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LANTERN

LIVING LABS INTERFACES
FOR THE ENERGY TRANSITION

SWEET Lantern Onboarding booklet

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Abbreviations & Acronyms

2IESCAP	Institutionalized Integrated Sustainable Energy and Climate Action Plans
AOTF	Action-oriented Task Forces
BAPV / BIPV	Building Applied Photovoltaics / Building Integrated Photovoltaics
BIM	Building Information Modelling
BM	Business Model
CBP	Capacity Building Programme
CVC	Computer Vision Center
DC	Direct current (about power supply)
EbAs	Ecosystem-based Approach solutions
EC	Energy Community
EIB	European Investment Bank
ELLA	Energy Living Lab Association
ENoLL	European Network of Living Labs
GHG	Greenhouse Gas
GM	Governance Model
HES-SO	University of Applied Sciences Western Switzerland
HEPIA	Geneva School of Landscape, Engineering and Architecture
IMP	Innovation Management Plan
IPR	Intellectual Property Right
IT	Information Technologies
JRC	Joint Research Centre
KTT	Knowledge Technology Transfer
KWMC	Knowledge West Media Centre
Lantern	Living lAbs iNTerfaces for the Energy tRansitioN
LEC	Local Energy Community
LL	Living Lab
LLIP	Living Lab Integrative Process
MCA	Multi-Criteria Analysis
MIT	Massachusetts Institute of Technology
MOU	Memorandum of Understanding
oPEN Lab	Positive Energy Neighbourhoods (PENs), EU-funded project
PEN	Positive Energy Neighbourhood
PPPP	Public-Private-People Partnership
PV	Photovoltaics
SFOE	Swiss Federal Office of Energy
SME	Small and Middle Enterprises
SRL	Societal Readiness Level
SWEET	Swiss Energy research for the Energy Transition
SWOT	Strengths and Weaknesses, Opportunities and Threats
TRL	Technology Readiness Level
UAB	University of Barcelona
WG	Working group
WP	Work Package
WPL	Work Package Leader
ZHAW	Zurich University of Applied Sciences

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LIVING LABS INTERFACES
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I.
LIVING LAB THEORY & FUNDAMENTAL

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1. WHAT IS A LIVING LAB

1.1 DEFINITION

A Living Lab is an **'innovation intermediary' that orchestrates an ecosystem of actors in a specific region.** Its **objective is to co-design solutions in an iterative way in a public-private-people partnership (PPPP**) **and in a real-life environment**. To achieve its objectives, the Living Lab **mobilises existing innovation tools or develops new ones**. (Mastelic, 2019)

Five meanings for which the concept of Living Lab is used (Dutilleul et al., 2010):

- an innovation system;
- a real-life social setting;
- an approach for user involvement in innovation;
- an organisation facilitating living lab approaches;
- the European living lab "movement".

1.2 LIVING LAB PRINCIPLES

Value	Influence	Sustainability	Openness	Realism
Public Authorities & Stakeholders in terms of meeting their planning, project or business value. People in terms of improvement of life quality.	Launching of the decision-making process beyond Stakeholders participation, involvement and engagement.	Meeting the needs, with regards to LL processes goes beyond environment and resources and builds on creating relationships for the present and the future.	Collaboration between people of different backgrounds, perspectives, knowledge and experience that secure faster and feasible integrated sustainable energy planning.	Generations of solutions and results that are valid for a particular context and an integrated sustainable energy planning.

(Adapted from Habibipour, 2018)

1.3 LIVING LAB CHARACTERISTICS

A Living Lab :

- **operates as the orchestrator within the ecosystem to connect and partner up with relevant stakeholders**.
- Is **actively involves stakeholders in each phase and in relevant activities,** ensuring their insight is captured and implemented throughout the whole lifecycle of the innovation.
- values are co-defined in a **bottom-up process**, not only for but also by all relevant stakeholders, ensuring a higher adoption at the end.
- operates in **open innovation ecosystems in the real-life setting** of the final users, infusing innovations into their real-life instead of moving the user to test sites to explore the innovations.
- Each Living Lab activity is **problem driven**. Therefore, the methodological approach towards every individual activity is selected based on the expected outcomes of the activity and the stakeholders who needs to be involved. A Living Lab uses tools from different **disciplines and creates new ones.**

(Adapted from Schuurman, 2015)

1. WHAT IS A LIVING LAB

1.4 LIVING LAB BENEFITS & CHALLENGES

Benefits

- Co-creating new solutions with users
- Mastering the value chain of the given project
- Identifying key stakeholders' values
- Providing methods and tools to guide stakeholders

Challenges

- Theoretical & methodological challenges
- Governance & Process-related issues
- Actors' motivation, need and expectations not always satisfied
- Ethical challenges with participant's data

