Monitoring strategy of the Lyon Lighthouse project

Deliverable D3.6.1
Version 0.3

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REVISION CHART AND HISTORY LOG

Versions

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EXECUTIVE SUMMARY

This document describes the monitoring strategy developed and implemented within the Lyon lighthouse project. The main objective of this monitoring strategy is to prepare the monitoring and evaluation phase (conducted in WP6). It concerns the following projects:

- Refurbished buildings
- Renewable energy systems
- Energy infrastructure networks
- Mobility

Other deliverables already submitted are related to the monitoring strategy of the Lyon Lighthouse project:

D3.3.2. Final report on the low-energy district achievements – zero carbon objective
D3.3.3. Buildings refurbished and renewable energy systems commissioned.
D3.4.2. Report on deployment of Linky smart power meters in the area
D3.4.3. Final report on the connected district achievements

Deliverable scope:

- Description of monitoring strategy philosophy and project organisation concerning monitoring and evaluation
- Description of the link between WP3 (Lyon Lighthouse Project) & WP6 (Monitoring & evaluation of SMARTER TOGETHER)
- Description of the monitoring solutions for each thematic:
  ◦ Brief presentation of the Lighthouse projects
  ◦ Monitoring strategy and implemented solutions
  ➔ To explain the monitoring strategy on an illustrative and pedagogic way with the use of a homogeneous frame for each solution implemented (cf list of tables).
1. Monitoring strategy description

1.1 Philosophy underlying the monitoring strategy

The SMARTER TOGETHER project proposed a number of measures to be implemented within the three lighthouse cities of Lyon, Munich and Vienna. These measures should result in direct improvement in the fields of energy, mobility, economy and wellbeing and engagement of citizens. Furthermore, these measures have to act as demonstrators and therefore provide accessible, usable and useful lessons learnt and returns of experience.

The monitoring of SMARTER TOGETHER in Lyon has been anticipated from the very beginning of the project, and relies on a strong will to operate an efficient and valuable evaluation.

Based on the large experience of the Project team in Lyon concerning monitoring and evaluation, focus had been put in the first months of the project to precisely assess the sought results and potential operational uses to be offered by monitoring implementation and analysis. Different case studies had been elaborated with the different partners to clearly expose the perimeter of evaluation and identified needs of returns of experience. This lead to define the corresponding set of data needed to reach these objectives, before the implementation of the Lighthouse projects.

This comprehensive anticipation of the monitoring allowed an important optimization of the monitoring costs and a facilitated and efficient deployment of the whole “chain” of data.

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<th>Data generation / collection</th>
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<th>Data quality check / processing</th>
<th>Data analysis</th>
<th>Valorisation and follow up</th>
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Lighthouse projects are like prototypes. They constitute full-scale laboratories, and are therefore rich in lessons. Nevertheless, it is necessary to evaluate them carefully in order to understand how they constitute a success or not. Whatever the conclusion, it will always be a progress and will improve the knowledge of all those in charge of building European cities.

The objective of the Lyon project team had been therefore to plan a full evaluation of the Lighthouse projects. That means to assess, for each project, detailed consumptions of different uses, but also to study explanatory parameters having an influence on these consumptions. This will allow to explain why we obtain the observed results and therefore give a precious material to bring out valuable lessons and lessons learned.

Monitoring strategy in Lyon had also been elaborated considering the great motivation to take profit of SMARTER TOGETHER evaluation to infuse lessons learnt and returns of experience on the city stakeholders’ practices. From the beginning of the project, future possibilities of associated services with the data structure built have been discussed, in
order to link the needs of the evaluation within the framework of the project to an operational and sustainable use of the developed solutions.

1.2 Project team organisation concerning monitoring

The SMARTER TOGETHER project team dedicated to Lighthouse projects implementation, monitoring and evaluation is small in Lyon and constitutes an operational “task force”, gathering specialists in all fields.

- **SPL Confluence**: role of coordinator, with important level of understanding and skills on all subjects (technical, economic, financial and legal, etc.). SPL Confluence has a strong and precious relationship of trust and proximity with the different stakeholders.

- **Hespul**: technical manager of SMARTER TOGETHER project, operator facilitator in Lyon, photovoltaic specialist.

- **Lyon Metropolis - DINSI (Data platform department)**: network/IT specialist, legal advisor for data sharing agreements, technical operator for data collection / storage / processing.

- **Enertech**: energy measurement specialist, data analysis technical operator, assistance and support role on generation / collection / transmission and data use (fully involved from the very beginning of project).

This complementary and operational project team allowed a successful implementation at each level.

1.3 Link with Work Package “Monitoring & evaluation” (WP6)

The main objective of the monitoring strategy is to anticipate and prepare the monitoring and evaluation phase, which will be conducted through SMARTER TOGETHER WP6.

Enertech mostly plays the role of interface between WP3 and WP6, representing Lyon consortium and WP3 within the different WP6 working groups, and in charge of monitoring and evaluation for Lyon Lighthouse projects.

Enertech has a wide experience of monitoring and evaluation, on a large spectrum (integrated skills from data generation to data collection, processing and analysis). Enertech is used to monitoring equipments and measurement campaigns from the last 20 years (for example owns more than 20,000 energy monitoring sensors). This “integrated” competence explains that Enertech is in charge of most of the monitoring and evaluation tasks within SMARTER TOGETHER Lyon.

Monitoring and evaluation through WP6 pursue several interlinked objectives:
First objective will be to assess the concrete achievement of targeted actions within the project, in order to justify the appropriate use of the funds. Monitoring and evaluation should provide clear view of achievements.

Second objective of WP6 will be to assess objectively the real improvements made by SMARTER TOGETHER projects implementation.

