2023 APCS+APCSW Joint Conference Discussion Meeting
Agenda for Special Session - Climate Services for Energy

October 18, 2023

Services for the Energy sectors
and
Power Demand Forecast based on AI

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Today’s Contents

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1．Introduction of JWA’s services for the energy field

2．Demand Forecast with AI technologies and Big data

Japan Weather Association (JWA)

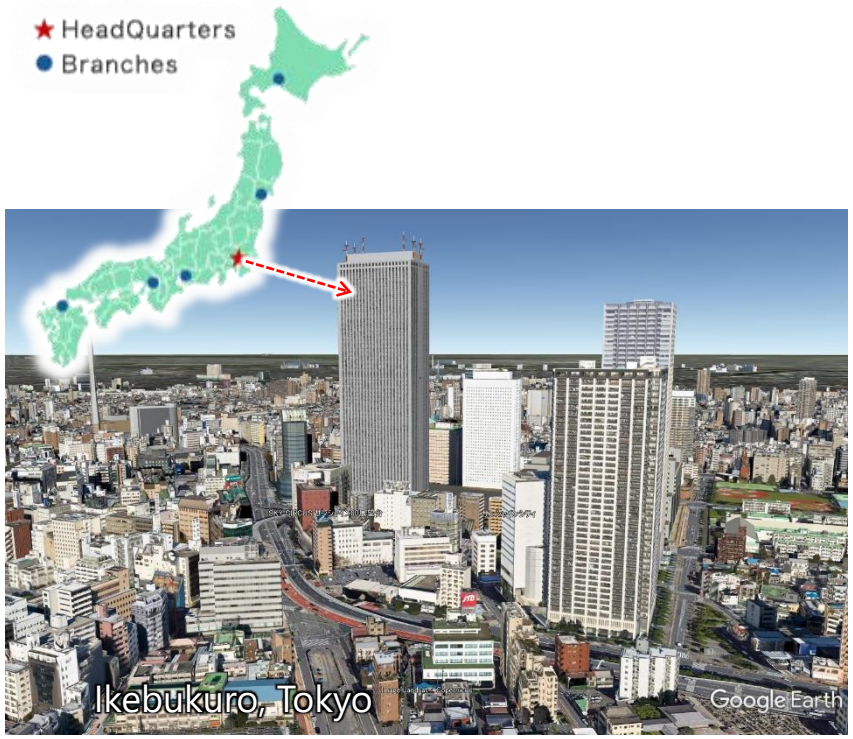
日本気象協会

About us

- Established in 1950
- The first private weather company in Japan ≠ 気象庁 Japan Meteorological Agency

Company profile

- Over 800 employees
- HQ in Tokyo & 5 regional offices
- 3 main pillars:
  - **Social and Disaster Management Dept.**
  - **Environment and Energy Dept.**
  - **Media and Consumer Service Dept.**



Our Business Fields and Services

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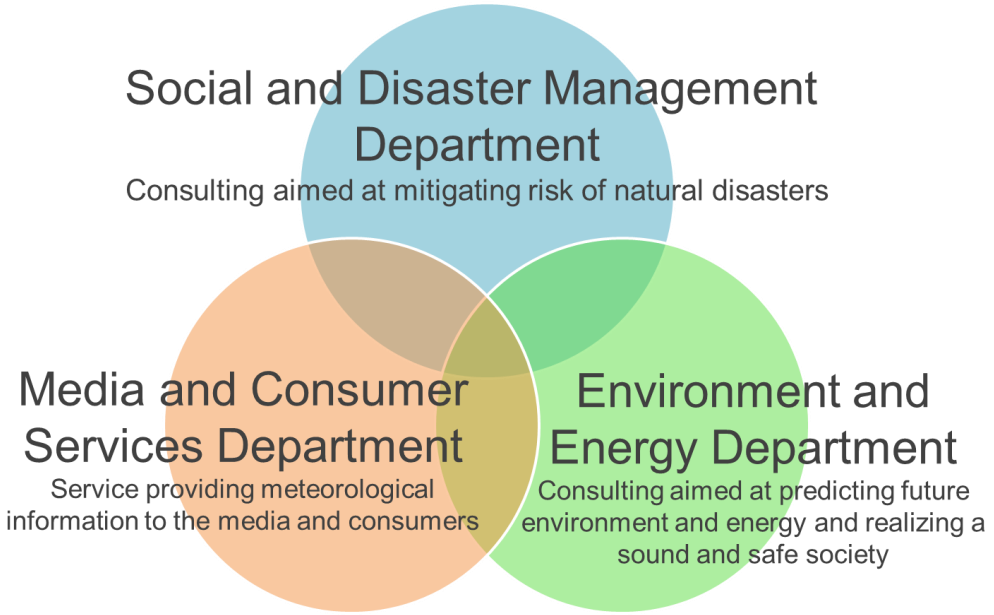