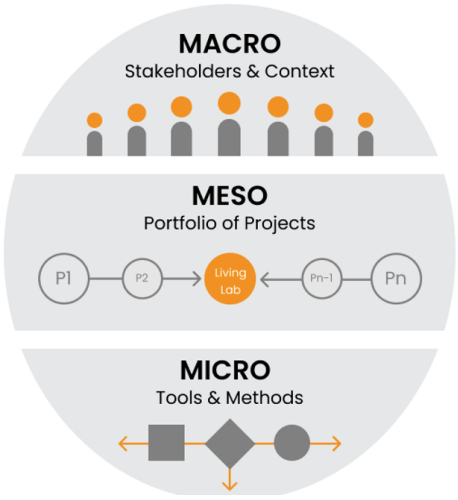
(Habibipour, 2019)

1.5 THREE-LAYER MODEL

One of the most important Living Lab concepts is the so-called "Three-layer Model". Living Labs act at different levels and this is our conceptual representation of it.

- The **MACRO level is where we will talk about Stakeholder and Context analysis.**
- The **MESO level will consider the different projects that could be managed by the Living Lab**.
- The **MICRO level refers to the specific Tools and Methods available to support and to help fulfil activities and projects taken on by the Living Lab.**

It is important to mention that there is no hierarchy between these three layers. For example, the use of Tools within your MICRO level during the projects' development, will support Stakeholder and Project management.



- Stakeholders' management
- Context analysis
- Governance model for the Living Lab

- Creation of Regional Living Labs
- Development of SECAPS

- PESTEL, SWOT
- Participative Workshops
- Interviews & Surveys
- Interest-Influence Matrix

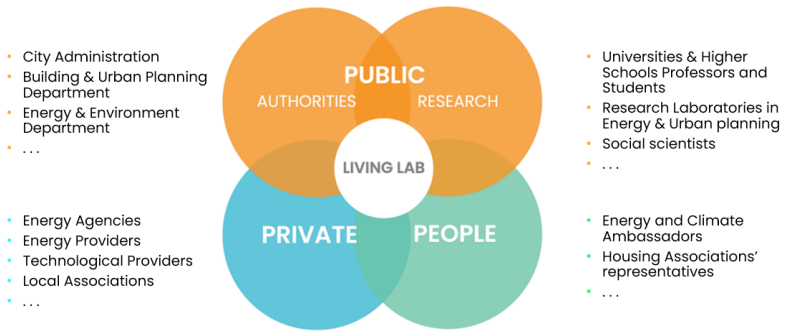
(Adapted from Schuurmann, 2013)

1. WHAT IS A LIVING LAB

1.6 QUADRUPLE HELIX MODEL

In Living Lab methodology, we consider the perspectives of each stakeholder area.
There are **4 different stakeholder areas** and for this reason, we call it the Quadruple-Helix model, consisting of:

- The **Public** sector concerning **Authorities:** this will include all institutions at local, regional and national levels together with the government, the **Research and Academic** sector, that includes for example, Universities.
- The **Private** sector: companies and businesses, of all sizes
- The **People** comprise the citizens as individuals.



Example of Stakeholders from 2iSECAP project

1.7 ROLES & TYPES OF STAKEHOLDERS

This table presents the different types of actors to be considered in setting up and running a Living Lab.

- **Utilizers** are those who will use the Living Lab methods to create innovative solutions. These might hire a Living Lab team to develop a project.
- **Enablers** are the resources providers, such as cities.
- **Providers** could be private companies.
- **Users** are the citizens who will be affected by the project work.
- **Researchers** are mostly representatives of the universities who generate and structure knowledge of the Living Lab.

These actors will vary according to each project.

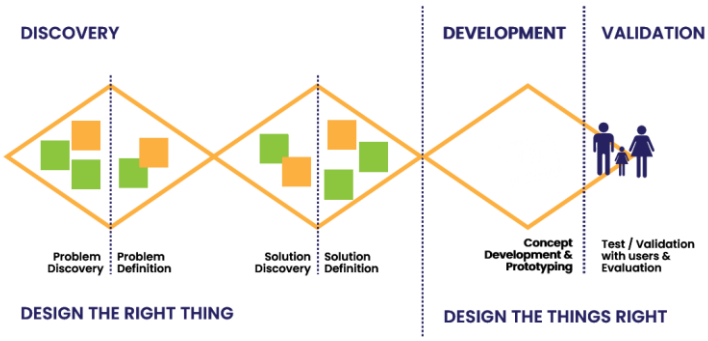
Utilizers	"Customers" of the Living Lab who use it to co-create innovations.
Enablers	Resources (financial) providers or facilitators to sustain the Living Lab activities.
Providers	Infrastructure or service providers to be used in Living Lab projects.
Users	Participants of the Living Lab activities (inhabitants).
Researchers	Knowledge generators of the Living Lab (user & stakeholder co-creation).

