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技研
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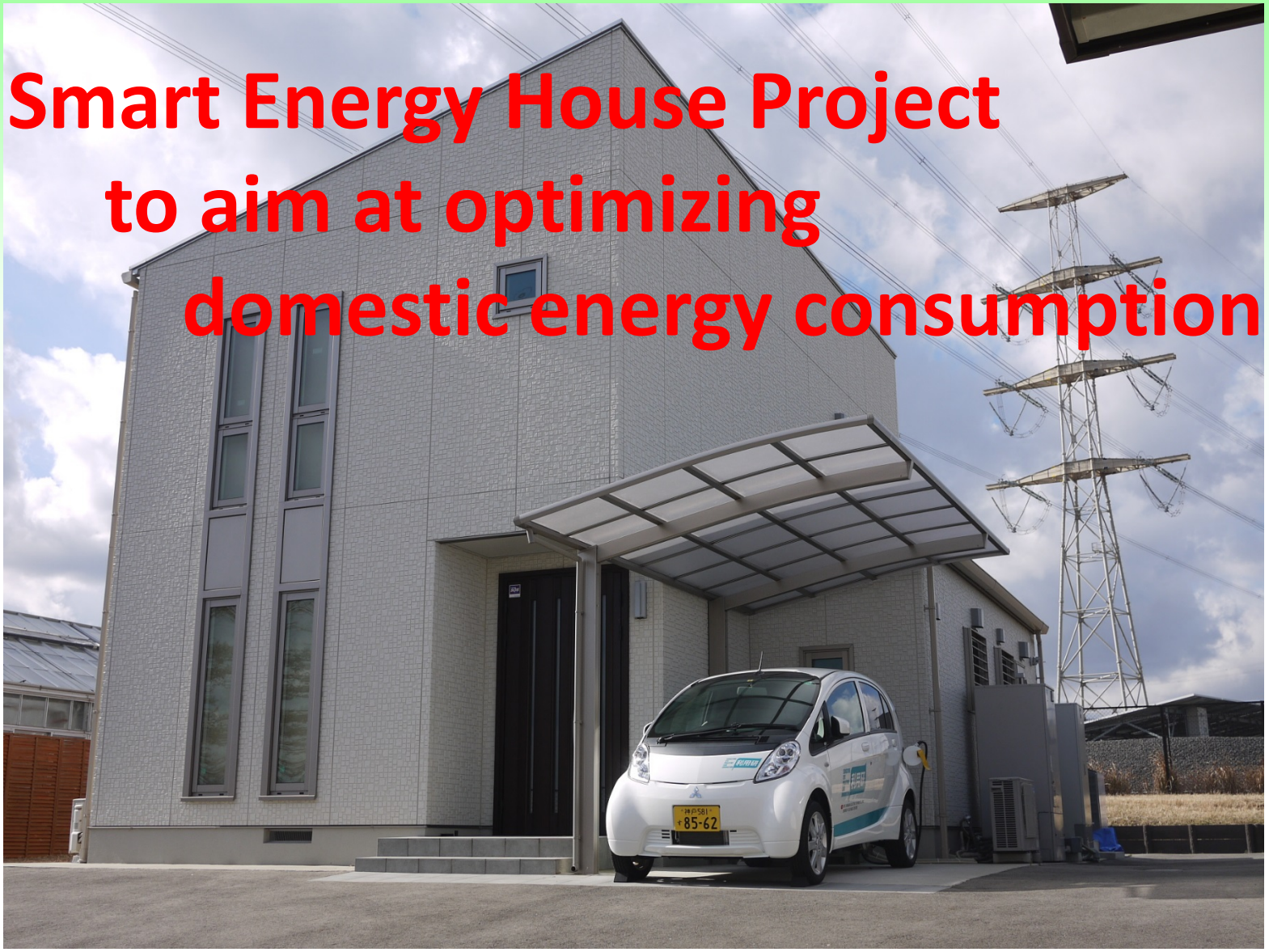
Smart Energy House Project to aim at optimizing domestic energy consumption



Kansai's ad mascot
"Hapita"

関西電力
power with heart

The Kansai Electric Power Co.,Inc.

