

SUNSHINE



Deliverable D1.2

PROJECT REQUIREMENTS

WP 1 – Pilot preparatory activities

Task 1.2 – Users and training requirements

Task 1.3 – Services requirements

Task 1.4 – Hardware and software client/server requirements

Task 1.5 – Data, metadata & modelling requirements

Revision: final

Dissemination level	PU (public)
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Page 1 of 39

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Due date	15-07-2014	
Submission Date	25-07-2014	

REVISION HISTORY AND STATEMENT OF ORIGINALITY

Task 1.2 – Users and training requirements

Revision	Date	Author	Description
Draft	26 th June 2014	Tomislav Stašić (HEP ESCO),	Document revision
v1.0	8 th July 2014	Federico Prandi (GRAPHITECH)	First revision
v1.1	11 th July 2014	Tomislav Stašić (HEP ESCO)	Second revision
v1.2	14 th July 2014	Luca Giovannini (SGIS)	Third revision
v1.3	21 th July 2014	Tomislav Stašić (HEP ESCO)	Fourth revision
v1.3	21 th July 2014	Federico Prandi (GRAPHITECH)	Fifth revision

Task 1.3 – Services requirements

Revision	Date	Author	Description
Draft	10 th May 2013	Luca Giovannini (SGIS)	Document creation
Draft	24 th May 2012	Luca Giovannini (SGIS)	Requirements drafting
v1.0	3 rd June 2013	Luca Giovannini (SGIS)	First Revision

Task 1.4 – Hardware and software client/server requirements

Revision	Date	Author	Description
Draft	19 th March 2013	Tomislav Stašić (HEP ESCO), Miroslav Kovačec (HEP ESCO)	Document creation
Draft	30 th April 2013	Tomislav Stašić (HEP ESCO), Miroslav Kovačec (HEP ESCO)	Requirements drafting
v1.0	29 th May 2013	Tomislav Stašić (HEP ESCO), Miroslav Kovačec (HEP ESCO)	First Revision
V1.1	26 th July 2013	Tomislav Stašić (HEP ESCO), Miroslav Kovačec (HEP ESCO)	Second Revision

Task 1.5 – Data, metadata & modelling requirements

Revision	Date	Author	Description
Draft	10 th May 2013	Luca Giovannini (SGIS)	Document creation
Draft	17 th May 2012	Luca Giovannini (SGIS)	Requirements drafting
v.1.0	27 th May 2012	Luca Giovannini (SGIS)	First Review
v1.1	7 rd June 2013	Luca Giovannini (SGIS)	Corrections to First Review
v.2.0	17 th July 2013	Federico Prandi (Graphitech)	Second Review
v2.1	14 th July 2014	Luca Giovannini (SGIS)	Third revision
v2.2	21 th July 2014	Tomislav Stašić	Fourth revision
v2.2	22 th July 2014	Federico Prandi	Fifth revision

Statement of originality:

This deliverable contains original unpublished work except where clearly indicated otherwise. Acknowledgement of previously published material and of the work of others has been made through appropriate citation, quotation or both.

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Table of contents

1	Introduction	8
1.1	Users and training requirements	8
1.2	Services requirements	8
1.3	Hardware (incl. Meters etc.) and software client/server requirements	9
1.4	Data, metadata & modelling requirements	9
2	Document timeline	12
2.1	Users and training requirements document timeline	12
2.2	Services requirements document timeline	13
2.3	Hardware and software requirements document timeline	14
2.4	Data, metadata & modelling requirements document timeline	15
3	Users and training requirements	17
3.1	Scenario 1	17
3.2	Scenario 2	17
3.3	Scenario 3	18
3.4	Training requirements	18
3.5	Definition of requirements from an ESCO standpoint	18
4	Services requirements	20
4.1	Services Requirements for Sunshine Server	21
4.1.1	Geographical Data Management services	21
4.1.2	Infrastructure Data Management services	21
4.1.3	Weather Data Management services	21
4.1.4	Building Outdoor Weather Forecast service	22
4.1.5	Meter and Billing Data Management services	22
4.1.6	Remote Control System Management service	23
4.1.7	Building Energy Performance Computation service	23
4.1.8	Building Weather Alert and Suggestion service	23
4.1.9	Remote System Sensor Alert services	24
4.2	Services Requirements for Sunshine Clients	24
4.2.1	Energy Web Portal services	24
4.2.2	Building Weather Alert App services	25
4.2.3	Lighting Network Management App services	25
4.3	Non-functional Services Requirements	26
5	Hardware Requirements	27
5.1	Sunshine Server, Clients and Software	27
5.1.1	Generic requirements on server, clients and software	27
5.2	Web and Mobile Client requirements	30
5.2.1	Hardware requirements at the mobile client level	30
5.2.2	Hardware requirements at the web client level	31

5.2.3	Software requirements at the web client level.....	31
5.2.4	Software requirements at the mobile client level.....	31
5.3	Smart-Grid Infrastructure	32
5.3.1	Requirements at the smart meters and generally Remote Terminal Units (RTUs).....	32
5.3.2	Requirements for SCADA systems.....	33
5.3.3	Lighting Network Infrastructure.....	34
6	Data, Metadata and Modelling Requirements.....	35
6.1	Data and Metadata Requirements.....	35
6.1.1	Geographical data.....	35
6.1.2	Infrastructure data.....	36
6.1.3	Weather Forecast data.....	36
6.1.4	Meter and Billing data.....	37
6.1.5	Sensor data.....	37
6.1.6	User Profile data.....	37
6.2	Modelling Requirements	38
6.2.1	CityGML Model	38
6.2.2	Building Outdoor Weather model.....	38
6.2.3	Building Indoor Climate model (for weather alert and suggestion).....	39
6.2.4	Building Energy Performance model.....	39

Acronyms

AMI	Automatic Measurement System
AMR	Automatic Meter Reading
EPS	Epsilon International SA, Greece
GIS	Geographical Information System
GL	Grafica Light, Italy
GRAPHITECH	Fondazione Graphitech, Italy
GSYS	GeoSYS Limited, Malta
HEPESCO	HEP ESCO d.o.o., Croatia
INFOTN	Informatica Trentina, Italy
LP	Light Pole
NOC	Network Operation Centre
POP	Point of Presence
RTU	Remote Terminal Unit
SCADA	Supervisory Control and Data Acquisition
SET	SET Distribuzione SpA, Italy
SGIS	Sinergis, Italy
SUNSHINE	Smart Urban Services for Higher eEnergy Efficiency
T	Task
TNET	Trentino Network, Italy

1 Introduction

In the previous deliverable, *D1.1 Use cases analysis*, all the use cases that will have to be addressed by the system and tested during later technical activities, have been identified, with the support of pilot's users.

