ENEL SMART INFO AFTER ONE YEAR ON FIELD: LESSONS LEARNED, EVOLUTION AND RESULTS OF THE PILOT

Marina LOMBARDI
Enel Distribuzione – Italy
marina.lombardi@enel.com

Silvia DE FRANCISCI
Enel Distribuzione – Italy
silvia.defrancisci@enel.com

Lorenzo PIZZOFERRO
Enel Distribuzione – Italy
lorenzo.pizzoferro@enel.com

Luca DI STEFANO
Enel Distribuzione – Italy
luca.distefano@enel.com

Stella DI CARLO
Enel Distribuzione – Italy
stella.dicarlo@enel.com

Barbara ZITO
Enel Distribuzione – Italy
barbara.zito@enel.com

ABSTRACT

Enel Info+, the large scale trial of the Enel smart info device, has been carried out in Isernia (Italy) since Decembre 2012, aiming at investigating whether giving to end users a feedback on their energy consumption can address more efficient energy behaviours.
Two waves of interviews to a sample of participants gave an interesting insight into the consumers' awareness, understanding and attitude towards energy, and into how their energy use has changed during the project while estimating the effect of the proposed monitoring technologies. Some features turned out to be of outmost importance for most people: having an easy to use interface, a simple installation process (of devices and software as well), a frequent update of the instantaneous power (close to real time), receiving alarms in case of overload so that load shedding is prevented, etc.. This feedback from the customers and the several lessons learnt within the various stages of the pilot have been valuable inputs for investigating the monitoring solutions proposed within the project and evaluating the best way to fine-tune them to make them more effective.
Thus plenty of new features have been introduced in the Smart Info Display currently on field (the instantaneous power can be refreshed on demand, a scatter plot of its maximum historical values for different periods of time can be displayed, consumption habits are displayed together with the measured consumption data in the graphs, etc).
The usability of the pc software Smart Info Manager has been enhanced taking into account the needs of prosumers who turned out to be the most keen users of this kind of application.
A new procedure for connecting each Enel smart info with a smart meter is being released to provide consumers with a fully plug&play solution while ensuring a quicker and robust customer relationship management.
Establishing continuous communication with consumers is one of the main conditions that keep them "active" in the project, so that they can reach their goals of personal efficiency while having a key role in supporting the aforementioned continuous improvement process of the proposed technological solutions. For this reason a sample of experimenters started receiving quarterly personalized reports on their usage of energy as a feedback.
Further investigation on Enel Info+ results and lessons learnt is carried out within ADVANCED (Active Demand Value ANd Consumers Experiences Discovery), a research project co-funded by the European Community's Seventh Framework Programme (FP7/2007-2013) under grant agreement n° 308923, that aims to shed light on ways to overcome the barriers hindering the mass deployment of Active Demand in Europe. Both the consumption data and the answers to the sociological surveys are used as an input to explore the mechanisms behind user behaviour and the way interventions for behavioural change can work. Moreover in-depth qualitative interviews with approximately 20 pilot participants are carried out to extend the study with some insights into socio-economic drivers of consumers' behaviour.

INTRODUCTION

Enel Info+ is an energy efficiency pilot that aims to demonstrate whether enabling people to access in an easy way to their own energy consumption can increase their awareness and improve their energy behaviors. Currently, electronic meters are often installed in difficult to access locations and the interface is usually a black-and-white small display with no graphical representation of data. In order to make it easier for consumers to access their energy consumption data, Enel Distribuzione designed Enel smart info: the only device that can be plugged in every socket to collect the certified data managed by the smart meter through powerline.
Enel Info+, the large scale trial of Enel smart info, has involved a representative sample of LV (low voltage) households and small commercial activities served by the Carpinone primary sub-station in some municipalities in the area of Isernia since December 2012. The project is currently on-going and its conclusion is foreseen at the end of 2014. All the consumers participating in the project receive an energy monitoring kit including Enel smart info and dedicated interfaces that they are supposed to use for one year to view how much electricity is currently being used in their household and to process their historical

