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1. Brief introduction of Hitachi
2. JUMPSmartMaui Ph1
3. JUMPSmartMaui Ph2
4. Other solutions from Hitachi

1-1. Business fields of Hitachi (FY2013)

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■Financial Services

■Others
(Logistics and Other services)

■Smart Life &
Ecofriendly Systems

■Automotive Systems

■High Functional Materials &
Components

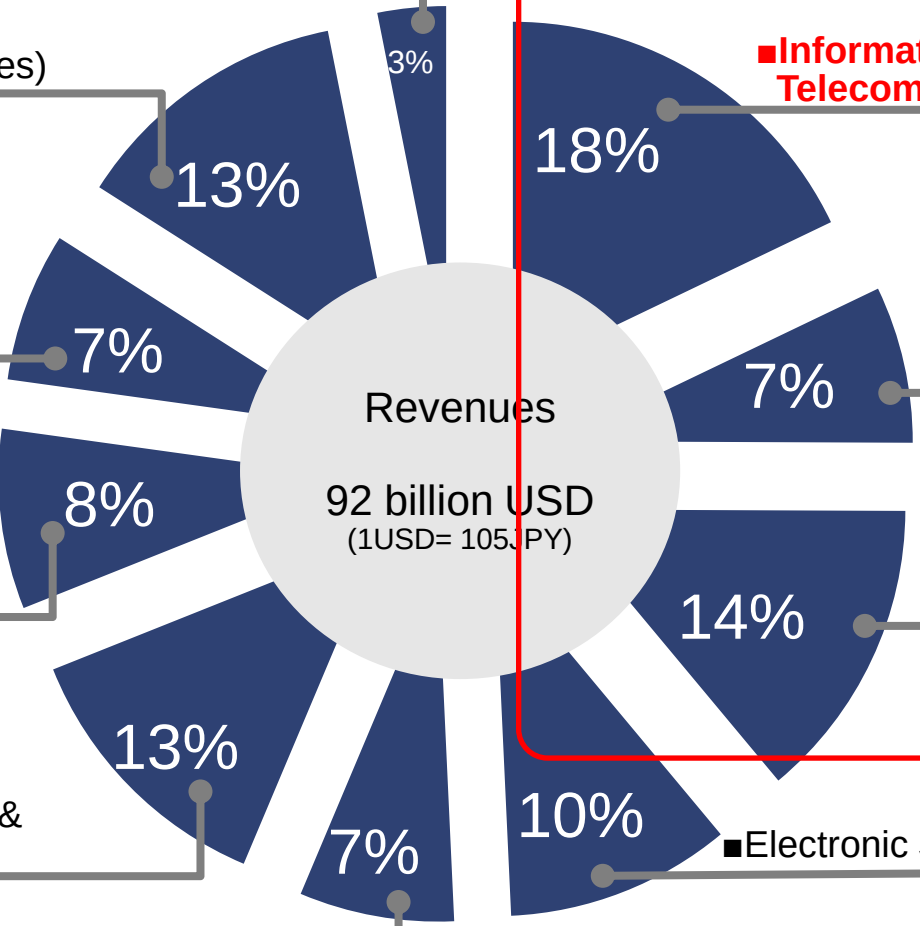
■Information &
Telecommunication Systems

■Power Systems

■Social Infrastructure &
Industrial Systems

■Electronic Systems & Equipment

■Construction Machinery



* The percentages are based on the new segment classifications effective from FY2014

1-2. Major activities for Smart Community of Hitachi

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CHINA [Dalian]
Eco-City

U.S.A. [Hawaii]
Japan-US Island Grid Project (JUMPSmartMaui)

U.S.A. [New Mexico]
Smart Grid Demonstration - Battery Storage

UK [ETI SSH Project]
UK Nation-wide Smart Systems & Heat Programme

UK [Greater Manchester]
Load-balancing aggregation technology in Greater Manchester

JAPAN [Okinawa]
EV Charge Management System

JAPAN [Y-PORT]
Smart City global support

JAPAN [Kashiwa-city]
Kashiwa-no-ha Smart City Project

JAPAN [Yokohama]
Smart City Project

JAPAN [Rokkasho-village]
Smart Grid Demonstration Site – Micro-grid

JAPAN [Hitachi-city]
Future City Model Project in Hitachi-City

SPAIN [Malaga]
Smart Community Demonstration Project in Malaga City

Basic models establish through small scale demonstrations.

Basic models

Demonstration

Real business

Development & Renovation of Smart City(incl. IT)

Energy Mobility Water IT IT

1-3. Smart xx solutions as Social Innovation Biz.

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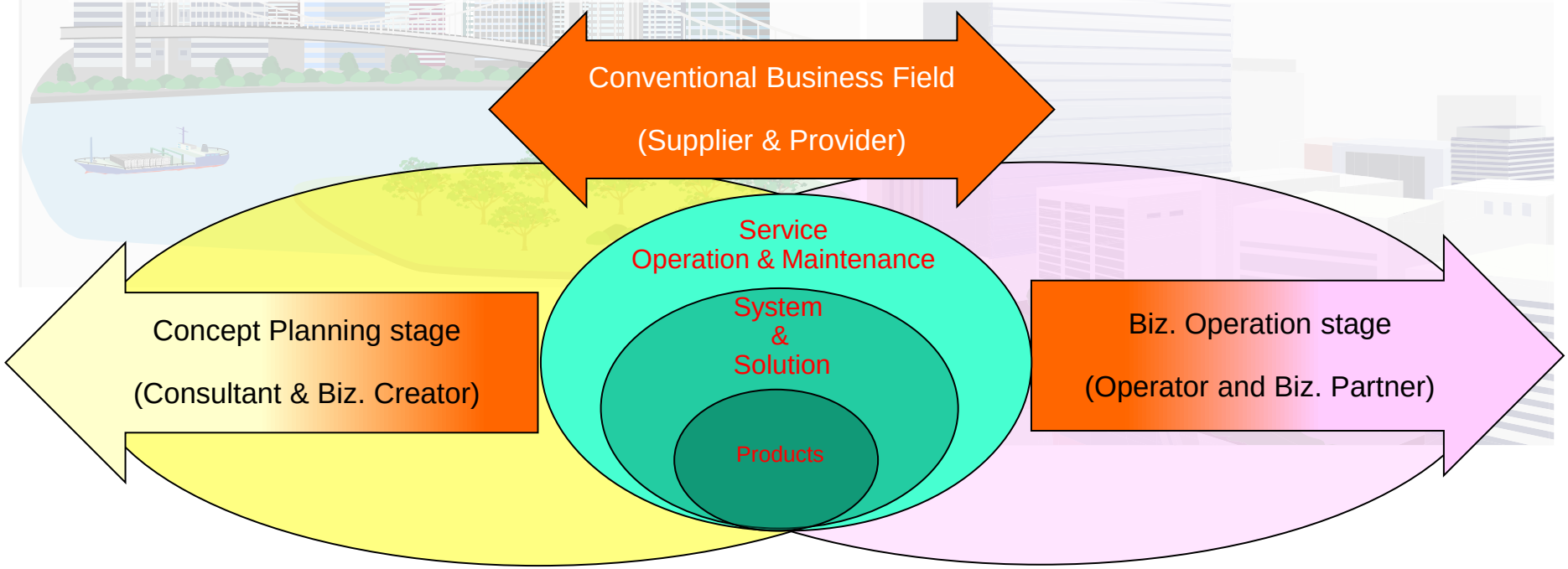
- Smart Community movement is expanding and creating its new business fields.
  It has several features from city construction to city management service.
  Players in these markets are required to enhance and stretch their business style.



