

## Energy Research Institute @ NTU

# ENGAGING CONSUMERS FOR SMARTER GRIDS

CHERIF ASSAF

PROGRAMME DIRECTOR, ERI@N

# CONTENTS

- 1.** Energy Transition in Singapore
- 2.** Consumer-Assisted Green and Flexible Energy
- 3.** Efforts and Ideas on Engaging Consumers
- 4.** Discussions

# Energy Transition in Singapore

## The Four Switches

(Courtesy: EMA, SG)



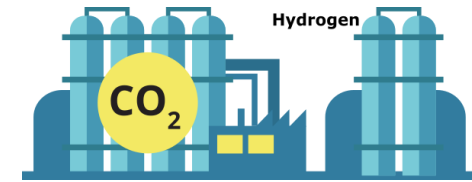
Natural Gas



Solar



Regional  
Power Grids



Low-Carbon  
Alternatives

## The Many Ds

Decarbonisation

Digitalisation

Decentralisation

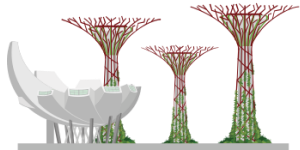
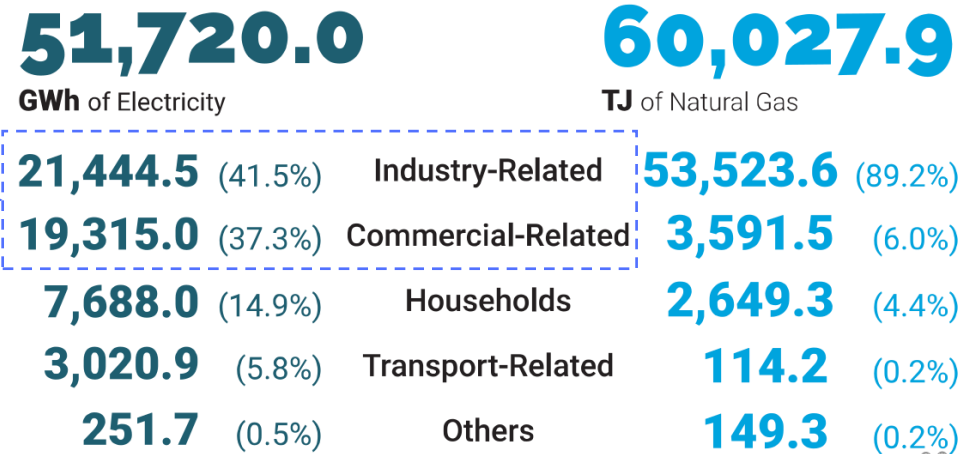
D...

What about the consumers?  
How do they feature in the energy transition?



# Singapore – Facts and Considerations

## Energy Consumption in 2019



Major consumers of electricity (~79%)

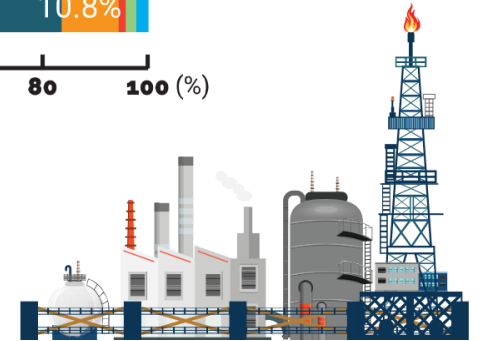
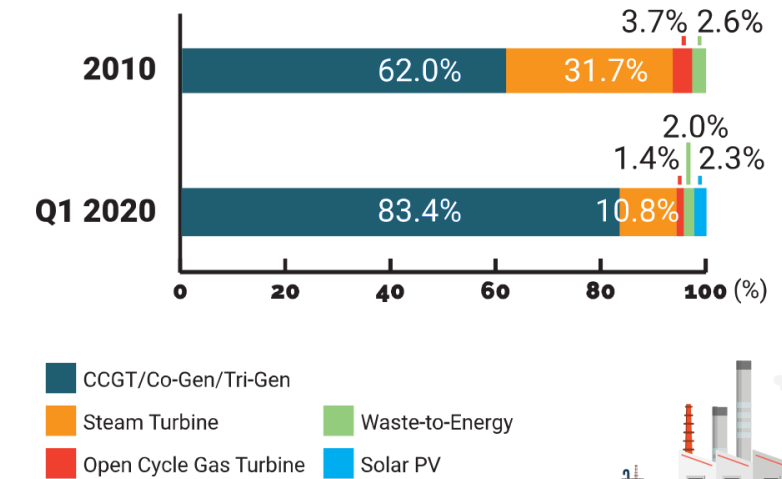


