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Development of a Demand Response Programme to Resolve Local Network Congestion

***Brian TY MAK[1)], Thomas KH TAM[2)], Tianxiang JIANG[3)], Tony TT KWOK[4)]**

[1)]Senior Engineer
[2)]Senior Manager – Process Change Management
[3)]Principal Manager – Smartgrid Strategy
[4)]Associate Director – Smartgrid & Innovation
Smartgrid and Innovation Department, Power Systems Business Group, CLP Power Hong Kong Ltd.

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Abstract

Our society is currently undergoing a low-carbon transition in both the power generation and electricity consumption sectors. On the power generation side, fossil fuel-based generation, such as coal and oil, is gradually being replaced by cleaner energy alternatives such as nuclear power, wind, and solar. However, these energy sources present challenges in maintaining supply-demand balance due to their potentially inflexible and intermittent nature. On the consumption side, the increasing load density driven by urban development and the adoption of electric vehicles (EVs) marks a substantial shift toward cleaner transportation. The widespread charging of EVs may pose challenges to the existing power infrastructure and result in local network constraint.

To address these challenges economically and avoid inefficient reinforcements, CLP Power Hong Kong Limited (CLP Power) is strategically leveraging customer-side resources, such as incentive-based demand response programmes, as an effective solution. Since 2021, the Localised Demand Response (LDR) pilot was established to understand customer behaviour and assess the technical effectiveness of LDR in alleviating local network congestion.

The LDR pilot adopted a 3-phase approach targeting different voltage levels, i.e. LV network for phase 1, 11kV ring network for phase 2, and 132kV/11kV transformer for phase 3. This progressive approach started with smaller customer groups for quick start, allowing the project team to make adaptive changes for subsequent phases. The actual implementation of the pilot included: 1) the selection of circuits based on criteria such as loading level and smart meter coverage; 2) the development of load forecast models for each selected circuit to determine the initiation of DR events; 3) the measurement, verification and remuneration to participating customers; and 4) the analysis and review of customer data.

The results of the LDR pilot allow CLP Power to gain valuable insights into customer behaviour and their responses to incentive-based demand response programmes at the local network level, which provided CLP Power with an innovative alternative to effectively resolve local network constraints.