Unlocking the Potential of Demand Side Management

…for Doubling Energy Efficiency Improvements

14th May 2024

Alliance for an Energy Efficient Economy

Objective of Demand Side Modeling

Assess the technical potential of demand flexibility for different customers

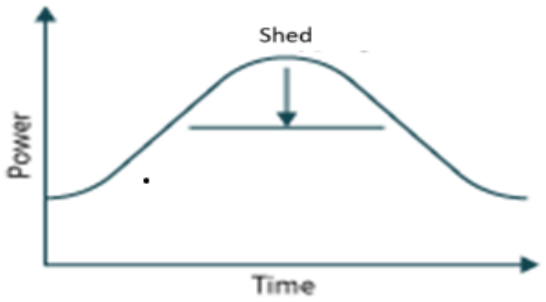
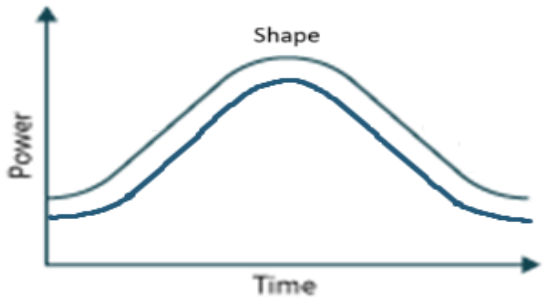
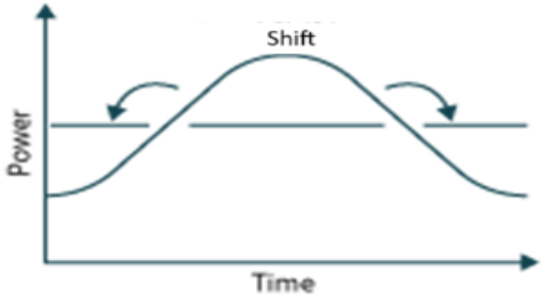
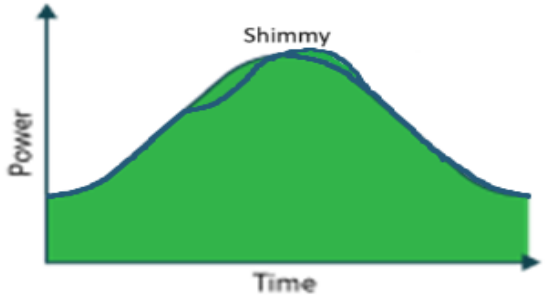
Questions we explored

- What is the composition of the demand by end-use?
- Which of the end-usages can be flexed or controlled?
- What will be the change in the demand with flexing and for what duration?
- How can the variable generation and behind the meter storage further enable DF?
- What will be the potential of DF upon aggregation (e.g.- feeder)?

Demand Flexibility – A tool for optimizing Electricity Demand

Demand Flexibility- Ability of a customer (Prosumer) to deviate from its normal electricity consumption (production) profile, in response to price signals or market incentives." **(Source- EU Smart Grids Task Force)**

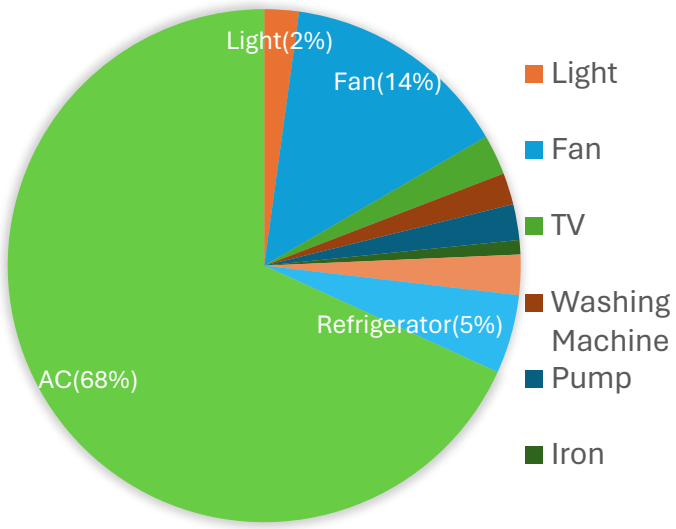
Different Strategies for Demand Response Implementation

Event	Load curve	Definition
Shed	 	Loads are curtailed to support the grid as per the signals received from the operator. This reduces the total energy consumption.
Shift		Loads are shifted from one time to another depending on the requirement. It does not reduce the energy consumption but helps to reduce demand at a particular time to support the grid.
Shimmy	 	It is a versatile strategy to provide flexibility to grid as it can be used to increase as well as decrease the demand.
Shape		Changing consumer behaviour to change the shape of overall load curve at a longer horizon (example- yearly).

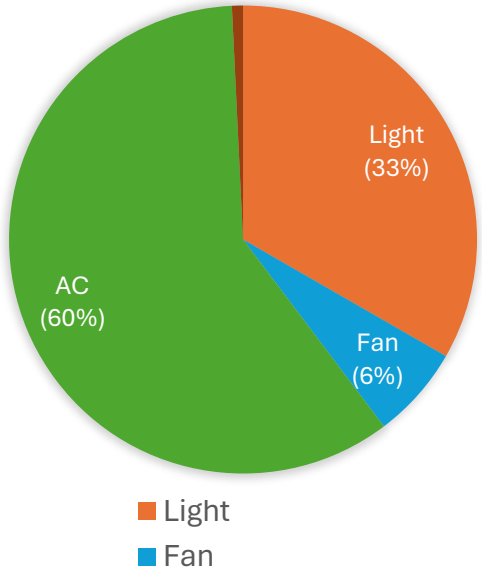
Opportunity for DF Strategies

	Demand flexibility strategies		
Appliance	**Shift**	**Shed**	**Shimmy**
Space Cooling	OFF-ON	OFF	Set-point change
Heavy Plug load	OFF-ON	OFF	NA
Water Pumping	OFF-ON	OFF	NA
Battery Storage	OFF-ON	OFF	Rate of charge and discharge
Refrigeration	NA	OFF	NA
Hot water	OFF-ON	OFF	NA
EV	OFF-ON	OFF	Rate of charging

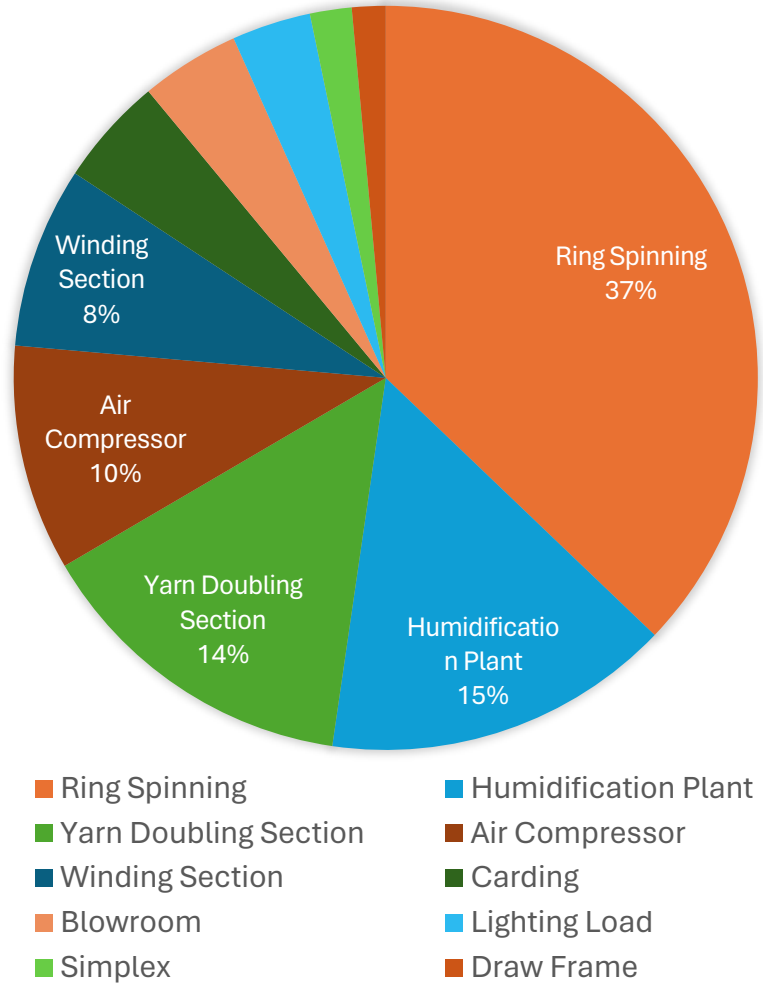
Residential Electricity Consumption (in %)



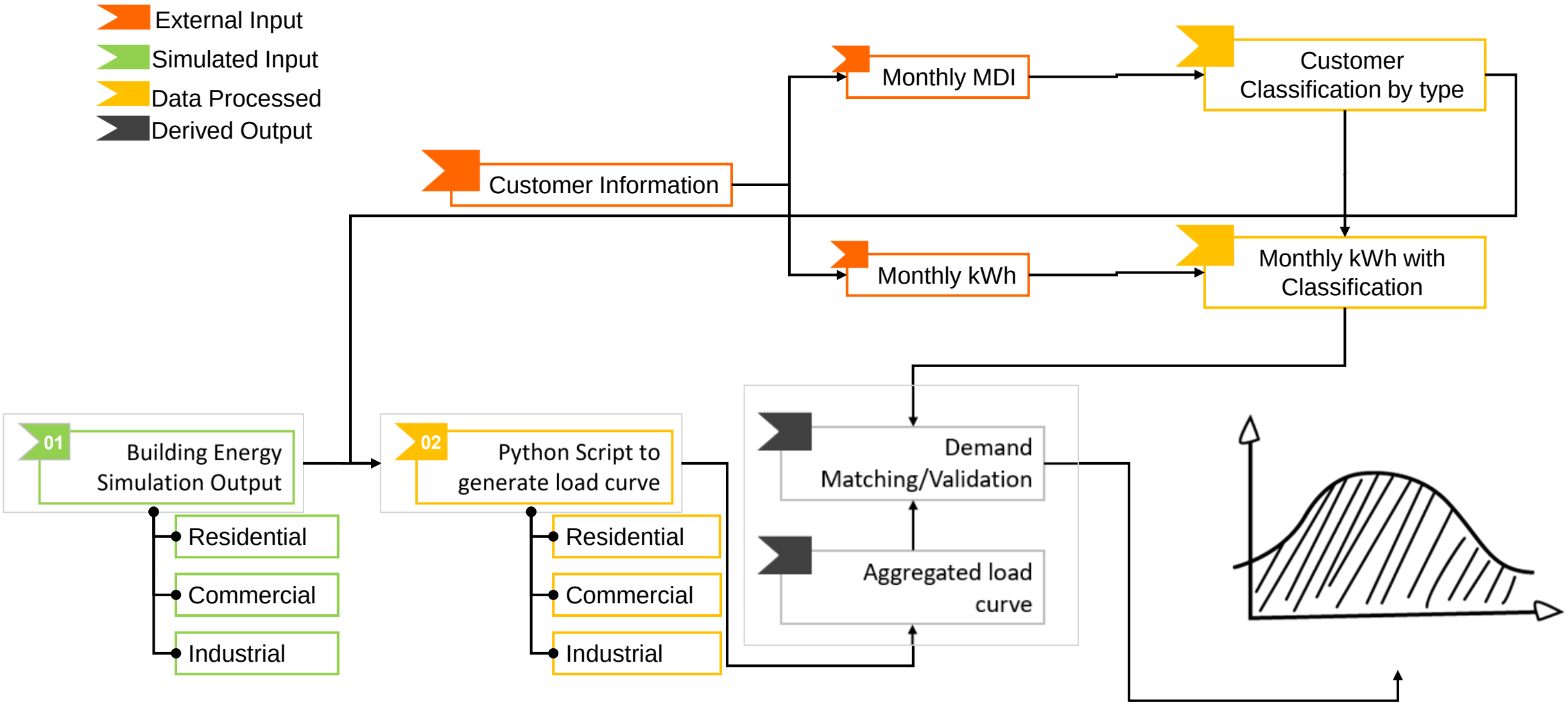
Small Commercial Electricity Consumption (in %)



