Case Study: Smart Community Demonstration in Malaga

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1. Introduction

During the period between 2012 and 2015, there had been a Spain-Japan joint project for smart community demonstration in Malaga, Spain, focusing on road transportation system in a society with high EV penetration. As one of the NEDO Smart Community Overseas Demonstration Projects, ZEM2ALL was launched based on the technical development collaboration agreement "Japan-Spain Innovation Program (JSIP)" concluded between NEDO and the Center for the Development of Industrial Technology (CDTI), a Spanish public organization. Under the MOU signed between NEDO and Malaga City in 2012, a total of six private companies from Spain and Japan established a consortium (ZEM2ALL) and participated in the demonstration (Figure 1).

The project had important implications for the process of building smart community infrastructure and implementing EV power demand management, etc. which were designed for the further spread of EV. Not only the technical demonstration of smart city, customer relationship building was also conducted actively in collaboration with Malaga City. In this sense, the demonstration project had a huge social role as well.

In this Case Study, lessons learnt from the demonstration on smart community related technology and the social significance of the project were summarized.

2. Overview of demonstration infrastructure

In Spain, road traffic accounts for about 40% of total energy consumption in the country, most of which depends on fossil fuel. This is an impediment for achieving the high CO2-reduction goal assigned to European countries.

In the project in Malaga, spread of EV was considered to be a solution to this issue. Accordingly, quick chargers were installed, and a platform for EV data collection and analysis to build an EV smart infrastructure was developed to accommodate EVs in large quantity.

Also, various information regarding the demonstration was also actively transmitted. Through such public relations activity, it was sought to draw Malaga citizen's attention to the project thereby providing a boost for the demonstration, gathering demonstration participants and promoting the active use of EV.

In this chapter, the demonstration infrastructure constructed in Malaga is described from the following two standpoints:

- Construction of EV Smart infrastructure
- Outreach activities

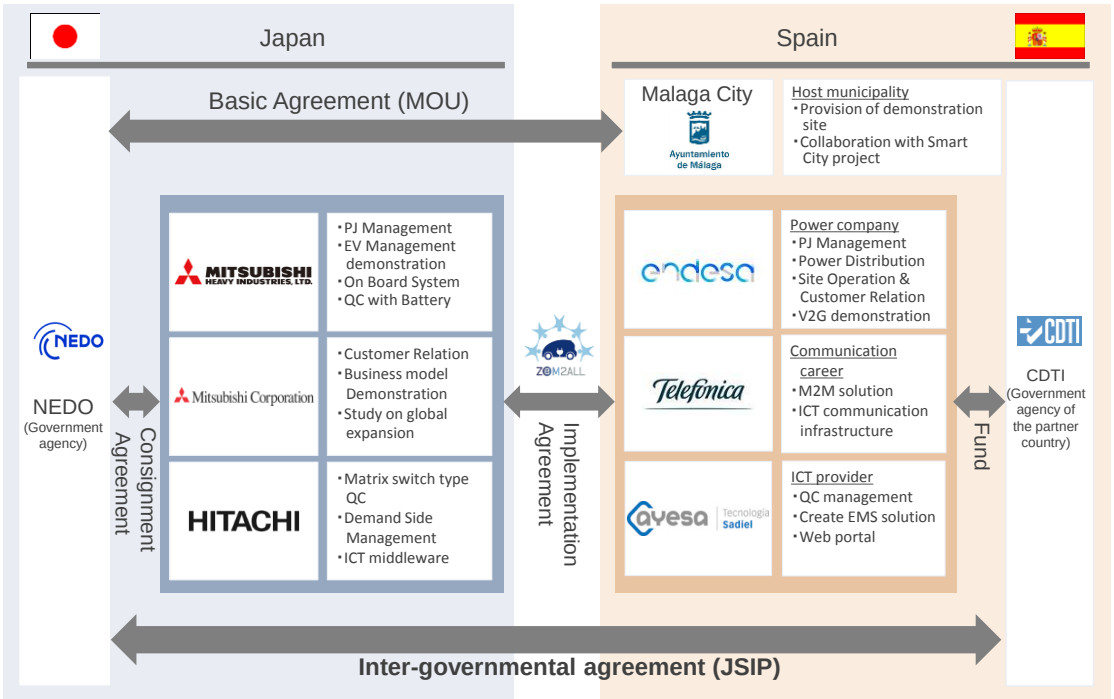

Figure 1 Organizational structure of the demonstration project

Note) ZEM2ALL is the abbreviation of Zero Emissions Mobility to All

2.1. Construction of EV Smart infrastructure

In an effort concerning building EV smart infrastructure, the functions which can manage the data from EV and charging equipment in an integrated way and also holds the concept of providing EV users and EV infrastructure operators with various services were developed.

Installation of quick chargers

In consideration of the operation when EV is popularized in future, there had been discussions about the number, type and the installation sites of quick chargers, and the quick chargers were installed in 9 different sites in total (Figure 3).

Concerning the type, two CHAdeMO-type quick chargers were introduced in addition to normal quick chargers: one for combined type charging station and the other for M:N type quick charging station (Figure 2).