1.Overview of Smart Energy House Project

Smart Energy House Project

- More and more need for energy conservation, demand cut and energy security is argued especially after The Great East Japan Earthquake in 2011.
- Kansai conducted Smart Energy House Project to fulfill the need above, integrating its various technologies.

Kansai Science City

Location: Seika City, Kyoto pref.

Diagram of Smart Energy House

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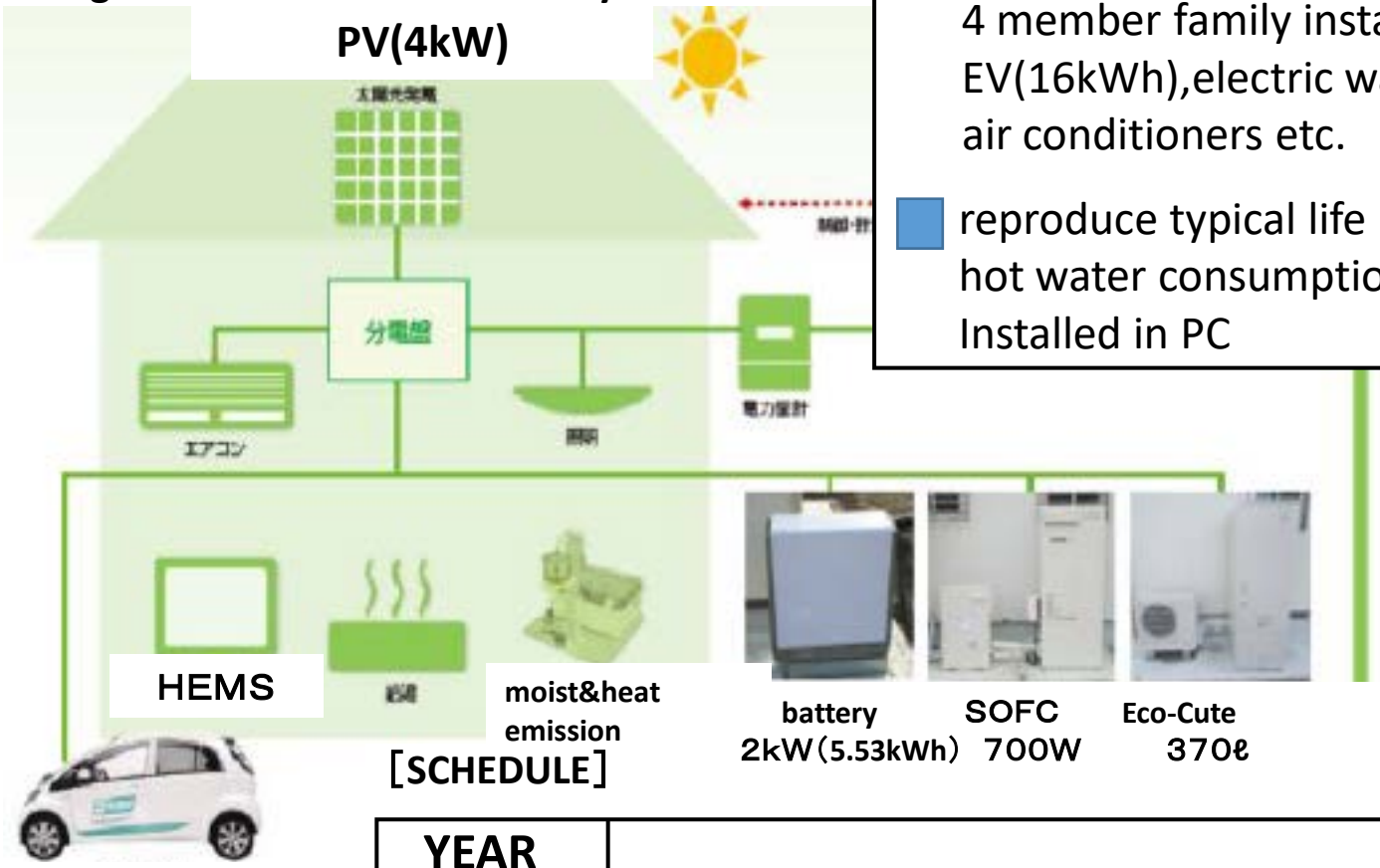
Average house for 4 member family



