BRICKER

ENERGY REDUCTION IN PUBLIC BUILDING STOCK

Total Renovation Strategies for Energy Reduction in Public Building Stock

Official Periodic Reporting:

Month 19 to month 36 progress report

WP 1, T 1.1

From: April 2015 To: September 2016

(This report includes most of the M1 to M18 progress, due to the fact that the new PTA might wish to have all the information from the beginning)

Date of document

November, 5th 2016

Authors: Juan de las Cuevas

Integration of technologies for energy-efficient solutions in the renovation of public buildings

EeB.NMP.2013.3

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Technical References

Project Acronym	BRICKER
Project Title	Total renovation strategies for energy reduction in public building stock
Project Coordinator	Juan Ramón de las Cuevas ACCIONA juanramon.cuevas.jimenez@acciona.com
Project Duration	1 October 2013 – 30 September 2017 (48 Months)

Periodic reporting	M1 to M18
Work Package	***WP 1***– Project Management
Task	***T 1.1*** – Overall coordination
Partner	ACCIONA

Versions

Version	Person	Partner	Date
1	Juan Cuevas (PC)	ACC	November 5th 2016

Table of Content

0 Project objectives for the Period.

This is the First Reporting period, so there are not previous recommendations from any other Period.

In the following table, there is a concise summary of the project objectives for this first 18-month period, described Task per Task, taking into consideration that the development of the activities listed in the tasks does not have to be linear in time.

WP	Description	Period 2 data		
Work Package 2: Envelope retrofitting solutions for demand reduction				
Task	**Name**	**Planned P2**	**Achieved P2**	**Deliverables P2**
2.1.	Design of the ventilated façade for the Turkish demo	100%	100%	-
2.2.	Development of novel insulation materials with embedded PCMs	100%	100%	-
2.3.	Development of smart and high performance aerating windows	100%	100%	-
Work Package 3: Zero emissions energy production technologies				
Task	**Name**	**Planned P2**	**Achieved P2**	**Deliverables P2**
3.1.	Technical requirements and specifications of the cogeneration prototype and its components.	100%	100%	-
3.2.	Design, construction, test and optimization of the cogeneration prototypes	100%	100%	D.3.19 D.3.21
3.3.	Design and construction of the new collector fields for easy roof installation and operation at temperatures up to 300ºC.	100%	80%	D.3.12 postoned
3.4.	Development of optimized structures to connect and integrate the solar	100%	100%	-

WP	Description	Period 2 data		
	collectors´ structure in different building roof configurations.			
3.5.	Control and hydraulic system of the solar field adaptation to provide optimal temperature and flow conditions to the system.	100%	90%	D.3.22
3.6.	Biomass plant requirements and specific design to work as hybrid system for the cogeneration prototypes.	100%	100%	-
3.7.	Chiller plant requirements and specific design to work in trigeneration mode with the cogeneration prototypes.	100%	100%	-
Work Package 4: BRICKER technologies´ implementation in buildings, guidance for implementation and technology transfer.				
Task	**Name**	**Planned P2**	**Achieved P2**	**Deliverables P2**
4.1.	Concept design, model design and simulation of the BRICKER technologies in different scenarios	Turkey 100% Belgium 100% Spain 100%	100% 100% 100%	-
4.2.	Optimal PASSIVE Systems integration project in the buildings, based on WP2 and WP5	Turkey 100% Belgium 100% Spain 100%	50% 50% 100%	D.4.23 D.4.24 D.4.25
4.3.	Optimal ACTIVE Systems integration project in the buildings, based on WP3 and WP5	Turkey 100% Belgium 100% Spain 100%	25% 100% 100%	D.4.23 D.4.24 D.4.25
4.4.	Operation strategies	Turkey 100% Belgium 100% Spain 100%	25% 100% 100%	D.4.23 D.4.24 D.4.25
4.5.	Guides for design, commissioning and maintenance	80%	10%	-

WP	Description	Period 2 data		
4.6.	BRICKER concept transfer to social housing	100%	15%	-
Work Package 5: Demonstration and evaluation in three existing public buildings in Europe				
Task	**Name**	**Planned P2**	**Achieved P2**	**Deliverable s P2**
5.1.	Monitoring and performance evaluation of the buildings before renovation	100%	100%	D.5.26
5.2.	Manufacturing of the solutions to be installed in the demonstration buildings	100%	100%	D.5.27
5.3.	Installation, commissioning and start-up in the three demonstration buildings	Turkey 100% Belgium 100% Spain 100%	12 months 12 months 24 months DELAYS	D.5.28 D.5.29 DELAYED
5.4.	Monitoring and performance evaluation of the buildings after renovation	Not started	-	-
5.5.	Economic analysis of the three demo sites´ implementation	100% in M1-M48	25%	None
Work Package 6: Exploitation and replication				
Task	**Name**	**M1-M48**	**M1-M36**	**Deliverables P2**
6.1.	Exploitation	100%	80%	D.6.32
6.2.	Business models for each of the key results	100%	60%	-
6.3.	Replication	100%	30%	D.6.33
Work Package 7: Dissemination and communication				

Task	Name	M1-M48	M1-M36	Deliverables P2
7.1.	D&C Secretariat built-up and operation	100%	40%	-
7.2.	Project Website	100%	45%	-
7.3.	Dissemination and communication plan	100%	37%	D.7.30

1 Work Progress and achievements during the period.

1.1 General overview at the use of resources.

1.1.1 Personnel efforts

In the following table, there is a complete list of efforts as justified in the Form C´s for the Second Period, distributed by Work Packages. In the last column, there is a presentation of the percentage used in the first 36 months of the Project, which corresponds to the 66% of the total Project life span.

1.1.2 Other costs reported.

In the Form C tables, there is a report of the actual expenses justified by Partners during Period 2. This belongs to the administrative side of the Project, and by that, it is out of this report, which is covering the technical progress.

1.1.3 Deliverables of the Managerial Work Package

In this third period, in relation to the Project Management Work Package, the following deliverables are to be submitted:

- ✓ The second year progress report (D.1.20).
- ✓ The third year progress report (D.1.31).
- ✓ The Second Periodic Report (this document).

1.1.4 Gantt Chart at month 36

The updated version of the Gantt Chart at month 36, September 2016 is here below:


BRICKER GANTT CHART - Month 36 - October 2016
2014
2015
2016
2017
2 4 6 8 10 12 14 16 18 20 22 24 26 28 30 32 34 36 38 40 42 44 46 48
WP1 PROJECT MANAGEMENT
Task 1.1. Governance structure, communication flows and methods.
2D
Task 1.2. Overall coordination .
D D D D
WP2 ENVELOPE RETROFITTING SOLUTIONS FOR DEMAND REDUCTION
Task 2.1. Design and development of a sustainable and light weight ventilated façade.
D
Task 2.2. Development of novel insulation materials with embeded PCMs to improve thermal inertia of the building envelope.
D
Task 2.3. Development of smart and high performance aerating windows.
D
WP3 ZERO EMMISSIONS ENERGY PRODUCTION TECHNOLOGIES
Task 3.1. Technical requirements and specifications of the Cogeneration prototype and its components.
D
Task 3.2. Design, construction, test and optimization of the Cogeneration prototypes.
D D D
Task 3.3. Design and construction of the new collector fields for easy roof installationand operation at temperatures up to 300°C.
D
Task 3.4. Development of optimized structures to connect and integrate the solar collectors´ structure in different building roof configurations.
D
Task 3.5. Control and hydraulic systems of the solar field adaptation to provide optimal temperature and flow conditions to the system.
D
Task 3.6. Biomass plant requirements and specific design to work as hybrid system for the cogeneration prototypes.
D
Task 3.7. Chiller plants requirements and specific design to work in tri-generation mode with the Cogeneration prototypes.
D
WP4 BRICKER TECHNOLOGIES´ IMPLEMENTATION IN BUILDINGS, GUIDANCE FOR IMPLEMENTATION AND TECHNOLOGICAL TRANSFER
Task 4.1. Concept design, model design and simulation of the BRICKER technologies in different scenarios.
D
Task 4.2. Optimal Active Systems integration project in the buildings.
D
Task 4.3. Optimal Passive Systems integration project in the buildings.
D
Task 4.4. Development of the operation strategies for the Active technologies
D
Task 4.5. Guides for design, commissioning and maintenance.
D
Task 4.6. BRICKER Concept transfer to Social Housing.
D
WP5 DEMONSTRATION AND EVALUATION IN THREE EXISTING PUBLIC BUILDINGS IN EUROPE
Task 5.1. Monitoring and performance evaluation of the buildings before renovation.
MONITORING D
Task 5.2. Manufacturing of the solutions to be installed in the demonstration buildings.
D
Task 5.3. Installation, commissioning and start-up in the 3 demo buildings.
D D
Task 5.4. Monitoring and performance evaluation of the buildings after the renovation.
MONITORING D
Task 5.5. Economic analysis of the 3 demo site implementations.
D
WP6 EXPLOITATION AND REPLICATION
Task 6.1. Exploitation.
D D
Task 6.2. Business model ~~and business plans~~ for each of the key results.
D D
Task 6.3. Replication.
D D
WP7 DISSEMINATION AND COMMUNICATION
Task 7.1. Dissemination and Communication Secretariat build up and operation.
D
Task 7.2. Project website.
D
Task 7.3. Dissemination and Communication Plan.
D D D D
Milestones (months) 6 12 18 24 30 36 42 48
Periods (months) 1 1st Period 18 19 2nd Period 36 3rd Period 48
Key
D=Deliverable/s
D=New Deliverable/s D
Extended/modified activities
Re-scheduled activities, not started due to their link to others
Bottle-neck task
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2 Work Package 2 Progress.

2.1 Task 2.1. Design and development of a light weight ventilated façade (ACCIONA).

General status Table;

Period	Task	Planned	Achieved	Deliverables
1	**2.1.**	**100%**	**100%**	**D.2.8. at M18**

In P1, all the design phase was complete.

In P2, the general production and quality check was performed.

Partial progress items:

2.1.1 Initial evaluation of the building (ONU).

This activity was finished in P1. All the necessary information was sent by Turkish team and collected by ACCIONA during Turkish demo visit in May 2014. The sub-activities have consisted in:

- ✓ Historical weather data to be considered on the façade design (maximum wind speed, height of snow and maximum and minimum temperature recorded)
- ✓ Analysis of the European, National and local regulation for refurbishments, structural calculations, procurement management and licenses request, if needed.
- ✓ Visit to building and data compilation for the initial design
- ✓ Building survey
- ✓ Definition of the solutions for the openings, corners and other structural elements of the building

It is important to highlight about the proposed façade surfaces that:

Figure 2.1: Turkish demo façades proposed to be improved.

Total surfaces are in table below;

Wall section	Orientation	Surface (m^2)
Surface 1	East	390.85
Surface 2	South-East	678.57
Surface 3	South	392.23
Total (sqm)		**1461.65**

Table 2.1: Turkish demo façade surfaces proposed

Figure 2.2 Scope of the Turkish demo façade to be improved with existing budget

From those total surfaces, the surfaces to be improved with the ventilated façade are listed in the table below:

Wall section	Orientation	Surface (m^2)
Surface 1	East	390.85
Surface 3	South	392.23
Total (sqm)		**783.08**

Table 2.2: Surfaces to be improved with existing budget

Total budget first approach was in the following table;

Units	**New demo (ADU Hospital)**	
Material and manufacturing	1461.65 m2 Ratio: 82.89€/m2	121.592€*
Façade preparation and integration works	1461.65 m2 Ratio: 41.05€/m2	60.000€**
Total ventilated façade (€)		**185.445**

Table 2.3: Turkish demo ventilated façade budget estimations.

Current total cost (after system development)

Units	**New demo (ADU Hospital)**	
Material and manufacturing	783.08 m2 Ratio: 147.50 €/m2	121.592€*
Façade preparation and integration works	783.08m2 Ratio: 41.05€/m2	32.145 €**
Total ventilated façade (€)		**153.737 €**

Table 2.4: Turkish demo ventilated façade budget new estimations.

We have also identified the fact that we will need to install solar protection systems in some windows, according to the first approach below:

Sun Control Window Films for Windows of Block A	
164 windows units west and east facade (1.300 m^2) in Block A	13.000€
164 windows units west and east facade installation works (1.300 m^2)	3.250€
TOTAL WINDOWS FILMS	**16.250€***

Table 2.5: Turkish demo budget estimations for solar protection.

2.1.2 Definition of the ventilated Façade Concept (ACC).

This activity was 100% completed in P1 and consisted in:

- ✓ General description of the ventilated façade concept, normative reference, application field
- ✓ Classification, description and illustration of ventilated façades
- ✓ Definition of the system components characteristics

- ✓ Identification and analysis of the structural stability of a ventilated façade (loads supported by building's structure)
- ✓ Numerical modelling of a ventilated façade

2.1.3 Design of the ventilated façade proposed (ACC).

This activity was 100% completed in P1 and consisted in:

- ✓ Development of Panels of Green Cast, detection of lack of mechanical properties.
- ✓ Research and development of an alternative material to substitute Green Cast.
- ✓ Definition of the cladding panels: material, layout, dimensions, thickness, embedded anchors, finishing, etc.
- ✓ Pre-Design of the aluminium structure: anchorages to the existing envelope and auxiliary vertical & horizontal profiles
- ✓ Proposal of solutions to adapt the ventilated façade to the existing structure
- ✓ Design and validation of the supporting profiles to be attached on the cladding panels
- ✓ Structural calculation (dead, wind & seismic loads) to determine the best whole layout to be implemented in the demonstrator.

2.1.4 Prototype, test and validation (ACC).

This activity was 100 % completed in P1. Manufacturing of cladding's specimens and validation of its mechanical properties at ACCIONA´s facilities.

- ✓ Manufacturing of lab-scale whole system and validation through a standardized tests at certified lab:
  - wind suction
  - wind pressure
  - impact hard body
  - impact soft body
  - shear load
  - at certified lab

2.1.5 Report and tender info

- ✓ This activity was 100 % completed in P1 and included the specifications for public tender for Turkish demo building, including each component and their installation drawings.
- ✓ Deliverable D2.8 (Innovative sustainable and light weight ventilated façade) was submitted to the SESAM; system of the EC in due time.

2.2 Task 2.2. Development of novel insulation materials with embedded PCMs to improve thermal inertia of the building envelope (PURINOVA).

Partial progress items:

Task	Planned	Achieved	Deliverables
2.1	**100%**	**100%**	**D.2.9. at M15**

Partial progress items:

2.2.1 Research (PUR).

Research on PIR system with optimal lowest enthalpy is finished. During research works two possible solutions were developed. First one was simple PIR panel with PCM embedded. Optimal polyisocyanurate (PIR) system was selected based on its mechanical, thermal and fire resistance properties. All parameters achieved are good in comparison with insulation products on the market: it has one of the lowest lambda values available. The product was tested regarding reaction to fire according to EU standards with positive results: it meets the requirements for E class. Tests results (mechanical, thermal, fire resistance) are shown in Deliverable 2.9., and have also been reviewed by Building Owners.

Problem: Implementation limitations

Due to flammability levels of PCM itself, its maximum content in the foam to be implemented directly on the building can be 5%. Such low PCM concentration can lower the effect of energy storage.

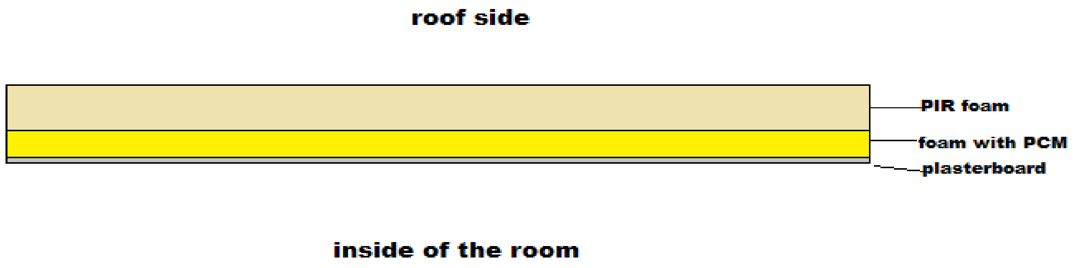
Solution:

Second solution developed is sandwich panel construction.

In case of sandwich panel, where the PCM PIR layer is covered by plaster or other solutions, the PCM percentage can be increased up to 20% according to the fire resistance limitations.

Sandwich panel consist of three layer as follows:

material	main goal	thickness [cm]
PIR foam	excellent insulation	10
PIR with PCM	energy storing	2
plasterboard	fire barrier	1,2



PIR+PCM Integration limitations

- *External, façade*: In simulations performed by Partner EURAC (WP4 Leader) it was proved that the benefits from PIR with embedded PCM were really limited when installed as external wall insulation (for the specific building in Liege). In this scope, a different approach was developed. According to new simulations, some part of the PMCs in façade external insulation weren't activated during the whole year. Probable cause of this is using PCM outside, where is big difference of temperature between seasons.
- *Internal, façade*: Because of construction of the building, insulation can't be done internally on walls.
- *External, roof*: For the same considerations of the external façade implementation, the activation cycles of the PCMs is negligible, so this option is also discarded. At the same time roof insulation done with good insulation material will bring great benefits for Energy efficiency of the building.
- ***Internal, roof***; Taking into account the mentioned facts, in consultation with building owners, PCM producer and partners performing simulation, it was decided to change insulation plan in order to obtain the best solution for building heating demands savings and PCM performance. Foam with embedded PCM will be used to insulate ceiling in Block 1 from the inside, which should give better results of PCM embedded. Providing proper ventilation will increase charging/discharging cycles of PCMs. External layer of the panel made of plasterboard (fire resistance class A) will provide fire resistance. Picture 2.2 show surfaces of Block 1 ceiling that will be insulated.

Final solutions selected:

According to this decision, insulation with PCM will be implemented in Block 1 externally (ceiling insulation of the highest floor). Purinova delivered also PIR foam for the roof, Block 6.

Based on simulation results, final insulation plan for the Belgium building include:

- 620 m^2 of PIR with PCM sandwich panel (13cm thickness) – ceiling Block 1, and 650 m^2 of PIR (12cm thickness) – roof Block 6.

The composition of both types of foam is finished. Also laboratory test of the foams are finished with good results of mechanical properties, thermal properties and fire resistance class.

To ensure the safety of developed solution, sandwich panel was additionally tested for fire resistance in notified special laboratory, according to Construction Products Regulation (CPR (UE) no 305/2011). Final solution with use of sandwich panel is certified as fire class B s^1d^0.

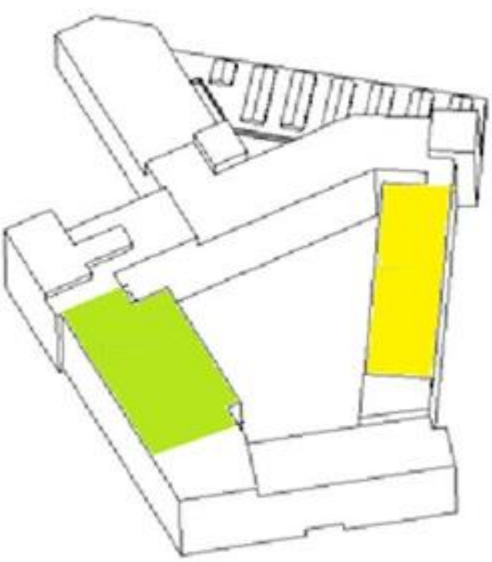


Figure 2.2: Ceiling area for PCM insulation (green) and external roof insulation (yellow).

2.2.2 Prototypes (PUR).

This activity was finished in P1. The mixing head machine and the production molds are tested for PIR panels production. All the parameters of the purchased equipment are adjusted for optimum production performance. Insulation boards prototypes were also tested in the PURINOVA laboratories.

2.2.3 Real scale (PUR).

This activity is finished. PURINOVA prepared technical specification for the Belgian Building Owner. According to decision made in the GA Meeting in Cáceres, it consists of detailed insulation implementation plans. The objective of the plan is to avoid thermal loses, optimize the use of material and provide direct instruction for sub-contracting company.

- All plans were sent to the Building Owner and Partner SPB.
- A fire certificate was achieved and also sent to SPB.

Innovative insulation developed within Bricker - PCM embedded in the PIR foam - will be used on the ceiling, Block 1.

<u>Installation date is October 2016, which is the first month of Period 3.</u>

Figure 2.3: Mixing head machine (up) and mold machine (down).

2.3 Task 2.3. Development of smart and high performance aerating windows (GREENCOM).

General status Table;

Task	Planned	Achieved	Deliverables
2.3.	**100%**	**100%**	**D.2.10.**

Partial progress items:

According to the Gantt chart, the following activities are reported:

Task	Planned	Achieved	Deliverables
2.3.1.1 Specification of the smart aerating window	100%	100%	No

Task	Planned	Achieved	Deliverables
2.3.1.4 Energetic and comfort analysis of the classroom via a dynamic model.	100%	100%	No
2.3.1.7 Control & regulation specification.	100%	100%	No
2.3.1.9 Thermodynamical modelling of HX, fan and unit.	100%	100%	No
2.3.1.11 Integration study leading to electrical, aesthetic and flow distribution performances (CFD).	100%	50%	No
2.3.1.14 Test and validation of the prototype via climatic chamber.	100%	100%	No
2.3.1.15 Report.	100%	100%	No

Table 2.6: GREENCOM activity progress table.

Partial progress items:

- Specification of the smart aerating window: The final specification document is completed and available on the BRICKER TEAM SITE.
- At the time of this report (October 2016), the GREENCOM double flow ventilation systems (22 units) are under installation in the identified classroom according to the plan :
    - Classroom 105 (max capacity 30 students), Block #6, schoolyard side, Level+1, 4 units.
    - Laboratory 293 (max capacity 15 students), Block #6, schoolyard side and back façade, Level +2, 8 units.
    - Auditorium 428 (max capacity 80 students), Block #1, schoolyard side, 8 units
    - Office 316 (max capacity 2 persons), Block #6, schoolyard side, Level +3, 2 units.
- Energetic and comfort analysis of classroom 114 via a dynamical model and thermodynamical modelling: The thermodynamical model of the aerating windows has been made together with ULG and given to Partner EURAC for integration the global building model. Internal comfort and flow analysis have been made to determine ideal working point of the unit. Also a CO2 monitoring has been made is this classroom during one week helping us to parameterize the classroom for the simulations
- Control and regulation specification: different fans options have been studied. 2 fans options have been selected. Prototypes have been ordered and tested. The comparison made us choose the most appropriate one. Control and regulation specification has been made.

- Thermodynamical modelling of HX, fan and unit: The heat exchanger, the fans and the filters has been selected and modelled.
- Integration study. Different global arrangement possibilities have been studied. The final arrangement has been selected and the according updated final specification has been given to SPB early in June 2016 (preliminary and final version available on the team site). Also, the product has been developed so that it could be placed in several arrangements in order to answer to a maximum of different cases. The integration study will be validated after final installation of the units.
- Test and validation of the prototype. The first prototype has been tested and validated. The different components have been ordered. The first final product (unit 0) has been tested in a climatic chamber in June 2015.
- The main production of the units has occurred between April and July 2016
- 10 units have been delivered to SPB on the 26/08/2016. GREENCOM delivery note LCG160038.
- 12 units have been delivered to SPB on the 16/09/2016. GREENCOM delivery note LCG160043.
- The task 2.3 is thus closed. Related open points and actions are :
    - Follow-up of the installation and starts-up of the units.
    - Monitoring and comparison between classrooms with and without smart aerating windows. Presentation of the result as a study case.
    - Some technical improvements of the unit have been identified.
    - To facilitate the exploitation of the results, it has been identified that the development of a multifunctional casing would be a strong benefit (cf. project extension request).

3 Work Package 3 Progress.

3.1 Task 3.1. Technical requirements and specifications of the Cogeneration prototype and its components (RNK).

General status Table;

Task	Planned	Achieved	Deliverables
3.1.	**100%**	**100%**	**D.3.5.**

Partial progress items:

3.1.1 Selection of the working fluid (RNK).

Regarding the working fluid selection, special attention has been paid to the security properties, as toxicity, flammability, thermal stability and environmental properties.

Seven different refrigerants (R134a, R245fa, SES36, R1234yf, R1234ze(Z), R1233zd, R1336mzz) are investigated, being other options like Toluene, OMTS and hydrocarbons discarded for the application due to toxicity and flammability issues.

Fluid	Toxicity/Flammability	GWP	ODP	Tcrit (ºC)	Pcrit (bar)	Tmax (ºC)
R134a	1000/Non-flammable	1300	0	101	40.59	<200
R245fa	300/Non-flammable	950	0	154	36.51	250
R1234yf	500/Low-flammability	4	0	94.7	33.82	<200
R1234ze(Z)	500/Non-flammable	1	0	150	35.30	<200
R1233zd	300/Non-flammable	1	~0	165.6	35.71	200
R1336mzz	500/Non-flammable	2	0	171.3	29	250
SES36	1000/Non-flammable(*)	3710	0	177.55	28.49	190

Table 3.1: ORC´s refrigerant alternatives considered.

Finally, **R245fa has been selected as the best commercially available option (low toxicity, non-flammable)**, with a good theoretical expected performance in generation and cogeneration modes (maximum temperature of 250ºC).

HFO-1336mzz would be another option, with promising results, but it is no still commercially available.

3.1.2 Technical requirements of the equipment (RNK).

Heat transfer fluid for the high temperature loop (outside the ORC) will be thermal oil, **Terminol SP**.

The possibility of using steam as heat transfer fluid has been rejected due to the high pressures required. The following figure shows different production modes considered for the estimations of the thermal parameters, like the expected performance in partial loads (linearity decrease) with the selected working fluid.

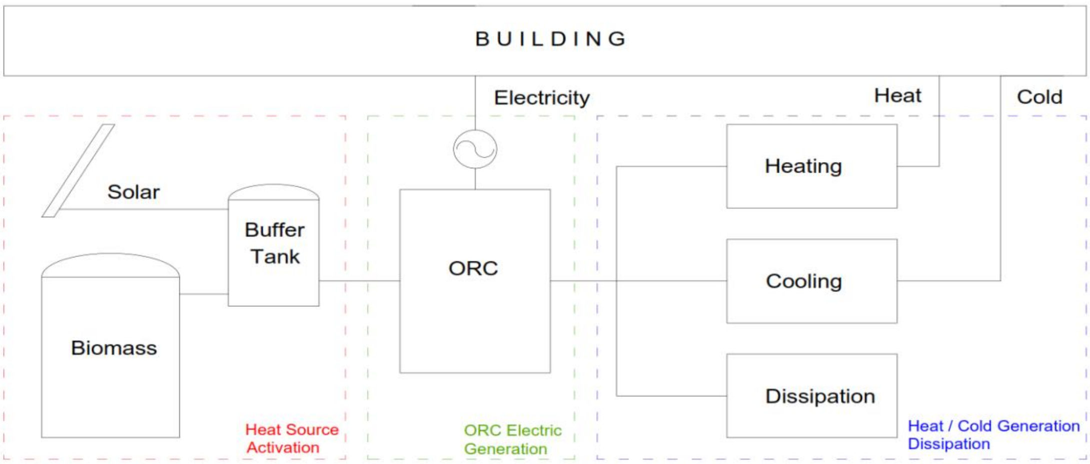


Figure 3.1: General layout for definition of requirements.

3.1.3 Selection of the thermodynamical cycle (software works) (RNK).

Attending to the ORC configuration, the adoption of a recuperative heat exchanger has been considered, due to the high temperature of the heat source compared with the critical temperature of the working fluid selected, having to work with high superheat degree.

The possibility of working in transcritical conditions has been studied and rejected due to the increase on the pump consumption that reduces the net efficiency of the cycle.

Finally, the best configuration is the use of a recuperative heat exchanger in subcritical conditions.

3.1.4 Operation points optimization (software works) (RNK).

With the working fluid and the configuration selected, the last step in the optimization of the ORC module is the operation points´ selection.

Parameters like the evaporating pressure and superheating have high influence in the cycle efficiency and a previous optimization of these parameters will help in the selection of the components of the ORC module in order to improve the performance of the system.

As result of the optimization process, the evaporating pressure, the superheating degree and the regenerator efficiency have been obtained for addressing the system design.

Expected Rated Performance: Once the expander prototype has been developed and the technology of the rest of components has been selected. (task 3.2), the operation points has been recalculated, obtaining the expected rated performance (uncertainty ±15%)

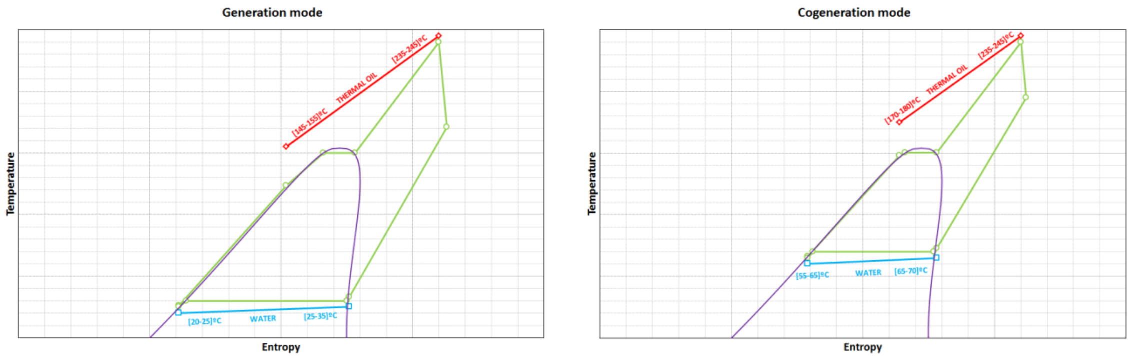


Figure 3.2: Optimized operation points.

Expected partial load performance: The control stablished for the cogeneration prototype is based on maintaining the secondary fluids flow rates and varying the secondary fluids temperatures. In this way, the ORC performance results on smooth dynamic behaviour, based on previous experience.

Therefore, in the following, the expected partial load behaviour when the inlet temperatures of thermal oil (Therminol SP) and water are changed are presented in terms of thermal oil thermal power, water thermal power, gross electrical power, thermal oil outlet temperature and water outlet temperature. The expected performance presents an uncertainty of ±15%.