The main objective of this deliverable, *D1.2 Project requirements*, is collecting requirements for the deployment of the SUNSHINE system, including:

- User requirements;
- Training requirements;
- Service requirements;
- Hardware requirements;
- Data/metadata requirements.

The following paragraphs provide the description of tasks as contained in the DoW. The results of the activities of these tasks are described in this report.

1.1 Users and training requirements

This task, *T.1.2 – Users and training requirements*, will identify the types of users involved in the pilots and the definition and analysis of their needs/requirements. The objective is to identify the major categories of services and functionalities of the system that best comply with the needs of the users and their perceived requirements with regard to daily activities. A key issue in achieving this goal relates to collecting the views of the users on the potential system functionalities and performance. Interviews and well-designed surveys will be employed in order to accomplish this task.

With regard to this, GL will provide insight into scenario 3 “Optimization of power consumption of public lighting systems”. INFOTN will instead contribute to the definition of requirements regarding the first two scenarios. HEPESCO and SET will contribute by defining requirements from an ESCO standpoint. CEIT, TNET and GSYS will further provide users and training requirements of relevance for their pilots.

1.2 Services requirements

This task, *T.1.3 – Services requirements*, will identify the requirements at service level; this will provide a detailed and technical description of software requirements for both server and client components. For geographical information, this task will be based on EN ISO 19119 : Geographic Information- Services. Service requirements will include compliance with sensors-related standard from Open Geospatial Consortium (OGC) such as:

- Sensor Observation Service (SOS).
- Sensor Alert Service (SAS).
- Sensor Event Service (SES) (the latter being currently proposed as standard).

As well as from International Electrotechnical Commission (IEC) including:

- IEC 61968-9 – Interface Standard for Meter Reading & Control [MR],
- IEC 61968-3 – Interface for Network Operations [NO].

GRAPHITECH, GIST, and EPS will contribute to the definition of OGC-related services. SGIS and HEPESCO and SET will contribute to the definition of IEC standard requirements. Additionally, EPS, TNET, CEIT, SGIS, GSYS, GL will provide specific service requirements related to various pilots. METGRID will provide requirements relating to service-based access to weather and alert data, which is relevant to pilot scenario 2.

1.3 Hardware (incl. Meters etc.) and software client/server requirements

This task, *T.1.4 – Hardware (incl. Meters etc.) and software client/server requirements*, will identify requirements emerging from the use of specific hardware and software within SUNSHINE, necessary for deployment of SUNSHINE client and server technologies (including requirements for servers, desktop clients, mobile clients), as well as those related to smart grid technologies including, but not limited to:

- Smart meters and generally Remote Terminal Units (RTUs),
- SCADA (Supervisory Control And Data Acquisition) systems,
- Automated Metering Infrastructures (AMI),
- Meter Data Management (MDM) systems,
- Operational Data Storage (ODS) repository.

GRAPHITECH will provide requirements regarding the portal and mobile client, while HEPESCO, SGIS and EPS will focus on requirements regarding RTUs, AMI, MDM and ODS. Lastly HEPESCO, CEIT, GL, TNET, GSYS, SET will deal with requirements regarding online monitoring systems and service based infrastructures (e.g. in the context of SCADA systems).

Within this task hardware necessary to ensure remote monitoring and control will be deployed within the relevant pilot locations as described within section B.2.1.1.

1.4 Data, metadata & modelling requirements

This task, *T.1.5 – Data, metadata & modelling requirements*, will include a definition of requirements relating to data and metadata with particular regard to geographical information, sensor information (incl. meters), billing information, user profile information and building reference information.

SGIS will concentrate on all data & modelling requirements focusing with RTUs, AMI, MDM and ODS as well on requirements emerging from the pilot in Ferrara. INFOTN & HEPESCO will focus on requirements regarding the pilots. HEPESCO will concentrate on ESCO-driven requirements.

The deliverable D1.2 details the achievements of several tasks: task 1.2 and task 1.4 are implemented under the co-ordination of HEP ESCO, task 1.3 and task 1.5 are implemented under the co-ordination of SINERGIS (SGIS). The deliverable D1.2 includes four tasks (T.1.2, T.1.3, T.1.4, T.1.5) and involves 12 partners (in alphabetical order):

EPS	Epsilon International SA, Greece
GIST	GiStandards LTD, United Kingdom
GL	Grafica Light, Italy
GRAPHITECH	Fondazione Graphitech, Italy
GSYS	GeoSYS Limited, Malta
HEPESCO	HEP ESCO d.o.o., Croatia
INFOTN	Informatica Trentina, Italy
METGRID	Farisa Asesores y Consultores S.L, Spain
SET	SET Distribuzione SpA, Italy
SGIS	Sinergis, Italy
TNET	Trentino Network, Italy

In order to be accurately tested SUNSHINE technology will eventually be piloted in the context of 9 sites across 5 countries, specifically:

- **Italy:** 20 public buildings in Ferrara; 90 technical buildings across the Trentino Province; 3 public lighting lines in the centre of Bassano del Grappa (Italy) (total of 71 lighting units), 5 public lighting lines in the city of Rovereto (Italy) (total of 95 lighting units); the Sport and leisure centre (CTL) in the Paludi Area and a classroom in the High School Campus in Cles, both in the area of Val di Non (Italy) .
- **Croatia:** 10 buildings owned by HEP in Zagreb, Split, Varaždin, Rijeka and Križ and the lighting systems in the surroundings of one of HEP power plant in Zagreb (11 lighting units).
- **Greece:** five buildings in Lamia owned by Technological Educational Institute of Lamia.
- **Malta:** 2 buildings owned by Malta College of Arts, Science and Technology in Paola.

