Generalized Operational FLEXibility for Integrating Renewables in the Distribution Grid (GOFLEX)

D8.1 Report on Requirement and Prosumer Analysis – Use Case 2

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Imprint

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Executive Summary

This document (D8.1) presents the first activities of Task 8.1. This document presents the local conditions of the Swiss pilot (actors, existing infrastructure…), the type of prosumers/consumers that will be approached, as well as the foreseen architecture of the pilot. It also clarifies what will be implemented and tested, based on the original DoA.
It presents also two prosumers for both factories and households that are representative of the future pilot participants. It defines also the roles for handling the pilot, as well as the business models that will be investigated. Based on these example prosumers and business models, it defines the requirements of the GOFLEX solution that has to be fulfilled by the solutions providers (WP2-6) to achieve a successful pilot phase.

Document History

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List of Acronyms and Abbreviations

Abbreviation	Definition
GA	Grant Agreement
WP	Work Package
DSO	Distribution System Operator
DSM	Demand Side Management
FEMS	Factory Energy Management System
HEMS	Home Energy Management System
CEMS	Charging Energy Management System
CDEMS	Charging Discharging Energy Management System
EV	Electric Vehicle
ITI	Intelligent Trading Interface
KPI	Key Performance Indicator
TSO	Transmission System Operator
CBA	Cost and Benefit Analysis
SME	Small-Medium Enterprise

1 Introduction

1.1 Purpose

This document provides a progress report regarding the situation and the accomplished work of WP8 – System Deployment & Evaluation – Use Case 2 after 6 months (November 2016 – April 2017). It provides the reader with a description of WP8, details about the demonstration site settings, a detailed analysis of the involved prosumers (industrial, residential and public charging stations), and a description of the demonstration requirements in terms of existing infrastructure and components to be installed.

1.2 Related Documents

This document is related to the similar deliverables of the other WPs (2-9).

1.3 Document Structure

This document presents the D8.1 deliverable of WP8: Report on Requirement and Prosumer Analysis - Use Case 2 [month 6].

Section 2 follows this introduction and contains a description of WP8 and the related Tasks (T8.1 to T8.6). The main goal of WP8 is to prepare, mount, run and analyze the Swiss demonstration, where the project solution will be deployed and where the interaction with the different field actors (prosumers, DSO, energy provider, etc.) will be tested in real life.

Section 3 contains a description of the Swiss demonstration site settings including details about the location, the involved partners, the prosumers (industrial, residential and public charging stations) and the infrastructure.

Section 4 contains a detailed analysis of the prosumers: industrial, residential and public charging stations. Based on this analysis, Section 4 also provides a list of the most promising prosumers as well as the requirements for the interaction with the different types of prosumers.

Finally, Section 5, followed by a short conclusion, contains a description of the demonstration requirements in terms of existing grid and ICT infrastructure as well as in terms of how the components to be installed will be tested and approved.

2 Work Package Description

This description is taken from the DoA.

2.1 Introduction

WP8 - System Deployment & Evaluation - Use Case 2 [Months: 1-36]
Participating partners: HES-SO, INEA DOO, AAU, ETREL, ROBOTINA, BAUM, ESR
The goal of this WP will be to prepare, mount, run, and analyse a demonstration in Switzerland where the project solution will be deployed and where the interaction with the different field actors (prosumers, DSO, energy provider...) will be tested in real life. The goal of this Swiss demonstration is to recruit between 200 and 250 prosumers (households), 10 industrial partners (consumers), 10 electric vehicles owners, and 30-50% of the households (50) in a small distribution grid (behind a single MV/LV transformer) to test the influence of DSM on the grid. With this number of prosumers, a few MW of power will be controlled to have a significant effect to measure. This demonstration will thus serve as a test bed for the different tools developed in the previous WPs (WP 2-6).

2.2 T8.1 Requirement Analysis, Business Models & KPIs

Participating partners: ESR; BAUM, HES-SO [Months: 1-12]
To prepare the demonstration case in Switzerland, it will be necessary to look at all the critical aspects required for making this testing phase work correctly. These critical points encompass, but are not limited, to the business models used with the prosumer engaged in the demonstration phase, contract between ESR and its clients, data privacy, system security, system monitoring, communication, and getting prosumer engaged in the process. All these aspects will be investigated and discussed with the required key people (clients, data protection commissioner, lawyers, etc.). This phase will be critical to ensure that no non-technical aspect will block the trial phase and will ensure that the solution deployed during this demonstration phase is durable. Furthermore, KPIs along with associated risks will be identified in order to assess and benchmark the business model both qualitatively and quantitatively. Based on the identified KPIs, this task analyses requirements + influencing factors of the CBA analysis that will be performed during the demonstrations, leading to a detailed design of the CBA.

2.3 T8.2 Prosumer Recruitment

Participating partners: ESR; HES-SO [Months: 6-24]
Since the Swiss demonstration site can be considered quite large, this dedicated task aims at recruiting willing prosumers. During the demonstration phase, two types of prosumers will be participating: private households and companies. To recruit the required number of prosumers, a great deal of work will be required, especially for the industrial clients of ESR. Thus, this task will focus on the recruitment of the demonstration participants. At the beginning, the main effort will be made by contacting numerous industrial clients of ESR and investigating their consumption flexibility. The goal is to acquire 10 willing industrial partners with interesting flexibility in electricity consumption and if possible production, to get a sufficient amount of flexible energy to control. Then, the task will focus on the recruitment of the 200+ prosumers (PV producing households with flexible consumption), defining also the exact contract and

services offered to the prosumers to recruit them willingly. In parallel, the location of the distribution grid experiment will be investigated and the local inhabitants contacted. The goal is to recruit 30-50% of the local households that possess flexible electrical consumption to get a sufficient level of action to observe the impact on the distribution grid. In parallel, the task will aim at getting 10 electric vehicle owners participating to the demonstration, with charging stations both at work and at home.

