Demand Response
Smart Grid Economics Project in Japan

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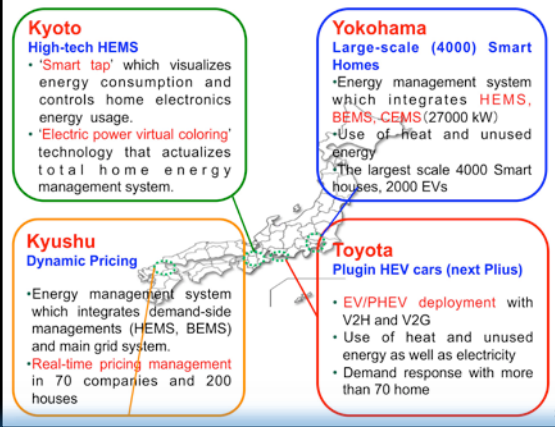
What Japan's Energy Policy Will Be After the March 11 Disaster?

The Current Discussions include the following points:

- Decrease the nuclear power share from 30% at present to 0% (possibly) in the long-run.
- Increase the renewable energy share from 10% at present to 20% in 2020.
- Speedup the smart meter deployment among 80% households within 5 years.
- Reconsider the structure of electricity industry including the vertical separation.
- Proceed the smart grid pilots to cut demand peaks.

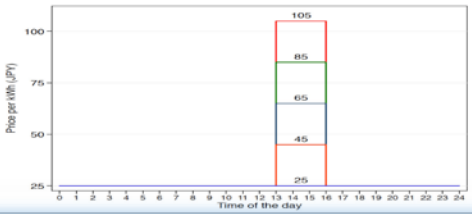
The Disaster and Smart Grid Policy

- In light of the March 11 earthquake and the Fukushima crisis, a radical reconsideration of Japanese energy policy is now being discussed.
- The smart grid consists of home appliances equipped with ICT technology, connected to the power grid, and can achieve energy saving and cost reduction.
- The Ministry of Economy (METI) of Japan started an experiment called the smart community program in four cities from 2011 to 2014: Yokohama, Toyota, Kyoto, Kyushu.
- I now work as an economic advisor to investigate the economic consequences and manage the social experiment by introducing Smart meter, Home Energy Management System, and Smart Community.



Multiple Critical Peak Pricing Treatments

- Past experiments had only one level of CPP (critical peak pricing) and seldom estimated the global demand elasticity. I therefore offered that multiple CPPs should be examined, such that some response threshold would be detected.
- TOU (time of use) = ¢45 for the non-event days, multiple CPPs = ¢65, ¢85, ¢105 /kWh randomly for the event days.



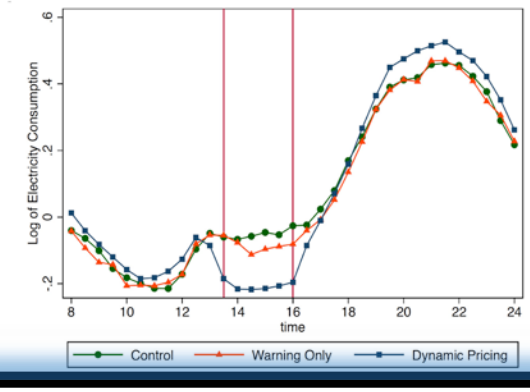
Randomized Assignment of Treatment but Samples are Self-Selected

- Randomized assignment of treatment

Control Group	Dynamic Pricing Group	Conservation-Warning Group

- Sample selection process:
  - Participants receive $200 per year for a participation reward
  - Receive a smart meter & in-home display for free
  - Agree that their electricity price may change
  - We guarantee that their excess payment never exceed $100 per year
  - No one exceeded this $100 threshold during the experiment

(Kyoto Experiment)
Mean Log Consumption of Treatment and Control



The Kyoto Experiment Result

- Conservation Warning has the 3% peak cut effect on 15 DR event days.
- TOU has the 6% peak cut effect on non DR event days.
- Multiple CPPs have the 15 – 19 % peak cut effects on 15 DR event days.
- The effects increase with the price level, but the width decreases gradually.

Peak Cut Effects		Effects (%)	Statistical Significance
Conservation Warning		- 3.3%	5% significant
Non DR Event Day	TOU (¢ 45)	- 6.0%	1% significant
DR Event Day	CPP (¢ 65)	- 15.1%	1% significant
	CPP (¢ 85)	- 17.2%	1% significant
	CPP (¢ 105)	- 18.5%	1% significant

From Social Experiment to Social Development

- Smart grids will impact the complete deregulation of retail electricity prices that is planned in Japan for 2016.
- The introduction of smart meters will enable smart pricing in accordance with electricity usage and trigger the entry of new electric power companies that target specific customers.
- Moreover, the smart grid encourages the efficient consumption of electricity. This would increase the management efficiency at electric power industries through reductions in imports of primary energy and of surplus power-supply equipment.
- Now, it is time for the nation to take on the challenge of implementing this social reform.