Adapted from Leminen, Westerlund & Nystrom (2012)

2. LIVING LAB INTEGRATIVE PROCESS

2.1 ORIGINE OF THE LIVING LAB INTEGRATIVE PROCESS

The Living Lab Integrative Process, presented in the next section is originally based on the **Design thinking approach**. Design thinking is an iterative process in which creators search to understand their users, challenge assumptions, define problems, and create innovative solutions by prototyping and testing.
Design Thinking is a continuous process with the participation of users.



2.2 LIVING LAB INTEGRATIVE PROCESS (LLIP)

The LLIP consists of three stages: **The Problem Space, The Solution Space,** and a recent addition, **the Deployment space.**
Each stage contains action steps, annotated below on this flowchart. There are **7 steps in total and the process works by iterations;** we move through the steps depending upon our circumstances. For example, if we already have a list of ideas for our project, we can start prototyping and testing. The process should flow, if we have tested our solution and understood that some function is not working properly for our users, we modify it and try again, eg test the adapted solution, see what happens, and so on until we have a desirable, viable, and feasible project.

Problem space		Solution space			Deployment space	
Empathise	Define	Ideate	Prototype	Test	Implement	Scale up
Select a practice: The context is researched to understand the socioeconomic and cultural setting. User behaviours and social practices are understood.	**Integrate stakeholders**: A People Public Private Partnership (PPPP) Model is used to integrate stakeholders.	**Uncover barriers**: Community based social marketing helps to uncover barriers.	**Co-design plan**: A common vision and shared goals enables mash up and then co-design with the user and not for the user.	**Pilot an intervention**: Real-life experimentation is carried out in the field.	**Evaluate performance**: Measurement, verification and performance scorecards enable scale up.	**Demonstrate the system**: Actual system proven in operational environment.	**Exploit the solution**: Test the solution outside the initial scope. Enlarge the solution, pollinate it and replicate it in other settings.

(Adapted from Mastelic, 2019)

2. LIVING LAB INTEGRATIVE PROCESS

2.3 CAPACITY BUILDING HANDBOOK

If you want to know more about:
- How to set up a living lab
- International Use cases of Living Labs and best practices
- How to co-create and co-design with your users
- Stakeholders' ecosystem management
- Governance model
- Business Models
- Tools & Methods from the Living Lab Integrative Process
- Toolbox from oPEN

>> Check this completed guide:
HES-SO, OPENLAB project (2023). Capacity building handbook and mentoring report by the OPEN project

Summary:
This Capacity Building Handbook and Mentoring Report is a practical guide to support setting up and implementing Positive Energy Neighbourhoods (PENs) using a Living Lab approach. As important drivers of transformational change for the successful decarbonisation of the European building stock, PENs seek an integrated, participatory and neighbourhood-based approach to maximise the impact of innovative energy systems. Living Labs facilitate this change by co-designing solutions with citizens through open and user innovation.
Through the oPEN Lab project, three Living Labs at Genk (Belgium), Tartu (Estonia) and Pamplona (Spain) have been working extensively to establish their Living Labs focused on PENs' development. This Capacity Building Handbook summarises the methodology and key outcomes of applying Living Lab concepts, methods, and tools in the three oPEN Labs from September 2021 to March 2023. It also presents multiple examples from existing Living Labs around Europe.

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II. SWEET LANTERN

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3. CONTEXT OF THE SWEET LANTERN

3.1 SUMMARY

The project **assesses the relevance of socio-technical aspects, e.g. social practices, use of technologies, norms and context of use with respect to the sustainable energy transition in Swiss households, leisure activities and workplaces.** In **real-life Living Labs, corresponding new services, programs and policies will be co-designed, tested and validated on different scales** (e.g., in homes, institutions, districts, or city level).

3.2 STORY OF THE MAGIC LANTERN

The “Magic Lantern” is a 17th century invention. It allowed, thanks to a source of light, to project an image on a wall. It is the ancestor of the slide projector and has given rise to numerous successive innovations. At the time of its invention, it fed the fears of the citizens, who took it for a supernatural manifestation. Three centuries later, we still benefit from this extraordinary invention. **The LANTERN proposal also wishes to help citizens and stakeholders to project themselves into the future, to imagine desirable futures collectively** (Giunta, Cattaneo, Scolozzi, 2021), as a fundamental condition for the success of the energy transition. Resistance to change will be studied and considered in the development of real-life interventions, to overcome fears and barriers to action, as it was the case for the magic lantern and its incredible evolution over the centuries.

3.3 WHY THE SWEET LANTERN ?

The SWEET Call 1-2021 provides a unique opportunity to **investigate new ways of living and working with energy use**, in a conjuncture of profound uncertainty and crisis, marked by the COVID-19 pandemic, climate change and pressing political agendas (the 2030 Agenda for Sustainable Development, the Paris Agreement, Switzerland's energy strategy 2050 and 2050+). The climate change crisis and our dependence on non-renewable resources highlight the **need for urgent and profound changes in our societies** if detrimental impacts from severe climatic events, shortages, lack of social justice and the potential political instability induced by all these are to be prevented. In Switzerland, more than **half of the annual greenhouse gas emissions are caused by buildings and mobility** - the largest CO2 source of the country with minor changes achieved so far during the last years (BAFU, 2021).