consumption. A full colour, touch screen in-house display (Smart Info Display), and two software applications (Smart Info Manager and Smart Info Mobile, for personal computers and smart-phones respectively) have been conceived to monitor, collect and analyze energy data. "Prosumers", consumers who are also producers of renewable energy (by photovoltaic or mini-eolic plants), receive an additional Enel smart info in order to manage both production and consumption metering data.
At this date about 4500 kit have been already delivered with an opt-in rate of21%.
The consumption of the LV households and small commercial activities in the municipalities included in the project have been observed by Enel Distribuzione since 2011. Moreover the experimenters' consumption will be observed by Enel Distribuzione for the whole duration of the trial and compared with the pre-pilot ones as well as analysed in relation to other factors (e.g. household size, number and type of appliances, etc..). Besides, a "control group" of consumers who will not take part to the trial will be selected and monitored, to verify that the use of the Enel Info+ kit is actually responsible for any change in the load curves.

LESSON LEARNED

Data gathered within the project include both consumption data and the answers to three waves of sociological surveys.
The first wave (that has been completed before the massive distribution of monitoring kits to the trial participants) was aimed at defining a representative model of the consumers living in the area of Enel Info+ in terms of habits, household size, number and type of appliances in the household, etc… 30% of the interviewed families have children, and about 60% is made of 3 or more people. 47% live in condominium apartment houses and 63% of the houses have more than 6 rooms. 76% of the people answering the interviews are between 35 and 64 years old (26% between 25 and 44, 26% between 45 and 54 and 24% between 55 and 64%). 58% declared they have a high electricity consumption. 20% of the interviewed families do not have any personal computers nor flat screen TVs, more than 60% do not have any smart-phones with internet connection, microwaves, electric heaters, consoles and electric hobs, more than 85% do not have any air-conditioners (80% have gas heating) nor electric water heaters. Only a small percentage (6%) do not have any high efficient appliances or do not know the energy efficiency class of their domestic appliances. The interviewed sample showed an awareness on energy efficiency and on energy saving: 80% declared they try to make their consumption more sustainable, 77% believe the use of Renewable Energy Sources (RES) helps reduce environmental pollution, 86% think that the higher the efficiency of their house the higher the saving in energy bills, 66% would like to know how much electricity is used in their household in real time. Women are better informed about electronics and domestic appliances. The Enel Info+ project was presented during the interview and 67% of the interviewees showed their interest in the project (25% answered "Absolutely" or "Very much", 42% answered "Enough").
The second wave of surveys (two months after the distribution of monitoring kits to the trial participants) was aimed at collecting the early on consumers' awareness, understanding and attitude towards energy and its use and the first impression of the Enel Info+ kit. 94% of the participants declared they acquired a better understanding of their consumption (54% answered "Absolutely" or "Very much", 40% answered "Enough"). 92% of the participants declared they acquired a better understanding of the distribution of consumption within time bands (59% answered "Absolutely" or "Very much", 33% answered "Enough"). 9% of the participants discovered an unexpected consumption due to some of their appliances and decided to replace them with modern, energy efficient ones, while 59% declared they modified their habits in the usage of their appliances and/or the time in which they use them. 79% of the participants declared the kit is a good means for verifying whether their supply contract is appropriate to their usage of energy (39% answered "Absolutely" or "Very much", 40% answered "Enough"). 81% would suggest a friend the participation to the project. 96% of the participants gave a positive judgment of the kit in terms of usefulness (55% answered "Absolutely" or "Very much", 41% answered "Enough") and 95% in terms of simplicity of use. 52% declared they like the kit because it gives them a quick access to data with minimum effort and 14% because they receive a warning when their consumption exceeds some thresholds. 77% of the experimenters use the display at least two or three times a week.
The last wave of surveys (at the project completion) is aimed at verifying whether the consumers' awareness, understanding and attitude towards energy and its use have changed during the project, while estimating the effect of the proposed monitoring technologies. These interviews have not been completed yet. The current preliminary outcomes related to the level of awareness and understanding of consumption and its distribution within time bands are quite aligned with those of the previous wave. The same holds true for the percentage of participants who declared they modified their habits (in the usage of their appliances and/or the time in which they use them) or replaced old appliances, for the positive judgment of the kit, for the preferred features of the kit and for the satisfaction with the project. In addition 61% of the participants declared they reduced their consumption level thanks to the Enel Info+ kit.
Both in the second and the third surveys some features turned out to be of outmost importance for most people: having an easy to use interface, a simple installation process (of devices and software as well), a frequent update of the instantaneous power, receiving alarms in case of overload so that load shedding is prevented, information about the electricity usage of the appliances, etc. This feedback from the customers and the several lessons learnt within the various stages of the pilot have been valuable inputs for investigating the monitoring solutions proposed within the project and