2 Document timeline

2.1 Users and training requirements document timeline

Due date	Job	Output	Who
29-mar	Types of users' collection. Each partner writes the types of users related to its pilot. Please upload the types of users in the Project Dropbox folder WP1\Task 1.2 call your document as: <partner>-PR-draft (HEPESCO-PR-draft)	Types of users involved in the pilots in the Dropbox folder	All partners
16-apr	Sharing of Types of users among the partners. Please read all collected types of users written by the partners in order to design your own survey of user needs/requirements, with regard to their daily activities. Requirements for energy performance of buildings apropos legislation in energy efficiency and energy management for every pilot-country (By-law defining energy certification of buildings with existing methodology).	Design of survey of user needs/requirements	All partners
26-apr	Factorization of types of user and their needs/requirements.	Draft version of users and training requirements Output: D1.2 Project requirements draft.doc	All partners
03-may	With respect to the previously collected user needs/requirements will provide scenario 3.	Insight into scenario 3, "Optimization of power consumption of public lighting systems."	GL
17-may	Review by the partners	Definition of requirements regarding scenario 1 and scenario 2	INFOTN
17-may	Review by the partners	Definition of requirements from an	HEP ESCO,

		ESCO standpoint	SET
24-may	Review by the partners	Users and training requirements	CEIT, TNET,GSYS
07-jun	Sharing and review by the partners	Final version of users and training requirements Output: D1.2 Project requirements rev1.doc	All partners
21-jun	Deliverable D1.2 release for WP leader and co-ordinator review	Output: D1.2 Project requirements final.doc	HEP ESCO
28-jun	Deliverable D1.2 reviewed by co-ordinator	Output: D1.2 Project requirements final.doc re-sent for improvements	GRAPHITECH
11-july	Deliverable D1.2 v1.1 release	Output: D1.2 Project requirements final.doc	HEP ESCO
22-jul	Deliverable D1.2 v1.3 reviewed by co-ordinator	Output: D1.2 Project requirements final.doc re-sent for improvements	GRAPHITECH

2.2 Services requirements document timeline

Due date	Job	Output	Who
10 may	Publication of timeline and draft index	Draft	SGIS
24 may	Requirements drafting	Draft	SGIS
31 may	Review	rev1	All Partners
07 Jun	Requirements for weather and alert services	rev1_partner	METGRID
14 Jun	Contribution to services standards (OGC, IEC)	rev1_partner	GRAPHITECH, GIST, EPS, SGIS, HEPESCO, SET
14 Jun	Contribution to pilot-driven services requirements	rev1_partner	All Partners
21 Jun	Review	rev2	All Partners
25 Jun	Final review	final	SGIS

2.3 Hardware and software requirements document timeline

Due date	Job	Output	Who
30-apr	List of requirements for specific hardware and software necessary for the deployment of SUNSHINE client and server technologies. Please upload the list of requirements in the Project Dropbox folder WP1\Task 1.4 call your document as: <partner>-HS-draft1.doc (HEPESCO-HS-draft1.doc)	List of requirements existing or planned hardware and software in the dropbox folder	All partners
30-apr	List of requirements of necessary server technologies – including requirements for servers, desktop clients, mobile clients, etc. Please add this list in the previous file and upload in the Project Dropbox folder WP1\Task 1.4 call your document as: <partner>-HS-draft2.doc (HEPESCO-HS-draft2.doc)	List of requirements of necessary server technologies in the dropbox folder	All partners
10-may	List of requirements for related smart grid technologies including: Smart meters and generally Remote Terminal Units (RTUs), SCADA (Supervisory Control And Data Acquisition) systems, Automated Metering Infrastructures (AMI), Meter Data Management (MDM) systems, Operational Data Storage (ODS) repository. Please add this list in the previous file and upload in the Project Dropbox folder WP1\Task 1.4 call your document as: <partner>-HS-draft3.doc (HEPESCO-HS-draft3.doc)	List of requirements related smart grid technologies in the dropbox folder	All partners
21-may	Sharing of list of requirements among the partners. Please read all requirements written by the partners in order to review and finalize your own list.	Draft version of hardware and software client/server requirements Output: D1.2 Project requirements draft.doc	All partners

31-may	Review by the partners	Comprehensive list of requirements regarding the portal and the mobile client	GRAPHITECH
31-may	Review by the partners	Comprehensive list of requirements regarding RTUs, AMI, MDM and ODS	HEP ESCO, SGIS, GSYS
31-may	Review by the partners	Requirements regarding online monitoring systems and service based infrastructures	HEP ESCO, CEIT, GL, TNET,GSYS, SET
14-jun	Sharing and review by the partners	Final version of hardware and software client/server requirements Output: D1.2 Project requirements rev1.doc	All partners
25-jun	Deliverable D1.4 release for WP leader and co-ordinator review	Output: D1.2 Project requirements final.doc	HEP ESCO

2.4 Data, metadata & modelling requirements document timeline

Due date	Job	Output	Who
10 may	Publication of timeline and draft index	draft	SGIS
17 may	Requirements drafting	draft	SGIS
24 may	Review	rev1	All Partners
07 Jun	Contribution on sensor data requirements and modelling requirements	rev1_partner	SGIS
07 Jun	Contribution on pilot-driven requirements	rev1_partner	INFOTN, HEPESCO
07 Jun	Contribution on ESCO-driven requirements	rev1_partner	HEPESCO
14 Jun	Review	rev2	All Partners
25 Jun	Final review	final	SGIS
22-jul	Deliverable D1.2 v1.3 reviewed by co-ordinator	Output: D1.2	GRAPHITECH

		Project requirements final.doc re-sent for improvements	
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3 Users and training requirements

This chapter contains the description of the user and training requirements in terms of functionality and expected results, taking into consideration the three different scenarios addressed by SUNSHINE project.

