Title	Challenge : prevent power outage by mobile technology and social media : The network preventing power outage by citizens
Sub Title	市民のネットワークによる停電回避
Author	エレファントデザイン株式会社(elephant design co., ltd.) イサナドットネット株式会社(Isana.net, inc.) 神武, 直彦(Kotake, Naohiko) Greene, Dick
Publisher	慶應義塾大学大学院システムデザイン・マネジメント研究科
Publication year	2011
Jtitle	Active learning project sequence report Vol.2011, (2011.) ,p.131- 192
JaLC DOI	
Abstract	Company The members of our group are from different backgrounds such as business, ngineering, statistics, economics, and marketing. We are working with cooperation of two companies specialized in the IT and new technologies, and in system design. Need After the 3.11 earthquake, the risk of the power outages has risen as a national problem, and our team has been asked to design a system based on incentives and the contribution of citizens to avoid blackouts by leveling the energy consumption. Solution The final solution is to work with work in cooperation with both the householders and TEPCO by encouraging the householders to apply for the Night Plan promoted by TEPCO. By using the application we developed, they will be able to follow their consumption habits. By using the application, we will provide the users advices (OKAN) about how to optimize their energy consumption to both financial and social purposes. On the other hand, TEPCO will be able to optimize their supply function based on the data we can provide from the application. Market This system will be based on an existing project that has 800.000 users, and our goal is to increase this number to create a community and be able to cooperate with other companes on other areas of Japan and in the world. Competition Many companies launched programs for energy consumption, but their scope and goals are different. The existing projects are for a short term and are for marketing purposes. But, if this system succeeds to create a new market, the competition will be hard. Business Model By creating a community of our application users, it will be possible to analyze their life style. This data will be provided to TEPCO for each user and every day. It will be interesting for TEPCO to buy this data for 5yen per person per month because, they can use it better satisfaction of their customers. This system will have an effect on the reduction of the fix costs of TEPCO, and also the costs for the promotion of the Night plan program. Regarding the cost, we estimate a cost of 500000 yen for the development of the application. Other costs will marginal because our partners are already covering it. The exportability of the system is considered as well, but it has to be adapted to the local culture.
Notes	Student final reports Group B
Genre	Research Paper
URL	https://koara.lib.keio.ac.jp/xoonips/modules/xoonips/detail.php?koara_id=KO40002003-00002011-0131

Group B

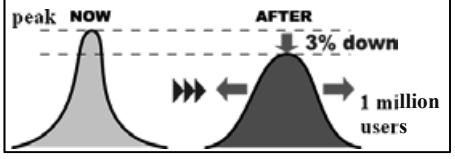
Group B's Theme Proposed by elephant design co., ltd with ISANA.net

ALPS "Symbiosis and Synergy" theme title : **The Network preventing power outage by citizens** 2011/5/14

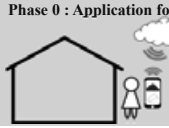
Proposer Organization's Name: **elephant design co., ltd with ISANA.net**
Contact Person's Name: **Kohei NISHIYAMA & Isana ISHITANI** Contact Person's email: t.ikawa@cuusoo.com

Challenge : Prevent Power Outage by Mobile Technology and Social Media

Switch off Air Conditioners to offload the peak



Phase 0 : Application for outage area search



After 311, 800 thousand users downloaded application for outage news feed.

Phase 1 : Add alert and Visualization feature to application.

Direct message to users to switch off air conditioners. Tool to visualize how many users have "checked in" to community of off-loading and visualize the effect.

Phase 2 : Automated offloading Network

3G / Wireless LAN to connected to air conditioner

Abstract : Citizens Responding to Risk

Unlike risks of natural disasters such as earthquake or Tsunami, risk of societal risks such as power outage can be avoided by cooperation of citizens.
Supplier of electricity alone could not solve outage of electricity when supply capacity is lower than demand. Since 311, Japanese have become familiar to the concept of citizens preventing power outage by switching off appliances. However the precondition is that right data and methodologies have to be given in right timing.

Hypothesis : Form a Risk Response Community

With the widespread of mobile devices and social media, information to invoke citizen participation could be provided at micro level and user behavior could be studied in much detail.

Currently there are 800 thousand users who have downloaded the application to find out more information on outages.

Project Goal : Find Answers To The Questions

In ALPS project, we would like to come up with much sophisticated information architecture to learn how to make user respond to low supply capacity.

1. How to offload 3% of demand forming community of one million users ?
2. What are the incentives and how do they differ by user segment ?
3. How could we automate the offloading mechanism in the future ?

ALPS Final Report 2011

Group B

Project Title:

Challenge: Prevent Power Outage by Mobile Technology and Social Media

Theme:

The Network Preventing Power Outage by Citizens

Proposer Organization: elephant design co., ltd with ISANA.net

Proposer Organization's Supporters: Kohei NISHIYAMA & Isana ISHITANI

Keio Mentor: Naohiko KOHTAKE & Dick GREENE

Members:

Jorge NIKAIDOH

Kyoko WATANABE

Motoshi KANKE

Yosuke SHINODA

Abdelhamid ADDI

Graduate School of System Design and Management

Keio University

KEIO UNIVERSITY
Graduate School of System Design and Management

ALPS 2011: "Symbiosis and Synergy"

Proposer Organization's Name: **elephant design co., ltd with ISANA.net**

Challenge: Prevent Power Outage by Mobile Technology and Social Media

Group B:

Jorge Nikaidoh

Kyoko Watanabe

Motoshi Kanke

Yosuke Shinoda

Abdelhamid Addi

1. Executive summary

Company

The members of our group are from different backgrounds such as business, engineering, statistics, economics, and marketing. We are working with cooperation of two companies specialized in the IT and new technologies, and in system design.

Need

After the 3.11 earthquake, the risk of the power outages has risen as a national problem, and our team has been asked to design a system based on incentives and the contribution of citizens to avoid blackouts by leveling the energy consumption.

Solution

The final solution is to work with work in cooperation with both the householders and TEPCO by encouraging the householders to apply for the Night Plan promoted by TEPCO. By using the application we developed, they will be able to follow their consumption habits. By using the application, we will provide the users advices (OKAN) about how to optimize their energy consumption to both financial and social purposes. On the other hand, TEPCO will be able to optimize their supply function based on the data we can provide from the application.

Market

This system will be based on an existing project that has 800.000 users, and our goal is to increase this number to create a community and be able to cooperate with other companies on other areas of Japan and in the world.

Competition

Many companies launched programs for energy consumption, but their scope and goals are different. The existing projects are for a short term and are for marketing purposes. But, if this system succeeds to create a new market, the competition will be hard.

Business Model

By creating a community of our application users, it will be possible to analyze their life style. This data will be provided to TEPCO for each user and every day. It will be interesting for TEPCO to buy this data for 5yen per person per month because, they can use it better satisfaction of their customers. This system will have an effect on the reduction of the fix costs of TEPCO, and also the costs for the promotion of the Night plan program. Regarding the cost, we estimate a cost of 500000 yen for the development of the application. Other costs will marginal because our partners are already covering it.

The exportability of the system is considered as well, but it has to be adapted to the local culture.

2. Table of contents

3. Problem statement

After the big earthquake on March 2011, a nuclear plant is out of service and there is was a risk of power outages in the area of Tohoku in Japan that might have a big impact on the industry and also in the normal life of people.
This situation has stimulated the interest to conceive a system that will help to avoid power outages using Internet and social media. Our proposer had several requirements regarding this system. After analyzing those requirements, we could understand that the most important one is the interaction with citizens to change their behavior of electricity consumption by providing data on appropriate time. For that, there is a need to build a large community. Offloading 3% of electricity demand by creating a community of 1million users is another requirement that have been included in the analysis. To reach these goals, the proposer asked us to design an incentive-based system and how to automate the offloading mechanism in the future.

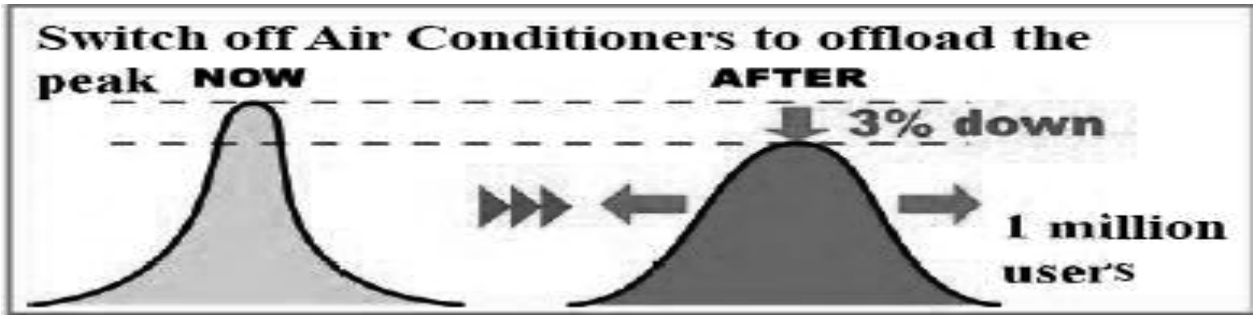


Figure 1: Main requirement

At the time our team has started to design this system, many companies launched their campaigns to encourage people to think about their energy consumption and financial incentives were mainly used, such as a telecommunication company that gave discounts for their customers after showing a bill of electricity consumption showing a reduction compared to the previous month. The objective of this type of campaigns is to help the Japanese society in the difficult time, and also a marketing action by caring about the crisis and environment.

However, the system we are asked to develop is different from time lime projects and campaigns, because one of the objectives involves the change of the behavior of people and that needs long time. Thus, even if this system's potential users' size is very important, but the segments are difficult to define because of the behavioral aspect. Two conditions are defining the size of the potential users: the number of people using smartphones and Internet, and the duration of belonging to the community.

The analysis of the population that we might target for this system cannot neglect the question of targeting people already conscious about reducing electricity consumption or target all people and have as an objective to change their behavior.

After analyzing the different requirements and the situation after the earthquake we noticed that the project will face many constraints. First of all, the perimeter of the project is very confusing. Also, to change the behavior of citizens regarding the energy consumption needs long term planning and the size of the community that has to be recruited for that purpose should be large. But, the interviewees that we asked for the project are more interested in the financial incentives. However, this type of incentives is more suitable for short term projects and its retention effect is lower than other types of incentives. On top of that, the sponsor specified that the system should be conceived and designed without including any profit-based analysis for them, which makes the set of incentives that might be adopted very narrow.

4. ALPS methods

Our Project process is divided in three parts. The first one is from 1 to 14(Initial Part). In this part our proposal was to create a social incentive to Tohoku Area. However, after doing an interview and using "enabler method" we realized that with a social incentive we would not be able to achieve our final goal (Second Part; Transition Part). Therefore we changed our concept totally, and finally decided to create an economical incentive and help people saving energy (Third Part; Final Output Part.) In what follows, we are going to explain the methods we used in chronological order.

4.1.Scenario Graph

First of all, we tried brainstorming for each category such as who, what, where, when, main function, why and how. Then, we made three scenarios, pick up two of them and merged into one scenario as our main scenario. The reason why we merged two scenarios into one is we decided to focus on householders as our target including housewives and elder people who are likely to stay in their own houses. In addition, other category of scenario graph except for who, are same in scenario1 and 3. Therefore, we merged them to one scenario.

Who	TEPCO Elephant Design Isana.net Population in those areas house wife kids elder people neat student husband worker living alone LOHAS
What	Saving energy using application changing behavior
Where	Tokyo Osaka Nagoya (where there is a possibility of power outage) TEPCO area JAPAN Hiyoshi Futako Shibuya house(home) (university)
When	Peak time(10~20) other time summer time winter am/pm after working weekend rainy hot/cold day(35℃↑)
Main	Making people save energy (3%)

function	
Why	To avoid outage to save charges environment protection to save consumption
How	By making people think about their use of energy By offering incentives to people to cooperate and commit By charging statements of contract w/ energy supplier By changing life style

Table 1: 5 why's

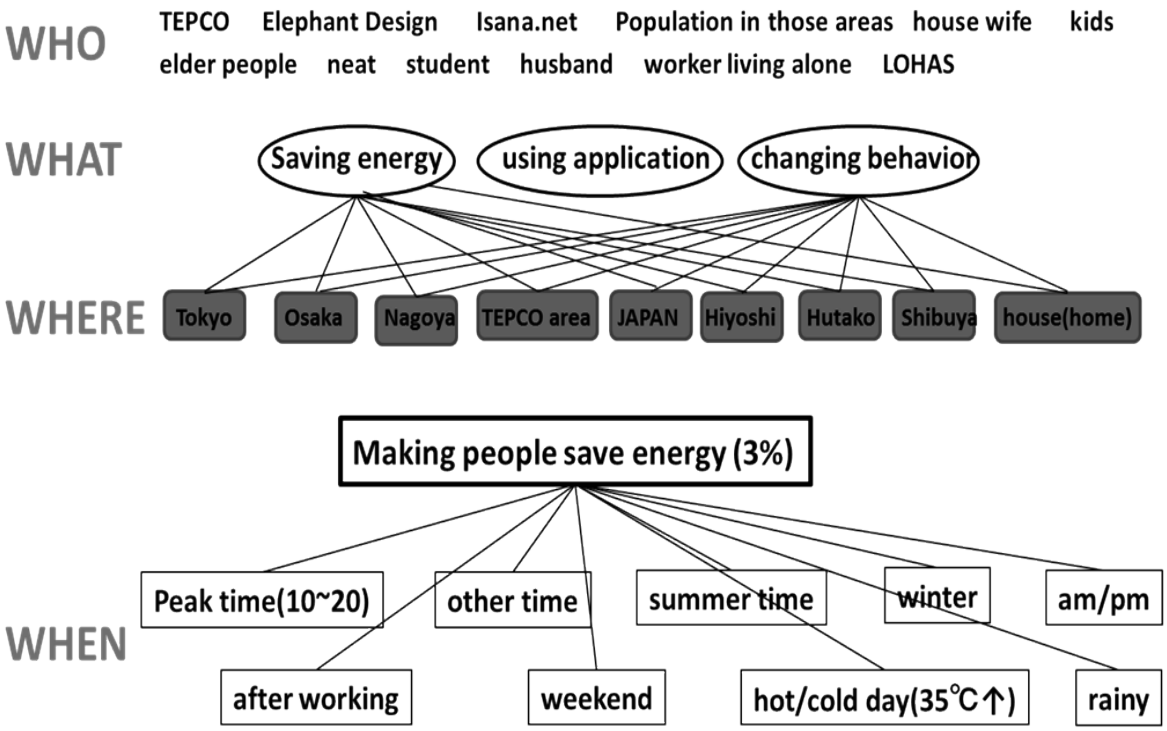


Figure 2: scenario graph

4.2.CVCA

We tried to CVCA to analyze the relationships among each stake holder. We raised five main stakeholders related to this project like following:

1. Elephant Design & Isana.net: Our proposer. Originally, they are different companies; however they work together in this project and have intention to make joint venture in the future. Therefore we regard them as one main stakeholder. Elephant Design is capitalized by TEPCO.
2. TEPCO: Supplier of electricity to houses, commercial buildings, factories, hospitals, schools, companies, and so on. They are responsible to control demand and supply of

electricity, and avoid outage. Therefore, they want make save energy. But, that is short time view for them, because their business is selling electricity, not saving energy.

3. People in house in day time: Our target. Mainly housewives and elder people staying in their house in daytime. The success of this project depends on whether they save energy or not, or whether they change their lifestyle or not.
4. Japanese government: They provide public services with all citizen of Japan. They have to save life of people in Japan, so they execute various means, such as laws, regulations, big campaigns to save energy and avoid outages. In addition, now, they strongly observe and control TEPCO to make it to supply energy stably.
5. Companies in charge of incentives: They provide incentives with users. Now, we are not sure specifically who they are. This is also our task to do from now on.

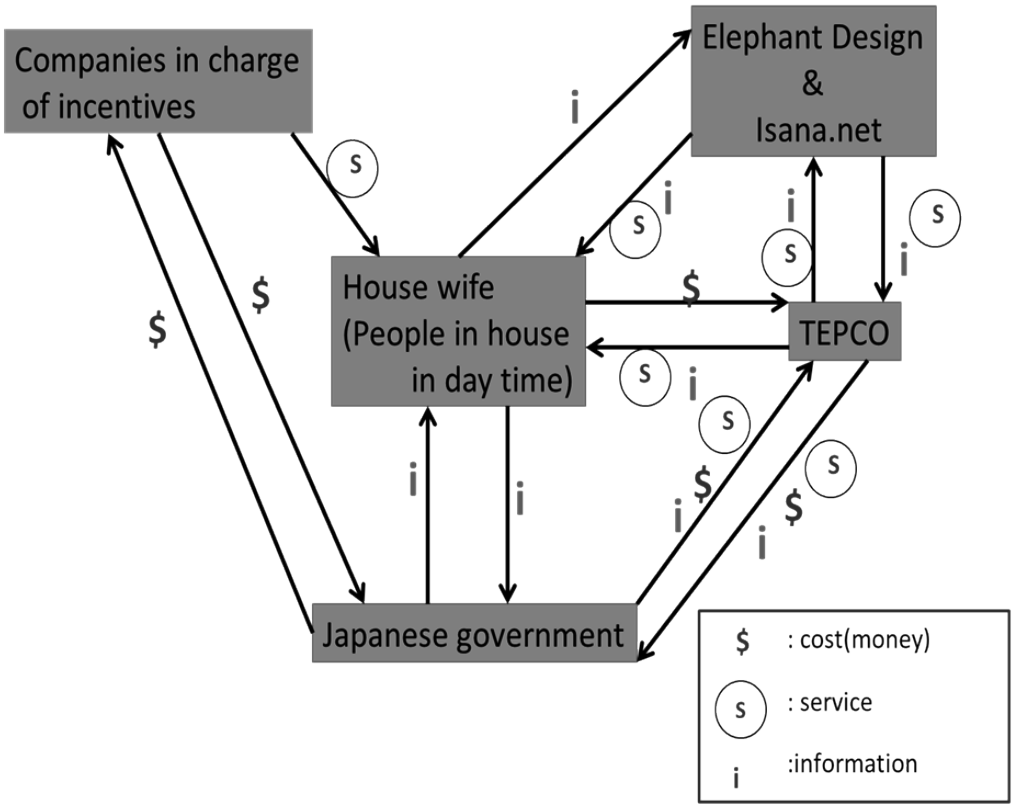


Figure 3: CVCA

4.3.WCA

After CVCA, we also analyzed relationships among main stakeholders by using WCA. The results are like following. WCA analysis made us realize that we should add other two stakeholders who are Sponsor and possibly victims in areas suffering from the earthquake to satisfy every stakeholder's wants. However, we are not sure who would be this new two stakeholders as well as companies in charge of incentives. We have to specify them while thinking system to meet requirement from our proposer.

