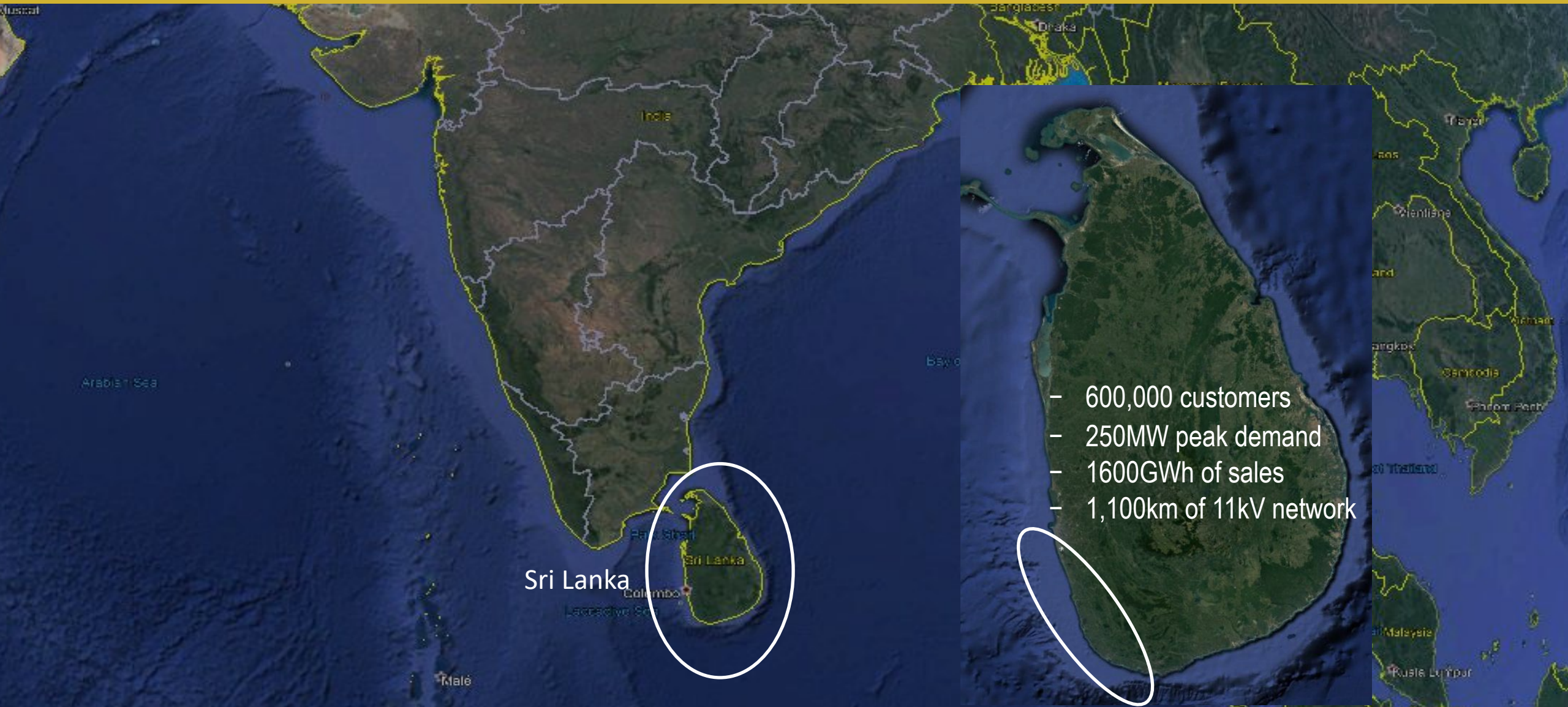
Urban Micro-grids

Narendra de Silva, PhD.