3.1 Scenario 1

REQ-USR-001.	Sunshine shall estimate the energy performance of buildings based on data available from public services such as cadaster, planning, imagery, buildings destinations and uses, heating/cooling system types.
REQ-USR-002.	Sunshine shall provide a visual overview of the overall state of the buildings energy performance.
REQ-USR-003.	Sunshine shall provide suggestions on building improvements, aiming to increase its energy performance.
REQ-USR-004.	Sunshine shall allow developments of renovation policies through enforcement of energy efficiency policies.
REQ-USR-005	Sunshine shall help in the creation of a public repository of detailed data on building energy performance

3.2 Scenario 2

REQ-USR-006.	Sunshine shall enable monitoring and control of energy consumption of heating/cooling systems of the buildings by connecting the application to the energy meters
REQ-USR-007.	Sunshine shall provide access to local weather data and ability and make recommendations on how

	to set the controllers in order to optimize the consumption of energy related to weather change
REQ-USR-008.	Sunshine shall provide notifications in case of important events (e.g. consumption larger than average)
REQ-USR-009	Sunshine shall help building managers/technicians to better control heating/cooling system following application suggestions
REQ-USR-010	Sunshine shall also allow forecast analysis about improved tuning of the heating/cooling system relating to historical data and measuring any improvements or efficiency with the new consumption policy that the user can adopt

3.3 Scenario 3

REQ-USR-001.	Sunshine shall enable the optimization of power consumption of public lighting installation through remote control of public lighting levels
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3.4 Training requirements

REQ-TRE-001.	The local pilot partner shall ensure training for building managers, technical persons (technicians) and energy managers in order to use SUNSHINE platform
REQ-TRE-002.	SUNSHINE shall ensure through local pilot partner training for SUNSHINE platform (on server and client level)
REQ-TRE-003.	SUNSHINE shall ensure through local pilot partner training for heating/cooling control adjustments
REQ-TRE-004.	SUNSHINE shall receive any suggestion given by the user through Wiki methodology, in order to improve all the functionalities during its lifecycle

3.5 Definition of requirements from an ESCO standpoint

REQ-ESP-001.	SUNSHINE shall provide effective support for an ESCO in the implementation of its business, it shall offer help on planning, monitoring and fulfilment activities.
REQ-ESP -002	SUNSHINE shall provide a dashboard for an energy manager, through it he can plan and control energy consumption on a specific object or installation.
REQ-ESP-003	SUNSHINE shall assist an energy manager in the difficult task of user education, through it he can demonstrate and introduce best practices for reducing energy consumptions.

4 Services requirements

This chapter contains the requirements at service level; these are grouped into two main categories:

- Functional Services
 - Server services;
 - *Geographical data management services*: to allow access and management of geographic information in accordance with EN ISO 19119: Geographic information-Services;
 - *Infrastructure Data Management services*: to allow ingestion and archiving of SUNSHINE related information;
 - *Weather Data Management services*: to allow the access to and management of meteorological data;
 - *Meter and Billing Data Management services*: to allow access to and management of the billing and meter data;
 - *Remote Control System Management service*: To allow communication to and from the remote sensor and instruments.
 - *Building Energy Performance Computation service*: to allow processing of functionalities in order to calculate the energy building performance.
 - *Building Weather Alert and Suggestion service*: to allow computation and notification of energy suggestions related to the weather conditions
 - *Remote System Sensor Alert services*: to allow communication from the public light system to the final users.
 - Client Services;
 - *Energy Web Portal services*: web services interface to allow interaction between the SUNSHINE web client portal and the SUNSHINE middleware services
 - *Building Weather Alert App services*: web services interface web services interface to allow the interaction between the SUNSHINE energy app and the SUNSHINE middleware services.
 - *Lighting Network Management App services*: web services interface web services interface to allow the interaction between the SUNSHINE public light management app and the SUNSHINE middleware services.

- Non-functional services;

4.1 Services Requirements for Sunshine Server

4.1.1 Geographical Data Management services

REQ-SRV-001.	Sunshine server application shall connect to external OWS to access geographical data.
REQ-SRV-002.	Sunshine server application for the temporary archiving needs of geographical data shall have access to a data warehouse (DWH).
REQ-SRV-003.	Sunshine server application shall expose all the geographical data to which it has access via OWS.

4.1.2 Infrastructure Data Management services

REQ-SRV-004.	Sunshine server application shall ingest building data provided by the user via Sunshine client with a dedicated ingestion service.
REQ-SRV-005.	Sunshine server application shall ingest lighting network data provided by the user via Sunshine client with a dedicated ingestion service.
REQ-SRV-006.	Sunshine server application shall archive infrastructure data in a data warehouse (DWH) whose schema is suited for OWS.

4.1.3 Weather Data Management services

REQ-SRV-007	Sunshine server application shall interface with external weather services to download forecasted atmospheric conditions and meteorological geographical features over the area of interest.
REQ-SRV-008	Sunshine server application shall ingest and manage data of ECMWF historical observation and prediction records of atmospheric conditions over the area of interest.
REQ-SRV-009	Sunshine server application shall be able to ingest and manage data of new and historical

	meteorological features over weather stations associated with a building or group of buildings of interest.
REQ-SRV-010	Sunshine server application shall be able to ingest and manage indoor climate data for buildings of interest.
REQ-SRV-011	Sunshine server application shall interface with outdoor weather stations and indoor climate stations via an established and secure communication standard in order to receive readings.

4.1.4 Building Outdoor Weather Forecast service

REQ-SRV-012	Sunshine server application shall be able to compute the adjusted day degree values for the buildings of interest.
REQ-SRV-013	Sunshine server application shall be able to compute a statistical model to generate local outdoor forecasts over a building or a group of buildings of interest, relying on weather data (observations, forecasts and historical), geographical data and infrastructure data.

4.1.5 Meter and Billing Data Management services

REQ-SRV-014.	Sunshine server application shall interface with the head end terminals of Automated Metering Infrastructures (AMIs) via an established and secure communication standard in order to receive meter readings.
REQ-SRV-015.	Sunshine server application shall receive\poll meter readings, handle Validation, Estimation and Editing (VEE) procedures and aggregate consumption data in a consumption Operational Data Store (ODS).
REQ-SRV-016.	Sunshine server application shall have access to billing data and integrate these data to the corresponding consumption data in the consumption ODS.
REQ-SRV-017.	Sunshine server application shall archive data from the consumption ODS in a data warehouse whose schema is suited for data exposure via web services.

