



LIFE19 CCM/AT/001226

Mid-term Report
Covering the project activities from 01/07/2020 to 31/10/2021

15/02/2022

LIFE 3R «LIFE Retradeables»

Data Project

Project location:	Vienna (AT), Athens (GR), Bratislava (SK), Czech Rep (CZ), Hungary (HU)
Project start date:	01/07/2020
Project end date:	30/06/2023 Extension date: <dd/mm/yyyy>
Total budget:	€ 2,921,204
EU contribution:	€1,591,536
(%) of eligible costs:	55.00% of total eligible budget

Data Beneficiary

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2. List of key-words and abbreviations

3R = Recover, Recycle and Re-use

F-gases = Fluorinated gases

CO₂= carbon dioxide

GHG = green-house gas

SK = Slovakia

CZ = Czech Republic

HU = Hungary

AC = Air conditioning

HFC = hydrofluorocarbons

GA = Grant Agreement

HVAC-R = heating, ventilation, air conditioning and refrigeration

GC = Gas chromatography

GPG = Good Practice Guidelines

KPI = Key Project-level Indicator

GDPR = General Data Protection Regulation

EU = European Union

DACE =Daikin Airconditioning Central Europe HandelsmbH

DENV = DAIKIN EUROPE N.V

MAT4NRG =Gesellschaft für Materialien und EnergieanwendungenmbH

NTUA = National Technical University of Athens

LSBTP = Laboratory of Steam Boilers and Thermal Plants

3. Executive Summary

The main objective of LIFE 3R is to develop an innovative F-GAS CIRCULAR ECONOMY ECOSYSTEM based on a Self-certification platform with reliable F-gases declaration for composition/recovery/recycling; F-gas identification and recycling IOT equipment; and a 3R Marketplace platform to support and guide EU companies to Recover, Recycle/Reclaim and Re-use F-gases. LIFE 3R project will contribute to the depletion of fluorinated greenhouse gases (F-gases) by reducing the non-proper treatment of F-gases at the end of the lifecycle in Air Conditioning and Refrigeration equipment, recycling 1.485 metric Tons of F-gases, which means 3,1 MILLION TON EQ. CO₂. The demonstration will be at national level in 3 member states: Slovakia (SK), Czech Republic (CZ) and Hungary (HU). To develop the innovative F-GAS CIRCULAR ECONOMY ECOSYSTEM, **the specific objectives are the following:** **O1: To develop a new market for recycled F-gases in Europe towards 3R Marketplace platform**, mobile optimised offering SELLERS: primary air conditioning (AC) and refrigeration sector; and BUYERS: F-Gas Distribution companies a reliable trade in real time and onsite guaranteeing legal frameworks, secured payments, transaction methods with transparency standards of recovered F-gases. **O2: To develop a Self-certification scheme** supported by professional laboratory testing done by the distributor companies. A **coherent and robust methodology** allowing to track F-gas handling within all European markets. A **database** (a F-gas logbook/**Self-certification platform**) will be developed where all stakeholders (mainly installers) could insert prerequisite and optional additional details per retrieved / analysed/ classified batch of F-gas quantity. **O3: Efficient recovery/recycling reducing 80% of raw materials (594 Ton/year)** towards updated characteristics and **IOT functionalities** in the equipment allowing installers to analyse the composition of the refrigerant gas on site prior to the recovery and upload data automatically to the self-declaration Platform. Based on the outcome of the analysis, the same equipment will support the recovery and recycling or only the recovery of the refrigerant, if reclamation is required. **O4: Raising awareness and stakeholder involvement** through training campaign to 600 individuals in demo countries (Life training and webinars). **O5: To boost overall competitiveness; 3 new direct jobs (DENV) and 69 indirect direct jobs** due to the increased recovery F-gases activity. LIFE 3R will close the loop for trading F-gases (demand-recycling-offer) **contributing to the HCF phase-down**.

The project key deliverables are considered to be: LIFE 3R (Retradeables) website, Market study, Marketplace Platform, Monitoring methodology and tools, Laboratory test of the unit, Prototype unit that can identify R32, R134a (pure HFC) and performance assessment, Prototype unit that can identify blends (R410A, R404A, R407C) and performance assessment, IOT functionalities on the prototype unit, Database structure, Environmental and socio-economic impacts (1st, 2nd and final report), Replication and transferability plan and Stability check of platforms.

The work progress of the project during the Mid-term reporting period (M1-M16) has been in line with the Grant Agreement (GA). All objectives/tasks were successfully met, all deliverables were completed and the milestones planned for this period have been achieved, too. The only exception includes the milestone "Prototype unit for identification and removal of Oil and Moisture" (ongoing activity). The reasons for this delay are the global chip crisis also affecting the HVAC-R manufacturers, the Suez Canal blockage and their subsequent impact on the supply chain (e.g.: lack of containers to ship goods and consumables). As the world shut down because of the COVID-19 pandemic, many factories closed with it, making the supplies needed for chip manufacturing unavailable

for months. Increased demand for consumer electronics caused shifts that rippled up the supply chain. Orders began to pile up as manufacturers struggled to create enough chips to meet the new levels of demand. Regarding the project, the main effect of the existing chip shortage is that some products were delayed, thus partially hindering the smooth development of the prototype units. Due to this emergency, two relevant deliverables have also been rescheduled for the next reporting period (Deliverable: "Prototype unit that can identify R32, R134a (pure HFC) and performance assessment" and Deliverable: "Prototype unit that can identify blends (R410A, R404A, R407C) and performance assessment"). All the above mentioned deviations are independent of the other project actions. Consequently, it is important to say that these deviations will have no impact on the project.

The major achievement of the first months of the project was the realization of the Retradeables Marketplace platform. During the preparation and launch of Retradeables platform, we encountered different legal frameworks regarding the definition and handling of used refrigerant in our three pilot countries – Slovakia, Hungary and Czech Republic. In Hungary and Czech Republic such a refrigerant is declared as waste, which restricts its handling, while in Slovakia recovered refrigerant from the unit is not immediately declared as waste and represents a valuable resource. Generally, we lobby for a uniform EU regulation that recovered refrigerant should not automatically be classified as a waste unless the holder declares it as a waste. By not being classified as a waste, we avoid all barriers which waste regulation brings, and we would be able to stimulate circular economy of the refrigerants and open new opportunities for our project. Efforts are being made to escalate the issue of 'refrigerant not being a waste' to EU authorities to work towards a common EU legal frame for the recovered refrigerant, in order to support circular economy. A unified EU regulation, with a precise definition that recovered refrigerant is not a waste unless holders decide to declare it as waste, would be a great support for the circular economy of refrigerants. By removing existing barriers to the domestic and international trading & transport of refrigerants (of course, suitable for recycling or reclaiming), we enable the reuse of existing resources, increase the amount of reclaimed refrigerant, open-up additional commercial and business opportunities for SMEs, in line with EU's strong determination to support circular economy. Next to this, we will further stimulate business activity with used refrigerants, reduce the risk of refrigerant release into the atmosphere (reduced leakage rate, since the refrigerant will have a value) and improve cross-border refrigerant circulation in the country and in the EU and reuse of refrigerants – increasing the amount of reclaimed refrigerants and thus the success of circular economy.

Regarding the technical part, during the first 16 months of the project, several tasks were running in parallel and were successfully finalized. In Action C1, a coherent and robust methodology & Good Practice Guidelines (GPG) -for the installers - were developed to provide the knowledge and define the practical skills to sample, analyze and characterize the F-gas. In Action C2, a method for the estimation of the composition of refrigerants using gas chromatography was developed. Intercomparison tests with a Mastercool Analyser tool showed that the Gas Chromatographic method is ca. 10 times more sensitive than the tool. In Action C3, the first functional version of the 3R (Retradeables) Marketplace platform as a web application (general set-up and architecture) was completed, including both front-end (client side) and back-end (server, app, database). The F-gas circular economy ecosystem was designed. An indicative questionnaire model was developed for the upcoming online surveys towards simple users. This follow-up action is expected to start by the end of Q1 2022. Once a year, the results of the answered questionnaires will be analysed and taken into account in project

development decisions. Moreover, face-to-face interviews will take place as soon as the Self-certification and 3R Marketplace platforms are functional enough to allow reliable real-time and on-site transactions between installers (Daikin partners) and distributors in each of the 3 demo countries (SK, HU, CZ). A questionnaire model with 13 questions was developed as a guideline for this purpose. Since the first interviews with key users are envisaged for Q3 2022, an update is more than likely. In Action C4, Market study has been completed and plays a guiding role in the implementation of exploitation strategy, transferability and IPR analysis as well as replication and transferability plan. A basic estimation is that the final version of 3R project is capable of limiting the annual bulk imports in the range of 20% by mass when being scaled to all European member states markets. Preventing greenhouse gas emissions as well as mitigating dependence in bulk gases by non-European countries (mainly from China, United States and Japan) are some other positive aspects. In Action D1, the methodology and tools for project monitoring were defined to ensure the effective follow up of the intended results during the project and 5 years after the end of the project, respectively.