Electricity Network is the largest machine humans have built

Lanka Electricity Company (Private) Limited



Preamble

Future of our world has to be seen through the lenses of four megatrends

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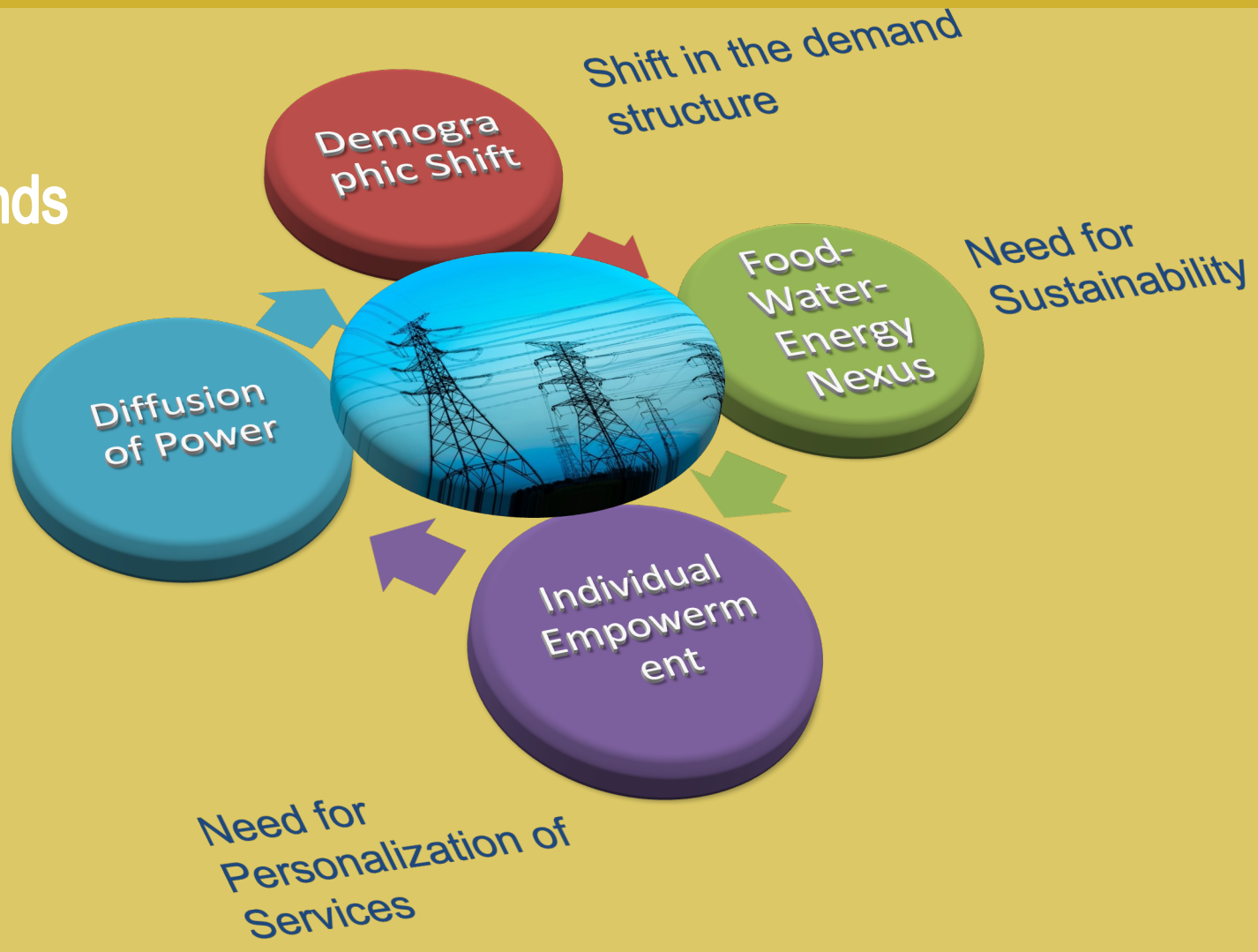
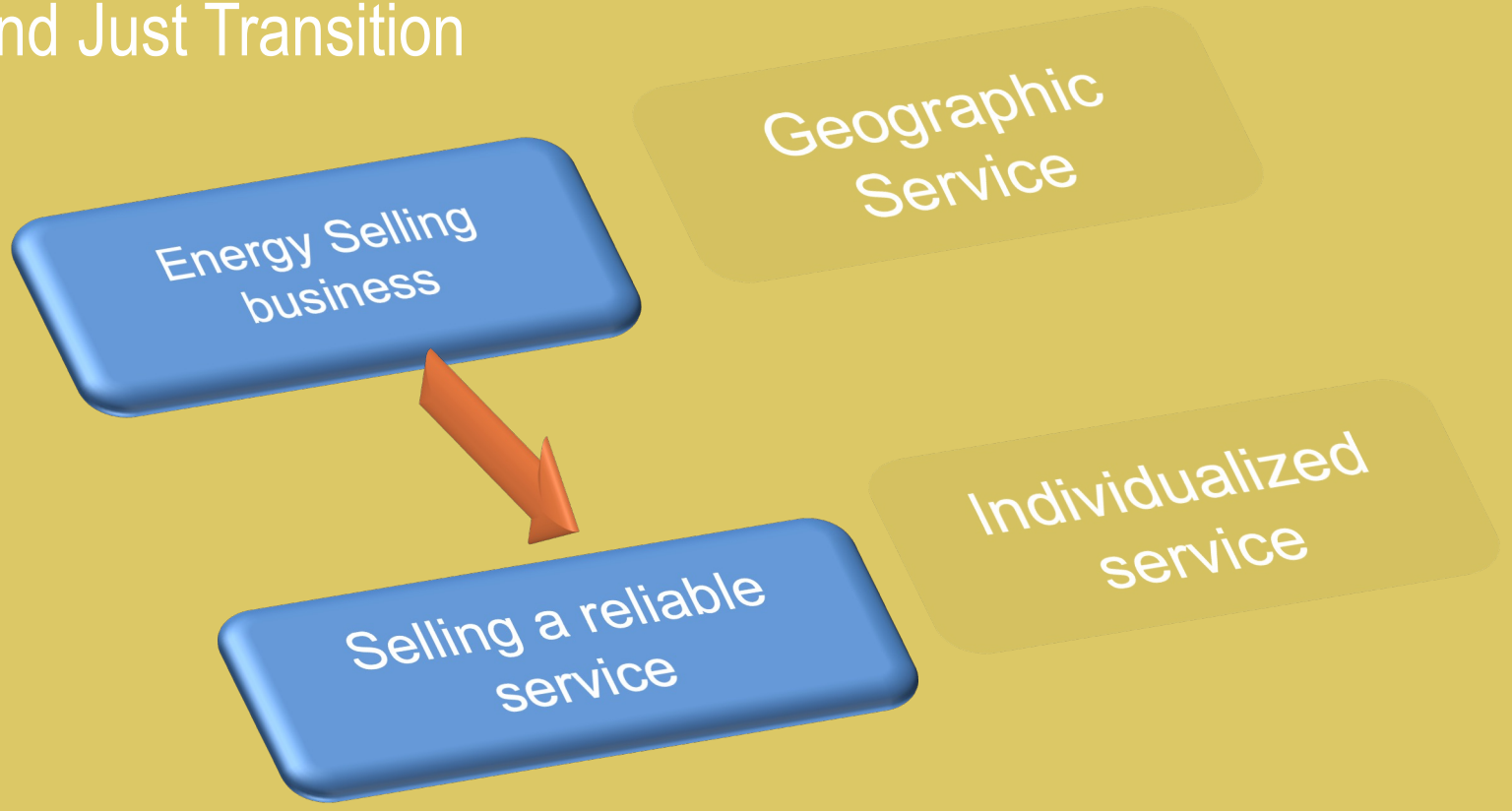
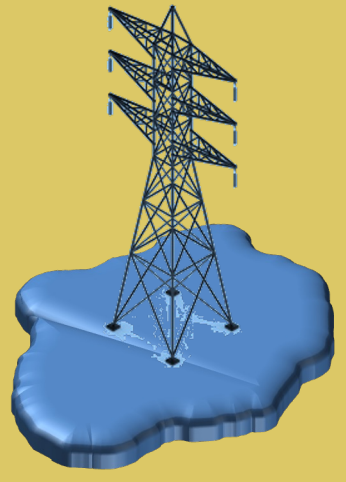