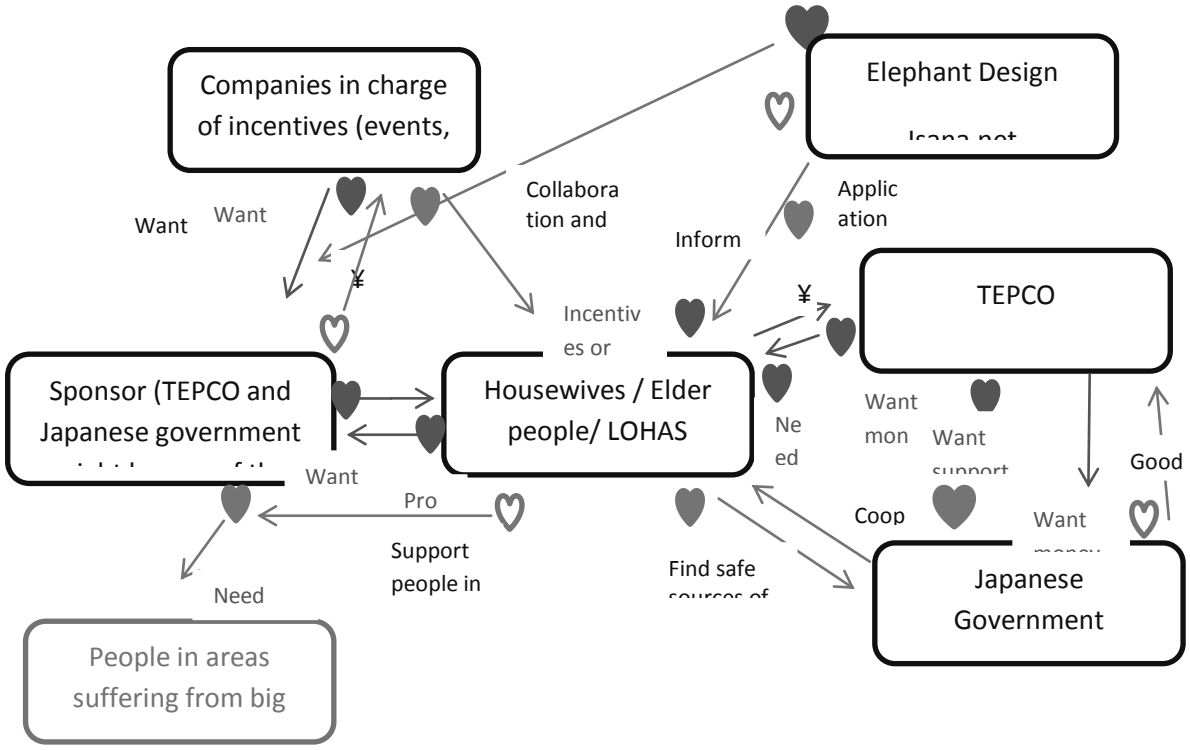


Figure 4: WCA

4.4.Interview, Observation

Our first interview object was TEPCO. Since it was one of the main stakeholders and all our system had relation with "electricity" we interview them in order to know their requirements, expectations, worries and of course to know more about "the night plan" (we were convinced that they had hints that would be usable in developing our system).

Below are the results of the phone interview:

a) About the Simulation of Night Plan:
They said that in the simulation page of the website you should fill in the amount of power used during the day and night separately. However, in the original electricity bill there is no some kind of segmentation. Thus, in order to know the power rate precisely, it is needed to readout the meter at 7am and 11pm, then calculate the proportion of the amount used in both of these, and finally calculate the total amount.

b) About subscription to the Plan:
The subscription is by phone through TEPCO customer center. After that, the responsible will call you in order to change the meter and make start the night plan.

c) Impressions:
We had the sensation that they are not recommending the night plan. Also, we can say that the subscription procedure was very complicated and could not be secure if the information was exact.

4.5.Morphological Diagram

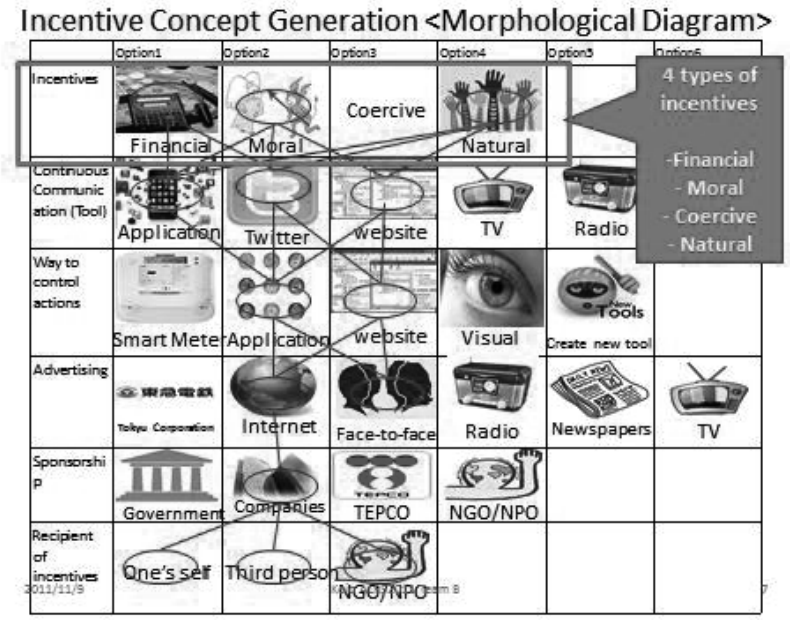


Figure 5: Morphological diagram

As a result of the Morphological Diagram we were able to generate three "incentive concepts."

a) Concept 1: Moral Incentives in order to support the Tohoku Area.
b) Concept 2: Natural Incentives. To send photos of good looking girls/guys to everyone who saved electrical energy.
c) Concept 3: Financial Incentives. To give coupons to people or community that saves energy.

4.6.Scenario Prototyping Rapidly

After the morphological diagram, we "thought" that a moral incentive would be the best selection of all the incentives we had created by this method. Therefore, to have a clearer vision of the system flow we made a prototyping of it, when a person wants to donate money to Tohoku. One of the surprises by prototyping our system was that, we found it a little difficult to make a subsystem that donates automatically money to the Tohoku area. Hence, we would have to use existing money transfer system (PayPal, visa, etc.), and it means a new "cost" for our system.

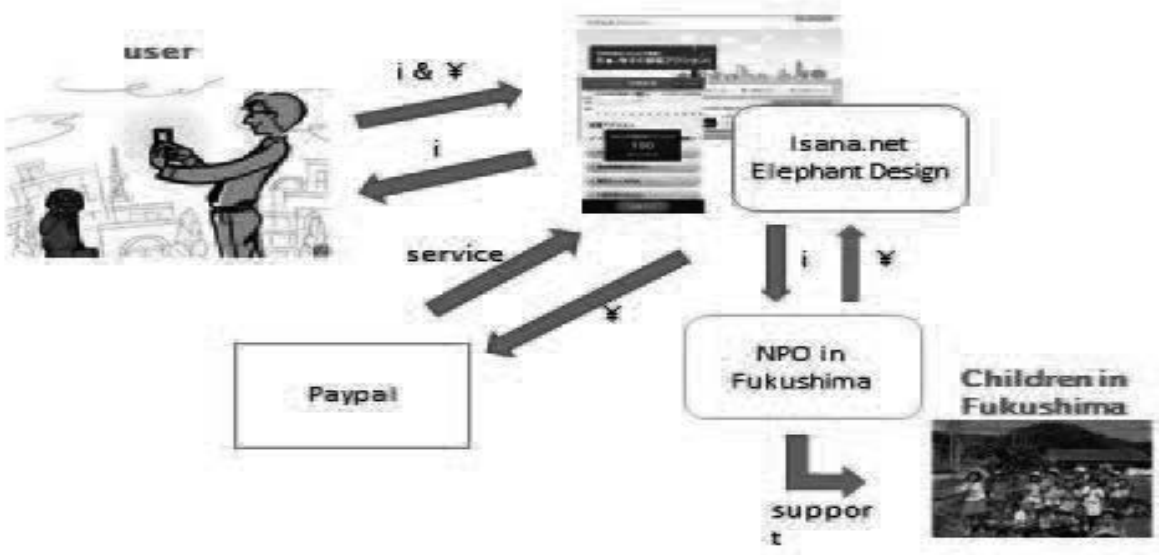


Figure 6: new view of the CVCA

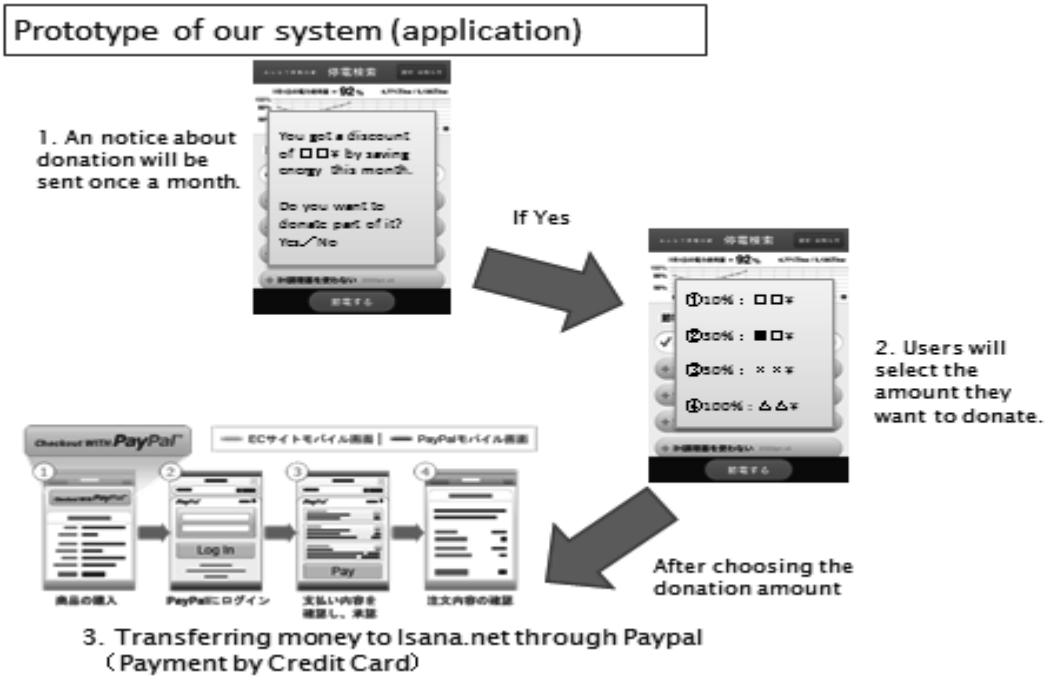


Figure 7: prototype 1

4.7.Value Graph

In order to apply QFD to our system we made a Value Graph based on the results of the interview we made to TEPCO and also to some house holders. Below are the results:

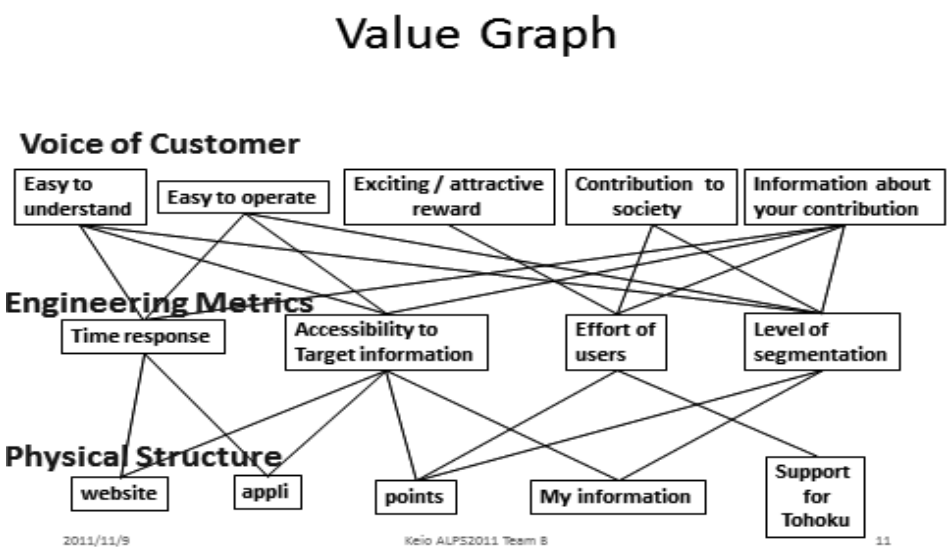


Figure 8: value graph

4.8.QFD I&Ⅱ

After doing the value graph we applied the QFD to our concept. As written above, we chose the VOC`s based on the interview we have did before. About the engineering metrics, we chose it by comparing our system with others that already exist. Finally, the weight of each element was determined by the results of interviews. The results of QFD1&2 are as follows:

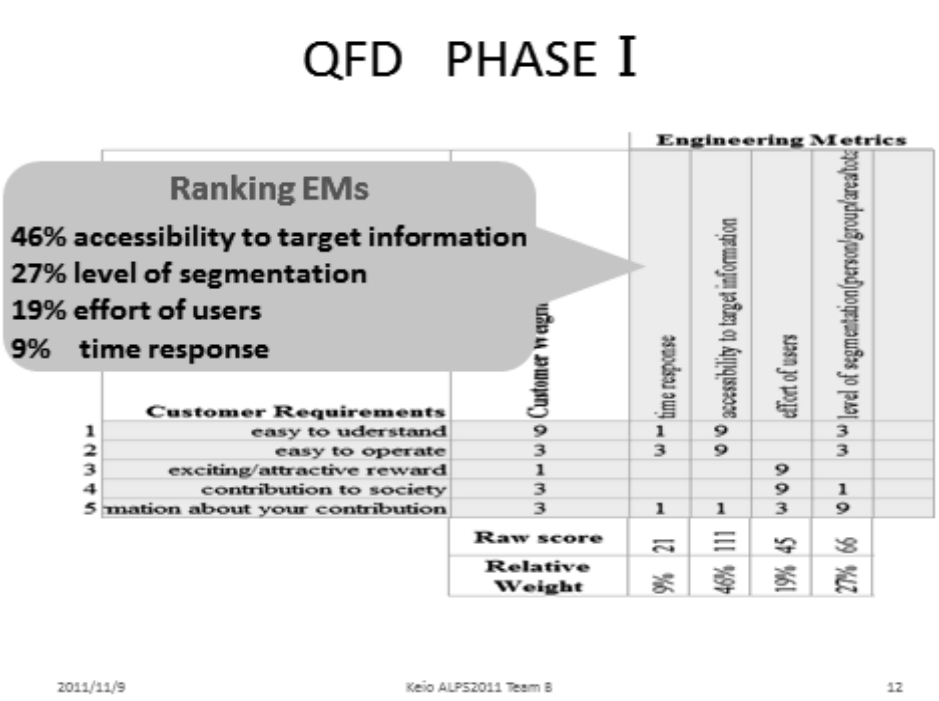


Table 2: QFD phase I

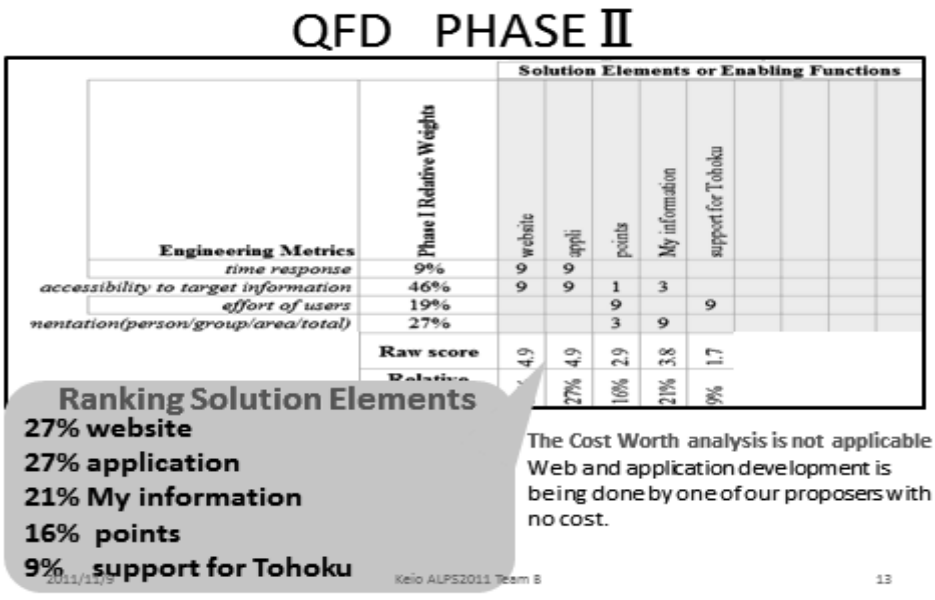


Table 3: QFD phase II

4.9.Cost Worth Analysis

This tool couldn't be applicable in our project. The unique cost in our system could be the web page and application development fee. However, both of these have been done already for one of our proposers. Therefore, we think that our system development is virtually free of cost

4.10. Pugh Selection Matrix：Decision of the best type of incentive system.

If we base on the following table, we can say that the best alternative to choose is "Support for family in Tohoku." However, we also found that "setsuden bijin" should be an option to take into consideration, because "support to Tohoku" is very effective in a long-term. On the other hand, "setsuden bijin" is effective in a short-time vision. In other words, if we have results as soon as possible and also a sustainable system, we thought that a combination of these two options could be a good choice. Moreover, since the difference in structure of these two, we though these were fusion-able. The concept of "setsuden bijin" is to give some incentive to the person who saved energy, but the concept of "Support to Tohoku" is to give some incentive to some other according to the amount of energy that people save.

Incentive Concept Selection
<Pugh Selection>

	Concepts			
Criteria	Existing	節電美人 "Setsuden Bijin"	Support for Tohoku by using application	"Saving energy coupon in local community"
Easiness to participate	D	S	S	S
Time that "the action" requires	A		S	–
Moral Retribuition for users			+	S
Low economical Cost (for users)			S	S
High Durability of system (if users will participate for a long term or not. whether it is transitory or not. Boom?)	M	+	+	+
Σof +		1	2	1
Σof -		0	0	1
Σof S		4	2	4
Overall		1	2	0

Support for Tohoku

Table 4: Pugh selection

4.11. Scorecarding

First, we set our project objective as the biggest Y. As the same way, we decided the main factors to measure it (project objective) and put these as Y_1 and Y_2. Finally, control factors and noises were decided by brain storming and also based in the methods we had made before (mainly morphological diagram, QFD and Pugh selection.)