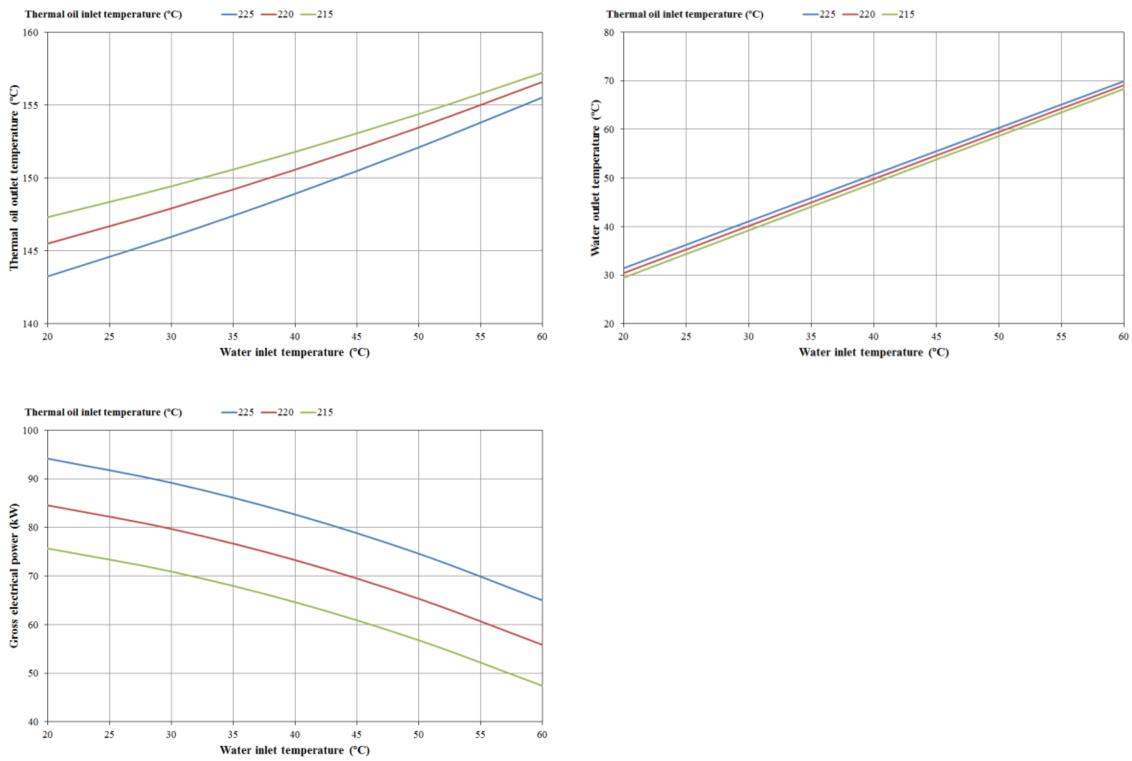


Figure 3.3: Partial load behaviour.

3.2 Task 3.2. Design, construction, test and optimization of the Cogeneration prototypes (RNK).

General status Table;

Task	Planned	Achieved	Deliverables
3.2.	**100%**	**100%**	**D3.11 at M18** **D.3.19 at M21** **D.3.21 at M24**

3.2.1 Scaled prototype.

Once the working fluid and the cycle configuration have been defined, the first step for the prototype design is to address the expander design.

The expander technology selected to meet the prototype requirements has been analysed, and, finally, volumetric expander is proposed. So, based on the power requirements and the operation points, two proposed expander prototypes have been obtained.

Figure 3.4: Simulation and first expander prototype

The expected performance for both expander prototypes has been experimental tested in the test bench constructed ad-hoc for the expander tests. Thermal and electrical power haven been scaled down to meet the disposal thermal power on the test bench, with a 1:3 scale. The test bench allowed experimentally characterize the expander prototypes.

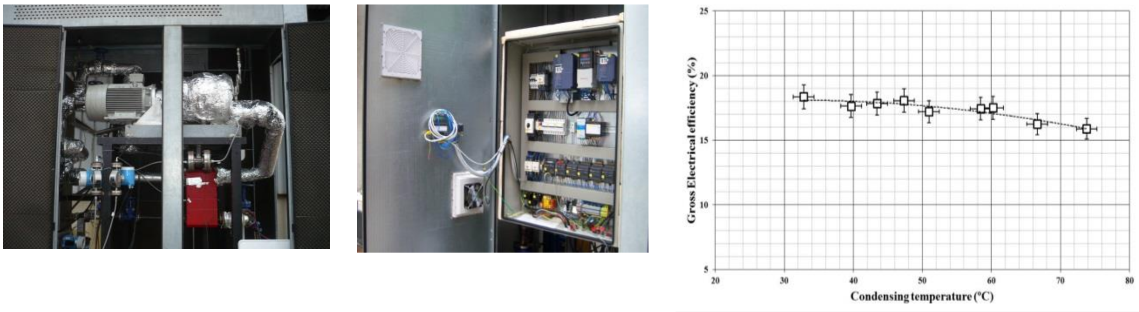


Figure 3.5: Control cabinet, ORC test bench and test results.

Partial experimental tests have been carried out with the expander prototypes mounted in the 1:3 scale ORC prototype, obtaining results using both expander designs. Finally, the expander prototype has been designed according to the second proposal, optimizing the cogeneration mode (mode with maximum overall efficiency) and the feasibility of the ORC system, avoiding the disadvantages of the other design.

3.2.2 Real scale unit.

Regarding the pump system, the technology provider (Rank) has developed a special design for the ORC pump in order to meet the design requirements based on a rotative volumetric technology. Regarding to the heat exchangers, attending to the technical requirements, compact heat exchangers have been selected for the 3 real scale ORC prototypes (allowing this compact heat exchangers temperatures up to 225ºC and 40 bar of working pressure). Specifically, brazed plate heat exchangers customized to achieve the required characteristics of the application are selected.

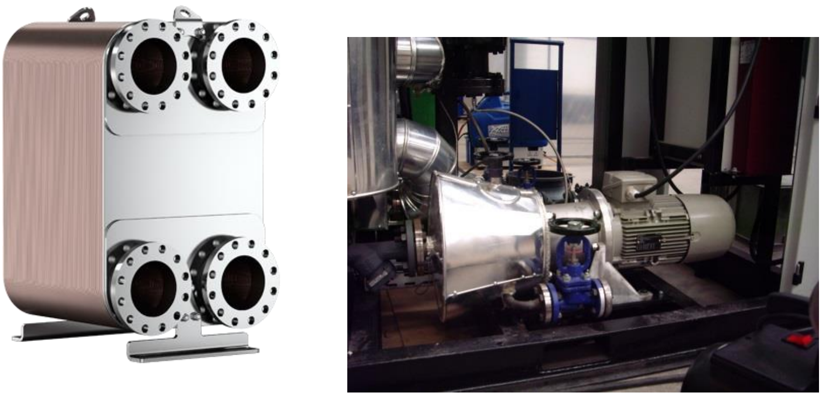


Figure 3.6: Heat Exchangers and pump prototype.

With all the components selected, the 3 real scale ORC prototypes layout has been determined, based on the know-how of the technology provider (Rank). So, the first ORC prototype (to be installed in Liege demo site) has been assembled. After the design modifications for the real scale components, pre-commissioning tests and the experimental campaign are carried out.

Figure 3.7: Liege ORC unit ready to be shipped.

All documents regarding to installation, commissioning, operation and maintenance has been developed. So the Safety analysis to the machine has been done in order to do the CE Declaration of Conformity.

Although this fact has been already mentioned at the 3.21 deliverable, it must be highlighted the importance of operating temperatures in the efficiencies of the ORC prototypes. The initial targets for the efficiencies were 21% and 18% for generation and cogeneration mode respectively, with heat source inlet temperature of 270ºC. This temperature was limited to a final value of 225ºC, as it was explained within at 3.21 deliverable. After selecting R245fa as the best working fluid (with low toxicity, non-flammable, technical feasible), the temperature was limited to 240ºC in order to work bellow its maximum allowable temperature, following the manufacturer advice in order to avoid risk of degradation of the organic fluid. After continuous operating of the scaled prototype in the test bench, the allowable temperature has been reduced to 225ºC in order to maximize the life of the components, as some degradation was observed above that temperature. On the other side, the expander prototype was designed optimizing the cogeneration mode in order to maximize the overall efficiency of the system and the feasibility of the future product in market. This fact and the reduction of the activation temperatures have resulted on final efficiencies near 17% and 14% for generation mode and cogeneration mode, respectively, lower than the initial targets but better than those theoretically expected in previous reports. However, the resulting ORC prototype is associated with a future product in the market with greater technical and economic feasibility.

Finally, the other two real scale ORC prototypes, to be installed in Turkey and Spain, are being assembled.

Figure 3.8: Turkey and Spain ORC units assembled.

The unit for Turkish demo site is ready to install pump and expander and will be finished in 4 weeks. After this test shall be done in order to check all parameters.

Spanish ORC is still under pressure and leaks test and will be ready in 8 weeks from this date, which is October 2016.

3.3 Task 3.3. Design and construction of the new collector fields for easy roof installation and operation at temperatures up to 300°C (SOL).

General status Table;

Task	Planned	Achieved	Deliverables
3.3.	100%	80%	D.3.12.*

The task is in line with the foreseen time plan.

*Deliverable D.3.12 is completed with the sole exception of control panels and units whose procurement has been postponed to avoid theft while waiting for shipment to the demo sites. During several conference calls and meetings which also included a detailed site visit done by the Turkish partners, it was agreed that Soltigua would ship the collectors 3 months after receiving the notification of the required shipment date by the demo site owners.

This unforeseen delay is now being used to further improve the on-board control panels (which are currently PLC based) and to study how to substitute them with electronic control units, which could reduce their cost by at least 30%.

Mirrors were acquired together due to their longer delivery time and to exploit scale economies.

Parallel to the development of the BRICKER prototypes in time, development of relevant collector components is also continuing, in order to have an even improved version by the end of the project.

3.3.1 PTC development by design (SOL).

During period 2, developments have included 3 main activities:

1. Collector modelling,
2. Development of new receiver, and
3. Shift from on board control panels to control units

Within activity #.1, Soltigua's current modelling techniques were validated with a TRNSYS model done together by Eurac. During this activity we exploited a synergy with H2020 project FLEXYNETS, started in summer 2015, in which both Eurac and Soltigua are active.

Within activity #.2, several options were considered to optimize the modular not evacuated receiver within the operating temperature range of the developed ORC cogeneration units.

First, a higher attention was given to the optical and thermal properties of the absorber and of the glass tube. In this respect, also by exploiting a synergy with the work of EU FP7 project FRESH NRG, we studied new SolGel coatings for not evacuated receiver tubes. The new coatings could provide a performance increase of the optical transmittance of the outer glass tube from approximately 92% to around 97%. Unfortunately, to be exploited, these coatings would require to set-up a dedicated pilot coating line, whose cost is not supported by the current volumes foreseen for the technology.

A second line of improvement was to adopt flangeless receiver tubes, so to reduce the thermal losses provided by the collector flanges. This solution could also decrease by a small amount the cost of the collectors. After careful analysis it was however decided that such solution, which would require some degree of on-site welding, is more suited for large, ground based installations, in which a turn-key solar solution provider can manage directly the welding and the overall solar construction. In the spirit of exploiting public tenders with local suppliers, it was judged better to adopt a welding free modular receiver solution, with flanges to connect the different parts of the receiver tube.

Activity #.3 was born taking into account two elements. On one side, the delay of the demo projects forced Soltigua to delay the acquisition of the control panels, to avoid the risk of damage and/or theft. On the other side, this extra time could be used to optimise the control system by shifting from on board PLC-driver control panels to fully standardized electronic control units, which would be simpler to install and more cost competitive. This activity started towards the end of P2 and we plan to continue it until Month 42.

3.3.2 Prototype development by testing (SOL).

Main focus of testing is the verification of the collector with particular reference to the receiver tubes and the control panels and units.

This makes also possible to validate the performance foreseen by current modelling which simulates it by using an efficiency curve based on EN 12975 standards.

Testing will take place mostly on a dedicated full blown outdoor loop which can test the tubes in real conditions while mounted on a collector.

We plan to run the testing activities in parallel to the actual operation of the demo field, to optimise activities compare results.

3.3.3 Manufacturing of the Turkish solar field (SOL).

Activities continued to both execute the manufacturing of the prototypes and on setting up a system for effective procurement and manufacturing, also in view of future industrial exploitation after the end of the project.

This included consolidating the supply base by asking – whenever possible/meaningful – more than one offer as a way to ensure effective use of public money.

Also, the introduction of an MRP (Material Requirement Planning) was initiated to further reduce cost, lead time and inventory to favour the future exploitation of the technology.

Despite the lack of precise timing for the demos, mirrors were bought for both the Turkinsh and the Spanish demo, in order to take advantage of scale economies (an important factor which will be taken into account for future exploitation plans). Ordering of last components (control panels/units) is being aligned to expected shipment dates so to avoid too long storage time, which may lead to risk of theft and/or product deterioration/damage.

As indicated before, this challenge has been transformed into an opportunity by the initiated development of a new control unit, which shall reduce the cost of the on board control panels.

3.3.4 Manufacturing of the Spanish solar field (SOL).

Same as 3.3.3. for these first 18 months.

3.4 Task 3.4. Development of optimized structures to connect and integrate the solar collectors´ structure in different building roof configurations (ONU).

General status Table;

Task	Planned	Achieved	Deliverables
3.4.	100%	100%	D.3.13 at M18

Activity terminated in P2. Here we report the partial progress items for the sake of providing clarity and continuity to the document.

3.4.1 Structure for the Turkish solar field (ONU).

As the solar field shall be placed on the ground in an empty site, foundation project is to be carried out for the panels and anchorage system. Alternative installations are studied simultaneously.

Anchor plate first design is complete. Proposed solution is provided below briefly. The anchorage system for each support was designed in accordance with the details provided by Partner SOLTIGUA. The software PROFIS Anchor 2 provided by HILTI was used to design the whole anchorage system. The analyses were ruled by Guideline for European Technical Approval of Metal Anchors for Use in Concrete (ETAG 001-05). The design is also in complience with the Turkish National Code for Reinforced Concrete Structures.

Due to a recent change in the placement of the solar field we need to compute best possible layout with support from Partner SOLTIGUA. However, our efforts to find the best possible ground anchorage system is not significantly effected by this change.

The advantages of this design are:

- Using much less concrete, in comparison to single block foundation.
- 60cm height from the ground minimizes the ground effects such as grass, dirt, flood, without increasing the cost much.

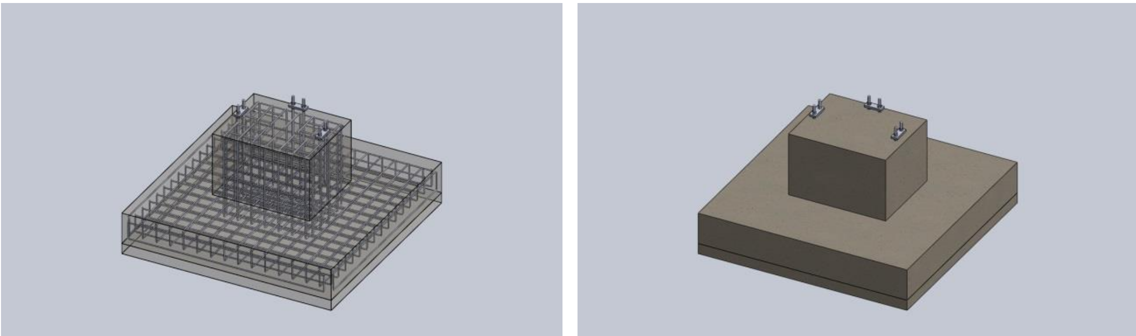


Figure 3.6: 3D view of the anchorage solution

Considering the installation of the collectors over the foundations, a gusset column, as a constructive means, was envisaged and designed to ensure an adequate thickness for the embedment depth of anchors, and to avoid unforeseen problems due to levelling the ground.

All anchor plates were specified as it is available in dimensions and with 2ϕ22 holes. The software offers solutions with respect to the anchor types produced by HILTI.

Among various anchor types, HIT HY-200+HIS-RN M16 with a diameter of 16 mm hold out all the support forces within varying Load/Capacity ratios. Required embedment depth for the anchor is 170 mm and the anchor is mounted by means of a mortar after a sufficient auger drill is provided.

<u>**WORKS DONE IN PERIOD 2:**</u>

→ Selecting best layout for the new solar field (ONU & OZU & SOL)

→ Verification and finalizing design of the anchorages (ONU & OZU & SOL).

→ Preparation of the specification for the subcontractor (ONU).

3.4.2 Structure for the Spanish solar field (CEM).

Works were completed in P1. There is a technical report which conclusions are listed herein below.

The report elaborated for CEMOSA is divided in three phases:

1. Obtain the wind pressure, and the forces transmitted to the foundations and anchor plates from the calculated wind pressure
2. Design of the anchor plates and the bases of support
3. Checking of the structural behaviour of the roof with the new loads

The results obtained after to apply the detailed computation process described in the report are:

- The wind pressure for each PTMx-24 system is 1859 N/m^2.
- Three types of concrete foundations (1, 2 or 3) have been defined for each group of anchor plate (A, B, C or D) of solar collectors. All foundation types have the same dimensions (150 x 150 x 25 cm) and the same frame (mesh upper and lower steel diameter ϕ12 mm each 20cm).
- The execution of these foundations needs to remove the elements of the cover on the roof. The water proofing layer and thermal isolation will be replaced properly after to construct the new concrete foundations.

The location of foundations and the type are described in the attached plan:

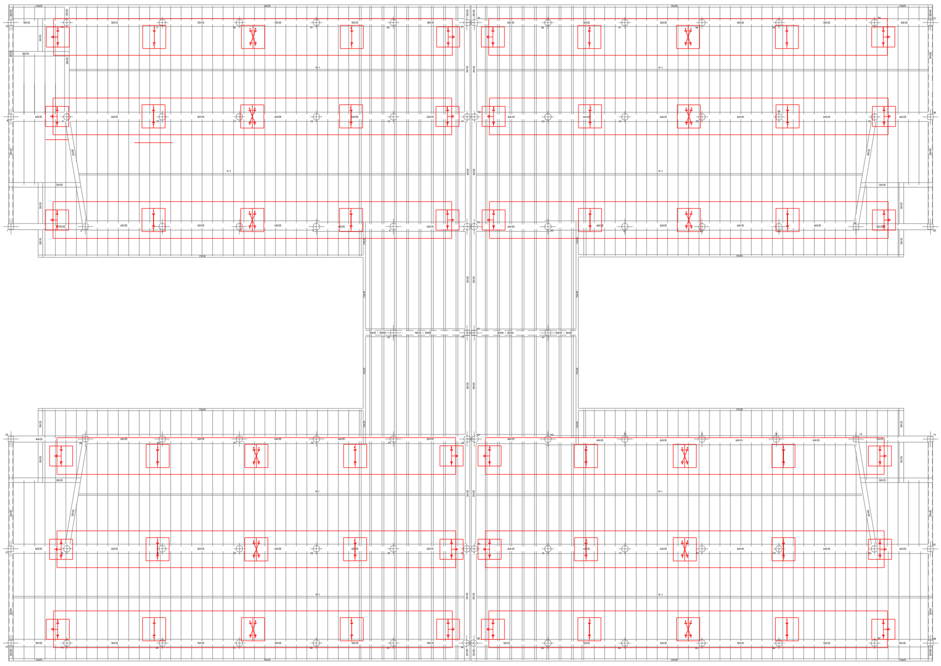
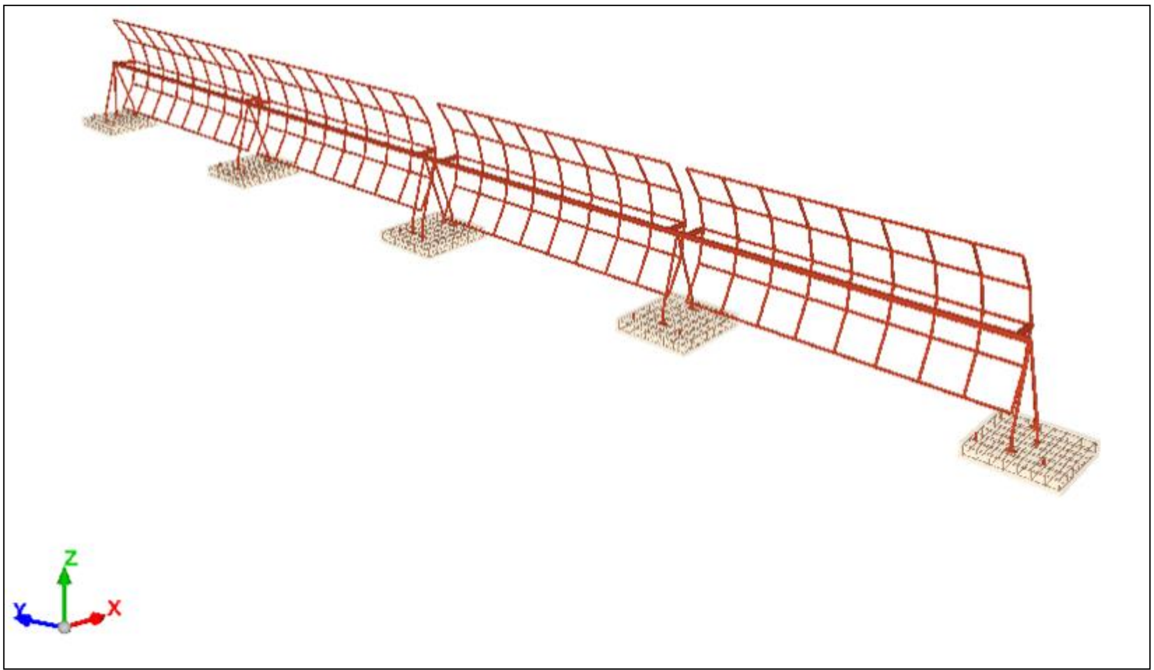


Figure 3.7: Collectors location (red) on the Spanish roof.

We get one type of concrete foundations with three different situations of anchors plates:



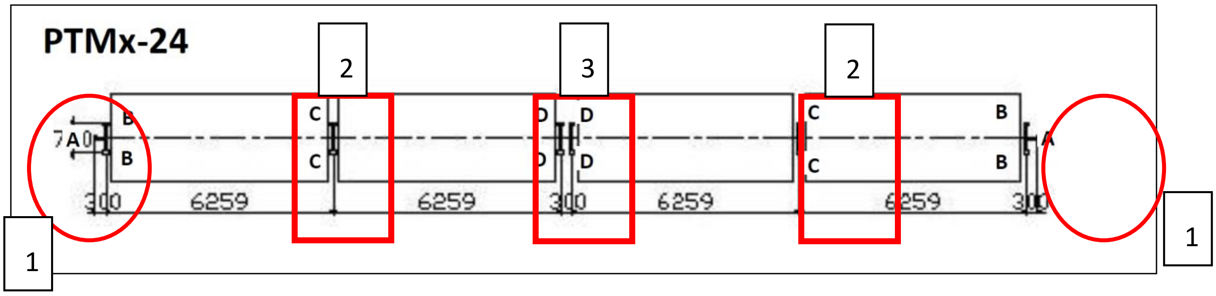


Figure 3.8: Foundation types

GENERIC FOUNDATION: Its dimensions are 150 x 150 x 0.25 m. armed with a mesh upper and lower steel diameter ϕ12 / 20 cm.

All the information, calculations and figures related to the foundation design is available in deliverable D.3.13.

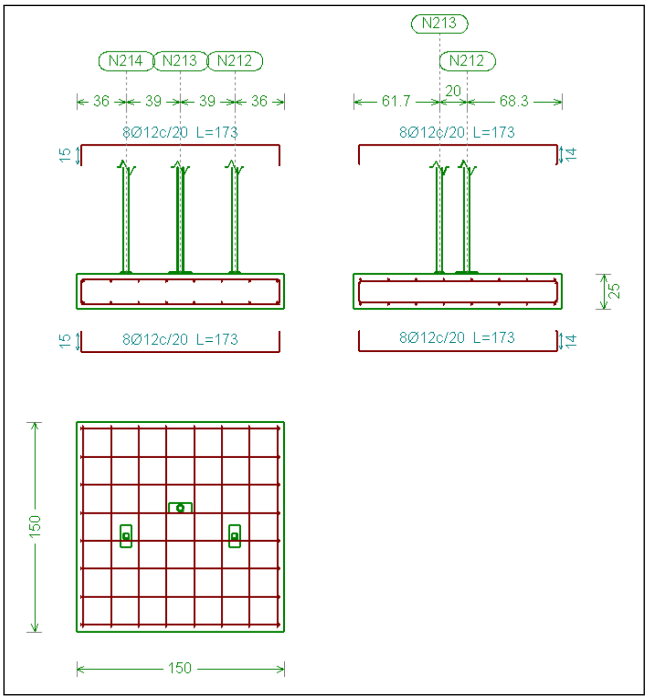


Figure 3.9: Foundation to support the anchors groups formed by type A and type B anchor plates.

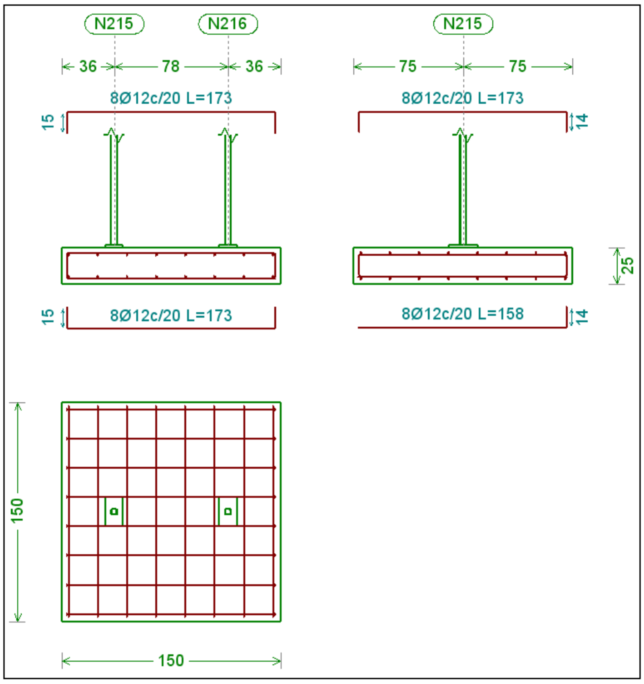


Figure 3.10: Foundation to support the anchors type C

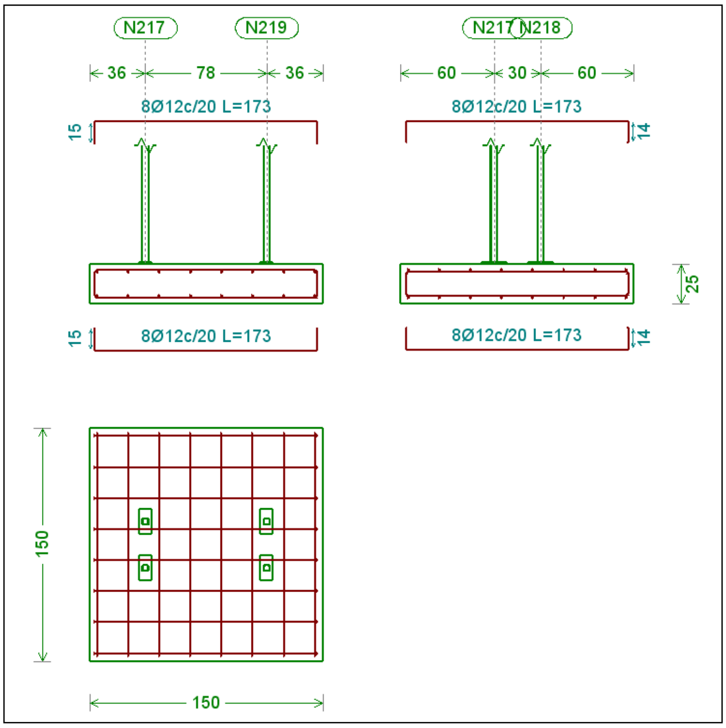
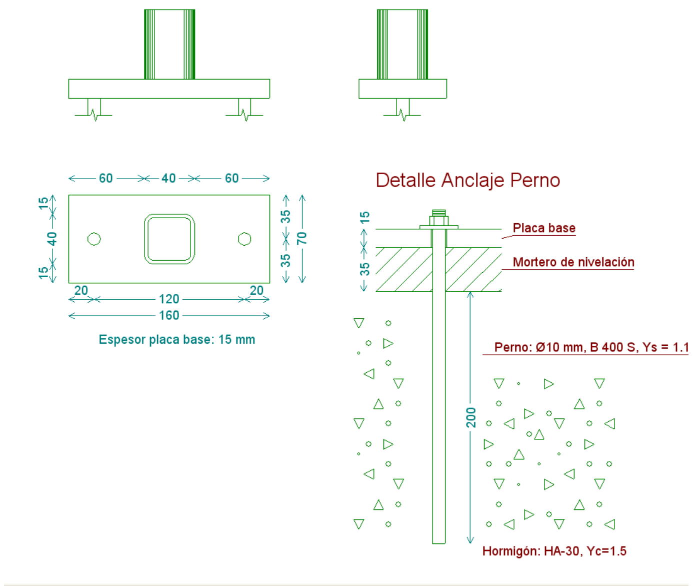


Figure 3.11: Foundation to support the anchors type D

After this, we design the anchor plates:



NOTE: regulation of the screws in order to compensate possible variations of height

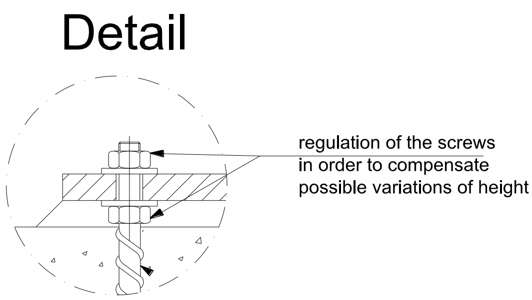
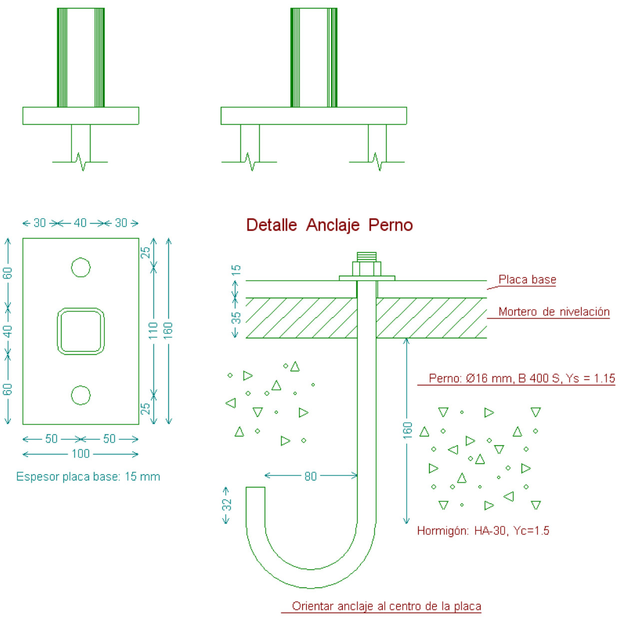


Figure 3.12: Anchor plate type A



NOTE: regulation of the screws in order to compensate possible variations of height

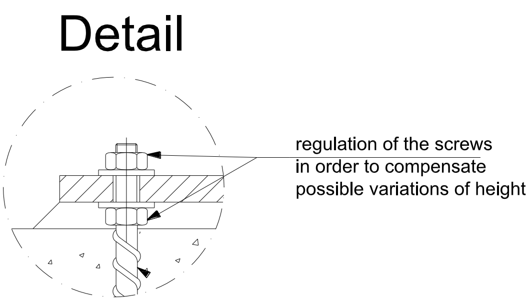


Figure 3.13: Anchor plate type B-D

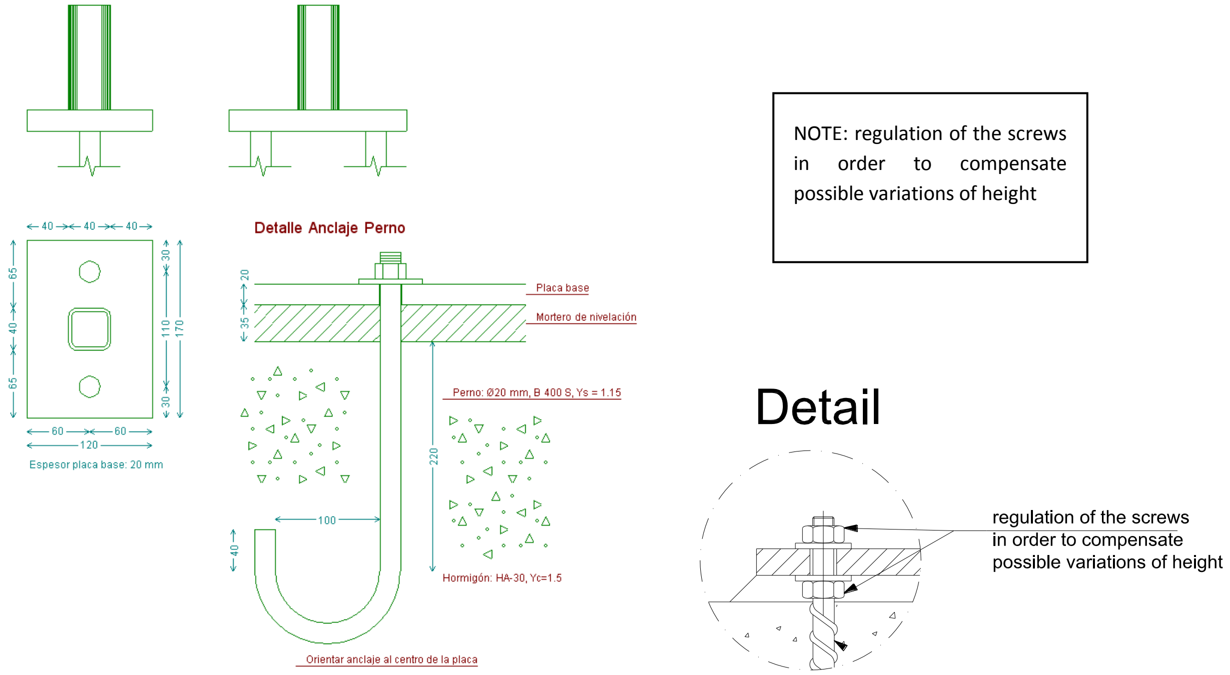


Figure 3.14: Anchor plates type C

Finally, the behaviour of the different structural elements of the floor to the new situation of loads is verified.

