

CERT Thematic Discussions: The role of 'behavioural aspects' for reaching net zero emissions by 2050

Impact of "Setsuden" - data survey on the potential for Japan's electricity savings by behavioural change

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What is "Setsuden" ?

- "Setsuden" is electricity savings resulting from technical/operational efficiency improvement – including behavioral change.
- To cope with the rolling blackout after the Great Eastern Japan Earthquake in 2011, Ministry requested industry, commercial and residential consumers to facilitate electricity peak savings.
- The behavioral change for electricity peak savings and electricity consumption savings – prompted by the emergency situation – continues to be implemented.

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Weather-adjusted Peak Electricity Savings Rate July-September (compared with July-September in 2010)

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Source: Nishio (2016). "Energy Efficiency, Electricity Savings Behavior - its Trends, Promoting Methods, and Challenges for Verification"





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The Outline of METI Commissioned Study: "Electricity Demand and Potential for Peak Demand Savings"



- For emergency preparedness and load leveling, the IEEJ implemented METI (Ministry of Economy, Trade and Industry, Japan) commissioned study in FY 2019 on the impact of "Setsuden". The study was conducted along with the Energy Conservation Center, Japan, Jyukankyo Research Institute, and Dentsu Corp.
- This presentation covers the results on residential sector although the METI's study included the analyses of the commercial sector.

Estimate Load Curve by Region



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Estimated Load Curve by Appliance (Summer)



Source: The Institute of Energy Economics, Japan (2020)

• Residential electricity load curve is estimated using 1) surveyed data, 2) statistical data, 3) measured data to compare with the regional hourly load curve data from electric utilities. This estimation is implemented for summer, middle, winter in 10 regions.

Regional Differences, and Seasonal Differences

Contributions to Peak Demand



Hours of Peak Demand by Season, and by Region

	Summer	Middle	Winter
Hokkaido	16:00	18:00	9:00
Tohoku	14:00	14:00	17:00
Kanto	14:00	14:00	17:00
Chubu	14:00	14:00	9:00
Hokuriku	14:00	14:00	9:00
Kinki	14:00	16:00	17:00
Chugoku	14:00	14:00	9:00
Shikoku	15:00	14:00	18:00
Kyushu	14:00	19:00	18:00
Okinawa	16:00	19:00	19:00

Source: The Institute of Energy Economics, Japan (2020)

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• Effective electricity savings options at peak load should consider operational characteristics by region.

Menu List of Electricity Savings (Basic List) and the Impact

		Manus for Electricity Sovinge	Electricity	Peak dema	Peak demand savings rate	
		Menus for Electricity Savings	savings rate	Kanto	Hokkaido	
	AC	Maintain room temperature at 28 $^\circ\!\mathrm{C}$	14%	6.3%	2.1%	
Summer	AC	Use of blind at window	10%	4.5%	1.5%	
	AC	Use of fan to minimize the use of AC	100%	44.0%	13.8%	
	Refrigerator	Set temperature at middle level, minimize the frequency of opening door, and do not put too much stuff inside	10%	1.8%	2.5%	
	Lighting	Switch off unnecessary light	50%	3.1%	5.4%	
	TV	Set at energy efficient mode, lower luminance level, and switch off when it is not necessary	25%	0.8%	1.1%	
	Electric Toilette	Switch off hot water supply function, and use energy efficient mode	100%	0.5%	0.8%	
	Rice Cooker	Avoid use during the peak hours, and keep those that are ready in refrigerator or freezer.	100%	2.5%	7.0%	
	Stand-by	Plug off when appliances (TV, PC and Printer) are not in use	100%	0.8%	1.1%	
F	Refrigerator	Set temperature at middle level, minimize the frequency of opening door, and do not put too much stuff inside	10%	3.0%	2.3%	
	Lighting	Switch off unnecessary light	50%	5.8%	11.1%	
Spring/	TV	Set at energy efficient mode, lower luminance level, and switch off when it is not necessary	25%	1.5%	2.2%	
Autmun	Electric toilet	Switch off hot water supply function, and use energy efficient mode	100%	1.0%	0.9%	
	seat	In case there are no above functions, plug-off when it is not in use.		11070	01070	
	Rice Cooker	Avoid use during the peak hours, and keep those that are ready in refrigerator or freezer.	100%	10.1%	8.2%	
	Stand-by	Plug off when appliances (TV, PC and Printer) are not in use	100%	1.5%	1.1%	
	AC	Maintain room temperature at $20^\circ\!\mathrm{C}$	16%	3.7%	0.3%	
	AC	Draw curtain at the window	5%	1.2%	0.1%	
R	Refrigerator	Set temperature at middle level, minimize the frequency of opening door, and do not put too much stuff inside	10%	1.6%	1.8%	
	Lighting	Switch off unnecessary light	50%	4.1%	3.9%	
Winter	TV	Set at energy efficient mode, lower luminance level, and switch off when it is not necessary	25%	0.9%	0.8%	
	Electric toilet seat	Use energy efficient mode. Lower temperature setting for seat and hot water, and close the rid when it is not in use.	27%	0.2%	0.2%	
	Rice Cooker	Avoid use during the peak hours, and keep those that are ready in refrigerator or freezer.	100%	8.7%	6.1%	
	Stand-by	Plug off when appliances (TV, PC and Printer) are not in use	100%	0.8%	0.9%	