For these two objectives, and given the difference of context, existing practices, regulation, incentives politics, calculation standards, etc., within the 3 lighthouse cities (and more generally within different European countries), a methodology has been set in order to define a common set of accurate indicators, allowing to objectively assess the achievements and improvements made by SMARTER TOGETHER project implementation. These Key performance indicators constitutes the base of current monitoring and evaluation methodology of the project.

Taking profit of its large experience and maturity concerning evaluation, Lyon project team had wished from the beginning of the project to go beyond the KPIs. An advanced level of monitoring and evaluation infrastructure had been therefore implemented in order to proceed to deeper and detailed analysis for relevant projects.

Two levels of evaluation had been sought for each operation:

- **Level 1-Base level (meters data use):** establish detailed results of energy consumptions for the different energy uses + analyse the dynamic profiles of the different uses (load curve, evolution of the load rates, evolution of peak demands, evolution of consumption, etc.)

- **Level 2-Advanced level (complementary sensors data use):** study of the explanatory variables to explain the results and consumptions obtained (influence of the various variables and impact on consumptions, verification of the correct operation of systems and settings, detection of eventual dysfunctions, assessment of comfort level, etc.)

The detailed monitoring plan and infrastructure are described below in the present document.

This further analysis for relevant operations of Smarter Together Lighthouse projects relies on the creation of a new task within the WP6 (T6.7) in order to allow reallocating resources for that purpose. This new task is currently one of the subjects of Amendment n°3, currently under process.

Its implementation will effectively complete the WP6 methodology, allowing the study of the dynamic behaviour of each consumption uses and the explanatory parameters having an influence on these consumptions. This will allow explaining why we obtain the observed results, and therefore give a precious material to bring out valuable lessons and lessons learned.
Organization of the present document

Description of the monitoring solutions for each thematic:
- Brief presentation of the Lighthouse projects
- Monitoring strategy and implemented solutions

To explain the monitoring strategy on an illustrative and pedagogic way, a specific frame has been designed for each solution implemented (see below).

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Table 1: Template of monitoring strategy illustration

This table exposes for each step of monitoring and evaluation, which stakeholder is responsible and involved, distinguishing the operator (responsible for implementation) and support & assistance resource structure.

It allows, in a synthetic way, to fully understand the monitoring strategy considered for each of the Lighthouse projects thematic (Buildings eco-refurbished, Renewable energy systems, Energy infrastructure network, mobility).
2. Refurbished buildings

2.1 Lighthouse projects presentation

There are 9 buildings eco-refurbished within SMARTER TOGETHER, in the Lyon-Confluence area (see deliverable D3.3.2 Final report on the low-energy district achievements – zero carbon objective):

- 2 social housing blocks belonging to social housing operators
  - Cité Perrache (owner: Grand Lyon Habitat)
  - Cité Mignot (owner: Régionale d’HLM de Lyon)
- 3 housing buildings belonging to private groups of owners
  - 35 rue Smith
  - 61 rue Delandine
  - 54 rue Smith & 21-23 rue Casimir Périer
- 6 office buildings and/or public facilities (former parts of the wholesale market)
  - King Charles (office spaces)
  - Girard Hall (office spaces/public facility)
  - Garage / Zadigacité (office spaces)
  - C5 building (office spaces)

Figure 2: Advancement Eco-refurbishment in Lyon at the end of 2018
2.2 Monitoring strategy for housing buildings

Table 2: Monitoring strategy Refurbished Buildings

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**Operator**

Support & Assistance

**Monitoring plan:** based on previous experiences, **standard specifications had been defined by the Lyon project team** in order to obtain most cost-efficient set of data (cf Annex 7.1- Specifications for building eco-refurbishment monitoring plan). This anticipated monitoring plan allows getting optimized data:
- Detailed consumptions for space heating and Domestic Hot Water + technical temperature and flows from the meters (Mbus communication type). See illustrated scheme below
- Detailed consumptions for electricity uses of common part (Lighting, Sub-station, Ventilation systems, Underground parking, Elevators)
- Indoor temperature for a sample of households (25% of households)

Data generation/collection: Thanks to the guidelines provided by project team, the monitoring plan specifications have been included into the calls for tenders made by the owners of the building refurbished. This allows optimizing the cost of monitoring equipment purchase and installation. The Eco-refurbishment project team is therefore responsible for correct implementation of monitoring equipment and data generation infrastructure. Nevertheless, technical and organizational support and assistance have been provided by the SMARTER TOGETHER project team, and controls in situ to validate correct implementation are currently undertaken.

Data transmission: The data transmission and communication is a highly sensible aspect, with significant and regular risks of dysfunction. To ease the process (and reduce the costs), it has been decided that the data concentrators of each refurbished building will not be integrated in the tender of each building owner. Instead, the purchase, commissioning and setting of the data concentrators are mutualized in a tender made by Hespul, with the same provider for all the refurbished buildings that need such concentrator. Technical support is provided all along the process by project team (included site visit control).

The specifications of this centralized tender are presented in Annex 7.2 – Specifications for building eco-refurbishment concentrator.

The following aspects are covered and taken in charge:

Figure 3: Illustration of refurbished building monitoring plan
Supply, programming, installation and connection of the concentrator, including supply of necessary connection cables and connectors and power supply to the concentrator;

Provision of parameterization and commissioning. The service will be considered complete only when the concentrator autonomously communicates all data in the correct format for a minimum of one week.

**Data recuperation / data base setting:** assumed by the Lyon Metropolis - DINSI, recuperation of the data on the Lyon city data platform.

For more details, see “Deliverable 3.4.3 Final report on the connected district achievements” and “Deliverable 3.3.2 – Final report on the low-energy district achievements - zero carbon objective”.

The figure below is a recap of the data flows established in SMARTER TOGETHER for Eco-refurbished buildings.