2.4 T8.3 Preliminary Measures and Experiments

Participating partners: HES-SO; ESR, INEA [Months: 6-24]
Running a demonstration phase of 12 months with hundreds of customers will be really difficult without some foreknowledge. As a result, this task will focus on measures done in the field to get a good insight of what will happen during the demonstration phase. Likewise, preliminary tests of interfacing buildings and controlling some flexible appliances will be done, to be able to test the material, and especially discover the problems linked to the installation of such material in the field to control the flexible electrical appliances. It will also focus on gathering data before the running of the demonstration phase to get a point of comparison and training data for the solution developed in the previous WPs (WP 2-6). Additionally, the cost elements of the CBA analysis will be built in detail in this task. This might include a preliminary CBA with anticipated costs and benefits.

2.5 T8.4 Material Installation

Participating partners: HES-SO; ESR, INEA, AAU, ROB, ETREL [Months: 20-26]
This task will focus on the installation of the required material for controlling the appliance and monitoring the experiments. The HES-SO will serve as a technical advisor to ESR during the installation, letting ESR employees focus on the electrical installation and handle the communication with the consumers/prosumers.

2.6 T8.5 Demonstration

Participating partners: HES-SO; ESR [Months: 24-36]
This task will handle the whole demonstration phase. Multiple aspects will have to be taken care of to keep the prosumers satisfied during this testing period. A first aspect will be the communication to the participants, with information regularly sent to keep them entertained during the whole phase. Likewise, a problem handling service will have to be setup for the whole duration of the demonstration phase to handle technical or other kind of problems. An intervention group has also to be created to make the required reparations when problems arise in the field. Finally, the task will also focus on the following of the experiments themselves, planning them, monitoring the results and their effect on the distribution grid and on the aggregated load curve. An important subtask will be to get regularly in touch with the providers of the deployed solutions developed in the previous WPs (WP 2-6) to keep them informed about the field results and give them feedback for optimizing their equipment.

2.7 T8.6 Demonstration Results and Evaluation

Participating partners: ESR; HES-SO [Months: 27-36]

This task will focus on the analysis of the result of the demonstration. First, a technical analysis of the experiments will be done to verify that the foreseen effect of controlling flexible sources (DSM) is able to achieve what was foreseen during T8.1. The effect on the distribution grid will also be investigated. An analysis of the demonstration participants and the interaction with them will also be done to get a clear picture of the related problems (contract, prosumer interest, engagement...). An economic analysis of the gains of deploying such a solution in comparison to the costs will also be done to verify that the business models investigated are correct. The CBA analysis will be completed in this task and the quantified benefits will be reported using actual costs.

2.8 Description of Deliverables

The deliverables of this work package will report the activities of the demonstration site in Switzerland, including requirement analysis, business models, KPIs, CBA, installation, testing, demonstration and evaluation.

D8.1: Report on Requirement and Prosumer Analysis - Use Case 2 [Month 6]
This deliverable will be the first result of T8.1. It will present a report on a first analysis of ESR clients to pinpoint the most promising ones. It will also specify what are the requirements to interact with clients, making first propositions for aspects such as contract, comfort guarantees, data privacy, security, stability, monitoring, communication with the client, etc.

D8.2: Business Model Design and KPI Definition - Use Case 2 [Month 12]
This deliverable will present the business models that are envisioned to be implemented with ESR clients. It will also define the key performance indicators (KPIs) that will be used to evaluate the business models of the pilot phase.

D8.3: Report on the System Prototype Implemented in the Field - Use Case 2 [Month 24]
This report will present the implementation of the system prototype in real test case in the ESR area. To reduce the risk of problems with real client, the first tests will be certainly implemented on site of ESR or HES-SO, or in household of both companies' collaborators. This report will present a technical analysis of the prototype (reliability, performances, etc.) as well as wider aspects such as installation routines and problems, interaction with local inhabitant, information provided to the client, etc.

D8.4: Report on Demonstration Results Evaluation - Use Case 2 [Month 36]
This report will present the results of the pilot phase. It will encompass an analysis of the deployment and the maintenance of the infrastructure (installation complexity, problems observed, field maintenance, etc.). Another aspect will be the interaction with the client (contract, information, communication, problems, etc.). A third aspect will be an analysis of the technical performance of the GOFLEX solution. The fourth aspect will be an analysis of the business models tested during the pilot phase. Finally, this deliverable also reports on the CBA analysis with concrete evidence on the results achieved.

3 Demonstration Site Settings

3.1 Location Description

One of the three GOFLEX demonstration sites will be implemented in Valais, Switzerland. Valais is located in the middle of the Alps and therefore hydroelectric power plants are the main producers. However, more and more other new renewable energy providers (solar, wind, biomass, etc.) are appearing. The construction of photovoltaic installations in Valais are expected to continue to be subsidized by the Federal government as Valais benefits from very generous weather conditions. Indeed, Sion (capital of the canton of Valais) enjoys yearly more than 2000 hours of sunshine.

Figure 1: Municipality of Sion, in Valais, Switzerland.

3.2 Roles and Players

Energie Sion Région (ESR) is a Swiss utility company located in Sion that serves multiple roles, such as electricity supplier, electricity producer, distribution system operator (DSO), water and gas supplier, internet provider, etc. It possesses more than 54'000 electricity clients and distributes more than 500 GWh of electricity per year. In the scope of this demonstration case, ESR will serve as both energy provider and DSO. In the same city lies the Institute of System Engineering of the University of Applied Sciences and Arts Western Switzerland (HES-SO). One of the two main axes of research of the institute is energy. HES-SO will serve as an integrator, support ESR during the demonstration phase, and coordinate the pilot experiments.

3.3 Prosumers and Infrastructure

ESR, with more than 50'000 clients, possesses a good basis to get prosumers involved into this project. They registered more than 400 PV producers in the area. Sion possesses numerous small-medium Enterprises (SMEs), an airport, swimming pools, a skating rink, a hospital, a rehabilitation center, and a lot of other big electricity consumers. About 300 electric vehicles are registered in Valais, and numerous renewable power plants exist such as small hydro, biomass, etc. For this demonstration case, the main goal will be to involve about 200 small PV producers (mainly rooftop), installing interfacing equipment to shift their flexible consumption (such as boilers, heat-pumps, etc.), as well as monitoring their renewable production. Another goal is to get 10 electric vehicle owners to use their vehicle as flexible load. We also aim to equip a small neighborhood (about 100 households) with interfacing equipment to control their flexible load (space and water heating), while monitoring the distribution lines and the MV/LV transformers, to measure the impact of DSM on the distribution grid. In parallel, SMEs and industrial partners will be contacted in the area to get 10 willing participants to a DSM program involving dynamic pricing of electricity to give them an incentive to shift their flexible loads. Similarly, 10 households will be equipped with energy management systems and offered dynamic pricing to enroll them in a DSM sketch.

