

Experimental Power Grid Centre and its Microgrid Research

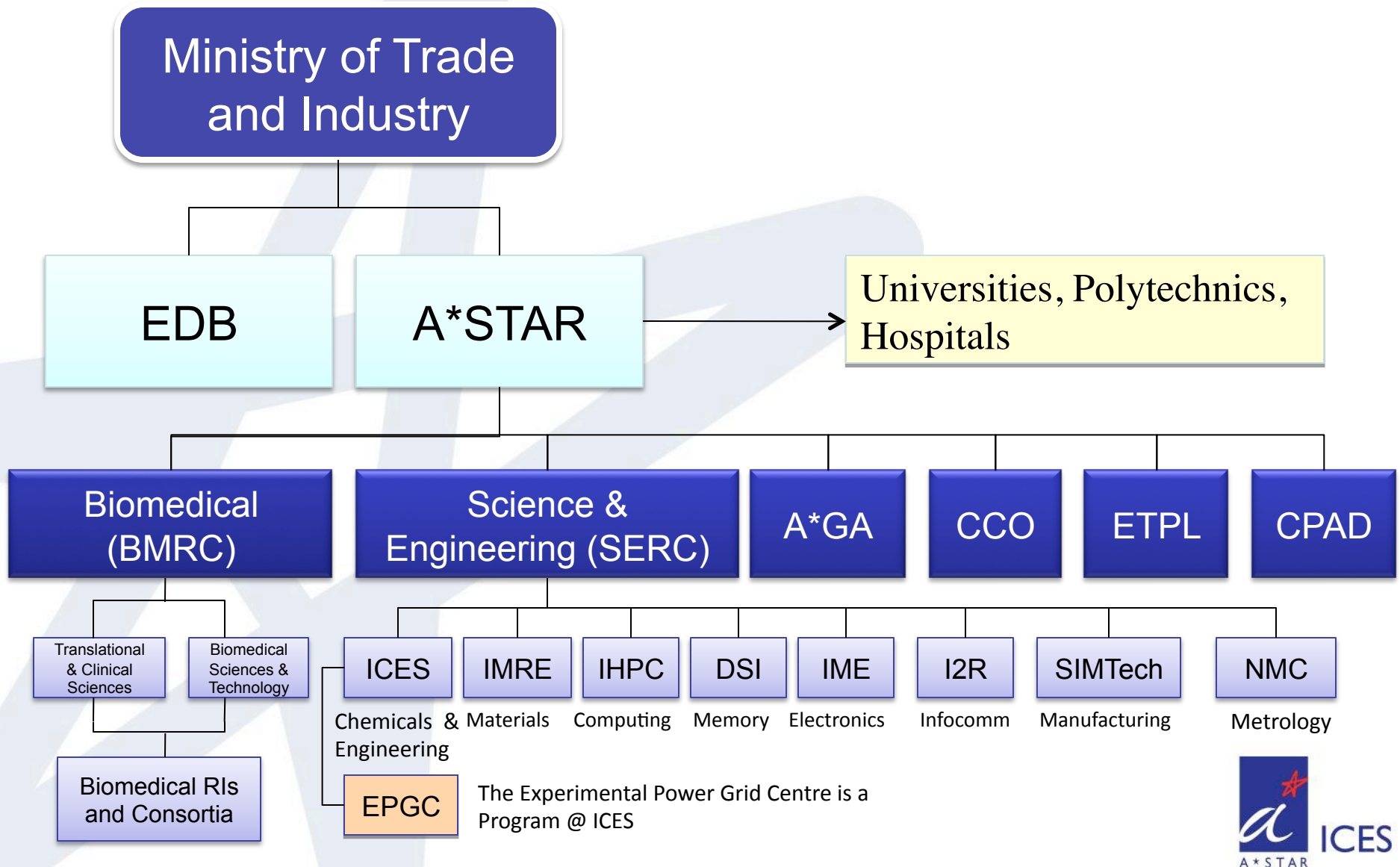
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Siew-Chong Tan
Senior Scientist

Experimental Power Grid Centre

tan_siew_chong@ices.a-star.edu.sg

EPGC is a program under ICES which, like other A*STAR RIs, is part of MTI.



Experimental Power Grid Centre (EPGC)

- ⦿ Program funded from Mar 2007 – Mar 2012
- ⦿ Government funding of S\$38M (USD 31M)
- ⦿ Two components
 - ⦿ national-level infrastructure for R&D, test-bedding and demonstration of sustainable energy technologies
 - ⦿ a pool of researchers with core capabilities in grids and renewable energy technologies

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EPGC's Mission

- To undertake Research and Development activities in defined **core areas** for intelligent and decentralised power distribution, interconnection and utilisation
- To develop collaborative R&D with A*STAR Research Institutes, Universities, Industry and Singapore Public agencies
- To promote quick adoption and implementation of innovative technologies