4.1.6 Remote Control System Management service

REQ-SRV-018.	Sunshine server application shall interface with the head end terminals of remote control systems (lighting networks) via an established and secure communication standard in order to receive sensor readings and send commands to the system.
REQ-SRV-019.	Sunshine server application shall receive\poll readings from different sensors of the remote control system and aggregate them in an Operational Data Store (ODS).
REQ-SRV-020.	Sunshine server application shall archive sensor data from the ODS in a data warehouse (DWH) whose schema is suited for SWE services.
REQ-SRV-021.	Sunshine server application shall be able to ingest and execute user-defined command schedules for sensors and controllers of the remote system.

4.1.7 Building Energy Performance Computation service

REQ-SRV-022.	Sunshine server application shall be able to compute an energy performance rating for buildings, relying on micro-weather data, consumption data and infrastructure data.
REQ-SRV-023.	Sunshine server application shall integrate building energy performance rating into the CityGML model via the specifically developed ADE for Building Energy Performance.
REQ-SRV-024.	Sunshine server application shall suggest building improvements in order to increase their energy efficiency, basing on building energy performance rating.

4.1.8 Building Weather Alert and Suggestion service

REQ-SRV-025.	Sunshine server application shall be able to visualize relationships between historical series of consumption, weather and internal temperature data in order to support speculations on their correlation and stimulate the user to operate the building more efficiently.
REQ-SRV-026.	Sunshine server application shall be able to identify weather events (sudden change in meteorological variables, exceeding thresholds or rare eventualities) that can have a relevant impact on the energy performance of buildings and shall elaborate a suitable corrective action specific to each building, relying on weather data, consumption data and building energy performance data.

REQ-SRV-027.	Sunshine server application shall allow the user to define comfort situations.
REQ-SRV-028.	Sunshine server application shall notify the user of the upcoming events (relevant weather event or comfort situation at risk) and corresponding suggested actions.
REQ-SRV-029.	Sunshine server application shall allow the user to subscribe to and configure multiple channels for weather alert and suggestion notification.

4.1.9 Remote System Sensor Alert services

REQ-SRV-030.	Sunshine server application shall allow the user to define rules and conditions for sensor event triggering.
REQ-SRV-031.	Sunshine server application shall identify sensor events, based on user-defined rules and conditions.
REQ-SRV-032.	Sunshine server application shall notify the user of the identified sensor event with a sensor alert notification.
REQ-SRV-033.	Sunshine server application shall allow the user to subscribe to and configure multiple channels for sensor alert notification.

4.2 Services Requirements for Sunshine Clients

4.2.1 Energy Web Portal services

REQ-SRV-034.	Sunshine energy web portal shall allow the user to provide user profile data and infrastructure data.
REQ-SRV-035.	Sunshine energy web portal shall be equipped with a 2D/3D visualization environment that provides support for spatio-temporal data (via time-extended OGC standards) and for sensor data (via SOS standard).
REQ-SRV-036.	Sunshine energy web portal shall support alerts via the standard SAS/SES as well as their configuration in a visual way.
REQ-SRV-037.	Sunshine energy web portal shall allow the visualization of 2D/3D thematic maps related to building

	energy performance, building weather response and lighting network status.
REQ-SRV-038.	Sunshine energy web portal shall allow the computation of building energy performance, the retrieval of the corresponding pre-certification and the visualization of the related suggestions for building efficiency improvement.
REQ-SRV-039.	Sunshine energy web portal shall allow the monitoring of consumption data via a front-end dashboard interface
REQ-SRV-040.	Sunshine energy web portal shall allow the monitoring, control and scheduling of lighting network system via a front-end dashboard interface

4.2.2 Building Weather Alert App services

REQ-SRV-041.	Sunshine building weather alert app shall allow the user to provide user profile data and building data.
REQ-SRV-042.	Sunshine building weather alert app shall support alerts via the standard SAS/SES as well as their configuration in a visual way.

4.2.3 Lighting Network Management App services

REQ-SRV-043.	Sunshine lighting network management app shall allow the user to provide profile data and lighting network data.
REQ-SRV-044.	Sunshine lighting network management app shall be equipped with a visualization environment that provides support for spatial data (via OWS standards) and for sensor data (via SOS standard).
REQ-SRV-045.	Sunshine lighting network management app shall support alerts via the standard SAS/SES as well as their configuration in a visual way.
REQ-SRV-046.	Sunshine lighting network management app shall allow the visualization of the real-time lighting network status and allow for its control.

4.3 Non-functional Services Requirements

REQ-SRV-047.	Sunshine system shall be equipped with intuitive and user friendly interfaces.
REQ-SRV-048.	Sunshine system shall implement security and privacy protocols to protect Personal Identifiable Information (PII).
REQ-SRV-049	Sunshine system shall provide a fast and stable remote connection between server and clients.
REQ-SRV-050.	Sunshine system shall be able to compute the energy performance rating of buildings and derived services.
REQ-SRV-051.	Sunshine system shall be able to elaborate corrective actions for relevant weather events.

5 Hardware Requirements

This chapter reports on hardware requirements. The requirements are grouped into two classes. One is related to Sunshine Server, Clients and Software and the other to Smart Grid Infrastructure (RTU's, AMI, MDM and ODS).

5.1 Sunshine Server, Clients and Software

5.1.1 Generic requirements on server, clients and software

Server requirements

REQ-SCS-01.	Server shall enable central database implementation to store all required data.
REQ-SCS-02.	Server shall enable web services for the integration of different modules
REQ-SCS-03.	Server shall enable control unit for the monitoring and the collection of the data
REQ-SCS-04.	Server shall enable centralized hardware to be used by dedicated technician/administrator for routine administration
REQ-SCS-05.	Server shall enable processing of all the necessary data for automatic energy classification of buildings - .able to process data in a fast way
REQ-SCS-06.	Server shall enable access to data – depending on the type of user (administrator, janitor, etc.)

