

Distributed Energy Resources and Research Activities in CRIEPI related to DER Platform Requirement

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Stance of ENIC and presentation outline

The research fields of ENIC (Energy Innovation Center) of CRIEPI (Central Research Institute of Electric Power Industry) are demand side and distribution grid, which have been in great transformation with the massive integration of renewable energy, penetration of ICT (AI/IoT), and changes in customers.

Our mission is to find solutions from the End Use of energy supply & demand chain.

Points:

1. Two categories of DERs depending on the relation with customers
2. EcoCute, an attractive device with high potential as DER
3. CRIEPI's research activities related to analysis tools for DER Platform

1.

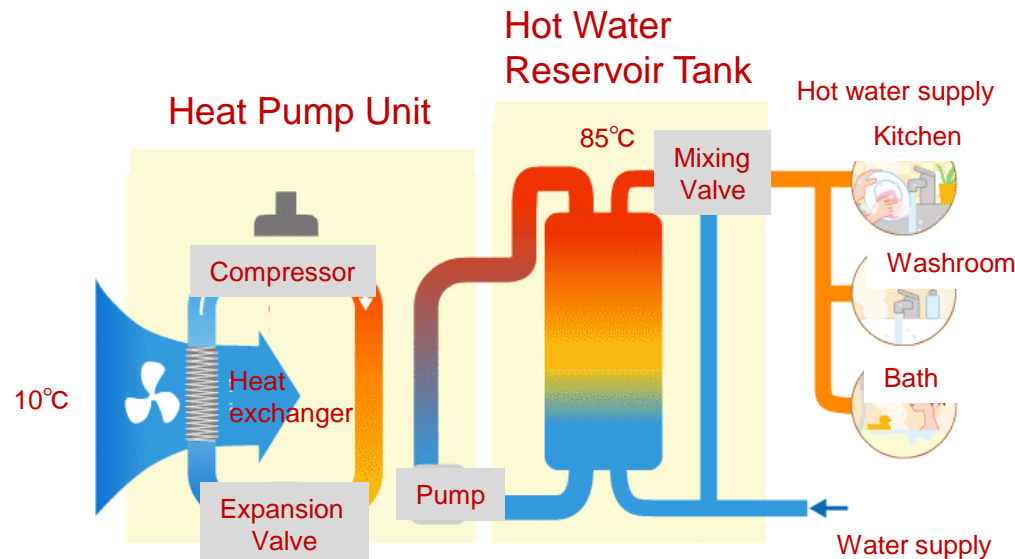
Two categories of DERs depending on connected line voltage class and the relation with customers

Line Voltage	PV	Battery	EV	EcoCute	Combined Heat and Power	WF	Bioamss, etc	Emergency Generator
	Autonomous Decentralization Control or Hybrid Control							
100-200V 1 φ	Roof top PV(>10kW)	ZEH, ZEB Battery for Emergency	V2H V1G, V2G	HP with Hot Water Tank	Fuel Cell			Diesel
200V 3 φ		ZEB	Fast Charge	HP with Hot Water Tank				Diesel
6.6kV	Mega solar	ZEB For Grid operation	Fast Charge		Gas-Cogeneration	WF	Biomass	Diesel Gas-turbine
Over 20kV class	Mega solar	For Grid operation				WF	Biomass	
	Central Control							

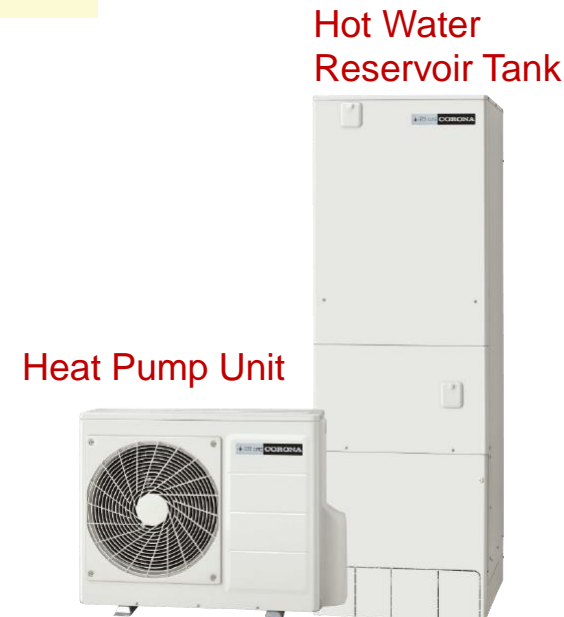
2. EcoCute is an attractive device with high potential as DER