3.4 Demonstration Objectives and Use-Cases

- Optimization of the balance for ESR to reduce corrective costs (one day ahead planning to reduce intra-day correction costs)
- Use DSM to reduce peak loads on the distribution grid, thus reducing the need of upgrading the infrastructure in an area where decentralized PV production is increasing.

3.5 Business Models

The business models are linked to the previous use cases, using dynamic pricing or other kind of contract to get flexible consumers to shape their load in accordance to ESR needs, for both reducing the intra- day corrections costs and reducing the upgrading investments in the distribution grid. Moreover, maximizing self- consumption will also be investigated with the 200 PV prosumers. On that aspect, the various financing schemes of PV retributions will have to be considered. Currently in Switzerland, multiple models exist in parallel, spanning from RPC (“retribution à prix coutant”: Feed-in tariff at cost) where prosumers have no interest to consume their own production, to installation without subsidies, where prosumers are eager to self-consume.
Another business model that will be investigated is to sell the aggregated flexibility to TSO for tertiary reserves (ancillary services for TSO).

4 Prosumers

This section describes the identification and selection process of the industrial and residential prosumers for Demonstration Site 2 in Switzerland. The general target is to involve 10 industrial partners and between 200 and 250 residential prosumers. Furthermore, 10 electric vehicles charging stations will be installed. In more details, the architecture of the Swiss Demonstration Site will link the Intelligent Trading Interface with:

- 200+ residential prosumers directly controlled by a global server
- 20 residential prosumers with a HEMS, with 5 of those having electric vehicles
- 10 factories (FEMS)
- 10 public charging stations (CEMS)

The 10 public charging stations will typically be installed near workplaces to guarantee flexibility. Currently, existing charging stations cannot be regarded as exploitable, since the clients want to charge their vehicle immediately. Figure 2 shows the architecture of the Swiss Demonstration Site. On this figure, ITI (Intelligent Trading Interface) symbolize the link between the prosumers/consumers and the central GOFLEX solution. A more thorough description of the components to be installed stands at the start of Chapter 5. The participation to both factories and households will allow for a comparison of the flexibility offered by both type of actors.

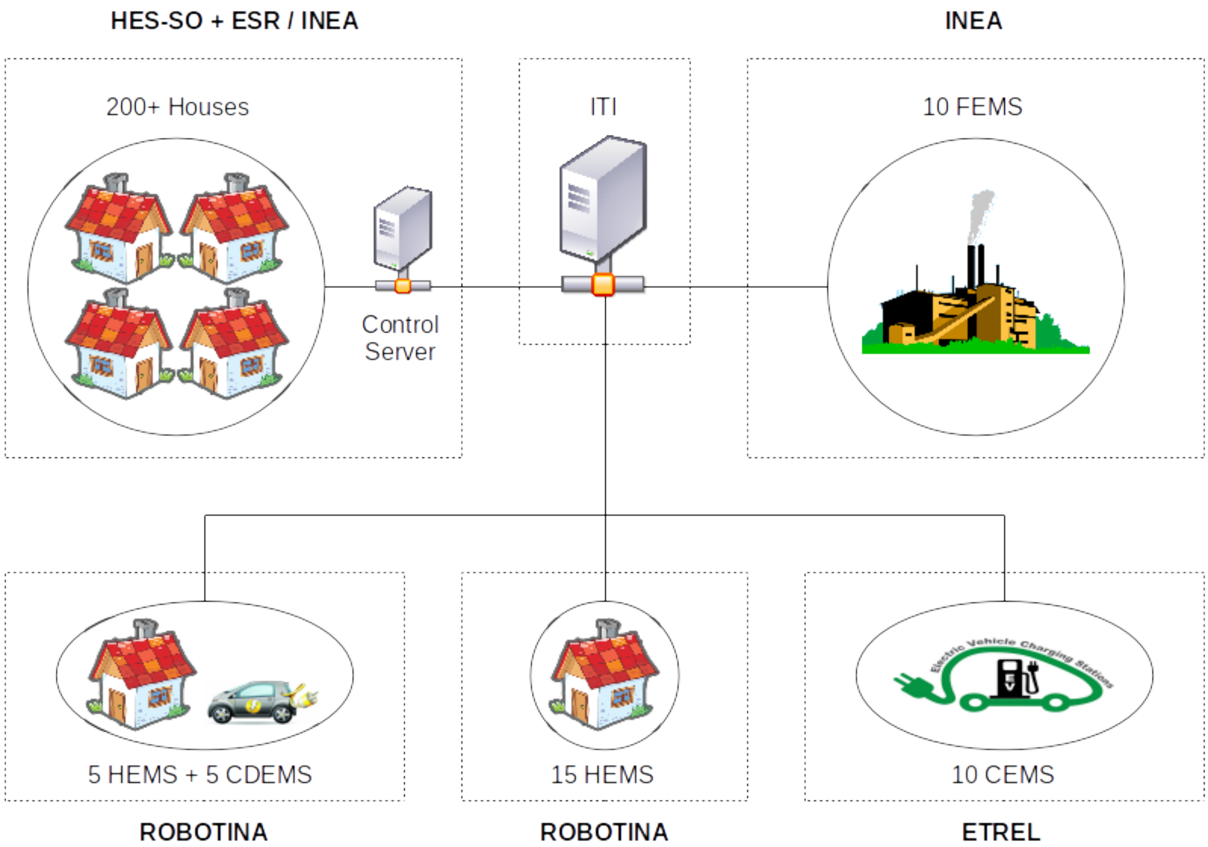

Figure 2: Architecture of the Swiss Demonstration Site

4.1 Analysis

4.1.1 Industrial Partners

The selection process of the industrial partners relies on two unique key elements provided by ESR and HES-SO. On one hand, ESR has long experience in meeting its industrial partners' energy needs and has detailed data about their energy consumption, in particular their yearly electricity consumption and their peak and minimum power consumption. On the other hand, HES-SO has been working closely with several local and/or international companies in Valais for many years, helping them designing their infrastructure and also optimising their energy consumption. The different industrial processes as well as the energy needs of these companies are therefore very well understood. The combination of these two elements was crucial for a smooth contact with the potential industrial partners and the selection of the most promising ones.
An initial list of 51 potential industrial partners was split into six categories according to their activities, as shown in Table 1. They were also categorised according to their power and time flexibility, from high flexibility (++) to no flexibility at all (--).