In the **building sector,** low energy or positive-energy buildings, energy retrofit technologies, low-tech cooling systems and efficient tiny houses can lead to substantial large-scale CO2 reductions. In **mobility**, replacing fossil fuel vehicles with electric ones charged with renewable electricity sources can, too, lead to fast decarbonisation. Further, **digitalisation** and its applications in automated and smart energy systems have the potentials for higher efficiency in building energy consumption and corresponding energy (both, renewable and non) savings – if users are properly included in their design and implementation. Despite the growing awareness regarding future sustainability challenges, **current transformation trajectories are not sufficient to meet the required targets** (see the last IPCC Assessment Report (2021) and the conclusions of UNFCCC COP26). In mobility, while the share of electric vehicles in sales of new cars is growing, the daunting challenge of renewing the entire fleet remains unsolved. Moreover, simply replacing fossil fuel cars with electric technologies will not solve growing congestion problems when considering Switzerland’s expected population growth and its strongly car-centric transport system. In the building sector, energy savings obtained through efficiency measures are often compensated by rebound effects (Lange et al, 2021; Santarius, Walnum & Aall, 2018) leading to an overall marginal reduction in energy consumption.

3. CONTEXT OF THE SWEET LANTERN

Hence, next to introducing new technologies with a clear understanding of the socio-technical framework required for its successful diffusion on the large scale, **sufficiency in addition to efficiency will be required for the sustainable decarbonisation of Switzerland**. In this context, a number of trends and approaches offer great leverage opportunities (Sandberd, 2021). New work forms like working from home, remote and co-working, as well as down-shifting offer the possibility to re-think working and living (including shopping, leisure and recreation) locations to less carbon intensive options. Today citizens have greater opportunities for joining energy cooperatives, participating in co-owned renewable energy production and taking on the role of energy prosumers. In **mobility,** electrification in conjunction with the new sharing economy and the creation of a strong and flexible public transport system through mobility-as-a-service approaches can play a crucial role in abandoning the current car-centric system. Finally, new **values and lifestyles** combined with the current heightened environmental awareness can foster sufficient behaviour in all activities. Adapting the current energy system to the needs of society will not succeed without reflections and actions to adapt our needs to limited resources and technologies.

The rejection, in June 2020, of the referendum for the amendment to the CO2 Act has revealed the urgent need for the scientific community to not just "bring evidence", but also to engage with the public towards more creative and more inclusive solutions for the decarbonisation of the country. The main ambition of Lantern is therefore to provide "**interfaces**" that connect energy research in multiple ways: connecting fields of knowledge separated by disciplines; connecting science, society and territories through Living Labs as "innovation intermediaries" (Mastelic, 2019); re-connecting innovative ambitions with the daily concerns of citizens through participatory research and social sciences (Loloum, Abram and Ortar, 2021). It will do so by applying inter- and transdisciplinary R&D at the intersection of markets, technology, policies and society. Lantern follows a threefold strategy of energy transition, relying on **efficiency, consistency, and sufficiency**. This will be achieved by not only fostering technological innovation, but also by exploring low-tech and no-tech solutions that rely on social innovation (Hargreaves et al, 2013). Additionally, while economic competitivity is crucial to ensure the deployment of energy efficient products on the market, we will also explore alternative economic models (e.g. sharing economy, circular economy) compatible with post-growth or net-zero economic growth scenarios. Overall, Lantern targets three fields of actions to decarbonise the energy system: a) **actions to change users' and citizens' practices and values**; b) **actions to change the regulatory framework and institutions**, c) **actions to change technical artefacts and material conditions** (Geels, 2004, Geels et al, 2015, Köhler et al, 2019). Lanterns interventions take place across several territorial scales, economic sectors and social contexts.

3.4 HOW TO ACT ?

These actions will be developed and implemented with the following objectives:

1) to **investigate** the energy implications of new ways of living and working;
2) to **connect** science (and its disciplines), society and the territorial articulation of Switzerland;
3) to **reduce** CO2 emissions and energy consumption (both fossil and renewable) through efficiency and sufficiency measures;
4) to **transfer** and replicate the know-how, tools and solutions developed beyond LANTERN and into Swiss society in its broadest terms.

Specific goals of the consortium (detailed in 4.2) include improvement of participatory research and co-design methodologies (WP3), empowerment of users in increasingly digitalised and flexible energy systems (WP4), reduction of energy demand in changing work-life balance and work-home spaces (WP5), decarbonisation of mobility (WP6), acceleration of energy retrofitting (WP7), increase of renewables through energy communities and energy cooperatives at district level (WP8), decarbonisation of cultural imaginaries and reduction of energy consumption in recreational time (WP9), integrated monitoring of impact (WP10).