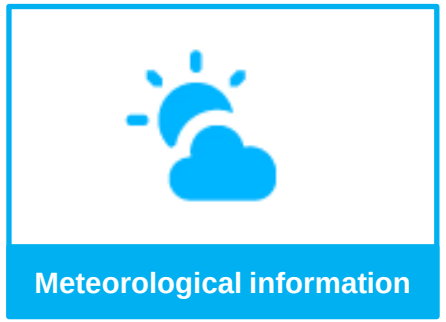

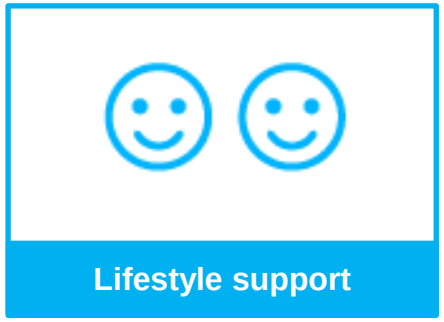

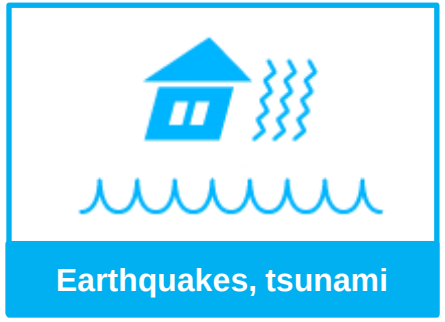

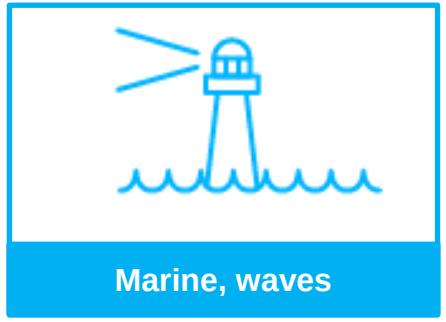

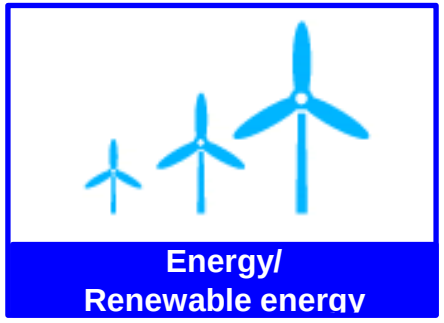

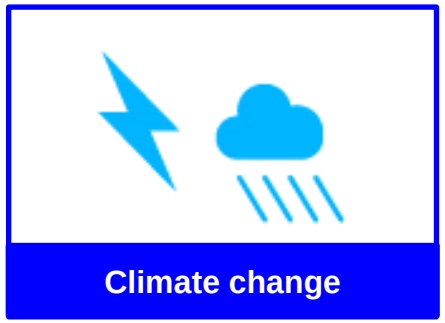

Our Services for Energy Sector

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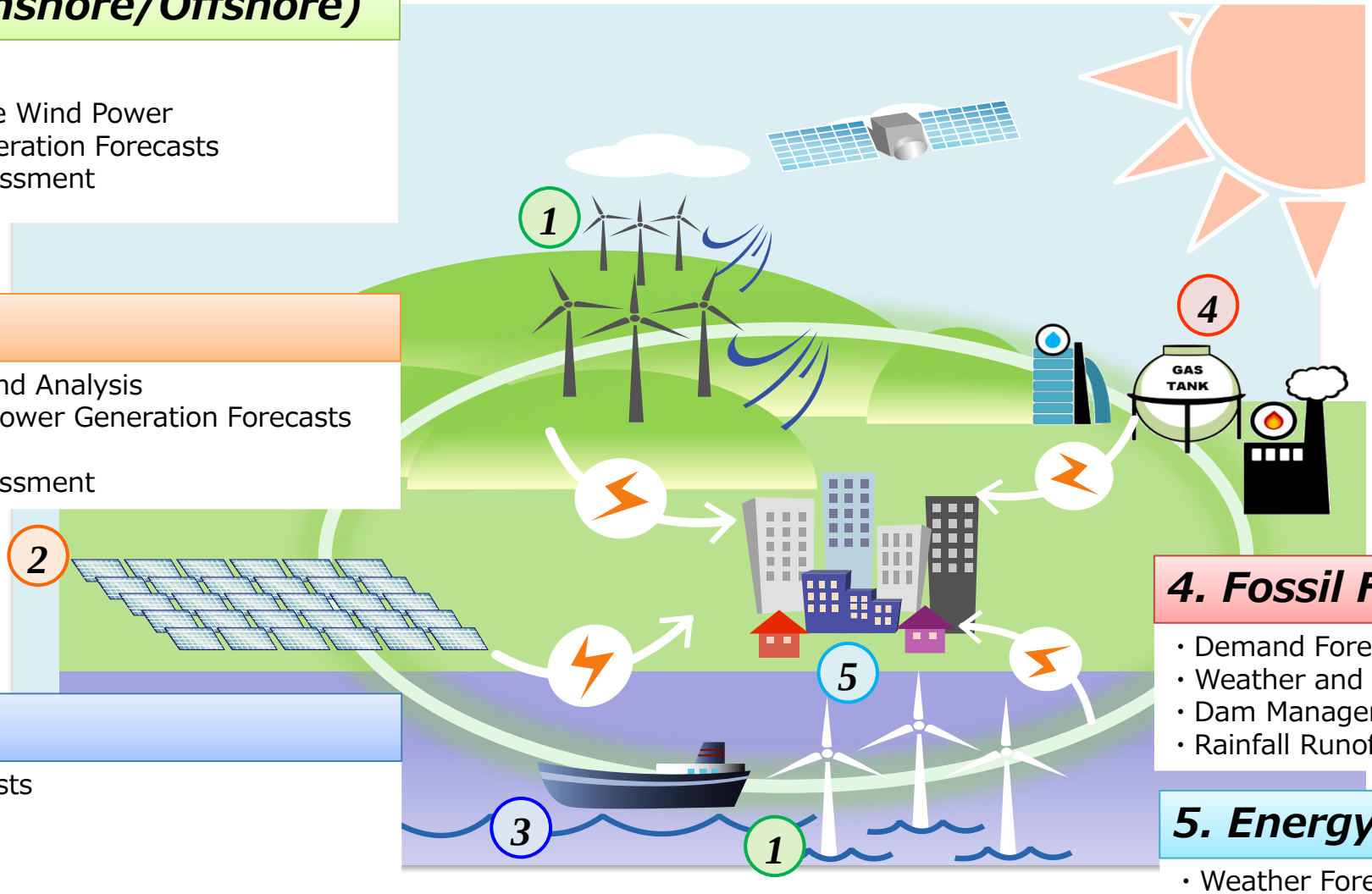
Covering Whole Energy System

1. Wind Power (Onshore/Offshore)

- Feasibility Surveys
- Design Support for Offshore Wind Power
- Wind Forecasts/Power Generation Forecasts
- Environmental Impact Assessment

2. Solar Power

- Solar Radiation Database and Analysis
- Solar Radiation Forecasts/Power Generation Forecasts
- PV Malfunction Diagnosis
- Environmental Impact Assessment



3. Ocean Energy

- Marine Analysis and Forecasts
- Wave Estimation Database
- Wave Simulations
- Tsunami Simulations

4. Fossil Fuel

- Demand Forecasts
- Weather and Ocean Forecasts
- Dam Management Systems
- Rainfall Runoff Forecasts

5. Energy Management

- Weather Forecasts

Our Approaches to Climate Change

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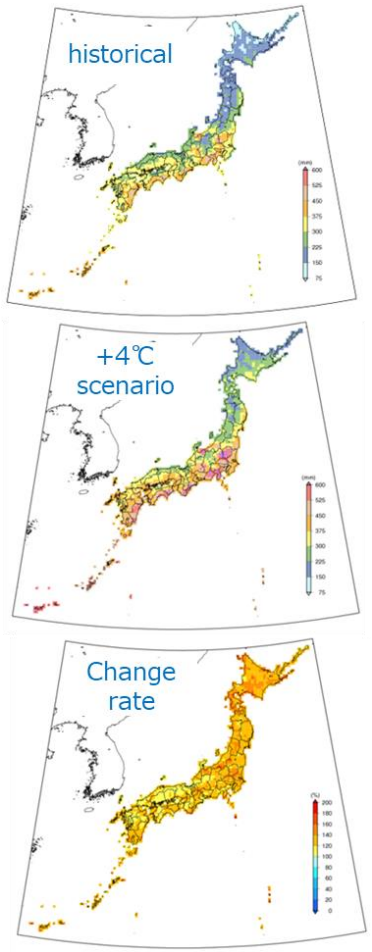

Analysis of future rainfall
(24-hour precipitation,
100-year return period)

Business Activities

- Mitigation strategies
- Impact assessment and adaptation strategies
- Climate change—related services＊

Support at IPCC session

Heatstroke Zero project

＊including activities in ICCP

Our Support for Renewable Energy

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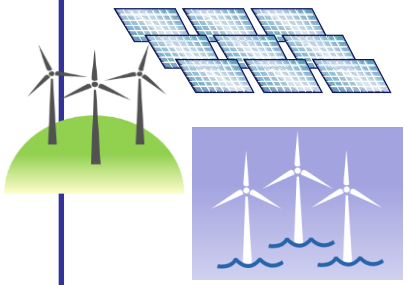
	Planning/Design	Operations
Renewable energy	**Potential Analysis** **Feasibility Surveys**	**Forecasts/Monitoring**



	Planning/Design	Operations
Environmental Considerations	**Support for SEA** (Strategic Environment Assessment) **Support for EIA** (Environment Impact Assessment)	**Follow-up surveys and Environmental Monitoring**

We provide extended support for renewable energy for every development phase, using both meteorological and environmental technologies.