Table 1 - Categories of industrial partners

Type	Description	Flexibility
A	Public infrastructures (hospitals, schools, domestic water pumping stations, etc.)	+
B	Shopping centres (food)	- to +
C	Shopping centres (non-food), offices with air conditioning, air treatment	+ to ++
D	Industrial cold production	+ to ++
E	Other industries	+ to ++
F	Hotels, restaurants	-

4.1.2 Residential Prosumers

For the residential prosumers, the idea is to involve between 200 and 250 households with electrical heating (heat pumps or resistive heating for space and/or domestic hot water heating). A large proportion of these households will also be equipped with photovoltaic panels. Overall, the goal is to involve at least 50 households with PV installations (7 kWp on average for each prosumer) and a heat pump (3 kW on average for each prosumer), between 100 and 150 households with PV installations and resistive electric heating, and a few electric vehicle owners (with or without PV installations). The remaining households will only be equipped with electrical heating. Figure 3 illustrates the different types of households that will be involved in the Swiss demonstration site (either heat pumps and/or direct electrical heating, and when available photovoltaic panels or electrical vehicles). The selection process is underway; the targeted ESR clients will be contacted in the next few months. The prosumer recruitment is the main objective of Task T8.2 and will happen between months 6 and 24.

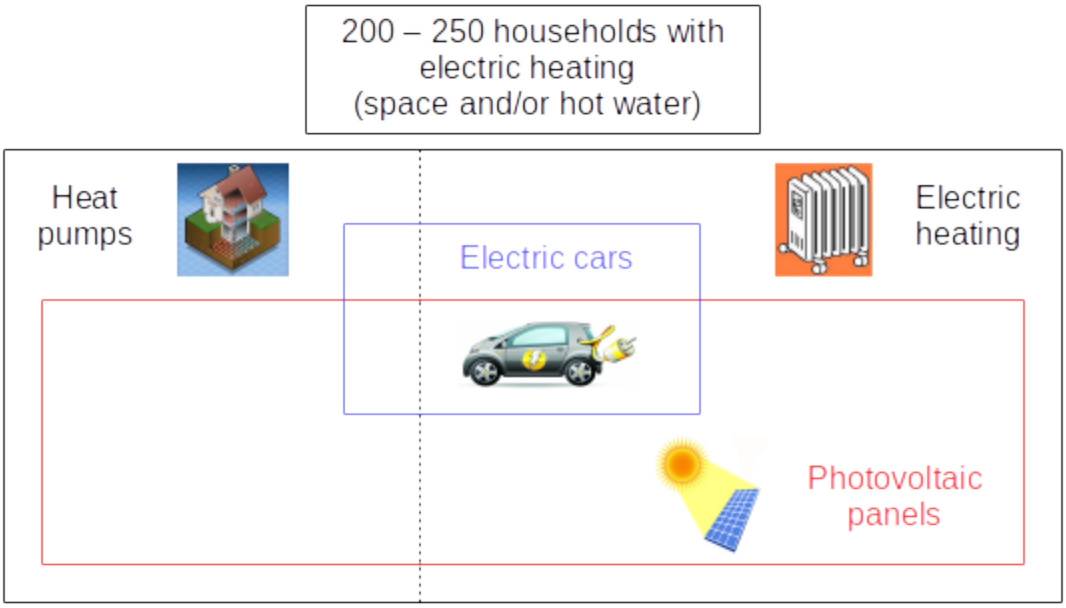

Figure 3: Types of residential prosumers involved in Demonstration Site 2

4.1.3 Data protection

The new EU data protection directive will certainly have an influence on the current Swiss law (Federal Act on Data Protection, 235.1[1]). As a result, we will follow with our jurists the modification of the Swiss law and act accordingly during the collection of data in the Swiss Pilot. A clear plan for data protection will thus be included in D8.2, with the other contractual aspects that will be described in this deliverable (contracts with the pilot participants).

[1] https://www.admin.ch/opc/en/classified-compilation/19920153/index.html

4.2 Identification of Most Promising

Based on the initial analysis, the 17 most promising industrial partners were pre-selected, as shown in Table 2**Error! Reference source not found.**. These 17 companies sum up to a yearly electric consumption of 22.8 GWh and most of them have good to excellent power and time flexibility. At this stage of the project, a particularly significant potential has been identified in two ESR industrial clients. ESR and HES-SO have recently met the managers of these two industries and explained the goals of the GOFLEX project. This first contact and the feasibility studies are very encouraging with these two industries.

Table 2 - Details about the 17 pre-selected most promising industrial partners

Name and Category		Annual Consumption [GWh]	Min Power [kW]	Max Power [kW]	Flexibility
Pumping station 1	A	1.1	0	3450	-
Pumping station 2	A	0.9	-	-	+
Pumping station 3	A	0.3	-	-	+
Swimming pool	A	1.3	-	344	+
Total Category A		3.6			
Large supermarket 1	B	2.1	70	534	+
Large supermarket 2	B	1.6	18	345	-
Total Category B		3.7			
Large supermarket 1	C	0.6	3	211	+
Large supermarket 2	C	0.4	2.4	146	-
Large supermarket 3	C	0.3	2.4	98	+
Total Category C		1.3			
Industrial cold production 1	D	1.7	56	495	++
Industrial cold production 2	D	1.4	33	375	+
Industrial cold production 3	D	1.3	58	326	+
Industrial cold production 4	D	0.3	6	107	+
Total Category D		4.7			
Other industry 1	E	7.8	83	1635	+
Other industry 2	E	0.4	-	332	++
Total Category E		8.2			
Hotel 1	F	0.7	-	192	-
Hotel 2	F	0.6	10	229	-
Total Category F		1.3			
TOTAL		22.8			