1. Climate in Japan is very adequate for atmospheric heat source heat pump
2. Energy consumption for hot water supply is $\sim 30\%$ of residential sector in Japan
3. EcoCute is a high efficient (COP ~ 4) electric heat pump, water heating and supply system, equipped with a hot water reservoir tank and using low GWP refrigerant. More than 6 million units have already been installed.

Hot water is produced by day time PV, and can be used at night time.



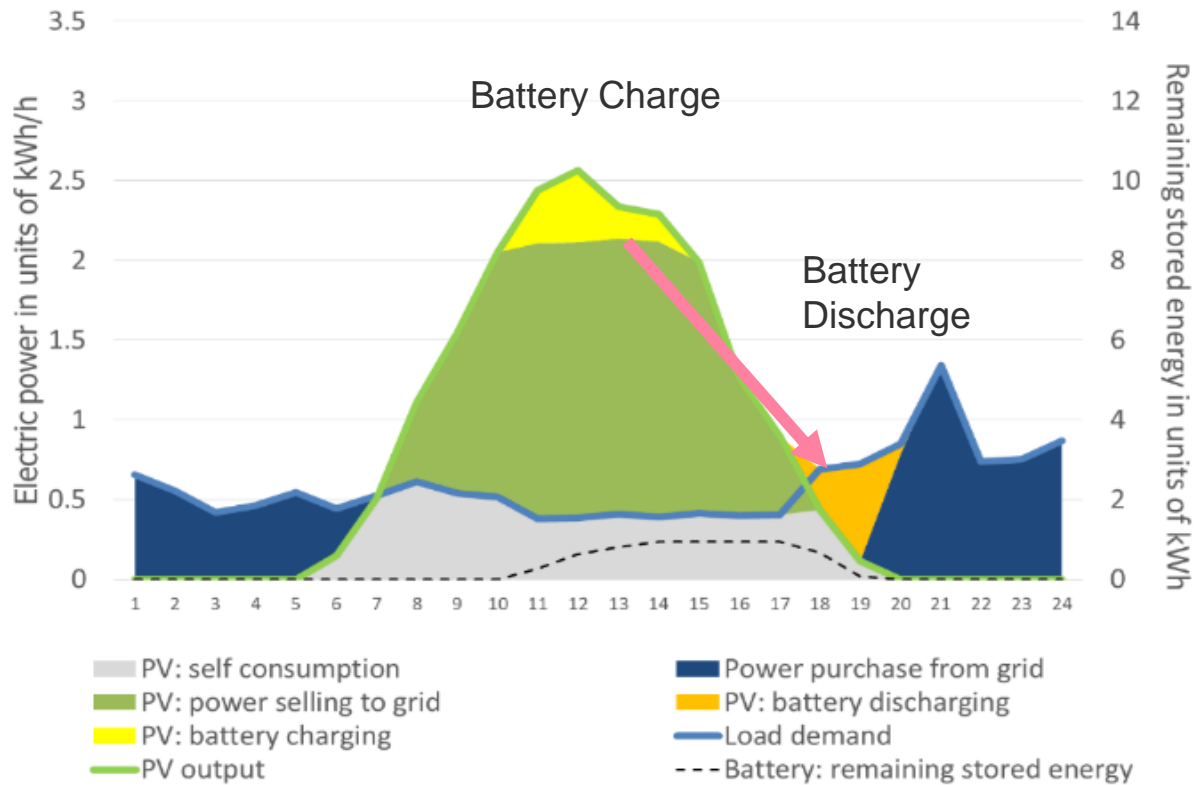
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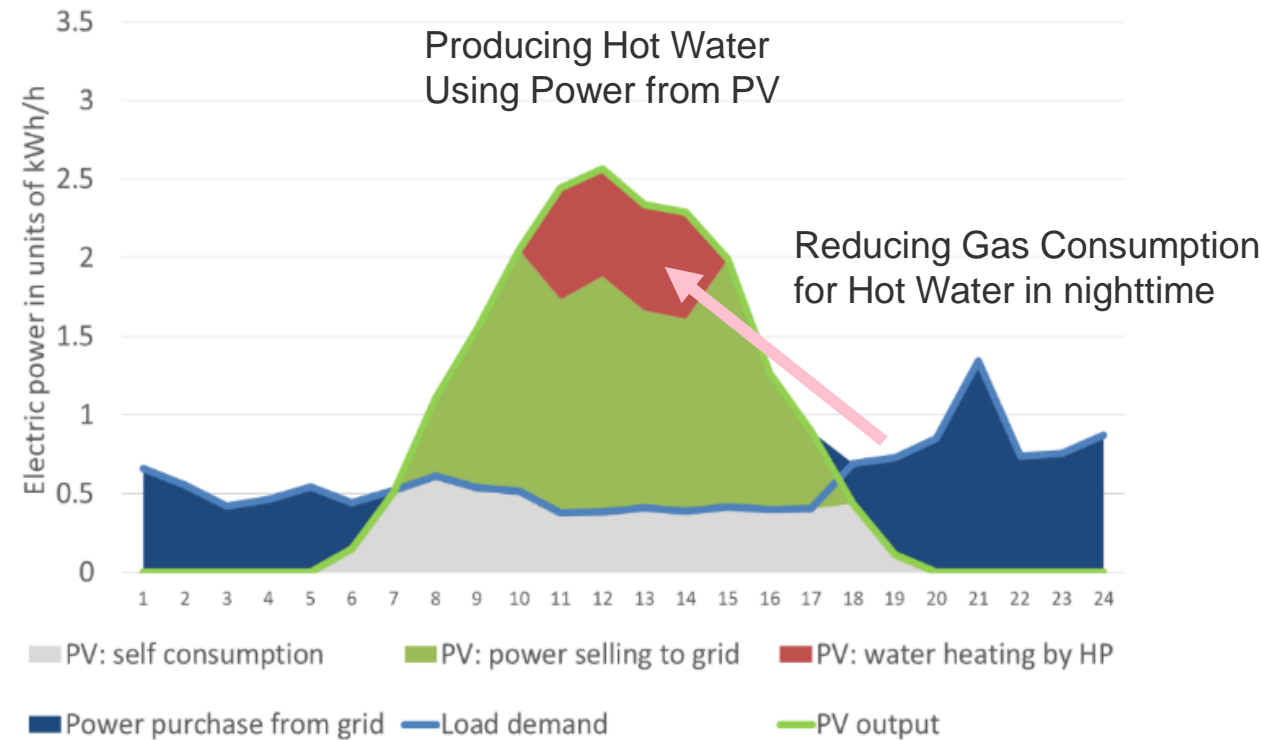
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Heat pump can create electricity demand in daytime

