

12 June 2017

Ben Noone  
Senior Advisor  
Australian Energy Market Commission  
PO Box A2449  
Sydney South NSW 1235

Dear Mr Noone

### **Five Minute Settlement (ERC0201) Directions Paper**

Arrow Energy (Arrow) welcomes the opportunity to provide comments on the Australian Energy Market Commission's (the Commission) Directions Paper concerning the proposed Five Minute Settlement rule change.

The proposed rule change - shifting from thirty minute settlement to five minute settlement – will have a negative impact on gas-fired generation assets in the National Electricity Market (NEM), which are currently crucial to providing system security, reliability and price stability. The rule change would lead to increased market volatility and impact pricing at a time when Governments and consumers are demanding stability to manage challenging market conditions on the Australian east coast.

### **About Arrow Energy**

Arrow is an integrated coal seam gas (CSG) company that engages in the exploration, development, production and supply of CSG, and generates electricity. Arrow is the owner and operator of Braemar 2 Power Station (450MW) and holds 100 per cent interest in the electricity generated. Arrow also has an interest in the electricity sales from the Daandine (30MW) and Townsville (234MW) power stations. Each of these assets represents gas-fired generation, located in QLD and dispatched into the NEM.

### **Overview**

The proposed rule change would represent a significant adjustment for the NEM. As a consequence, market participants would be exposed to very large costs and risks during the transition period and thereafter. There are also wider market risks including potentially higher prices for electricity consumers. After reviewing the rule change proposal, Arrow does not believe there are material efficiencies to be achieved by moving to five minute settlement at this time, and the costs and risks outweigh the perceived benefits.

Arrow's opposition to the proposed rule change is based on the following issues:

- Strategic late rebidding has been addressed;
- Benefits of five minute settlement not adequately quantified;
- Displacement of essential generation assets;

- System security and reliability risks (conflicting with the National Electricity Objective (NEO));
- Contract market liquidity concerns;
- Risk of increased spot market volatility, and
- Technology neutrality inconsistencies.

Arrow does not support the view that thirty minute settlement is responsible for creating significant inefficient outcomes in the NEM. In its rule change request, Sun Metals focuses on strategic “late rebidding” as a major inefficiency in the wholesale electricity market and a driver for settlement change. The Commission has already implemented measures to address this bidding behaviour, with its Bidding in Good Faith rule change. Since its implementation there has been a notable change in generator bidding behaviour and resulting price outcomes, suggesting this rule change has to-date successfully, achieved its objectives.

Given the significance of the proposed rule change and implications for new and existing market participants, insufficient quantitative analysis has been put forward to validate the perceived benefits of transitioning to five minute settlement. It would be prudent to ensure that the feasibility of the rule change can withstand arguments put forward by all market participants (both for and against the rule change) before proceeding further.

Arrow believes that five minute settlement would in many instances result in poor market outcomes, by potentially threatening the financial viability of existing participants, increasing electricity prices for consumers and promoting greater price volatility, as well as risking system security and reliability. Such an outcome is not consistent with the promotion of the NEO.

Moving to five minute settlement would restrict the ability of “peaking” generators (principally gas-fired generators) to react to unexpected high price events and defend contract positions. Alternatively, peaking generators may be forced to generate when prices are uneconomic, purely to prevent missing a high price interval. Either scenario would devalue these assets, an inefficient outcome for this relatively young generation fleet. Further, a strong argument has not been made that new generation technology would be able to efficiently and effectively replace gas-fired generators in the near/medium term.

If gas-fired generators are forced out of the market, critical generation assets that can dispatch for long periods of time and provide substantial electrical output (MWh's) would be displaced, impacting supply and system security. This is an inefficient outcome and not in line with the NEO. It is Arrow's view that new technologies have not yet proven their capacity to meet this generation shortfall for sustained periods, and will further increase instability in the market due to the growing role of intermittent generation in the NEM.