3.5 Task 3.5. Control and hydraulic systems of the solar field adaptation to provide optimal temperature and flow conditions to the system (FBK).

General status Table: Please note that all the documents referenced here are available at the Team Site.

Task	Planned	Achieved	Deliverables
3.5	100%	90%	D.3.22 at M24*

* Plus Internal Report for Control Tender.

Note: Deliverable 3.22 is complete and it has already received the approval from the previous PTA. It is therefore ready to be uploaded on the Team Site.

Partial progress items:

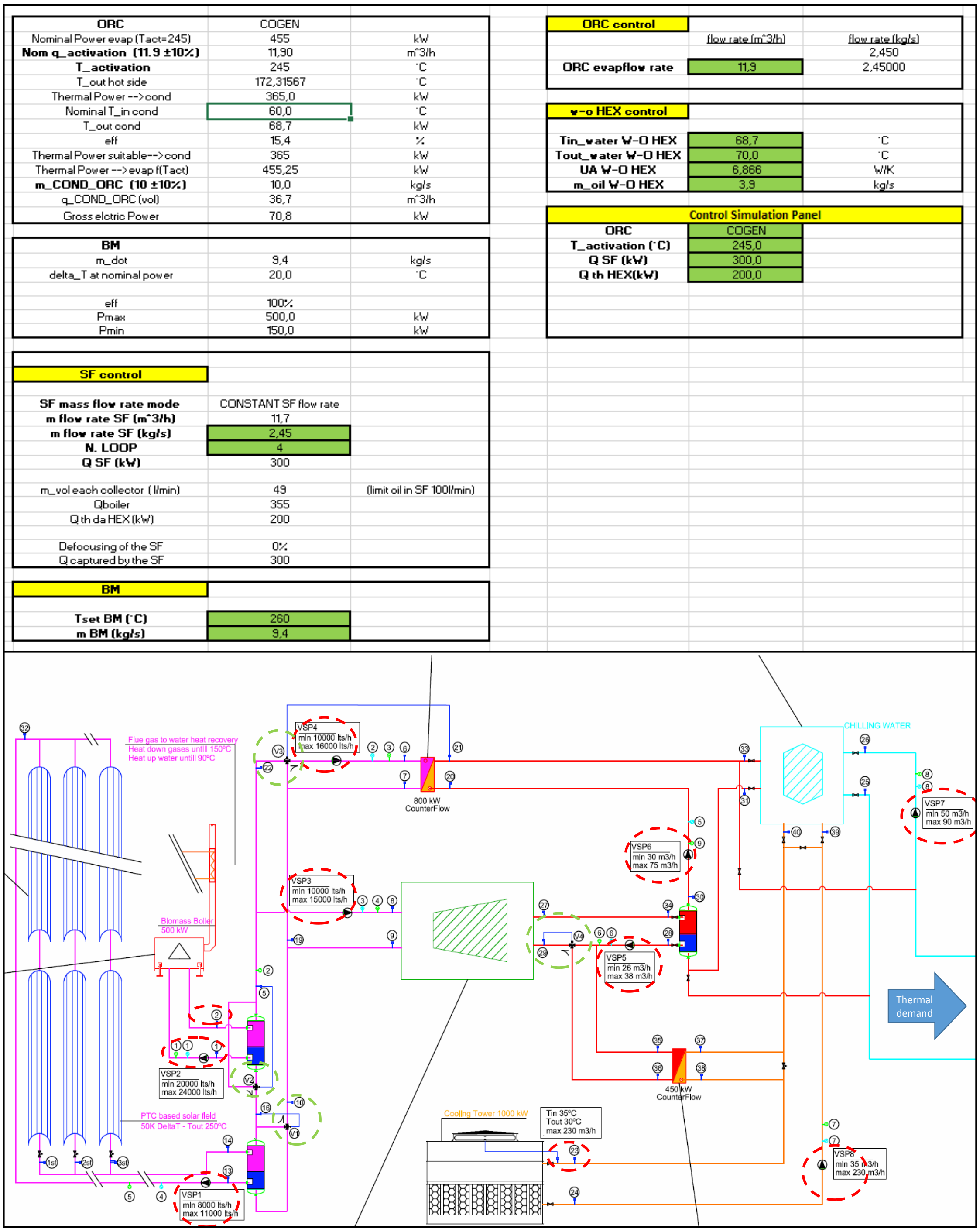
3.5.1 Specification.

After collecting data on SOLAR, BIOMASS, ORC and CHILLER from partners (SOL, RANK, CARTIF) the active plant layout and control strategies have been analysed and a solution is presented, taking into account the energy constraints, annual working hours and technology constrains.

A file collecting the specification has been created and updated collaboratively by the partners involved in WP3. This document is very important in order to have a common ground of discussion for the all partners involved (it is currently maintained by FBK and ACCIONA).

3.5.2 Development.

Layout Configurations for the Spanish, Belgian and Turkish demo sites have been defined and analysed with an energetic level trough stationary lumped models. The flow charts for Spain, Turkey and Belgium have been realized according to the systems constraints and peculiar sites characteristics.



ORC	COGEN	
Nominal Power evap (Tact=245)	455	kW
Nom q_activation (11.9 ±10%)	11,90	m^3/h
T_activation	245	°C
T_out hot side	172,31567	°C
Thermal Power -->cond	365,0	kW
Nominal T_in cond	60,0	°C
T_out cond	68,7	kW
eff	15,4	%
Thermal Power suitable-->cond	365	kW
Thermal Power -->evap f(Tact)	455,25	kW
m_COND_ORC (10 ±10%)	10,0	kg/s
q_COND_ORC (vol)	36,7	m^3/h
Gross elctric Power	70,8	kW

BM		
m_dot	9,4	kg/s
delta_T at nominal power	20,0	°C
eff	100%	
Pmax	500,0	kW
Pmin	150,0	kW

SF control		
SF mass flow rate mode	CONSTANT SF flow rate	
m flow rate SF (m^3/h)	11,7	
m flow rate SF (kg/s)	2,45	
N. LOOP	4	
Q SF (kW)	300	
m_vol each collector (l/min)	49	(limit oil in SF 100l/min)
Qboiler	355	
Q th da HEX (kW)	200	
Defocusing of the SF	0%	
Q captured by the SF	300	

BM	
Tset BM (°C)	260
m BM (kg/s)	9,4

ORC control	flow rate (m^3/h)	flow rate (kg/s)
		2,450
ORC evapflow rate	11,9	2,45000

w-o HEX control		
Tin_water W-O HEX	68,7	°C
Tout_water W-O HEX	70,0	°C
UA W-O HEX	6,866	W/K
m_oil W-O HEX	3,9	kg/s

Control Simulation Panel	
ORC	COGEN
T_activation (°C)	245,0
Q SF (kW)	300,0
Q th HEX(kW)	200,0

Figure 3.15: Example for the BoP (Balance of Plant) tool developed for the three demo site. This tool allows to calculate the energetic state of each component in system given different values of solar irradiation and load demand. The control components put in place are highlighted in the red and green boxes.

General requirements for the diathermic oil circuit, based on previous FBK experience have been distributed through an internal report to the three demos owner (Spain, Turkey, Belgium).

Control requirements for the cogenerative plants have been finalized and distributed for the tenders' preparation. In the report the main components which keep the system under energetic balance are presented and discussed using the Spanish demo as example.

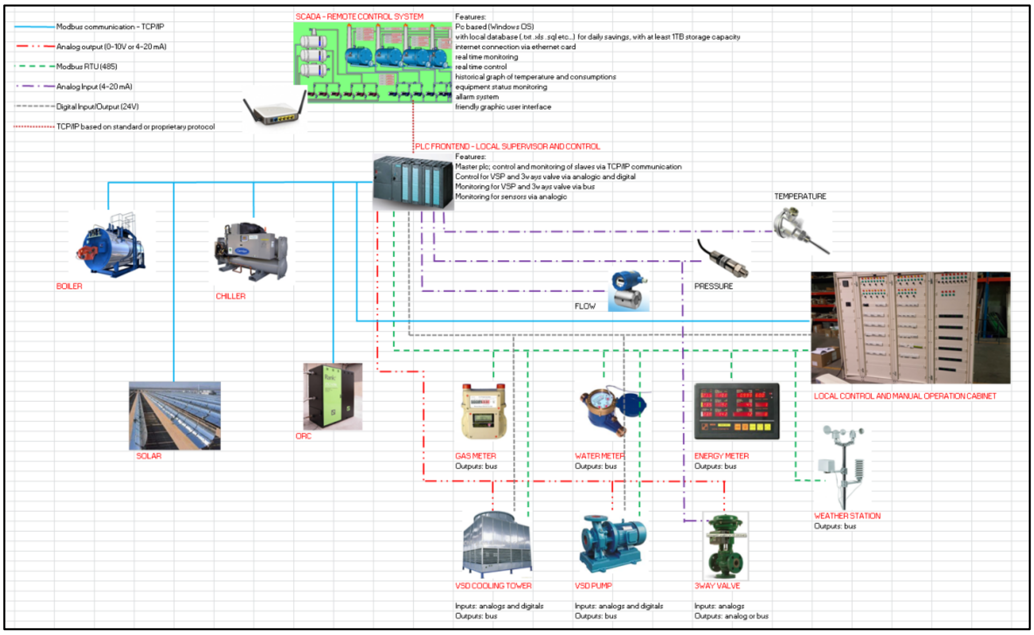


Figure 3.16: Control Architecture and control requirement for the tender preparation in the three Demos.

The work done during the activity period of 2015 was mainly focused on the development of the control flow charts for the three demo sites. In the following picture an example related to the Spanish demo is showed.

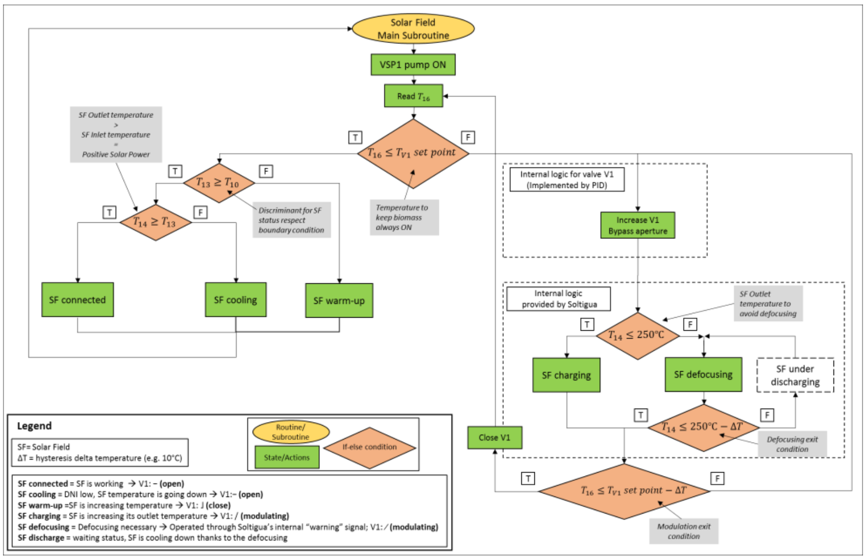


Figure 3.17: Example of control flow chart for the solar field in Spain.

The last period of activities is mainly focused on the development of specific models and dynamic studies to test the control logic developed during the previous period of activities. Thanks to the collaboration with University of Liege, a dymola environment model has been deployed for each single demo (Turkish demo is still under development due to some delays during the layout design).

The simulations carried out have been useful to test the reliability of the system. Important information related to the reactiveness of the systems and capacity to handle automatically specific situations (such ORC maintenance or biomass shortage) are then collected.

3.5.3 Validation (FBK).

The validation part aims to demonstrate through the use of dynamic models the feasibility and reliability of the control logics developed for the three demo sites. At this stage, Spanish and Belgium demo are completed while the model for the Turkish demo is still under implementation due to the delays related to the final layout.

In parallel these models are also used to develop and test the different control strategies for the demo sites related to the 4.4 of WP4 (Development of the operation strategies for the active technologies). The following pictures shows the implementation of the Belgian active layout into the Dymola environment and its control logic. Last step of the validation will be to compare the real behaviour of the system with the predictions obtained from the models.

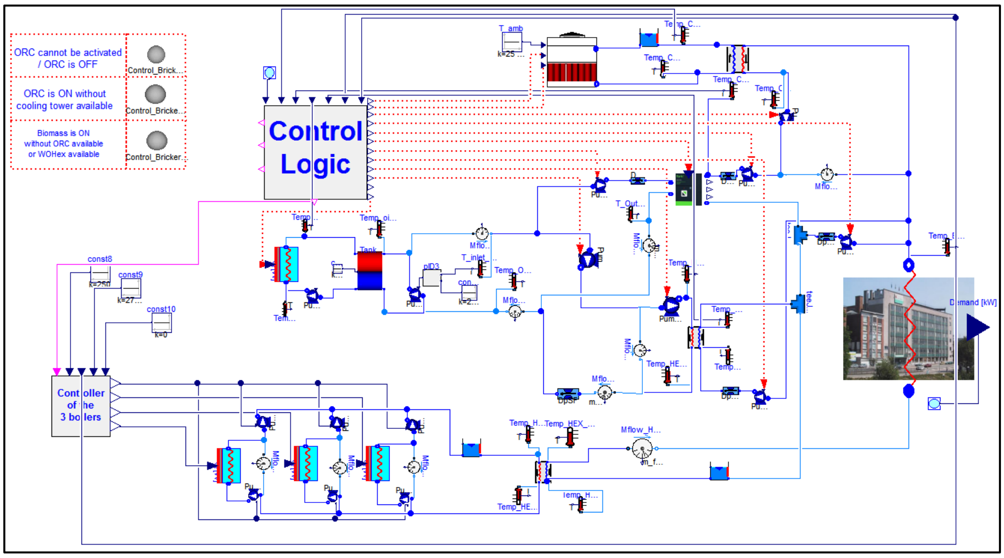


Figure 3.18: Dymola implementation of the Belgian poli-generative plant.

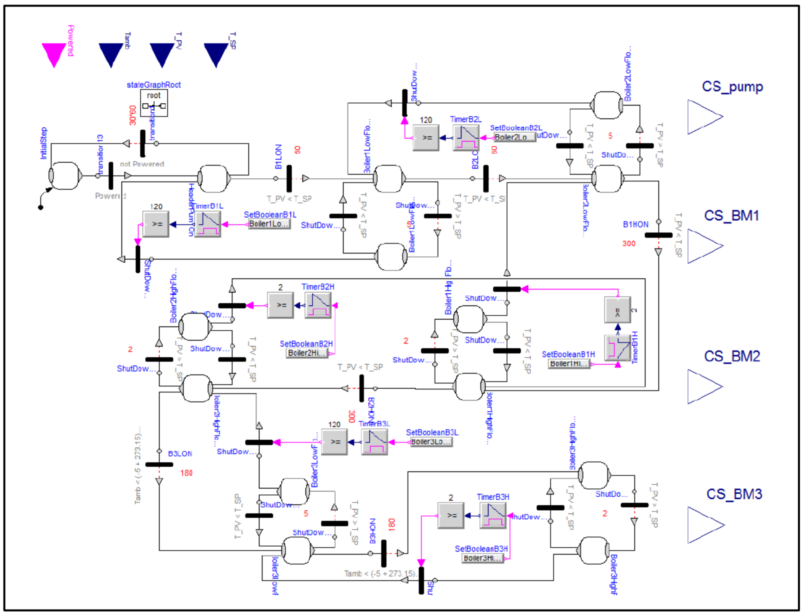


Figure 3.19: Example of control logic implemented for the Belgian demo.

3.6 Task 3.6. Biomass plant requirements and specific design to work as hybrid system for the cogeneration prototypes (CAR).

General status Table;

Task	Planned	Achieved	Deliverables
3.6.	**100%**	**100%**	**D.3.14 at M18**

Activity terminated in P1. The content of P1 report including all progress has been left in this P2 report, as there is a new appointed PTA who will assist the Project execution, and by this we intend to leave evidence of the past milestones achieved.

Partial progress items reported in P1:

The technical characteristics of the biomass boiler plants were described in Deliverable 3.14 to support the building owners in the Public Tender context. That Deliverable 3.14 is currently completed. The document describes the state of the art of different biomass boilers and the available systems in market for storage, transport and feeding and reports their characteristics and possibilities for being used in the BRICKER system. Furthermore, available biomass types, their prices and possibilities for being used in each demos site. The selection for specific cases of Belgian and Spanish demonstrators was described from a technical point of view. Biomass local markets (specifically Caceres and Liege in Spain and Belgian, respectively) were also studied and an optimization of its supply was considered to minimize the economic and environmental impacts. Additionally, some strategies for the management of ashes and reduction of boiler's emissions have been analyzed.

3.6.1 Biomass plant for Spain.

It has been selected a biomass boiler for the Spanish demonstrator in Cáceres. The boiler has a power of 500 kWt and uses oil as thermal fluid, specifically Therminol SP. The selection of this boiler with this power has been mainly to meet the full requirements of the ORC, i.e., to feed the ORC only with the biomass boiler in the worst conditions (e.g. not available solar radiation for solar collectors). The selection of the thermal oil is linked to the possibility to work with high temperatures and with low pressures in comparison with the steam and superheat water, besides other advantages such as the low freezing point, easy control, no risk of corrosion and freezing damages and, it does not require a staff certified in steam boiler on charge of the installation at full time.

On the other hand, it has been also analysed the biomass market in Spain (and deeply in Cáceres area). At this moment, it is known the location of manufactures and providers of each type of biomass to feed boiler, supply capacity and prices (pellets, chips and olive kernel). The final decision about the biomass fuel seems to be chips. However, in the selection of the biomass boiler, it has taken into account the availability of other cheapest biomasses, hence, a multi-fuel boiler will be installed in Spanish demo.

Finally, the normative for the installation of this kind of plants has been identified in order to know the specific requirements to take into account.

A layout with the integration of where all the equipment has been integrated, including the biomass boiler (red box below), has been developed (See Figure 3-20).

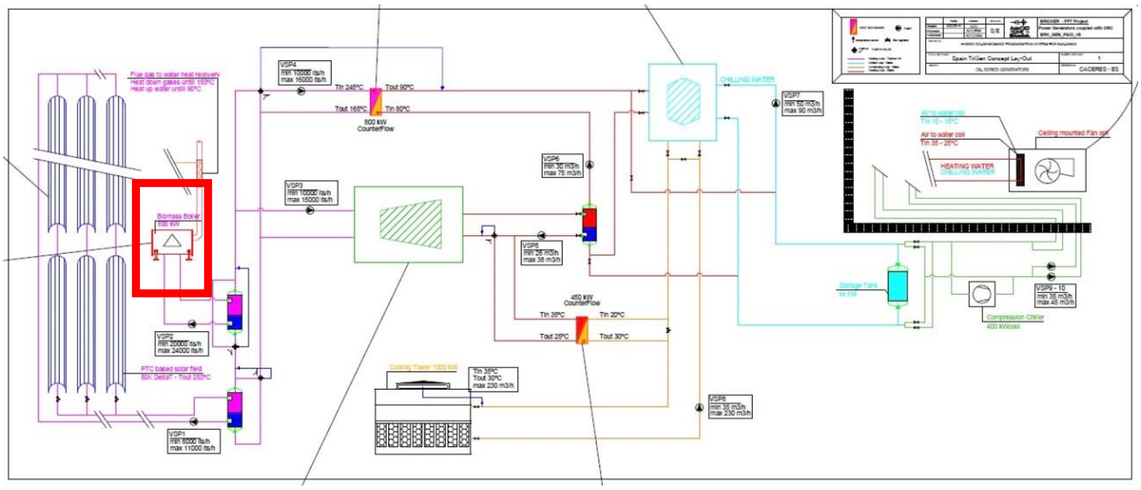


Figure 3-20: Biomass boiler integration in the Spanish layout.

Possible manufactures/providers of thermal oil biomass boilers have been identified for this range of power. Within the most remarkable are Sugimat and D'Alessandro Termomeccanica (SATIS). They have provided budgets (around 100,000 €), technical specifications and equipment dimensions. The budget matches with the expense assigned to the project (170,000 €).

For the biomass storage, three different scenarios have been developed (conservative, intermediate and minimum) depending on the hours of operation of the boiler. Because the biomass supplier can change during the combustion plant life, and in the same way its transport, a versatile silo will be considered. Selected silo allows to discharge from a tipper truck transport into an external hopper that feeds the silo with a screw elevator, and a discharge from a pneumatic truck directly through a hole in the silo's wall.

The location for the biomass boiler and also for the storage and rest of auxiliary equipment will be out of the building in a specific room intended to house the BRICKER system. As the technical room is new, there are not any restrictions in dimensions and no need for modifications. A proposal to place the system has already provided (see Figure 3-21).

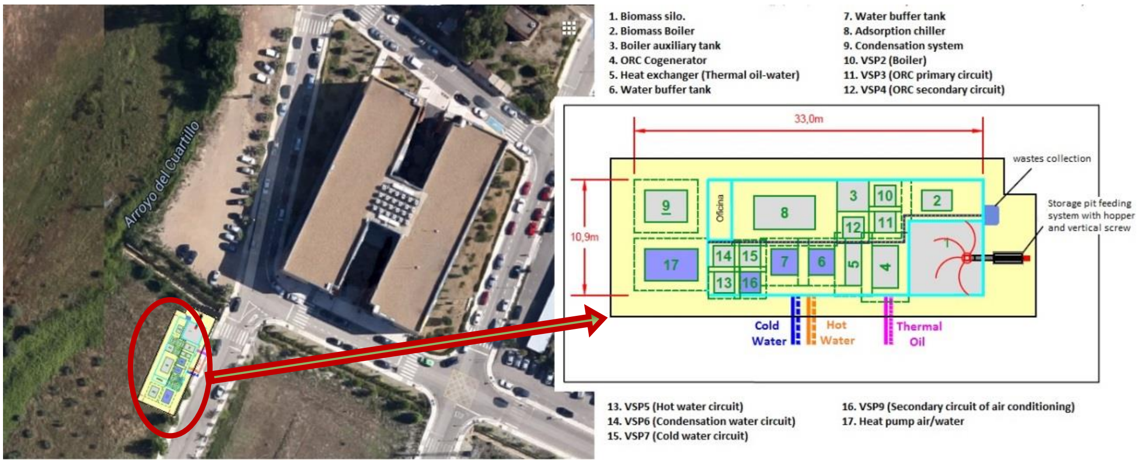


Figure 3-21: Biomass boiler selection activities Spain.

3.6.2 Biomass plant for Belgium.

A biomass boiler for the Belgian demonstrator in Liege has been selected. The boiler has a power of 1,500 kWt and uses oil as thermal fluid, specifically Therminol SP. Two options had been proposed, OPTION 1: 1 thermal oil boiler 500 kW for the ORC + 1 hot water boiler 1,000 kW low temp. for heating; OPTION 2: 1 thermal oil boiler 1,500 kW for the ORC and (with heat exchanger) for heating.

With this boiler besides to meet the requirements of the ORC, it is possible to provide thermal energy to cover thermal demands of the building (DHW and heating) through a heat exchanger oil-water. The selection of the thermal oil has been due to the possibility to work with high temperatures and with low pressures in comparison with the steam and superheated water, besides the same advantages showed for the Spain demo site.

It has been analysed the biomass market in Belgium (and deeply in Liege area). The biofuel finally selected to feed the biomass boiler is wood pellet (due to the availability of local providers identified and the limit space inside building). At this moment it is known the location of manufactures and providers of pellet, supply capacity and prices. This selection has been due mainly to the space requirements inside the building as the pellet is the solid biofuel with higher power density and easy to transport and manage.

The technical regulation for this kind of boilers has been identified (Solid fuel heat generators, Burners, Fuel storage, Emissions, etc.). This is important in order to know the requirements to install the system.

A layout with the integration of all the equipment has been developed by the partners involved in the Belgian demonstrator, including within them the biomass boiler.

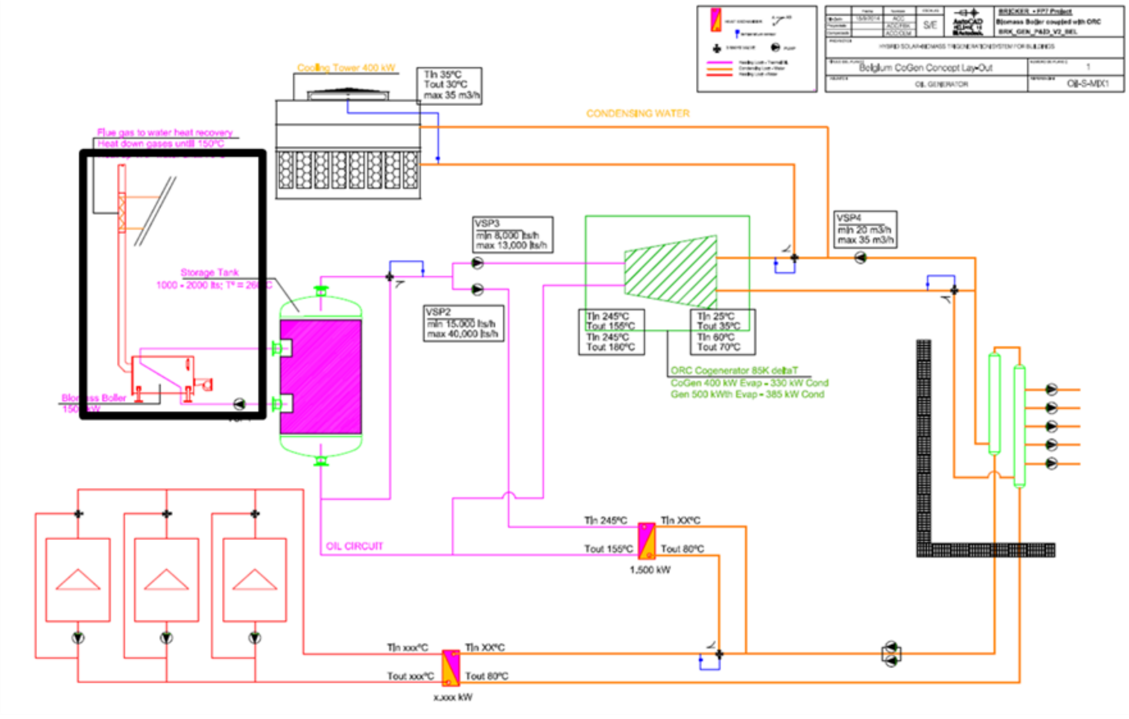
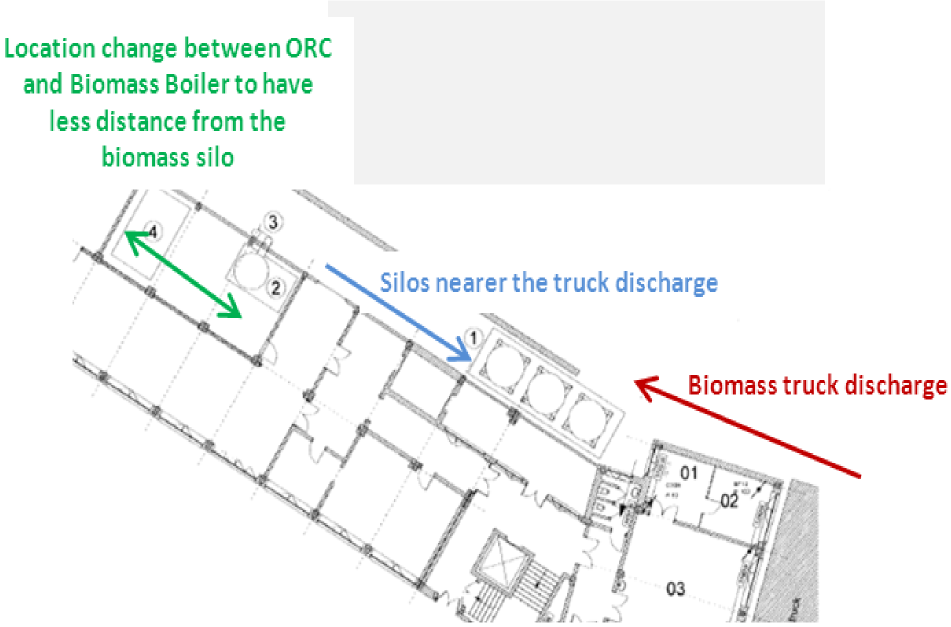


Figure 3-22: Biomass boiler integration in the Belgian layout.

Possible manufactures/providers of thermal oil biomass boilers have been identified for this power range. Within the most remarkable are L'Solé, Sugimat and D'Alessandro Termomeccanica (SATIS). They have provided budgets (between 130,000 to 300,000 €), technical specifications and dimensions for these machines. Some of the budgets (Sugimat) match with the expenses assigned for the project (190,000 €) although the building owner may propose to relocate budget form other interventions to purchase a specific boiler.

The location for the biomass boiler and rest of auxiliary equipment will be inside the building in a specific room intended to house the BRICKER system. As this room is inside the building, there are any restrictions in the dimensions of the equipment; anyway the selected proposal seems to be feasible with approximately 6 m of height for the biomass boiler. There were other proposals to locate the BRICKER systems but, due to the space limitations (mainly in height), and distances, they were rejected. The location of biomass boiler and ORC-prototype in a new technical room imposes some additional works to adapt this new technical room (fire-resistant, chimney, etc.).



(1) Biomass storage in external silos: 3x25 m^3

(2) Biomass boiler: available space 4.00 m x 2.50 m x H 4.80 m

(3) New specific chimney diam. 500 mm

(4) ORC module: available space 5.00 m x 3.00 m x H 4.80 m

Figure 3-23: Locations for the boiler (2) and storage silos (1).