— Simulation results of absorbing excess PV power using heat pump and battery —



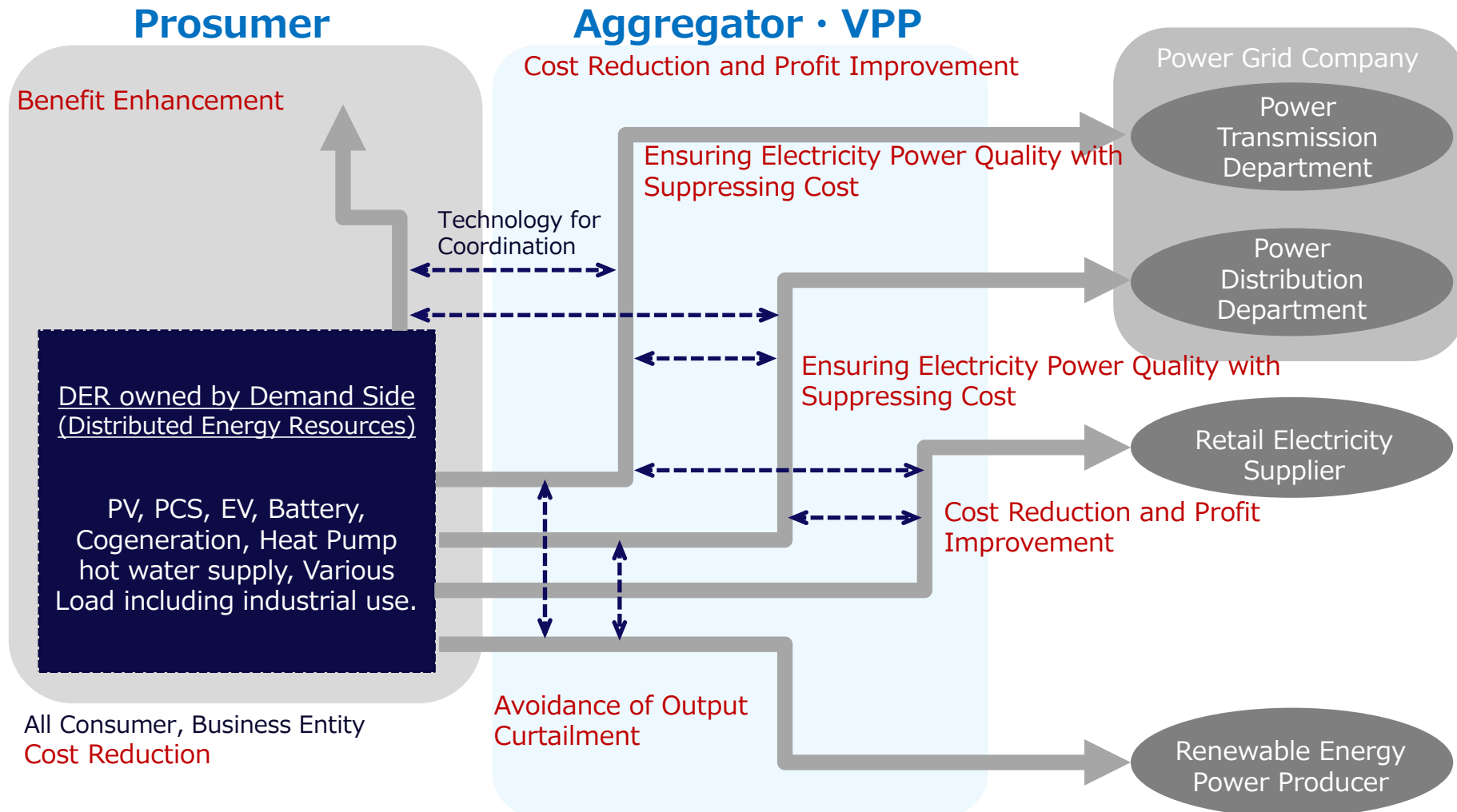
(a) PV + Battery(2kWh)