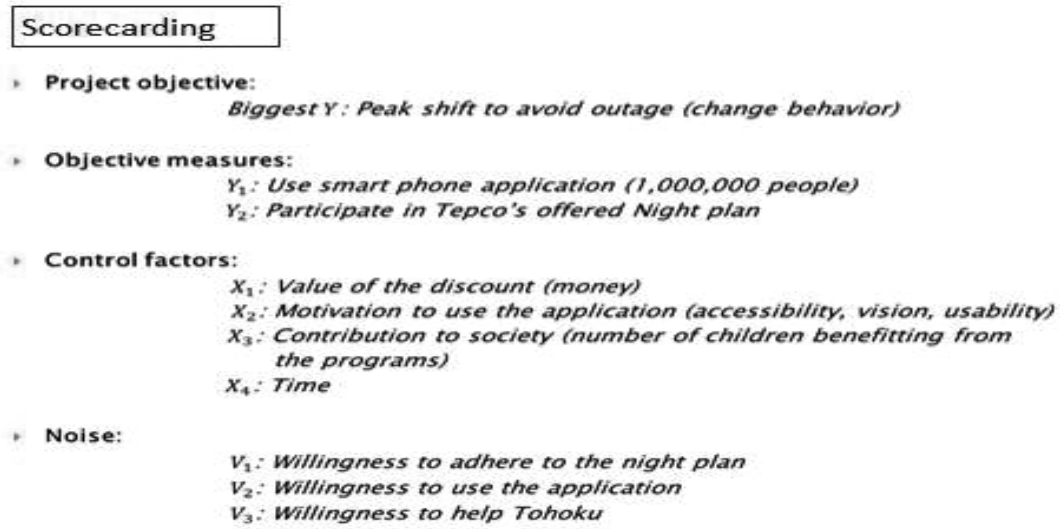
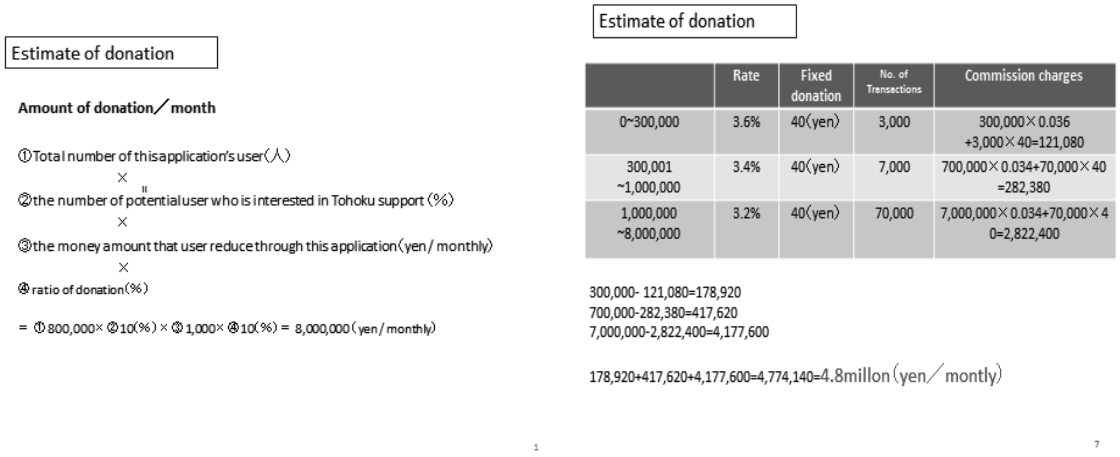


Figure 9: Scorecarding

4.12. Net Present Value Analysis

We calculated our system NPV by making an estimation of the monthly donation, advertisement revenue we would receive if promote our system, and by considering the amount of investment we would have to do.

Results are explained in the following tables and figures:



Advertisement Income

- To estimate the advertisement income for our application we are to base on the Nikkei shimbun application data;

Nikkei Shimbun	Setsuden application
1 million users	0.8 million users
Adv income: 300,000 yen / week	1 yen/month *800,000 = 800,000 yen/month
So that 0.04 yen/person· day	∴ 0.03 yen/person· day

- Comparing to Nikkei shimbun, since our application is still new, we assume that 1 yen/month per user is acceptable.
- Therefore, our total income will be:

∴ **800,000*1 yen= 800,000 yen/month**

Investment Evaluation

project period	4	quaterly			
discount rate	0.1	%			
initial investment	0	¥			
	0Q	1Q	2Q	3Q	4Q
Inflow		26,400,000	26,400,000	26,400,000	26,400,000
outflow		24,000,000	24,000,000	24,000,000	24,000,000
free cash flow		2,400,000	2,400,000	2,400,000	2,400,000
discount factor		0.2272727	0.2066116	0.1878287	0.9090909
present value		545454.55	495867.77	450788.88	2181818.2
net pesent value/NPV	3673929.376	¥			

Table 5: Net Present Value

4.13. New Interview & Questionnaire

After doing all the methods written above, we wondered if ours system really matches with the customer requirements. Therefore in order to verify it, we made a new and bigger interview to customers. And for our surprise (and benefit), we could realize that we were not going on the correct way. Thus, we decided to change our concept of "helping Tohoku Area" and made a new one "OKAN." (See number 18)

Below are the results of the interviews:

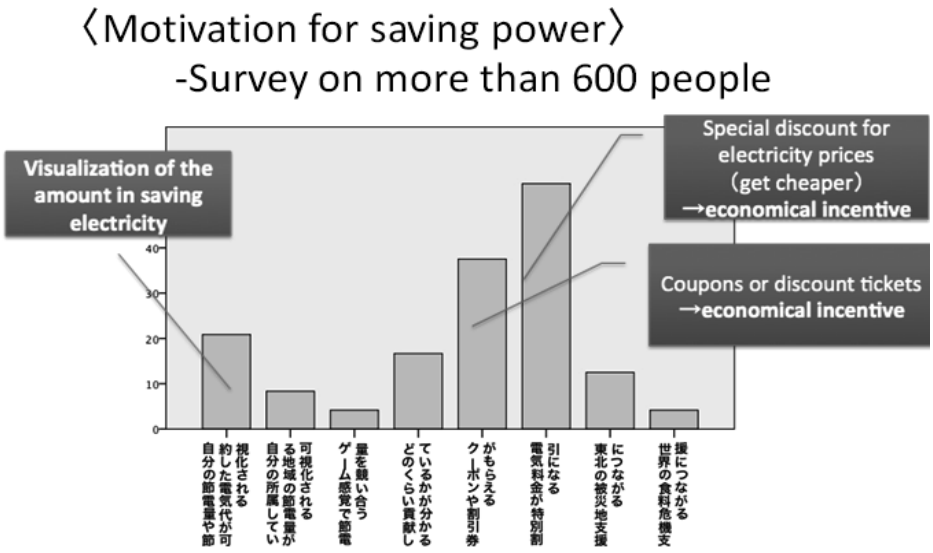


Figure 10: Survey

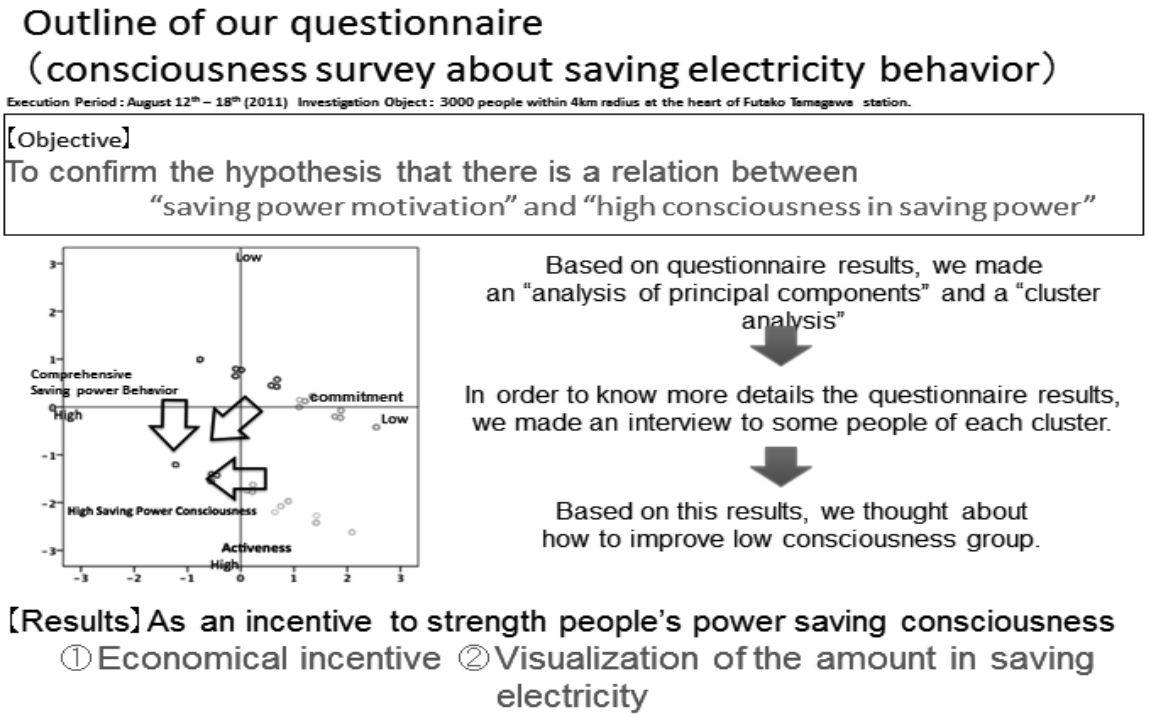


Figure 11: Interview

4.14. Enabler

As a next step to confirm that the new concepts we had created will help us to achieve our final goal, we used the enabler method. As a result we could reach to the conclusion that we need two kinds of "incentives" to make our final goal possible. The first one is an economical incentive (to make people to transfer to the Night Plan from the regular plan), and the second is visualization of their effort effects (to show people how much they have saved, and also to give them advices in order to optimize their energy consumption.)

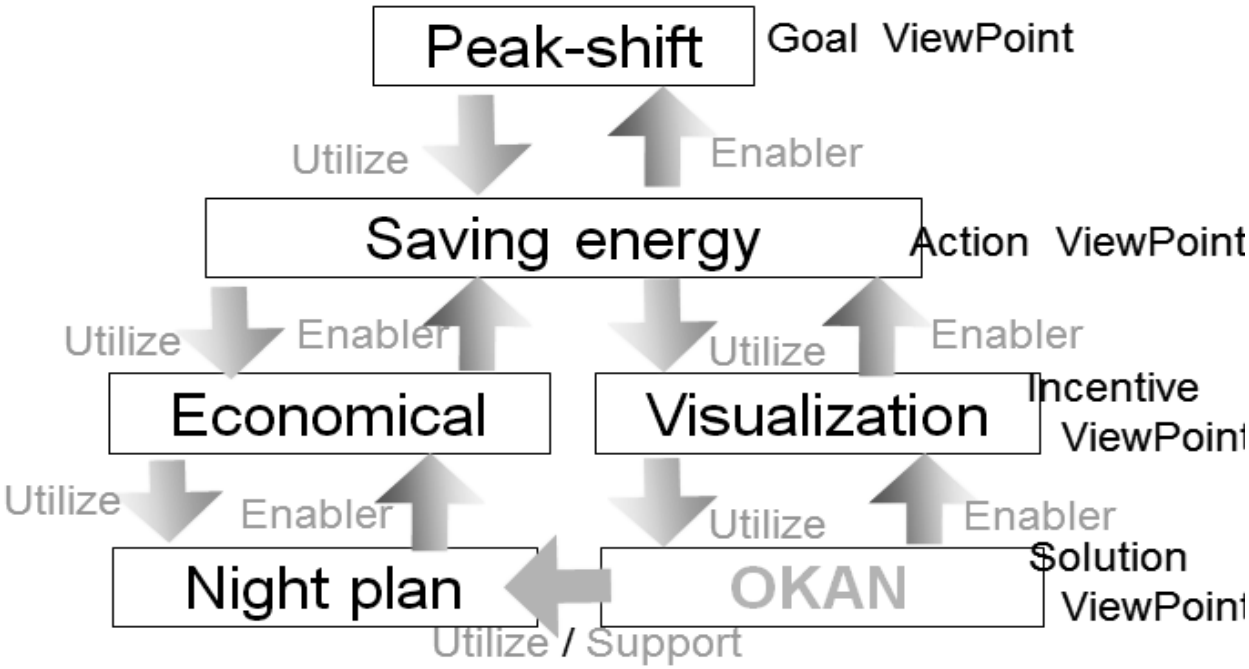


Figure 12: Enabler

4.15. OPM and Service Map for the final solution

Implementing the above two incentives in our system, we designed OKAN system as our final solution. We depicted the solution in OPM and Service Map to share clear understanding among the group members.

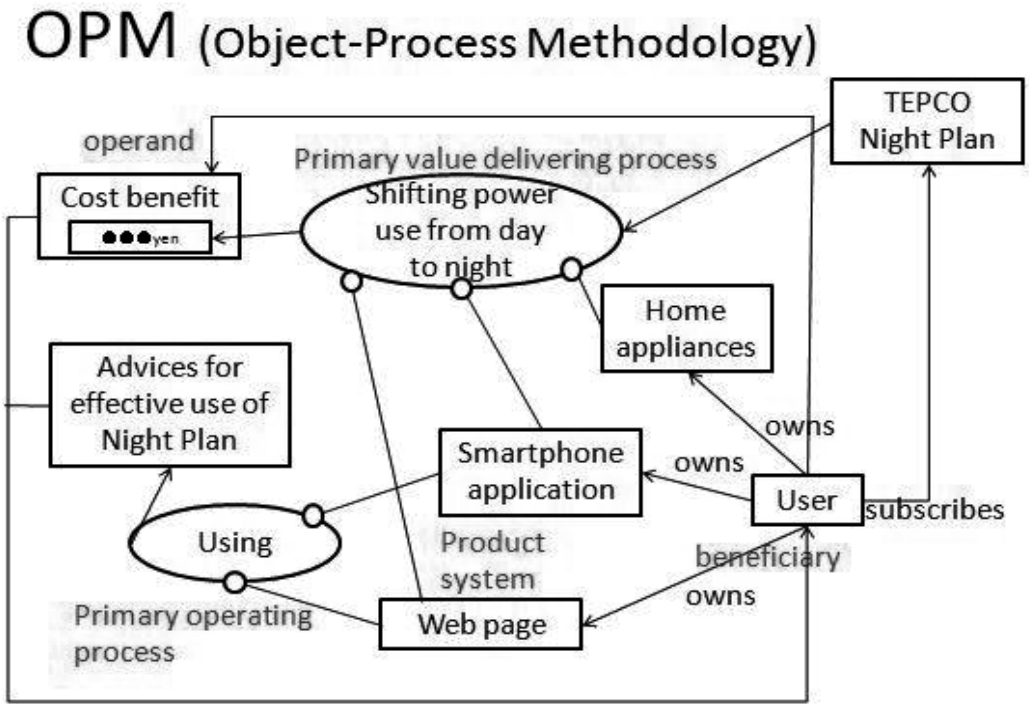


Figure 13: OPM

While depicting in this diagram, we could reconfirm about the structure of our system including stakeholders, inputs, outputs and processes.

Service Map

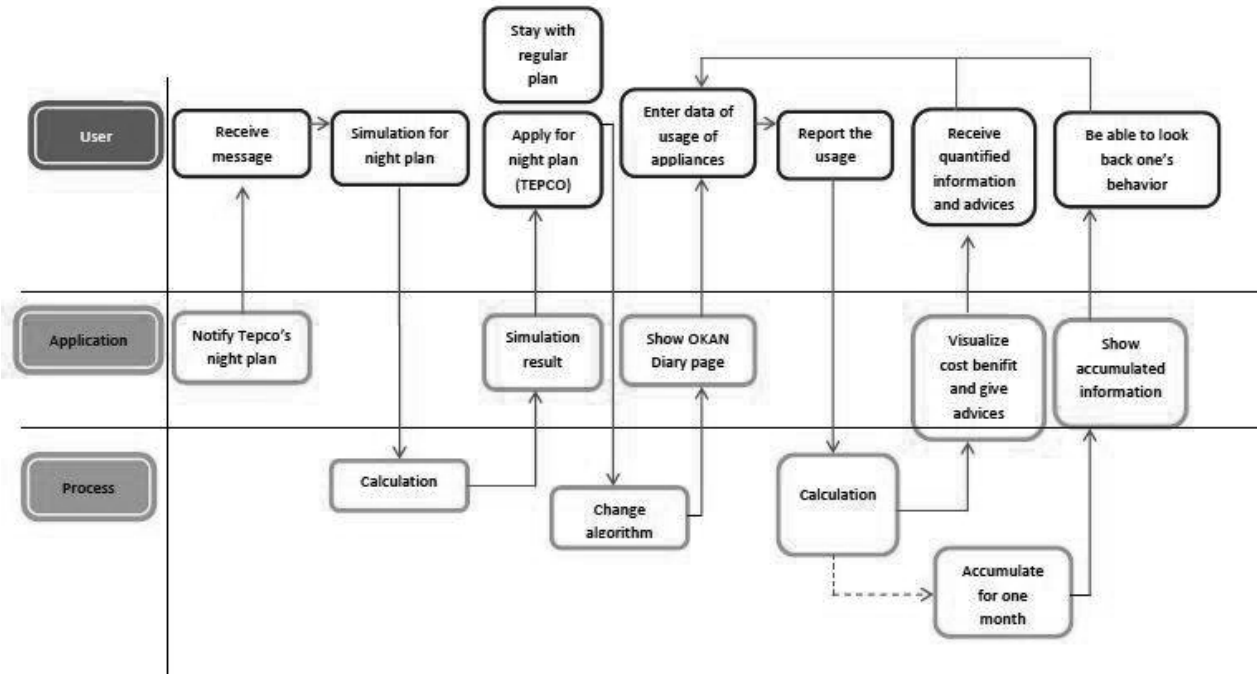


Figure 14: Service Map

Illustrating our service process in Service Map methodology, it became more and more clear which entity of the service handle which process and how they are connected each other. Also this helped us find the boundary of our service more clearly. In this map, we found that our system does not satisfy everyone. As you can see, when the simulation for the Night Plan did not work, users would not apply for the Night Plan and would stay with regular plan. These people would not be potential users for our system.

4.16. Prototyping

Finally, we decide that our final prototype and our final proposal to realize a "peak shift" in the actual consumption structure of TEPCO. (Prototypes and their details are shown in the following section, 5. Design Recommendation.)

5. Design recommendation

Our final solution is a system based on a smart phone application and a website to encourage people to change their use of electricity more during the night than the daytime. This will contribute to level the energy consumption by avoiding the daily peak and therefore help to avoid outages.

This is enabled by TEPCO's Night Plan, a power rate plan to provide lower rate (9.48 yen/kwh) during the night, and a bit higher rate (30.74 yen/kwh) during the day compared to the regular plan (22 yen/kwh.) The system first introduces people about the Night Plan, then encourages them to apply for this plan and helps users to use it plan effectively.

