

IDC PERSPECTIVE

Life in the Fast Lane: Bringing a Five-Minute Settlement to the Australia Utilities Market

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EXECUTIVE SNAPSHOT

FIGURE 1

Executive Snapshot: Life in the Fast Lane: Bringing Five-Minute Settlement to the Australian Utilities Market

This IDC Perspective provides an overview of one of the largest transformations programs in the global energy industry — the Five-Minute Settlement (5MS) program in Australia. This document describes the impact of 5MS on the Australia utilities market and industry participants and highlights the solution, approach, governing structure, benefits, and strategic partnership with Tata Consultancy Services, which has the Australian Energy Market Operator (AEMO) transform to achieve its desired outcomes.

Key Takeaways

- The 5MS program was a complex undertaking affecting the AEMO, generators, retailers, metering providers, and meter data and network service providers. All these stakeholders have had to work in harmony, improving their technological and organizational capabilities to ensure success.
- The AEMO adopted a new cloud platform that can store and process huge volumes of data and is highly scalable. The program overhauled the data model to support the required data capabilities.
- Apart from technical and functional expertise, implementing such a large program required strong partnerships and a steady rhythm and cadence across workstreams to maximize value creation.

Recommended Actions

- Finding the right governance model is a key aspect in delivering such a large, complex program that affects the entire industry and all market participants. Implementing strong governance enables delivery disciplines that contribute to the program achieving the desired outcomes.
- Building data capabilities is critical for success. The entire data life cycle needs to be managed and will require technical and functional expertise, including data engineering, data analytics, and data forecasting.
- Implementing a new technology stack requires new skill sets. Delivering the relevant training and educational programs to the workforce will help the organization successfully transition its business, technical, and support aspects.

Source: IDC, 2022

SITUATION OVERVIEW

Overview

This IDC Perspective explores one of the largest transformation programs in the global energy industry. The Five-Minute Settlement (5MS) program delivered by the Australian Energy Market Operator (AEMO) in 2021 was realized with its strategic implementation partner Tata Consultancy Services (TCS). 5MS is a first-of-its-kind project, putting Australia as the frontrunner globally for bidding, metering, and energy settlement at five-minute granularity and offering a road map for other energy markets around the world. A highly technical and complex project, 5MS required the AEMO to implement a strong governance structure and manage multiple stakeholders from steering committees and program management groups to industry participants and specialist committees. The project was a multiyear, large-scale undertaking in which AEMO enhanced or created (including application programming interfaces [APIs] and reporting) over 100 retail applications, 35 dispatch and bidding applications, and 90 settlement applications. At its peak in April 2020, the project had over 246 full-time staff, across AEMO and its partners, working on the program.

According to AEMO CEO, Daniel Westerman, "The successful implementation of 5MS, wholesale demand response (WDR), and customer switching will create better outcomes for market participants and consumers and produce a more efficient energy sector in Australia. The AEMO will operate a new market for large energy users to commit to lowering usage to help power system security and reliability, including days of peak demand and periods of high wholesale electricity prices, increasing competition with potential flow-on price benefits to electricity consumers."

In the 1990s Australia's power generation, distribution, and retailing were owned and operated by each state, with different governing authorities. It was a simple format in which the entire value chain was regulated, managed, and operated by a handful of players. Generation, transmission, distribution, and pricing were controlled by the state. However, in the late 1990s Australia began to deregulate the energy industry, and the government began to divest its energy assets and begin privatization. The entire wholly state-owned system was unbundled and is today made up of private generators, distributors, and retailers.

The National Electricity Market (NEM) was formed in 1998 to offer a wholesale marketplace, with spot prices for power generators and retailers. Settlement would occur for 30-minute blocks and across five regions: Queensland, New South Wales, Victoria, Tasmania, and South Australia. Currently, the NEM, with 300 registered participants, accounts for approximately 80% of all electricity consumed in the country. The wholesale energy market (WEM), with 88 registered participants, operates in Western Australia and accounts for the remaining 20% of the energy supply.

The industry and market have come a long way since the 1990s, and despite technologies in place, there are anomalies and discrepancies influencing the price signals within 30-minute settlements. As the world shift toward sustainability and net-zero emission targets, companies are targeting a lower carbon footprint, adopting renewable and distributed energy sources, and encouraging investments in newer and faster technologies. The expected benefit of the 5MS program was to remove the anomaly in the market, aligning settlement and dispatch periods. These efficiencies for NEM operations and investments support orderly bidding, deliver better price signals for demand response, and encourage investment in fast-response technologies.

