-bed methodology is the use of experimental economics laboratories. Laboratory methods of economics and political science are increasingly being used by policy makers as a tool for developing and evaluating proposed policy approaches. The CMD uses the economics laboratory to undertake controlled tests to determine if individuals are able to generate efficient policy outcomes when provided with monetary incentives to interact with a stylised version of a proposed policy, the process is described Box 1.

Box 1: Experimental economics

Experimental economics is a branch of economics that uses controlled experiments to evaluate theories and behavioural assumptions, as well as to test policies and their implementation. In contrast to econometric modelling, experimental economics helps policy makers to understand participants strategic behaviour and how they respond with varying degrees of information at their disposal. The controlled environment allows experimenters to examine how people behave under a particular set of rules that define how they interact in a market. See Smith and Plott.

Experiments typically take place in computer laboratories, with real people and financial incentives - there is no role playing in an experiment. An important part of laboratory experiments are the substantial financial incentives that are actually paid to participants. Participants can earn money and can be asked to repay any losses incurred during the experiment. The value that individuals place on a policy outcome is imitated by the possible financial payment (loss) that an individual will get (incur) depending on their actions during the experiment.

Experiments can differ considerably. In most policy applications, an experimental session consists of between ten and thirty individuals. Upon arrival at the laboratory individuals are seated in a partitioned cubicle. Participants must then read a set of instructions which explain in detail the experiment. The instructions also explain how each decision translates into earnings for the participant. Once all participants finish reading the instructions the experiment begins, in which individuals make decisions using a computer. In most experiments, participants have no direct contact with each other and, if required by the experiment, interact through their computers.

Experiments usually have three fundamental elements:

- a cost / value environment (e.g., the value each buyer places on the item being traded in the market and the sellers cost of production);
- an institution defining the rules of exchange; and
- the behaviour of participants.

The experimenter controls the environment and the institution, but observes the behaviour of participants. The laboratory testing allows economists and policy makers to test and refine the rules of the market, before incurring the risk and expense of real-world application.

Figure 1: The experimental economics laboratory at the University of Melbourne

The Centre for Market Design approach

Designed procurement

- An auction design and incentive design phase should be included in all procurement activities conducted by Victorian Government agencies.
- The objective of this step in the procurement process is to identify the specific auction format, rules and processes that achieve the objectives of Government with respect to procurement and to ensure that the goods and services supplied by third parties are consistent with government objectives with respect to quality and quantity.
- Bilateral negotiation processes should be avoided in favour of designed procurement auctions that specifically enhance the bargaining position of government relative to the market.

Electronic auctions

- All procurement activities should be transitioned from paper-based, sealed-bid tenders to electronic procurement auctions.
- Electronic platforms allow for a wide range of procurement auction formats to be run compared with paper-based processes that essentially limit the auction format to sealed-bid tenders.

Internet bidding

- All procurement auctions should be hosted on the internet.
- Advantages of internet hosting include: cost savings from improved design and increased participation; mitigation against collusion and corruption; and reduced internal red tape.

Designed incentive structures for procurement contracts

- All procurement contracts should be designed to address the moral hazard problem as well as being legally robust.

Test-bed

- There are significant benefits, in terms of mechanism efficiency, efficacy, administration, and participant familiarization to be gained from a systematic test-bed process.

Staged transition

- A staged approach is proposed to implement the reforms to procurement.
- The first step will be to develop a general procurement auction platform that enables different auction formats to be operated.
- Once this platform has been developed, a library of procurement auctions can be accumulated. As with all new institutions, it is useful to start with simple problems first.

Electricity Procurement

Electricity services are needed at virtually all government sites. There are approximately 4,300 Victorian government sites classified as small electricity users – sites consuming less than 160 MW of electricity per year. Small electricity users include schools, police stations, small offices, some train stations, public housing units, and healthcare facilities. These sites collectively consume around 110,000 MWh of electricity at a cost of $21.5 million per annum.

Current procurement model

Electricity procurement for small users is centrally organised. The procurement process is used to select an electricity retailer who then provides exclusive retail services to small electricity users under a State Purchase Contract (SPC) arrangement. The process involves a sealed-bid tender, followed by a negotiation phase, and finally a Best and Final Offer phase. Competition among retailers in the SPC process is over a weighted mix of retail service attributes. The evaluation metric includes electricity price, transition strategy, relationship management, capacity for innovation, and site management. Following the award of the SPC, individual sites are required to select an electricity contract from the successful retailer, and the rates negotiated through the procurement process apply to those contracts rather than advertised rates.

CMD Market Analysis

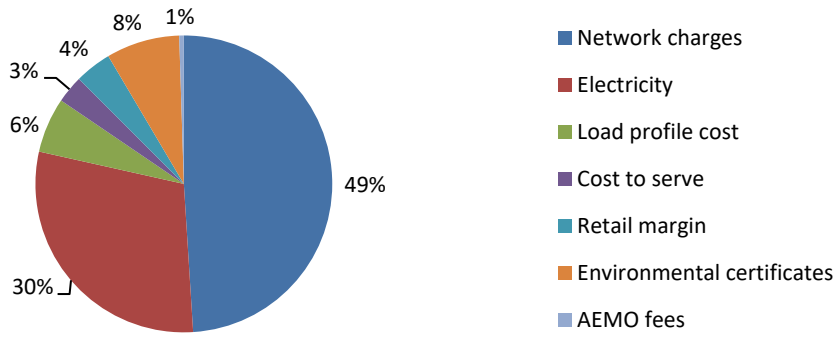
Retail electricity contracts contain a number of bundled products that allow small users to purchase electricity from a highly complex market in a simple way. The bundle of products included in a retail electricity contract and their relative costs are illustrated in Figure 1 below.

Procuring bundled electricity services through a single retailer relies on competition over aggregated electricity services, rather than on individual elements of the retail business, to deliver value for money. The characteristics of the Government's electricity demand and its ability to manage risk, however, mean that purchasing bundled products may not be the most cost-effective solution. To understand why, it is necessary to understand how prices are determined in the National Electricity Market and how these translate into the retail electricity prices government businesses are charged.

