Contribution to the BRIDGE working groups regarding interchangeability and interoperability
Version 1.0

Deliverable D3.13

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Short Description

Deliverable D3.13 describes the contribution from InterFlex project to the interchangeability and interoperability issues and practices in the frame of BRIDGE working groups.

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EXECUTIVE SUMMARY

This report presents the contribution from the InterFlex project to the BRIDGE working groups on the topics of Interoperability and Interchangeability.

Interoperability and interchangeability are part of the strategic objectives of InterFlex project, and are extensively studied and lab-demonstrated in the scope of WP3 "Impact and deployment analysis of the innovative solutions", while being implemented and field-demonstrated in the scope of the 6 InterFlex demonstrators (WP5 to WP9).
In particular, WP3 studies identified three main critical barriers for a DSO-oriented smart grid:

- Interchangeability of solutions involving grid connected electricity storage
- Interchangeability of solutions involving grid connected smart appliances and EVs
- Interoperability of IT systems in charge of making the merit order bidding for flexibilities in local market (both on DSO and aggregator side)

The outcomes from Interflex have been provided as an input to BRIDGE work on Interoperability: InterFlex partners being involved in this initiative disseminated the results and learnings from the project, mostly in the Data Management WG and the Business Models WG.

Finally, the Data Management WG listed four Interoperability-related barriers (and recommendations):

- Technical barriers:
  - Information model interoperability
  - Information communication interoperability
- Legal barrier: Regulation impact on interoperability
- Market behavior barrier: Interoperability requirement from market

Also, Business Models WG described the data to be displayed by the DSO in order to ensure the market transparency (volumes, prices, products) and the data to be exchanged between DSO and Aggregators to operate the local market (load curves, bidding, activations, etc.).

The contribution from InterFlex has significantly helped to guide the work of the WGs and to develop the results that are reflected in the published BRIDGE reports.

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1. INTRODUCTION

1.1. Scope of the document

BRIDGE is a cooperation initiative involving Smart Grid and Energy innovation projects funded under the Horizon 2020 program. It aims to foster the exchange of information, experience, knowledge and best practices among its members.

BRIDGE is made of four working groups (WG) representing the main areas of interest: Regulation, Data Management, Customer Engagement and Business Models.

The interoperability and interchangeability topics, while being mostly related to Data Management WG, are also related to the three other working groups.

In addition to the reports ([1] and [2]) on InterFlex contribution to each BRIDGE WG, this reports focuses on the contributions to the two topics mentioned above among the four WG.

1.2. Notations, abbreviations and acronyms

The table below provides an overview of the notations, abbreviations and acronyms used in the document.

DSO	Distribution System Operator
EC	European Commission
EG	Expert Group
EV	Electric Vehicle
EU	European Union
GA	General Assembly
IT	Information Technology
KPI	Key Performance Indicator
LCE	Low Carbon Energy
RIA	Research and Innovation Action
SGAM	Smart Grid Architecture model
SGTF	Smart Grid Task Force
WG	Working Group
WP	Work Package

Figure 1 – List of acronyms

1.3. EU Expectations from InterFlex

InterFlex is a response to the Horizon 2020 Call for proposals, LCE-02-2016 ("Demonstration of smart grid, storage and system integration technologies with increasing share of renewables: distribution system").

This Call addresses the challenges of the distribution system operators in modernizing their systems and business models in order to be able to support the integration of distributed renewable energy sources into the energy mix. Within this context, the LCE-02-2016 Call promotes the development of technologies with a high TRL (technology readiness level) into a higher one.

InterFlex explores pathways to adapt and modernize the electric distribution system in line with the objectives of the 2020 and 2030 climate-energy packages of the European Commission. Six demonstration projects are conducted in five EU Member States (Czech Republic, France, Germany, the Netherlands and Sweden) in order to provide deep insights into the market and development potential of the orientations that were given by the call for proposals, i.e., demand-response, smart grid, storage and energy system integration.