Urban Utility

Clean and Just Transition

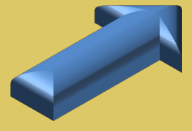


Future of Urban Utilities – Innovative technology fix



Present status of electricity grid

Operational as a monolithic structure



Micro-grids in connected and islanded mode

- Urban Utilities to metamorphosize into micro-grids.
- The micro-grids to provide reliability in islanded mode

Urban Micro-Grids – Mode of Operations

1. On-grid Operations

a. Peak Shaving mode – Battery is charged and discharged to shift the peak

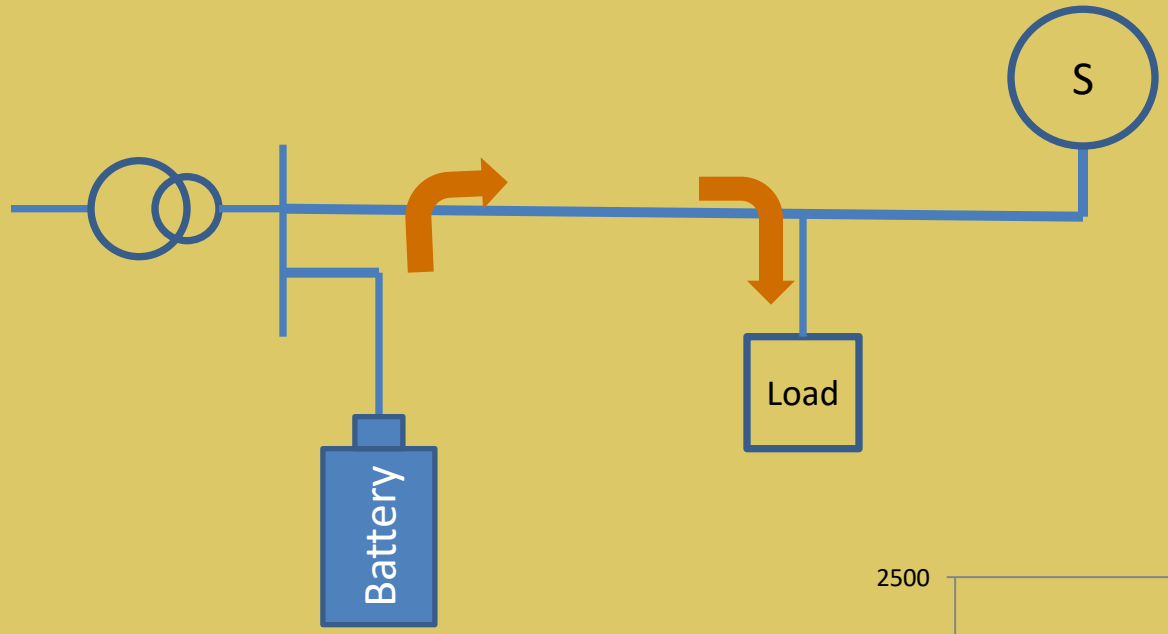
b. Solar intermittency mitigation mode – Battery is used for transient mitigation