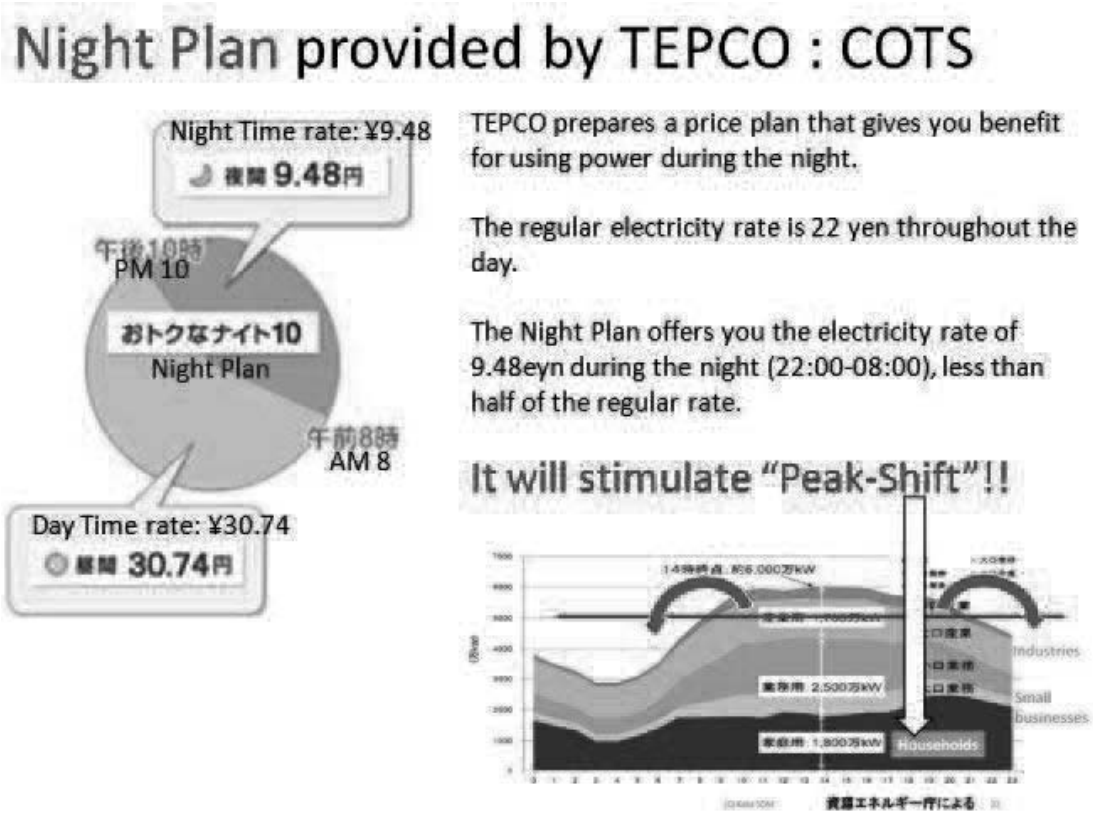


Figure 15: Night Plan

The Night Plan works as an incentive for users to use electricity at night instead of the daytime. This shift alone will bring cost benefit to users. Users would be induced to reduce power consumption even more by turning lights or air conditioners off to get more cost benefit.

This system's goal is not only to introduce the Night Plan, but also to introduce effective way to use the Night Plan by giving daily feedback and advices. The concept is named OKAN which is a character to give users feedback and advices on the application. OKAN is a Japanese word (often used in West Japan) to call "mother". It has a connotation of a mother being nagging but full of love for their kids. OKAN application says "Save money, save power! Cook at home! Clean your room!" based on the information gathered by users. This is like a "mother" talking to her kids living away from home, worrying about their health and lifestyle but saying it in a bit mean way.

We picked this character in order to make users feel easy about the situation where their system of life is watched and based on that they are advised on what to do by this application.

Feedback and advices given by this character visualize each user's power shifting and saving activities, and also the effectiveness of the Night Plan for each user.

5.1.Final Prototype – Power Saving OKAN

Our final prototype is a website system which works both on computers (Internet) and smart phones.

A. On Internet:

The conception of the website for the prototype was based on the feedback of the users and the requirement of the proposer. The website that was conceived as the final prototype is: http://setsudenokan.jimdo.com/

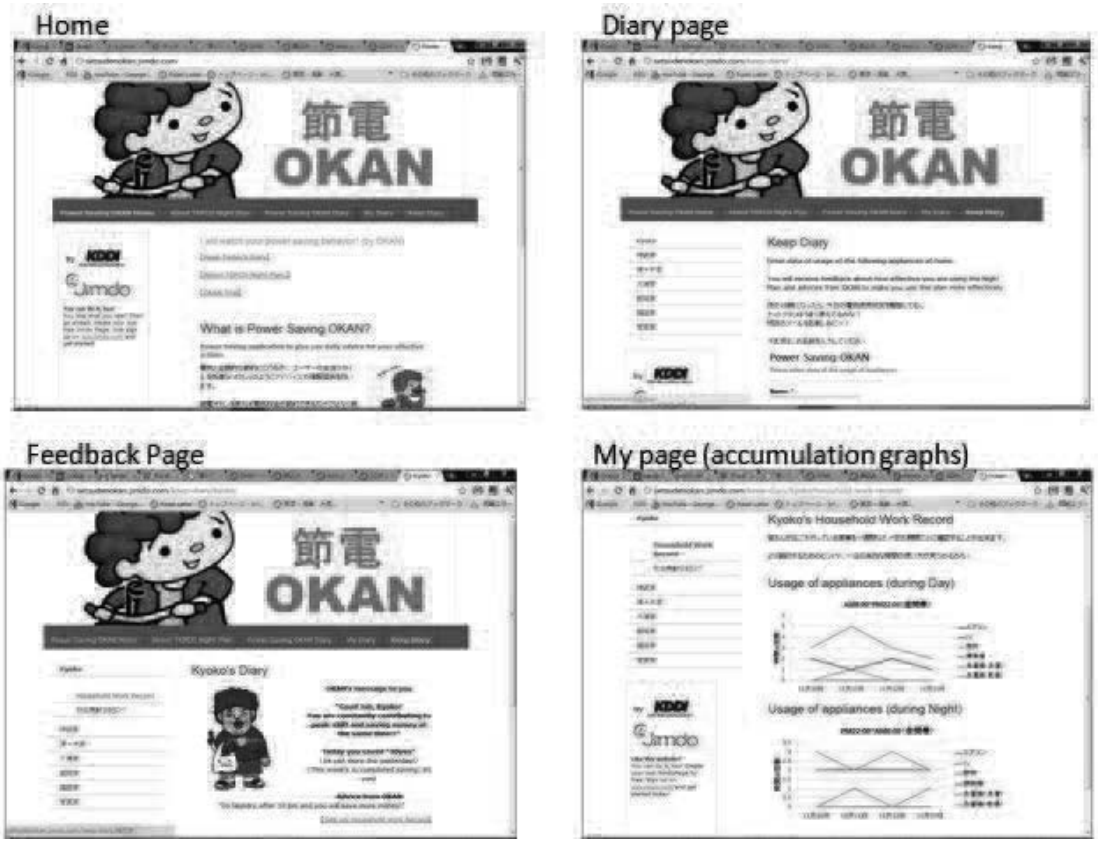


Figure 16: Final Prototyping Rapidly (PC)

B. On Smart phone

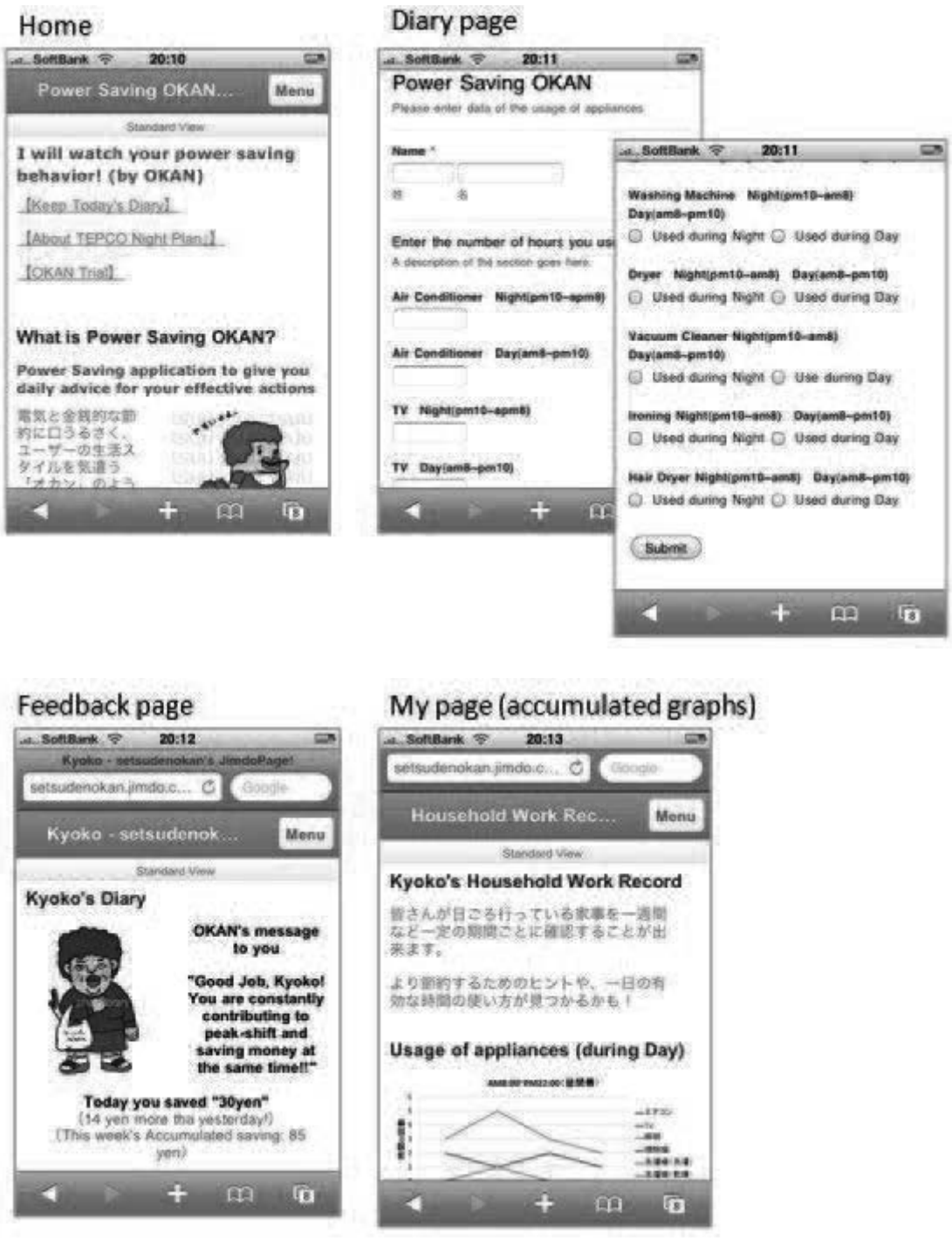


Figure 17: Final Prototyping Rapidly (Smart Phone)

Regarding the different parts of the prototype and the pages that it contains, the explanations are as follows:

Home page explains about the system.

Diary page asks users to enter data on major home appliance usage on a daily basis.

Daily feedback page tells users how effectively they are using this system.

My page displays graphs showing accumulated information on each user's home appliance usage.

5.2.Features of the system:

The system has three features:

A. Good for Society

TEPCO still forced to face the possibility shortage of power supply, OKAN system helps to avoid outages during the peak hours of power consumption.

B. Economical benefit

Good for your family budget. Shifting the power use from day to night will bring you cost benefit. If you try to reduce daytime power consumption even more, you will get more benefit.

C. Better life style

You get advice from OKAN to have better lifestyle. She is like your "mom", watching the way you use home appliances. Based on the information you enter in the application, she sometimes gives the user ideas to save money in power expense and sometimes gives him messages such as: "Clean your house!" or "You'd better sometimes cook at home!" or "It's a great season to enjoy colored leaves! Why don't you go out?"

In order to contribute to the society, the economical reward and the life style are conceived as incentives for the users to use the system and continue using for a long time.

5.3.Phases of the system:

OKAN contains four phases:

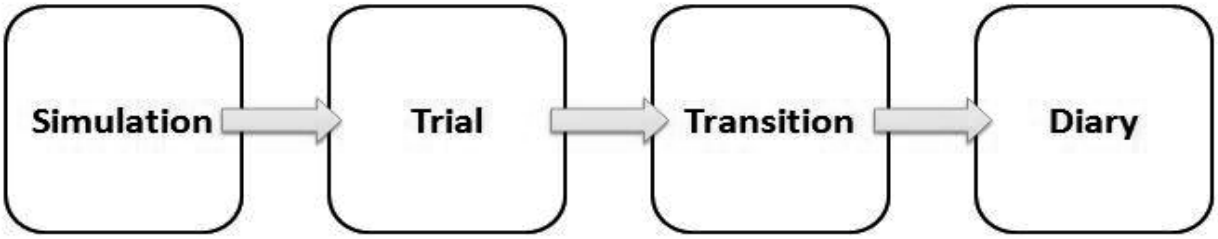


Figure 18: Four Phases

A. Simulation phase

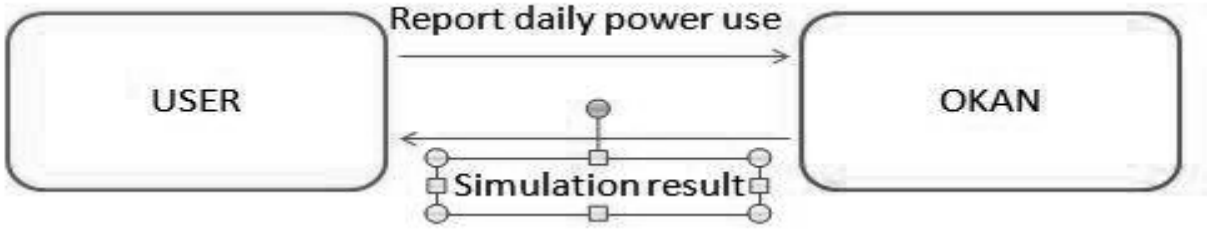


Figure 19: Simulation phase

In the Simulation phase, the users check whether the Night Plan is effective for their lifestyle or not. They enter the data of usage of the home appliances during the day and night separately on the input page (simulation page) on the application. The system performs a simulation calculating the power costs both for the Night Plan and the regular plan based on the entered data and sends back the result.

If a user still hesitates to apply for the Night Plan, he/she will go to the next phase.

B. Trail phase

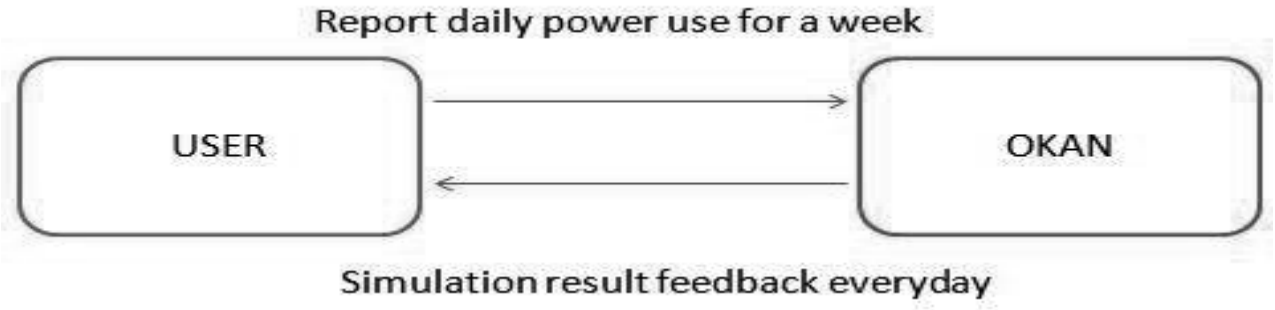


Figure 20: Trail phase

In the Trial phase, users check if the Night Plan is practical to them. Users enter the data in the same way as the simulation phase but this time for one week every day. The system gives feedback to users every day. Doing this for one week will give users clearer answer whether the Night Plan fits their lifestyle. If a user decides to apply for the Night Plan, he/she will go to the next phase.

C. Transition phase

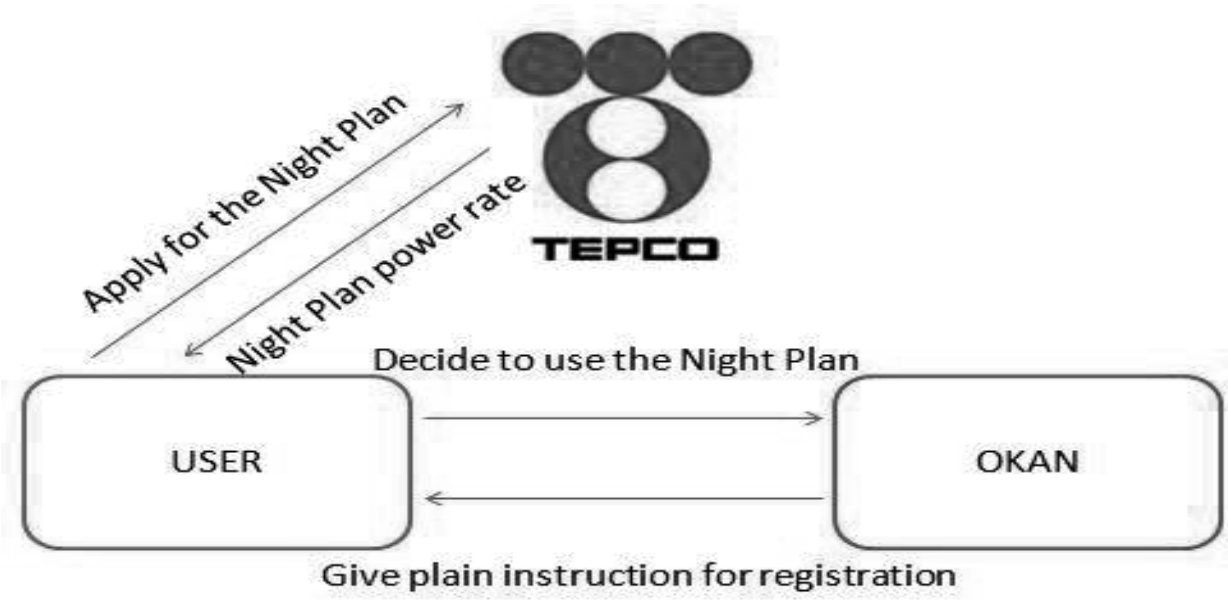


Figure 21: Transition phase

In the Transition phase, users apply for the Night Plan. Their power cost will be charged based on the Night Plan rate from this phase. In order to simplify this transaction for users, the system provides the plain instruction for registration and an easy access to call TEPCO to apply for the Night Plan.