4. SWEET LANTERN PROJECT

4.1 STRUCTURE OF THE CONSORTIUM

The LANTERN consortium is composed of **5 Urban Living Labs, 5 cities and other public sector institutions (canton, region), 2 universities, 4 universities applied sciences, 1 ETH, 41 companies and cooperation partners and 4 associations**. It reflects the diversity of the Swiss ecosystem and covers three linguistic regions with the main urban areas represented: Geneva, Sion in the French part; Lucerne, Winterthur, Zürich in the German part; Lugano in the Italian part. The added value of this consortium lays in its breadth, **integrating actors from the quadruple helix** (see 1.4).

4.2 OBJECTIVES AND HOW TO ACHIEVE THEM

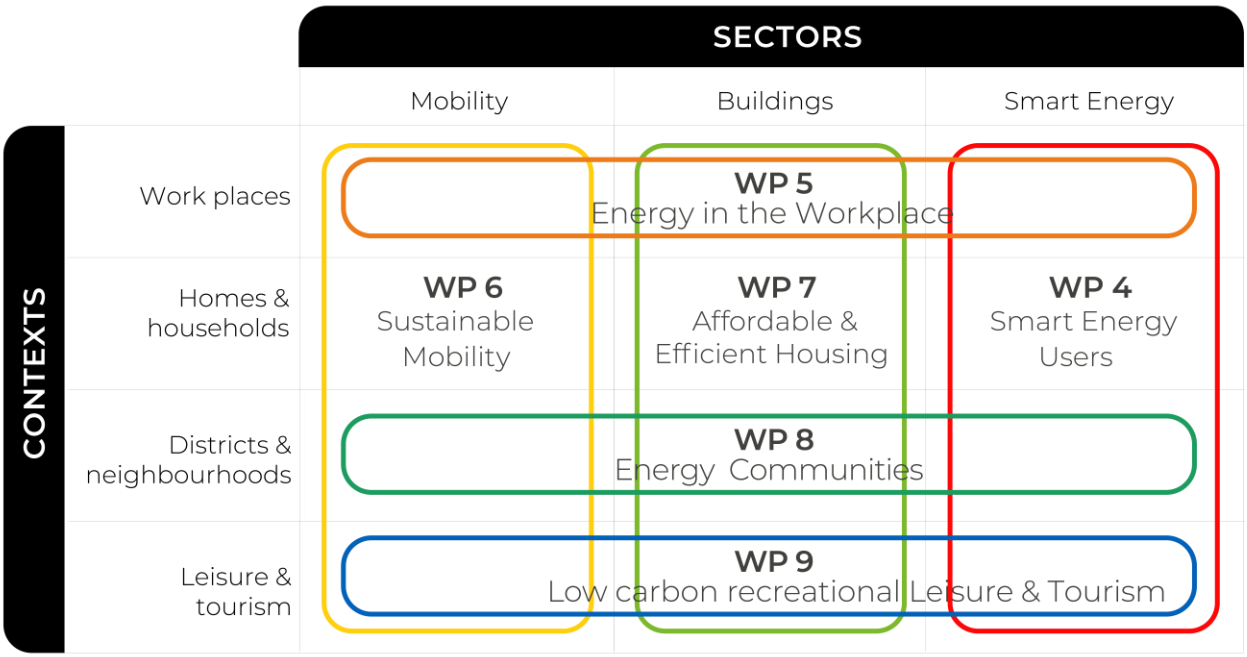
The aim of the LANTERN proposal is to co-design, test, validate, and scale up a portfolio of interventions for a user empowered, decarbonized, resource efficient and sufficient Switzerland. We will achieve it **through inter- and trans-disciplinary applied research** and development at the interface of markets, technology, policies and society. We will achieve our objectives through:

- A **strong governance** based on the different committees, our experience in leading national and international programs
- **A large and unique network of cooperation partners and Urban Living Labs (ULL), the involvement of public authorities (cantons, cities and communes)**. This enables us to tackle complex and wicked problems. Five of our running Living Lab partners are labelled by ENoLL (NEST, Energy Living Lab, Mobility Lab, iHome Lab, Lugano LL). The integration of the citizen at the beginning of the value chain with co-designed methods based on science is central in the LANTERN consortium (Living Lab Integrative Process).
- The **right interfaces and a dedicated work package** supporting the set-up and the scale-up (WP2) from the applied research projects in ULLs, to pilot and demonstrators (P&D), and impacting the society with replication, exploitation and dissemination activities in WP11. We acknowledge the importance of consistently monitoring successes and failures in the portfolio of interventions (WP10 Impact assessment), replicating the best practices and learning from the failures. The program shall as well perpetuate its effects after the funding period and increase its impact in the long-term.
- **Excellence in applied research**: the academic partners, from recognised institutions with scientific as well as innovation backgrounds. We combine theory building and quasi-experiment in ULLs with a transdisciplinary approach.

