**Licence**: CC BY

**Citing**: Jaraite, J. & Kazukauskas, A. (2021) Open access codes for „ESO Smart“ mobile app for electricity consumers with smart meters. GitHub.

**Contact**: andrius.kazukauskas@evaf.vu.lt

**Purpose**

Widespread installations of smart electricity meters create new opportunities for electricity retailers and their customers. Smart meters combined with information provided via mobile apps will make it easier for users to understand data on electricity use and their analysis will help the users to change their habits of electricity use accordingly. It also provides various opportunities for retailers to propose insights on individual consumption data and help energy clients engage in energy efficiency activities.

In the beginning of 2021 „ESO Smart“ mobile application has been launched by Vilnius University for electricity consumers with smart meters in Lithuania. The scientific purpose of the application was to test different solutions with real life consumers. The goal of this scientific project was to test the effectiveness of different app designs/information on the electricity use.

**Project**

The project was implemented by VU scientists Dr. Andrius Kažukauskas and Dr. Jūratė Jaraitė-Kažukauskė. They have implemented a four-year project “How application of non-price measures may help to increase energy efficiency at the needed time” (according to the program of actions financed from the EU investment funds “Promotion Research and Development and Innovation”, project No. 01.2.2-LMT-K-718-02-0007).One of the physical performance deliverables of this project is open access codes of the mobile application that could be used as a starting base to create their own mobile applications capable to provide their customers with relevant information tools to optimize their electricity consumption.

The pilot mobile application “ESO Smart” was terminated in June 2022.

**Functionalities of app and design of tests**

„ESO Smart“ application contains the following functionality:

* Hourly electricity consumption information;
* Electricity consumption and production (for prosumers) reports for days, weeks and months;
* Electricity consumption comparison with similar homes;
* Current and next day's electricity market prices.

The field experiment (tests) was implemented in collaboration with a state-owned electricity and gas distribution company AB “Energijos skirstymo operatorius” (AB ESO), which participated in designing and implementing the mobile application ESO Smart. The mobile application was designed by a procured private company (“Dizaino Kryptis”).

To study the information effects on households’ consumption decisions, we conducted four treatments employing a between-subject design. Our baseline treatment (T1) has no messages about surge pricing and no peer comparisons while all other three treatments include different informational environments:

* Treatment 1 (T1): no messages about surge pricing and no peer comparisons;
* Treatment 2 (T2): peer comparisons available;
* Treatment 3 (T3): messages about surge pricing but no peer comparisons;
* Treatment 4 (T4): messages about surge pricing and peer comparisons available.

Figure 1 presents the main screens of ESO Smart mobile application. Participants in Treatment 1 received the basic version of ESO Smart app, which contained information about the household’s net consumption of electricity and net production of electricity delivered to the grid for future consumption (see panel a in Figure 1). Net consumption is presented with positive bars and net production with negative bars. Participants could observe the hourly net consumption and net production of last day, the hourly average net consumption and production of the last week, and the hourly average net consumption and production of the last month.

Participants in Treatment 2 and Treatment 4 received an additional screen with social comparison information, which contains three bars. The bars, labelled “*Mano suvartojimas*” and “*Mano vidutinis suvartojimas*”, provide information about the household’s last day’s net consumption of electricity and the household’s 7-day moving daily average (or weekly/monthly average), respectively. The third bar on the far right, labeled “*Panašių namų ūkių suvartojimas*”, shows 7-day moving daily average for other similar households (or weekly/monthly average). Similar households were identified according to historical electricity consumption. All households were grouped into three categories: (1) households with electricity use of up to 1,000 of kWh/year, (2) households with electricity use of between 1,001 and 5,000 of kWh/year, and (3) households with electricity use of more than 5,000 of kWh/year. Social comparison screen also contained information in text about how a particular household’s (daily/monthly) net electricity consumption compares to his own historical average (daily/monthly) electricity use and that of similar households (daily/monthly) in terms of percent. In addition, by clicking on bars users could see detailed information how particular number is calculated.

Figure 1. Main “ESO Smart” mobile application screens

|  |  |  |
| --- | --- | --- |
|  | Screen picture | Key features of the screen |
| 1. Hourly electricity consumption |  | *Mano suvartojama elektro energija* (my consumption of electricity)  *Praėjusios paros* (last day)  *Paskutinės savaitės* (last week)  *Paskutio mėnesio* (last month)  *Suvartojimas ryte* (net consumption in the morning, dark green bars)  *Suvartojimas dieną* (net consumption during the day, blue bards)  *Suvartojimas vakare* (net consumption in the evening, orange bars)  *Suvartojimas naktį* (net consumption at night, light green bars)  *Gamyba* (net production)  App users could observe hourly daily, weekly and monthly net electricity consumption and production. |
| 1. Social comparison screen |  | *Mano suvartojimas* (my daily/weekly/monthly consumption)  *Mano vidutinis suvartojimas* (my average daily/weekly/monthly consumption)  *Consumption of similar households* (consumption of similar households on daily/weekly/monthly basis)  App users could compare their daily, weekly and monthly net electricity consumption to other similar households.  Text message expresses the comparison in percentages. |
| 1. Notification screen |  | Message in Lithuanian:  *Dėl numatomų žymiai aukštesnių nei  vidutinių elektros energijos kainų biržoje, jeigu turite galimybę, prašome sumažinti savo elektros energijos vartojimą šiomis kritinėmis rytojaus (pvz. ketvirtadienio) valandomis: X-X. Sumažinę savo elektros vartojimą šiomis valandomis Jūs labai prisidėsite prie Lietuvos elektros energetikos sistemos sklandaus veikimo. Ačiū!*  Translation:  *Due to the expected significantly higher than average electricity prices on the power exchange, if you have the opportunity, please reduce your electricity consumption during the following critical hours tomorrow (e.g. Thursday): X-X h. By reducing your electricity consumption during these hours, you will make a significant contribution to the smooth operation of Lithuania's electricity system. Thank you!* |
| d) Electricity price screen | C:\Users\1333508\Dropbox\NUOTRAUKOS\phone_AK\Screenshots\Screenshot_20211006-151152.png | *Elektros pagaminimo rinkos kaina* (electricity sport price in the Nord pool day-ahead market + VAT)  *Elektros perdavimo ir skirstymo kaina* (cost of electricity transmission and distribution + VAT)  *Mano kaina* (my electricity tariff). This information could is customized by each app user. |
| 1. National electricity production and consumption | C:\Users\1333508\Dropbox\NUOTRAUKOS\phone_AK\Screenshots\Screenshot_20210920-110429.png | *Prognozuojami sekančios paros nacionaliniai elektros gamybos ir suvartojimo duomenys, MW* (forecasted next day's national electricity production and consumption data in MW).  *Elektros energijos vartojimas* (consmption of electricity)  *Elektros energijos gamyba* (production of electricity)  *Vėjo elektrinių gamybą* (production of wind turbines)  App users could also observe historical numbers for electricity consumption and production. |

Participants in Treatment 3 and Treatment 4 received day-ahead surge price notifications, which were implemented as push notifications. The example of the message and its translation is presented in panel c of Figure 1. The notifications were sent on selected hours to make sure that the notifications are not too frequent by targeting not more than four notification per month.