With Enedis as the global coordinator and ČEZ Distribuce as the technical director, InterFlex relies on a set of innovative use cases. Six industry-scale demonstrators are being set up in the participating European countries:

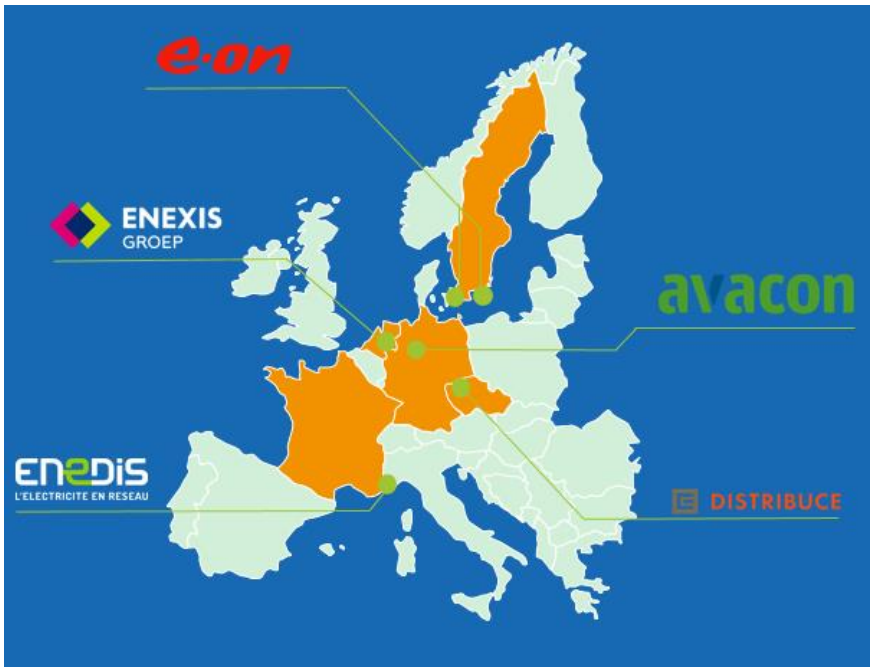

Figure 2 - InterFlex Demo Map

Through the different demonstration projects, InterFlex will assess how the integration of the new solutions can lead to a local energy optimisation. Technically speaking, the success of these demonstrations requires that some of the new solutions, which are today at TRLs 5-7, are further developed reaching TRLs 7-9 to be deployed in real-life conditions.

The LCE-02-2016 call, as well as the other smart grid calls from Horizon 2020 program, explicitly required:

- To coordinate "with similar EU-funded projects in particular for policy relevant issues such as regulatory framework, business models, obstacles to innovation". This coordination is hosted by the BRIDGE initiative and its four WG (regulation, business models, data management, consumer engagement).
- To perform "a detailed analysis of current regulations, standards and interoperability/interfaces issues applying to their case, in particular in connection to ongoing work in the Smart Grid Task Force and its Experts Groups in the field of Standardisation (e.g. CEN-CLC-ETSI M/490)".

In particular, interoperability and standards are key enablers to allow the replicability of the project results, by ensuring a harmonised solution between EU countries.

The work detailed in this deliverable replies to these expectations by pushing the work around interoperability and interchangeability performed in InterFlex at EU level, in coordination with ~20 other H2020 projects, to finally highlight common requirements, issues and solutions.

1.4. References

[1] InterFlex D3.10 Contribution to the working groups of BRIDGE and other working groups for cooperation between LCE projects – 1st year, Version 1.0
[2] InterFlex D3.11 Contribution to the working groups of BRIDGE and other working groups for cooperation between LCE projects – 2nd year, Version 1.0
[3] InterFlex D3.1 Demo and use case view on required interfaces/functionalities, Version 2.0
[4] InterFlex D3.3 Feedback on demonstrations and use case interoperability, Version 2.0
[5] BRIDGE Data Management WG report on Data Handling, Version 1.0

2. INTEROPERABILITY AND INTERCHANGEABILITY

2.1. Scope

As defined by the AFUL[1], "Interoperability is a characteristic of a product or system, whose interfaces are completely understood, to work with other products or systems, present or future, in either implementation or access, without any restrictions."
By extension, the interchangeability can be defined as a characteristic of a product or system to keep working without any restriction while being replaced by other products or systems, present or future.

