# *Digital Energy Platform for Transmission and Distribution*

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**Abstract**

Mitsubishi Electric provides Enterprise Resource Planning systems such as the wheeling fee calculation package (BLEnDer TS*1) for Transmission System Operators (TSO), and thereby contributes to the smooth execution of transmission and distribution operations(1). On the other hand, transmission and distribution operations require operational improvements for the next generation, such as responding to revenue caps*2, expanding renewable energy, and improving service levels. To address these challenges in transmission and distribution operations, we are developing a digital energy platform for TSOs (hereinafter referred to as a "digital energy platform for transmission and distribution") aimed at service delivery, rather than providing products based on conventional from-scratch development.

## 1. Introduction

The Japanese transmission and distribution domain has undergone various institutional and operational reforms since the start of power retail liberalization in 2000, including the liberalization of high-voltage consumers in 2004, expansion to low-voltage consumers in 2016, and legal separation of transmission and distribution divisions in 2020. As a result of repeated additions to existing operations, as well as system modifications and expansions, operations and systems have become complex and bloated, and are now reaching their limits in keeping up with large-scale institutional changes such as distributed energy resource support, next-generation central load dispatching instruction support, simultaneous markets, and transition to nodal systems*3. Meanwhile, the method of setting wheeling fees has changed from rate-of-return regulation*4 to revenue cap regulation, and the recent impact of labor shortages has caused resource shortages in planning, development, and maintenance for both operations and systems, and there is a need for fundamental efficiency improvements and cost reduction initiatives.

This paper provides an overview of the development of our digital energy platform for transmission and distribution, our new initiative to transition from conventional product delivery (selling products) based on from-scratch development and package development, to service delivery (selling services) based on new solutions that combine global solutions with our own expertise.

## 2. Digital Energy Platform for Transmission and Distribution

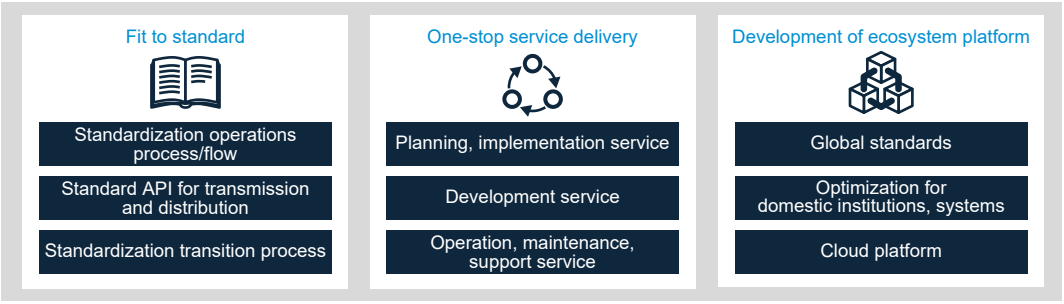
The digital energy platform for transmission and distribution provides new services with three basic concepts: fit to standard, one-stop service delivery, and development of an ecosystem platform. The solution concepts are shown in Fig 1.

*1 One of the BLEnDer series of packaged software products, developed by Mitsubishi Electric, for the power market to comprehensively address electricity trading and supply-demand control.

*2 A mechanism whereby TSOs set wheeling fees based on business plans approved by the national government as "revenue caps," and achieve cost efficiency while securing necessary investments within that scope.

*3 A market-driven congestion management method that sets different prices at each location (node) reflecting transmission network congestion and constraints, and awards contracts starting from the lowest-priced power sources in the power market.

*4 A pricing method that determines services by adding appropriate profit (appropriate business compensation) to the supply cost. The method is applied to rates of highly public service businesses for which stable supply is essential, such as electricity, gas, and water rates.




API: Application Programming Interface, DX: Digital Transformation

**Fig. 1 Solution concepts**

### 2.1 Fit to standard

Wheeling operations—one type of transmission and distribution operations— are carried out according to general provisions (such as wheeling service general provisions) created by each TSO based on the wheeling service system established by the Ministry of Economy, Trade and Industry. Therefore, basic concepts such as fee calculation formulas are uniform across all companies. On the other hand, differences in actual operational processes/flows occur among companies due to differences in interpretation of general provisions, region-specific conditions (such as the presence or absence of remote islands), historical operation practices, and differences in existing overall system configurations. Furthermore, individual company requirements (add-on development) arise in system development, resulting in issues with development scale escalation and lead time prolongation. Therefore, the digital energy platform for transmission and distribution aims to reduce individual company requirements and optimize development scale through fit to standard.