Technological Capabilities

Capabilities existing in A*Star

Information Processing

Cyber Security

Data Communications

Sensors

Fuels/BioFuels

Storage Materials

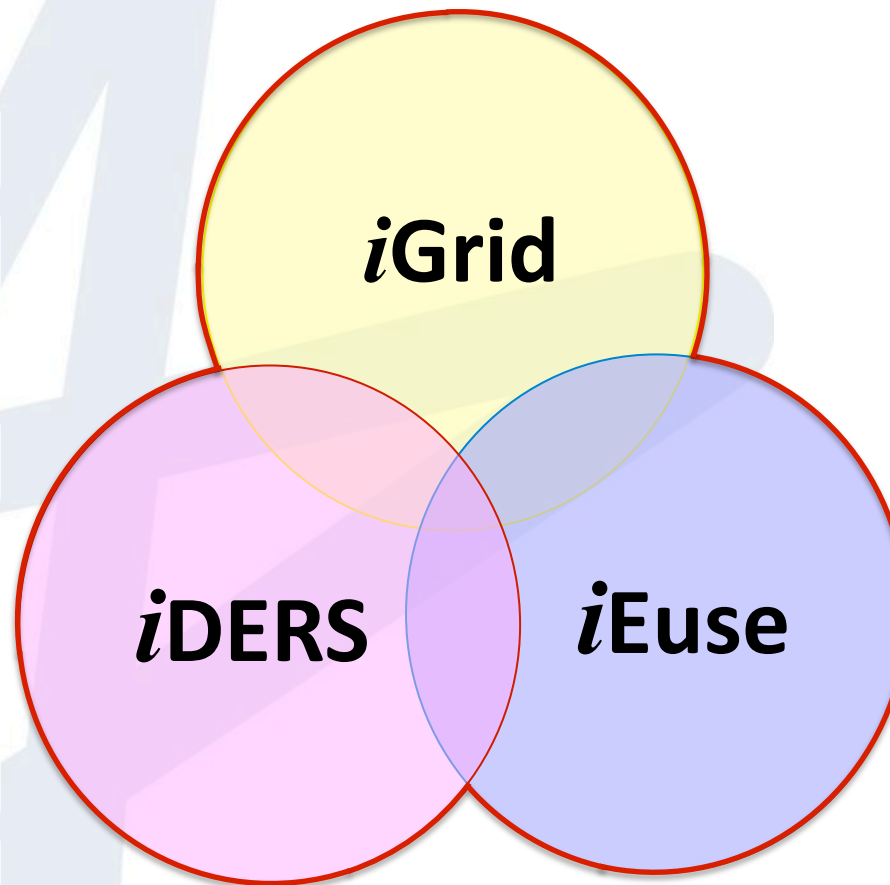
Packaging

Fuel Cells

StarHome

High Performance
Computing

Asset Management



Capabilities existing in EPGC

Renewable Energy
Systems

Power Converter
Systems

Flexible and self-
healing

Large complex
systems

Storage systems

Diagnostics

Smart Demand
Response

Decentralized Control

Plug and Play

Life cycle
assessments

Smart users

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Research Facility For Grid Technology



@ Fusionopolis

High speed link



@ Jurong Island

On Google map ...



What is the EPGC facility?