Regarding the communication part (Action E1), the trademark registration was finalized. The project's LinkedIn account, YouTube channel, and website are operational (link: <https://retradeables.com/>). The Retradeables trading platform launched. Among the rest of the actions for Communication, training campaigns (at this stage consist only of webinars) planned for each demo country. The training campaign structure and material have been completed.

All necessary actions for the project management and coordination were undertaken (Action F1). The coordination of the consortium is running smoothly with good understanding and collaboration between all partners towards the achievement of the objectives according to the Work Plan. KPIs (baseline) recorded through the KPI webtool.

The work quality has been ensured through regular and systematic monitoring processes that have been organized by DACE with the support of each partner responsible for the main tasks. Milestones and deliverables have been and shall be the primary basis for progress monitoring until the end of the project. The Action leaders are responsible for the detailed coordination, planning, monitoring and reporting of the tasks in their Actions. Regular teleconferences and e-mail communication between the coordinator and Action leaders have helped to monitor progress and resolve any issue that arises. Regarding the financial part, the progress has been in line with the budget, the proper implementation of the work plan and the achievement of project objectives.

4. Introduction

F-gases are a family of man-made gases used in a range of industrial applications, are powerful greenhouse gases, with a global warming effect up to 23.000 times greater than carbon dioxide (CO₂). F-gas emissions have increased by 60% since 1990, in contrast to all other greenhouse gases, meaning that the F-gas emission levels need to be drastically reduced. The EU has taken regulatory measures to control F-gases as part of its policy to combat climate change. To this end, the Life 3R project is considered to significantly assist in the alternative management of used F-gases.

In particular, the main objective of the project is to develop an innovative F-GAS CIRCULAR ECONOMY ECOSYSTEM based on 3 key elements: a Self-certification platform with reliable F-gases declaration for composition/recovery/recycling; F-gas identification and recycling IOT equipment; and a 3R Marketplace platform to support and guide EU companies to Recover, Recycle/Reclaim and Re-use F-gases.

The LIFE 3R project has the potential to enable the development and demonstration of innovative climate change mitigation technologies, systems, methods and instruments that are suitable for being replicated, transferred or mainstreamed. Specific replication measures are envisaged within the project by collecting during demos the necessary requirements from the different stakeholders and by standardising the entire ECOSYSTEM. As a proof of concept, a consistent replicability and transferability plan has already been defined. In addition, the project uses dedicated measures for promoting knowledge, dissemination of information and stakeholder involvement.

The 3R ECOSYSTEM is the first demo project focusing on a solution to solve a current problem in accordance to EU climate initiatives of the F-gases phase-down. This will be achieved by generating data that is almost unavailable today as there is no centralised platform to process it and providing a clear aggregated overview of the F-gas volumes across all markets, given that installers are responsible for keeping a logbook of their F-gas usage. This data will be integrated into the 3R Marketplace platform, allowing a database of all transactions, including the quantity and quality assumed by the installers and, on the other hand, enriching this data by including the validation of the handled F-gas.

In addition, the project is expected to contribute to the reduction of emission of F-gases to the atmosphere mainly focusing in pure HFCs like R32 or R134a, and also in HFCs blend like (R410A, R407C and R404A). Specifically, it is estimated that 1.485 metric Tons of F-gases (REDUCTION OF 3,1 MILLION TON CO₂ EQUIVALENT) will be recovered and recycled/reclaimed during the 3 demos (2021-2023). Moreover, the 3R ECOSYSTEM will be replicated in 13 countries, leading to a total recovery and recycling/reclamation of 32.000 Tons of F-gases after 5 years (REDUCTION OF 65 MILLION TON CO₂ EQUIVALENT).

Therefore, LIFE 3R will act as a catalyst to promote the integration of climate objectives into other EU policies and private sector practices and contribute to the reduction of greenhouse gas emission for 2030 by 40% through the phase-down of HFC. The circular economy model served by the 3R ECOSYSTEM will be essential for the transition to a low-carbon economy in compliance with the Framework strategy for a resilient Energy Union with a forward-looking climate change policy, the roadmap for moving to a competitive low-carbon economy in 2050 and the EU strategy on adaptation to climate change.

LIFE 3R will also develop, test and demonstrate a new approach to F-gas management which is expected to ultimately lead to best practices and solutions for reducing greenhouse gases emissions. Then, the certification and standardisation measures supported by the 3R ECOSYSTEM (i.e. Self-certification schemes) are expected to promote the joint development of new policies.

Overall, the launch of the 3R ECOSYSTEM will bring a 1 new business model through the 3R Marketplace platform that provide full transparency about Acting parties, Volumes & types of Refrigerants, Prices, Availability of Refrigerants. In the meantime, innovative SELF-CERTIFICATION & SELF-DECLARATION SCHEMES will be established, involving installers to implement the proposed methodology and access to the database created in LIFE 3R to insert all the necessary data, acting responsibly through a real-time and on-site self-declaration scheme. All these will foster the use of high-quality, cost-efficient recycled F-gases and an accurate database of information.

5. Administrative part

The project is coordinated/managed by DACE. Regular online meetings are held with all beneficiaries and e-mail communication between the coordinator and WP leaders and final decisions are taken after discussion with all beneficiaries. During the project, extra meetings have been held to help beneficiaries deal with the financial and administrative aspects of the LIFE programme. Regarding the management of information, DACE has created an online platform where all the administrative and financial archive of the project is uploaded, with access to all beneficiaries. Financial and administrative information is regularly updated to this platform. The structure of this platform is the following:

- Folder 00/Project Material: Includes general material of the project (promotional material - leaflets, project logo, etc, participants' contact list and logos, templates for documents and presentations)
- Folder 01/Actions: Contains common material for each action like draft versions of deliverables, diagrams, results, etc.
- Folder 02/ Deliverables: Contains final version of deliverables
- Folder 03/ Reporting: Contains reports and related files
- Folder 04/Meetings: Contains material of project meetings (presentations, minutes, photos, etc)
- Folder 05/Dissemination Activities: Contains material from events like workshops or participation in exhibitions where LIFE 3R material has been promoted, or copies of any announcement/publications in media
- Folder 06/EU Documents: Contains useful documents like Grant Agreement and project proposal
- Folder 07/Planning and Communication: Contains material for the planning of the project like current state of current and coming deliverables, Gantt chart, list of emails
- Folder 08/Publications: Contains journal publications connected to the project results.

The communication with the external team from NEEMO is very regular on an e-mail and call/chat basis, and yearly, online meetings are organised (face to face meetings replaced with online due to Covid) with the monitoring expert. The monitoring expert has provided constant, prompt, and highly helpful support, and communication with EC was conducted in a highly effective manner. All of the team's inquiries were addressed in an efficient timely manner.

Although the project is well on track, the global chip crisis, that also affecting the HVAC-R manufacturers and their supply chain capability, caused a delay in the project's prototype development process. However, it is important to say that the "prototype development" tasks are independent of the other project's actions. Consequently, these delays will have no impact on the project. In general, great efforts are being made from all beneficiaries to meet all objectives and carry out the activities according to the initial programming. Thus, there are no noticeable delays in the General Timeline.

In the next reporting period (December 2021), one Amendment to the Grant Agreement (change of the project acronym) will be requested. The project acronym will change from "LIFE 3R" to "LIFE Retrtradeables". The change of the acronym from LIFE 3R to LIFE Retrtradeables is necessary to align with the official name of the online trading platform, our social media accounts and other marketing activities. 3R stands for Recover, Reclaim & Re-use and was more of a working title during the application phase. This modification will not impact the normal running of the project.

6. Technical part

6.1. Technical progress, per action

C. Implementation actions

ACTION C1: Self-certification & Self-declaration schemes

State: Ongoing

Foreseen start date: 01/07/2021

Actual start date: 01/07/2021

Foreseen end date: 31/05/2022

Actual (or anticipated) end date: 31/05/2022

C1.1 Development of a methodology & Good Practice Guidelines (led by NTUA, M1-M12)	Status: Completed
C1.2 Database design and development (led by NTUA, M7-M23)	Status: Ongoing

- ✓ All deliverables to be submitted in this reporting period have been completed. No deviations from Grant Agreement have occurred and foreseen, in terms of delays of Deliverables and milestones.