Industrial Electricity consumption (in %) Textile-spinning

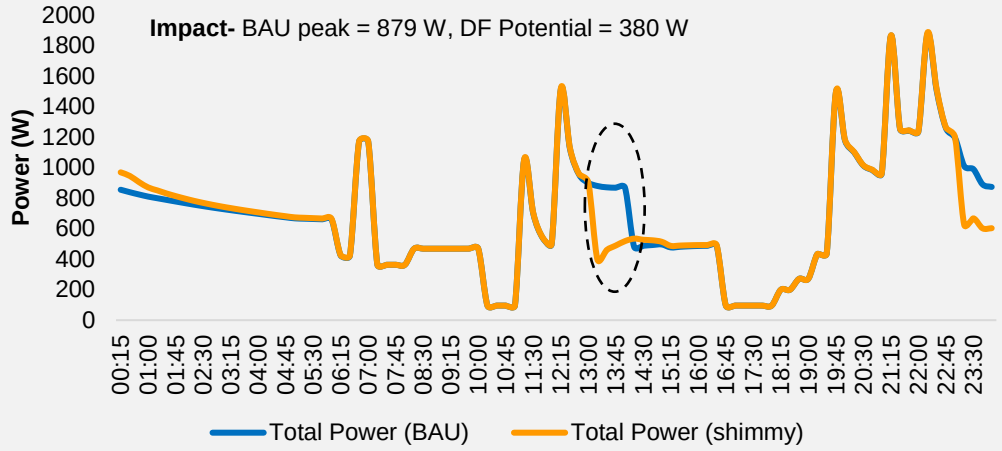


Modelling Framework: Bottom-up Approach

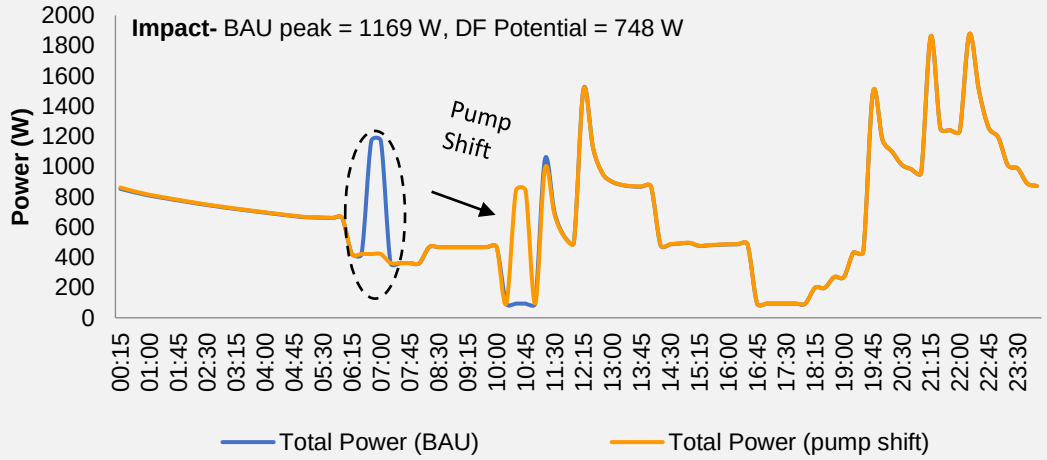


Unit Level Simulation- for Residential Customers (Summer)

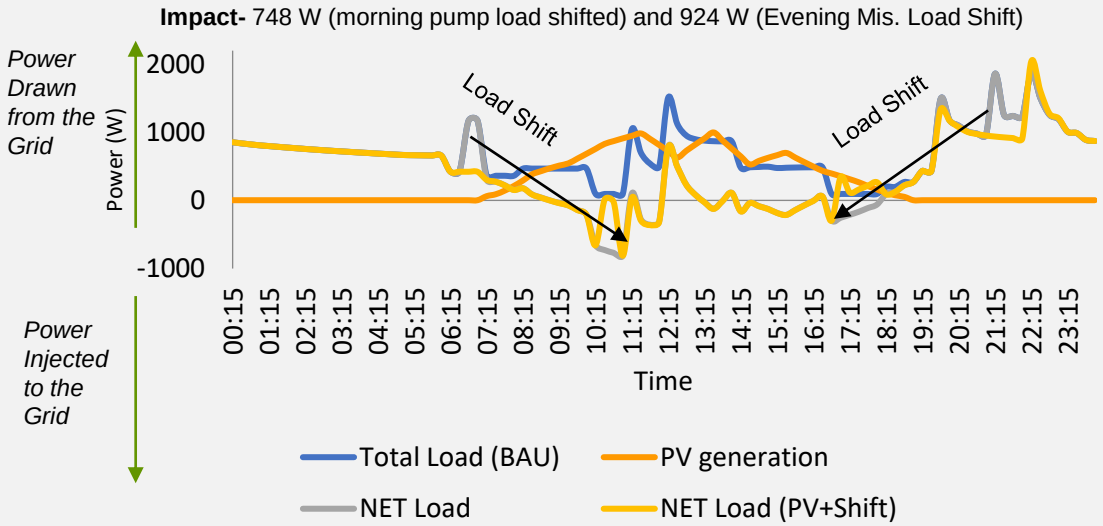
DF scenario – shimmy



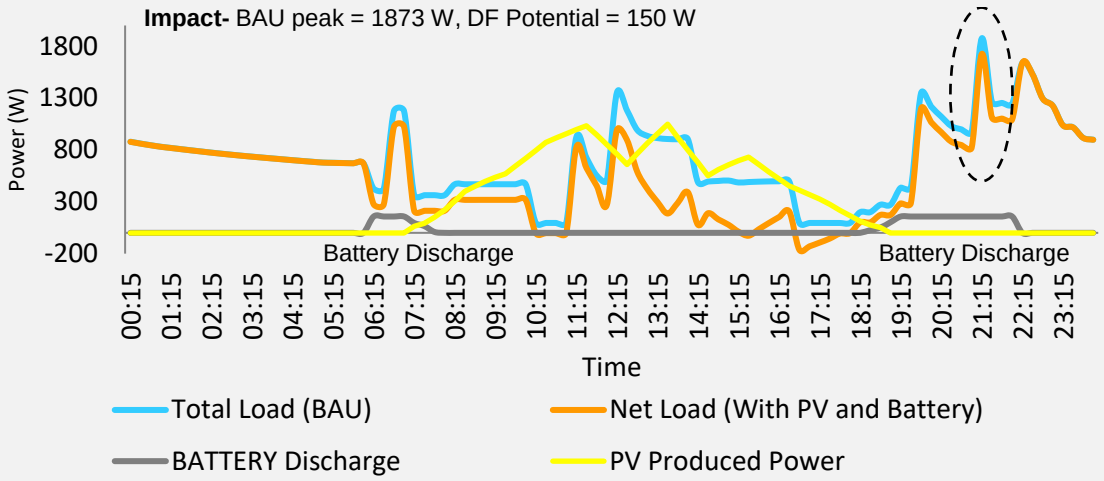
DF scenario – shift



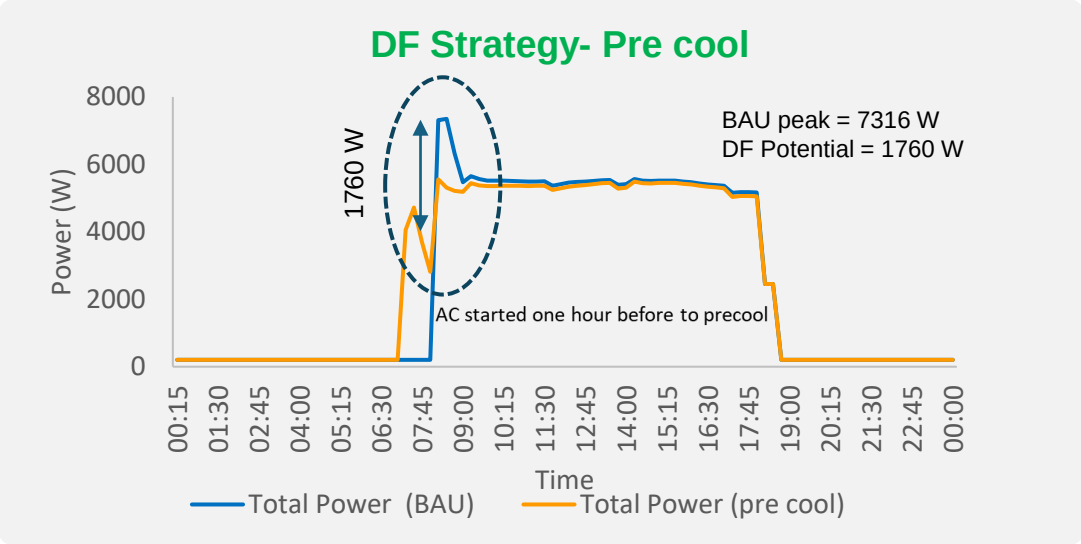
DF scenario – PV integration and load shift