Rating
1 MW

Initial Assets
600kW



Emulators



Flow Batteries



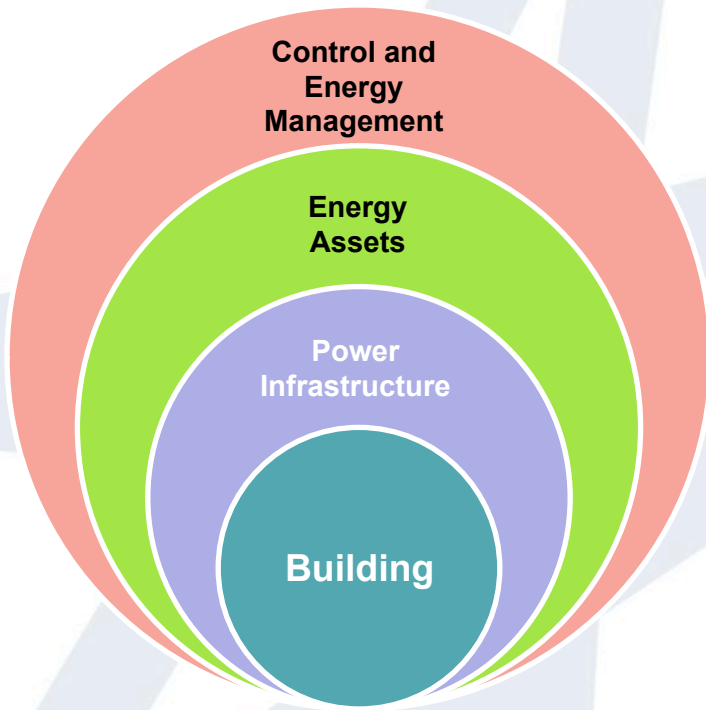
Microturbines



Fuel Cell



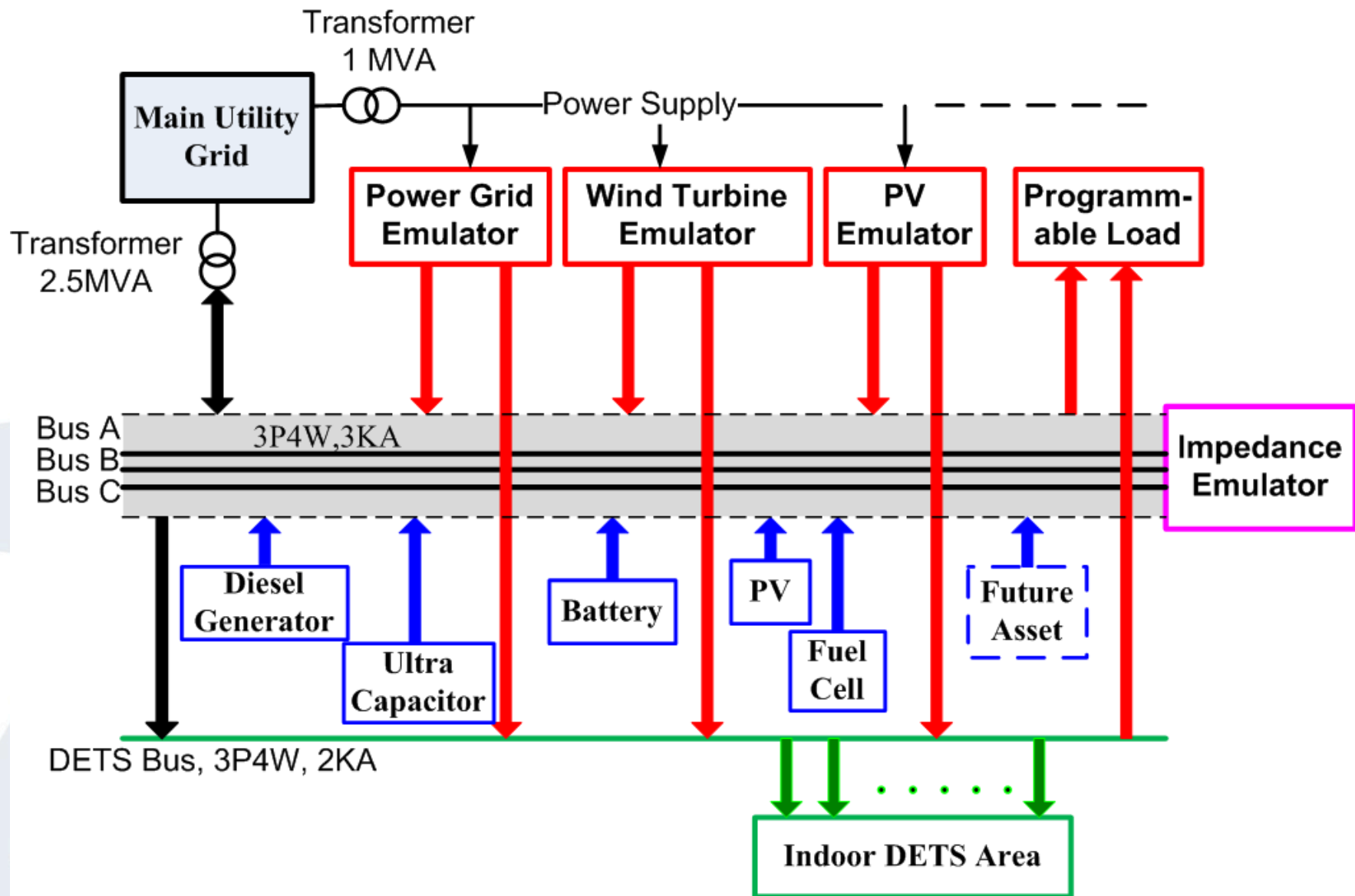
EV charging



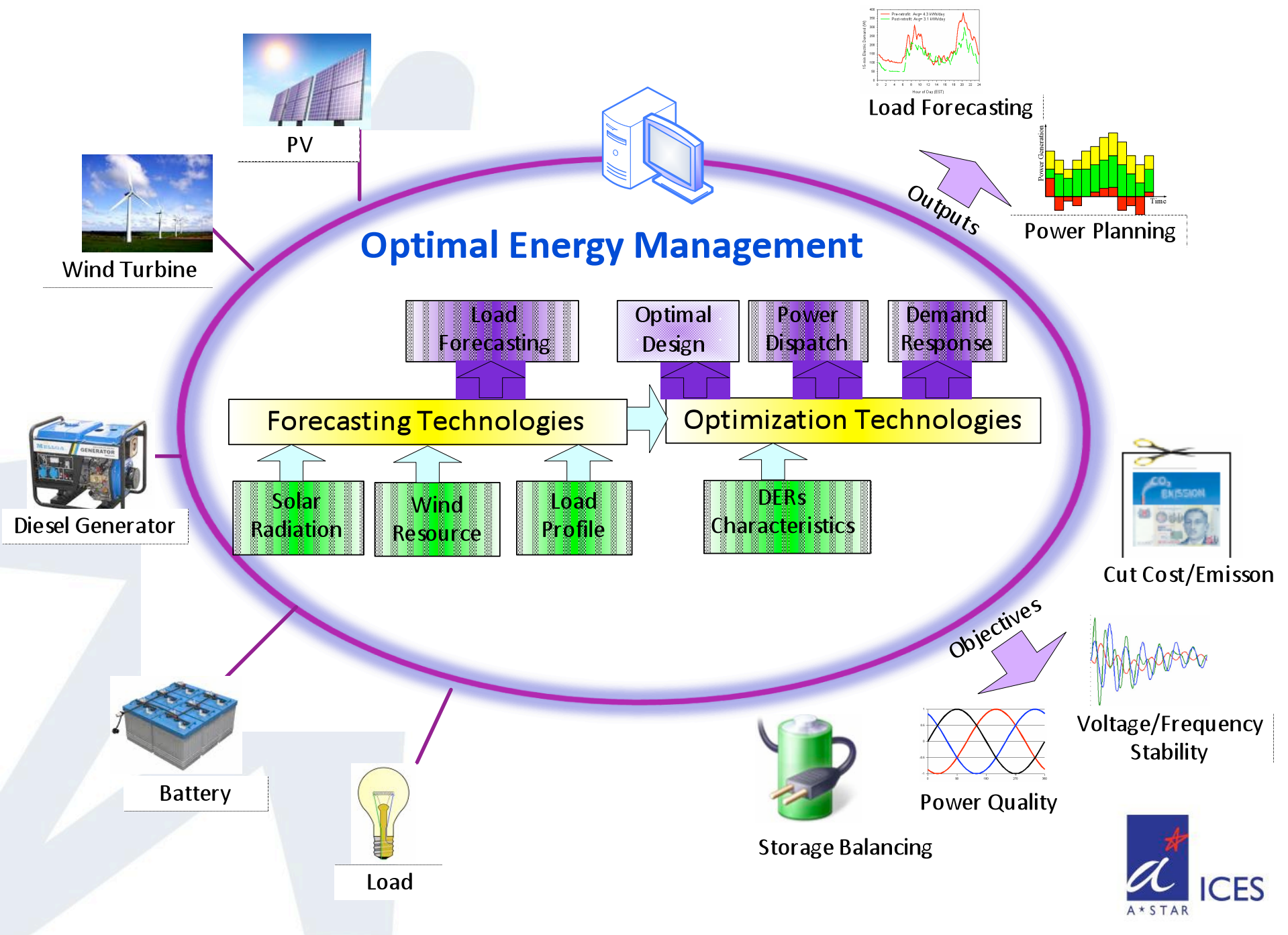
What is the EPGC facility?

