GUIDELINE: INTRODUCING DEMAND SIDE MANAGEMENT TO SMES

Abstract

In this guideline we advise aggregators and energy companies on approaching small and medium sized enterprises (SMEs) with the agenda of including them into the demand response (peak levelling and electrical energy adaptation) programmes. The process of introducing demand response to SMEs should start by obtaining an order for the feasibility study from the company's energy management team. This process consists of several consecutive steps elaborated in this document. The tool Questionnaire for engaging SMEs can be used in the actual process of engaging SMEs.

What is it?

Peak levelling is one of the first smart grid functionalities introduced to small and medium sized enterprises (SMEs), when at the end of the 1970s fully automated solutions came to existence. Peak levelling by consumers contributes to lower system peaks, resulting in a lower necessary grid capacity. On the other hand it has to bring financial benefits for prosumers to incentivize them to cut their peaks (through actions such as load shedding and/or increasing the power of their own production units).

The idea of the other functionality, while using the same technology, – energy adaptation – is to adapt the consumer's consumption profile in order to support grid operator system service. For example, beside a system peak reduction (as at peak levelling), shifting the consumers' energy production or consumption in time contributes to balancing between the overall consumption and production on the grid

Since the same load control technology at the consumer may be used for both services also similar procedures may be applied for the end user engagement to the services. Addressing the SMEs with a proposal to become a part of demand response programme, can be done effectively using a structured approach, which is based on a process consisted of consecutive steps as described in this guideline.

When to use?

This guideline focuses on SME engagement in smart grid projects. It is used when a service provider wants to have end users with large adaptation capacity and reliable demand response in its portfolio. The industrial sector has members with very large installed powers therefore they possess also a lot of energy consumption that could

potentially be shifted in time. Generally speaking SMEs avoid drastic changes of their daily routines and putting their product quality at risk, therefore automated solutions are likely to be preferred as they are very reliable.

What do you need to do?

The major issue of the service introduction is the analysis of all the necessary end user data with technical estimation of end user peak levelling potential and its respond to electrical energy adaptation requests.

To perform the estimation the service provider should follow the following steps (Figure 1):

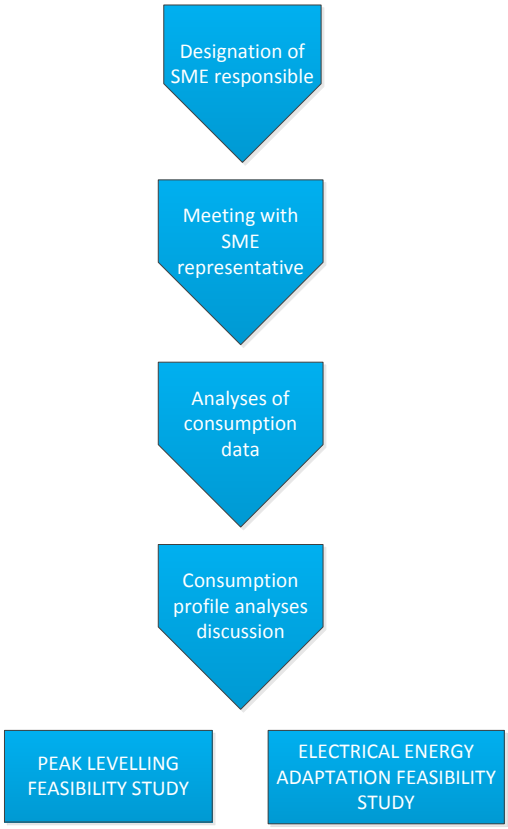

Figure 1: Steps toward feasibility study

1. **Find out who the responsible person for energy management is at the SME**
   The responsible person must be interested in the implementation of the project otherwise the success of the project may be threatened. Usually this person is the energy manager or the maintenance manager. The responsible person is designated as the project owner on the consumer side.

2. Organise a meeting with the SME's representatives

From the SME side executive manager, the energy manager, members of the energy responsible team covering production and support process and technologists must be present. The purpose of the meeting is that all participants understand the main issues of the peak levelling and electrical energy adaptation functionalities with an emphasis on interaction with their existing technological processes.