4. SWEET LANTERN PROJECT

4.3 STRUCTURE OF THE PROJECTS' PORTOLIO

Lantern pulls together a full system of actors to coordinate (WP1) a portfolio of six **applied research projects** (WP 4-9) aimed to investigate new ways of living and working with energy and to codesign solutions through urban Living Labs, fostered by harmonized methodological process, the **Living Lab Integrative Process** (WP3). The results of the R&D projects are tested and showcased through six **Pilots and Demonstrators (P+D)** set to grow further during the project. WP2 concentrates efforts to **"set-up"** a shared understanding of the LANTERN's scientific approach among applicants and partners, and to support **replication and upscaling** within and beyond LANTERN. WP10 provides an integrated impact assessment for specific interventions in the short, medium and long terms at WP and programme level. It is formative and delivers feedback to the R&D work package leaders. WP11 provides an efficient communicational concept, including KTT channelled towards scale up and dissemination towards the wider public.



The overall structure of the work plan has been co-designed with the consortium following an **agile method** to align the different partners on a common vision**. The R&D projects have been developed according to a thematic matrix in the figure above intersecting the most energy intensive sectors of activity (mobility, buildings, digital) and the social contexts of energy use** (work, neighbourhood, leisure). This **integrated approach contemplates context-specific solutions**: living and working temporalities and spatialities, while allowing transversal replicability and upscaling at the sector level. Results from R&D projects will be merged within dedicated P+Ds

The projects will interact through thematic interfaces (joint workshops, publications and collaborations between contextual and sectoral WPs), but also through territorialised interfaces, the Living Labs. Each R&D WP, in turn, relates to several LLs, P+Ds and other projects (SFOE, SNF, H2020, etc.).

4. SWEET LANTERN PROJECT

4.4 PRESENTATION OF THE WORKPACKAGES

The project is divided into different work packages (WPs) managed by WP Leaders.
The Lantern consortium adopts a participative governance approach, based on autonomy, transparency, feeling and responding to change, and human interactions at the core. Coordination is key in the participative governance as we follow the principles of self-managed organisations.

WP1 – Program Management and Coordination
WP1 provides the organisational support necessary for a successful project operation and implementation. This includes coordination and monitoring actions, project planning and progress control, internal collaboration, organisation of project meetings, management of the digital workspace, community management, administrative, technical and financial reporting, data, ethics and quality control and risk management, innovation management, impact monitoring, establishing and maintaining links to SFOE, as well as with related SWEET programs and other Swiss and EU initiatives.

WP1 Leaders: Joëlle Mastelic & Tristan Loloum

WP2 - Set-up and scale-up
WP2 has two main objectives: assessing the replicability within the Living Labs, which are situated in different cities and linguistic regions and are on different scales and maturity levels; applying trans-disciplinarity in the energy theme spans scales, sectors of activity and social contexts. In this WP, the transferability of solutions will be ensured from research to a real-life setup beyond existing and involved Living Labs.

WP2 Leaders : Ludger Fischer & Yousra Sidqi

WP3 – Living Lab Methodologies
Living Lab Methodology at the Macro and Meso levels, as well as the development of research methods and tools (Micro Level) for the set up, scale up and evaluation of energy living labs and the research they are supporting.

WP3 Leaders : Fiona Zimmermann & Anton Sentic

WP4 – Smart Energy Users
We define and test the potential benefits (efficiency, sufficiency, and resilience) of sharing data between energy consumers and digitalized energy systems. We define consumers and incentives for sharing data, assess the value of data for forecasting and system resiliency, and test in a living lab.

WP4 Leaders: Devon Wemyss & Philipp Heer

WP5 – Energy in work
WP5 explores energy saving potential of new working models of office jobs, i.e., new ways of where, how, when, and how much people work, with a particular emphasis on efficient and reduced use of working.

WP5 Leaders: Sebastiano Maltese & Evelyn Losiger-Kägi

4. SWEET LANTERN PROJECT

WP6 – Sustainable mobility
This WP adopts an avoid-shift-improve-replace approach to co-design and implement interventions for the sustainable transformation and deep decarbonization of Swiss mobility while guaranteeing high quality of life across all social and territorial strata.

WP6 Leader: Andrea Del Duce

WP7 - Affordable & energy-efficient housing and retrofitting
New strategies need to be found for energy retrofitting of the housing sector with the objective of near complete decarbonisation while ensuring affordability, effectiveness (esp. avoidance of the performance gap) and scalability. All strategies need to be assessed regarding their technical, economic, environmental, social and legal implications. They will be codesigned within living labs and evaluated in testbeds, e.g., in the Cité-Jonction neighbourhood in Geneva and in Lucerne-Süd.

WP7 Leader: Ricardo Lima

WP8 - Energy Communities and Cooperatives at District Level
Our aim is to promote energy communities at the district level to accelerate the energy transition in the residential building sector. To do this, we will develop and test organizational and socio-cultural tools with which municipalities or other actors will be able to initiate energy communities.