The first very promising site is an asphalt production plant equipped with 4 tanks maintaining the bitumen at high temperatures using electrical heating resistors and representing a total storage of 280 m^3. Figure 4 shows the bitumen tanks of this asphalt production plant. The resistors consume on average 190 MWh per year to maintain the bitumen at temperatures between 130°C and 160 °C. Figure 5 shows the electric power consumed by the asphalt production plant over a week (24 – 30 August 2015). The tanks are very well insulated with 40 cm of mineral wool, allowing a very efficient energy storage. Indeed, preliminary measurements show a maximum temperature drop of 4 degrees in 24 hours with an initial temperature difference between inside and outside the tanks of 140 °C. In theory, the maximum energy storage capacity is around 3'000 kWh. However, this strongly depends on the filling levels of the tanks as well as on the bitumen quality specifications imposing minimal and maximal storage temperatures. In practice, the energy storage capacity is estimated between 700 kWh (worst case) and 2'000 kWh. During production period, (March to December), bitumen is typically stored 2 or 3 days and bitumen delivery happen at the same rate. Finally, the flexibility is estimated to about 40 kW during 13 hours when the installation is used.

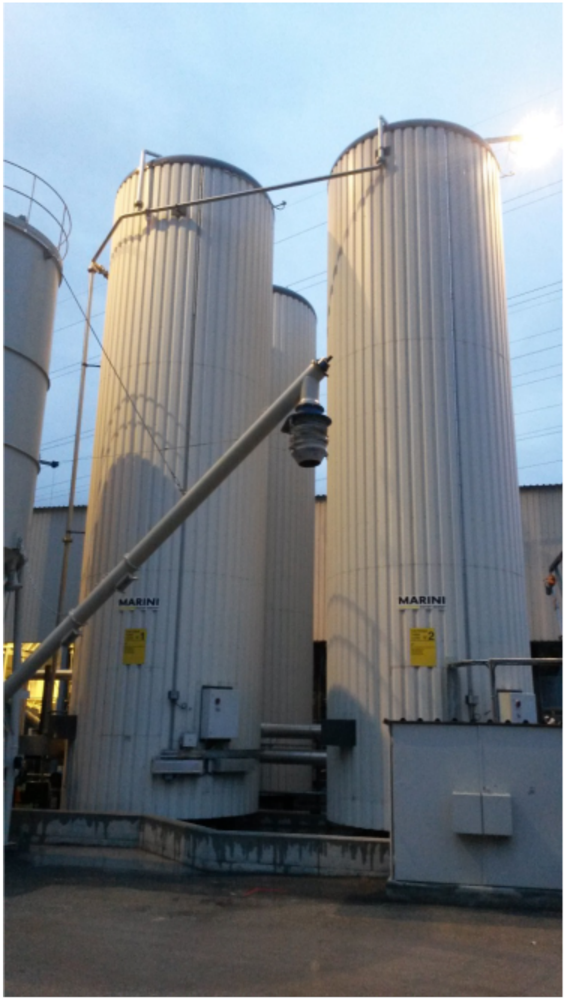

Figure 4: Bitumen tanks of the asphalt production plant

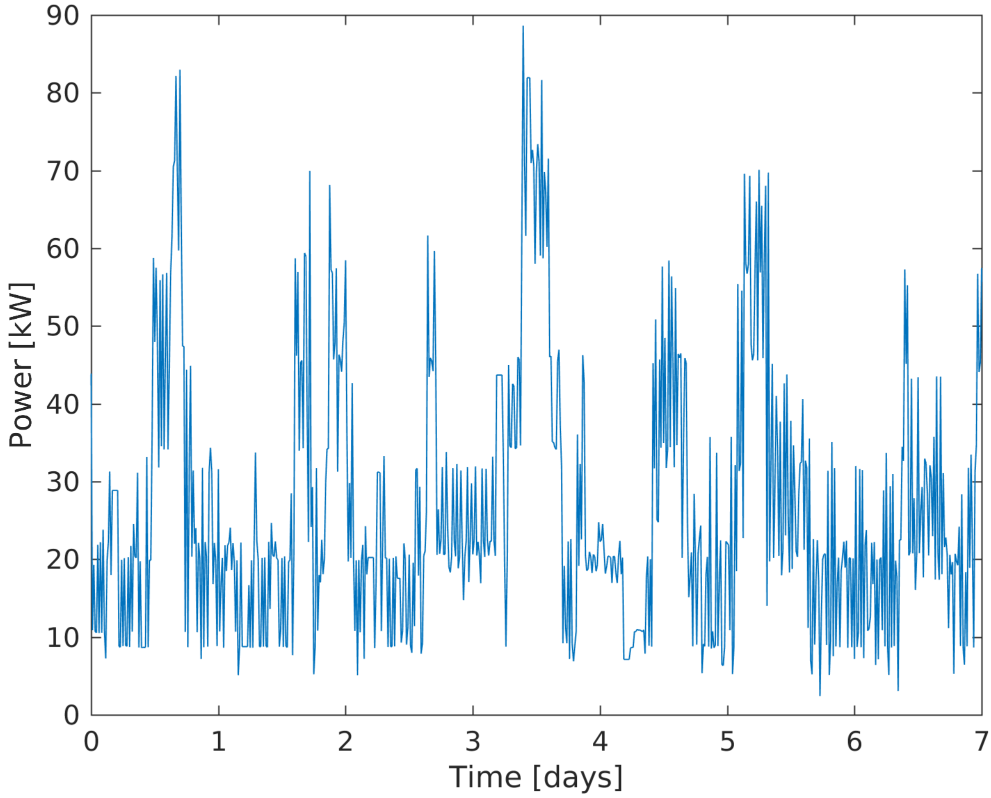

Figure 5: Electric power consumed by the asphalt production plant over a week (24 – 30 August 2015).