![Figure 4: Synthesis of data flow of the refurbished building](image-url)
The figure below is a recap of the data flows established in SMARTER TOGETHER Task 3.4 “Integrated infrastructure and connected district”. From right to left:

- Various data providers with their own data formats and communication protocols
- Data collected on the metropolitan data platform and stored in a unique format namely Sensor Observation Service (SOS), supported by the Open Geospatial Consortium (OGC)
- Data available (with possible access restriction depending on the agreements) for users or application such as the Confluence Management System (CMS) for data visualization and analysis

**Figure 5: Synthesis of data flow on Lyon data platform (Grand Lyon DINSI)**

**Data quality check / data processing**: Lyon data platform technical service will proceed to quality check of the data and data processing, in particular for Confluence Monitoring System (CMS) use.

In parallel extraction of raw data related to monitoring and evaluation will be provided for WP6 purpose. Enertech will proceed to quality check of the data with internal tools already developed (Enertech is used to large measurement campaigns with several millions data and has developed specific tools).

**Data analysis**: will be undertaken by Enertech through WP6

**Valorisation**: The analysis and results will be valorised within WP6, where specific methodology is currently developed (Task T6.6 of WP6).
In addition, other valorisations are considered:

- A restitution of results and analysis will be provided to each building tenant and beneficiaries.
- The analysis of explanatory variables (if considered, cf 1.3) of the different uses will provide a deep knowledge of the working conditions and correct regulation of the different installations. The restitution of the monitoring and evaluation will therefore allow the building owner and his operating company to pilot in an improved way the different equipment and installations.
- All the process and infrastructure implemented, especially at City level (Lyon data platform and processing tools), could be used in the future to implement an offer of technical services from the city services towards building stakeholders (currently in discussion).

### 2.3 Monitoring strategy for tertiary buildings

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<tbody>
<tr>
<td>Data generation / collection</td>
<td>BMS already existing</td>
<td>organisational support</td>
<td></td>
<td>technical support / verification</td>
</tr>
<tr>
<td>Data transmission</td>
<td>BMS already existing</td>
<td></td>
<td></td>
<td>technical support</td>
</tr>
<tr>
<td>Data recuperation / base setting</td>
<td>BMS already existing</td>
<td>Lyon data platform</td>
<td>preparation data for WP6</td>
<td></td>
</tr>
<tr>
<td>Data quality check / processing</td>
<td></td>
<td>CMS</td>
<td>WP6</td>
<td></td>
</tr>
<tr>
<td>Data analysis</td>
<td></td>
<td></td>
<td>WP6</td>
<td></td>
</tr>
<tr>
<td>Valorization and follow up</td>
<td>Building reinforced control</td>
<td>Development of service offer ?</td>
<td>Development of service offer ?</td>
<td>WP6</td>
</tr>
</tbody>
</table>

Table 3: Monitoring strategy TERTIARY BUILDING ECO REFURBISHED

**Data generation/collection:** Building Management Systems already exist within the different tertiary buildings. SMARTER TOGETHER team collects the exhaustive list of existing data and decides which ones are useful and should be included in the data sharing convention (and underlines data missing if any).

**Data transmission:** The data transmission and communication aspect is considered for each project. Except technical incompatibility, the data transmission and communication is done by the BMS.

**Data recuperation / data base setting:** idem housing building, cf 2.2
Data quality check / data processing: idem housing building, cf 2.2

Data analysis: idem housing building, cf 2.2

Valorisation: idem housing building, cf 2.2

3. Renewable energy systems

3.1 Lighthouse projects presentation

Photovoltaic energy systems have been commissioned, within SMARTER TOGETHER, in the Lyon-Confluence area:

- Electric-renewable energy sources from five photovoltaic (PV) systems located on the roof of existing, new and eco-refurbished buildings.

<table>
<thead>
<tr>
<th>Name</th>
<th>Developer of the photovoltaic system</th>
<th>Power</th>
<th>Commissioning of the photovoltaic system</th>
</tr>
</thead>
<tbody>
<tr>
<td>King Charles</td>
<td>Helexia</td>
<td>100 kWp</td>
<td>July 2017</td>
</tr>
<tr>
<td>Chanfray Gym Hall</td>
<td>Générale du Solaire</td>
<td>206 kWp</td>
<td>September 2017</td>
</tr>
<tr>
<td>A3 block</td>
<td>Transénergie</td>
<td>423 kWp</td>
<td>March 2018</td>
</tr>
<tr>
<td>Girard Hall</td>
<td>Générale du Solaire</td>
<td>243 kWp</td>
<td>September 2018</td>
</tr>
<tr>
<td>B2 block</td>
<td>EDF ENR Solaire</td>
<td>174 kWp</td>
<td>2019 (not finished yet)</td>
</tr>
</tbody>
</table>

Table 4: PV systems installed within SMARTER TOGETHER

Figure 6: Advancement Renewable systems in Lyon at the end of 2018
3.2 Monitoring strategy for the photovoltaic

<table>
<thead>
<tr>
<th></th>
<th>Building owner / refurbishment project team</th>
<th>SPL</th>
<th>NESPUL</th>
<th>Grand Lyon - DINSI</th>
<th>Enertech</th>
</tr>
</thead>
<tbody>
<tr>
<td>Data generation / collection</td>
<td>Included in specifications of PV project</td>
<td>organisational support</td>
<td>technical support / verification</td>
<td>Through Epices</td>
<td>Lyon data platform</td>
</tr>
<tr>
<td>Data transmission</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Data recuperation / base setting</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Data quality check / processing</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Data analysis</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Valorisation and follow up</td>
<td>Installation reinforced control</td>
<td>Development of service offer ?</td>
<td>Development of service offer ?</td>
<td>Development of service offer ?</td>
<td>WP6</td>
</tr>
</tbody>
</table>

Table 5: Monitoring strategy PHOTOVOLTAIC SYSTEMS

**Data generation/collection:** Using inverter monitoring functions thanks to a web platform (Epices Energie), allowing the supervision of installation producing renewable energy (http://www.epices-energie.fr/).