Because of the building is located along an avenue and between many others buildings, the available spaces to storage the biomass fuel is limited as well as the access to the building. It is not possible to discharge a truck with wood pads or other biomass fuel. The adopted solution is storage in external silos and delivering of pellets with pneumatic truck.

Three external silos of 75 m^3 have been proposed for the pellet storage. An estimation of the potential working hours at nominal power according to the storage volume proposed has also been performed (around 130 working hours at nominal power).

It has been also analysed different transport system alternatives from biomass storage silos to biomass boiler in order to identify the most suitable. The pneumatic transport has been chosen because of the distance and the existence of corners which make difficult other options.

3.7 Task 3.7. Chiller plants requirements and specific design to work in tri-generation mode with the Cogeneration prototypes (CAR).

General status Table;

Task	Planned	Achieved	Deliverables
3.7.	100%	100%	D.3.15. at M18

Activity terminated in P1. The content of P1 report including all progress has been left in this P2 report, as there is a new appointed PTA who will assist the Project execution, and by this we intend to leave evidence of the past milestones achieved.

Partial progress items reported in P1:

The technical characteristics of the cooling technologies were described in Deliverable 3.15 to help the building owners in the Public Tender context. That Deliverable 3.15 is currently completed. The document covers a wide state of the art of the thermally activated cooling technologies, including a very detailed list of possible manufacturers/providers. Furthermore, the requirements of the chiller plants for Turkish and Spanish demonstrators to work in trigeneration mode (climate conditions, cooling demand of the building, heat source levels, existing conventional production systems, interaction with the rest of the BRICKER system and conventional systems, etc.) have been identified. The selection of the most suitable technology for each demo cases is also included in the report as well as suggestions about potential constructors.

3.7.1 Chiller plant for Spain.

After an exhaustive analysis, an adsorption machine has been chosen for the Spanish demonstrator in Cáceres for the cold production. This selection has been taken for the limitations of the available heat sources (condensation heat from the ORC) to work in trigeneration mode.

For the selection of the power capacity of this adsorption machine in this specific administrative building, has been established the needs to cover the demand of the building in which is going to be installed or at least only requiring the support of additional cooling units to cover occasional peak loads.

The normative analysis has concluded with any existing regulation is applied for this kind of machines since there are any hazardous components and it is not achieved high pressures.

A layout including the adsorption chiller (red box below) has been developed (see Figure 3-24).

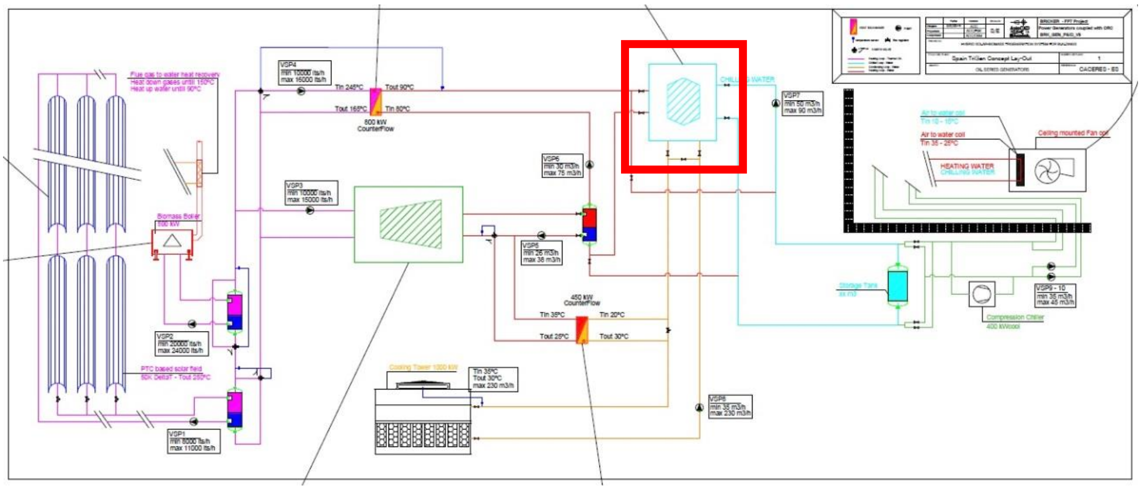


Figure 3-24: Chiller integration in the Spanish layout.

Possible manufacturers/providers of adsorption chiller units have been identified within the range of power selected for the administrative building (e.g. Mayekawa, GBU and Nishiyodo (ICOGEN). Within them is important to remark Nishiyodo (ICOGEN) as the only provider has been possible to contact with and to get specific information and a continuous feedback (Budget, technical characteristics, dimensions, etc.). The estimated cost for the Nishiyodo machine is 160,000 € which is within the budget available for the project (218,000 €).

The chiller will be located outside the building in a specific room intended to house the BRICKER system (see Figure 3-21). The only requirement for the chiller is to be protected from the weather conditions and to have enough space for the O&M.

3.7.2 Chiller plant for Turkey.

Because of the limitations to work with a trigeneration system are the same in both demonstrators, the final decision about the adsorption machine is based on the same arguments. The main difference is in the heat source that feeds the ORC unit because in this case will be solar thermal collectors supported by a natural gas burner.

In addition, due to the great cooling demands of this building asis a big hospital, the selection is based only on the restrictions coming from the ORC and the economic limitations, so the idea is just to cover part of the cooling load of the building.

Possible manufacturers/providers have been identified within the range of power selected (e.g. Nishiyodo (ICOGEN), ECO-MAX and Mayekawa). Within them is important to remark Nishiyodo (ICOGEN) and ECO-MAX as the only providers which have provided information. The estimated cost for the Nishiyodo and ECO-MAX machine is around 160,000 € which is within the budget available for the project (220,000 €).

The location of the adsorption unit is going to be out of the building, near the existing chillers as can be seen in the Figure 3-25**Error! Reference source not found.**, therefore there is not dimension restrictions to locate this machine.

Figure 3-25. Location of the adsorption unit in the Turkish demo case

4 WP4 INTEGRATION (EURAC).

4.1 Task 4.1. Concept design, model design and simulation of the BRICKER technologies in different scenarios (EUR)

General status Table;

Task	Planned	Achieved	Deliverables
4.1.Turkey	**100%**	**100%**	**D.4.7.**
4.1. Belgium	**100%**	**100%**	**D.4.7.**
4.1. Spain	**100%**	**100%**	**D.4.7.**

Partial progress items:

4.1.1 Detailed characterization of the demo building (EUR)

This activity deals with the preparatory activities for carrying out a detailed energy simulation of a building. In order to achieve this aim, the following tasks have been done:

1. Data acquisition and energy audit for detailed building simulation.
   a. Turkey. Task accomplished.
   b. Belgium. Task accomplished.
   c. Spain. Task accomplished.
2. Development a Word document for reporting on building boundary conditions (internal gain, ventilation, infiltration, geometry…). This document will be part of the final deliverables of WP4.
   - The document has been developed and it is continuously updated according to the model development process.
   a. Turkey. Template delivered, document in a draft phase.
   b. Belgium. Template delivered, document in a final phase.
   c. Spain. Template delivered, document in a final phase.
3. Development of an Excel sheet where the specific value of the different boundary conditions are specified.
   a. Turkey. Task accomplished.
   b. Belgium. Task accomplished.
   c. Spain. Task accomplished.
4. Weather analysis of average and extreme data set and weather file definition.
   - The analysis has been carried out by using the software Meteonorm and the weather files have been made available. A further plausibility check has been made by comparing DNI values with those provided by PVGIS.

   a. Turkey. Weather file delivered.
   b. Belgium. Weather file delivered.
   c. Spain. Weather file delivered.
5. Creation of the subdeck on weather boundary conditions.
   - This task has been already accomplished.

4.1.2 Existing building modelling (EUR)

For each demo building the followings activities have been done so far.

1. Definition of the thermal zones, according to the existing energy system and control strategy.
   a. Turkey. Task accomplished.
   b. Belgium. Task accomplished.
   c. Spain. Task accomplished.
2. Simplification process of the building model in order to define a trade-off between accuracy of the model and computational effort.
   a. Turkey. Task accomplished.
   b. Belgium. Task accomplished.
   c. Spain. Task accomplished.
3. Definition of the final building model.
   a. Turkey. Task accomplished.
   b. Belgium. Task accomplished.
   c. Spain. Task accomplished.
4. Simulation of the existing building (building envelope + existing energy system):
   a. Turkey. In progress.
   b. Belgium. Task accomplished.
   c. Spain. Task accomplished.
5. Simulation report:
   a. Turkey. A draft version is in progress.
   b. Belgium. Final version has been distributed in March 2015.
   c. Spain. Final version distributed in March 2015.

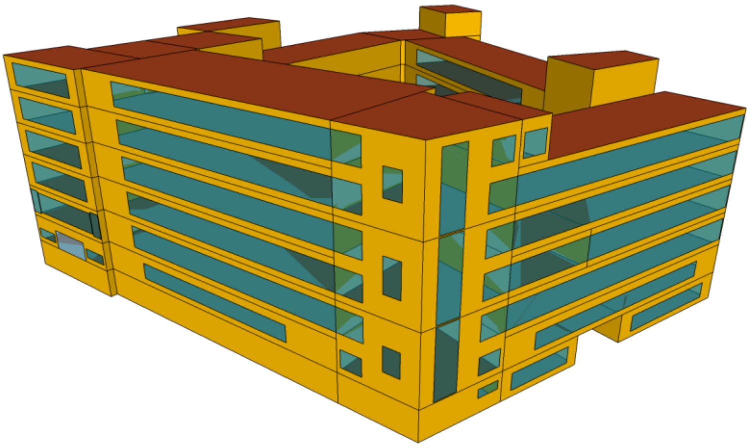


Figure 4.1: View of the Belgian demo building model made with Trnsys 3D plugin.

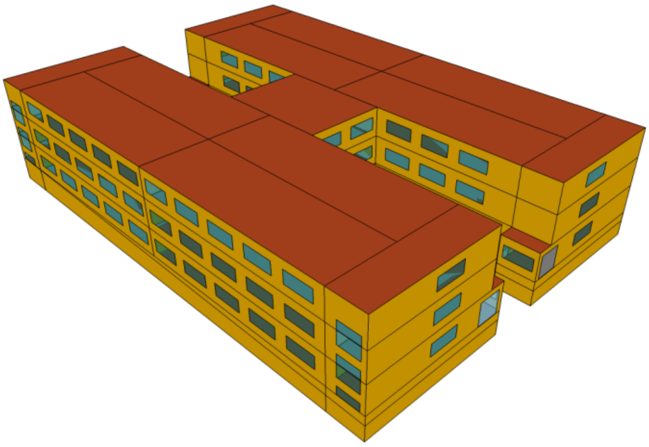


Figure 4.2: View of the Spanish demo building model made with Trnsys 3D plugin.

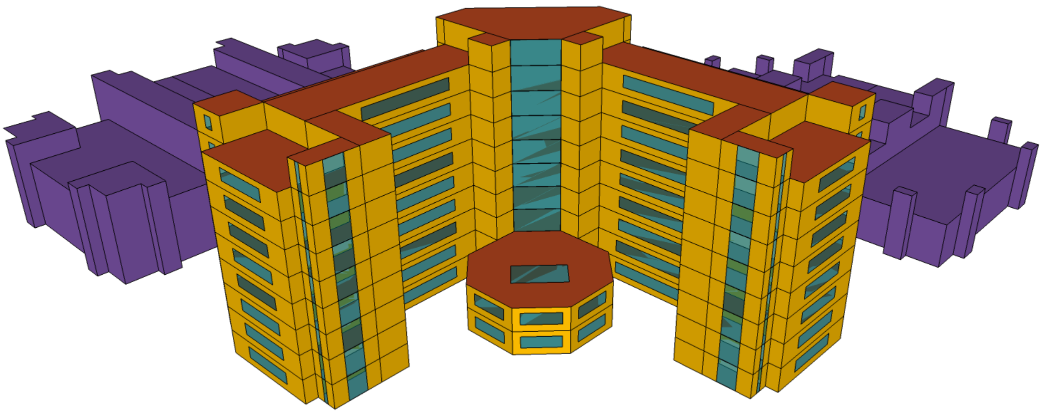


Figure 4.3: View of the Turkish demo building model made with Trnsys 3D plugin.

4.1.3 Definition of a sub-deck for each active and passive technologies (Studio file) (EUR)

The development process of the sub-deck has started by doing the following activities:

1. Definition of the purpose of the model in order to understand which level of detail is required (white, grey or black box model).
    a. PCM insulation material. Task accomplished.
    b. Ventilation façade. Task accomplished.
    c. Aerating window. Task accomplished.
    d. Concentrating solar collector. Task accomplished.
    e. Chiller & biomass boiler. Task accomplished.
    f. ORC unit. Task accomplished.
2. Brief literature review on the existing numerical codes for simulating a given active/passive technology and selection of the Trnsys type.
    a. PCM insulation material. Task accomplished.
    b. Ventilation façade. Task accomplished.
    c. Aerating window. Task accomplished.
    d. Concentrating solar collector. Task accomplished.
    e. Chiller & biomass boiler. Task accomplished.
    f. ORC unit. Task accomplished.
3. Development of the sub-deck eventually with the implementation of a low-level control strategy + documentation of the numerical models.
    a. PCM insulation material. Task accomplished.
    b. Ventilation façade. Task accomplished.
    c. Aerating window. Task accomplished.
    d. Concentrating solar collector. Task accomplished.
    e. Chiller & biomass boiler. Task accomplished.
    f. ORC unit. Task accomplished.
4. Plausibility tests for model verification and validation according to existing monitored data or laboratory test results.
    a. PCM insulation material. Task accomplished.
    b. Ventilation façade. Task accomplished.
    c. Aerating window. Task accomplished.
    d. Concentrating solar collector. Task accomplished.
    e. Chiller & biomass boiler. Task accomplished.
    f. ORC unit. Task accomplished.

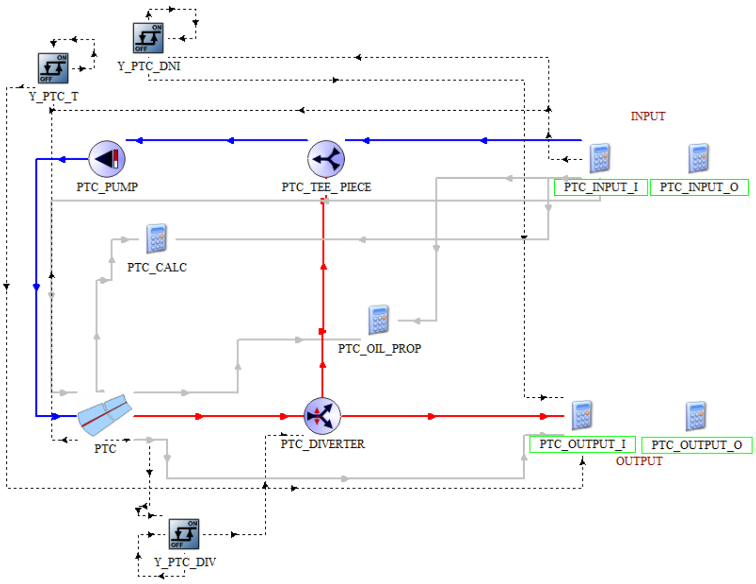


Figure 4.4: View of Trnsys subdeck of Parabolic Trough Solar Collectors.

4.1.4 Creation of Trnsys deck modular template (EUR)

This task has been tackled firstly defining the syntax among the simulating team. The main activity taken at the moment was to formalize the main simulation approach, consisting in defining the structure of the simulation environment based in Trnsys, the nomenclature and the syntax to use for each sub-deck development.

This task has been accomplished.

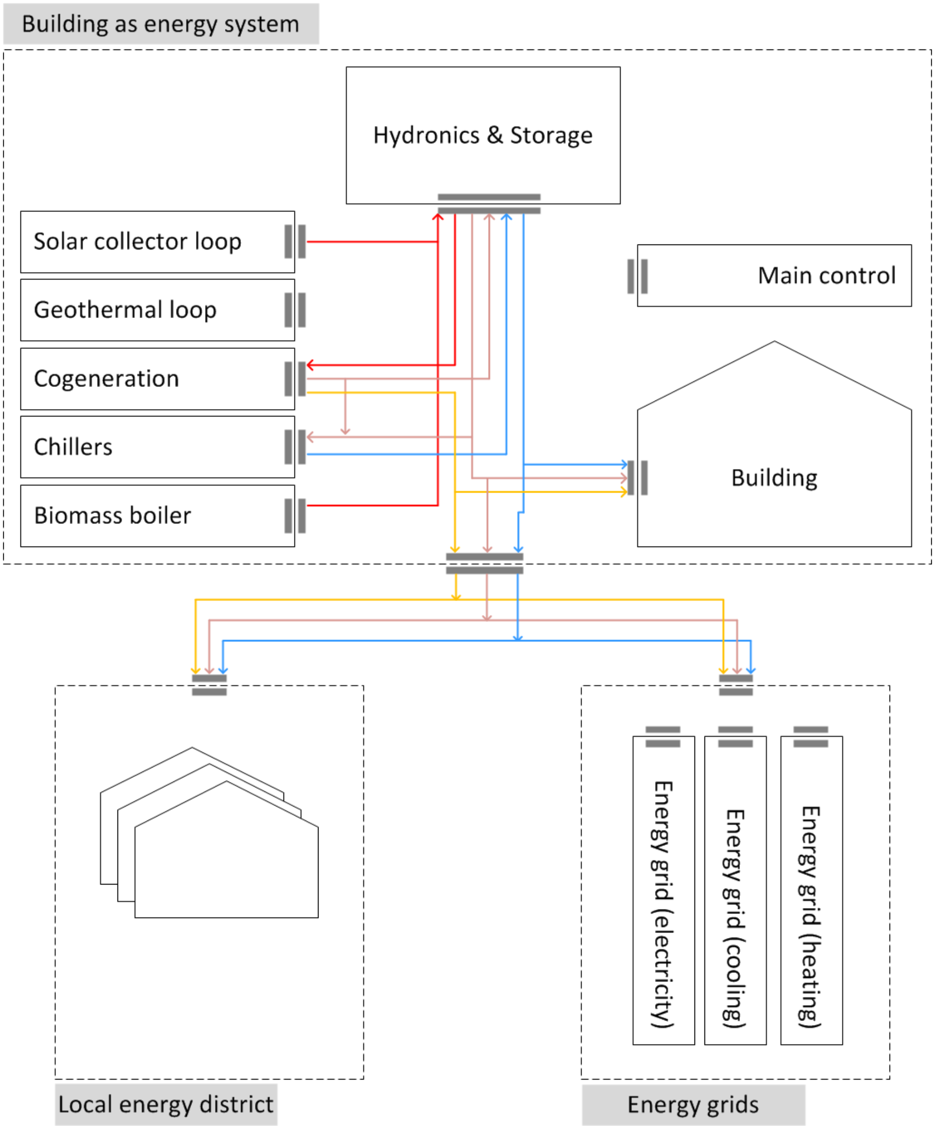


Figure 4.5: Concept visualization of the modular Trnsys template.

4.2 Task 4.2. Optimal PASSIVE Systems integration project in the buildings, based on WP2 and WP5 (EUR)

General status Table;

Task	Planned	Achieved	Deliverables
4.2.Turkey	**100%**	**50%**	**D4.23 at M24, in progress**
4.2. Belgium	**100%**	**100%**	**D4.24**
4.2. Spain	**100%**	**100%**	**D4.25**

Partial progress items:

4.2.1 Analysis of the energy saving potential due to passive technologies (EUR)

A set of preliminary simplified simulations have been carried out on passive technology in order:

- to evaluate and quantify the impact of passive technologies on the installation site with respect the actual scenario;
- to compare the effectiveness of alternative traditional interventions;
- to recommend optimized operation strategies.

The actual status of the work is the following:

a. PCM insulation material: a final document has been distributed among partners (variants: 1. installation of PCM+PIR on the external side of vertical wall delivered 11.10.2014; 2. Installation of PCM+PIR on the internal side of roof ceiling delivered on 15.01.2015);
b. Ventilated façade: a final document has been distributed among the partners on 27.11.2014;
c. Ventilated window: a first simulation report has been shared with Greecom the 13.02.2015. The optimization of the system has been reviewed and delivered the 08th of April 2015.

4.2.2 Definition of cost-optimal scenarios for passive technologies (EUR)

The integration of Bricker renovation concepts in the Turkish and Belgium demos has accomplished. A dedicated simulation report has been distributed with project partners.

4.2.3 Input to building owners for tender preparation (PASSIVE) (EUR)

The preliminary set of simulation has provided inputs for tender preparation for Belgium and Turkish demo buildings. The Spanish demo building does not foresee any intervention on the building envelope.

4.2.4 Detailed project of PASSIVE technologies (EUR)

A detailed project for renovation of building envelope for the Belgium and Turkish demo buildings is accomplished. Thanks to the input provided to the building from Task 4.1, a project of the refurbishments intervention has been possible.

4.3 Task 4.3. Optimal ACTIVE Systems integration project in the buildings, based on WP3 and WP5 (EUR)

General status Table;

Task	Planned	Achieved	Deliverables
4.3.Turkey	**100%**	**25%**	**D4.23, in progress**
4.3. Belgium	**100%**	**100%**	**D4.24**
4.3. Spain	**100%**	**100%**	**D4.25**

Partial progress items:

4.3.1 Analysis of the energy saving potential due to active technologies (EUR)

This activity on the Spanish demo building is accomplished. The implementation of active Bricker technologies into Belgian demo building is at the moment in progress. A Trnsys model of the Bricker energy concept has been completed based on the P&ID developed so far. Up today the control strategy of the system is still under discussion among, building owner, technology providers and system integrators. The main difficulty is related to the integration of Bricker layout in the existing system.

With respect to P4.3 related activities, the Turkish demo installation is suffering delays. At the moment, the simulation activity has focused on the development of the numerical model of the solar field.

4.3.2 Definition of cost-optimal scenarios for active technologies (EUR)

Cost optimal scenarios for the Spanish demo building have been discussed. Different operation strategies are compared in terms of yearly operational energy costs. The definition of appropriate economic boundary conditions is crucial since it influences significantly the problem. This activity is meant as a starting point for investigating the feasibility of using Bricker energy concept in social housing (see WP4.6).

Cost-optimal scenarios for Belgian and Turkish demo building have not started yet.

4.3.3 Input to building owners for tender preparation (ACTIVE) (EUR)

The required information of tender preparation have mainly dealt with the definition of minimum performance requirement of system components such as the biomass boiler or the sorption chiller. The capacity of active components has been based on heating and cooling building's loads derived from numerical simulations.

4.3.4 Detailed project of ACTIVE technologies (EUR)

A detailed project is currently under development for the Turkish demo building. This activity for Spanish and Belgium demo buildings can be considered accomplished.

4.4 Task 4.4. Operation strategies (FBK)

General status Table;

Task	Planned	Achieved	Deliverables
4.4.Turkey	**100%**	**25%**	**Contributions to D.4.23.**
4.4. Belgium	**100%**	**80%**	**Contributions to D.4.24.**
4.4. Spain	**100%**	**90%**	**Contributions to D.4.25.**

The operation strategies have been developed by FBK carrying out simplified numerical simulations in Dymola. The outcome of this preliminary activity is then implemented into a whole system simulation in TRNSYS environment developed by EURAC.

The work related to the operation strategy is almost finalized for Belgian and Spanish demos. Regarding the Belgian demo, the collaboration with University of Liege has permitted to finalize the work in a short time. The result will be in part integrated in the WP4 deliverables. Also the Spanish dynamic model has been recently finalized and control strategies are still under investigation.

For the Spanish demo the operation of the system under various options has been evaluated on a week basis and a finalized document will be soon available. The following pictures give a general overview of the operation strategies integrated in the numerical model of the of the system.

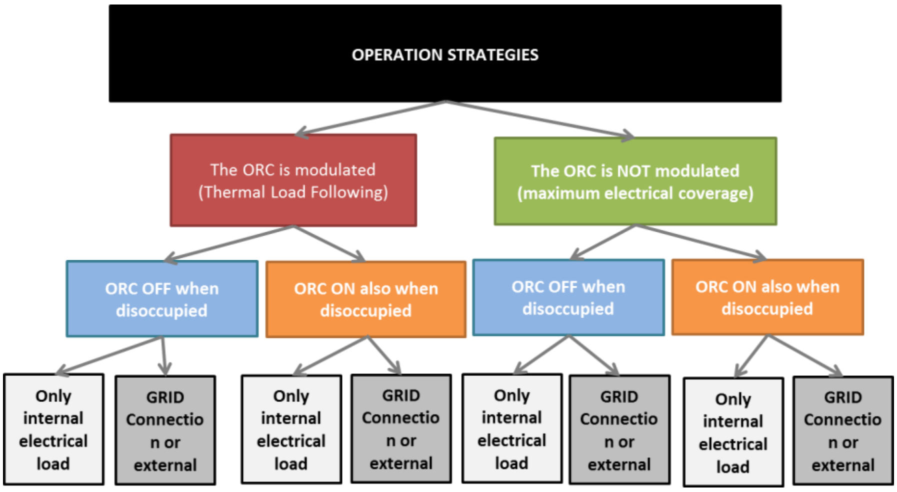


Figure 4.6: Operation Strategies.

For each demo site different control strategies are discussed with EURAC and tested individually in order to define benefits and disadvantages of each configuration. The following picture partially describes some of the strategies adopted and studied during the analysis of the Belgian demo.

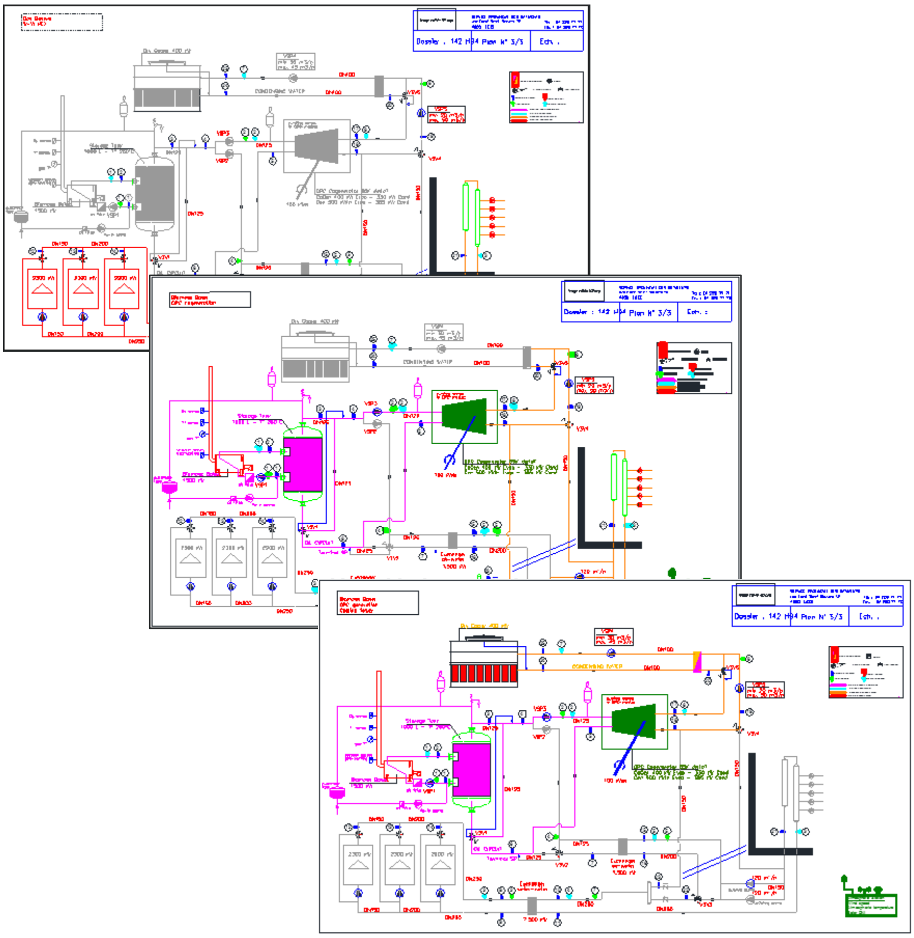


Figure 4.7: Control strategies simulated through the use of Dymola software for the Belgian demo site.

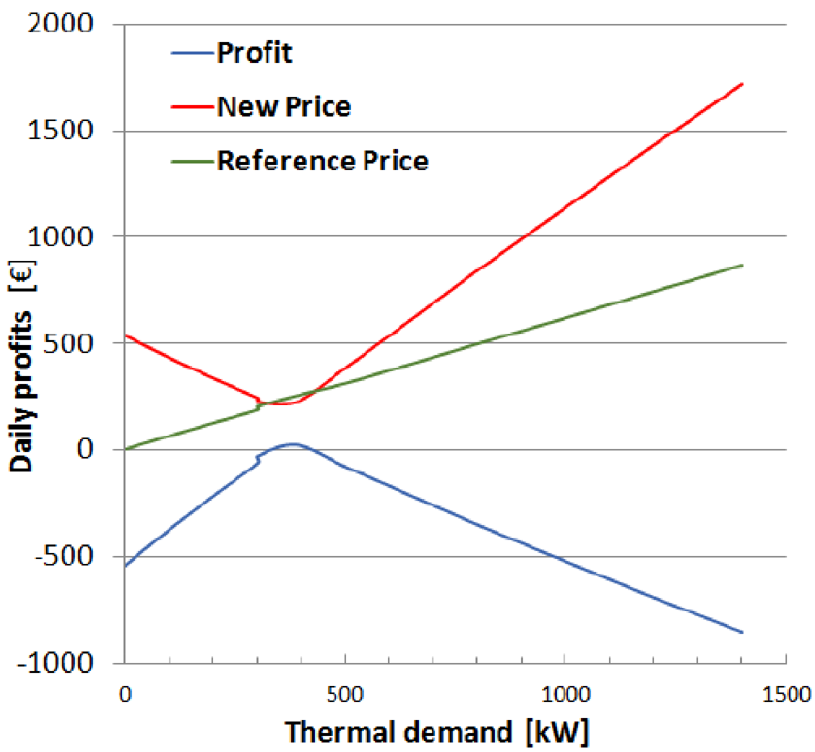


Figure 4.8: Comparison different operation strategies – Part I.

The previous picture depicts the result of a typical daily dynamic simulation performed to understand how to make the Belgian demo profitable depending on the biomass price. Next step will be to complete the implementation of the Turkish demo in Dymola, then performing the simulations of the proposed control strategies for the last demo site of the Bricker project.

The fine tuning of the best performing operation strategies keeping in mind long term strategies will be realized through dedicated yearly TRNSYS simulations which are under development with the support of EURAC.

4.5 Task 4.5. Guides for design, commissioning and maintenance (ONU)

Task	Planned	Achieved	Deliverables
4.5.	80%	10%	D.4.34. at M48

Partial progress:

This task is strongly delayed due to the fact that it depends from Task 5.3 completion, which is related to the Installation, commissioning and start-up in the three demo buildings. Please see section in WP5.

However, the structure of the guides has been discussed in several meetings, and this task is having already some feedback and material available coming from other Work Packages, where there is already a good progress.

4.6 Task 4.6. BRICKER Concept transfer to Social Housing (TEC)

Task	Planned	Achieved	Deliverables
4.6.	100%	15%	D.4.37. at M48

In this Task, the implementation of the BRICKER Concept in Social Housing Residential buildings will be analysed and discussed, with the aim of obtaining conclusions about the BRICKER replicability to the residential sector.