The second very promising site is a fruits and vegetables cooperative using large refrigerated storage rooms, two 7'000 m^3 rooms and one 5'000 m^3 room. The overall nominal electric power of the cooling compressors is 250 kW. The refrigerant used is CO_2 with condensers on air and ground water. A few years ago, the cooperative built a 8'000 m^2 photovoltaic plant with a nominal power of 1'152 kWp. Figure 6 shows the storage rooms and the photovoltaic plant of this fruits and vegetables cooperative. The yearly production of this photovoltaic plant is around 1'250 MWh, corresponding more or less to the actual electric consumption of the cooperative. Figure 7 shows the electric power consumed by the cooperative over a week (24 – 30 August 2015). In theory, the maximum energy storage capacity, corresponding to the compressors operating at nominal power for 12 hours, is 3'000 kWh. However, this strongly depends on the temperature set values as well as on the filling of the refrigerated rooms. Finally, the flexibility is estimated to 250 kW during 15 hours, before the temperatures should get out of the required boundaries.

The selection process of the remaining eight industrial partners is ongoing and ESR together with HES-SO are in contact with different companies (Table 2) such as a semi-industrial bakery, food providers and transporters, shopping and sport centres, etc. Again, the prosumer recruitment is the main objective of Task T8.2 and will happen between months 6 and 24.

Figure 6: Storage rooms and photovoltaic plant of the fruits and vegetables cooperative.

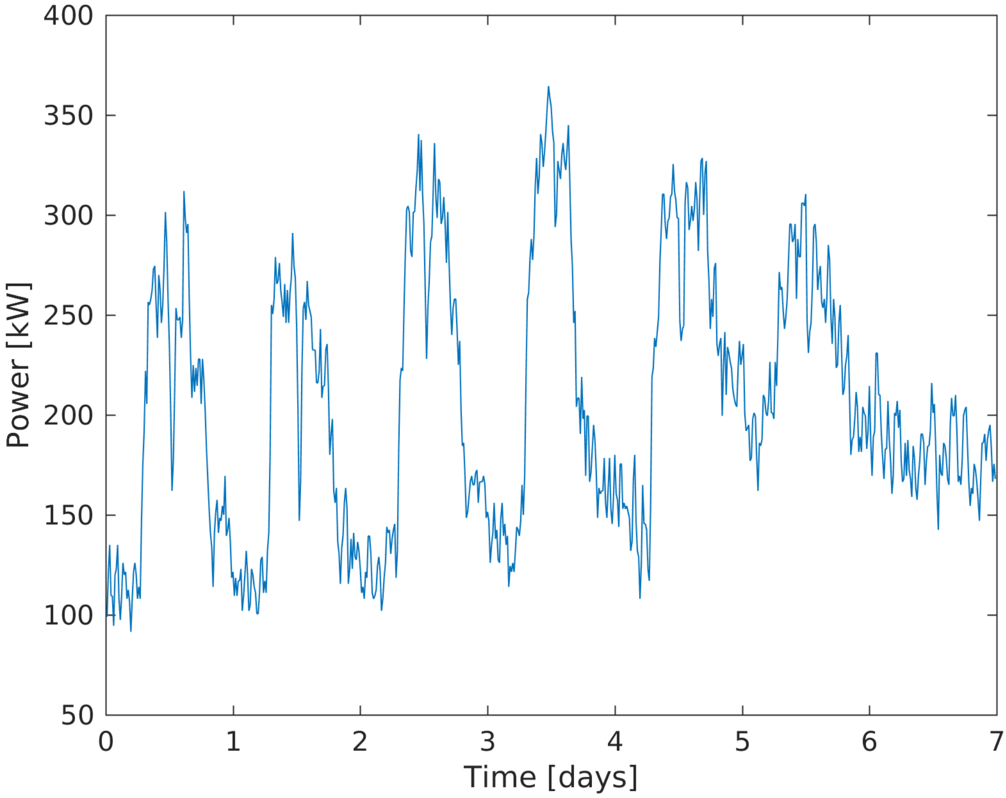

Figure 7: Electric power consumed by the fruits and vegetables cooperative over a week (24-30 August 2015)

4.3 Requirements for Interaction

The fundamental requirement for a smooth interaction with the prosumers is that the GOFLEX solution must have absolutely no impact on the activities of the industrial partners or on the comfort of the residential partners. To reach this goal, two essential concepts will have to be followed early in the design and installation of the GOFLEX solution.

First, a detailed and accurate provisioning system will have to be designed and implemented to ensure quick detection and solving of potential problems generated by the GOFLEX solution. This includes, but is not limited to, detection of connection breakdown, loss of data or inaccurate data. Second, the installed hardware will have to be flexible enough to accept software updates remotely, allowing to easily deploy bug fixes or other software improvements. Indeed, the GOFLEX solution will most likely be scalable and thus the embedded software will have to be easily updatable with new features.

For residential prosumers, the key elements for a successful interaction will be accurate and reliable measurements of consumed power (heat pump, space heating, boiler and electric vehicle), generated power (photovoltaic) and temperature (indoor and boiler).

For industrial partners, the key elements for a successful interaction may vary on a case-by-case basis. However, in all cases an accurate and reliable measurement of the consumed power and if any of the generated power will be essential. Other key measurements to perform may include: heating temperatures (asphalt production, space heating, etc.) and cooling temperatures (large scale refrigerators, space cooling, etc.).

Finally, another more technical potentially key aspect consists of the reliable prediction of the side effects of acting momentarily on flexible loads. A decrease or increase of the consumption could have an important impact when the system is released back to its standard mode of operation (e.g. synchronized restart of all load inducing a restarting peak). This will be important to evaluate the flexibility of each prosumer (HEMS and FEMS) and the effects of using this flexibility. It can be performed by preliminary tests and targeted simulation.

5 Demonstration Requirements

The Swiss use case will involve multiple components that will be tests. Table 3 presents the technical components that will be tested in Switzerland. Figure 8 presents the overall architecture of the Swiss pilot.