Under the proposed rule change, cap contracts would be considered of greater risk for peaking generators. Given these generators would have a reduced ability to defend their cap contract positions, appetite to sell these contracts would be greatly reduced, leading to reduced liquidity and higher contract prices. With fewer cap contracts sold, generators would be less incentivised to dispatch to subdue price volatility, and thereby remove a price buffer that had traditionally subdued prices typically above \$300/MWh. The effect to both the contract market and the physical wholesale market would be substantial.

From a hedging and risk management perspective, the proposed rule change may represent a market disruption event and force existing contractual arrangements to be renegotiated or terminated. This is an imbalanced and disruptive outcome for participants who have contracted strategically, most likely benefiting one party over another. This represents a major risk for some

market participants because long term contractual arrangements often represent a large proportion of the overall portfolio.

The Directions Paper focuses on the benefits of five minute settlement for new technologies with very rapid start times, and Sun Metals indicates technologies are dissuaded from joining the NEM under the thirty minute settlement. Arrow would note that many new fast-start generation technologies (such as battery technology) and demand-side technologies are already economically viable and currently being installed throughout the NEM. Further, promoting new technology over existing generation technology is not consistent with a technology neutral approach to assessing the promotion of the NEO.

In addition, it is unlikely that battery technology would be incentivised to subdue high prices. When a future price signal occurs in pre-dispatch, battery technologies would likely allow the high price to realise and subsequently turn on to absorb the benefits of the high-price five minute interval. Battery technology benefits from volatility; hence the technology's interest in the rule change is to remove exposure to a smoothing of price over a thirty minute period.

It is Arrow's view that a number of other issues are contributing to inefficient price outcomes in the wholesale electricity market, such as regional characteristics specific to individual states, which deserve more attention. The data shows that most recent price volatility is concentrated within specific regions and is not generally a NEM-wide issue that can be addressed through settlement changes. These factors, and others, should be considered by the Commission.

Yours sincerely,



Ivan Tan  
Chief Operating Officer

## 1.

### **How suitable is the proposed assessment framework for this rule change request?**

Arrow is in favour of changes being made to the National Electricity Rules (NER) in instances where the changes support the NEO. In its Directions Paper the Commission indicates that the key areas of the NEO that would likely be considered as part of its assessment framework are the promotion of *efficient investment in, and efficient operation and use of electricity services with respect to the price of electricity*. It is Arrow's opinion that the rule change request put forward by Sun Metals would not only influence the price of wholesale electricity in the NEM, but have broader implications for the electricity market, such as disrupting the role that existing gas-fired generation plays in supporting system security and reliability. As such, the scope of the assessment should consider whether the proposed rule change promotes the NEO with respect to: price, quality, safety, reliability and security.

Arrow is concerned that existing generation, particularly gas-fired generation, would be adversely impacted by the proposed rule change. It is important to remember that significant gas-fired generation capacity in the NEM is less than ten years old, with many more decades of operational viability. Further, these assets represent significant financial investments and provide valuable support to system security and reliability. As such, changes to the market rules which would likely displace one asset class, in favour of another (for example, existing gas-fired generation in favour new fast-start technology) should be carefully considered given this context. Such an outcome would not support the assessment framework's criteria for technology neutrality.

Given some technologies are adversely impacted greater than others as a result of the proposed rule change, Arrow recommends that the Commission consider the technologies that would be most effected in determining the impact on the market and conclude if this in alignment with the NEO.

### **Are there any additional factors that should be considered in assessing this rule change request?**

Arrow recognise the benefits of battery power and other new fast-start technologies in the NEM, however more consideration must be given to the overall quantity installed and the dispatch capability of this technology prior to implementing the proposed rule change. Current battery technology can only respond for short-term intervals and would not be available for prolonged periods of price sensitivity. Serious consideration should be given to the dispatch capability of this new technology, its interaction with the wholesale electricity price and the potential impact on price when capacity is depleted. Importantly, this is not only a question of price efficiency, consideration should also be given to how new technologies will meet the other categories of the NEO, such as security of supply and reliability.

