



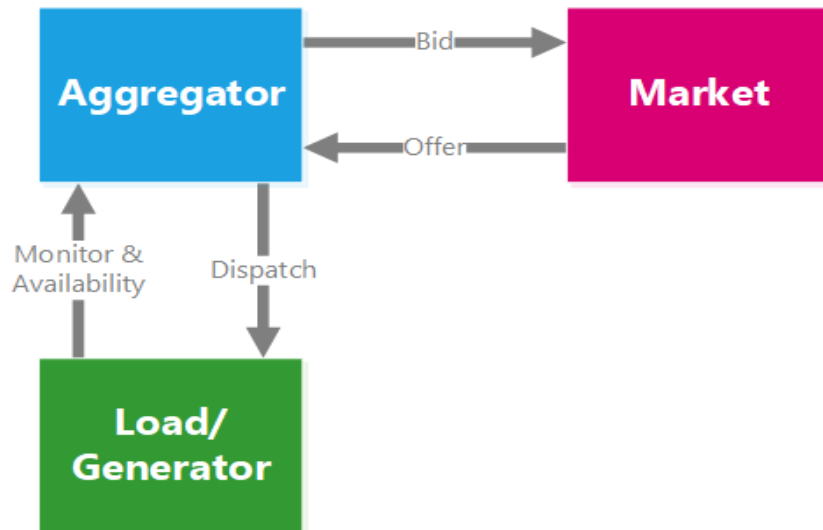
DEMOCRASI

Dispatchable Energy Market Optimized Constrained  
Real-Time Aggregated System Interface

# Problem Statement



DER aggregators (flexible service providers) provide their services through the distribution network to the wholesale market at a cost to distribution network operator (DNO/LDC). This leads to **grid instability** and **asset degradation**, thereby increasing the need for **higher capital expenditures** borne by consumers.



## Key Consideration

Modern grids should consider the local distribution network such that DER market activities do not degrade the state of the grid.

## Solution Statement

- Providing visibility to LDCs (location, service type and asset dispatch schedules for bulk services driven by capacity and price)
- Empower LDC Optimization: minimizing local system constraints via dispatch of DER for bulk level services

# Joint Solution

The DEMOCRASI product solution formalizes the integration between the two software solutions, GridOS® and Kiwi Core™. GridOS® and Kiwi Core™ are software solutions built and owned by Opus one Solutions and Kiwipower respectively.