Deliverable name	deadline	status
Database structure	05/2022	Ongoing-to be completed 05/2022 by NTUA-no delay
Methodology & Good Practice Guidelines	06/2021	Completed by NTUA

Milestone name	deadline	status
Database final version	05/2022	Ongoing - to be achieved 05/2022-no delay

C1.1 Development of a methodology & Good Practice Guidelines (led by NTUA, M1-M12)

A coherent and robust methodology has been developed to provide installers with the knowledge and practical skills required to sample, analyse and characterise recovered F-gas. Furthermore, Good Practice Guidelines (recommendations and tips on how to undertake leakage checking, recovery, installation, servicing and maintenance of stationary refrigeration, air conditioning and heat pump equipment containing refrigerants) have also been established. **(Deliverable: "Methodology & Good Practice Guidelines")**

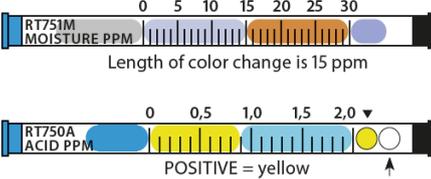
The proposed sustainable **methodology provides an effective F-gas recovery/recycling process in real-time and on-site**. Includes a series of instructions in the form of an operating manual so that (field) installers can access all the basic knowledge as well as the practical skills required for sampling, analysis and characterization of recovered F-gas.

The proposed F-gas recovery process includes six (6) different diagnostic tools:

1. Portable Moisture and Acidity Checkers
2. Recovery Bottles
3. Portable Composition Analyzer
4. Vacuum Pump
5. Drier Filters
6. Recovery Machine

A summary of the key characteristics and operating principles of each of them is depicted in Table 1 that follows:

Table 1: Key Characteristics & Operating Principles of diagnostic tools.

Diagnostic tools	Key Characteristics & Operating Principles	
<p><i>Portable Moisture & Acidity Checkers</i></p>	<ul style="list-style-type: none"> ➤ Colour comparing sticks, refrigerant is injected through the stick. ➤ The sticks have an expiration date. Be aware to use it before the expiration date. 	
<p><i>Recovery Bottles</i></p>	<ul style="list-style-type: none"> ➤ Should equip both liquid and vapor valves (Recycling equips liquid valve, oil removal equips vapor valve in upside-down position, vacuuming equips vapor valve). 	
<p><i>Portable Composition Analyzer</i></p>	<ul style="list-style-type: none"> ➤ Relies on Non-Dispersive Infrared Technology. ➤ Liquid and vapor sampling possible. ➤ Blended refrigerants should be liquid sampled. 	
<p><i>Vacuum Pump</i></p>	<ul style="list-style-type: none"> ➤ Quality of vacuum has a very high correlation with moisture and non-condensables level of the output. 	

<p><i>Drier Filters</i></p>	<ul style="list-style-type: none"> ➤ Removal of moisture relies on the differentiation of evaporation temperatures for water and the refrigerants. ➤ Moisture is also extracted with oil. ➤ For better output results drier filters on suction line and on discharge line is necessary. ➤ Drier filters should be replaced every x kg of reclaim (x is stated in the info sheet of the drier filter). ➤ Quality of Drier Filter has a big impact on moisture levels. 	
<p><i>Recovery Machine</i></p>	<ul style="list-style-type: none"> ➤ R-Cycle is easy to use. ➤ Can be connected directly to the installed HVAC-R equipment. ➤ After connecting the refrigerant recovery bottle, the recovery and recycling process is automatic. 	

Good Practice Guidelines - GPG

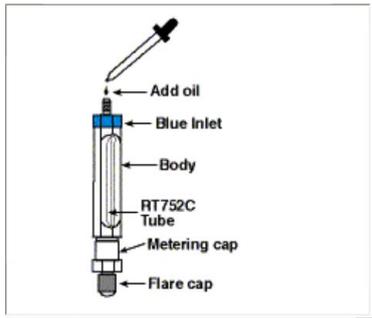
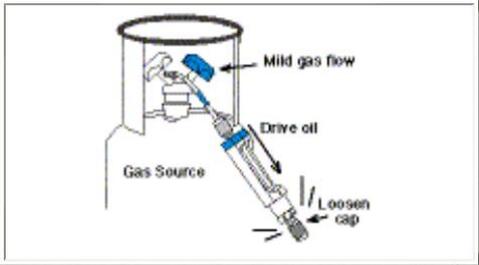
The practical recommendations and tips on how to undertake leak checking, installation, servicing and maintenance of stationary refrigeration, air conditioning and heat pump equipment containing refrigerants are presented in the tables 2-6 below.

Table 2: Good Practice Guidelines (GPG) for Recovery Machine.

<p>Step by Step</p>	<p>Recovery Machine – Good Practice Guidelines (GPG)</p>
<p>GPG 1</p>	<p><i>Make sure the drier filter is connected to the suction portion of the recovery machine. Connect the recovery bottle to the discharge portion on the recovery machine and verify that it is in the closed position. Then start the recovery on the liquid side.</i></p>
<p>GPG 2</p>	<p><i>Reconnect your gauges to the condensing unit.</i></p>
<p>GPG 3</p>	<p><i>Connect the yellow hose to the filter drier that connects to the inlet on the recovery machine. Make sure it is set to liquid.</i></p>
<p>GPG 4</p>	<p><i>Open the valve and plug the recovery machine.</i></p>
<p>GPG 5</p>	<p><i>Nozzles must be set to recover and turn on the machine. Open the outlet suction.</i></p>
<p>GPG 6</p>	<p><i>Now we're going to open the liquid gauge.</i></p>

GPG 7	<i>After a few minutes, you may check the gauge and the recovery machine level of refrigerant.</i>
GPG 8	<i>Once you hit 0, close the right gauge, inlet, and outlet suctions. Turn off the recovery button and the system. Close the valves.</i>
GPG 9	<i>Take the gauge and transfer it to the vapor side. Open the valve. Set the inlet button to vapor. Switch on the recover, the outlet button and press start.</i>
GPG 10	<i>Open the low side gauge and we wait until we are below zero.</i>
GPG 11	<i>Close the low side, close the vapor valve on the recovery tank. Close the inlet suction, the recovery button and shut down the pump.</i>

Table 3: Good Practice Guidelines (GPG) for the Easy Oil Test.

Step by Step	Testing Oil "Outside" a System – Good Practice Guidelines (GPG)	
GPG 1	<i>Add about two (2) drops of Oil to the Blue inlet of a fully assembled unit with Detector Tube in place.</i>	
GPG 2	<i>Open gas valve to pressurize the assembly.</i>	
GPG 3	<i>Loosen flare cap for a mild bleed.</i>	
GPG 4	<i>Gas pressure will quickly drive the Oil through the Transfer Agent and deposit a stain on the Indicator.</i>	

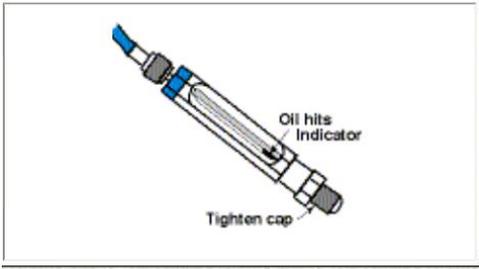
GPG 5	<i>Stop flow by tightening the flare cap and close the gas valve.</i>	
GPG 6	<i>Disconnect entire assembly at extension hose relieving any remaining back pressure.</i>	
GPG 7	<i>Remove Detector Tube and match the Indicator to the Colour Chart.</i>	

Table 4: Good Practice Guidelines (GPG) for Moisture & Acid Detector Tubes.

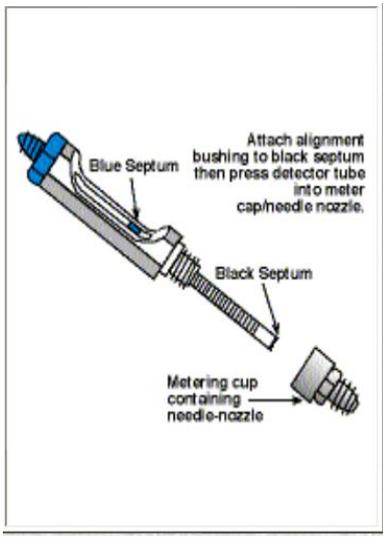
Step by Step	Moisture & Acid Detector Tubes – Good Practice Guidelines (GPG)	
GPG 1	<i>Arrange hose gauge manifold (as pictured above) with 8-10 ft. of 1/4 inch ID hose. Optimum is 9 feet.</i>	
GPG 2	<i>Connect Blue extension hose and Checkmate Body to gas source.</i>	
GPG 3	<i>Purge extension hose and body with the test gas.</i>	
GPG 4	<i>Stop purge. Slide and press Detector Tube into body Blue end first.</i>	
GPG 5	<i>Screw down metering cap.</i>	
GPG 6	<i>Connect to hose gauge arrangement.</i>	
GPG 7	<i>Start Refrigerant flow. <u>Stop gas flow when low side gauge reaches the correct Termination Pressure for the Refrigerant being tested. Refer to Chart on back cover.</u></i>	
GPG 8	<i>Remove Detector Tube and note the length of colour change. Refer to chart on inside back cover.</i>	

Table 5: Good Practice Guidelines (GPG) for Drier Filters.