## 2.

### **How material are the price signal inefficiencies under 30 minute settlement and are there other data or data sources that would enable this issue to be more comprehensively addressed?**

Arrow considers that it has not been clearly demonstrated that price signal inefficiencies caused by thirty minute settlement are material or warrant the substantial costs and disruption that would be caused by proposed changes to settlement timing. Further there has not been a thorough quantitative assessment of the proposal and its potential outcomes under various scenarios.



The inefficiency claims made by Sun Metals, and further highlighted in the Commission's Direction Paper, focus on the bidding behaviour of generators under thirty minute settlement, in particular, rebidding in the last five minutes of a trading interval (late rebidding). While late rebidding has contributed to wholesale market volatility, the Commission's changes to the Bidding in Good Faith rule from 1 July 2016, has already sought to address this concern. As an active participant in the generation space, Arrow has seen the bidding behaviour of many generators change since the rule change was implemented (evidenced by a reduction in the concentration of high price events in the final five minutes of settlement) and it would appear that the rule change has materially addressed this inefficiency. The Bidding in Good Faith rule change must be given further time to prove itself, before considering a more costly and disruptive rule change.

### **What extent would a move to five minute settlement address inefficiency in price signals from 30 minute settlements?**

Arrow, in principle, supports a wholesale electricity market that is reflective of the underlying demand and supply balance at a point in time. Arrow's concern is that the practical application of the proposed five minute settlement rule change would not produce the desired efficiency outcomes. This view is shaped by the physical limitations of most existing peaking generation technologies, which cannot physically respond from rest, to changes in price and demand within a five minute interval (for example, even most internal combustion diesel generators which require some human interaction as part of the response time). Further, Arrow also understands from earlier participant submissions on this issue, that many demand-side participants do not have the flexibility to decrease load within five minute intervals, nor the appetite to respond to numerous short-lived high prices that disrupt their core operations, without some certainty around duration and timing of the interruption.

Until new generation is installed in the NEM that can switch on and start exporting to the grid almost instantly and sustain output on a scale to reliably support the NEO, changing to five minute settlement may lead to higher wholesale electricity prices. With the existing thirty minute settlement timing, a high electricity price in one five minute dispatch interval is averaged over six intervals. If the high price interval occurs early enough in a thirty minute period, peaking generation is incentivised to turn on and capture some of the revenue created by the high price. By bidding to turn on, gas-fired generators for example, often prevent further high price intervals from occurring, thereby reducing the impact of high prices for end-use customers. Under the proposed five minute settlement, this incentive would diminish, with no price certainty for generators who turn on.

During January and February 2017, wholesale electricity prices in QLD were relatively volatile. Price volatility occurred despite the shift in generator bidding behaviour - away from late rebidding. It is Arrow's observation that in some regions market participants can influence wholesale electricity prices by withholding generation through bidding large volumes of generation at very high prices. This behaviour can be used to influence high prices during any of the six dispatch intervals during thirty minute settlement, particularly when market conditions exhibited key characteristics including high demand, constraints on interconnectors and low output from renewable generation. As a result, the most extreme (and inefficient) price outcomes are unrelated to the timing of settlement in the wholesale electricity market. It is Arrow's opinion that changing to five minute settlement intervals would not fundamentally change this strategic bidding behaviour.

