opusone solutions

1.2 Use Cases Definition Document

In Support of Project DEMOCRASI's Milestone 2 Submission

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Contents

Lexicon

C&I	Commercial & Industrial
CA	Capacity Auction
DER	Distributed Energy Resource
IESO	Independent Electricity System Operator
LDC	Local Distribution Company
MW	Mega Watt
PV	Photo-Voltaic (Solar)
UC	Use Case

Notes:

Project DEMOCRASI utilizes Lakeland Power Distribution Ltd. network – Lakeland Power has full visibility.
Bracebridge Generation Ltd. owns and will control the DEMOCRASI assets on Lakeland Power's network.
Bracebridge Generation adheres to Lakeland Power's conditions of service.

1 Introduction

DER aggregators provide their services through the distribution network to the system operator at a cost to local distribution companies (LDCs). This leads to grid instability and asset degradation, thereby increasing the need for higher capital expenditures, the cost of which is borne by rate payers.

This document describes the use cases that will demonstrate how a constraint-aware dispatch signal can be generated through the joint product solution and allow for the dispatch of Distributed Energy Resources (DERs) to participate in the bulk market without negatively impacting the distribution grid. For example, identifying a capacity constraint at a substation and determining a schedule for a battery to respond to an IESO Demand Response event, without violating that constraint.

The joint product solution team is composed of:

- Opus One Solutions Energy Corporation (Opus One solutions), which owns the software solution GridOS
- Kiwi Power, which owns the software solution Kiwi Core[1]

1.1The DEMOCRASI Project

DER aggregators typically provide their services through the distribution network to the system operator at a cost to local distribution companies (LDCs). Modern grids should consider the local distribution network such that DER market activities do not degrade the state of the grid.

The goal of the DEMOCRASI project is to demonstrate the viability of a modern approach to asset aggregation where asset dispatch is optimized to meet the demands of the bulk market while also serving local grid needs.

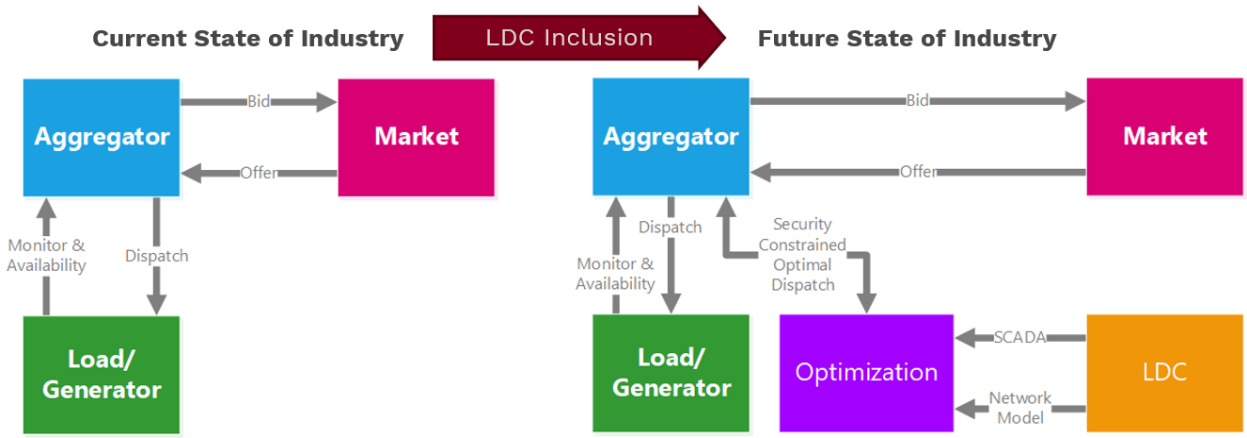

Figure 1 Current and Future State of Industry

1.2 Value Proposition

The proposed solution aims to provide the following set of values:

- Optimally dispatches DERs for participation in a bulk market while also serving local grid needs without affecting grid reliability
- Gives LDC visibility and control over participating assets

[1] Referred to as KOMP in Report 1.1.

1.3 High Level Deployment Plan

The DEMOCRASI solution will be deployed at Lakeland Power in Parry Sound, and is developed in collaboration by Kiwi Power and Opus One Solutions. The IESO will be the bulk market for integration into the solution.

The initial deployment will demonstrate viability through simulation in the IESO Capacity Market. The primary focus will be to demonstrate functionality prior to future scaling opportunities.

For the initial deployment, the solution will simulate participation in the bulk market whenever possible and will be falling back to serving the local grid when bulk market participation is not possible. The solution will utilize GridOS' optimal power-flow engine to ensure that bulk market participation does not negatively impact the local grid. For details around the logical flow dictating this process, see the 1.5 Joint Product Specification document.

1.4 Initial Deployment Scope

The initial deployment will not directly integrate with IESO due to IESO market structure changes occurring in parallel with project design and execution. It is planned that live market integration will occur in 2021. For the initial deployment, anticipated market signals will be simulated to demonstrate the viability of the approach.

