Paris Session 2022

Automation of grid operation systems using AI and other technologies in Japan

SC C2

PS1-3 Question 1.8

Given the capacity of advanced intelligent systems to process large amounts of data and quickly compute an answer can AI replace a human operator in system operations?

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Summary

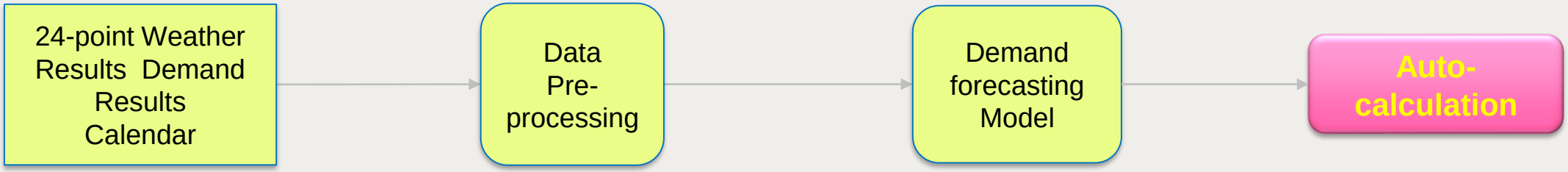
- It is expected that many areas can be automated using AI and other methods. On the other hand, it is necessary to develop countermeasures for infrequent events or to separate them.

Area	Event	Automation area	Outline
Automation is progressing	normal conditions	Voltage regulator	Automatic adjustment of reactive power supplier and generator voltage
		Frequency regulator	Automatic control of LFC area
		Power flow regulator (thermal stability)	Automatic planning of system operation plan based on N-1 events
		Demand forecasting, Renewable power forecasting	Automatic forecasting based on weather information, etc.
	When a system failure occurs	Fault clearance, Rapid auto-reclosing	Identification of failure location and automatic re-closing based on the failure phase
		System stabilizing control	Out-of-step prevention for generators, Frequency regulation at system separation, Elimination of abnormal voltage, Automatic control of equipment overload elimination
Automation has not been developed	When a system failure is expected	Areas where there is room to consider automation and potential for realization through big data analysis, etc. in the future	Preventive control in case of lightning, Prior restraint in the event of a supply-demand imbalance

An example of automation of grid operation tasks (Demand forecasting)

- Here is an example of the automation of grid operation tasks at Kansai Transmission and Distribution, Inc.
- Based on the results of demand forecasting, we will check supply capacity and secure the regulated power supply for frequency control.
- In the past, the variability in forecasting accuracy due to differences in operator's experience and the shortening of work time have been issues.
- The automation of demand forecasting has improved the accuracy of forecasts and increased operational efficiency.

〔Image of automation of demand forecasting〕



Osaka's 24-point temperature and solar radiation, past demand results, and special day settings.

・Daily quantity term such as maximum temperature
・Flag terms around holidays
・Flag terms for near term results, etc.

・Multi-dimensional Multiple regression calculations, etc.

Toward further automation of grid operation systems in the future

- There are areas where automation is not possible at this time, mainly in areas where events cannot be organized in sequence.
  - ex：Preventive maintenance measures, etc., to minimize the impact on the grid when severe weather is anticipated.
- In order to realize the above, data analysis and other methods are effective. However, the data-collecting environment has only recently been established.
- On the other hand, for infrequent events, automation is expected to be difficult from a cost-effectiveness perspective.
  - ex：Decide whether or not to shut down substation equipment to prevent physical injury when intrusion detection equipment reacts, etc.

〔Image of data-collecting environment for automation of grid operation systems〕