Planning/Design of Solar Power

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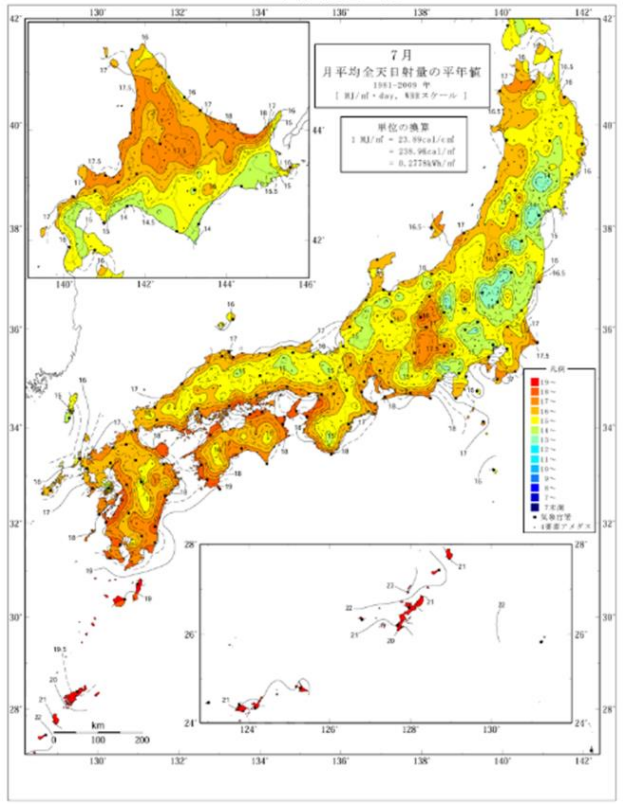
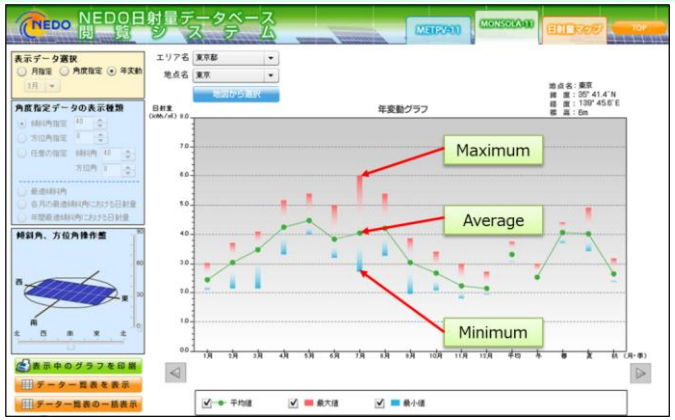
- Providing services for solar power **for over 40 years**
- Estimating solar radiation based on the observed values of sunlight duration or meteorological satellite images, **even if there is no observed value of solar radiation**

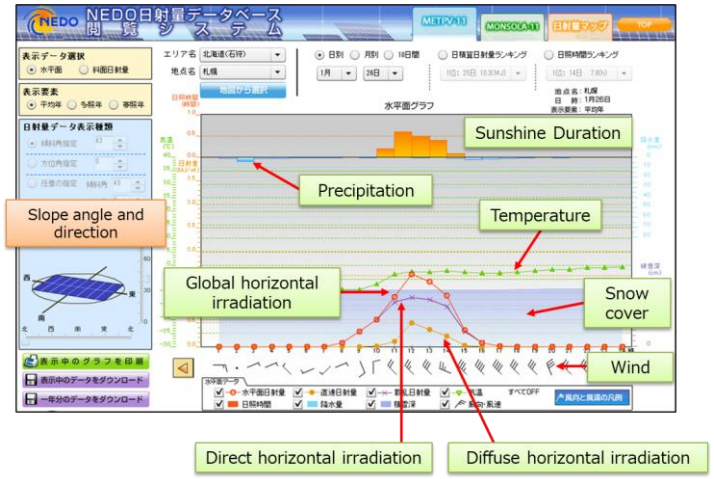
Solar Radiation Database



▲ Solar irradiation map



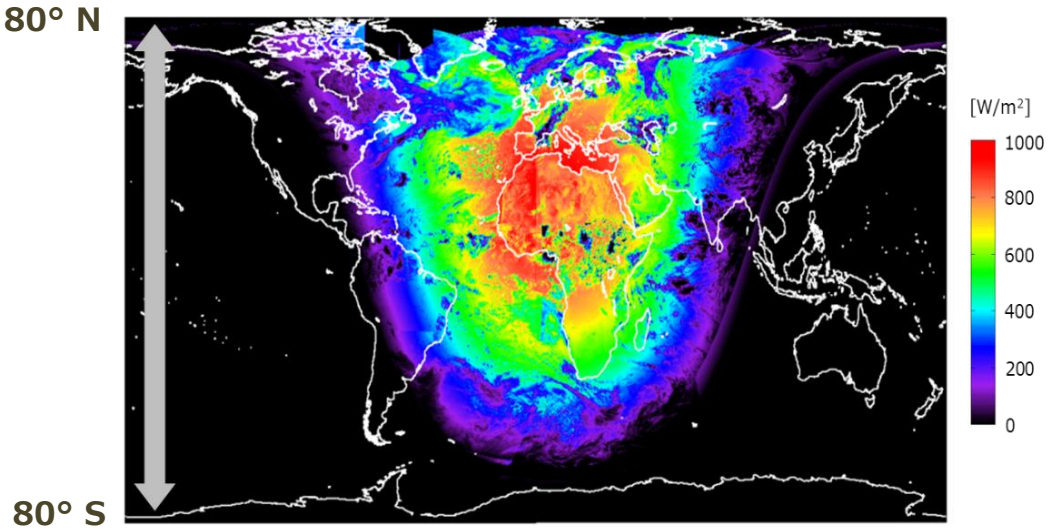
▲ Monthly Database (MONSOLA-11)



▲ Hourly Database (METPV-11)

Estimation from satellite images

「SOLASAT-**Global**」



▲ Example of estimated global radiation

- **Data: Jan. 2011 - now**
- **Spatial resolution: 5 km**
- **Time resolution: 1 hour**

Operations of Solar Power

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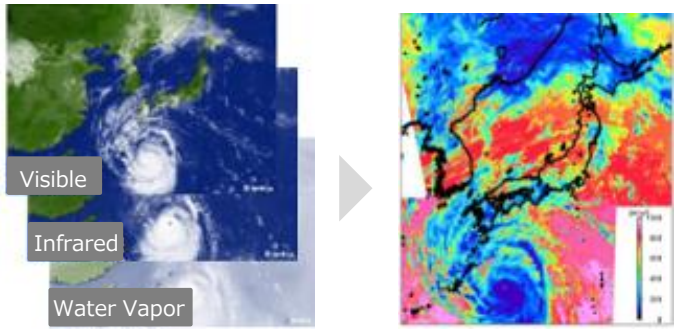
- **Improving the accuracy** of solar radiation estimation and prediction by using satellite images and a specialized meteorological model (SYNFOS)
- **Services employed by many companies** (power transmission and distribution companies, renewable energy power generation companies, etc.)

SOLASAT 9-Now
(Estimated solar radiation)

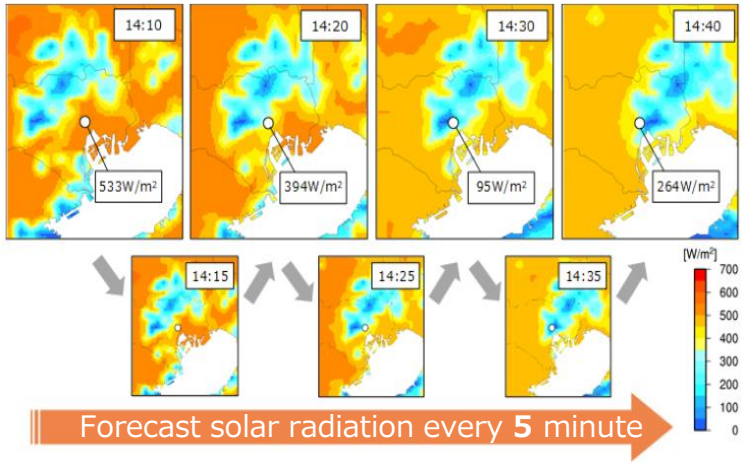


satellite images → SOLASAT 9-Now

Estimate the amount of solar radiation from satellite images using a proprietary solar radiation conversion model

- Spatial resolution : 500 m
- Update frequency : 2.5 minutes

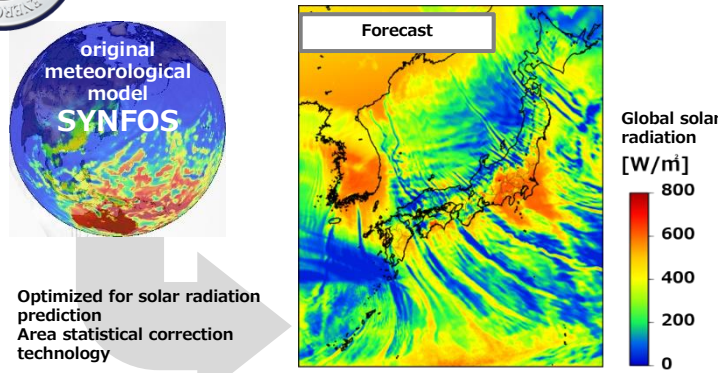
SOLASAT 9-Nowcast
(Forecast ahead a few hours)