Combined type charging station (MHI)

M:N type quick charging station (Hitachi)

Figure 2 2 types of quick charging station

The combined type charging station was built along with storage batteries so as to ensure the leveling of local electric consumption thereby enabling stable charging. The M:N type quick charging station, on the other hand, is equipped with multiple charging ports to enable charging of multiple number of vehicles at a time with limited charging capacity by making adjustment of each charging port.

Based on the consultation with the counterparts, the combined type charging station was installed in the suburbs of Malaga City and neighboring cities where the charging demand is considered to account for the larger portion of demand in the local grid capacity, and the M:N type fast charging station was installed in the central area of the city where much demand for charging was expected.

Final decision on the sites was made with full cooperation of Malaga City and other local governments, who proposed to make their land and facilities available for the demonstration. Especially, it would not have been possible without the efforts made by the Japanese organizer and Malaga City to obtain the cooperation from Marbella City, which is assumed to be another popular destination for EV users, as well as Fuengirola City that locates between Marbella and Malaga, and to install quick chargers.

Development of EV Management Center

It is important, for the implementation of the concept of EV smart infrastructure, to have the function to collect and analyze different information including location information (probe data) from EVs as mobile electric load to enable various services.

In this demonstration, in-car devices equipped with information collection function were installed in EVs to collect probe data such as GPS information of the vehicle while moving, speed, battery SOC, and operational status of electric components (air conditioner, light, etc.) (Table 1).

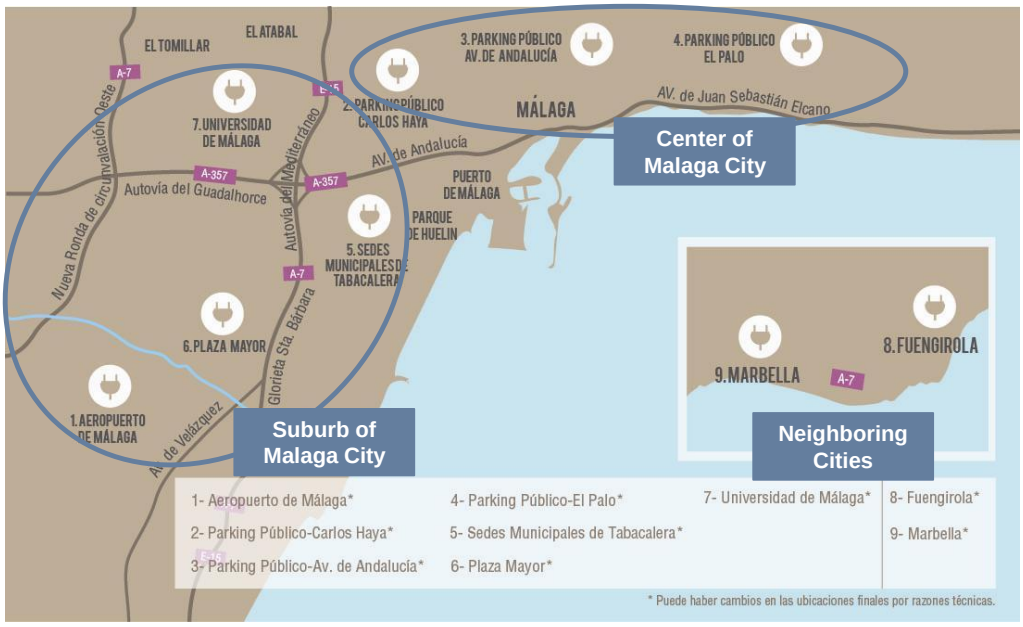

Figure 3 Quick chargers installation sites

Table 1 In-car devices to collect probe data

#	Components		Description
1	Membership card		To be used to identify driver of shared vehicle, and for personal authentication and billing when user use public charger.
2	OBU	Card reader	Driver is identified when a card is inserted in the card reader. In the demonstration, services tailored to users' individual taste and way of using the vehicle were examined.
3		Main unit	Transmit vehicle data using 3G communications line (UMTS2100) of mobile phone. (e.g. location information, vehicle profile, speed, battery SOC, etc.)
4		Bluetooth unit	Connect main unit and other devices (smartphone, etc.) by in-car WiFi.
5	Smartphone (+ car mount)		User's interface device. To be used as a portable web browser and a receiver of mails. Also used as OBU display device by placing smartphone on a holder cradle.
6	CAN gateway		Device to extract information through access to a vehicle LAN.

In the Integrated ICT Platform constructed in the demonstration, it was possible to collect and manage the data from quick chargers in addition to EV probe data, and to combine them with external information such as weather and membership data to conduct various analyses. EV Management Center is the application in the Integrated ICT Platform and capable of providing EV users and EV infrastructure operators with the information using the collected data.

In order to handle increased volume of data associated with the further spread of EV, the Integrated ICT Platform and the EV Management Center were designed with the following features:

- Vast amount of data processing can be allocated to a number of servers to share the load so as to improve the processing capacity;
- Mechanism to aggregate and process data for analysis in advance is constructed so as to enable quick analysis of mass data;
- Backup measures are taken to guarantee that the mass probe data can be received continuously even in case of failure.
- Security measures are taken to prevent leakage of critical information (GPS data, etc.) included in the probe data.