Client requirements

REQ-CLI-01.	Client shall enable mobile clients for on-the-move monitoring and control
REQ-CLI-02.	Client shall enable usage on every personal computer (Desktop clients) - Website
REQ-CLI-03.	Client shall enable to be easy usable on every mobile (Mobile clients) - Mobile Application or Mobile Website communication via mobile Internet or Wi-Fi

REQ-CLI-04.	Client shall enable easy to use, user-friendly
REQ-CLI-05.	Client shall enable easy to add new buildings to the system
REQ-CLI-06.	Client shall enable simply adding new data to existing buildings
REQ-CLI-07.	Client shall enable ability to change data on existing buildings
REQ-CLI-08.	Client shall enable to manage more than a building at the same time
REQ-CLI-09.	Client shall enable to connect to meters and sensors in a secure way

Software requirements

REQ-SOF-01.	Software shall enable different access modes: global user (with access restricted to public data, e.g. community administrators) or local user (with access to both public data and private data for specific buildings, e.g. building managers)
REQ-SOF-02.	Software shall enable t more than one building to be managed at the same timeat the same time
REQ-SOF-03.	Software shall enable easy switching from one building to the other
REQ-SOF-04.	Software shall enable t easy addition and modification of y static data
REQ-SOF-05.	Software shall enable real-time access to dynamic data
REQ-SOF-06.	Software shall enable easy monitoring and visualization of collected data
REQ-SOF-07.	Software shall enable easy sharing of data publicly
REQ-SOF-08.	Software shall enable running on multiple operating systems
REQ-SOF-09.	Software shall enable user friendly software application, so that every dedicated technician can use it

REQ-SOF-10.	Software shall enable clear and compact visualization of the necessary data for energy classifications of the building
REQ-SOF-11.	Software shall enable extensible Interface to add additional information (Customizable)
REQ-SOF-12.	Software shall enable security relevant connection to the existing sensors
REQ-SOF-13.	Software shall enable profile Manager for customize view of the different users (technician, manager, ...)
REQ-SOF-14.	Software shall enable durable and highly availability
REQ-SOF-15.	Software shall enable remote Access to the different Sensors of the Sunshine system
REQ-SOF-16.	Software shall enable modular system
REQ-SOF-17.	Software shall enable fast processing of data
REQ-SOF-18.	Software shall enable to display 3D CityGML models smoothly
REQ-SOF-19.	Software shall enable
REQ-SOF-20.	Software shall enable

Sensors, meters and controllers hardware

REQ-SMS-01.	SMS hardware shall enable that energy meters readings shall be made remotely accessible to the Sunshine system (meters are part of the of local Energy Service Company AMI)
REQ-SMS-02.	SMS hardware shall enable ancillary sensors (all the sensors deployed besides energy meters) shall be equipped with a Remote Terminal Unit (RTU) in order to let the Sunshine system access their measures remotely. Ancillary sensors shall also be able to be controlled remotely

5.2 Web and Mobile Client requirements

5.2.1 Hardware requirements at the mobile client level

Smartphone/Tablet

CPU	>= 1 GHz processor
RAM	1 GB of RAM and 4 GB Storage or more
Network	HSPA/WCDMA: Europe/Asia: 850/900/2100 MHz, GSM/GPRS/EDGE: 850/900/1800/1900 MHz
OS	Android OS version 2.1 or later (minimal API level7) / iOS 6 or later
Screen Resolution	480x800 (Smartphone) 1024x768 (Tablet)
Accessories	GPS receiver, either built-in or external (connected through Bluetooth)

5.2.2 Hardware requirements at the web client level

Standard PC Desktop/Notebook

CPU	not specifically
RAM	4 GB of RAM
Network	10/100/1000 Lan Network Card or WIFI
Video Card	4.6.1.1.1 OpenGL compatible card (http://www.worldwindcentral.com/wiki/Video_Card_Compatibility)

5.2.3 Software requirements at the web client level

Standard PC Desktop/Notebook

REQ-WEB-01	Client should allow a registered user to modify the configuration of their own building to update the information related to the infrastructure
REQ-WEB-02	Client should allow selection of buildings and lighting networks
REQ-WEB-03	Client should provide a report (PDF or other format) detailing the results of the pre-certification computation phase and the amount of energy saved by using the SUNSHINE system
REQ-WEB-04	Client should visualize summarized information of the buildings and lighting networks
REQ-WEB-05	Client should visualize summarized information related to the meteo forecast
REQ-WEB-06	Client should display the result of energy saving performances by modifying the building configuration accordingly with the provided suggestions
REQ-WEB-07	Client should provide the 3D visualization of the pilots buildings and ecomaps
REQ-WEB-08	Client should support the general configuration of the system
REQ-WEB-09	Client should support the specific configuration of the system according with the calendar events
REQ-WEB-10	Client should allow users to insert relevant events in the calendar
REQ-WEB-11	Client should visualize and manage the sensor status of the lighting network
REQ-WEB-12	Client should visualize information regarding the internal and external climate
REQ-WEB-13	Client should visualize building configuration suggestions
REQ-WEB-14	Client should allow the user authentication

5.2.4 Software requirements at the mobile client level

Smartphone/Tablet

REQ-MOB-01	Client should allow a registered user to modify the configuration of their own building to update the information related to the infrastructure
REQ-MOB-02	Client should allow selection of buildings and lighting networks

REQ-MOB-03	Client should provide a report (PDF or other format) detailing the results of the amount of energy saved by the using of the SUNSHINE system
REQ-MOB-04	Client should visualize summarized information of the buildings and lighting networks
REQ-MOB-05	Client should visualize summarized information regarding the meteo forecast
REQ-MOB-06	Client should display result of energy saving performances by modifying the building configuration accordingly with the provided suggestions
REQ-MOB-08	Client should support the general configuration of the system
REQ-MOB-09	Client should support the specific configuration of the system according with the calendar events
REQ-MOB-10	Client should allow users to insert relevant events in the calendar
REQ-MOB-11	Client should visualize and manage the sensor status of the lighting network
REQ-MOB-12	Client should visualize information regarding the internal and external climate
REQ-MOB-13	Client should visualize building configuration suggestions
REQ-MOB-14	Client should allow the user authentication