Step by Step	Drier Filter – Good Practice Guidelines (GPG)
GPG 1	<i>Cut the pipe, clean it, install the drier filter.</i>
GPG 2	<i>Cut the pipe.</i>
GPG 3	<i>Clean both ends.</i>
GPG 4	<i>Remove the plastic inserts on both ends and dry fit your pipe into your filter drier.</i>
GPG 5	<i>Straighten the connections with a torch and let it cool off afterwards.</i>
GPG 6	<i>Install the valves into the condensing unit and pull the vacuum in to remove any contaminant.</i>

Table 6: Good Practice Guidelines (GPG) for Portable Composition Analyzer.

Step by Step	Portable Composition Analyzer – Good Practice Guidelines (GPG)
GPG 1	<i>Press the left button on the analyzer.</i>
GPG 2	<i>Allow it to power on and then connect your supplied sample hose to the device.</i>
GPG 3	<i>Once the warm up process is complete, an air calibration will be required.</i>
GPG 4	<i>Press the right key button to begin. Air Calibration takes 130 seconds.</i>

Overall, it is estimated that both the proposed methodology and the guidelines of good practice (GPG) will make (field) installers capable of carrying out a composition analysis, in real-time and on-site, for any used F-gas contained in HVAC-R equipment as well as also proceeding to the recovery and recycling/reclamation of it, thanks to the Daikin's R-Cycle Unit. In any case, the characteristics and requirements arising from the evolving F-gas market

as well as the considerations of stakeholders will be appropriately integrated through one or more updates.

The LIFE 3R training campaign (Action E1) has been designed in such a way as to be directly related to the methodology and Good Practice Guidelines (GPG). Therefore, it is basically aimed at making the relevant theoretical material fully understood and practically applied by the installers and the other stakeholders involved in the F-gas sampling, analysing and characterisation procedures.

C1.2 Database design and development (led by NTUA, M7-M23)

The appropriate implementation of both the proposed methodology and GPG will lead to a coherent and robust Self-certification scheme, acting as an accurate database with a wide range of valid information on the F-gas quantity and quality. The design and development of the database (definition and categorization of all individual parameters that will be considered as data entries) is an ongoing task. The expected date of completion is set for the end of May 2022. The main results will be reported in the Deliverable: "Database structure" in M23.

The structure and architecture of the database will encompass filtering, constraints, mandatory fields and other abilities that will assist in the ease of access by users and at the same time the supervision by the administrator. The administrator of this platform will be a third party such as Laboratory of Steam Boilers and Thermal Plants (LSBTP) of NTUA. All necessary actions will also be foreseen, ensuring traceability of all quantities during the recovery, analysis, data logging and re-usage process. In addition, an index value will be linked to each registered user (mainly installers). This index value will be updated regularly based on criteria such as on time delivery, as stated quality of the F-gas, regularly calibrated analysers, other quantitative and qualitative criteria.

ACTION C2: F-gas identification & recycling prototypes

State: Ongoing

Foreseen start date: 01/01/2021

Actual start date: 01/01/2021

Foreseen end date: 30/06/2022

Actual (or anticipated) end date: 28/02/2023

C2.1 Requirements of prototype units for F-gas identification & recycling (led by DENV, M7-M24)	Status: Ongoing
C2.2 Intercomparison tests, validity of measurements and performance of the equipment (led by MAT4NRG, M11-M24)	Status: Ongoing
C2.3 Upgrade units with IOT (led by DACE, M22-M24)	Status: Planned to start M22

- ✓ All deliverables to be submitted in this reporting period have been completed and the milestones have been achieved except for the milestone "Prototype unit for identification and removal of Oil and Moisture", due to the global chip crisis affected the HVAC-R manufacturers and their supply chain capability, too. Although this milestone will be achieved with a delay, **no noticeable impact on other project actions is expected.** The deviations from Grant Agreement that have occurred and foreseen, in terms of delays in deliverables and milestones can be seen in the table below.

Deliverable name	deadline	status
Evaluation of current solutions for R134a	12/2021	Ongoing/to be completed by DENV/MAT4NRG on 12/2021-no delay
Prototype unit that can identify blends (R410A, R404A, R407C) and performanceassessment	12/2021	Ongoing(foreseen delay) due to global chip crisis affected the HVAC-R manufacturers and their supply chain capability this deliverable will be completedby DENV/MAT4NRG with a delay/ estimated date of completion: 31/12/22 No impact on the project/ No impact on other actions
IOT functionalities on the prototype unit	12/2021	Ongoing-to be completed by DENV on 12/2021-no delay
Intercomparison tests / validity of measurements / proposed equipment & analysers	06/2021	Completed by MAT4NRG

Prototype unit that can identify R32, R134a (pure HFC) and performance assessment	12/2021	Ongoing(foreseen delay) due to global chip crisis affected the HVAC-R manufacturers and their supply chain capability this deliverable will be completed by DENV/MAT4NRG with a delay, estimated date of completion: 31/12/2022 No impact on the project /No impact on other actions
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Milestone name	deadline	status
Final Prototype including IOT. Total check of the flow of the data from Self Certification to the Market Place	05/2022	Ongoing(foreseen delay) due to global chip crisis affected the HVAC-R manufacturers and their supply chain capability this milestone will be achieved with a delay/estimated date of achievement: 28/02/23 No impact on the project/No impact on other actions
Prototype unit for identification and removal of Oil and Moisture	07/2021	Ongoing (foreseen delay) due to global chip crisis affected the HVAC-R manufacturers and their supply chain capability this milestone will be achieved with delay, estimated date of achievement: 31/12/22 No impact on the project/ No impact on other actions
Laboratory Test of the unit	09/2021	Achieved

C2.1 Requirements of prototype units for F-gas identification & recycling (led by DENV, M7-M24)

The development of innovative prototype units that can provide AC technicians with an easy-to-use tool for the real-time and on-site identification, recovery and recycling of F-gases is an ongoing project. The innovation element in this concept is the combination of a classic refrigerant composition analyzer with the Daikin's R-Cycle unit. The latter one is a

portable refrigerant recovery device which applies an additional functionality by supporting a unique electrostatic separation method suitable not only for removing oil and contamination as a large distillation apparatus, but also moisture and acid by a large filter dryer. All the minimum requirements of equipment and analyzers have been defined so far. These requirements take into account parameters such as critical measures for the classification of the recovered F-gas, accuracy of the measurement, LOD & LOQ of the measuring principle, robustness, portability, durability, etc.

Therefore, the prototypes under development will enable the on-site composition determination of existing refrigerant, its categorization as well as the removal of oil and moisture from it. **This will have a very positive impact on field installers as the relevant procedure will be significantly upgraded and simplified in relation to the current practice.** In this direction, the final version of the prototype units will incorporate IOT capabilities as extra in order to ensure the easy and direct data transfer from the unit to the Self-certification platform.

The Recovery and Recycling of Refrigerant Portable Unit, under the Daikin brand and with model name RRDQ220V1 is shown in figure 1.



Figure 1: Recovery and Recycling of Refrigerant Portable Unit

During the reporting period the proper operation of the unit was evaluated and also the performance versus different qualities and types of refrigerants of recovered product was executed.

Description of Operation

RRDQ220V1 is easy to use. It can be connected directly or via recovery pump to the installed F-gas equipment. After connecting the refrigerant recovery bottle, the recovery and recycling process is automatic.

High purity is achieved by using three methods of filtering. The unique electrostatic separation technology, the high-performance filter drier and the evaporation of refrigerant removes the maximum of impurities, such as oil and moisture.

Key features:

- Three steps of recycling to maximize the quality:
 - Oil separation and electrostatic filtering
 - Filter drier to remove moisture

- Liquid separation via evaporation
- Oil less compressor preventing oil from the compressor to contaminate the refrigerant.
- Unique electrostatic filtering technology allowing increased oil and moisture removal from the Recovered refrigerant.
- Constant recovery and recycling volume for all refrigerant gases both high pressure and low pressure ones (vapour phase).