## **GridOS®**

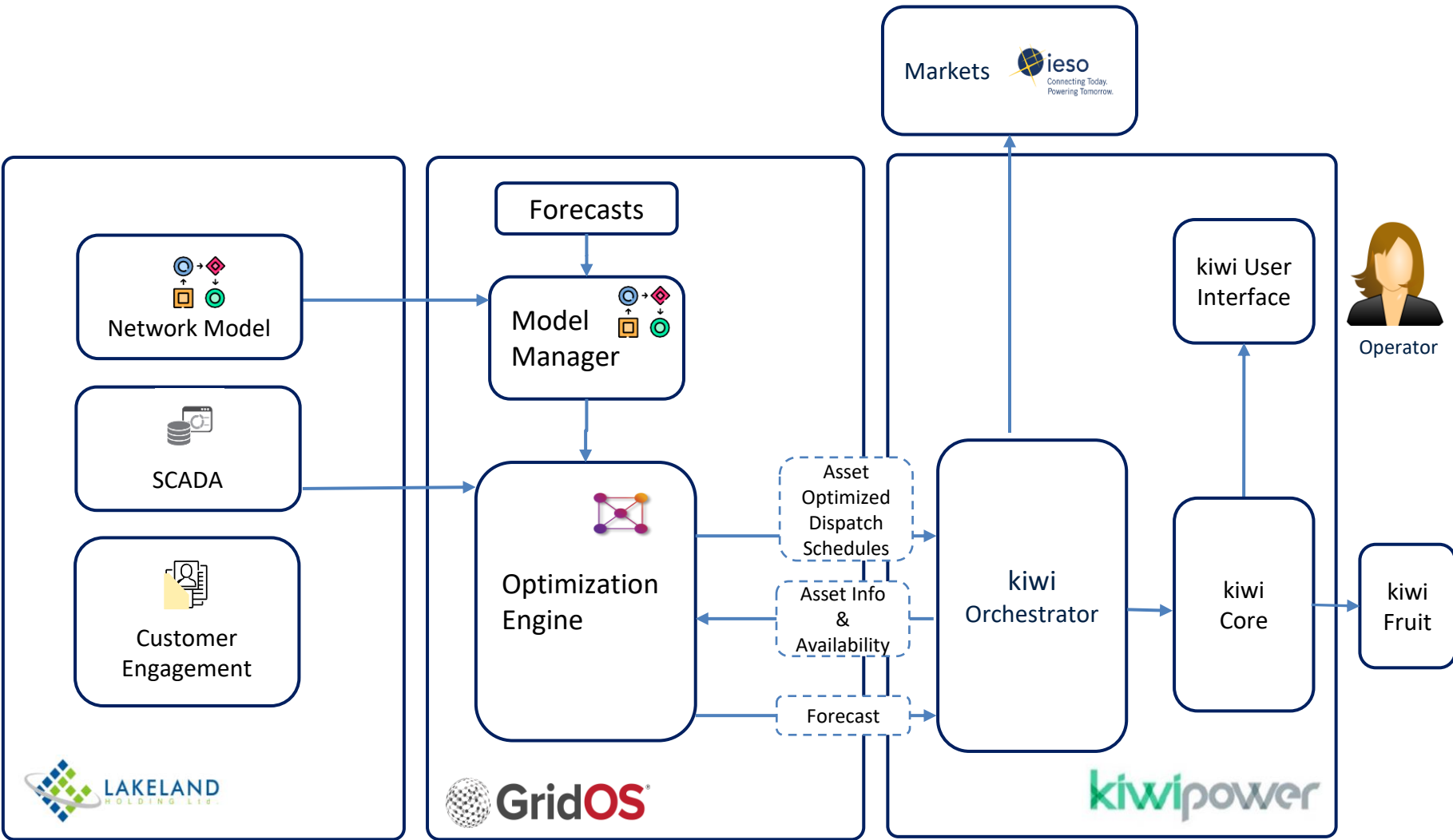
Provides the optimization functionality (example: *operating envelope optimization, bid fulfillment optimization, peak shaving*). It performs three-phase unbalanced time-series optimization on distribution and sub-transmission networks.

## **Kiwi Core™**

Provides the bulk system interaction, aggregator functionality and the operator interface. It offers visibility and control of flexibility assets for effective participation in local and bulk markets.



# Solution Architecture



# The Project



## Markets

- Facilitates Wholesale Market Orchestration
  - Simulacrum
  - Business Rules
  - Process
  - Limitations
  - Settlements
- Deploys Local Flexibility Market
  - Co-optimization