evaluating the best way to fine-tune them to make them more effective. Thus plenty of new features have been introduced in the Smart Info Display currently on field, the usability of the pc software has been enhanced and a new procedure for connecting each Enel smart info with a smart meter is being released to provide consumers with a fully plug&play solution.

SMART INFO DISPLAY

The first version of Smart Info Display was designed to provide both close to real time and historical information on energy consumption, which are shown in bar graphs and pie charts to highlight their mean value and how they split in tariff time bands for different periods of time (a single day, one week, one month, a bi-month, one year). Historical data is stored for about three years. Tariff time bands are displayed, together with the date and time of tariff time bands switching and colours settings can be modified to be consistent with the user's tariff structure. Alarms can be set by the user to receive an alert when the energy usage gets to modifiable thresholds, helping consumers keep it under control and reach their goals of personal improvement. When the contractual power is exceeded an alarm is automatically generated likewise, so that load shedding is prevented. Moreover additional feedback contents are given such as contractual data, date, time, etc..
The new version of Smart Info Display that is currently on field is an upgrade of the first one including some useful new features: consumption habits are displayed together with the measured consumption data in the graphs, helping consumers identify variations. The instantaneous power is reported together with a scatter plot of its maximum historical values for different periods of time (a single day, one week, one month), thus consumers can check whether their supply electricity contract is consistent with their actual needs. The instantaneous power values can be refreshed automatically as well as on demand and the power used by a specific appliance can be measured using a dedicated wizard. Dedicated announcements can be received by the Distribution System Operator (DSO).

SMART INFO APPLICATION

The software application for personal computer allows consumers to examine their consumption data in detail on and energy prosumers to compare production and consumption data.
The installation procedure of the software application was simplified and the customer is guided through it step by step. The graphic interface was redesigned in accordance with that of Smart Info Display. Browsing through menus and functionalities is straightforward (e.g. the "message" section has a google-like structure).
Besides this effort towards usability and familiarity, the software offers a new set of features, with the potential to further improve them. First of all, data can be collected either from Enel smart info or from Smart Info Display. It can manage several different databases (i.e. several Enel smart info devices can be connected to a single pc), automatically selecting the set of data regarding the Enel smart info that is currently connected. Power consumption and production are displayed on a single graph, thus self consumption is easily identified as well as the amount of energy that is injected in the grid. This data are very important for prosumers, since they determine the value of incentives, which are directly calculated using a simple tool of the software.
Furthermore, it is able to measure and store the instantaneous power absorbed by any electronic device. As in the past, it can send the consumption and production data to a dedicated web-server and make them available for remote monitoring through either the existing Smart Info Mobile Application or the new web-application which is now under development. This new web-app will be displayable by any electronic device connected to the internet (smartphone, tablet, iphone, pc, etc.).

SMART INFO PLUG & PLAY

A new procedure for connecting each Enel smart info with a smart meter is being released to support two use cases:

1. Ready to start device, which provides consumers with a fully plug&play solution.
2. Flexibility, that is the possibility to easily set up the smart info device several times in order to move it to different LV households.