- detached house with average floor area for 4 member family installed with PV(4kW), EV(16kWh),electric water heater(Eco-Cute), air conditioners etc.
- reproduce typical life pattern of power and hot water consumption based on the schedule Installed in PC

[SCHEDULE]

YEAR	
2013	basic measurements, comparison between Eco-Cute and SOFC
2014	combination of PV, SOFC and stationary battery/ self-sustaining/ HEMS
2015	V2H /VPP

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Equipment of Smart Energy House

Moist&heat emitter
(human body simulator)

Fuel cell (SOFC 700W)

Lithium ion stationary battery
(2kW 5.53kWh)

Interior of the house

EV connected to EV-PCS

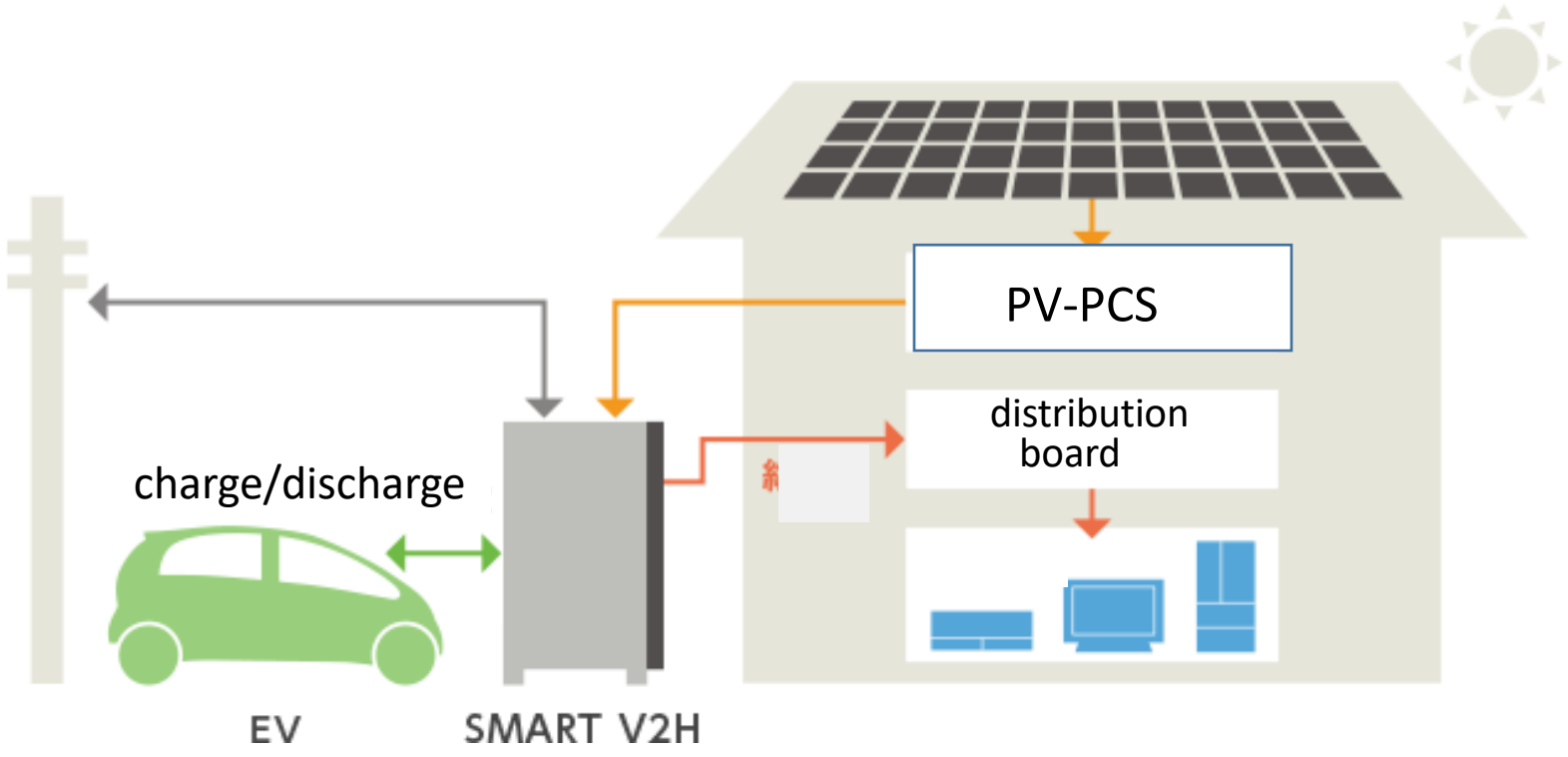
Electric water heater “Eco-Cute”(370liter)