Table 3 - Components to be installed

		Use Case 2: Switzerland
O1: Trading		BRP level
O2: Storage	**virtual**	10 FEMS, 20 HEMS 200+ direct control
	explicit	5 CDEMS (EV in garage, or emulation by batteries)
O3: DR ready xESM		22 residential EMS, 10 factory EMS, 10 micro power plants EMS
O4: EVs		10 Public (charging)
O5: Distribution Observability		Localised DR effect on primary substation feeders: 200+ buses/branches, with 50+ households controlled
O6: Cloud data services		SCADA: 100-200 points AMI: 20-50 points Weather: public gridded data, HES-SO station 100+ Forecasting Models

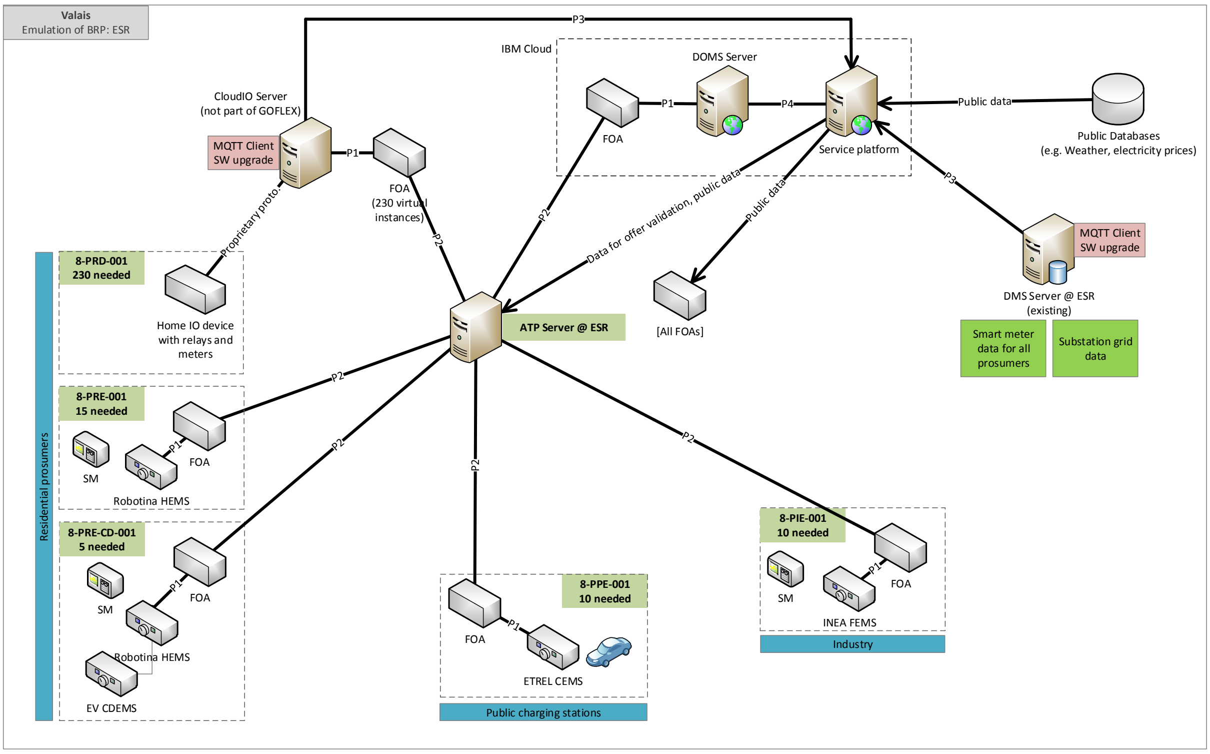

Figure 8 - WP8 - GOFLEX Swiss demo site ICT architecture (general)

5.1 Existing Grid Infrastructure

By the end of 2015, ESR was distributing electricity to 54’417 clients in the 19 shareholder municipalities shown in Figure 9:

- Arbaz, Ayent, Chermignon, Conthey, Evolène, Grimisuat, Hérémence, Icogne, Lens, Les Agettes, Montana, Mont-Noble, Savièse, Sion, St-Léonard, St-Martin, Vétroz, Vex and Veysonnaz.