- Best solution to the stakeholder will be different from others.

Existing Infrastructure	x	Investment cost	x	Technology Level	x	Stakeholder contribution	=	Optimum Smart Infrastructure

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4. Other solutions from Hitachi

2-1. JUMPSmartMaui Project: Stakeholders

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NEDO

Hawaiian Electric

Maui Electric

Hawaii Natural Energy Institute

Pacific Northwest NATIONAL LABORATORY

NREL NATIONAL RENEWABLE ENERGY LABORATORY

Sandia National Laboratories

mauieconomic DEVELOPMENTBOARD

MIZUHO

CyberDefense

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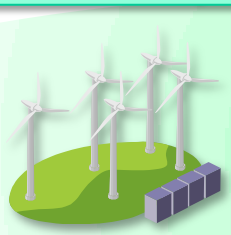
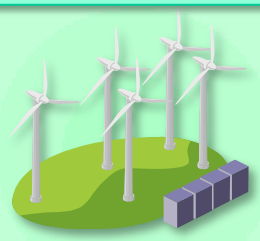
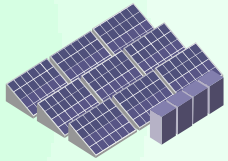
Achieving 65% renewable energy in Hawaii by 2030

- Hawaii has the highest dependence on oil by far among the 50 states.
- Electricity prices in Hawaii have more than tripled the United States average price due to soaring crude oil prices.

- By 2030, the state of Hawaii has set a goal to produce 40%of its electricity demand by renewable energy (RE), from around 10% at 2010.
- RE ratio is significantly increasing in the state of Hawaii. In particular, Maui county of the state already accounts 30% RE of the total electricity demand with 72MW of wind turbine and 40MW of photovoltaic as of the end of 2013.
- On August 26, 2014, Hawaiian Electric Companies revealed their plan:
  - -More than 65% RE
  - -Nearly triple the amount of distributed solar
  - -Electric bills reduced by 20 percent


2-3. JUMPSmartMaui: Issues and solutions

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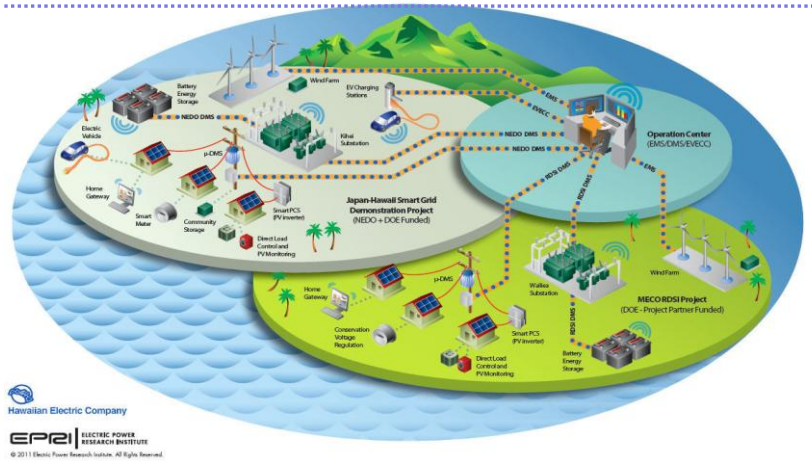
2011	2012	2013	2014-2016
Feasibility Study	System Design	Construction	Demonstration



In Maui, large scale renewable energy resources have been introduced. In addition, PV and EV high penetrations have been expected.

Issues

- Excess Energy
- Influence on frequency
- Influence on distribution line voltage

Six cutting-edge initiatives as solutions

1. Energy Efficiency	Maximum Utilization of Renewable Energy
2. Stabilization/Balancing	DLC and Advanced Load Shift as Demand Response function
3. EV infrastructure & QC stations	EV charger control and Batteries
4. Cyber Security	Ensure adequate security
5. Autonomous System	Energy control via Autonomous Decentralized System
6. ICT Technology	ICT technologies to improve Quality of Life

2-4. JUMPSmartMaui: Overview

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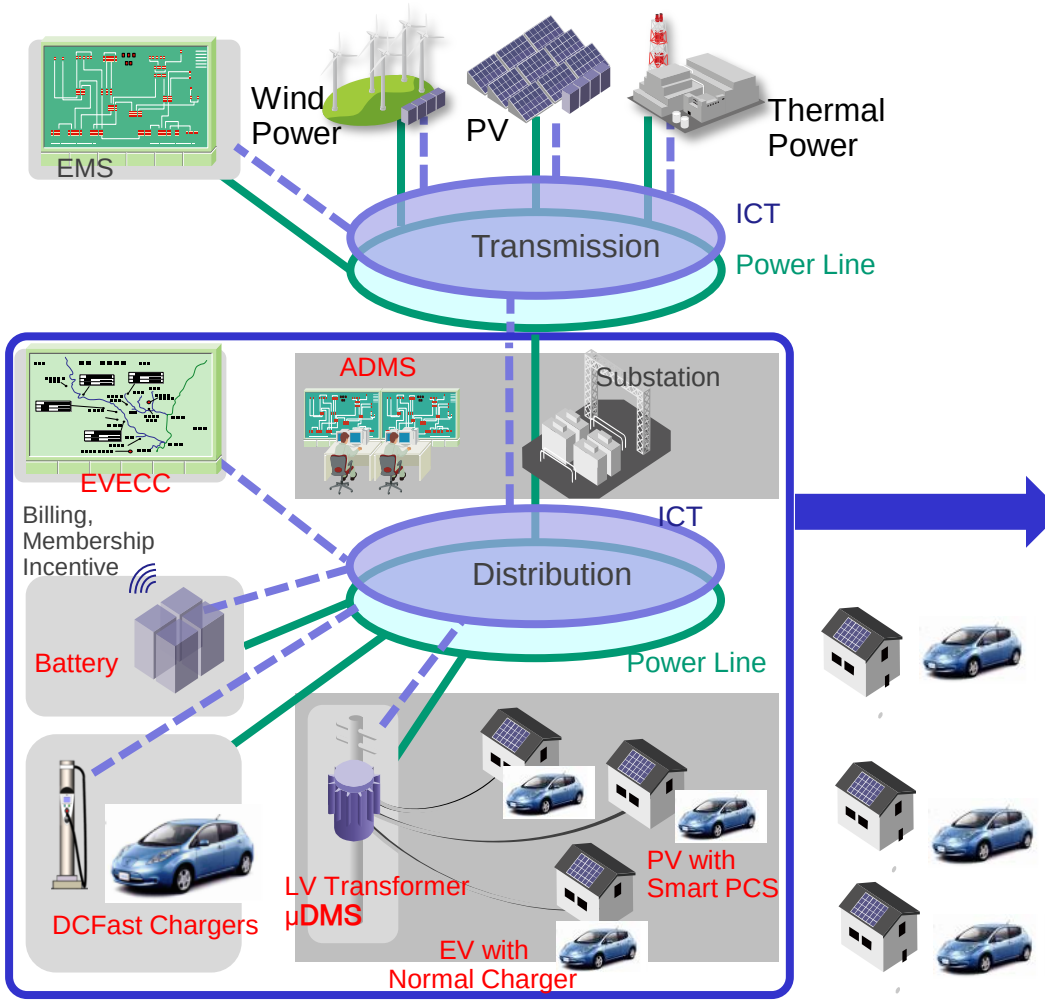
■ EV batteries are utilized as stationed Batteries for storing excess energy and controlling frequency fluctuation.