D. Diary phase

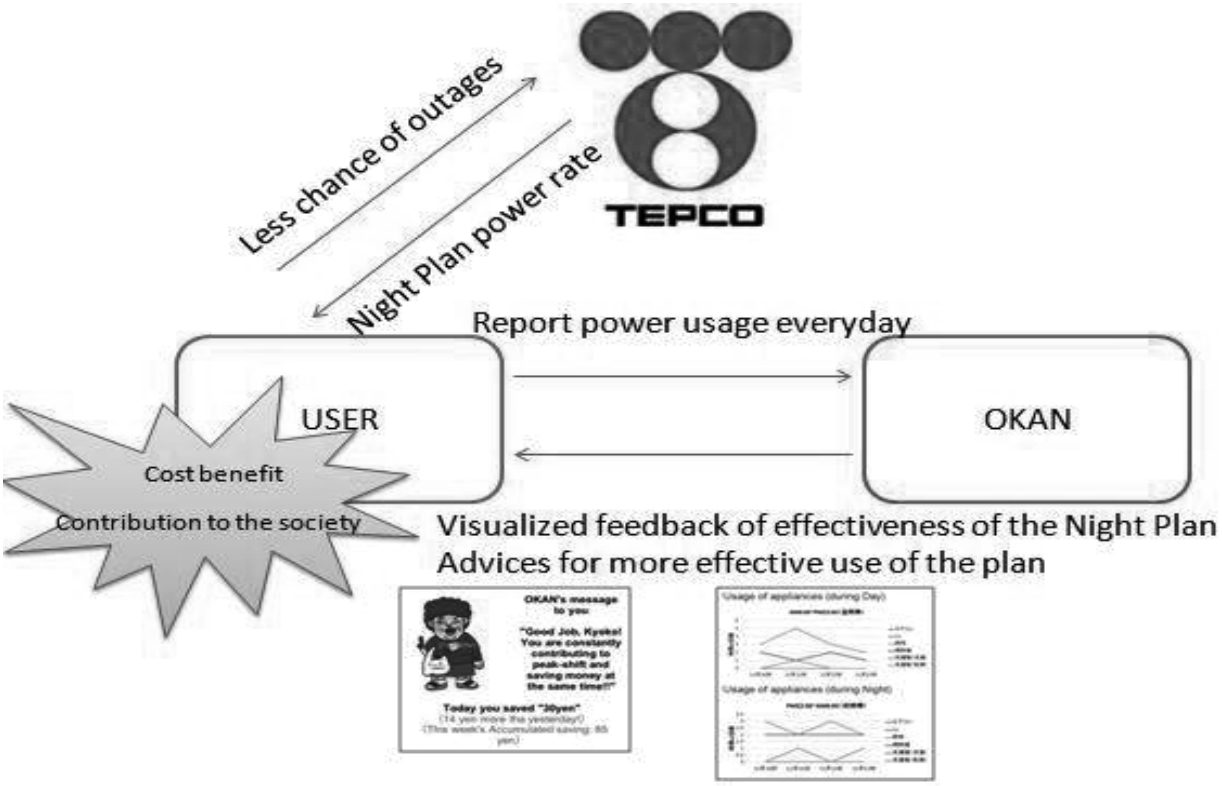


Figure 22: Dairy phase

In the Diary phase, users enter their data every day. The system informs the users about how much money they saved comparing to the regular price plan and give adequate advice to save more power and money. Also the data users enter every day are compiled into graphs. These graphs will help users visualize back their power shifting and saving behaviors.

5.4.Process Specification

OKAN is a smart phone application and website system. Smart phone users can easily access to our system and receive push notification. PC users can access to our system via our website interface on web browser.

