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Living Lab for Testing Digital Energy Solutions at JRC Ispra

Proceedings of the first co-design workshop open to all staff (30 January 2020)

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Abstract

The Living Lab for Testing Digital Energy Solutions (DES-Lab) aims at involving the JRC staff and stakeholders in testing the Living Lab method, with the objective to transform the JRC Ispra site into an Energy Living Lab. The project will serve as a tool to support site modernisation, as well as to reach ambitious energy performance objectives.

The ongoing pilot phase of the project, expected to be concluded by December 2020, will most likely be postponed due to the force-majeure situation linked to the COVID-19 outbreak.

The organisation of workshops to engage JRC Ispra staff is essential for the success of the project. To this purpose, a co-design workshop was organised on 30 January 2020 by unit C.3 jointly with Unit H.1, in collaboration with Units R.I.4, C.2 and C.4, and co-developed by Prof. Jöelle Mastelic and Dr. Francesco Cimmino, University of Applied Sciences Western Switzerland.

The co-design workshop aimed at:

- ✓ engaging the main stakeholders, and setting a common vision and objectives for the implementation of pilot use cases.
- ✓ empowering the participants – JRC staff, in fostering a "practice what we preach" approach;
- ✓ understanding the different individual perspectives, needs and barriers to enable the co-design of solutions closer to these needs, and to increase their adoption and uptake.

The co-design workshop focused on three key subject matters, i.e.:

- ✓ Smart charging systems for electric mobility, concentrating on staff needs and concerns, and commuting habits;
- ✓ Energy efficiency and savings, particularly in terms of buildings' energy monitoring and management systems;
- ✓ Open data and visualisation, with the goal of opening and sharing energy-related data with the staff, as a first step.

Commitment from senior management is crucial to ensure that the subsequent experimentation and piloting phases benefit from the necessary human, technical, and financial resources.

The event was attended by over 50 participants, mostly JRC Ispra staff belonging to various Directorates and Units. Representatives from the Municipality of Milan in charge of the H2020 Sharing Cities project, and from the Italian start-up Cartender were also among the participants.

1 Introduction

The JRC has recently launched a new "one JRC" project for the development of Living Labs in all its sites, aiming to engage staff in ideating and implementing solutions for a more sustainable life at the JRC. The Living Labs will also consider solutions offered by external entities, such as technological start-ups, who can apply to a JRC public call for expression of interest[1]. The Living Labs will focus on the topics of Digital Energy, Future Mobility, Circular Economy and Waste Management.

The **Living Lab for Testing Digital Energy Solutions (DES-Lab)** aims at involving the JRC staff and stakeholders in testing the Living Lab method, with the objective to transform the JRC Ispra site into an Energy Living Lab, using the existing infrastructure and integrating key stakeholders in the development of products, services and programs. The project will serve as a tool to support site modernisation, as well as to reach ambitious energy performance objectives (i.e. improving energy use, efficiency and consumption, and increasing the use of renewable energy on site).

The organisation of workshops to engage JRC Ispra staff is essential for the success of the project. To this purpose, a first *ideation* workshop was held in May 2019, followed by a *co-design* workshop on 30 January 2020.

The co-design workshop aimed at:

- ✓ **engaging the main stakeholders**[2], and setting a common vision and objectives for the implementation of pilot use cases. Commitment from senior management is crucial to ensure that the subsequent experimentation and piloting phases benefit from the necessary human, technical and financial resources;
- ✓ **empowering the participants** – JRC staff, in fostering a "*practice what we preach*" approach;
- ✓ understanding the different individual perspectives, needs and barriers to enable the **co-design of solutions** closer to these needs, and to increase their adoption and uptake.

Based on the outcomes of the ideation workshop, the co-design workshop focused on three key subject matters, i.e.:

- ✓ **Smart charging systems for electric mobility**, concentrating on staff needs and concerns, and commuting habits;
- ✓ **Energy efficiency and savings**, particularly in terms of buildings' energy monitoring and management systems;
- ✓ **Open data and visualisation**, with the goal of opening and sharing energy-related data with the staff, as a first step.

The event - organised by unit C.3 jointly with Unit H.1, in collaboration with Units R.I.4, C.2 and C.4, and co-developed by Prof. Jöelle Mastelic and Dr. Francesco Cimmino, University of Applied Sciences Western Switzerland – was attended by over 50 participants, mostly JRC Ispra staff belonging to various Directorates and Units. Representatives from the Municipality of Milan in charge of the H2020 *Sharing Cities*[3] project, and from the Italian start-up Cartender were also among the participants.

All presentations given at the workshop are available for download at the dedicated *Living Labs at JRC* page in Connected[4]. After the event, feedback was collected from participants, on a voluntary basis.

The present document summarises the main outcomes from this first co-design workshop (Sections 2, 3), and proposes a number of actions to proceed with the implementation of pilot solutions on the Ispra site (Section 4).

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[1] https://ec.europa.eu/jrc/en/research-facility/living-labs-at-the-jrc/call-expression-interest-future-mobility-and-digital-energy-solutions

[2] Following the principle of the Quadruple Helix, the main DES-Lab stakeholders include: JRC staff and visitors, JRC management and hierarchy, applicants to the call for expression of interest (such as start-ups) and JRC external service providers, and collaborating universities (such as University of Applied Science Western Switzerland, Polytechnic of Milan and Bocconi University).

[3] http://www.sharingcities.eu/

[4] https://webgate.ec.europa.eu/connected/docs/DOC-216521

The identified actions – ranked in terms of priority and feasibility – will be brought to the attention of the JRC hierarchy, Site Management., and all potentially interested contributors from JRC staff.

The agenda of the workshop, along with additional details on the Living Lab project, the process followed, the lessons learned, and the feedback received by participants, are found in the Annexes.

2 The Living Lab *co-design* workshop

The first Living Lab workshop for co-designing solutions held at JRC Ispra 30 January 2020 was attended by a heterogeneous group of participants (in terms of competences, background, roles and responsibilities, gender, and age). This was particularly appreciated, as the Living Lab method encourages cross-fertilisation of ideas, and benefits from views of a multitude of different actors[5].

There is no unique process in Living Labs. The methodology adopted for the workshop, i.e. the Living Lab integrative process, is inspired by Community Based Social Marketing (Mc Kenzie Mohr, 2000), in which open discussion and confrontation of ideas on barriers and drivers are encouraged as a mean to ultimately build a common vision of the challenge.

This methodology – adapted to the JRC Ispra context – was developed by the Energy Living Lab from the University of Applied Sciences Western Switzerland (HES-SO) that develops applied research projects and services in energy management. More information on the methodology is found in Annex 3.

For the workshop, two long working sessions were organised, while one-way presentations were kept to a minimum, only to set the scene and context, and to showcase an inspiring example from the Municipality of Milan.

2.1 Structure of the workshop

The workshop was structured into three main sessions, as shown in the agenda (Annex 1), i.e.:

- ✓ **Session I** – Presentation of the Living Lab projects in Ispra;
- ✓ **Session II** – <u>Group working session</u>: Identifying drivers as well as barriers to change;
- ✓ **Session III** – <u>Group working session</u>: Co-designing solutions.

The purpose of session I was to provide the audience with clear information on the context, on current activities and main objectives of the Living Lab project, along with data, facts and figures related to the present situation of the JRC site's infrastructure and future development plans.

In Session II, participants were asked to work in groups on specific pilot use cases (see Section 2.2), to identify drivers to develop and facilitate uptake of the use cases, as well as barriers that may preclude their uptake. In Session III, participants worked in groups on the same use cases to co-design prototype solutions.

Session III was preceded by an exhaustive presentation from the Municipality of Milan[6] on the main interventions carried out in the framework of the H2020 *Sharing Cities* project for creating nearly-zero emission districts.

