

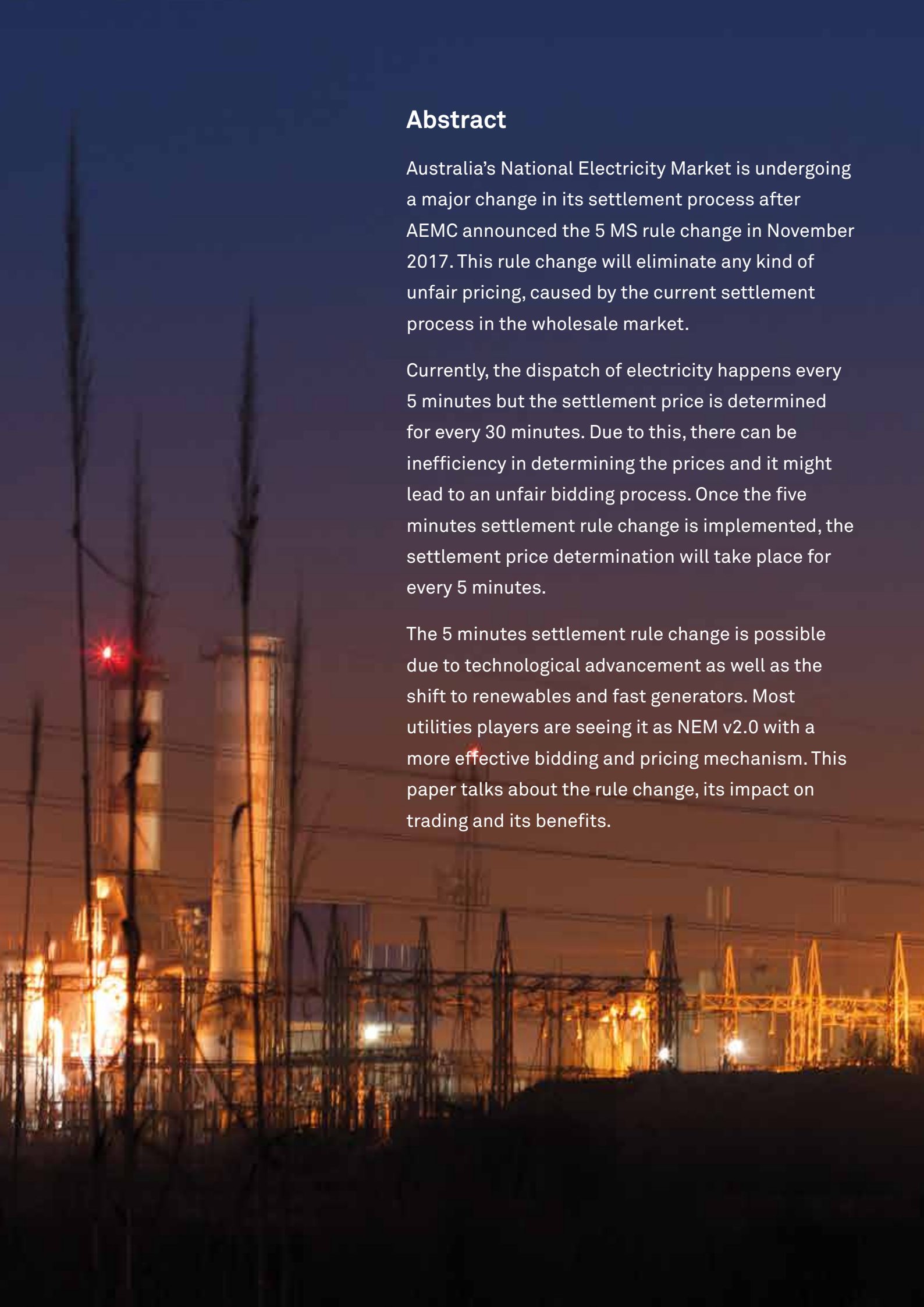
The title text is centered within a large, semi-transparent pink-to-purple gradient circle. The text is in a bold, white, sans-serif font. The background of the entire slide is a photograph of high-voltage power lines and towers silhouetted against a dramatic, colorful sky at sunset or sunrise, with warm orange and yellow tones near the horizon and cooler blue tones at the top.

