

GUIDELINE: GUIDELINE USING FLEXIBILITY MANUALLY OR AUTOMATICALLY

Abstract

In this guideline information is provided on ways to manage the flexible part of electricity consumption. In practice this can be done in two ways: manually or by an automated system. Although no strict rules apply on how to choose one over another, either type of load control generally suits certain applications and target groups better than others. The process of implementing either type (manual/automatic) is also described. This guideline is aimed at those looking for ways to help consumers shift their energy consumption, such as project managers, product developers and utilities.

What is it?

One of the goals of consumer engagement in smart grids is to create an active participation in the consumers when it comes to making their energy consumption more flexible. From a technical point of view, there are two different approaches to exploit such a potential: automatic control and manual flexibility operation.

Automatic control relies strongly on technology and requires deep engagement with consumers during the preparation phase: in fact, each consumer should be approached through procedures aimed to select the proper loads and installation in their dwellings, taking into account their characteristics, peculiarities, needs and expectations. It is highly recommended to include loads which are already automated for other reasons (i.e. HVAC system) and which are also too complicated for manual operation control.

An alternative approach to automatic control is manual load flexibility operation, where the consumer himself has to change their change energy consumption behaviour in order to provide flexibility. This behaviour change can be incentivised by offering information (e.g. about the current price in a dynamic tariff structure or about the availability of renewable energy in the grid) to the consumer via different media, e.g. in-house display, internet pages for PCs, smartphones, etc. Generally, this approach is far less technologically intensive.

Industrial automatic demand response (KIBERnet, SI)

The project KIBERnet is an example of the flexibility operation in the industrial environment. The automatic demand response solution deals with energy shift (foundry and HVAC system) as well with energy change (by controlling gas turbines generating the production steam). Even though the industrial users were familiar with automatic solutions, before actual start of KIBERnet project the demand response has been done manually. The automatic solution, which was implemented by the KIBERnet project was initially causing some concerns. But after a successful demonstration the operators have recognised that automatic, precise and reliable control of loads enables them to effectively manage costly electrical peaks and to better plan and predict consumption of electricity.

More information: <http://www.kiber-net.com>

Investigating people's reactions on encounters with Smart grid techniques and appliances (EcoGrid, DK)

This project is set on the island of Bornholm in Denmark, which has a total of 28.000 residents. Seeing that the taxes on energy in Denmark are relatively high compared to the rest of Europe the motivation for any Danish islander is there to make use of the new techniques the smart grid offers in order to save energy and thus money. The two main goals were investigating how price mechanisms of the future smart grid work in practice; and how people react on these encounters with the smart grid techniques and appliances. Experiences in the project EcoGrid (DK) have shown that manual response could require too much effort for frequently logging in on the internet just to check the actual electricity price in a highly dynamic pricing scheme. Consumers clearly stated that a lesser level of involvement should be implemented, for example semi or fully automated systems.

The participants in the manual control group (without the dynamic electricity price) stated that they found the ability to monitor their consumption very positive. This has led to improved awareness of their energy behaviour. But, as stated on the project's web site, to many people the information about prices and consumption on the webpage is difficult to access: "Increased accessibility to information via e.g. an app could be a significant improvement...".

More information: <http://www.eu-ecogrid.net/>

When to use?

During operations, the automatic solution requires a lower commitment by the consumers. Automatic control tends, in fact, to preserve consumers' comfort to the maximum extent, while not reducing the amount of the energy consumed. Therefore, the load shift effect is predominant. On the other hand, the manual approach may have a stronger energy change effect since it requires a larger consumers' involvement as well as consumption behaviour change. Manual flexibility operation

also targets different types of loads: the loads with a strong end-user manual operation like cleaning, ironing and cooking cannot, in fact, be subject to automated control. Manual flexibility might lead to a broader consciousness of energy consumption and/or sustainability could lead to more flexibility than initially expected.

Interconnecting electricity production and consumption to communicate with one another (MeRegio, DE)

In MeRegio the aim was to use energy intelligently, increase energy efficiency and reduce CO₂ emissions. They have achieved that in practice by interconnecting centralised and decentralised energy production plants which communicate with one another. Moreover, they have used home electronic appliances that communicated with the central system and were coupled to a dynamic tariff. Automated design of integrated devices has enabled that the entire energy system operated in an optimum state at any time. The permanent exchange of data guaranteed that electricity was always produced, fed and used as required ("energy on demand"). In particular, regional differences in electricity prices could be taken into account for the first time. The schedule of the three tariff system was announced for the one day ahead. Results have shown that residential users decreased their energy consumption (by 7%), while the time shift of energy consumption to lower tariffs was not negligible either with a 16% reduction of peak loads.