- Spatial resolution : 500 m
- Time resolution : 5 minutes

SYNFOS-solar 1km
(Forecast ahead 78 hours)

New Energy Award 2018
Agency for Natural Resources and Energy Commissioner's Award



- Spatial resolution : 1 km
- Time resolution : 30 minutes

Planning/Design of Wind Power

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- Observing and profiling **wind conditions** for onshore and offshore wind, including **design support**
- Participating in numerous **national research and survey projects** on onshore and offshore wind power

Planning/Preparation

Observations/ Maintenance

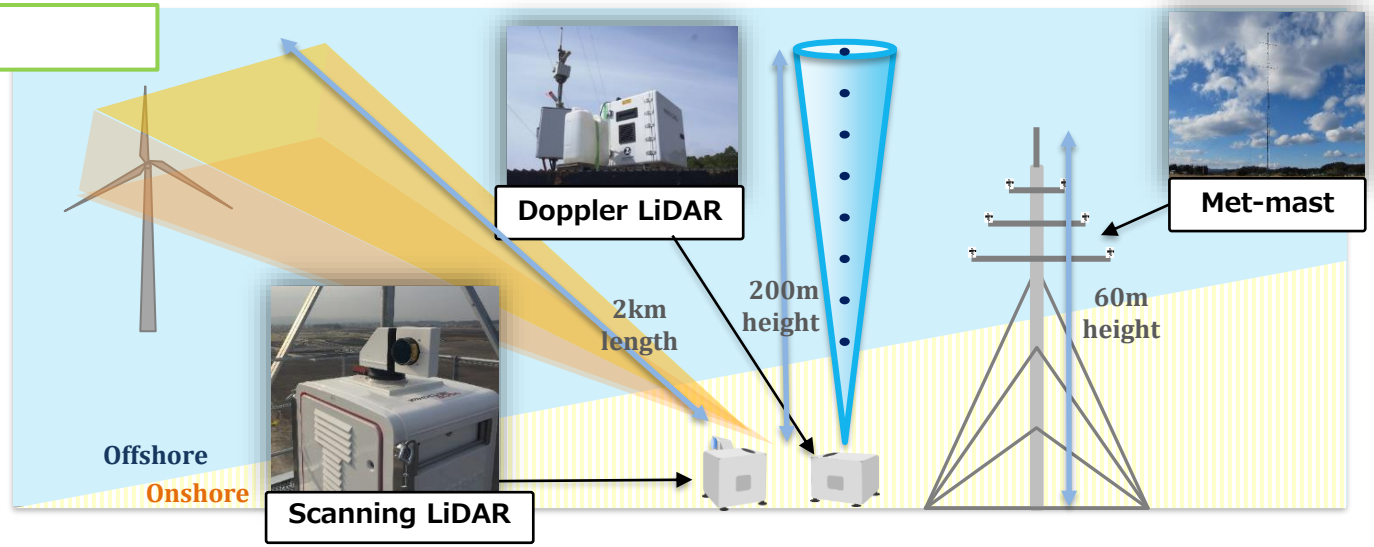
Data reduction/Analysis

Simulations

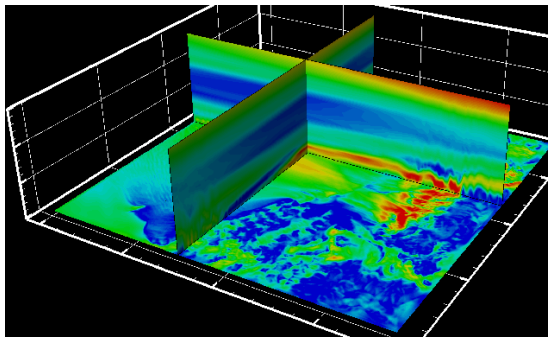
Evaluating business feasibility

▲ Implementation flow for evaluating business feasibility

Wind Observations

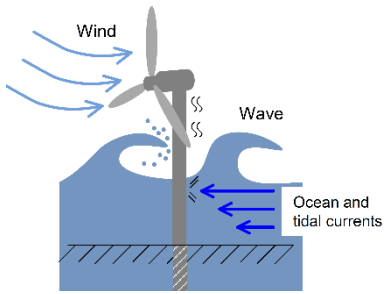


Wind Simulations

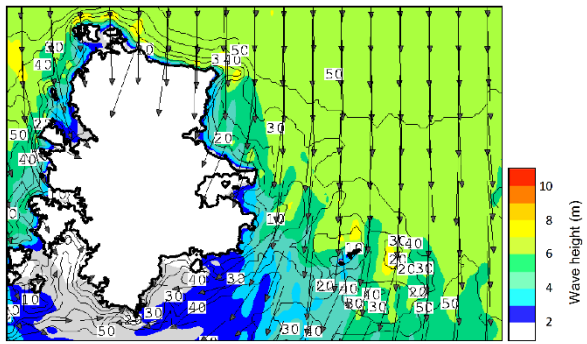


▲ Example of offshore wind simulation

Design Support for offshore Wind Power



▲ Various external forces toward wind turbines



▲ Wave height distribution by numerical models

Operations of Wind Power

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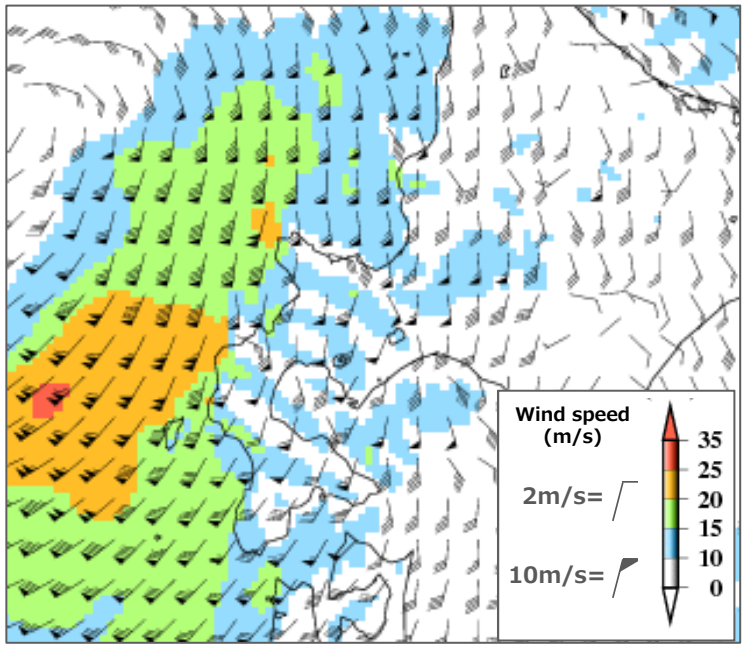
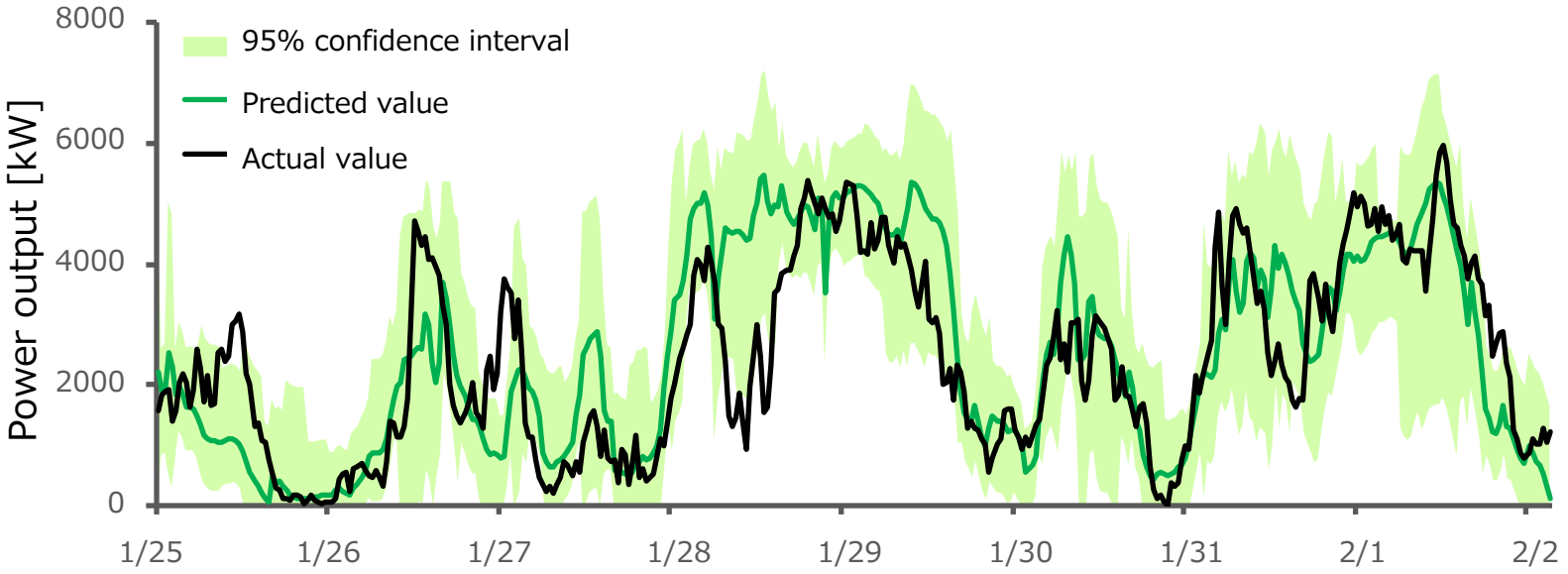
- Predicting wind speed and wind power output at target sites by **combining multiple meteorological models** including our specialized meteorological model
- Providing **sequential corrections** based on local observation values and information on **confidence intervals** for both onshore and offshore wind power.



