Plug-N-Harvest

WP5 – CIRCULAR ECONOMY BUSINESS MODEL AND EXPLOITATION PLAN

ORGANIZATION: AIGUASOL, EIG, CERTH
PRESENTER(S): TONI HERENA (AIGUASOL), CRISTINA SENDRA (EIG), NIKOS MARGARITIS (CERTH), CHRISTOS RAVANIS (CERTH)

Plug-N-Harvest: Presentation Outline

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   2. Task 5.2 – Evaluation methodologies and Impact Assessment of CE solutions
   3. Task 5.3 – Life Cycle Costing analysis
   4. Task 5.4 – Development of financial Business Models and implementation for demo cases
   5. Task 5.5 – Standardization Models and Analysis
   6. Task 5.6 – Exploitation Strategy and Business Plans

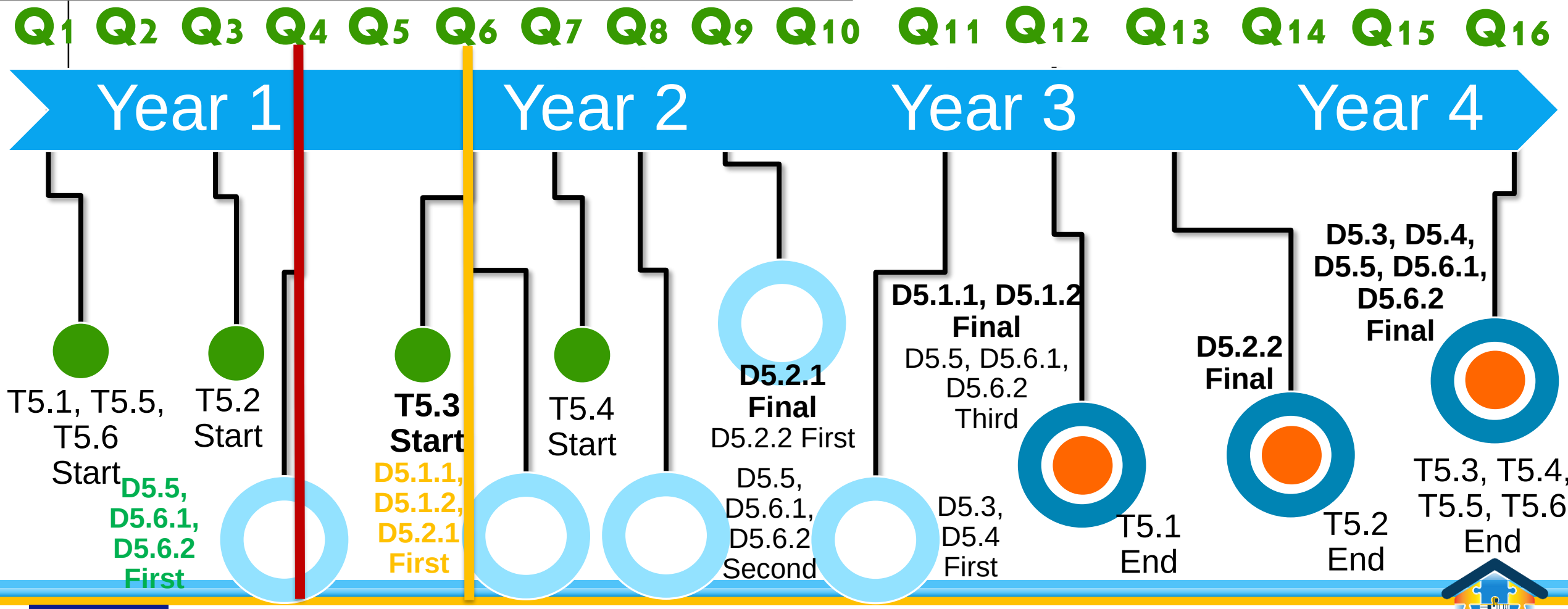
Summary WP5

Summary WP5

- The main goal of WP5 “Circular Economy Business Model & Exploitation Plan” is to develop and implement products as business models based on the Circular Economy, allowing the massive replicability of the solutions developed according to the market conditions, and ensuring paybacks periods less than 10 years by considering the complete solutions as physical and financial asset
- This breaks down as follows:
  - Develop business models for each one of the demo cases, adjusting to their singularities, technical and financial boundary conditions and national regulations to obtain viable models based on renting and leasing options
  - Design a modular ADBE solution (product & system) consistent with the concepts of circular economy: for instance, the use of reusable non-toxic and recyclable materials or the guarantee of maximum energy reductions and maximum energy harvesting
- In order to ensure the viability of the developed economic models, the work will be done transversally to the rest of WPs, in a continuous feedback loop process

WP5 Schedule and Progress

WP5 Timeline



WP5 progress

- Task 5.1: delivered first versions of D5.1.1 and D5.1.2 on February 28th
  - T5.1.1 – Five Circular Economy design requirements
  - T5.1.2 – Development of a materials database based on circular materials and products
- Task 5.2: delivered first version of D5.2.1 on February 28th
  - T5.2.1 – Design of a methodology to assess the degree of compliance of CE principles for the construction and building renovation sector
  - T5.2.2 – Life Cycle Assessment, starts in March 2019
- Task 5.3: just started in January 2019
  - Life Cycle Costing Analysis
- Task 5.4: just started in March 2019
  - Development of Financial Business Models
- Task 5.5: delivered first version of D5.5 on August 31st that will be annually updated
  - Standardization Models and Analysis
- Task 5.6: delivered first versions of D5.6.1 and D5.6.2 on August 31st that will be annually updated
  - T5.6.1 – Market analysis and Business Plans
  - T5.6.2 – Exploitation Plans

Overview of WP5 Tasks progress

WP5 – Circular Economy Business Model & Exploitation Plan

T5.1 CIRCULAR ECONOMY DESIGN DELIMITANTS, CONDITIONERS & MATERIALS DATABASE

TASK RESPONSIBLE: EIG
PRESENTER(S): CRISTINA SENDRA

MEETING: 5TH PLENARY MEETING, AACHEN, 26-27 FEBRUARY 2019

Task 5.1 Circular Economy design requirements, conditioners & Material Database

- Task Leader: EIG
- Task activities:
  - Determination of Circular Economy Design Requirements and internal and external dissemination of them
  - Development of a Materials Database Web Tool, including materials and solutions of façades and for different latitudes and technical requirements
- Deliverables:
  - D5.1.1a Guidelines On Circular Economy Design Requirements And Conditioners (submitted)
  - D5.1.2a Materials Database Web Tool (submitted)
  - D5.1.1b Guidelines On Circular Economy Design Delimitants And Conditioners (due February 2020)
  - D5.1.2b Materials Database Web Tool (due February 2020)
- Status of task: 1st stage almost completed