The EV Management Center utilizes the data in three ways: Only EV probe data; only quick charger data; and both EV and quick charger data in an integrated manner. Here are the scenarios for each case:

- Utilizes only EV probe data: Provide EV users with EV related data (charging records, charging station information, etc.) via web/smartphone applications and enable analysis of traffic information referring to external data such as weather data.
- Utilizes only quick charger data: Provide EV users with services including charging reservation and charging station search via web/smartphone applications. Also, provide EV infrastructure operators with maintenance information.
- Utilize both EV and quick charger data in an integrated manner: Conduct demand management to control EV electric demand by obtaining and forecasting the demand for EV charging.

2.2. Outreach activities for the demonstration

By transmitting information regarding the demonstration, the outreach approach had a significant role in creating interest in the project and EV in Malaga City, attracting participants in as well as promoting awareness of the demonstration project.

Specifically, operation of web portal, production of advertisement and commercials, creation of Project videos, appearance on radio, holding of the Ceremony for the Operation Startup and its promotion using mass media, establishment of the Show Room, distribution of newsletter, organizing Project Final Report Conference, and others were conducted.

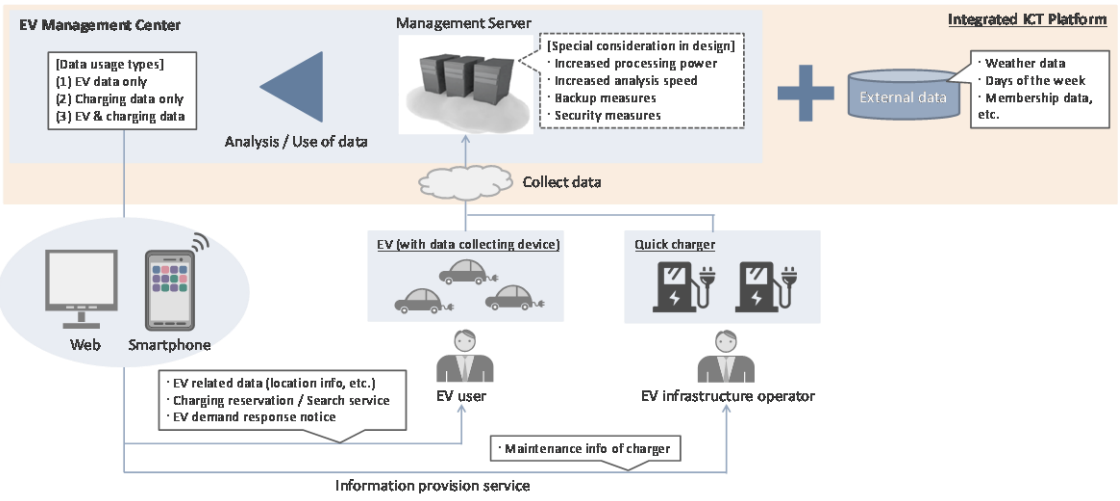

Figure 4 Image of data usage by EV Management Center

Approach in the early phase

In the early phase of the project, demonstration monitor acquiring campaign was conducted, the Ceremony for the Operation Startup was held, the Show Room was operated and public relation activities with mass media were carried out.

In the demonstration participants acquiring campaign held during April to June 2012, private and business monitors for approximately 200 EVs were successfully acquired in a short marketing period of about two months, through a comprehensive promotion of the demonstration combining various events, advertising by media and display of EVs in airport, railway stations, shopping malls and the open space in front of the port.

In April 2013, the Ceremony for the Operation Startup was held inviting the King Felipe of Spain (the then Crown Prince) thereby attracting a lot of attention from the media. After the ceremony, 60 to 100 people expressed their intention to participate in this demonstration and their names were placed on a waiting list, which tells how massive the response was.

Figure 5 Media coverage on the Ceremony for the Operation Startup (part)

Approach throughout the demonstration

Outreach activities on web portal, newsletter, Show Room and others were performed throughout the demonstration period.

The web portal was developed to make the demonstration project widely known and perform the service, operation and maintenance in a comprehensive manner. The vast majority of the page views come from within Spain but visitors from outside of the country were also increasing as the profile of the demonstration got higher through international events like Smart Community Forum.

Newsletter was published to strengthen communication with demonstration participants, covering not only the traveling distance of EV in the demonstration and invitation to workshop but also EV related news in other countries. A high level of satisfaction was garnered from the participants in the demonstration.

With the objective of generating much interest in the demonstration as well as EV from the citizens of Malaga City, there were EVs and demonstration contents displayed, promotional video footage shown and briefing sessions using presentation panels held in the Show Room. This Show Room was built right next to the automotive museum to hopefully attract tourists and people who are interested in cars. A lot of local elementary and junior high school students visited the Show Room to study about EV and utilized the space for their excursion. The number of visitors showed a sharp increase after 2014 to eventually attract 5,613 visitors, about 20% of which turned out to be foreigners who came not only from EU but various other countries.

Through these dispatch of information and customer relations building activities, the demonstration project has become widely recognized not only among the demonstration participants but also in Malaga City and even in foreign countries.