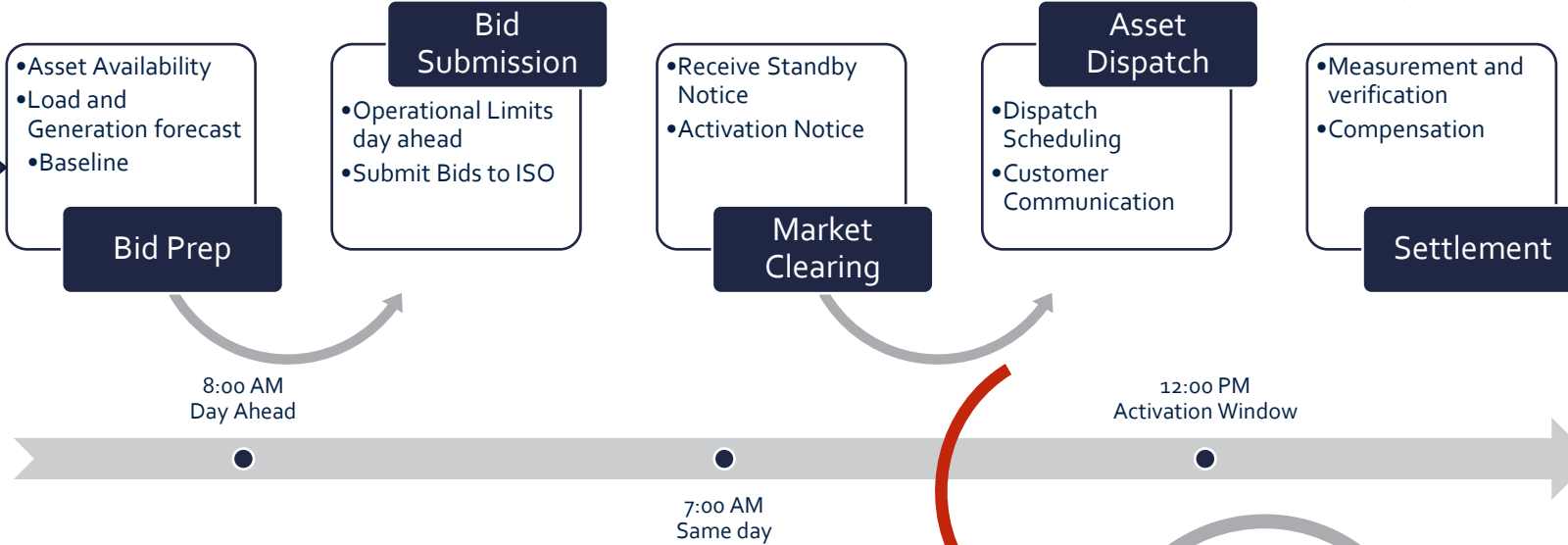
## Assets

## Optimization

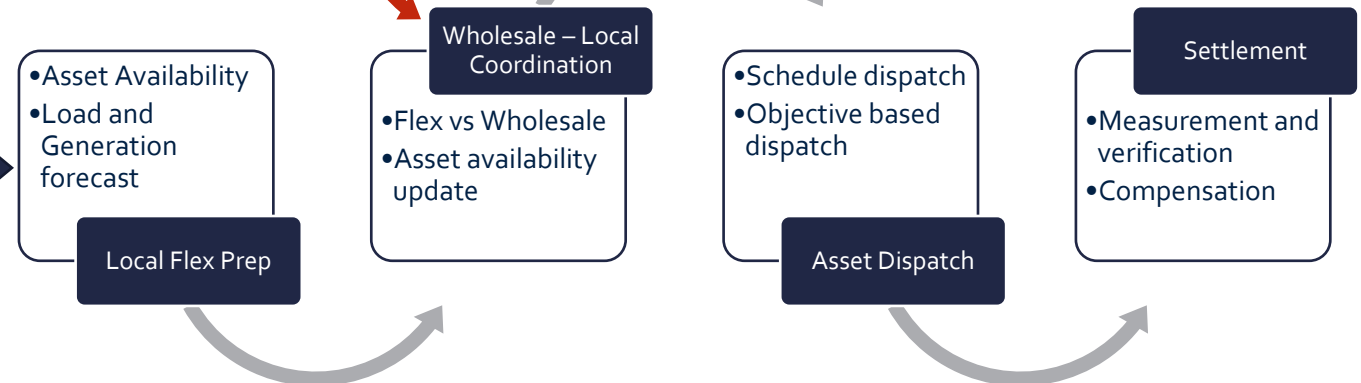
# Wholesale Market and Local Flexibility Orchestration