Sun Metals suggests that thirty minute settlement does not incentivise new fast-start technologies to join the NEM. This viewpoint is not sufficiently supported, with new fast start technology (such as battery technology) already being installed. While five minute settlement may suit some new technologies more than thirty minute settlement, not all instances of high prices in the current market are restricted to one-off five minute intervals, meaning that some half hours for example,

can settle at, or near, the market price cap. Further, not all new fast-start technologies will be able to achieve significant levels of generation within a five minute interval, thereby limiting the revenue incentives for such short run profiles. To suggest that fast-start technologies require a wholesale price close to the market price cap to justify market entry, also indicates that this new technology is at a developmental stage where it will have little impact on price stability (an outcome also sought by the rule change proponent), at least until the costs of this technology fall dramatically. In addition, AEMO's 2016 National Electricity Forecast Report (NEFR) assumes approximately 4,000MWh of battery capacity will be installed in the NEM by 2030, without changes to the timing of market settlement.

Arrow suggests that the assessment scope should be broadened to evaluate the possible market impact of promoting new generation technologies in favour of the current generation mix, without sufficient testing of new technologies in the NEM environment.

### **Are there any other inefficiencies that should be considered?**

Figure 3.2 in the Directions Paper highlights the historical average annual variation between five minute dispatch interval prices and thirty minute trading interval prices in each NEM region. From the data it is clear in recent years that interregional differences have emerged between price outcomes, particularly in Queensland and South Australia.

Arrow believes that there are significant market inefficiencies, specific to Queensland and South Australia, which are amplifying Sun Metals' and the Commission's concerns about inefficient price outcomes in the broader wholesale electricity market. Thirty minute settlement is not the fundamental cause of these inefficiencies else all regions would be affected similarly. With Queensland and South Australia connected to the very ends of the electricity network, these regions are at times especially impacted by the limitations of existing interconnector capacity. When interconnectors are constrained, price separation and volatility are more likely outcomes, with local generators having greater market power at these times. Strategic bidding by market participants in an "islanded" region can lead to periods of sustained very high prices. Identifying inefficiencies in these two locations may lead to much better outcomes than changing the timing of settlement in the broader NEM.

While not always easy to address, improvements in forecasting tools and systems would also contribute to more efficient outcomes. Generators rely heavily on the demand forecasts produced by AEMO, for example, to influence their bidding and operational decisions. Further, forecasting wind and solar outputs is becoming more and more critical, another area that could be improved to promote positive market outcomes.

### **3.**

### **How does an aging generation fleet together with rapidly evolving digital technologies and the increasing role of intermittent generation affect the prospects of five minute settlement as compared with 30 minute settlement?**

In the current electricity market, gas-fired generation plays a critical role in supporting intermittent generation and ensuring a secure and reliable supply of electricity across the NEM, thus promoting the NEO. Few other technologies can provide similar fast response times or act as a genuine alternative for retiring coal-fired generation. In addition, peaking generation assets in the NEM are all relatively new, with substantial capacity installed in the past ten years, including: Braemar 2 (450MW), Darling Downs (645MW), Uranquinty (664MW), Mt Stuart expansion (131MW), Condamine (144MW) etc. Gas-fired generation has proven reliability, is cost effective, currently exists on a meaningful scale, as well as producing less harmful emissions than equivalent coal-

fired generation. While new technologies will contribute more to the energy mix going forward, gas-fired generation is the only genuine solution in the near to medium term. It is important that the Commission carefully considers in its evaluation the adverse impacts the proposed five minute settlement rule change will have on gas-fired generation.

Recent high electricity price events in some NEM regions, demonstrates the importance of having adequate reliable peaking generation in the energy mix. Dependence on large-scale renewable generation and insufficient reliable supporting generation, coupled with periods of high demand, low wind availability and interconnector constraints, has contributed to significantly higher and more volatile electricity prices than may have otherwise been.

Changing to five minute settlement would have negative consequences for gas-fired generation and adverse flow-on effects for the wider market. Gas-fired generators would not be able to respond from rest to a high price five minute interval as it takes more than five minutes to start, ramp-up and synchronise to the grid, and export electricity. Gas-fired generator who have sold cap contracts to hedge their revenue, may find it financially untenable to remain in the wholesale electricity market if they cannot respond to high prices and physically back their contracts. With thirty minute settlement, the risk exposure is more manageable. The withdrawal of gas-fired generation would promote much higher prices and increased volatility in the wholesale electricity market, as well as impacting system stability and security.