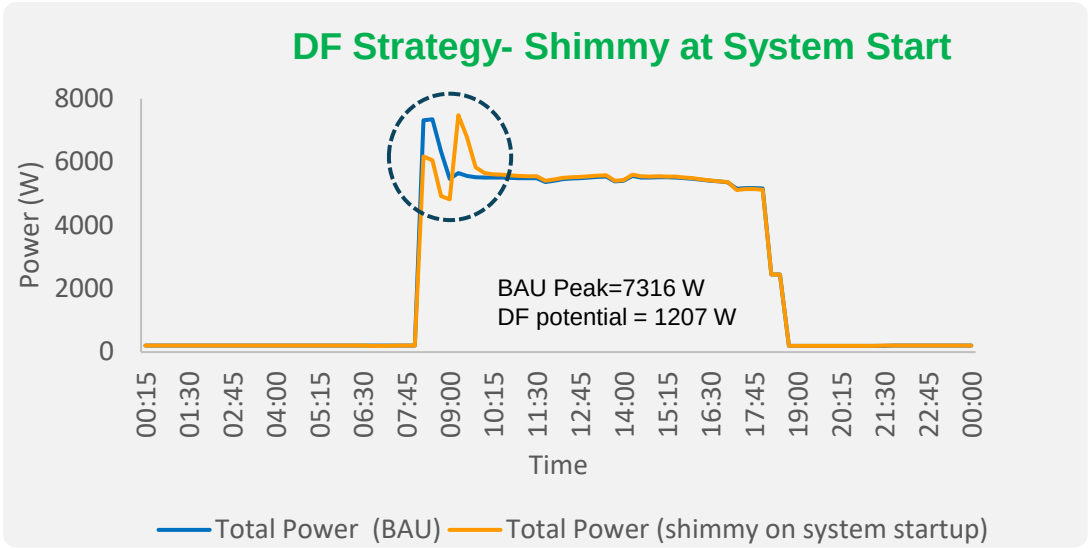


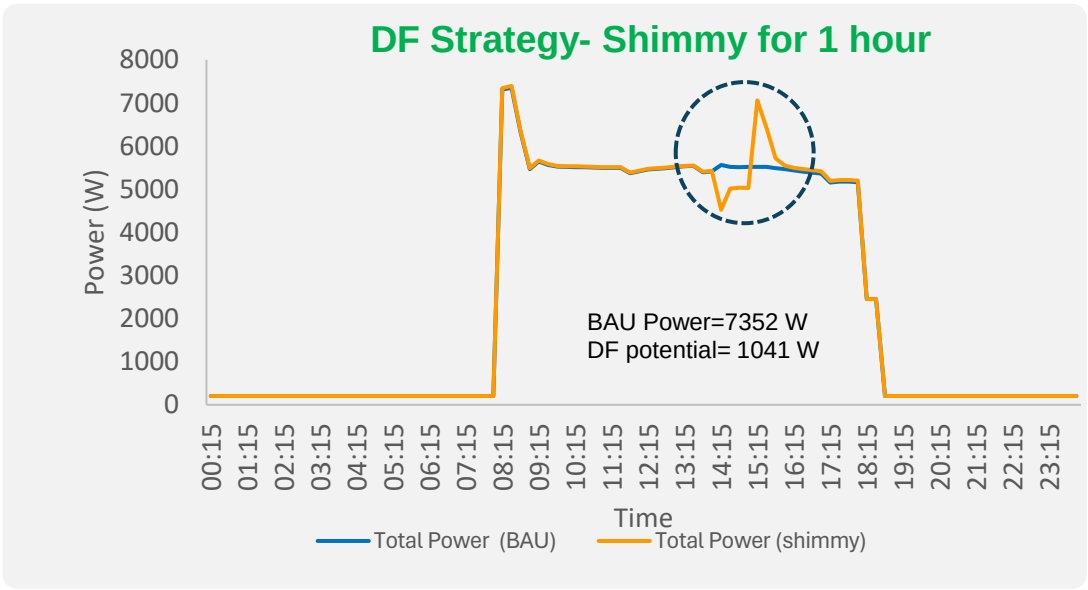
DF scenario – PV and Battery integration

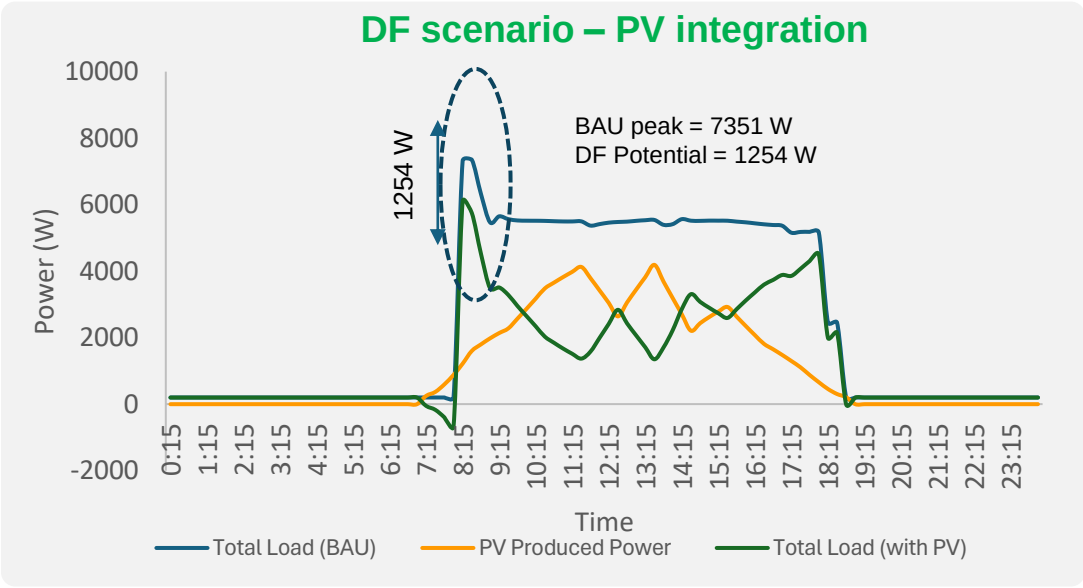


Unit Level Simulation- for Small Commercial Customers (Summer)



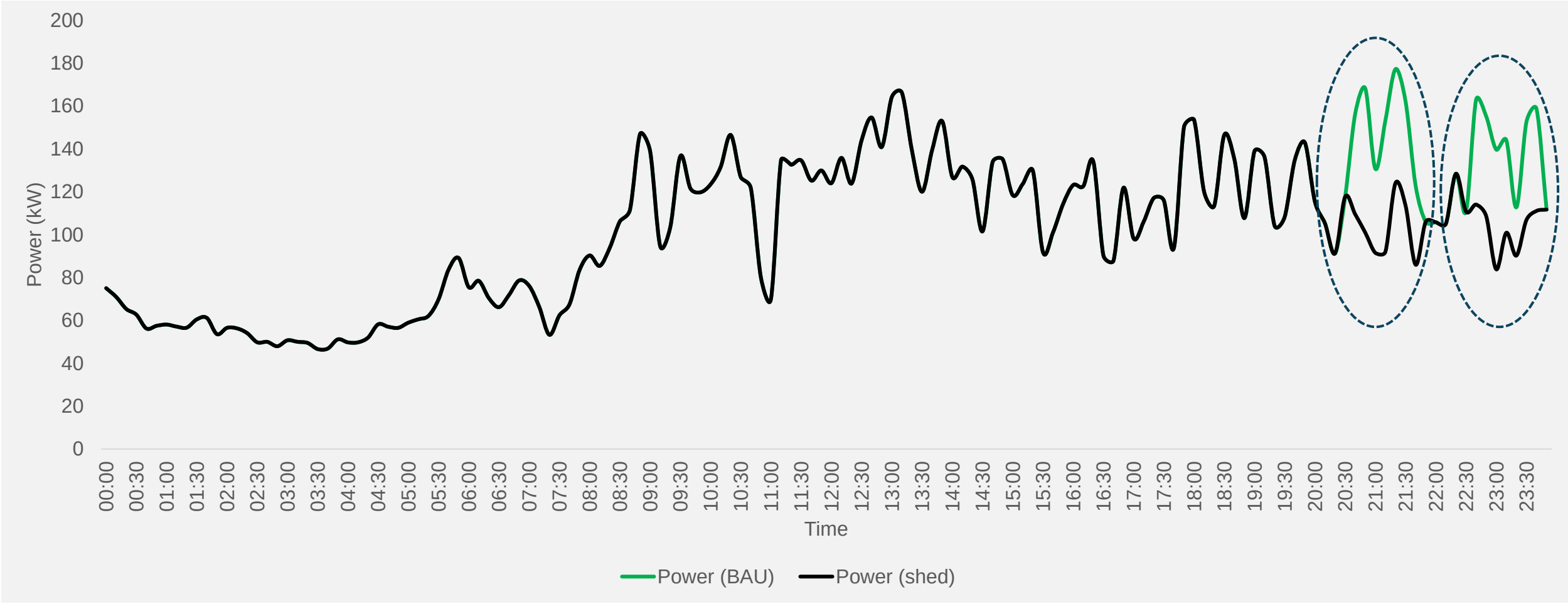






Unit Level Simulation for Industry: DF scenario – shed

Textile spinning



Shed for 2 hours

- 08:30 PM to 09:30 PM
- 10:30 PM to 11:30 PM

Impact-

BAU peak = 177 Kw, DF Potential = 53 kW

Test Feeder Assumption

Number of customers connected for different categories in Test Feeder

Residential

LIG (457), MIG (913)
HIG (152)