In the first approach of this deliverable, the task was planned to be focused on an existing building located in the same region as the Spanish BRICKER Demo, following analogous steps to the other tasks on WP4 and developing a virtual implementation of BRICKER concept. The very first efforts on this task were aligned with this approach (as described on M18 progress report).

On the 1st Review Meeting (M18), it was pointed out and agreed the convenience of expanding the scope of the task from one specific building to diverse social housing replication scenarios. Moving from a simulation based quantitative approach to a wider and more qualitative one would improve the replication conclusions of BRICKER concept to social housing at European level.

Since M30, the new approach has been discussed on calls and meetings. According to this first discussions, the expectable outcomes of this task are the definition of the boundary conditions (climatic, regulatory, energy, economic, …) that would make BRICKER transfer to social housing economically attractive and the identification of scenarios across Europe that likely would satisfy that conditions. It is being discussed the approach for these estimations and the possibility of developing a light simulation tool (probably based on Excel). In fact, in T5.5 *Economic analysis of the 3 demo site implementations* a spreadsheet is being developed to determine economic and energy indicators of the 3 demo sites (see details in the description of T5.5 in this report). It is expected to use this spreadsheet also for a backward analysis to identify the inputs values that provide satisfactory economic and energy indicators for the 3 demo sites. This methodology could be replicated for the transfer to social housing.

Therefore, this task will take into account inputs from the simulation and economic tasks regarding the three demos on non-residential buildings (WP4 and WP5, especially T5.5) and also provide feedback to WP6 *Exploitation and replication*.

Basing on the first outcomes of T5.5, the definitive methodology for T4.6 will be established and implemented, developing the bulk of this task during the last 9 months of the project. There is no delay expected for this deliverable.

5 WP5 DEMONSTRATION (ACCIONA).

5.1 Task 5.1. Monitoring and performance evaluation before renovation (ACC).

General status Table;

Task	Planned	Achieved	Deliverables
5.1.Turkey	**100%**	**100%**	**D.5.26**
5.1. Belgium	**100%**	**100%**	
5.1. Spain	**100%**	**100%**	

General budgetary situation for the pre-monitoring (to be confirmed after P2 financials are approved)

#	What?	Spain	Belgium	Turkey
A	Sensors, network analysers, thermometers and other metering equipment.	CEMOSA: 10.000€ to purchase these consumables	ULG: 10.000€ to purchase these consumables	ONU: 10.000€ to purchase these consumables
B	Installation of A, including cables, protections and other material needed.	CEMOSA: 4.000€ to subcontract the installation	ULG: 4.000€ to subcontract the installation	ONU: 4.000€ to subcontract the installation
C	Data collectors and communication equipment: BRICKER monitoring cabinet.	ACCIONA; 25.000€ for the 3 demo sites, to purchase servers or any other communication equipment needed.		
D	Installation of C	GEX, included in their subcontracting demo budget	SPB, included in their subcontracting demo budget	ADU, included in their subcontracting demo budget

Figure 5.1: Monitoring budget table per demo.

5.1.1 Preparation for monitoring (ACC).

Turkey;

As the Spanish case has been the reference, the adaptation of the Spanish memo to the Turkish case has been finished, and there is a “monitoring report” available for the Turkish demonstrator with technical specifications.

As the Hospital is going to tender the implementation of the monitoring system, the Turkish Partners are working on the preparation of the documentation to select a subcontractor to perform the implementation of the selected measures.

Chilled water demand, heating consumption and Electric consumption of Block A will be measured.

The pre-monitoring architecture has been defined and it’s being implemented. A total of 107 signals will be monitored and sent to Bricker control centre using web Services

DIMON EDC (Energy data collection) embedded PC application collects real-time data from the analysers, meters, and sensors installed to monitor the energy behaviour of the building.

The data collected is sent to local SCADA solution DIMON EEMS, the data is published via web services, last 5 days of data can be collected real time, data will be stored with a 10 minute frequency, monthly archives with historical data can be manually sent.

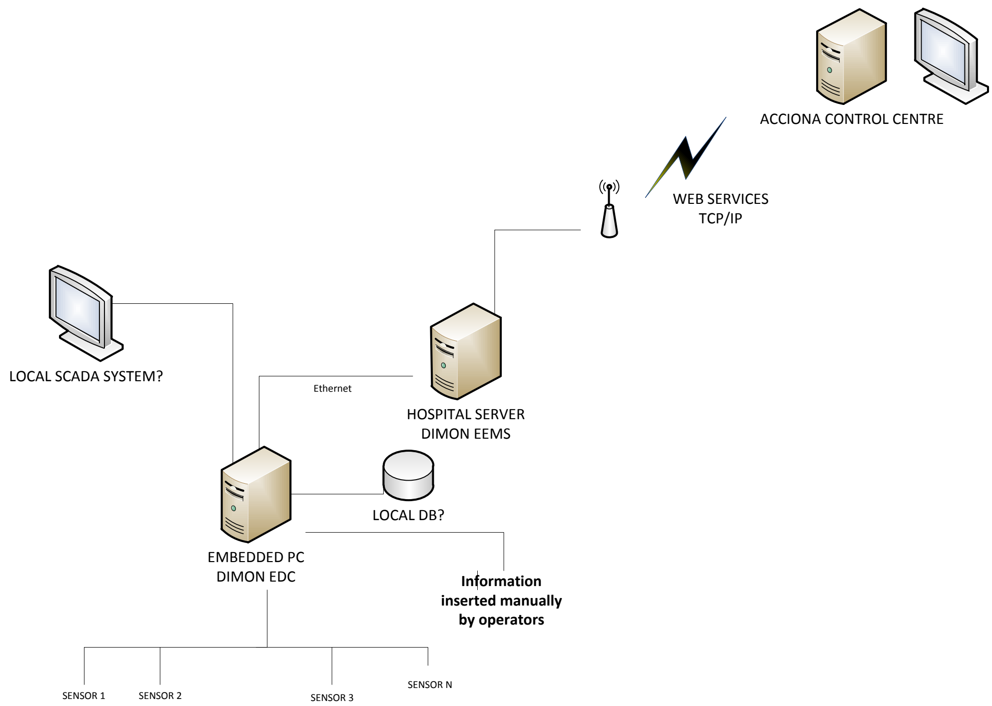


Figure 5.2: Bricker monitoring layout in the Turkish demo.

Belgium;

There is historical energy consumptions available (bills) from 2010, 2011 and 2012 for the WHOLE BUILDING (all blocks), so this is a starting reference in relation to the building energy use.

BRICKER interventions focus only on Blocks 1 and 6, so we have to break down the energy use for those 2 blocks.

The Belgian building is being monitored (all blocks, gas and electricity) by the local energy provider, E.D.F., since October 2013, so this has been considered as a positive actions from which some synergies and agreements have been made.

Specifically:

- Heating consumption: SPB installed individual heating meters for each of the 11 heating distributing collectors in April 2014 (in agreement with E.D.F.). Taken this into consideration, we focused on the **3 pipes which provide heating service to Blocks 1 and 6**.
- Electrical consumption: After a number of visits to the building started in March 2014, we identified **7 electrical circuits serving Blocks 1 and 6. All these lines were monitored in June 2014.**

In relation to the communication of the monitoring data to the ACCIONA data Centre in Madrid, an FTP server was activated in Madrid, and we are working on the first tests to receive daily files from E.D.F Server in Paris, containing all the relevant measures of SPB Building.

Once the file transfer process is active, a middleware to migrate this data into ACCIONA Data Centre will be implemented. This is the only remaining work in relation to the Belgian demonstrator monitoring.

Files have been received in ACCIONA Data Centre in a daily basis since beginning 2015 and the information received will be displayed in ACCIONA Data Centre.

Spain;

The building is 100% electrical powered. We are monitoring:

- Total Heating and cooling, on one meter.
- Total Ventilation; 3 meters, one per floor.
- Rest of energy (lighting and other uses) on one meter.
- Indoor air quality in floor 1, using 4 sensors in a representative area.

The Spanish monitoring project is to be used as a reference for the other 2 demos.

Up to now, main works already finished are:

- Monitoring project available since March 2014.

- Installation of the monitoring equipment finished in June 2014, performed by a local subcontractor of the Building Owner, Partner GEX.
- Start-up of the data collection and data transfer to ACCIONA Data Centre in progress is active since the 15th of July 2014. This is the official start date of this demonstrator.

Figure 5.3: Bricker Cabinet installation in GEX building

5.1.2 Monitoring and analysis (ACC).

IPMVP (International Performance Measurement and Verification Protocol) implemented by Efficiency Valuation Organization (EVO) has been followed and data analysis procedures are being developed. All Data from the buildings will be analysed in a monthly base and Excel data templates will be created and used for data analysis.

Turkey:

Data is being stored locally in DIMON EEMS SCADA, integration with ACCIONA data centre is in final stage.

Integration of local data stored in DIMON EEMS SCADA and ACCIONA control centre has been completed. Data has been monitored and stored in ACCIONA database, energy analysis including energy baseline for electric and heating consumptions is being completed. The methodology of the analysis is included in deliverable D5.26 Energy performance assessment of the 3 buildings before renovation.

Belgium:

Final communication tests are to be finished before the end of October 2014, and the middleware needed to convert the daily files received in Madrid with the ACCIONA Data Centre is planned to be developed by a subcontractor and installed during the last months of 2014.

Data is being received since 1 July 2014 in a daily base; 26 points are being collected with a 10 minute granularity.

Integration with ACCIONA data centre is in final stage.

Data has been monitored and stored in ACCIONA database, energy analysis including energy baseline for electric and heating consumptions has been fulfilled. Results are included in deliverable D5.26 Energy performance assessment of the 3 buildings before renovation.

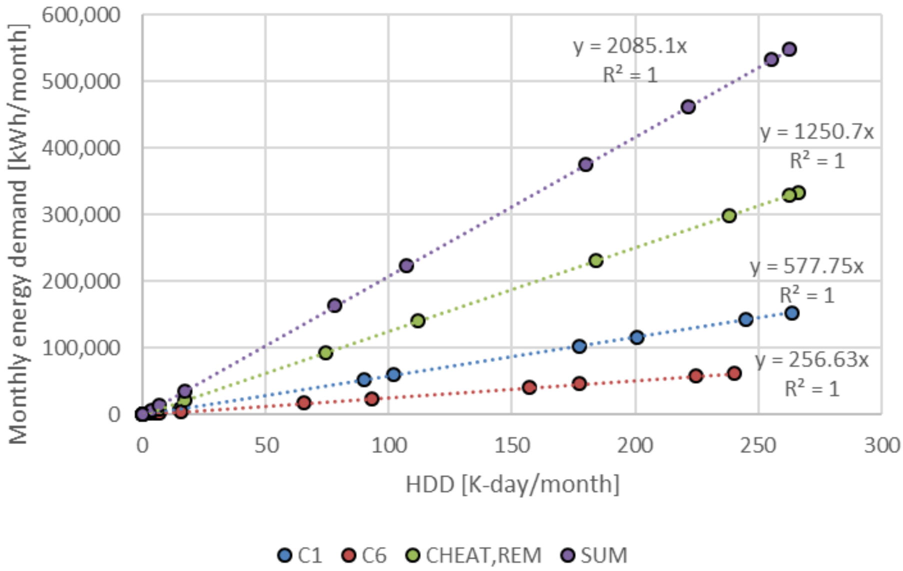


Figure 5.4: Monthly heat energy demand versus heating degree days.

<u>Spain;</u>

Monitoring started in July 15th 2014. Data will be stored for its analysis in the ACCIONA Data Centre System.

Herein below, there are 2 screen shots of the ACICONA Data Centre interface developed by ACCIONA for the Spanish demo. The same structure for presenting data will be implemented in Belgium and Turkey.

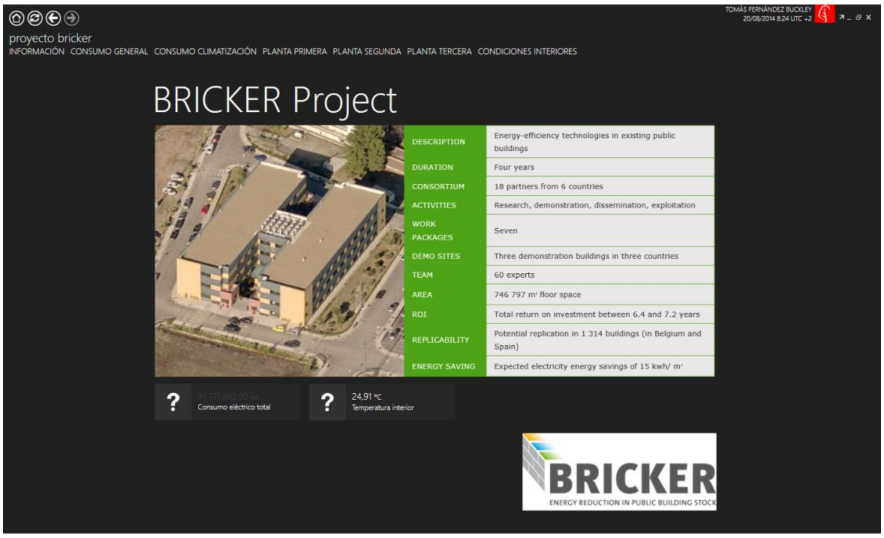


Figure 5.5: BRICKER monitoring user´s interface, main screen.

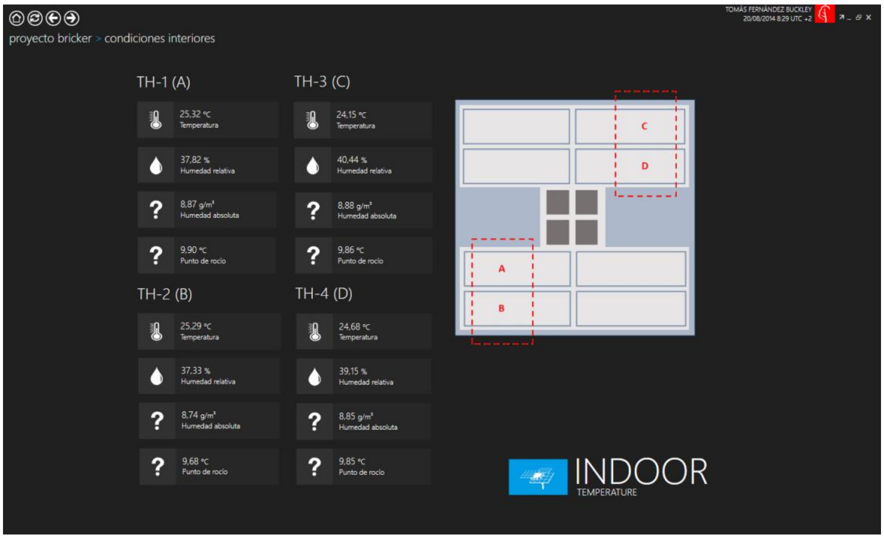


Figure 5.6: BRICKER monitoring user´s interface. First floor indoor parameters.

Data has been monitored and stored in ACCIONA database, energy analysis including energy baseline for electric consumption has been fulfilled. Results are included in deliverable D5.26 Energy performance assessment of the 3 buildings before renovation.

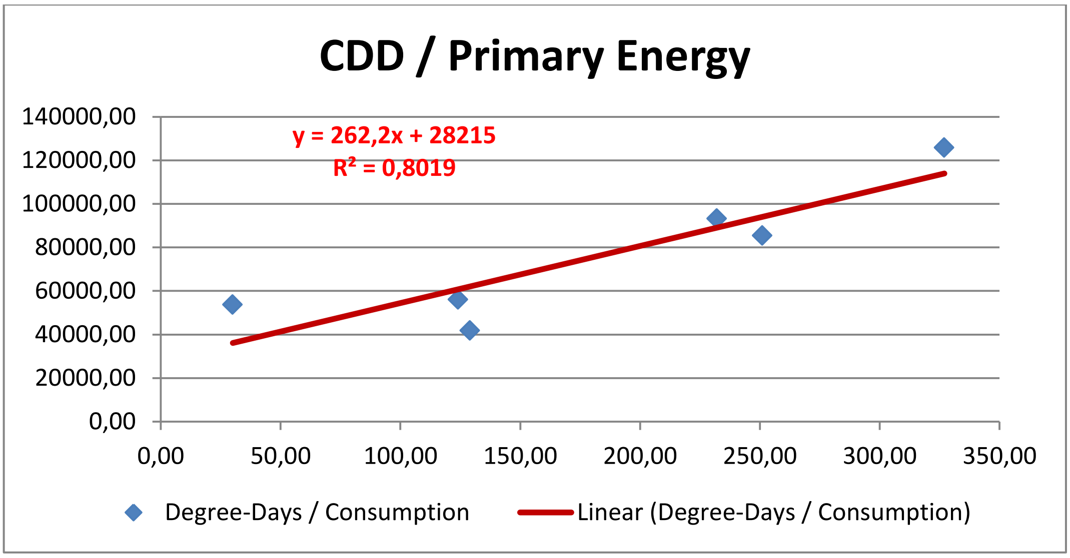


Figure 5.7: Primary energy baseline.

5.2 Task 5.2. Manufacturing of the solutions to be installed in the demonstration buildings (ACC).

General status Table;

Task	Planned	Achieved	Deliverables
5.2.Turkey	100%	100%	D.5.27
5.2. Belgium	100%	100%	
5.2. Spain*	-	-	

* There are no solutions to be manufactured for the Spanish demo.

According to the DoW WP5 section, there are three components to be manufactured within this task, which are the ventilated façade for the Turkish demo (ACCIONA), the ventilation units for the Belgian demo (GREENCOM) and the PIR foam panels for the Belgian demo (PURINOVA). In the three cases, works include manufacturing and transportation to demo sites. Again, in the three case, the transportation costa initially planned to be assumed by the manufacturers (or the technology senders) has been relocated to the receiver Partners, the building owners, due to customs and ease of execution.

Partial progress items describe works done up to date:

5.2.1 Ventilated façade for Turkey (ACC).

All the façade elements were ready to be shipped from Madrid to Aydin in due time, according to the original plan. However, there has been a delay in the launching of the Turkish tenders, due to the political situation in this country, among other reasons. By this, the façade was sent by ACCIONA to Turkey, and is there ready to be installed by the selected subcontractor.

It is to be remarked that the subcontracting budget to send the components to Turkey was shifter from the Spanish Partner ACCIONA to the Turkish “receiver” Partner ADU, due to customs and border facilities.

In the following pictures, all material and components are shown as stored in Madrid and the Hospital demo prior to its installation in due time. It is to be remarked that during the transportation, some panels were broken and a new delivery had to be organised by ACCIONA.

Figure 5.1: BRICKER ventilated façade components stored in ACCIONA facilities in Spain.

Figure 5.2: BRICKER ventilated façade components stored in Turkey by the Hospital, ready for installation.

Figure 5.3: Broken panel after the first delivery.

5.2.2 Double flow ventilation units for Liége (GRE).

In the last proposal for the installation of the double flow ventilation systems from Partner GREENCOM, it was decided to use 22 units, instead of the originally 15 planned. This is due to the fact that each window has 2 units, and in order to monitor 11 windows, we need 22 units.

In the following figure there is a group picture of the GREENCOM team with the first units manufactured.

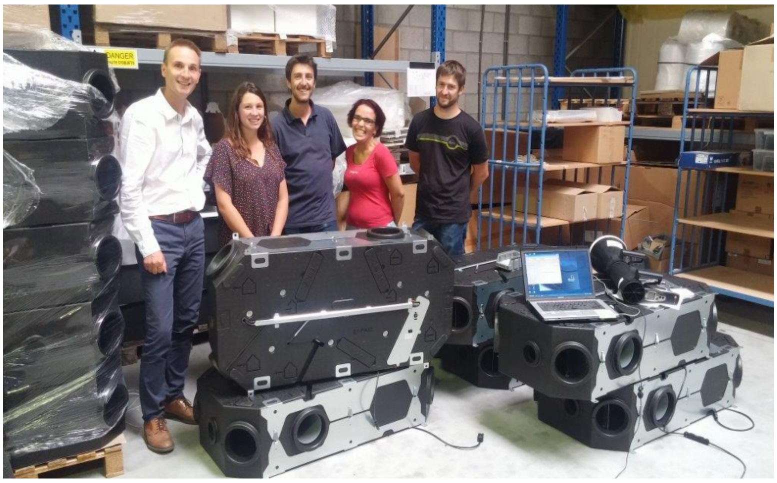


Figure 5.4: GREECOM team with the first double flow units.

Figure 5.5: GREECOM first double flow unit installed at MONTH 36.

5.2.3 PIR foams for Liége (PUR).

All the panels were manufactured by PURIONOVA, using the specifications and the PCMs sent by ACCIONA.

The picture below shows (in month 37), the start of the installation process in the Belgian demonstrator where these are going to be installed and monitored.

Figure 5.6: PIR foam panels with embedded PCM installation works in Liége.

5.3 Task 5.3. Installation, commissioning and start-up (ACC).

This is a strongly delayed Task, and by that the bottle neck for the overall Project Progress. Due different reasons, the delay affects the three demonstration buildings, which are publicly owned. In the following subsections there is a breakdown of the works included in this task, and an indication of the reasons and contingency actions proposed, including a request for Project extension, 12 extras months are considered to be needed to fulfil the requests indicated in the Grant Agreement in the three demonstration buildings.

Works have been divided into several phases, depending on each dem, but in general, two main milestones are foreseen:

- Tender preparation.
- Tender launching and contract selection.
- Works execution.

Partial progress by demonstration site.

5.3.1 Tender preparation: prices and technical specification for the public tender (ONU, SPB and CEM).

TURKEY (Building owner ADU);

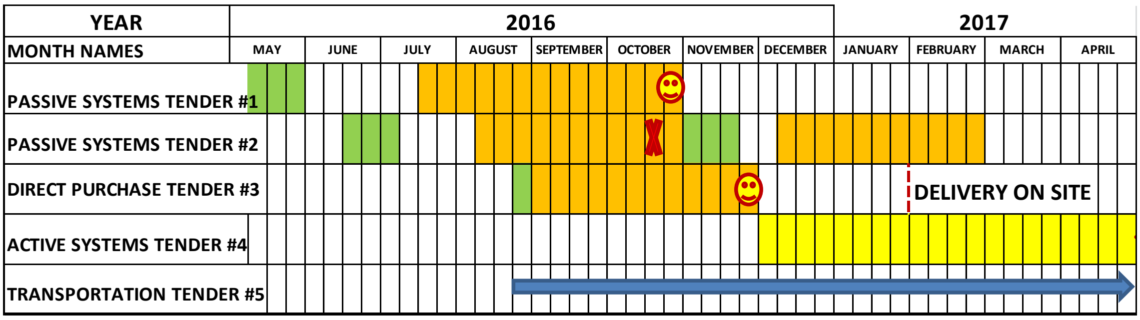
After some meeting and considering different legal, technical and administrative issues, the Turkish Demonstrator will be retrofitted in 5 different tenders, chosen by administrative efficiency, indicated in the table below:

Tenders TURKEY	Description	Budget (€)	Tender start/end date	Works execution start/end date
1 - Passive tender A	Approximately 11000 m^2 mineral insulation on walls. Approximately 800 m^2 Ventilated Façade Works. Approximately 1000 linear meters Window Sills. Approximately 1390 m retrofit and installation of vertical drain pipes.	250.000	May 2016	July to October 2016
2 - Passive tender B	Approximately 4000 m^2 mineral insulation on roof Approximately 550 linear meters Aluminum coping on the roof Approximately 1350 m^2 Window solar reflective film application	160.000	June to July 2016	August 2016 to February 2017
3 - Active systems BRICKER	BRICKER Active systems integration; solar + ORC + Adsoprtion into the existing HVAC Facilities – EPC contract	670.000	August 2016	September to November 2016
4 - Chiller direct purchase	Independent tender to ease of administration. Direct purchase of the Adsorption chiller	150.000	2016	December 2016 to April 2017
5 - Transport tender	Transport of the façade from Spain to Turkey	12.000	December 2015	February 2016
TOTAL Estimated (€)		**1.242.000**		

Table 5.8: Turkish demo tenders´ table updated at month 36.

As for the project progress, tender 5 is finished, and tenders 1, 2 and 4 are ongoing. There is a significant delay with respect to the original plan, but actions have been taken by the Turkish team to absorb them. Although the post monitoring period might be reduced, works are planned to end up on time for the actual project duration, which is ending in October 2017.

The Turkish team has reported an updated Gantt chart for the tenders, dated October 2016, and it looks like the one below;



Considering that the original plan was to end up the construction works in April 2016, the delay is 12 months.

<u>BELGIUM (Building owner SPB);</u>

They have planned the following sequence of procurements, divided in **<u>4 independent contractors</u>**. Up to date, all tenders have been awarded, all contracts signed.

The final economic data is therefore available, and the following table shows the estimations and the final bids awarded, with the deviations respect to the original plan.

Although the building owner Partner SPB has offered to absorb the economic deviations with their own budget, t is to be remarked that any available budget will be considered for allocation to this Partners at the Project termination.

All works have started with the exception of Tender 4, which is still under the engineering phase. Works in this tender are planned to start month 39.

				OFFERS	
Nr Files	Description	Bricker Budget (exclusive VAT) defined in the DoW	Budgetary allocations (VAT included)	Awarded Offer (VAT included)	Deviations
142 H94	Works for installation of biomass cogeneration ORC unit, hydraulic piping, electric cables, control system, biomass boiler plant and biomass storage	415.800 €	503.500 €	**860.044,44 €**	**+ 70 %**
143 H94	Works for retrofitting of the main skin facade in block 1	630.000 €	762.300 €	**797.602,82 €**	**+ 5 %**
144 H94	Works for insulation roofs of block 1 and 6	214.500 €	260.000 €	**224.297,63 €**	**- 14 %**
145 H94	Works for insulation of external walls, replacement of windows and integration of decentralized ventilation-units in blocks 1 and 6	1.041.620 €	1.306.120 €	**1.425.769,02 €**	**+ 9 %**
		2.301.920 €	**2.831.920 €**	**3.307.713,91 €**	**+ 17 %**

Table 5.9: Belgian demo tenders´ table, estimated and awarded, including deviations, updated in April 2016.

The updated situation at month 36 is, per tender, the following.

TENDER 1:

Date of contract: 21/04/2015
Expected planning: 01/06/2015 to 31/03/2016
Begin of works: 14/09/2015
Deviations occurred:
Delivery time for Biomass Boiler from supplier SUGIMAT : 10 months
(Expected delivery date: May 2016).
Concrete slab in technical room not strong enough to support all materials and accessories.
Delay in delivery of ORC-module from RANK
(Expected delivery date: end of October 2016).
Hydraulics' and electric's calculations received from subcontractor DETHIER not sufficient to guarantee a proper working of Bricker's technologies.
Decisions made:
Subcontractor DETHIER makes all works in relation with the fire resistant walls and ceilings and all preparation works to receive materials and accessories.
He installs piping between the existing heating's room and the new technical room.
SPB had to launch an additional tender for the reinforcement of concrete slab.
SPB collaborates with ULG to provide hydraulics' calculations.
Actual Delay: 7 months

TENDER 2:

Date of contract: 02/05/2015
Expected planning: 01/06/2015 to 31/03/2016
Begin of works: 25/01/2016
Deviations occurred:
Delivery of official urbanistic permits from the regional authorities of the city of Liège. (25/11/2015 – Delay: 5 months)
In February 2016, significant budget deviation due to the presence of asbestos fibres in the joints of glazing frames of curtain walls A & B. A new dismantling procedure is required.
In March, additional works in classrooms are mandatory (building of temporary walls between some classrooms and the main façade) to allow regular use of the building (school).
In March, over costs about cutting of concrete's slab (curtain wall B) to insure a proper alignment of the new façade.
Actual Status: Works finished since June 2016. (Delay: 4 months)

TENDER 3:

Date of contract: 30/11/2015
Expected planning: 01/06/2015 to 31/03/2016
Begin of works: 24/04/2016
Deviations occurred:
Delivery of official urbanistic permits from the regional authorities and from the city of Liège. (25/11/2015 – Delay: 5 months)
Some delay in the delivery of Purinova's panels
(Expected delivery date: May 2016).
In May 2016, the subcontractor pointed out the bad quality of Purinova's panels regarding the finishing level and irregular panel's thickness.

Decisions made:
Beginning of works in May 2016 with ceiling's dismantling.
Selection of panels with similar thickness and admissible finishing look.
Actual Status: Works ongoing
Actual Delay: 7 months

TENDER 4:

Date of contract: 24/11/2015
Expected planning: 01/06/2015 to 31/03/2016
Begin of works: 01/02/2016
Deviations occurred:

Delivery of official urbanistic permits from the regional authorities and from the city of Liège. (25/11/2015 – Delay: 5 months)
Some delay in the delivery of Greencom's decentralized ventilation units
(Expected delivery date: June 2016).
Delivery of 10 units in August 2016 and 12 units in September 2016.
Overcosts for installation of ventilation's units: 44 additional sound's reducers.
Subcontractor asks some additional days to execute works caused by the delay in the delivery of ventilation's units.
Decisions made:
Beginning of works in March 2016 with external works: replacement of windows frames and facades insulation.
Agreement about 39 additional days in the execution schedule. Decentralized ventilation units will be installed from September 2016.
Actual Status: Works ongoing
Actual Delay: 7 months

Considering that the original plan was to end up the construction works in April 2016, the delay is 12 months.

SPAIN (Building owner GEX);

Spain is the most delayed Partner. They are still working on the tender preparation, and their planning is the bottle neck related to the Project extension request.

Justification of the delay:

In this period, some political events have happened, which have had an influence on the Project Progress. The most significant are:

- Elections were held in Extremadura in June 2015. It brought change both in the government and in the institutional name. Nowadays this Administration is named “Junta de Extremadura” instead “Gobierno de Extremadura”.
- The competency in Energy and Efficiency used to belong to The “Consejería de Agricultura, Desarrollo Rural, Medio Ambiente y Energía”, but nowadays these competencies belong to The “Consejería de Economía e Infraestructuras”.
- Due to mentioned changes the Authorised Legal Representative and the Legal Entity Appointed Representative (LEAR) have been modified too. Now they are Ms. Olga García García and Mr. Manuel García Pérez respectively.
- The previous responsible engineer of the Spanish demo left the project in August 2015, and unfortunately nobody was doing his job until the middle of March 2016 when a new person was appointed for BRICKER duties in the Administration.
- And the current budget approval was delayed because of the change of the government. It was not until April when the tender process could be started.

All of these events have caused a lot of project delays. One of the most important delays is because the administrative building (in the below picture, the “H-shaped” building where the reduction energy consumption will be make thanks to Bricker System) and the whole place around it, belong to the Consejería de Agricultura, but the works will be carried out by the new Consejería (Economía e Infraestructuras). **Although the legal personality is unique for both**, we must to obtain the permission from the previous Consejería (Agriculture) and from the administrative organ with competency in heritage.

In the following table, there is a presentation of the most recent planning provided by Partner GEX, building owners of the Spanish demonstrator.

