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2023

R2EC
Final Report

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ERA-NET RegSys – 1st call for proposals

FINAL REPORT

FFG Project number	876987	eCall number	29999696
Short title	R2EC – Regional Renewable Energy Cells	Applicant	**FH Technikum Wien (Lead)**, 4ward Energy Research GmbH, EffiCent Energieeffizienz Dienstleistungen GmbH, EVN AG, KEM / Wynergy e.U., TPPV - Österreichische Technologieplattform Photovoltaik
Consecutive number of the report	4	Reporting period	05/2022 – 10/2023
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Please note: length approx. 10 - 20 pages, upload to eCall in PDF format

1. Goals and results

- Have the objectives defined in the funding agreement been achieved? Are these objectives still valid or realistic? (Please note: changes to objectives require the consent of the FFG)
- Compare the objectives with the results achieved.
- Describe the “highlights” and problems that occurred in achieving the objectives.

Objectives of the project

The project R2EC aims at developing a scalable system for decentralized, interacting energy cells with a high concentration of local renewable energy generation such as from photovoltaic (PV) systems, storage element as well as high electric use like e-heating, heat-pumps and e-vehicles. This system aims at maximizing the use of renewable generated energy at the local and regional level through intelligent interaction of generation, storage and consumption. Also, the system will optimize the interaction on the local level with other energy cells, and thus improve the local energy use. Investigations are also to be made concerning the overall system optimization and resilience, as well as the market participation through aggregation.

The project R2EC will use a holistic approach to develop a system of interacting energy cells with a high concentration of renewables, storages and transport integration. Within the project, a variety of different adjacent energy cells in Austria, Belgium and Norway are planned to be analyzed and used for the development of a regional and renewable energy cell system – while the energy cells produce, use, supply and share renewable energy. This approach aims at developing tailor-made solutions that meet the local and regional requirements and demand of the observed energy cells. In this regard, R2EC will make investigations to compare and further advance the optimization of the overall system in different countries and climate zones and therefore enhance the system resilience and security on a regional and interregional level. Simulation models will be used to optimize the energy flow at energy cell level and support the economical assessment of the system. Furthermore, these models will be used to identify and specify critical needs of the local energy system implementation.

The main objectives of R2EC and the Austrian consortium are:

- the creation of a simulation model / extensive implementation concept,
- further development of hardware and software needed for the system and the
- prototypical application of system components in the observed test beds.

The project aims to develop a system of decentralized energy cells with various preferable renewable energy sources, storage solutions and transport integration. This system maximizes the use of generated energy at the local and regional level through cross-generational and cross-sectoral, intelligent interaction of generation, storage and consumption (own energy consumption and cross-building supply of several local users). At the local level these cells interact with other energy cells, built up according to the same principles, and thus optimize the local energy fluxes on an interregional level, also aiding system resilience and security. Therefore, the overall energy system optimization is another focus of the R2EC project. More specifically, the project R2EC has the following objectives and goals:

- Survey of the framework conditions for the observed energy cells and identification of additional energy cells (typical energy demand profiles, potential disturbances, etc.) (WP2, WP3).
- Evaluation of possible interaction with other potential businesses and sectors for improved business cases and utilization of otherwise unused by-products (WP2, WP3, WP4).
- Creation of a simulation model (optimization of the energy use, interaction of energy cells and evaluation of superordinate contribution), also aiding an economic analysis (WP4).
- Identification and/or (further) development of hardware and software needed for the system (WP5).
- Testing and implementation of the overall system in laboratory environment (i.e. TRL 5) (WP5).
- Testing of individual prototype components directly within the observed energy cells (i.e. TRL 7) (WP5).
- Testing of a local energy market to ensure local optimization considering trans-regional, overall situation (WP3, WP4).
- Integration of stakeholders and end users in the development process (co-creation) (WP3).
- Development of a system that enables (also indicated separately in the KPIs) a self-consumption coverage of a building network / of energy cells > 100 % (WP4).
- Amortization in less than 10 years at the simulation level also considering non-energy related values (WP4).
- Creation of an extensive implementation concept (WP4, WP5).
- Prototypical application of the developed systems (WP5).

Results Achieved:

With regard to the above listed goals and objectives, the following results were achieved, and are described as follows:

- Survey of the framework conditions for the observed energy cells and identification of additional energy cells (typical energy demand profiles, potential disturbances, etc.).
  An overview of key characteristics and structural data, both on average building- as well as energy cell level of the six observed energy cells were already described in the second and third interim report.
- Evaluation of possible interaction with other potential businesses and sectors for improved business cases and utilization of otherwise unused by-products.
  The results and outcome of all mentioned points can be found within the existing D2.1 deliverable report, as well as the D3.1 / D3.2 deliverable report, and also the minutes of meetings / report of the Use Case Workshop. The business model development was finalized in 05/2022 and economic evaluations were concluded in 08/2022 for the selected testbed scenarios.
- Creation of a simulation model (optimization of the energy use, interaction of energy cells and evaluation of superordinate contribution), also aiding an economic analysis.
  The description of the model, control strategy, the results and the evaluation are already provided in the third interim report. The investigations on the interaction of energy cells (WP4) and a brief overview of the economic analysis (WP3) will be described in section 2.2. Furthermore, it was already established in the previous reports and three publications that both the individual and overall Self Consumption Rates (SCRs) and Energy Autarchy Rates (EARs) significantly increased in all the test beds with the implementation of the predictive control described in the simulation model description and simulation results in Deliverable 4.1.
  The economic evaluation of selected scenarios showed the Austrian region, supported by the adequate support mechanisms like grid fee reductions, was the most economically viable and profitable. In the Belgian and Norwegian testbeds, without the right support mechanisms and legal framework, there was no opportunity for value generation. However, sensitivity analyses were conducted to confirm the economic viabilities - reduced control device costs and reduced/ almost zero community management costs. With the base case assumptions, the Austrian testbeds (8/15 scenarios) were the only cases with a net positive cash flow. The Austrian use cases were deemed to be the most profitable out of the use cases defined for the three regions However, with a reduction of control device costs to 250 €/device, and community management costs to almost zero ensured the economic viability in 5/8 investigated cases for the Belgian region. The Norwegian region has currently no established legal framework for ECs and therefore no support mechanism exists, the included generation in the several scenarios with the base case assumptions already generated enough value to the testbed participants by increasing self-consumption of their generation. However, it was

observed that with a reduced control device cost of 500 €/device and 25€/month community management costs, 8/16 investigated scenarios were economically viable with positive net cash flows, and a further reduction of control device costs to 250€/device as with the Belgian test case ensured economic viability of all the investigated cases in the Norwegian region. The net present cash flows in the investigated Austrian cases (left) showing the economic viability through the positive net present cash flows in several of the investigated scenarios.

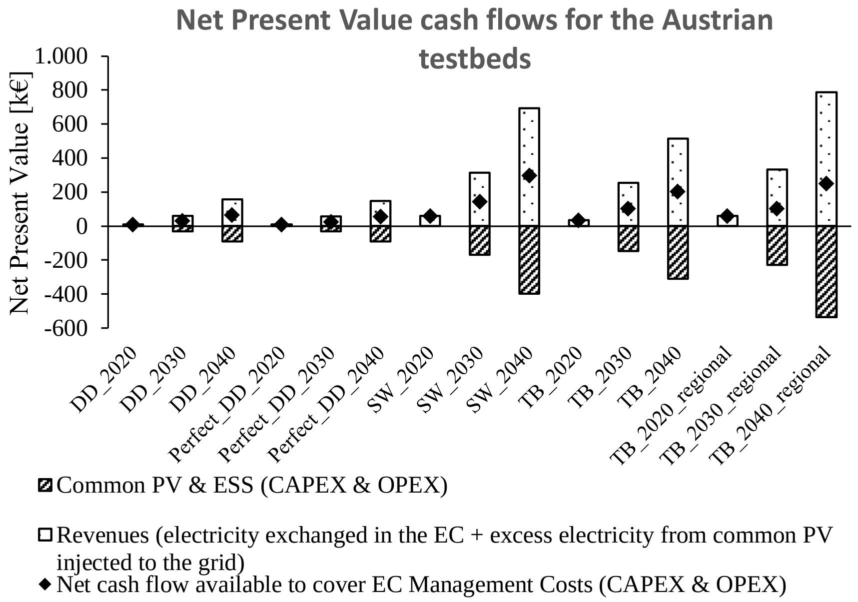

Figure 1 Net present value cash flows in the Austrian testbeds

The economic analysis is further discussed in detail along with the business models developed for each test region in the Deliverable 3.2.