▲ Example of wind direction/speed prediction using a meteorological model

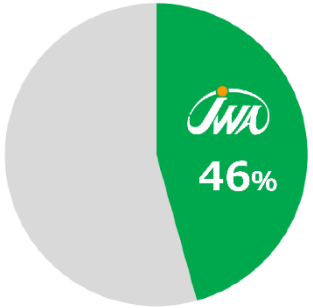


▲ Example of wind power output forecast example (forecast of next day)

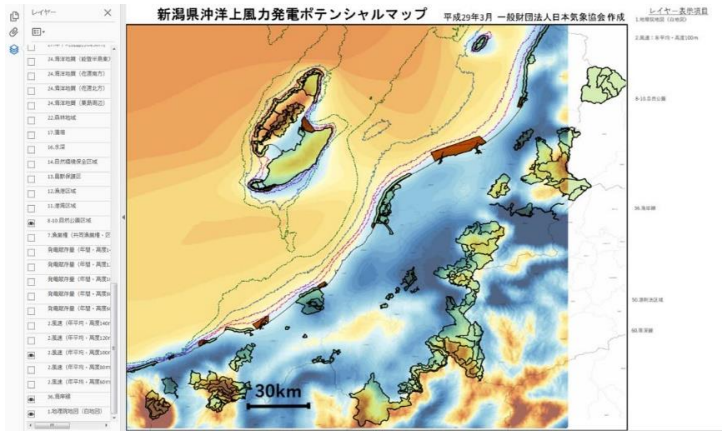
Environmental Considerations

- JWA has **the largest share of EIA*** wind in Japan's wind power sector.
- JWA also owns the **Bird Monitoring Technology** used in domestic and overseas offshore wind power generation facilities.

Domestic market share of EIA for wind power



Offshore wind potential map including environmental and legal constraints



▲ Example of potential map (Niigata pref.)

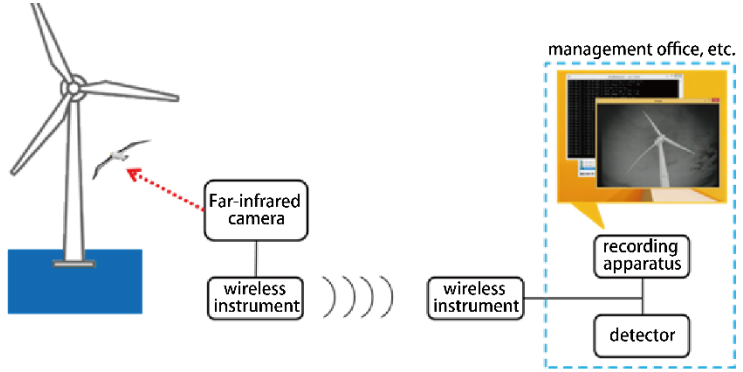
Bird monitoring for wind power generation

Conventional Survey
(Visual Inspection, Corpse Survey, etc.)

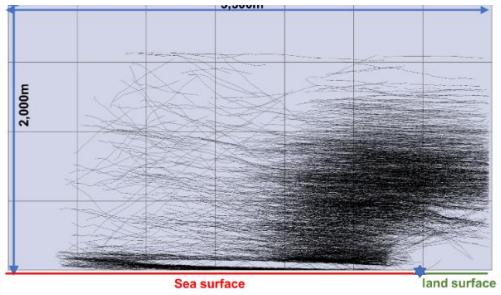
+

JWA's "Birds Migration and Collision Monitoring Technology"
- Bird Migration Tracing Extraction System
- Bird Strike Detection System

Bird strike detection system



Bird migration tracking extraction system



** Environmental impact assessment*

Today’s Contents

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1．Introduction of JWA’s services for the energy field

2．Demand Forecast with AI technologies and Big data

Why High-precision demand forecasting is required?

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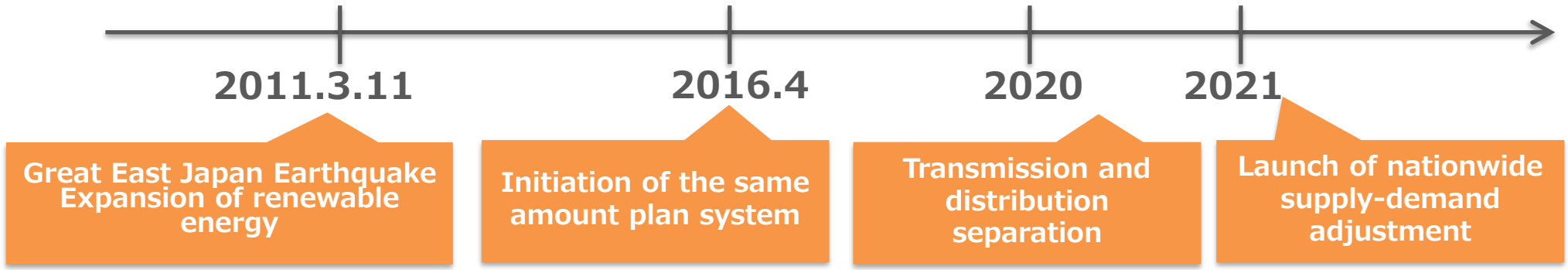
High-precision demand forecasting is required due to power system reform