Demonstration will be implemented by 200 EVs and 40 Residences in whole island of Maui.
(Final target is to establish EV-Virtual Power Plant)

EVECC: EV Energy Control Center, ADMS: Advanced Distribution Management System, LV: Low Voltage, DOE: Department of Energy

2-5. JSM: Example of system operation

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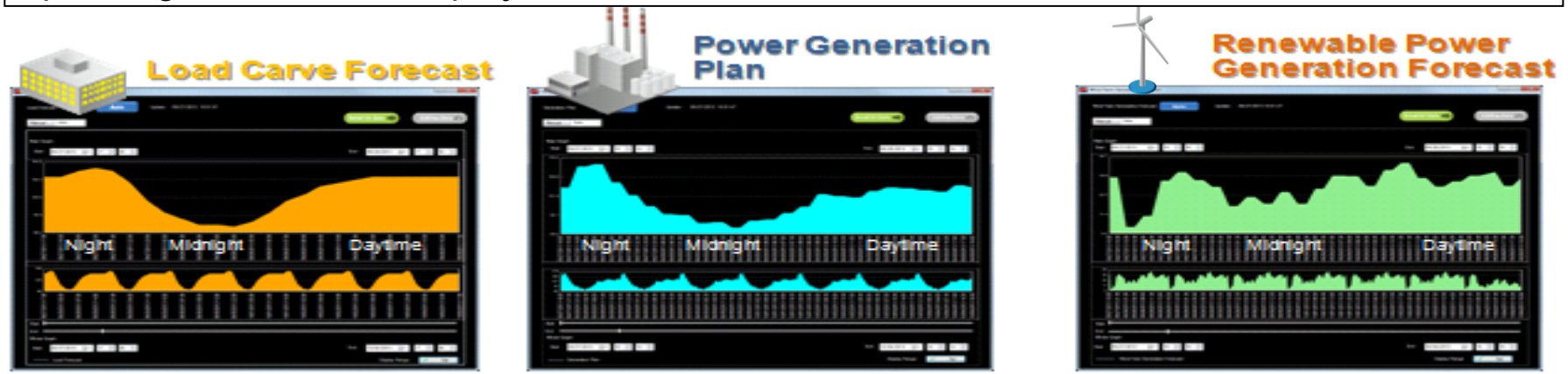
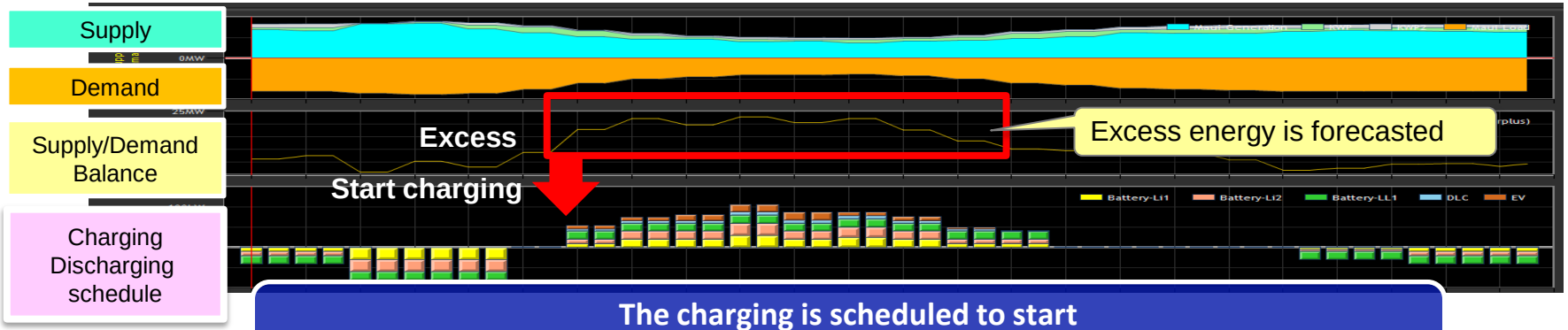
Maximum Utilization of Renewable Energy

Advanced load shift

Helps shift energy demand by integrating forecasts of renewable power generation with the operating schedule of the project's batteries.





The charging is scheduled to start when the balance would have excess supply

The conventional load shift technology + **Advanced**

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Stable Supply of Electric Power