D5.1.1 CE Design Requirements

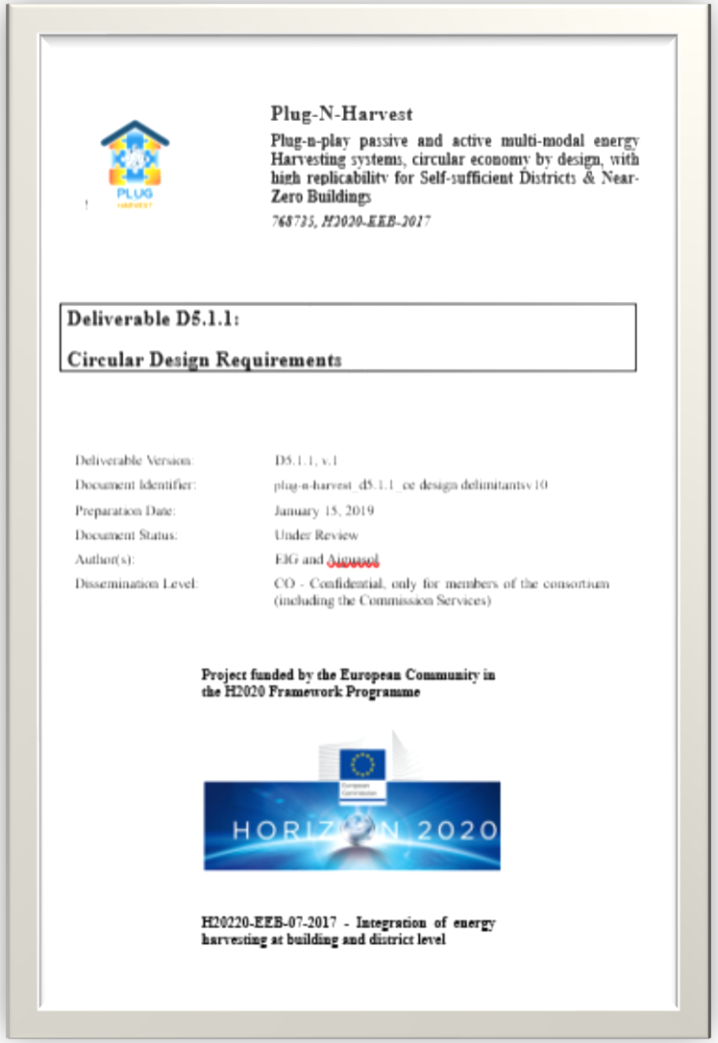
- The main outputs of D5.1.1 are:
  - A thorough review of current market CE measures
  - The clear definition of five CE design guidelines to be internally (Webinars, meetings) and externally (KUMU) disseminated
  - Provide support to incorporate the CE design guidelines into the Tenders for PLUG-N-HARVEST pilot implementation

D5.1.1 CE Design Guidelines

- The main outputs of D5.1.1 are:
  - A thorough review of current market CE measures:

CIRCULAR DESIGN REQUIREMENTS, based on 5 Design Guidelines:

i. Safe materials
ii. Design for Cycling
iii. Transparency and Traceability
iv. Preserve Critical raw Materials
v. Circular Business Models



Plug-N-Harvest

Plug-n-play passive and active multi-modal energy Harvesting systems, circular economy by design, with high replicability for Self-sufficient Districts & Near-Zero Buildings

768735, H2020-EEB-2017

Deliverable D5.1.1:

Circular Design Requirements

Deliverable Version:	D5.1.1, v.1
Document Identifier:	plug-n-harvest_d5.1.1_ce design delimitantsv10
Preparation Date:	January 15, 2019
Document Status:	Under Review
Author(s):	EIG and Aimarsol
Dissemination Level:	CO - Confidential, only for members of the consortium (including the Commission Services)

Project funded by the European Community in the H2020 Framework Programme

H20220-EEB-07-2017 - Integration of energy harvesting at building and district level

D5.1.1 CE Design Guidelines

MAKE USE OF

CE Design guidelines

- SCHEDULE MEETINGS WITH ALL PARTNERS TO REVIEW DESIGN APPROACH
- REVIEW DESIGN OF ALL PILOTS
- CIRCULAR WEBINARS

Ensuring this way that Plug-n-Harvest solution meets CE requirements and are compatible with Circular Business model

D5.1.1 CE Design Guidelines

MAKE USE OF

CE Design guidelines into the TENDERS

Through the technical specifications

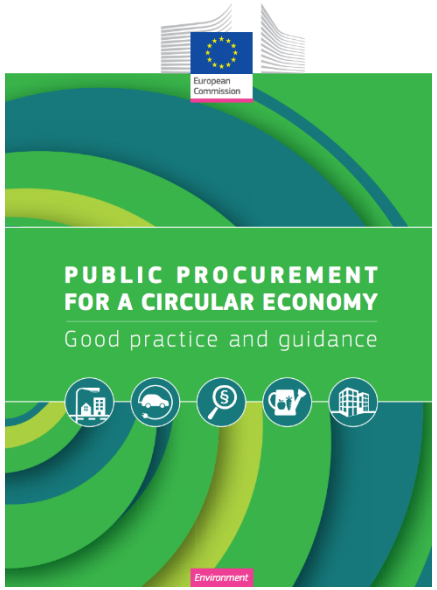
Ensuring this way that Plug-n-Harvest solution meets CE requirements

D5.1.1 CE Design Guidelines

EACH WP

should revise the tender with the pilot site to make use of the Circular Economy Design guidelines in each Work Package

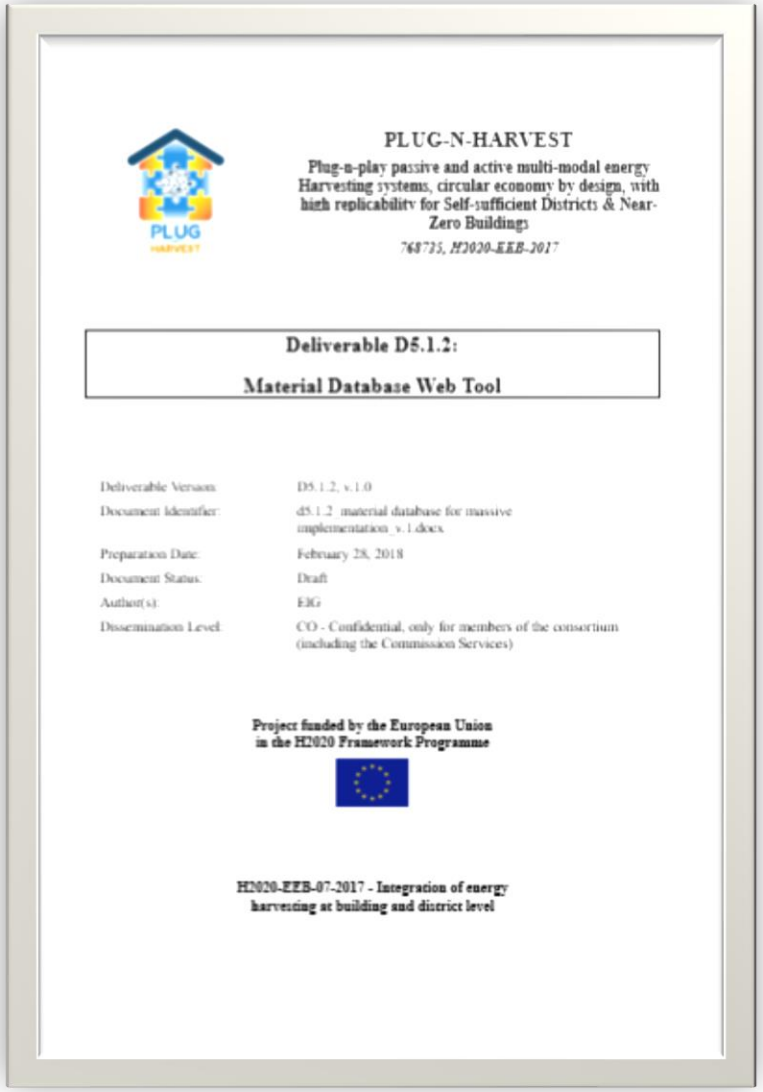
Defining a truly circular tender!!