The National Electricity Market

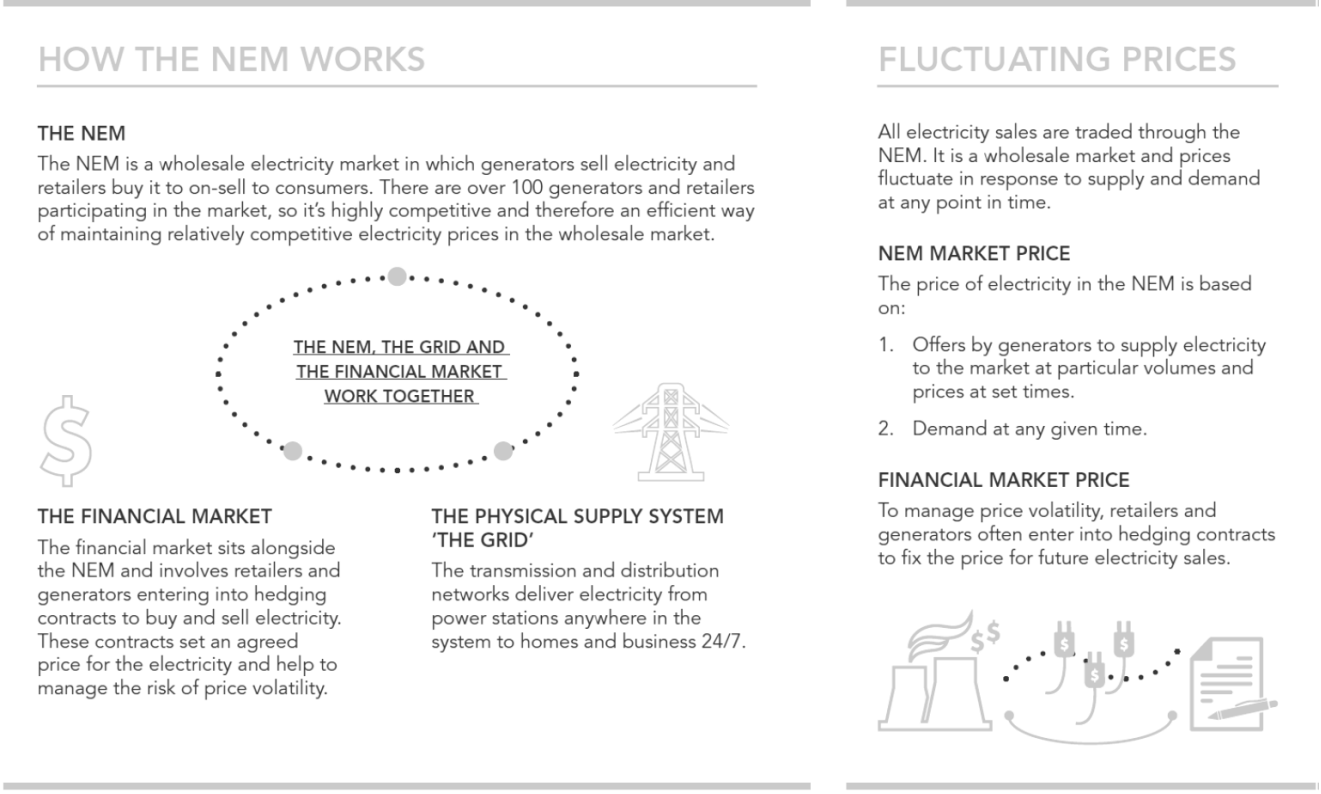
The National Electricity Market (NEM) is a wholesale market through which electricity is traded in southern Australia. Electricity cannot be stored simply at low cost so the NEM operates as a pooled market, where electricity supply and

Figure 1: Components of a retail electricity contract listed by percentage contribution to total energy costs



demand is continually matched through a centrally coordinated auction process. Electricity generators offer to supply the market with specified amounts of electricity at specified prices for set time periods. From all the bids, the Australian

Figure 2: The National Electricity Market



Source: AEMO

Energy Market Operator decides which generators will be deployed to produce electricity, according to the principle of cost minimisation. The NEM uses sophisticated systems to send signals to generators instructing them how much energy to produce each five minutes so that electricity generation is precisely matched to consumer requirements. The auction process occurs every five minutes, so a wholesale electricity price is determined every five minutes. Prices in the NEM are able to fluctuate between a market floor price of -$1,000 per megawatt hour and market cap of $13,800 per megawatt hour – the average price in Victoria for the financial year 2014-15 was $30.35 per megawatt hour.

The main electricity buyers in the NEM are electricity retailers. Retailers purchase electricity from the NEM at volatile prices and convert this into a retail consumer contract with a stable price. In order to manage the financial exposure between the NEM and the retail market, retailers typically use financial derivatives in the form of swaps or hedges, options and futures contracts (see Figure 2). Retailers also participate in markets for renewable environmental certificates on behalf of consumers according to Federal government legislation that gives effect to renewable energy targets. Prices in the renewable energy certificate market are reasonably volatile so energy retailers manage their financial exposure in a similar way to the NEM.

The other main players in the NEM are the electricity transmission and distribution businesses whose functions are deliver electricity from the electricity generators to the consumer, and to maintain and develop the 'poles and wires' network. For the most part, these businesses are regulated monopolies whose costs are recovered from end users via electricity retailers.

An alternative procurement model

The main function of energy retailers is to act as an intermediary between consumers and the various participants in the NEM. Retailers pass on wholesale costs, network costs, and risk management costs to consumers, in addition to charging for billing and administrative services and a retail profit margin. For procurement of electricity, the structure underlying the retail market means that there are few opportunities to further exploit competitive forces to improve value for money outcomes. The NEM is fully competitive and cannot be harnessed by the procurement process to deliver value. Similarly, the environmental certificates market is competitive and unable to deliver further cost savings. Network and distribution costs are regulated so procurement is again unable to improve cost outcomes. That leaves only two competitive margins in the bundled retail service that may be exploited in the procurement process:

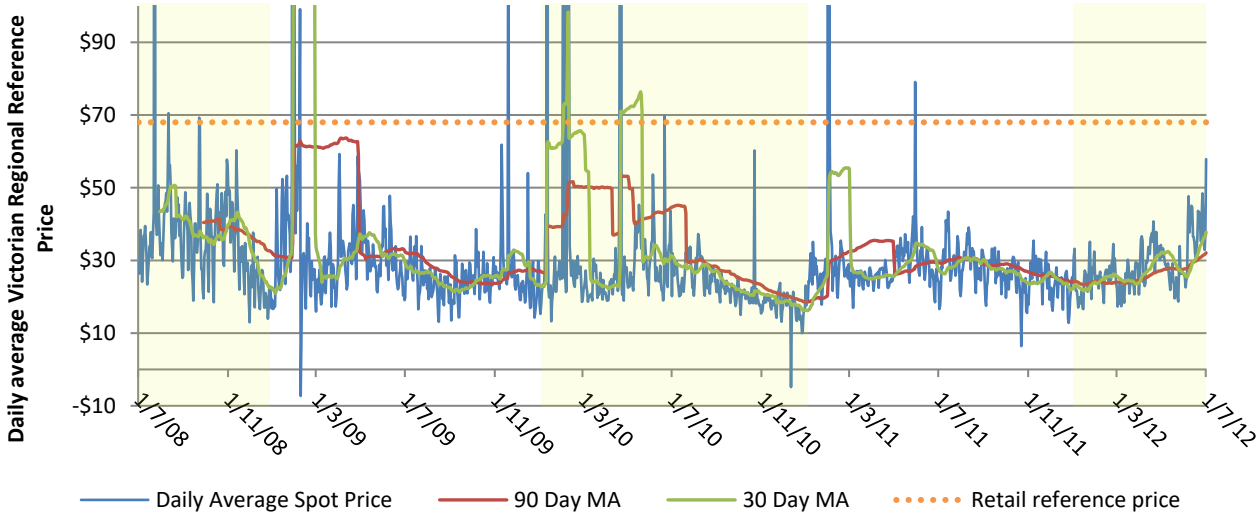
- Price risk management, and
- Billing and administrative services.

The price risk management service provided by electricity retailers are tailored to the preferences and risk appetite of small consumers. Most small consumers prefer stable prices so retailers manage most of the price risk on their behalf. In the existing State Purchase Contract, all price risk was managed by the electricity retailer such that each Government site paid a fixed price for electricity.

Efficient allocation of price risk requires that it be borne by the party who is able to manage it at least cost. With household electricity contracts, it is clear that the retailer can manage price risk at lower cost than households. Where Government is the customer — a very large entity with diverse sources of income — it should be able to bear risk at lower cost than the retailer. The optimal supply contract between an electricity retailer and the Government will therefore have a different distribution of price risk compared with the standard household contract.

The cost savings from government managing its own price risk are potentially very large. Figure 3 illustrates the variability in NEM spot prices over a four-year period relative to an approximate, fixed retail price. Whilst most of the variation stems from normal seasonal variability, the first two years reflect the impact of severe drought conditions and bushfires, in particular, restrictions on water availability for generator cooling which had a prolonged effect on prices. Even in such unfavourable market conditions, the NEM prices would still have presented a value-creating opportunity for the government to manage its own price risk as illustrated simply by the 90-day moving average price. For the latter period over 2011 and 2012, the favourable market conditions realised then would have delivered large cost savings.

Figure 3: Daily average National Electricity Market spot prices for Victoria: 1/7/2008 to 1/7/2012



The second opportunity to deliver procurement savings is through improved transparency in the way retailers compete for the Government contract. The bundled nature of the contract in past procurements meant that it was difficult to determine the most efficient provider of billing and administrative services. By government managing its own price risk, and paying only regulated prices for network services, it may be possible to heighten competition over the billing and administrative component and deliver procurement benefits.

The procurement process

The electricity procurement process would be centred on an auction to identify the retailer with the lowest billing and administrative services margin. The procurement process may be run through a simple electronic auction. The property right allocated in the auction would be a contract to exclusively supply government entities with the following services:

- cost pass-through for electrical energy, environmental charges, and network costs,
- billing and customer services, noting the changed arrangements for pass-through costs, and
- financial costs associated with managing volume risk and cash flow.

To maintain simplicity for the end users of electricity, implementation would largely involve the same customer interaction and experience as was the case under the existing process. The successful electricity retailer would use their standard market offer contract to contract with each government location who would pay the advertised rate. The savings realised through the government managing its own price risk, relative to the retailer's standard market contract, would be accrued over time and periodically refunded to each government establishment as a dividend.

Provided participants in the procurement auction are made aware of these arrangements, they can incorporate the cost of any additional accounting, financial or other costs into their bid in the auction. The approach minimises the administration impost on government and retains a highly competitive bidding space for retailers.

Retail service	Competitive margin available	Optimal procurement strategy	Expected savings
Generation	• Rents dissipated by competition • Not possible to exploit profit margins beyond those determined through the NEM auction	• Buy electricity directly from the NEM	Nil
Distribution and Transmission	• Rents thought to exist in transmission and distribution • Prices and service levels in are regulated • Not possible to exploit margins through procurement	• Buy network services at regulated prices	Nil
Billing and customer services	• Risk management, billing and customer services are currently bundled making it difficult for consumers to compare retail service offers • Competition across unbundling services to reveal the administratively efficient retailer	• Unbundle administration services from risk management services • Retailers compete for government contract through a procurement auction	Unknown
Price risk management	• Government able to price risk at lower cost than electricity retailers • Procurement savings possible by tailoring price risk management strategy	• Buy electricity and environmental certificates at respective spot prices • Hedge price risk to suit government risk preference	Large Large

Table 1: Summary of the proposed electricity procurement process

Fuel Procurement

Fuel is used as a business input for many government services requiring vehicles including community safety and emergency response, various human services, and administrative and advisory services. The Victorian Government purchases around 50 million litres of fuel each year which equates to approximately 1% of the total volume of fuel sold in Victoria each year.

Current procurement model

Fuel is procured by inviting providers to compete over the right to have their fuel card placed in all government vehicle fleet cars. Since it is convenient for users of fleet vehicles to pay with a fuel card, winning the right to have a fuel card placed in a fleet vehicle assures a predictable level of business over the life of the government contract. In the procurement process, fuel providers offer a discount – in cents per litre – to the fuel prices advertised at their branded outlets. The successful providers are contracted to supply fuel at the discounted rate to holders of the fuel card when it is used as the payment method in one of their branded outlets. In the most recent procurement process, three providers were awarded two-year supply contracts with the Victorian government.

Fuel procurement occurs according to a staged, sealed bid tender process. In the first stage, fuel providers submit a provisional discount offer and a subset of bidders are shortlisted to proceed to the second stage. In stage two, shortlisted bidders enter into a negotiation phase with the government to refine their bids, they then submit a Best and Final Offer (BAFO), and the government selects the winning fuel providers using a multi-criteria analysis.