- Testing of a local energy market to ensure local optimization considering trans-regional, overall situation (WP3, WP4)

  Within both WP3 and WP4, several discussions about the best usage of local flexibilities were conducted to ensure an optimum in the local usage of local energy and flexibilities. With several workshops conducted in 2020 and 2021 on the development of business models, and the simulation model was designed to optimize the self-consumption of the individual and the overall energy cell. The control strategy of predictive control was used in the control of flexibilities defined in the energy cells like heat pumps, electric vehicles and battery storage, thus improving the self-consumption of the locally generated renewable energy. The simulations showed that there was a significant increase not only in the self-consumption of individual energy cell participants, but also an increase in the overall self-consumption rates in the energy cells by a significant margin (refer Table 1) in all the three regions.

  The possibility of interaction of different cells in a trans-regional setting was analysed in detail. Four representative weeks (Monday to Sunday) for spring, summer, autumn and winter are defined and simulated within the specific simulation horizons and analysed.

Furthermore, no additional control has been applied in the simulations, meaning that the behaviour of the Heat Pumps and Electric Vehicles is only dependent on the objective of minimizing the self-consumption of an individual cell, neglecting the interactions on higher levels. It was observed that the total energy generation in the testbeds was the highest understandably in the summer week and significantly smaller in the winter week. However, the total consumption was the highest in winter by a large margin and lowest in summer. Depending on the energy production and consumption, the energy shared within the energy cells was also found vary slightly. The self-consumed energy was observed to be higher during the weeks with larger total production values.

The simulation results on a higher detail level showed that between spring and autumn, around 1 - 1.3 MWh of electrical energy was calculated to be shared between the three energy cells within the representative weeks. This constitutes 1 – 5 percent of the total generation and from 7 – 10 percent of the total demand, and consequently lead to increased overall Self Consumption Rates (SCRs) and Energy Autarchy Rates (EARs). This effect is significantly less noticeable in the winter weeks, due to the comparatively lower PV generation and an increased consumption due to heat demand in all regions. The PV generation during the winter was even insufficient to satisfy the Austrian and Belgian cell demands, and the Norwegian testbed was the only one with surplus generation (due to additional generation from Wind), transferring around 54 kWh of energy to the Austrian and Belgian cells. The highest increase in the overall SCR, at 15 percent, was during the autumn week, and the lowest during winter. The increase in EARs was the highest at 10 percent in spring, where there is both significant generation and consumption, while the lowest during the winter week, where there was a large difference between the generation and the consumption. The identified key parameters resulting from the interaction of the different regions is as shown in the figure below.

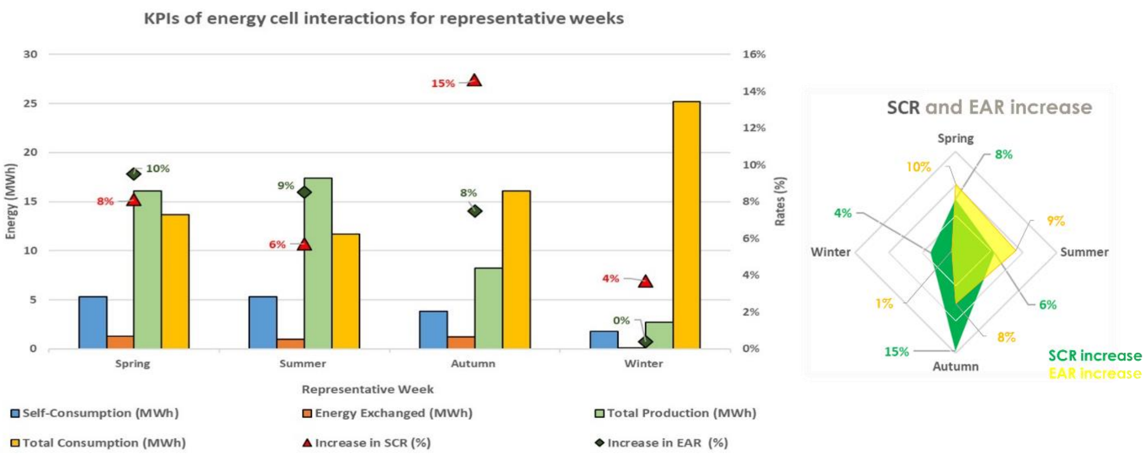

Figure 2 Key parameters of energy cell interactions for each investigated represented week (left) and comparison (right)

- <u>Integration of stakeholders and end users in the development process (co-creation)</u>
  The second and the last stakeholder co-creation workshops were held in the beginning of the year 2022 in Austria (Third interim report), while the second and a third/ final workshops

in the Belgium test region were held in the month of May (Third interim report) and in September 2022, where the economic results were further disseminated, along with the highlights of the test week implementation of the 'Community Forecaster' UI web application. A feedback was also gathered from the participations of the final workshop there.

- Development of a system that enables (also indicated separately in the KPIs) a self-consumption coverage of a building network / of energy cells > 100 % (WP4).

  From the technical simulations, it was observed that there was a significant increase in the self-consumption of individual users and the overall energy cell, with the implementation of predictive control. Also, the investigations of regional cross-border cell interactions assured the advantages of the R2EC system implemented on a simulation level. The developed system implements a control strategy of predictive control, designed to utilize flexibilities available in the energy cell to maximize the self-consumption rates of not only the individuals within the energy cell but also the overall energy cell. An increase of ~12% in overall energy cell SCR and upto a maximum of 30% in individual user SCR was observed on a simulation level. The quantifications of the positive effects of establishing an EC with the R2EC system is described in Table1 below.

Table 1 Quantification of positive effects of establishing an EC with the R2EC system in the different regions

Country	Scenario	Production (MWh)	Consumption (MWh)	Self-Consumption (MWh)	Distribution within energy cell (MWh)	Increase of SCRs	Increase of EARs
AT	Tulbing 2021	94	315	70	18	**20 %**	**6 %**
AT	Tulbing + surrounding 2021	205	581	133	51	**25 %**	**9 %**
AT	Badesiedlung 2021	10	58	3	7	**66%**	**11 %**
AT	St. Andrä – Wördern 2021	161	447	86	52	**32 %**	**12 %**
BE	Pool 7 – low electrification	277	488	71	61	**22 %**	**13 %**
BE	Pool 8 – high electrification	316	594	77	61	**19 %**	**10 %**
NO	Pool 1 - low electrification	138	165	55	18	**13 %**	**11 %**
NO	Pool 1 - low electrification + wind	146	163	66	15	**10 %**	**9 %**
NO	Pool 2 - high electrification	138	212	77	17	**12 %**	**8 %**
NO	Pool 2 - high electrification + wind	146	212	83	17	**12 %**	**8 %**

- Amortization in less than 10 years at the simulation level also considering non-energy related values (WP4).

  Based on inputs from the simulation results, the business models were derived for the several testbeds which are described in detail in the deliverable 3.2. The business models highlight the economic viability of the selected scenarios in the different testbeds in the Austrian Belgian and Norwegian regions. The Austrian region was the region with the highest profitability, and the economic viability of the Belgian and Norwegian testbeds were only possible with reduced control device costs and community management costs. The sensitivity analysis to reach economic viability in the Belgian testbeds can be seen in the figure below. The business model development process and the tasks involved are described in the section 2.2.