Courtesy: Singapore Energy Statistics 2020, Energy Market Authority (EMA) Singapore, URL: <https://www.ema.gov.sg/cmsmedia/SES2020/Infographics.pdf>

- >50 billion units (kWh) of yearly energy consumption
- >95% of fuel mix is natural gas since Y2014
- Carbon emissions are mainly due to demand
- ~7.7 GW peak system demand (till date)

## Electricity Generation Capacity by Technology Type

by Technology Type

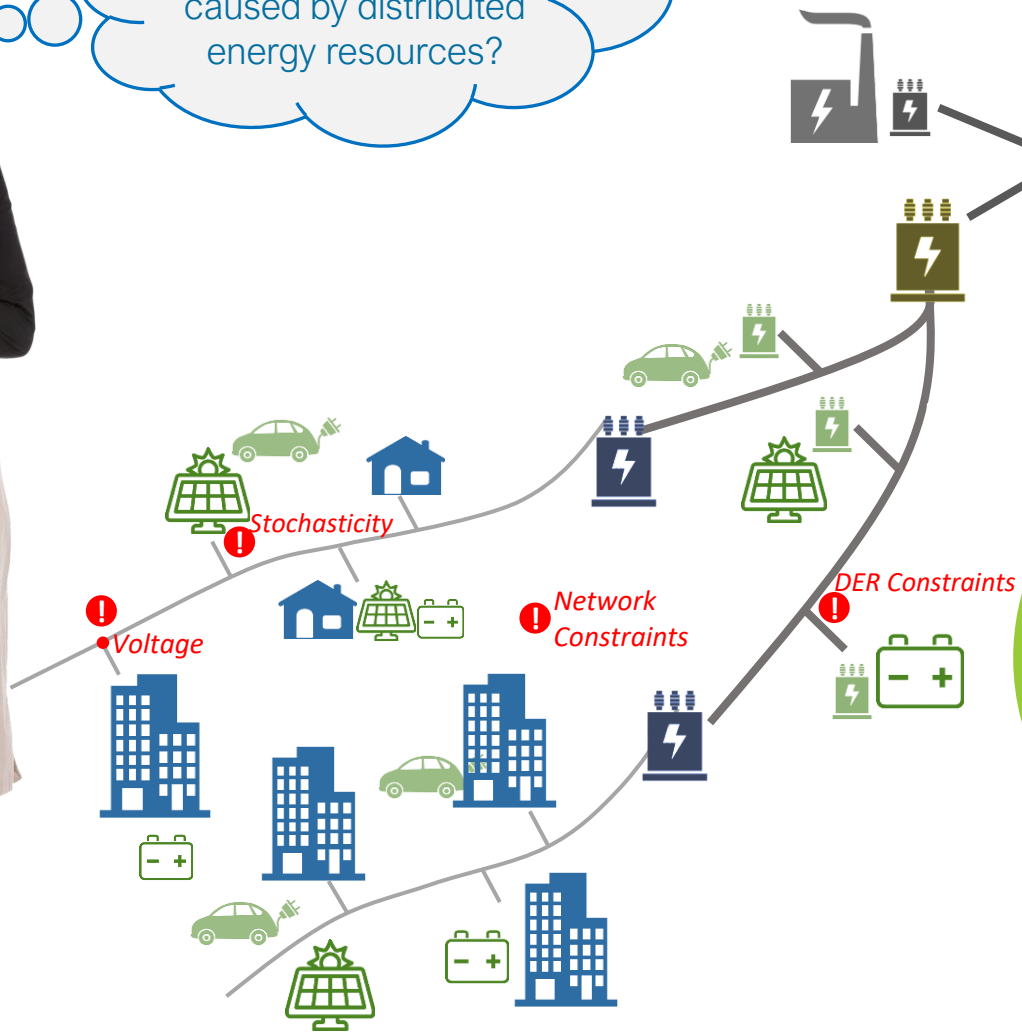


- Target of ≥200 MW of energy storage systems beyond Y2025
- Target of deploying 2 GWp of solar by Y2030
- Target of 60,000 EV charging points by Y2030

Courtesy: Energy Market Authority (EMA) Singapore, URL: <https://www.ema.gov.sg/Statistics.aspx>, URL: <https://www.ema.gov.sg/ourenergystory>



How to manage the power variability caused by distributed energy resources?