Owing to the specific needs of different government businesses, fleet vehicles involved in non-emergency services were assigned two fuel cards and fleet vehicles used for emergency services and regional service provision were assigned three cards. Emergency services and regional vehicles have less flexibility in anticipating vehicle usage rates and the location of fuel demand so three fuel cards was reasoned to provide an appropriate balance between cost-effectiveness and outlet availability.

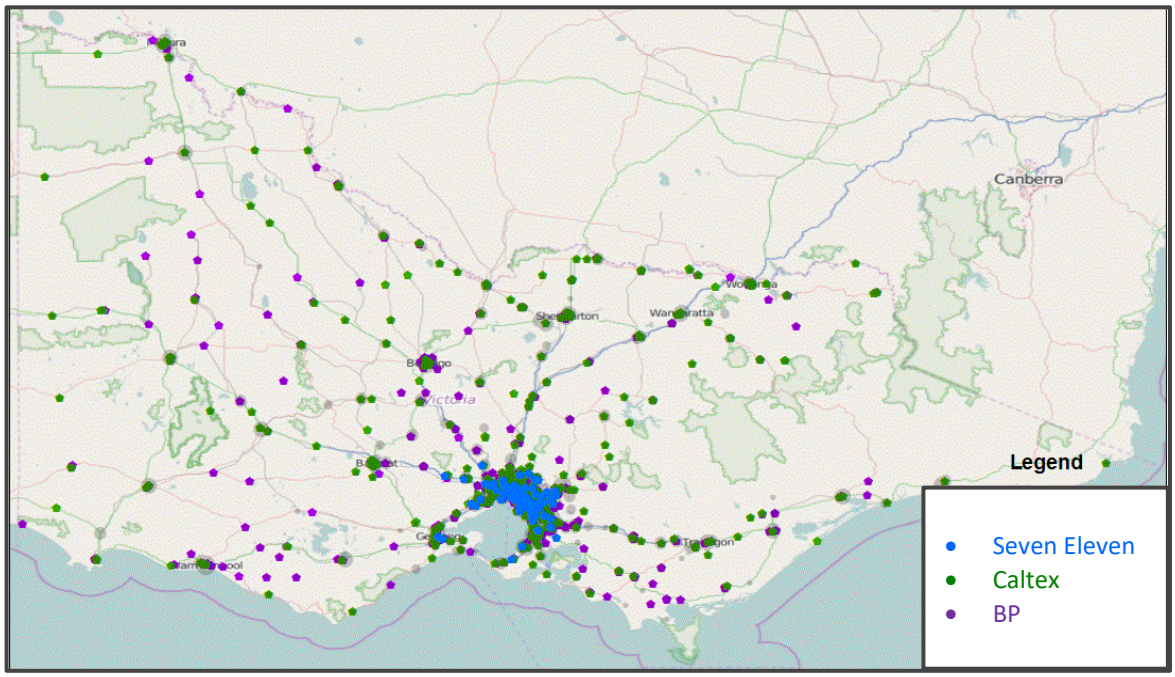
The value for money outcomes realised under the established procurement process are heavily influenced by the fuel pricing strategy adopted in the procurement and the consequent choices of individual drivers. Successful bidders are contracted to supply fuel according to the discount specified in their offer – a pay-as-bid pricing rule – so the three contracted providers may deliver different price discounts. Individual drivers are given no incentive to select the least expensive provider, so it may be more profitable for a fuel supplier to finish second in the auction if they are able to charge a higher price than first place supplier, with no demand penalty. Depending on the demand characteristics of emergency service vehicles, it is possible that coming third in the procurement is the most profitable outcome for some fuel suppliers. These perverse incentives have consequences for bidder behaviour in the procurement and may increase total fuel costs to the Government.

CMD Market Analysis

Fuel is a commodity for which there is a well-established market. Where markets are highly competitive, there should be limited scope to secure additional procurement discounts unless the characteristics of government demand allow for value to be created in a way that is not available in the general marketplace – otherwise the benefits rely on providers providing a discount based on goodwill and a reduction in transaction costs. One example may be that the volume and certainty of government demand allows for improved hedging in commodity markets. Given the characteristics of government demand, however, these types of value creation opportunities are not likely to be present in the fuel sector. The case for centralised procurement benefits therefore relies on either:

- the existence of inefficiency in the fuel market as a consequence of imperfect competition,
- the existence of bulk purchase discounts not available in the market, or

Figure 4: Fuel business branded outlet locations in Victoria



Source: CMD analysis of VicGov data

- the potential to reduce transaction costs and spatial disadvantage through cooperation between government agencies.

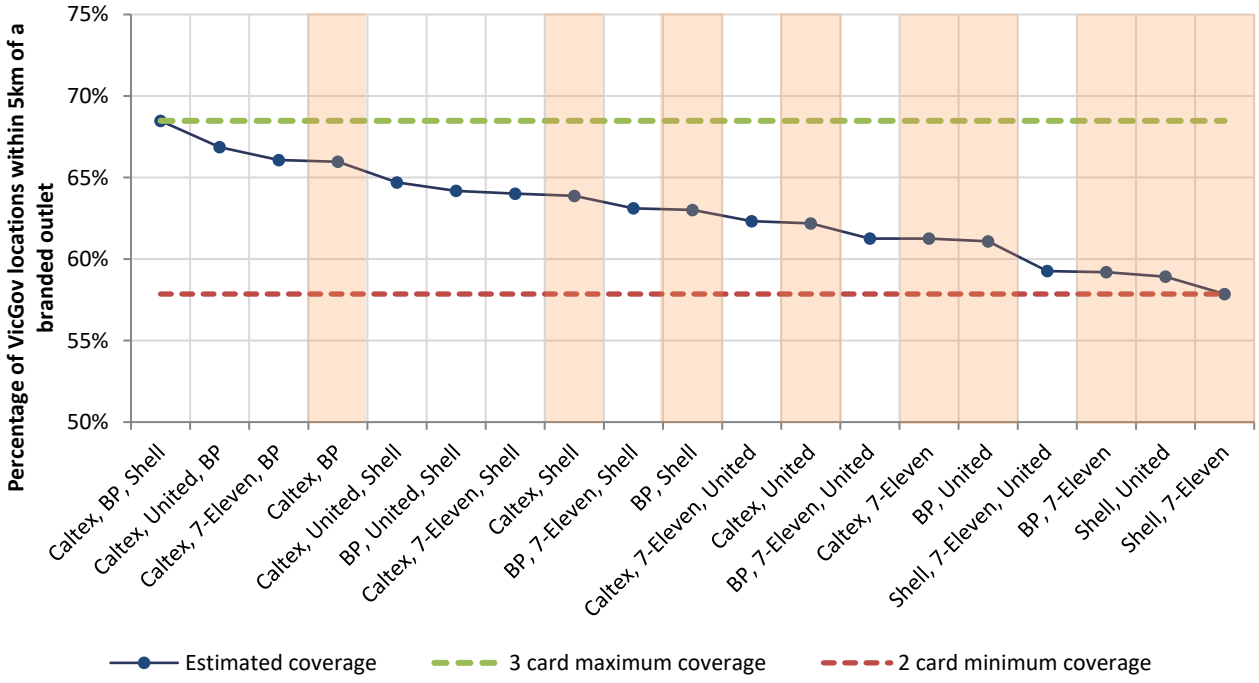
The strongest rationale for centralised procurement process is imperfect competition, as evidenced by numerous ACCC publications. There may also be some advantages in centralised procurement in terms of consolidating transaction costs, although these are likely to be small.