Abstract

Australia's National Electricity Market is undergoing a major change in its settlement process after AEMC announced the 5 MS rule change in November 2017. This rule change will eliminate any kind of unfair pricing, caused by the current settlement process in the wholesale market.

Currently, the dispatch of electricity happens every 5 minutes but the settlement price is determined for every 30 minutes. Due to this, there can be inefficiency in determining the prices and it might lead to an unfair bidding process. Once the five minutes settlement rule change is implemented, the settlement price determination will take place for every 5 minutes.

The 5 minutes settlement rule change is possible due to technological advancement as well as the shift to renewables and fast generators. Most utilities players are seeing it as NEM v2.0 with a more effective bidding and pricing mechanism. This paper talks about the rule change, its impact on trading and its benefits.



About Five-Minute Settlement

*1st Oct, 2021

5 Minutes Settlement Rule Implementation

In November 2017, the Australian Energy Market Commission (AEMC), the rule-maker for the NEM, decided 5 Minute Settlement should be implemented in the NEM and come into effect on 1st Oct, 2021.

*The Implementation of 5 minutes settlement has been rescheduled by AEMO for 1st Oct, 2021 due to COVID-19 pandemic.

5th September,
2017

Draft Rule Published

AEMC published its draft rule determination to change the time interval that NEM settlements are calculated

May, 2016

Sun Metals Corporation requested for the rule change

- Australian Electricity Market Operator dispatches electricity every 5 minutes, so generators are required to bid in every 5 minutes period.
- Currently, for the purpose of settlement, this price is averaged out for 30 minutes.
- This is referred to as the **5/30 problem**. It causes pricing anomaly leading to:
 - Unfair pricing
 - Disorderly bidding

Since 1998

Mismatch between dispatch & settlement

Reason behind proposing the rule change was, the current system:

- Allows generators to artificially inflate the prices for consumers; and
- Makes it difficult for fast response generation and demand side response to enter the market.

Key Impact:

- Both dispatch and settlement will occur at five-minute intervals.
- The spot price will be determined for each five-minute trading interval instead of being an average of half an hour thereby enabling a better and fair pricing mechanism.



The Math Explained...

AEMC has explained the mathematics as to how the 30 minutes settlement is calculated and how it leads to unfair pricing: The dispatch price is set by the price of the highest cost generator required in the five-minute interval. For the six intervals in the graphic, the dispatch prices are: \$40, \$80, \$80, \$100, \$100 and \$80.

This averages to $\$480/6 = \80 which is the spot price for the half-hour trading interval. Due to this averaging of the price, the generator bidding at \$40 receives double the amount of what the bid was, whereas the generator with dispatch price as \$100 incurs a loss.