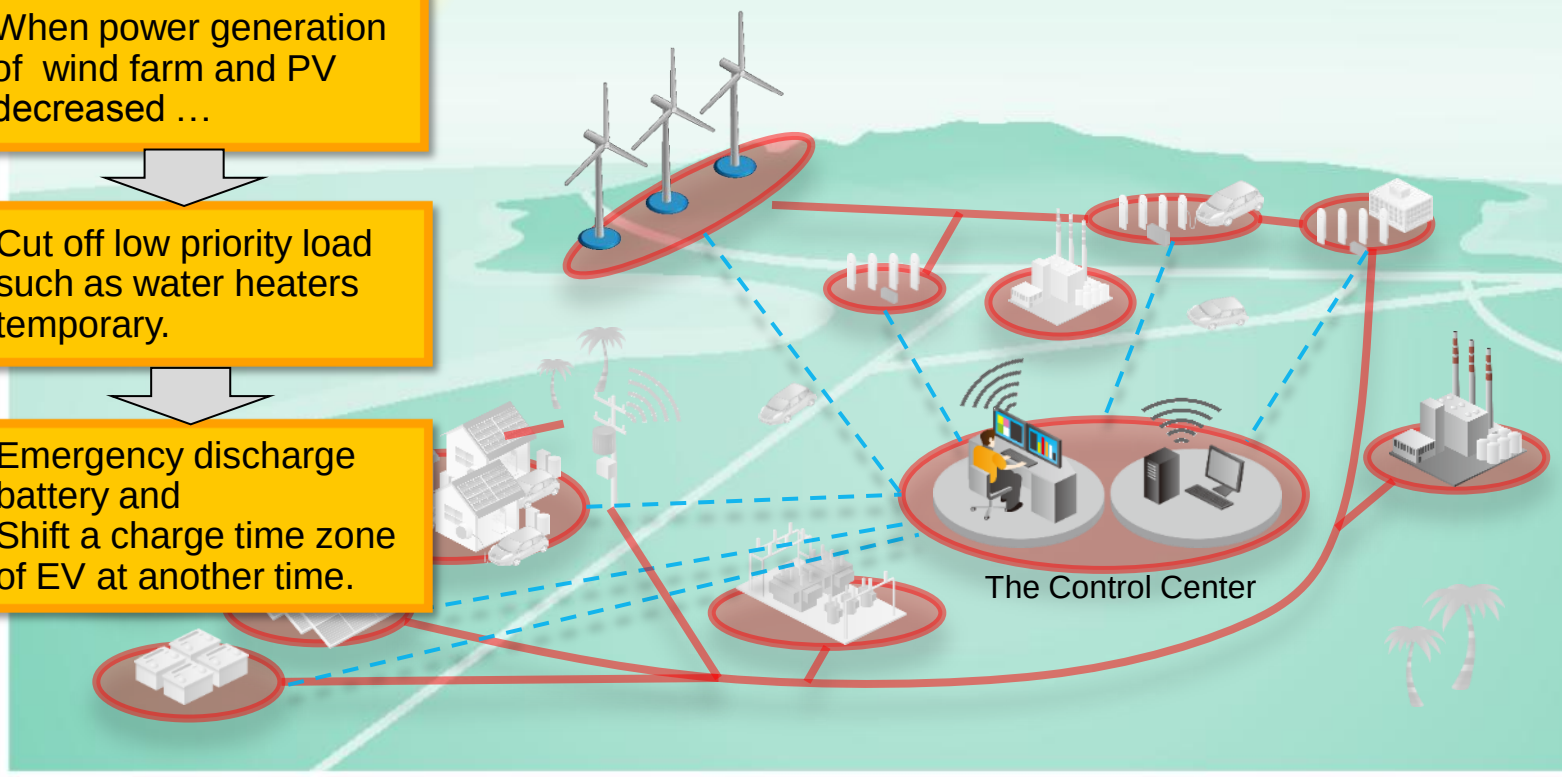
Emergency demand and supply control

Keeps the electric power system stable by controlling and helping to restore loss of balance between power supply and demand.

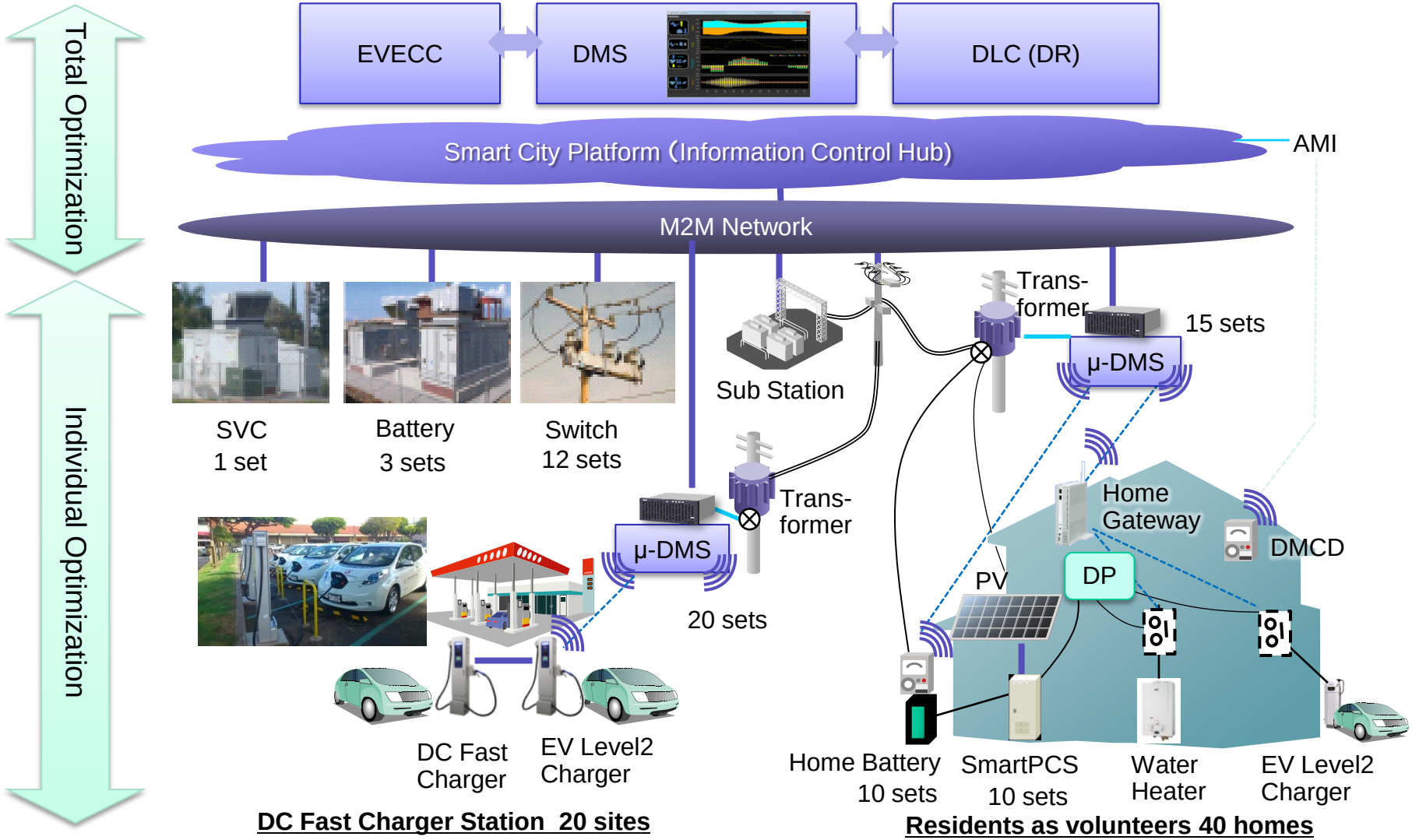
When power generation of wind farm and PV decreased …

Cut off low priority load such as water heaters temporary.

Emergency discharge battery and
Shift a charge time zone of EV at another time.