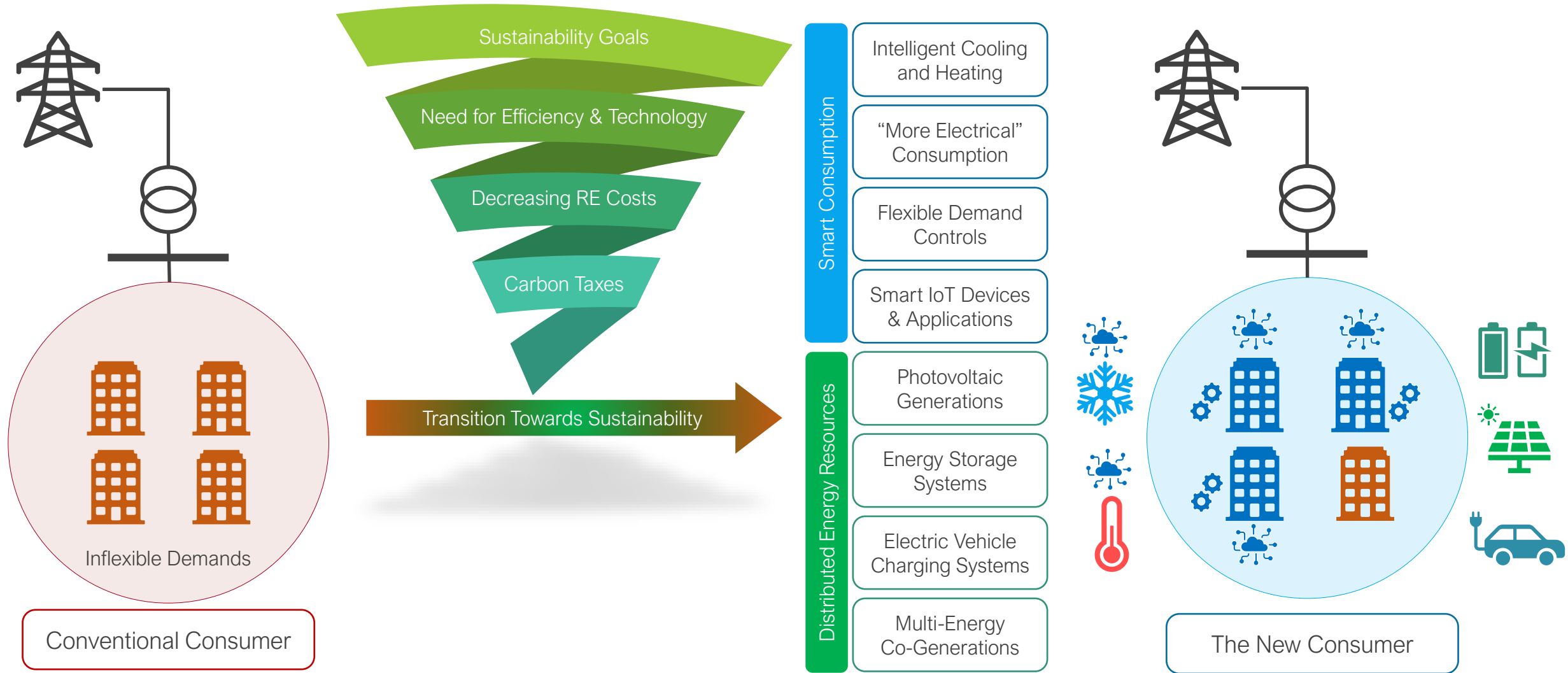


How to support the sustainability targets without heavy investments?

