ABSTRACT

In this paper, we summarized the demonstration project in Penetanguishene of Canada. Penetanguishene area is located 150km north of Toronto and a small remote area which is about 10,000 populations. This area has problems of maintenance and extension cost for transmission network and those affect the profitability of distribution utility. To solve the problems, KEPCO and PowerStream, launched the demonstration project. The demonstration project is divided into two stages. One is for the demonstration of isolated operation for feeder level, customization of MG operation system for North American market, control of active distribution network, peak shaving and valley-filling, and protection issue from long-term isolating operation. The other is the additional R&D demonstration for actual business. This is for the demonstration of trade of demand resources (VPP, market service), prototype business model application, long term isolating operation and etc.

INTRODUCTION

According to the IEEE, a microgrid is defined that the integrated energy system network consisting of distributed energy resources (DER) and multiple electrical loads as d/or meters operating as a single, autonomous grid either in parallel to or islanded from the existing utility [1]. A nd the type of microgrid is divided into the utility, commercial and isolated microgrid. Utility microgrid is that whole or part of distribution network is operated independently of other distribution network. In this network, ESS and DER is utilized for energy self-sufficiency and high reliability. The operation system is advanced from conventional distribution operation system and the various application programs for enhancement of network operation reliability and efficiency are mounted. The size of UDM (utility distribution microgrid) is substation or distributor on feeder level and the operation object is for the advanced distribution operation and reliability enhancement using commercial microgrid resources and VPP/DR resources.

KEPCO (Korean Electric Power Corporation) has been developed for the core technical solutions for UDM. That is focused on the KEPCO’s own UDM operation system platform and application and UDM engineering technology. The business strategies of KEPCO for microgrid are divided into the basic, technology intensive and future type. Their objects are the electrification of developing country, the production and sales of electric power and water using MG (microgrid) and the business model of high end market, respectively. Since 2014, KEPCO cooperated with PowerStream that is Canadian distribution company for the obtainment and field test of future type MG. The cooperation project is titled Penetanguishene Distribution MG Project and the duration is from March 2015 to February 2017. The target area is Penetanguishene, Ontario. The final goal of the project for KEPCO is the demonstration site construction and the obtainment of track records for KEPCO’s UDM operation system.

CURRENT STATUS OF PENETANGUISHENE

The network hierarchy of PowerStream and Penetanguishene are illustrated in Fig. 1. As shown in Fig. 1, Penetanguishene area feeds from Waubaushene substation (23/0/44kV) and It has 4 municipal station (MS421~424). KEPCO’s MG is constructed on MS422 feeder 1.
fore, we focused on the uninterrupted island operation, customization of KEPCO’s MG operation system, active distribution operation, peak shaving and long term island operation. The final demonstration item is shown in Table 1.

Table 1. Demonstration items of Penetanguishene Prj.

<table>
<thead>
<tr>
<th>No</th>
<th>Benefit</th>
<th>Solutions by Demo</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Increase of selling price</td>
<td>Improvement of power quality and reliability using variety DM S functions (state estimation/voltage optimization) and FDIR using ESS</td>
</tr>
<tr>
<td>2</td>
<td>Decrease of Purchasing price</td>
<td>ESS daily scheduled operation that based on electricity price and ESS yearly schedule operation for the reduction of peak load</td>
</tr>
<tr>
<td>3</td>
<td>Expansion of EPC business</td>
<td>Reduction of the intermittency of DGs in terms of PCC point power flow</td>
</tr>
</tbody>
</table>

The demonstration site is shown in Fig. 2.

![Fig. 2. Demonstration site design](image)

The network diagram for installation of ESS/PCS is illustrated in Fig. 3.

![Fig. 3. ESS/PCS network diagram](image)

The structure of UDM operation system is shown in Fig. 4. That is 1 machine structure.

![Fig. 4. Structure of UDM operation system](image)

Fig. 5 describes the communication network diagram for Penetanguishene project.

![Fig. 5. Communication network diagram](image)

**DEMONSTRATION SITE CONSTRUCTION**

Fig. 6 shows the demonstration construction.

![Fig. 6. Demonstration construction](image)
Installation of ESS/PCS

Fig. 6. Photos of site construction

Fig. 7 shows the basic communication test for MG operation system. More detail test results will be finished until June 2016.

REFERENCES