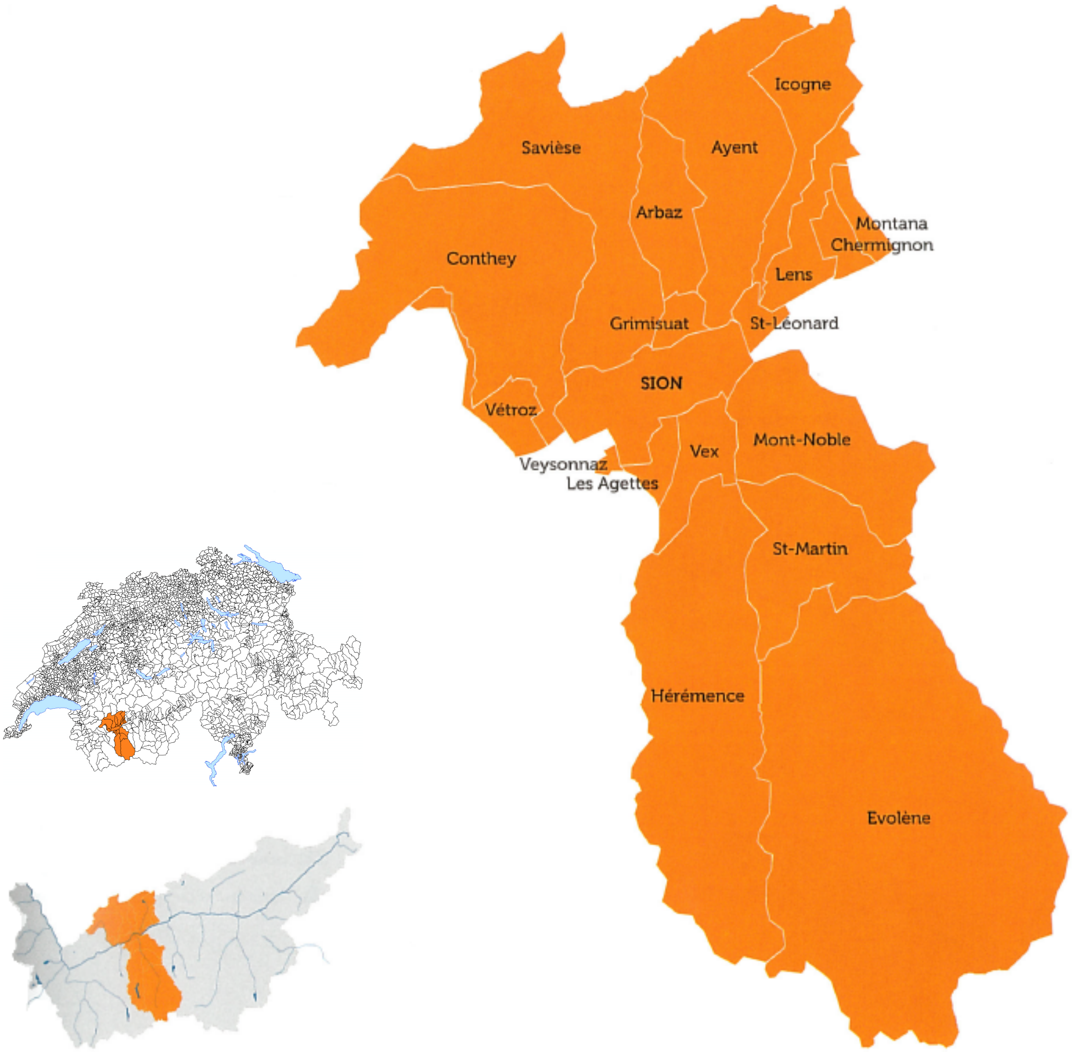

Figure 9: ESR domain of activity

For many years, ESR has been replacing overhead electric lines with underground cables. Thus, the medium-voltage network is over 91% underground, while less than 15% of the low voltage network is still overhead. Table 4 shows the key figures of the ESR grid.

Table 4 - ESR grid's key figures

High-Voltage (65 kV)	39.4 km
Medium-Voltage(16 kV)	615 km
Low-Voltage (400 V)	2’022 km
Installed Power	465 MVA
Transformer Stations	728
Photovoltaic Installations	Over 500
Photovoltaic Production	14 MWp
Micro Hydropower Plants	27
Introduction Boxes	28’279

The yearly total consumption on the ESR domain is currently about 530 GWh, 210 GWh durint the hotter six months and 320 GWh during the colder six months. About 465 GWh are absorbed from the high voltage grid (> 65 kV) and about 65 GWh are locally injected (16 kV / 400 V). The total installed power of the local injection is above 32 MW and is scattered over almost 600 locations. Table 5 shows the breakdown of the local injection.

Table 5 - Breakdown of the local injection

Type of plant	Number	Aggregated Power [kW]	Installed
Photovoltaic (< 30 kWp)	480		3’723
Photovoltaic (30 – 100 kWp)	20		1’174
Photovoltaic (> 10 kWp)	32		9’678
Photovoltaic Sub-Total	523		14’575
Hydropower (< 1MWe)	25		7’299
Hydropower (> 1MWe)	2		6’020
Hydropower Sub-Total	27		13’319
Biomass	2		257
CHP	8		470
Waste combustion	1		4’000
Total	570		32’621

5.2 Existing ICT Infrastructure

In terms of existing ICT infrastructure, the ESR grid is equipped with:

- a SCADA (Supervisory Control and Data Acquisition) system (TG 8000) measuring the flow between the distribution grid and the upstream network at each exchange point.
- a ripple control allowing the control of high consuming appliances such as storage and direct heating, boilers with a capacity over 100 liters, dishwashers, washing machines, tumble dryers, heat pumps, saunas, hot tubs and public lighting.

- an EDM (Energy Data Management) system for the collection and storage (once a day) of the grid's data and the high consuming clients' data measured every 15 minutes.
- a local consumption and production prediction software, using multiple data (historical, weather…) to predict the global load curve of ESR.
- a cable television and internet network, partially equipped with fiber-optic, connecting most the electricity clients.

The use of this ICT infrastructure will strongly depend on the adopted business models. For example, if the focus is set on reducing the balance energy costs, the SCADA system will be very useful. The ripple control will only be used and adapted if the rebound effect (peak induced by synchronized restart of the loads) can accurately be predicted.

5.3 Testing and Acceptance of Components to Be Installed

Preliminary measures and experiments is the main objective of Task T8.3, and this will happen between months 6 and 24. This will be followed by the material installation (Task8.4, between months 20 and 26). During this preliminary phase, components provided by HES-SO (200+ houses), INEA (200+ houses and FEMS), ROBOTINA (HEMS and CDEMS) and ETREL (CEMS), will be tested and evaluated to ensure optimal installation and operation.

For the residential prosumers (200+ houses and HEMS), different solutions corresponding to the different configurations available (heat pump or electric heating for space and/or water heating, photovoltaic production or not, electric vehicle or not) will be tested and validated on an initial small group of houses. The adopted solutions will then be installed at large scale (Task 8.4).

For the 10 industrial partners, a specific solution will have to be designed and implemented for each of them as they will all have very different configurations. This will be performed by Task 8.3 and Task 8.4.

The global GOFLEX solutions, resulting from WP 2 to 6 (e.g. trading system), will also be tested on a small group of pilot participants to insure their usability for both ESR and the pilot participants. The performance of the system (flexibility offered and used) will also be evaluated on this subgroup.

6 Conclusion

This document presents the D8.1 deliverable of WP8: Report on requirement and Prosumer Analysis – Use Case 2 [month 6]. After a short introduction, a description of WP8 and a description of the demonstration site settings, details about the prosumers are provided.

The general target is to involve 10 industrial partners and between 200 and 250 residential prosumers. Furthermore, 10 electric vehicle charging stations will be installed. Of an initial list of 51 potential industrial partners, the 17 most promising have been pre-selected. Two of these 17 have already been contacted and their collaboration is secured. They are described in details, one is an asphalt production plant and the other one is a fruits and vegetables cooperative. For the residential prosumers, the idea is to involve between 200 and 250 households with electrical heating (heat pumps or resistive heating for space and/or domestic hot water heating). A large proportion of these households is also equipped with photovoltaic panels. The prosumer recruitment is the main objective of Task T8.2 and will happen between months 6 and 24. The requirements for interaction are also described in details.

Finally, a description of the demonstration requirements in terms of existing grid and ICT infrastructure as well as in terms of how the components to be installed will be tested and approved is provided.

To summarise, the work within WP8 regarding Task T8.1 and Task T8.2 progresses well. In particular, the collaboration between ESR and HES-SO is very smooth and fruitful. The recruitment of the prosumers is in progress, and the preliminary measures and experiments leading to the validation of the components to be installed will start soon.