The aim of fit to standard is simple processes/flows that conform to domestic institutional systems and enable operational standardization among TSOs by incorporating the following four points:

(1) Knowledge gained from operation of current wheeling system, etc.
(2) Issues faced by TSOs (specifics examined by TSOs and Mitsubishi Electric in current operations with the aim of issue resolution)
(3) Standard processes/flows and operational (data) models in global solutions
(4) Measures for the next generation of transmission and distribution operations

By utilizing these standard processes/flows, it is possible not only to reduce the volume of development through reduction of the add-on development mentioned earlier, but also to provide systems that meet transmission and distribution operation requirements without the need for TSOs to examine operational requirements from scratch, and to improve lead times to system introduction. Table 1 shows the applicable scope of standardized operational processes/flows for wheeling operations.

**Table 1 shows the applicable scope of standardized operational processes/flows for wheeling operations**

| Operational domain | Scenario name |
|---|---|
| Customer information management | Contract management between consumers and generators (new contracts, modification) |
| | Contract management between consumers and generators (contract termination) |
| | Retailer management |
| | Temporary contract management (exceeding period) |
| | Temporary contract management (less than 1 year) |
| | Contract power management (actual quantity system) |
| | Contract power management (consultation system) |
| | Private power generation supplementation record management |
| Meter management and reading | Meter replacement |
| | Automatic meter reading |
| | On-site meter reading |
| Energy data management | Energy data calculation |
| | Energy data agreement |
| | Partial supply energy data allocation |
| | Generated energy data allocation (for transmission service charge) |
| | Generated energy data allocation (for imbalance) |
| | Overall contract power factor calculation |
| | Imbalance calculation |
| | Restriction/suspension total time calculation |
| | Supply halt or suspension period calculation |
| | Economic output control settlement basic data preparation |
| | Imbalance charge basic data preparation |
| | Balancing power charge basic data preparation |
| | Renewable energy voluntary wholesale supply energy data calculation |
| | Inter-operator settlement P0 |
| Power delivery | Delivery of 30 mins. of power |
| | Confirmed usage notification |
| | Energy data notification after generation allocation |
| | Monitoring of real-time supply-demand balancing |
| | Power data utilization |

| Operational domain | Scenario name |
|---|---|
| Fee calculation | Transmission service charge calculation (for consumers and generators) |
| | Ancillary fee calculation |
| | Imbalance fee calculation |
| | Balancing power fee calculation (for BSP) |
| | Balancing power fee calculation (for TSO) |
| | Inter-operator settlement |
| | Renewable energy specified wholesale supply fee calculation |
| | Renewable energy voluntary wholesale supply fee calculation |
| | Renewable energy purchased received/delivered power fee calculation |
| | Last resort supply fee calculation |
| | Settlement amount registration |
| | Difference settlement and correction recalculation for retroactive transfer, etc. |
| | Fee exception correction recalculation |
| | Unit price revision |
| | Fee calculation hold (individual designation) |
| Billing, money received | Money received (direct debit) |
| | Money received (credit card) |
| | Money received (convenience store) |
| | Money received (bank transfer) |
| | Return |
| | Notification (account payment request) |
| | Notification (bill payment request) |
| | Overpayment management |
| | Demand for payment |
| | Demand for payment (LR) |
| | Overdue interest |
| | Deposit (deposit recording) |
| | Daily closing processing |
| | Fee collection outsourcing |
| | Temporary payment procedures |
| | Refund (bank transfer) |
| | Deposit (return, payment appropriation) |
| | Payment management |
| Statistics | Statistics, reports for internal use |
| | Statistics, reports for regulatory authorities |
| | Statistics, reports for neutral bodies |
| | Operation quality statistics |
| Inquiries | Search for common information |

BSP: Balancing Service Provider, LR: Last Resort

### 2.2 One-stop service delivery

We will shift direction to the next generation regarding our method of providing value as well. Currently, we provide value through a product delivery (selling things) approach where we customize and develop add-ons for package products such as the wheeling fee calculation package (BLEnDer TS) to meet individual company requirements and realize solutions, and deliver the result to the customer environment. Providing packages has development benefits such as reduced development volume and costs due to common development elements, in comparison to from-scratch development by a single company. However, with the product delivery format, new and modified development is possible when requirements such as institutional response have been determined, but it is difficult to discover the latent needs of TSOs and create new value. Therefore, Mitsubishi Electric is shifting from the conventional product delivery format to an approach that provides one-stop delivery of services (selling services) ranging from planning to maintenance. Services are broadly divided into four types: system consulting/implement service, system development service, system operation service, and system technical support service. Stable operations and new value creation are realized by cycling through these four services. Figure 2 shows the service concept for one-stop services, and Fig. 3 shows the effects of one-stop services on each phase.