Overall Schedule

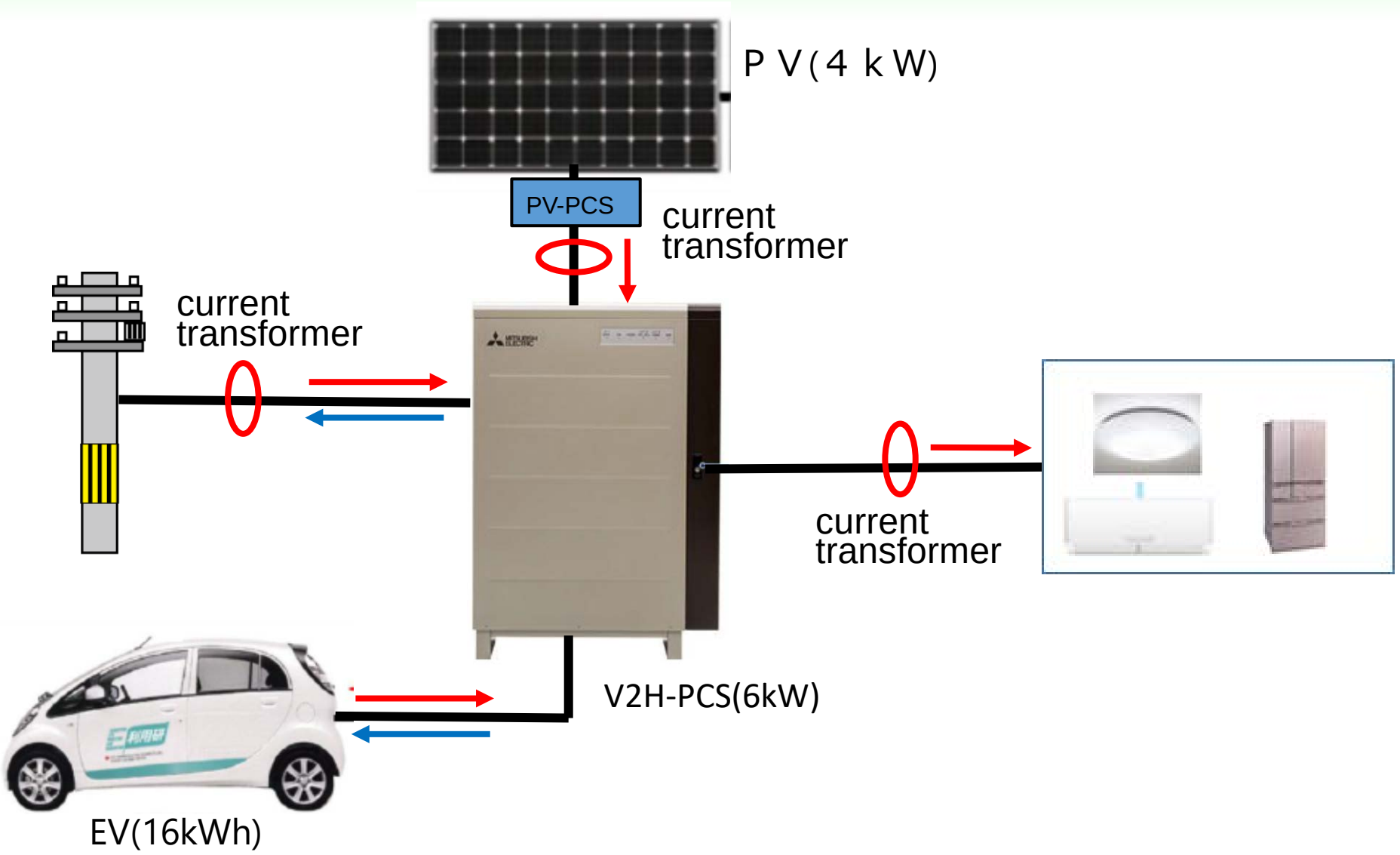
	2013	2014	2015
1.Basic Measurements	Basic measurements of SOFC, Battery etc.		Basic measurements of EV
2.Combination of PV, SOFC and Batt	Optimizing combination of PV, SOFC and Battery		
3.Self-Sustaining for Emergency	Prototype V2H-PCS		Commercial V2H-PCS
4.V2H			Combination of V2H and Eco-Cute
5.VPP			VPP through Open ADR&ECHONET Lite