For asset dispatch to be optimized to reduce cost globally, the price of bulk energy and the cost of operation of the assets must be known. The initial deployment of the DEMOCRASI solution at Lakeland will not consider the price of energy or the cost of operation to ensure the feasibility of the project in accordance with the agreed timelines and budget. Future deployments of the DEMOCRASI solution will optimize dispatch against the price of energy and the cost of operation.

2 Roles

The proposed solution requires the presence of the following customer and vendor roles:

Customer Roles:

- Local Distribution Company (LDC)
- Aggregator
- Asset Owner

Vendor Roles:

- Software Provider
- Fleet Manager

Customer Roles

Customer roles may be one corporate entity, multiple related entities, or a set of partnering independent entities. In the case where entities are partners, arrangements will need to be made to provide and/or integrate all required data with the solution.

It is possible for multiple Asset Owners to participate in the solution but at least one is required. For the initial deployment, the participating parties are organized as follows:

- Local Distribution Company: Lakeland Power Distribution Ltd.
- Aggregator: Lakeland Power Distribution Ltd.
- Asset Owner: Bracebridge Generation Ltd.

Vendor Roles

In addition, the proposed solution includes the following vendor roles:

- Software Provider
- Fleet Manager

These roles support and interact with the solution in different ways, detailed below.

2.1 Role Descriptions

Asset Owner

1. Owns assets that will be used for dispatch
2. Gives control of assets to Aggregator (contractual details out of project scope)
3. Provides asset availability to Aggregator (required to account for maintenance windows)
4. Provides revenue expectation or minimum price point required
5. Is financially compensated for flexibility provision (out of scope for project)
6. Is financially penalized for failure to provide flexibility (out of scope for project)

Aggregator

1. Controls how Asset Owner's assets are dispatched
2. Receives price for dispatch from bulk market, LDC (local flexibility)
3. Schedule asset dispatch based on price & request availability between bulk requests & local requests
4. Provides real-time telemetry of aggregation assets to LDC (visibility)
5. Provides measurement data to bulk system and to LDC (reporting, settlement)

6. Registers with the bulk market and acts as the bulk market participant
7. Lodges credit cover and pays any market participation fees (out of project scope)
8. Performs administrative tasks required by the bulk market
9. Receives and redistributes payments for bulk market participation

Local Distribution Company (LDC)

1. Offers local flexibility requests to Aggregator
2. Gets real-time telemetry of aggregation assets from Aggregator (visibility)
3. Available telemetry will depend on customer/market arrangement

Fleet Manager

1. Operates fleet(s) of assets
2. Provides a programmatic interface that provides asset measurements and receives control commands from clients
    a. May provide additional services through the interface

Software Provider

1. Supports DEMOCRASI product solution through on-going software support and integration services; this includes software integrators that may be involved in a deployment

2.1.1 Notes

For the initial deployment, the solution will always choose the bulk market if it is available since cost of operation is out of scope for the initial deployment (see Initial Deployment).

Visibility is defined as measured active power, reactive power, voltage, and current of an asset, as well as its availability and its future (scheduled) and past performance.

2.2 Use Case Data Requirements

Required

1. Network model from LDC
2. Feeder and other loading data from LDC
3. Local flexibility price OR costs associated with network operation from LDC
4. Bulk market signals (price, quantity, duration, …) from Bulk Market

Optional

1. Load & generation forecast integration; example forecasts that could be required:
    a. Meter point load
    b. Feeder loading
    c. Photo-voltaic (PV)
    d. Hydro
    e. Commercial & Industrial (C&I) loading
    f. Grid connected battery

2.2.1 Notes

Local Flexibility

Local flexibility request details could include:

1. Price/Cost Savings ($/MW)
2. Quantity (MW)
3. Duration
4. Location

For future deployments, solution may automatically generate local flexibility price if cost of operation data is available.

Local flexibility could be expressed through a cost-savings program or an explicit local market. This is indicative of future work and is out of the scope of this document.

Bulk Market

For the purposes of this document, the concept of a “Bulk Market” includes both implicit and explicit demand response programs.

Explicit demand response changes consumption or generation patterns upon request of a system operator.

Implicit demand response reacts to dynamic market or network pricing signals.

3 Use Cases

The primary use cases listed below apply to the product solution and primarily target future deployments of the solution. Due to the limitations of the initial deployment, some use cases are altered as indicated below. See Initial Deployment for more information.

3.1 Users

Each use case below utilizes one or more of the following users:

Name	Customer Role	Description
Smart Grid Operator	LDC	Monitors DERs on the local grid, taking action to ensure the reliability of the grid.
Aggregator Operator	Aggregator	Monitors aggregated DER fleet and participating markets. Ensure that available DERs are participating in the most lucrative actions available.
Asset Owner	Asset Owner	Maintains owned DERs, ensuring availability for dispatch. Communicates scheduled or unscheduled downtime with the Aggregator.