Arrow would like to see the Commission's assessment framework include a more thorough examination of the potential for new fast-start technologies to fill a potential supply-shortfall should existing gas-fired generators be forced from the wholesale electricity market, as well as the impacts on the financial viability of existing gas-fired generation, and potential effects on reliability and security of supply.

Figure 3.7 in the Directions Paper does not appear to accurately capture the true age distribution of NEM thermal generation plant, and by doing so underrepresents the contribution of newer thermal generation assets. The power stations referred to above, alone represent far more than the indicated 667MW of thermal generation installed in the NEM in the past ten years.

#### 4.

#### **What kinds of generator bidding behaviours would emerge under five minute settlement as compared with 30 minute settlement?**

A change in the settlement timing would mean that offline gas-fired generators would not capture any of the revenue from one-off high price events. As a result, these generators would be in two minds about bidding to run units when a high price interval occurs, with the risk for the generator being that the following interval(s) result in low prices that do not support the economic operation of the units. In situations where gas-fired generators do not switch on, the risk of consecutive high price intervals would then potentially increase, leading to higher overall wholesale electricity prices for market participants and end-use customers. This is an inefficient outcome, and does not promote the NEO.

Accuracy of forecasting by AEMO would be paramount, even more so based on the Commission's expectation that increasing volumes of demand-side participation and battery generation technologies would join the market under five minute settlement. Given these market responses are unscheduled in nature, in reality, forecasting would become increasingly difficult. This would make it even more difficult for peaking generators to bid and operate efficiently, potentially leading to increasingly volatility in the wholesale electricity market. A comment in the Directions Paper that suggests gas-fired generators would be motivated to improve their forecasting ability under five

minute settlement, to determine if only one, or multiple high price intervals are likely in forthcoming intervals, is far too simplistic an assumption. Forecasting is difficult at the best of times, and increased demand-side participation from multiple sources would only exacerbate the inherent difficulties.

Most gas-fired generators sell cap contracts to smooth their revenue profiles. These contracts also limit price risks for retailers and loads. Five minute settlement would make it more difficult for gas-fired generators to support these contracts, and ultimately offer these contracts in the market, if they were not able to respond to high price events. Under five minute settlement, a gas-fired generator who retains existing caps, may be forced to bid in a very conservative fashion, switching units on at uneconomic prices rather than risk being offline when high price intervals occur. To facilitate this type of operation, generators may also decide to operate at reduced output levels to conserve gas for longer periods, a highly inefficient outcome, but still allowing the unit(s) to ramp quickly to maximise the revenue captured from one-off high priced intervals. Ultimately, such operating behaviour may not be financially sustainable.

## 5.

**Is there other data or data sources that can better inform the analysis of the materiality of the problem with 30 minute settlement or the move to five minute settlement?**

While Arrow is not supporting this change, Arrow wonders why other time frames for settlement are not being examined (a view also raised by other participants in earlier submissions). For example, would fifteen minute settlement intervals align with the operating profile of more generation alternatives and demand-side participants?

## 6.

**How material are the issues identified around demand-side optionality? Are there any material issues or benefits that have not been identified?**

In terms of offering demand-side participants optionality for settlement timing, Arrow's view is that any change to the settlement rules should be equally represented on the supply-side and the demand-side. While difficult to quantify materiality, allowing supply-side participants the flexibility to choose thirty minute or five minute settlement and potentially alternate between settlement timings; would create additional inefficiencies, complexities and reduce transparency for market participants.