2.Demonstration of V2H

V2H system integrating PV, EV and system power supply

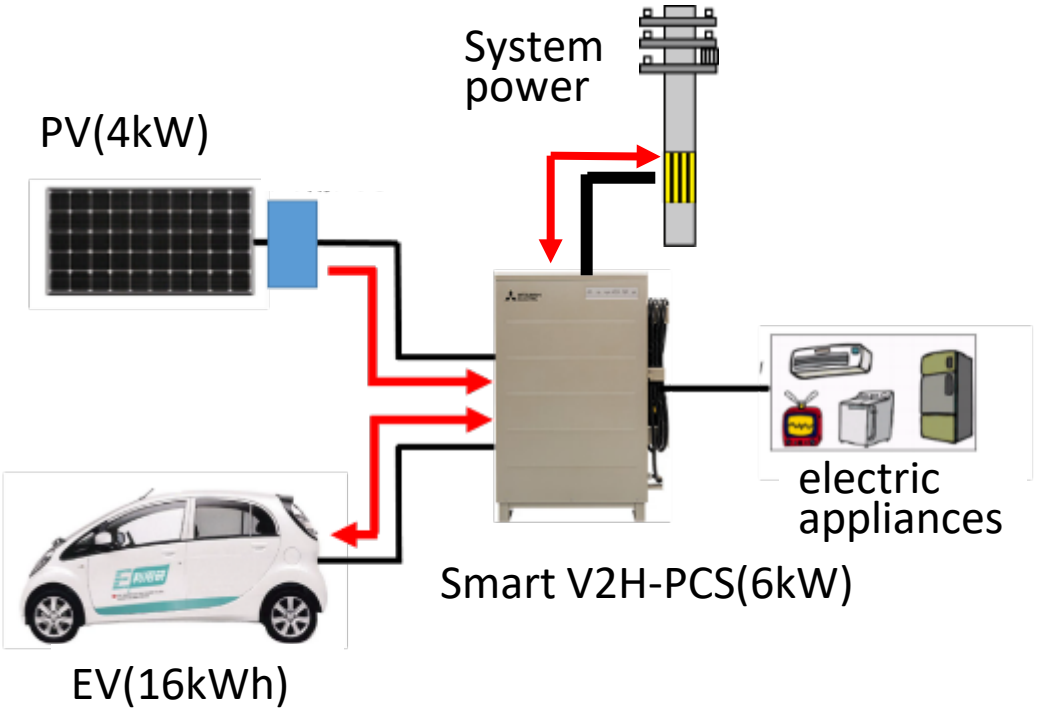


Smart V2H-PCS



Features of Smart V2H-PCS

- can supply power to household, integrating PV, EV and system power supply seamlessly without momentary outage
- connector based on CHAdeMO with rating of 6kW can charge EV in half a time compared with 200V regular connector
- can supply power even in case of utility outage with discharging EV and PV surplus without momentary outage



Operation modes of Smart V2H-PCS

mode	
Economic mode1 (maximize SELL)	chrging EV at cheap price at night, discharging to household during the day, maximizing SELL of PV power