PLANNING PROVISIONAL DE EJECUCIÓN DE OBRAS E INSTALACIONES DEL PROYECTO BRICKER 6/10/2016

	2016									2017												2018			
	Abr	May	Jun	Jul	Ag	Sep	Oct	Nov	Dic	En	Feb	Mar	Abr	May	Jun	Jul	Ag	Sep	Oct	Nov	Dic	En	Feb	Mar	Abr
			M1	M2	M3	M4	M5	M6	M7	M8	M9	M10	M11	M12	M13	M14	M15	M16	M17	M18	M19	M8	M9	M10	M11
1) NAVE INDUSTRIAL																									
Procedimiento de licitación	O	O	O	F	F	F	F	F	F																
Ejecución de la obra				O	O	O				F	F	F													
4) SISTEMA DE CLIMATIZACIÓN																									
Licitación y Proyecto	O	O	O	O	O			F	F	F	F	F	F	F	F										
Ejecución de la obra						O	O	O	O	O						F	F	F	F	F					
3) INSTALACIÓN DEL SIST BRICKER																									
Licitación y Proyecto	O	O	O	O	O	O	O	F	F	F	F	F	F	F	F	F	F								
Ejecución de la obra								O	O	O	O	O	O					F	F	F	F	F	F	F	F
2) ADECUACIÓN DE LA CUBIERTA																									
Procedimiento de licitación	O	O	O	O	O	O	O	O	O	F	F	F	F	F	F	F	F								
Ejecución de la obra										O	O	O								F	F	F			

O (pink): Tender phase of the **Original** Planning
O (grey): Impementation phase of the **Original** Planning
F (orange): Tender phase of the **Final** Planning
F (light grey): Impementation phase of the **Final** Planning

Table 5.10: Retrofitting plans for the Spanish demonstrator, version M36.

Considering that the original plan was to end up the construction works in April 2016, the delay is 24 months.

The technical content of each of these 4 tenders planned for Spain is listed in the following table.

Tender	Measure	Budget	Tender start/end date	Works execution start/end date
1- WAREHOUSE	Warehouse construction to house the production central of BRICKER system.	109.393€	07/2016 to 12/2016	01/2017 to 03/2017
2-HVAC	Hydraulic and electrical connections between the production central and the administrative building. New HVAC system.	250.000€	09/2016 to 06/2017	07/2017 to 09/2017
3-BRICKER	BRICKER Tender	735.000€	11/2016 to 08/2017	09/2017 to 04/2017
4-SOLAR	Concrete foundations in the roof of the building.	76.979€	01/2017 to 07/2017	11/2017 to 01/2018
TOTAL Estimated		**1.171.372€**		

Table 5.11: Tender contracts for Spain, updated M36.

***** The BRICKER tender is an EPC contract, which includes;

- Purchase the biomass boiler, according to the specifications provided by Partners, construction of the biomass storage room. Technical support (one week, one technician) will be covered in the tender for the connection, and start-up.
- Purchase the adsorption machine and the cooling tower, according to the specifications received from BRICKER. Installation in the place selected, construction works and technical support included.
- Contract including installation of all the BRICKER Components, control system, start up and maintenance during one year.
- Equipment available for the contractor will be:
  - ✓ Solar collectors and ORC, coming from BRICKER.
  - ✓ Biomass, adsorption and cooling tower.
- Equipment to be purchased and installed by contractor will be:
  - ✓ Buffers, tanks, heat exchanges, piping, valves, and control and hydraulic…

In spite of the above obstacles, important works have been implemented along the second period. In the following paragraphs they are explained, Tender by Tender:

TENDER 1 (The warehouse construction):

This tender has been divided in three "subtenders" due to administrative requirements. These are the three ones and their current situation:

NAME of the "Subtender"		STATUS
A)	Subtender for CONTRACTING THE PROJECT	_
B)	Subtender for CONTRACTING THE WORKS	In process
C)	Subtender for CONTRACTING THE DIRECTION OF THE WORKS AND STUDY OF HEALTH AND SAFETY	In process

(A) Before writing, the project geologic and hydrologic studies have been necessary, which are finished. They were hired thanks to a tender launched by the Administration. In other hand, in the final project there were some mistakes which were corrected in collaboration with Acciona. This subtender is completed.

(B) This subtender is always the longest and most difficult one because it involves a lot of phases and with a very strict regulation.

It is just in the previous phase of the publication because the tender file has been already **approved by the auditors.**

In the same way all the **permissions and license** from other Administration (like the competent authority in environmental protection, the Town Council**...)** **have been obtained too**.

(C) The subtender C is in process and will be finished at the same time that the subtender B.

When all of these are concluded the works of the warehouse construction will start.

TENDER 2 (The renovation of the air conditioning system):

The current air conditioning system of the administrative building must be replaced by a new HVAC System which is compatible with the Bricker System. This tender will not be divided in subtender.

The first we did was the selection of the location of the chiller, the water tanks and the pumping equipment in agreement with the Building authorities and Acciona. The PCT (technical conditions of the contract) and PCA (administrative conditions of the contract) are being prepared.

TENDER 3 (Bricker System):

This tender has not been started yet.

TENDER 4 (The modifications on the roof of the administrative building-SOLAR):

Like the tender 1, this tender has **been divided in three** subtenders.

NAME of the "Subtender"		STATUS
A)	Subtender for CONTRACTING THE PROJECT	_
B)	Subtender for CONTRACTING THE WORKS	In process
C)	Subtender for CONTRACTING THE DIRECTION OF THE	In process
D)	WORKS AND STUDY OF HEALTH AND SAFETY	

(A) This subtender is completed.
(B) And (C) these ones will be carried out according to the implementation plan.

Regarding the **2016 and 2017 budget** of the BRICKER Project established by the Junta de Extremadura, it has have been approved an amount of **525.063€** and other of **543.159€** respectively. And it must be highlighted that the amount for the 2016 budget is not used this year it will be incorparated to next year's budget.

5.4 Task 5.4. Monitoring and performance evaluation of the buildings after the renovation (ONU).

Not started - Plans are ongoing to precisely define the sequence of activities to be carried out in the analysis of the data bases to be produced in each demo site, according to the equipment installed during the execution works defined in the tenders, the occupation patterns, the weather conditions and the rest of the parameters to be considered in tasks 5.5. and 6.3.

5.5 Task 5.5. Economic analysis of the 3 demo site implementations (TEC).

General status Table:

Task	Planned M1 - M48	Achieved	Deliverables
5.5	**100%**	**25%**	**D.5.38. at M48**

This task is focused on the economic evaluation of the BRICKER implementations in the 3 demo sites. The expected main outcome of the task is to update precisely the economic and energy indicators expected on the proposal phase, basing on the monetary/energy costs of yearly operation of the facility before and after BRICKER implementation, and on the final costs of this implementation.

The outcomes will include economic indicators (payback period, Net Present Value, Internal Rate of Return), energy ones (energy reduction) and also environmental ones (CO_2 emission reduction), in order to check the convenience of BRICKER systems to fulfill the latest European directives and concepts (such as nearly-zero energy buildings), underlining the renewable characteristics of the BRICKER trigeneration system.

During the current reporting period, a methodology for carrying out this economic analysis and its scope have been designed. The operation costs will be based on the energy simulations developed in TRNSYS on WP4, which will be complemented with the monetary variables and CO_2 emission factors.

here have been organized several calls among the partners to discuss the simulation scenarios and control strategies to be considered for this task, and it was agreed to select among the ones developed for the tasks of WP4 (at least two: an scenario where BRICKER active technologies are just used to cover the thermal demand of the buildings and another one where they are used as electricity generation mode, beyond the periods when thermal demand is cover).

On the other hand, the investment costs will be gathered from the building owning partners and aligned with the rest of WP5. A datasheet has been developed by TECNALIA (screenshots below), to calculate the economic indicators once the operation and investment cost are determined.

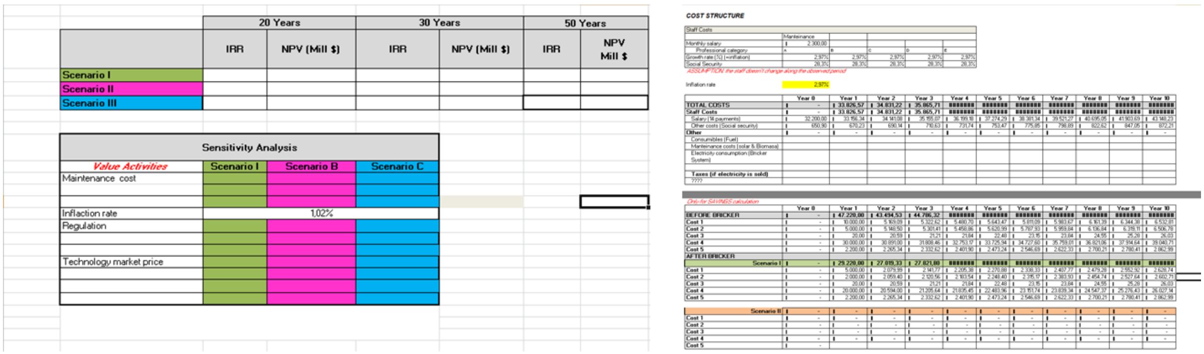


Table 5.12: Data collection tables.

The main subtasks planned are the following:

5.5.1 **Development of the economic analysis tool:** This task includes the information gathering about the economic, regulatory, CO_2 emission framework for each demo country (started for Spain) and the development of the spreadsheet (already developed, to be slightly adjusted once the input variables are gathered).

5.5.2 **Simulation of energy costs of 3 demos:** Aligned with the outcomes of WP4, diverse simulation scenarios will be selected for each demo. The energy simulation outputs will be provided by EURAC (likely on time-step resolution) and CARTIF will complement them with economic and environmental factors (for the current economic/regulatory context and, in a second instance, under different context assumptions that could make BRICKER implementation more economically attractive).

5.5.3 **Gathering actual costs of the demos:** This subtask will be led by TEC, interacting with the diverse building owners of the demos to obtain the final costs of BRICKER implementation and to understand each of the concept. It will be started with the Belgian demo.

5.5.4 **Analyses based on actual costs of the demos**: TEC and CAR will implement all the gathered data in the spreadsheet to obtain the economic indicators of the implementation under the current conditions (for both the building owner and the EC).

5.5.5 **Analyses based on expectable market prices for the demos:** In this subtask, CAR will work with the manufacturing partners to determine expectable market prices for the prototypes. At the same time, TEC will analyse the current demos to subtract the investment cost that would not be intrinsic to BRICKER replication under different conditions. Combining both subtasks, the spreadsheet implementation (as done in T5.5.4) will be replicated, what should provide more attractive economic outputs.

5.5.6 **Backward analysis to determine attractive ranges for the inputs**: As an independent task, once the spreadsheet is calibrated, it could be used for carrying out a backward analysis to determine the attractive (and realistic) ranges for the inputs (energy demand, tariffs, subsidies, …) that would maximize the economic effectiveness of BRICKER implementation. This subtask would provide feedback to the approaches on T4.6 (transfer to social housing) and T6.3 (replication).

6 WP6 EXPLOITATION AND REPLICATION (STEINBEIS).

6.1 Task 6.1. Exploitation (SEZ).

General status Table:

Task	Planned (M1-48)	Achieved	Deliverables
6.1.	100%	80%	Deliverable 6.32/33 at M36

Partial progress items:

6.1.1 Identification and definition of the relevant project results (SEZ).

An exploitation plan will be produced and updated along the project lifetime. The aim of the exploitation plan is to outline for all project results how to minimize exploitation risks and detail the actions for exploiting the main results. The exploitation plan is built up around an exploitation strategy including exploitation workshops organized regularly. They are the main tool for defining a successful exploitation plan that will include the following issues:

- Identification and documentation of the main exploitable results
- Deep market analysis and assessment of the socio-economic aspects of the knowledge and technologies generated and the factors that influence their exploitation such as standardisation and regulatory aspects.
- Value innovation analysis of the main results.
- Risk assessment &Overall IPR strategy and management of new knowledge delivered by the project.
- Definition of Business model options for each of the main results (this will be specifically developed in task 6.2).
- Pre-assessment of the result's market potential and exploitation options.
- Technology implementation plan.

The identification and definition of key project results was elaborated by all partners in various exploitation workshops.

6.1.1.1 Exploitation Workshops (SEZ)

Duration of activity: (January 2014 – ongoing)

The objective of the exploitation workshops (WS) is to support the project partners in developing long term exploitation strategies, especially through combination of technical results and through organisation of exploitation workshops. The target group are the project partners, who contribute to results (foreground) with potential for commercial exploitation and also joint exploitable results with other partners, to work on intellectual property issues (ownership, access rights, exploitation claims, risks…), to support the selection of application fields and customer segments as well as the applicable markets. This includes the specification of the functionality and value of their technologies, to identify the markets, market size and stakeholders and to be able to develop own business models.

The aim is that in the end the partners are able to develop their own exploitation strategies fitting to the exploitation strategies of the partners' own company structures and objectives as well as elaborating joint strategies.

<u>Development of exploitation WS timeline and WS topics</u>: The SEZ-team worked out a structure and methodology for the exploitation workshops and their interaction with the different activities WP6 tasks with other WPs. These workshops build a framework to the consortium to provide a set of exploitation strategies and support services to identify needs, potential and steps towards exploitation and to give the opportunity have a consensus among the partners involved in the exploitation of results.

The workshops are linked to the annual general assembly meetings and also steering committee meetings to meet face2face (in-between telcos or webinars are also possible tools). The output of the WSs will be used as input for the exploitation modules/tasks in WP6 as well but are primarily done to support the partners' work and decisions for their own exploitation activities.

All workshops have an interactive character beginning with the preparatory work before the workshop, group working during the workshops and consolidation after the workshop. The preparatory works have already been described in the progress report of M18.

There might be modifications in the order of the workshops or in the focus of contents. SEZ will be flexible to react on the partners' needs during the project period. Further Workshops – done via Webinar – might be added in case of necessity. External experts will be invited to participate upon necessity.

- The first workshop took place in October 2014 in Caceres - Spain.
- The second workshop took place in a series of webinars from February to July 2015.
- The third workshop took place in September 2015 in Liège - Belgium.
- The fourth workshop took place in Mai 2016 in Madrid.
- Further Workshops are planned in 2017

<u>Internal Deliverables:</u> Three internal reports on "exploitation workshops" have been submitted.

- o *First deliverable describing the time schedule, the methodology for Workshop 1: identification of results for exploitation, Workshop 2: IPR Management, Workshop 3: Road maps for exploitation, Workshop 4: Market deployment/Business Models as well as the description of the next steps was submitted on 28. January 2014.*
- o *Second deliverable describing the WS 1 methodology, performance and outcome was submitted on 18. February 2015.*
- o *Third internal deliverable on WS 2 methodology, performance and outcomes was submitted in July 2015.*
- o *Fourth internal deliverable on WS 3 methodology, performance and outcomes was submitted in November 2015.*
- o *Fifth internal deliverable on WS 4 methodology, performance and outcomes was submitted in August 2016.*

Description and reporting of the **Exploitation Workshop 1: "Identification of exploitable results"** has been done in the progress report M18 which was submitted for the review meeting.

Exploitation Workshop 2: IPR Strategies and management (performed via a series of webinars, February – July 2015)

This workshop was planned to be performed during the steering committee meeting in M18. As this meeting was declared as review meeting in Brussels it was not feasible to implement a workshop in addition. Therefore SEZ agreed with ACC to perform a series of webinars. In total 3 webinars have been organised by SEZ in the time frame of February to July 2015.

Goal: The webinars build upon the results of WS1 and taking into account the work performed during the project period. It will give more detailed information and knowledge on IPR issues / IPR strategies to give input for appropriate protection of results. The webinars built upon theoretical input and included an introductory part of exercises that was done by the partners as "exercise" up to the next webinar.

Specific Goals:

- Show the relevance of intellectual property (IP) and intellectual property rights (IPR)
- Provide an overview on the notion of IP and IPR
- Localise IP issues and Access Rights in Background, Foreground, Exploitable Results
- Introduce the Grant Agreement and the Consortium Agreement as sources of IPR management
- Show the possibilities of concretely protecting IP in European projects
- Look at the merging of Exploitable Results already suggested by project partners
- Understanding of ownership rights and obligations
- Understanding of access rights during and after the project duration
- Understanding of exploitation claims
- Monitoring for IPR and Risk Planning

Webinar 2.1: IPR rules and management

Date: 19th February 2015, Character of the meeting: webinar;
Trainers: Dr. Frederik Metzger, Charlotte Schlicke (both SEZ), Duration: 2 hours;
Documentation: Power Point and recording of webinar are available in the intranet (teamsite)
NOTICE: PPT was attached in the Annex of Del Report 6.17/18_M18.

TOPICS – questions addressed to the webinar:

- Why talking about Intellectual Property Rights (IPR)?
- What is IP and how to protect it?
- What to consider concerning IP in FP7-projects?
- What to consider when exploiting results beyond the project's scope?
- How to concretely protect a result?

Further exercise on exploitable results for all partners:

- Check contributing partners, Check background of contributing partners, Check status of clustering results and characterisation into commercial / academia and other use – option to identify further overlapping of results

Outputs:

Explanation on the different expectations on exploitation as well as their knowledge on IP issues of partner organisations was presented e.g. expectations from RTD partners are different to those from industry partners. Basics on the relevance of intellectual property (IP) / IP rights (IPR) / IP protection as well as the used notations were given. Sources for contractual agreements related to IP / IPR as well as access rights options in the GA and CA were explained. The different types and procedures of protection and a little scenario of access rights and exploitation were presented.

Webinar 2.2: Review of WS 2.1 / Topic of Ownership

Date: 11th June 2015, Character of the meeting: webinar
Trainers: Charlotte Schlicke; Duration: approx. 1 hour;
Documentation: Power Point and recording of webinar are available in the intranet (teamsite)

TOPICS: Review of exercise, with discussion on result overlapping, introduction on ownership responsibilities, how to identify result owners.

Further exercise on exploitable results:

- Check/identify result's owner / joint ownership by all partners requested

Outputs:

Based on the webinar 2.1 the focus was laid on the definition and understanding of ownership, rights and obligations. The possibility of joint ownership was discussed.

Webinar 2.3: Review of owner requests / Topic of Exploitation claims

Date: 3rd July 2015, Character of the meeting: webinar;
Trainer: Charlotte Schlicke, Duration: approx. 1 hour;
Documentation: Power Point and recording of webinar are available in the intranet (teamsite)

TOPICS: Review of exercise, on how to handle multiple ownership requests, introduction on next steps on exploitation claims on exploitable results.

Further exercise on exploitable results:

- Announcement of exploitation claims by all partners requested

Outputs:

Based on the previous webinars the focus was laid on the definition, understanding and importance of exploitation claims that specify the access right requests. The possibility of multiple claim requests for the same use was discussed.

Exploitation Workshop 3: Exploitable Results (Joint Developments) / Customer Segments; Value Propositions; Key Partners / Roadmapping (during General Assembly Meeting in Liège, BE)

Date: 30th September 2015, Character of the meeting: face2face workshop;
Trainers: Dr. Frederik Metzger, Charlotte Schlicke (both SEZ); Duration: approx 5 hours;
Documentation: Power Point and pictures are available in the intranet (teamsite)

Goal: The partners shall receive a structured review on the work done in WS 1-2, helping do understand the importance of the interactions of all the previous steps and the level of detail. The lacking information will be discussed, the reasons for that will be analysed. The importance of the future involvement of the legal departments in the process will be explained to ensure the legal basis for future steps in the clarification of exploitation claims. Further the partners shall receive further knowledge on exploitation by understanding further modules the business model Canvas (customer segments, value propositions, key partners and key activities). The future work will focus on smaller groups related to joint development (products / services) on the creation of successful business models for these exploitable results (which will be part of WS4).

The WS 3 was performed as a WS with theoretical presentations and interactive exercises with all partners. The content of the workshop was discussed with the established exploitation board (ACC/TEC/SEZ) and also introduced to the EISC consultant Mounib Mekhilef in the forefront of the WS. Mr Mekhilef was participating at this workshop and involved as speaker in the IPR part by highlighting specific topics of IPR management and Risk management. It was communicated by Mr Mekhilef that his report to the EC will underline the applied exploitation methodology of BRICKER to be on the right way.

Agenda – different parts with different topics:

Time	Topic
09:30 – 11:00	Introduction to Workshop **Exploitation Results Packages** (commercial) • Presentation on grouping of single exploitable results towards packages • Discussion on partner suggestions, • Agreement on services and products *Moderated by: Frederik Metzger, Charlotte Schlicke (SEZ)*
11:00 – 11:15	*Break*
11:15 – 11:30	**IPR Issues** Important steps to take into account in each partner organisation *Moderated by: Mounib Mekhilef (ESIC consultant)*
11:30 – 13:00	**Customer Segments, Value Propositions & Key Partners** to selected Exploitable Results • Introduction, exercise and pitching *Moderated by: Frederik Metzger, Charlotte Schlicke (SEZ)*
13:00 – 14:00	*Lunch*
14:00 – 15:30	**Roadmapping – Action Plan** to reach the Market Deployment/Replication • Introduction and exercise • Brainstorming • Roadmapping *Moderated by: Frederik Metzger, Charlotte Schlicke (SEZ)*

In the following the single parts of the Agenda will be more detailed described:

a) To part Exploitation Result Packages:

Methodology and Outcomes:

The identified exploitable results out of the WS1 were again displayed and discussed with the whole group of partners. Special focus was given to the PTA comments on commercial exploitable results (given after the review meeting in April 2015) and on jointly developed exploitable results.

The improved single technological results were not specifically focussed, as they build a new product/service in the individual companies' portfolio. The aim was to identify technology combinations that could be exploited as a joint product or developed methodologies to be exploited as a:

- BRICKER product/service taking into account the expertise of the partners and the
- BRICKER methodology taking into account the technological improvements and external expertise not binding to partners out of the consortium.

A rating at the end of this exercise highlighted 4 exploitable results:

- **ER - PACKAGE: BRICKER Envelope Retrofitting**, including ER 3 (FG2) *Light weight ventilated façade composed by an innovative polymer concrete panel, an specific anchorage system supported by aluminium profiles*, ER 4 (FG16) *Decentralized ventilation for classroom and small tertiary sector* and ER 9 (FG 25) *Decentralized ventilation for classroom and small tertiary sector;*
- **ER - PACKAGE: BRICKER Trigeneration System (active),** including ER 2 (FG 1) *BRICKER TRIGENERATION SYSTEM, A system to produce heat, cool and electricity based on 100% renewable energies, for building applications. Including the control and operation systems - (DESIGN, IMPLEMENTATION)*, ER 10 (FG 7) *Integration of current HVAC system with a hybrid ORC based on parabolic CSP and biomass*, ER 11 (FG 8) *Profitability analysis of hybrid facilities in buildings*
- **ER - PACKAGE: Pre-Investment Analysis,** including ER 1 (FG 32) *Integration of methodology / strategies*, ER 11 (FG 8) *Profitability analysis of hybrid facilities in buildings*, ER 17 (FG 40) *Optimised Energy Performance Building Public Procurement Guidelines* and ER 21 (FG 19) *Guides of design, commissioning and maintenance of energy efficient buildings retrofitting with the technologies demonstrated*
- **ER - PACKAGE: Simulation & Analysis (STEP 1) & PACKAGE: Simulation & Analysis (STEP 2) + DESIGN**:
  - Step 1 including ER 2 (FG 14) *Simulation Tool for Analysis of configuration and Control of a PTC+ORC+BIOMASS Plants*, ER 2 (FG 15) *Dynamic Modelling of integrated energy systems for different applications (eg industrial process heat)*
  - Step 2 including ER 2 (FG 14) *Simulation Tool for Analysis of configuration and Control of a PTC+ORC+BIOMASS Plants*, ER 2 (FG 15) *Dynamic Modelling of integrated energy systems for different applications (eg industrial process heat)* and ER 12 (FG 10) *Integrated simulation environment based on Trnsys software & components numerical models.*

Figure 6.1: Single ER, joint products and services, green dots = voting for key-ERs

Exploitable Result (ER)	Main Partner	Foreground - Title
ER - PACKAGE: BRICKER Passive Solutions		
ER 3	ACC	Light weight ventilated façade composed by an innovative polymer concrete panel, an specific anchorage system supported by aluminium profiles
ER 4	GREENCOM	Decentralized ventilation for classroom and small tertiary sector
ER 9	PUR	Advanced PIR system for insulation to be used with nanoparticles (e.g. PCM), fitted to the specific applications in buildings (roofs, walls)
ER - PACKAGE: BRICKER Trigeneration System (active)		
ER 2	ACC	BRICKER TRIGENERATION SYSTEM: A system to produce heat, cool and electricity based on 100% renewable energies, for building applications. Including the control and operation systems. (DESIGN, IMPLEMENTATION)
ER 10	CEMOSA	Integration of current HVAC system with a hybrid ORC based on parabolic CSP and biomass
ER 11	CEMOSA	Profitability analysis of hybrid facilities in buildings
ER - PACKAGE: Pre-Investmenet Analysis		
ER 1	TEC	Integration of methodology / strategies
ER 11	CEMOSA	Profitability analysis of hybrid facilities in buildings
ER 17	ONU, ADU, SPB, ACC, GEX, CEM	Optimised Energy Performance Building Public Procuremenet Guidelines
ER 21	ONU, TEC	Guides of design, commissioning and maintenance of energy efficient buildings retrofitting with the technologies demonstrated
ER - PACKAGE: Simulation & Analysis (STEP 1)		
ER 2	FBK	Simulation Tool for Analysis of configuration and Control of a PTC+ORC+BIOMASS Plants
ER 2	FBK	Dynamic Modelling of integrated energy systems for different applications (eg industrial process heat)
ER - PACKAGE: Simulation & Analysis + DESIGN (STEP 2)		
ER 2	FBK	Simulation Tool for Analysis of configuration and Control of a PTC+ORC+BIOMASS Plants
ER 2	FBK	Dynamic Modelling of integrated energy systems for different applications (eg industrial process heat)
ER 12	EURAC	Integrated simulation environment based on Trnsys software & components numerical models

Figure 6.2: Bricker Exploitable Results Packages

b) To part IPR Issues:

Methodology and Outcomes:

A presentation was held by Munib Mekhilef who is working as a consultant for the ESIC service. Mr Mekhilef presented the ESIC services and his competence on IPR issues and risk management, gave recommendations to the consortium such as connecting the exploitable results with all linked legal issues (background, contributions, access right requests, exploitation claims) to the legal departments to build up a clear legal basis for further discussions. He also mentioned the importance of the Risk Management (not related to technical risks that are treated in a different workpackage but risks related to exploitation). In the frame of his consultancy support he delivered a short report to the EC, to the coordinator and SEZ. Previous to the report Mr Mekhilef pointed out that the BRICKER exploitation approach and the ESS service of ESIC are similar and that the BRICKER exploitation plan leads straight to the market deployment.

c) To part Customer Segments, Value Propositions & Key Partners:

The part focused on the following questions:

- Who is our customer
- How to create value to the customer → characterisation
- Key partners needed to reach the customer

Methodology and Outcomes:

Following the Business Model Canvas modules the core action was to find out main customers who would benefit of the exploitable results and which value propositions would convince them. Further the key partners needed to be identified to bring the results into the market.

This topic was also performed as an exercise. Partners were requested to work in 4 groups on the two best ranked ER packages (highlighted bold: ER - PACKAGE: BRICKER Trigeneration System (active), ER - PACKAGE: Pre-Investment Analysis). The groups presented their expectations regarding the targeted customers and customer segments, related to value propositions (related to the business model canvas) and related to the needed key partners (from the consortium or outside) to bring the results to the market. These outputs were presented in the format of an elevator pitch to the group (playing the role of potential end-users/ investors).

For this exercise the following questions were presented and implemented in the group work:

- **For whom** are we creating value?
- Who are **our most important customers**?
- What **value** do **we deliver** to the customer? (select out of 11 characteristics)
- Which one of our customer's problems are we helping to solve?
- What **bundles of products and services** are we offering to each Customer Segment?
- Which **customer needs** are we satisfying?
- Who are the **main key partners** that are relevant to bring exploitation of results to success?

Outputs:

ER Package: BRICKER Trigeneration System		
GROUP 1		
Main Customers	**Value Propositions**	**Key Partners**
Private Building Owners	• Cost reduction • Reliability	} contractors, fuel providers => biomass
Public Building Owners	• Cost reduction • Image • Reliability	} technology suppliers, designers, simulators
ESCOs	• R.O.I. (price + perf. + cost) • Convenience	
GROUP 3		
Main Customers	**Value Propositions**	**Key Partners**
Public Building Owners (hospital, university, school)	• Risk reduction (energy supply) • Cost reduction (policy´s country) • Getting the job done + maintenance	• Renewable energy departments (country) • Integrator companies in every country
Private Building Owners (hotels, airports, shopping malls, tertiary buildings)	• Custumisation • Getting the job done + maintenance 3 facilities • Brand status (green) • Cost reduction (in terms of fuel supply)	

ER Package: Pre-Investment Analysis		
GROUP 2		
Main Customers	**Value Propositions**	**Key Partners**
1. Building owners 2. Local government 3. National government 4. Regional government 5. Municipalities 6. Bank 7. Funds 8. Engineering & agricultural firms & consultants	1. Cost reduction 2. Risk reduction 3. Price 4. Convenience/ 5. Usability 6. Performance	1. Engineering companies 2. Investment bank 3. Financial account 4. ESCOs
GROUP 4		
Main Customers	**Value Propositions**	**Key Partners**
1. building owners (public and private)	• Performance • Cost reduction • Price	EURAC ONU OZU ADU TEC FBK SPB CEM ACC GEX RANK
2. banks	• Risk reduction • Custumisation	
3. investors	• Price • Risk reduction • Newness	
4. developers	• Newness • Custreduction • Price • Performance • Convenience/usability	

Figure 6.3: Group work outcomes on key customers (purple), value propositions (orange) and key partners (green).

d) To part Roadmapping - Getting from concept to action:

The definition of roadmapping is to work out a "participative planning process that enhances the actors to define coordinated actions for realising joint goals".

Methodology and Outcomes:

To reach the objectives of the WP6 the joint collaboration of the consortium is needed, so SEZ presented the roadmapping exercise to reach the market deployment of the highlighted exploitable results by defining the needed steps and asking for contributions of the consortium. The exercise contained different brainstorming actions – starting with the actions to be done for the market preparatory activities (what is needed in the step before launching a product /service on the market) - to the needed components of a business plan (specifically related to competencies & resources) - to preliminary activities to the business plan (such as defining end-users, willingness to pay analysis…) - to framework conditions. The last step: to discuss the contributions of the partners to the different steps was not done within the workshop but will be followed up after the workshop.

Outputs:

The roadmap with key activities to reach the market deployment of the two highlighted exploitable results (ER - PACKAGE: BRICKER Trigeneration System (active), ER - PACKAGE: Pre-Investment Analysis) was created jointly. In a next step the activities will be allocated to partners' efforts and experiences.

Exploitation Workshop 4: Exploitable Results Packages BRICKER Trigeneration System and BRICKER Envelope Retrofitting: USP, Value Propositions, Macro environment (PESTL/SWOT), Market analysis, Value Innovation Analysis, Canvas Business Model (Madrid, Spain)

Date: 22nd and 23rd June 2016, Character of the meeting: face2face workshop; Trainers: Carsten Rückriegel, Dr. Meike Reimann, (both SEZ); Duration: approx 6 hours each; Documentation: Power Point and pictures are available in the intranet (teamsite)

Notice: Parts of workshop 4 are described in other sections of this deliverable

Goal: The partners shall receive a structured review on the work done in previous workshops and in preparation of WS4, helping to understand the importance of the interactions of all the previous steps and the level of detail.

The fourth exploitation workshops were not be performed with the whole consortium but with the small groups related the commercial and academic jointly exploitable results that will be further focused on for the business models.