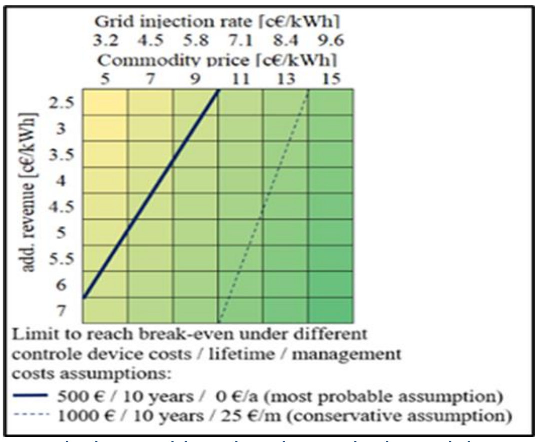

Figure 3 sensitivity analysis to achieve breakeven in the Belgian test cases.

- Creation of an extensive implementation concept (WP4, WP5).
  The extensive implementation concept is already described and discussed in the third and previous interim reports. The tasks conducted in the final year, and the outputs from the WP2. WP3 and WP4 activities are described in the section 2.2 respectively and in the deliverables 2.1, 3.1/3.2 and 4.1 respectively.
- Prototypical application of the developed systems (WP5).
  The detailed plan for the laboratory implementation of the R2EC system has already been discussed in the Third Interim report. The updates and details on the laboratory implementation and the testbed implementation are also described in detail in the Deliverables 5.2 and 5.3.
  However, due to complexities and challenges in the available situation, and the large delay to the start of the WP5 because of compounded delays from the COVID restrictions in 2020 and 2021, only a part of the implementation concept was implemented in the laboratory and testbeds. The tasks involved, and the results from the WP5 activities are described in the section 2.2.

Highlights of the final project year

In the following, highlights of the final project year are listed and roughly described:

- Regular monthly online meetings continued at the last Friday of every month/ first week of following month until October 2022. The protocols of the minutes of meetings are provided as Deliverable 1.1.

- A combined National and international consortium meeting was organised as an in-person and online event in June 2022 at Vienna, Austria.
- An End-of-Project meeting event was organized again as an in-person and online hybrid event on 20-21 October 2022 at Stavanger, Norway.
- Regular workshops, both online and in-person were organized in cooperation with another ERANet project SONDER, for information and expertise exchange on the topic of Interoperability of systems, within an Energy Community.
- Several dissemination activities were conducted during the last project year
    - A journal paper titled '*Techno–economic simulation and evaluation of scalable 'energy cells' locally generating renewable energy*', was submitted in the journal e&I in the month of August, and was published in the October issue. DOI: https://doi.org/10.1007/s00502-022-01068-3
    - A conference paper titled '*How to make a solar PV-based energy community economically attractive in Belgium?*' and presentation was presented in the WCPEC 2022 international conference in Milan, Italy in the month of September 2022 and was published in the conference proceedings as a paper. DOI: 10.4229/WCPEC-82022-5DV.2.131
    - A conference paper titled '*Self-Consumption and Energy Autarky in Energy Communities – simulation and evaluation of scalable 'Energy Cells' in Austria, Belgium and Norway*' and presentation was presented in the AEIT 2022 international conference in Rome, Italy, in the month of October 2022, and was published in the conference proceedings in IEEE Xplore digital library later in November 2022. DOI: 10.23919/AEIT56783.2022
- The project activities were disseminated during the ERANet P2P feedback sessions with a project pitch, feedback from other projects in the session was disseminated within the project consortium.
- The project activities and results were presented to an international gathering at the ERANet JPPSES Deep Dive sessions in October 2022.
- Green Energy Lab monitoring report for the reporting period was submitted and workshop attended in the month of October 2022.
- The project and the activities were also disseminated through student projects as a part of the master curriculum courses 'Energiesysteme: Ganzheitliche Systementwicklung und interdisziplinäre Bewertung', and 'Energiesysteme: Modellierung und Simulation' at the University of Applied Sciences Technikum Wien, Austria, where the Master students had to design a MATLAB based energy model for selected R2EC testbeds for a techno-economic analysis.

<u>Issues within the final project year:</u>

- Delay of the final user co-creation workshops Belgium (WP3): Due to the delays caused in the Second and Third project years, the final co-creation workshops in Belgium were also delayed and were conducted finally as in person events in the month of May 2022 and September 2022.
- Delay within WP4: Due to the delays reported in the Third interim report, the results of the simulation and the economic analysis, and the subsequent tasks in the WP4 were delayed. Though several workshops were successfully organized in cooperation with project SONDER, the work on interoperability faced severe challenges.
- Delay within WP5: Due to the severely delayed kick-off of WP5, and the WP5 activities being highly dependent on WP3 and WP4, work on the laboratory implementation began in the month of August 2022. Furthermore, due to the complexity of the activities and more complications arising from hardware and software issues, along with other challenges even pushed the activities of the WP5 towards the end of the year.

2. Work packages and milestones

2.1 Synoptic tables

- Explanatory notes:
  The tables are structured according to the funding application.
  Scheduled date: date according to the funding application or according to the contractual project plan.
  Current date: date according to the plan valid at the time of reporting.

Table 2 Work packages

WP No.	Work package title	Stage of completion	Scheduled date		Current date		Results achieved / Deviations
			Start	End	Start	End	
1	Project management and dissemination	100%	04/19	03/22	04/19	10/22	With a 6-month delay, according to the new project plan, planned end was to be October 2022. However, severe delays in WP5 pushed project activities until 01/2023
2	Identification boundary conditions and in-depth analysis of observed energy cells	100%	04/19	04/20	04/19	04/20	No deviations, all planned results could be reached. Deliverable report D2.1 is available. WP2 was finished in the second year.
3	User integration and business model development	100%	04/19	02/22	04/19	09/22	With the delay of the user survey and the development of the Business models, WP3 needed 6-month extension. Work on BMs already were finalized with inputs from WP4
4	Development of concept and simulation of energy cells	100%	11/19	02/21	11/19	05/22	Deviations because of delays in WP3 and the complexity of the simulation. Simulation results completed, Deliverable 4.1 finalized
5	Development, laboratory implementation and testing of required system prototype components	100%	07/20	10/21	12/21	10/22	Further delay as results of BMs needed and work on laboratory implementation began in 07/2022, faced several complications like PV simulator array failures, delayed repairs and server complications – activities extended until 01/2023

6	Knowledge Community Standard Work Package	100%	04/19	03/22	04/19	10/22	Further contribution to ERA Net SES living documents on expera platform of knowledge community, and cooperation from ERANet until end of project.

Table 3 Milestones

Milestone No.	Milestone title	Scheduled date	Current date	Milestone achieved on	Results achieved / Deviations
1.1	Project Start and kick-off meeting carried out	04/19	05/19	05/19	Kick-off meeting carried out in May 2019 successfully with all international and national project partners
1.2	Project successfully determined with final report	03/22	03/22	10/22	No deviations, ERANet report submission deadline extended to 31.01.2023
2.1	Legal, environmental, technical and economic constraints of the energy cells are defined	03/20	03/20	03/20	No deviations, Deliverable report finished
2.2	Renewable energy sources are evaluated and flexibility elements are defined	01/20	01/20	01/20	No deviations, Deliverable report finished
3.1	Key stakeholder for each demo site are identified	06/19	06/19	06/19	No deviations; successful identification of stakeholders for each testbed
3.2	Process design for stakeholder participation is set up	08/19	08/19	08/19	No deviations; successful process design for stakeholder participation
3.3	Starting stakeholder workshop is conducted	09/19	09/19	09/19	No deviations; starting stakeholder workshop successful conducted
3.4	Main stakeholder workshop is conducted	03/21	01/22	01/22	Main stakeholder workshop conducted in Austria (January 2022) and Belgium (May & September 2022).
3.5.	Ending stakeholder workshop is conducted	02/22	08/22	09/22	Additional Final workshop conducted in September 2022
4.1	Detailed concept for regional, renewable energy cells developed	10/20	04/21	05/21	Due to delays in WP3 and due to the complexity of the simulation it took a while to come up with a reasonable definition satisfying all requirements.
4.2	Method for local supply and demand forecasting developed	12/20	07/21	07/21	Deviations because of delays in WP3.
4.3	Simulation of observed energy cells	02/21	10/21	04/22	Deviations because of delays in WP3 and the complexity of the simulation. Simulation results already available, first draft of Deliverable under review.
5.1	Development and implementation of hard- and software for prototype components	10/21	01/22	01/22	Due to delays in WP3 and WP4 in the need of a delay, but online discussions conducted in January 2022, finalized in 09/2022.
5.2	Testing and monitoring of prototype components in the laboratory	09/21	08/22	10/22	Due to delays in WP3 and WP4 in the need of a delay. Further delayed to 01/23 due to unexpected complications.
6.1	Involvement in formative evaluation	03/22	09/22	10/22	Since the project needs an extension of 6 months, the cooperation with ERA-Net was also extended by that time

6.2	Crosscutting Knowledge Community activities	03/22	09/22	10/22	Since the project needs an extension of 6 months, the cooperation with ERA-Net was also extended by that time

2.2 Description of the work carried out during the reporting period

- Describe the work carried out during the reporting period broken down into the work packages.
- Have the work steps and packages been completed according to plan? Have there been relevant deviations?
- The description must also include any changes to the methodology applied (please note: changes to the methodology and relevant changes to the work plan require the consent of the FFG).