Through the technical specifications

D5.1.2 Material Database

- The main outputs of D5.1.2 are:
  - A Material Database web tool (airtable support)
  - Definition of the key parameters that are included in the Database
  - Description of the sorting and filtering criteria
  - Cover letter to encourage database nourishment by external stakeholders



PLUG-N-HARVEST

Plug-n-play passive and active multi-modal energy Harvesting systems, circular economy by design, with high replicability for Self-sufficient Districts & Near-Zero Buildings

768735, H2020-EEB-2017

Deliverable D5.1.2:

Material Database Web Tool

Deliverable Version:	D5.1.2, v.1.0
Document Identifier:	d5.1.2_material database for massive implementation_v.1.docx
Preparation Date:	February 28, 2018
Document Status:	Draft
Author(s):	EIG
Dissemination Level:	CO - Confidential, only for members of the consortium (including the Commission Services)

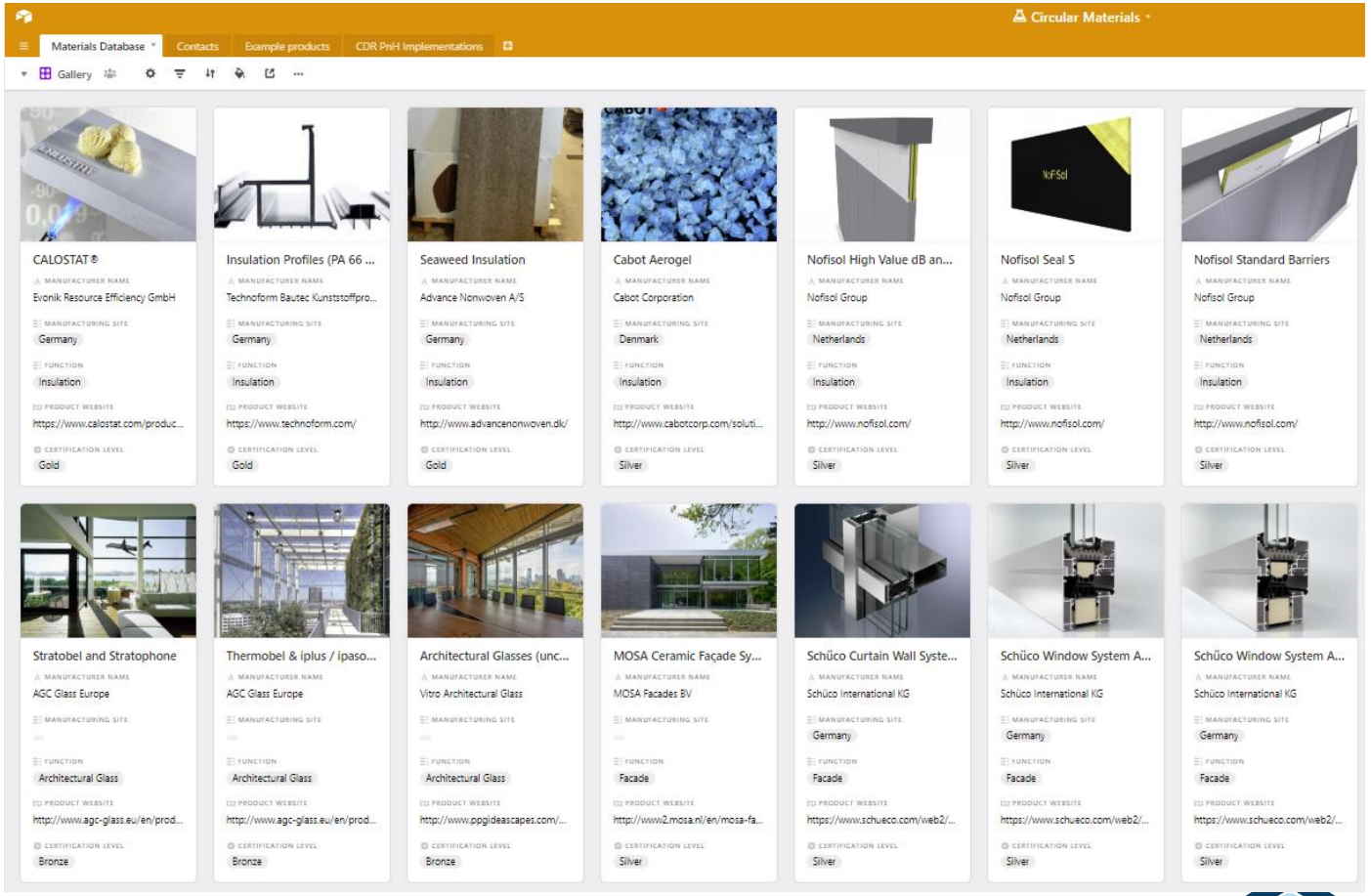
Project funded by the European Union in the H2020 Framework Programme

H2020-EEB-07-2017 - Integration of energy harvesting at building and district level

D5.1.2 Material Database

- Database with all properties needed. Additionally, this database can be filtered by the product functionality, etcetera.
- All data for KPIs and DPIs related to circular economy is gathered there. Using the data will generate:

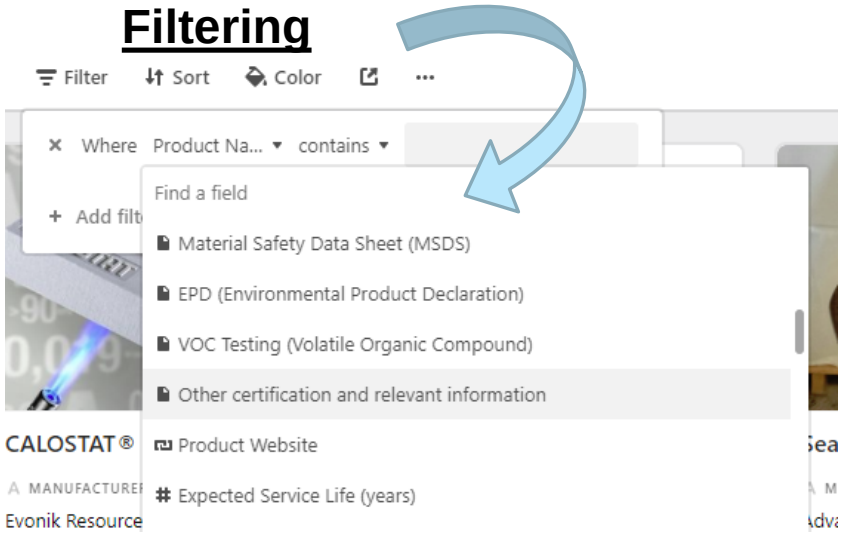
Products RATING in order to help pilot sites in the material selection