In a smart grid system, such as the ones demonstrated in InterFlex, the requirement for interoperability and interchangeability is very high and concerns many products and sub-systems, such as:

- Connection between a Home Energy Management System (HEMS) and smart appliances.
- Connection between a grid operator and the flexibility aggregators.
- Connection between an electric vehicle charging station and an electric vehicle.

An analysis of the interoperability requirements and barriers within InterFlex demonstrators is detailed in D3.1 [3].

2.2. Main barriers and potential impact on BRIDGE WGs

Within InterFlex, two criteria were defined in order to identify the most critical interfaces from interoperability and interchangeability perspective (see [4]):

- **The interface is between different actors.** In such case, there is a risk of different understandings of the interface and therefore potential difficulties to align the implementations, possibly leading to interoperability issues or vendor dependancy.
- **No clear standard is identified in the industry for this interface.** In such case, additional work is required to identify a good solution. Furthermore, the lack of maturity of the solution may lead to interoperability issues.

Finally, the following barriers were identified as critical for of a DSO-oriented smart grid (see [3]):

- Interchangeability of solutions involving grid connected electricity storage
- Interchangeability of solutions involving grid connected smart appliances and EVs
- Interoperability of IT systems in charge of making the merit order bidding for flexibilities in local market (both on DSO and aggregator side)

The potential impacts on BRIDGE WGs are:

- Data Management: the interoperability and interchangeability topics directly concern data management, all along the data life cycle (data capture, data exchange, data storage and data access). They have to be considered at both communication (protocol) and information (data) level.

[1] See http://interoperability-definition.info/en/

- Regulation: an “interoperable understanding” of roles and actors is required to ensure a viable implementation of new market models by different actors and/or in different countries. This should also address preventing “gaming” (i.e. taking (unrealistic) market positions to be more profitable).
- Business models: new business models will need new interfaces and/or data exchanges between actors or systems. Interoperability is a key factor key factor in enabling new business models to be successful.
- Customer engagement: the lack of interoperability and/or interchangeability, e.g. for home energy management, EV charging or smart appliances, has a negative impact on customer engagement because it complicates the appropriation and use of the means of flexibility and therefore can reduce the potential contribution of consumers to flexibility.

3. CONTRIBUTION TO THE BRIDGE WGS

3.1. Data Management WG

The interoperability and interchangeability topics have been addressed in the Data Management WG, mostly in the scope of "Data handling" topic.

From November 2017 to February 2019, corresponding to the release of the first complete version of the Data Handling report (see [5]), InterFlex led the "Data handling" topic that included an Interoperability sub-topic.

In this scope, InterFlex provided the following contributions:

- Definition of the approach and scope of the Data Handling topic, together with the WG chair (Flexiciency) and the sub-topic leaders (CROSSBOW for Data access, STORY for interoperability, inteGRIDy for Cybersecurity).
- Coordination of the WG efforts on Data Handling topic.
- Review and validation of the questionnaires sent to the contributing projects.
- Answer to the questionnaire from 3 InterFlex demos point of view: German, Dutch and Swedish demos.
- Selection of the most critical interfaces to focus on.
- Active writing and reviewing of the Data Handling report.
- Dissemination of the results to SGTF EG1-EG3 and LCE-01 RIA projects.

When dealing with this topic, the WG decided to focus[2] on four DSO-oriented data flows, identified as critical from interoperability perspective:

1. **DSO to Aggregator**: this data flow mainly covers flexibility request from the DSO to the aggregator.
2. **Aggregator to Prosumer**: this data flow mainly covers demand-response commands from the aggregator to the prosumer.
3. **Prosumer to Aggregator**: this data flow mainly covers demand-response feedback from the prosumer to the aggregator.
4. **Prosumer to DSO**: this data flow mainly covers metering and grid quality measurements from the prosumer to the DSO.

[2] The selection of these interfaces is based on the answers to the questionnaire from the contributing projects. However, it has to be noted that, in the scope of Interflex, additional data flows are at stake, e.g. in the Czech demo (WP6) where there is a direct bidirectional interaction between the DSO and the prosumers (i.e. not through an aggregator).