National Initiative: The Role of Different Bodies and the 5MS Program

The Roles of the Australian Energy Market Commission, AEMO, and NEM

The Australian Energy Market Commission (AEMC) is responsible for the rules, policies, and systems that govern the NEM. These rules and systems are, in turn, managed and operated by the AEMO. When the NEM was launched, the process of settlement was split into 48 blocks of 30-minute settlements per day. In short, as electricity is measured similar to fluid moving in time (i.e., kilowatt hours), the trading day was split into 30-minute blocks offered by the generators to retailers. In 2017, all of this changed when the AEMC tasked the AEMO to design and deliver a program that reforms the market to better align settlements with dispatch by offering 5MS.

The Australia energy market is one of the most competitive markets in the world and is transforming at the fastest pace worldwide. In recent times, the energy landscape has changed dramatically with the rising popularity of renewable energy sources (particularly solar and wind), new battery storage technologies, and smart metering at the consumer level. This has created a much more fluid energy environment in which distributed energy resources and increased volatility in supply, demand, and pricing have led to the need for a more dynamic marketplace. The energy industry in Australia caters to 9 million customers, consuming approximately 185TWh of electricity per annum, and the AEMO is responsible for US\$16.1 billion in settlements per annum.

5MS

5MS is a national regulatory and compliance change. The AEMO was given the responsibility to update all market procedures and systems to prepare for and facilitate a move to the new system. In October 2021, after several years of planning, testing, and industry collaboration, the 5MS program went live in which the settlement period changed from 30 minutes to 5 minutes. The AEMO was also tasked with implementing the Global Settlements (GS) rule change, which would improve the distribution of costs of unaccounted for energy (UFE). Previously, UFE was borne from a limited number of retailers under a system known as "settlement by difference," but now with GS, UFE will be more fairly allocated by ensuring all retailers share the cost of UFE.

The program has three major workstreams — dispatch, metering, and settlements:

- **Dispatch.** The main function of dispatch is to ensure that demand is met. It manages demand forecasting and helps with the physical dispatch of the generation (electricity) and dispatch price every five minutes (and aggregates a spot price every 30 minutes). With 5MS in place, the number of daily bidding intervals will increase from 48 to 288, requiring a robust system and new bidding engine to handle the new data structures (required to receive, use, and store five-minute bids and offers).
- **Metering.** This workstream required the largest transformation under the 5MS program. It deals with the retail end of the value chain and manages the receipt, storage, and processing of metering and standing market data. The deployment and activation of five-minute capable meters would create huge volumes of incoming data (more than 2 trillion data points by 2028), and the existing technology stack would be incapable of handling such demand. Metering data providers will keep feeding the meter data in a granularity of 5-, 15-, and 30-minute intervals, and the new system will profile all the different granularity into 5-minute reads to enable market settlement in 5 minutes. This would require a solution that is flexible and scalable. Hence, a move from on-premises to a cloud-integrated model was required.
- **Settlement.** This workstream manages the calculation of financial liabilities and credits between market participants daily and settles all trade in the NEM on a weekly basis. Prices in

five-minute granularity get passed from the dispatch system, metering data flows from the enterprise meter data management (EMDM) system in five-minute granularity, and the final settlement amount (market participant liability and credits) gets calculated in the settlement system to settle the market in five minutes.

Implementing such a large-scale program demands a robust governance structure and stakeholder management. The internal governance arrangement consists of the AEMO board, a program steering committee, program management groups, and various advisory and specialist committees. To manage the complexity involved in the program, the AEMO held extensive industry engagements with over 150 industry working groups and forums, 7 general information sessions (with over 550 participants), and 12 industry readiness surveys and issued 15 program update newsletters. The external governance structure is composed of:

- An executive forum (EF) for executive level representatives
- A program consultative forum (PCF) to provide relevant documentation and management oversight
- A readiness working group (RWG) to coordinate readiness activities across the industry
- A system working group (SWG) to manage industry inputs on system design and interface changes to support 5MS
- A procedures working group (PWG) to engage with industry stakeholders during procedure development processes
- An industry testing working group (ITWG) to engage 5MS testing in detail

Impact and Benefits of 5MS

The 5MS program has impacted market participants and required not only changes in business process changes but also a rework of the entire technology landscape. The changes are not limited to the AEMO and its numerous internal stakeholders but also includes the wider industry, including generators, retailers, meter providers, and meter data providers that have all had to change their systems and processes and prepare for 5MS.

As the price settlement will be at five-minute intervals, all other periodical meter data also needs to be converted to match the five-minute cadence. Data will flow at tight intervals with more granularity and handling this vast amount of periodical data demands better data management capabilities. According to TCS' forecast, by 2028, market data volume growth will grow by 317%. Hence, the new platform was required with the capability to scale to meet future demands.

