



Plug-N-Harvest

WP3: THE PLUG-N-HARVEST CONTROL AND MANAGEMENT AT BUILDING AND DISTRICT LEVEL

ORGANIZATION: CERTH, ODINS, ETRA I+D, SIEMENS
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MEETING: 7TH PLENARY MEETING 26-27 FEBRUARY 2020, BRUSSELS, BELGIUM

Plug-N-Harvest: Project Information

Cordis Europa URL:

http://cordis.europa.eu/project/rcn/211287_en.html

Project Website: www.plug-n-harvest.eu

Project Acronym : PLUG-N-HARVEST

Project ID: 768735

Funded under: H2020-EU.2.1.5.2. - Technologies enabling energy-efficient systems and energy-efficient buildings with a low environmental impact

Project Start Date: 1st of September 2017

Duration: 51 months

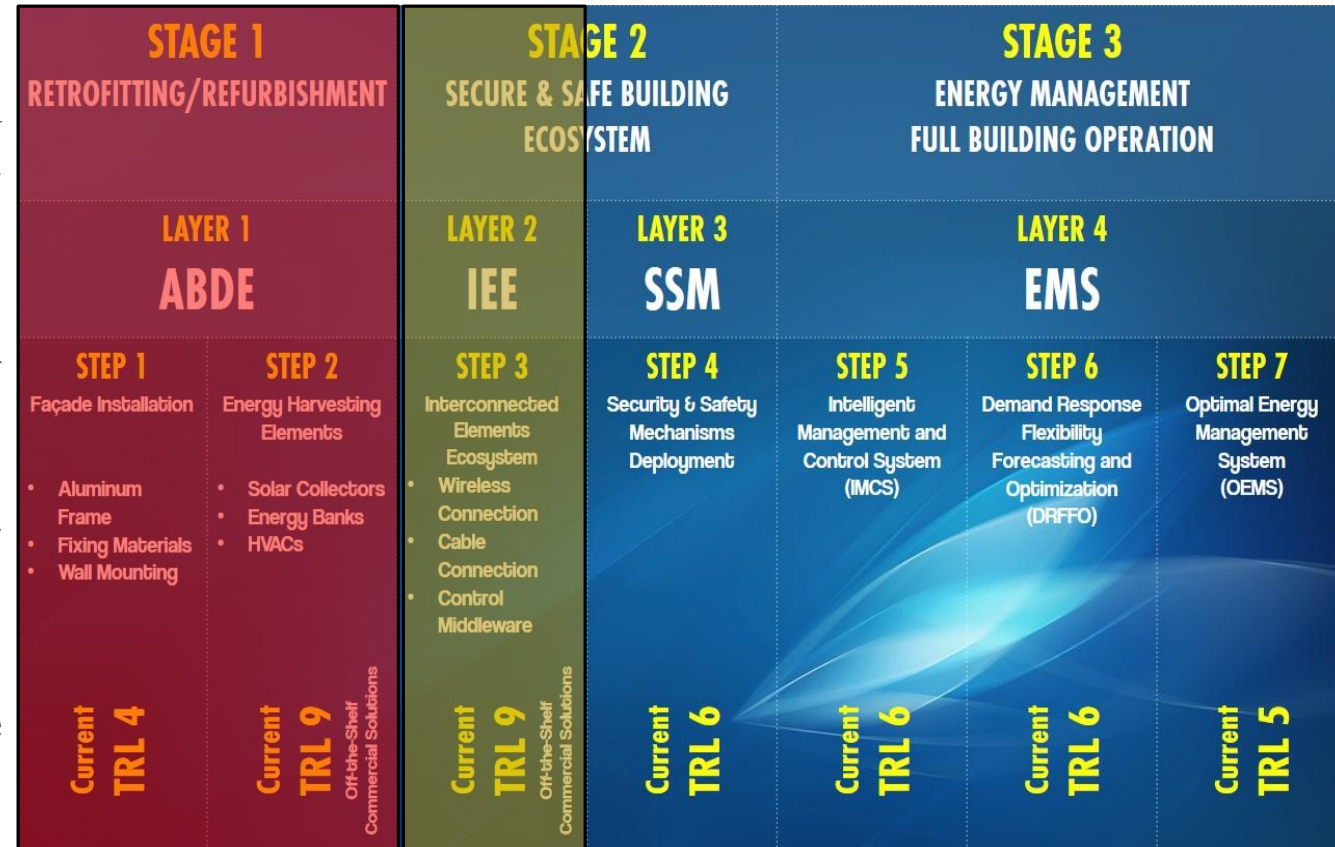
List of Participants

1	Centre for Research and Technology Hellas - CERTH
2	Rheinisch-Westfaelische Technische Hochschule Aachen - RWTH
3	Cardiff University – CU
4	Aloumyl, Biomichania Alouminioy Anonimi Etairia - ALUMIL
5	Sistemes Avancats De Energia Solar Termica Sccl - AIGUASOL
6	Odin Solutions s.l. - ODINS
7	SIEMENS SRL - SIE
8	Etra Investigacion Y Desarrollo Sa - ETRA
9	Energy Transitions Limited - ET
10	Eco Intelligent Growth, SL - EIG
11	Agencia De L'habitatge De Catalunya - AHC
12	Periferia Dytikhs Makedonias - RWM
13	County Council Of The City And County Of Cardiff - CCC