Project time plan, Gantt Chart

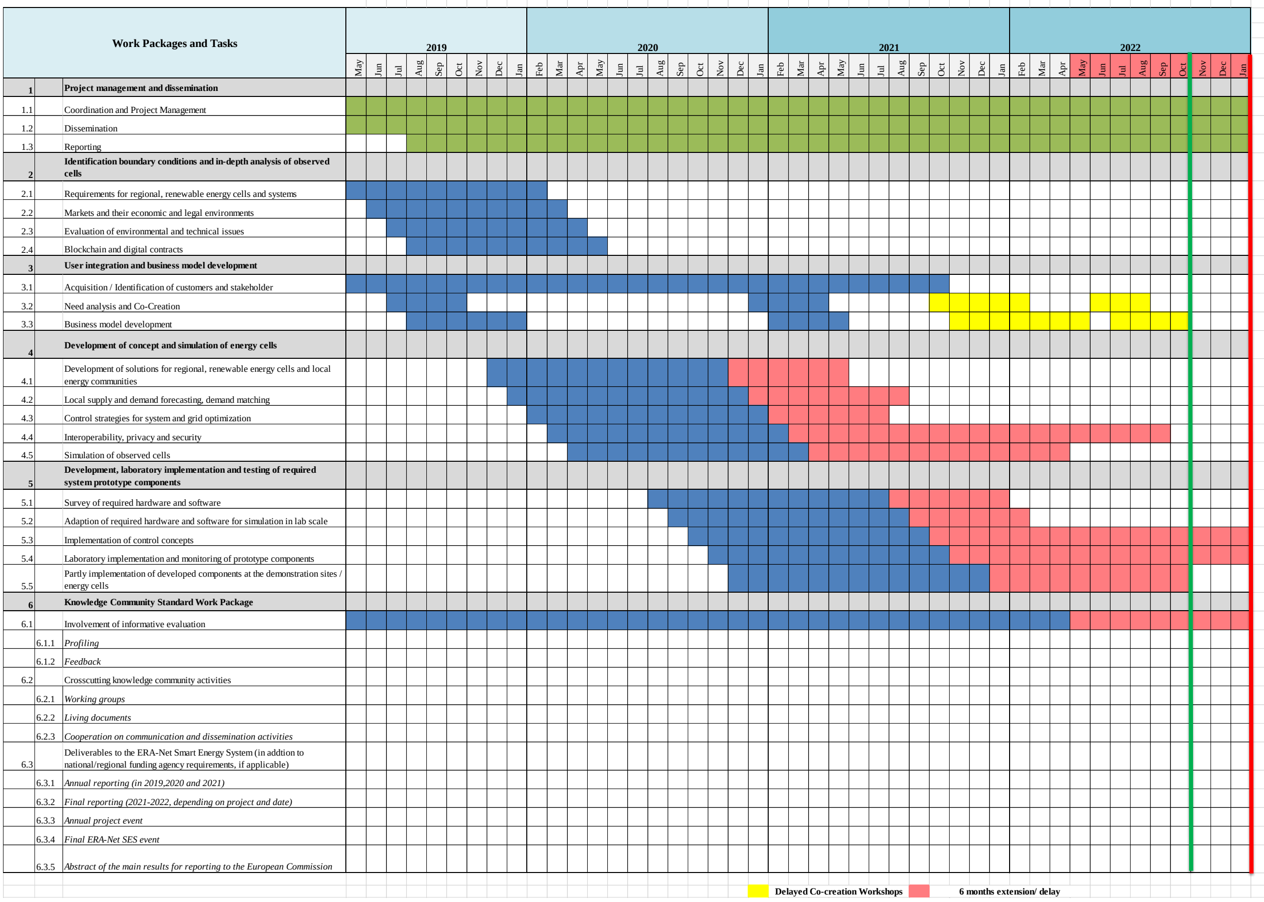

Figure 4 R2EC project Gantt chart / time plan

In the following **Fehler! Verweisquelle konnte nicht gefunden werden.**, the R2EC project Gantt chart / project time plan is illustrated. It shows the needed extensions and delays within the different Tasks. Months marked with red consider the 6-month project extension and the extensions of the WP timelines due to delays within these tasks. The Cells marked in yellow show the delays in the second and the final Co-Creation-Workshop. The green vertical line signifies the end of the project as per original extended schedule (October 2022), and the red vertical line signifies the delays observed within WP5 due to unforeseeable complications (January 2023).

Project deviations

The project activities overall, and the original planned timeline faced several delays due to COVID restrictions as mentioned in the Second and the Third Interim reports.

Within **WP1** the deviations occurred with respect to activities in WP5 being delayed due to unexpected complications arising from the repeated failures and delays with repairs in the hybrid energy lab, where the laboratory implementations were conducted. Furthermore, the planned kick off of WP5 activities was further delayed due to COVID infections at the beginning of the year 2022. However, project management has always tried to stay on schedule, and most of the activities were completed within the original extended timeline (October 2022).

Within **WP2**, there were no significant delays and activities were already completed within the first project year.

Within **WP3**, as previously reported in the Third interim report, several compounded delays resulting from COVID restrictions delayed the conclusion of project activities, and the work on Business models was completed as planned in May/ June 2022.

Within **WP4**, as previously reported in the Third interim report, there were delays, which also delayed the project activities related to the task interoperability.

Within **WP5**, as previously reported in the Third interim report, due to delays in WP3 and WP4, there was a major delay in the beginning of activities, further compounded delays due to repeated failure of the PV simulator array and delay in repairs, and also few server issues.

Within **WP 6** there has been no deviations from the original proposal.

The following section briefly describes the activities conducted in the various work packages in the final reporting period.

WP 1 - Project management and dissemination

The coordination and project management in the national as well as the international project consortium was successfully conducted. The regular monthly online meetings on the last Friday of the month continued until the end of the project in October 2022. With the repeated failure of the PV simulator and repeated delays in the repair process, the work on laboratory implementation was further delayed. In October 2022, the project management coordinated with the ERANet and FFG and the deadline for ERANet reporting was further shifted three months in line with the national reporting deadline at the end of January 2023. Between October and January, work on laboratory implementation further continued at the hybrid energy lab with several interruptions due to the failure of the PV simulator again, and an issue with the server. However, the laboratory implementation was conducted successfully with certain modifications as best as possible within the time available. The final National and international project consortium meeting was organized as both online and in-person hybrid event successfully on 28 July 2022 at the FH Technikum Wien campus in Vienna. Furthermore, an End-of-project in person and online event/ meeting was also conducted on 20-21 October 2022, to finalize the work on the several work packages, at the Norce research campus in Stavanger, Norway. Partners from Belgium, Austria travelled to Stavanger to meet in person and several other partner representatives also took part in the meeting online due to scheduling conflicts. On a monthly basis, every last Friday of the month, a monthly international project consortium WebCo has regularly taken place in order to discuss about on-going activities and exchange information about the activity progress. On an average, around 10 representatives together from the national and international partners have regularly interacted during these sessions, and a detailed minutes of meeting document/ meeting protocol was always shared after the webco with the consortium via Email. These protocols are to be found in the Deliverable 1.1.