## Wholesale Market Participation



## Flex Services Participation



# The Project



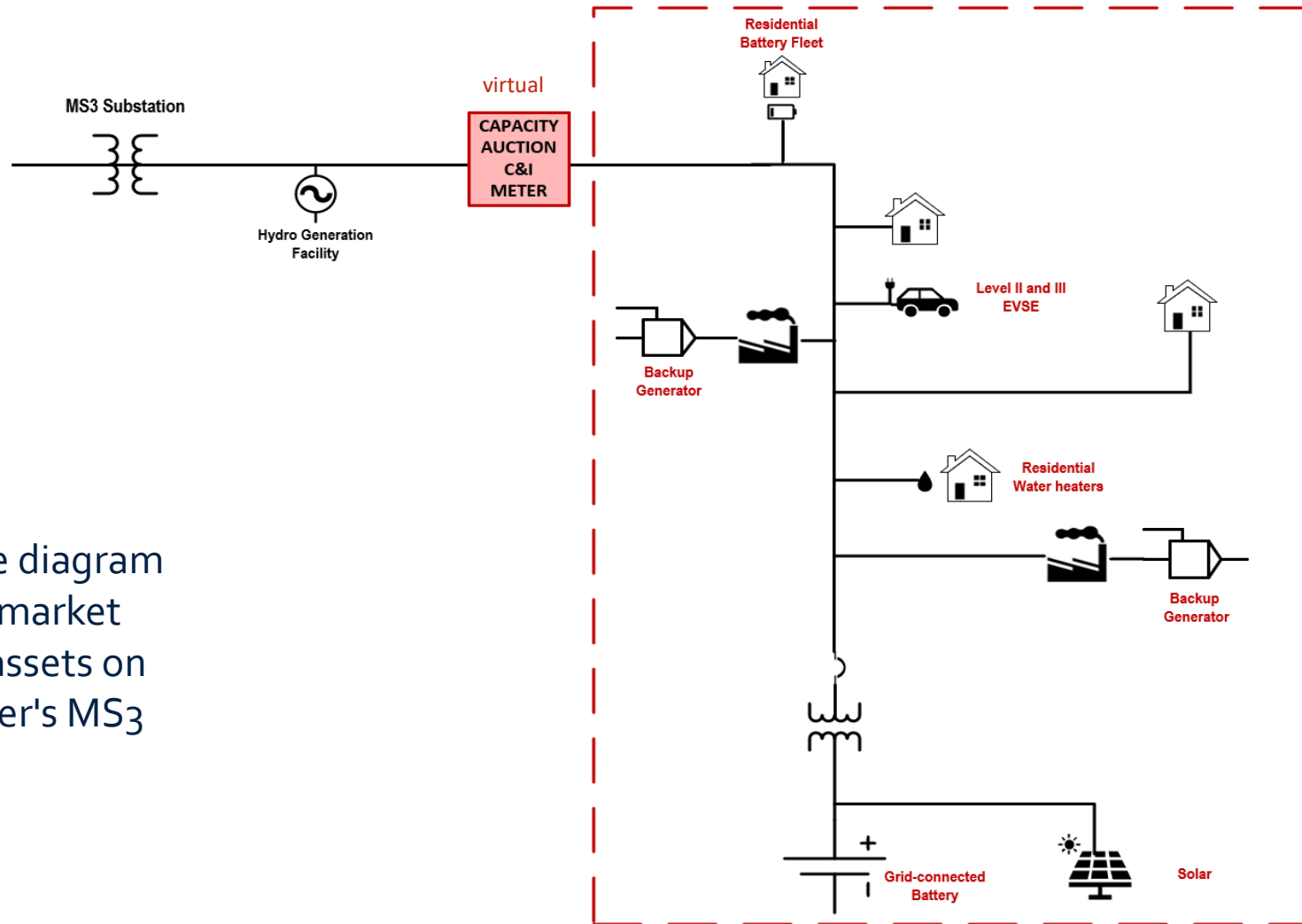
## Markets

## Assets

- Existing Assets
  - DER and IoT
- New Industrial Assets
  - Municipal Owned Generators
- A variety of Customers
  - Residential
  - Commercial
  - Industrial
- Network Model

## Optimization

# Simplified Network Model



This single line diagram visualizes the market participating assets on Lakeland Power's MS3 feeder.