Changing market settlement to five minute intervals would result in significant upfront costs for all market participants and represent a large administrative burden. For those participants who don't already have appropriate five minute metering assets, assets would need to be upgraded, as well as additional systems to support five minute data (representing six times the volume of existing data). The quantities being measured by this infrastructure often represent very significant financial obligations and therefore need to reflect high levels of accuracy. While SCADA systems have been discussed as a more cost-effective alternative, these systems are not a viable option given they have known accuracy and reliability issues.

Allowing two different settlement intervals would force some participants to maintain dual systems to manage data, to assess settlement payments and inform decision making. Such an approach would increase complexity and potentially lead to errors and increase costs. This outcome is not consistent with improving efficiency in the NEM. Further, different exposure and settlement requirements would need separate portfolios to be managed, thereby effectively doubling the reporting and administrative requirements.



Implications for contracting would also be material, introducing additional risks and costs for participants, due to the variability in reference prices between thirty minute settlement and five minute settlement. For example, a generator who holds a contract that references the thirty minute price, but who is settled at the five minute price, would be exposed when the wholesale revenue earned is inconsistent with the financial payout obligations under the contract, purely as a result of the settlement timings. The forward market for contracts would likely split into two, with participants not wanting to be exposed to the basis risk differences between five minute and thirty minute settlements.

Two forward markets could lead to liquidity issues, as was the case when the AFMA pass-through carbon clause was introduced between 2011 and 2014. While contracting is supposed to reduce exposures for many market participants, it would seem that allowing demand-side optionality would serve to create additional exposures.

**How might the contract market react if demand-side optionality is adopted on a temporary basis?**

Arrow believes that allowing demand-side optionality for a transitional period while changing the wholesale electricity market to five minute settlement would have negative consequences for the contract market, drive unnecessary market complexity, and disproportionately effect market participants exposed to two portfolios.

**8.**

**To what extent would a transition period mitigate the one-off contract negotiation costs of a move to five minute settlement?**

A transition period would likely alleviate some costs associated with contract negotiations for market participants. This would depend on what time period was chosen for the transition and how many contracts expired during this period. It is likely that many market participants would have long-dated contracts which would outlast the proposed three year transition period. Further, the number of different contract parties would influence the costs involved.

**What length of time would be appropriate to enable contracts to either expire or be adapted to take into account the future implementation of five minute settlement?**

While each market participant would have a different position, the proposed three year transition period would not be sufficient to enable all contracts to expire for participants. For instance, many Power Purchase Agreements (PPA's) are long dated. Furthermore, many gas-fired generators have large volume, long dated, OTC contracts written to underwrite their assets. A move to five minute settlement would considerably destabilise these contracts and generate substantial legal costs, uncertainty and financial risks.

Arrow suggests a transition period of at least ten years would be required, with no demand-side optionality. Further, sufficient and proven new generation technologies should be in place before the transition.

**9.**

**To what extent would contract market liquidity be affected by a move to five minute settlement, as distinct from other pressures on liquidity?**

Under the proposed rule change, contract market liquidity would be affected by a move to a five minute settlement in two ways:

Firstly, with regards to cap contracts, most peaking generators would be unable to cover their contracted exposure efficiently or effectively, due to physical response limitations. Generators who typically offered cap contracts to the market but found the risk of not being able to respond to high price intervals too great, would have reduced appetite to sell these contracts. This would have a twofold effect:

- Fewer contracts available would substantially increase the wholesale market price, potentially forcing participants to reconsider a higher strike price. A higher strike would set a higher price signal for generators to react to, ultimately resulting in higher electricity prices for consumers.
- Generators would have lower hedging levels, so the behaviour of generators in the wholesale electricity market would change, whereby generators would be unlikely to defend all prices at the cap strike price. Caps operate like a buffer to higher price intervals; if peaking generators were not incentivised to implement those buffers, greater volatility would likely occur, further increasing the risk associated with caps and therefore the availability of them.