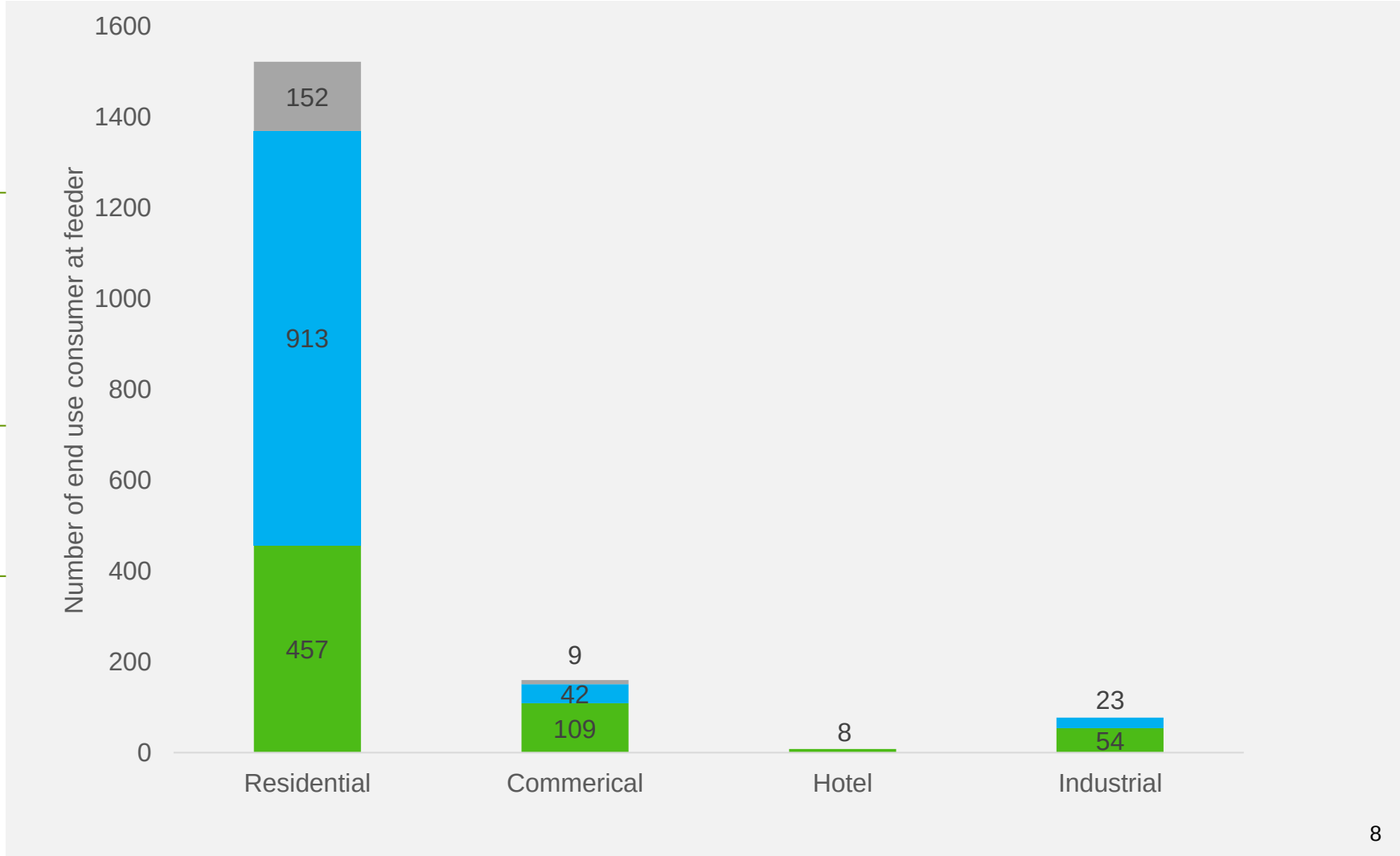
Commercial

Small Scale (109)
Medium Scale (42)
Large Scale (9)

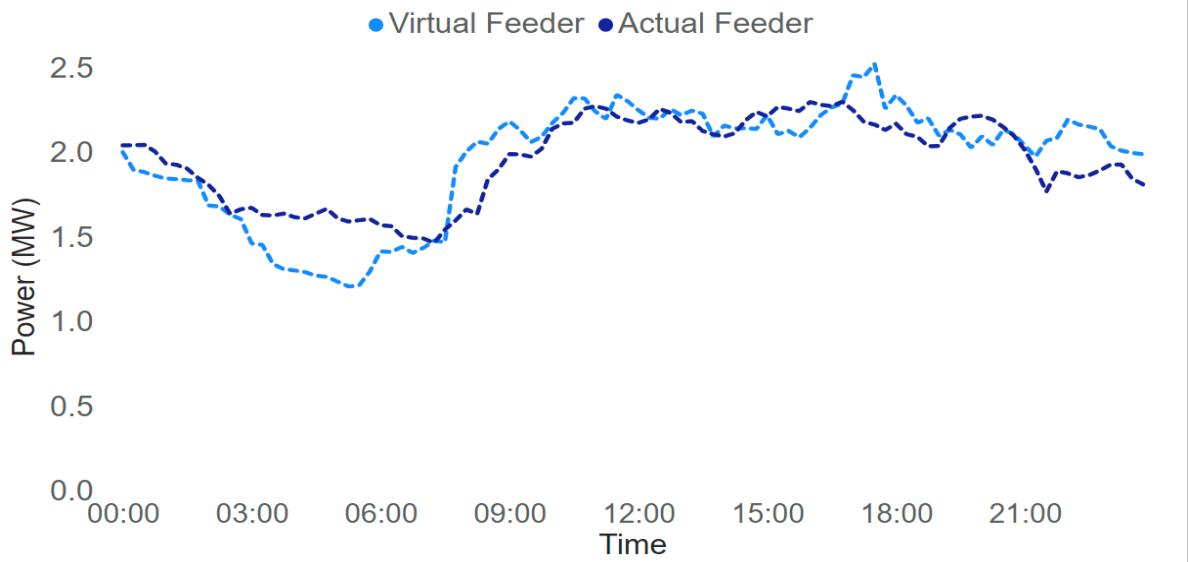
Hotel (8)

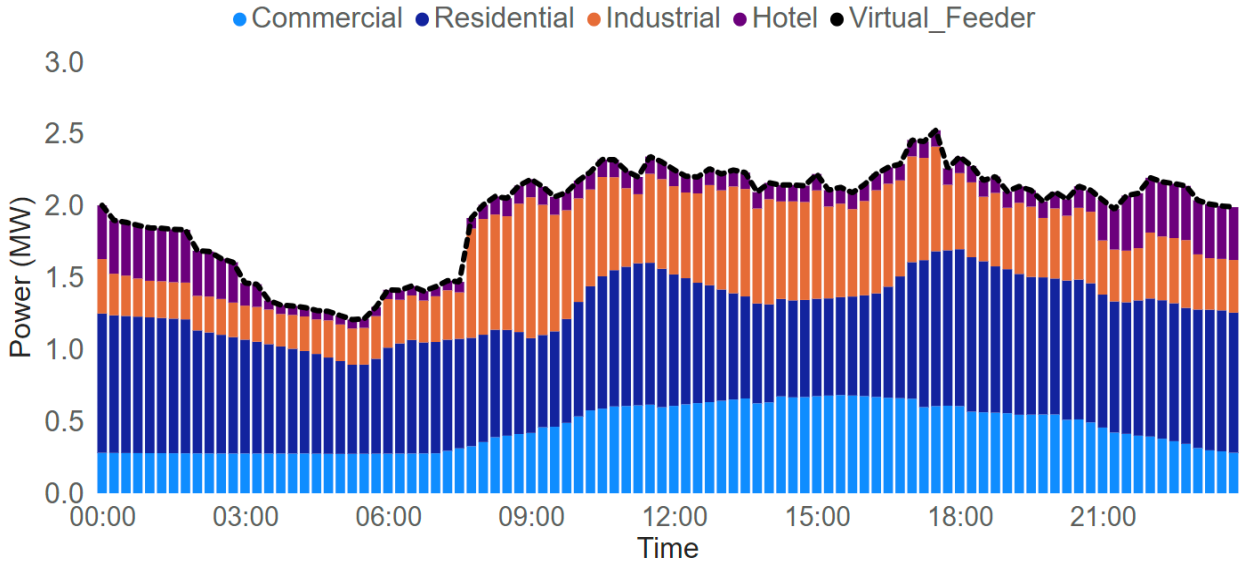
Industry

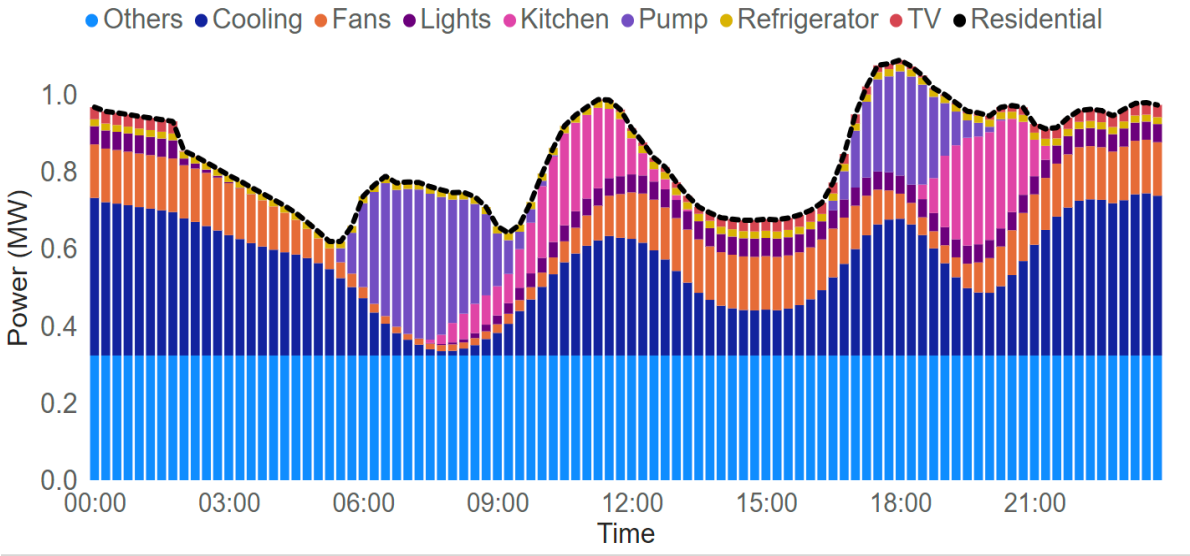
Medium Scale (54)
Large Scale (23)