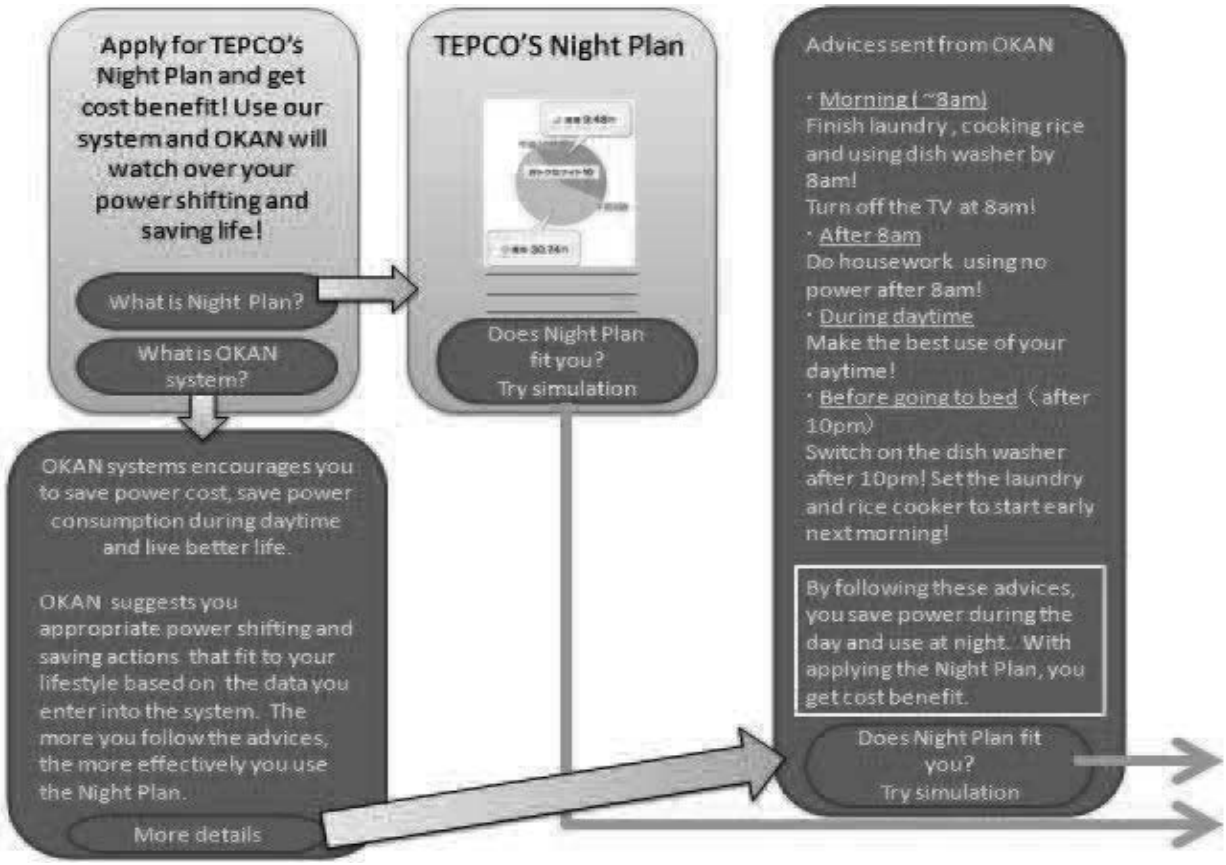


Figure 23: Process specification 1

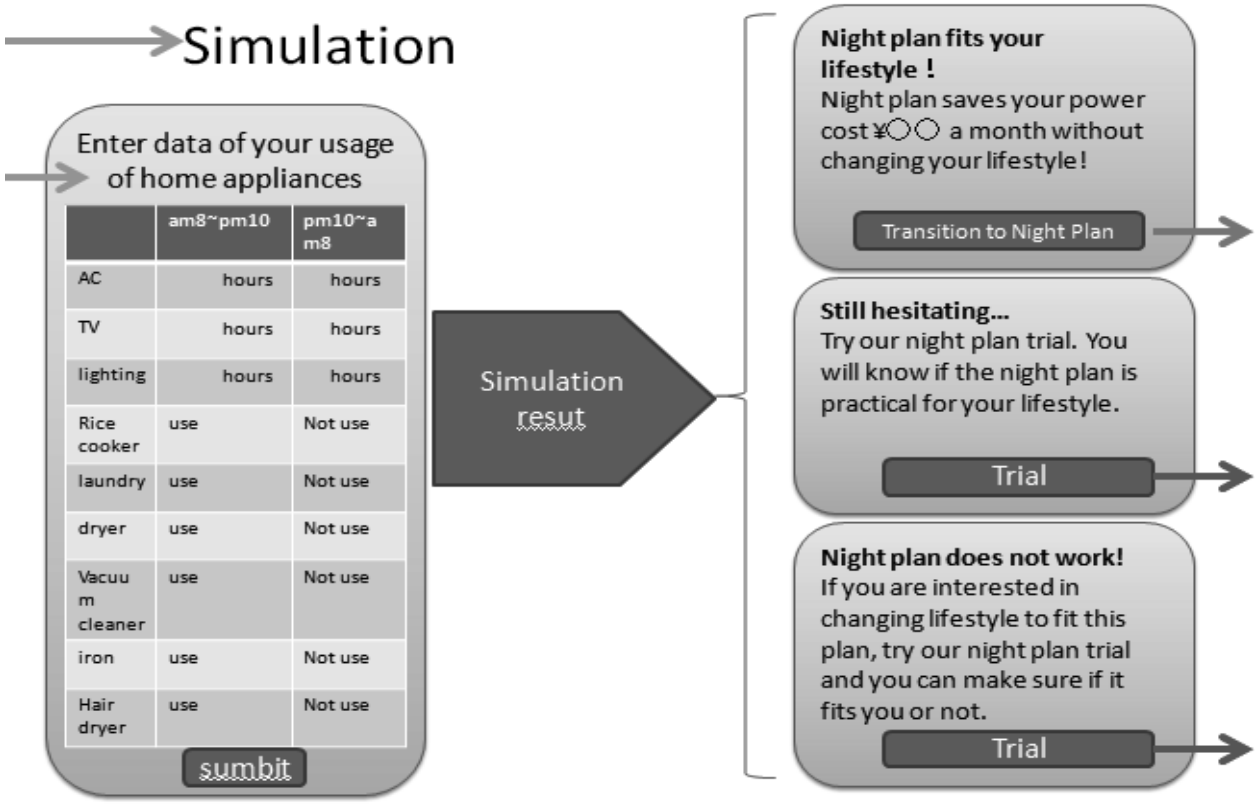


Figure 24: Process specification 2

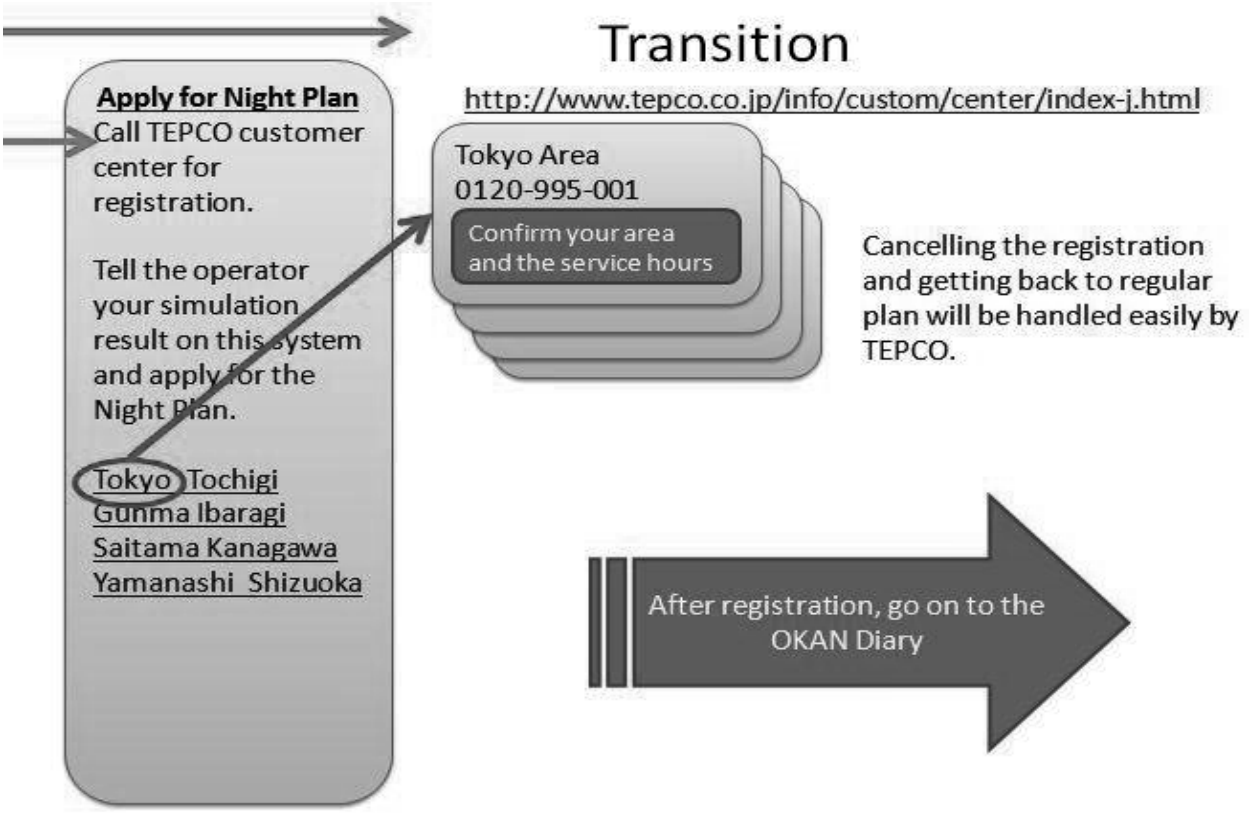


Figure 25: Process specification 3

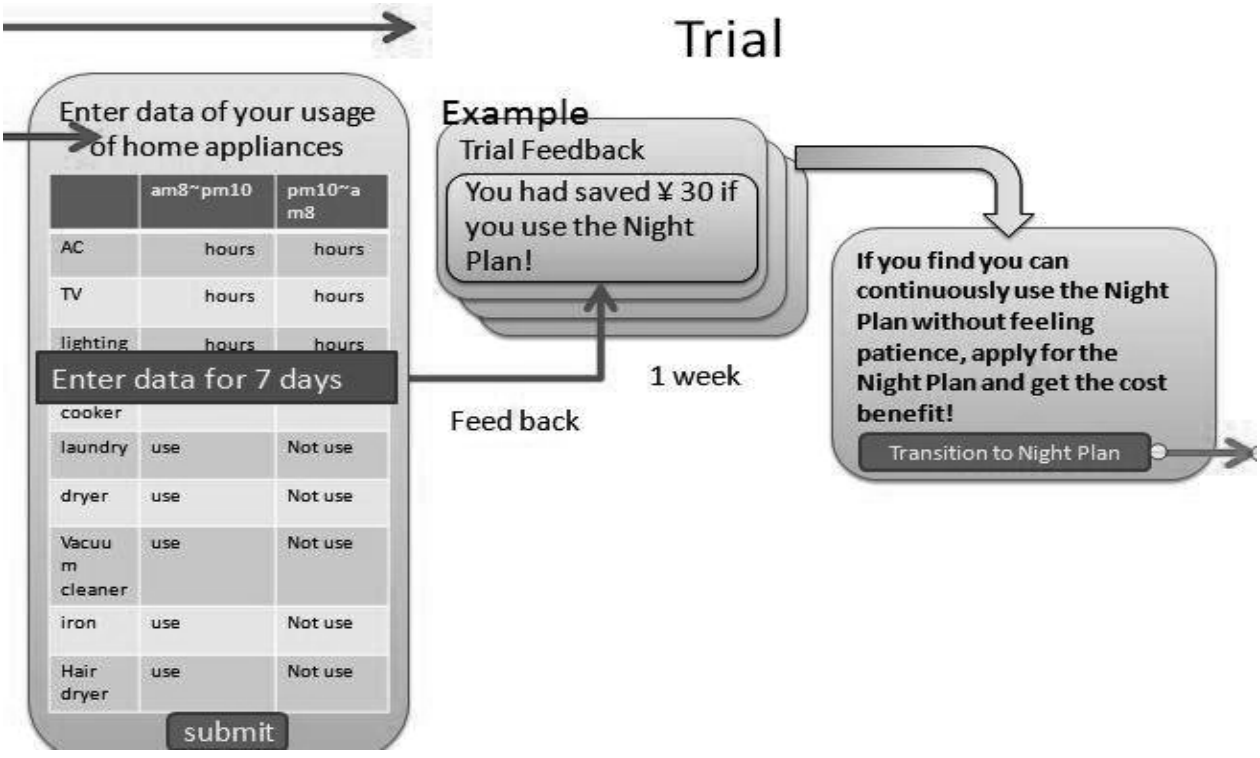


Figure 26: Process specification 4

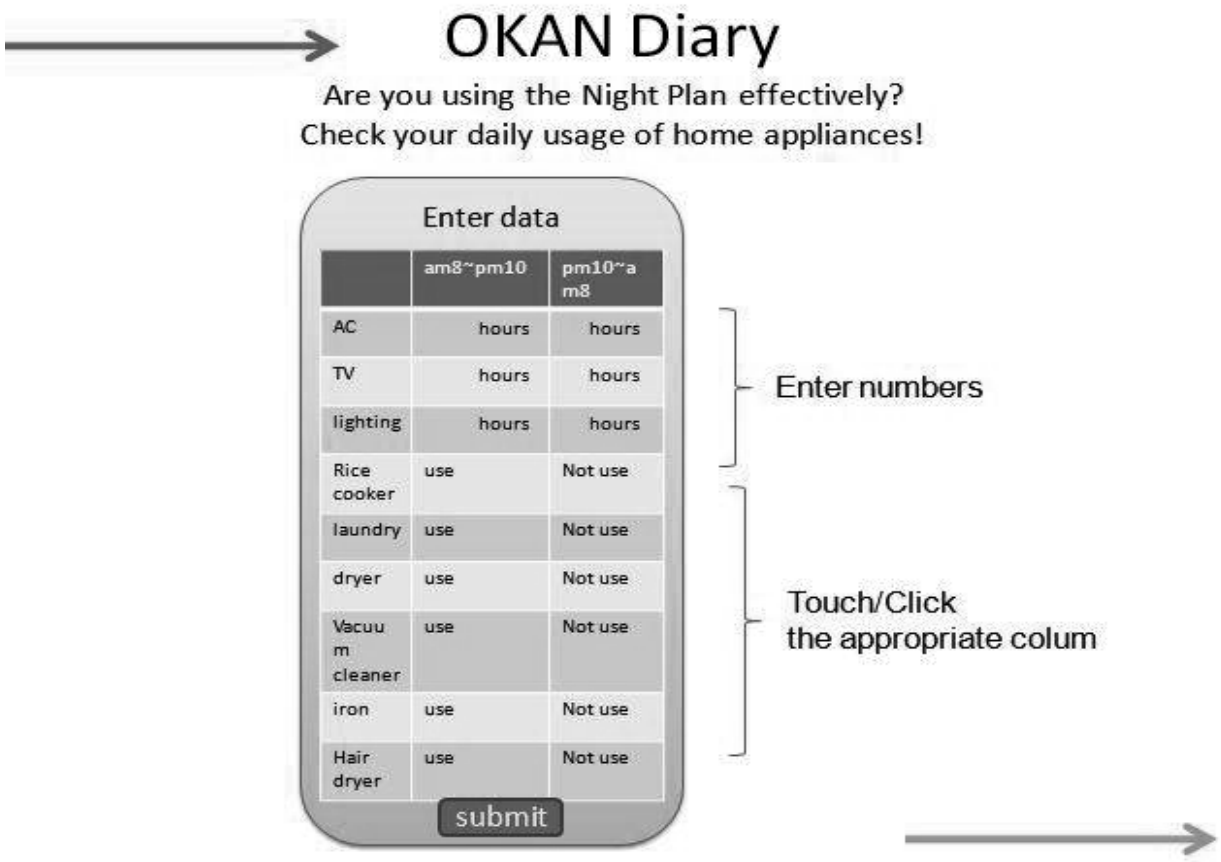


Figure 27: Process specification 5

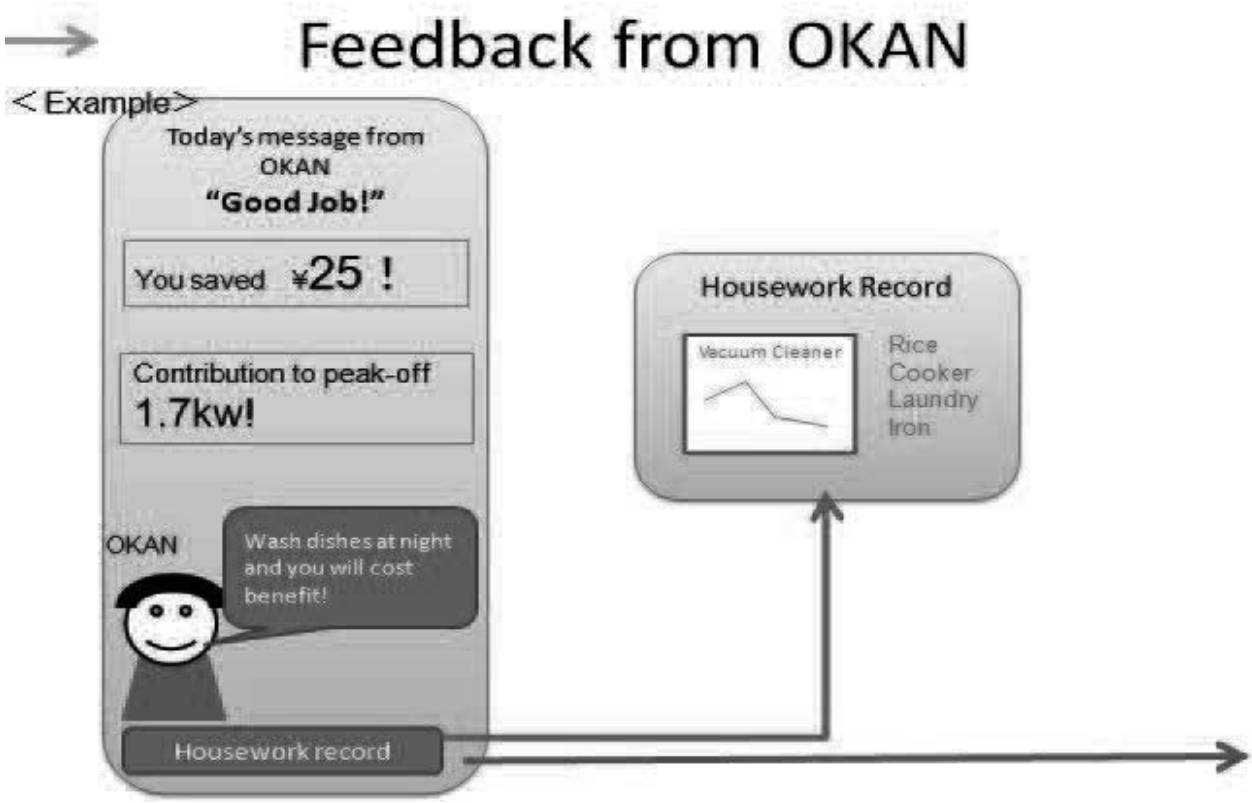


Figure 28: Process specification 6

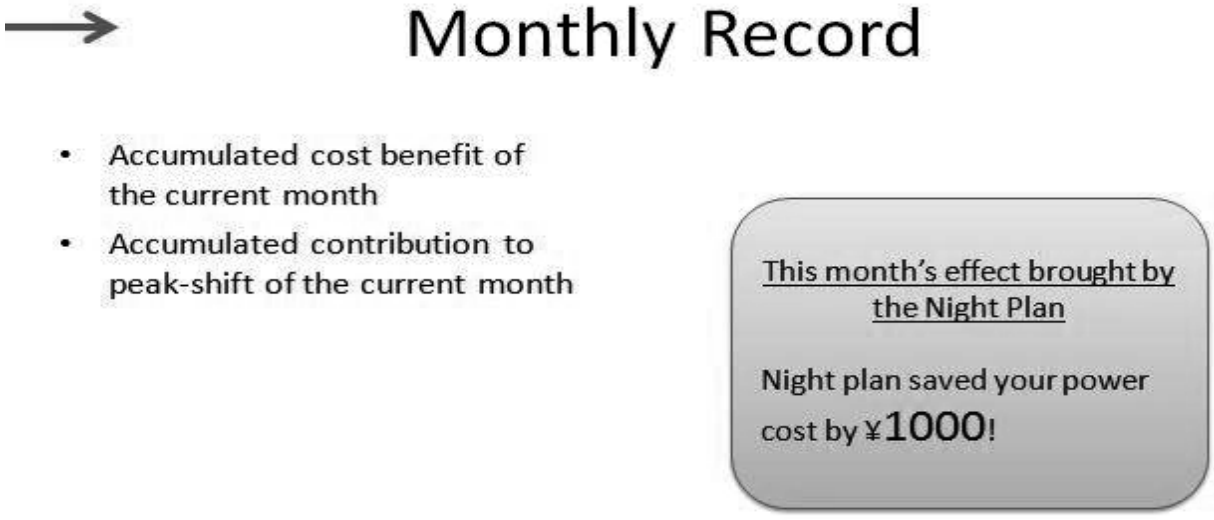


Figure 29: Process specification 7

5.5.Implementation Plan

Our proposers are Elephant Design (E.D.) and Isana.net (Isana.) E.D. is entitled to make the decision to launch this system and Isana.net is in charge of developing the application and its implementation.

OKAN system will be delivered to users through the channel of an existing power saving application which has 700 thousand users.

This application is originally designed and developed by E.D. and Isana soon after the 3.11 earthquake in Tohoku area in Japan. Later, in order to avoid summer power outages, a consortium was formed to design a new system together with Keio SDM faculty members and students (three ALPS B members) and other businesses. And "TEIDEN KAIHI" (avoid outages) system was designed and launched early this summer.

However, due to rather cool temperature for this summer, the system could not work as effectively as expected. And the proposers gave us challenges to design incentives for users to continue to use this system to realize peak-off of daily power consumption.

Therefore, OKAN system application will be developed by Isana based on the system and process structures and algorithm for appropriate calculation and advices, all designed in ALPS. And the system will be marketed by E.D.

Technical Support

Technical support service will be provided by Isana.net.

Isana is the application and web system developer and provider and also an experienced provider of technical support for their systems.

Life Cycle Plan

OKAN system will be improved through test, service and recycle cycle. During the launch of the system, we should use the available channels for advertising about the system. The available community of 700.000 users will be targeted to give a boost to the system. In the beginning, many barriers might be faced such as convincing people about the importance of this system. The willingness to change the energy consumption habits is a big deal in a society considered an energy wasting society. Therefore, after many a short period, many users might feel that the effort to change their behavior is higher than the benefit. In that case, we should think of implementing new types of incentives for retention.

Test

Periodical surveys will be conducted. Questionnaire pages will be prepared and push notifications will inform the users about the survey. Also, users log data showing how users use this application will be observed.

Findings and new requirements will be extracted from the survey and observation results. Based on these outcomes, small updates, new features and modifications will be conducted.

5.6. Service

Test results will be brought into the system and thus the system will be improved.

We already found several new requirements from users which should be reflected to the service.

They include:

- ***Choice of push notifications (sometimes users don't want to receive push notifications)***
- ***Time choice of push notification (users can select time to receive the notification)***
- ***Choice of characters (some users may like other characters other than OKAN)***
- ***Providing information about power consumption of each major appliances***
- ***Wider variety of OKAN's advices for users to motivate peak-shift***

5.7. Recycle

The OKAN system can be introduced and launched in other countries where people are seeking to level off the power consumption.

Descriptions will be translated and customized to the local customs and cultures including the character of "OKAN."

You can refer to detailed description of the simulation in the appendix.

6. Competitive analysis

First of all, to be able to analyze the competitiveness of this system, we should have an overview of its possible business model.

6.1.Overview of business model and value proposition

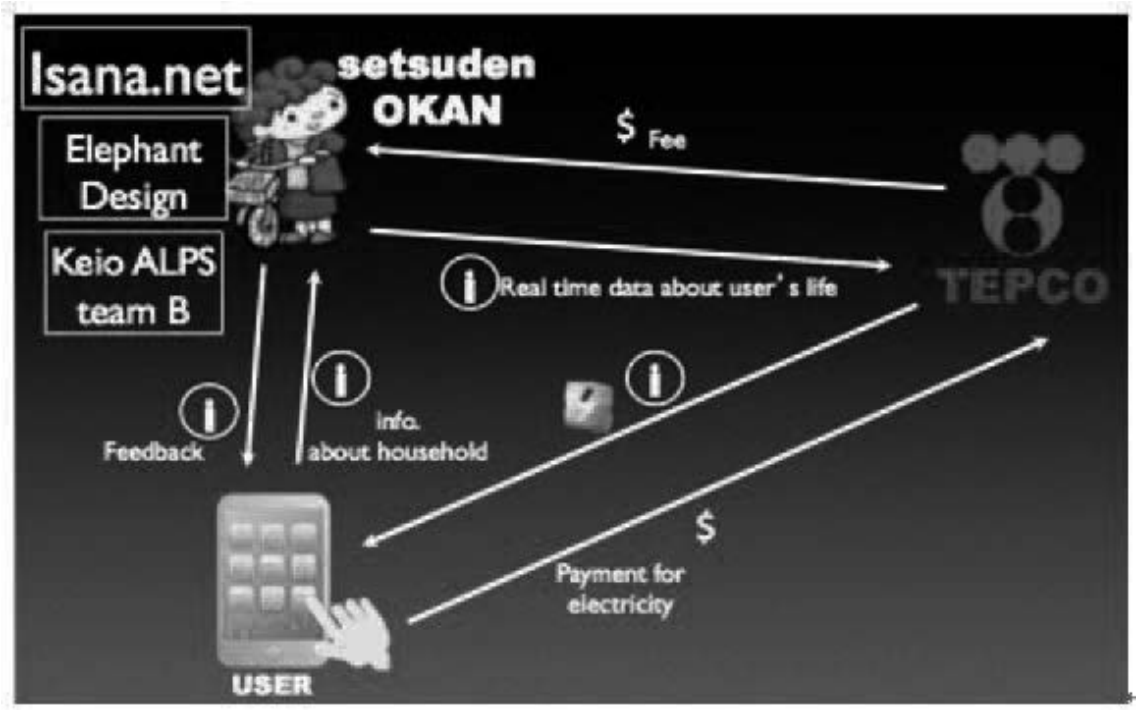


Figure 30: Business model

The business model for our OKAN system is where we provide TEPCO with users' information and get income. We collect real time data about usage of home appliances while users use this system everyday entering data of when, how long and how often users use each major home appliance.

In the viewpoint of TEPCO, the value of this system resides in this information daily provided by users about their usage of appliances. The system promotes TEPCO's Night Plan and gives users advices to use the Night Plan effectively. The daily data collected from users show TEPCO the trend in the real time power consumption of the Night Plan users in the domestic sector. This will enable TEPCO to lower the power supply to the minimum level during the peak time and thus helps lower the cost for power supply.

6.2.Revenue sources, Cost structure

A. Revenue sources

We receive revenue from TEPCO in exchange for users' real time data of power usage at home we collect in this system.

B. Cost structure

The cost structure is: Labor cost + Necessary environment for application development

a. Labor cost:

10 h/day (time spent by a programmer for application development a day) × 5 days (duration necessary for application development) = 50 hours (total time spent by a programmer for application development).
Labor cost = 50h × 10,000 yen/h = **500,000 yen**

b. Necessary environment for application development

Isana.net, an application developer, is to be in charge of development of this system application. The company is equipped with the necessary environment for application development. Therefore, the cost for this environment will be 0 yen.

C. Assumption for cost and demand prediction

Six families tested our system application. They were one 3-generation family, four families with kids and one family without kid. The result showed that the Night Plan worked effectively for the family without kids and 3/4 of families with kids. However it did not work effectively for the 3-generation family.

Assuming that Japan has 50,000 households and the structure consists of 3-generation families (10%), families with kids (50%) and families without kids (40%), it is predicted that the Night Plan works effectively for 38,750 households. The number of these households could be turned out to be the demand for this system application.

D. Development Time/ Risk

The risk for this application is that it can inspire other companies to develop a similar one. Also, if the project is interesting for new entrants, the competition will be hard inside of Japan especially that the number of households is limited.

6.3.Protections strategy against competition

Our business model of selling users' real time power usage data to TEPCO could be threatened by a competitor who develops a similar application. This would cause the price competition for the selling price of data and we might lose this competition. Therefore, it is necessary to build the exclusive and cooperative relationship with TEPCO as soon as possible.

7. ALPS road map and reflections

During the design of this system, we could discuss about many scenarios and could benefit from each member's experience and knowledge to make the decisions. The consensus of the members was very important for the project.

7.1.Roadmap:

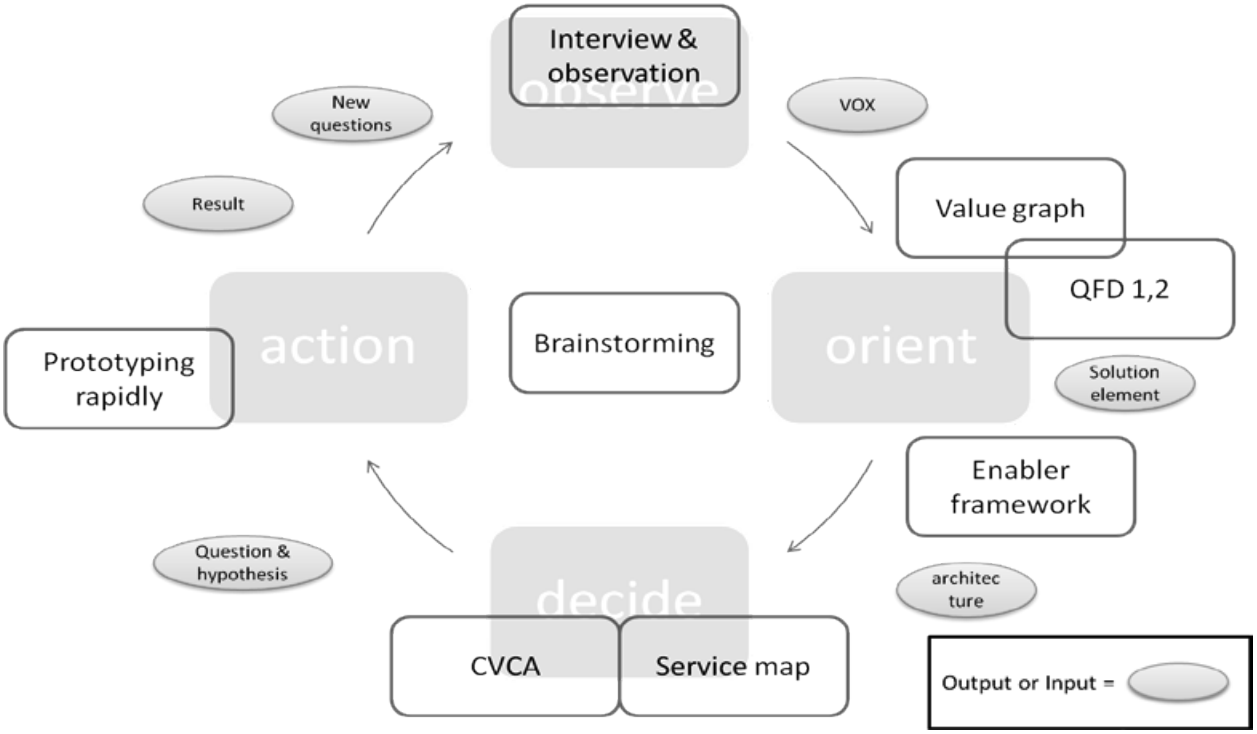


Figure 31: Road map

First of all, we started from interview or observation in "observe phase". We got many VOXs from our target, householders.

Based on these VOXs, we used the value graph and the QFD to determine the solution elements. After that, we used enabler framework to make sure that these solution elements will enable our system to achieve our goal. Finding out that our system can work by enabler framework gives us viewpoints of the architecture of our system in "orient" phase.

Based on the architecture, we created a service map to verify each stakeholder's processes and CVCA to understand relations among stakeholders especially in terms of money or information, services etc. in "decide" phase.

From “orient” phase, we got questions and hypotheses. In order to answer these questions and verify the hypotheses, we implemented a prototype. We asked our target users to try using our prototype and we got feedback showing us where to orient to system design. But many questions needed answers, so we went back to “observe” phase and tried to get VOXs by interview and observations.

We put brainstorming on center of our actual roadmap in figure 1, because we think we used and needed brainstorming in every phase.

7.2.“Aha, Oops, and Eureka”

We got “Aha, Oops, and Eureka” in each phase as showed in figure 3.

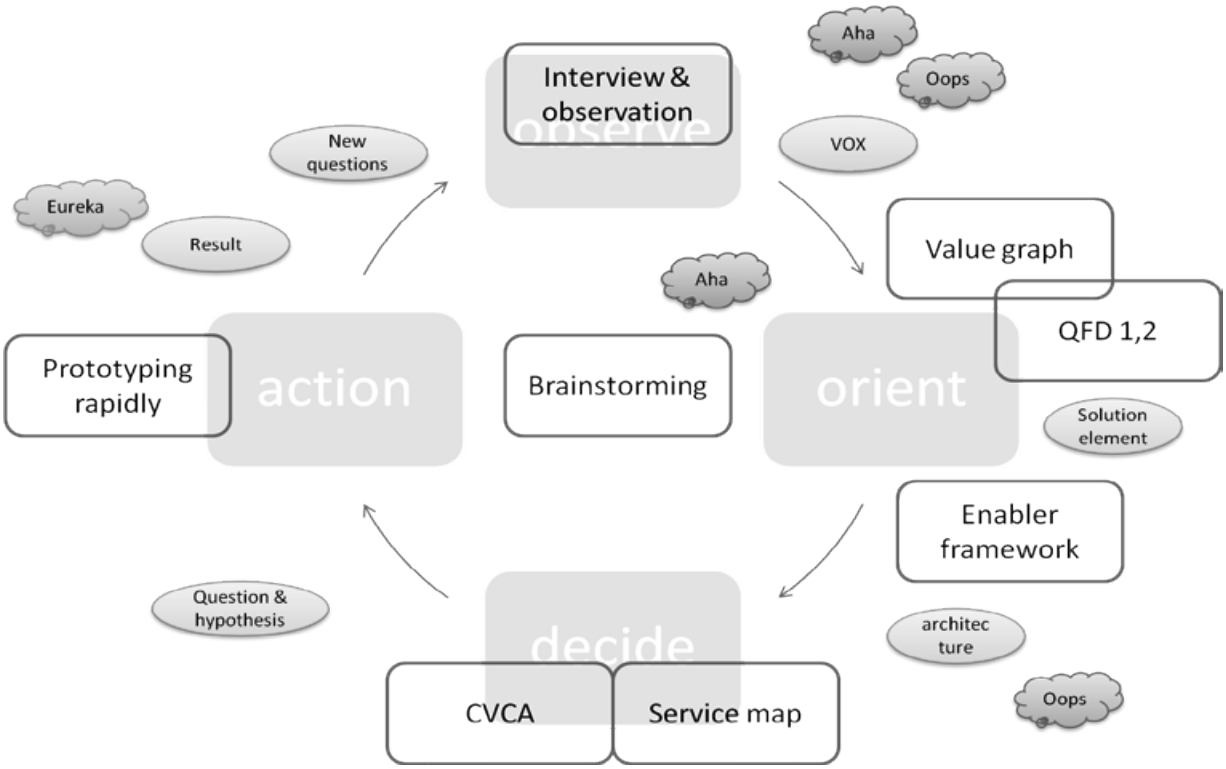


Figure 32: Aha, Oops and Eurekas

A. “Observe” phase

Before we created our system, we got many “Aha”s. From those “Aha”s, we got tips to create our system.