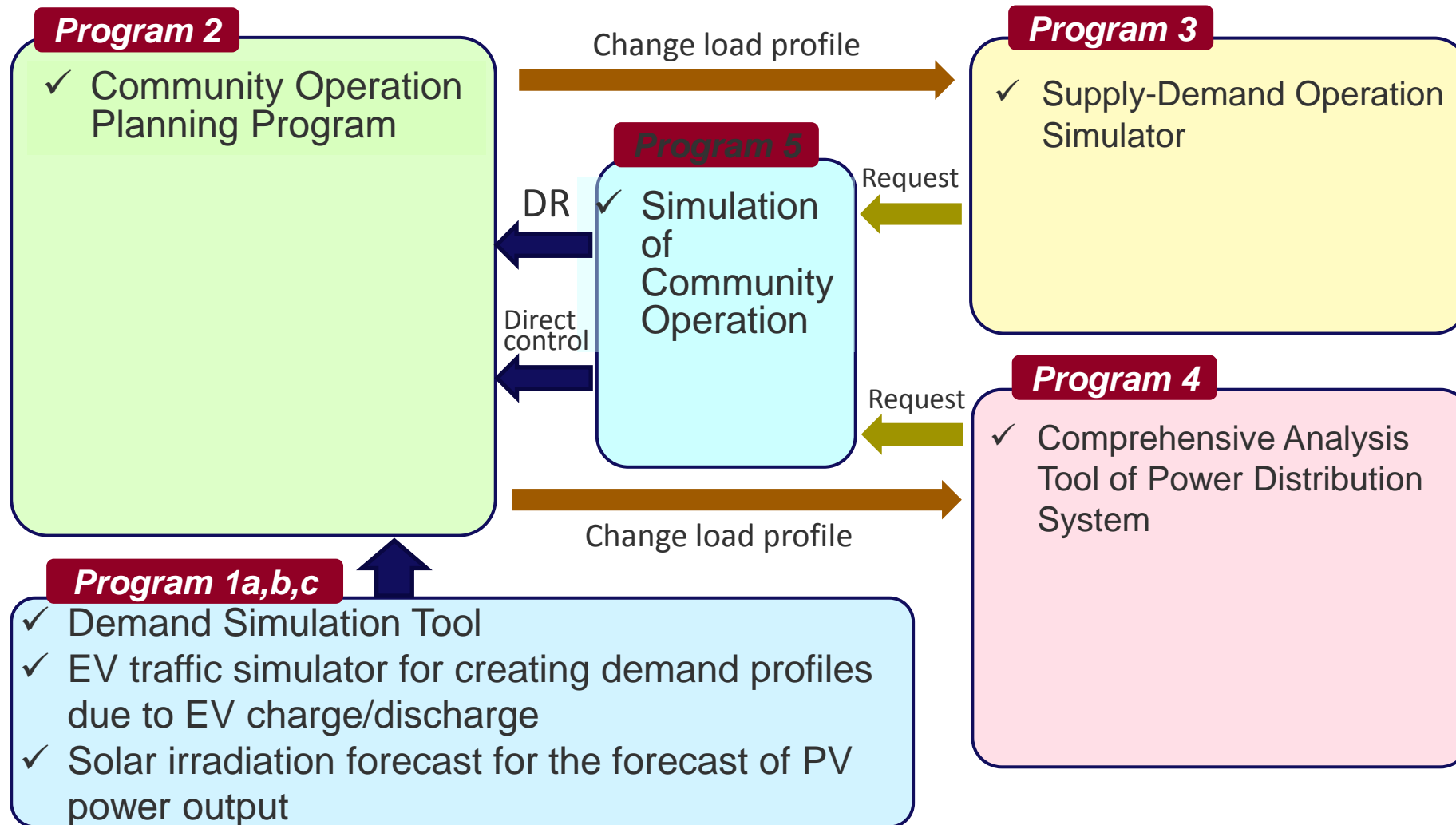
(b) PV + Heat Pump

3. Schematic of Coordinative Structure for DER Management

◆ Building a Win-Win Relationship between Various Players is essential

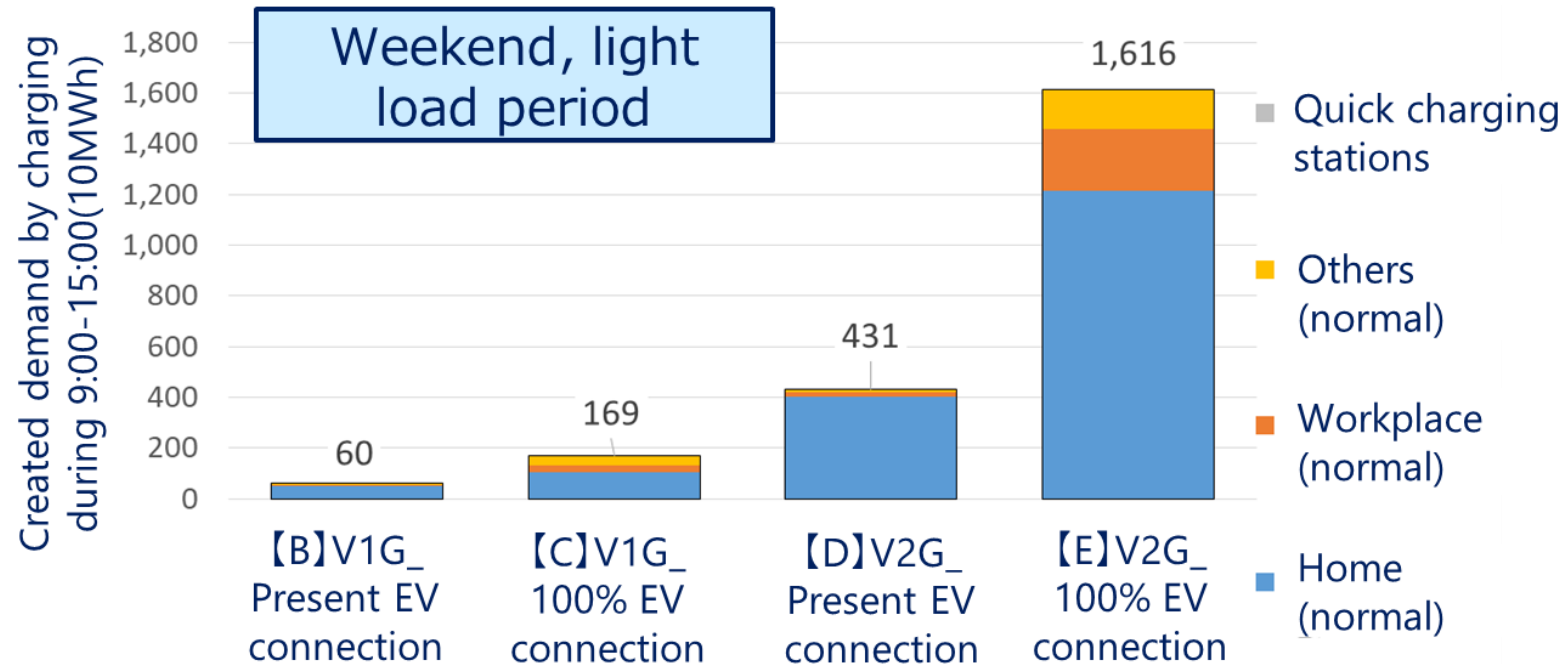


Comprehensive simulation platform to evaluate cooperative operation techniques between supply side and demand side



One Example of DER Simulation Study

Estimated demand creation potential in southern area of Japan with EV



- Wide spread of V2G charging points, especially at homes, and increasing the possibility of EV connection to the charging points can contribute to the demand creation potential by EVs
- Our estimation shows that the case of V2G_100% EV connection gives a maximum potential of 16160MWh/6hours.

Summary

1. It is important to consider two DER categories depending on the relationship with customers in order to design appropriate DER management.
2. EcoCute can be an attractive DER to absorb daytime surplus PV power by time shifting electricity demand, and by creating daytime electricity demand.
3. Building a win-win relationship between various players concerned with DERs is essential. Various analysis tools are inevitable for designing of such Platform for DERs. CRIEPI is working to develop each essential analysis tools.

Colleagues contributed to this presentation

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- Dr. Hiroshi Asano
- Dr. Tomohiko Ikeya
- Mr. Eitaro Oomine
- Dr. Hiroyuki Hatta
- Ms. Madeleine Carlier

Thank you for your attention!