**Data transmission:** To facilitate the data collection from photovoltaic systems, Epices Energie solution is used to make the interface between each installation and the Lyon Métropole data platform.

**Data recuperation / data base setting:** Assumed by the Lyon Metropolis - DINSI, recuperation of the data on the Lyon city data platform.
Data quality check / data processing: as for eco-refurbishment (cf 2.2), use of data for CMS on the one hand, raw data extraction for WP6 on the other hand, quality check by Enertech.

Data analysis: Through WP6.

Valorisation: In addition to WP6, monitoring the operation for long-time period.
4. Energy infrastructure Network

4.1 Lighthouse projects presentation

- Heat from renewable and non-renewable energy sources from 21 new smart substations of the district heating for a total capacity of 7.3 MW.

<table>
<thead>
<tr>
<th>Reference of the substation</th>
<th>Name of building/block</th>
<th>Date of commissioning</th>
<th>Power (kWp)</th>
</tr>
</thead>
<tbody>
<tr>
<td>F001</td>
<td>J1A</td>
<td>19th January 2016</td>
<td>150</td>
</tr>
<tr>
<td>F002</td>
<td>Cité Perrache</td>
<td>4th April 2016</td>
<td>847</td>
</tr>
<tr>
<td>F003</td>
<td>Halle aux fleurs</td>
<td>1st December 2016</td>
<td>110</td>
</tr>
<tr>
<td>F004</td>
<td>J1B</td>
<td>13th May 2016</td>
<td>130</td>
</tr>
<tr>
<td>F005</td>
<td>Maison de quartier Bayard</td>
<td>4th November 2016</td>
<td>200</td>
</tr>
<tr>
<td>F006</td>
<td>Case me Suchet</td>
<td>2nd November 2016</td>
<td>260</td>
</tr>
<tr>
<td>F007</td>
<td>J2</td>
<td>17th October 2016</td>
<td>290</td>
</tr>
<tr>
<td>F008</td>
<td>Reflet2Vie</td>
<td>15th November 2017</td>
<td>600</td>
</tr>
<tr>
<td>F009</td>
<td>Study Hall</td>
<td>3rd August 2017</td>
<td>250</td>
</tr>
<tr>
<td>F010</td>
<td>ESMA (student residence)</td>
<td>10th August 2017</td>
<td>434</td>
</tr>
<tr>
<td>F011</td>
<td>A3 nord</td>
<td>22th November 2017</td>
<td>671</td>
</tr>
<tr>
<td>F012</td>
<td>A3 sud</td>
<td>26th September 2017</td>
<td>600</td>
</tr>
<tr>
<td>F013</td>
<td>M3 sud - Ycone</td>
<td>31st September 2018</td>
<td>300</td>
</tr>
<tr>
<td>F014</td>
<td>G nord – Loges de Saône</td>
<td>4th June 2018</td>
<td>300</td>
</tr>
<tr>
<td>F015</td>
<td>G sud – Loges de Saône</td>
<td>22nd June 2018</td>
<td>350</td>
</tr>
<tr>
<td>F016</td>
<td>Rinck</td>
<td>14th June 2018</td>
<td>384</td>
</tr>
<tr>
<td>F017</td>
<td>French Tech</td>
<td>18th December 2018</td>
<td>305</td>
</tr>
<tr>
<td>F018</td>
<td>Hotel 71</td>
<td>18th December 2018</td>
<td>70</td>
</tr>
<tr>
<td>F019</td>
<td>Cité Mignot</td>
<td>18th December 2018</td>
<td>760</td>
</tr>
<tr>
<td>F020</td>
<td>35 rue Smith</td>
<td>12th October 2018</td>
<td>105</td>
</tr>
<tr>
<td>F021</td>
<td>61 rue Delandine</td>
<td>11th October 2018</td>
<td>120</td>
</tr>
</tbody>
</table>

Table 6: Smart sub-stations installed within SMARTER TOGETHER
The deployment of the smart meters is part of the cross-cutting ICT solutions implemented. The Linky smart meter, designed by Enedis, uses PLC technology to communicate electricity production and/or consumption data to the distribution network operator. The deployment of Linky meters in France will involve 35 million customers by 2021 and is fully deployed on Confluence district.

### 4.2 Monitoring strategy for the electrical network

<table>
<thead>
<tr>
<th>Operator</th>
<th>Support &amp; Assistance</th>
</tr>
</thead>
</table>

#### Table 7: Monitoring strategy for the electrical network

<table>
<thead>
<tr>
<th>ELECTRICAL NETWORK</th>
<th>Enedis</th>
<th>SPL / HESPUL</th>
<th>Grand Lyon - DINSI</th>
<th>Enertech</th>
</tr>
</thead>
<tbody>
<tr>
<td>Data generation / collection</td>
<td>Linky smart meter</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Data transmission</td>
<td>Linky smart meter</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Data recuperation / base setting</td>
<td></td>
<td>Lyon data platform</td>
<td>preparation data for WP6</td>
<td></td>
</tr>
<tr>
<td>Data quality check / processing</td>
<td></td>
<td>CMS</td>
<td>WP6</td>
<td></td>
</tr>
<tr>
<td>Data analysis</td>
<td></td>
<td>WP6</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Valorisation and follow up</td>
<td>Network reinforced control</td>
<td></td>
<td>WP6</td>
<td></td>
</tr>
</tbody>
</table>

**Data generation/collection:** through Linky smart meter, see deliverable “D.3.4.2 – Report on deployment of Linky smart meters power in the area”
**Data transmission**: installation of concentrators in order to be able to communicate data from Linky to the central system, see deliverable “D.3.4.2 - report on deployment of Linky smart meters power in the area”.