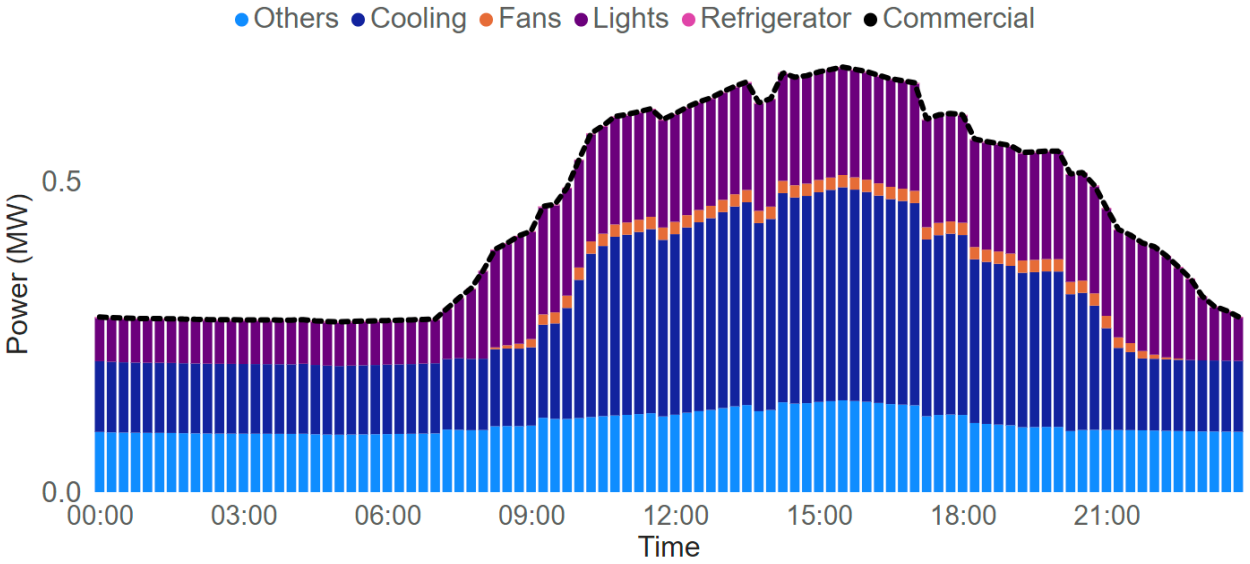


Feeder Level Aggregation (summer)



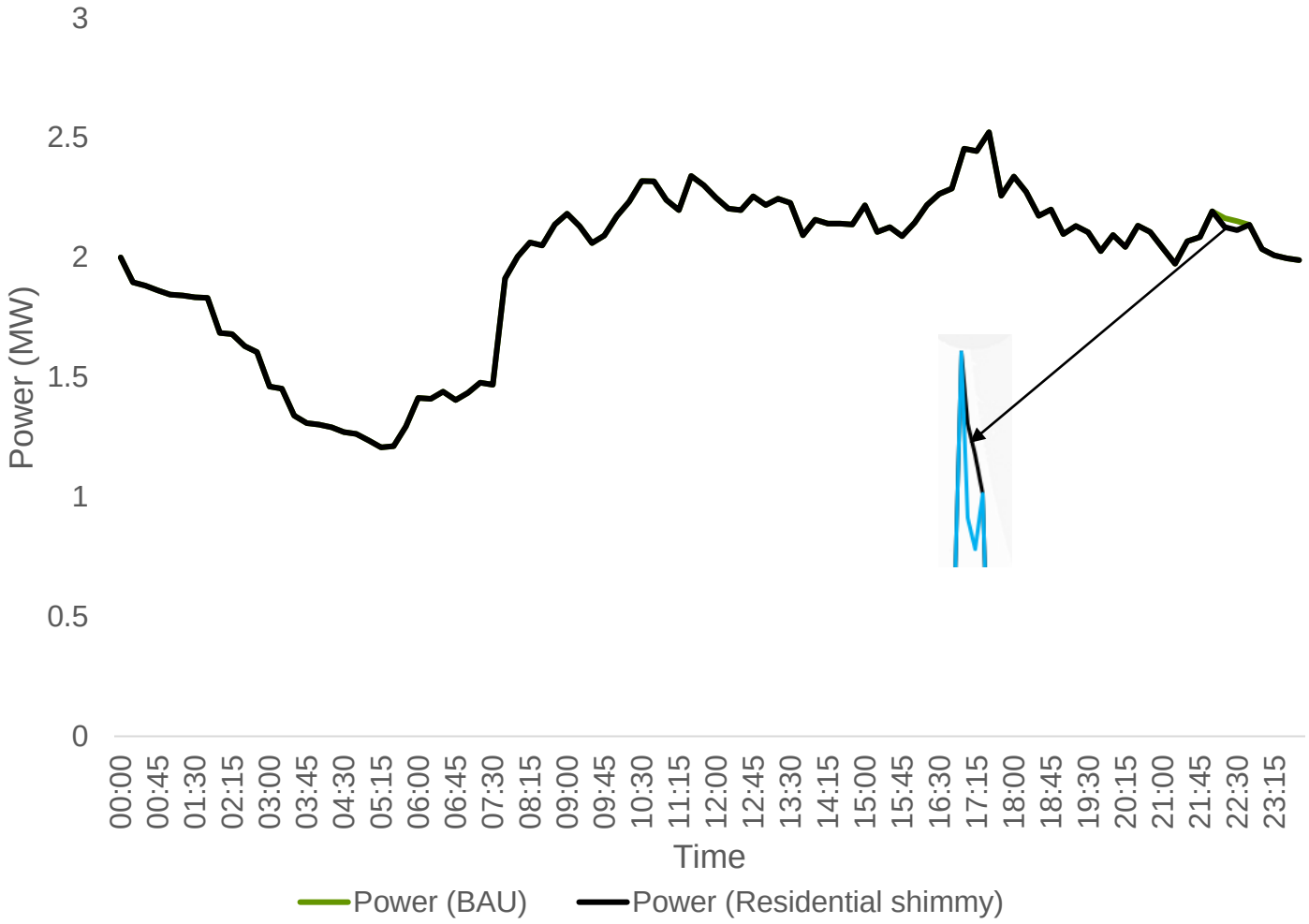


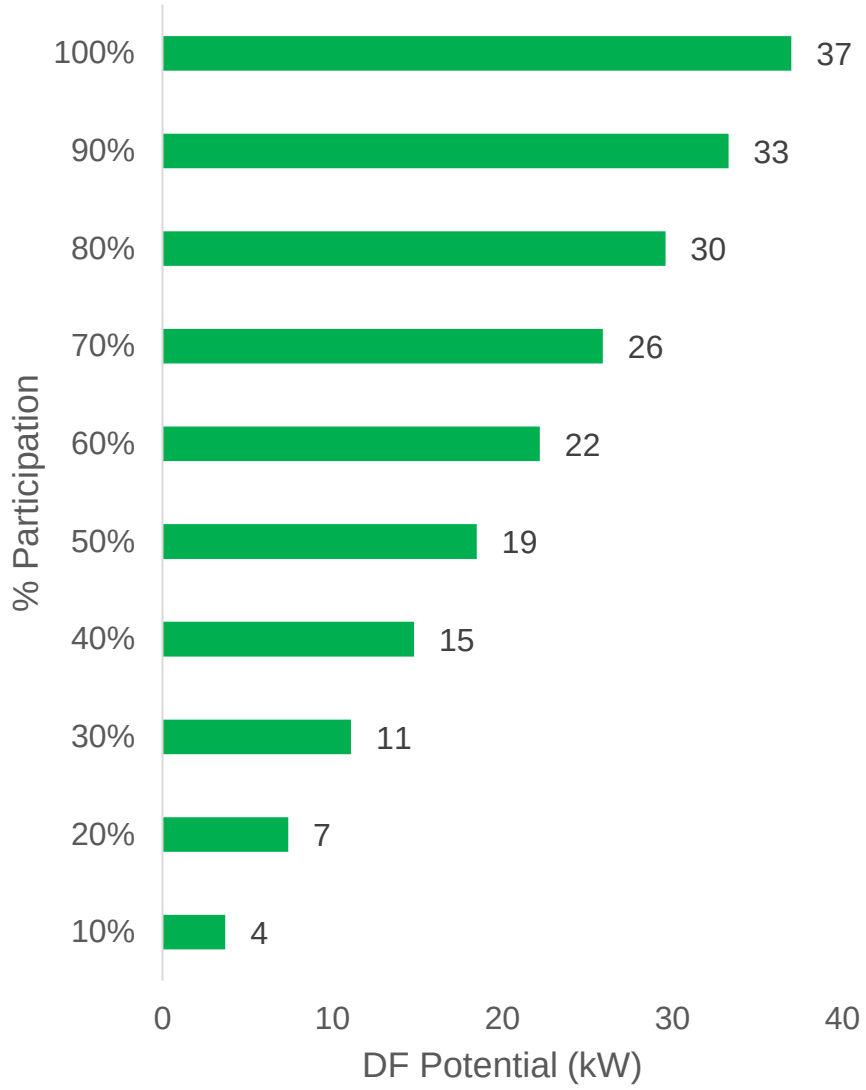




The consumption profile for a typical summer day

DF Scenario – Residential shimmy





Shimmy for 30 minutes

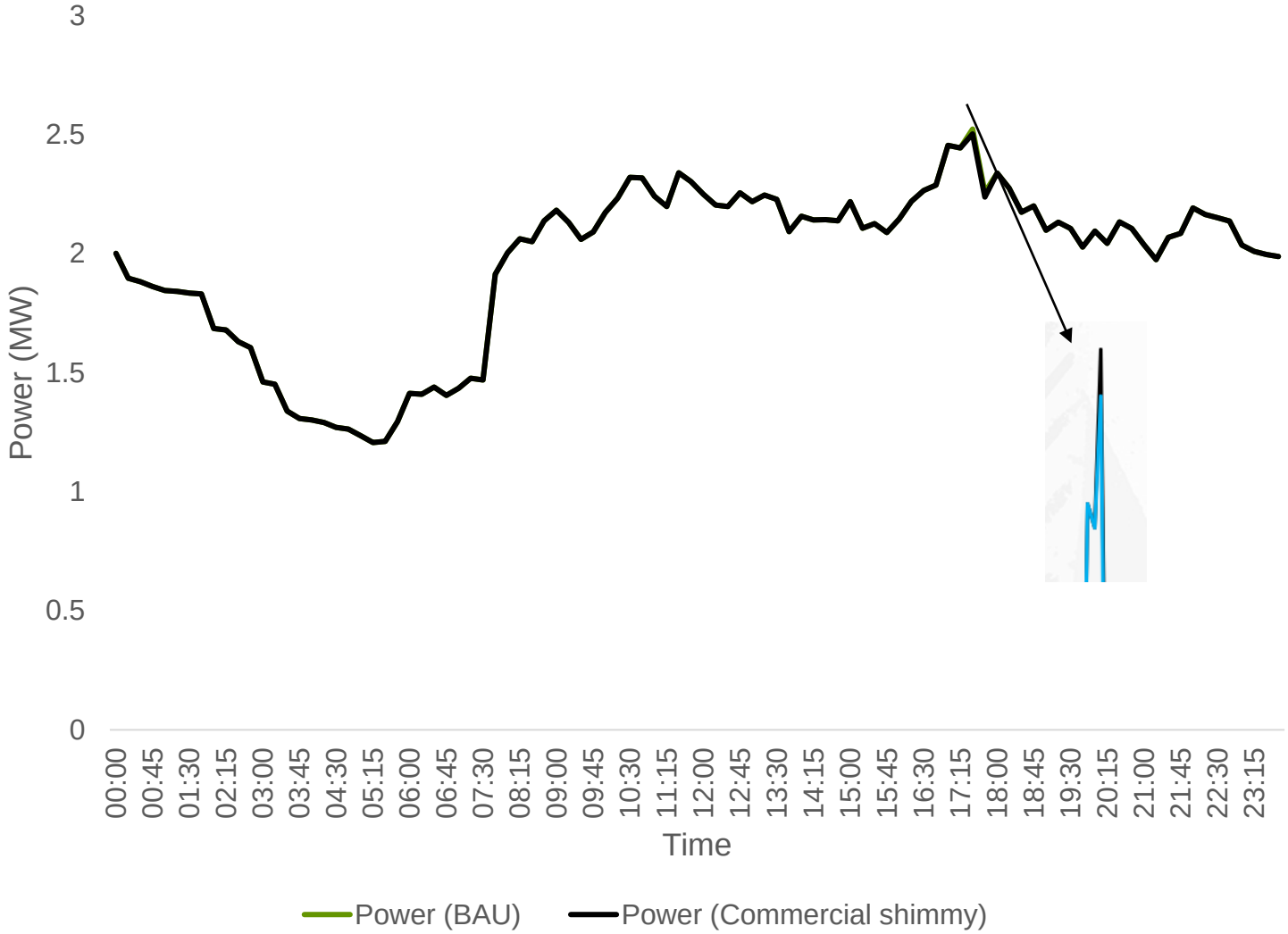
- 10:00 PM to 10:30 PM
- 718 AC's are operational out of 2739