Benefits

Implementing the massive 5MS program is a great example of program management and demonstrates impressive business, technical, and functional achievements:

- Previously, dispatch took place every five minutes. Hence, there were six dispatches in 30-minute intervals, and the price was averaged out within a 30-minute settlement period. This anomaly was removed by 5MS.
- With the new clean energy targets and growing share of renewable energy and distributed energy resources (DERs), the market will need more flexibility to adjust to increased demand and supply variability. 5MS will enable this and provide better price signals for renewable energy.

The costs of unaccounted energy (distribution loss and energy loss) will be more equitably distributed as a result of global settlement, reducing the burden on local retailers. There are several benefits to the energy industry, such as:

- Improved price signals and transparency, with fewer settlement disputes
- Accurate price signals for investment in technologies, such as batteries for storage and gas peaking generators
- More accurately rewarding those that can deliver supply- or demand-side responses with financial incentives that are aligned to operations
- Improved performance with automation from APIs and a user-friendly interface and improved bidding incentives
- Standardization of business processes and procedures

According to Violette Mouchaileh, AEMO chief market services officer, "This reform provides better price signals for investment in faster-response (electricity generation and demand side response) technologies, such as batteries and gas peaking generators. It enables more efficient bidding, operational decisions, and investments aligned with dispatch and financial settlement periods."

Challenges

To achieve a more accurate and transparent electricity market, the 5MS program was required to synchronize the dispatch and settlement pricing. These changes affected all the market participants and posed many challenges, some of which are ongoing:

- **Coordination with the market participant.** This program was not about implementing a single system. Rather, it is going to affect all market participants, from generators, retailers, and meter providers to meter data providers. All the market participants also needed their own 5MS programs to update their systems and processes within their budget and delivery timelines.
- **Locked-in dates.** Shifting to the new environment and implementing the technology stack to provide a future-ready platform were challenging, especially when working within a regulatory framework with locked-in dates.
- **Organizational approach.** To maximize the value and manage the cost with cloud technology (a subscription model against the existing annual fee model), a different organizational approach was needed, requiring the adoption of new business processes and systems.
- **Cadence across workstreams.** Establishing rhythm and cadence across the different workstreams and keeping them aligned using agile execution were challenges with the new delivery methodology.
- **Data capabilities.** Data is a core critical success factor for the 5MS program. It poses many challenges in the life cycle of data management. Massive amounts of data flow require a deep functional understanding of what, where, and how. Further, data storage and analytics demand deep data engineering capabilities and skilled resources.
- **Scalability.** The solution and platform should be flexible, configurable, loosely coupled, and highly scalable. It should be replicable and reusable for other energy market ecosystems in the future.
- **Technology and expertise.** Choosing the right technology in alignment with enterprise technologies and platforms and access to resources with the required technical expertise to address the complexities involved was a significant challenge.

Solution, Approach, and Engagement with TCS

5MS was a highly complex, multistakeholder project that delivered a complete overhaul of the energy market for dispatch, bidding, and settlement. It is a future-proof system that ingests the data provided by the meter data provider (MDPs) and is expected to manage a projected 2 trillion data points by 2028. TCS was appointed by the AEMO as a key strategic partner to deliver and implement this project and was responsible for this first-of-its-kind solution architecture and deployment on state-of-the-art cloud technology.

Each of the workstreams (dispatch, metering, and settlement) described earlier had specific objectives and goals that needed to be achieved, and the AEMO has a well-defined governing structure that tracks outcomes. An equivalent structure was defined and implemented by TCS under the metering workstream that contributed to the largest component of changes and transformation. For the retail arm of the workstream, the strategic nature of this partnership for the 5MS program came to the fore in which new capabilities and services were brought into play, including understanding requirement procedures, traceability to ensure compliance, risk management, process mapping, change management, readiness and training, and operational readiness.

AEMO's meter data management (MDM) system was replaced with an EMDM system, making it better placed for future needs. The solution was built utilizing cloud-native services on Azure. Apart from replacing the MDM system, the integration of upstream processes was key to deliver an end-to-end retail solution, and hence, the solution was built and optimized in harmony. Under this program, the AEMO went through substantial changes from an infrastructure perspective, with active collaboration from TCS. With the expected volume and size of the data, the new platform was built with scalability as a key capability. Therefore, the microservices and architecture are composed of many complex components. The solution used API-enabled cloud-native services and Azure-native capabilities.

This was a program of many firsts. In partnership with TCS, the AEMO successfully completed the standardization of its architecture, tools, coding, Azure Kubernetes Services, Cosmos DB, and Databricks to uplift its capabilities. TCS helped the AEMO build the latter's digital platform strategy through the 5MS program by delivering enterprise cloud, DevOps, automated testing, and agile practices. The platform modernization can now manage the ever-increasing data volumes, with 20.5 million daily meter reads expected by 2025 and 95TB of meter data by 2028.