Figure 6 In the Show Room

Also, a car sharing service was provided with the objective of testing new EV service, resulting in facilitating outreach activities. Targeted to users who wish to use an EV for short time and short distance travel, car sharing service is considered to best fit with EV's characteristic of being suitable for short distance travel. In consultation with local rental car company for system development, the car sharing service was provided locally using 10 EVs. The service lasted only about seven months but there have been inquiries from local citizens on car sharing even after the completion of the project, indicating there was a certain level of public reaction.

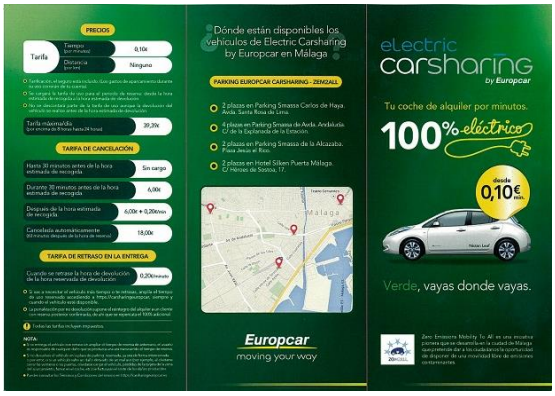

Figure 7 Leaflet of Car Sharing Service

Project Final Report Conference

The Project Final Report Conference was held in January 2016, and a large number of people involved in the demonstration including Mayor of Malaga City and demonstration participants gathered. Malaga Mayor commented in his complimentary address that he was very happy with the project and would continue to implement policies aimed at creating sustainable environment. The Conference was covered by various local media, gathering momentum beyond expectation.

Figure 8 Project Final Report Conference

3. Demonstration content and accomplishment

With EV smart infrastructure developed during the initial phase of the demonstration project, demonstration of data collection/analysis and the services assumed to be provided in the community where EV has become common was conducted in the latter part of the project. In this case study, the content and result of the followings are summarized:

- EV user behavior analysis
- Load management by EV demand response

3.1. EV user behavior analysis

Content of analysis

With EV becoming more popular, the impact of EV charging on local electric demand is expected to grow. In order to control the electric demand by EV charging, it is necessary to grasp the EV electric consumption and charging behavior.

Being aware of this, the behavior of the EV users was analyzed utilizing EV Management Center. See Table 2 for basic data (preconditions) of the analysis.

Table 2 Period and subjects of analysis

Period	May 1, 2013 – December 31, 2015
No. of EV	209
EV model	i-MiEV:163, LEAF:43, Other:3
Private/Business	Private：64, Business 145 (general corporation: 70, Public institutions: 45, Car sharing/rental car company:30)

The data collected in the demonstration for the analysis was broadly divided into two types: 'Quick chargers usage records' and 'probe data collected from the in-car devices equipped in EV.' By analyzing the probe data, usage status of normal chargers and traveling tendency can be obtained. Table 3 shows the number of data collected during the analysis period. With the development of ICT integrated system, more than 100 million data logs were collected.

Table 3 Number of data collected during the demonstration

Data to be analyzed	No. of data
Quick charger usage data	3,991
Probe data	Approx. 130 million

Result of analysis

Analysis was made on the behavior of EV user in terms of various parameters like time, place, user category, weather, etc.

First, it was found that quick chargers were used most frequently when the user traveled near fast charger station on their way to remote suburbs apart from the center of Malaga or neighboring cities, and that the demand for quick charging was higher outside than in the urban area (Figure 9).

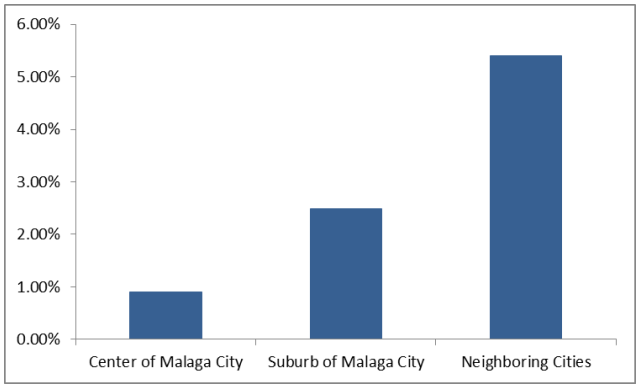

Figure 9 Usage rate of quick charger when traveling near quick charger station

Note) Usage rate of quick charger when traveling near quick charger station can be expressed as (No. of days when quick charger was used) ÷(No. of days when the user drove near quick charger station)

The result of the analysis on the trend in hourly use of EV by private and business users for the data of the year starting on January 1, 2014

and ending on December 31, 2014 is shown below (Figure 10). The peak of EV usage by business users ends at 14:00, which is probably because in Malaga business people take a longer lunch break from 14:00 to 16:00 therefore business use of the EVs seem to focus on between 8:00 and 14:00.

For private users, the peak comes at commuting hours of 7:00-8:00 and 18:00-20:00. Analyzing the movement of EVs resulted in another peak at 13:00-14:00, which is believed to be the users returning home. It was therefore considered that this peak was due to those who had their lunch at home.