In order to to start data collection from a smart meter, Enel smart info has to be set up with the address of that smart meter within the communication network (together with some additional configuration data). This is currently a remote managed process. Within the new connecting procedure a proper configuration file, technically called "script file", will be directly downloaded to Enel smart info using its USB interface. Configuration files will be downloadable in an encrypted format from a dedicated web portal. Downloads will only be available to registered users, that will fill in a search form with the identification data of the smart meter Enel smart info has to be interfaced with.
As soon the device is plugged into the electrical socket of the electrical system measured by the selected smart meter, the communication between Enel smart info and the smart meter is established.

REPORTING

Establishing continuous communication with consumers is one of the main conditions that keep them "active" in the project, so that they can reach their goals of personal efficiency while having a key role in supporting the aforementioned continuous improvement process of the proposed technological solutions. For this reason a sample of experimenters started receiving quarterly personalized reports on their usage of energy as a feedback.
These reports are split into three sections: in the first one the energy consumption data in the quarter is reported together with the energy consumption data in the same months of the previous year, the total change in energy consumption (in kWh and in percentage) and the breakdown of energy consumption in tariff time

bands.
The second section provides a comparison between the change in energy consumption of the experimenter and the average change in energy consumption of the other participants.
In the third section some advices for using the Enel Info+ kit are reported.

ADVANCED

Further investigation on Enel Info+ results and lessons learnt is carried out within ADVANCED (Active Demand Value ANd Consumers Experiences Discovery), a research project co-funded by the European Community's Seventh Framework Programme (FP7/2007-2013) under grant agreement n° 308923, that aims to shed light on ways to overcome the barriers hindering the mass deployment of Active Demand (AD) in Europe. In order to reach the project objectives, data and lessons learned collected through four major AD pilot projects currently running or finished shortly in Europe (the so called "ADVANCED" sites) are analysed: two ADDRESS pilots (Spain and France), E-DeMa pilot (Germany) and Enel Info+ pilot (Italy). Furthermore, data collected in VaasaETT's database (from over 110 European Active Demand projects with the participation of around 450,000 residential consumers) are be exploited.
The investigations in ADVANCED rely on the definition of a conceptual model of active consumer participation in AD in which all relevant factors influencing the participation of consumers in AD programmes are included and their relationships described. This model is validated in the project by using the data collected in the ADVANCED sites (both the consumption data and the answers to sociological surveys at household level) to uncover what profiles of household consumers adjust their consumption the most or the least to certain interventions and to what extent and further explored through the analysis of each ADVANCED site results and lessons learned.
Within the scope of the ADVANCED project qualitative interviews have been carried out with 22 participants to Enel Info+: 7 interviews to small commercial consumers (bars, food shops, services companies ..) and the rest to residential consumers.
The participants declared they initially felt fearful and skeptical about the project, and that the main drivers of their participation where the fact they knew the promoters personally, their curiosity about the kit's functionalities, their interest on technology. Another driver was the fact they could have control over their consumption, however they declared they were unwilling to reduce it if it led to a loss of comfort (for residential consumers) or it had an impact on their activities (for small commercial consumers).
Installing the Enel Info+ kit has been found very simple and intuitive: "you only have to plug it in and then it makes everything by itself" as one experimenter said. The display, in particular, has been perceived as modern, intuitive and interactive, an experimenter confirmed "it is very fast and easy to understand, it helps me have a general control".
The main benefit of the kit for all targets (small commercial and residential consumers) is keeping energy consumption under control, in order to avoid energy waste. Experimenters confirmed they are better aware of appliances' consumption and their impact on total consumption: "I have been more aware of my consumption since I have installed the device. I didn't know exactly my consumption level before; I knew the stove was very consuming but I did not have any proofs". They also declared they are better informed about some failures (old appliances for example) or anomalies: "It happened that we had left the light on and the display was showing it, and then we realized it was our light outside".
The kit turned out to be mainly used to get basic information in order to better monitor the daily/weekly (sometimes even monthly) consumption: "It has become a habit, from time to time I check my energy consumption and the time band. I check if the bar chart is green , yellow or red"
Commercial consumers mainly liked the kit because it helped them discover an unexpected consumption of some pieces of their equipment that were thus replaced: "Now I have changed the bulbs in the bathrooms of the bar, I put some low energy bulbs and I saw the consumption decreased". Moreover commercial consumers acquired a conscious involvement in energy consumption and started avoiding useless wastes of energy and money, to this regard an experimenter declared: "I check the time bands, If I can cook the pastries before 8am, I can eventually gain money because of the microwave which is energy spending".
All targets take great benefit from the alarm that beeps when the contractual power is exceeded: "The alarm tells me that I am exceeding the limit, it happens for example when my wife uses two appliances at the same time, she has time to turn one off before the load shedding"