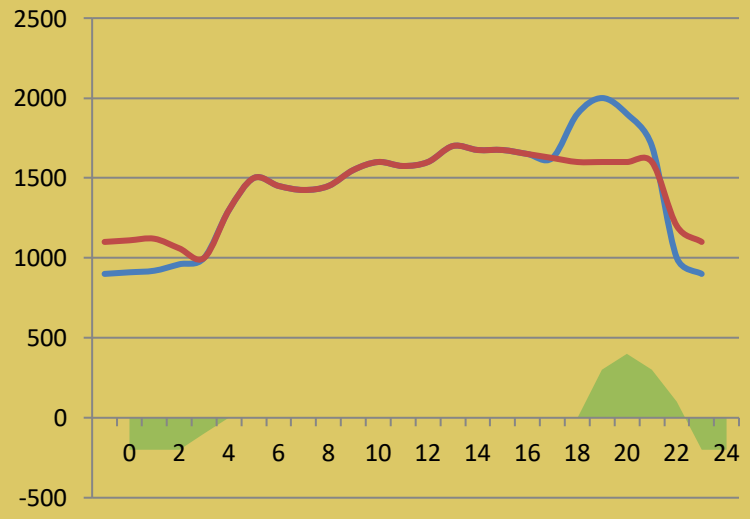
2. Off Grid Operations

a. Fault outage mode – Battery is used for fault ride-through

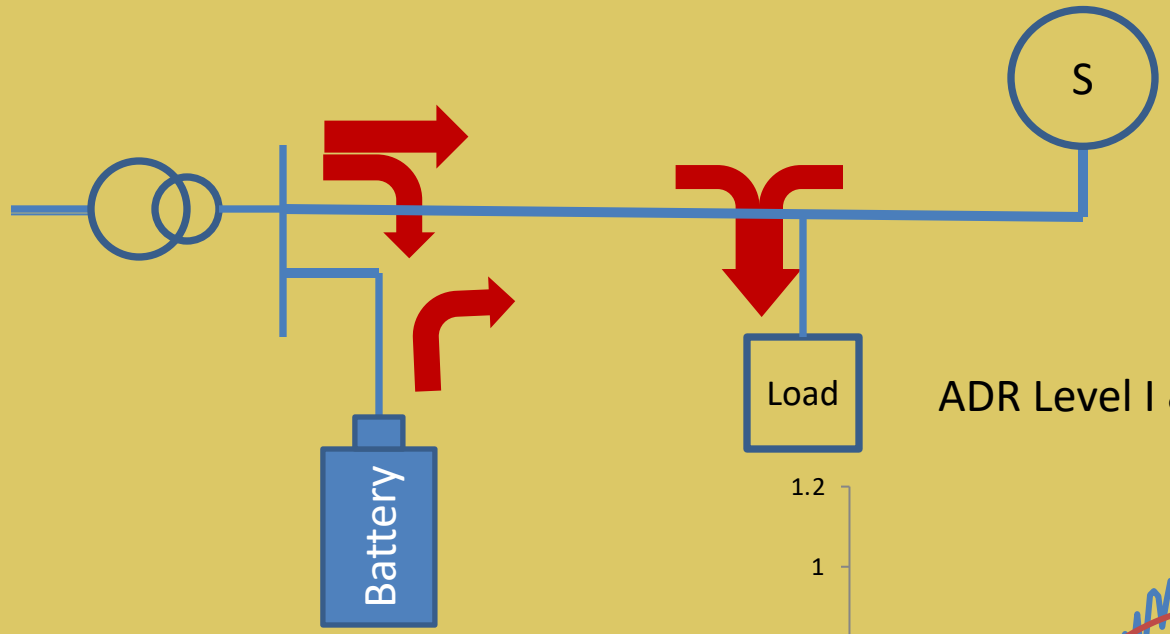
b. Planned outage mode – Battery is used to maintain supply for longer durations