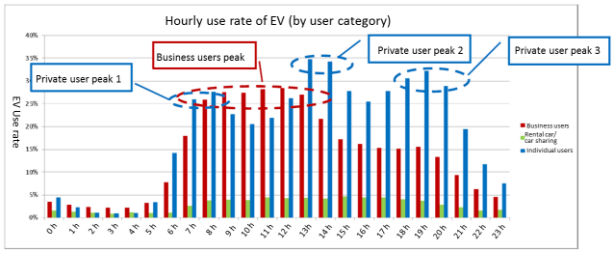

Figure 10 Trend in use of EV by user segment

3.2. Load management by EV demand response

Implementation method

If the capacity of chargers connected to grid is increased with the spread of EVs, there will be a risk that the load on the local electric grid becomes bigger as a result of simultaneous charging of many EVs and/or charging of EV during peak load hours in the area.

It was from such point of view that the valuable points were used for the use of quick and normal chargers to verify the feasibility of load management by EV demand response (hereinafter, "DR") in this project.

In Spain, power demand increases at lunch time (11:00-13:00) and night (20:00-22:00), and decreases before dawn (3:00-5:00) and evening (16:00-18:00). It is expected to perform DR program during these hours in order to limit or increase the energy demand (Figure 11).

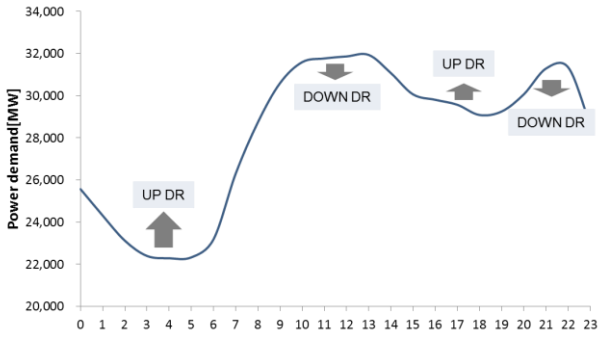

Figure 11 Power demand in Spain and DR target hours

Note) Power demand data is as of Wednesday April 27, 2016 sourced from "Real-time demand and generation" by Red Eléctrica de España.

In order to implement DR, specifically, the three steps of Understand, Forecast and Control of EV charging demand using EV Management Center were performed (Figure 12).

- Understand : Information on how much EV charging demand is generated under what conditions is obtained.
- Forecast : Future demand is forecasted based on the obtained EV charging demand.
- Control : EV users are encouraged to reduce or increase the demand with valuable points based on the forecasted demand.

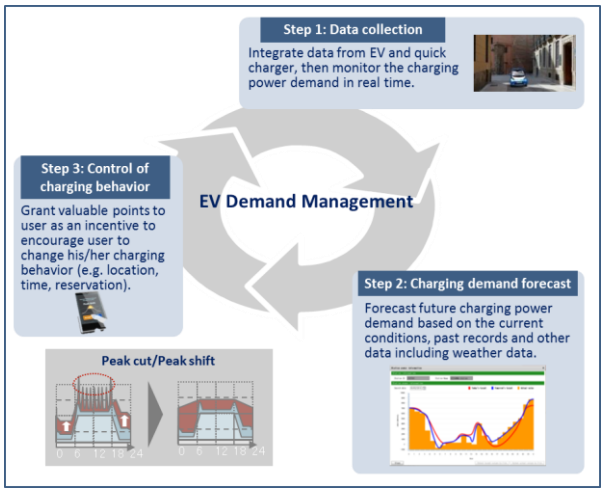

Figure 12 DR processes

Based on these processes, the demonstration of DR was conducted for two cases using quick charger and normal charger.

Result - DR with quick charger

For the DR with quick charger, the "Quasi-Dynamic Pricing Method" was introduced. In this method, valuable points are used to virtually set the time-of-day charging fees (Figure 13).

One of the reasons why the quasi price using valuable points were introduced instead of normal dynamic pricing was that it was difficult at that time to control and change daily electric tariff as in the same way as normal dynamic pricing under the agreement with demonstration participants and practical restrictions.

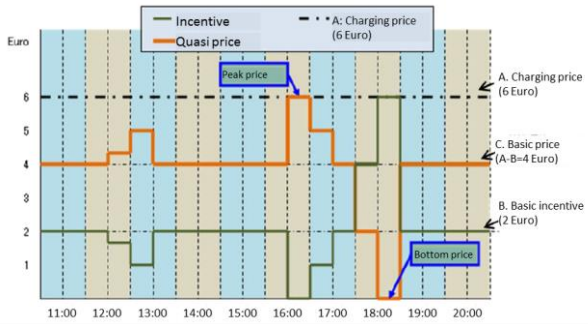

Figure 13 Quasi-Dynamic Pricing using valuable points

DR using quick charger was conducted with the objective of examining the price effect of "how much change will be produced in the usage rate of quick charger depending on the price?" for all hours and place, specifically, switching control of demand increase/decrease was conducted once every other hour (to allow the monitor to get cheaper charging fee if he/she waits or hurries for a while).