Foreseen delays:

Due to the global chip crisis affecting also the HVAC-R manufacturers, the Suez Canal blockage and its subsequent impact on the supply chain (e.g.: lack of containers to ship goods and consumables), the development of project prototypes will be delayed. As the world shut down because of the COVID-19 pandemic, many factories closed with it, making the supplies needed for chip manufacturing unavailable for months. Increased demand for consumer electronics caused shifts that rippled up the supply chain. Orders began to pile up as manufacturers struggled to create enough chips to meet the new levels of demand. Regarding the project, the main effect of the existing chip shortage is that some products were delayed, thus partially hindering the smooth development of the prototype units.

Deliverables foreseen delays:

1. Prototype unit that can identify R32, R134a (pure HFC), and performance assessment -completion estimated date: 31/12/2022
2. Prototype unit that can identify blends (R410A, R404A, R407C) and performance assessment- completion estimated date: 31/12/2022

It should be noted that refrigerant composition analysers are available today for the AC sector, but they cannot perform removal of oil and moisture. A different device is used for this purpose. **The above common practice will continue to be applied until the full development of the innovative prototypes for F-gas identification and recovery, with the relevant data being manually uploaded to the Self-certification platform.** It is expected that, thanks to the prototypes, installers will be able to determine the composition of F-gas, categorise it and also remove the oil and moisture out of it, in real time and on site. Furthermore, the unit will finally be upgraded with IOT technology to transfer data directly from the unit to the different platforms of the eco-system.

C2.2 Intercomparison tests, validity of measurements and performance of the equipment (led by MAT4NRG, M11-M24)

A method for the estimation of the composition of refrigerant gases using gas chromatography has been developed. For that we needed first to find the right conditions for the gas chromatograph, to find the right column with the right filling material which is able to separate the components of the refrigerants of interest (at present R410 A). The method should deliver results as quick as possible, without affecting the quality of the separation and the measurement in general.

For that we performed several tries with different parameters for oven and detector temperature, carrier gas and make-up gas flow rates, and also experiments to find out if the

oven will be kept isothermal during the measurement or if a temperature gradient in the oven is necessary to reduce and optimize the measurement time.

Further we performed intercomparison tests with a Mastercool Analyser tool provided by DAIKIN. The comparison results between GC and Mastercool Analyser shows that the gas chromatographic method is approx. 10 times more sensitive than the tool (Deliverable: "Intercomparison tests / validity of measurements / proposed equipment & analysers").

ACTION C3: Demos: Go-Live and Roll-out to EU markets**State: Ongoing**

Foreseen start date: 01/07/2021

Actual start date: 01/07/2021

Foreseen end date: 30/06/2023

Actual (or anticipated) end date: 30/06/2023

C3.1 Development of the Marketplace platform (led by DENV, M1-M15)	Status: Completed
C3.2 Slovakia (SK) (led by DACE, M16-M36)	Status: Just started
C3.3 Czech Republic (CZ) (led by DACE, M16-M36)	Status: Just started
C3.4 Hungary (HU) (led by DACE, M16-M36)	Status: Just started
C3.5 Validation of the 3R ECOSYSTEM (led by DENV, M31-M36)	Status: Planned to start M31

- ✓ All deliverables to be submitted in this reporting period have been completed. No deviations from Grant Agreement have occurred and foreseen, in terms of delays of Deliverables and milestones (see table below).

Deliverable name	deadline	status
Work Package: Buyer – Company R-Market	01/2021	Completed by DENV
Face to face interviews with key users and online survey towards the rest of the users	09/2021	Completed by DACE
CZ demo report	06/2023	To be completed by DACE on 06/2023-no delay
HU demo report	06/2023	To be completed by DACE on 06/2023-no delay
Upgrade to final version	03/2023	To be completed by NTUA on 03/2023-no delay
Work Package: Seller - Company account management	09/2020	Completed by DENV
Work Package: Seller - Company user accounts management	10/2020	Completed by DENV
Work Package: Seller - Installer account management	11/2020	Completed by DENV
Work Package: Installer R-Gas management	03/2021	Completed by DENV
Marketplace platform	06/2021	Completed by DENV

SK demo report	06/2023	To be completed by DACE on 06/2023-no delay
Stability check of platforms	06/2023	To be completed by DACE on 06/2023-no delay
General set up and architecture	08/2020	Completed by DACE
Work package: Seller - Company R-Market	02/2021	Completed by DENV
Work package: Buyer - Company account management	10/2020	Completed by DENV
Work package: Buyer - user accounts management	11/2020	Completed by DENV

Milestone name	deadline	status
Upgrade to final version	03/2023	To be achieved 03/2023-no delay
End of the demos	06/2023	To be achieved 06/2023-no delay
Start of the demos	07/2021	Achieved
Marketplace ready for testing	06/2021	Achieved

C3.1 Development of the Marketplace platform (led by DENV, M1-M15)

One of the basic goals of the Life 3R project is to establish **an online high-end marketplace across Europe**, thus enabling both sellers and buyers to have a reliable trade of recovered F-gases within an innovative circular economy ecosystem. In this context, special emphasis has been given on the proper development of the Retradeables platform so that well-defined legal frameworks, full-transparent transaction processes as well as secure payments methods **can be guaranteed** for all the acting parties.

Overall, the Retradeables marketplace is based on state-of-the-art technology to provide best performance and easy usage. Although new upgrades are constantly applied until the final version is officially confirmed, a huge progress has already been made since a wide range of functionalities is incorporated into the current beta version of Retradeables.

The basic operating principles of the Retradeables platform that have been assumed so far, in a more advanced version (beta) as a direct result of the continuous improvements achieved because of the applied “Plan Do Check Act” cycle can be seen in figure 2.

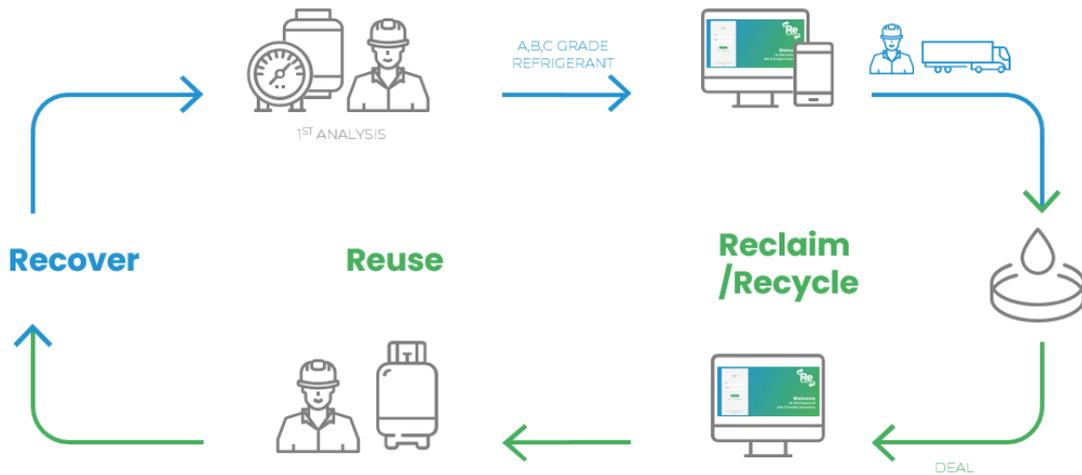


Figure 2: The basic operating principle of the Retradeables platform.

Sign-up process

For both F-gas sellers (installers) and buyers (distributors) wishing to use 3R ECOSYSTEM to participate in the relevant transaction procedures through the Marketplace platform, an account must first be created. The sign-up process can be divided into 4 key steps:

- Step 1: Register for an account on the Retradeables website.
- Step 2: Add your information and F-gas certificate details.
- Step 3: Complete the KYC process to activate trading.
- Step 4: Start buying and selling your recovered F-gases.

The F-gas seller/buyer must initially visit the Retradeables website (<https://retradeables.com>) homepage and click on the "Join Retradeables" button on the left-hand corner of the screen (Figure 3).