# The Project



## Markets

## Assets

## Optimization

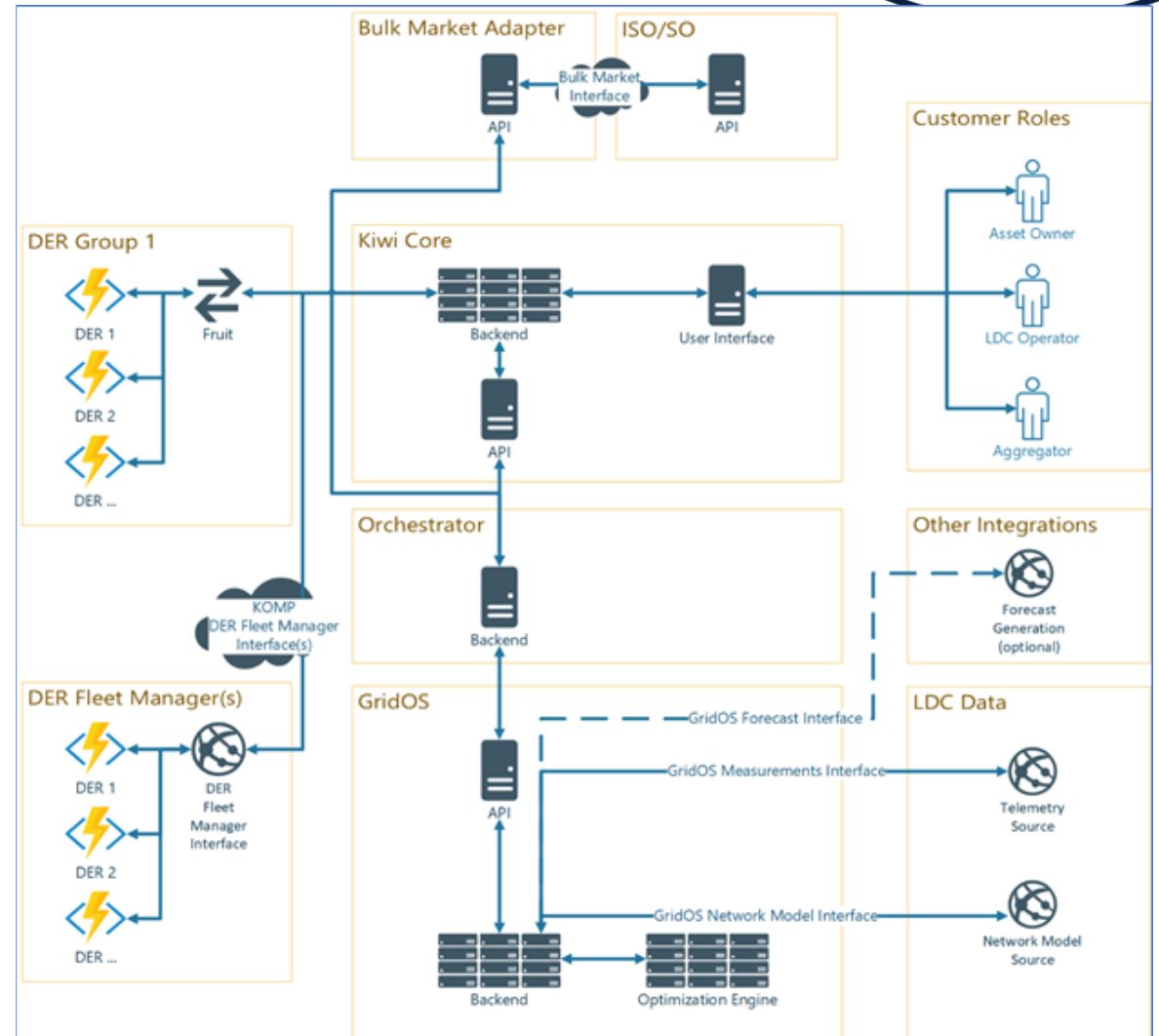
- Software Engineering for the Joint Solution
- Optimization Objectives
  - Wholesale market
    - Bid Update (operating envelope objective)
    - Bid Activation (bid fulfilment objective)
  - Local Flexibility
    - Peak Shaving Objective (demand management)