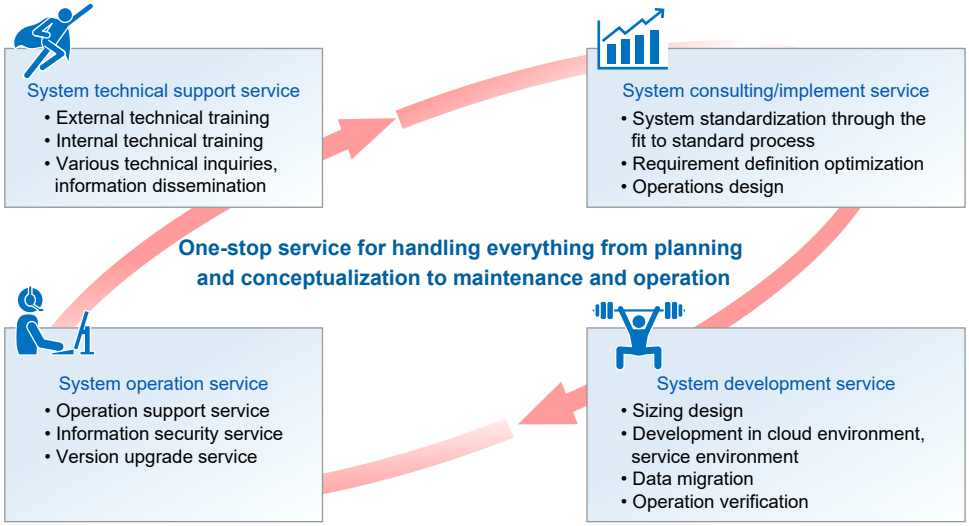
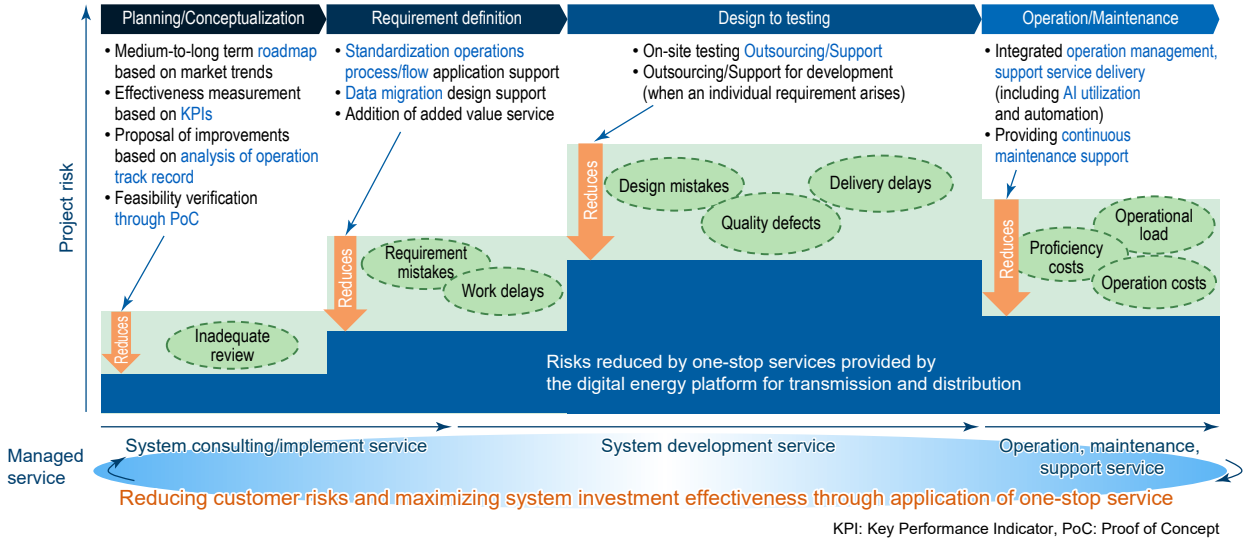



**Fig. 2 One-stop service**




KPI: Key Performance Indicator, PoC: Proof of Concept

**Fig. 3 Effects of one-stop services on each phase**

### 2.2.1 System consulting/implement service

Mitsubishi Electric examines new needs and creates value based on information from various national committees and the Organization for Cross-regional Coordination of Transmission Operators, JAPAN (OCCTO), as well as operational issues analyzed concerning the system operation service. We create development roadmaps and formulate plans for service delivery. Based on the roadmap, we provide TSOs with operation improvement and system implementation policy proposals that maximize the effectiveness of system investment.

### 2.2.2 System development service

This service supports system construction for requirements confirmed through the system consulting/implement service. Upon request, we also undertake system construction contracts for individual company requirements. This includes user education and environment setup to make services ready for use.