The service provider prepares a questionnaire to collect the basic data about the end user consumption characteristics (see tool Questionnaire for engaging SMEs), which is filled in during the meeting. The SME staff is informed beforehand about the data they should prepare and supply for a successful implementation of the feasibility study. These data include a.o.:

- the existing tariff system description,
- electricity consumption data for last year as relevant for their tariff system,
- a list of major loads and electricity production units,
- a list of loads and production units offered for the adaptation,
- factory blueprint showing positions of loads and production units.

The tariff system for the peak levelling is detected either from the electrical energy invoice, from the electricity contract or from a government regulation act. The SME can its consumption data from their distribution system operator or from their electricity supplier.

It is recommended to prepare and further explain in detail a form for the load and production unit table. Based on the data collected from the load and production unit table the adaptation system can be designed and investment evaluated. Example is presented in Figure 2.

Load or production unit		
ID	1	2
Name	Oven	Steam turbine
Position	Foundry	Power station
Adaptation power [kw]	1000	2500
Operational power [kW]	2500	12000
Max. intervation time [min]	30	60
Adaptation energy per 1 hour [kWh]	500	2500
Operational activity	6:00 - 22:00	0:00 - 24:00
Type of action	AutOff/AutIn	AutOff/AutIn
Connection digital input	3	
Connection digital ouput	2	
Connection analog input		
Connection analog ouput		
Protocol		Profibus DP

Figure 2: Example of load and production unit table (Source: INEA material)

3. Analyse the SME's consumption data

This provides the necessary information about the electrical consumption daily profile, peak profile, production behaviour and rough estimation of the peak levelling capacity. Comparing the list of loads and production units offered for shedding with the list of all major loads should give an indication whether all the major loads could be used for load shedding. The list of the loads and production units offered for shedding gives the first estimation of the adaptation power and energy.

4. Discuss the consumption profile of the SME at a second meeting

After the analysis of the information from the previous step the consumption profile and its characteristics are discussed with the end user representatives on the next meeting. The service provider should clarify which elements in the production could be changed to adapt the consumption profile. The service provider then goes through the list of loads and the production units offered for the shedding together with the SME staff. When all details are clear, the locations of selected loads are examined, especially regarding the possibility to connect to the adaptation system (electrical box, cables, etc.). If the collected data are complete, there is no need for further meetings. If some additional data are needed, a direct contact with the person who keeps this data is made. Usually the energy manager is the person who can give all the necessary data and support.

Engagement of an SME in the paper industry (KIBERnet, SI)

This guideline was used to review the adaptation capacity of the existing user in the KIBERnet project. The representative of the paper industry participated with one load (gas turbine) with maximal 4 MW of adaptation capacity. Using this guideline and the questionnaire Questionnaire for engaging SMEs' showed additional reduction capacity in grinding machines, chopping benches and others, with a total of 6.5 MW of reduction

capacity. In this case structural approach showed a great added value comparing to a 'common sense' approach as alternative.

5. Perform a feasibility study

There are a few differences between the feasibility study for the peak levelling and the feasibility study for the electrical energy adaptation. First the issues for the peak levelling feasibility study are described and then the differences with the electrical energy adaptation feasibility study are highlighted.

The peak levelling feasibility study

a) The peak levelling feasibility study starts with an executive summary, where all the results of the feasibility study which are necessary for the business decision are described, including saving potential, predicted costs, payback period.
b) In the introduction chapter the following information is included: technological background, peak levelling system description, load shedding approach, managing the production units, etc. This chapter gives the reader all theoretical background needed to understand the content of the feasibility study.
c) The next chapter includes the peak consumption analysis. Here sorted 15 minutes power charts are analysed, giving the information about peak distribution, peak characteristics (long, short, hourly, etc.) and peak occurrences during days of the week. After that the organizational peak levelling methods, which result in a lower peak, are described. These methods include recommendations about changing the peak tariff system and/or changing the production schedule.
d) In the next chapter the savings potential through implementation of the peak levelling system is analysed. This can be done based on experience, taking into account the information from load and the production unit table, or a dedicated simulation software for simulating behaviour of the peak levelling system implemented at the SME.
e) In this chapter the architecture of the peak levelling system is described, including the necessary effort and equipment for system implementation. The peak levelling system should be configured as modular, allowing additional new loads and production units to be added later. The necessary work and equipment include: electrical and mechanical design documentation, electrical and mechanical installation and, additional measurement and control equipment. Based on this architecture description the investment costs are estimated.
f) The last chapter in the feasibility study calculates the simple payback period. This chapter summarizes the savings and costs and calculates the payback

period. The payback period is the ratio between the peak levelling system installation costs and yearly savings.