**Data recuperation / data base setting**: Assumed by the Lyon Metropolis – DINSI, recuperation of the data on the Lyon city data platform.

<table>
<thead>
<tr>
<th>Data supplier</th>
<th>ENedis</th>
<th>ENedis</th>
<th>ENedis</th>
<th>ENedis</th>
</tr>
</thead>
<tbody>
<tr>
<td>Type of data supplied</td>
<td>Electricity production and consumption of buildings</td>
<td>Type of licence</td>
<td>Private access</td>
<td>State of progress of the data sharing contract</td>
</tr>
<tr>
<td>API used</td>
<td>SOAP Web service “j/2 collectors”</td>
<td>Sensor</td>
<td>Linky meter and other types of energy meters</td>
<td>Communication protocol</td>
</tr>
<tr>
<td>Source data format</td>
<td>JSON</td>
<td>Target data format</td>
<td>SOE (i2 North server)</td>
<td>Measuring step</td>
</tr>
<tr>
<td>Frequency of data collection</td>
<td>Daily</td>
<td>Comment</td>
<td>10 minutes to daily depending on datasets</td>
<td></td>
</tr>
<tr>
<td>Example</td>
<td>Power (W) C5 building – 24/9/2018</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

The JSON data files follow the Enedis EU-MED format/model (deduced from CM Europe standard). Depending on the number of dwellings per building and consents obtained, data is detailed or aggregated.

Figure 9: Electricity production and consumption data collection (Lyon DINSI – extract D3.4.3)

**Data quality check / data processing**: as for eco-refurbishment (cf 2.2), use of data for CMS on the one hand, raw data extraction for WP6 on the other hand, quality check by Enertech.

**Data analysis**: Through WP6.

**Valorisation**: In addition to WP6, lessons learned will lead to reinforced network management, see deliverable “D.3.4.2 - Report on deployment of Linky smart meters power in the area”.
4.3 Monitoring strategy for the District Heating Network

### Monitoring strategy for the District Heating Network

#### Operator
Support & Assistance

<table>
<thead>
<tr>
<th>DISTRICT HEATING NETWORK</th>
<th>DISTRICT HEATING NETWORK'S MANAGER</th>
<th>SPL</th>
<th>Grand Lyon - DINSI</th>
<th>Enertech</th>
</tr>
</thead>
<tbody>
<tr>
<td>Monitoring plan</td>
<td>Validation of technical feasibility</td>
<td>Monitoring specifications</td>
<td>technical support</td>
<td></td>
</tr>
<tr>
<td>Data generation / collection</td>
<td>Included into network management system</td>
<td>initiation of the process</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Data transmission</td>
<td>Included into network management system</td>
<td>initiation of the process</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Data recuperation / base setting</td>
<td>Lyon data platform</td>
<td>preparation data for WP6</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Data quality check / processing</td>
<td>CM5</td>
<td>WP6</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Data analysis</td>
<td></td>
<td>WP6</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Valorisation and follow up</td>
<td>Network operation supervision</td>
<td></td>
<td>WP6</td>
<td></td>
</tr>
</tbody>
</table>

Table 8: Monitoring strategy for the District Heating Network

**Monitoring plan:** SPL has elaborated technical specifications for SMARTER TOGETHER (dynamic data generation). The monitoring plan has been validated by district heating network’s manager.

**Data generation/collection:** Each substation is equipped with a communicating monitoring infrastructure, which is part of the heating network management system.

**Data transmission:** Communication infrastructure in each substation is able to send data to a supervision system, to operate the district heating system. In addition, the supervision system shares some data with the Lyon data platform.
**Data recuperation / data base setting**: Assumed by the Lyon Metropolis – DINSI, recuperation of the data on the Lyon city data platform.

<table>
<thead>
<tr>
<th>Data supplier</th>
<th>SFL Lyon Confluence</th>
</tr>
</thead>
<tbody>
<tr>
<td>Type of data supplied</td>
<td>Energy delivered by each of the substations</td>
</tr>
<tr>
<td>API used</td>
<td>No API</td>
</tr>
<tr>
<td>Source data format</td>
<td>CSV</td>
</tr>
<tr>
<td>Frequency of data collection</td>
<td>Daily</td>
</tr>
<tr>
<td>Example</td>
<td>Heat power (W)</td>
</tr>
</tbody>
</table>

Data quality check / data processing: as for eco-refurbishment (cf 2.2), use of data for CMS on the one hand, raw data extraction for WP6 on the other hand, quality check by Enertech.

Data analysis: Through WP6.
Valorisation: In addition to WP6, lessons learned will help SPL Confluence to reinforced network operation supervision.

5. Mobility

5.1 Lighthouse projects presentation

Figure 12: Presentation and advancement of electric mobility solutions in Lyon at the end of 2018

5.2 Monitoring strategy for electric mobility services

<table>
<thead>
<tr>
<th>NAVLY</th>
<th>NAVYA</th>
<th>SPL / HESPUL</th>
<th>Grand Lyon - DINSI</th>
<th>Enertech</th>
</tr>
</thead>
<tbody>
<tr>
<td>Monitoring plan</td>
<td>Validation of technical feasibility</td>
<td>Monitoring specifications</td>
<td>technical support</td>
<td></td>
</tr>
<tr>
<td>Data generation / collection</td>
<td></td>
<td>organisational support</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Data transmission</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Data recuperation / base setting</td>
<td>Lyon data platform</td>
<td>preparation data for WP6</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Data quality check / processing</td>
<td>CM5</td>
<td>WP6</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Data analysis</td>
<td>Development of service offer?</td>
<td>Development of service offer?</td>
<td>WP6</td>
<td></td>
</tr>
<tr>
<td>Valorisation and follow up</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Table 9: Monitoring strategy for the NAVLY AUTONOMOUS SHUFFLE
Table 10: Monitoring strategy for E-CAR CHARGING STATIONS