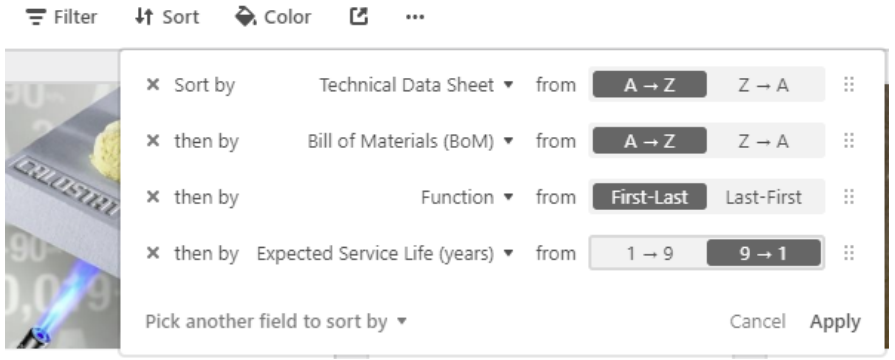
D5.1.2 Material Database

Different possibilities to visualize data within the Material Database

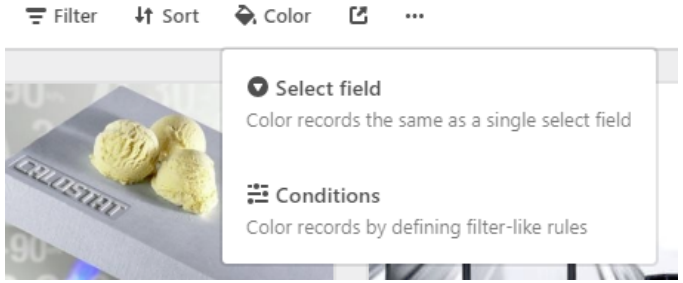
Filtering



Sorting



Colouring



https://airtable.com/shrqupcVajnDQd9YW

WP5 – Circular Economy Business Model & Exploitation Plan

T5.2 EVALUATION METHODOLOGIES AND IMPACT ASSESSMENT OF CIRCULAR ECONOMY SOLUTIONS

TASK RESPONSIBLE: AIGUASOL
PRESENTER(S): TONI HERENA

MEETING: 5TH PLENARY MEETING, AACHEN, 26-27 FEBRUARY 2019

Task 5.2 Evaluation methodologies and Impact Assessment of CE solutions

- Task Leader: AIGUASOL
- Task activities:
  - Development of a methodology to assess the degree of compliance of CE principles in the field of construction sector
  - Performance of a Life Cycle Assessment (LCA) of the designed solutions
- Deliverables:
  - D5.2.1a Methodology To Check The Degree Of Compliance Of CE Principles On The Initial Stages Of Design (submitted)
  - D5.2.2a Report On Environmental Impact Assessment (due January 2020)
  - D5.2.1b Methodology To Check The Degree Of Compliance Of CE Principles On The Initial Stages Of Design (due November 2019)
  - D5.2.2b Report On Environmental Impact Assessment (due November 2020)
- Status of task: 1st stage almost completed

Task 5.2 Evaluation methodologies and Impact Assessment of CE solutions

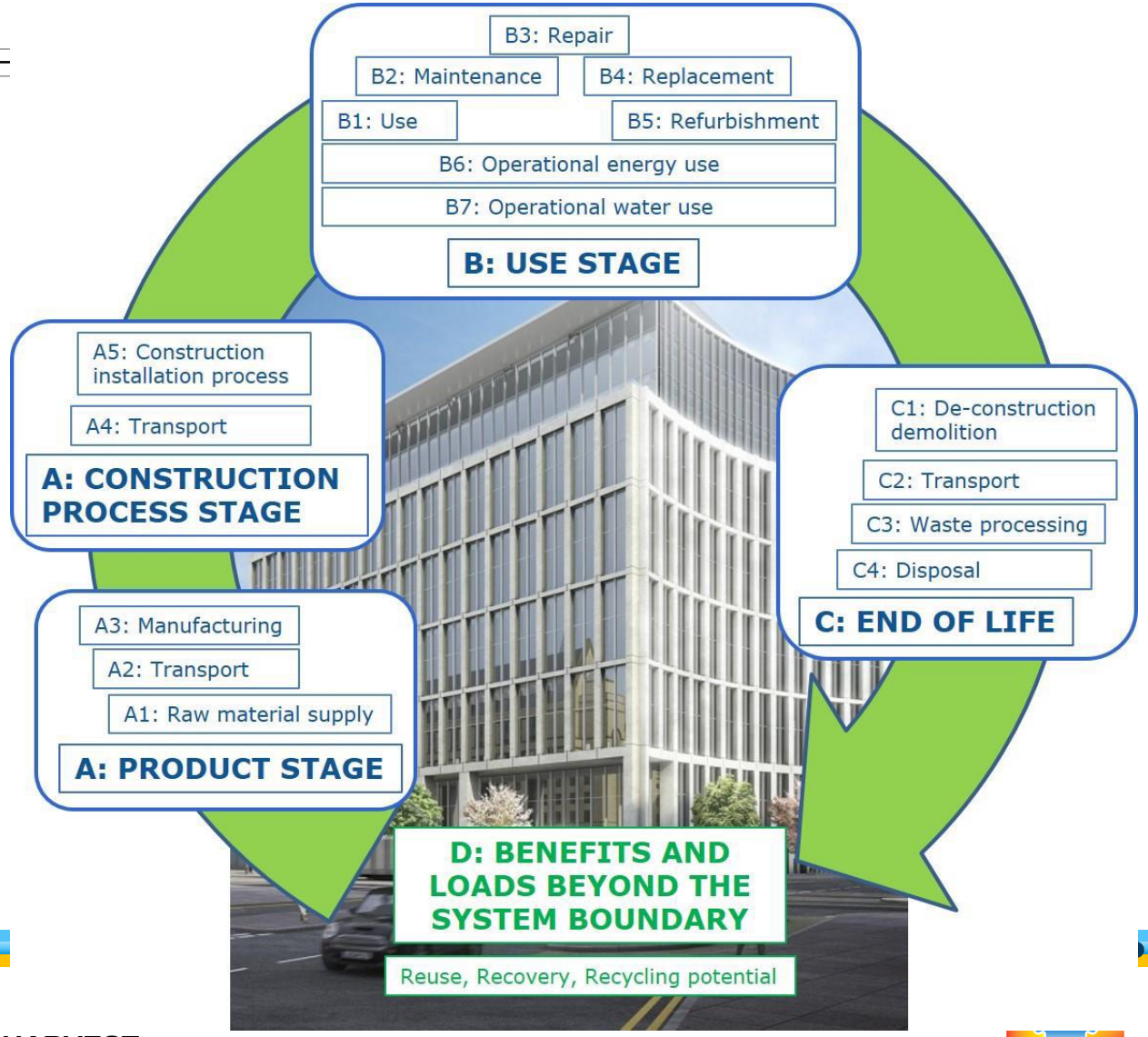
- Main outcome of Task 5.2.1 is a methodology to assess the degree of circularity in the building construction sector under a life cycle approach
  - New building construction
  - Major renovation

- Circularity is addressed from the perspective of 4 main vectors:
  - Energy use
  - Materials use
  - Water use
  - Social impact

- The methodology include the economic evaluation of the activity addressed (new building construction or major renovation)

Task 5.2 Evaluation methodologies and Impact Assessment of CE solutions

- Circularity addressed in four life cycle stages (according with EN 15978 Sustainability of construction works – Assessment of environmental performance of buildings)
  - Product stage
  - Construction stage
  - Use stage
  - End of life