2-7. JSM: Hierarchical configuration

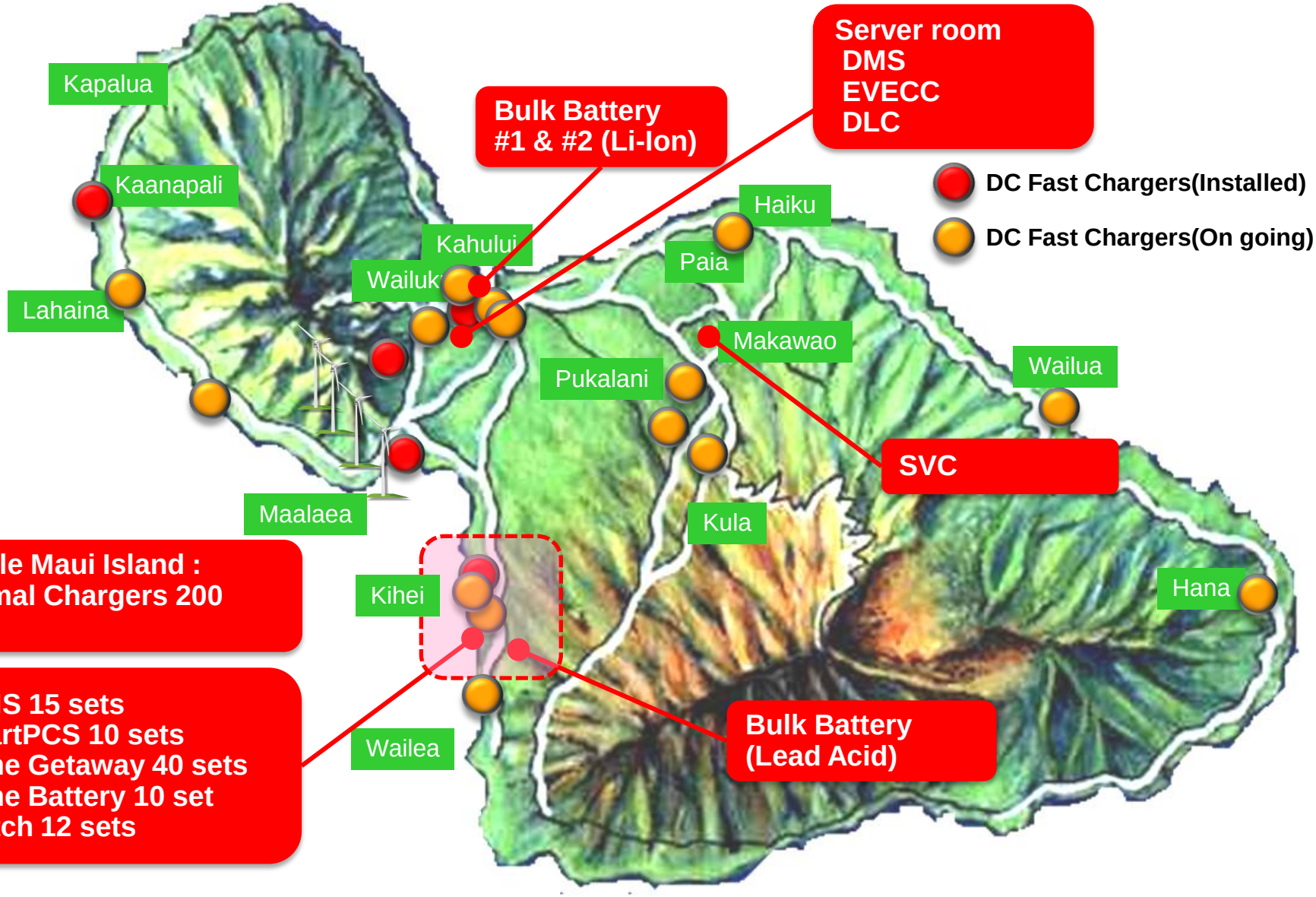


EVECC: EV Energy Control Center
DMS: Distributed Management System
DLC: Direct Load Control
DR: Demand Response

AMI: Advanced Metering Infrastructure
M2M: Machine to Machine
SVC: Static Var Compensator
DMCD: Data Measuring & Communication Device

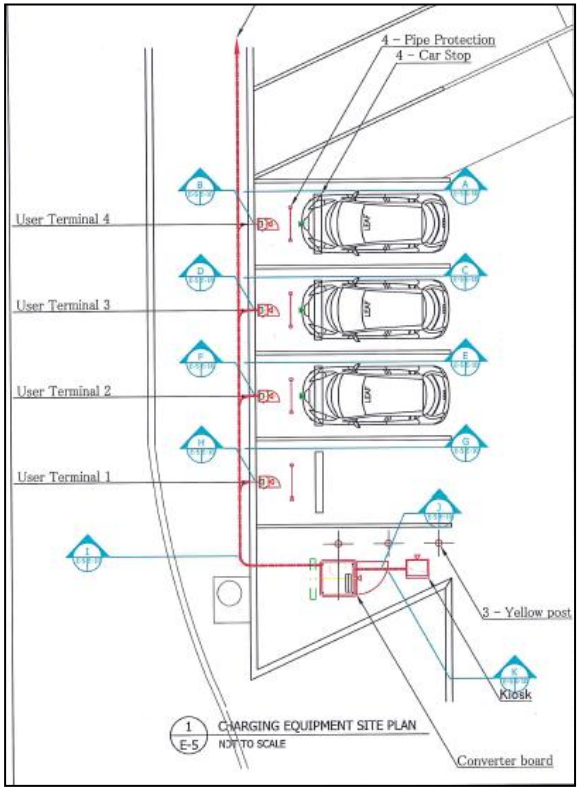
DP: Distribution Panel
PV: Photovoltaic
PCS: Power Conditioning System

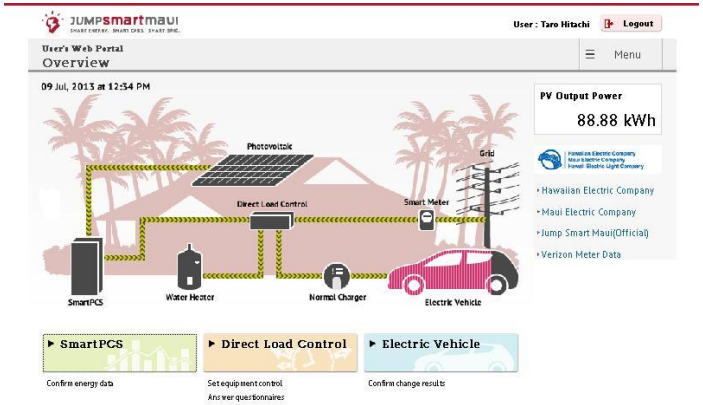
2-8. JSM: Locations of equipment



2-9. JSM: Example of DCFC installation

Volunteer recruit kick-off Ceremony
@ Queen Kaahumanu Center
Jun 15, 2013 4:30 pm - 6:00 pm





DCFC: Direct Current Fast Charger

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3. JUMPSmartMaui Ph2
4. Other solutions from Hitachi

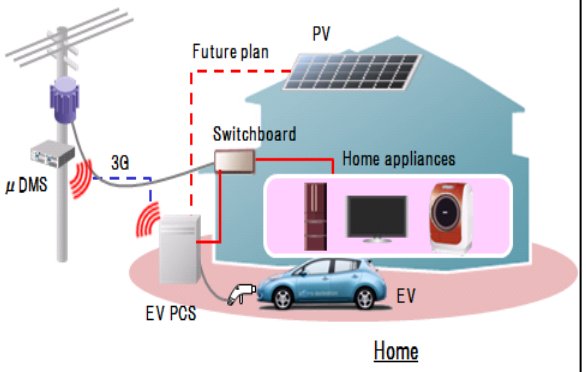
3-1. JSM Ph2: Overview

Phase2: Demonstration with “Dis-charging” function

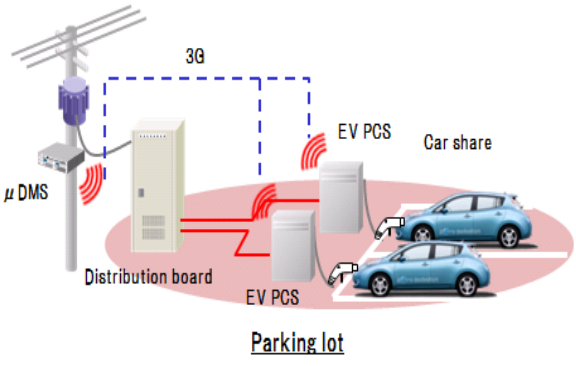
By demonstration in highly RE penetrated area like Maui:

Phase2 will evaluate using integrated, controlled EV battery discharge and management of distributed loads including V2X, as a “Virtual Power Plant (VPP) ”

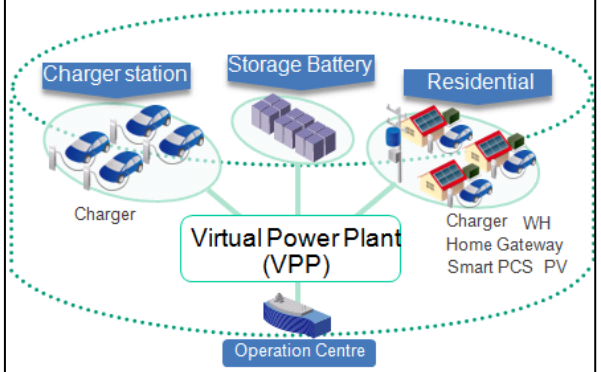
V2H (Vehicle to Home)



