Work package number	6	Start Date or Starting Event	M01
Work package title	Helsinki Smart Brownfields		
Work package leader	HEL		

Objectives

The overall objective of Helsinki's Kalasatama Lighthouse is to demonstrate new solutions supporting sustainable urban living, especially in terms of energy behaviour. This will be done through the following four concepts:

- **Smart energy efficiency in buildings and district.** Energy efficient buildings including smart control and integration to smart grid. The technologies are applied in buildings in the brown field transformation area and in the connected urban areas. Efficient energy chain (tri-generation) including multi-optimised control of energy production, renewable energy, energy storage, electrical cars charging point and demand side management.
- Sustainable City Mobility "Mobility as a service" concept is focusing on seamless mobility services for citizens. In Kalasatama it is realized via proactive transport management with real-time follow-up of transport and creating new service infrastructure for citizen mobility. To increase energy efficiency and living comfort, new smart services for city logistics and maintenance are also addressed in Kalasatama.
- **City Data Integration and Analytics** Harmonization of open data and development of interfaces for services. Acquisition, integration and analysis of Kalasatama infrastructure utilization data to enable performance measurements and the development of a monitoring application. Development of open interfaces for enhancing interoperability between systems and support for data analytical applications.
- **Smart citizen engagement in new energy behaviour** In Kalasatama Living Lab citizens and users are engaged to vision, co-create, concept and test energy and mobility related new smart living products and services together with other stakeholders. The engagement aims to increase awareness and adaptation, that is to make energy and mobility related smart service development better match user behaviour and facilitate the deployment of the new services. A special objective is to activate the developer community to create new services and applications for smart energy behaviour and mobility.

Description of work

Task 6.1 Requirements collection and analysis (Lead: FVI, VTT) M01-M36

The main objective of this task is to initiate the work of the Helsinki consortium, create a common vision and targets, involve stakeholders, define key metrics and ensure effective work of the project organization.

An important part of this task is to develop an overall framework/vision of Kalasatama Smart City Lighthouse project, including urban planning, buildings, energy networks, mobility and citizen interfaces. The vision of the Smart Kalasatama brownfields will be created in participatory process with all the relevant stakeholders. The vision will include short term objectives and targets, which will serve both the development work of different stakeholders, and the creation of monitoring and assessment criteria in task 6.7.

This task includes project management within WP6 and reporting of the project advancement. Part of this task is continuous communication with selected stakeholders via relevant channels (newsletters, mailing lists, events, blogs, websites). In order to do that, stakeholder analysis is carried out.

Task 6.2 Stakeholders value network/ collaboration platform (Lead: FVI**) M04-M36**

This task will create, coordinate and support engagement of as well as partnerships and collaboration among relevant smart city value networks. These networks include industries (including SMEs) in the fields of construction, energy transportation and ICT; municipalities and their decision makers and city planning authorities; installation and maintenance providers; research community; financiers; as well as citizen organizations, citizens and other end-users. Also the emergence (potential) of new business ecosystems will be analyzed. The Kalasatama living lab is a central collaboration platform facilitating most of the activities in this task. This task works jointly with the tasks 6.3, 6.4, 6.5 and 6.6. So, the ideas, concepts and demos developed in those tasks can be taken to the Living Lab for testing, distribution or co-creation.

This task is vital to ensure the citizen engagement in the design, execution, testing and roll-out of the solutions developed. The living lab activities aim at engaging citizens and residents of Kalasatama to envision, co-create, concept and test energy and mobility related new smart living products and services. It facilitates gaining better understanding of user needs and requirements, especially related to energy efficiency, mobility solutions and consumption. These activities help participating companies to make energy and mobility related smart service development better match user behaviour and facilitate the deployment of the new services. The work includes stakeholder interviews, workshops, business development activities and living lab services. Aim is to organize ten workshops/co-creation sessions/events every year.

An important objective is to engage the developer community. So, the Kalasatama Living Lab activates developer minded individuals, companies and organizations to participate in innovating new smart city solutions and services related to energy behaviour and mobility. In addition to that, Smart Kalasatama offers a platform to utilize open data. In order to facilitate the developer engagement, a coherent coordinated program is created. The work is based on the experiences with and connected to the activities of the local developer communities like Helsinki Loves Developers and Hack de overheid. The program is tailored to the needs, expectations and requirements of the SMEs in the domains of mobility and energy as well as the local focus areas of the cities. Target is to organize two large events (e.g. hackaton, challenge or SME camp) annually and meanwhile keep the developer communities engaged with active communication.