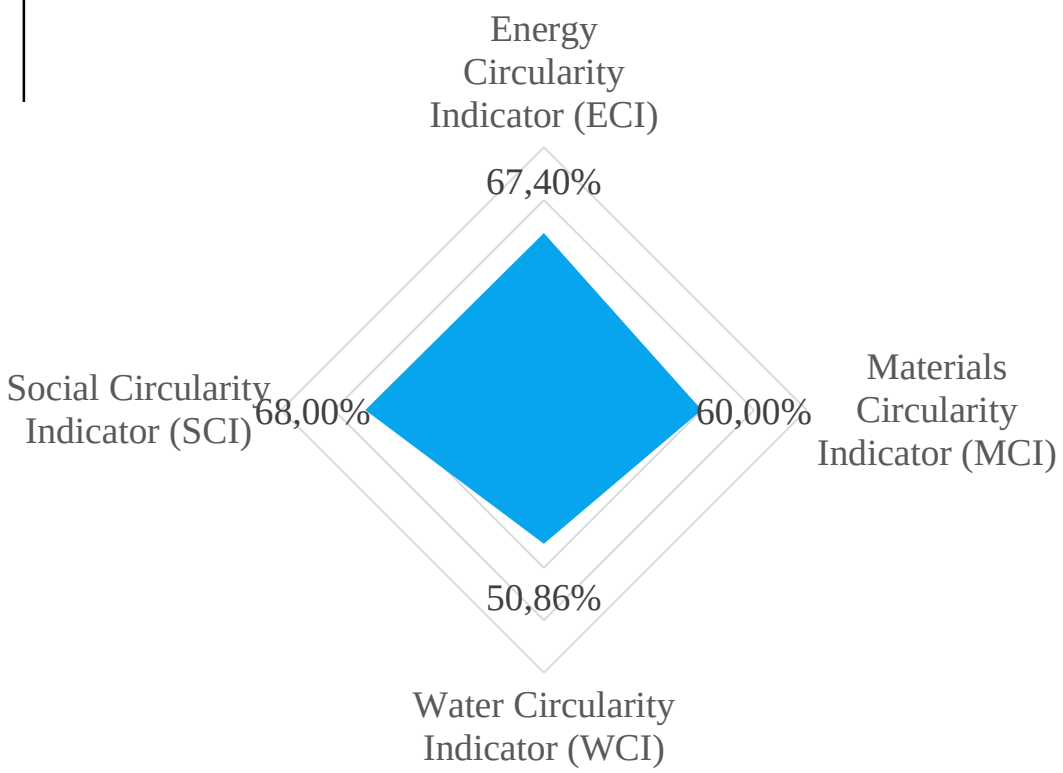
Task 5.2 Evaluation methodologies and Impact Assessment of CE solutions

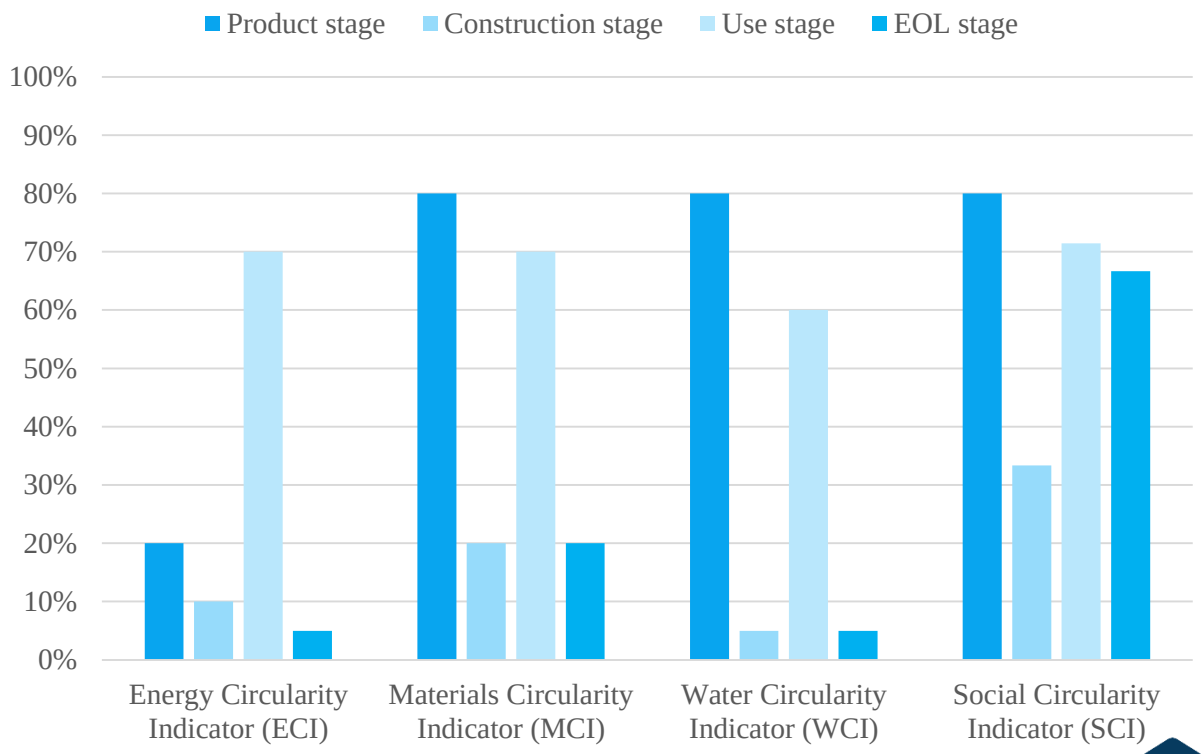
- The results will be given in % of circularity over the total magnitude of consumptions or requirements

Circularity Assessment	Circularity indicator ratios [%] and circularity vectors magnitudes										
	Product stage		Construction stage		Use stage		EOL stage		Total		
	Ratio (%)	Magnitude	Ratio (%)	Magnitude	Ratio (%)	Magnitude	Ratio (%)	Magnitude	Ratio (%)	Magnitude	Units
Energy Circularity Indicator (ECI)											kWh
Materials Circularity Indicator (MCI)											kg
Water Circularity Indicator (WCI)											m3
Social Circularity Indicator (SCI)											# of categories

Task 5.2 Evaluation methodologies and Impact Assessment of CE solutions

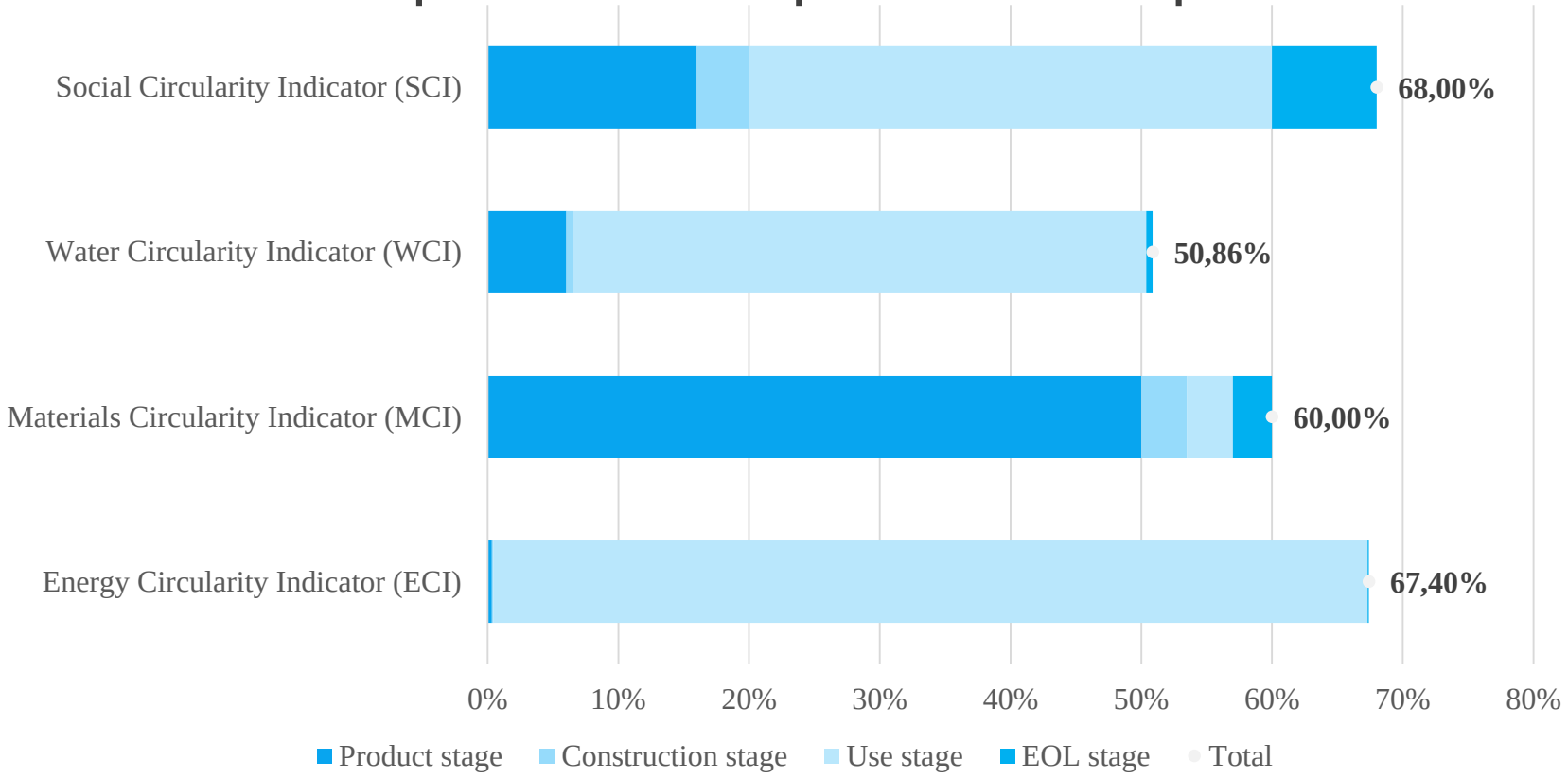
- The results are also expected to be presented in plots