There have been several dissemination activities (see also project highlights mentioned above). A Journal paper, and two conference papers were published in the reporting period. The techno-economic simulation results and analysis were published in the e&I journal October edition. A conference paper was presented in September 2022, and was published in the conference proceedings of the WCPEC 2022 international conference in Milan, Italy. Another conference paper was presented in October 2022, and was published as proceeding in the IEEE Xplore magazine, with the AEIT 2022 international conference in Rome, Italy. The project consortium also presented the project and its activities, results and evaluations at the ERANet P2P session in June 2022 and at the JPPSES Deep Dive Session in October 2022. Furthermore, students of the University of Applied Sciences Technikum Wien (master's / bachelor's degree of Urban Renewable Energy Systems / Technologies) worked on student projects as a part of the lecture Energiesysteme: Modellierung und Simulation in the first semester and the lecture Energiesysteme: Ganzheiliche Systementwicklung und interdisziplinäre Bewertung in the third semester. The students in the third semester also interacted with the partner representatives and through them the testbed participants via online surveys as a source of input to their individual projects.

Several initial meetings with concerned project partners were held to work on a follow up project proposal with the already available testbed infrastructure, which resulted in several initiatives for new projects. The interest and motivation for a follow up project was established also among the testbed participants through the final stakeholder workshops. These initiatives were also discussed with the project partners during the end of the project meeting, and will be pursued at the earliest possible time.

WP2 - Identification boundary conditions and in-depth analysis of observed energy cells

WP2 was already concluded at the end of the first project year.

WP3 - User integration and business model development

A major portion of the activities in the WP3 was already conducted, finalized and discussed within the third interim report. The second and third stakeholder workshop and meeting in the Belgium testbed was conducted as in-person event in May 2022 and September 2022 respectively. Within the second workshop, the implementation of the UI web application was announced and was widely disseminated that it would be tested among the participants in the month of August 2022.

The final stakeholder workshop was conducted to gather user feedback from the test week and to further disseminate the project, and to discuss ways to improve the UI application. The evaluation of the short survey conducted in the second stakeholder workshop and the subsequent developments within the project activities, along with the future possibilities to set up an energy community in the test bed was also discussed in detail with the participants.

Business model development Economic analysis:

The overall aim of business model development is to identify what value one can create by optimizing a series of technical and financial parameters within a given framework. The flow chart illustrated below represents the step by step process and the inputs from the different activities in the other work packages to be used in the business model development.

In case of R2EC, the main goals for the business model development were considered to be

- Minimize environmental footprint, mainly through reduced fossil fuel consumption
- Maximize cost efficiency through exploration of potential sources of revenues
- Increase self-sufficiency and reduce grid dependency
- increase user acceptance to foster the adoption of behaviours and investments for renewable energy integration

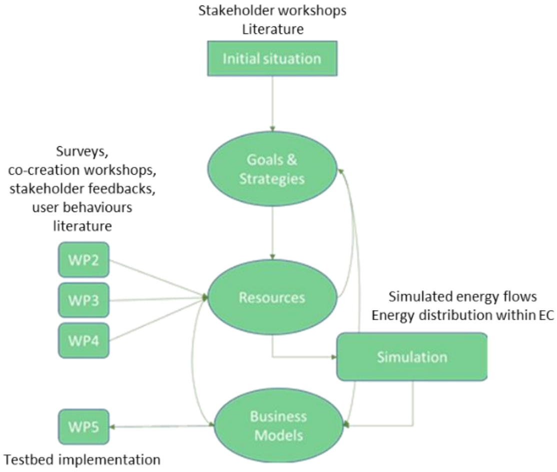

Figure 5 Process flow and inputs from other WPs to the business model development process

Based on the local conditions of the different investigated testbeds, the priorities within these goals may shift - like with a robust regulatory framework and more progress in EC establishments, Austrian region might focus more on maximizing their cost efficiency, while in the Norwegian region where there is no high degree of renewable energy integration, self-sufficiency increase and user behaviour adoption would be prioritized. To quantify and optimize these goals, some key performance indicators (KPI) were identified. The table below gives an overview of the goals, the possible strategies to reach them and the KPIs to measure the effectiveness of the solutions that were investigated.

Table 4 Strategies and KPIs used in quantification and optimizations of defined goals for business model development

R2EC overall goals	***Strategies***	***KPIs***
Minimizing environmental footprint	Maximizing integration of renewable energy Maximizing system efficiency	kg_CO2/kWh
Maximizing cost efficiency	Increase self-consumption and collective self-consumption Load shifting/shaving Interaction between energy cells Existing potential /infrastructure utilization	€/kWh

Reducing grid dependency (guarantee local security of supply)	Local load balancing Energy storage (electric and thermal) System decentralisation/redundancy	Share of the total energy consumed which is produced on-site/year
Maximizing user / stakeholder acceptance	Involve users in the process Raise awareness around energy and sustainability Improve user-friendliness of energy solutions	Number of participants at co-creation meetings Sample size of surveys Number of smart meters

With the inputs of energy flows from the simulations and the investigations for the business model development, the economic analysis of the selected scenarios of the testbeds were conducted with some initial base assumptions, which were mainly derived from the feedback from real Energy Communities, and could be an overestimation in some cases. The base assumptions of electricity tariff, remuneration for grid injection, community management costs and the equipment costs assumed in the course of the analysis are as described in the table below.

Table 5 Table Base case assumptions for the economic analysis

	Austria	***Belgium (Wallonia)***	***Norway***
Energy price (c€/kWh)	7	7	9
Grid injection (c€/kWh)	4	4	3,5
Support mechanism	2 – 3 c/kWh (LEC), 3 – 5,5 c/kWh (REC), Network Tariff exemption	2,5 c/kWh, 'Green Contribution'	None
PV CAPEX (€/Wp) ***(2020/2030/2040)***	0,8/ 0,75/ 0,7*	0,8	-
PV OPEX (€/kWp.a)	8	8	-
ESS CAPEX (€/kWh) (2040)	100	-	-
ESS OPEX (% of initial CAPEX)	1,5%	-	-

**In the 2020 case, the investment premium under the Austrian Renewable Energy Expansion Act (EAG) is considered*

The community management costs in each case was assumed to be 50 €/month, and the cost of each control device was assumed to be €1000 with 10 years of lifetime.

It was observed that under the base assumptions for energy cell management costs, 8 cases out of the investigated scenarios are economically attractive with a net positive cash flow. The considered cost assumptions, along with the addition of battery storage in the year 2040 (assuming expected cost reduction for storage achievable by that year), and under the considered increase in the electrification within the energy cell appears to be profitable in the Austrian region. It was also observed that the test bed scenarios with a diverse consumption profiles, including larger electricity consumers like small industries and businesses gain the most benefit.

However, in the Belgium testbed, where the support mechanisms for energy communities do not include the reduced network tariffs, and where there is no economic interest for individual PV systems to participate to the community, the economic benefit to the participants is non-existent under the base assumptions. A sensitivity analysis was conducted as the uncertainty level concerning management costs and equipment costs in the region was relatively high, and the economic viability was checked. The Norwegian testbed was understandably the least profitable in comparison, with no regulatory framework in place, and very similar consumption and generation profiles within the participants. The improved individual self-consumption with the original base case is already highly economically attractive, which can hardly be improved by creating an energy cell/ community, without a proper regulatory framework. A sensitivity analysis was also conducted, to check if considered cases were economically viable. The business model development and the economic evaluations are described in detail in the Deliverable 3.2.