Spatial Coverage

One of the key variables that affects competition in the fuel industry is outlet location. Among other things, fuel businesses adopt pricing and spatial coverage strategies to maximize returns. Some businesses, including Caltex and BP, have good spatial coverage across Victoria whereas others like Seven Eleven and United are more concentrated in areas close to Melbourne and major urban centres (see Figure 4). The spatial coverage strategy of each fuel company is, to some extent, dependent on the strategy of its competitors. While the coverage of fuel outlets across Victoria may be approximately optimal, the spatial coverage of any subset of the fuel companies chosen to supply fuel cards will always provide lower coverage than that of the entire market. Most Victorian Government fuel consumption occurs in and around the Melbourne metropolitan region, however, the regional distribution of police and emergency services locations are important considerations in fuel procurement.

Different combinations of fuel cards offer alternative spatial coverage characteristics. The existing model with three suppliers provides approximately 68.5 per cent spatial coverage as measured by the percentage of Victorian government locations within 5 kilometres of a fuel outlet. Using the same metric, Figure 5 shows the spatial coverage characteristics of alternative two and three card combinations of fuel suppliers – many combinations have broadly similar coverage characteristics. Nonetheless, there is likely to be a trade-off between spatial coverage and price in the procurement.

Figure 5: Spatial coverage of VicGov sites for different possible fuel card combinations



Source: CMD analysis of VicGov data

An alternative procurement model

The value for money outcomes realised from fuel procurement are dependent on how competition is generated in the procurement process. The level of competitive tension among fuel businesses in the procurement process is related to:

- the specification of procurement objectives,
- the definition of the property right allocated in the procurement, and
- the extent to which the procurement model is robust to markets with limited competition and possible price signalling.

In past procurement processes, the multiple apparent objectives balanced overall cost savings with spatial coverage and other value for money factors. This model assured a very high level of convenience for fleet vehicle users at the cost of lesser average price discounts, and consequently higher total fuel costs. For most government fleet vehicle users, however, a single fuel card and a little forward planning provides a sufficient level of spatial coverage. For regional and emergency service vehicles, the nature of demand means that greater spatial coverage is required.

The CMD recommended rebalancing the procurement objectives to give greater weight to cost savings. The implementation approach structures competition around a Primary Fuel Card and two Secondary Fuel Cards. The Primary Fuel Card is for use in all government fleet vehicles whereas the two Secondary Fuel Cards are, only for regional and emergency service vehicles. The two-tier strategy increases competition over the more desirable primary card, limits undesirable strategic behaviour in the procurement process as there is no perverse incentive to finish second, and will increase the overall frequency of use of the most cost-effective fuel card by fleet vehicle users.

To ensure appropriate overall spatial coverage of the Primary Fuel Card, a prequalification step is necessary to determine the suppliers capable of holding the Primary Fuel Card and which are suitable only for the Secondary Card.

Competition over the fuel cards may be enhanced by considering how the product definition interacts with how fuel is priced in the procurement. Fuel prices may be determined in one of the following ways:

- A cents-per-litre discount for all fuel types, e.g., 5CPL for all fuel types,
- A cents-per-litre discounts for each fuel type, e.g. 4CPL for petrol, 6CPL for diesel… , or
- A margin above a benchmark wholesale price of each fuel type, e.g., Singapore tapas + X.

Experimental laboratory sessions conducted by the CMD recommended using a cents-per-litre discount for all fuel types as it represented a balance between implementation simplicity and robustness to bidders gaming the process. Bidding on each fuel type was found to open-up a strategy space that would allow high discounts on fuels that are sold in low volumes (e.g., LPG) and low discounts on high volume fuels (e.g., unleaded petrol), resulting in poor efficiency properties and poor value for money outcomes. Benchmark-based bidding would increase procurement complexity to levels disproportionate with the value of the contract as a different margin would be needed for each region in the State.

Having defined the procurement prequalification requirements, the product definition, and the biddable factor, the procurement format was used to address the possibility of limited competition and price signalling. Working with international experts, the CMD designed an electronic, web-based platform for the fuel procurement. The electronic procurement process determines the prices of all three cards simultaneously using a multiple clock, ascending price auction. The format allows participants to place bids on any of the three fuel cards, but they can only ever win one of the three cards – it works according to the following process:

1. Participants place initial bids on the fuel cards for which they are eligible,
2. Provisional winners are determined given the bids submitted,
3. Participants observe the prices of the provisionally winning bids, but not their identity,
4. Upon observing the results, participants are able to submit new bids (i.e. higher discounts) on the fuel cards for which they are eligible, but are unable to change a provisionally winning bid,
5. A countdown clock commences at the beginning of the auction, and is reset whenever a new, provisionally winning offer is received,
6. The auction ends when the countdown clock reaches zero.

This auction format establishes a competitive bidding environment that allows participants the flexibility to modify their bids in response to the bids of others. The electronic environment allows bidding to be conducted interactively and quickly. The information structure of the auction makes it robust to collusion and able to harness competition in a thin market environment. An extensive test-bed process was used to refine and test the auction and validate the objectives of the design. The testing phase was completed jointly between the experimental economics laboratory at the University of Melbourne (EMU) and the experimental economics laboratory at CALTECH.