Plug-N-Harvest: WP3 Description

- WP3 activities are related to:
 - Support the requirements identification and suggest solutions for the **Interconnected Elements Ecosystem (IEE) – Layer 2**.
 - Develop tailored solutions for **Security and Safety Mechanisms (SSM) – Layer 3**.
 - Develop tailored solutions for **Energy Management System (EMS) – Layer 4**.
 - Integrate Layer 2 and verify the functionalities Layers 3 and 4.



Plug-N-Harvest: WP3 Deliverables

No	Title	WP	Responsible	Type	Dissem. Level	Expected Del. Date	Actual Del. Date
3.1	Plug-n-Play Intelligent Management and Control System (IMCS) for ADBE	3	CERTH	R	PU	a:M18 b:M39	M19 (March 2019)
3.2	Plug-N-Play Optimal Energy Management System (OEMS) at District/Grid Level	3	ETRA	R	PU		
3.3	Control Safety Mechanisms	3	CERTH	R	PU		
3.4	Privacy and Security Components Description	3	ODINS	R	PU		
3.5	Integration and Verification of IMCS/OEMS for ADBE	3	CERTH	R+DEC	PU/CI	a:M21 b:M39	M23 (July 2019)



Plug-N-Harvest: WP3 Timeline and Progress

Implementation Cycles Date(s): *01/12/2017 (M4) – 28/2/2019 (M18) & 01/12/2019 (M28) – 30/11/2020 (M39)*

- Outcomes so far: conducted **19** joint telcos
 - Functional description for all WP3 components [10/01/2018].
 - Internal technical discussion of WP3 contributors to resolve minor collaboration issues [6/3/2018].
 - Equipment specifications for BMS compatibility [23/4/2018].
 - List of necessary equipment for building control (feedback vector) [11/5/2018].
 - Merged list of necessary equipment both for building control and evaluation (monitoring) [24/5/2018].
 - Wireless indoor deployment strategy support map [in July 2018/by OdinS, CERTH]
 - Dummy remote server for interfaces verification [in October 2018/by OdinS]
 - Verified remote connections [in November 2018/by CERTH, ETRA, SIEMENS]
 - WP3 modules architectural topology [in November 2018/by ALL]
 - Cloud-based deployment strategy for ICT modules [in February 2019/by ALL]
 - Integrated architectural topology **peer reviewed publication** [accepted in February 2019/by OdinS+CERTH]
 - Data Annotation of common data model [in February 2019/by ALL]
 - Modules execution sequence definition [in May 2019/by ALL]
 - Data exchange NGSi mapping formalized [in August 2019/by ALL]
 - Technical manual for gateways and BMS interfaces deployment [in January 2020/by CERTH+OdinS]
 - Pre-pilot data collecting and storing modules for historical data collection (BMS server, weather API, comfort index calculation API, gateway dockers, central database, etc.) [in January 2020/by OdinS+ETRA+CERTH/ITI]
 - Modules execution sequence implementation using BMS tokenized operation [in February 2020/by ALL]
 - Preliminary joint verification tests at CERTH's pre-pilot site [in February 2020/by ALL]



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Plug-N-Harvest: Task 3.1 Intelligent Management and Control System (IMCS)



Plug-N-Harvest: Task 3.1 IMCS

- **Development steps of IMCS module finished:**
 - Architecture.
 - Development of functionalities.
 - Connection with dummy server.
 - Definition of inputs/outputs.
 - Data exchange format.
 - Connection with BMS server.
 - Real connection with BMS server in the pre-pilot case.
 - Send/Receive data to/from BMS server.
 - Token/Message exchange with BMS server.



Plug-N-Harvest: Task 3.1 IMCS

■ Next steps

- Integrate within a common execution management framework.
- Connection with other ICT modules.
- Test IMCS module in pre-pilot test case.



Plug-N-Harvest: Task 3.2 OEMS & DRFFO



Plug-N-Harvest: Task 3.2 OEMS & DRFFO

- **Pending:**

- Define communication protocol between ETRA/CERTH modules in DRFFO -> Pending telco.



Plug-N-Harvest: Task 3.2 OEMS

■ **DONE:**

- Communication with Synchronization channel
- Communication with BMS (IoT Gateways)
- Integration of historical data from pre-pilot
- Architecture finished in lab environment
- Defined data model.
- Prepared production environment

■ **PENDING:**

- Integration of tokens sequence for Synchronization channel.
- Integration of Pilots' gateways information.



