Study Committee C2

Power System Operation Control

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Demonstration Project of Low Carbonization and Advancement by Online Optimized Control of Transmission System Voltage and Reactive Power utilizing ICT

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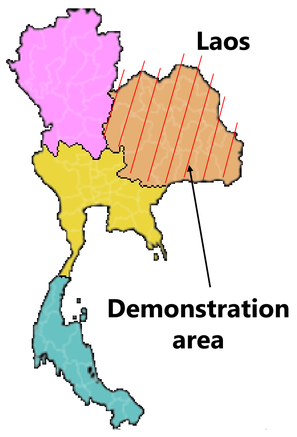
Introduction

- As an emerging country highly vulnerable to the impact of climate changes, Thailand attaches great importance to the global efforts to address this common and pressing challenge. Thailand intends to reduce its greenhouse gas emissions by 20% by 2030 as set forth in NDCs[1].
- Currently in Thailand, SCADA automatically controls trans-former taps to maintain the bus voltage of DSO connection points, while the control of shunt devices is depending on manual operation by dispatchers. Coordinated control of these devices may improve the voltage stability and reduce the transmission losses.

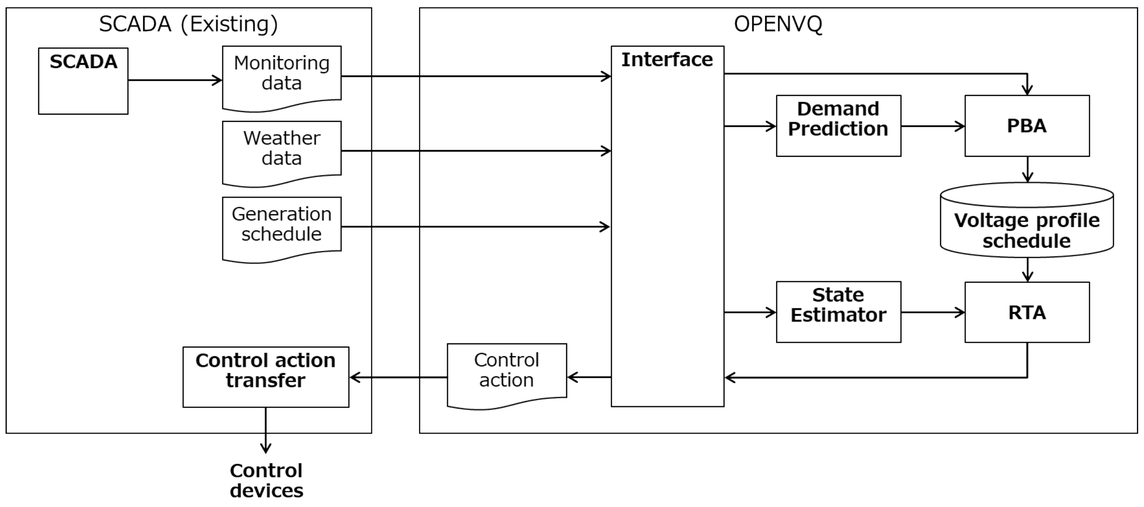
Demonstration Project



- Authors are proceeding a demonstration project to apply OPENVQ[2], an automated voltage control technology for computing optimal control schedule based on the future state prediction, to Thailand.
- The project targets northeastern region, where renewables penetration is high.
- In this project, authors are developing a scheme to acquire CO_2 credit by applying JCM[3] methodology. Reduction of CO_2 emission equivalent to the transmission loss reduced by the OPENVQ can be recognized as CO_2 credit.