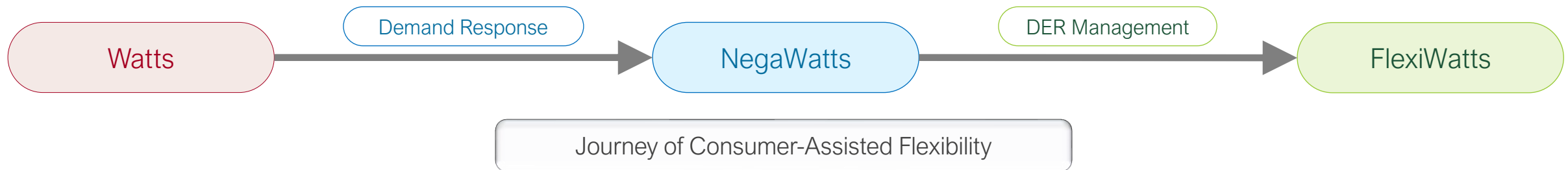
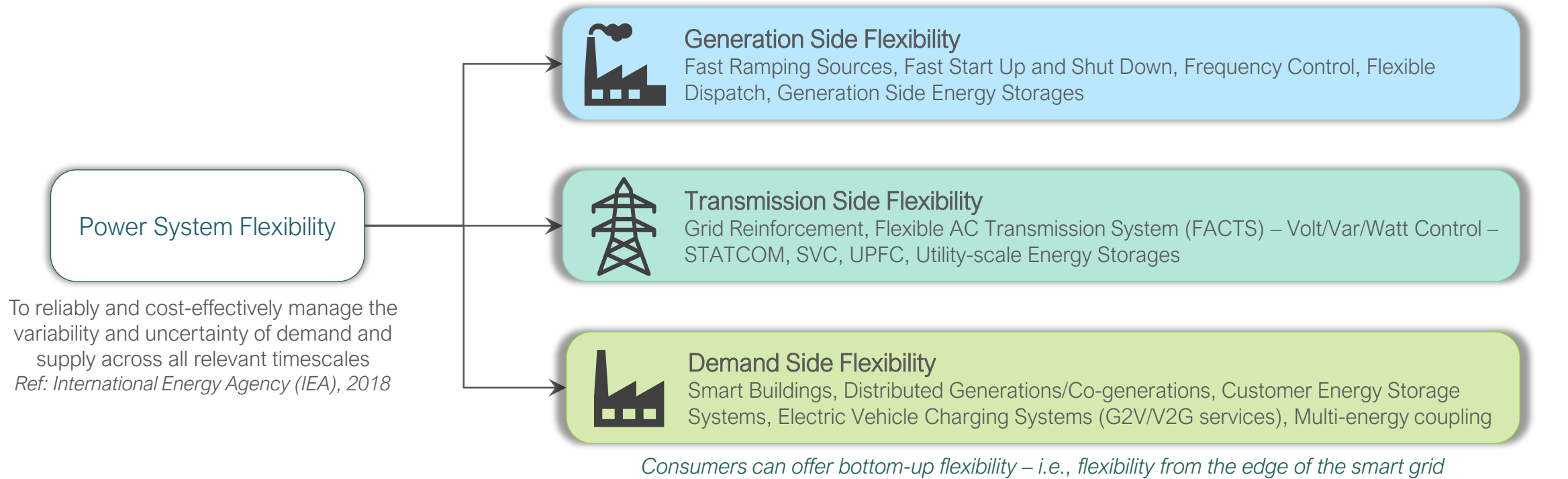




# Consumers Reimagined



# Consumer-Assisted Flexible Energy & Power for Smarter Grids



# Consumer-Assisted Flexibility – Interesting Challenges (non-exhaustive)



Siloed



Orchestrated

Single-user  
operating system



Single-user  
car ride



Single-user  
battery



“Sharing” or Access Model

*Digitalised “Access Economy” where multiple parties access services from the same asset, sometimes at the same time, using digital technologies.*