The main objective of a Living Lab environment in the context of mobility is to involve citizens in co-creating better urban mobility services together with industry, research community and city authorities. For example, a bus operating in a real environment will be used as an open development platform where new services and technology can be tested and demonstrated. Travellers will be involved in the innovation process for new services to better understand their mobility needs, requirements and preferences. Living Lab bus will demonstrate how new businesses can use existing infrastructure and data sources and enter the mobility service market, thus supporting interoperability of solutions and decreases the risk of customer lock-in situations.

In addition to testing and validating new services, the Living Lab objectives include developing and validating new co-creation and co-operation models that support businesses in agile testing of their services to enable rapid large scale replication of successful solutions.

Task 6.3 Efficient energy chain management (Lead: VTT, HEL, PHI**)** M04 – M36

This task will focus on the efficient design, as well as operation and management possibilities of integrated district heating, cooling and electricity concepts of a low energy district. In addition to energy efficient chain management the focus on engaging users for energy management. The main focus is in:

This task will focus on the efficient design, as well as operation and management possibilities of integrated district heating, cooling and electricity concepts of a low energy district. The main focus is in:

- Cross-cutting ICT concepts for overall management of energy system (central energy supply, optionally use of renewable energy, optional use of energy storage, electrical vehicles charging points and buildings' and lighting energy use).
- Analyzing new potential energy pricing tariff methods for optimizing the benefits of utilizing local energy sources for the final consumers.

- Active participation of user to reduction of energy use by user friendly energy information interfaces.

This task is developing methods and concepts for district level electricity management including integrated grid connected components, such as buildings, lighting, optional energy storage, optional PV panels, electrical vehicles, etc. One of the focus points is to develop applications of possible energy storage to support high EV penetration and high power charging.

For the cross-cutting ICT concepts for energy management it is important to define the data sources and data interfaces in different layers. These will guarantee fluent utilization of available data in the integrated and consistent data to be developed in T6.6 and by the individual application developers.

Option for smart energy management entities in buildings is developed. The entities are designed cost-efficiently that they are affordable also for social housing, schools and day care. In addition, the grouping of electricity loads in buildings are structured in a way that they can be built and managed in a cost effective way.

Further efforts will be put on different alternative options to optimize district energy management mechanisms including new energy brokering systems, since existing tariff structures sometimes hinder the adaption of local renewable energy sources.

Active participation of users in energy use reduction is based on easy-to-understand information. Technologies such as QR are used for specific user preference information (e.g. temperature control) in the further development of user interfaces. The user interfaces are developed both for the apartment energy system but also for separate applications for users.

Task 6.4 : Integrated smart Urban Infrastructure (Lead: HEL, Helen, Phi**)** M04 – M36

This task focuses on the integration of smart solutions into the urban infrastructures (buildings, energy, waste and transport) targeting optimization in respect of CO_2, primary energy use and costs. The key focus in Kalasatama will be:

- Poly energy networks for district heating and cooling with storage, and their integration to the efficient use of tri-generation (combined heating, cooling and power generation). Smart integration of building systems to the smart grid. The smart grid in Kalasatama consists of optional electricity storage, optional PV generation and demand side management possibilities in buildings (work will be integrated with task 6.3 Energy management).
- The cost-effective refurbishment of existing buildings with special focus on apartment buildings.
- Efficient waste management based on underground vacuum collection system.

This task develops a method and suggestion on how to improve an energy supply system to perform in an optimal, secure and stable way with relying highly on local energy sources. The energy supply based on is tri-generation. Impacts from this energy supply system are analyzed, including the expected emission and energy cost reductions. One important aspect is also to evaluate, how buildings can be integrated to the smart grid efficiently, and how the smart grid in Kalasatama area can be implemented. Impacts of the energy system will be assessed.

In addition cost-effective refurbishment of existing buildings is done, with the special focus being on apartment buildings. The renovated buildings are located in connected areas to Kalasatama. The aim is to improve the energy efficiency of the buildings by 30%. In addition to the traditional energy efficiency refurbishment, the focus is on the energy systems of the buildings and user friendly efficient energy use. The renovated buildings are replicating the energy management systems developed in the previous task 6.3. This task includes also evaluation of three different renovation scenarios, which are analyzed in respect of CO_2, primary energy, peak energy demand and disturbances to tenants.

Last, this task focuses on intelligent waste management and collection system. An automated underground vacuum waste collection system will be implemented. The system increases the efficiency in waste logistics (less logistical transport in living areas). It also improves the general area aesthetics and decreases odour

problems caused by waste handling.