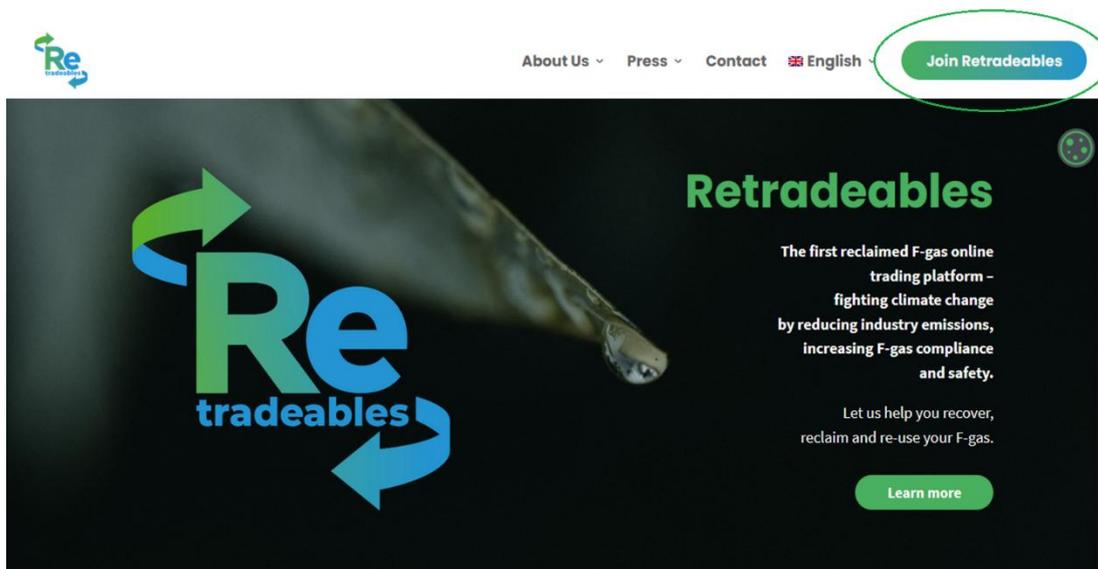


Figure 3: The Retradeables website homepage

Automatically, he/she will be redirected to the login form. Since an account has not yet been created, the user needs to click on "Sign Up", underneath the "Login" button (Figure 4).

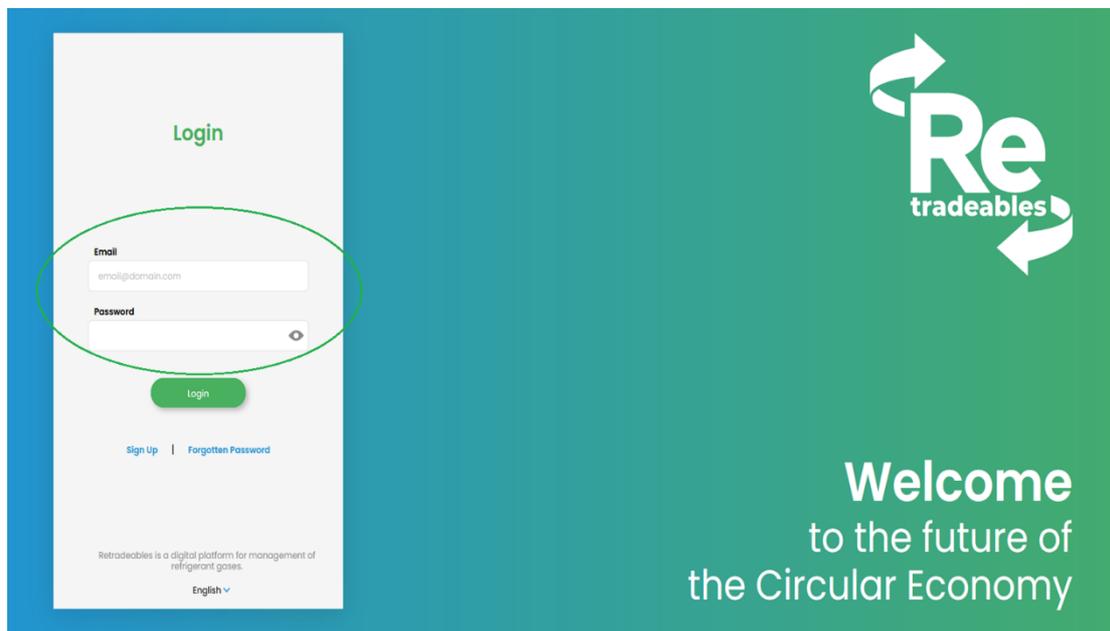


Figure 4: User Interface (UI) design for "Login" form.

F-gas selling process taking place within the Retradeables platform

The supply side (F-gas sellers) in the 3R trading scheme is considered to be the various F-gas installers/installation companies as well as the service companies and partner networks that have access to refrigerant through small/medium or large installations. It is expected that the implementation of the Life 3R project will enable them to handle and sell any quantities of recovered F-gas in a sustainable way, thus contributing to an extra revenue and asset stream, too. The selling process within the Retradeables Marketplace platform is divided into the following 5 key steps:

- Step 1: Offer your stock onto the Retradeables Marketplace.
- Step 2: Accept the most desirable offer.
- Step 3: Arrange the collection of the stock with buyer.
- Step 4: Receive quality test results from the buyer.
- Step 5: Finalise your offer.

F-gas buying process taking place within the Retradeables platform

The demand side (F-gas buyers) in the 3R trading scheme is considered to be the various F-gas distributors/distribution companies wishing to increase the amounts of product received from the market and relax the pressure on their quota. It is expected that the

implementation of the Life 3R project will enable them to access high quality recovered refrigerants and at a lower price, too. The buying process within the Retradeables Marketplace platform is divided into the following 5 key steps:

- **Step 1:** Register for an account on the Retradeables website.
- **Step 2:** Browse through all available listings in the Sales Centre.
- **Step 3:** Make a bid for the F-gas you need.
- **Step 4:** Collect accepted bids and test the quality.
- **Step 5:** Finalise your bid and pay with your e wallet.

More details for all operating principles of the **Retradeables Marketplace** can be found in the "**Marketplace platform**" deliverable.

F-gas circular economy ecosystem

The F-gas circular economy ecosystem has been designed to consist of three basic elements:

- A Self -certification platform with reliable F-gases declaration for composition/recovery/recycling
- A F-gas Identification and recycling IOT equipment and
- A 3R Marketplace platform to support and guide EU companies to Recover, Recycle/reclaim and Re-use F-gases (LIFE3R)

An overview of the 3R ECOSYSTEM as it will be after the implementation is depicted in Figure 5:

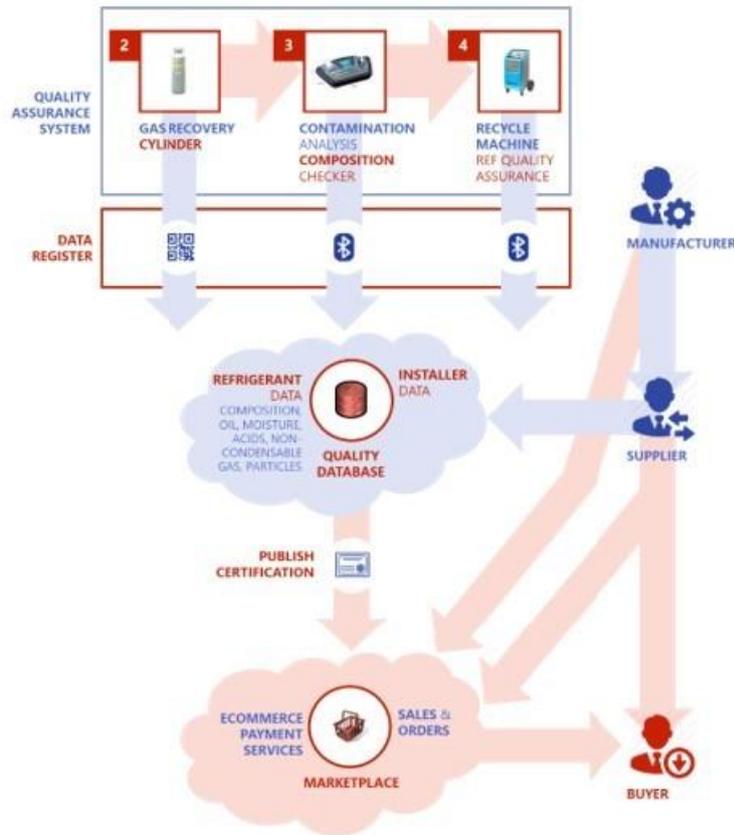


Figure 5: Overview of the 3R ECOSYSTEM.

Basic web architecture overview

First of all, the application is a Web Application accessed through the browser with the possibility to be also installed as a Progressive Web Application onto a mobile app, i.e. a slimmed down mobile version of the web site in a container. Thus, it is about a .NET Application built in the React framework on the frontend and with .NET Core on the backend. Data is stored on Azure in a SQL database which is accessed from the backend.

Basically, the Web Application has a frontend URL router built with the “react-router” library which based on the browser URL decides the screen that is appropriate to show to the user. Moreover, it is logically separated into screens which use a service layer to fetch data from the backend. That service layer uses HTTP POST and GET requests to fetch data from the backend and update data on the backend. Also, on the frontend, styling and theming of the app is handled by the Styled Components framework to guarantee reusability and easy swapping of themes in the future.

On the backend, the application is a .NET Web API application built with a layer of controllers between the frontend and the backend which takes requests from the frontend and transforms them into requests for the mediator framework, MediatR. The backend requests are then validated by the Fluent Validation framework, and if valid, processed by a MediatRhandler, which uses Entity Framework to fetch and update data on an Azure SQL Server database which guarantees data consistency through relational constraints.