### 2.2.3 System operation service

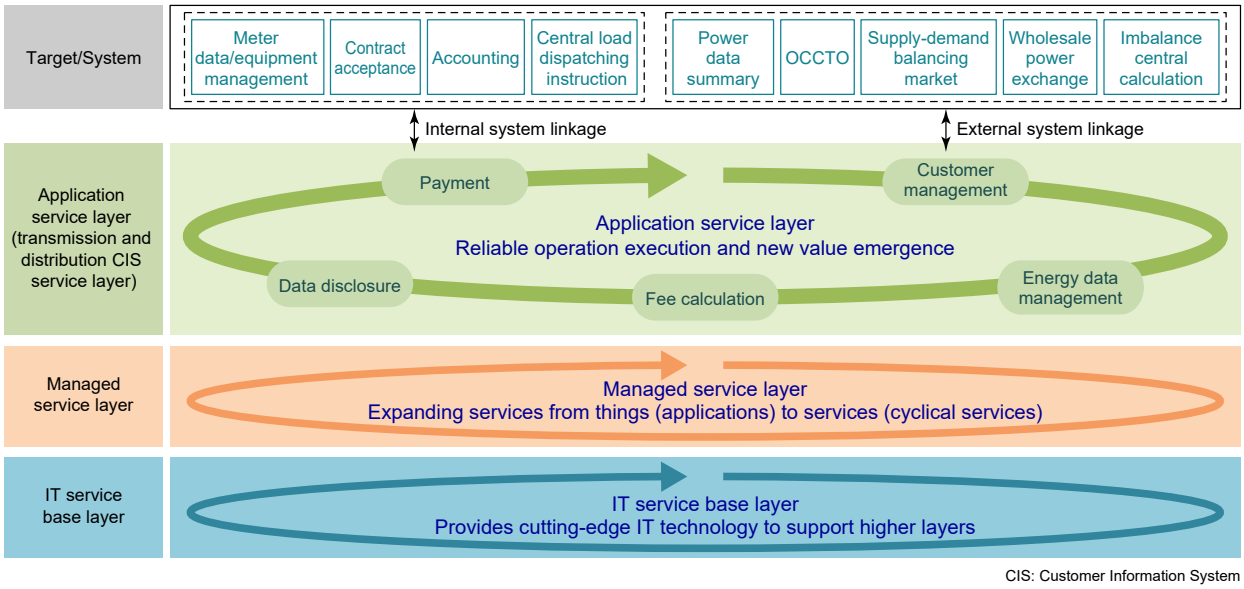
This is a service to support stable operation of the provided systems and services. Through system monitoring, fault response, regular maintenance, performance optimization, and other steps, we minimize system downtime and ensure operational continuity. Furthermore, by analyzing operations and identifying issues based on information (such as logs) obtained during maintenance and operation, we deploy insights in system consulting/implement service, and connect to creation of new value.

### 2.2.4 System technical support service

We provide technical products that contribute to improving the efficiency of operations and in-house development, such as Digital Adoption Platform (DAP), no-code/low-code tools, and process mining, as well as various types of support including design guidelines, learning content, and educational training for using various services.

## 2.3 Development of an ecosystem platform

We are developing an ecosystem platform as a foundation for providing the fit to standard and one-stop services described in sections 2.1 and 2.2. The digital energy platform for transmission and distribution is composed of three layers: an application service layer that provides various operational functions, a managed service layer that serves as the foundation for providing one-stop service, and the IT service base layer that serves as the technical foundation of the application service layer and the managed service layer. Figure 4 shows the platform's three-layer structure.




CIS: Customer Information System

**Fig. 4 Platform three-layer structure**

Furthermore, the digital energy platform for transmission and distribution actively adopts global solutions in these service layers. In the recent evolution of IT technology, global IT service investment has been focused on the cloud and Software as a Service (SaaS), resulting in accelerated progress, and it is inefficient from both a management perspective and in terms of cost-effectiveness to achieve everything through in-house development. Therefore, it is necessary to provide value that previously could not be independently realized, by combining multiple solutions through alliances and other means. For the wheeling operations domain that is our current focus, we provide new value while holding down development costs and shortening development lead times. This is achieved by utilizing the latest IT technology of global solutions combined with the technology and knowledge gained from our current operations.

In the future, we aim to provide a service foundation for creating new businesses for TSOs by integrating and realizing visualization and sophisticated analysis of various types of operational information from TSOs, including information obtained from grid-related systems such as Distributed Energy Resource Management Systems (DERMS) and Supervisory Control and Data Acquisition (SCADA) systems.

## 3. Conclusion

This paper has described the three concepts of the digital energy platform for transmission and distribution: fit to standard, one-stop service delivery, and development of an ecosystem platform. Through the digital energy platform for transmission and distribution, we hope to provide an environment enabling creation of new value while realizing stable transmission and distribution operations, and contribute to implementing the next-generation transformation of transmission and distribution operations.

## Reference

(1) Electricity Billing System “BLEnDer TS” for Transmission Services, Mitsubishi Denki Giho, 80, No.1, 56 (2006)