Type of assets	Description	Quantity
Photovoltaic system	<ul style="list-style-type: none"> • Mono-crystalline • Poly-crystalline • Amorphous 	20 kWp 20 kWp 20 kWp
Internal combustion engines/generators	<ul style="list-style-type: none"> • Diesel generator unit 1 • Diesel generator unit 2 • Diesel generator unit 3 	250 kVA 125 kVA 50 kVA
Storage	<ul style="list-style-type: none"> • Lead-acid batteries • Lithium-ion batteries • Ultra-capacitors unit 1 • Ultra-capacitors unit 2 	110 kWh 40 kWh 90 kW 60 kW
Programmable loads	<ul style="list-style-type: none"> • Load bank 1 • Load bank 2 • Load bank 3 	R:62 kW, L:100 kVAr, C:95 kVAr R:375 kW, L:400 kVAr, C:285 kVAr R:190 kW
Emulator	<ul style="list-style-type: none"> • Power grid • Wind turbine • PV emulator 	90 kW 10 kW (future)

Conceptual Diagram of Power Network



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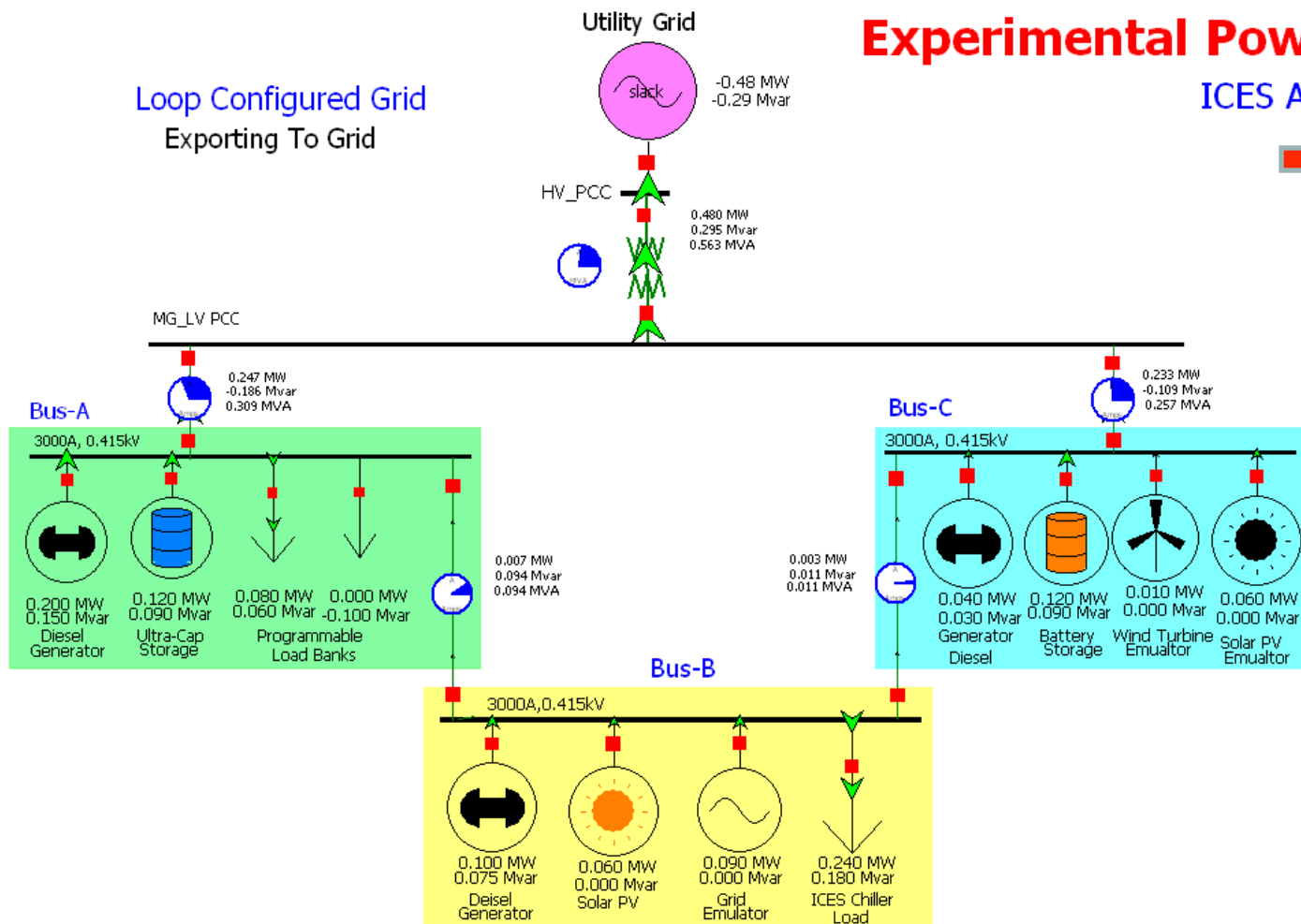