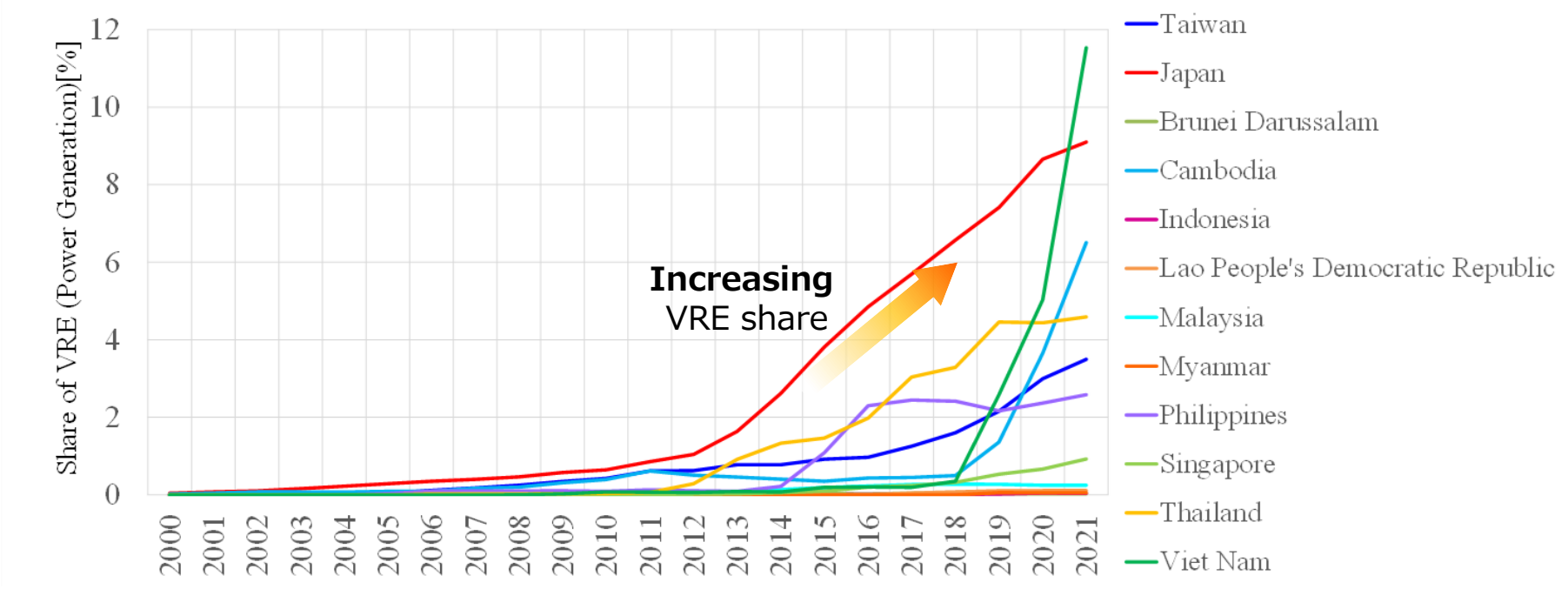
- Expansion of renewable energy
- Planned simultaneous amount system
- Transmission and distribution separation
- Use for the power transaction market



Climate Change and Variable Renewable Energy (VRE)

VRE installation is steadily increasing worldwide since 2012 as an alternative for fossil fuel (as shown in the figure).

However, excess of VRE may result in the destabilization of the energy supply.



▲ Renewable Energy Share [GWh], IRENA

To balance *large-scale VRE installation and ensure the energy supply stability*, **high-precision forecasting** is indispensable.

Overview: What is JWA's power demand forecasting service?

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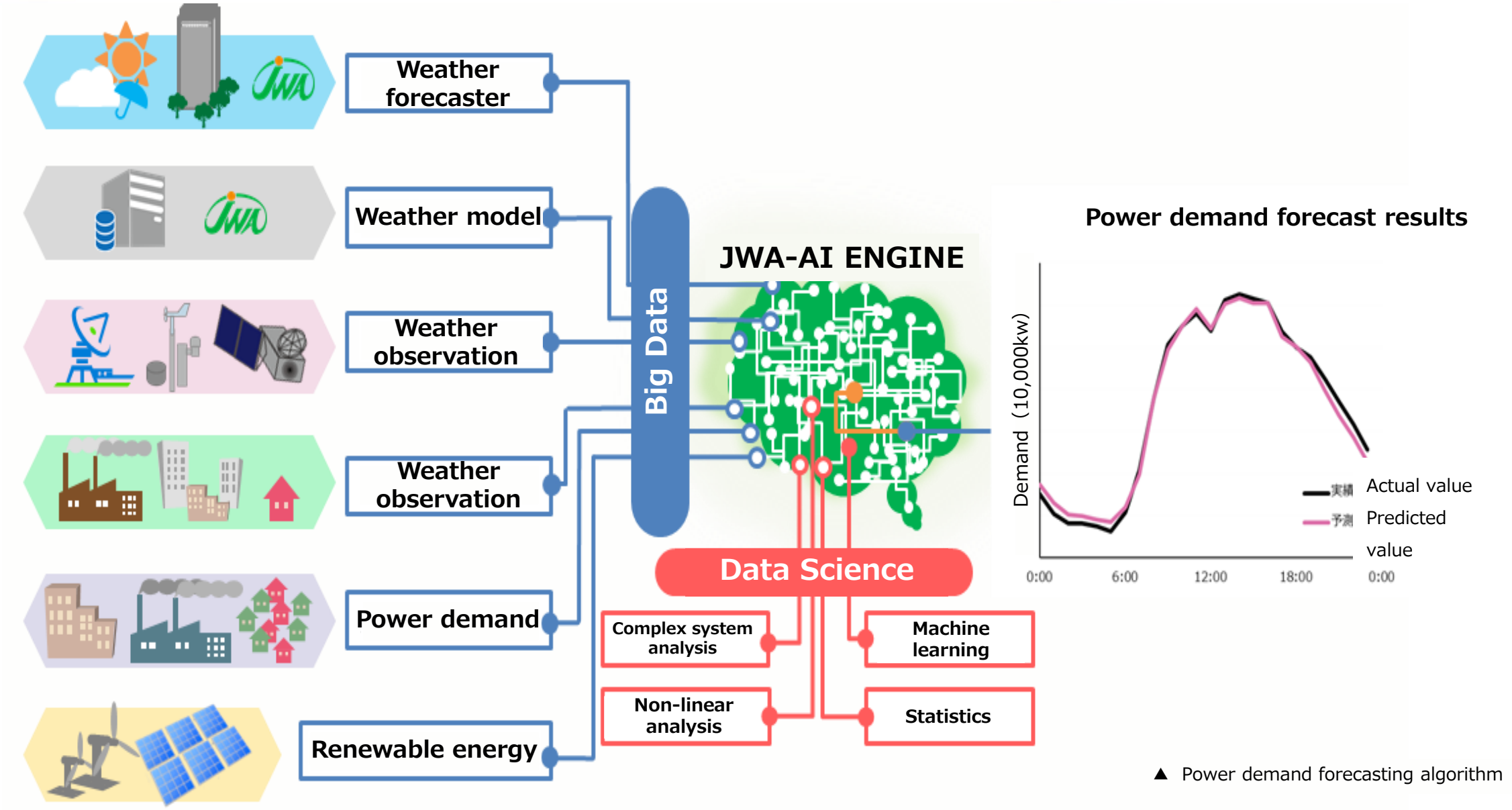

▲ Power demand forecasting algorithm

Overview：JWA's power demand forecasting service

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Full operational support
from **demand forecast data distribution** to **operational accuracy evaluation** and **model tuning**

Customer

Actual Demand

Actual contracted Power

Energy Demand Forecasting system

- **Data Integration**
- **Training on previous data**
- **Demand forecasting**
- **Accuracy evaluation**
- **Model tuning**