Multi-user  
operating system



Multi-user  
car ride

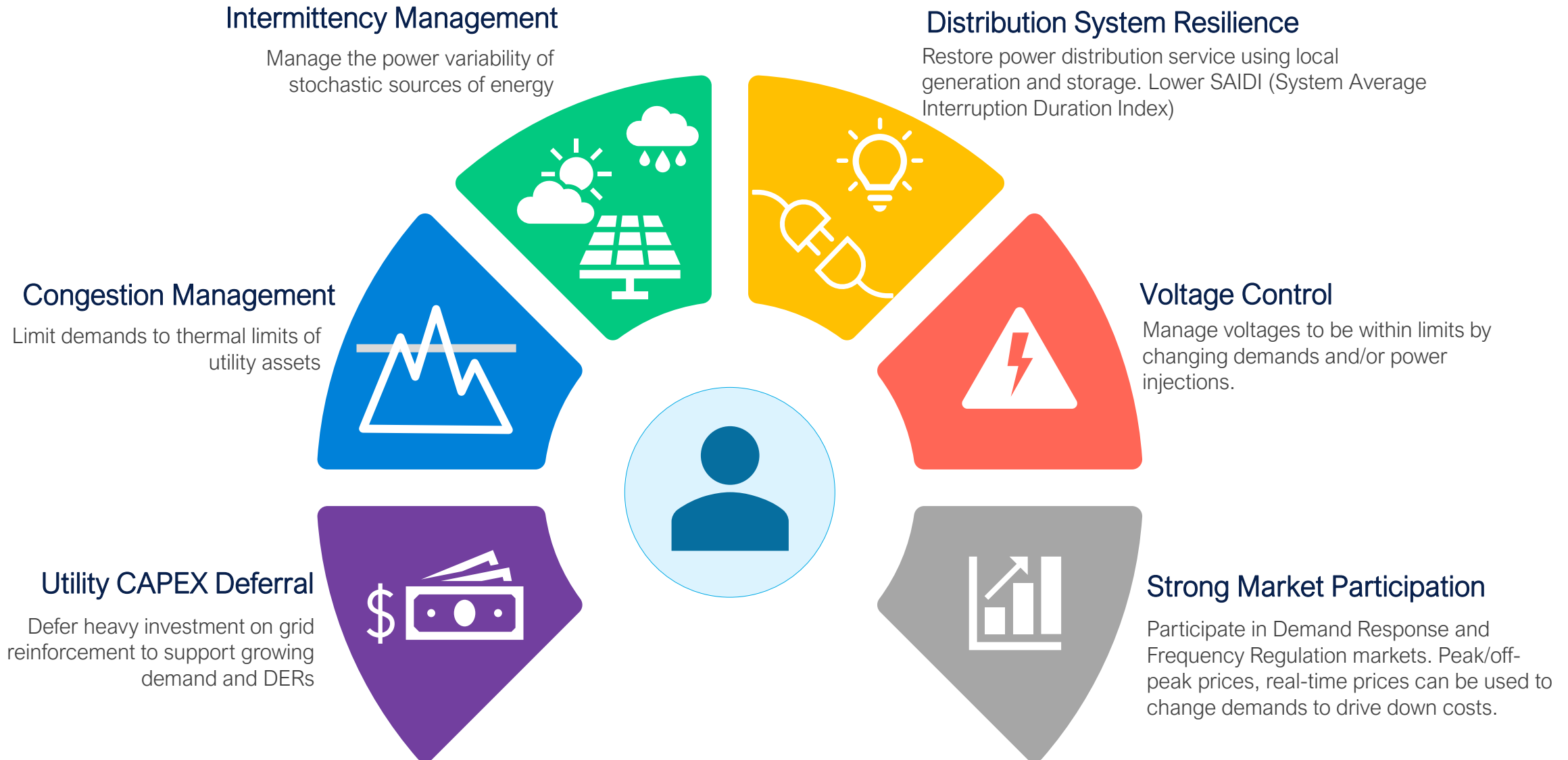


Multi-user  
battery





# Consumer-Assisted Flexibility – Values to Offer (non-exhaustive)



# Solutions from ERI@N for Singapore & Beyond



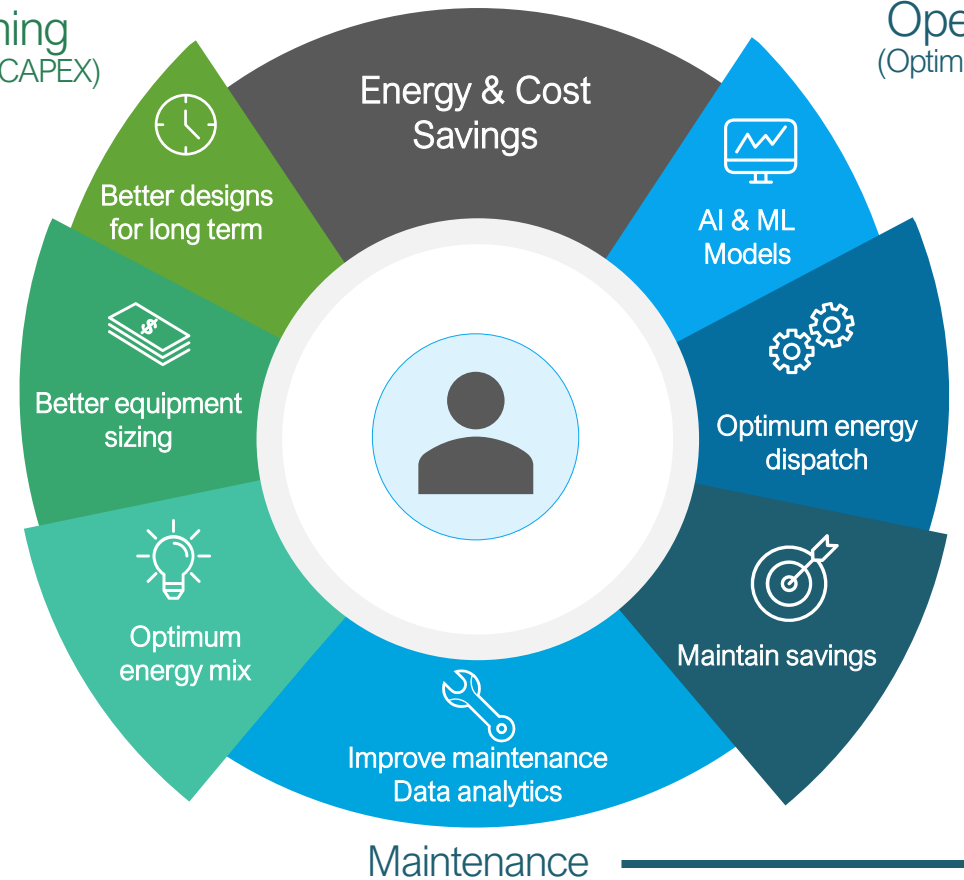
## Smart Multi-Energy System

Funded by National Research Foundation (NRF), Singapore

Optimal Design,  