Task 5.2 Evaluation methodologies and Impact Assessment of CE solutions

- The results are also expected to be presented in plots



Task 5.2 Evaluation methodologies and Impact Assessment of CE solutions

- Economic results are closely linked with Task 5.3 – Life Cycle Costing Assessment

Economic Circularity Assessment reporting	Product stage [€]	Construction stage [€]	Use stage [€]	EOL stage [€]	Total [€]
CAPEX					
OPEX					
Revenues / Reduced burdens					
TOTAL					

Task 5.2 Evaluation methodologies and Impact Assessment of CE solutions

- Task 5.2.2 will work in close collaboration with Task 5.3 to carry out a joint Life Cycle Assessment and Life Cycle Costing assessment

- Subtask just started

WP5 – Circular Economy Business Model & Exploitation Plan

T5.3 LIFE CYCLE COSTING ANALYSIS

TASK RESPONSIBLE: CERTH
PRESENTER(S): NIKOS MARGARITIS

MEETING: 5TH PLENARY MEETING, AACHEN, 26-27 FEBRUARY 2019

Task 5.3 Life Cycle Costing analysis

- Task Leader: CERTH
- Task activities:
  - Carry out a Life Cycle Costing (LCC) modelling
  - Provide and assessment of the long-term cost effectiveness of each component
- Deliverables:
  - D5.3a Report On Life Cycle Cost Analysis (due May 2020)
  - D5.3b Report On Life Cycle Cost Analysis (due August 2021)
- Status of task: ongoing (incipient stage, started January 2019)

Task 5.3 Life Cycle Costing analysis: Methodology and key issues

- Main categories: construction, operation, maintenance, refurbishment and disposal
- Energy savings and externalities costs: to be in line with Life Cycle Analysis (in Task 5.2)
- Cost effectiveness of each component
- Functional unit: €/m2/year
- Approach to the scalability at district scale level

WP5 – Circular Economy Business Model & Exploitation Plan

T5.4 DEVELOPMENT OF FINANCIAL BUSINESS MODELS AND IMPLEMENTATION FOR DEMO CASES

TASK RESPONSIBLE: AIGUASOL
PRESENTER(S): TONI HERENA

MEETING: 5TH PLENARY MEETING, AACHEN, 26-27 FEBRUARY 2019

Task 5.4 Development of financial Business Models and implementation for demo cases

- Task Leader: AIGUASOL
- Task activities:
  - Adaptation of financial business models to demo cases
  - Analysis of risks and benefits considering the technical, energetic and economic real results obtained
  - Study of scalability at district level scale
- Deliverables:
  - D5.4a Report On Financial Business Models (due May 2020)
  - D5.4b Report On Financial Business Models (due August 2021)
- Status of task: just started (March 2019)

WP5 – Circular Economy Business Model & Exploitation Plan

T5.5 STANDARDIZATION MODELS AND ANALYSIS

TASK RESPONSIBLE: CERTH
PRESENTER(S): CHRISTOS RAVANIS

MEETING: 5TH PLENARY MEETING, AACHEN, 26-27 FEBRUARY 2019

Task 5.5 Standardization Models and Analysis

- Task Leader: CERTH
- Task activities:
  - Identification of the necessary activities to facilitate acceptance and utilization of the developed solutions by the market
  - Provision of starting information for other WPs to ensure compatibility and interoperability with already existent solutions through standards
  - Use standardization as a dissemination tool
- Deliverables:
  - D5.5a Report On Standardization Models (submitted)
  - D5.5b Report On Standardization Models (due August 2019)
  - D5.5c Report On Standardization Models (due August 2020)
  - D5.5d Report On Standardization Models (due August 2021)
- Status of task: ongoing

D5.5 Report on Standardization

- The main preliminary conclusions of D5.5 are:
  - Standardization procedure leads to **shape quality characteristics** in the area of material qualities such as thermal insulation, which e.g. provides information regarding thermal conductivity of insulating materials. Regarding technical components and constructions, European standardization defines standards that are further tightened by national annexes.
  - **PLUG-N-HARVEST development and products will be based on existing standards** assisting their integration, operation, maintenance and exploitation at the end of the project (e.g. Façade technology: PVs & Batteries)
  - Standardization procedure demands the participation of all technology experts: **During the development of an innovative technology without the existing standard exploitation, product may not be escalated, distributed and be a part of another system** (e.g. collaborations)

D5.5 Report on Standardization

- List of PLUG-N-HARVEST key concepts to monitor standardization:
  - Construction/Renovation
  - Aluminum structures
  - Energy efficiency, management
  - Façade technology: PVs & Batteries
  - Façade technology: Insulation
  - Façade technology: HVACs
  - Networking & Internet of Things
  - Software Development
  - System Security and Privacy
  - Circular Economy
  - Green Materials
  - Thermal Comfort
  - Air Quality

WP5 – Circular Economy Business Model & Exploitation Plan

T5.6 EXPLOITATION STRATEGY & BUSINESS PLANS

TASK RESPONSIBLE: AIGUASOL
PRESENTER(S): TONI HERENA

MEETING: 5TH PLENARY MEETING, AACHEN, 26-27 FEBRUARY 2019

Task 5.6 Exploitation Strategy and Business Plans

- Task Leader: AIGUASOL
- Task activities:
  - Definition of a plan for the exploitation and commercialization of the results using outputs from the rest of WP5
  - Identification of project exploitable results and related target groups
  - Development of the PLUG-N-HARVEST business model, including marketing and pricing strategy, cost-benefit analysis, risk analysis and risk management activities
- Deliverables:
  - D5.6.1a Market Analysis & Business Plans (submitted)
  - D5.6.2a Exploitation Plans (submitted)
  - D5.6.1b Market Analysis & Business Plans (due August 2019)
  - D5.6.2b Exploitation Plans (due August 2019)
  - D5.6.1c Market Analysis & Business Plans (due August 2020)
  - D5.6.2c Exploitation Plans (due August 2020)
  - D5.6.1d Market Analysis & Business Plans (due August 2021)
  - D5.6.2d Exploitation Plans (due August 2021)
- Status of task: ongoing