The evaluation of DR effect was conducted by making comparison of the charging results between the period without valuable points (Jun. – Nov. 2014) and the period with valuable points (Jun. – Nov. 2015). Result of DR demonstration using quick charger is shown in Table 4.

Table 4 Result of DR demonstration using quick charger

	Private user	Business user
DOWN DR (DR to curb demand)	−16.2% ○	+14.2% ×
UP DR (DR to stimulate demand)	+16.2% ○	−14.2% ×

Note) The marks ○ and × represent as follows:
○: It was considered that there was difference in selection probability with a certain level of significance (10%), indicating there was demand stimulating/curbing effect. ×: No demand stimulating/curbing effect identified in the demonstration.

The reason why the change in the selection rates are equal for UP and DOWN DR was that, because all hours were subject to DR, an increase (decrease) in the selection rate in the demand curbing range became equivalent to the decrease (increase) in the selection rate in the demand stimulating range in entire range.

Business users did not show DR effect in the demonstration, but private users, when given valuable points, tended to perform DR to get the valuable points.

Why no DR effect was identified with business users is considered to be due to the following three points. First, they are bound by the company in terms of time. DR is dependent on user's degree of freedom. Business users lose their freedom of time with the start of office hours. Second, it is unlikely that business users are incentivized to change their driving route with the risk of affecting their operations in order to get the valuable point. Third, even when a business user performed DR successfully, valuable points are given to the company and the user who belongs to the company and drives EV could not get an incentive directly.

On the other hand, valuable points given to private users with greater freedom of action will be directly linked to their interests, bringing about effects of DR of a certain degree.

Result - DR with normal charger

For DR with normal charger, the "Incentive Method" where a DR request is sent in advance during the specified hours for demand to be curbed or stimulated was introduced. The usage rate of normal charger was assumed to be higher than quick charger, therefore it was concluded that the sufficient examination of the leveling effect of peak load was possible even with the method that specifies the time periods of DR.

In concrete, based on the usage records of normal charging brought by each participant who agreed to cooperate in the normal charger DR demonstration, demand curbing request was sent during the hours when probability of use of charger was high (more than 70%) and demand stimulating request was sent during the hours when the probability was low (less than 30%) (Figure14).

With the operation only to send requests automatically in specified DR hours according to the above mentioned basis, however, a demonstration monitor may receive DR request a number of times a day or in midnight. Therefore, screening of the DR hours was conducted so as to allow the monitors to receive the signals during the hours when they can easily respond, three to four times a week.

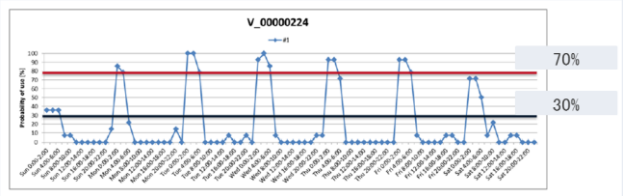

Figure 14 Probability profile of use of EV charger

For the assessment of the effect of the DR, a DR notice was sent on the day before or on the day to the demonstration monitors to compare the charging probability when DR is conducted and the average charging probability for the same time period. See Table 5 for the notice schedule.

Table 5 DR notice schedule for DR with normal charger

Part	DR hours	DR signal transmit time
I	AM (08:00-12:00)	22:00 previous day
II	PM (12:00-17:00)	08:00 same day
III	Night (17:00-08:00)	14:00 same day

The demonstration resulted in a success in decreasing the monitors' charging probability for given hours from 90% to 35% with DR to curb the demand, and also increasing from 13% to 25% with DR to stimulate the demand (Figure 15).

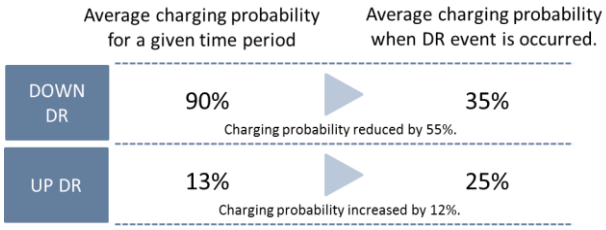

Figure 15 DR demonstration results with normal charger

It has been said that demand response with EV can contribute to load management of power grid. With this demonstration, it can be said that the objective verification of the feasibility could be conducted based on the actual data.

4. Key findings -Lessons Learnt-

Various lessons were learnt throughout the demonstration project. Please see below for the lessons learned which are organized in four points.

Point (1): Significance of active involvement of the citizens

Nowadays, smart community related efforts are taking place around the world. Among others, this Malaga project was unique and characteristic in the way that the demonstration participants had found much value in the next generation of the smarter EV infrastructure provided to them in the demonstration and actively engaged in the project from beginning to end. After the project, we have been carrying out interviews with the participants of the demonstration. Here is a comment we received from one of them.

Comment from a demonstration participant

I am really happy that I participated in the demonstration. I could deepen my understanding of EV and also raise environmental consciousness. It's a shame that the demonstration project is over. I would like to continuously use the services offered in the project.

Not only private EV users, but also business users, like companies, participated in the demonstration project. Europcar is a business user that participated in the project as an EV rental provider. Mr. Rafael Gonzalez of Europcar recalls their effort as follows, indicating that the demonstration had functioned as a trigger to create new business in Spain.