WP8 Leaders : Chris Young & Ulrike Sturm

WP9 - Low-carbon recreational cities
Recreational activities play a significant role in contemporary energy-intensive lifestyles. The goal of the “Low-Carbon Recreational Cities” WP is to decarbonise travel & leisure practices through, co-design low-carbon tourism planning tools, and improve the sustainability of sports and culture events through collaborative research.

WP9 Leaders: Tristan Loloum & Francesca Cellina

WP10 – Impact Assessment
The work package aims at developing, testing and applying an integrated impact assessment for all R&Ds and P&Ds. It will combine impact assessments for technological/energy, economic, and social issues and integrate them while taking into account interactions and dynamics.

WP10 Leaders: Jan Rosset & Selin Yilmaz

WP11 – Dissemination
The main goal of the WP11 is to carry out a global project-wide dissemination plan, in order to make the project known to a wider public, beyond typical research and policymakers, and thus support work packages in their communication efforts towards the public. It should also ensure consistency and inclusiveness in communication, and visibility of the project results.

WP11 Leaders: Colm Kuonen & Valentino Piana

5. LIVING LABS

5.1 LIVING LABS IN THE SWEET LANTERN

Why do we need living lab approaches and real-life quasi-experiments to achieve these objectives? Scholars has shown that evidence from research on information feedback is not enough to change behaviour: there is also **a need to transform the practices** (Mckenzie-Mohr, 1999; EEA, 2013; Geels, 2004, 2015). In a complex system, understanding the effects of a changing variable seeks for experimentation (Kurtz and Snowden, 2003). **This assumption shifts the focus directly on the socio-technical system and the use of participatory, co-design or common governance methods to induce individual behaviour, institutional and organizational changes and monitor the effects of the interventions.** To achieve this, the urban living lab (Nesti, 2018) acts as an innovation intermediary (Mastelic, 2019) and orchestrates the ecosystem of actors required for common governance which helps in building trust among the actors (Dupont et al, 2018). **ULLs offer a safe space for debate of ideas to approach complex and wicked problems and to build a common vision** (Brennan, Previte, Fry, 2016). Interventions in the different thematic sectors will be tested (mobility, energy efficiency, digitalisation).

5.2 TRANSDISCIPLINARY APPROACH IN INTERACTION WITH LIVING LABS

Living Labs are considered as “extreme citizen science” (English, Richardson, Garzón-Galvis, 2018) as they **integrate stakeholders from the quadruple helix not only in the data collection phase but also in the first research phase of co-designing research questions.** Defining a common vision, objectives with the society, installing a **bilateral dialog between science and citizen** is paramount of a **transdisciplinary approach.** There is also a need for city-to-city learning approach to avoid a technocratic smart city implementation as described in the meta-analysis and process of the REPLICATE project (Calzada, 2020).

Transdisciplinarity can be supported by architectures of adaptive integration (Wright Morton et al, 2015). Living Labs and their contribution to achieve the objectives Lantern relies on a strong network of national and international Living Labs. Existing Living Labs (LL) with an already established Public Private People Partnership (PPPP) will facilitate the integration of actors and engage them in the innovation process. From the **13 Living Labs certified by ENoLL in Switzerland including every domain** (Energy, Health, Culture and Creativity, Agriculture…), 5 are members of our consortium (in yellow in the Annex 6). Other Living Labs are not yet certified by ENoLL but are active and established in Switzerland (in blue in the Annex 6).

The participative governance is already in place. LLs will give access to their infrastructure and to the field: WP4 - access to and mutualisation of the existing IoT infrastructure; WP5 and 6 - access to multi modal mobility systems and building systems both interacting with test concepts at the interface. WP7, 8 and 9 - access to buildings and neighbourhoods, hotels, and destinations. LLs will also facilitate quicker data collection, important for research and impact measurement while respecting data privacy (cf. DMP and risk sections). **LLs will be used to co-design, test and evaluate the impact of the changes on technical artefacts, social practices, rules and regulations**. LLs are at different stages of development: a building (NEST, ihome Lab, Energypolis), a district (QUBE, CELL, Cité Jonction), a city (Lugano, Winterthur, Sion). We call the LL at the city level Urban Living Lab (ULL). They are located in urban and sub urban areas (according to the FSO’s typology). These cities have developed an energy and climate plan and requested support from researchers and innovators to co-design, test and support the deployment of interventions.

5. LIVING LABS

5.3 ESTABLISHED LIVING LABS

Sion Living Labs

The Sion Living Lab has the vision to bring the excellence and experience of Energypolis to the benefit of the City, the Valais Central region and all its citizens, by co-creating together, a sustainable energy future. The collaboration of the **Energy Living Lab @ HES-SO**, **Mobility Lab**, City of Sion, the partners of Fabulle and the cooperation partners of SWEET Lantern in the region will enable the co-design of new socially innovative solutions for living and working.