Experimental Power Grid Facility

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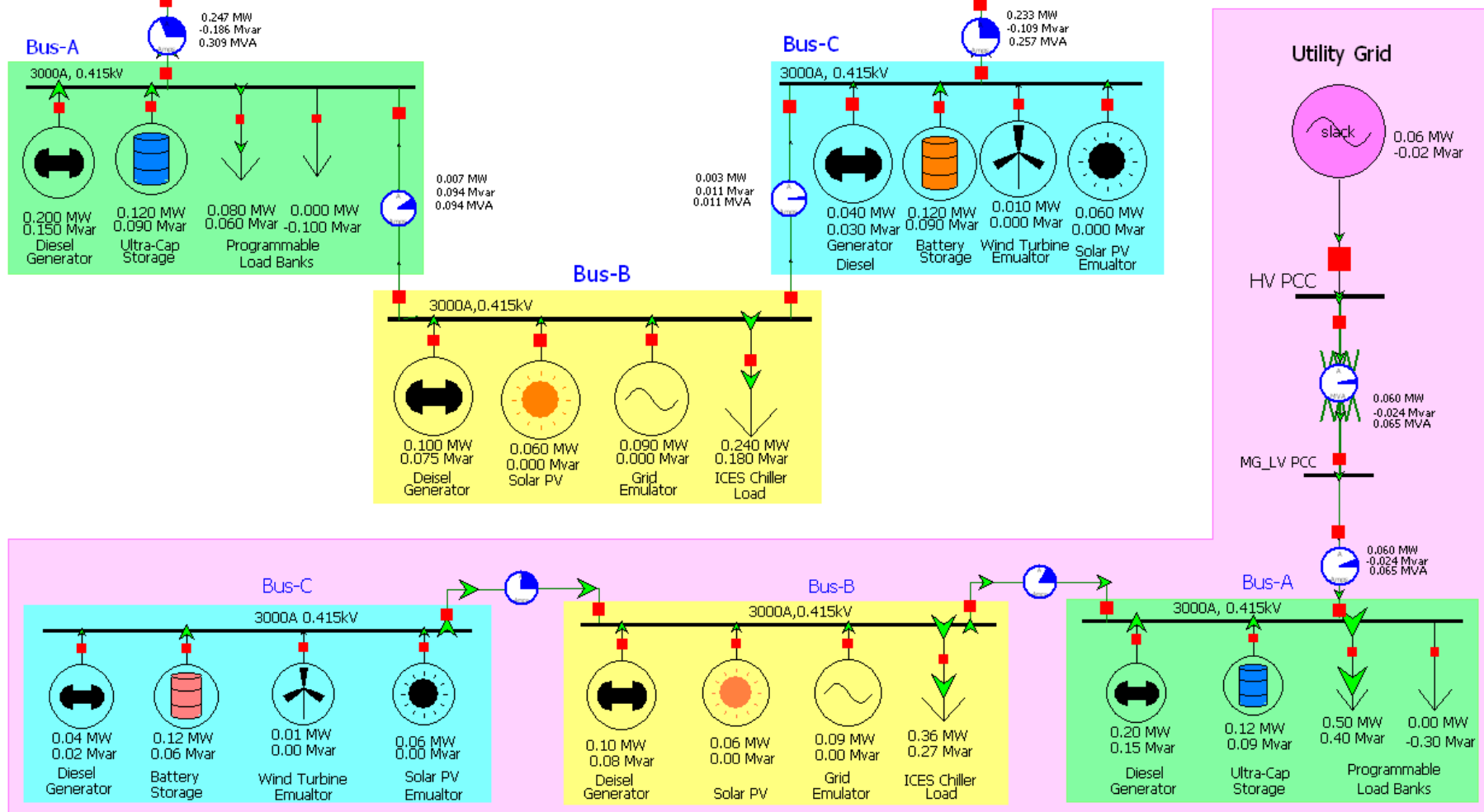


Loop Configured Grid
Exporting To Grid



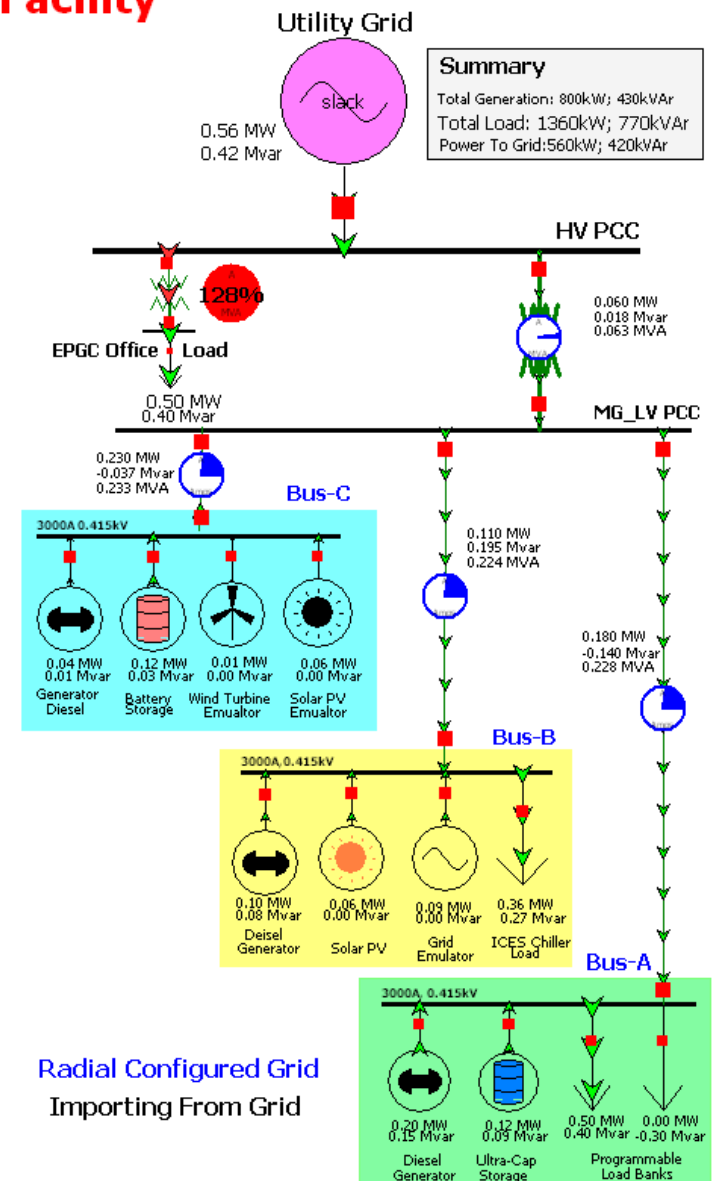
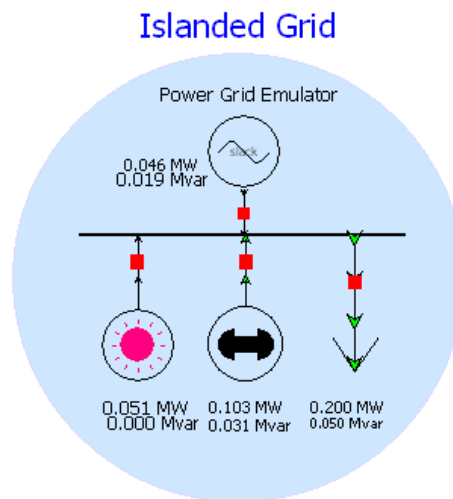
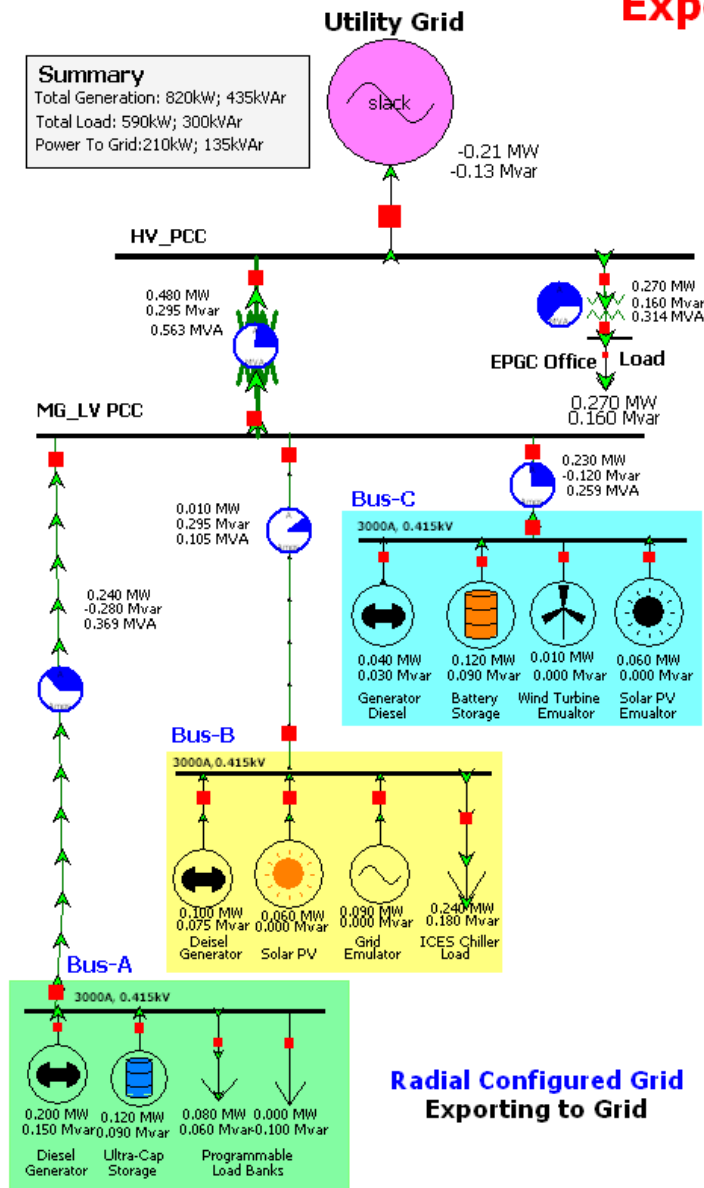
Serial Configured Grid