Optimal Operation,  
Maintenance & Analytics  
of  
**Multi-Energy Demand Nodes of  
Consumers**

**Outcome:** More Efficient & Greener  
Industrial Consumers

Planning  
(Optimize CAPEX)



Maintenance

Added efforts on IoT & data-fusion for  
engagement of smart homes

Operation  
(Optimize OPEX)



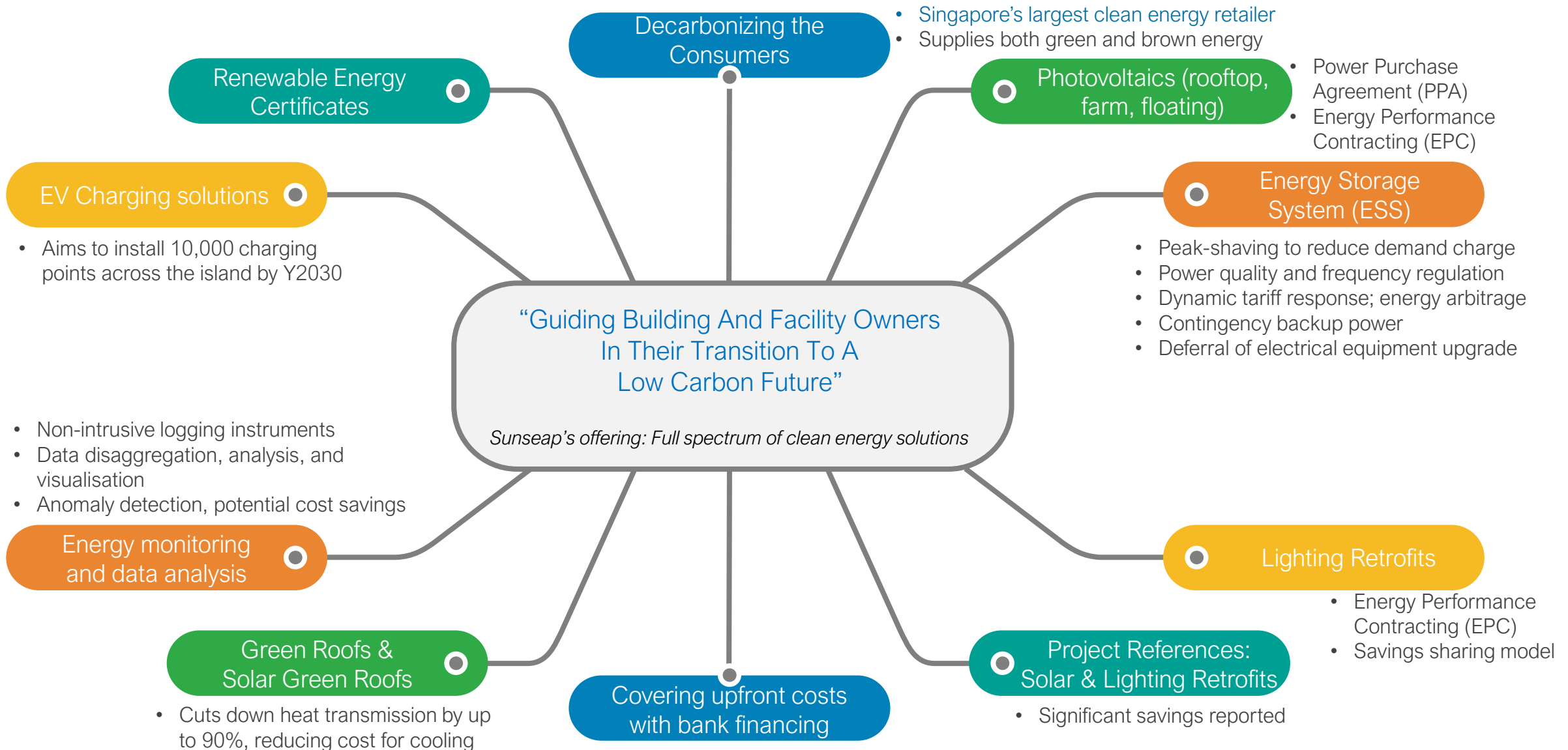
## Distributed Energy Resource Management System