Box 2: Implementation of fuel procurement

The electronic, multiple clock auction developed by the CMD was not fully implemented. However, many of the design features developed by the CMD were incorporated into a sealed bid auction completed in December 2015. Key changes incorporated were:

- Auction format: binding bids with no negotiation phase,
- Biddable factor: bid in c/litre for all fuel types,
- Property right: primary card and two secondary card structure for the fuel cards,
- Tie-breaking strategy:
- Spatial coverage: optimised spatial coverage trade-off.

The procurement process embodying these features resulted in a 100 per cent improvement in the discount of fuel purchases compared with the previous procurement outcomes.

Medical Panels Procurement

Each year, thousands of referrals are made to Medical Panels as part of the assessment or management of Workers Compensation claims, or Wrongs Act claims. Medical Panels are a used to provide expert medical opinions on disputes over aspects of workplace injuries or medical conditions, and to answer referred medical questions resulting from an injury through the Accident Compensation Act (1985) or the Wrongs Act (1958). In Victoria, each Medical Panel functions as an independent tribunal.

On receipt of a valid referral, the Convener of Medical Panels assembles a Medical Panel of approved experts to form a medical opinion on the disputed matter. The Medical Panel includes a Presiding Member, and an appropriate number of additional panel members with the required training, knowledge and skills needed to address the questions and issues relevant to each referral. Referrals can range from relatively straight forward to very complex cases that may require detailed research and synthesis of information and opinion from different disciplines. Each referral has a statutory response time of 60 days unless an extension is obtained.

The panel members are selected based on the specialities that are required to answer the medical question that has been asked. All panel members are highly experienced and qualified within their field of expertise. Being a Panel Member is not a full-time role, and can fit around other commitments. The skills required to provide a legally robust medical opinion are typically quite different from the skills that many medical experts would regularly practice in other settings.

Current procurement approach

Assembling Medical Panels that have the knowledge and training required to address referrals, and scheduling Panels to meet the referral timelines is a complex and time-consuming administrative task. It necessitates the selection of an appropriately skilled group of experts, and coordinating them to make medical assessments at a central location. These processes are completed manually by the Office of the Convenor of Medical Panels (the Office).

The Office nominates appropriate panel members, or Medical Experts, from a list of eligible medical practitioners. To become eligible to serve on Medical Panels, Medical Experts apply to the Office and must be pre-approved as suppliers by the Minister for Finance. Based on forecasts about the type of injuries usually referred, the Office pre-arranges for experts to be available at particular times, and iteratively puts together referrals with the available experts as details about the actual referrals become known. Since Medical Experts are often in high demand, pre-arranging their availability may occur months in advance of the Medical Panel actually taking place. Medical Panels are convened for no more than an hour, but much of the time taken to provide opinions involves preparing the documentation, which can be completed in the Medical Experts' own time. For logistical reasons, the Office aims to fill the six available examination rooms from Monday to Friday, 9am-5pm.

Medical Experts are paid according to an administratively determined fee schedule that specifies a remuneration rate per case completed. More complex cases require more hours of preparation and analysis on the part of Medical Experts and so command a greater fee per case in order to attract the necessary supply of medical practitioners. The fee schedule is approved by the Minister for Finance and revised on a regular basis. In 2015, a five-tier fee structure was introduced to replace a three-tier structure in recognition of the growth in the number of complex referrals and the willingness of medical practitioners to assess them under the three-tier schedule. Administratively determining the fee schedule applicable to the more complex cases has been a significant policy challenge in recent times.

CMD Market Analysis

Medical Panels deliver value for the public because the advice they provide saves legal, advisory and courts costs, relative to the cost of administering the Medical Panels system. Their core function is providing authoritative advice on the referral, so each Medical Panel relies on careful matching of expertise to the medical problem at hand. Under the present procurement model with administered prices, the principal policy complexities concern attracting and retaining a

sufficient number of appropriately skilled medical practitioners to participate in the program, and the need to schedule Medical Experts in advance of knowing the types of referrals that will occur in order to secure their availability.

The problems that manifest in assembling Medical Panels are a consequence of the interaction between remuneration policy, demand uncertainty, and scheduling logistics. The competing demands for Medical Experts' time mean that the Office scheduling their availability is of paramount importance, however their availability may be tempered given the administered price available, particularly for complex referrals. Maximising the value from Medical Panels requires that the Office determine **efficient pricing.** Efficient pricing means that the procurement process must offer each Medical Expert remuneration that provides just enough incentive for them to make themselves available for each type of referral.

An alternative procurement model

A common approach to allocation problems that involve uncertain demand (e.g., commodities, financial markets) is to contract forward to meet a proportion of anticipated demand. That is, to contractually secure supply for a future date, at a pre-arranged price—this is referred to as a forward market. The forward contracting approach may be applied to Medical Panels where patterns of total demand and categories of referrals can reasonably be forecast from historical data. As actual demand is realised over time, any shortfall relative to the anticipated demand contracted for in the forward market may be made up from the pool of remaining unassigned Medical Experts at the prevailing short-term market price.

To create a forward market for Medical Panels, the Office would need to make a decision about the proportion of total expected demand that can be contracted forward. Once a forward quantity has been determined, participating Medical Experts would be requested to provide information relating to:

- the total hours per week they are willing to commit to act on Medical Panels,
- the days and times they are available to act on Medical Panels, and
- the remuneration rate they require to act on Medical Panels at various tiers of complexity.

The procurement process would accept information on total hours required, pricing, and availability and, in principle, determine the most efficient allocation of forward contracts to Medical Experts. Efficient allocation of forward contracts requires that the least cost, highest productivity Medical Experts be chosen as suppliers. For the Office to allocate forward contracts efficiently, however, they will require Medical Experts to reveal reliable information about their costs and productivity. Only a few classes of procurement auctions provide participants with incentives for truthful revelation of such information in their bids. One auction with this characteristic is known as the Vickrey, Clarke, Groves, or VCG mechanism. In broad terms, the VCG mechanism provides participants with an incentive to reveal truthful information about their costs because their bid determines if they are successful in the procurement, but not how much they are paid, which is typically more than what they bid (see Box 3). In addition to efficient allocation of forward contracts, the VCG procurement auction is an appropriate format for Medical Panels since:

- The availability of experts to provide high quality opinions on Panels over the long term is the primary objective and the VCG is able to determine fair remuneration rates,
- Each successful bidder receives a unique payment that reflects the value of their effort,
- Medical Experts may nominate remuneration rates that would increase their availability, and
- The mechanism works through the globally optimal allocation of referrals, recognising the various levels of complexity, and skills of Medical Experts.