And also, we got “Oops”s from after prototyping rapidly. These “Oops”s mean that our hypotheses are not verified, nor our questions answered.

In this phase, we were already thinking about an incentive system based on the requirements of the proposer, but the users' requirements were not going to be satisfied in that design was adopted.

B. "Orient" phase

We got "Oops"s especially from enabler framework. Even though we tried to create solution elements from value graph and QFD, enabler framework often proved that our solution couldn't achieve our project goal systematically. Every time that we failed in this phase, we came back to observe phase or had to try to create new idea.

C. "Action" phase

We got "Eureka"s after prototyping rapidly and tested it. Without prototyping and testing, we could not make sure that we reached a good solution. We think prototyping rapidly is essential to get "Eureka"s.

7.3.Reflexions

Even if we could do the project again from the beginning, we would follow almost the same path as this time. However, we would change three points like following.

First, the value of the voice of customers is important in early stages to have a good idea about their requirements to be able to precise the scope of the path to follow for the design of the system.

Second, if we have next ALPS project, we tried to prototyping rapidly as soon as possible. We got important tips from prototyping and testing. We wish we had tried more quickly.

Third, one of the most difficulties in our ALPS project is to set up our specific goal with our consensus as a team. Saving energy has several ways to execute like just decreasing the amount of electricity consumption or changing the time to use electricity to avoid peak-time, which was often confusing us. If we have next opportunity to work on same project, we would specify the meaning of saving energy in early stage of the project.

7.4.Feedback

A. Understanding

Especially in early stage of ALPS, the meaning and impact of each tool was not clear to us. As ALPS progressed, we became able to understand why and how we use each tool. This might be your intention in terms of practical education. On the other hand, we wonder if you can teach how and why to use each tool more clearly.

In our discussion, we were confused with how system thinking and design thinking differ. Some students thought ALPS was the program for students to be educated as system engineer, while

some of us thought that ALPS was the chance to experience design thinking. We think this was influenced by previous education background. Especially students who took d-school class provided by Mr. Sun Kim and Mr. Sushi were confused about what ALPS was and how system thinking and design thinking differ.

B. Period:

Half a year is too long to learn the essence of ALPS.
Some of the members in our group mentioned that ALPS was too long to devote time considering of what we learned. We propose that ALPS should be shortened like a month boot camp, which might be enough to learn essence of ALPS. On the other hand, we understand such a boot camp style is difficult for student working while studying at SDM. This is a difficult issue for SDM.

C. Proposer:

We need more serious proposers. Some proposers seem to think that ALPS students are just workforces. Some of them seem to think that ALPS is just an education program that they don't need to be serious. If students work on seriously, proposers also should be as serious as students.

D. Evaluation:

We couldn't understand how to measure our performance in ALPS. Especially, in final presentation evaluation criterion was so ambiguous that students can't be satisfied with their efforts and results in the project.

7.5.Idea changing:

Until ALPS #3, we designed the social contribution incentive like supporting Tohoku area suffered from East Tohoku Big Earthquake for households to encourage people to save energy.

However, we realized that economical incentive was critical essence to stimulate households' saving energy based on the results of the questionnaire and the interview. So, we adapted economical incentive and embedded it into our system.

We concluded that the change was a good decision. We used night plan provided by TEPCO, which enables householders to save energy consumption and charge from TEPCO, as mentioned before. Using night plan encouraged householders to use electricity in night time (not peak time) to avoid using electricity around peak-time. We achieved our original goal of this project by using night plan, in other words, economical incentive. Without economical incentive, we might have not achieved our goal, so we think it was a good decision.

8. Conclusion and future work

The system is based on the willingness of the citizens to change their behavior regarding the electricity use. To encourage those actions, a financial incentive is considered. Also, the

visualization and the follow of the users' actions by themselves is a form of incentives to make them regularly think wisely about their consumption. A concept (OKAN) has been developed to combine these concepts and also to give the users many advices about the power outages and about their energy use. Many of the potential users said that they are more willing to subscribe for the Night Plan if they get advices from OKAN.

However, the leveling of the energy consumption is still being confused with energy reduction by our proposers and many companies. The peak-off and the energy consumption reduction are two different concepts. Thus, the actions needed for these projects are also different. For that reason, our proposer's understanding is one of the limits for the development of this system.

Also, the cooperation from TEPCO is doubtful because until now TEPCO is still aiming to maximize the consumption of electricity by its customers and any project that might cause a decrease in their profits is not acceptable.

This project might face another limit which is the duration of the use of the application. The risk of the occurrence of blackouts has been neglected by people starting from the middle of august.

This project might be interesting in countries where the possibility of power outages is very high. Then, we can develop other concepts and incentives based on the local characteristics.

This system could have improved so much if the participation of a sponsor has been possible. A sponsor can be in charge of providing financial incentives to a community of people willing to change their energy consumption behavior based on the points that they can earn after each action. Also we can think of helping other areas of Japan where people are suffering hard time after the big Tsunami.

As a contingency plan, if TEPCO is not willing to cooperate with us in this system we can get income from advertisement on the application and the website.

9. Acknowledgments

Kohei Nishiyama(Elephant Design)　Isana Ishitani(isana.net)
Naohiko Kohtake(Keio)

＜Teiden-Kaihi (Avoid outage) consortium＞

Hiroyuki Goto(IBM Japan) Satoshi Ishidera(Tokyu Corporation)
Yosuke Matsuda(McKinsey & Company) Toshiyuki Yasui(Keio)
Seikoh Shirasaka(Keio)

11people who responded to the interview

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(TEPCO)

11. Appendix

11.1. Simulation calculation

Simulation

	Hours of use	
appliances	AM8:00~PM10:00	PM10:00~AM8:00
AC	hours	hours
TV	hours	hours
Lightings	hours	hours
...		
...		
Rice cooker	times	times
Laundry (washing)	times	times
Laundry (drying)	times	times
Microwave Oven	times	times
...		
Vacuum cleaner	use	use
Hair dryer	use	use
Iron	use	use
Cost under the regular plan	¥XX,XXX	
Cost under the Night Plan	¥XX,XXX	

Standby power consumption is added to this

Standby power consumption of AC, TV, Toilet warmer, Rice cooker (warming), Refrigerator (included in standby power consumption) added up to 356(W/h).

FLow

① Users enter the number of hours/times they used each appliance during the day and night separately.

② Calculate the power consumption (W) by multiplying the w/h by hours

③ Calculate the power cost of both the Night plan and regular plan using the above (W).

④ Add the standby power cost to the above result ③. This turns out to be the power cost for the day.

※The system will not ask users to list home appliances they are using in order to pursue simple and easy operation for users. The system uses 356 (w/h) as the fixed figure for standby power consumption.

Figure 33: Simulation calculation 1

Simulation sample

Appliances	usage AM8:00~PM10:00	usage PM10:00~AM8:00
AC	8 hours	2 hours
TV	9 hours	2 hours
Lighitings	6 hours	2 hours
...		
...		
Rice Cooker	1 times	0 times
Laundry (washing)	1 times	0 times
Laundry (drying)	0 times	0 times
Microwave Oven	1 times	1 times
...		
Vacuum Cleaner	use	use
Hair dryer	use	use
Iron	use	use
Cost under the regular plan	¥444.84	
Cost under Night Plan	¥481.5	

Calculation detail

	Regular plan	Night Plan AM8:00~PM10:00	Night Plan PM10:00~AM8:00
	600(w/h)× 10(h)=6000w	4800w	1200w
	150(w/h)× 11(h)=1650w	1350w	300w
	160(w/h)× 8(h)=1280w	960w	320w
	700(w/h)× 2/3(h)=466w	466w	0w
	500(w/h)× 2/3(h)=333w	333w	0w
	1300(w/h)× 1/6(h)=216w	108w	108w
	1000(w/h)× 1/3(h)=333w	333w	0w
	800(w/h)× 1/6(h)=133w	133w	0w
	1200(w/h)× 1/3(h)=400w	400w	0w
Sub Total	10915w	8987w	1928w
		¥276.26	¥18.28
	¥249.51		¥294.54
Total (standby cost added)	¥444.84		¥481.5

13 **Result of calculation: Night Plan does not work. It increases the power cost by ¥37.**

Figure 34: simulation calculation 2

11.2 Cluster Analysis

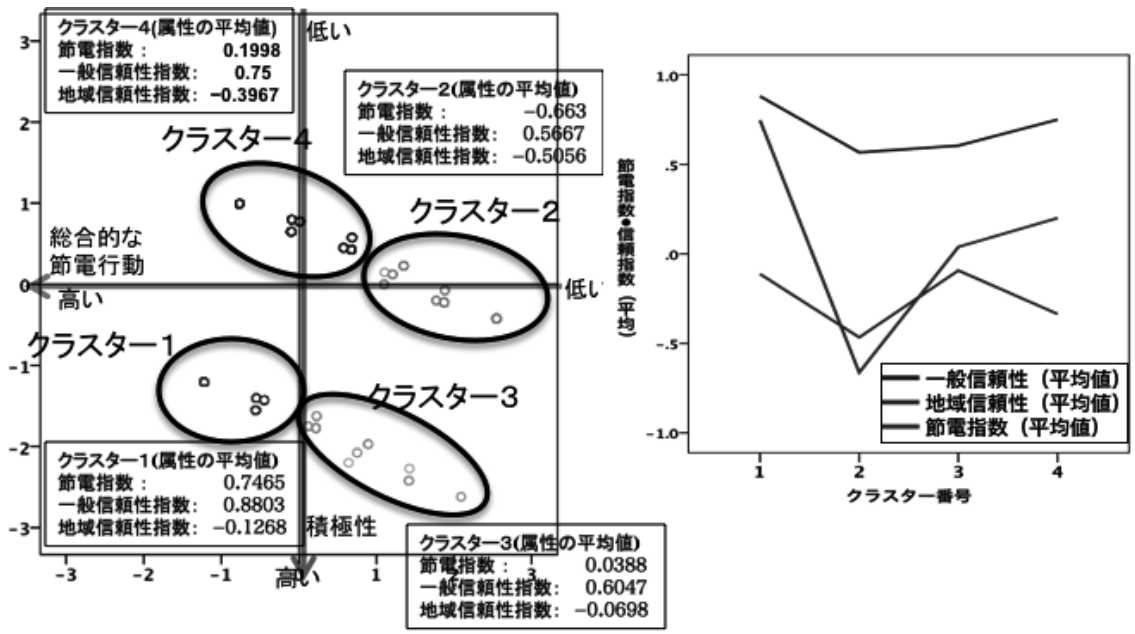


Figure 35: Cluster Analysis

12. Figures and Tables

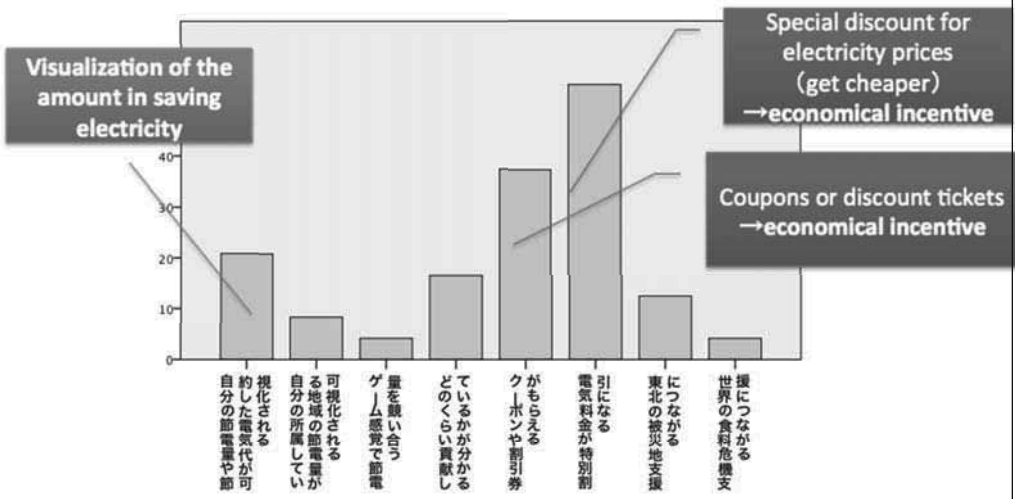
Group B’s Final Presentation Slides

ALPS Final Presentation

ALPS2011 Team B
2011.11.18

TeamB
Jorge Nikaidoh
Kyoko Watanabe
Motoshi Kanke
Abdelhamid Addi
Yosuke Shinoda

〈Motivation for saving power〉
-Survey on more than 600 people



VOX from interview with 11 people

"If people can **see the effort effects** in saving energy, this kind of work would be energized."

"It would be convenient to **know how much they consume** and if they are **using electricity excessively**."

"In order to save energy without burden it is important to not allow users to experience a difficult time and to find waste and get rid of it."

Outline of our questionnaire
（consciousness survey about saving electricity behavior）

Execution Period: August 12th – 18th (2011) Investigation Object: 3000 people within 4km radius at the heart of Futako Tamagawa station.

【Objective】
To confirm the hypothesis that there is a relation between
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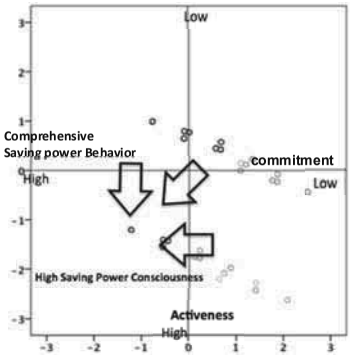


Based on questionnaire results, we made an "analysis of principal components" and a "cluster analysis"

In order to know more details the questionnaire results, we made an interview to some people of each cluster.

Based on this results, we thought about how to improve low consciousness group.

【Results】As an incentive to strength people's power saving consciousness
①Economical incentive ②Visualization of the amount in saving electricity

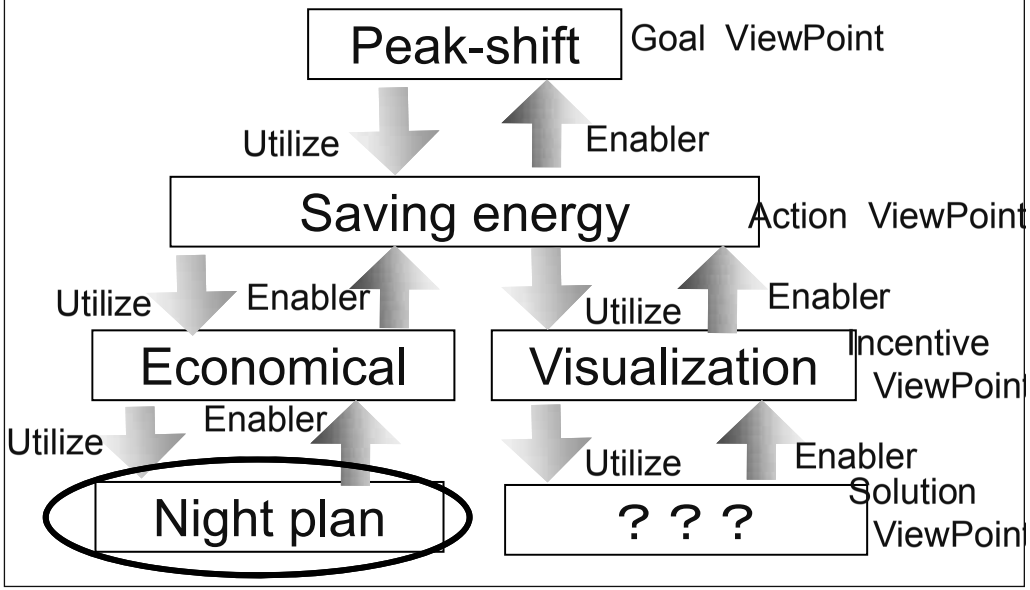
Wrap Up of our Survey Research

How can we provoke power saving action to users?

→With Economical Benefits

→By visualizing the users' effort in reducing electricity consumption.

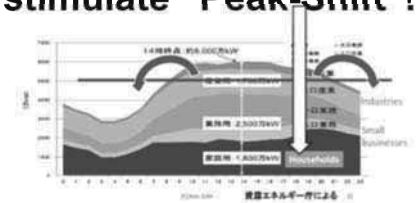
Enabler framework applied for our system



Night Plan provided by TEPCO : COTS

TEPCO prepares a price plan that gives you **benefit for using power during the night.**
The regular electricity rate is 22 yen throughout the day.
The Night Plan offers you the electricity rate of **9.48yen during the night (22:00-08:00),less than half of the regular rate**.

It will stimulate "Peak-Shift"!!



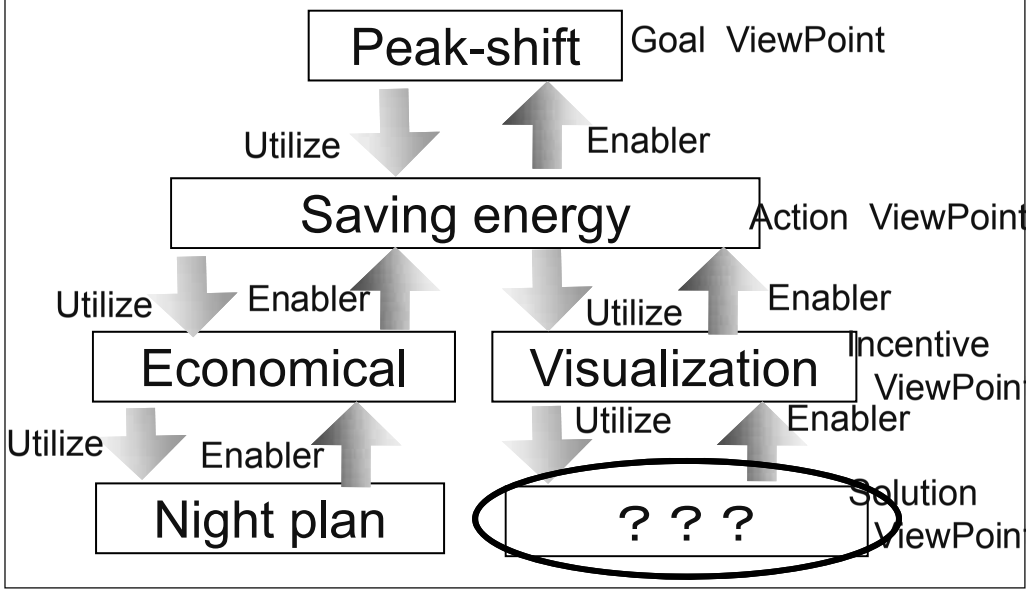
VOX form interview with 11 people

About the Night Plan

- 6 out of 11 said that "they know or had heard about it".
- "They don't know if it would be suitable to their lifestyles. Therefore they are not considering to use it"
- "They want to see the advantages of it by doing a simulation"
- "They want an easy way when transferring to Night

-Plan"

Enabler framework applied for our system



Here is SYSTEM designed by team B

-> movie

Two questions raised…

Can households make effective use of the Night Plan

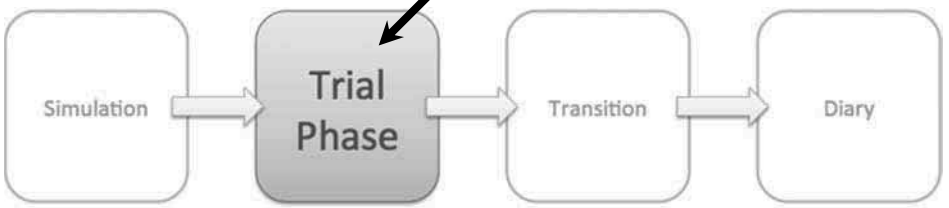
without patience？ → • 1st prototyping rapidly

Continuously？ → • 2nd prototyping rapidly rapidly

The 1st question

Can households make effective use of the Night Plan

without patience? → • 1st prototyping rapidly



1st prototyping : Simulation Function

Purpose

: To make sure if standard households would be able to put the Night Plan into practical use

Validation

- Duration: 4days (Saturday ~ Tuesday)
- Participants: 6 families

•Participants report us about their **use of appliances in each time segment** on the check table sheet.