2.2 Pilot use cases

The selection of the pilot use cases was based on the results of the previous *ideation* workshop, ranking all needs, ideas and concerns that had emerged at that event in terms of **thematic pertinence, feasibility, and relevance** to EU policy.

Three pilot use cases emerged from the *ideation* workshop and have been thus selected for the subsequent *co-design* workshop:

- ✓ Case 1. Smart charging of electric vehicles;
- ✓ Case 2. Smart energy management system;
- ✓ Case 3. What data are we interested in?

Case 1. Smart charging of electric vehicles

JRC selected Cartender s.r.l., an Italian-based start-up on electric vehicles, for a pilot experiment, to test their solution in JRC laboratories and to install some of their prototypes on site.

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5 The Quadruple Helix is part of the definition of a Living Lab, integrating citizens, researchers, companies and public authorities in a public-private-people partnership to transform the JRC Ispra site.

6 Sharing Cities: An integrated approach for the Smart City, Presentation by Clara Maddalena Callegaris (Head of Smart City Unit, Milan Municipality)

Cartender illustrated its EVOCS system (Electric Vehicles Open Charging System) – a novel solution for making e-charging easier for the customer.

Workshop participants were asked to discuss barriers and drivers for the deployment of such a smart system for charging electric vehicles onsite.

Case 2. Smart energy management system

The JRC has a system for monitoring both energy consumption and renewable energy production of the Ispra site.

For case 2, workshop participants were encouraged to discuss: the monitoring and evaluation of energy consumption in offices and common areas (both indoors and outdoors); future charging points for electric vehicles; and new installations for renewable energy production.

The objective was not only to propose solutions for providing energy monitoring and reporting at site level, but also for maximising energy savings, while maintaining comfort, and increasing energy efficiency.

Case 3. What data are we interested in?

Various types of data are collected at the Ispra site every day: air quality and site energy consumption are just two examples. Integrating and opening these data to researchers and the JRC staff is a key issue, though not easy to realise.

Discussions in the *ideation* workshop in May 2019 indicated the staff's interest for accessing data related to temperature, humidity, ventilation, lights, noise, etc.

Participants to this working group were asked to discuss the types of data they would like to access and the main barriers which prevent this from happening.

Participants were also encouraged to imagine effective ways of visualising the data, along with strategies for deployment of the tools onsite.

3 The working group sessions

The present section summarises the main outcomes of the working groups' discussions on the three pilot use cases, for the two working group sessions (i.e. Sessions II and III).

This material is intended to give key insights to the development of each pilot case action plan.

3.1 Session II – Identifying barriers

Case 1. Smart charging of electric vehicles

The main outcomes of the discussions on smart charging of electric vehicles are outlined in Table 1.

Table 1. Main barriers and drivers associated with the smart charging of electric vehicles

<table>
<tr><th colspan="4">Reporting of Groups</th></tr>
<tr><td colspan="2" rowspan="3">Questions:</td><td colspan="2">What is the target user group?</td></tr>
<tr><td colspan="2">What is the social practice to be targeted?</td></tr>
<tr><td colspan="2">What drivers and barriers do you foresee for deploying the charging points on site?</td></tr>
<tr><td colspan="3">Target group:</td><td>Social practice:</td></tr>
<tr><td colspan="3">All JRC staff and visitors</td><td>Changing mobility patterns, charging and driving electric vehicles</td></tr>
<tr><td>SUMMARY</td><td colspan="3">In order to facilitate the transition to e-mobility, the understanding and acceptance of the related technology is important. Participants emphasized the need for more information from trusted sources, such as JRC experts on e-mobility. Understanding the socio-technical context of the potential users is the starting point. Electric mobility implies a different mind-set as to how trips are organised by users. Issues related to vehicle ownership and car-sharing practices will emerge and new business models could be developed.</td></tr>
<tr><th colspan="3">BARRIERS</th><th>DRIVERS</th></tr>
<tr><td colspan="3">Lack of information on electric mobility</td><td>Incentives to staff, such as agreements with car manufacturers and free charging, charging with solar energy</td></tr>
<tr><td colspan="3">Lack of an infrastructure for electric charging</td><td>Provide staff with socio-technical and environmental information on electric mobility and offer an electric driving experience</td></tr>
<tr><td colspan="3">Investments required: electric vehicles are more expensive to buy (not everyone can afford them)</td><td>Reduce the carbon footprint caused by transport</td></tr>
<tr><td colspan="3">Cultural change and habits: transition to e-mobility implies a different mind-set (e.g. planning trips in advance, charging times)</td><td>Availability of dedicated parking slots onsite</td></tr>
<tr><td colspan="3">Free charging onsite to JRC staff may be perceived as unfair by external communities</td><td>Online access to information on available charging stations and possibility to book them.</td></tr>
</table>

Case 2. Smart energy management system

The main barriers and drivers identified by the working groups for the development of a smart energy management system are shown in Table 2.

Table 2. Main barriers and drivers to the development of a smart energy management system.

<table>
<tr><th colspan="2">Reporting of Group</th></tr>
<tr><td rowspan="3">Questions:</td><td>What is the target user group?</td></tr>
<tr><td>What is the social practice to be targeted?</td></tr>
<tr><td>What drivers and barriers do you foresee for the implementation of a smart energy management system?</td></tr>
<tr><td>Target group:</td><td>Social practice:</td></tr>
<tr><td>JRC staff</td><td>Reduce energy consumption levels in buildings</td></tr>
<tr><td>SUMMARY</td><td>The main issue is the massive energy use in buildings, especially old ones, and the presence of large experimental facilities which can sometimes be very demanding in terms of energy. To achieve the results, one of the key elements is the segmentation and targeting of specific users' groups. In the workshop, the participants proposed to target JRC staff (taking into account different profiles, such as researchers and administrative staff, management team, etc.), and external energy providers. An internal Energy Management System exists in the JRC but users are not informed about the site's energy consumption.</td></tr>
<tr><th>BARRIERS</th><th>DRIVERS</th></tr>
<tr><td>Current lack of financial resources devoted to the subject</td><td>New "European Green Deal"</td></tr>
<tr><td>Little staff awareness of changing social practice; Lack of communication regarding energy consumption</td><td>Willingness to keep up with the rapidly evolving technology</td></tr>
<tr><td>Personal data protection</td><td>Information, training and raising awareness initiatives</td></tr>
<tr><td>Heterogeneity of the Ispra site and its infrastructure (presence of old/new buildings, and offices/laboratories)</td><td>Scientific interest of staff in the topic</td></tr>
<tr><td>Cultural differences among the international staff (e.g. subjective concept of comfort)</td><td>Economic savings</td></tr>
<tr><td>Management buy-in, rigid governance and regulation</td><td>Improvement of wellbeing and reduction of environmental pollution</td></tr>
<tr><td>Partial availability of energy-related data</td><td></td></tr>
</table>

Case 3. What data are we interested in?

The main outcomes of the group discussions on the barriers and benefits of granting access to available data are provided in Table 3.

Table 3. Main barriers and benefits to open/available data access.