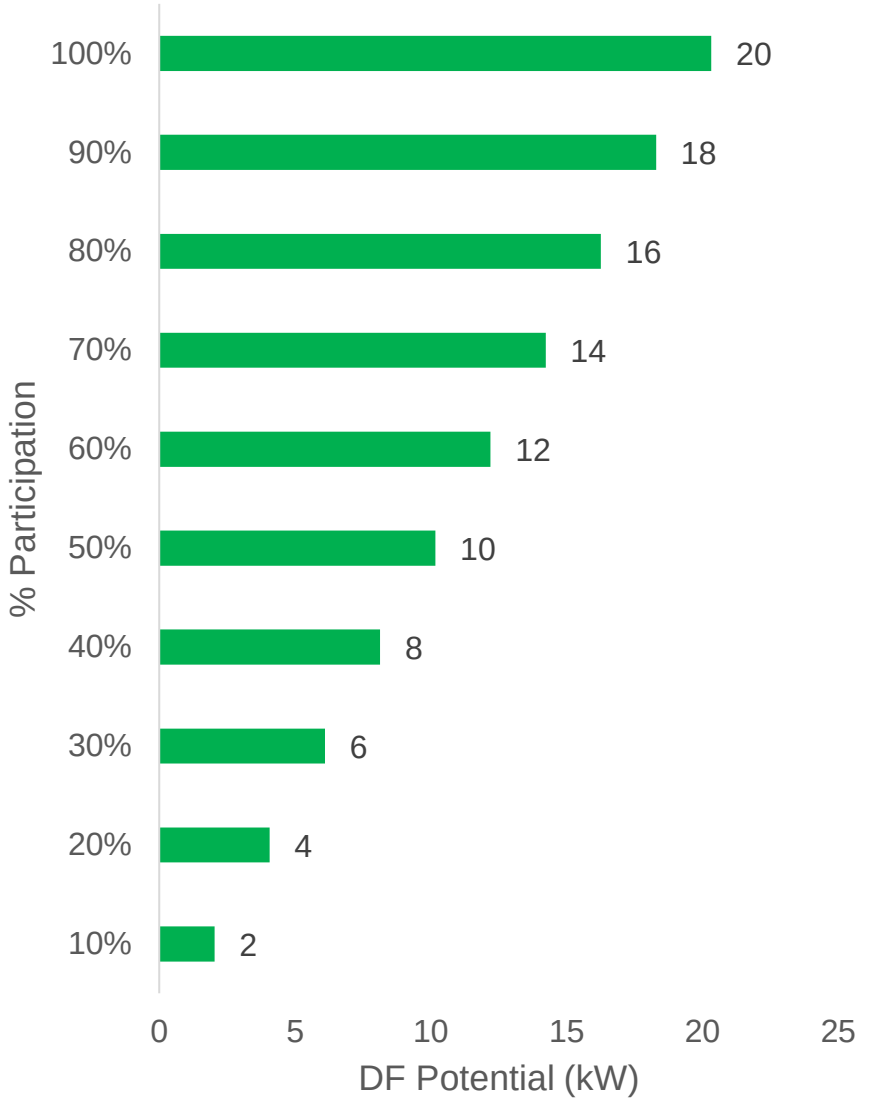
Impact

BAU Power =2164 kW

DF Potential = 37 kW

DF Scenario – Commercial shimmy





Shimmy for 30 minutes

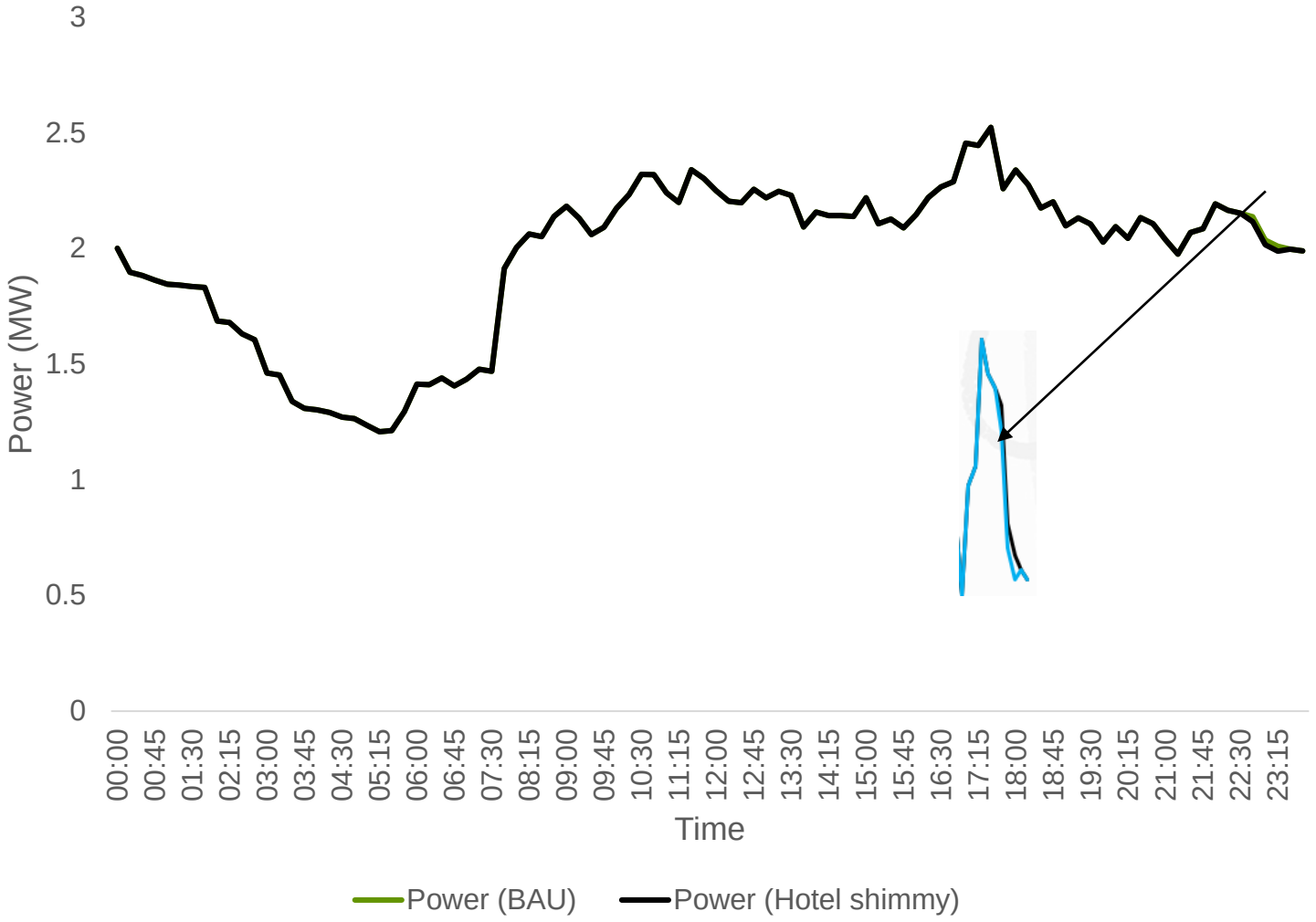
- 17:15 PM to 17:45 PM
- No of consumers = 160