The partners that were participating in the BRICKER Envelope Retrofitting Workshop were the following:

- Acciona (ACC): Experts for light weight ventilated facade
- Purinova (PUR): Experts for novel insulation materials
- Greencom (GRE): Experts for aerating facade/ windows
- Steinbeis-Europa-Zentrum (SEZ) and Tecnalia (TEC): exploitation partners

The partners that were participating in the BRICKER Trigeneration System Workshop were the following:

- Acciona (ACC): Integration expert
- Cemosa (CEM): Integration expert
- Steinbeis-Europa-Zentrum (SEZ), TEC (Tecnalia): exploitation partners

Methodology of the Workshops

The workshop participants were involved by commenting on results of the exploitation questionnaire that was send in advance to the relevant partners, contributing ideas and statements concerning market and exploitation-related questions in terms of each single product and in terms of the each whole package. Agenda of the WS 4:

- **Session 1: Introduction:** clarifying the description of each single product (exploitable result – ER) and of the whole package (already described in this chapter before; USPs are mentioned below).
- **Session 2: Macro-Environment and System Analysis of the Package**: macro-environment of the package and the single solutions were analysed by using PESTEL, SWOT, and a value chain analysis (more details can be found below).
- **Session 3: Market Analysis:** market analysis including customer, competitors, suppliers as well as further stakeholders such as policy-makers or regulatory bodies was conducted. Within this holistic approach of the market, market segments in terms of geography, building types, and customer groups were taken into consideration (more details in chapter 6.1.2).
- **Session 4: Alternatives – Value Innovation Analysis:** A value innovation analysis (4) was conducted to find potential new ways of avoiding direct competitor confrontation following the idea of the 'blue ocean strategy' (more details in chapter 6.1.3)

- **Session 5: Challenges and Gaps**: potential gaps, challenges, and risks which could hinder the successful exploitation of the BRICKER Envelope Retrofitting were discussed (more details in chapter 6.1.4).
- **Session 6: Business Aspects**: business aspects like distribution channels, customer relationships, costs structures, and key partners were summarized in a business model canvass (more details in chapter 6.2.2).

Outputs:

Outcome of the Workshops (see following chapters and D33/34 for more details)

Workshop - BRICKER Envelope Retrofitting

Apart from clarifying the composition of the package (see also 6.1 workshop 3 description) the unique selling propositions were elaborated:

The common unique selling point of the whole BRICKER Envelope Retrofitting Package can be characterized as following:

- Tailored and customized energy saving solution
- Ecological/green façade, ecolabel
- Green and sustainable solution
- Decentralized solution including heat recovery
- Integration solution, one-stop shop solution
- Solution including health and comfort aspects
- Aesthetic solution
- Simple installation procedure
- Inflammability reduced

In order to conclude, the BRICKER Envelope Retrofitting are tailored and customized retrofitting products with the target to reduce energy consumption including ecological and environmental-friendly material – and are targeting customers interested in high quality (premium) solutions.

Deviation	**Explanation and Solution proposal**
none	-

6.1.2 Market analysis and Pre-assessment of the results market potential and exploitation option (SEZ, partners' involvement)

Duration of activity: April 2014 – ongoing

The market analysis was implemented by performing a thorough a desk research for getting a general understanding of the relevant market – specially the non-residential green retrofit market, for the BRICKER solutions because of the need and request of the project partners. In the first step a general overview of the market analysis aims the general trends and developments in the field of retrofitting and green markets with relevance for the building sector. In a second step potential target markets for the BRICKER solutions, with focus on selected countries, are evaluated. These two steps are followed by a review on energy performance certificates in the EU, and completed by a conclusion of the market analysis general overview.

As the first step a rating matrix was generated (see D33/34 also for the Methology) to define the geographic Countries with the highest market potential. Following parameters were selected:

1) Total non-residential stock floor area in square meters
2) Equivalent major renovation rate
3) On-going financial and fiscal support programmes for non-residential stock
4) Share of the renovation market (non-residential building segment)
5) BRICKER main markets (markets if the project partners)

As a result of the matrix selections following markets were selected for the analysis: **France, Germany, Norway, Spain, Italy, and Poland**. Although of the poorly comparable data of the **Turkish** market, the Turkish market was still chosen as an excursion due his relevance for the BRICKER Solution and as a sales market.

In the end a second rating matrix was set up (see table below, and see D33/34 for the Methology) in order to filter the best potential BRICKER markets. As a basis for decisions the following parameters were selected:

1) Total non-residential stock floor area in square meters
2) Equivalent major renovation rate
3) On-going financial and fiscal support programmes for non-residential stock
4) Share of the renovation market (non-residential building segment)
5) Market review based on the estimated economic growth.

Rating matrix for the best potential BRICKER markets						
	Total non-residential stock floor area (m^2)	Equivalent major renovation rate	On-going financial and fiscal support programmes for non-residential stock	Share of the renovation market (non-residential building segment)	Market review based on the estimated economic growth	**Total rating points**
France	3	3	3	2	3	**14**
Germany	3	2	1	3	2	**11**
Norway	1	3	3	n/a	3	**10**
Spain	1	1	3	2	3	**10**
Italy	1	1	2	3	2	**9**
Poland	2	1	1	1	3	**8**
Belgium	1	1	1	2	2	**7**

Figure 6.4. Rating matrix for the best potential BRICKER markets

Outputs from the general global trends:

- There are high economic potentials; especially, the constantly growing global retrofit market with an expected volume of nearly €117.3 billion by 2020. This global retrofit market will almost double compared to the current market volume.
- The trends forecast for non-EU markets predicts a large growth in emerging economies like Brazil, China, India, Saudi Arabia, and South Africa.
- Retrofit markets such as US, Canada, and Mexico are notably higher than in the EU countries.
- The financial indicators and expectations the operational costs over five-years for new green retrofit and renovation projects have saving potentials of 13%.
- The operating costs over five years the costs decrease fastest in the US and Western Europe by 14%. Lowest is the decrease of operating costs over five years in Canada by 11%.
- It is expected a growth in asset value for traditional buildings – whether new or renovated, by 7%.
- The dynamic from longer to shorter payback times of green retrofit projects it should be considered as quite low.
- With a glance on the EU-building stock it can be stated that most EU buildings were built before 1980. Especially educational facilities have a potentially high demand for green retrofitting due to the big gap between the number of older building stock and newer building stock; the latter rate is quite low.
- All building types in the EU have an older building age structure as new buildings. Thus, there is a high demand for green retrofit for all existing building types.

Outputs from the analysed Countries (the most potential EU markets for the BRICKER solution, descending; *The conclusion give just an indication, which can be used as a first view of the potential markets. Also, it should not be forgotten that some of these markets are home markets and home advantages are not considered in detail in this market analysis*):

1) France has with a total rating score of 14 points the best rating. Furthermore, France has also the second highest total non-residential stock floor area in square meters and the second highest renovation rate, as well as the second highest on-going financial and fiscal support programs for non-residential stock. In the category share of the renovation market and in terms of the estimated growth by selected countries France has just average values in comparison to the other countries.

2) Germany ranked as second with 11 rating points. The German market is characterised through the highest total non-residential stock floor area in square meters and the second highest share of the renovation market. In all other categories Germany is slightly above the average, which is assessed as positive when considering of all data.

3) and 4) Norway and Spain are rated on place three and four. Even through Spain has the lowest value of equivalent major renovation rate in comparison to the other countries it is outstanding due to its thirteen on-going financial support program for the non-residential stock; this is the highest value in the view of the market analysis. This considerable differences between the on-going financial support programmes and the comprehensible residential stock area in square meter ensure that the Spanish market is only in the midfield regarding to Norway the country has the highest equivalent major renovation rate in comparison of the average of selected countries and with twelve on-going financial and fiscal support programs for non-residential stock the second highest value in this category. In addition, the expected estimated economic growth rate is still high in the period between 2015 and 2016. Nevertheless, the market potential is just medium because of the low value of the non-residential stock floor area in square meters.

5) Italy is rated on the ranking place five. Although the low values of the Italian renovation market in the non-residential building segment it is the highest value in comparison to the average of selected countries (without Norway). Moreover, Italy has nine on-going financial support programs for the non-residential stock which is a solid number of federal support programs and from that point of view it is an attractive market for the BRICKER solution.

6) The great strength of Poland (rated on place six) and also a chance for the BRICKER solution is the outstanding estimated economic growth rate which is far ahead of the most EU Member States (Excurse: The same applies to Turkey – even more because of the highest economic growth rate of all analysed countries). All other data in Poland indicate a more small sales market for the BRICKER solution.

7) Belgium – which gets in total 7 rating points, has failed in all categories as a potential market low – in comparison to the analysed countries – and thus Belgium is the most challenging market for the BRICKER solution.

In summary, all seven countries of this market analysis have their potentials not least because most of them are the largest or the most promising markets for the BRICKER solution within the EU.

The Energy Performance Certificates (EPCs) are a key instrument of the economy and sustainable environment activities of many UN Member States to create a demand driven market for energy efficiency in the building sector. State March 2013, a total of 19 EU Member States reported that around 2.189.049 EPCs were registered. The Bricker solution should try to make use of these relatively new Energy Performance Certificates (EPCs) market to identify, e.g., where potential non-residential building customers and market agglomerations are located. In general, EPCs generate a lot of useful information which could help to accelerate the BRICKER solution deployment into the green retrofit market.

6.1.3 Value innovation analysis of the main results (SEZ).

Work performed: Continuation of this activity that started with the first exploitation workshop where the partners presented their solutions during the exploitation workshop 2 and 3 where all partners further specified exploitable results (clustering of use, consolidating) taking into account the relevant issues worked out in the Business Model Canvas related to value propositions of the solutions. Building on the work that was completed in workshop 2 and 3, the main part of the value innovation analysis was implemented in workshop 4 (the methodology is described in the next section). Further insights were already gained in the framework of the exploitation questionnaire analysis that contributed to the findings of the workshop 4, too.

Methodology: The value innovation analysis, that was conducted within the WP6, bases on the idea of finding potential new ways of avoiding direct competitor confrontation ('red ocean') by finding new markets and alternative strategies ('blue ocean strategy'). After having consolidated and clustered the exploitation results in packages (1), each of the elaborated packages are analysed in detail in the next step (2). To perform this task, each package (BRICKER Envelope Retrofitting and BRICKER Trigeneration System) is split into separate functions that are addressing customer needs. A function in this context is for example 'simplicity of installation'. In a third step (3), every function was analysed in terms of degree of fulfilment by competitors. Some of the main functions could be addressed by competitors better or worse compared to BRICKER. The fourth step (4), which was not implanted during workshop 4, but will be done between M36 and M48, contents elaborating the specific avoidance strategy for each package. There are four strategies within the Value Innovation Analysis that are possible: elimination, reduction of quality, increasing of quality, and adding a function.

Outputs:

The Value Innovation Analysis was implemented for the following packages: the BRICKER Envelope Retrofitting and the BRICKER Trigeneration System. The following two paragraphs present the outcome of the analysis.

Nine main functions of the **BRICKER Envelope Retrofitting** were underlined that address customer needs: Insulation, aesthetics, sustainability, air renewability, heat recovery, filtering (indoor air quality), effective insulation, adaption to climate and space, and simplicity of installation. The BRICKER Envelope Retrofitting have for most of the mentioned functions strong competitors (such as BASF, 3M or Rockwool for instance) that outperform the package in some of the functions, but do not achieve the same level in the functions of 'sustainability', 'adaption to climate', and simplicity of installation. As underlined before, BRICKER's unique selling proposition is characterized by an integration and 'green thinking' approach, which is not to the same extent fulfilled by competitors. In addition, due to the big consortium of different partners and expertise in terms of geographical and market know-how, BRICKER Envelope Retrofitting have the advantage to be customizable to different climate zones as well as to different environmental conditions in general.

Six main functions of the **BRICKER Trigeneration System** were underlined that address customer needs: green electric production, price of the green electric production, stability green electric production, price of the BRICKER Trigeneration System, CO2 footprint of the trigeneration system, and degree of independency. Similar to the above mentioned package the BRICKER Trigeneration System have for some of the mentioned functions also strong competitors that are better than the package, but do not achieve the same level in the functions of 'stability', 'CO2 foot print', or 'degree of independency'. As stated before the BRICKER's unique selling proposition is characterized by the combined generation of electricity, heating, and cooling using CO2 neutral energy sources, which is not to the same extent fulfilled by competitors. In addition, due to the big consortium of different partners and expertise in terms of geographical and market know-how, BRICKER Trigeneration System have the advantage to be customizable to different climate zones as well as to different environmental conditions in general.

6.1.4 Risk assessment and overall IPR strategy (SEZ)

Risk assessment: The potential risks for the successful exploitation and replication of the project results are identified during the exploitation workshops but also during the overall work in WP6 (questionnaire, interviews, desk research). The mitigation strategies to overcome the risks are worked out within the exploitation workshops, steering committee meetings or in working groups within the consortium. At the current stage, the workshops are a good tool to identify risks and conflicts related to the exploitation strategy of the BRICKER project. The risks that have been identified during the four workshops are listed in the following table (extended list in annex).

	Potential risks identified	Identification in:	Solution strategy
IP risks	Correct/clear understanding of exploitable results (ER)	T6.1 – (WS1-4)	Short descriptions of the individual ERs are included within deliverable D17/18 and for the BRICKER packages within this deliverable.
	Overlapping of expected exploitation claims on ER	T6.1 – (WS1-4)	Identification in advance and discussion with the concerned parties to set priorities and agreements on the use of exploitable results. Many exploitable results are stand-alone products without overlaps. In the case of overlapping claims, bilateral discussions are initiated.
Personnel and organisation related risks	Identification of specific exploitation strategies.	T6.1	Issue was topic of WS3. Individual exploitation strategies already ongoing in case of further EU-projects or strategic cooperation partners.
	Identification of modules of overall BRICKER system (service). The BRICKER system needs to be defined and a responsible partner for the exploitation far beyond the implementation phase and project end is needed.	T6.1-6.3 (WS3-4)	Issue was topic of WS3 and WS4. Individual exploitation strategies versus the BRICKER system exploitation were discussed. In a next step the marketing strategy / value propositioning will be worked out together with WP7 in year 4.
Political risks	Exploitation and Replication barriers: socio-economic aspects/ technology factors that influence the exploitation such as standardisation and regulatory aspects	T6.1 (DoW)	Market analysis, partner inputs and WSs
Market risks	New markets expected however not identified clearly	T6.1-6.3	Market analysis, expected trends, and future developments were focus of workshop 4, its preparatory questionnaire and the market analysis.
	The value proposition of the offers is not mastered	T6.1-6.2	The value proposition of the most important exploitable results and the exploitable result packages were formulated in workshop 4 and its preparatory works.
Financial risks	Clarification of financial issues related to access rights	T6.1-6.3	CA and GA state clearly how to handle access rights during the project duration and after 1 year of the project end. Bilateral agreements needed for time after 1 year of the project end. Actions undertaken for IP risks help to

	Potential risks identified	Identification in:	Solution strategy
			identify the value of partner contributions etc. to clarify the value of sharehold.
	Requested resources to further develop the upscaling is not guaranteed	T6.1-6.3	Within further works preliminary business plans will include aspects of upscaling.
Technological risks	Technological maturity not reached by the end of the project	T6.1-6.3	Identify the LCA as soon as possible

Figure 6.5. Identified potential risks (extended table can be found in Deliverable D32/33)

IPR strategy: First ideas on IPR issues have been presented at the WS 1 and were further introduced during the series of webinars of WS 2. A third highlighting of IP relevant issues were presented during WS 3 by the ESIC service. The insights gained were included into the consortium IPR management strategy. The workshops guide the decision making of each partner related to IP protection. It is the basis to decide on results that need protection and gives more clarity about ownership – especially regarding joint developments that result in joint ownership.

Deviation	Explanation and Solution proposal
No deviation	-

6.1.5 Technology implementation plan (SEZ).

The technology implementation plan will be the last stage of the exploitation plan compiling all the developments of the work that was done before – which means also that at the present moment only parts of the technology implementation plan are elaborated. All findings of the previous tasks will be summarised in the plan, pointing out opportunities and barriers in technology implementation in case of market deployment for the targeted and potential markets.

In the framework of the third workshop a roadmap towards exploitation was developed showing the steps, tasks, and milestones for 2015 to 2017 (a detailed picture of the roadmap can be found in the Deliverable D32/33). The roadmap clarifies 1) the means: 'How the BRICKER could be exploited', 2) the content: 'What could be exploited?', and 3) the goal: 'Why should the BRICKER be exploited? The starting point for the exploitation roadmap and thus the technology implementation in order to specify the 'How?' are clarifying the framework conditions (e.g. descriptions of exploitable result packages) followed by pointing out the competencies and resources of the BRICKER consortium (e.g. market analysis). These 'How?'-activities should be done by the end of 2016 according to the elaborated roadmap. The question of 'What?' (content of the BRICKER roadmap) is divided in the sub categories of 1) market-preparatory activities, 2) business plan, and 3) preliminary activities. Within this part of the roadmap (starting in 2015 and finalized at the beginning of 2017) tasks such as clarifying the price and end-user definition are completed. The part of 'Why?' addressing what is actually offered to the customers (products and services) will be further specified in detail at the end of 2016 until the end of the project in an ongoing process.

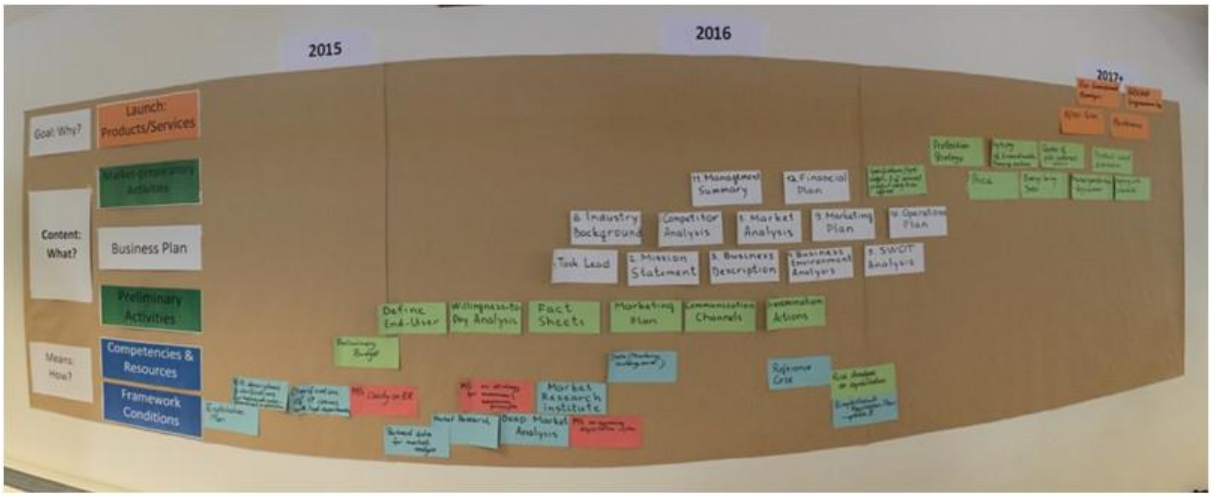


Figure 6.6. Roadmapping exercise with planned actions and time line

Deviation	**Explanation and Solution proposal**
No deviation	-

6.2 Task 6.2. Business models (SEZ).

General status Table;

Task	Planned M1-M48	Achieved	Deliverables
6.2.	**100%**	**60%**	**Input for D32/33 .**

The identification of a suitable exploitation strategy for the partners regarding the most promising commercial exploitable results differs in the implementation depending on the status of ownership, networks and capability of the organisation, strategic plans/portfolio of the organisation etc. These criteria are already introduced and consolidated as part of task 6.1 and will help to build on different approaches of business models. All approaches are implemented to support the continuation of exploitation steps:

- Learning from good practices of similar EU projects (FP6, FP7, CIP, H2020)
- Individual support is given to identify strategic partnerships for joint exploitation with externals (→ synergies with EU-wide Business Networks like Enterprise Europe Network, information on cooperation requests and offers, information about brokerage events organised by the network);
- Individual support in identifying open calls for proposals for market uptakes in H2020;
- Development of suitable business model frameworks (according to the Business Model Canvas[1] but also according to business models defined in the DoW: from single product selling to whole package of ESCO model)

6.2.1 Check/Comparison of existing business models (partners and external projects e.g. CONCERTO, IEE projects)

To learn from existing experiences with business models running or finished EU projects will be identified to compared the implemented financing solutions. The projects will be selected from past and running EU Framework Programmes: FP6, FP7, CIP and H2020.

- **FP6 – desk research (CONCERTO Projects/ FP6 projects)**
- **FP7 projects (CONCERTO, EeB, SCC)** – questionnaire will be distributed and interviews held
- **IEE (CIP) projects[2]** – questionnaire will be distributed / interviews held
- **H2020 projects (EeB, SCC)**– questionnaire will be distributed and interviews held

[1] The Business Model Canvas is a strategic management and lean start-up template for developing new or documenting existing business models. It is a visual chart with elements describing a firm's/product's value proposition, infrastructure, customers, customer channels and relations, as well as finances (like revenue streams and cost structure).

[2] The programme, Intelligent Energy Europe Programme (IEE), was part of a broad push to create an energy-intelligent future with projects near to the market and working on market barriers. It supported EU energy efficiency and renewable energy policies, with a view to reaching the EU 2020 targets. IEE aimed to create better conditions in areas as varied as renewable energy, energy-efficient buildings, industry, consumer products and transport. The programme was under the umbrella of the Competitiveness and Innovation Framework Programme (CIP). The CIP ran from 2007 to 2013.

6.2.2 Development of business models frames for main results in collaboration with partners

a) Business Modelling for key commercial exploitable results *(incl. value proposition, configuration of the value creation and the revenue model)*

In order to create and finally choose the right business models different approaches were chosen to collect the necessary data and elaborate the most promising business models in order to commercialize the exploitable results: questionnaires, workshop sessions, business model canvas. Aspects like target markets, IPR issues, and value propositions were already described in chapter 6.1 – anyhow, some points will be repeated in this section, too. **The business model analysis was focussed on the BRICKER Envelope Retrofitting and BRICKER Trigeneration System**.

Basic information about the exploitable results was gathered through four sided **questionnaires** that were circulated in the run-up of the workshop 4: Information about the price and cost range of the exploitable result, the structure of the distribution channel, the time to reach the break-even point and to achieve a return on investment as well as the foreseen market launch date and the estimated TRL at different phases of the project was collected. This questionnaire was sent to consortium members that were directly contributing to a specific exploitable result package.

Additionally, further business aspects were compiled through the **workshop 4 sessions** such as analysing the landscape of the BRICKER consortium, the SWOT analysis session, and the PESTEL session: Summarizing of stakeholders of the upstream value chain (e.g. suppliers), of the downstream value chain, and additional stakeholders for instance. The participants of the workshops, as mentioned in section 6.1, were chosen among the consortium members that were directly involved in the exploitable result package by contributing a module to the overall package.

The **Business Model Canvas** method was used during an inter-active session of workshop 4 and to a lower extent during workshop 3 to gather business-relevant information. The Business Model Canvas is an integrative framework to plan and evaluate business models of ventures but also of projects. This is why it fits the context of the BRICKER project, where individual exploitable results are to be evaluated concerning their commercialisation. The introduction of Business Model Canvas structure was done already during WS 1, and was continued in each of the workshops, but the main focus in of work was within WS 3-4. The Business Model Canvas allows to work jointly during the workshops but also individually. The following 9 areas were addressed:

1. Customer Segments (to be served by the ER owner)
2. Customer Relationships (maintained for each customer segment)
3. Channels (Value Propositions are delivered to Customers through communication, distribution and sales channels)
4. Value Proposition (ER seeks to solve customer problems, satisfy customer needs…with value propositions)
5. Key Resources (assets required to offer and deliver the above mentioned elements)

6. Key Activities (to be performed to reach value proposition…elements above)
7. Key Partnerships (for activities outsourced, etc.)
8. Revenue Streams (result from value propositions)
9. Cost Structure (all elements result in cost structure)

Outputs:

Results for the **BRICKER Envelope Retrofitting:**

As underlined before the **USP (unique value proposition)** of the package is the integration of different customer needs into a one shop solution which could be described by customized, green, and aesthetical sophisticated including health and comfort aspects. The **customer segment** is particularly wealthy and green thinking – the package is addressing B-to-C and B-to-B clients like building owners, decision makers, builders, architects, subcontractors, and standardisation bodies.

Key partners are besides the BRICKER Envelope Retrofitting partners, the academic experts and the sales network of the BRICKER consortium. Patents as one of the **key resources** group are mostly held by each consortium partner and not shared between two or more BRICKER partners. Due to the a huge variety of exchange and adaption as well as integration processes the consortium partners share common understanding and routines, which was shown in previous workshops before, but not really necessary to patent at this or even at a future stage. **Key activities** of the BRICKER Envelope Retrofitting business model are engineering and customization but moreover sales, consulting, and service – including maintenance and monitoring. The clients are involved during the selling and after sales processes such as maintenance and monitoring. The **cost structure** and revenue streams for the BRICKER Envelope Retrofitting are depending on the costs of the single products of the different involved partners, Acciona, Greencom, Purinova, and on the costs that are resulted of the communication, exchange, and integration processes of the whole package. The **distribution channels** for the BRICKER Envelope Retrofitting as a whole are the networks of the consortium at international/ European and national level. Each of the involved partners will benefit from the partnership by a growing distribution network. For the BRICKER Envelope Retrofitting as a whole the distribution channel will shift more to system integrators as it is a more complex complete solution.

Key partners:	**Key activities:**	**Value Propositions:**	**Customer Relationship**	**Customer Segments**
-Bricker partners (for passive solution) -Academic Experts (from consortium) for tailoring/customising to improve products -(Bricker) sales network	R&D Engineering-Improvement Production/Tailoring customisation Sales Consulting Service (Maintenance, Monitoring Commissions)	- Energy saving - Demand reduction with PS - Tailored/automated solution - Green Building/Eco label - Aesthetic nice facade - Health and comfort/air quality - Easy to install	-sell -sell & maintenance service -Big Data maintenance monitoring	-B-C Building owners -B-B Builders, Decision makers. Green thinking Customers -European Customer (local if insulation material -cold,(medium) countries beneficial

-Suppliers (established links, to be identified for upscale →better)	Key resources - Material - JPR/Patent/Brand - Human (scientists/ engineer, Sales) - Financial?	- Not inflammable - Heat recovery - Manage & monitor Energy Effiency Consumption - JOT/Digitalisation/Sensors/Big Data - Confession Business	Channels International European &National Networks →Growing through partnership	for AWN) -Global green thinking rich countries -Influencing Stakeholders (Ecosystem to be convinced: Engineers/Architects, politicians, standardisation)
Cost structure: -Development -Production -Sales -Services (Material/human resources)				

Figure 6.7. Group work outcomes Business Model Canvas Envelope Retrofitting

Results for the **BRICKER Trigeneration System:**

As underlined before the **USP (unique value proposition**) of the BRICKER Trigeneration System is the integration of different customer needs into a one package. The solution can be described as a system that generates electricity, heat, and cold in combination with nearly zero emissions and tailored to the customer. The package is moreover a stand-alone solution. . The **customer segment** consists of B-C building owners and B-B commissioning ESCOs that are mostly based in the EU. In particular, large and high consumption buildings are the target market including private building owners, too. **Key partners** are besides the BRICKER Trigeneration System partners, the academic experts and specialists in terms of sales and marketing. Patents as one of the **key resources** group are mostly held by each consortium partner and not shared between two or more BRICKER partners. **Key activities** of the BRICKER Trigeneration System business model are engineering and customization but moreover sales, consulting, and service like maintenance and commissioning. The **cost structure** for the BRICKER Trigeneration System are depending on costs for development, production, sales, and service. The **revenue streams** are sales profit, operation commissioning ESCOs and maintenance contracts. The **distribution channels** for the BRICKER Trigeneration System as a whole are the European and global networks of the consortium as well as the strong national links of the consortium members. For the BRICKER Envelope Retrofitting as a whole the distribution channel will shift more to system integrators as it is a more complex complete solution.

Trends and Drivers: CO2 Reduction (P) Footprint Increase oil price (Energy dependency (E)) Environmental Requirements (L) Transfer to Europe > close to market		Renewable directives EU and national regulations EC-increase energy price S- "smart building" T- more efficient novel solutions L- Environmental Requirements
Suppliers Upstream value chain Thermal Oil provider HVAC Provider Suppliers of Bricker partners Bricker Partners for components solutions Equipment Automation Control EQ JT	**Component X** Renewable Zero emission Active solution Renewable Trigeneration system based in solar & biomass Green, smart energy saving solution Nearly-zero emission/energy building Solar parabolic collectors ORC (Rank) Chillers (commercial) Biomass boilers (commercial)	**Customers Downstream value chain** ESCOs energy service companies Owners of buildings with large energy consumption/size (airports, hospitals, stations) Concession model maintenance contracts Building owners public Building owners private
Additional influencing factors: Access to finance White certificate green labels Government incentive funding Green aspects for image Raise awareness Regulation	**Additional stakeholders:** Architects Insurance companies Energy companies Politics regulations	

Figure 6.8. Group work outcomes Business Model Canvas Trigeneration System.

b) *Synergies with EU-wide business networks for technology transfer / business contacts (like the Enterprise Europe Network) - supporting individual exploitation of partners* *(starting M13)*

<u>Synergies with Enterprise Europe Network:</u> During BRICKER General Assembly Meeting in Caceres (M13), the review meeting in Brussels (M18) and General Assembly Meeting in Liège (M24) SEZ presented an extraction of Business/Technology opportunity profiles out of the database of the Enterprise Europe Network in the format of a printed catalogue. The Database compiles technology and business profiles (requests and offers) from all over EU and abroad. The catalogue was created upon the technology keywords of the project issues and involved partners. Partners were invited to check the profiles in the catalogue and to choose those profiles in which they were interested to cooperate with. These expressions of interests were submitted to SEZ. SEZ is member of the Enterprise Europe Network (EEN) and links the expressions of interest to the local network contacts of the partners who will offer individual free services to those partners located in their region.

This approach will support the BRICKER technology providers (SME partner, industry and RTD) who are interested in cooperating with the offers / requests to expand their businesses or at least their networks. It is planned that they offer the outputs of the BRICKER project to the EU market also via this dissemination and exploitation channel. The process of informing the partners about the current status of interesting technology and business profiles (requests and offers) will be continued. SEZ will load up updates of the specific profile catalogue on a regular basis on the BRICKER teamsite (intranet) and will communicate this to the consortium partners. Further SEZ will inform about selected brokerage events to enable the identification of strategic partnerships for exploitation.

Outputs:

- EURAC reacted with seven expressions of interest to profiles that are of strategic interest for them. SEZ generated the connection to their local EEN office. They are now in contact with their local EEN partner for further steps like development of an own Business/Technology Profile. This will help to offer their expertise generated in the BRICKER project to potential strategic partners in EU.
- ACC requested five expressions of interest to profiles. Same procedure by SEZ as described for EURAC.
- OZU requested two expressions of interests. Same procedure by SEZ as described for EURAC.

c) H2020 / KIC IE applications for market uptake *(2014 - ongoing)*

For those partners who have foreground with no joint ownership/development or who are interested in further market take-up measures, e.g. partners' participation in H2020 or KIC InnoEnergy innovation projects will be informed about opportunities. SEZ will distribute information related to H2020 / KIC InnoEnergy calls for proposals for SME/Industry/RTD which are supporting the market entry of highly innovative products / services on a regular basis.