5.3 Smart-Grid Infrastructure

5.3.1 Requirements at the smart meters and generally Remote Terminal Units (RTUs)

Smart meters

REQ-HDW-001.	Energy meters to be used within the Sunshine system shall be smart meters, able to receive commands and send readings remotely, integrated in an Advanced Metering Infrastructure (AMI) capable of interfacing with the Sunshine system via established and secure communication standards.
REQ-HDW-002.	The Sunshine system shall be granted remote near real-time access to energy meters consumption by AMIs administrators.
REQ-HDW-003.	Energy meter types supported by the Sunshine system shall include: heating/cooling fuel consumption, electrical energy consumption.
REQ-HDW-004.	Energy meters management and data storage shall be centralized in a Meter Data Management (MDM) infrastructure within the Sunshine server.
REQ-HDW-005.	All remote terminal units (meters, sensors, controls) shall be characterized by high technical reliability and user friendliness.

RTU

Remote communication	
Modem	GSM standard SMS, Fax, CSD, GPRS Class10, support for PBCCH, support for 850, 900, 1800, 1900 MHz GSM band
Antenna attachment	SMA female 50 Ω
Supported network services and protocols	v4, TCP, UDP, DNS (client), PING, POP3 (client), SMTP (client), FTP (server, client), HTTP server
FLASH RAM module	SD memory card (to 4 GB)
Processor module (MPU)	Programmable module with capability of scripting. A remote firmware update and remote installation of applications are possible
I/O	
Digital inputs	2 x digital input, opto- isolated non-voltage contact, 12V isolated source in the device
Digital outputs	2 x digital output opto- isolated semiconductor relay, 60V, 700 Ma max
Analog inputs	2 x analog input, current, 4... 20 mA $R_{in} < 25m\Omega$
Analog outputs	2 x analog output, current, 4... 20 mA galvanic isolated
Serial communication	1 x serial TTL I/O, isolated typ, with limited current, appropriate for direct drive optocoupler LED's (e.g. Instroment 333, Instroment 444 volume correctors) 1 x RS232 or 1 x RS485, DB9

5.3.2 Requirements for SCADA systems

Freely programmable upgradable device on automation level	
Supported network services and protocols	TCP/IP, LONWorks, KNX, RS 485
Connections	RJ 45, USB, Ethernet socket
FLASH Ram	Up to 80MB
Processor module (MPU)	Programmable
I/O	
Digital inputs	Minimal 2 x digital input, opto- isolated non-voltage contact, 12V isolated source in the device
Digital outputs	Minimal 2 x digital output opto- isolated semiconductor relay, 60V, 700 Ma max

Analogue inputs	Minimal 2 x analogue input, current, 4... 20 mA $R_{in} < 25m\Omega$
Analogue outputs	Minimal 2 x analogue output, current, 4... 20 mA galvanic isolated

5.3.3 Lighting Network Infrastructure

REQ-HDW-006.	Light pole lines to be used within the Sunshine system shall be managed by a proprietary management and control system up to their main electrical cabinets.
REQ-HDW-007.	Main electrical cabinets shall be capable of interfacing with the Sunshine system via established and secure communication standards to receive commands and send readings remotely.
REQ-HDW-008.	Lighting network control and data storage shall be centralized within the Sunshine server.
REQ-HDW-009.	Light pole sensors supported by the Sunshine system shall include: lamp presence detection (yes/no), lamp status (ok/not ok), current brightness level, dimmer level and number of burning hours.
REQ-HDW-010.	Additional sensors and controls attached at light poles (i.e. noise level detection, movement detection, speakers, etc) shall be integrated in the common control infrastructure.
REQ-HDW-011.	Main electrical cabinets shall each be equipped with a smart meter in order to measure the electrical energy consumption of each light pole line.

6 Data, Metadata and Modelling Requirements

This chapter reports the requirements in terms of Data/metadata and modelling information needed to achieve the SUNSHINE objectives. The data and metadata requirements are divided into six main categories:

- *Geographical data*: geometrical information needed to represent the urban landscape into a geo-referenced graphical environment. These can include the needed information to generate the cityGML model as well as required spatial information.
- *Infrastructure data*: collection of dataset regarding the buildings related information.
- *Weather forecast data*: collection of meteorological and climatic information.
- *Meter and billing data*: information concerning the energy consumption acquired by smart metering as well as using billing systems.
- *Sensor data*: information provided by the smart lighting system as well as.
- *User profile data*: information regarding the profile of the users as well as the subset information for the sensor configuration.

The modelling section contains the list requirements in order to full fill the modelling purpose of SUNSHINE in particular:

- Requirements related to the CityGML Creation procedure. In particular, requirements on input data for the procedure will be stated.
- Requirements related to the Building Micro-Weather computation procedure. In particular, requirements on input data for the procedure will be stated.
- Requirements related to the Building Energy Performance computation procedure. In particular, requirements on input data for the procedure will be stated.

6.1 Data and Metadata Requirements

6.1.1 Geographical data

REQ-DAT-001.	Geographical data shall include the 3D CityGML model (up to Level of Detail 1) of buildings for the area of interest or, alternatively, shall include all the necessary data to create it.
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REQ-DAT-002.	Optional geographical data for visualization purposes shall include: imagery, street network data and electric network data for public lighting.
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6.1.2 Infrastructure data

REQ-DAT-010.	Building class data shall include: construction year and building type (according to TABULA project).
REQ-DAT-011.	Building volumes data shall include: heated building volume, surface of the heated part of the building, total floor area, height of the building, number of storeys, assessed percentage of the building, number of apartments, occupation status of rooms.
REQ-DAT-012.	Building environmental data shall include: number of days in the heating season, average outside temperature for the heating season, inside design temperature.
REQ-DAT-013.	Building energy performance data shall include: average heat transmission coefficient of the building envelopes, specific U-values (for walls, roof, floors and windows), specific energy consumption rates (for heating, cooling, hot water, lighting, ventilation).
REQ-DAT-014.	Thermal systems data shall include: method of heating, type of heating fuel, main heating controls, method of cooling, type of fuel for cooling, type of ventilation, type of air conditioning.
REQ-DAT-015.	Lighting network data shall include: light points coordinates, light points position (indoor/outdoor), dimmable property (yes/no), type of lamp.
REQ-DAT-016.	Building configuration data shall include the state throughout the day of: windows, shutters, ventilation and room occupation.
REQ-DAT-017.	Available existing building energy certificates or historical consumptions of building, these data are needed in order to evaluate and calibrate the large scale energy performance evaluation.