<table>
<tr><th colspan="3">Reporting of Group</th></tr>
<tr><td rowspan="3">Questions:</td><td colspan="2">What data do you consider useful accessing?</td></tr>
<tr><td colspan="2">Who is the target user group?</td></tr>
<tr><td colspan="2">What are the benefits and barriers for accessing data?</td></tr>
<tr><th colspan="2">Target group:</th><th>Social practice:</th></tr>
<tr><td colspan="2">JRC staff/labs</td><td>Access to available data</td></tr>
<tr><td>SUMMARY</td><td colspan="2">Participants agreed on the necessity to have access to the following categories of data:
✓ Energy consumption: Most of the information is already being collected. A better use of that information is the goal. Data could be used for better decision-making, to optimise resources and eventually reduce environmental impact.
✓ Occupancy: Occupancy of offices, social areas, meeting rooms.
✓ Mobility: the staff is interested in receiving information on parking slots and on available means of transport to move around the site, or even outside, e.g. in case of daily commuting.</td></tr>
<tr><th colspan="2">BARRIERS</th><th>BENEFITS</th></tr>
<tr><td colspan="2">Interoperability of the various data collection systems</td><td>Achievement of more transparent rules for data protection</td></tr>
<tr><td colspan="2">Rules and legislation (like limitations in terms of GDPR 2018 regulation)</td><td>Information, training and raising awareness among staff</td></tr>
<tr><td colspan="2">Resources (budget, human resources with data analytic skills)</td><td>Display available information on energy production/consumption</td></tr>
<tr><td colspan="2">Data accessibility and lack of willingness from the users to share the data, lack of trust on how the data will be used</td><td>Increase wellbeing and reduce carbon footprint</td></tr>
<tr><td colspan="2">Technical feasibility (is it technically feasible to aggregate data at office level?)</td><td></td></tr>
</table>

3.2 Session III - Co-designing solutions: the Seven step-stones to innovation[7]

Session III was divided into two types of activities:

- ✓ **Co-design a solution and its features**, based on existing products and services (mash up), to overcome the barriers and use the drivers identified in the previous Session;
- ✓ **Evaluate the proposed solution and modify it**, using a model based on seven questions, i.e. the "**seven step-stones to innovation**", listed in Box 1. Additional details on the model are found in Annex 3.

Box 1. Seven step-stones to innovation

1. **Practical usefulness**: How does the new solution allow to be more efficient?
2. **Financial benefits**: What are the financial benefits of the new solution?
3. **Ease of use**: How much effort is required from users to use the solution?
4. **Impacts on habits**: What do users of the solution need to change in their habits?
5. **Emotional relationship**: Will the users become emotionally attached to the solution? Can they trust the solution?
6. **Social influence**: What will be the impact of the solution on the social status of the users?
7. **Physical space**: How do we need to adapt the physical space to the solution?

The outcomes of Session III, for each of the three use cases, are presented in the following paragraphs.

Case 1. Smart charging of electric vehicles

Part One. Features

Questions:	What kind of features should a charging station have?
	What incentives could be offered to staff to pass to e-mobility?
SUMMARY	✓ The Living Lab should organise information-days on e-mobility with the support of experts. ✓ The solution should be easy to use and provide a good user experience. ✓ The JRC could offer an infrastructure with many charging stations onsite and some available also in the parking area outside the JRC. The charging stations should offer smart communication tools through an app that can display chargers' availability, booking options, current state of battery charge, and power flow from charger to battery. ✓ The charging station should be able to provide data on the share of renewable energy that is being used for charging. ✓ The number of available charging stations should always be adequate to the fleet of electric cars circulating on site. ✓ Two options for the charging process could be proposed: either billing for the electricity consumed or free charging in exchange of energy-related data to be used for research purposes within the Living Lab project. As for the billing option, there is the need to identify the service users. This requires handling and processing personal data in compliance with GDPR.

[7] Original methodology developed by Human Centricity at the École Polytechnique Fédérale de Lausanne (EPFL)

Part Two. Seven step-stones to innovation

1. **Practical usefulness**: measure the energy efficiency of an electric vehicle trip from home to the JRC. Estimate CO_2 savings using the Green Driving Tool[8] available at the JRC.
2. **Financial benefits**: they should exist only for staff, not for JRC. Drivers of electric cars will save the cost of fuel. The savings can be estimated using the Green Driving Tool.
3. **Ease of use**: one of the goals is to avoid trips to gas stations: *one drives to work, plugs, works, at the end of the day, unplugs and drives home.* Locations of the charging station are very important, not too far from the main buildings and the social areas.
4. **Impact on habits**: E-mobility demands planning long trips in advance, due to recharging time and limited availability of charging stations. The incentives provided by JRC may not be offered by other employers, and this may represent an issue for personnel at the end of their contract with the JRC.
5. **Emotional relationship**: User experience is important. A critical mass of passionate green drivers will facilitate the formation of an interest group that grows larger and larger.
6. **Social influence**: The JRC can showcase a good example of green driving to its visitors by offering a place *where one can travel using solely solar energy,* thus incentivizing e-mobility. The data collected by the Living Lab will be useful to recognize the effort that JRC is doing towards de-carbonisation.
7. **Physical space**: The JRC has enough physical space to accommodate the charging stations. Sufficient physical space is available to use photovoltaic panels – to be installed on top of charging stations (or even lampposts) - to produce the electricity required by the chargers. In addition, parking slots could be painted in green.

8 https://green-driving.jrc.ec.europa.eu/

Case 2. Smart energy management system

Part One. Features

<table>
<tr><td rowspan="3">Questions:</td><td>How would you like to design such a system?</td></tr>
<tr><td>What benefits would you see from it?</td></tr>
<tr><td>Which data would you like to integrate?</td></tr>
<tr><td>SUMMARY</td><td>✓ It was proposed to focus on one representative building of the JRC where to develop an energy monitoring system. Building 101 might be a good selection because it has the following characteristics: it is rather new, hosts approximately 200 people, has a big recently-renovated atrium with a social area, and has screens installed that can be used for data visualisation.

✓ The proposal is to implement a system to monitor energy consumption (heating, cooling and electricity) and production from the PVs installed on the roof. At the initial stage, data could be collected only at building level since the available infrastructure does not allow collection of all data at office level.

✓ A collaborative challenge could be proposed so that all the staff working in building 101 could work together to reduce the building's energy consumption. "We can foresee a long time window where we start collecting data and then launch a campaign that lasts a few weeks where everybody is committed to save as much energy as possible"[9], trying to be very attentive to the consumptions (lights, heating/cooling, appliances…). At a second stage, a competition among the staff occupying the various offices (or areas) of building 101 could be organised.

✓ It is proposed to organise a dedicated event to explain the project to the staff working at building 101 (of course all other staff will be invited to attend). Before, during and after the campaign, the data will be visualised on the screens. After the campaign, the staff will be invited to a co-evaluation meeting where the collected data will be made available, analyses will be conducted, and results interpreted. Useful feedback will be collected. The staff will be personally engaged in finding ways to reduce the energy bill for their building.</td></tr>
</table>

Part Two. Seven Step-stones to innovation

1. **Practical usefulness**: reducing energy consumption of the buildings will save costs and raise awareness of the staff working in building 101. This could be re-invested in energy efficiency actions.
2. **Financial benefits**: it could decrease the energy bills and create a domino effect: "*what we learn at work, we can use it when we are back home*". For a future emission trading scheme within Commissions' premises, the JRC will have to pay for the CO_2 emissions it will produce. If energy consumption is reduced, there will be less costs for the JRC.
3. **Ease of use**: the infrastructure is in part already there; the co-designed solution should be as easy to use as possible. The Building Energy Management System (BEMS) should be user-friendly for the JRC staff.
4. **Impact on the habits**: games and challenges could be developed to change the habits of the target group. The example of the city of Milan is inspiring. A long-term goal is important, such as targeting a zero-energy building, that the Commission is committed to achieving in its premises by 2030.
5. **Emotional relationship**: feeling part of the JRC community, influencing together the energy consumption of the working space could be rewarding. At the end of the activity, the staff would feel proud, engaged and empowered.
6. **Social influence**: communication is essential in order to implement the plan. Specialists in this field could be involved to engage the staff.

[9] Quote from participant to the workshop.

7. **Physical space**: The infrastructure, the metering devices are already there. The screens are already there. There is no need to adapt the physical space. In order to change consumption on the long run, changing the default settings and the context of use is extremely important (Sunstein, 2017).

Case 3. What data are we interested in?

Part One. Features

Questions:	Let us agree on 2/3 types of data to be discussed.
	Think about ways to display data, other than screens/dashboards. You may use also real-life examples (e.g., visualisation tools used in other cities).
	What are the main elements that make data visualisation effective? (e.g., use of specific colours, shapes, size).
	What areas of the Ispra site would be more suitable for the deployment of visualisation tools? Why?