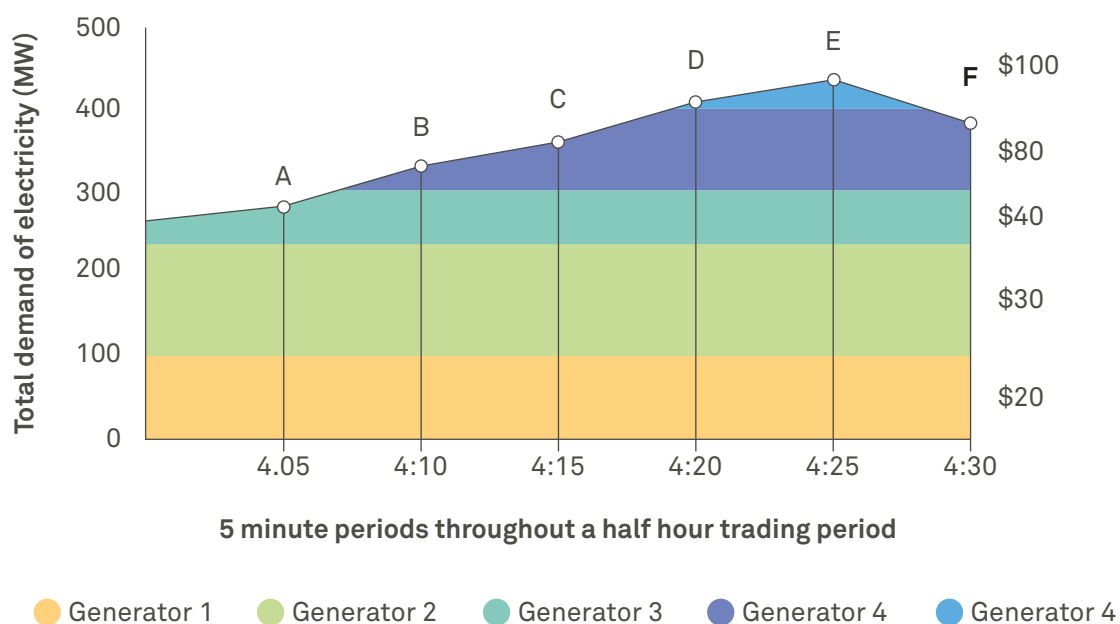
The difference in time-period (dispatch at every 5 minutes and settlement at 30 minutes interval) was primarily due to historical arrangements prior to market start, including limitations on metering and data communications.

The technological advancements such as smart meters, enhanced metering infrastructure, analytics for better forecasting and fast generators in place, it has now become possible to dispatch and determine the spot price for every 5 minutes.

Let us now understand the impact of this rule change on the utilities value chain, trading and short-term trade life cycle.

(Source: AEMC Fact sheet: How the spot market works)

Example: Scheduling generators in the NEM

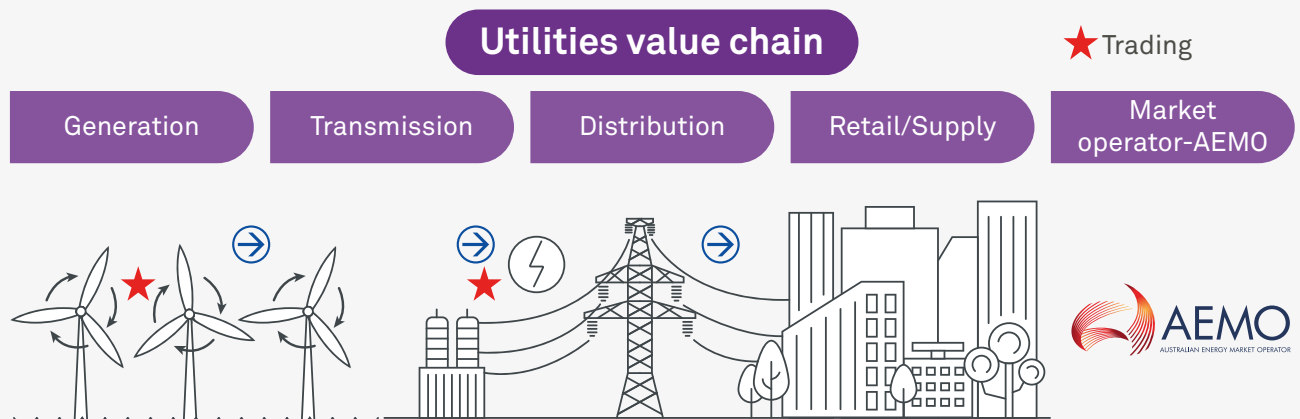


Impact of Five-Minute Settlement

Impact on Utilities Value Chain

With the change in the settlement time from 30 minutes to 5 minutes, various areas of the value chain will be impacted. The figure below depicts the changes corresponding to each of these areas.

Let us now understand the impact of this rule change on the utilities value chain, trading and short-term trade life cycle.