6.1.3 Weather Forecast data

REQ-DAT-020.	Weather forecast data and derived variables shall be available with very high resolution (up to the single building resolution) for the relevant area of interest.
REQ-DAT-021.	Weather forecast data shall include: temperature, precipitation, wind, storm, snow, clouds, fog, humidity and pressure.
REQ-DAT-022.	Weather forecast derived probabilistic information shall include: frost, rain, maximum wind gusts above 100 Km/h.

REQ-DAT-023.	Weather forecasts shall be available with a minimum of two releases per day, shall have a time span up to the tenth day and shall have an hourly temporal resolution at least in the first days
REQ-DAT-024.	Historical weather predictions shall be accessible to the Sunshine system.
REQ-DAT-025.	Weather data shall be available in grib or netcdf format.

6.1.4 Meter and Billing data

REQ-DAT-030.	Meter data types handled by the system shall include: electrical energy, thermal energy, and heating fuel consumption.
REQ-DAT-031.	Meter readings shall report the measured consumption, the corresponding timestamp and the feature of interest (building, light point, etc) the meter is related to.
REQ-DAT-032.	Meter readings shall be taken at least with an hourly frequency and shall be available in near real-time.
REQ-DAT-033.	Energy billing data shall be accessible to the Sunshine system.

6.1.5 Sensor data

REQ-DAT-040.	Sensor data for lighting networks shall include: lamp presence detection (yes/no), lamp status (ok/not ok), current light level, dimmer level, power consumption, burning hours.
REQ-DAT-041.	Sensor data for lighting networks shall optionally include noise level and movement detection.
REQ-DAT-042.	Sensor data from building outdoor weather station shall be optional and may include: pressure, relative humidity, air temperature, wind components, precipitation.
REQ-DAT-043.	Sensor data for building indoor climate shall be optional and may include temperature and relative humidity.
REQ-DAT-044.	Sensor readings shall report the measured quantity, the corresponding timestamp and the feature of interest (building, light point, etc) the sensor is related to.
REQ-DAT-045.	Sensor readings shall be available in near real-time.

6.1.6 User Profile data

REQ-DAT-050.	User profile data shall include: command schedules for remote sensors/controllers, building
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	comfort levels rules for sensor event triggering, choice of alert notification channels and corresponding configuration parameters, user data sharing level.
REQ-DAT-051.	User-defined rules for sensor event triggering shall specify: the sensor of interest, the triggering condition and the action corresponding to the triggering.
REQ-DAT-052.	User-defined command schedules for remote sensors/controllers shall specify: the sensors/controllers of interest, the desired action, start and duration of action execution.

6.2 Modelling Requirements

6.2.1 CityGML Model

REQ-MOD-001.	Sunshine application shall mandatorily have access to geo-referenced building footprints for the area of interest in shp, dxf or dwg format.
REQ-MOD-002.	Sunshine application shall mandatorily have access to digital terrain models with sub-meter resolution for the area of interest in asc, surfer grid or lidar format.
REQ-MOD-003.	Sunshine application shall mandatorily have access to digital surface models with sub-meter resolution for the area of interest in asc, surfer grid or lidar format.
REQ-MOD-004.	Sunshine application shall mandatorily have access to information about the year of construction and use of the buildings.
REQ-MOD-005.	Sunshine application shall optionally have access to a 3D model of the area of interest in 3ds, obj, collada or cityGML format.
REQ-MOD-006.	Sunshine application shall optionally have access to orthophotos for the area of interest in tiff, png, jpg or ecw format.
REQ-MOD-007.	Sunshine application shall optionally have access to more detailed data (at least LoD3) for specific buildings of interest.

6.2.2 Building Outdoor Weather model

REQ-MOD-010.	Sunshine application shall mandatorily have access to updated forecasts, historical predictions and observations of the weather conditions over the area of interest.
REQ-MOD-011.	Sunshine application shall optionally have access to updated and historical meteorological features over weather stations associated with a building or a group of buildings of interest.

REQ-MOD-012.	Sunshine application shall optionally have access to geographical data modelling the ground features of the area of interest (DTM, DSM or 3D city model).
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6.2.3 Building Indoor Climate model (for weather alert and suggestion)

REQ-MOD-020.	Sunshine application shall mandatorily have access to updated and historical consumption data.
REQ-MOD-021.	Sunshine application shall mandatorily have access to updated and historical outdoor building weather forecast.
REQ-MOD-022.	Sunshine application shall optionally have access to updated and historical indoor climate data.
REQ-MOD-023.	Sunshine application shall optionally have access to updated and historical building configuration data (windows, shutters, ventilation, and occupation state).
REQ-MOD-024.	Sunshine application shall optionally have access to user-defined desired indoor comfort level.

6.2.4 Building Energy Performance model

REQ-MOD-030.	Sunshine application shall mandatorily have access to data on footprints, height, construction year and building use (residential, commercial, industrial, public, etc) for all the buildings in a well defined pilot area of interest.
REQ-MOD-031.	Sunshine application shall mandatorily have access to official energy certification data or official energy consumption data for a number of the residential buildings in the pilot area of interest.
REQ-MOD-032.	Sunshine application shall mandatorily have access to building typology data for all the pilot areas of interest.
REQ-MOD-033.	Sunshine application shall optionally have access to data on building storey number, storey height and number of building units for all the residential buildings in the pilot area of interest.