V2G (Vehicle to Grid)



VPP (Virtual Power Plant)



Virtual Power Plant (VPP):
Aggregating and optimizing available distributed energy resources (such as EV, storage and home side energy capability) to use optional energy sources

3-2. JSM Ph2: Virtual Power Plant with V2X

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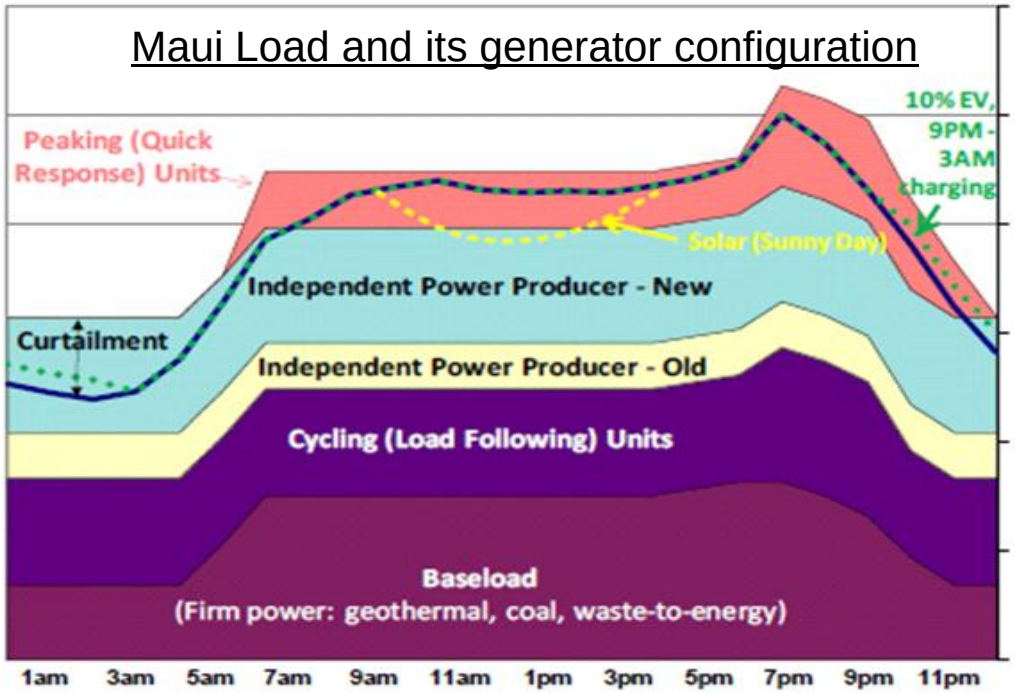
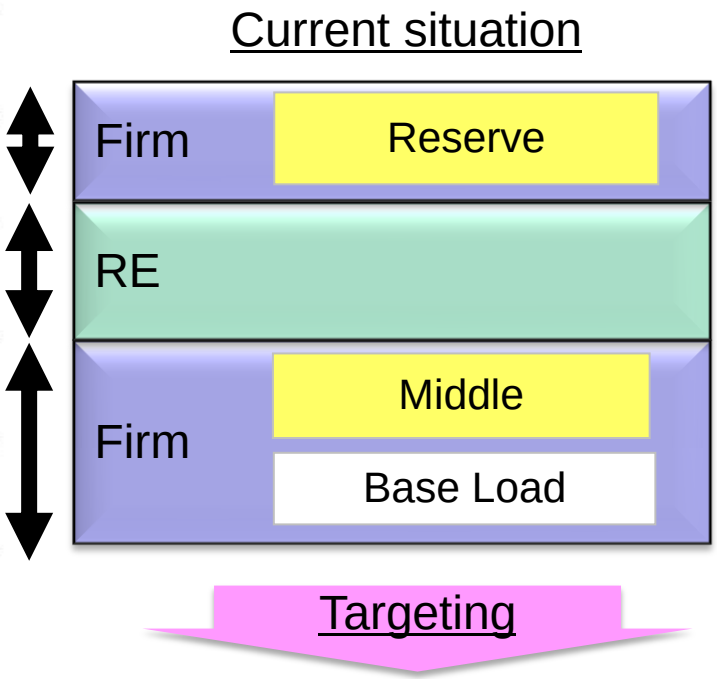
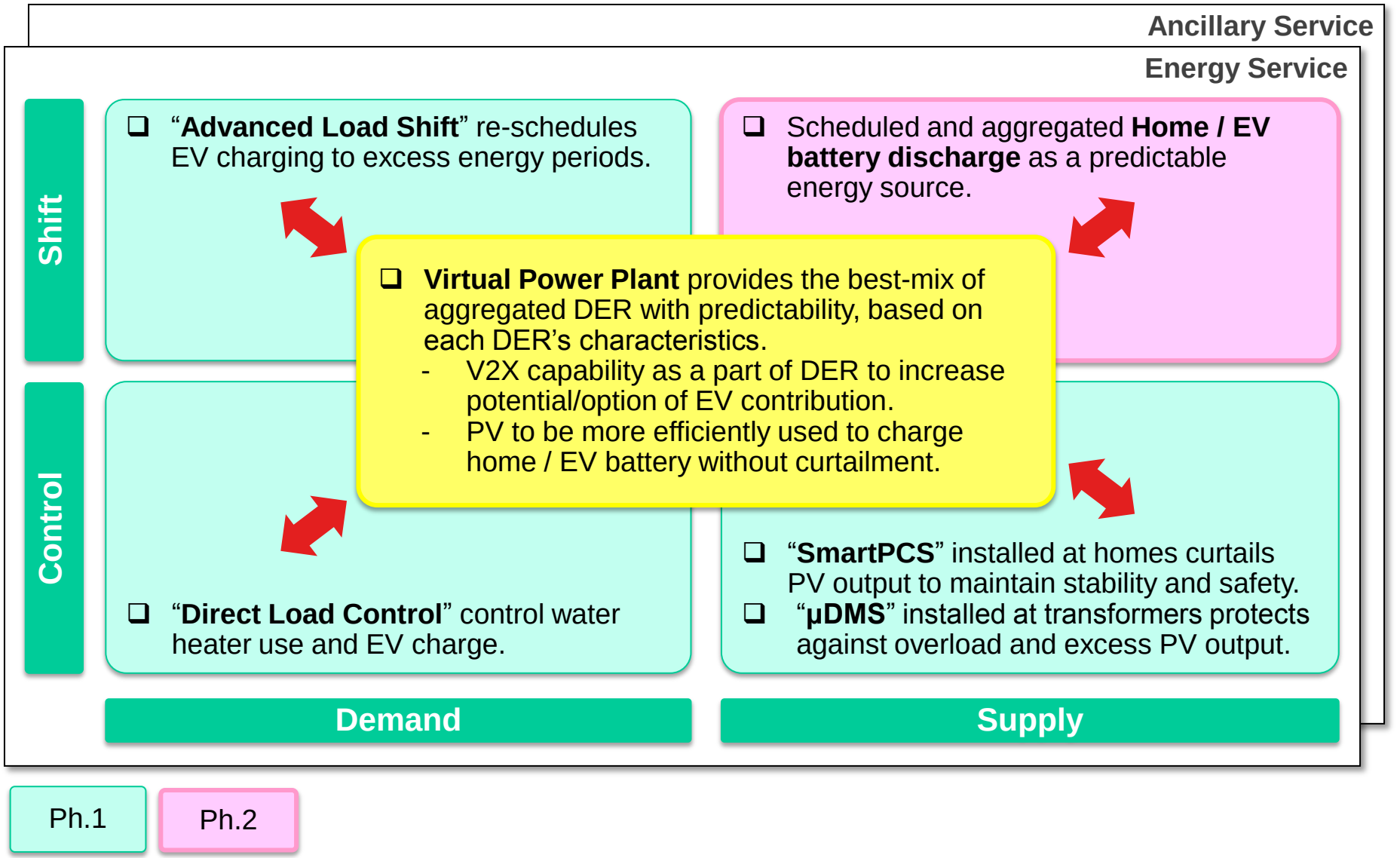
VPP system conducts integrated management of distributed energy resources while assuring the reliability, to provide energy supply and reserve power like a generation facility