SUMMARY

- ✓ Data visualization tools should be kept simple without trying to “*communicate too many numbers, too many indicators, otherwise people will get confused*”[10] and will lose interest. The visualization tools could be enriched step by step as people get acquainted with the information displayed.
- ✓ **Production of energy**: this would be the first key data that people will be interested in, not only the amount but also the share of energy that is coming from renewable sources. *“This would be something that we would try to aggregate as a site and then maybe per building”*[11]. The possibility to tag the energy that is cogenerated and the energy that is purchased by the outside network. These numbers will contribute to raise staff awareness and eventually show them the site’s footprint.
- ✓ **Energy usage**: The different types of buildings (laboratories, offices, social areas) could be monitored separately to compare specific KPI’s. In addition to consumption in offices, staff should be made conscious of the energy used by the large infrastructures available on site (datacentre, laboratories, canteen, etc.). Geographical information systems could facilitate the display of information.
- ✓ **Access**: a website or a mobile app would be appropriate for displaying data; however, one needs to install the app, or to visit the website. In other words, we have to pull information from the database. In order to push the same information, screens can be used to display simple, comprehensive information that needs to be normalized in order to compare buildings of different sizes and use. Dashboards should visualise normalized data, which would be fairly comparable.
- ✓ **Occupancy and mobility**: An additional field could be added to the individual SECPAC dashboard where staff would be asked to insert information on the type of engine of their vehicle (conventional, hybrid, hybrid plug-in, or full electric). It could be possible to retrieve this information automatically from the “Motorizzazione Civile” using the licence plate. This information could be useful to monitor staff fleet per engine type to see how fast the transition to electric mobility is happening at the JRC.
- ✓ **Parking availability**: *Some colleagues think that finding some parking space is sometimes difficult.* Having some indication and monitoring availability of parking spaces in high-density areas (like the one in front of the auditorium) could be an interesting project to be implemented. With such a system, one *knows that there is no need to look for a slot in that parking area. Some other colleagues* think that this could be counterproductive because if they know there is a parking space available, this could encourage the use of vehicles.

[10] Quote from participant to the workshop.
[11] Quote from participant to the workshop.

Part Two. Seven step-stones to innovation

1. **Practical usefulness**: opening up the data to the staff could increase usefulness and overall service level at the JRC Ispra site. An example has been proposed for mobility, but this is also valid for energy consumption in buildings, air quality and other key subjects: knowledge of the number of electric cars entering on site every day could inform on the reduction of the carbon footprint.
2. **Financial benefits**: collecting data on energy consumption in buildings *would allow the management to make evidence-based decisions with regards to the renovation of buildings.* As an example, it was proposed to consider using liquid, instead of air, to cool down IT servers and equipment, leading to a massive reduction of energy consumption. Such a decision could be supported by data analysis.
3. **Ease of use**: information should be accessible, understandable (visualisation), interpretable (e.g. with a color scale to be able to compare buildings' energy consumption).
4. **Impact on habit**: availability of energy consumption data could positively impact the habits of staff members as it would incentivise them to reach targets of minimum consumption.
5. **Emotional relationship**: knowing that a parking space is available in front of a building may induce one to take the car. Actually, the incentive should be to take a walk or to ride a bike.
6. **Social influence**: awareness of data could influence energy consumption behaviours.
7. **Physical space**: use existing digital signage tools for displaying data and, add a sign at the main entrance, or in the social areas, showing information that can be seen and understood easily

4 After the Workshop: The Action Plan

The ideas discussed at the workshop and the solutions emerged therein have been scrutinised by the Living Lab team, who is proposing the following action plan. Three use cases will be piloted and implemented:

1. Provision of incentives to use electric vehicles and pre-deployment of electric charging stations on-site;
2. Development of an Energy Monitoring System in Building 101;
3. Development of data collection strategies and visualization tools.

The use cases are described in the next sub-sections.

The identified actions – ranked in terms of priority and feasibility – will be brought to the attention of the JRC hierarchy, the Site Management., and all potentially interested JRC contributors.

In order to implement the proposed solutions, and to deliver on-time, management buy-in and support from the hierarchy is a prerequisite to ensure the allocation of adequate financial, human and technical resources.

4.1 Provision of incentives to use electric vehicles and pre-deployment of electric charging stations on-site

The objective of this use case is to provide incentives to JRC personnel to encourage their transition to e-mobility. This will be realised by organising an info-day at the Ispra site, and pre-deploying an open solution for electric vehicles' smart charging.

The info-day will be organised jointly with Unit C.4. Informative/educational material will be prepared along with quizzes and hands-on sessions on how to charge e-cars.

The pre-deployment of charging stations will be carried out through an open solution for smart charging proposed by the start-up Cartender s.r.l., who is about to sign a 12-month collaboration agreement with the JRC after being selected in the context of the Living Lab open call[12].

The solution proposed by Cartender offers charging points for e-vehicles that can be fully adapted to the users' needs. The charger is easy to customise by the user, offering charging services based on solar production or other specific requirements. A dedicated app also allows users to program the charging process upon specific necessity.

The pilot project will consist of two steps.

A preliminary testing phase of the solution for compliance with the existing standards, electromagnetic compatibility, stress-tests, etc. The tests will be conducted in the European Interoperability Centre of Smart Grids and Electric Vehicles located in Ispra and Petten.

After successful conclusion of such tests, the solution will be pre-deployed on site. The pre-deployment will enable the JRC to:

a. experiment charging sessions and gather user experience and feedback;
b. offer incentives to staff to gradually shift to e-mobility;
c. test advanced billing options for charging sessions; and
d. contribute to the modernisation of the JRC sites.

During the pre-deployment phase, data on electric power flows per charging point will be collected by the internal Living Lab data-warehouse for subsequent analysis. For example, information on single charging stages will also be collected, namely the total amount of electricity that has been supplied by the charging point during a charging cycle[13].

In exchange of such data for research purposes, it is proposed that the users may charge their vehicle for free.

[12] During the research project, and before the pre-deployment, Cartender will test their solution in the European Interoperability Centre of Smart Grids and Electric Vehicles at the JRC Ispra and Petten.

[13] For example, charging point #3 has supplied 56 kWh between 14h30 and 17h30 on 06/11/2019.

The collected data will be anonymous as no user authentication is required when plugging a car to the charging point.

The whole process will be divided into six subsequent stages, as described in Box 2 below:

Box 2. Phases for the deployment of electric charging stations for staff members and provide incentives to use electric vehicles on-site

1. Mapping of the current private and service vehicle fleet circulating on site by class of emissions;
2. Identify, with the support of JRC staff, suitable outdoor site locations for installing the charging points. Such charging stations will be used to charge both personal vehicles and JRC service e-cars (and even autonomous shuttles in the future).
3. Collaborate with Department R.I. in order to set-up the infrastructure that will host the charging points (basements and cables). Installation of solar PV panels and storage systems close to the chargers will also be considered.
4. Proceed with the installation of the Cartender s.r.l. charging stations in the identified locations and put them into operation. Wireless connections will be established between each charger and the Living Lab servers to gather the relevant data.
5. At this stage, the experimentation phase will take place. JRC staff will be offered to use chargers, and the collected data will populate the Living Lab database. In parallel, data will be analysed to produce meaningful indicators, and visualised. This data will enable the Living Lab to test user feedback and alternative pricing options, depending on the electricity demand and the energy mix supplied by the JRC.
6. Organise a co-evaluation workshop with JRC staff to present the results of the pilot experimentation, to analyse and interpret them. At this stage, discussions will be held regarding the success of the experimentation, the optimal location of the charging points, and on the worthiness to permanently deploy chargers on site (in terms of number and locations). Considerations for billing options will be made for possible future permanent deployment of the charging points.