Test-bed

The CMD is currently working with the Office of the Convenor of Medical Panels and the Department of Treasury and Finance to test whether the VCG mechanism delivers the expected benefits to organising Medical Panels.

Firstly, the CMD will recruit students to test the software and approach in a laboratory setting, and then the approach will be trialled in the laboratory with real stakeholders. If all goes well, the mechanism will be tested through a pilot with MEs competing for real wages and real contracts.

Implementation

The CMD and DTF are working with the Office of the Convenor of Medical Panels to develop an implementation plan, should a decision be taken to proceed with the mechanism.

Box 3: The Vickrey Clarke Groves Auction

The Vickrey Clarke Groves (VCG) auction is a method that may be used to increase the economic value created from procurement processes. It allocates contracts to the suppliers with the lowest bids, but the way successful bidders are paid is different to auctions more commonly seen in procurement. The way that bidders are paid influences how they bid in the auction. The defining characteristic of a VCG auction is that the pricing rule provides bidders with an incentive to bid their actual costs of supplying services, rather than inflating their costs in the auction in order to be awarded a higher wage. When bidders report their actual costs of supply, it allows the auctioneer – in this case Medical Panels Victoria – to allocate contracts to the most productive suppliers and in so doing generate the most efficient outcome.

The truthful bidding property of the VCG auction arises because successful bidders are paid more than what they bid in the procurement auction. The supplementary amount may differ across the successful bidders. It depends on who would have been successful in the procurement auction if a successful bidder did not participate and how much that unsuccessful participant bid. More precisely, each successful bidder is paid the amount of their bid, plus the difference between the sum of successful bids in the optimal allocation and the sum of the successful bids if they were not present in the procurement. This pricing rule means the optimal strategy for bidders is to reveal their actual supply costs as they are rewarded for telling the truth (Crampton, 2006). Suppose we wish to allocate three cases among three Medical Experts who provide the following wage bids and caseload constraints:

Medical Expert	Wage bid per case	Maximum caseload availability
A	$6	1
B	$8	2
C	$10	2

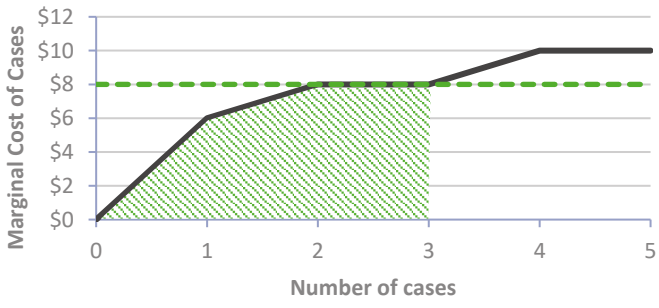
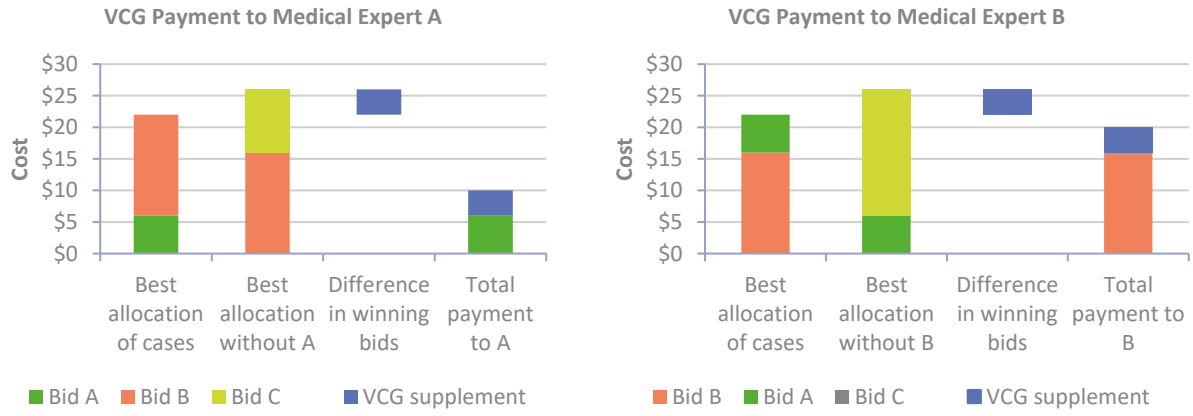


Table 2: Example VCG bid structure

The VCG solution is to allocate the cases to the bidders with the lowest bids, so A is awarded one case and B two. Medical expert A's payment is equal to her bid of $6, plus the difference between the sum of the bids in the optimal allocation, $22, and the sum of the bids in the best allocation without her. This simply means that Medical Expert C would have been awarded 1 case, so the sum of costs is $26 (see Figure 6). The payment to A is therefore

$6 + ($26 - $22) = $10. Using the same approach, the payment to Medical expert B is $20, or $10 per case.

Figure 6: Illustration of how payments to Medical Experts are determined using a Vickrey Clarke Groves auction



Although VCGs are preferred in theory, they are not often used in practice. The main problems are that they are subject to collusion if bidder numbers are low relative to the volume required and they can be difficult to explain to bidders. When these conditions do not prevail or can be overcome, VCGs are a mechanism that leads to efficient allocation of resources in the economy.

Procuring ecosystem goods and services

Many environmental goods and services have public good attributes – they are not owned by private entities and indiscriminately benefit many people. In some domains of the environment, it is possible to achieve environmental outcomes by creating markets for permits (e.g., pollution rights). Other environmental goods and services cannot be readily measured or attributed to economic units. In these instances, governments typically procure environmental outcomes. The United Nations Statistical Commission acknowledges that there is little prospect of measuring ecosystem services such as clean air and water, and species preservation. They argue measuring ecosystem stocks may be more tractable. Most government environmental programs aim to increase the stock of ecosystem assets, such as the area and quality of habitat, that produce a bundle of ecosystem services. In these domains of the environment, government is tasked with procuring increases in the stock of ecosystem assets and taxpayers have an interest in cost-effective procurement.

Current procurement models

Governments procure ecosystem goods and services in a variety of ways including: regulation (e.g., regulation on land clearing); government investment (e.g., investment in national parks); and grants or subsidies to private landholders. These are all forms of procurement in which government seeks to increase the stock of ecosystem assets for the purpose of increasing the supply of ecosystem services and incurs a cost, either directly or to the economy, in doing so.