To ensure success, the program used a top-down approach, and product owners from the metering business led and facilitated the business requirements. Activities, such as design spec and the complex testing of components, required collaboration, coordination, and a holistic play to ensure the delivery and outcomes were as per expectations. Additionally, for optimum delivery, the operating model was well-tuned with people, system, and processes working in harmony while utilizing the distributed team model. Delivery frameworks were well-defined strategically and technically to articulate the changes needed to be achieved. Finally, the agile execution model included seven different agile scrum teams within its delivery execution framework, delivering and churning out features every two weeks endorsed by product owners.

The Road Map Going Forward

The road map going forward will involve:

- **Changing energy landscape.** With the increasing share of renewable energy and DERs, coupled with the retirement of conventional plants, AEMO will be looking forward to a new power supply mix.

- **Data capabilities.** Large volumes of data are getting generated by the 5MS program. About 2 trillion data points are expected by 2028. Therefore, data capabilities, including analytics, intelligence, and forecasting, will have an increased focus. Extended technologies, such as, artificial intelligence, will also be a focus area for the AEMO.
- **Regulatory energy markets.** Energy markets are evolving. Australia's energy landscape is undergoing rapid and unprecedented levels of change. The AEMO will continue to actively drive and plan for Australia's energy future.
- **Fastening the codependent sectors.** The AEMO is looking toward coupling different codependent sectors (such as gas, electricity, electric vehicles, water, and hydrogen) and designing a holistic approach to meet the demand-side needs.
- **The consumer as an active participant.** The AEMO was always market-focused, but with a growing number of intelligent devices and enhanced consumer involvement in the energy ecosystem, it is going to focus on price sensitivity and innovative consumer-facing businesses.
- **Climate change and resilience.** Multiple climate events are inducing vulnerabilities and challenging the demand side. The AEMO has an increased focus on these areas with disaster recovery, outage management, integrated planning to quickly recover and control the demand side. It is the AEMO's role to ensure Australians have access to affordable, secure, and reliable energy, and it plays a key role in assisting Australia's drive toward net-zero emissions.

ADVICE FOR THE TECHNOLOGY BUYER

IDC recommends the following:

- **Governance model.** Finding the right governance model is a key aspect in delivering such a large, complex program that affects the entire industry and all market participants. Implementing strong governance ensures that conflicting priorities are avoided, the program is steered in the right direction, and it can achieve the desired outcomes.
- **Agile delivery model.** Apart from the technological aspect, there is a high level of functional complexity involved. An iterative delivery model or agile execution model could suppress the challenges by offering improved project/ program management, scheduling, issue resolution, risk mitigation, resourcing efforts, and overall cost reduction.
- **Skills and knowledge.** Implementing a new technology stack requires new skill sets. Delivering the relevant training and educational programs to the workforce will help organizations successfully transition from business, technical, and support standpoints.
- **Data capabilities.** Building data capabilities is critical for success. The entire life cycle of data needs to be managed and will require technical and functional expertise, including data engineering, data analytics, and data forecasting.
- **Stakeholder engagement.** Stakeholder engagement and coordination are crucial to manage such a unique program as 5MS. Forums, sessions, and surveys assist in information sharing. Provide regular check-ins with stakeholders to ensure the industry as a whole is progressing in the right direction.

LEARN MORE

Related Research

- *IDC FutureScape: Worldwide Utilities 2022 Predictions* (IDC Energy Insights #US47075621, October 2021)
- *IDC Perspective: A Framework for the Future Power Enterprise in Asia/Pacific* (IDC Energy Insights #AP47075421, July 2021)
- *Utilities Priorities Within the Australia and New Zealand Power Sector* (IDC Energy Insights #AP46517420, May 2021)
- *Regulatory Environment for Power Utilities in Asia* (IDC Energy Insights #AP43672419, November 2020)

Synopsis

This IDC Perspective provides an overview of one of the largest transformations programs in the global energy industry — the Five-Minute Settlement (5MS) program in Australia. This document describes the impact of 5MS on the Australia utilities market and industry participants and highlights the solution, approach, governing structure, benefits, and strategic partnership with Tata Consultancy Services, which has the Australian Energy Market Operator (AEMO) transform to achieve its desired outcomes.

"5MS is a significant reform that has impacted all participants in the Australia electricity market. It will not only vanish market anomalies and bidding inconsistencies but also bring equitable price signals across generation fleets as well as encourage battery storage and renewable technologies investments," says Jayesh Verma, senior research manager, IDC Energy Insights.

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