At the end of the collaboration agreement, the JRC will launch on open call for the procurement of charging stations. Data collection and processing will continue in the context of the Living Lab through, for example, periodical co-evaluation workshops that might, as an outcome, lead to the decision to increase the number of charging points. Such data will be integrated with the energy monitoring and management system at the site level to measure and observe, for example, how much energy used by the electric vehicles has been generated from renewable sources.

The company Cartender will be involved JRC during both testing and pre-deployment phases. In particular, during pre-deployment, Cartender will support the JRC in the installation of the charging points, participate to the experimentation and to the co-evaluation workshop.

4.2 Development of an Energy Monitoring System in Building 101

The purpose of this use case is to offer, to JRC staff working in building 101 and to any other personnel visiting the building, visual information about that building’s energy consumption. The objective is to engage staff in finding ways to reduce as much as possible the energy consumption of the building and to propose rewarding scheme for good practices, and accountability of energy footprint through “fac-simile” billing, etc.

The task is composed of three steps, described in Box 3.

Box 3. Phases for the development and implementation of an energy monitoring system in building 101.

1. The Living Lab will develop a system to monitor energy consumption (heating, cooling and electricity) and production from the PVs already installed on the roof at the level of the whole building. Data will be collected in the Living Lab servers and visualised in the atrium of building 101 on the available screens.

2. The Living Lab team will organise a meeting to explain the project to the staff of building 101 (all other staff will also be invited) and to propose a collaborative challenge by stimulating the personnel to act together towards reduction of the energy consumption of the building. The challenge will be co-designed with staff and a raising-awareness campaign will be launched to commit staff into saving as much energy as possible (lights, appliances, heating/cooling, etc.).
3. Data will be visualised on the screens before, during and after the campaign in order to keep staff well informed of the situation. After the campaign, a co-evaluation meeting will be convened where the collected data will be made available, analyses conducted, and results interpreted. Feedback will be collected and follow-up actions established.

4.3 Data collection and visualization tools

Data on energy production are not currently available from the energy management system on site. At present, only consumptions are recorded.

It is proposed to collect the following data:

1. energy produced on site, including the share of electricity produced by renewable sources, ideally tagging the electricity produced autonomously and that taken from the grid;
2. energy consumption data at building level for the most populated buildings on site;
3. vehicles circulating on site by class of emissions (same issue emerged from use case 1).
4. parking availability, especially in the area in front of the auditorium.

Given the available time and resources, the Living Lab team will focus only on items 1 and 2 above.

The present use case is composed of five steps, i.e.:

Box 4. Phases for the development of visualisation tools

1. Set up of data collection infrastructure;
2. Start data collection;
3. Co-development of indicators and dashboards;
4. Visualisation of indicators[14];
5. Co-evaluation of implemented dashboards / interpretation of results / suggestions for improvement.

Ad-hoc workshops will be organised with staff with reference to Items 3 and 5.

[14] A certain time period will be allowed to staff for familiarising with the new tools and information displayed.

4.4 Summary of actions

The following table summarises the main actions foreseen for the implementation of the three pilot use cases.

ACTION POINTS	STEPS	EXPECTED TIMING[15] (starting time, ending time)	EVALUATION STRATEGY
Deployment of electric charging stations for staff members and provide incentives to use electric vehicles on-site	Mapping of the current private and service vehicle fleet circulating on site by class of emissions	T0, T0+2	Sharing anonymised information from Security (SECPAC), EU survey
	Identify installation spots	T0, T0+2	Feedback collection (oral, written, via online forms) Ex post evaluation of energy saving from (PV) Calculation of CO_2 equivalent Evaluation of alternative billing forms
	(Together with JRC R.I) set up of needed infrastructure	T0+2, T0+5	
	Wiring of the whole data chain (from charger to living lab servers)	T0+4, T0+6	
	Experimentation with staff, data gathering, feedback from users	T0+6, T0+12	
Development of an Energy Monitoring System in Building 101	Data collection and harmonization	T0, T0+12	Feedback collection (oral, written, via online forms). Quantification of energy saving Identification of behavioural patterns
	Data visualization in common areas (atrium, coffee rooms)	T1, T0+12	
	Presentation of results to staff and co-creation of common challenge	T0+4, T0+12	
Data collection and visualization tools	Set up of energy data collection infrastructure	T0, T0+2	Co-development and co-evaluation events
	Start data collection	T0+2, T0+12	
	Co-development of tools for visualization of indicators	T0+2, T0+4	
	Visualisation of indicators	T0+5,T0+12	
	Co-evaluation of implemented dashboards/ interpretation of results/suggestions for improvement	T11, T12	

15 Starting time (T0) is intended as the date in which the activity begins. The numbers given represent the month in which the activity will be completed counting from the starting time. For example, "T0, T0+2" means that the activity will begin at time T0, and will be completed two months later, i.e. counting 2 months from T0.

The proposed solutions are expected to be piloted on the Ispra site with the participation of the different stakeholders willing to contribute to these real-life experiments.

A measurement plan will also be elaborated to evaluate the results of the experimentation. A co-evaluation workshop will then be organised to discuss the main findings from the data measurement campaign, including an assessment of the overall impact of the proposed solutions and identification of potential improvements.

It must be highlighted that, in order to proceed with the proposed action plan, the support of the hierarchy is as important as staff engagement. It will therefore be of the utmost importance to ensure the following:

- ✓ management buy-in and adequate resource allocation (i.e. human, financial and technical resources);
- ✓ co-planning with key stakeholders.

The Living Lab is looking for colleagues who could devote a small part of their working time to the implementation of the action plan. Any colleague who is interested in innovating with the living lab team is welcome to contact the living lab coordinator.

5 Conclusions

The Living Lab *co-design* workshop held on 30 January 2020 was organised to engage the JRC Ispra staff in the co-development of three solutions to be piloted on site with the purpose of increasing energy efficiency, supporting the transition to e-mobility, and opening energy data to staff.

The event attracted the interest of numerous JRC colleagues, who provided useful perspectives and suggestions for the implementation of future solutions.

The present document summarises the main outcomes from the event, and proposes a structured action plan, addressing the following use cases:

1. Provision of incentives to use electric vehicles and pre-deployment of electric charging stations on-site;
2. Development of an Energy Monitoring System in Building 101;
3. Development of data collection strategies and visualization tools.

The identified actions (listed in section 4) – ranked in terms of priority and feasibility – will be brought to the attention of the JRC hierarchy, Site Management., and all potentially interested JRC contributors.

The proposed solutions are expected to be piloted on the Ispra site with the participation of all different stakeholders willing to contribute to these real-life experiments.

<u>It should be pointed out that, in order to implement the proposed solutions, management buy-in is a prerequisite to ensure the allocation of adequate financial, human and technical resources.</u>

Collaboration with motivated JRC staff is also essential for the success of the project. <u>The Living Lab team would appreciate voluntary collaborations from colleagues willing to devote a small part of working time to the implementation of the action plan.</u>

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List of abbreviations and definitions

BEMS	Building Energy Management System
DES-Lab	Living Lab for Testing Digital Energy Solutions at JRC
EVOCS	Electric Vehicles Open Charging System
GDPR	General Data Protection Regulation
KPI	Key Performance Indicator
PV	Photovoltaic (system)

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Annexes

Annex 1. Agenda of the Living Lab co-design workshop (30 January 2020)