Economic mode2 (sell Pv surplus)	supplying to household with PV and selling PV surplus to the utility during the day charging EV at cheap price at night and discharging to household
Green mode （charge EV with PV surplus）	supplying to household with PV and charging PV surplus to EV during the day discharging to household at night
Charging mode	charging EV with system power

Preconditons of experiments

1.Time of use of EV

Ev runs between 10:15-12:00 for 15km

2.Energy consumption of EV

Energy consumption of EV is as follows based on the measured value on the site
［summer：5.6km/kWh，mid：8.3km/kWh，winter:4.5km/kWh]

3.SOC

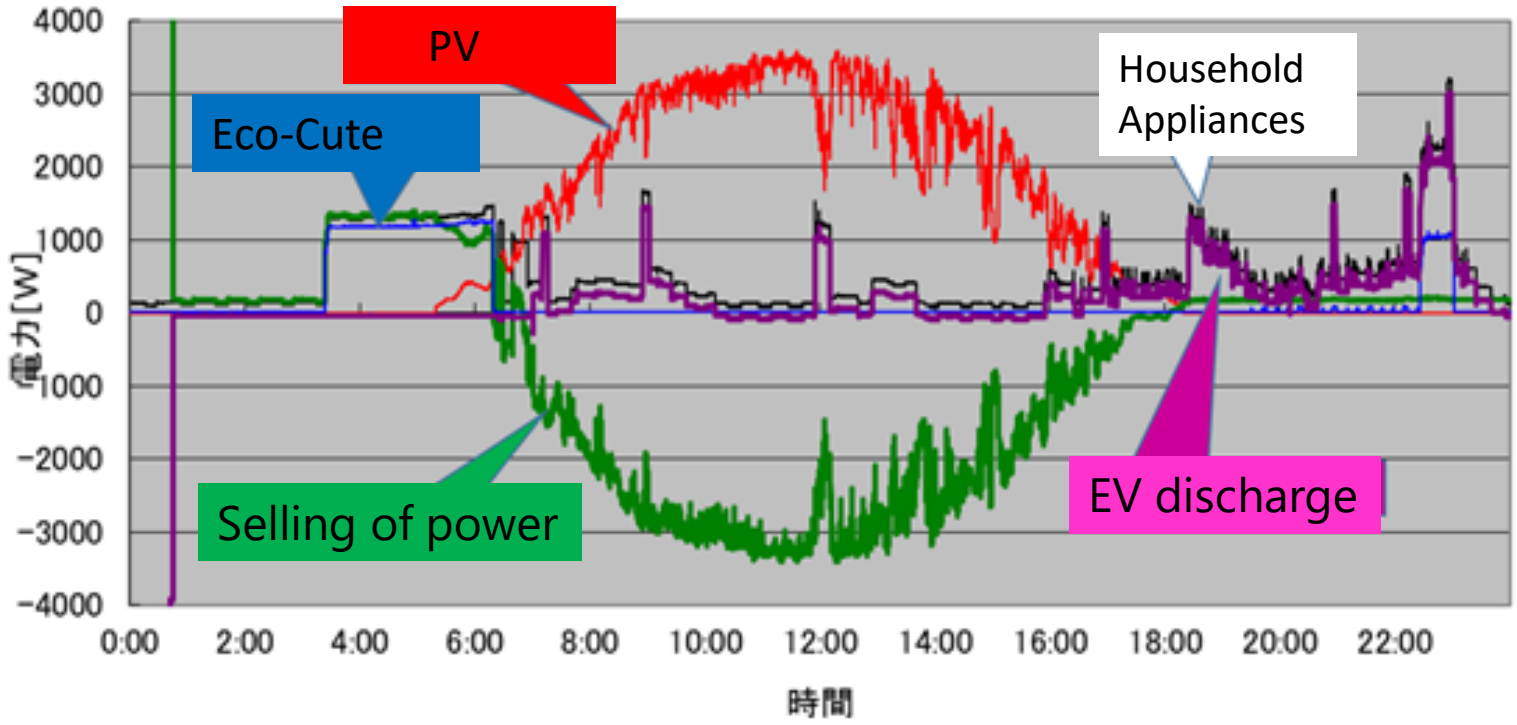
Usable SOC is 27-87% based on the measured value on the site