<table>
<thead>
<tr>
<th>Monitoring plan</th>
<th>Charging station owner</th>
<th>Enedis</th>
<th>SPL / HESPU</th>
<th>Grand Lyon - DINSI</th>
<th>Enertech</th>
</tr>
</thead>
<tbody>
<tr>
<td>Data generation / collection</td>
<td>Car use data</td>
<td>Electrical charge data</td>
<td>organisational support</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Data transmission</td>
<td>Car use data</td>
<td>Electrical charge data</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Data recuperation / base setting</td>
<td></td>
<td></td>
<td>Lyon data platform</td>
<td>preparation data for WP6</td>
<td></td>
</tr>
<tr>
<td>Data quality check / processing</td>
<td></td>
<td></td>
<td>CMS</td>
<td>WP6</td>
<td></td>
</tr>
<tr>
<td>Data analysis</td>
<td></td>
<td></td>
<td></td>
<td>WP6</td>
<td></td>
</tr>
<tr>
<td>Valorisation and follow up</td>
<td>Development of service offer ?</td>
<td>Development of service offer ?</td>
<td></td>
<td>WP6</td>
<td></td>
</tr>
</tbody>
</table>

**Monitoring plan:** SPL has elaborated technical specifications for SMARTER TOGETHER monitoring.

**Data generation/collection:** For autonomous shuttle NAVLY, data are collected by internal supervision system. For E-car sharing use, data are collected by charging station owner. Electrical consumptions of the charging stations are collected through Linky smart meters, see 4.2.

**Data transmission:** For autonomous shuttle NAVLY, data are transmitted from internal supervision system. For E-car sharing use, data are transmitted from Bluely and CNR/GIREVE servers. Electrical consumptions of the charging stations are transmitted through Linky smart meters, see 4.2.

Figure 13: Synthesis of data flow for mobility smart solutions
Data recuperation / data base setting: Assumed by the Lyon Metropolis - DINSI, recuperation of the data on the Lyon city data platform.

![Figure 14: Autonomous shuffle NAVLY data collection (Lyon DINSI - extract D3.4.3)](image-url)

<table>
<thead>
<tr>
<th>Data supplier</th>
<th>Type of data supplied</th>
<th>Affixed</th>
<th>Source data format</th>
<th>Frequency of data collection</th>
<th>Example</th>
</tr>
</thead>
<tbody>
<tr>
<td>NAVLY</td>
<td>Electric shuttle: distance covered, energy consumed, lines and stops</td>
<td>Sensor</td>
<td>CSV files</td>
<td>Daily</td>
<td>Hourly mileage of the electric shuttle (kilometers)</td>
</tr>
<tr>
<td>Bluely</td>
<td>Charging stations: location, availability of cars &amp; parking slots</td>
<td>Sensor</td>
<td>JSON</td>
<td>Hourly</td>
<td>Location, availability of cars and parking slots: Bluely station of cours Charlemagne</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Type of licence</th>
<th>Public access and restricted access</th>
<th>State of progress of the data sharing contract</th>
</tr>
</thead>
<tbody>
<tr>
<td>NAVLY shuttle</td>
<td>Public access</td>
<td>Signed</td>
</tr>
<tr>
<td>Bluely API</td>
<td>Private access</td>
<td>State of progress of the data sharing contract</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Communication protocol</th>
<th>Measuring step</th>
<th>Hour of the most</th>
</tr>
</thead>
<tbody>
<tr>
<td>FTP</td>
<td>Hourly</td>
<td>Data collection</td>
</tr>
<tr>
<td>HTTP</td>
<td>1 minute</td>
<td>Data collection</td>
</tr>
</tbody>
</table>
Data quality check / data processing: as for eco-refurbishment (cf 2.2), use of data for CMS on the one hand, raw data extraction for WP6 on the other hand, quality check by Enertech.

Data analysis: Through WP6.

Valorisation: In addition to WP6, possibility of development of offered services on mobility use? (Under discussion).
6. Conclusion and lessons learned

The monitoring of SMARTER TOGETHER in Lyon has been anticipated from the very beginning of the project and is based on a large and operational experience of such project evaluation.

This comprehensive anticipation of the monitoring allowed an important optimization of the monitoring costs. Indeed the costs are much lower if the monitoring equipment are integrated into the calls of tender of refurbishment project rather than considering their implementation after refurbishment.

The small size of operational project team and presence of complementary high skilled experts within the different partners allowed a facilitated and efficient deployment of the whole “chain” of data.

- Facilitation of data generation and collection: redaction of guidelines and assistance and support (juridical, organizational, technical, site control visit) to insure the feasibility and correct implementation of monitoring equipment.

- Centralized tender for data transmission: purchase, commissioning and setting of the building data concentrators are mutualized in a tender made by Hespul, with the same provider for all the refurbished buildings. All electricity data are transmitted through Linky smart meter solutions deployment. Transmissions of other data are precisely defined in data sharing convention, and technical expertise is conducted by project team.