WP4 - Development of concept and simulation of energy cells

The WP4 activities were almost concluded by the end of the third year and is already described in detail in the Third interim report. However, the WP4 activities concluded later in July 2022 with the finalization of the Deliverable 4.1. The simulation results and the economic analysis of the testbeds were also disseminated through publications (journal and conferences) and also in the JPPSES Deep Dive session in October 2022, and are described in detail within the deliverable 4.1 and 3.2. The simulation results were discussed in detail within the consortium, disseminated to the respective stakeholders in the final stakeholder workshops in Austria and Belgium, feedback was also gathered. The request to simplify and summarize the simulation results was noted, and a summarized table with the quantification of positive effects of establishing an energy community with the R2EC system was generated and disseminated (Tulbing, KEM/Wynergy presented summarized table in one of their gatherings). Further interest in analysis of cross-border interactions of the energy cells was established. Thus, the WP4 activities were extended to include the analysis on cross-border interactions,

Simulation and analysis of interactions between energy cells in different regions:

Further investigations regarding the interactions between the energy cells in the different testbed regions were also considered, as it was found that the consumption and generation patterns had a seasonal and geographical variation. The analysis and the resulting conclusions reflect the real implementations better than the individual analyses of the testbeds. One energy cell from each region are selected for the investigations - St. Andrä Wördern (Austria), Pool 1 (Norway) and Pool 7 (Belgium). As the data for the individual simulations were collected at different timeframes, the simulations for the cross border analysis could only be conducted in the different timeframes. The Norwegian data has a time resolution of 1 hour, in comparison to the 15-minute resolution in the other testbeds. Therefore, the Norwegian data is further sampled by repeating the same power value for all four time steps within the resolution of 1 hour. Based on this sampling, and reference to the other time frames and resolutions in the Austrian and Belgian testbeds, four representative weeks were designed and simulated to analyse the cross-border interactions within the three different testbed regions.

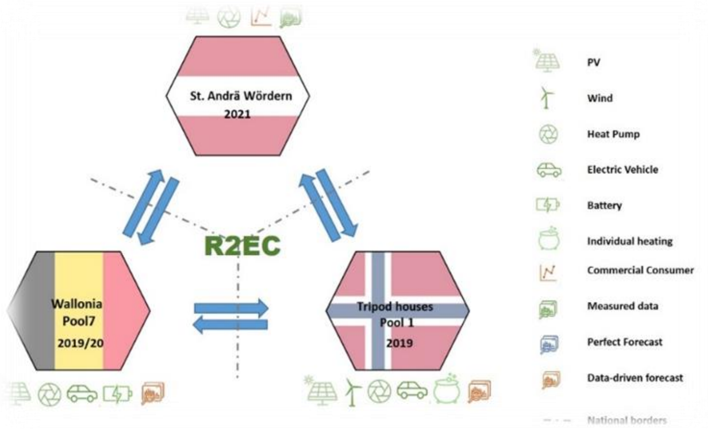

Figure 6 Cross-border interactions of energy cells in different regions

The simulated results of the interactions were also presented and published at the AEIT 2022 international conference in Rome, Italy and in the Deep Dive Session of the JPP SES Annual conference organized by ERANet. Both occasions garnered positive feedback and interest on the results and the analysis.

<u>Interoperability:</u>

In order to enable remote control of e.g. community owned batteries or member-battery capacities made available to the community, the project cooperation between R²EC and SONDER, developed the "Storage Integration Profile: Remote Access to Energy Storage Flexibilities" on the basis of the IES Framework (see: https://www.smartgrids.at/integrating-the-energy-system-ies/technical-frameworks.html). The integration profile specifies the essential functionality, procedures and features required for interoperability among systems to utilize storage flexibilities in a coordinated manner based on the IEC 61850 standard for communication networks and systems for power utility automation. For this purpose, the integration profile specifies the use case, the actors involved, their transactions necessary to fulfil the use case, and the representation of the information transmitted. In addition, Solution Building Blocks were elaborated, which describe the application of the underlying standards to fulfil the required functions. On the basis of the integration profile, implementation tests have been carried out and the interoperability test procedure has been defined for following interoperability tests.

<u>WP5 - Development, laboratory implementation and testing of required system prototype components</u>

<u>Laboratory Implementation:</u>

The compilation of the list of hardware and software, which was the first task within the WP5, was already completed in the third reporting period. However, as a kick off to the laboratory implementation activities, a discussion was held to refresh/update the list. Once the list was finalized, the activities on the implementation of the R2EC system in the hybrid energy lab at the University of Applied Sciences Technikum Wien began after the international consortium meeting in June 2022. The detailed concept of the implementation is already discussed in the Third interim report, and the activities were planned based on this extensive implementation concept.

The system was developed and implemented, based on the requirements and framework conditions that were identified in the course of the project. The goal was to increase the communal self-consumption by coordinated demand side management. In other words, the adaption of the community load profile according to the community generation profile, by making use of the individual flexibilities of member households. The system is based on the assumptions, that energy management can best be performed by energy management systems under the control of the community members and, that cost savings are most effective to motivate a wide range of participants to shift their loads. Therefore, due to the derivability of the resulting individual current electricity price (when the dynamic allocation system is deployed), the current community self-coverage ratio was identified to be a suitable information basis for individual energy management.

Member Energy Management Systems (MEMS) influence the consumption profile of the households based on current community self-coverage ratio provided by the Community Service Provider (CSP) as illustrated in Figure 7.

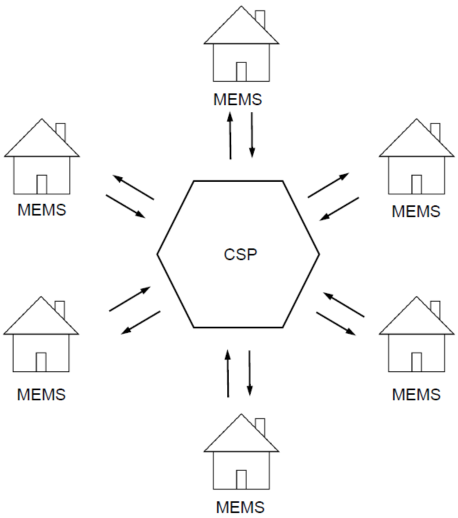

Figure 7: System architecture

The system was implemented in the Hybrid Energy Lab (HEL) - a smart grid laboratory equipment of the University of Applied Sciences Technikum Wien, located in the "Renewable Energy Laboratory" at Giefinggasse 6. The laboratory represents a part of a low voltage distribution grid in which four "prosumer households” (see Figure 8) are equipped with components such as smart meters, inverters, battery storage and variable loads. Smart meters and Raspberry Pi based controllers, which execute load shifting functions based on the information provided by the CSP were installed in the ‘households’.

Figure 8: Hybrid energy lab

The CSP was implemented with the plant monitoring software Reisenbauer Multiserver. It provides the visualisation of the system (as shown in Figure 9) as well as the required information basis for individual energy management. The visualisation is intended to inform and encourage potential users to reflect on their consumption behaviour and to influence their behaviour regarding manually triggered processes like cooking, the making of laundry, vacuuming, and the like.

Figure 9: System visualisation

The laboratory infrastructure allows the simulation of different generation and load situations through the use of controllable loads and PV simulators. In this way, specific consumption or generation of the individual households can be specified independently of the real generation of the integrated PV system in order to investigate the system behaviour. Pluggable devices as well as a battery storage system can react to the community self-coverage ratio as defined in the load shifting conditions.

<u>Testbed implementation:</u>

In order to investigate user behaviour, especially the demand shifting potential that can be harnessed by influencing the user behaviour through visualisation and information, the UI webpage application ‘Community Forecaster’ was implemented in the Flobecq area of the Belgian testbed during the month of August 2022. The figure 7 gives a representation of the UI web application which was designed by the Belgian partner GreenWatch.