08:30-09.00	Registration and coffee
09:00-09:10	Welcome and Opening of the Workshop (P. Szymanski, Director JRC.C)
09:10-09:20	Overview of the agenda (S. Tarantola, C.3)
09:20-10:00	Session I – The Living Lab projects in Ispra
	09:20 – Introduction to the JRC Living Lab project (N. Brinkhoff-Button, R.I)
	09:30 – Status of the JRC energy Living Lab project and description of the pilot use cases (A. Guimaraes Pereira, H.1)
	09:45 – JRC Ispra Infrastructures: current situation and development constraints (P. Di Ianni, R.I.4)
10:00-10:30	Coffee/tea break
10:30-12:00	Session II – Group working session: Identifying barriers
	Participants will be asked to discuss in groups the main barriers to development and uptake of the pilot use cases proposed.
	Case 1. Smart charging of electric vehicles (Setting the scene with a short presentation of EVOCS - Smart e-charging solution by Cartender s.r.l.)
	Case 2. Smart energy management system
	Case 3. What data are we interested in?
12:00-12:30	Plenary session
12:30-13:30	Networking lunch (buffet)
13:30-13:45	Sharing Cities - An integrated approach for the Smart City (Municipality of Milan)
13:45-15:45	Session III – Group working session: Co-designing solutions
	Participants will be asked to discuss possible innovative solutions and their features, as well as their potential for uptake.
	Case 1. Smart charging of electric vehicles
	Case 2. Smart energy management system
	Case 3. What data are we interested in?
15:45-16:15	Coffee/tea break
16:15-16:45	Plenary session
16:45-17:15	Wrap-up and final remarks
17:30	End of the workshop

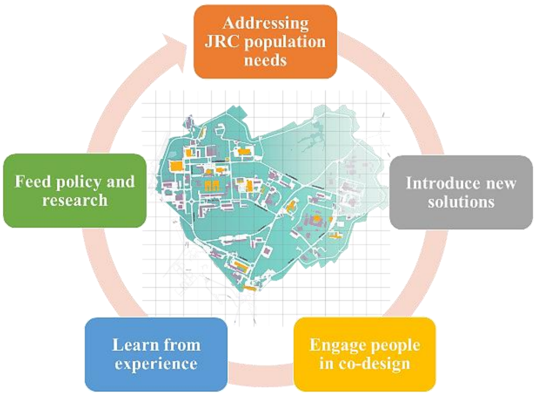
Annex 2. The Living Lab for Testing Digital Energy Solutions at JRC Ispra

A **Living Lab** may be defined as "*an innovation intermediary, which orchestrates an ecosystem of actors in a specific region. Its goal is to co-design products and services, in an iterative way, with key stakeholders in a public-private-people partnership and in a real-life setting. One of the outcomes of this co-design process is the co-creation of social value (benefit). To achieve its objectives, the Living Lab mobilises existing innovation tools and methods, or develops new ones*"[16].

In a smart city context, Living Labs are a modern instrument of open innovation that allows citizens – thus consumers – to participate actively in co-designing and successfully deploying innovative solutions with the aim of improving urban sustainability by addressing numerous aspects of everyday life, including energy, mobility, environment, and security.

Living Labs are a form of bottom-up, real-time and real-life experimentation of innovative solutions for urban planning and policy making. They are an ideal tool to overcome barriers to uptake, as they encourage the creation of user-centred environments. They are expected to test new solutions and so contribute to increasing the competitiveness of EU industry, and to accelerating the move towards a sustainable low-carbon and circular economy.

Figure A.2.1. The Living Lab concept at JRC



Source: JRC (2019).

The activities related to the **Living Lab for Testing Digital Energy Solutions (DES-Lab)** fall within the remit of JRC C.3 *Energy Security, Distribution and Markets*, which encompasses *inter alia* policy and research areas such as the energy system's electrification and digitalisation, interoperability of solutions and citizens' empowerment.

The objectives of the DES-Lab include:

- To become the first European Commission's testbed for evidence-based policy-making, taking advantage of the JRC's existing physical infrastructures, the direct involvement of the JRC community, as well as expert staff, and dedicated research facilities;
- To devise a methodology to support the development of smart cities;
- To promote best practices for citizens' energy communities by testing strategies to implement innovative services to citizens, and by providing hands-on demonstrations to town and city mayors;
- To deploy innovative solutions with the aim of improving citizens' quality of life and sustainability;
- To pilot and test the interoperability of innovative solutions from start-ups, Small Medium Entreprises (SMEs), private and public research organisations, in an independent, safe and real-life environment;
- To facilitate the identification of adequate regulatory frameworks to ensure proper smart city development and implementation;

[16] Mastelic, J. (2019), *Stakeholders' engagement in the co-design of energy conservation interventions: The case of the Energy Living Lab*, Doctoral Thesis, University of Lausanne

- To identify and fill possible gaps in standardisation at the EU level regarding smart city R&D activities;
- To contribute to the modernisation of JRC sites, in line with the Ispra and Petten sites' development plans for 2030.

Additional information on the Living Lab projects may be found at the dedicated section in Connected[17].

The JRC Ispra site and the DES-Lab project

With its 167 hectares, the JRC Ispra site is the largest of all JRC sites, with over 100 buildings and more than 2000 people present on site every day (with an additional 200 visitors per day). For its small town-like features, the JRC Ispra site is considered to be particularly suitable for the development and implementation of solutions designed and adopted using the Living Lab approach.

According to the JRC Ispra site development plan for 2030, and in line with UN Sustainable Development Goal #11 "*Make cities and human settlements inclusive, safe, resilient and sustainable*", the JRC is committed to becoming smart, open, sustainable, and efficient[18].

In order to reach such ambitious targets – and to turn the Ispra site into a smart city – a number of areas will need to be addressed, from smart grid/energy/utilities to smart transportation, from smart buildings to smart government and open data.

The Living Labs approach (with its associated open call for expression of interest) is one of the instruments to achieve this goal. Other initiatives include cooperation with policy DGs, H2020 project partners, and scientific collaborations with European universities and research centres for the development of specific smart city applications and management tools (e.g. Snap4ICity.org).

Concerning the JRC Ispra site energy data[19], in 2019:

- ✓ Primary energy consumption was 103'191 MWh (showing a continuous decrease since 2010, and now approaching the target of 96'248 KWh set for 2020);
- ✓ Electricity consumption was 35.501 MWh (similar to the yearly consumption of 13'100 EU households);
- ✓ CO_2 emissions amounted to 19.347 t.

In order to "*accelerate the process of making the JRC Ispra site more environmentally friendly, possibly even creating a smart green campus powered by renewable energy sources [….]*[20]", the JRC Ispra has made a commitment (for 2023 and 2030) to reach Eco Management Audit Scheme (EMAS) targets concerning energy used for buildings, non-renewable energy use, and CO_2 emissions from buildings.

In order to reach the set targets, a number of actions are planned/being put in place, i.e.:

- ✓ Revamping of the cogeneration plant: integration with smart grids and renewable local production;
- ✓ Photovoltaic panels: capable of producing progressively up to 35% of the electrical energy demand. Currently, there are five photovoltaic plants, producing 203 kWp; the set target is to achieve 2 MWp onsite by 2022;
- ✓ Electrical storage equipment: to be developed following the cost decrease;
- ✓ New heat pumps: for heating and cooling of buildings;
- ✓ Increasing the energy savings (energy management);
- ✓ Increasing the energy efficiency (refurbishment of buildings, new technologies).

A number of challenges also need to be carefully addressed, such as:

- ✓ Growth of the Ispra site and new energy loads, due to the construction and set-up of new VeLA facilities and the decryption platform (data centre);

[17] https://webgate.ec.europa.eu/connected/community/jrc/living-labs
[18] Introduction to the JRC Living Lab project, Presentation by Norbert Brinkhoff-Button (JRC R.I)
[19] JRC Ispra Infrastructures: current situation and development constraints, Presentation by Paolo Di Ianni (JRC R.I.4)
[20] Maschio, I., Bavetta, M. and Paci, D., *JRC Ispra site energy transition: Energy transition scenarios to 2030 for JRC Ispra site*, European Commission, Ispra, 2018, JRC113368

- ✓ Obsolescence of buildings and infrastructure. More than 50 % of the buildings of low energy efficiency class (D to G). On the contrary, new buildings or recently renovated buildings are highly efficient (or even nearly zero energy buildings);
- ✓ Contemporaneous use of labs (which results in an increase of peak power);
- ✓ Limited options for renewable energies on site;
- ✓ Interdiction to export electricity to the external electricity grid.