Task 6.5 : Catalyzing sustainable mobility actions (Lead: HEL, VTT, FVH, subcontractors**)** M04-M36

Kalasatama brownfield has the objective to establish itself as a sustainable urban transport (sub)system, with seamless and efficient connection to the surrounding city of Helsinki. The corner stone of the area's transport planning is the transport interchange (hub), where the existing metro station is expanded to a node for new tramlines, freight and logistics services, cycling and pedestrian networks, electric vehicle renting and charging services. The mobility plans promote sustainable transport modes, car-free blocks and smart mobility services accessible primarily via personal mobile devices. The hub will have also a multitude on non-transport offerings, such as: a shopping center, health care services, sports facilities, educational establishments, etc. Further, city of Helsinki will provide an open data interface for service providers at Kalasatama to develop their services.

Mobility as a Service (MaaS) approach

Mobility as a Service (MaaS) approach will be piloted in Kalasatama. MaaS means a system in which comprehensive ranges of mobility services are provided to customers by mobility operators (MaaS-operators). The MaaS operators act towards customers as a single service provider, although the range or services may be produced by different transport service producers. MaaS is resource efficient: The need for owning a car will decrease, whereas the car utilization rate will increase. Hence, it will enhance traffic flow, free infrastructure capacity and inhibit congestion. Furthermore, it contributes to an increase in the share of sustainable travel modes. Thus it will contribute to energy efficiency as well as to multimodality and efficient use of resources.

Within this task, **sustainable mobility actions** are facilitated, monitored and assessed in three pilots: 1) Mobility as a Service, 2) Smart Street maintenance, 3) Optimised logistics, including construction site logistics and local logistics 2.0 (last 100 meters).

Subtask 6.5.1 Mobility as a Service pilot

Within this task a MaaS pilot will be carried out. To enable the pilot, the City of Helsinki has already agreed to support it with several actions:

- Opening the current monopoly of selling public transport tickets thus enabling new market-driven ticket types and packages
- Piloting the purchase of current city-organised transport services from MaaS -operators
- Granting special parking licenses to MaaS -operators' fleets
- A dedicated area for MaaS -fleets 'depot', specially focusing on providing charging for EV's
- Together with Ministry of Transport enabling the pilot use of new types of electric vehicles not currently recognised by Finnish law or city regulation
- Opening public transport stations for pilot-use activities and services (eg vehicle rental)
- Supporting the interaction and customer participation that MaaS concept relies on by further developing existing interfaces such as Open311 and related mechanism in city organisation recently developed in CitySDK project.

This task will deploy MaaS consumer pilot carried out in Kalasatama district. Kalasatama Living Lab in involved in the real life testing and co-design of the piloted services.

The MaaS pilot will comprise of the following integrated consumer services:

- Travel chain service including payment, reservation and reporting.
- Car sharing and related services.
- Carbon footprint tracking and routing based on impacts.

Subtask 6.5.2 Smart Street Maintenance

The City of Helsinki owns and operates a large scale street maintenance work covering the whole city.

Street maintenance includes cleaning, repairing, snow plowing and park work. This type of work requires special vehicles, being quite energy consuming. The citizens also keep complaining of the constant uncoordinated maintenance work blocking the streets. Street Maintenance is highly visible in the streets of Helsinki. Thus, it's a great opportunity to model EV's, smart logistics and new technologies in the streets of Helsinki. Moreover, Helsinki is committed to finding new ways to optimise energy efficiency and utilise alternative fuels.

The target of this task is that, Kalasatama, 100 % electric or alternative fuelled vehicles and mobile equipment in maintenance work will be used by the end of the project.

So, within this task the following steps are taken:

- Creating a plan to switch the maintenance vehicles to electric vehicles or deploying alternative, lighter vehicles to manage those tasks
- Modeling how traffic and demand-supply data can optimise maintenance tasks and routes to reduce travel
- Developing and utilising gas generators to charge electric vehicles during construction when electric charging is not yet in place
- Installing and modifying Kalasatama infrastructure to support new work methods and equipment: using rfid tags installed in streets corners (e.g.under pavement) to aid usage of autonomous vehicles and machinery in maintenance tasks
- Supporting actions such as deploying eco-driving tools and rethinking procedures to enable new more energy efficient work methods

Subtask 6.5.3 Smart Local Logistics

The object of this task is to model how to optimize energy efficiency and reduce unnecessary traffic for logistics in dense urban structure. Kalasatama suits well to pilot new solutions for complex local logistics. As Kalasatama will be fully built within next 15-20 years, during the course of this project there will be numerous construction sites established and run. The biggest and most centric one is the 'Redi' shopping centre area around Kalasatama metro station. This challenging location suits particularly well to pilot new means of smart urban logistics.