Funded by National Research Foundation (NRF), Singapore

Grid-inclusive, Grid-edge,  
Decentralised Operation,  
Management & Analytics  
of  
**Multi-DER Flexible Demand  
Nodes of Consumers and the  
Utility**

**Outcome:** More Reliable & Greener  
Consumer-assisted Distribution Grid

# Speaker-1: Peter Goh, Vice President, Sunseap Group



## Speaker-2: Jean-Philippe El Khoury, Head of Sales, Smart Grid, East Asia and Japan, Schneider Electric

### Uplight – An illustration of engaging consumer

- Consumers may experience disconnect due to complexity of signing up for utility's schemes.
- Uplight company bridges the gap between energy providers and their customers.
- Software-as-a-service (SaaS) model is used.

### Easy Consumer Engagement

- Patented instant rebate engine for bundling smart thermostat offers.
- Instant enrollment in energy saving scheme (*"Digital Customer Activation"*)
- Optimise and control thereafter.
- Provides energy disaggregation analytics.

### HVAC/Temperature Control

- Consumers get a better rate of electricity in exchange of letting utility control more.
- Optimal HVAC control is performed to reduce high-priced consumption.
- Co-optimization considers PV & ESS too.

### Plus App from Uplight (pilot)

- Plus bundles multiple utility programs into simple, personalized offers in a consumer-friendly digital experience.
- Customer pays the same amount every month i.e., predictable bills during the pilot study.

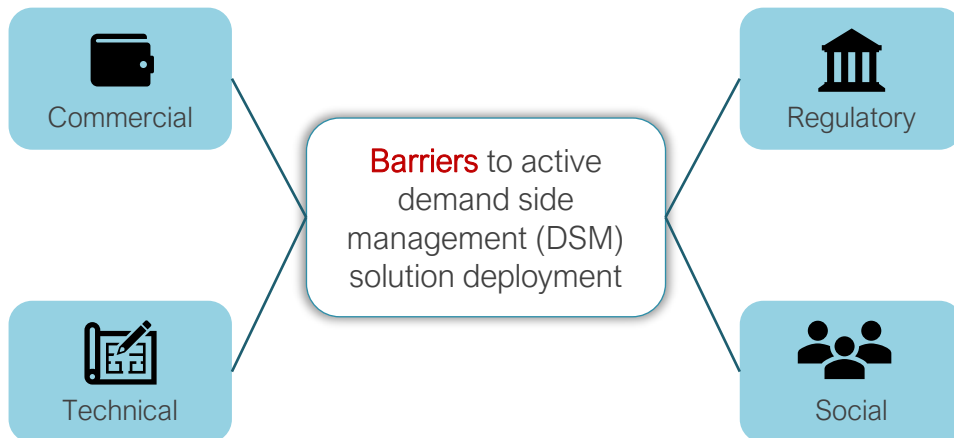
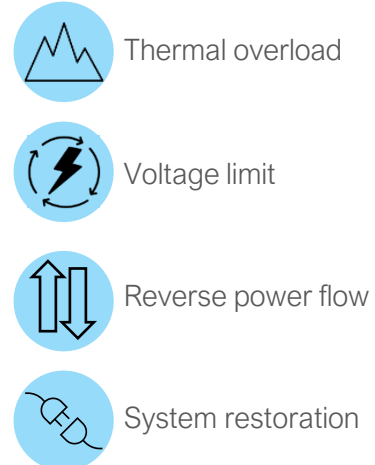
# Speaker-3: Anne-Soizic Ranchere, Principal, Enea Consulting, Singapore