At present, there are 12 charging stations (with 21 charging plugs) inside the Ispra site used for the JRC internal fleet. Another two charging stations (and four charging plugs) - located outside the JRC fence - are available to the general public.

An energy management system is already in use at JRC Ispra, provided and maintained by an external company. It mainly consists of systems for monitoring both energy consumption in a number of buildings, and energy production (from cogeneration plant and from PVs).

Annex 3. The Living Lab process and adopted methodology

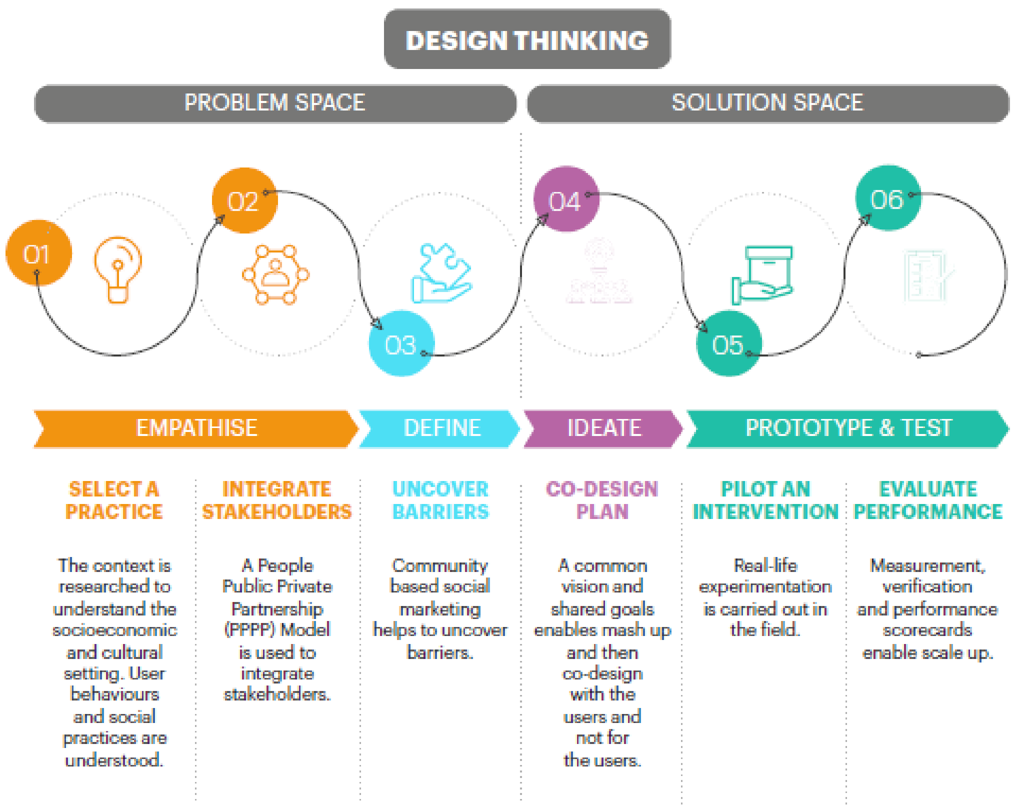
Living Labbers come from different disciplines and bring with them their own theoretical frameworks, methods and tools. There is no unique process in Living Labs but a combination of transdisciplinary processes. A user experience designer, a social marketer, a service designer, an energy engineer will develop a unique way of co-designing with stakeholders in a Living Lab.

In order to be named "Living Lab", different criteria are required, and a standardised certification process is proposed by the European Network of Living Labs (ENoLL). Only Living Labs that have passed the certification process are allowed using the label ENoLL. Four main principles drive these criteria: (1) User centric design, (2) Participative governance (Public Private People Partnership), (3) Real life experimentation, (4) Co-design with key stakeholders.

The Energy Living Lab[21] from the University of Applied Sciences Western Switzerland (HES-SO) has been created in 2014 and develops applied research projects and services in energy management. It is focused on energy efficiency, energy conservation, development, and spreading of renewable energy.

The Energy Living Lab has developed the **Living Lab integrative process** (Figure A.3.1). It is a unique combination of design thinking, social marketing and social practices theory. It has been experimented in the energy field but also in environment (Living Lab for Positive Economy), in the inclusion (Living Lab for disabilities), in the mobility sector (Mobility Lab). It is composed of 6 phases: (1) Select a practice, (2) Integrate stakeholders, (3) Uncover barriers, (4) Co-design a plan, (5) Pilot and intervention, and (6) Evaluate performance.

Figure A.3.1. The Living Lab Integrative Process[22]



Source: Adapted from Mastelic, J. (2019).[23]

[21] www.energylivinglab.com

[23] Mastelic, J. (2019), *Stakeholders' engagement in the co-design of energy conservation interventions: The case of the Energy Living Lab*, Doctoral Thesis, University of Lausanne

Detailed implementation of the Living Lab Integrative Process

From the operational point of view, a more extensive explanation of the steps that constitute this integrative process is given in the following.

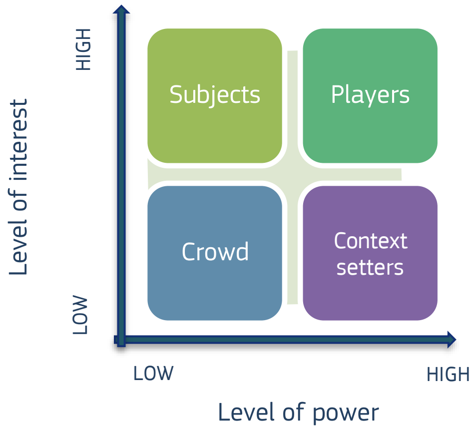
- **Selecting a practice**

This step consists in studying the available data on the energy service. What practices have a strong impact (either in positive or negative terms) on the efficiency of the energy service? Try to define the root causes of the problems, and not just the symptoms.

- **Integrating stakeholders**

Make a list of the stakeholders who have an influence on the energy service (e.g. end users, energy service provider, and/or financial managers). Try to place them in a *power/interest matrix (Bryson, 2004)* (using own assumptions), shown in Figure A.3.2.

Figure A.3.2. Power/interest matrix



Source: Adapted from Eden & Ackermann in Bryson (2004)[24].

- **Identifying barriers**

In this "empathising" phase, the goal is to better understand the challenge ("*problem space*"). What are the barriers and levers of action of these actors towards efficiency? There are two objectives in the Living Lab: (1) Increase the level of power (empowerment of the "crowd" and the "subjects"), (2) Increase the level of interest (engagement of the "crowd" and the "context setters"). The key stakeholders become "players" for the co-design phase.

- **Co-designing the solution**

Bring together the key players (using for instance, workshops, world cafés, BarCamps methods), and ensure that the four types of actors (public authorities, companies, citizens/users, and academics) are invited. Work towards developing a common vision and shared objectives for the energy service. Co-develop solutions *with* users, not *for* users (using design service, design thinking, crowdsourcing, etc.). Adapt the vocabulary to an audience with a low level of energy knowledge.

- **Piloting an experiment**

Test the co-designed solution in the field and not in offices! Collect feedback to improve the energy service (by means of interviews, ethnographies). Perform as many iterations as necessary without waiting for a final prototype (agile methods).

[24] *Bryson, J. M. (2004). What to do when stakeholders matter: stakeholder identification and analysis techniques. Public management review, 6(1), 21-53.*

- **Evaluating Performance**

Define the measurement and verification plans before the pilot (e.g., International Performance Measurement and Verification Protocol, IPMVP), and evaluate the results regularly. Triangulate the data to verify the conclusions (qualitative/quantitative, simulations/real consumption data, etc.).