Outputs:

- SOLTIGUA submitted a H2020 SME Instrument[3] phase 2 proposal (cut of dates 06/2015 and 09/2015) with support of SEZ. The proposal has been selected for funding. The topic of the proposal[4] is linked to BRICKER outputs and experiences gained so far. It therefore would help SOLTIGUA to step towards the market and the implementation. SEZ explained the SME Instrument rules, application documents, and worked out the focus of eligible actions as well as the issues related to the business model part.

Deviation	**Explanation and Solution proposal**
No deviations	-

[3] The SME instrument consists of three separate phases. Participants can apply to phase 1 (a feasibility study) with a view to applying to phase 2 (an innovation project) at a later date, or directly to phase 2.

[4] Proposal Title: Re-deployable solar boilers based on concentrating solar collectors for ESCO type sale of thermal energy to industrial processes.

6.3 Task 6.3. Replication (TEC).

General status Table:

Task	Planned M1 - M48	Achieved	Deliverables
6.3.	100%	30%	D.6.33. at M36

The main objective for developing a Replication Plan is to facilitate the potential implementation of demonstrated technologies in future energy retrofitting actions to be carried out in the European building stock. Suitability of the demonstrated solutions for the stocks owned by project partners, as well as expected benefits and implementation strategies are addressed and estimated in these Replication Plans. In order to accomplish such objective, the results of this task 6.3 are going to be released in three deliverables. As for the period that this report covers, the updated content in D6.33 refers to the 'Identification of the Public Building Typologies' and 'BRICKER integration potential evaluation and impact assessment in each building type'. The last deliverable of this task (M48) will content a detailed description of Bricker replication plan, once the technical conclusions from WP4 and WP5 are consolidated.

Partial progress items:

6.3.1 Identification of the Public Building Typologies: Public building stock of project partners

Firstly, a description of the building stock of the project partners is provided: Gobierno de Extremadura (GEX), Service Provincial des Bâtiments (SPB) and Adnan Menderes Universiti (ADU). The gathering process of more detailed information is secondly described. It will allow TECNALIA (leader of Task 6.3) to develop a first classification of building stocks taking as a baseline the four main building typologies studied on WP4 are studied - the demonstrators (office, educational, hospital) and the potential transfer of BRICKER concept to social housing. The objective of this data gathering process is twofold: a) contribute to the categorisation of the public building stock according to the typologies previously mentioned and b) elaborate the baseline for the potential evaluation and impact assessment in each building type. TECNALIA distributed the questionnaire among the owners of the building stocks, partners of the project and provide them a detailed explanation of the objectives of such process. By the due date of the second deliverable, the data gathering process had not been completed.

It is expected to divide this classification in subgroups and targets of special interest as the identification of attractive boundary conditions advances. E.g., among the hospital buildings, the energy demand will vary on amount and time-extension between an outpatient care centre (from Monday to Friday, 12hours a day, heating and cooling demand of office rooms, medical consults and minor surgery) and a complete hospital with overnight inpatient care, complex medical treatments and equipment (bigger energy demand, 365 days, 24 hours).

6.3.2 European building stock suitable for BRICKER replication

Additionally, through a literature review, the building stock in Europe has been explored and constitutes the first useful information for providing an overview of the potential of BRICKER replication at European scale. From such analysis, it can be noted that the building floor area in EU is related to residential buildings and non-residential ones as well as their weight in energy consumption and therefore suitability for BRICKER implementation is significantly different.

Among residential floor area, 64% belongs to single-family houses and 36% to apartment blocks. Although the final conclusions for BRICKER replication will arise on the final report at M48, it can be advanced that single-family houses will not be an interesting target of BRICKER system, especially for its active technologies which power scalability to single-family loads is out of the scope of this project. The transferability of BRICKER concept to social housing is being discussed on project's tasks 4.6 and its conclusions will be reflected also on the last version of this deliverable, which will provide an overview for apartment blocks (public and private owned).

The explored non-residential floor area can be classified in similar building typologies than considered on BRICKER demonstrators such as offices, educational and hospitals. Other typologies such as hotels & restaurants and wholesale & retails could be two interesting targets for a hypothetical future extension of BRICKER system to private buildings, as both usually present large floor areas and thermal demands to be covered along many hours or even uninterruptedly. The main interest of the non-residential sector for BRICKER replication is that its average yearly energy consumption intensity is 280 kWh/m2 (40% bigger than residential sector one), as it involves a complex energy use (lightning, equipments, heating, cooling,…). Other main conclusion is that hospitals and hotels & restaurants are the two building types with the highest energy intensities (up to 300-400 kWh/m^2) among the non-residential sector and a very continuous demand (up to 365 days 24 hours), which already arises as one of the attractive environment for maximizing the exploitation of a BRICKER active system. Hospitals therefore are a building type where BRICKER replication can facilitate a significant energy and $C0_2$ emissions reductions, among the public owned building stock, while hotels would be interesting for a possible replication of BRICKER to privately owned buildings.
The subtask 6.3.1 is under development and will be updated in the last deliverable of this task 6.3 in M48.

In the last 12 months of the project, the additional following tasks will be started and its results included in the last version of the replication plan deliverable (M48):

6.3.3 BRICKER integration potential evaluation in each building type (inputs from WP4 and T5.5)

6.3.4 Roadmap for implementation

6.3.5 Alignment with European Action Plans

6.3.6 Main conclusions and recommendations of Replication approach

Deviation	**Explanation and Solution proposal**
No deviation	-

7 WP7 DISSEMINATION AND COMMUNICATION (YOURIS).

During the second reporting period (M19-M36), the BRICKER dissemination and communication activities were continued from the initially developed strategies and implementations. New developments during the 2nd reporting period include:

- Setting up and maintaining a BRICKER company page on LinkedIn in order to enhance outreach about the project
- Implementation of image galleries on the BRICKER web site for following the progress in works at the Liège and the Aydin demo sites, updated with 2-3 new photos per months.
- Open a deliverable download section on the web site where web site visitors public can retrieve public deliverables.
- Organising two workshops in collaboration with the same call projects A2PBEER and RESSEEPE at SP2015 and SP2016.

Details about these innovations can be found below.

7.1 Dissemination and Communication Secretariat build up and operation (YOU).

In the second reporting period, the main activities within Task 7.1 included maintaining the Dissemination and Communication Secretariat, preparing Deliverable 7.30 (3rd version of the Dissemination and Communication Plan) launching public communication and dissemination actions (press releases, web articles) and requesting input from partners regarding their stakeholder network, their publications and events participation. In addition the BRICKER LinkedIn page has been set up and feed with regular posts about the project life.

General status Table;

Task	Planned M1-48	Achieved M1-36	Deliverables
7.1.	**100%**	**40 %**	**D.7.1. at M1**

Partial progress items: Collecting information about stakeholders and D&C Actions among the partners, clustering, support partners to organise events.

7.1.1 Dissemination and Communication Secretariat build up (YOU).

The BRICKER D&C Secretariat has been set up at the beginning of the project. D7.1 (due in M1) describes details of its concept and implementation.

7.1.2 Dissemination and Communication Secretariat operation (YOU).

Among the operations of BRICKER D&C Secretariat were the continuous update of the contact and mailing lists of all partners and provision of access to the team site for new team members. Also, regular updates were made regarding the contact details of the D&C group (consisting of representatives of partners as the main interface of the secretariat for dissemination and communication actions), and the presentation and document templates. Seven press releases about the outcome of BRICKERs first project review, about participation at SP2015, about a first prize won students working on BRICKER during a Researchers Night event, about the 2nd general assembly and BRICKER meeting in Liège, about an OpenHouse at the university in Liège, about the participation of BRICKER at the EeB Impact Workshop 2016, and about the BRICKER mini-test site located in Seville were prepared, published on the BRICKER web site and distributed through multiplier platforms and the social web.

Several short news pieces about developments at the BRICKER demo sites were are also prepared by the secretariat and published on the BRICKER web site in the "Latest News From "The Demo Site" sections.

In addition to the brochure, the bookmark, and the roll-up poster, dissemination supports have been made available to the partners: the BRICKER poster, in a 100x70 format.

Figure 7.1: The BRICKER poster

In the current reporting period, three newsletters have been compiled, published and distributed to stakeholders and through stakeholder platforms: in May 2015, in December 2015 and in May 2016. Since Newsletter 4 (December 2015), a new format and mailing has been adopted. Newsletter 4 was edited and published with a new publishing tool called scoop.it!, a web based content management platform, collecting and curating contents in an interactive magazine-like format around themes. YOU is subscribed to a dedicated premium account, which enables templates to be created according to the graphic layout and visual image needed in the communications. The Newsletter in this format will be sent to the list of registered users via email, it will be published on the website in the Newsletter section and it will also be available on scoop.it! which can be considered as an additional distribution channel working, in some way, as a social media platform thus addressing an even larger public[5]. The newsletter remains available on the web site in pdf.

The BRICKER company page on LinkedIn[6] was set up in March 2015. Nearly sixty posts were uploaded during the reporting period and the page has 78 followers to date. These 60 posts have been seen by 21 780 LinkedIn users.

To prepare dissemination and communication for stakeholder groups, partners were invited to provide information about their stakeholders. Two rounds of stakeholder update have taken place in the current reporting period, in September 2015 and in September 2016. Not all partners have provided stakeholder contact details, due to data protection and privacy issues. Those partners keep their stakeholders informed by forwarding information issued by the project to them.

To prepare coordination of dissemination actions by partners, partners have been asked in September 2015, February 2016 and September 2016 to provide updates about their publications and events participation in the last six months as well as about the plans for the coming year. Partners report regularly about their dissemination and communication actions.

In view of clustering activities suggested by the EC, the D&C Secretariat has organised two clustering events together with the fellow projects from the same call RESSEEPE and A2BPEER. The first workshop took place during SP2015 was about “Innovative Retrofitting” and the second during SP2016 addressed “Challenges of public buildings retrofitting”.

Furthermore, the D&C Secretariat is responsible for the implementation of the D&C Plan. Respective actions are described in section 7.3 below.

[5] The new newsletter production process allows also for tracking outreach and uptake. Detailed results will be presented in the final version of the D&C Plan.

[6] See https://www.linkedin.com/company/bricker

7.2 Project website (YOU).

The BRICKER web site www.bricker-project.com has been continuously updated with press and news releases, articles and interviews during the last 18 months. To date 52 web users are registered on the web site in order to receive Newsletters directly to their Inbox and/or download public deliverables.

Task	Planned M1-48	Achieved M1-36	Deliverables
7.2.	100%	45%	D.7.3. at M3

Partial progress items: News and press releases; articles and interviews; revision of home page new sections for *Interventions at the demo sites;* image galleries to follow progress of the interventions; deliverables for download.

7.2.1 Project website set up (YOU).

The BRICKER project web site contains all the institutional information about the BRICKER project. The web site aims at main communication and dissemination channel for the project's results and for the involvement and enlargement of the stakeholders' community. The site works as a share point for the BRICKER partners containing all institutional information including working documents and deliverables through a reserved partners' area, the team site. Daily upload email alerts have been implemented on the team site. The web site set up has been documented in D7.3 (due in M3).

7.2.2 Project website continuous update with contents (YOU).

The main update of the BRICKER web site during the reporting period consisted in setting up image galleries for visualizing the progress of the works at the BRICKER demo sites. Currently, the Liège gallery and the Aydin gallery are active. The gallery for Cáceres will be set up as soon as the works start.

Figure 7.2: Screen shot of image galleries

Also, the home page of BRICKER web site has been revised, allowing direct access (without using menu buttons) from the homepage to the following sections: Interventions at the Demo Sites, Featured technology, Latest News, News from the demo sites, Meet us at events, and a button “Subscribe to the Newsletter” as well as “Follow us on LinkedIn”.

Figure 7.2: Screen shot of revised BRICKER homepage

Numerous articles, interviews, press and new releases have been uploaded on the web site during the second reporting period in order to enrich the contents of the web site and keep it attractive for the users.

Furthermore, search engine optimization (SEO) strategies have been refined and enhanced by giving high importance to the right meta-tags. .

Recent web statistics reveal that web users are mainly interested in the "Technologies" section as this section is the most visited after the homepage, though. During the last 18 months the web site had over 24 000 hits, with a total of over 6 000 visitors and over 8 000 sessions.

7.3 Dissemination and communication plan (YOU).

The D&C plan is the operative guide and tool for all dissemination and communication activities to be carried out by the Consortium. The third version of the D&C plan has been delivered in March 2016 (D7.30).

Task	Planned M1-48	AchievedM1-36	Deliverables
7.3.	**100%**	**37%**	**D.7.4. at M6** **D.7.16 at M18** **D.7.30 at M30**

Partial progress items: Newsletters, Web communication: articles, interviews, press releases, dissemination tracking, posts on BRICKER LinkedIn company page, video on Belgian demo site.

7.3.1 Dissemination and communication plan reports (YOU).

Deliverable 7.4 – Dissemination and Communication plan is the basis for all WP7 actions. The D&C plan is the operative guide and tool for all dissemination and communication activities to be carried out by the Consortium. It contains a description of the overall dissemination and communication strategy. It defines the BRICKER key messages, describes the main target groups and stakeholders, presents communication and dissemination channels, contains the roles and responsibilities of the partners, and lays out the rules for authorship and IPR protection for dissemination and communication actions. Deliverable 7.16 – Second version of the D&C plan includes updates on open access publication, on stakeholder segmentation, on SEO strategies for the BRICKER web site, the planning for web communication M19-M30, the dissemination material available to the BRICKER partners, on the institutional video, and on clustering activities. Additionally, results about use of the web site, publications by the partners and the D&C Secretariat including outreach and uptake data as well events attended by the partners are reported in the second version of the D&C plan. The third version of the D&C Plan (D 7.30) enhances the contents of the first and the second version. New elements in the third version are refined stakeholder segmentation, a detailed description of the institutional video production process, the planning of the Best Practice Book, plans for dissemination and communication actions of the partners regarding publications, participation in events as well as organisation of the dissemination workshops and final conference towards the end of the project. The results of dissemination and communication actions between M1 and M30 are also reported here.

7.3.2 Dissemination and communication plan roll out: Publications (YOU).

Some activities such as issuing press releases, collecting information from partners about stakeholders and D&C actions have been organised by the D&C Secretariat (T7.1.2). The roll-out of the D&C plan has started in M7 with the acceptance of D.7.4.

During the second reporting period, 2 **articles,** 5 **interviews** with BRICKER partners, 8 **press releases** and 9 **short news pieces** about actions at the demo sites have been published on the BRICKER web site[7]. Articles and interviews are prepared by youris.com independent journalists, the press releases and short news pieces by the D&C Secretariat. Articles, and interviews were also published on the following online news services: AlphaGalileo, BuildUp, Construction21,Phys.org and Cordis Wire. Articles and most interviews are also published on the youris.com web site[8]. Press releases are published on AlphaGalileo, BuildUp, Construction21.

The publication of BRICKER content in online news services guarantees wide distribution and take up of BRICKER. A tracking system has been put in place in order to monitor outreach. All articles and interviews published on the BRICKER web site have been tracked. Details about outreach of web communication and referrals until M30 are reported in third version of the D&C plan.

Three **BRICKER Newsletters** have been published in May 2015 (Newsletter3), December 2015(Newsletter4) and June 2016 (Newsletter5). The D&C Secretariat sends the newsletters to the web users subscribed to the newsletter on the BRICKER web site (52 users) and by email to another 80 contacts BRICKER team members, EC stakeholders). Partner SEZ sends the newsletter to other groups of about 750 contacts. The newsletter is available online on the BRICKER web site, it can be browsed and downloaded in pdf[9]. It is also promoted on the BRICKER company page and have received the following impressions: 243 for Newsletter 3, 489 for Newsletter 4, and 745 for Newsletter 5.

BRICKER partners have also started to publish **articles** about BRICKER in **scientific publications and specialised journals**. In the current reporting period, 9 contributions to papers and proceedings were made. [10]

For the **institutional video** that is planned for BRICKER we have focused for the moment on the demo site in Liége, Belgium. This is due to delays at the demo sites in Turkey and Spain. In Turkey the groundwork has started in August 2016, so that a shooting at this demo site is conceivable at the beginning of 2017 (most probably in February / March). At what time the interventions in Spain will start is still not clear. With this in view we are in contact with Raymond Charlier, project coordinator of the demo site in Liége, to plan a second shooting at the college. Our first shooting at the college in Liége took place late in July 2016. Altogether we conducted three interviews: Raymond Charliér, project coordinator; Christian Wynan,

[7] See http://www.bricker-project.com/News

[8] See http://www.youris.com/

[9] See http://www.bricker-project.com/Newsletter/Editorial.kl

[10] Details can be found in D7.30, pp 49-50

principal; Jonathan Martens, Greencom. We filmed the installations of the new windows, the renovation of the façade, and the elder part of the building to be able to directly compare the building in the pre and after status. With regard to the upcoming review meeting on 8 and 9 November in Brussels we decided to create a short institutional video of the demo site in Liége. The video will have a length of about two minutes, and is explaining the different interventions that are made. We are also using 3D animations to be able to explain the decentralised ventilation system and the Organic Rankine Circle that is still not included in the building.

7.3.3 Dissemination plan roll-out: Fairs, Conferences, Workshops (YOU).

The BRICKER Work plan lists a considerable number of fairs and conferences for which contributions about BRICKER results and achievements are planned. It is also intended to organise seven national workshops and a BRICKER conference in Brussels.. The organisation of national workshops and the BRICKER conference are planned in 2017 from M40 onwards.

During the reporting period, BRICKER has co-organised two workshops on the occasion of SP2015 and SP2016, in collaboration with the fellow projects from the same call A2PBEER and RESSEEPE. Both workshops focused on exchanges between the three projects about innovative retrofitting of public buildings. Furthermore, 2 Open House events for students, teachers and visitors have been organised at the Liege Building.

In order to raise awareness about BRICKER, the concept and expected results, the partners promote BRICKER actively since the beginning of the project in fairs, conferences, workshops and more.

During the reporting period under consideration, BRICKER partners have attended

- 26 conferences
- 14 workshops
- 8 fairs

During these events scientific contributions and presentations about BRICKER were held and information material (brochure, bookmark, newsletter) were distributed.

4 training sessions and visit exchanges took also place during the 2nd reporting period of BRICKER.

Details about the events attendance can be found in D&C Plan 3 in section 4.4.

8 WP1 Project Management (ACCIONA).

8.1 Task 1.1. Governance structure, communication flow and methods (ACCIONA).

8.1.1 Amendment #1. Requested on 20th of February 2014.

In period 1, the Project Coordinator requested an amendment to the Grant Agreement due to the substitution of one of the demonstration Partners, which did not access to the Grant Agreement due to economic problems. Main content of this amendment is listed herein below;

- ✓ New partner, Adnan Menderes University. Turkish demonstration Partner. Accesses the Grant Agreement in February 2014 (4 months after the Kick Off Meeting).
- ✓ Other minor adjustments:
    - ACC: Price of the PCMs, 12.000€ instead of 5.000€.
    - PUR: Fire resistance testing unit, 5.000€.
    - SPB is Local Demo Coordinator in Belgium, instead of ULG with personnel effort transferred from one Partner to the other.
    - SOLTIGUA joins the Steering Committee, as technological representative.

There is a new version of the DoW which was approved on July 25th by the European Commission.

Main objectives remain for the new Turkish Demo, although a delay (estimated 4 months) is foreseen due to the negotiation and integration of the new Partner in February 2014.

Governance structure.

There is a new governance structure, in which SOLTIGUA is a member of the Steering Committee. The rest of the structure remains as in the original DoW.

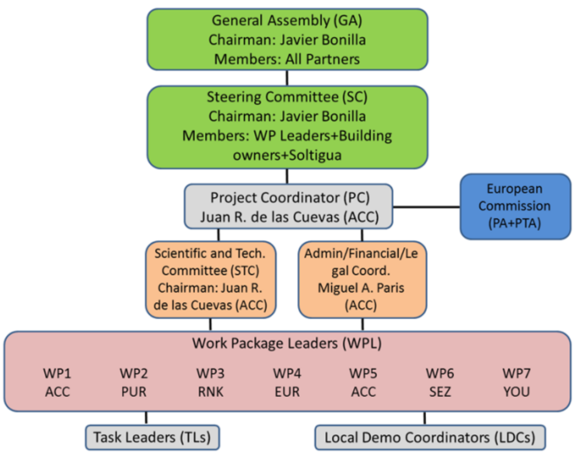


Figure 8.1: BRICKER governance structure.

Modifications with respect to the DoW:

WP2: Task 2.1. Scope change in task 2.1. of the DoW.

Due to the research works performed in the different activities and tasks during the first year of project execution, there has been a scope deviation from the content of work in relation to the work described in the Description of Work, *Task 2.1. Design and development of a sustainable and innovating ventilated façade for the Turkish demo*.

As this change is a consequence of manufacturing and testing of prototypes and the goal of the Project in the Turkish demonstration site has not suffered significant deviations, it has been considered that another Amendment to the Grant Agreement would not be necessary, although this change is reported to the European Commission in this email and in other supporting documentation to come in the following weeks, to confirm this position.

The change consists on the following:

- The original material selected for the façade, called Green Cast and developed by ACCIONA, has been replaced for an alternative lightweight polymer-concrete based on recycled materials.
- The reasons that justify this change are the following;

  - ✓ The Green Cast was tested in the ACCIONA facilities in Spain, and it was demonstrated that it does not meet the seismic and wind load requirements of the REAL demo site in Turkey. Despite the fact Green Cast's mechanical properties can be definitely enhanced; BRICKER approach and timing do not permit to do it. Therefore, with these results on the table, ACCIONA carried out a market study to search for innovative, sustainable and adequate material to be implemented in the Turkish demonstration Hospital, with the warrantee of safety during installation, operation and life-time of the solution and trying to keep the scope of the targets established
  - ✓ Also the Turkish regulation for seismic and wind load requirements was analysed to make the selection of this alternative material, as there two parameters are quite limiting in relation to the materials that can be used in this country.
  - ✓ The final solution derives from a ready-to-market lightweight polymer-concrete which base composition has been modified pursuing the BRICKER goal to develop an innovative, sustainable and lightweight ventilated façade. The product proposed is made of crushed marble, recycled crushed glass, low-density aggregate and polyester resin with recycled PET. The material's manufacturer is a Spanish company with a long experience in plastic and ceramic manufacturing in the building sector both for envelope and indoor applications and adaptable to market and client demands.

This change has been sent to the PTA with a request for revision/approval of the proposed changes.

On October 1st, 2104, our intention is to launch the purchase order of the materials to the manufacturer: As the delivery period after confirming the purchase is long (2-3 months) and we are willing to deliver the material by ship to Turkey (2-3 weeks plus border protocols), we would like to start with this purchase order with the intention of avoiding Christmas period and future delays in the project execution.

WP2: Task 2.3. Work Package 2 changes in the aerating systems.

Deliverable D.2.10 changes its dissemination level from PUBLIC to RESTRICTED as is contains confidential information from the ventilation system manufacturer, partner GREENCOM.

The number of aerating systems to be installed in the real demo changes from 15 to 22, keeping the same budge, due to the window size. More information can be found in the Deliverable D.2.10.

WP3: Task 3.3. Deliverable D.3.12 postponed from Month 18 to Month 21.

D.3.12. Novel solar prototype fields developed and manufactured, due in month 18, has been postponed to month 21. The PTA accepted this relocation in an email on January 2nd 2015. The reason for this change is that the building owners will not need the collectors on site until the subcontractors start the execution works to install the BRICKER system, and this will not happen until the end of the summer 2015.

WP3: Task 3.3. Turkish solar field is ground mounted rather than roof mounted.

Justification included in the report D.3.13.

WP6: New list of deliverables for Work Package 6.

As recommended by the PTA (Mr. Cousin) during the Kick-off meeting, the 6 deliverables of WP6 related to the exploitation and replication reports for M18, 36 and 48 (total **six** documents) will be merged to **three** reports covering exploitation and replication, due in months 18, 36, 48 with specific sections, so there will be three instead of six deliverable reports. This way, the new deliverables for Work Package 6 are:

- D.6.1.7 and D.6.18. → D.6.17.
- D.6.32. and D.6.33. → D.6.32.
- D.6.39. and D.6.40. → D.6.39.

8.1.2 Amendment #2 requested on August 30th 2016.

At the end of Period 2, it begins to be clear that the delay in the renovation works of the demonstrators in general is going to cause a strong impact on the post-monitoring campaign compromised in the DoW.

In June of 2016, the PC establishes contact with the PO, Ms. Planchon, and upon her request, the PO prepares a pre-amendment request document (attached to the present as an annex) explaining the delays and presenting impacts and contingency plans to absorb/minimise the deviations. The PO informs the PC that there are budgetary deviations (minimal) related to subcontracting of transport costs and other minor PMs allocations, and the PO explains that an email with an explanation is enough for her to approve those minor changes. This email will be prepared once all the Form C´s from all 18 Partners are reviewed and approved by the PC which will be not later than November 30th 2016.

The review meeting to show progress related to the 2nd Project Period is to take place in Brussels on the 8th and 9th of November 2016. The PO has confirmed their assistance, whereas the PTA has not.

The 30th of August, the PO sends via e-mail the official letter of Amendment request, including JUST the PROJECT EXTENSION, in view of an easier administrative process for the Amendment not to interfere the 2nd Periodic Payment, due 60 days after the 30th of September of 2016. The letter is also sent via postal service, but there is no evidence in Brussels that is has reached the Administrative Service, and after another conversation, the letter is sent again on October 21st.

At the date when this report is being finished, November 4th 2016, ACCIONA does not have any official answer from the EC regarding the Amendment request.

8.2 Task 1.2. Overall coordination (ACCIONA).

8.2.1 General Progress.

During the second period, the Project Team is working efficiently and with a good performance. Considering the high number of Partners and the 3 demos, the level of collaboration, performance and involvement has been really positive during this second Period.

The only exception is the delay caused by the public nature of the demonstration buildings. Due to a variety of political reasons, all demonstration activities have been delayed.

In the case of Turkey, the coup attempt of July 2016 had a direct impact on the project technical and budgetary situation. The Educational profile of the Turkish partners was an added problem, as this collective suffered the negative effects of the political instability during those days. However, the Turkish Partners reacted in a positive way, and now works are ongoing on the hospital.

In relation to the Spanish demonstrator, the change of the governing Party made the Public Administration be stopped for at least 6 months, while the structural bodies were being replaced and reorganised. This caused a delay yet to be evaluated, but al least one year of the Project work were lost by this external factor, which on the other hand, is totally uncontrollable from the PC.

As for the Belgian demo, problems were not of the same nature, and delays were related to the normal progress of works in the frame of a collaborative project, where 18 Partners are working around a Public building, to make it more efficient via deep renovation. This is by far, the most ambitious renovation of the three demonstrations of BRICKER, and on top of that, delays are not long enough as to be critical.

8.2.2 Deliverables.

Deliverables from this first Second period are delivered at the date of the Review Meeting. There is a new appointed PTA to assist the PC, and we will meet her in Brussels during this, her first Review on board of BRICKER.

Not all deliverables are available on the BRICKER TEAM SITE and the SESAM system of the European Commission, as the PC s waiting to receive feedback from the PO and PTA in the 2nd Review Meeting.

This list of documents includes the following:

Del. no.	Deliverable name	WP no.	Nature	Dissemination level	Due date (month)
D3.19.	Cogeneration components performance simulated and optimized	3	R	CO	21
D1.20.	Second year Progress report (technical and financial) including gender equity actions, at month 24	1	R	PU	24
D3.21.	Selected Cogeneration prototype constructed, tested and validated	3	R	RE	24
D3.22.	Control and hydraulic systems of the solar field adapted	3	R	RE	24
D4.23.	Project for Optimal Active and Passive Systems integration and operation strategies in the Turkish demonstrator	4	R	PU	24
D4.24.	Project for Optimal Active and Passive Systems integration and operation strategies in the Belgian demonstrator	4	R	PU	24
D4.25.	Project for Optimal Active Systems integration and operation strategies in the Spanish demonstrator	4	R	PU	24
D5.26.	Energy performance assessment of the 3 buildings before renovation	5	R	RE	24
D5.27.	All solutions manufactured and located in the demo sites	5	D	PU	24
D.5.28.	Technical specifications for the three Tender Processes, at engineering project level.	5	R	CO	24
D5.29.	BRICKER systems installed, started-up and commissioned	5	D	PU	30
D7.30.	Third version of the Dissemination & Communication Plan	7	R	PU	30
D1.31.	Third year Progress report (technical and financial) including gender equity actions, at month 36	1	R	PU	36
D6.32.	Second version of the exploitation plan including business models for the exploitable results	6	R	PU	36
D6.33.	Second version of the Replication Plan within the public building owners	6	R	PU	36

Meetings during the Second Period.

Work progress is reported by WP Leaders every six months. There is no need to report personnel justifications (Time sheets), but works execution.

Some of the important face to face meetings and some of the teleconferences are listed in the following table.

Place	Date	Purpose	Assistants	Report
Italy. Visit to SOLTIGUA Premises	June 2015	Technical work	ONU, OZU, ADU	Report available
SC Teleconference	June 2015	Managerial	SC Members	Minutes available
Turkish demo telco	September 2016	Technical works	AC, ADU, OZU, ONU	Minutes available
ACCIONA visits GEX	September 2016	Managerial	ACC, GEX	Minutes available
ACCIONA internal meeting Madrid	June 2016	Technical works	ACC team	Report available
GA Liege	September 2015	Technical and Managerial	All Partners	Minutes available
ACC visits SPB	March 2016	Technical works	ACC, SPB	Report available
ACC and CEM	March 2016	Technical works around Spanish demo	ACC, CEM	Reports available
SEZ in ACC	April 2016	Technical works	SEZ (E.H) and ACC	Minutes available
SC Seville	September 2016	Technical and managerial	SC Members	Minutes available
ACC internal progress meeting	September 2016	Technical and managerial	ACC team	Minutes available
WP6 Workshop Madrid	June 2016	Exploitation Workshop	SEZ (Leads), ACC, CEM, TEC, GRE, PUR	Report available
ACC visits RNK	September 2016	Technical progress	ACC, RNK	Report available
ACC visits SPB	October 2016	Technical progress	ACC, SPB, ULG, GRE	Minutes available
Review Meeting Period 2 Brussels	November 2016	Technical and financial reporting	ALL PARTNERS	-

Table 8.1: List of meetings Second Period.

In parallel to all the meetings listed above, there have been a number of teleconferences among Partners where the PC has not participated, and also many other day-to-day teleconferences and informal technical meeting which have not been recorded, but must be highlighted.

<u>Project Image.</u>

There is a project Logo and BRICKER Templates (meeting minutes, progress reports…) available for the Partners.

Figure 8.2: BRICKER Templates available.

Partner YOURIS has launched a collaborative server, called the TEAM SITE, with access for the BRICKER Partners, where we will store and manage all relevant information of the Project from month 1.

Also, the Project website is already launched, and really active with news, events, technology descriptions and other interesting sections. For more information please visit; www.bricker-project.com

8.3 Action plan / follow up

After the Review Meeting in Brussels, organized during the 8th and 9th of November 2016, the first action to be taken is to check the status of the Period 2 Deliverables with the PO and the new PTA. Besides that the financial reporting is to be consolidated by the PC with support from the EC, and on November 30th these figures shall be final.

It is of great importance to highlight the fact Partners are waiting to receive feedback of the European Commission in relation to the request for extension made on August 30th and October 21st 2016, in order to act accordingly.

The updated version of the Work Plan is the best planning tool that the Consortium has developed, together with the fluent communication and working atmosphere already existing among all Partners of the Consortium.