Comment by Mr. Rafael Gonzalez, Europcar

It was a valuable opportunity for us to participate in the demonstration project as a rental car company. We could achieve high customer satisfaction by offering rental EV. Lots of users said "EV is essentially convenient and easy to use." We are going to consider new EV businesses based on the observations collected from the demonstration.

Besides these direct voices from the demonstration participants, the objective data indicating that, as shown in Figure 16, the general satisfaction rating for the demonstration was kept as high as about 8.5/10 points , and that, as shown in Figure 17, more than 80% of monitors bought or renewed the lease on the EV used in the demonstration, were obtained.

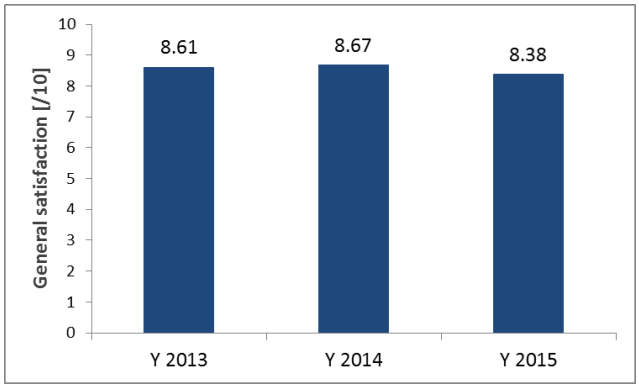

Figure 16 Questionnaire result
(General satisfaction ratings of the demonstration)

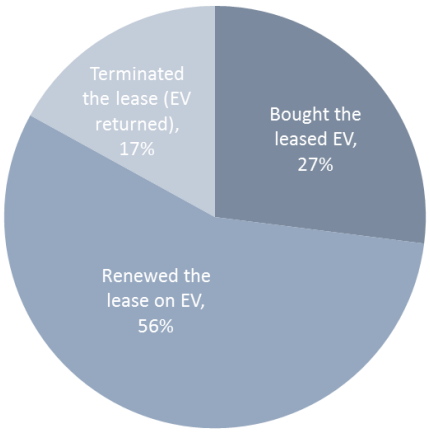

Figure 17 Handling of EV after the demonstration

Supporting such a high level of interest and contribution of the participants to this demonstration, were the active outreach activities led by Japanese organizers. Mr. Takeshi Ogino of Mitsubishi Corporation who took charge in customer relation of the project described the Project Final Report Conference held on January 29, 2016 as follows:

Comment by Mr. Takeshi Ogino, Mitsubishi Corporation

About 240 people, including EV users who participated in the demonstration, gathered in the Project Final Report Conference. I was so surprised and pleased to see such a great number of people there, because our initial estimate of visitors was much less. I also feel very happy that I participated in the project and was able to assume a role to build customer relations as I found overflowing people smiling and delighted.

For the construction of smart community, it is important that each citizen who constitutes the community understands the significance of smart community and collaborates in building such community. From that perspective, there have been constant efforts made during the demonstration to promote the citizens' understanding of and active involvement in EV and the construction of smart infrastructure. Mr. Jaime Briales of Malaga City recalls the project as follows.

Comment by Mr. Jaime Briales, Malaga City

It was significant that the demonstration of EV, which was visible and had big impact on every citizen, was performed. Receiving requests from the people for the continued demonstration, I realize that the project largely contributed to building a sustainable community in the future.
The monitors as well as general people in Spain and abroad seemed interested in the demonstration. I believe that this project has refined the value of this city as a result.

As mentioned above, the project is deemed to be of great significance in terms that it provided one form of next-generation transportation system to the EV users who participated in the project, including the people in Spain and abroad, and that it attracted much interest from them. Lastly, we would like to introduce a comment by Mr. Juan Carlos, who engaged as the docent and guide of the Show Room.

The effort taken this time in this pilot project was meaningful in that it threw the light on community building by the new generation.

Comment by Mr. Juan Carlos, the Show Room guide

Thanks to the effort of Malaga City, we had lots of children visiting from nearby schools as their excursion. I was very happy watching them listening to my explanation with stars in their eyes, but at the same time felt the weight of responsibility for providing explanation to the young generations who will bear the future society.
There were people who visited the Show Room after hearing from their children about my explanation.

Point (2): Possibility of DR to increase demand

Various technical discoveries were made in the demonstration. Among others, the fact that the validity of DR had been confirmed in the demonstration is of particular significance. As shown in Figure 15, it was found out that EV users responded to the DR using valuable points in both the demand decrease (DOWN) direction (refrain from EV charging in certain hours) and the demand increase (UP) direction (actively charge EV in certain hours).

What is important in this context is that the demand response was indicated to be effective even for the direction of demand increase. In Japan currently, there seems to be an emerging need for the output curtailment of renewable energy due to oversupply of capacity as excessive amount of PV generation has been introduced in a short time. In order to address this situation, what is necessary is not to reduce demand but to increase demand during certain hours, and the demonstration in Malaga has proven that EV could be a solution to the issue. On this point, Mr. Ignacio Gonzalez from Spanish utility Endesa Energia made a comment as follows.