Some parts of functionality of firm generations can be substituted by VPP as optional flexible source

Summary of JUMPSmartMaui



Ph.1 Ph.2

Summary of JUMPSmartMaui

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Ancillary Service

Energy Service

Shift

Contro

❑ "**Advanced Load Shift**" re-schedules
EV charging to ov

❑ Scheduled and aggregated **Home / EV**
as a predictable

Our goal is to establish a business model that can be adapted to other islands and other power grids around the world.

tails
and safety.
transformers protects
overload and excess PV output.

❑ "**Direct Load**
heater use and EV charge.

Demand

Supply

Ph.1

Ph.2

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4-1. Recent microgrid project: Kashiwa-no-ha

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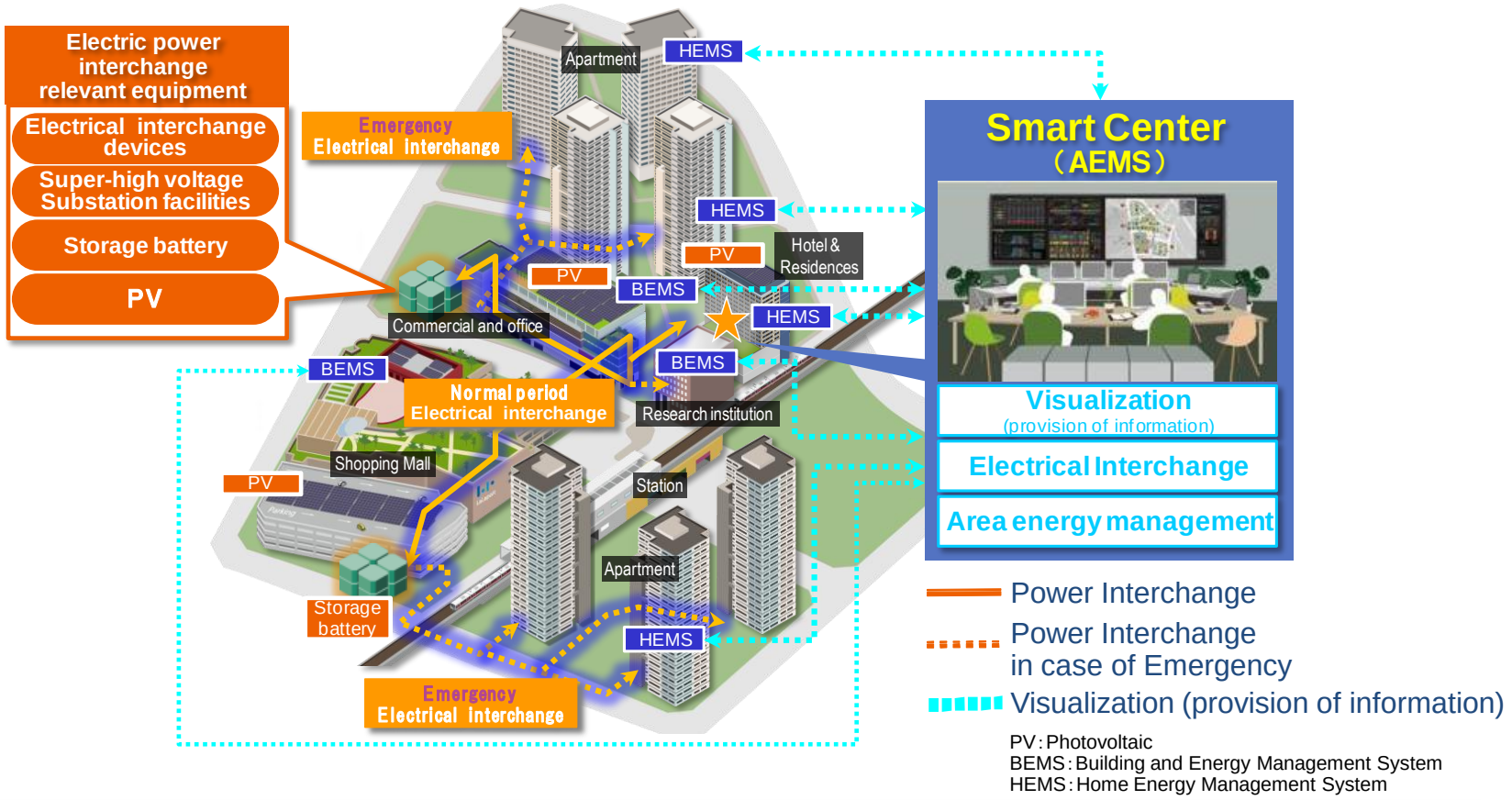
"Smart Center" manages regional energy

- Visualize energy consumption such as electricity, water and gas.
- Interchange power supply between different blocks in the town.



- "Kashiwa-no-Ha Smart Center" has begun operations from May, 2014.
- Aiming to provide new services by utilizing Big Data.

4-2. Kashiwa-no-ha Smart-City (Value 1 of AEMS)

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Value 1 Promote Eco-friendly Lifestyle — The Action Navigation

Smart Center

- The support through advice, such as energy saving residents
- Contributing through advice to energy interchange
- Instructions action to tenants to imposition of BCP

Electricity, Water, Gas consumption

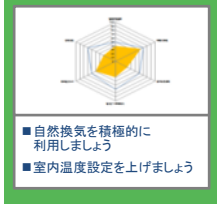
Eco navigation screen
(Reference Example)

The Action Navigation

The visualization of energy consumption

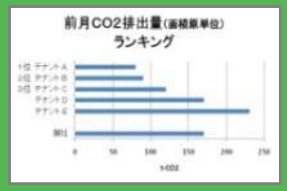
Visualization of the energy consumption of each tenant and the entire

Operational advice



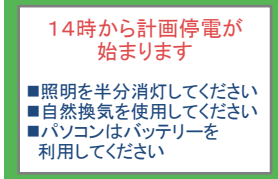
Manifested in radar chart a KPI number of items.
Shows operational advice to suit the condition of the apartment and climate.