Figure 10 UI web application 'Community Forecaster' used in the Belgian testweek
(https://communityforecaster.greenwatch.be/home/flobecq)

The UI web application 'Community Forecaster' was designed to provide information on the best times to self-consume the PV generation, based on the weather forecast data. The application provides information in specific timeslots during the day if there was generous surplus local generation (green- best times for self-consumption), moderate local generation (yellow - also times for self-consumption), no local generation (orange) and DSD Warning (red – do not self-consume). During the planning of the test week, there were positive expectations of co-ordination with the local DSO ORES to provide feedback with consumption data during the test week, but despite several attempts of communication, the consumption data was not obtainable by the Belgian partners. However, the user statistics of people connected to the app during the test week was finalized in the third and final stakeholder workshop, and user feedbacks were collected. The user feedback showed that the information provided by the application during the test week was already quite easily known and thus of limited interest. This was mainly because the weather was sunny throughout the duration of the test week, most of the participants already expected the times of excess generation and were aware of the times to self-consume their generation. Though this was the general idea, it was also observed that some of the participants changed their consumption patterns, but mostly because of the energy crisis created by the ongoing Ukraine-Russia conflict and very high energy prices. They were found to mostly reduce their consumption in general, rather than shift their consumption to different times. However, the participants showed interest in the information that the application could provide them in the case of the presence of a battery system, and also that the information provided by the application in a season with limited sunlight. The further steps to set up a community was also discussed during the event, as there is also a delay in the expected framework rollout which enables the possibility to form an EC, and the participants were disappointed that the project duration had ended before the decree was actually passed. The participants strongly expressed interest of their participation in a follow up project to R2EC, if and when such a project would be proposed.

Gathering the user statistics was one of the major goals of the test week, and though the consumption data from the local DSO was not obtained (which would be needed for the in depth analysis of the individual and collective user behaviours), the user statistics shed light on several important aspects. Though more users connected to the web application in the beginning of the test week, several spikes in the number of connected users were observed, mainly when the reminder email was sent to the participants (mailing list was designed to send to a maximum of 30 people at a time). This showed that the users, who initially had high interest had to be reminded to use the application to check the times of higher forecasted generation to self-consume their generation at the latter part of the test week. The user statistic gathered is as described in the figure below.

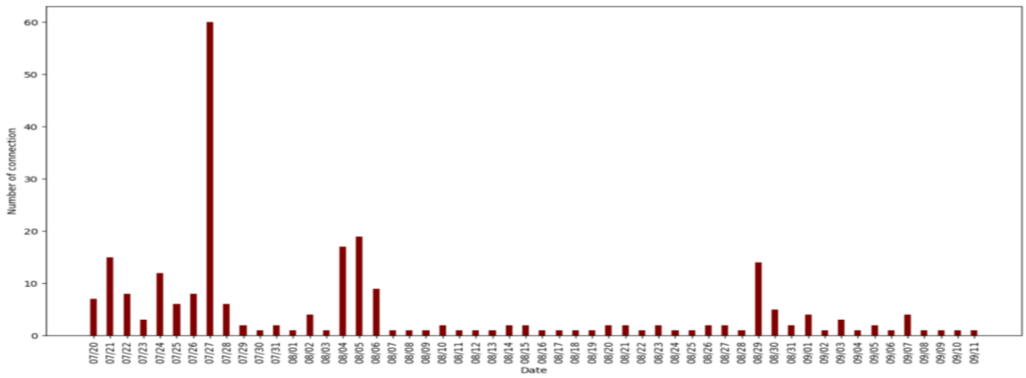

Figure 11 Number of users/participants connected to the web application through the duration of the test period

Another interesting user statistic is the time slot during which the users connected to the application. It was expected that more users would connect/use the application in the morning or in the evening, but it was observed that the usage was sufficiently well distributed during the day. Though more users tended to use the application during the day, there were significant number of users who also accessed the web application very early in the morning or late in the night. This shows the interest and the intent of the users in using the application for the useful information provided through the web application. The statistical distribution of users throughout the timeslots in an average day is as shown in the figure below.

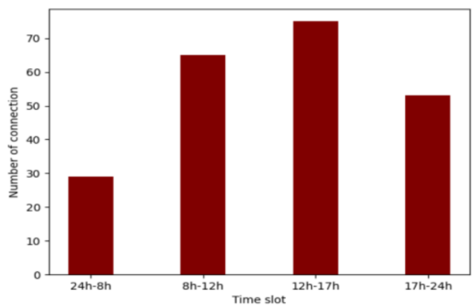

Figure 12 Timeslots within an average day when the users accessed the web application

With the feedback from the test week, it was conclusive that the application could be soon forgotten after a brief period without the sending of regular reminders to the participants to check the information on the application at certain times. Two possible improvements were suggested as solutions to this problem:

- An automated notification system that would be designed to notify the participants every day with the preferred times of self –consumption for the day.
- To get participants more involved through the implementation of a more complex version of

the application providing more useful information to the participant.

These solutions were discussed during the monthly meeting and it was decided that though an automated notification system would be really helpful to the participants, there was not enough time to implement the notification system. Thus, a second version of the application was designed with a new interface. The second version of the Community Forecaster application can be seen as illustrated in the figure 8 below, which was developed as an improvement to the initial version tested.

Figure 13 UI web application 'Community Forecaster' used in the Belgian test week

In the second version of the application, the users/ participants would have to register and add all the devices they normally prefer to use at a preferred time. In this case, every time the user would want to start using a device, they would need to request/ consult the application for the preferred time to start the device, at the bottom of the UI screen as observed in the figure. The main advantage in this case is to have a better knowledge of the future consumption and then adapt the forecast in real time with those data. The main drawback is that many users do not want to register to an application and manually perform the necessary steps every time they plan to start a particular device- ex. their washing machine, even if the whole process would only take less than a minute.

WP6 - Knowledge Community Standard Work Package

The project pitch was presented and the activities conducted during the 2021/2022 were disseminated in the ERANet P2P feedback sessions, where interactive discussions within several ERANet projects created an opportunity for valuable feedback on the pitch presented.

The project partners actively contributed and participated in the various knowledge community meetings and activities, and also contributed actively as required to the living documents on the Expera platform. The active contributions within the taskforce Energy Communities (Local Energy Communities: Policy Recommendations 2021 - B: Regulatory Framework), the Working Group System Architecture and Modelling, and the Working Group Regional Matters, was recognized during the working group meeting closing co-creation cycle, and a final review and discussion of the 2022 spotlights edition during the Joint Programming Conference Smart Energy Systems 2022 in

October. The project's contributions to the Policy Brief Draft for the Working Group Regional Matters, was also recognized and summarized during the event. The project activities and results were also presented during the Deep Dive sessions held during the online event. Furthermore, any and all information received by the project management from knowledge community was always actively and timely disseminated to the national and international partners.

Changes in the course of the project

- Are there any changes? What effects do they have? How does the plan need to be adjusted?

Due to several delays within the project, mainly because of the ongoing covid19-pandemic, the project was **extended by 6 months from May 2022 to October 2022**. Due to unforeseen complications, the activities of the WP5 had to be further delayed, so an extension to the deadline for the submission of the ERANet final report (until 31 January 2022) was requested and granted after consultation with the national funding agency. The exact extension of each Tasks and work packages in R2EC can be seen in Chapter 2.2.

3. Project team and cooperation

- Have there been major changes to the project team (internal key personnel and third party service providers)?
- For consortium projects: describe the cooperation within the consortium.
- Please describe changes in the work allocation. Do they have an effect on the cost/financing structure and objectives?

The cooperation within the consortium (national and international) worked as planned and according to the project communication plan. Though there were challenges to communication during the COVID crisis, and also during the aftermath, there was frequent exchange and communication happening between WP leaders and experts, as well as between the consortium leader and WP leaders. Within monthly WebCos for the entire project consortium, ongoing activities and urgent matters were discussed.

4. Final Report only: Dissemination and exploitation

- Describe the exploitation and/or dissemination activities carried out so far. Is it possible to exploit the project results?
- List all publications, PhD theses, diploma theses and patent applications that have resulted from the project.
- What further R&D activities are planned?
- How will the prototypes created during the project be used further?

The project was extensively disseminated through newsletters, newspaper/magazine articles, journal publications, conference publications, student bachelor and master theses, and dissemination through lectures at the FH Technikum Wien.