Comment by Mr. Ignacio Gonzalez, Endesa Energia

Because the demonstration this time was rather small from the standpoint of grid size, it is not necessarily appropriate to say that the project was fully successful or not, but at least it was significant that we could confirm the positive result of DR including demand stimulation for the possible future when the EV is widespread and the share of EV in the overall load is increased. In Spain, supply sometimes exceeds demand because of too many supply facilities; therefore, we have to control supply and demand in an integrated manner for both upward and downward directions.

Obviously, this does not necessarily mean that everything was clarified regarding the utilization of EV as a demand response solution and succeeded in every way. This point will be described in Point (4).

Point (3): Collection of valuable data on the EV behavior

Apart from the above, a massive amount of data regarding the behavior of EV, approximately more than 100 million data for quick charger usage and EV probe data, was successfully collected during the demonstration project. This might be the first project to collect such a huge amount of data.

Mr. Yoshihito Nasu of Hitachi, Ltd. who managed the construction of Integrated ICT platform, which serves as a basis of data collection, commented that the data collection platform constructed was the largest in scale at the time.

Comment by Mr. Yoshihito Nasu, Hitachi, Ltd.

The system we constructed to collect a large volume of data was larger than the massive public data collection system and the first of its kind.
In constructing the Integrated ICT platform, we considered interoperability as an important issue and standardized the interface so that data could be collected through the devices of different manufacturers.

It is recognized on the Spain side that the data collected were extremely useful to understand the characteristics of EV as the load which people have never experienced before. Mr. Ignacio Gonzalez of Endesas Energia mentioned as follows on the collected data.

Comment by Mr. Ignacio Gonzalez, Endesa Energia

Through the DR demonstration, we were able to learn about the EV demand trends by segment, for example, that private users charge EV when they returned home and companies that use a number of vehicles charge during daytime hours. We have never carried out a demonstration of this scale. We think that we could collect valuable data.

The data collected in this large-scale demonstration focusing on EV will serve as the precious basic information to consider future transportation system in a society with high penetration of EVs. It is desirable that such data would be utilized effectively in various other scenes, not just for this demonstration.

Point (4): Clarification of issue and future approach

The demonstration project can be said to be a big success in that it provided citizens with certain value, an effective system was developed, and useful data was collected. On the other hand, various issues for the smart community construction were identified and the actual circumstances were revealed.

First, there is a gap between the forecast of EV penetration in the initial phase of the demonstration and the actual condition. When the project was launched, there was a target in Spain to introduce 250,000 EVs by the end of 2014. The reality is, however, the number of EVs as of 2015 is holding at about 1 to 2% of the target. The situation is the same in England and France, the popularization of EV has been delayed in comparison to their respective target. It is therefore clarified that the market has not taken off as rapidly as expected by national governments and external organizations.

Second, the EV users were different from what was initially envisioned. Because in Europe many people have no parking space of their own and park their cars on the street, it was assumed that quick charger would be widely used as the daily EV charging method. However, most of the users who concluded the EV lease contract and participated in the demonstration had their parking and basically charged their EV with normal charger installed in the garage at home. Currently, the main target of EV is relatively wealthy group of people who own parking space at home where EV can be recharged. It will be necessary to appeal the use of EV to a wider range of people to realize further dissemination of EV.

Third, it was found that there is room for improvement in the mechanism of DR. For example, one of the demonstration participants made a comment on the DR notice as follows:

Comment by a demonstration participant

The notice of DR was sent in the evening of the day before or in the morning of the day, but it would be better if we receive the notice a few days before so that we can prepare and make a plan for participating in the DR. It is even better if TOU rate is notified so that we can make plans.

This comment provides the idea that the user has his/her own charging plan for the EV which is closely related to everyday activities and finds it difficult to change the plan at very short notice. Although demand response with EV is expected to bring about the flexibility because EV can respond to request with batteries, it is necessary to keep that kind of characteristics in mind.

These implications could not have been obtained until the demonstration took place. Mr. Takumi Okada of Mitsubishi Heavy Industries, Ltd., who served as the general organizer for the demonstration project, mentioned that, in light of the accomplishments and issues of the demonstration, it is necessary to incorporate the lessons learnt into the future business development.

Comment by Mr. Takumi Okada, Mitsubishi Heavy Industries, Ltd.

Various stakeholders were involved in the demonstration, but the three companies as the Japanese organizer worked together to get over difficulties. We are delighted that many people are satisfied with the project and our efforts are rewarded.
During the demonstration project, we were able to establish technology for smarter EV use, and I am sure that what we implemented in the demonstration will certainly be of help when EVs are introduced on a large scale in the future.
On the other hand, we identified challenges in developing the outcomes into real business. We would like to develop sustainable mechanism for future based on the insight obtained in the demonstration.

NEDO has also started utilizing the lessons learnt from this demonstration in other EV-related projects as a next step. By reflecting the implications obtained and lessons learnt from the smart community demonstration carried out overseas into the efforts being made in Japan, they expect that they will be able to contribute to the realization of a sustainable community in our country.

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