View of benchmark



Comparison in the same category tenants, and housing

Power saving advice (in emergency mode)



The view on the screen shows how to operate equipment

4-3. Kashiwa-no-ha Smart-City (Value 2 of AEMS)

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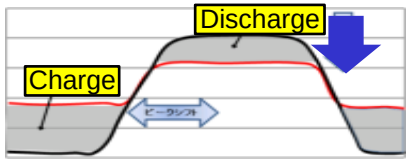
Value 2 Reduce CO_2 emission and electricity cost **Power Interchange**

Normal mode **Electric power interchange between buildings of different power peaks** ▶ **Lower electricity cost through peak cut/shift in total**



148 city block
Storage battery
PV
Commercial and office building
Hotel and Residential building
Grid power

Peak cut in normal times

Power Interchange device

150 city block (LaLaport)
Storage battery
PV
Shopping Mall
Grid power

[Hitachi, Ltd.]

To solve the problem of mixing different system power by converting the AC ⇔ DC ⇔ AC electricity once

147 city block (2nd avenue)
Housing
Grid power

151 city block (1st avenue)
Housing
Grid power

The AEMS manages PV, batteries and the power interchange equipment to carry out peak cut/shift through controlling energy flow between the city blocks.
The Power interchange equipment and self-power line, to carry out peak-shift & peak-cut across the city block.
It will contribute to low-carbon of the whole city.

4-4. Kashiwa-no-ha Smart-City (Value 3 of AEMS)

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Value 3 Maintain safe and secure life in case of blackout **BCP/LCP measures**

Emergency mode **Self-consumption without power supply from the grid** ▶ **Continuation of business and life with self-generated power supply**

148 city block
- Storage battery
- PV
- Emergency gas power generation
- Commercial and office building
- Hotel and Residential building

Grid power

Power Interchange device

150 city block (LaLaport)
- Storage battery
- PV
- Emergency gas power generation
- Shopping Mall

Grid power

147 city block (2nd avenue)
- Housing

Grid power

151 city block (1st avenue)
- Housing

Grid power

Emergency power supply to residential blocks

In case of disaster, and to provide power to life support loads, carve-up in the city district energy.

Example :
- Emergency elevator
- Emergency lighting
- available power more than 50% of normal

4-5. Example configurations for island microgrid

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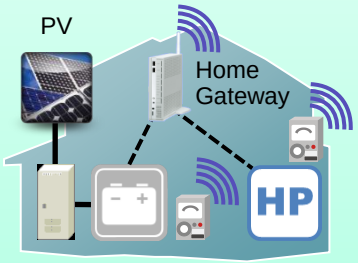
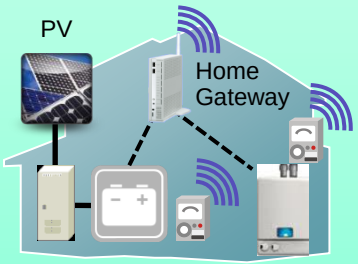
Smart Islands ICT Platform

Connectivity via Superfast Broadband

HEMS to optimise self-consumption and enable Tele-care



Smart PCS + Battery Heat Pump

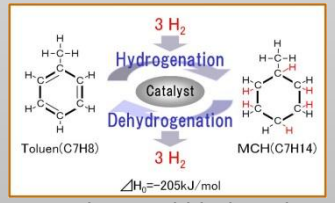


Smart PCS + Battery mCHP

Energy Storage and Backup Generation

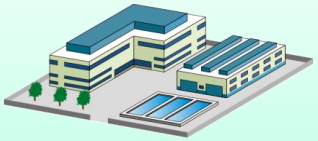
Community Energy Storage

Backup Diesel Generation

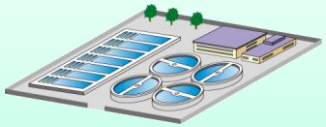


Carbon-Hydride (MCH) Energy Storage System

Integrated Seawater Desalination and Sewage-reuse



Seawater RO Desalination



RO Sewage Treatment

System Integration of Other Renewables

Small Scale PV

Wave Generation

Wind

EV Charging Infrastructure and Chargers

EV Rental Scheme

EV Quick Chargers

4-6. Example of timeline & FS items

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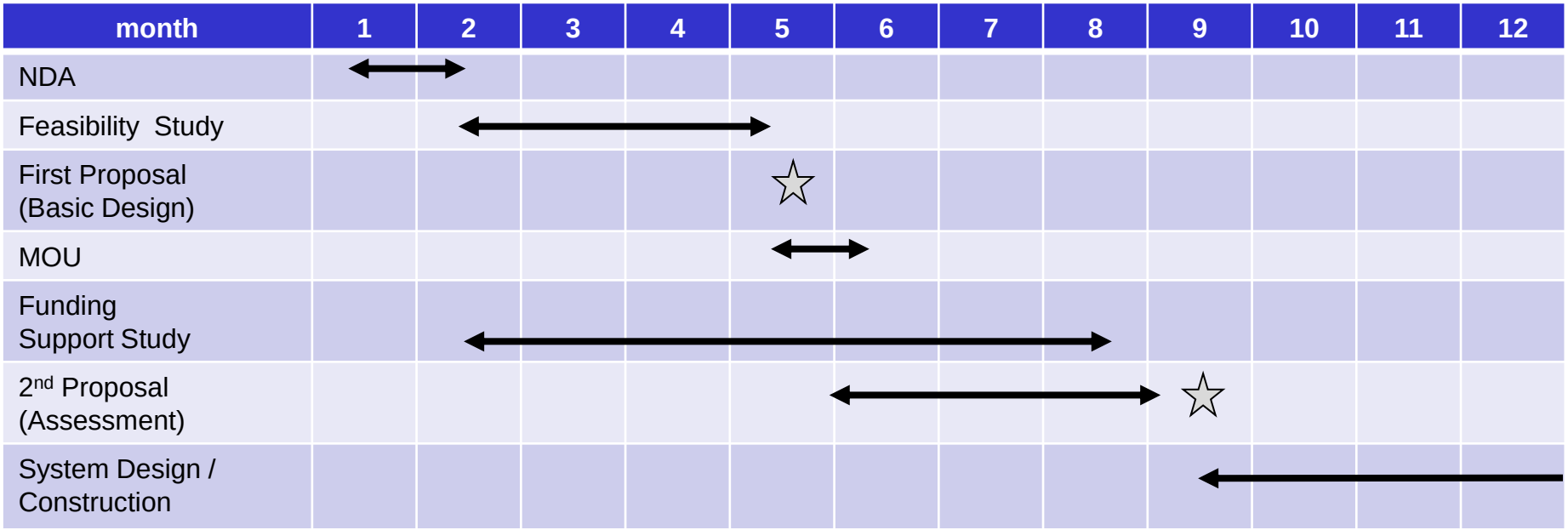

Interviewee on FS	Methodology	Key Outcomes
Government	Interviews- Leadership, transport, estates, strategy, healthcare etc.	• Qualify strategic goals & share preliminary proposals • Identify specific opportunities / challenges with specialists
Electric and Business segment	Focus group	• Understanding existing business challenges • Explore perceptions of Smart island opportunities
Residents	Focus group	• Understand existing challenges • Gauge appetite change • Explore perceptions of Smart island opportunities
RE cooperative	Focus group or Interview	• understand progress / programs to date • Explore future opportunities / goals aligned to Smart Island
Local engineers	Interviews – Energy, waste, water etc.	• Current infrastructure – technical assessment & challenges • Views on Smart Island opportunities


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