Finally, the application is deployed to a production Azure App Service as a single versioned package after it passes a suite of Unit Tests and additional testing on a quality assurance environment. A simplified system diagram is illustrated in Figure 6:

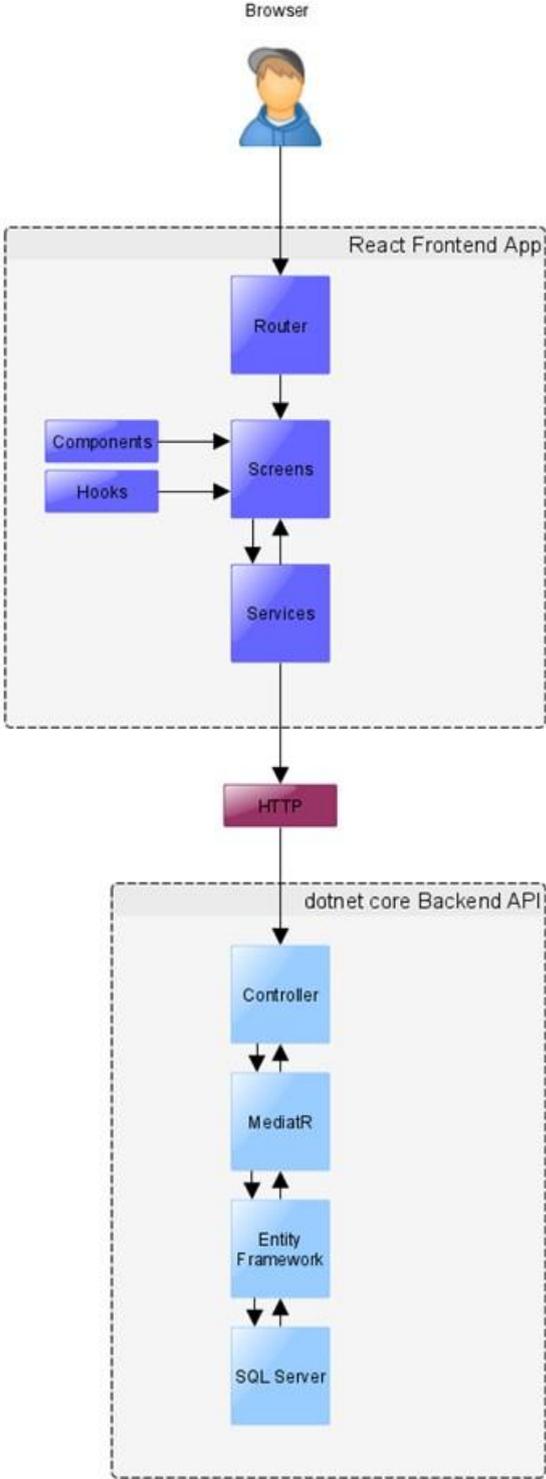


Figure 6: Simplified system diagram of the applied web application.

A more detailed description of the designed F-gas circular economy ecosystem, and the general set up and architecture of the relevant web application including the front-end (client side) and the back-end (server, app, database), respectively can be found in the **Deliverable: "General set-up and architecture"**.

Follow up actions:

- **Face-to-face interviews with key users of the 3R ECOSYSTEM**
- **Online survey for the rest of registered users**

Regarding the 1st follow-up action, this will take place once both the Self-certification and 3R Marketplace platforms are functional enough to allow reliable real-time and on-site transactions between installers (Daikin partners) and distributors. In terms of timing, the first interviews are envisaged in Q3 2022, given that the official release of the 1st version of 3R ECOSYSTEM is expected in early 2023. Regarding the 2nd follow-up action, it will start as soon as a sufficient number of user registrations on the 3R Marketplace platform ("Retradeables") is reached in each of the 3 demo countries (SK, HU, CZ). In terms of timing, this has been identified to happen by the end of Q1 2022. Therefore, a questionnaire model has already been prepared, including typical questions for simple users and subscribers to be answered during interviews of this kind (maximum 15 questions). This script currently serves as a guideline for the production of a simplified version (maximum 5 questions) to be utilized in the very near future with a web-based tool (e.g., Survey Monkey). The online surveys are considered to temporarily assist in the upgrade of the Retradeables Marketplace until full feedback is received through the face-to-face interviews, eventually making available a precise set of user requirements to be implemented for the development of a final version of the 3R ECOSYSTEM. The questionnaire models for face-to-face interviews and online surveys can be seen in Tables 7 & 8, respectively (Deliverable: Face to Face interviews with key users and online survey with the rest of the users).

Table 7: Questionnaire model for face-to-face interviews with key users of the Retradeables marketplace (key users: pilot group of installers and distributors who are Daikin partners).

<i>Thank you for taking the time to answer some questions about your first experience with the online marketplace for used F-gases, Retradeables.</i>	
Registration:	
1.	How did you experience the registration at Retradeables? (easy, complicated, quick, self-explanatory)
2.	How long did it take you to get registered?
3.	Have you experienced any bugs during registration process?
4.	Do you have any specific remarks about the registration process? Would you like to share something about it with us?
5.	Talking about your first impression: Did the platform fulfil your expectations?
6.	Let us know about your expectations and how the platform met them.
Routine implementation:	

7. How likely is it that the platform will become a regular part of your work routine?
8. Can you give us some insights on your implementation plans?
9. At which point do you think/hope that the platform will help you in your daily work routine?
10. Are there any features you wish to find on Retradeables in the future?
Users:
11. Who is going to take care about your profile and activities on the Retradeables platform? Job description?
12. How many employees do you plan to register under your company profile to enable them to be active on the Retradeables platform and what is their job description?
13. Additional Feedback: Are there any additional remarks/comments you wish to share with us?
Demographics:
Country in which you are mainly operating <ul style="list-style-type: none"> • Czech Republic • Hungary • Slovakia • Other _____
Size of your company <ul style="list-style-type: none"> • 1-5 employees • 6-20 employees • 21-50 employees • 51-100 employees • More then 100
Type of your company <ul style="list-style-type: none"> • Installation company • Distributor • Other _____
<i>Thank you for taking the time for this interview. If you have any questions or remarks you wish to share with us, please contact us via e-mail: contact@retradeables.com.</i>

Table 8: Questionnaire model for online surveys to simple users of the Retradeables marketplace

Dear Retradeables user!
Thank you for registering on the online marketplace for used F-gases. We would like to ask you to give us some feedback on your first impression of the platform by answering the short questionnaire below. It will only take you a few minutes.

1. Registration: How did you experience the registration at Retradeables? [scale]

(easy) 1 – 2 – 3 – 4 – 5 (complicated)
 (quick) 1 – 2 – 3 – 4 – 5 (long)
 (self-explanatory) 1 – 2 – 3 – 4 – 5 (assistance needed)

Do you have any specific remarks about the registration process, you'd like to share with us? [open]
 Answer: _____

2. Expectations: Talking about your first impression: Did the platform fulfil your expectations? [scale]

(expected it to be totally different) 1 – 2 – 3 – 4 – 5 (fully met expectations)

Let us know about your expectations and how the platform met them. [open]
 Answer: _____

3. Routine implementation: How likely is it that the platform will become a regular part of your work routine? [scale]

(low) 1 – 2 – 3 – 4 – 5 (high)

4. Users: How many employees do you plan to register under your company profile to enable them to be active on the Retradeables platform? [drop down]

1 – 2 – 3 – 4 – 5 – more than 5

5. Recommendations: How likely are you to recommend this platform to a partner?

(low) 1 – 2 – 3 – 4 – 5 (high)

Additional Feedback: Are there any additional remarks/comments you wish to share with us? [open]
 Answer: _____

Demographics:

<p>Country in which you are mainly operating [drop down]</p> <ul style="list-style-type: none"> • Czech Republic • Hungary • Slovakia • Other _____
<p>Size of your company [drop down]</p> <ul style="list-style-type: none"> • 1-5 employees • 6-20 employees • 21-50 employees • 51-100 employees • More than 100
<p>Type of your company [drop down]</p> <ul style="list-style-type: none"> • Installation company • Distributor • Other _____
<p><i>Thank you for taking the time to answer the questionnaire. If you have any questions or remarks you wish to share with us, please contact us via e-mail: contact@retradeables.com.</i></p>

C3.2 Slovakia (SK) (led by DACE, M16-M36), C3.3 Czech Republic (CZ) (led by DACE, M16-M36), C3.4 Hungary (HU) (led by DACE, M16-M36)

Demos' activities have just started in the 3 selected countries (Slovakia, Hungary, and Czech Republic). **These are considered to be the perfect test-case to scale the project to whole Europe.**

ACTION C4: Exploitation & Replication and Transferability plans

State: Ongoing

Foreseen start date: 01/07/2021

Actual start date: 01/07/2021

Foreseen end date: 30/06/2023

Actual (or anticipated) end date: 30/06/2023

C4.1 Exploitation plan (including IPR issues and a thorough Business plan) (led by DACE, M1-M36)	Status: Ongoing
C4.2 Replication and transferability plan (led by DENV, M19-M36)	Status: Planned to start M19

- ✓ All deliverables to be submitted in this reporting period have been completed and the milestones have been achieved. No deviations from Grant Agreement have occurred and foreseen, in terms of delays of Deliverables and milestones (see table below).