- All data are collected by Grand Lyon-DINSI experts to the Lyon data platform, with homogeneous data processing and quality check methods

- Extraction of raw data were made possible (xls format) to WP6 purpose (quality check, treatment and analysis of data by Enertech)

Further data possible uses are in discussion from the beginning of the project in order to operate an efficient and valuable evaluation and to infuse lessons learnt and returns of experience on the city stakeholders’ practices (to link the needs of the evaluation within the framework of the project to an operational and sustainable use of the developed solutions).
7. Annexes

7.1 Specifications for Building ecorefurbishment monitoring plan

Exigence pour le suivi de la consommation d'énergie des immeubles à éco-rénover éligibles aux subventions Horizon 2020 (mise à jour du 12/4/2017)

Généralités

Chaque immeuble bénéficiaire de la subvention européenne du projet européen Smarter Together (financements Horizon 2020) devra être équipé d'un dispositif de mesure des consommations d'énergie. Ce dispositif devra disposer d'une interface de communication permettant de partager automatiquement les données mesurées avec un serveur distant (plateforme de données du Grand Lyon) grâce à une application de type web service, dont les caractéristiques précises seront transmises ultérieurement. Les données seront collectées à des fins de suivi-évaluation de la consommation d'énergie de la copropriété : elles ne seront pas cédées à des tiers susceptibles d'en faire une exploitation commerciale. Ce dispositif permettra :
- de réaliser un suivi de la qualité des travaux de rénovation effectués,
- de proposer aux habitants un outil de suivi du fonctionnement de l'immeuble.

Les points de mesure nécessaires à l'atteinte de ces objectifs sont les suivants.

1) Points de mesure au niveau des services généraux
2) Points de mesure au niveau des logements
3) Concentrateur.

En complément de la fourniture et de la pose des points de mesure (précisés ci-dessous), est également incluse dans ce cahier des charges la prestation de paramétrage et de mise en service des équipements nécessaires à la collecte des données sur la plateforme de données du Grand Lyon. Ces prestations ne seront considérées comme finalisées qu'après test et validation des données par le projet européen (coordonné par la SPL Lyon Confluence).

Dès la fin des travaux de déco-rénovation, les équipements de mesure et de collecte des données mis en place conformément à ce cahier des charges devront être pleinement fonctionnels, et leur maintenance assurée jusqu'à la fin du projet européen Horizon 2020 / Smarter Together.

Après la fin du projet européen (en 2021), l'instrumentation Horizon 2020 sera cédée gracieusement à la copropriété qui en aura la charge.

La SPL Lyon Confluence est garantie auprès de la commission européenne de la bonne application du cahier des charges. Le retour d'appel d'offres doit donc lui être transmis, pour analyse, avant d'être soumis à la validation de la copropriété, ainsi que toute question éventuelle sur l'application de ce cahier des charges.
1) Points de mesure au niveau des services généraux

Pour les points de mesure au niveau des services généraux, le pas de temps des données collectées est de 10 minutes.

La fourniture et la pose des compteurs de chaleur au niveau des services généraux (consommation de chauffage et consommation d'eau chaude sanitaire) est à prévoir au moment du raccordement du réseau secondaire à l'échangeur du réseau primaire du chauffage urbain (et non pas lors d'une intervention après le raccordement).

Consommation de chauffage :
- 1 compteur de chaleur communicant M-bus (puissance thermique, index énergie, débits, température °C départ et température °C retour) pour chaque circuit de chauffage

Consommation d'eau chaude sanitaire (ECS) :
- 1 compteur de chaleur communicant M-bus pour l'appoint ECS sur la boucle entre l'échangeur et le ballon de stockage (puissance thermique, index énergie, débit, température °C allier et température °C retour appoint ECS)
- 1 compteur de chaleur communicant M-bus pour le boudage ECS sur le retour de boucle (pertes thermiques de la boucle, débit de bouclage, température °C départ ECS et température °C retour bouclage)
- 1 compteur volumétrique communicant M-bus sur l'entrée d'eau froide pour l'eau chaude sanitaire, afin de connaître les niveaux de puisage et les débits de pointe ECS

Si la copropriété refait le tableau électrique, la fourniture et la pose des sous-compteurs électriques des parties communes devra être incluse dans la prestation.

Consommation d'électricité des services généraux :
- sous-compteurs Modbus permettant de mesurer la puissance appelée et les index des postes suivants :
  - éclairage des parties communes
  - ventilation
  - sous-station
  - éclairage parking, le cas échéant
  - ascenseur, le cas échéant

L'ensemble des sous-compteurs sera interconnecté par un bus dont une attente ira jusque l'emplacement du concentrateur dans la sous-station.
Le suivi de la consommation d'électricité globale des services généraux n'est pas à prévoir, car il sera mis en place par Enedis à partir du 2ème semestre 2017, avec Linky. Par contre, les sous-compteurs mesurant la consommation électrique de plusieurs postes des services généraux (voir ci-dessus) sont bien à installer.
2) Point de mesure au niveau des logements

Temperatur interieure
- Une sonde de temperature par logement (pour un quart des logements) : sonde filaire avec connexion jusqu'à l'emplacement du concentrateur dans la sous-station et repérage du logement correspondant. Il est également possible d'envisager une sonde sans fil dans les logements jusqu'à un récepteur en gaine paisible, et ensuite filaire pour descendre en sous-station.

Le positionnement des sondes de température sera déterminé par le projet européen Horizon 2020 / Smarter Together (avec validation par la SPL Lyon Confluence en préalable à la pose).

Pas de temps des données température : 10 minutes.

Consommation d'électricité
Les compteurs d'électricité communicant au niveau des logements ne sont pas à prévoir, car ils seront mis en place par Enedis à partir du 2e semestre 2017 (avec Linky).
- Il sera demandé aux bénéficiaires de signer une autorisation permettant à Enedis de transmettre à la SPL Lyon-Confluence et au Grand-Lyon les consommations d'électricité par logement.

3) Concentrateur
Pour la communication des données de consommation d'énergie à la plateforme de données du Grand Lyon il est nécessaire d'installer et de paramétrer un concentrateur connecté au routeur du réseau de chauffage urbain. Ce concentrateur récupérera l'ensemble des données de la copropriété collectées par le dispositif d'Instrumentation, pour transmission à la plateforme de données du Grand Lyon. Ce concentrateur sera pris en charge par le projet européen, et n'est donc pas à intégrer dans le marché de travaux de la copropriété. Son installation sera supervisée par Hespul, qui assure la coordination technique du projet européen (en lien avec la SPL Lyon Confluence).