# Software Engineering for Joint solution



## Key Features

- Integrate with ISO
- Present user interface to Operator
- Dispatch and monitor DERs (Flexibility Resources)
- Optimization Objectives
  - Bid Update
  - Bid Activation
  - Peak Shaving
- Forecasting for Load and Generation
- Integrate with utility source systems



# Optimization Objective – Bid Update (Operating Envelope)



- Operating Envelope are **Swim Lanes** (**min** and **Max** dispatch limit) for market resources that guide them to develop their bids for market participation without causing grid constraints
- Swim Lanes are determined by performing two optimizations:
  1. Determine the maximum export from the market resources at the substation
  2. Determine the maximum import to the market resources at the substation

## Inputs:

- The Electrical Network Model
- The most recent load forecasts
- Market Participating Resources



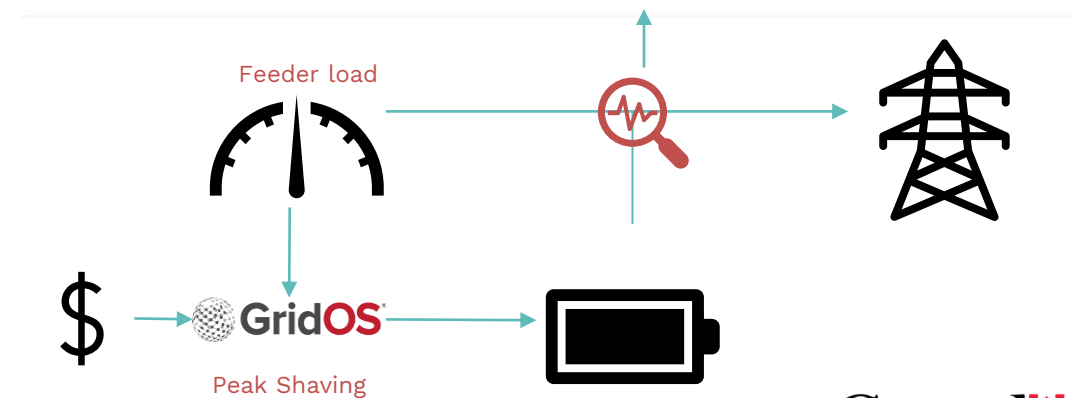
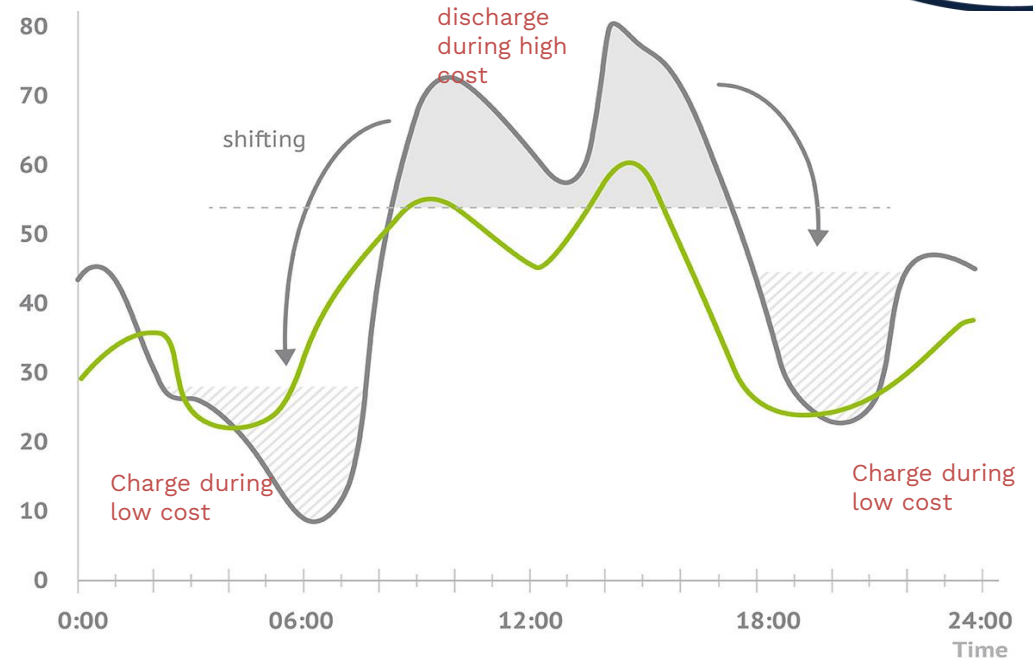
# Optimization Objective – Peak Shaving (Local Flexibility)