EMPA Living Labs

NEST is the modular research and innovation building of Empa and Eawag. At NEST, new technologies, materials and systems are tested, researched, further developed and validated under real conditions. Close cooperation with partners from research, industry and the public sector ensures that innovative construction and energy technologies are put onto the market faster.
NEST contributes to making the use of resources and energy more sustainable and circular.

Lucerne Living Labs

The Lucerne Living Labs consist of several entities in the suburban area of Lucerne and Zug that are organized / managed via their representatives:

- **Innovation Booster Living Lab :** The Enery Lab is an innovation ecosystem consisting in more than 200 proactive partners and relevant institutions in Switzerland. Its mission is to boost the energy transition through joint innovations.
- **QUBE Living Lab**: QUBE is the abreviation for : Neighbourhood-based energy cooperation in Wesemlin. The QUBE project brings together experts and homeowners to implement new, cooperative energy solutions for heating, hot water and electricity. The QUBE project aims to promote energy cooperation at neighbourhood level.
- **CELL Living Lab:** CELL – Collaborative Energy Living Lab (CELL) drives innovation for cyber-physical energy systems in Switzerland.
- **iHomeLab:** iHomeLab is a Think Tank and Research Centre for Building Intelligence. The researchers at the iHomeLab are conducting applied research in energy efficiency, ambient assisted living and internet of things. The competence center also offers education and acts as an interface with the general public, the industry and organizations

WinLab

With WinLab, the city of Winterthur wants to position itself as a real-world living lab to test in systematic ways social and technological innovations supporting the smart sustainable city development especially in the context of the energy and climate concept aiming at net zero by 2040**.**

Lugano Living Lab L*3

Lugano Living Lab – L*3 is the urban innovation laboratory of the City of Lugano. L*3 involves a broad partnership of public and private stakeholders interested in growing the local innovation ecosystem. The aim of the lab is to improve the quality of life, promote economic growth and the competitiveness of the region, focusing on digital transformation and sustainability.

6. CAPACITY BUILDING

6.1 CAPACITY BUILDING PROGRAMME

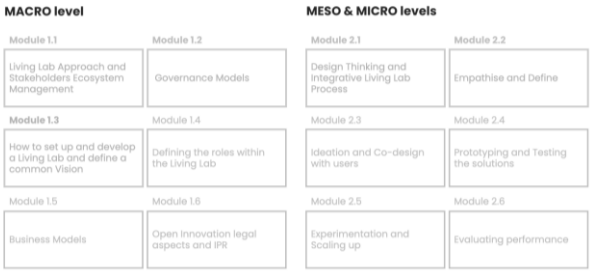
The capacity building programme **supports the long-term learning process** over the course of SWEET Lantern, **involving all stakeholders of the project consortium**, but especially Living Lab Managers, researchers from social sciences and humanities (SSH) and engineering, LLs, P&D project managers, cooperation partners. This will **allow a common understanding on how to set up and run LLs and how to conduct participative applied research and test solutions in a real-life**. The capacity building programme is led by WP2 Set Up and Scale Up and in collaboration with WP3 Methodology.
The Capacity Building Programme included in person workshops with dedicated interactive activities, online training during Consortium meeting and different platforms providing with some learning content, see above for more information.

6.2 CAPACITY BUILDING PLATFORMS

The SWEET Lantern Capacity Building Platform is an **online program composed of different software (Miro and online website) to enable the Consortium to acquire new knowledge and work collaboratively.** Teams programme is used by the consortium as the main communication tool, and it is also used to store all the documents related to the project. Each software is used for different purposes. You can see above the detail for each of them.

Miro
Interactive workspace for sharing of tools and methods within the Consortium as well as to enable a global view of the elements required for each WP. The goal of this workspace is to guide researchers and Living Labs through their development. In the Miro board you can find tools and methods templates with their description classify by phase of the LLIP; LLIP for each WP defining which tools and methods they will use trough their project; results from past workshops and activities.
Here is the link to the SWEET Lantern Miro board.

Website
Landing page being developed with information, learning modules, videos, use cases, publications related to the topic, Tools and methods, and outcomes of the SWEET Lantern project that can be disseminated publicly.
The page will also integrate other functions, such as 'onboarding booklet' for newcomers to the SWEET Lantern project.
Here is the link to the SWEET Lantern Capacity Building Platform.



Programme structure for the modules

Teams
The consortium uses Teams to communicate (message and video meeting), gather the documents and allow all the members to get access to it. It is an interactive way to work collaboratively on documents. The project teams is structured by WPs and thematic to focus communication through specific channels.

7. LINKS TO GO FURTHER

7.1 PROJECT

The proposal > link
Reporting > link

7.2 MANAGEMENT
Detailed work plan & deliverables > link
Consortium meetings > link
Coordination meetings > link

7.3 COMMUNICATION
Partners' logos > link
Partners' presentation > link
Visuals (charts, pictures, profile pictures, etc.) > link
Posters > link
Pictures of events > link
Presentation template > link

Published papers > link

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