More information: <http://www.meregio.de/en>

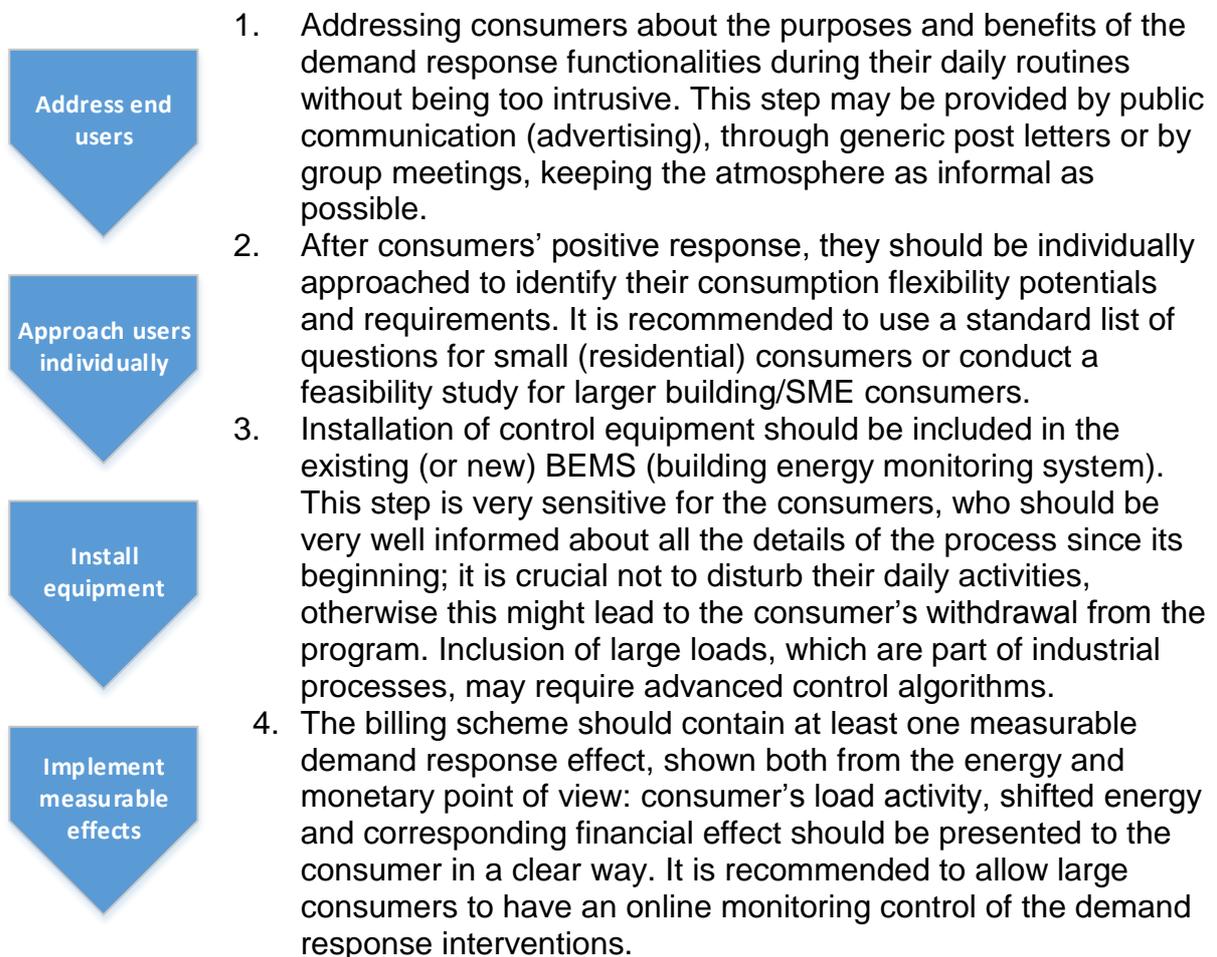
However both approaches described above may be combined: they can be applied not only to different types of loads but they also address different types of consumers. For example, consumers who do not care about the environment and can be considered not so active, would prefer the automatic solutions rather than manual ones.

What do you need to do?

The automatic and manual load flexibility operations require quite different approaches in order to reach successful implementation. The automatic control requires more individually oriented approach towards the needs of the consumers while the manual control allows consumers to have more room for tailoring the flexibility to their specific needs.