This task focuses on optimising the energy efficiency of construction site logistics by reducing the amount of transport, utilising smart warehousing, deploying alternative fuel vehicles for this use etc, with means of 1) offering both advanced ICT-systems for material resource and logistics planning of the construction companies, 2) physical warehousing areas in and outside Kalasatama with sufficient consolidation facilities and 3) developing efficient and flexible on-demand last mile delivery services from the consolidation/warehousing centres to the construction sites. Although this pilot takes place in a construction site, the learnings can be scaled to any dense urban infrastructure with versatile logistic neds.

Last mile

With exploding usage of internet shopping cities face an ever-increasing challenge of packet delivery crowding sidewalks and causing both traffic jams and environmental issues. Helsinki wants to develop and pilot new last mile methods and supporting ICT-systems to tackle these challenges.

A new model of poste restante -type of delivery, "Postbox 2.0", will be developed and piloted. Customers, both residents and companies, may choose an alternative shipping address for deliveries (eg local shop or bar), granting them the right to sign for their deliveries. This will have significant impact on savings for delivery companies and ease the 'delivery truck traffic jams'. The actual last mile delivery will be managed by e.g a bicycle messenger company, allowing more flexibility in delivery times.

Task 6.6: Integrated data for open interfaces and analytics (Lead: VTT, SIA, HEL, FVI**)** M04-M36

The main objective of this task is to enable interoperability between the various sub-systems in Helsinki as a foundation for the cross-platform services described in 6.1-6.5. In addition, the data should be made available for further analytics within the Helsinki Work Package (6.7) as well as within the horizontal work-

packages WP2 and WP3.

To allow cross-correlations between the heterogeneous data sets within Helsinki, advanced algorithms will be applied where relevant. In addition, the task will use results from other European research projects where technically appropriate. In order to support interoperability between systems, open interfaces will be used that allow users and customers to access the integrated data sets and to develop new analytics and applications on top of it. An important aspect of this task is, that data from multiple sub-systems in the partner cities will be aggregated in a standardized way and will be made available to KPI analytics applications, cross-city comparisons and in WP2.

In order to achieve this goal, the task will be structured as following. Based on the results of the tasks 6.1-6.5 requirements for data integration and analytics will be collected and consolidated. Furthermore, the task will screen the field systems in Helsinki for available data sources in order to align the pool of raw data with the requirements for the integrated solutions. The task will be closely linked to the work packages 2 and 3 in order to exploit synergies, results of WP2 and WP3 will be used as a basis for the deliverables of this task, tailored to the needs of Helsinki.

Another objective of this task is to integrate relevant data sets to the existing ICT structures of the City of Helsinki. Helsinki Region Infoshare extends regional open data catalog (www.hri.fi) to include public data sources identified and required during the Scale-UP project. HRI is responsible for public open data clearing house function: licensing, defining terms of use and promoting to developers.

Data formats and APIs will be harmonized in Helsinki following specifications defined in the WP4 whenever feasible to enable scalability and replication. In this project focus is on the lighthouse and follower cities, but all the efforts are also synchronized with existing similar cross-city initiatives like CitySDK, City Protocol and FI-WARE. CitySDK network and tools will be utilized to achieve effective co-operation between the cities and ensure sustainability of the harmonization process.

Task 6.7: Monitoring & Evaluation (Lead: VTT, HEL**)** M30-M60

This task will monitor the performance of the smart city solutions realized in Tasks 6.3 – 6.6 for the period of 2 years. A detailed monitoring plan will be prepared before the monitoring period. The monitoring results and their expected impacts will be compared to the previously set specific targets and to average living areas in Helsinki.

Behavior of citizens is one of the key areas. For smart mobility, citizen's strategic mobility decisions are scrutinized: how many trips are made; which means of transportation are chosen and when; how daily transport of goods are organized; what is the level of subjective satisfaction. After the demonstration period, the changes in travelling and transportation patterns, and based on them, further environmental, safety and cost impacts will be assessed.

A variety of methods, consisting of questionnaires, interviews and focus groups will be used to indicate and monitor the changes in mobility patterns. To get a continuous picture on the potential changes, the monitoring will be repeated several times during the two-year period. The first round will serve as a baseline for the impact assessment. Changes in the whole environment may, however, affect the monitoring, and hence it will be considered whether interviews with non-users need to be applied to tackle the issue.

Related to the Mobility as a Service concept, the evaluation and assessment work will include analyzing the effects of business models and concepts (such as revenue, customers, and creation of new business).