Urban Micro-Grids – On Grid operation for peak shaving

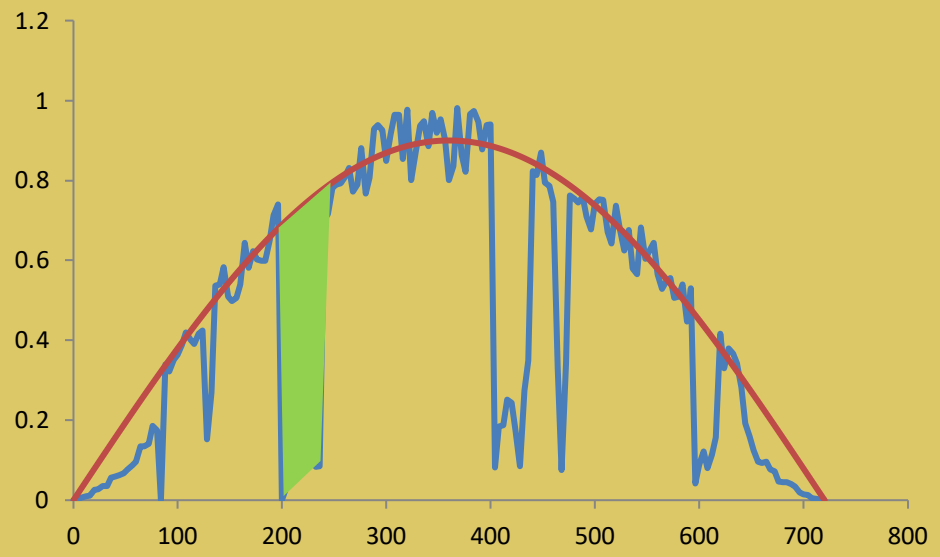




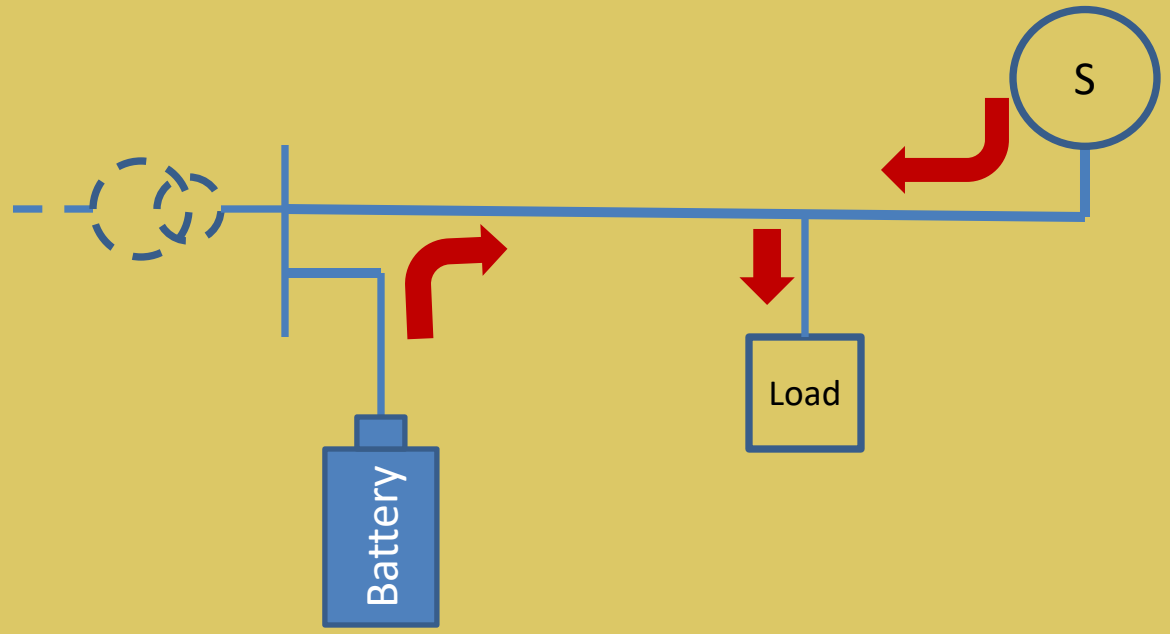
Urban Micro-Grids – On Grid operation for transient Mitigation