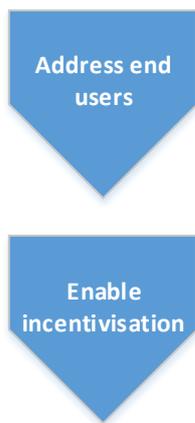
Automatic control

The following steps are needed to achieve a profound consumers' engagement in case of automatic control:



Manual flexibility

Setting up manual load control implementation project is a group or community oriented operation. The following steps need to be undertaken in order to reach a successful implementation:



1. To organize public advertising regarding the possibilities offered to consumers enrolled in the program. The announcement should contain information about purposes and benefits and also recommendations for the consumer actions and behaviour change to achieve the maximal effect. The announcement may be provided by the public communication channel to reach broader group of consumers. All the information must be clearly stated, allowing no room for misinterpretation.
2. The manual load flexibility through incentives should be accompanied by the application enabling consumers to follow the relevant information (pricing tariff, RES availability, gaming points awarded, social comparison status/rank etc.). Like in the procedure for the automatic control, it is recommended to install the required equipment within the existing EMS, in order to be as little cumbersome as possible.

Do's and don'ts

- **Let users have final decision over load operation.** It is strongly recommended to let consumers keep the final control on the load flexibility operations, also in the automatic approach.
- **Implement interface between user and service provider.** It is recommended that the service provider does not directly control consumers' loads, but it rather realizes the demand response with the interface implemented in the consumer energy management system. However, due to the cost effectiveness, this is not always feasible with small (residential) installations.
- **Automatic mode is preferable for industry and businesses.** The automatic approach is a preferable solution for industrial and other business related consumers, provided that their primary processes are not affected and there is always the option to override the system preferences.
- **Individualise consumers engagement procedures.** During the preparation phase, it is recommended to adapt consumers engagement procedure according to their characteristics. Small consumers (residential and building) may be approached with a general procedure (questionnaires) in order to select the proper loads and installation. On the other hand, for the large

consumers (industry) it is recommended to address them individually with a feasibility study first, for example.

- **Don't neglect safety procedures at hazardous processes.** In reality, in industry mixed auto-manual control regimes are often used due to considerations of safety of workers and equipment, quality of products, stability of production processes etc. For example, production processes could be automatically stopped due to malfunction or for safety reasons (such as temperature/pressure too high etc.). On the other hand production starts could be manual, since unexpected launch of machines could present a safety hazard to workers that are inspecting errors within the reach of moving parts.

Further reading

- *Products and services* (S3C D.3.4). <http://www.s3c-project.eu/Deliverables.html>
- Karjalainen, S. (2013). Should it be automatic or manual – The occupant's perspective on the design of domestic control systems, *Energy and Buildings* 65: 119-126.
- Kelley, R. C. (1968). Manual and automatic control: a theory of manual control and its application to manual and to automatic systems, *Wiley*
- Frey, H. (2012). *Smart Grid and Smart Metering – Solution that need Service Partners*, http://ahk.de/fileadmin/ahk_norwegen/Dokumente/Presentasjoner/SmardGrid2012/Session_2/Frey_-_EnBW.pdf

This guideline was developed in the S3C project, and is freely available from www.smartgrid-engagement-toolkit.eu.

S3C paves the way for successful long-term consumer engagement, by acknowledging that the "one" smart consumer does not exist and uniform solutions are not applicable when human nature is involved. Beyond acting as a passive consumer of energy, consumers can take on different positions with respective responsibilities and opportunities. In order to promote cooperation between consumers and the energy utility of the future, S3C addresses the consumer on three roles. The *smart consumer* is mostly interested in lowering his/her energy bill, having stable or predictable energy bills over time and keeping comfort levels of energy services on an equal level. The *smart customer* takes up a more active role in future smart grid functioning, e.g. by becoming a producer of energy or a provider of energy services. The *smart citizen* values the development of smart grids as an opportunity to realise "we-centred" needs or motivations, e.g. affiliation, self-acceptance or community.

S3C performed an extensive literature review and in-depth case study research in Smart Grid trials, resulting in the identification of best practices, success factors and pitfalls for consumer engagement in smart energy ventures. The analysis of collected data and experiences led to the development of a new, optimised set of tools and guidelines to be used for the successful engagement of either Smart Consumers, Smart Customers or Smart Citizens. The S3C guidelines and tools aim to provide support to utilities in the design of an engagement strategy for both household consumers and SMEs. The collection of guidelines and tools describe the various aspects that should be taken into account when engaging with consumers, customers and citizens. More information about S3C, as well as all project deliverables, can be found at www.s3c-project.eu.