Additionally required information for an adaptation feasibility study

The electrical energy adaptation feasibility study requires additional information in several chapters described above:

a) Important difference between peak levelling and demand response (DR)consumption adaptation is also that when talking about the peak levelling, we may use almost all the offered loads since they are usually all in operation (otherwise the peak would not occur). The electrical energy adaptation can happen at any time and the number of loads that could be used is usually lower and varies depending on the timing when the flexibility is needed. Therefore the chapter describing the peak consumption analyses should not state the maximal capacity but only the loads available during adaptation periods defined by service provider. If it is not declared the alternative may be foreseeing a reserve of flexible loads when stating the capacity in the contract.

b) The chapter describing the architecture of the system needs to point out that it is not only the local system which is impacted but that the system is connected to the network and thus privacy and security issues need to be emphasized, see guideline Privacy and data protection.

Investigation of SMEs gives promising demand response potential (Salzburg SME DR Study, AT)

The fact that SMEs need well planned strategy for effective inclusion into the DR programs is confirmed also in the project Salzburg SME DR Study, which goal was to analyse potentials for load shifting in small to medium enterprises in the Salzburg region. The first contact was made with the headquarter representative to check the openness for the topic demand response, later the technical details of surveys were analysed production experts. The contacting process showed that if the consumer uses some the of peak levelling, he is well aware of his adaptation potential. Additionally, flexible load in an enterprise strongly depends on the attitude of the contact person, e.g. a facility manager will estimate a higher amount than the production manager. Summing up the project has evidenced a reasonable high potential of 2,5MW power change for 15 min interval, what is more than 1/3 of the total load of 21 SMEs under examination.

Dos and don’ts

- **Fill in the questionnaire for SME engagement.** The service provider and SME energy manager together should have a look at the questionnaire for discovering the SME demand response potential - see tool “Questionnaire for engaging SMEs- and make the analyses for further project decisions.

- **Engage the management of the SME.** At the first steps the SME leadership should be involved and informed so it is assured that the project is supported from the SME executive level.
- **Make a presentation for all stakeholders in the SME.** The presentation should be made for all the involved participants from the SME-side (energy manager, production manager, technologists) and should emphasise the benefits and the assure that the energy adaptation will preserve the production processes to the maximal extend possible and that it won't impact the production quality and efficiency.
- **Help the SME make good decisions when it comes to what loads are suitable.** Be part of the team and help the SME with choosing the appropriate loads and own production units to include in the program. However, do not forget that the final say lies with the SME when it comes to decision making.
- **Don't perform the feasibility study for free.** For gaining full SME commitment it is not recommended to perform the feasibility study for free. However, it is possible to make an offer to the SME to reimburse the cost of the feasibility study in the implementation phase of the project.

Further reading

- Project Kibernet. http://www.kiber-net.com/
- Enernoc (2015). *Engaging business customers.* http://www.enernoc.com/for-utilities, June 2015.
- Leonardo Energy (2009). *Electric Load Management in Industry.* http://www.uie.org/sites/default/files/generated/files/pages/LoadManagement.pdf
- M. Starke, N. Alkadi, Oak Ridge National Laboratory (2013). *Assessment of Industrial Load for Demand Response across U.S. Regions of the Western Interconnect*. http://info.ornl.gov/sites/publications/files/Pub45942.pdf
- Karg, L. et al. (2014). *Lastverschiebungspotenziale in kleinen und mittleren Unternehmen und Erfolgsfaktoren zur Hebung dieser Potenziale*, in: Nachhaltig Wirtschaften Berichte aus Energie- und Umweltforschung (8/2014).

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 end user 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, end users can take on different positions with respective responsibilities and opportunities. In order to promote cooperation between end users and the energy utility of the future, S3C addresses the end user 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 end user 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.