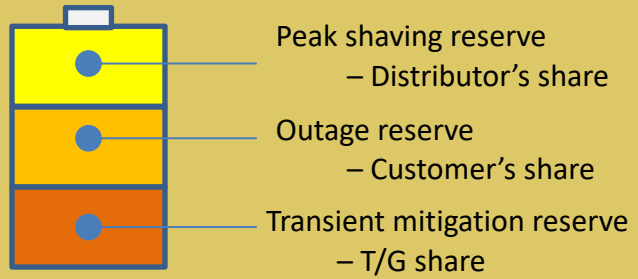


ADR Level I & II



Urban Micro-Grids – Operation during fault

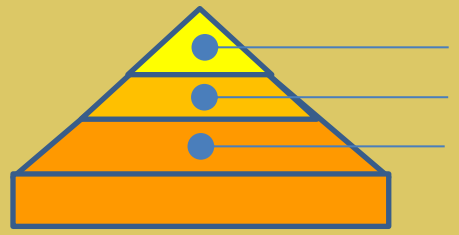




Peak shaving reserve
– Distributor's share

Outage reserve
– Customer's share

Transient mitigation reserve
– T/G share

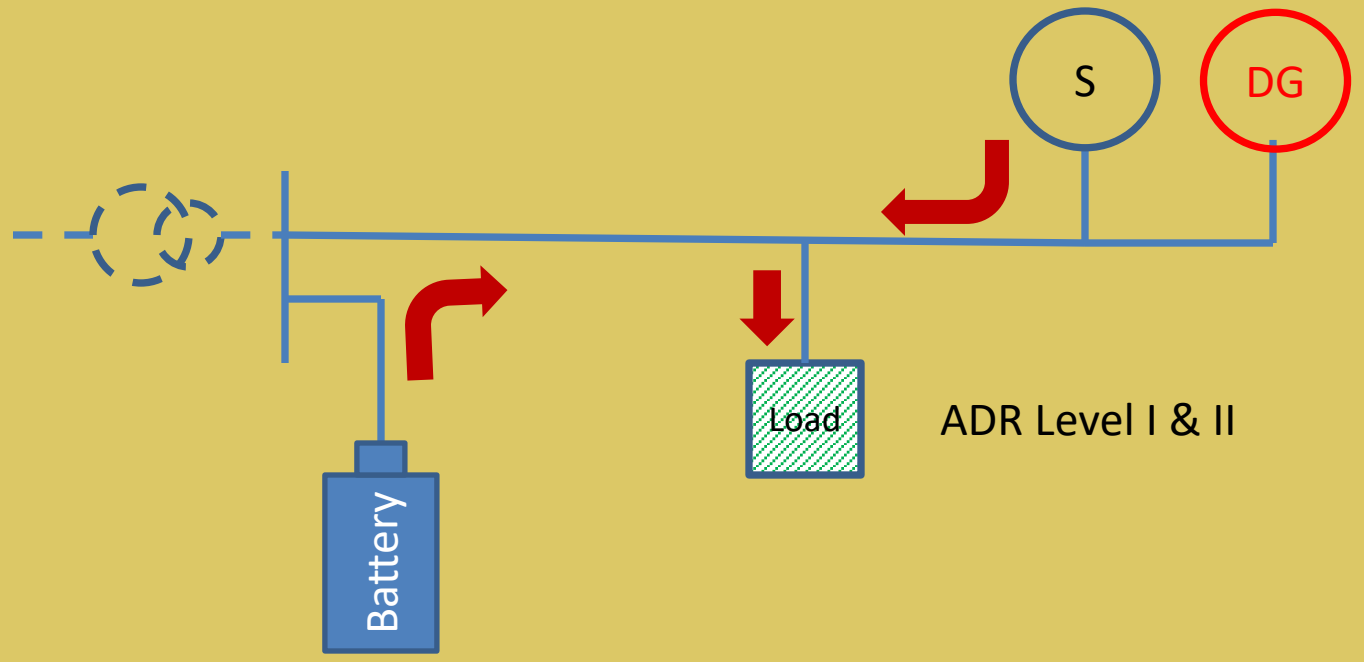


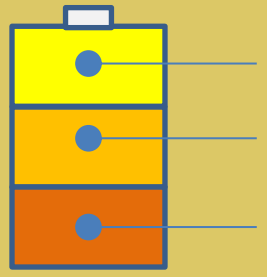
ADSM Level I

ADSM Level II