4.Average generated energy of PV

4kW PV turnout

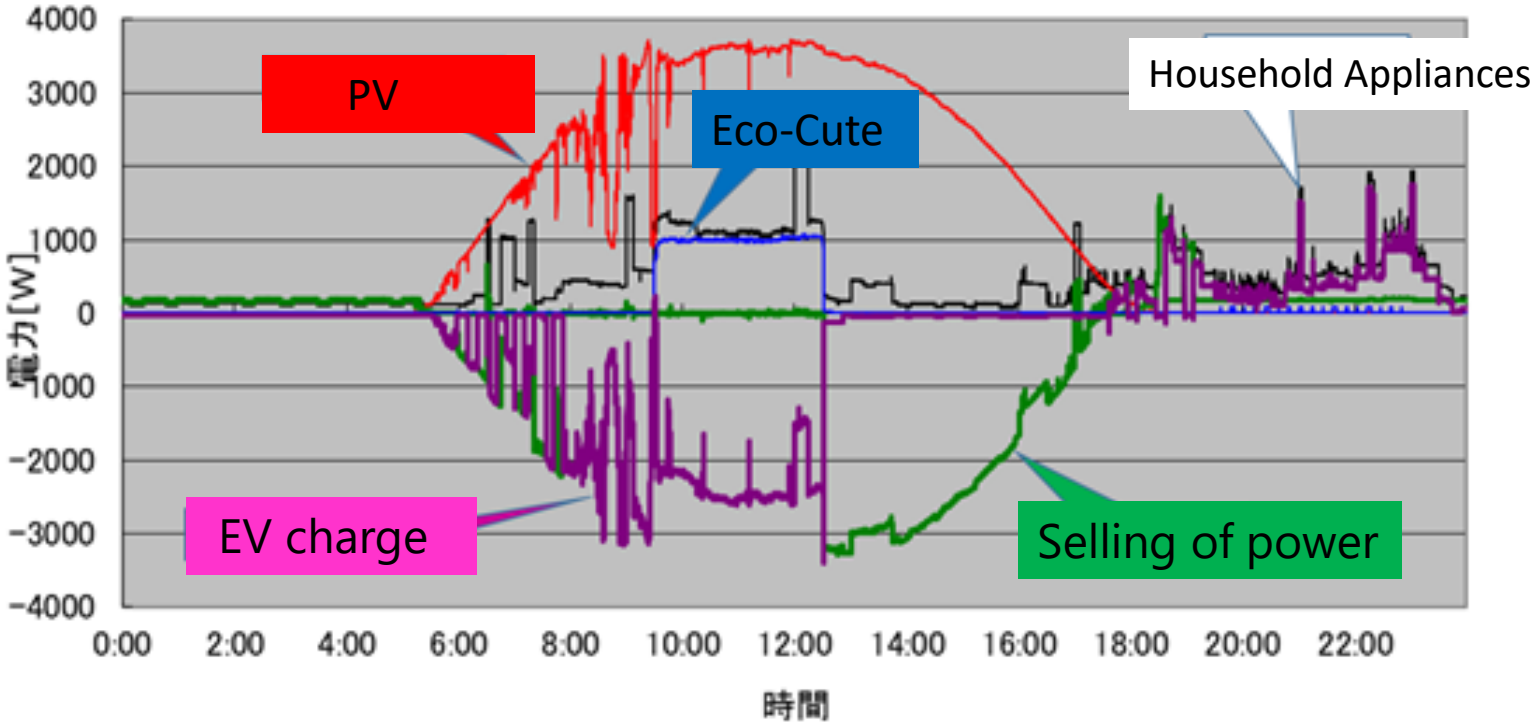
summer: 12.6kWh/day　　mid:10.6kWh/day　　winter:9.0kWh/day