- | Generation | Transmission | Distribution | Retail/Supply | Market operator-AEMO |
|---|---|---|--|---|
| <ul style="list-style-type: none"> • Processing of Demand Profile from 30 minutes to 5 minutes published by central body • Actual Demand generation based on dispatch signals – more frequent signals processing leading to a change in generation mix. • Change in Generation mix & Role of Demand Response Technologies such as Battery, Solar | <ul style="list-style-type: none"> • Processing of 5 minutes meter reads from central body – 6 fold increase • Billing and DUoS charge calculations • Change in file formats for inbound and outbound data – Central body & Retailers • More frequent settlement calculation with increased data • Undertake changes in metering systems | <ul style="list-style-type: none"> • Processing of 5 minutes meter reads from T&D – 6 fold increase • Metering and ToU Billing calculation changes • Change in file formats for inbound and outbound data – central body & T&D • More frequent 'internal' settlement calculation with increased data • Processing of metering system changes - T&D | <ul style="list-style-type: none"> • Change in file formats & data structure for inbound and outbound data – interface with Generators, Suppliers, T&Ds • Capability to process 6 times more data. • Future proofing to receive and process 5 minutes data directly from meters • Fundamental change to ancillary services | <ul style="list-style-type: none"> • Trading |



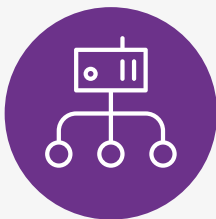
Generation:

- a. Demand profile processing would be done for every five minutes, after the implementation of 5 minutes settlement rule.
 - b. Since the demand profile would change, so will the dispatch signals. These dispatch signals will now become more frequent.
 - c. Due to the change in the processing of the demand profile and the increase in the dispatch signals, there would be a change in the energy generation mix and the role of the demand response technologies. Fast generators such as batteries and solar energy will now have a significant role to play in the generation mix.
-



Transmission and Distribution:

- a. There would be an increase in the meter reading. The increase would be 6 times as now the reading would need to be captured and published to AEMO for every 5 minutes as compared to 30 minutes.
 - b. Changes in the formats for data, both inbound and outbound for the central body and the retailers.
 - c. The frequency of the settlement calculation will increase due to increased data.
 - d. Calculations for billing and DUoS charges will change
 - e. Metering systems will undergo a change in order to support the five minutes settlement.
-



Retail/Supply:

- a. Processing of the meter reads from transmission and distribution will increase 6 fold due to the settlement moving from 30 minutes to 5 minutes
- b. Calculations for Metering and ToU Billing will change in order to support five minutes settlement data
- c. T&D metering system will undergo changes and metering data will increase 6 fold, the same would need to be processed for further calculations.
- d. Internal settlement calculations would become more frequent with the increased data.

Impact on Trading

There would be a considerable impact on the trading business due to the rule change. The figure below depicts the changes corresponding to each aspect of the trading business, from forecasting till risk management.

Trading business

Forecasting	Trading	Dispatch & market information	Trade settlement	Risk management
<ul style="list-style-type: none"> • Demand & supply • Price 	<ul style="list-style-type: none"> • Bids & auctions • Hedges • Balancing trades 	<ul style="list-style-type: none"> • Nominations • Actualization 	<ul style="list-style-type: none"> • Financial • Invoice & payments • Shadow settlements 	<ul style="list-style-type: none"> • Credit • Collateral • Market
<ul style="list-style-type: none"> ★ Bid submission for every 5 minutes as compared to 30 minutes 	<ul style="list-style-type: none"> ★ Change in Trading intervals from 48 (every 30 minutes) to 288 	<ul style="list-style-type: none"> ★ Nomination and Actualization to happen for every 5 minutes trade 	<ul style="list-style-type: none"> ★ Profiling algorithms introduced to derive 5-minute energy data 	<ul style="list-style-type: none"> ★ With the increased frequency of data from 30 min to 5 min, there's impact on overall risk management: <ul style="list-style-type: none"> • Risk Reporting • P&L Reporting • Regulatory Reporting
<ul style="list-style-type: none"> ★ Price determination for every 5 minutes 	<ul style="list-style-type: none"> ★ Balancing of trades for every 5 minutes 	<ul style="list-style-type: none"> ★ AEMO will create new data structures to receive, use and store 5-minute bids and offers 	<ul style="list-style-type: none"> ★ Transactions will need to be calculated for each 5-minute period 	
		<ul style="list-style-type: none"> 30-minute pre-dispatch and PASA processes that use bid information will be provided with 5-minute data 	<ul style="list-style-type: none"> Settlement estimation will calculate energy transactions for every 5-minute period 	
		<ul style="list-style-type: none"> Market participant systems will need to be updated to submit and receive confirmations of 5-minute bid and offer data 	<ul style="list-style-type: none"> Inter-regional and intra-regional residue will be calculated on a 5-minute basis 	
		<ul style="list-style-type: none"> AEMO will publish 5-minute data 	<ul style="list-style-type: none"> ★ A number of non-energy transactions, such as market ancillary services (i.e. FCAS) and compensation recovery, will be completed using 5-minute energy volumes 	