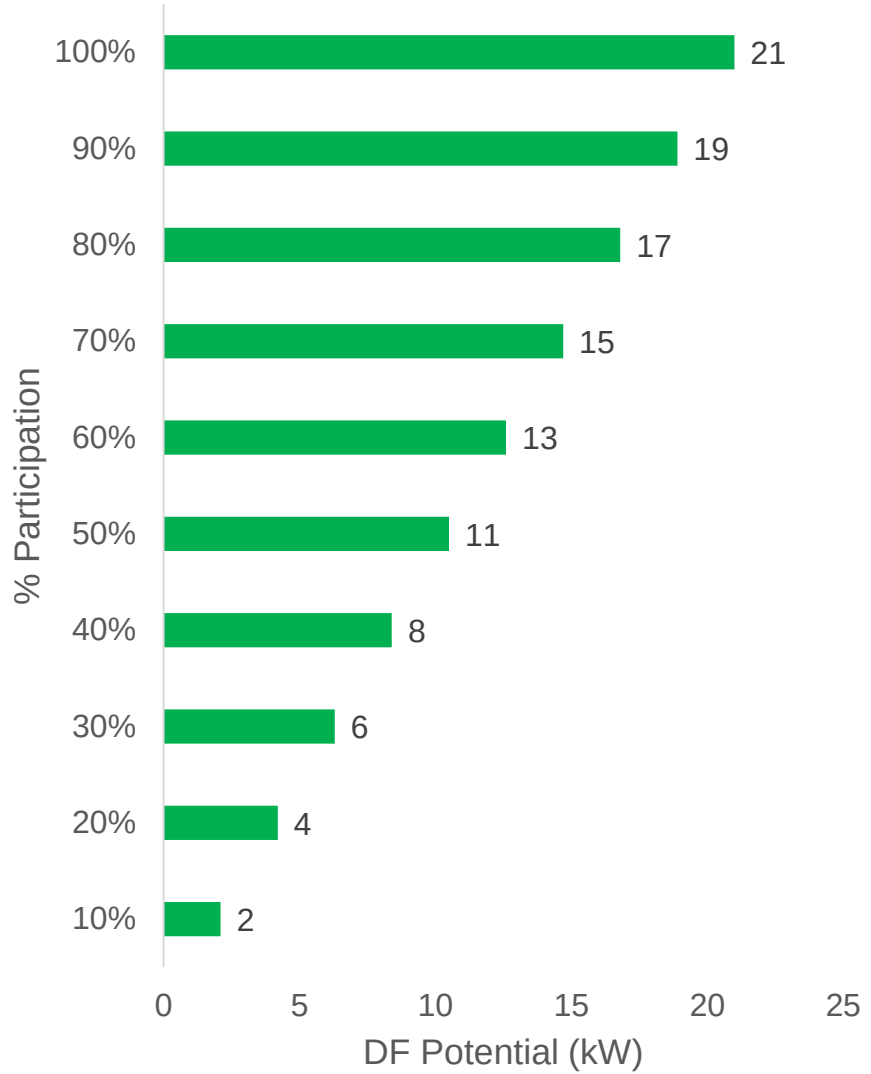
Impact

BAU peak = 2258 kW

DF Potential = 20 kW

DF Scenario – Hotel shimmy





Shimmy for 30 minutes

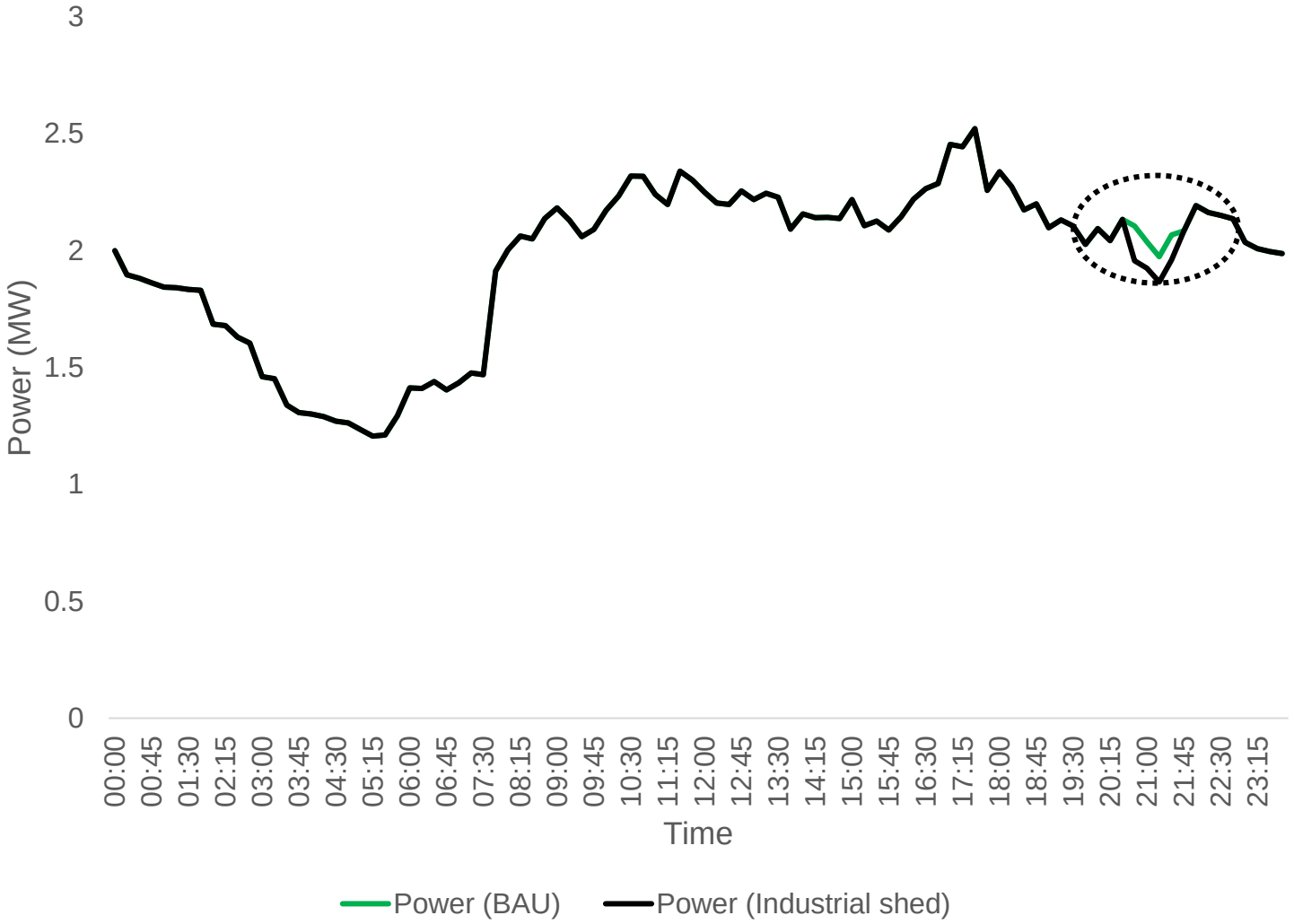
- 22:30 PM to 23:00 PM
- No of hotels = 8

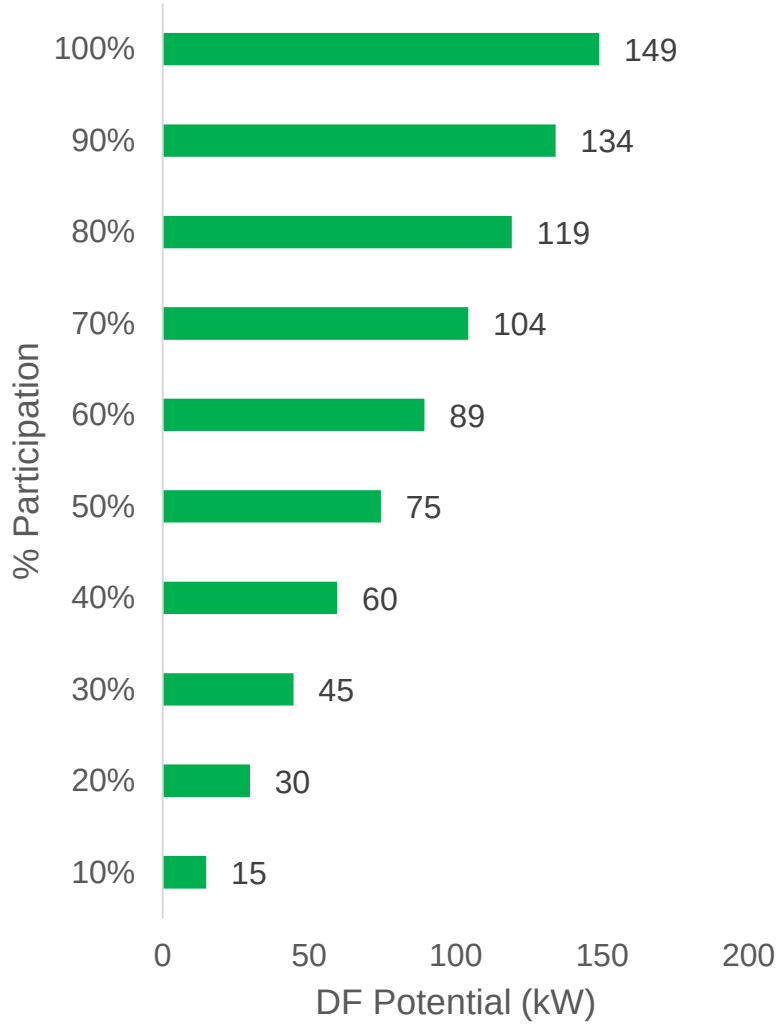
Impact

BAU power = 2136 kW

DF Potential = 21 kW

DF Scenario – Industrial shed





Shed for 1 hour

- 08:30 PM to 09:30 PM
- No of Industries = 77

Impact

BAU power = 2106 kW

DF Potential = 149 kW

Objective of Market Analysis

Assess the availability and interest of service providers

Questions we explored

- Which are the potential stakeholder types?
- Who are the market players?
- What is their interest in participation?

Stakeholder Types

Key Stakeholders

- **Utility**
- **Technology Provider / Service provider**
- **Aggregator**
- **M&V Entity**
- **End Customer**

Key Points

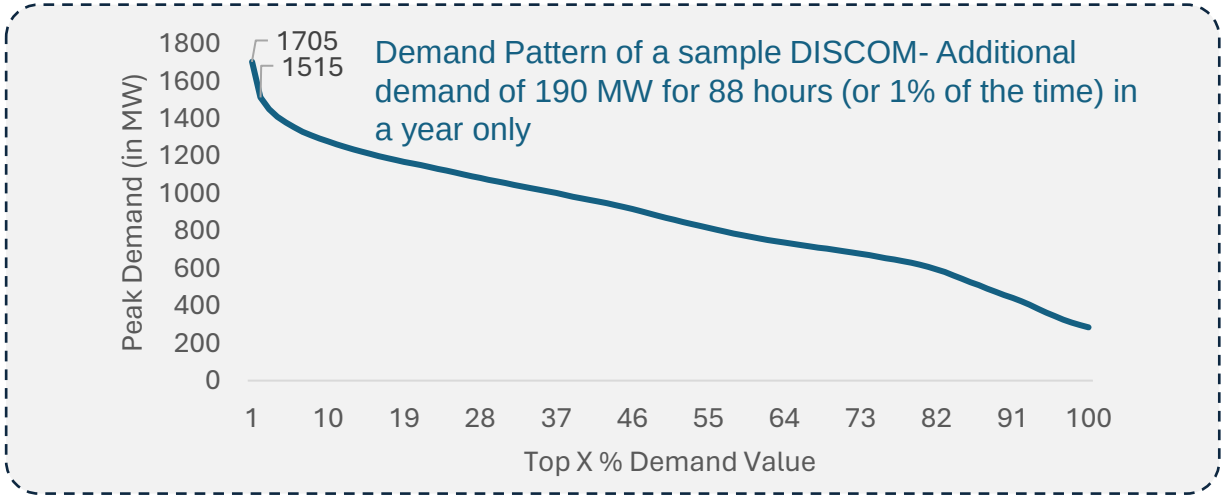
1. **Utility –** It can be a DISCOM, or load dispatch centers, or transmission companies
2. **DR service provider –** Provides specialized solutions (hardware or software technology), or is the system integrator.
3. **Aggregators –** Aggregates demand resources from multiple customer types, such as homes, businesses, EV etc. ***Aggregator, and DF Service Providers can be different or same entities***
4. **M&V –** Ideally by an independent agency. This process can also be totally automated obviating the need for a separate entity.
5. **End customers –** nudged through monetary or social incentives