• Electricity savings rate represents potential electricity savings from behavior change. The list is prepared reflecting 1) manufactures input, 2) discussions with experts and 3) literature study. Respective menu option has different impact by region.

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Impact of Behavioral Change for Electricity Peak Saving

Impact of Behavioral Change by the Residential Consumers

Will

			Ma		imum Possible		Emergency			
		Peak	Peak	Peak	Peak	Peak	Peak	Peak	Peak	
		Hours	Demand	Savings	Savings	Savings	Savings	Savings	Savings	
			(MW)	Potential (%)	(MW)	Potential (%)	(MW)	Potential (%)	(MW)	Max: all household
	Summer	16:00	4,340	5.7%	246	3.3%	144	0.5%	20	
Hokkaido	Middle	18:00	3,710	9.8%	365	5.7%	210	0.7%	25	
	Winter	9:00	5,230	5.1%	266	3.1%	162	0.2%	11	Possible: unimplemented household
	Summer	14:00	54,480	3.7%	2,042	2.2%	1,194	0.4%	228	mergency: cone w/t emergency request
Kanto	Middle	14:00	35,170	4.8%	1,680	3.0%	1,055	0.5%	172	inergency. cope w/t emergency request
	Winter	17:00	49,450	6.1%	3,000	4.0%	1,966	0.5%	255	

Questionnaire results: Electricity savings activities (Winter)



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Questionnaire results: Willingness to cope with the emergency requests (Winter)

Do not



Question list

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1	AC - filter clean up	19	Refrigerator - lower temp.
2	AC - temperature setting	20	Refrigerator - not put too much stuff
3	AC - with blind use	21	Light - switch off unnecessary ones
4	AC - shorter operation	22	Light - lower luminance
5	Electric carpet - smaller floor space	23	Toilet - EE mode
6	Electric carpet - set low temp.	24	Toilet - close the rid when not in use
7	Electric carpet - shorter operation	25	Toilet - lower temp setting
8	Electric carpet - lower frequency	26	PC - eco mode operation
9	Kotatsu - lower temp.	27	PC - turn off when not use
10	Kotatsu - shorter operation	28	Modem/Router - turn off when not use
11	Kotatsu - lower frequency	29	Washing machine - implement at onces
12	Dishwasher - lower temp	30	Dryer - shorter time
13	Shower - economize hot water use	31	Rice cooker - not use keep warm mode
14	Bath - sequential use	32	Electric water boiler - plug off when not use
15	TV - EE mode	33	Dishwasher - implement at onces
16	TV - switch off when not use	34	Dishwasher - shorter time
17	TV - plug off when not use	35	Vaccum cleaner - EE mode
18	Refrigerator - minimize open/close		

Information Diffusion/Consumers' Awareness

Contents Shown at Digital Signage



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Digital Signage





 Digital signage on facilitating EE behavior change – should be located at places that consumers can see on everyday basis. In addition, information should be combined with other essential information such as weather or earthquake. Use of SNS and push notifications will facilitate consumers' behavioral change.

Key Messages

- A list of options for "Setsuden" behavioral change for electricity peak savings should be prepared based on local characteristics and good understanding over how appliances/technologies are utilized.
- Appropriate method of information provision should be tailored to meet regional characteristics.
- Estimation of potential for "Setsuden" electricity savings at the demand side can benefit the supply side as it can avoid unnecessary investment at generation, transmission, and distribution.
- The purposes of listing-up options for behavioral change involve 1) emergency preparedness, and 2) load leveling for economic purpose – both offer significant impacts on CO₂ emissions reduction.