★ Use Case for ETRM

- With the change in the settlement duration from 30 minutes to 5 minutes, the demand and supply will need to be matched for every 5 minutes
- Settlement price determination will now happen for every 5 minutes instead of 30 minutes
- Trading intervals change from 48 to 288. Trading in the present scenario happens for every half hour for 24 hours = 48 intervals. Post the implementation of 5 minutes settlement, trading intervals will increase 6 fold, thereby increasing the number to 288.
- Balancing of the trades will need to be done for every 5 minutes post the implementation of 5 minutes rule.
- Nomination and Actualization will happen for every 5 minutes.
- AEMO will create new data structures to comply with 5 minutes settlement – Receipt, use and storage of trade data for every 5 minutes

- Transactions will occur for every 5 minutes and so the calculations will be done for every 5 minutes trade
- Non-Energy transactions such as market ancillary services and compensation recovery will be done for every 5-minute energy volume.
- In order to comply with the 5 minute rule change, the reporting will need to be done with the revised format published by AEMO.

Impact on Short-Term Trade Life Cycle

NEM is a wholesale market which is a pool or a spot market. The rule change will therefore impact the short-term trade life cycle. The various areas that are impacted as part of the short-term trade life cycle are:



Energy Market Management System (EMMS)



Settlements & Prudential



Dispatch



Market Reports



Settlement Residual Auction



Offers & Submissions



Credit Support

The below diagram represents the impact on front office, mid office and back office:

Trade life cycle – Short term trading		
Front office	Middle office	Back office
Bid/Offer Submission and response	Outstanding vs trading margins	Spot Market Transactions
Bid offer reports	Regional Reference Price	Reallocation transactions
Physical Notification	Risk Reporting	Ancillary Service Transactions
Bid System Modification	Credit Limit Reporting	Data collection for credit cover and estimate calculation

The rule change will have a considerable impact on trading business as well as the complete value chain. However, it brings a number of benefits to the various players in the utility industry. The next segment of the paper talks about the various benefits associated with the rule change.

5-Minute Settlement – Benefits

Every industry undergoes a change in due course. Five-minutes settlement is one such change that the utility industry is set to embrace. This rule change brings numerous benefits to the industry such as:

Improved price signals for:

- Increased efficiency in generation and usage of electricity
- Increased efficiency in the investment in capacity and demand response technologies in order to balance the supply and demand

Improved Bidding Incentives

- Efficient investment and innovation in appropriate amount of flexible generation and demand side technologies



Efficient behavior of the participants

- More accurate rewards to those who can deliver supply or demand side responses exactly when they are needed by the power system

Efficient investment in Renewables/Fast Generators

- Newer technologies such as batteries would support the storage of electricity generated using intermittent sources of energy.
- This would also allow wholesale prices to fall leading to lower electricity bills for end consumers.

Dynamic power system

- With the new rule, the way the complete power system operates will become more dynamic and more responsive
- Also, there would be enhanced technologies to make the rule change successful

Technological advancement has made it possible to implement and support the 5-minutes settlement rule change. The ETRM industry will see newer opportunities due to this change, and the Australian utility industry will derive benefits from the 5-minutes settlement rule change, making it a level playing field for all players.

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