↓

comparing power cost the **regular price** plan with that under **the Night Plan**

↓

•We **send back the simulation result** with an **adequate advice** to take advantage of the Night Plan

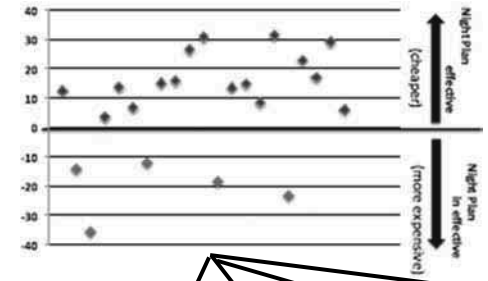
【Entry example】

Check table of electric power use

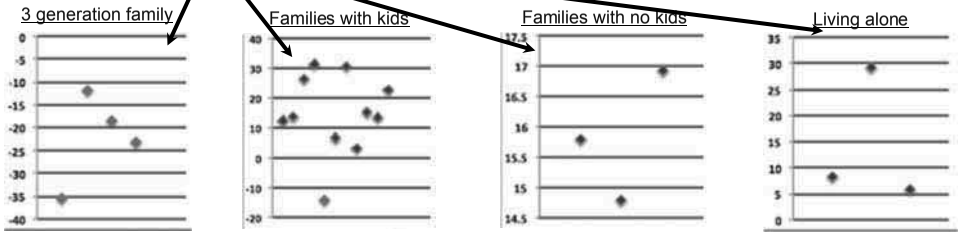
Oct.27

	Used time zone	
electrical goods	AM8:00–PM10:00	PM10:00–AM8:00
air conditioner	3	2
TV	7	1
Light	5	2
rice cooker(using)	1	0
rice cooker (heat-retention)	10	0
washing machine (using)	0	1
washing machine (drying)	0	1
microwave	1	1
cleaner	used / not used	used / not used
dryer	used / not used	used / not used
iron	used / not used	used / not used
clothes iron	used / not used	used / not used
current electricity charges	376.295 yen	
electrical charges in Night plan	356.369 yen	

<Calculation>
Power cost under the regular price plan–Cost under the Night Plan



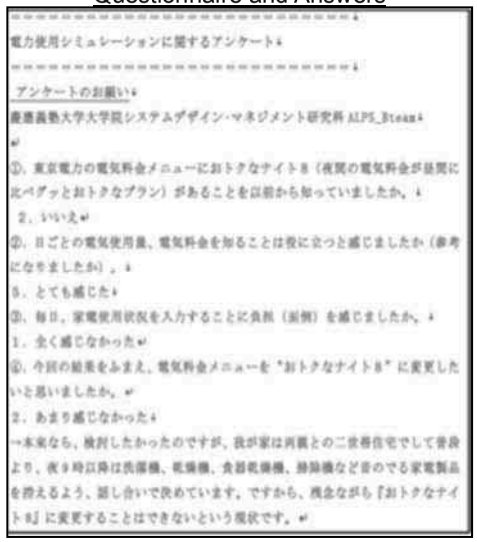
Simulation conducted on 6 families.
Compared the cost under the Night Plan with that under the regular plan.



Found that the **Night Plan does not fit the 3 generation household**.
Conducted a survey on this family to investigate further information.

Survey result <3 generation household>

Questionnaire and Answers



電力使用シミュレーションに関するアンケート

アンケートのお願い

慶應義塾大学大学院システムデザイン・マネジメント研究科 ALPS_Team

①、東京電力の電気料金メニューにおトクなナイト８（夜間の電気料金が昼間に比べグッとおトクなプラン）があることを以前から知っていましたか。

2、いいえ

②、日ごとの電気使用量、電気料金を知ることは役に立つと感じましたか（参考になりましたか）。

5、とても感じた

③、毎日、家電使用状況を入力することに負担（面倒）を感じましたか。

1、全く感じなかった

④、今回の結果をふまえ、電気料金メニューを"おトクなナイト８"に変更したいと思いましたか。

2、あまり感じなかった

→本来なら、検討したかったのですが、我が家は両親との二世帯住宅でして普段より、夜９時以降は洗濯機、乾燥機、食器乾燥機、除湿機などのでる家電製品を控えるよう、話し合いで決めています。ですから、残念ながら『おトクなナイト８』に変更することはできないという現状です。

- Knowing the daily power consumption and cost is **very helpful**.
- Inputting the information to the system was **not bothering at all**.
- Found that the Night Plan does not fit our lifestyle because we **don't want to make noise using appliances late at night**. It will bother our parents family.

【Result of simulation】
The Night Plan works effectively for households other than 3 generation family.

The 2nd question

Can households make effective use of the Night Plan

Continuously?

• 2nd prototyping rapidly

Simulation → Trial → Transition → Diary Phase

2nd prototyping : Power saving OKAN

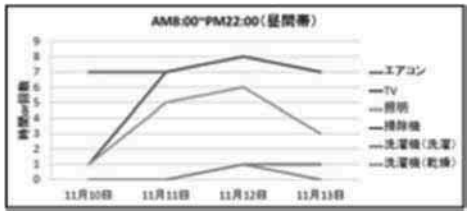
Purpose
: To make sure if standard householdswould be able to use the Night Plan continuously

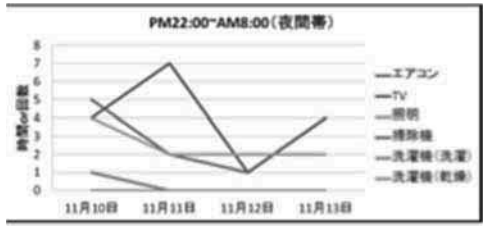
Demonstration
http://setsudenokan.jimdo.com/

Validation
- Duration: 4days (Thursday ~ Sunday)
- Participants: 6 families

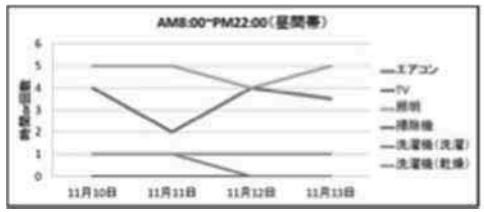
Additional function - Household work log ①

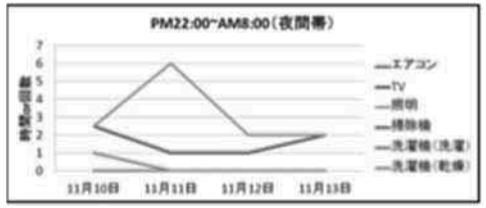
Family A





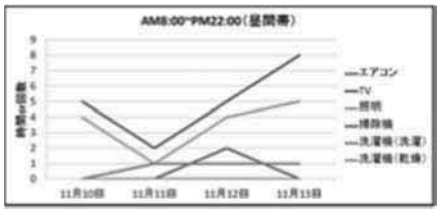
Family B

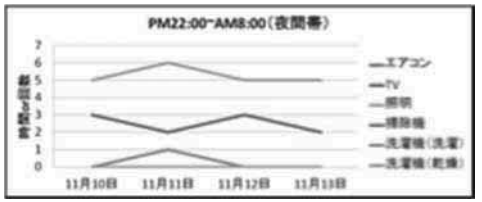




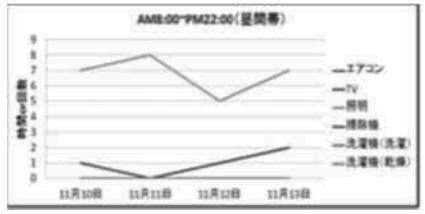
Additional function - Household work log ②

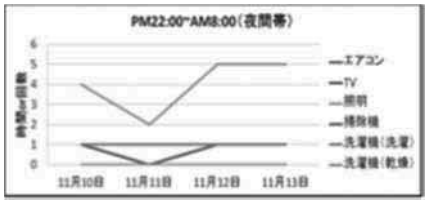
Family C





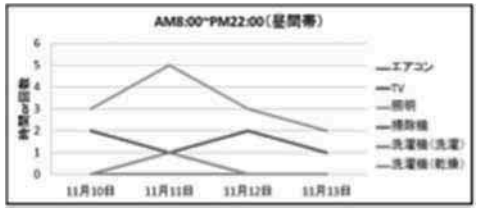
Family D

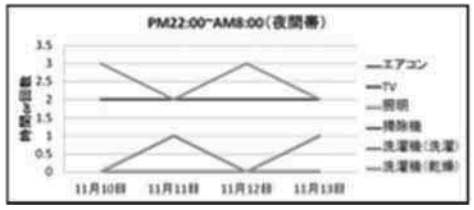




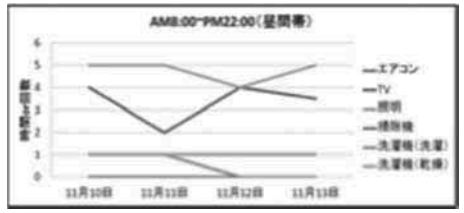
Additional function - Household work log ③

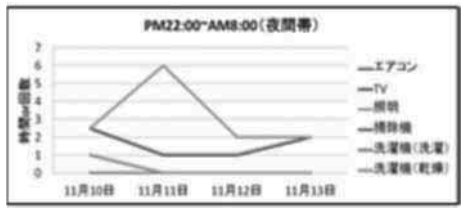
Family E





Family F





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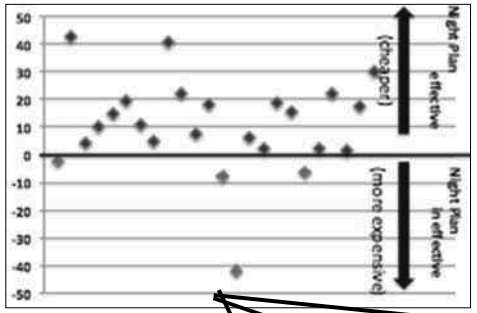
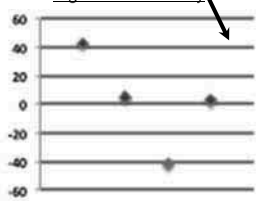
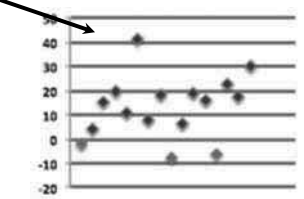


Simulation conducted on 6 families.
Compared the cost under the **Night Plan** with that under the **regular plan**.

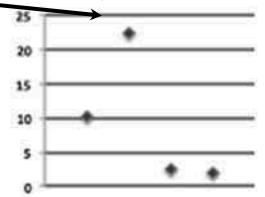
3 generation family



families with kids



family with no kids



Conducted a survey and an interview on all the participating families to investigate further information

VOX form interview

Reminder function:

- I want this function to **remind me in the morning only when I forget** to keep my diary the night before.
- Sometimes I might want to **cancel this function**. I don't want to be reminded while I am not in town.
- This function may work for users to make sure that they keep the diary everyday.
- I hope I **can select the time** to receive the reminder.

OKAN:

- I like this character.
- Any other characters to select?
- **I don't think I will need OKAN's advice everyday.**
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- I want to know how much I saved and how effectively I am using the Night Plan as daily feedback. •Effectivity could be shown as something like weather marks but not in words.
- I'd like to receive **OKAN's advice once a week** or have **the Advice button to ask for OKAN's advice.**
- I like this character, but I am not sure if every user likes it.
- Simply receiving the amount of money I saved and simple advice might be enough for some users.
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Graph presentation if use of appliances:

- I did not notice about it.
- The graph should also have information about power consumption for each appliance. This kind of information will encourage people to be more conscious about power saving.
- The graph is not easy to understand.
- **The graph will be much effective when the date is accumulated for a month.**

VOX form interview

Does OKAN's advice change your power saving behavior?

- **Yes it changes as much as it can be easily changed. Some actions like "using washing machines and dryers at night" are difficult because of the sound problem.**

- **No it didn't. I could have changed my behavior if I receive any advice suggesting actions that are fit to my life style.** I don't want to be patient and bothered by taking power saving actions even if it saves the power cost.

- **Yes it does. But I want more detailed information.** Words like "night time" should be linked to a page describing about this information.

Insight from protoyping

- Our result of our **prototyping was turned out to be successful.**
- Participants said they would **accept Okan's advice and change their behaviors** in power use. This means using this system will encourage people to make effective use of the Night Plan, **shifting power use during the day to night time, thus contributing to peak-shift** of overall power consumption.
- They also said that they will **not accept advices** when they do **not fit their lifestyle** or **force them patience**.

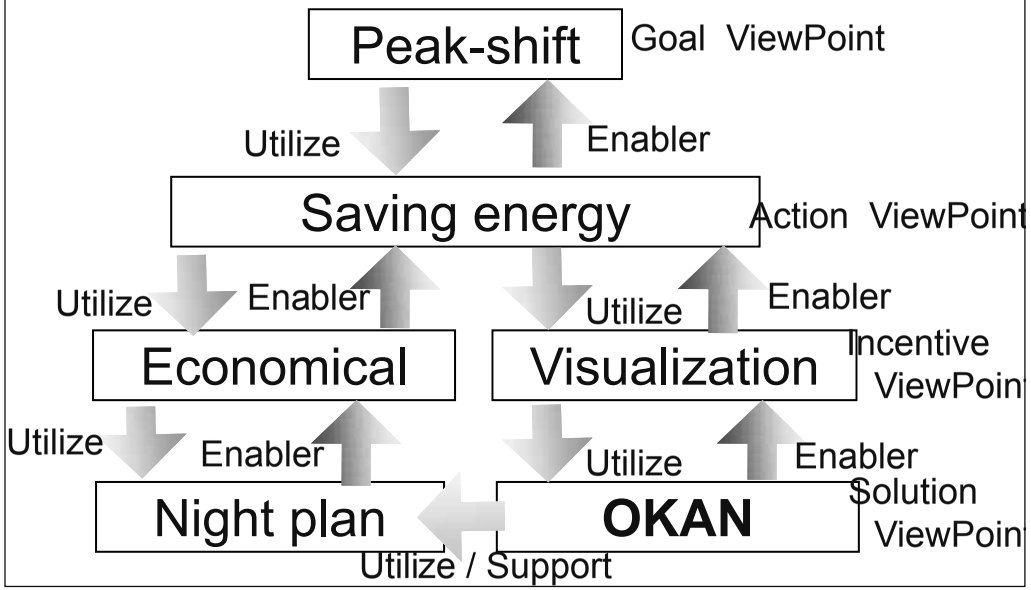
Next step

- **Findings**:

  Okan's advices should be provided **closely considering about each family's lifestyle.**

  It would be more effective to provide advices in certain steps **starting from ones that are easy to practice** and gradually leading to ones that are not so easy to practice.

Conclusion



Business structure(simplified CVCA)

Isana.net

Elephant Design

Keio ALPS team B

setsuden OKAN

$ Fee

TEPCO

i Real time data about user's life

i Feedback

i info. about household

i

USER

$ Payment for electricity

Merit for TEPCO

1.Diffusion of Night plan →encourage peak-shift

2.Real time data user's life pattern

3.Simplified process to apply for night plan

→Cost down for personnel

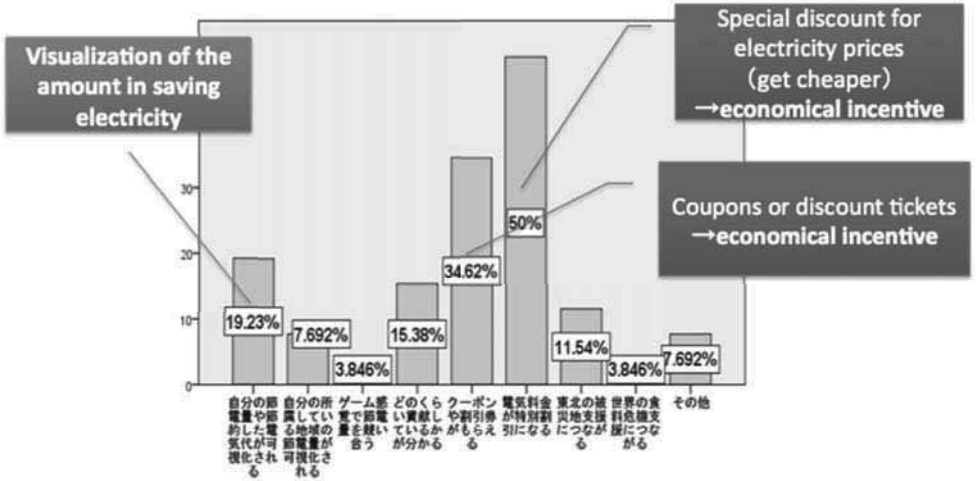
Thank you for your attention

ALPS team B

補足資料

〈Motivation for saving power〉

-Survey on more than 600 people



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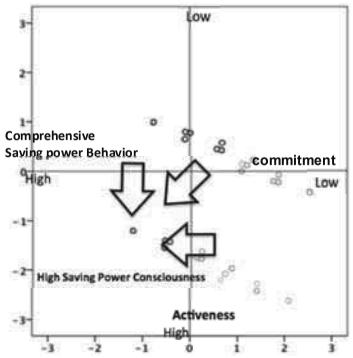

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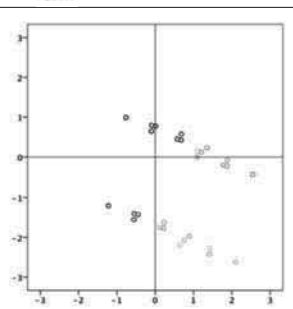

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①Economical incentive ②Visualization of the amount in saving elec