Une coordination des interactions en phase chantier est à prévoir par la copropriété, entre les entreprises travaux et Hespul/SPL Lyon Confluence ; afin de permettre une mise en service de l'ensemble de l'infrastructure communicante qui répond aux exigences de la commission européenne.
7.2 Specifications for refurbished building concentrator

Spécifications techniques du routeur pour le suivi des immeubles éco-rénovés dans le cadre d’Horizon 2020
Version du 26/01/2017

1 Généralités

Chaque immeuble bénéficiaire de la subvention européenne du projet européen Smarter Together (financement Horizon 2020) sera équipé de dispositifs de mesure des consommations d’énergie et des paramètres explicatifs associés. Ces dispositifs doivent partager automatiquement les données mesurées avec un serveur distant (plateforme de données du Grand Lyon) grâce à une application de type web-service, dont les caractéristiques précises seront transmises ultérieurement. Les données sont collectées à des fins de suivi-évaluation de la consommation d’énergie de la copropriété ; elles ne seront pas cédées à des tiers susceptibles d’en faire une exploitation commerciale. Ces dispositifs permettront :
- de réaliser un suivi de la qualité des travaux de rénovation effectués ;
- de proposer aux habitants un outil de suivi du fonctionnement de l’immeuble.

Les points de mesure nécessaires à l’atteinte de ces objectifs concernent les services généraux et les logements.

2 Détail des points de mesures

2.1 Spécifications communes

L’ensemble des points de mesures fait l’objet d’un autre cahier des charges. Le détail est présenté ici pour compréhension des besoins.

Le pas de temps de l’ensemble des données collectées, services généraux et logements, est de 10 minutes.

2.2 Points de mesure au niveau des services généraux

Consommation de chauffage :
- 1 compteur de chaleur communicant M-bus (puissance thermique, index énergie, débits, température départ et température retour) pour chaque circuit de chauffage

Consommation d’eau chaude sanitaire (ECS) :
- 1 compteur de chaleur communicant M-bus pour l’appoint ECS sur la boucle entre l’échangeur et le ballon de stockage (puissance thermique, index énergie, débit, température aller et température retour appoint ECS)
- 1 compteur de chaleur communicant M-bus pour le boudage ECS sur le retour de boucle (pertes thermiques de la boucle, débit de bouillage, température départ ECS et température retour bouclage)
- 1 compteur volumétrique communicant M-bus sur l’entrée d’eau froide pour l’eau chaude sanitaire, afin de connaître les niveaux de puisage et les débits de pointe ECS
Consommation d'électricité des services généraux :
- sous-compteurs ModBus permettant de mesurer la puissance appelée et les index des postes suivants :
  - éclairage des parties communes
  - ventilation
  - sous-station
  - éclairage parking, le cas échéant
  - ascenseur, le cas échéant

L'ensemble des sous-compteurs sera interconnecté par un bus dont une attente ira jusque l'emplacement du concentrateur dans la sous-station.

2.3 Point de mesure au niveau des logements

Température intérieure
- une sonde de température par logement pour un quart des logements.
3 Concentrateur

Pour la communication de l’ensemble des données collectées par les dispositifs d’instrumentations à la plateforme de données du Grand Lyon, il est nécessaire d’installer et de paramétrer un concentrateur et son alimentation électrique. Un accès Internet, via un modem ADSL, est à considérer déjà présent. D’un point de vue physique, la prestation du présent lot s’arrête donc au niveau de cet accès.

Entrées :
- Bus M-bus (4 compteurs);
- Bus ModBus (3 à 5 compteurs, voire plus si plusieurs sous-compteurs par poste);
- Sonde de température (au cas par cas selon les systèmes installés : analogique (résistance Pt, 0-10 V ou 4-20 mA), numérique ou Ethernet/IP).

Sortie :
- Réseau Ethernet TCP/IP via port RJ45.

Fonctions logiques réalisées :
- Interrogation de l’ensemble des capteurs et compteurs toutes les 10 minutes ;
- Transmission une fois par jour de l’ensemble des données collectées depuis la dernière transmission à la plateforme du Grand Lyon selon le modèle PUSH (le concentrateur est à l’initiative de la transmission) ;
- Export selon un protocole pris en charge par la plateforme de données du Grand Lyon et dans un format standard (type CSV, JSON ou XML) ;
- Enregistrement au minimum de 1 000 valeurs par points remontés (soit une durée d’archivage de quasiment 7 jours) afin de disposer d’un historique en cas de problème de communication ;
- Données (en particulier l’horodatage) représentées selon un format défini en concertation avec la plateforme du Grand Lyon ;
- Référencement des données défini en concertation avec la plateforme du Grand Lyon ;
- Mémoire glissante (efface les valeurs archivées les plus anciennes lorsque la mémoire est pleine) ;
- L’affichage des données en local n’est pas demandé.

Doit être fixé sur un mur, par exemple montage sur un rail DIN à installer. Le raccordement électrique sera effectué à partir du tableau de la sous-station (pas via une prise de courant).

À charge du présent lot :
- Fourniture, programmation, pose et raccordement du concentrateur, y compris fourniture des câbles de connexions et connecteurs nécessaires et alimentation du concentrateur ;
- Prestation de paramétrage et mise en service.

La prestation sera considérée comme achevée seulement lorsque le concentrateur communiquera de manière autonome l’ensemble des données au bon format sur une durée d’une semaine minimum.

Exemple de matériel : Trend I/O4 ou Schneider IRI/O avec les modules nécessaires.