The following peer reviewed publications have been achieved through the project:

- Weissenbacher, Nacht, Pratter & Schloffe, '*Evaluation of data quality of energy cells in the project R2EC*', e.nova International Conference, 26 - 27.11.2020, Conference proceedings, ISBN 978-3-7011-0460-4, volume 24, p.33.
- Bhat, K.S., Ganglbauer, J. & Bosch, E. *Techno–economic simulation and evaluation of*

scalable ‘energy cells’ locally generating renewable energy. Elektrotech. Inftech. 139, 612–620 (2022). https://doi.org/10.1007/s00502-022-01068-3

- P. Macé, E. Bosch, M. Aleman, ‘*How to Make a Solar PV-Based Energy Community Economically Attractive in Belgium?*’, 8th World Conference on Photovoltaic Energy Conversion, 5DV.2.131, p. 1687 – 1690, DOI: 10.4229/WCPEC-82022-5DV.2.131
- K. Subramanya Bhat, J. Ganglbauer and M. Tragner, "*Self-Consumption and Energy Autarky in Energy Communities – simulation and evaluation of scalable ‘Energy Cells’ in Austria, Belgium and Norway*," 2022 AEIT International Annual Conference (AEIT), Rome, Italy, 2022, pp. 1-6, doi: 10.23919/AEIT56783.2022.9951768

The following Bachelor, and student projects have also been achieved through the project:

- ‘V2G and V2H applications for energy communities – A R2EC testbed Tulbing case study’ - a student group project where a MATLAB based energy model was designed to investigate the technological, economical, ecological and social aspects of V2G and V2H processes in the R2EC testbed in Tulbing, Austria.
- ‘Socio-economic exploration and evaluation of national strategies for PV expansion in Belgium - A R2EC testbed example’ - a student group project a python based energy model was designed to investigate the designed strategy based scenarios of net-metering, peer to peer trading and a shared generation for the investigation of socio-economic aspects, based on technological simulation outputs.
- Bachelor thesis on ‘Energy Communities and the Importance of User Integration’ at the FHTW
- Student group project ‘Zielgruppenanalyse Datenanalyse zu Barrieren und Teilnahmegründen an Energiegemeinschaften’ (Target group analysis Data analysis on barriers and reasons for participation in energy communities) as a part of the masters program at the UASTW

Several initiatives were initiated and meetings held to further the R&D activities through a follow up project. The talks for these initiatives are underway, and planned to continue after the end of the project. These initiatives are based on the utilization of the infrastructure already installed at the testbeds in Austria for the project R2EC like smart meters, controllers, laboratory setups etc., in follow up projects which would include activities on testbed implementation of smart energy concepts and systems in energy communities.

The R2EC system prototype implemented in the laboratory implementation task in the WP5 can and will be used in the possible follow-up project, once the discussion regarding the project are finalized. As of now, a simple control strategy is implemented in the laboratory due to major challenges with hardware and software, however, with the experience gathered in the hybrid energy lab, the outputs of tasks 5.2 and 5.3 will be further used to implement model predictive control (as discussed in the implementation concept) and the prototype will also be used in a supporting role in other research projects on energy communities. The UI web application will be further developed independently or in the follow up project, using the user experience feedbacks from the R2EC test week and stakeholder interaction in Belgium.

5. Costs and financing

Overall, the **National consortium** reported a total cost of € 115804, among which 63.65 % of the total cost came from the research organization partners, and the rest from the industrial partners (36.35%) and others (0 %). Comments on cost can be found in Chapter 6 of this report.

The **FHTW** reported a cost of € 52140, out of which €46583 came from personnel costs, € 3179 came from material costs, and € 2378 came from travel costs (Conference and end of project event). Further comments on cost are found in Chapter 6 of this report.

4ward Energy Research GmbH reported a total cost of € 21567, out of which € 21222 came from personnel costs, and € 345 came from travel costs. Comments on costs can be found in Chapter 6 of this report.

Efficent Energieeffizienz reported a total cost of € 31109 during the reporting period. Personnel costs accounted to € 25540, material costs € 3069 and travel costs € 2500.

EVN AG reported did not report any costs for the current reporting period.

KEM/Wynergy e.U. reported a total cost of € 9982, of which € 9888 came from Personnel costs, and € 94 came from travel costs. Comments on costs can be found in Chapter 6 of this report.

The **TPPV** – Österreichische Technologieplatform PV did not report any costs during the current reporting period

6. Explanatory notes on cost

- The accounts must be uploaded as a separate file in Excel format. Use of the eCall template provided is mandatory. Please observe the cost guidelines (www.ffg.at/recht-finanzen/kostenleitfaden) and the call documents.
- Deviations from the cost plan must be described and substantiated.

Any major cost reallocations must be substantiated in the report. The relevant cost reallocation table (www.ffg.at/Kostenumschichtungen) must be uploaded as an annex to the report.

FHTW: The costs are well within the planned budget. In the category material costs, there is an entry named "Vorsteuer", which is related to an entry from the previous interim report (Konzeptentwicklung Community Platform) where tax was accidentally deducted in the entry. The tax has been added as cost (€ 2812.50) in this report.

4ward Energy Research GmbH: Regarding the statements in the 1st, Second as well as Third interim report (...the personnel costs in WP1 "Project Management and Dissemination" are significantly higher than planned...) the following has to be added or corrected:

The personnel costs in WP1 (approx. 21,000 EUR) are approx. 16,000 EUR higher than planned. This is due to the fact that many of the discussions, meetings as well as coordination originally planned for individual WP have taken place within the framework of WP-overlapping meetings. Their costs were allocated to WP1. Therefore, in almost all other WP the accounted costs are lower than planned. The total personnel costs are approx. EUR 5,500 higher than planned, this can be compensated by a saving in travel costs (mainly COVID-related)

EffiCent Energieeffizienz Dienstleistungen GmbH: No comments on costs yet

EVN AG: No reported costs during the reporting period. All costs were within the budget and no deviations from planned costs.

KEM / Wynergy e.U. : Due to the extension of the R2EC project and the Covid19-related shifts in content, there have been changes in the effort for the individual work packages compared to the original submission: Due to the omission of the in-person international meetings and the change of the monthly consortium meetings to online meetings, the position of travel expenses is significantly reduced. In return, there has been significant additional effort in WP1 specifically due to the extension of the project. Instead of the reduced hours in WP2 due to the COVID situation, KEM/ Wynergy was intensively involved in WP06 and participated in several international meetings and contributed to the development of the Living Documents.

TPPV - Öst. Technologieplattform PV : There were no reported costs in this reported period, and no deviations from the planned costs.

7. Specific conditions and requirements

- Please elaborate on any project-specific conditions and requirements (acc. to §6 of the funding agreement) specified in the funding agreement or contract for work or services.

1. Vor Auszahlung der Startrate hat der österreichische Partner bzw. die Konsortialführung der österreichischen Partner zu bestätigen, dass vor Beginn des Vorhabens eine Kooperationsvereinbarung existiert hat, in der die laut Unionsrahmen notwendigen Regelungen vereinbart wurden.
   - Kooperationsvereinbarung liegt vor.
2. Vor Auszahlung der Endrate ist nachzuweisen, dass ein von allen Projektpartnern erstellter publizierbarer Endbericht sowie eine Kurzfassung der Projektergebnisse im Format der Europäischen Kommission vorliegt. Der publizierbare Endbericht umfasst eine Darstellung aller wesentlichen publizierbaren Ergebnisse, der Arbeiten in den einzelnen Arbeitspaketen und eine Ausblick, wie die gewonnenen Erkenntnisse verwertet werden sollen.
   - nicht zutreffend für den ersten Zwischenbericht.
3. In allen Publikation ist in folgender Weise auf das ERA-NET Smart Energy Systems hinzuweisen: „This project has been funded by partners of the ERA-Net SES 2018 joint call RegSys (www.eranet-smartenergysystems.eu) - a network of 30 national and regional RTD funding agencies of 23 European countries. As such, this project has received funding from the European Union’s Horizon 2020 research and innovation programme under grant agreement no. 775970."
   - Verweis auf ERA-Net Smart Energy Systems hat in allen bisherigen Publikationen stattgefunden.

8. Reportable incident

Have there been special events or incidents concerning the project that must be reported to the FFG, e.g.

- changes in legal or economic influences on the funding recipient
- bankruptcy proceedings
- incidents that delay or prevent the performance of the funded work
- additional funding for this project

3-month extension to ERANet reporting deadline: Delayed Laboratory implementation due to repeated failure of PV simulator and repeated delays in repairs.