Customer

- Explanation of Demand Forecast Results
- Future Weather Outlook

power demand forecasting

Supply area of regional power companies in Japan

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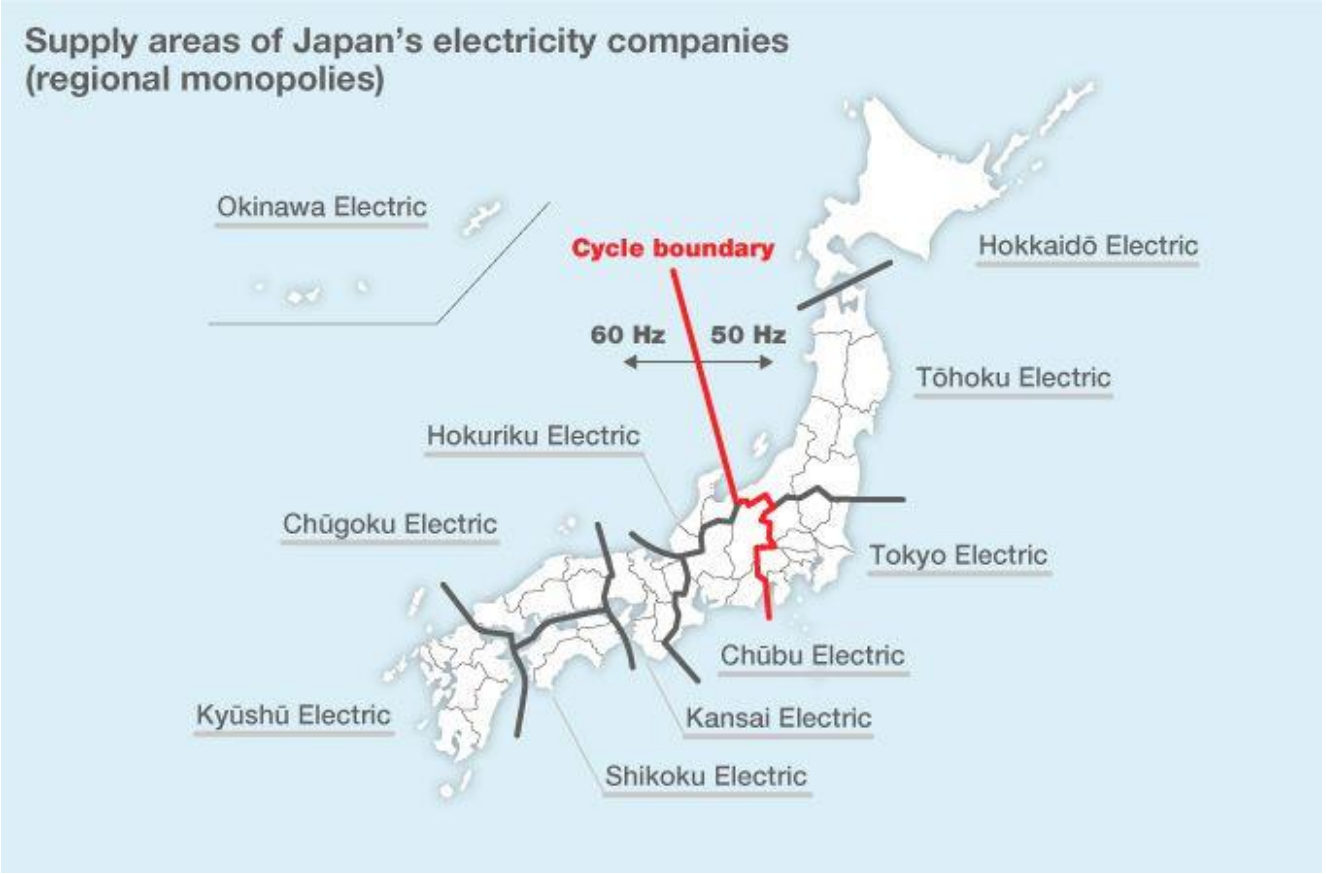
- JWA provides various forecast information targeting all 10 power areas nationwide
- In some cases, specific forecasting are demanded

  e.g., per prefecture, per voltage type



Source: METI Expert Committee on Electric Power System Reform

Features: JWA power demand forecasting service

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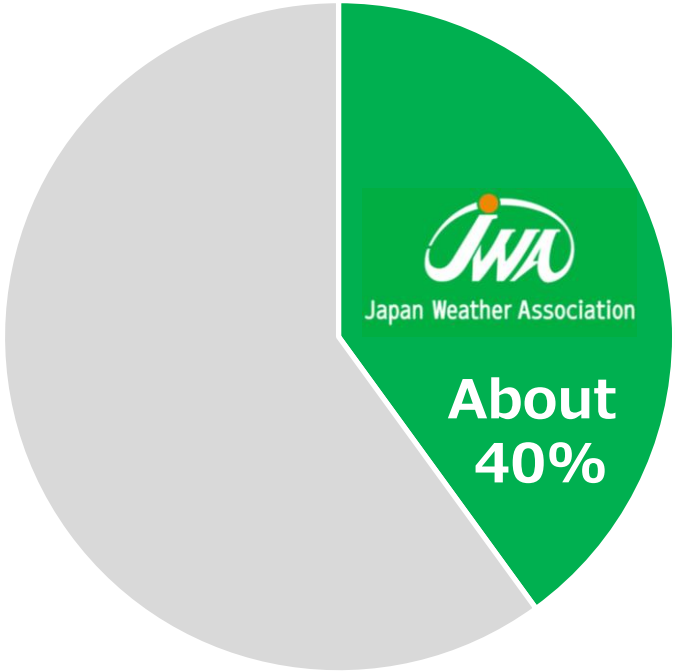
Top share* in the industry for power demand forecasting services in Japan

Category	Our share
Electricity sold by electric retailers	**40%**
Electricity demand managed by transmission system operator	**40%**

JWA is continuously **enhancing the forecasting model** based on our extensive experience with many installations for forecasting accuracy improvement.



Share in
Total electricity sold by electric retailers/
Total electricity demand managed by transmission system operator

We highly contribute to obtaining a stable electricity supply in Japan

*Based on our own survey

Example ： JWA's power demand forecasting service

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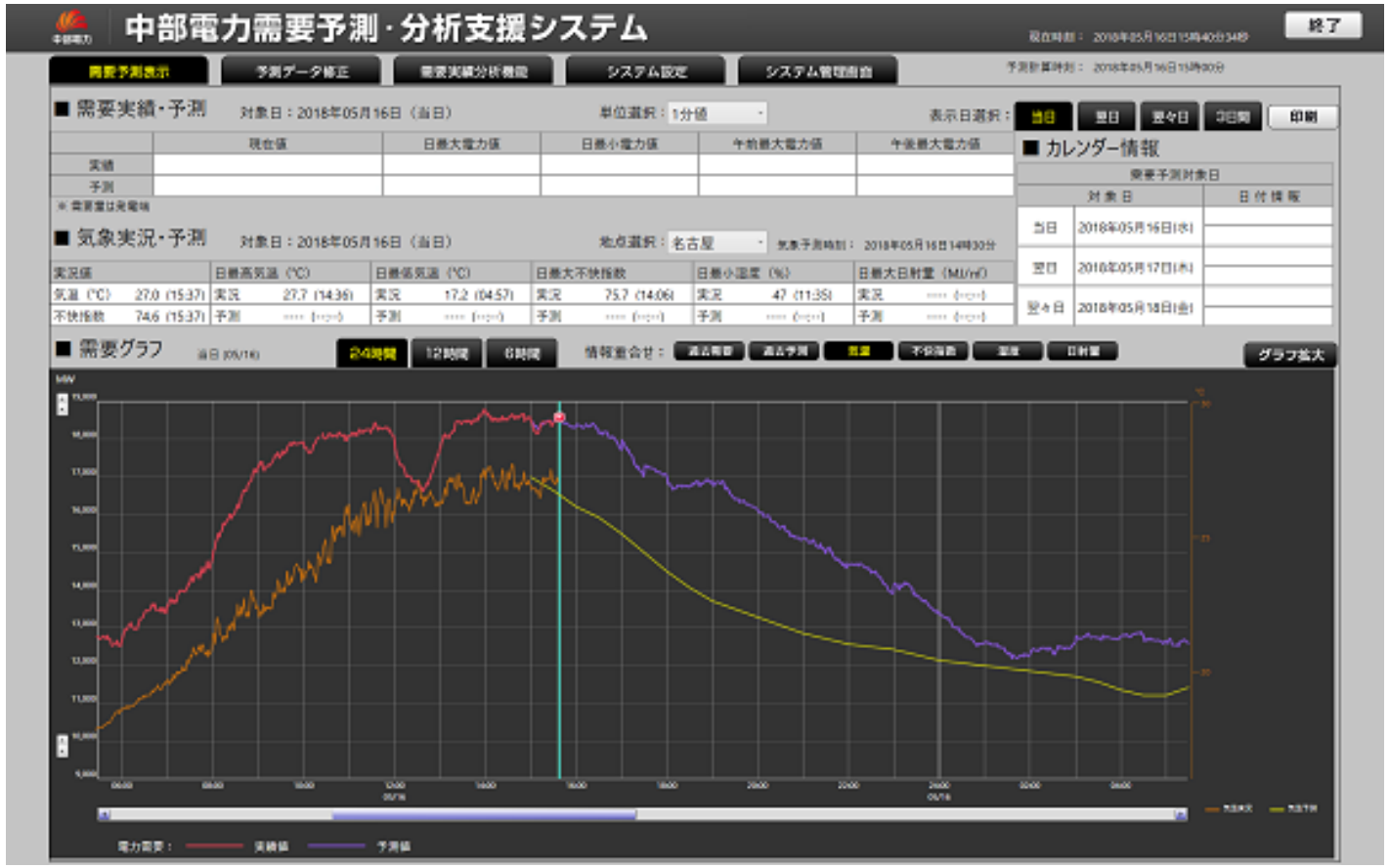
Case：Chubu Electric Power Co., Ltd.