Secondly, the forward over-the-counter (OTC) market would be split in two in the short term. This was seen in 2011 to 2014 with the AFMA pass-through carbon clause. In this situation, participants do not want to be exposed to the basis risk of five minute versus thirty minute settlement differences and therefore will try to hedge with one product over another leading to further inefficiencies and costs.

The Directions Paper makes mention of increasing vertical integration between generators and retailers in the NEM (i.e. internal hedging) leading to reduced contract liquidity.

### **How would the contract markets adapt to a move to five minute settlement?**

OTC contractual arrangements that already exist would possibly be subject to a market disruption event. This is a major risk for some market participants because long term contractual arrangements often represent a large proportion of the overall portfolio. The portfolios of market participants would be exposed to a high level of uncertainty as the renegotiation or termination of contracts was resolved.

ASX Australian electricity futures and options are standardised financial contracts which are settled via a thirty minute trading interval. Transitioning to five minute settlement would reduce the current futures products capacity to provide and manage price risk.

### **To what extent would existing generators develop new operating strategies to underpin hedge contracts?**

Peaking generators could consider a different contract offering that would potentially reduce exposure compared to cap contracts and still secure some financial hedging. For example, generators could evaluate selling average-price quarterly options (or similar), which would expose generators to the average price over the quarter rather than five minute intervals, as this spread the contract risk over the quarter rather than being exposed to individual intervals.

As identified above in 9(a) caps would be exposed to greater risk and less contract availability. This would increase premiums significantly and may drive the market to raise the strike price to

manage excessive premiums and entice gas-fired generators. The flow on effect from a higher cap strike would be a higher buffer in wholesale electricity price intervals.

**10.**

**What are the costs, synergies and risks involved in upgrading IT systems to accommodate five minute settlement?**

The risks involved in upgrading IT systems to accommodate five minute settlement would be impacted by the time allowed for transition, with a shorter transition period increasing the risks for market participants. Arrow's preliminary assessment of the transition suggests that there may be few IT synergies, meaning a significant contribution of man hours and financial resources to ensure new appropriate systems were ready in time for implementation.

Major internal costs identified, would relate to systems development as well as additional hardware requirements. External costs would include, but not be limited to: AEMO interface costs, metering costs and third party vendors.

IT systems that would be affected by a change to five minute settlement would include, but not be limited to, metering systems, data capture systems, settlement and accounting systems, risk systems and analytical systems

While not all systems would need to be fully replaced and some might be easier to transition than others, an entire review of all systems would need to be implemented to identify the costs and timing impacts to each participant. Expectations are that all participants would be exposed to a substantial IT system upgrade and this could run into the millions of dollars.

## What timeframes are required to upgrade IT systems?

Arrow believes that a transition period of at least five years would be appropriate (without demand-side optionality), and allow for necessary budgeting.

**11.**

Are there any further categories of costs that would be incurred if five minute settlement was adopted?

Legal costs are likely to be significant due to the requirement to potentially unwind contracts with counterparties which may not always be agreeable to both. Arrow notes that OTC contracts are not legally required to be reported to AFMA and the assessed exposure to OTC contracts may not be a true reflection of the market exposure.

Portfolios would be exposed to a high level of uncertainty as renegotiation or termination of contracts is resolved. This risk would expose market participants to hundreds of millions of dollars of uncertainty, while market fundamentals are at play over a prolonged period of time.

If demand-side optionality is adopted then further costs would be incurred by generators whom would be exposed to both five minute settlement and thirty minute settlement, which would require separate portfolios to be managed, settled and accounted for. This is no small task and the additional system and personal costs should be considered.

How suitable is the proposed two-stage transition period to implement five minute settlement? Do you consider there to be a more preferable approach to a transition period such as alternative timeframes?

Demand side participant optionality during the transition phase would impose a regulatory and administrative burden on those participants exposed to both five minute and thirty minute settlements. Different exposure and settlement requirements would need separate portfolios to be managed, thereby effectively double the reporting and administrative requirements.