Traditionally energy efficiency is measured in kWh/m^2, which useful when comparing buildings' physical properties in design phase. However it may favor unsustainable and less efficient ways of utilizing buildings in the operation phase. Therefore buildings will be monitored both in terms of absolute energy consumption but also in respect to occupation utilization rates. Since the utilization rates cannot always be monitored due to privacy, estimate is given based on average utilization rates in similar areas. In addition validations will be done based on questionnaires. The monitoring phase can also expose possible needs for further improvements, especially related to the realized ICT solutions.

The energy networks will be monitored and special attention is paid in on the energy utilization peaks and the share of renewables as well as the mismatch between renewable energy production and energy use. Decarbonisation of the energy system while making it more secure and stable is evaluated.

This task will also assess the potential for wide-scale replication of the innovative and integrated smart city solutions realized in Kalasatama.

Summary of evaluation and monitoring factors:

Factor	**End-users**	**Buildings**	**Energy systems**	**Mobility**	**Kalasatama district**
Share of renewables & local energy sources		x	x	X	x
Energy demand peaks		x	x		x
Mismatch in energy demand and supply			x		x
Energy savings	x	x	x	X	x
Energy costs	x	x	x	X	x
$CO_{2\text{-}ekv}$ reduction	x	x	x	X	x
Air quality, small particulate emissions	x			X	
Less congestion and swifter transport	x			X	x
Creation of local jobs					x
Participation to planning and active role	x		x	X	x
Repayment of implementation costs in large scale economic investments in acceptable time line					x

ID	**Deliverable description**	**Task no.**	**Nature**	**Dissemination level**	**Delivery date**
D6.1	A holistic framework/vision for the Kalasatama Lighthouse project including buildings, energy networks, transport and mobility and ICT. Key targets to execute the vision. KPI and criteria for monitoring and impact assessment towards the vision and targets of the WP7 Kalasatama Lighthouse project.	T6.1	R	PU	M08
D6.2	Model and organization for Smart City Living Lab services and practices for energy and mobility initiatives including a developer activation program plan.	T6.2	R	PU	M08
D6.3	Mobility service concepts including requirements for mobility data analytics&integration.	T6.5	R	PU	M10
D6.4	Requirements for energy management data analytics, data integration and data interfaces at	T6.3	R	PU	M18

ID	Deliverable description	Task no.	Nature	Dissemination level	Delivery date
	different urban levels including data privacy and security.				
D6.5	Analysis of refurbishment scenarios with minimized disturbance to tenants.	T6.4	R	PU	M27
D6.6	Concept of a building energy management entities and end-user energy use information interface including analysis of new potential tariff methods optimizing the benefits for the consumers.	T6.3	R	PU	M30
D6.7	Infrastructure development in Kalasatama: the optimal concept for the energy system with tri-generation, district heating and cooling networks and efficient energy use.	T6.4	DEMO	PU	M30
D6.8	Report and analysis of Kalasatama Living Lab thematic workshops, developer challenges, hackatons and co-creation with citizens and other stakeholders (industry, SMEs, researchers, local 3rd sector) related to the Lighthouse demos, e.g. to electric traffic or smart home technologies and practices.	T6.2	R	PU	M36
D6.9	Realised energy renovations and realized co-generated district heating supply and waste infrastructure in Kalasatama.	T6.4	DEMO	PU	M36
D6.10	Report and analysis of the realized mobility pilots	T6.5	R	PU	M36
D6.11	Application of data analytics to identify potential of infrastructure optimization within Helsinki enabling documentation of improved performance over short and long term periods and support for WP2 and WP3 to use the data for analytics and replication.	T6.6.	OTHER	PU	M36
D6.12	Harmonized open data and APIs for the development of services and a	T6.6.	OTHER	PU	M36

ID	Deliverable description	Task no.	Nature	Dissemination level	Delivery date
	toolkit of recommendations, specifications and documentation for the cities and developers. Relevant data sets listed with metadata in the data catalog of the City (hri.fi).				
D6.13	Analysis on the monitored and other available data compared to the expected impacts.	T6.6	R	PU	M54

	Relation with other Work packages
Input	Co creation with WP 2(integrating planning), WP3 on datas and scenarios City cases and tools for WP7 followers cities Co creation business case and analysis framework for WP8 uspcaling Co creation of the dissemination framework for WP9
Output	To WP2 (city DSS/KPI/scenarios/data and local assessment To WP3 (data catalogue/user cases/scenario/interface and interoperability To WP7 : demonstrator and methods to implement in smart hub To WP8 concrete business cases To WP9 Tools and materials for WP dissemination