・Electricity demand forecasting system developed by Japan Weather Association has started operation at a major power company of Chubu Electric Power. (April 2018 - now)



Screenshot of the on-premise power demand forecasting system

An overview of this system was introduced in the "Chubu Electric Power Technology Development News Issue 159" "Introduction of an Electric Power Demand Forecasting System—Efforts to Automate and Improve Electricity Demand Forecasting Operations" published in August 2018. The prediction accuracy evaluation results were introduced.

Features ： JWA's power demand forecasting service

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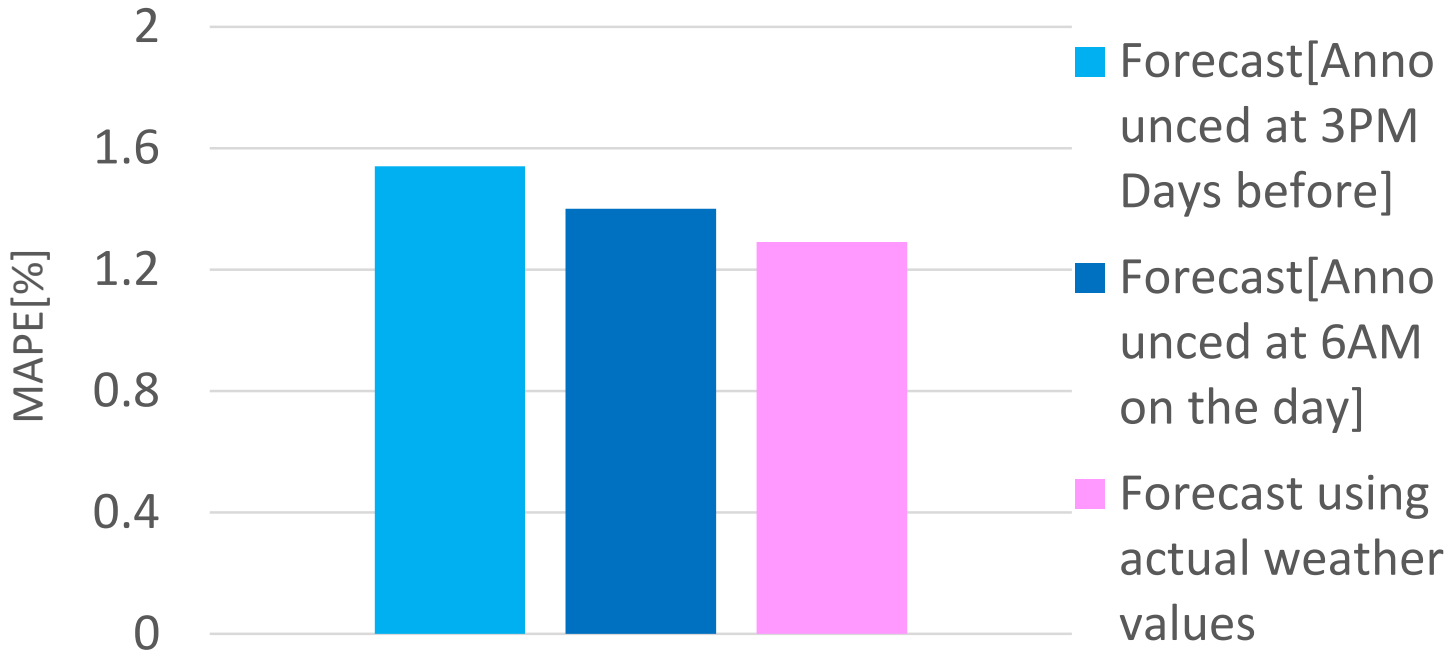
High Accuracy

- We provide highly accurate demand forecasting by **tuning our forecasting model to target characteristics and weather conditions**.

- For example, JWA forecast achieves **MAPE of 1% level** in all time section



▲ Annual MAPE of Chubu-Aria power demand (weekdays [excluding special holidays]), FY2018

MAPE: Mean Absolute Percentage Error
(*the closer to zero, the more accurate*)

Related activity： JWA's power demand forecasting service

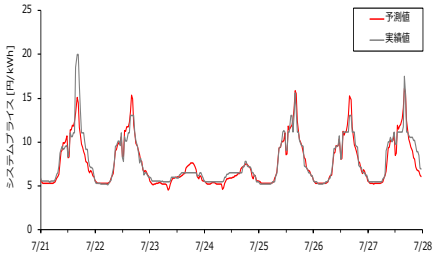
- In addition to Power Demand forecasting, we offer a wide range of related forecasting services corresponding to various needs.

Trading Price forecasting Service

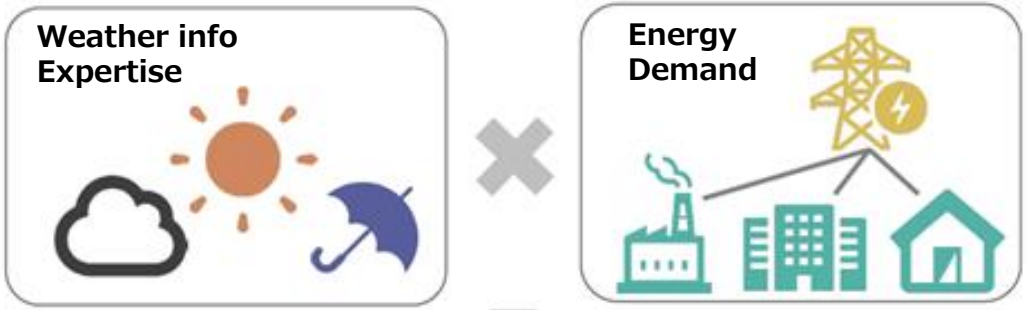
Input → *Forecast Model* → *Forecasting spot market prices*

- **Spot Market Prices (actual data)**
- **Weather Forecast**
- **Calendar information**

→ **JWA spot market prices model**



Energy Demand Variability Analysis



Energy Demand Variability Analysis

Time series analysis, correlation analysis, etc.

Understand the characteristics of demand fluctuations and the relationship between demand and weather parameters

More efficient energy demand forecasting

Summary ： JWA's power demand forecasting service

■Features of JWA power demand forecasting system

・ Achieving high-precision demand forecasting with our unique weather/renewable energy prediction technology and data analysis technology

・ Offering one-stop service from providing weather information to the operation of the demand forecasting system

・Compatible with various types of data receiving / delivery with selectable cloud type and on-premises type

■Performance

・ Trials conducted with major power companies demonstrate high forecast accuracy with annual MAPE of the order of 1%.


JWA will contribute to
the creation of green businesses
around the world
through
our services and technologies

THANK YOU FOR YOUR ATTENTION !

Contact Us

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