CMD Market Framing

Framing environmental programs as economic design problems leads to consideration of the causes of missing markets and the interventions that might be applied. Unfortunately, there is little that can be practically done to address the public good problem. This means that policy makers do not have reliable information about the values that people place on the production of additional units ecosystem services (in this case). There is, however, considerable scope to improve the efficiency and effectiveness of the supply-side of the "market" by addressing information and incentive problems. For example, environmental administrators typically do not have information about which landholders (including public and private landholders) can supply ecosystem services at low cost leading to the problem of adverse selection (choosing high-cost rather than low-cost suppliers) and have not been able to routinely measure the outcomes of activities intended to increase the supply of ecosystem services. The information needed to make cost-effective procurement decisions is decentralised – each landholder (whether public or private) has a private information about the physical characteristics of land, the inputs needed to manage land, the costs and profit margins of alternative uses of land etc. The purchaser of ecosystem services (e.g., the government) has an interest in knowing about the type and quantity of ecosystem services that can be produced from different areas of land and will want to contract landholders able to supply at low-cost. The hidden action problem also needs to be addressed in procurement. It arises because: it is difficult to measure environmental/ecosystem services directly; there is uncertainty associated with the transformation of inputs to environmental outcomes; government cannot observe the actions of landholder (in remote locations); and landholders have different incentives to government. See (Laffont 2002).

Failure to specifically address these problems predisposes environmental programs to high-cost and low-quality outcomes. Advances in microeconomic theory (economic design and incentive theory)[1] and environmental accounting mean that the supply-side problems can be substantially addressed (if not entirely) whereas the demand-side problem stemming from unobservable valuation of ecosystem services by consumers remains intractable. This means that government, rather than private firms/individuals are likely to remain the funder of ecosystem services but there is scope to improve the efficiency and effectiveness of environmental programs.

[1] See (Akerlof, 1970) and Akerloff, Spence and Stigltiz (**),

An alternative procurement model

Economic theory was applied to design *incentive contracts* and an *auction* to allocate conservation contracts to private landholders. This process was initially conducted as a pilot (Bushtender – See Stoneham et al 2003) and the mechanism was subsequently modified and expanded by the Victorian Government to enable procurement of multiple environmental benefits and integrate it with a tradable permit for carbon (EcoTender). The latter feature recognised that habitat (the asset that produces ecosystem services) and carbon sequestration are jointly produced.

The first observation to be made from the pilots is that transactions to supply environmental goods and services were facilitated through the institutions briefly described above. The auction of incentive contracts caused revelation of previously hidden information and incentive structures including progress payments improved alignment between landholder actions and the objectives of government. The key findings from early rounds of auctions include:

- Improved economic efficiency - Data from the auction suggest that a 30% improvement in economic efficiency was achieved by auctioning conservation contracts. This estimate was made by comparing the cost of outcomes from the auction (ranked according to supply cost) against a random allocation of contracts as occurs with grant, subsidy and regulatory mechanisms for which there is no investment to discover low-cost suppliers. This efficiency gain is distributed between the government, through reduced costs of procurement and the landholders in the form of information rents (payments needed to reveal private information).

- In-complete environmental information can lead to unwanted outcomes - The pilot demonstrated that environmental programs that do not take all environmental goods and services into account could sponsor changes to the landscape that cause environmental decline. If all of the environmental impacts of an action, such as tree planting, are not taken into account the investments could give rise to unwanted outcomes. Re-vegetation, for example, might cause streams to dry-up, with adverse impacts on aquatic species and the supply of irrigation.

- Cost savings from procuring multiple environmental outcomes – There are significant cost savings to be gained by the environmental agency from integrating ecosystem procurement programs with markets for carbon (where they exist). This arises from the joint production of habitat and carbon sequestration - provided relevant species are planted. It has been estimated from the pilot that a saving of 34% (to the environmental agency) could be expected if the price of carbon were to rise from $0/t (no market) to $12/tonne, in a revenue constrained auction, and by 26% in a quantity constrained auction. The savings to the environmental agency were shown to increase as the price of carbon in a tradable permit market increase.

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References

PLOTT, C.R., (1979), The application of laboratory experiments to public choice, in Clifford F Russel, ed., Collective Decision Making, Washington, Resources for the Future.

LAFFONT, J., MARTIMORT, D. (2002) Theory of Incentives: The Principal-Agent Model, Princetown, Princetown University Press.

ROTH, A.E., (2002), the economist as engineer: Game theory, experimentation, and computation as tools for design economics, Econometrica, Vol. 70, No. 4 (July, 2002), 1341–1378.

Smith, V. L. (1982), Microeconomic systems as an experimental science, American Economic Review, December pp.923-55

STONEHAM, G., CHAUDHRI, V., HA, A., STRAPPAZZON, L. (2003) Auctions for Conservation Contracts: An Empirical Examination of Victoria's BushTender Trial. Australian Journal of Agricultural and Resource Economics, 47, 477 - 500.

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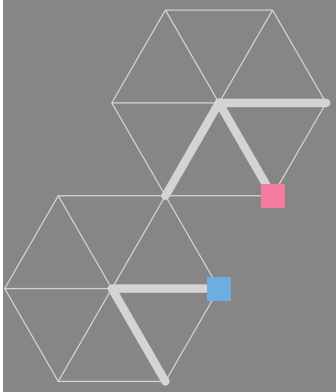

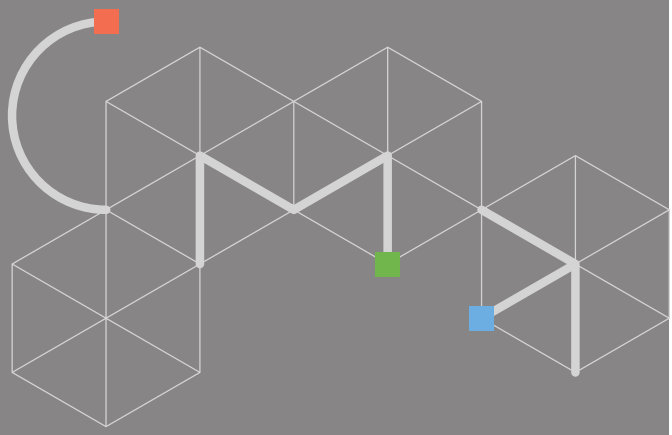

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