Importing From Grid

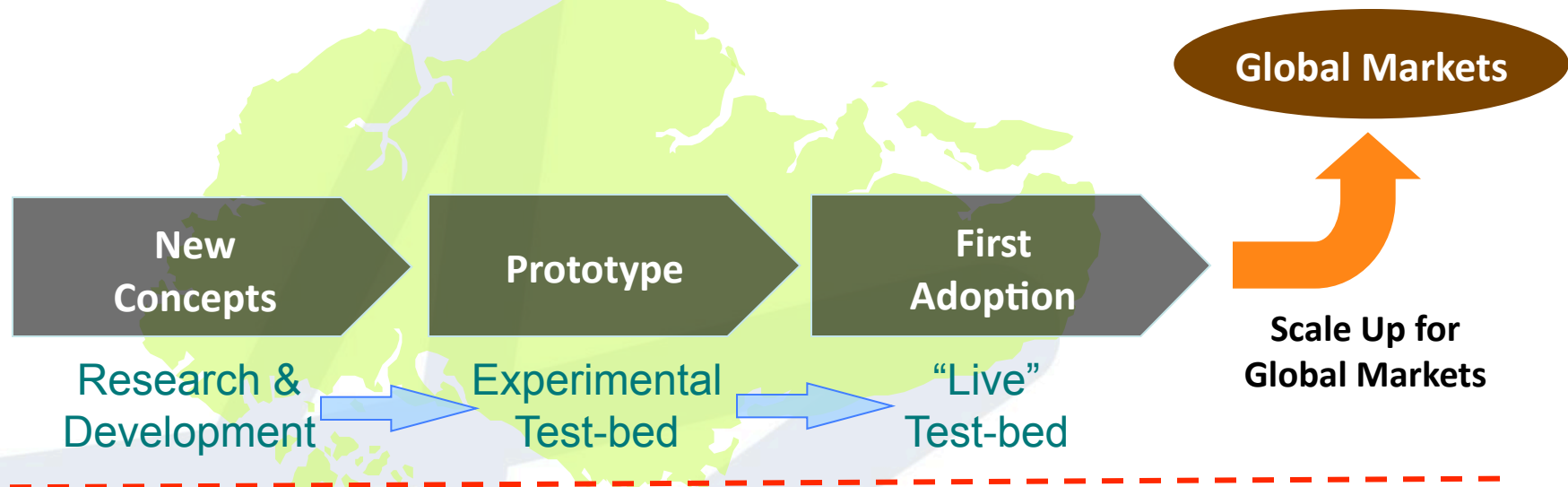


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Singapore as a Living Lab



Intelligent Energy
Distributed Systems

**Experimental Power
Grid Center**

Islanded Grids

Pulau Ubin Test-bed

Pulau Semakau Eco-Park

Zero Energy Building

Electric Vehicle Test Bedding

Punggol Eco-Precinct

Clean Tech Park

Intelligent Energy System
Pilot project

Partner Agencies:

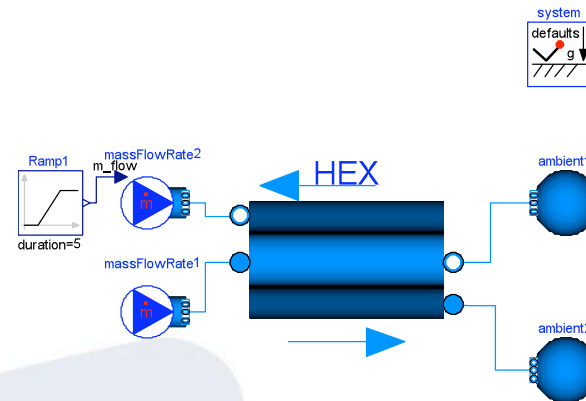


What we offer

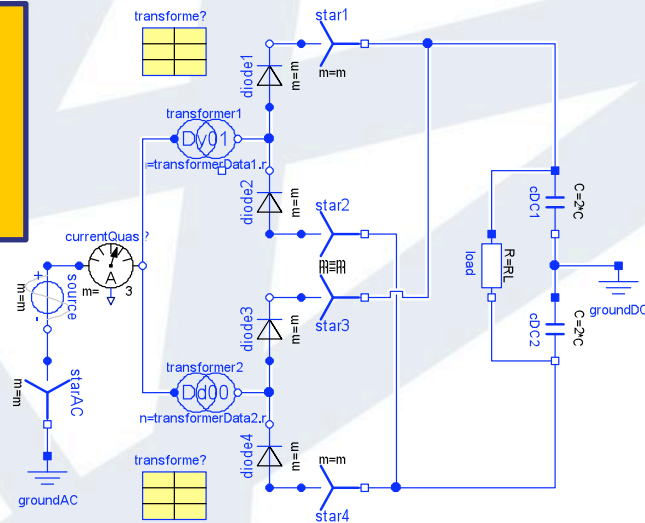
- **Resources** - Power systems and power engineering capabilities
- **Lab facilities and tools**
 - Wide range of high end simulation tools
 - State of the art R&D Facility (scheduled for Nov 2011)
 - Leveraging on other labs in Singapore
- **Value-add R&D activities**, integrated in A*STAR framework and capable of delivering proof of concept prototypes and finished products
- **A wide technology reach** (leverage from existing A*STAR research institutes capabilities)

Challenge: Multi-domain Modeling and Simulation

Thermal

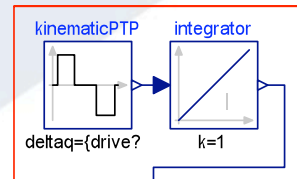


Electrical

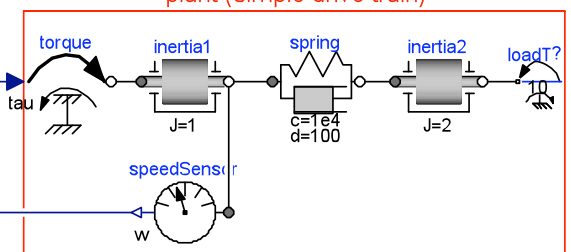


Control

reference speed genera?

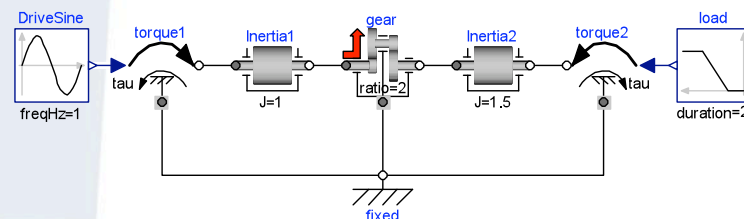


plant (simple drive train)