When considering the Smart Grid Architecture Model (SGAM), as defined by CEN-CENELEC-ETSI under M/490 mandate, the data flows can be schematized as follows:

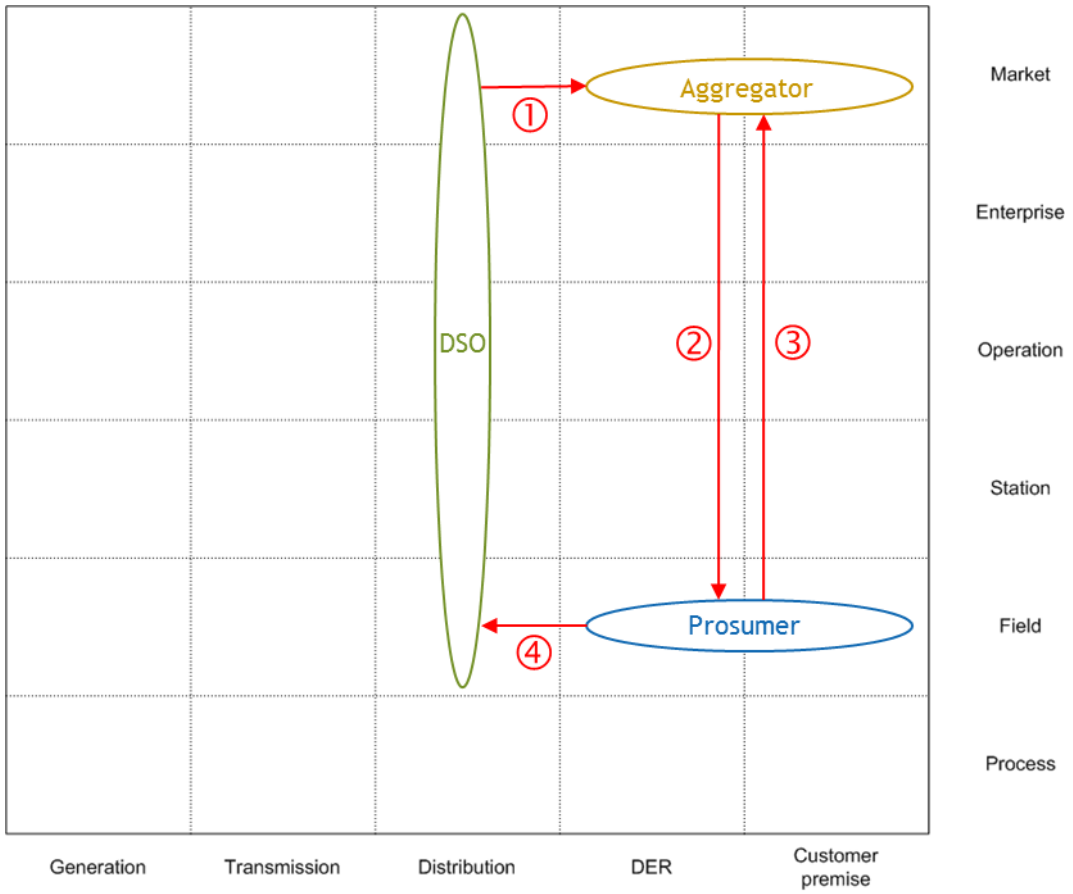

Figure 3 - Data flow focus of this report depicted in SGAM diagram

Finally, four Interoperability-related barriers (and recommendations) were listed in the report (see [5]):

- Technical barriers:
  - Information model interoperability
  - Information communication interoperability
- Legal barrier: Regulation impact on interoperability
- Market behavior barrier: Interoperability requirement from market

3.2. Regulation WG

The interoperability and interchangeability topics were not discussed in the Regulation WG.

3.3. Business models WG

The interoperability and interchangeability topics have been addressed in the Business models WG.

In particular, the WG described the data to be displayed by the DSO in order to ensure the market transparency (volumes, prices, products) and the data to be exchanged between DSO

and Aggregators to operate the local market (load curves, bidding, activations, etc.). InterFlex contributed to this definition as Rapporteur of the WG and also by sharing information about the platforms being developed in the French demonstrator (Nice Smart Valley).

However, the work is still on going as:

- the data definition will eventually depend on the market design which is still uncertain;
- the merit order criteria are still unknown and may depend on the area where there is a need for flexibility.

3.4. Customer engagement WG

The interoperability and interchangeability topics were not discussed in the Customer engagement WG.