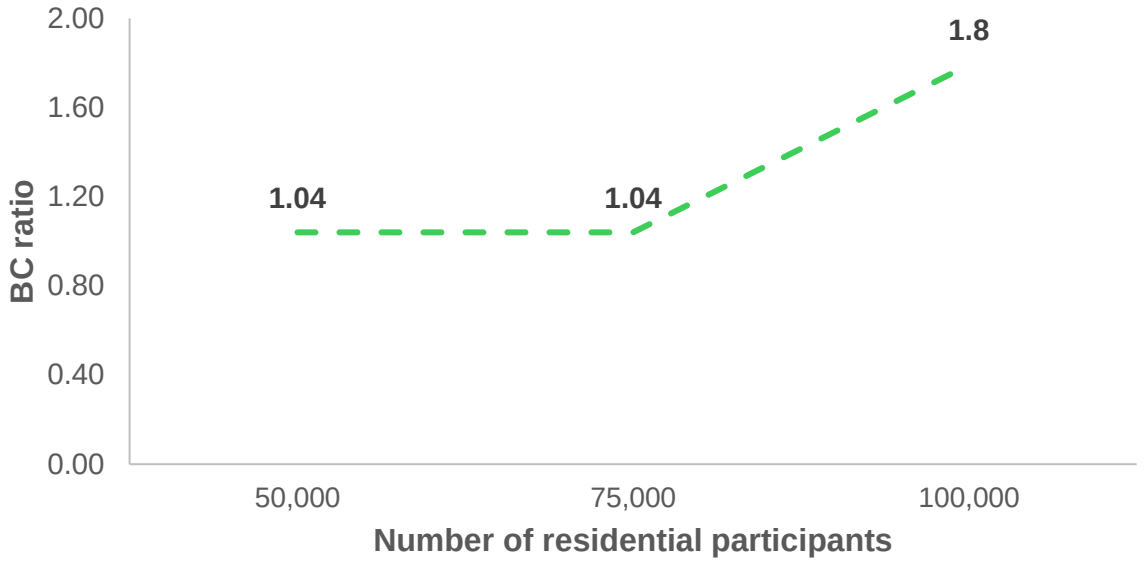
Market Players and Mapping

- **Presence in Indian Market**
- **Technological Capabilities**
- **Expertise or Experience in DF**
- **Innovation and Future Readiness**
- **Willingness to Invest**

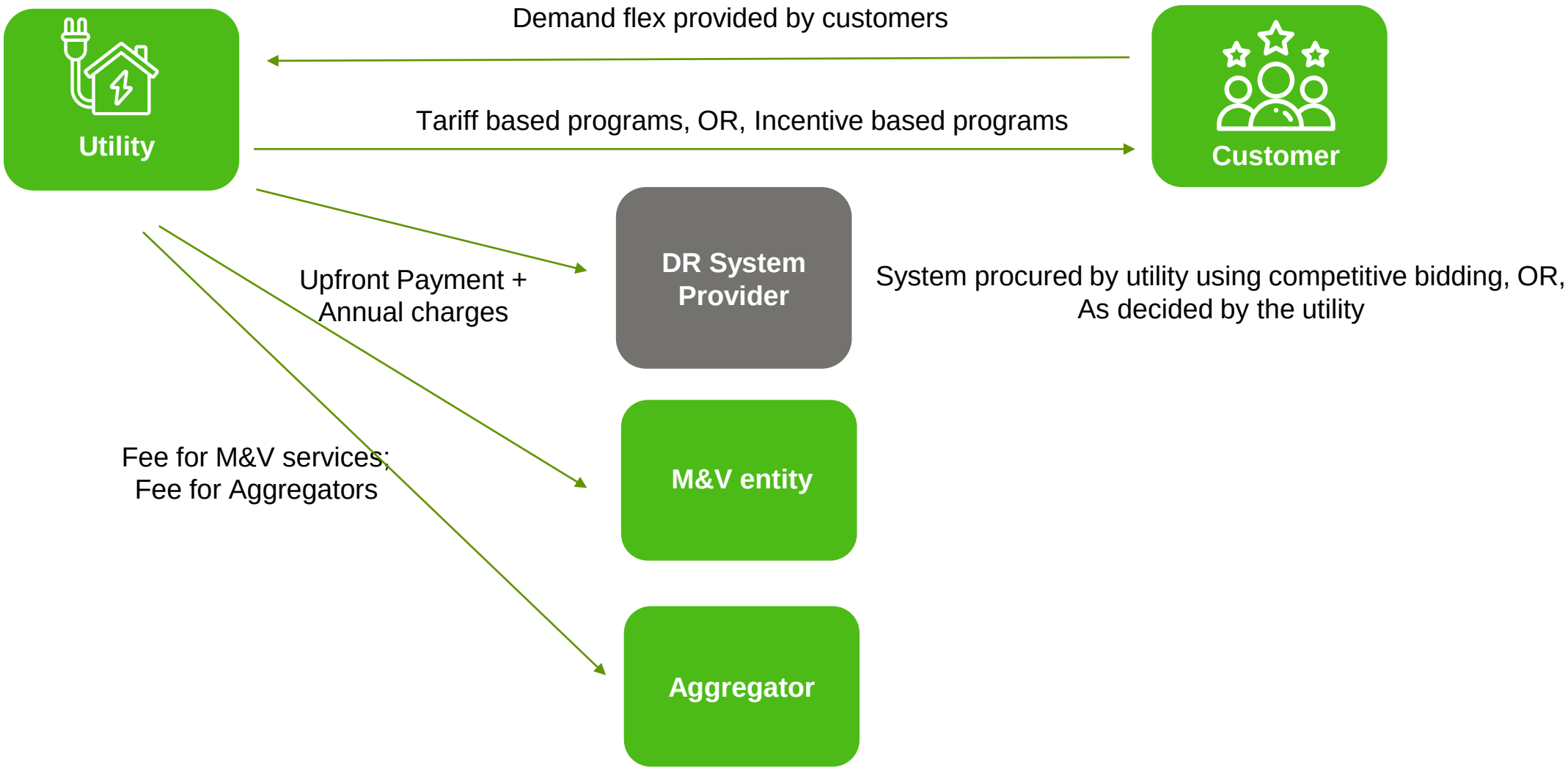
Name of company
ABB
AutoGrid
Bidgely
Blaze Automation Services Pvt. Ltd.
Energy Efficiency Services Limited (EESL)
Flock Energy
HoneyWell
HPX
OhmConnect
Oracle Utilities
Power2SME
PXIL
RE Connect Energy
Schneider Electric
Siemens
Smart Joules
Statcraft
ZedBee Technologies Pvt. Ltd.

Benefit Cost Analysis- Used for Stakeholder Interactions

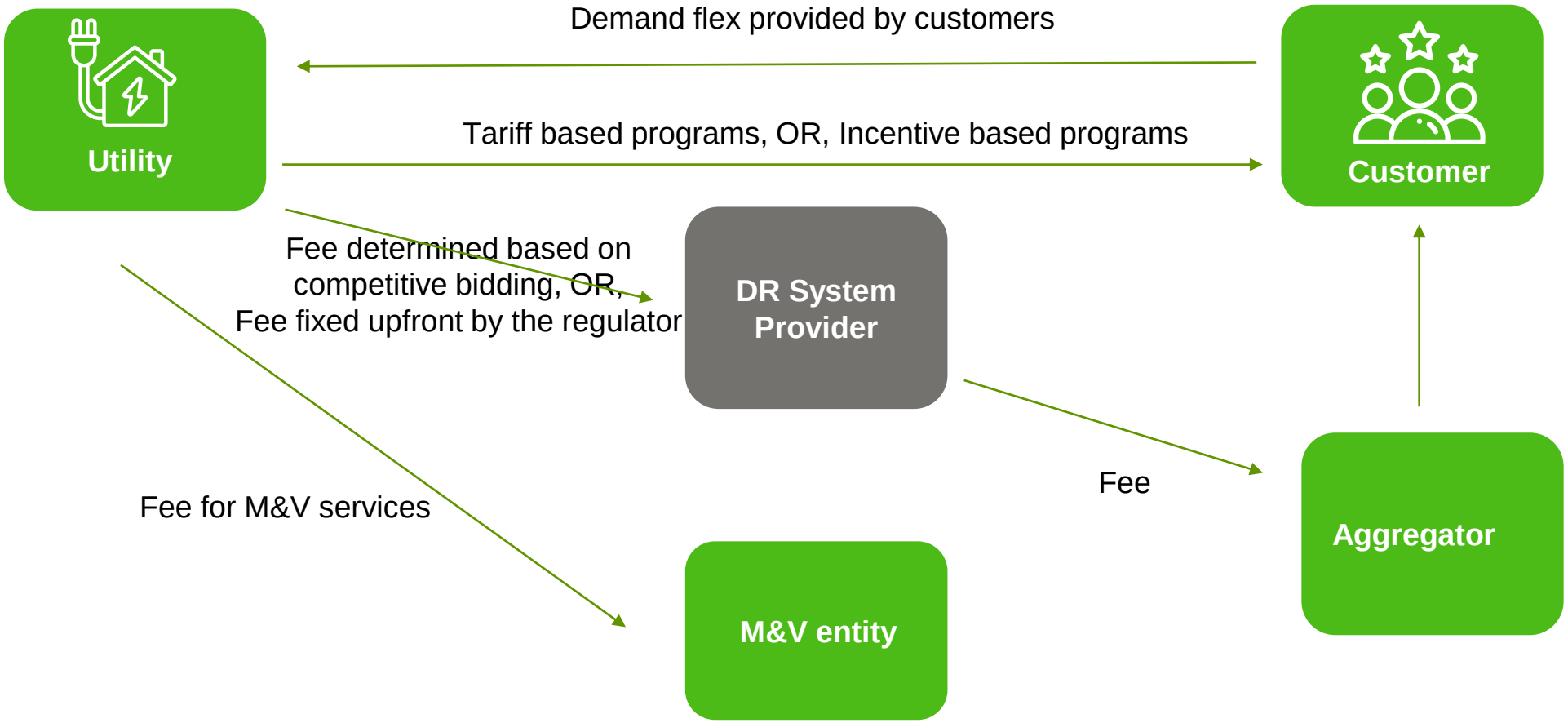




Business Model Illustration 1- Investment by Utility



Business Model Illustration 2- Fee for Service (FLESCO)



Note: Same business model can also be based on success fee

THANK YOU

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