

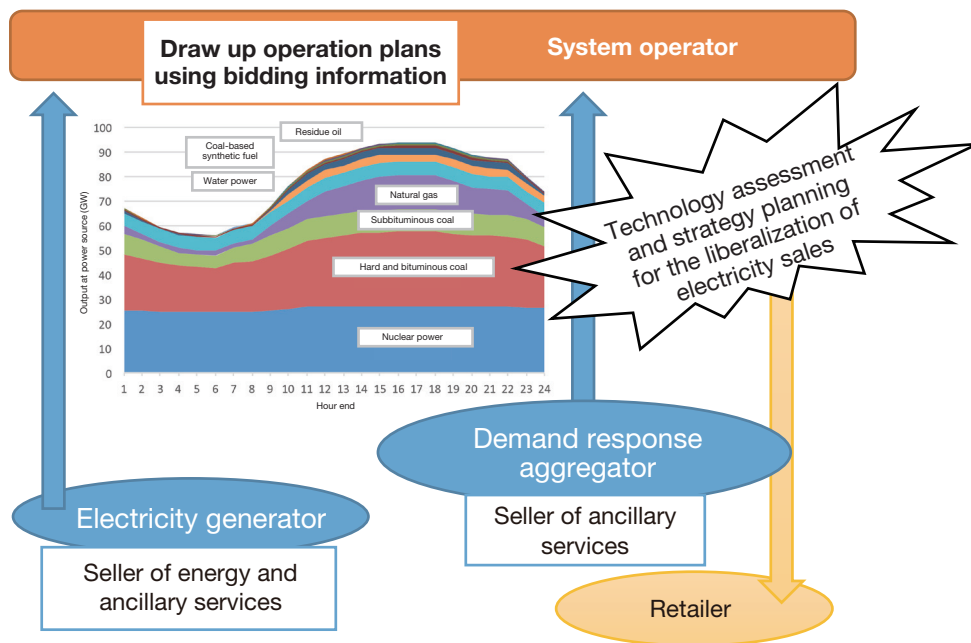
Nobuyuki YAMAGUCHI (Associate Professor, Department of Electrical Engineering, Faculty of Engineering, Tokyo University of Science)

## Purpose of Research

In Japan, the phased liberalization of electricity sales (electricity system reform) is under way with its completion scheduled for 2020. As a result, any company will be able to enter power generation, power transmission and distribution, and electricity retailing businesses if it obtains a license. With this deregulation, an electricity market worth ¥7.5 trillion is expected to emerge according to the Ministry of Economy, Trade and Industry. In Europe and North America, where the electricity market was liberalized earlier, not only electric energy (kWh), but also electric system control called an “ancillary service” is procured or traded openly, and this is attracting public attention as something that suggests how electricity business and technology assessment in Japan should be in the future.

## Summary of Research

This research uses mathematical programming to formulate operation plans aimed at cost minimization taking complicated technical restrictions at power plants into consideration and proposes optimal agreements for electricity users using demand response by adjusting power consumption according to wholesale electricity prices. It also assesses the value of ancillary services for electricity system control in order to support interconnected photovoltaic and wind power generation systems whose output fluctuate widely.



## Comparison with Conventional or Competitive Technologies

Setting questions in a way that is consistent with the technical restrictions of power plants, power transmission networks, distribution networks, etc. and with electric business policy in Japan and abroad and enabling strategy planning transcending the boundaries between engineering and policy-making

## Expected Applications

- Formulating a wholesale electricity trading strategy with ancillary services in mind
- Examining power source investment strategies taking future policy risks into account
- Lowering wholesale electricity procurement costs utilizing demand response

## Challenges in Implementation

Verifying the effectiveness and refining models based on not only sample data but also actual data

## What We Expect from Companies

Considering corroborative joint research using field data

## Points

- Enabling reviews focusing on technical restrictions and policy/market risks to which analyzers pay attention
- Analyzing power generation, power transmission and distribution, and electricity retailing businesses in an integrated manner
- Examining suggestions to Japan through research and analysis of overseas electricity business

## Future Developments

- Sophistication of analysis according to the progress in electricity system reform
- Establishment of a body to promote wide-area electricity use
- Creation of an hour-ahead market and full liberalization of electricity sales
- Creation of a real-time market and removal of pricing regulations

## Associated System:

Participating in the research project in the JST-CREST EMS area, named “Building System Theory for Harmonized Power System Control based on Photovoltaic Power Prediction” as its principal joint researcher (From April 1, 2015 to March 31, 2017)