- Peak shaving is an NWA (“non wires alternative”) methodology utilized by the DNO/DSO/LDC to achieve benefits such as capital deferral, demand management while maintaining grid reliability
- Peak shaving schedules for participating assets are determined by performing a cost minimization / demand reduction optimization

## Inputs:

- The Electrical Network Model
- The most recent load forecasts
- Local Market Participating Resources



# Maximizing **Value** from DER's

- The DEMOCRASI solution uses the LDC network model to **optimally dispatch assets**, balancing bulk and local needs.
- The solution provides LDCs/DNO with **visibility** over participating assets while also enabling them to procure **local flexibility** services from wholesale market participating resources.

## **Empowering the gate keepers**

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- One of the world's first utility implementations of an Optimization Engine (OE) & DERs with online optimal power flow (OPF)
- Empowering utilities to be able to plan, operate, optimize and create new business models
- Bridging LDC and TSO gap

## **New business models and value stacks**

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- Unlocking revenue opportunities for LDCs and customers
- Reducing capital expenditures
- Facilitating non wires alternatives (NWA's)
- Increased visibility of asset utilization to improve asset health



DEMOCRASI

Join us to experience the Demo of Our Operational Pilot  
(Interactive Display in this room)



# DEMOCRASI

The Project Consortium would like to thank the following organizations.





Bracebridge Generation is the lead partner in the DEMOCRASI project and is one of the subsidiaries of Lakeland Holding Ltd., along with Lakeland Power and Lakeland Energy/Networks.

Bracebridge Generation maintains 9 Hydroelectric plants in Ontario and 1 in Quebec.





Opus One Solutions is a software and solutions company with the vision of a digitalized, decentralized and decarbonized planet. Its intelligent energy network analysis platform, GridOS<sup>®</sup>, optimizes complex power flows to deliver operational time-frame energy management and integrated planning to distribution utilities and other managers of distributed energy resources. GridOS<sup>®</sup> is modular, scalable, and integrates seamlessly with existing data systems to unlock greater potential for distributed energy resources, including renewable generation, energy storage, and responsive demand.



Kiwipower simplifies participating in power markets across the globe. Founded in the UK in 2009, we now operate globally, deploying our unique combination of technology and expertise to unlock distributed energy resource (DER) value and serve sustainable energy needs. The proprietary software Kiwi core™ connects power generation and storage assets to energy markets so distributed energy resource owners can participate and succeed in the new energy world. Our platform is active in over 10 countries, optimising and monetising over 1GW of DERs on behalf of our partners.