D5.6.1 Market analysis and Business Plans

- Main outputs of D5.6.1a are:
  - **First approach of a market analysis** of the building renovation sector in the four countries were pilots are found (Germany, Greece, Spain, UK)
    - This market analysis is expected to be improved so contributions from local partners will be welcome
  - **Definition of potential CE-based business models** and allocation of PLUG-N-HARVEST internal partners in the value chain of the PLUG-N-HARVEST solution and definition of potential roles for exploitation
    - During the 3rd plenary review meeting, a workshop to open the discussion among consortium partners was held
    - The final solution is still to be selected with inputs from third party

D5.6.1 Market analysis and Business Plans

Product/ Service	Product as Service or Pay per Service	Maintenance and Upgrade	Reuse and Remanufacture	Valuable materials mining	CESCO models	Other BMs
ADBE	Commercialised as improved energy & comfort performance service. Both for residential and commercial based on a mixed model (ownership + service)	*(For Tertiary Buildings)* • System maintenance • Upgrade of components (when better performance technologies available)	*(For Tertiary Buildings)* Recovery for reuse or remanufacture of • Aluminium fixing structure • ADBE module	Recovery of valuable materials from ADBE	Commercialised as energy performance & comfort improvement service	Classical Linear BM for Façade solutions sale
ADBE + IMCS	*(For Residential and Tertiary Buildings)* Commercialised as: • Improved energy performance • Indoor air quality • Comfort service	*(For Tertiary Buildings)* • System maintenance • Upgrade of components (when better performance technologies available) • Upgrades of IMCS and/or PV panels • Additionally, maintenance of ADBE	*(For Tertiary Buildings)* Reutilization of modular ADBE structure, IMCS Remanufacture: ADBE modules	Recovery of valuable materials from ADBE and electronic components from IMCS Mining of scarce materials	*(For Residential and Tertiary Buildings)* Commercialised as energy performance & comfort improvement service	-
ADBE + IMCS + OEMS	*(For both Resid. and Tertiary buildings, public administration at building/district level)* Commercialised as: • Energy savings and/or efficient energy management at district/grid level • Indoor air quality • Intelligent energy mgmt. and trading system	• System maintenance • Upgrade of components (when better performance technologies available)	*(For Tertiary buildings)* Reusability: modular ADBE structure, IMCS Remanufacture: ADBE modules	Recovery of valuable materials from ADBE and electronic components from IMCS and OEMS Mining of scarce materials	*(For both Resid. and Tertiary buildings and Public Administration at Building/District level)* Commercialised as energy performance & comfort improvement service	-

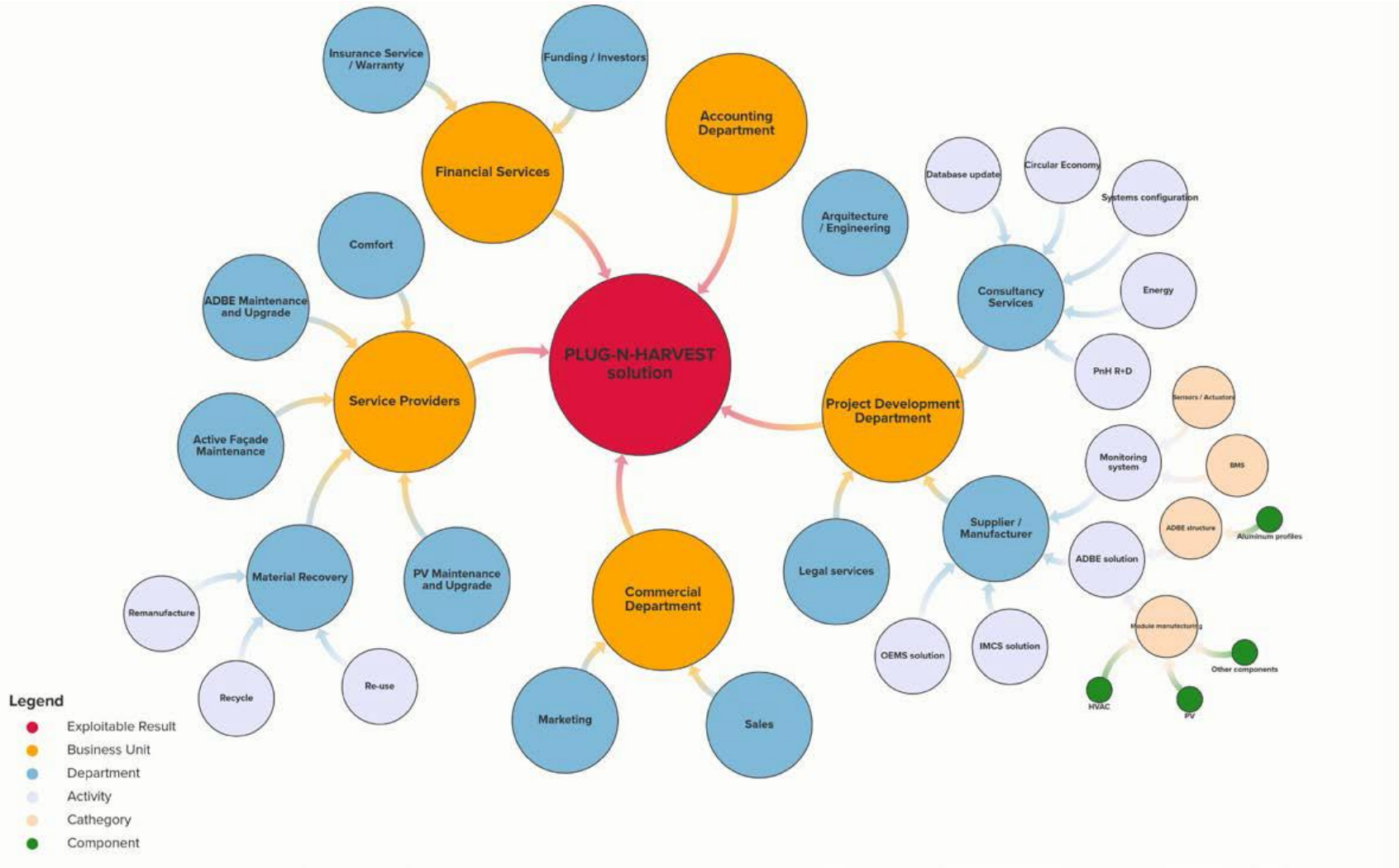
D5.6.1 Market analysis and Business Plans

Product/ Service	Product as Service or Pay per Service	Maintenance and Upgrade	Reuse and Remanufacture	Valuable materials mining	CESCO models	Other BMs
Consultancy Services	*(For Tertiary buildings or public building owners)* Consultancy services of PLUG-N-HARVEST solution that best fits customer's needs Advisory service for big tenants for building retrofit	Advisory for maintenance and upgrade service providers on financing opportunities or emerging technologies to optimize the system performance	*(For Tertiary buildings or public building owners)* Establishing the market conditions and concerned stakeholders' requirements for the definition of specific BMs and exploitation plans	Guidelines and procedures definition to commercially consider the valuable materials	*(For Tertiary buildings or public building owners)* Improved energy service and building performance (comfort). Advisory on systems' optimal configuration	Classical linear BM for Consultancy Services
BMS	Commercialised as secure monitoring and control service. Both for residential and commercial based on a mixed model (ownership + service)	*(For Tertiary Buildings)* • Maintenance of hardware sensors and BMS gateways. Upgrade of BMS cloud platform (when new functionalities are available)	*(For Tertiary Buildings)* Recovery for reuse or remanufacture of hardware products such as sensors, actuators and gateways.	Recovery of valuable hardware components	Commercialised as cloud service for monitoring and control with advanced privacy and security features	Classical linear BM for BMS exploitation through software licenses sale
Circular Materials Database		Maintenance and updating of the DB				
Teaching and Research capabilities	Research projects related with Circular Economy applied to construction sector under a "Pay per Service" scheme					Improved Teaching capabilities that might attract new students