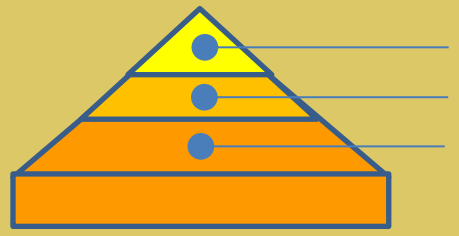
Non-essential
load disconnection

Urban Micro-Grids – Operation during planned outage



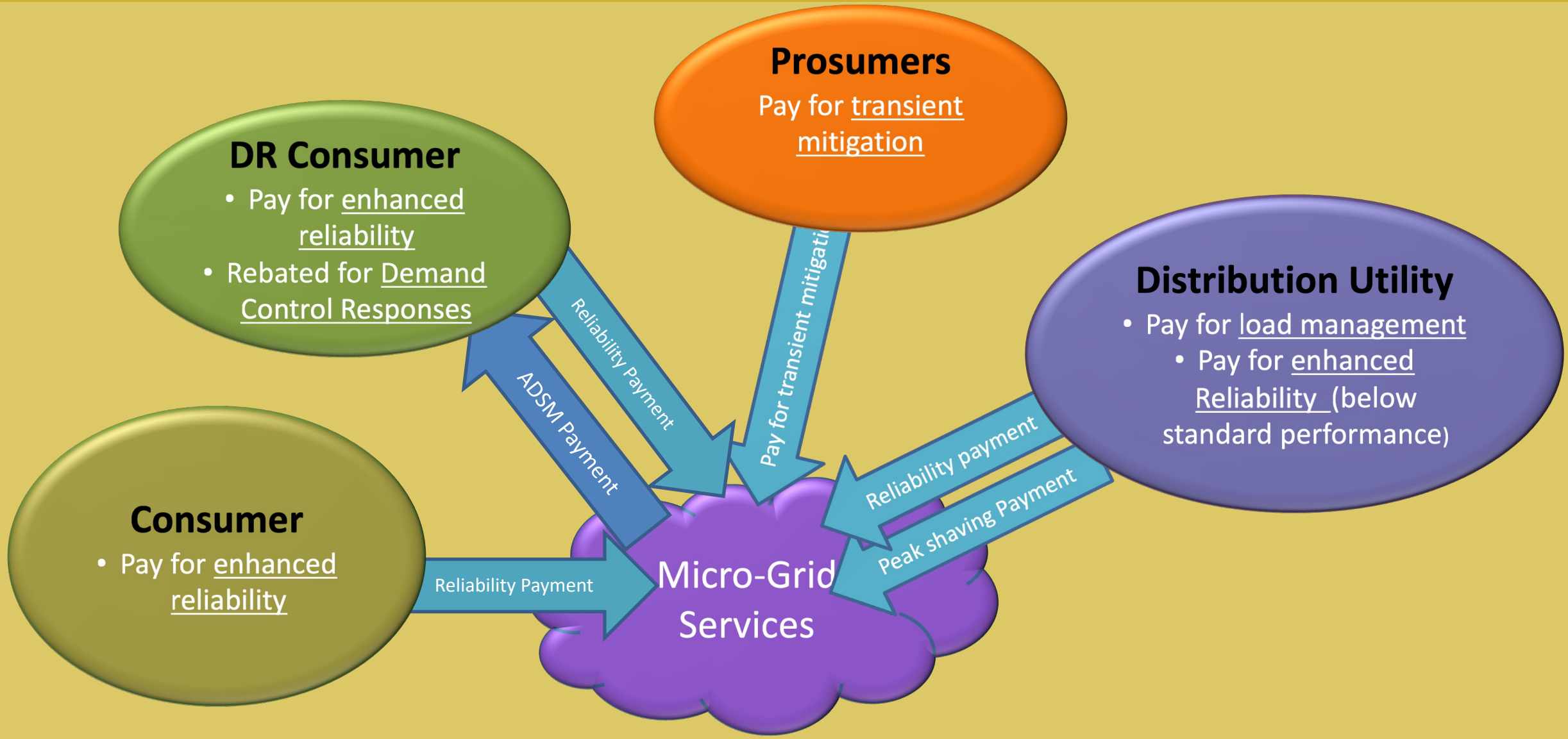


Transient mitigation reserve
– T/G share
Outage reserve
– Customer's share
Peak shifting reserve
– Distributor's share



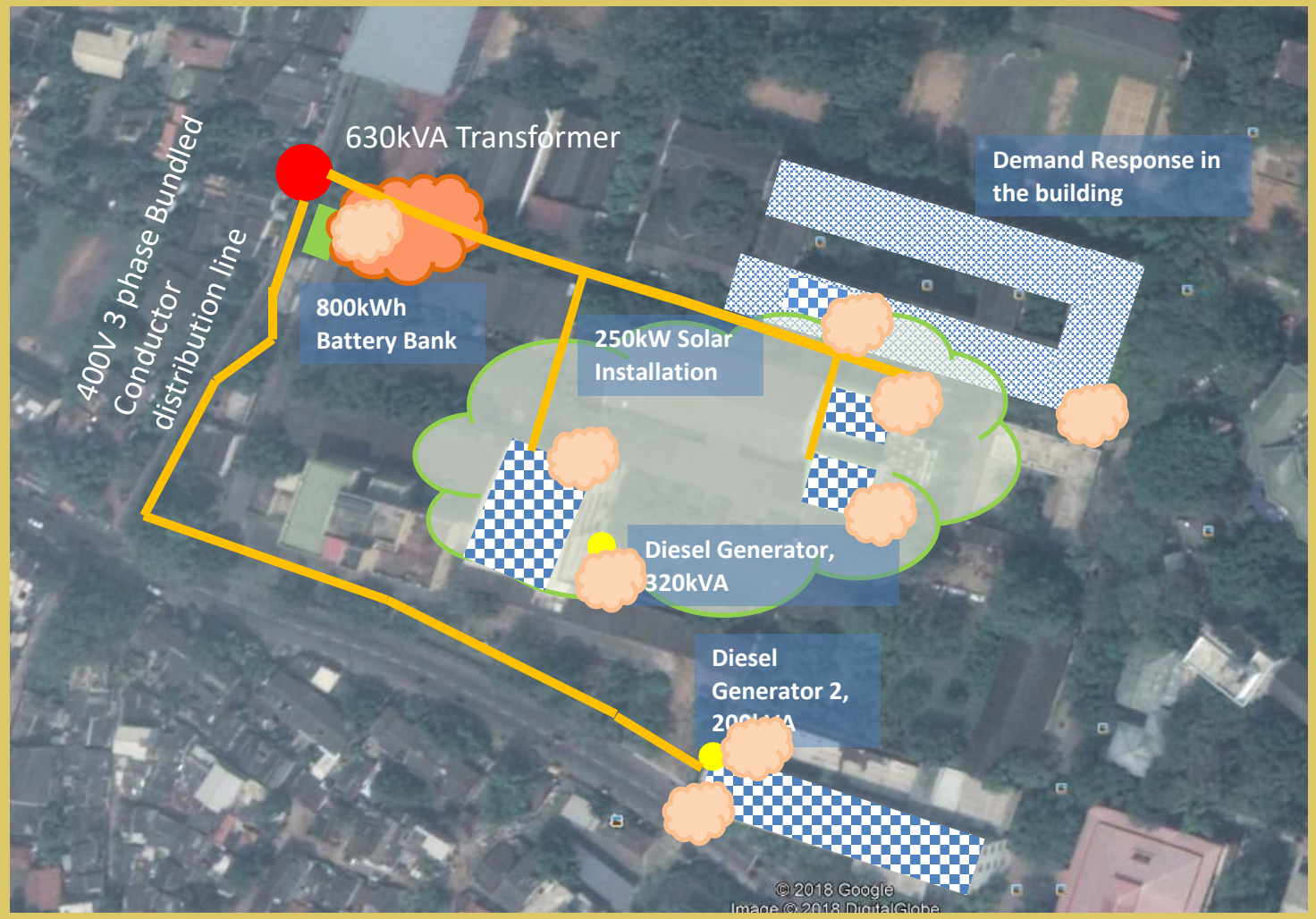
ADSM Level I
ADSM Level II
Non-essential
load disconnection