- **Communicating results and replication**

Communicate the results of the project to all stakeholders and celebrate success with them (media communication, end-of-project events, etc.). Share the success to allow others to replicate it (open innovation, open science).

The methodology adopted to the JRC Living Lab project

The JRC has tested the method in Ispra with specific actions:

Ideation workshop: an *ideation* workshop has been organised on May 14th, 2019. It was necessary to better understand the context and the preliminary thoughts of the staff related to energy transition on the site. This workshop has allowed the selection of three social practices to work on in the LL: (1) Commuting with individual vehicles, (2) Consuming energy in buildings, (3) Opening the data and using data for decision making.

Engagement or co-design workshop: The second phase consisted in opening the JRC to the external world (Open Innovation) to allow the integration of external stakeholders such as start-ups (invited to collaborate in a call for interest), nearest cities such as Milano, researchers from other universities... This co-design workshop described in detail in this document has allowed the key players to gather, reflect on the barriers and drivers and co-design an action plan for transition in Ispra.

Pilot experimentations: three pilots have been co-designed during the engagement workshop. Staff who declared an interest will be "empowered", integrated in projects teams. The city of Milan will share best practices from their experience, the start-up Cartender will co-design and test its electric chargers on site.

Follow-up workshop: a third workshop will be proposed in due time to follow the implementation, reflect on the pilots, share the learnings and continue the development on site. Key performance indexes will be followed closely by the Living Lab team and shared with the stakeholders.

The *Co-design* Workshop

The co-design workshop has been separated in two parts: the morning session was focused on developing a common vision with the stakeholders on the challenge, barriers and drivers. A world café has been used to discuss on the main barriers and drivers and on their intensity (ranking). During the afternoon, the co-design session has been based on an ethnographic tool: the ***seven step-stones to innovation***. After an ideation phase to reflect on potential actions that could be piloted in Ispra, a screening of these actions has been performed.

The Seven Step-stones to Innovation

Ethnographically inspired, the methodology – originally developed by Human Centricity at the École Polytechnique Fédérale de Lausanne (EPFL) - is based on seven perspectives, or "stones" that serve as criteria for anticipating the **success or rejection of a product/service**. It can be used with a pre-existing product/service/plan or before the development to support ideation.

The seven elements are the following:

1) **Practical usefulness** of the product. A product will increase its adoption rate if it offers something more in terms of efficiency, performance, time savings and effort: a more efficient product can replace one that is less efficient;

2) **Economic utility.** The user will obviously compare the cost of purchasing, using (e.g. electricity consumption) and maintaining the new product/service (e.g. repair parts) with the one they already use or with other products on the market.

3) **Ease of use.** The product must be as intuitive to use as possible, with a very short learning curve: the ultimate goal must be something that does not require a manual or specific technical knowledge.

4) **Impact on habits.** A product that calls on the user to radically change their habits without necessarily bringing more value is most likely to fail.

5) **Emotional attachment** towards the product or service. What is the relationship between the user and the product? Different types of emotions are linked to the use of a product: happiness, guilt, pride, etc.

6) **Impact on social life**. A product/service should help our social desirability. Depending on the type of product, it should make us "cool", friendly, kind, "chic", in brief, give us a social image that we consider positive depending on the circumstances.

7) **Physical space** required by the product can be a driver or a barrier. In the energy field, the context of use can have a strong impact on the product/service/plan. The default setting must be carefully analysed.

Figure A.3.3. The Seven step-stones to innovation

Source: Human Centricity, the École Polytechnique Fédérale de Lausanne (EPFL) (2014).

Annex 4. Feedback from the participants and lessons learned

A co-design workshop similar to that held in Ispra is due to take place at JRC Petten to co-design experiments to be piloted on that site. Lessons learned from the JRC Ispra workshop would therefore be key to improve the current Living Lab process.

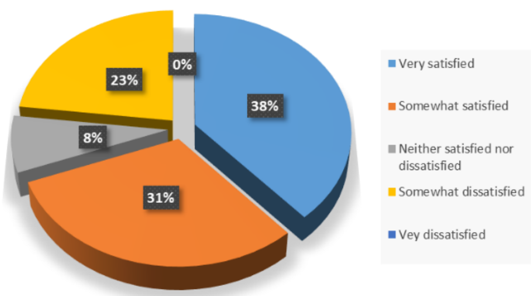
The main lessons learned are outlined in the following:

- ✓ A **definition of "Social practice"** is missing. Not all the working groups understood the notion of social practice. This will be duly clarified at the next workshop in Petten.
- ✓ **Stakeholders' analysis**: the working group sessions had begun with the barriers' identification, assuming that the stakeholders had already been identified them in the first phase (i.e. the first ideation workshop and the following preparation meetings). Time allowing, at the next workshop, a list of the stakeholders will be compiled with the participants and will then be placed on a power/interest matrix. Some stakeholders may have been forgotten, the perceptions of the participants about the power and interest of the different stakeholders' groups adds more value when carried out in groups.
- ✓ A **template for the action plan** could be prepared: what are the next steps? What are the requested resources (financial/human/physical)? What would be the deadlines? What are the Key Performance Indicators? This aspect would demand more time from the participants.
- ✓ Having **two groups working on the same subject** was particularly positive. It enriched the input on the barriers and drivers, it gave the opportunity to compare the outcomes, and check whether these were converging. It also encouraged more discussions in smaller groups. For the last working session, when the two groups working on the same subject were merged, less interactions, seemingly took place, as shown also from the feedback received from participants (see section below).
- ✓ The participants stayed until the end of the day and the room was nearly full for the presentation of the outcomes. This showed a **high level of engagement** that must be maintained over time, during the pilot phase.
- ✓ The **rules must be explained and repeated**: participants are not allowed to propose solutions at the stage of barriers' and drivers' understanding; ideation and prototyping come afterwards, when the barriers are really understood and prioritized (design thinking phases).

Feedback from the participants

Feedback from the participants was collected through a dedicated EU survey, on a voluntary basis[25]. Around 30% of the attendees replied to the questionnaire[26]. The main results are outlined below.

Figure A.4.1. Overall satisfaction with working groups' discussions



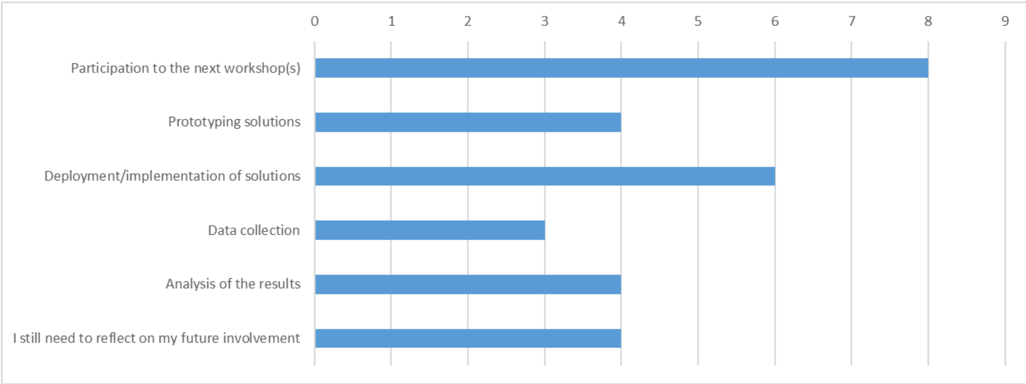
Source: JRC (2020).

Eleven out of thirteen participants declared their **willingness to continue to participate** to the activities for the development of the Living Lab, on many different aspects. Their intentions are shown in Figure A.4.2.

Many participants expressed their intention to participate in more than one type of activities, and this is reflected in the following charts. It shows the empowerment of the staff, willing to take part in the next steps.

[25] Feedback was requested <u>only</u> to JRC staff. No feedback was collected from external participants.
[26] As of 14 February 2020.

Figure A.4.2. Contributions to future Living Lab activities



Source: JRC (2020).

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