## Power system needs

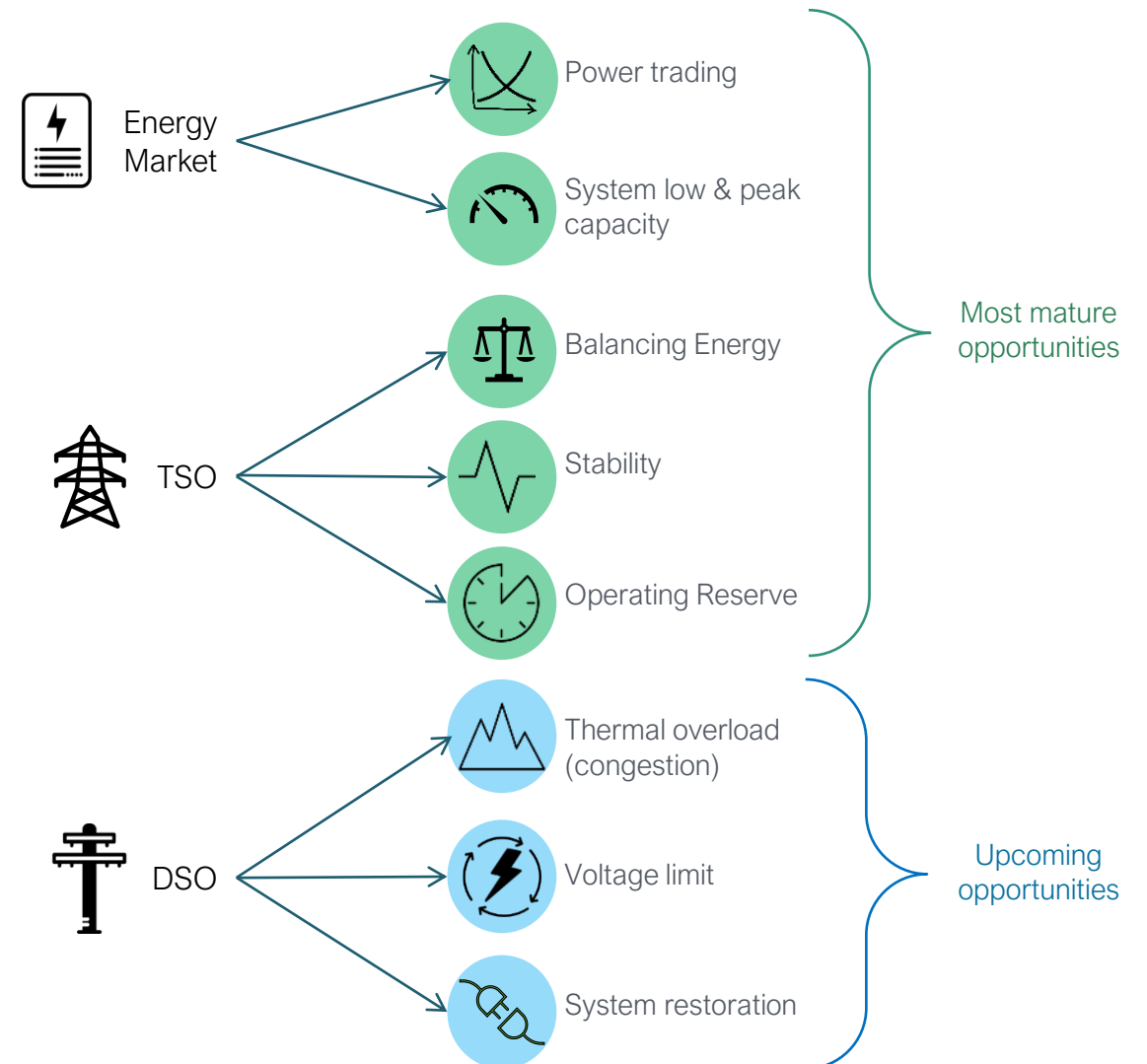
### Whole of System



### Distribution System



## Service / Revenue Streams





# Discussions

Engaging consumers is the key to Demand Side Flexibility and to achieve decarbonisation through allowing further renewable energy integration, while deferring investments on distribution grid reinforcement.

Multi-energy and distributed generation inclusive demand side management is crucial for Singapore. ERI@N-SMES and ERI@N-DERMS projects are focused on multi-energy consumers and flexibility from consumers, respectively.

**Sunseap** engages consumers who require clean energy, retrofits on building lighting, energy storage systems, solar green roofs, energy disaggregation, and targets installation of many EV charging points by Y2030.

**Uplight** achieves easy consumer engagement and participation in utility's schemes. Currently, a fixed amount as monthly bill in return of HVAC control is being piloted.

**Enea** would provide the perspective on energy transition, the grid perspective, the consumer perspective, and the revenue streams, barriers and opportunities in a consumer-centric grid.

For engaging consumers to be successful, both human elements and technological elements must come together.



**THANK YOU**