Economic mode1(maximize SELL)



Sell power generated with PV to the utility,
Operating Eco-Cute at night and supplying household appliances with EV during the day

Green mode（charge EV with PV surplus）



Chage EV with PV surplus, supplying Eco-Cute as well as household appliances with PV during the day

Annual Energy Reduction with V2H

	Real value			Converted value to annual average PV turnout		
	Economic mode1	Economic mode2	Green mode	Economic mode1	Economic mode2	Green mode
summer	207.0	169.7	54.4	207.0	169.7	100.5
	(base)	▲ 18.0 %	▲ 73.7 %	（基準）	▲ 18.0 %	▲ 51.4 %
fall	162.8	137.6	36.0	162.8	143.5	59.5
	(base)	▲ 15.5 %	▲ 77.9 %	（基準）	▲ 11.9 %	▲ 63.4 %
Winter	302.3	300.4	131.9	302.3	274.3	210.8
	(base)	▲ 0.6 %	▲ 56.4 %	（基準）	▲ 9.3 %	▲ 30.3 %
average	224.0	202.6	74.1	224.0	195.8	123.6
		Annual reduction 66.9%			Annual reduction 44.8%	

Operating Eco-Cute during the day, charging EV with PV surplus and discharging EV at night, it reduces energy consumption by 44.8%

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3.Comparion from the view point of customers

price

Energy conservation

profit

Typical Osaka granny

What is the best for customers?

Calculation precondition for utility cost

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1.Utility Price

Power tariff ¥/kWh

		Before April 2013	After May 2013	After October 2015
Day Time10-17h	夏期（7～9月）	31. 05	35. 84	38. 89
	その他季節	28. 35	32. 58	35. 54
Living Time 7-10 17-23h		21. 97	24. 59	27. 32
night Time 23-7h		8. 52	10. 76	13. 1

2.FIT price

FIT tariff ¥/kWh

	2012	2013	2014	2015	2016
PV only	42	38	37	33	31
PV with other power sources	34	31	30	27	25
Purchase period	10years				

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Comparison of operation modes

Utility Cost

¥/day	Economic mode1	Economic mode2	Green mode
Summer	137.2	78.5	170.9
	(base)		
Fall	55.0	28.3	74.1
	(base)		
Winter	375.0	337.7	452.7
	(base)		
average	189.1	148.2	232.6

From the viewpoint of the utility cost, Economic mode1 maximizing SELL is recommended to customers.
In addition,EV is available for unexpected use because EV is charged at night.

Primary energy

¥/day	Economic mode1	Economic mode2	Green mode
Summer	107.4	105.7	76.1
Fall	77.9	76.1	36.1
Winter	229.1	232.3	197.2
average	138.1	138.0	103.1

From the viewpoint of the whole society, Green mode charging EV with PV surplus is the greenest with the least primary energy consumption.

Thank you