System Configuration

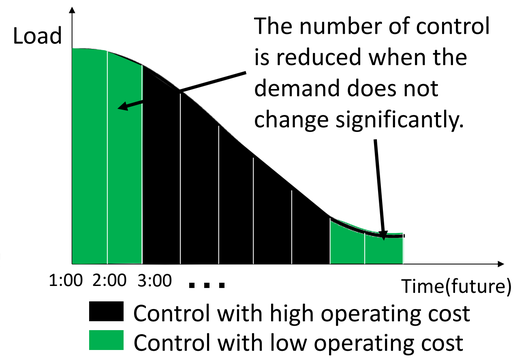
- To compute the optimal voltage control based on the online information, the OPENVQ demo system is installed in the northeastern area control center and connected to the existing SCADA system to acquire necessary input data.
- OPENVQ analysis to determine the voltage control can be classified into two timeline analysis: Prediction-based analysis (PBA) and Real-time analysis (RTA).
- Control actions, the result of OPENVQ analysis, are transferred to each control device via SCADA utilizing existing control scheme.



Simplified diagram of OPENVQ demonstration system

NDCs[1]: Thailand's Updated Nationally Determined Contribution
OPENVQ[2]: Optimized Performance Enabling Network for Volt/Var(Q)
JCM[3]: Joint Crediting Mechanism

OPENVQ Analysis



Reducing the number of control

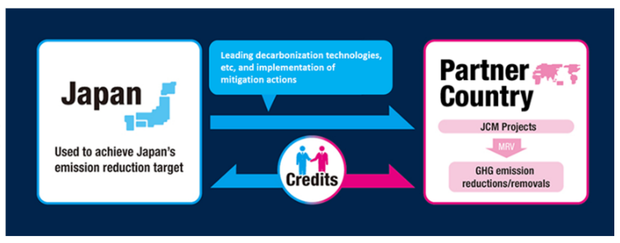
(1) Prediction-based analysis (PBA)

- PBA predicts the future states of the power system and plans the optimal control schedule to reduce the transmission loss.
- PBA considers the number of control when planning the schedule. For the time zone the demand does not change significantly, PBA formulates voltage control with small number of control to reduce the operation cost. We applied the demand prediction technology for each DSO connection point.

(2) Real-time analysis (RTA)

- RTA validates the control actions scheduled by PBA considering the predicted network status may contain errors. In case the scheduled control actions by PBA will worsen the voltage stability or increase the transmission loss, RTA adjusts the control actions.

JCM Methodology



What's JCM?

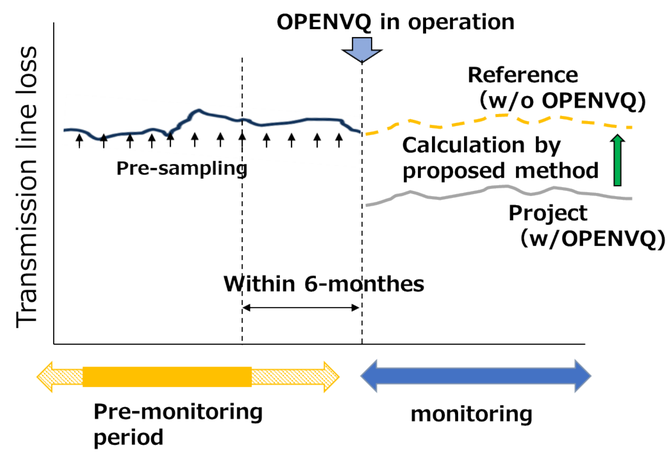
- JCM is appropriately evaluating contributions from Japan to GHG emission reductions or removals in a quantitative manner and Japan uses them to achieve its reduction target.

How OPENVQ projects use JCM?

- Authors have formulated the equations to calculate the transmission losses with/without OPENVQ from the monitoring data.

Target of this project

- From feasibility study, potential CO_2 credit might be 17 $ktCO_2$/year.
- Expected credit from this project is 10 $ktCO_2$/year considering any uncertainties.



Reference loss calculation to calculate CO_2 credit

Conclusion

- The OPENVQ system is installed to the northeastern area of Thailand to demonstrate that coordinated voltage control reduces the transmission losses.
- The project is expected to acquire 10 $ktCO_2$/year of CO_2 credits by applying JCM methodology, as the equivalent of transmission loss reduction.
- In the future, authors will confirm the versatility and practicality of the scheme through the system operation.

Acknowledgement

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