3.2 Use Case Descriptions

3.2.1 UC1

All customer roles have visibility over assets participating in bulk market or local flexibility

3.2.1.1 Definitions

Visibility is defined as measured active power, reactive power, voltage and current of an asset, as well as its availability and its future (scheduled) and past performance.

3.2.1.2 Example User Journeys

View asset performance

- User: Smart Grid Operator OR Aggregator Operator OR Asset Owner
- Steps
    - User visits asset visibility interface
    - User sees aggregation assets
    - User sees aggregated trend of asset performance (aggregated measurements; see definition of visibility above) over the next day and for previous days
    - User selects an asset
    - User sees asset performance over the next day and previous days

3.2.1.3 Initial Deployment Details

This use case will be represented in the initial deployment as described above.

3.2.2 UC2

LDC role provides local flexibility requests

3.2.2.1 Example User Journeys

Manually create local flexibility request

- User: Smart Grid Operator
- Steps
    - User visits local flexibility interface
    - User sees previous local flexibility requests
    - User visits page to create new local flexibility request
    - User enters request details (location, MW, duration, …)
    - User submits request

Review automatically created flexibility requests

- User: Smart Grid Operator
- Steps
    - User visits local flexibility interface
    - User sees local flexibility requests that have been automatically created by the system

3.2.2.2 Initial Deployment Details

Since cost information will not be considered as a part of the initial deployment, local flexibility will not utilize an explicit flexibility request implementation.

Instead, local flexibility will be implemented as automated peak-shaving at the feeder level when the bulk market does not send a standby signal by the daily cut-off time or when the bulk market does not send an activation signal by the daily cut-off time (see 1.5 Joint Product Specification document for more details).

3.2.3 UC3

Aggregator role participates in bulk market when bulk request is available, and price is high

3.2.3.1 Example User Journeys

View Bulk Market Participation Schedule

- User: Aggregator
- Prerequisites
    - Bulk market has granted participation award to aggregated assets
    - Solution has computed security optimized dispatch schedule for aggregated assets to meet bulk market dispatch requirements
- Steps
    - User visits notifications interface
    - User sees that bulk market award has been granted
    - User visits dispatch schedule interface
    - User sees that dispatch schedules have been created for the aggregated assets to meet the dispatch requirements

3.2.3.2 Initial Deployment Details

The initial deployment will not directly integrate with IESO due to IESO market structure changes occurring in parallel with project design and execution. See Initial Deployment for more details.

3.2.4 UC4

Aggregator role meets local request when local request is available, and price is high

3.2.4.1 Example User Journeys

View Local Flexibility Participation Schedule

- User: Aggregator
- Prerequisites
    - LDC has granted participation award to aggregated assets
    - Solution has computed security optimized dispatch schedule for aggregated assets to meet local flexibility requirements
- Steps
    - User visits notifications interface
    - User sees that local flexibility award has been granted
    - User visits dispatch schedule interface
    - User sees that dispatch schedules have been created for the aggregated assets to meet the dispatch requirements

3.2.4.2 Initial Deployment Details

For the initial deployment, the solution will participate in the bulk market whenever required and will be falling back to serving the local grid when bulk market participation is not possible. See Initial Deployment Scope for more details.

3.2.5 UC5

Aggregator role configures and operates DER for local flexibility and bulk market participation

3.2.5.1 Example User Journeys

Set asset availability and participation

- User: Aggregator
- Steps
    - User visits asset availability interface
    - User sees availability schedule of asset showing hours that it is available for operation and for participation
    - User sets availability of asset for operation for a future hour
    - User sets availability of asset for participation (one of bulk market or local flexibility) for a future hour
    - User sees that availability schedule has been updated

Notify bulk system of inability to dispatch

- User: Aggregator
- Prerequisites
    - Bulk market has granted participation award to aggregated assets
- Steps
    - One of:

        - User sees an alarm indicating that an optimal DER schedule could not be computed in response to a bulk market award
        - User is notified out of band that one or more assets intended to activate in response to the bulk market award will not be able to activate
    - User contacts bulk market operator out of band to inform of inability to respond to signal, negotiating and updating the bid based on available capacity

Stop dispatch during emergencies

- User: Aggregator
- Prerequisites
    - Bulk market has granted participation award to aggregated assets
    - Asset dispatch has started in response to the participation award
    - An emergency has arisen during asset dispatch
- Steps
    - User visits monitoring and dispatch interface
    - User sees active dispatch schedules for one or more assets
    - User selects the assets that need to be stopped to mitigate the emergency
    - User issues stop commands to those assets
    - User sees the active command for those assets update
    - After a short time, user sees that the dispatch activity of those assets has stopped

Submit measurement data to bulk system

- User: Aggregator
- Steps
    - User visits reporting interface
    - User requests system to produce a measurement report for submission into the bulk market for the desired time range (last month)
    - System produces requested report
    - User downloads report
    - User visits bulk market interface out of band and uploads submission report