Plug-N-Harvest: Task 3.2 OEMS

- **NEXT STEPS:**

- Testing of OEMS v1,
- Deploying OEMS in server,
- Integration of KPIs calculation in DRFFO,
- Finalization of OEMS GUI with C.E. alerts,
- Generation of scheduled actions.



Plug-N-Harvest: Task 3.2 Weather module

- **DONE:**

- Version 1 running and deployed in server

- **PENDING:**

- Incorporation of new tokens sequence for Synchronization channel

- **NEXT STEPS:**

- Development of version 2 (tokens' sequence)
- Deploying of version 2



Plug-N-Harvest: Task 3.2 DRFFO

□ DONE

- Architecture
- Development of functionalities
- Connection with dummy server
- Definition of inputs/outputs
- Data exchange format
- Finalized the deployment the DRFFO module in server
- Connection with BMS server
- Further development of DRFFO functionalities
- Real connection with BMS server
- Send/Receive data to BMS server
- Send/Receive historical data from CERTH/ITI pre-pilot to BMS server
- Send/Receive simulated data to BMS server finished
- Get current building operational states from CERTH/ITI pre-pilot smart-house



Plug-N-Harvest: Task 3.2 DRFFO

■ PENDING/ NEXT STEPS:

- Simulate building operational states from the current building operational state
- Optimal building operational state selection
- Building flexibility
- District flexibility
- Connection with other ICT modules
- Test DRFFO module in pre-pilot test case



Plug-N-Harvest: Task 3.3

Safety and Faults Mitigation



Plug-N-Harvest: Task 3.3 Safety and Faults Mitigation

- **Development of SFM module:**
 - Architecture finished after refactoring
 - Continues development of updated safety-functionalities supported by new architecture
 - Connection to BMS
 - Definition of inputs/outputs
 - Data model defined.
 - SFM base modules defined
 - Deployment of SFM on dev server.



Plug-N-Harvest: Task 3.3 Safety and Faults Mitigation

■ Next steps

- Token based connection with BMS server in progress
- Analysis of Pilots information
- Data-driven development of SFM functionalities.
- Analytics flow, trigger and sync mechanism optimization
- Profiling of solution in pilots use case
- Deploy on prod infrastructure



Plug-N-Harvest: Task 3.4 Security and Privacy Components



Plug-N-Harvest: Task 3.4 Security and Privacy Components

- **Development of Security/Privacy modules:**
 - Architecture Security/Privacy BMS finished.
 - Development of Security/Privacy functionalities finished.
 - Development of Secure Java Applications for IoT Gateways and other ICT modules.
 - Development of Common Historical Database finished.
 - Definition of Secure Interface and REST APIs finished.
 - Data model and exchange format finished.
 - Deployment of production BMS server finished.
 - Deployment of Common Historical Database server finished.
 - Connection in progress with other ICT modules (OEMS-ETRA, IMCS-CERTH, DRFFO-CERTH, Safety-SIEMENS)
 - Further development of functionalities for CP-ABE Synchronization tokens.
 - Real connection with CERTH pre-pilot.
 - Receive/Forward data from CERTH gateways and databases.



Plug-N-Harvest: Task 3.4 Security and Privacy Components

■ Next steps

- Test Actuations (e.g. Turn on/off) with CERTH gateway-software and pre-pilots actuators.
- Finish the connection with other ICT modules. OEMS-ETRA, IMCS-CERTH, DRFFO-CERTH, Safety-SIEMENS.
- Test CP-ABE Synchronization tokens with other ICT modules.
- Test BMS module and Common Historical Module in end-users pilots.
- Analyze the security improvements of Common Historical Module. (e.g. HTTPS, Oauth)



Plug-N-Harvest: Task 3.5 Integrated Functional ICT Module



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- **Development of Energy Management System (EMS) module:**
 - Architecture finished.
 - Development of functionalities finished.
 - Definition of inputs/outputs finished.
 - Data exchange format finished.
 - All modules up and connected to BMS server.
 - Sequence for monitoring release has been defined and agreed.
 - Sequence for holistic prototype release has been defined and agreed.



Plug-N-Harvest: Task 3.5 Integrated Functional ICT Module

- **Next steps**
 - Implement tokenized execution sequence for monitoring release.
 - Implement tokenized execution sequence for prototype release.



Plug-N-Harvest: WP3 Next Steps

- ❑ Pre-pilot data collecting and storing modules for historical data collection (BMS server, weather API, comfort index calculation API, gateway dockers, central database, user interface etc.) [in February 2020/by OdinS+ETRA+CERTH/ITI]
- ❑ Preliminary joint verification tests at CERTH's pre-pilot site [in February 2020/by ALL]

**Strongly related to
Task 4.1**





Thank you!