Commercial Model for Micro-Grid Operations

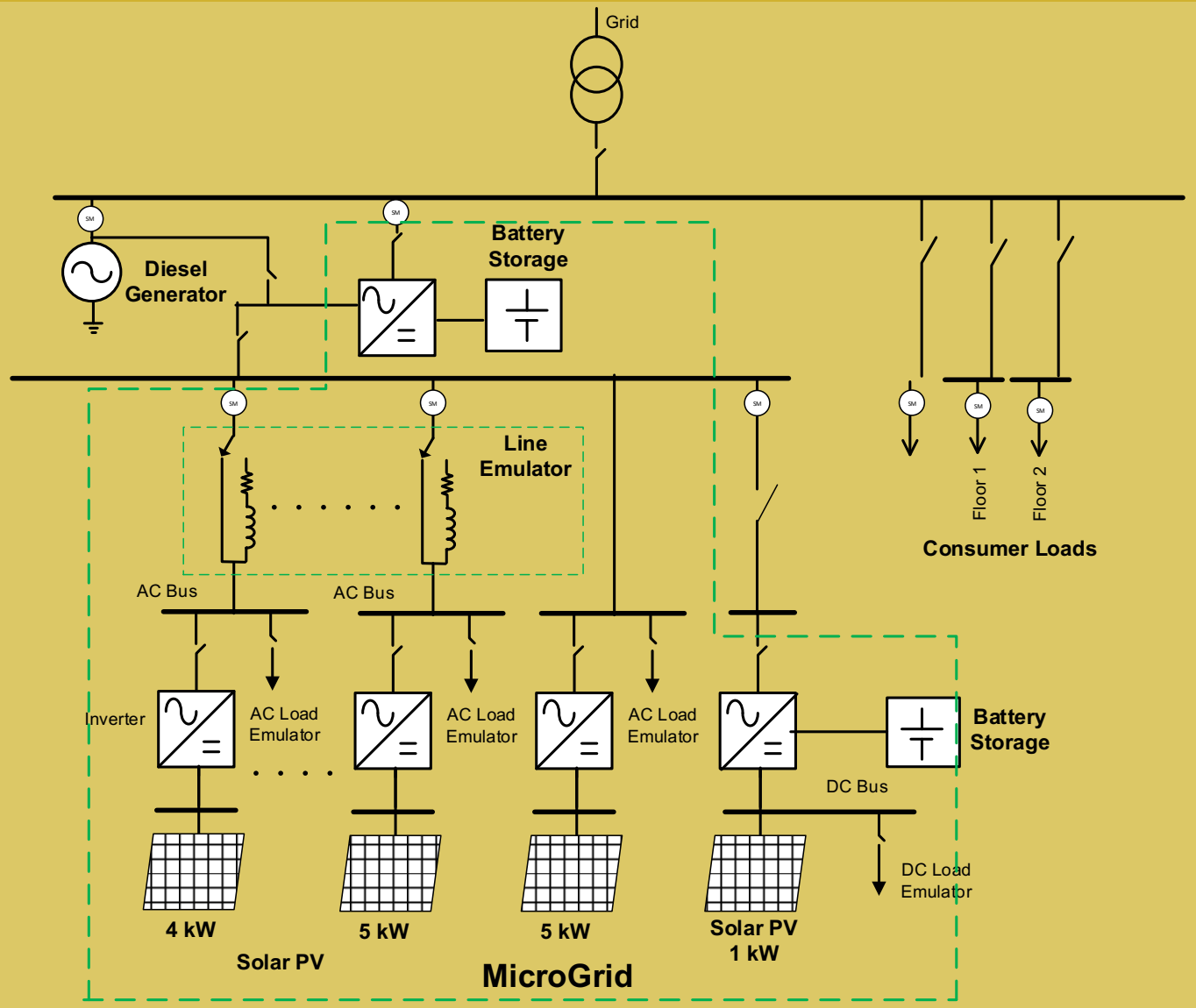


Thank You

Campus Micro-Grids – Design



Campus Micro-Grids – Design



Campus Micro-Grids – Project Cost

Item	Rate	units	Qty	Amount, USD
Rooftop Solar + inverter	1500	USD/kW	200	300,000
Battery	700	USD/kWh	800	560,000
MicroGrid Inverter	300	USD/kW	400	120,000
Sub total - microgrid				**980,000**
Rooftop Solar + inverter	2500	USD/kW	20	50000
Battery Inverter	200	USD/kWh	9	1,800
AC grid simulator	120000	unit	1	120,000
osciloscope	50000	LS	1	50,000
power analyser	35000	unit	1	35,000
1kVA AC load simulator	6000	unit	5	30,000
1kVA DC load simulator	6000	unit	1	6,000
Line emulator	500	unit	2	1,000
PV simulator (5 kW)	6000	unit	2	12,000
Open source inverters	15000	unit	2	30,000
Sub Total -Research Lab				**335,800**
Total				**1,315,800**