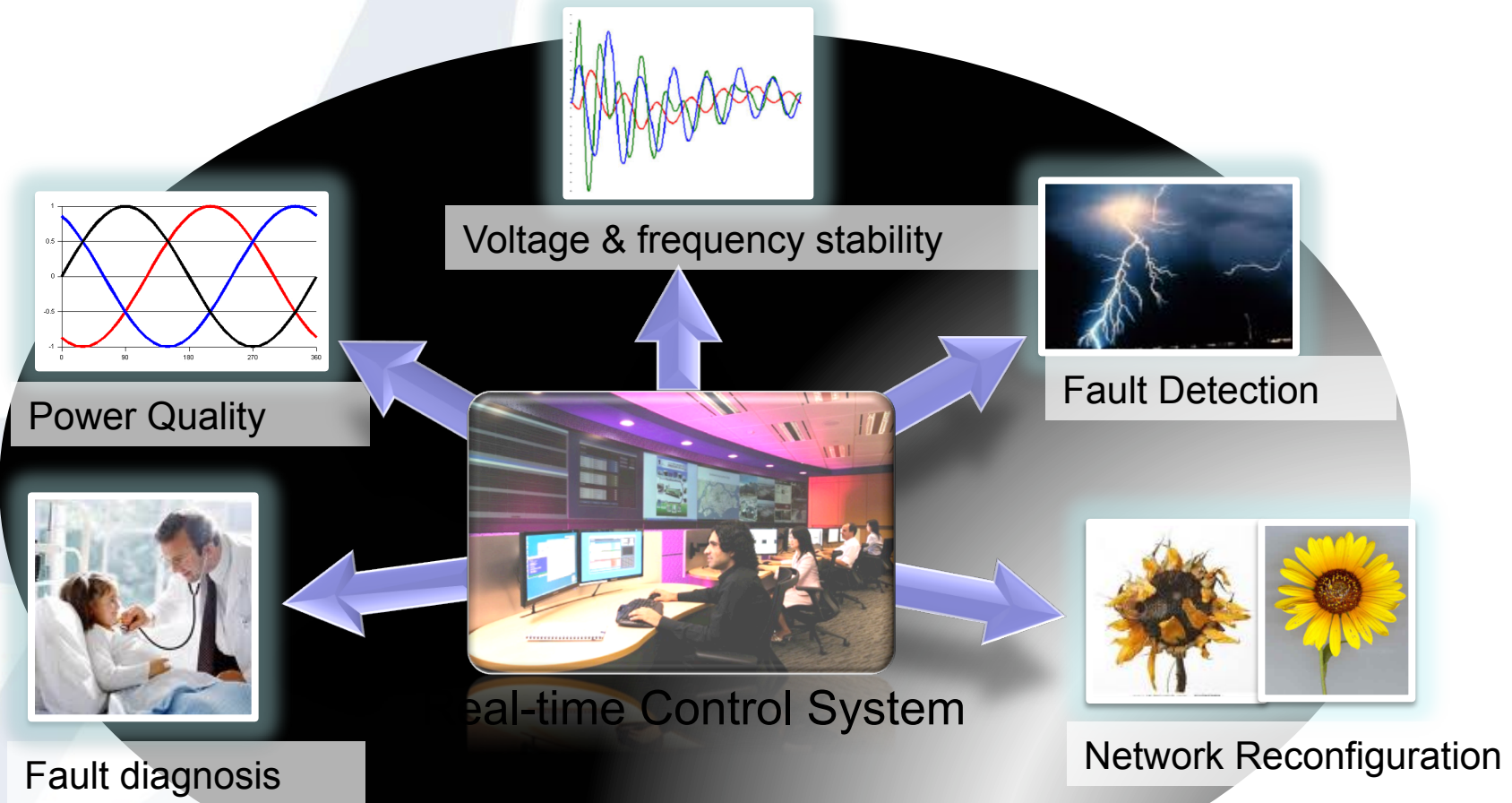


PI controller

Mechanical

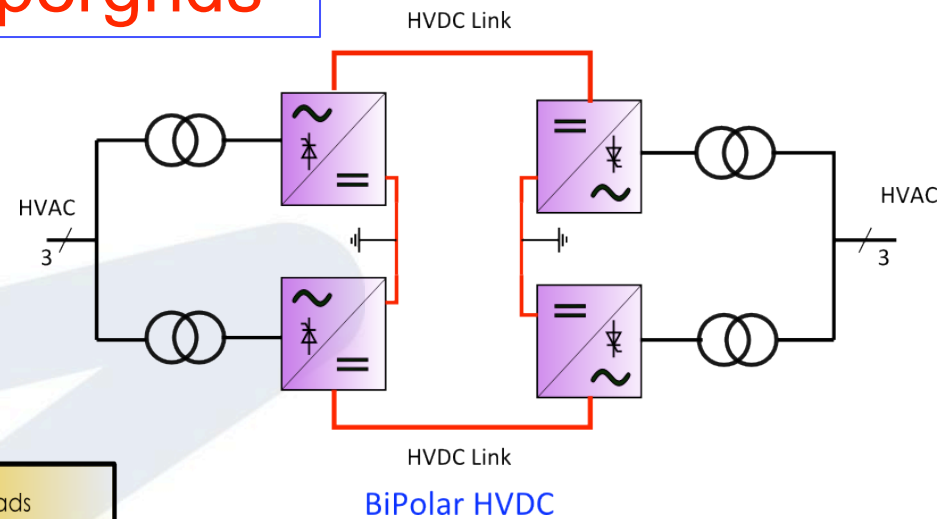


Core research to develop robust electrical power structures through *i*Grids

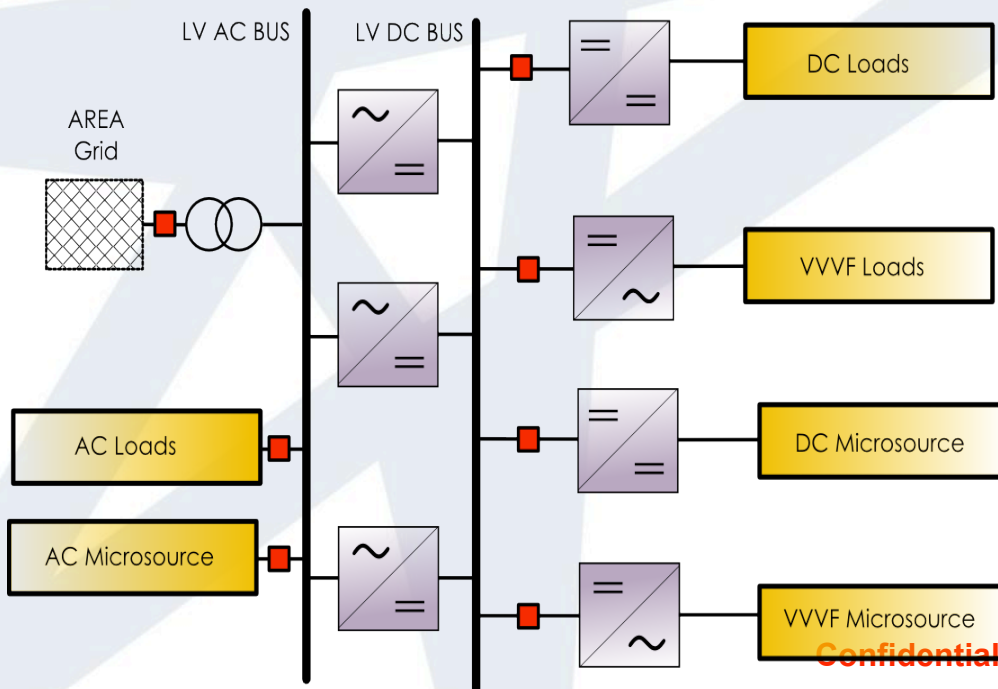


DC and AC Grid integration in core *i*Grids

Supergrids



Microgrids



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control and data flow



EPGC Facility: Building



Main Entrance



Test Bays

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PV Installation



Roof Mounted PV Arrays



Mono and poly-crystalline PV



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Thin Film Amorphous PV

Equipment in EPGC



HV Panel



LV Panel



Transformer



Diesel Generators



Uninterruptible Power Supply



Control System



RTUs



Wind Turbine Emulator



Load Banks

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Electrical Storages



Thank you!

Please feel free to contact us!