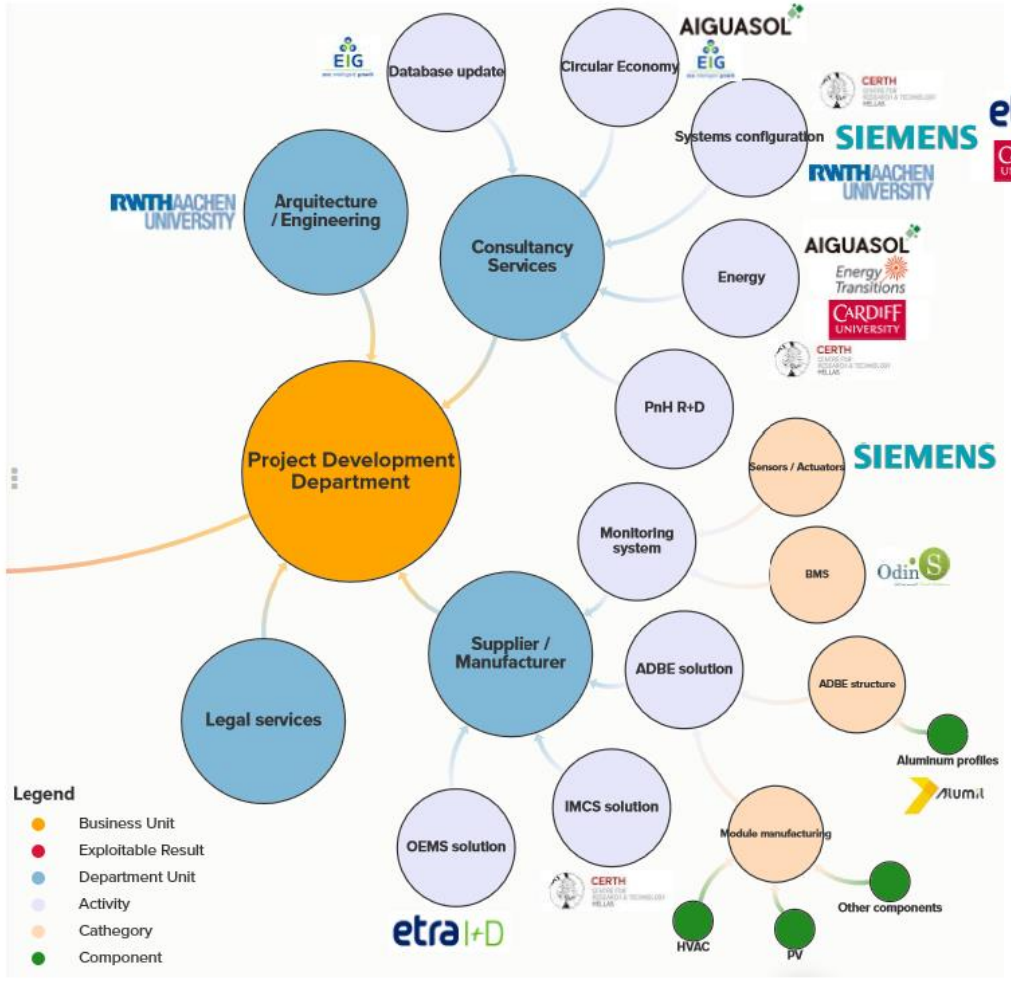
D5.6.2 Exploitation Plans

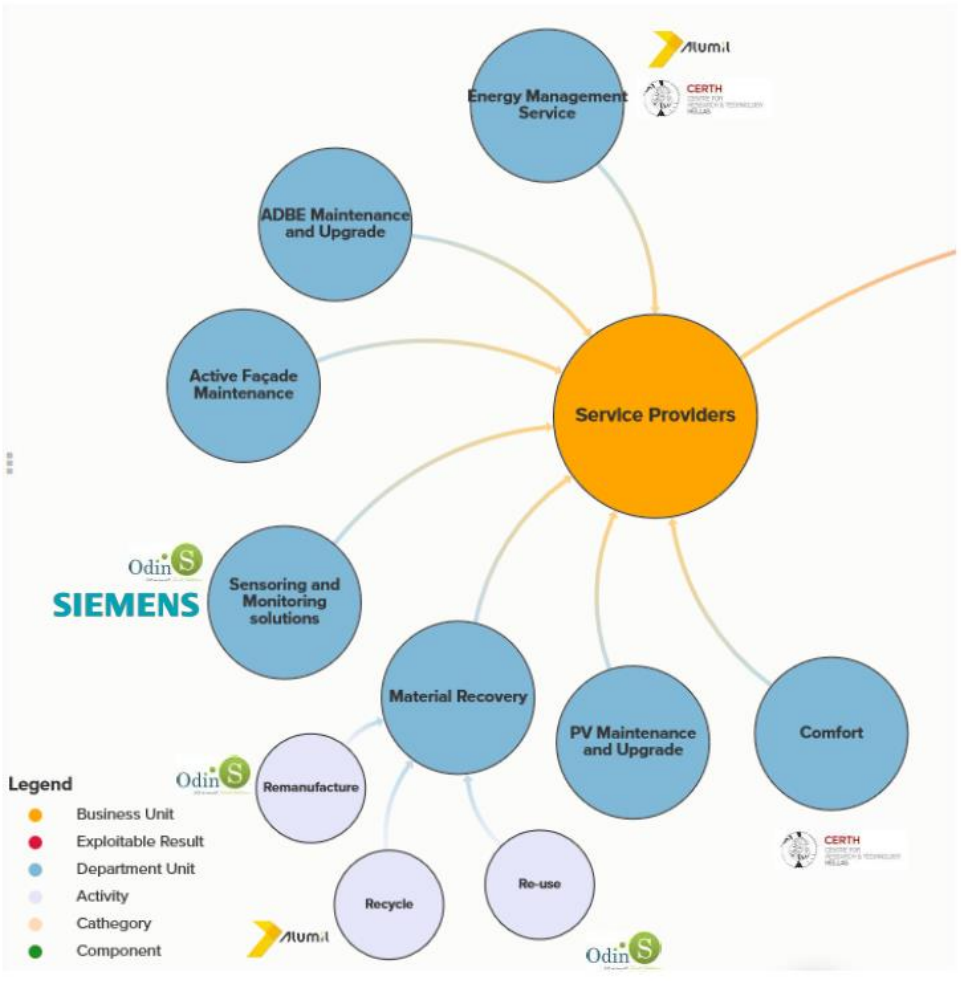
- Main outputs of D5.6.2a are:
  - **Description of CE business models for project's Direct Exploitable Results (DER)**
    - ADBE+IMCS+OEMS (entire PLUG-N-HARVEST solution)
    - ADBE+IMCS
    - ADBE alone
  - **Allocation of PLUG-N-HARVEST consortium partners** in the value chain for DER exploitation **and gaps identification**

D5.6.2 Exploitation Plans



D5.6.2 Exploitation Plans





Questions?

THANK YOU