CONCLUSIONS

Enel Info+ is an energy efficiency pilot that started on December 2012 in some municipalities in the area of Isernia. It aims to demonstrate whether enabling people to access in an easy way to their own energy consumption can increase their awareness and improve their energy behaviours. Thus the participants are provided with an energy monitoring kit including Enel smart info (a device that can be plugged in every socket to collect the certified data managed by the smart meter through powerline) and some dedicated user interfaces.
The feedback coming from the experimenters through dedicated waves of interviews are fulfilling as an high percentage of participants declared that thanks to the Enel Info+ kit they acquired a better understanding of their consumption (94%), gave a positive judgment of the kit (96%) and declared to be satisfied with the project (81%). Some participants (59%) declared they modified their habits in the usage of their appliances and/or the time in which they use them, reduced their consumption level (61%) and declared they replaced old appliances (9%). On the basis of the features that turned out to be more important and of the several lessons learnt within the various stages of the pilot the monitoring solutions proposed within the project have

been fine-tuned.
The Smart Info Display currently on field is an upgrade of the first one including some useful new features: the instantaneous power can be refreshed on demand, a scatter plot of its maximum historical values for different periods of time can be displayed, consumption habits are displayed together with the measured consumption data in the graphs, and it can receive dedicated announcements by the DSO.
The installation procedure and the usability of the pc software has been enhanced, and some new features have been designed taking into account above all the needs of prosumers.
A new procedure for connecting each Enel smart info with a smart meter is being released to support two use cases: ready to start device (which provides consumers with a fully plug&play solution) and flexibility (that is the possibility to easily set up the smart info device several times in order to move it to different LV households).
In order to keep the participants active in the project a sample of experimenters started receiving quarterly personalized reports on their usage of energy, that include the total change in their energy consumption (in kWh and in percentage) with respect to the same quarter of the previous year, the breakdown of energy consumption in time bands, a comparison with the other participants' behaviour and some advices for a better use of the Enel Info+ kit.
Enel Info+ results and lessons learnt are going to be processed within ADVANCED (Active Demand Value ANd Consumers Experiences Discovery), a research project co-funded by the European Community's Seventh Framework Programme (FP7/2007-2013) under grant agreement n° 308923, that aims to shed light on ways to overcome the barriers hindering the mass deployment of Active Demand in Europe. Within the scope of this project sites both the consumption data and the answers to sociological surveys (at household level) of the participants to Enel Info+ will be used to uncover what profiles of household consumers adjust their consumption the most or the least to certain interventions and to what extent. Moreover in-depth qualitative interviews with 22 pilot participants (7 small commercial and 15 residential consumers) were carried out to extend the study with some insights into socio-economic drivers of consumers' behavior. The outcomes of these interviews showed that the participants were initially quite fearful and skeptical about the project, and they decided to opt in because they knew promoters personally, or because of their curiosity about the kit's functionalities, or their interest on technology or because they liked the idea they could have control over their consumption. The easy installation procedure and use of the kit is very appreciated. The main benefit turned out to be the chance to keep energy consumption under control, in order to avoid energy waste and (for commercial consumers) the to discover unexpected consumption of some pieces of equipment.