Deliverable name	deadline	status
Exploitation strategy	01/2022	Ongoing-to be completed by DENV on 01/2022-no delay
Updated Business plan	06/2023	To be completed by DACE on 06/2023-no delay
Replication and Transferability plan	06/2023	To be completed by DENV on 06/2023-no delay
Market study	01/2021	Completed by DENV
Transferability and IPR analysis	01/2022	Ongoing-to be completed by DENV on 01/2022-no delay

Milestone name	deadline	status
Replication and transferability strategy developed	01/2022	Ongoing-to be achieved 01/2022-no delay
Market feasibility study completed	01/2021	Achieved

C4.1 Exploitation plan (including IPR issues and a thorough Business plan) (led by DACE, M1-M36)

Exploitation & Replication and transferability is the ultimate objective of the project. To this aim, a **F-gas market follow-up** at technical, economic, environmental and regulatory level concerning European Union (EU) has been carried out as part of task C4.1 (Deliverable "Market study"). Key points:

- Regulation (EU) No 517/2014 affects the whole HVAC-R value chain, aiming at industry awareness so that the greenhouse gas emissions to be reduced on time. LIFE

3R is considered to directly contribute to the EU's establishment as the first region to take such far-reaching steps to this direction. Special attention has been paid to the market status of Hungary, Slovakia and Czech Republic which have been selected to be the first 3 EU demo-countries (see Figure 7), with the prospect of being the reference for future implementation of the 3R ECOSYSTEM at an EU-wide level. Therefore, monitoring of project impacts on both environmental and socio-economic sector will be intensive during demos while extra requirements and customization issues from the different stakeholders will be detected and tackled.

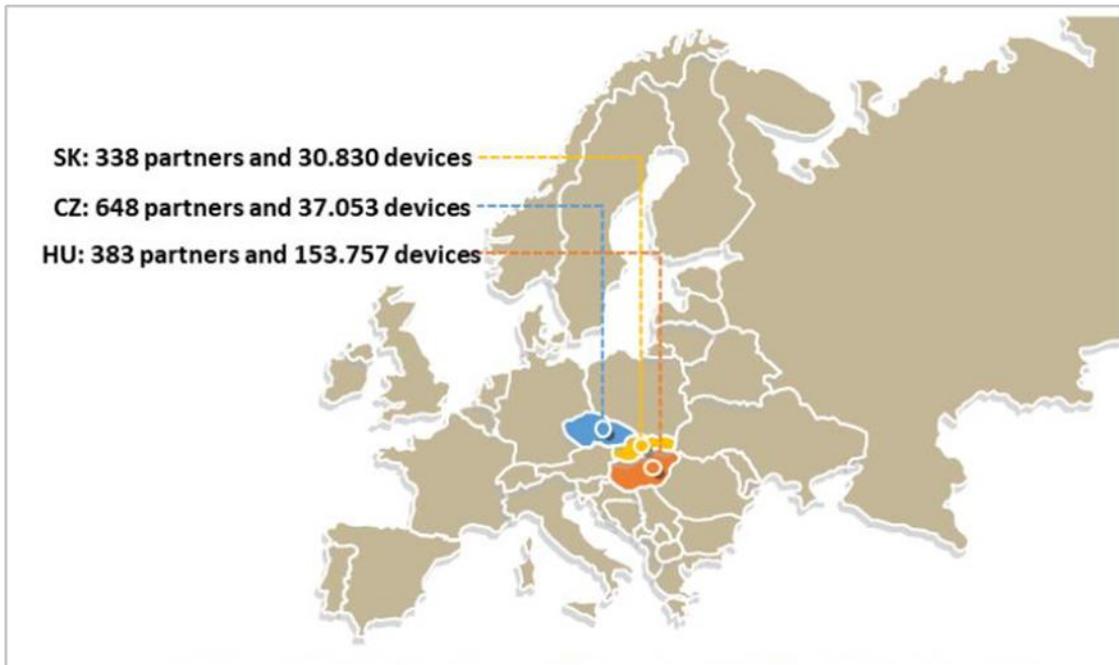


Figure 7: Demo sites and infrastructure for LIFE 3R.

- Considering the average renovation rate of each sector, the estimated recovered F-gas during the LIFE 3R project is approximately 1.490 metric tons of F-gases, a figure that is equivalent to almost 3,1 million CO₂ tons. The breakdown per demo as well as the totals of recovered F-gases and CO₂ emissions savings can be checked in Table 9:

Table 9: Breakdown per demo and totals of recovered F-gases and CO2 emissions savings.

	Renovation Rate (%)	SK: F-gas recovered via 3R		CZ: F-gas recovered via 3R		HU: F-gas recovered via 3R		Total recovered via 3R	
		tons F-gas	tons CO _{2,e}	tons F-gas	tons CO _{2,e}	tons F-gas	tons CO _{2,e}	tons F-gas	tons CO _{2,e}
Small Residential Units	10	41,4	86.516	40,5	84.544	216,3	451.507	298,2	622.568
Commercial light unit	15	10,9	22.702	32,8	68.368	19,3	40.227	62,9	131.297
Big Commercial unit	20	39,4	82.195	142,0	296.373	123,9	258.680	305,3	637.249
Small Heat Pumps	10	8,3	17.410	9,3	19.414	10,7	22.378	28,4	59.202
Industrial units	25	33,8	70.453	150,0	313.125	187,5	391.406	371,3	774.984
Supermarkets	45	62,1	129.634	155,3	324.084	207,0	432.113	424,4	885.831
Total		195,9	408.910	529,8	1.105.908	764,7	1.596.312	1.490,4	3.111.129

- A basic estimation is that the final version of LIFE 3R project is capable of limiting the annual bulk imports in the range of 20% by mass when being scaled to all European Member States Markets (see Table 10). Preventing greenhouse gas emissions as well as mitigating dependence in bulk gases by non-European countries (mainly from China, United States and Japan) are some other positive aspects, too.

Table 10: Installed and renovated base for EU countries with well-established DAIKIN network (Reference year: 2021).

EU member country	Daikin's business name	Estimation of installed base (tons refrigerant)	Estimation of installed base (tons CO _{2,e})	Estimation of renovated base (tons refrigerant)
Belgium	DAB	1.992,7	4.159.670	358,2
Central Europe	DACE*	14.537,2	30.346.395	2.500,9
Italy	DACI	19.697,0	41.117.555	1.793,6
Spain	DACS	12.850,2	26.824.814	1.276,7
France	DAF	13.874,1	28.962.197	1.768,0
Germany	DAG	7.437,6	15.525.996	1.865,4
Greece	DAGR	4.298,9	8.974.035	356,8
Netherlands	DANL	2.093,3	4.369.732	245,9
Norway	DANO	NA	NA	NA
Portugal	DAPT	2.436,7	5.086.533	233,5
Sweden	DASW	1.124,3	2.346.937	124,7
United Kingdom	DAUK	7.592,4	15.849.021	961,2
Total (with UK)		87.934,4	183.562.885	11.484,9
Total (without UK)		80.342,0	167.713.864	10.523,7

* DACE EU countries: Slovakia, Czech Republic, Hungary, Austria, Slovenia, Croatia, Romania, Bulgaria, Poland.

LIFE 3R contribution to EU market priorities

Currently, there is no common methodology or place applied for F-gas stakeholders to get in contact easily and trade refrigerants. Therefore, the development of an innovative Self-certification scheme is one of the LIFE 3R project main priorities, enabling both the removal of barriers existing today in HVAC-R sector as well as the efficient and reliable management of recovered F-gas within the EU market. Special emphasis is given on transparency in order to harmonise F-gases amounts, quality and prices.

LIFE 3R project also aims to the control of F-gases and the reduction of greenhouse emissions, via the implementation of an integral and economically viable f-gas circular economy scheme, thus providing a new sustainable business model into the European HVAC-R industry.

Assessment LIFE 3R legal barriers in EU

During the preparation and launch of Retradeables platform, we encountered different legal frameworks regarding the definition and handling of used refrigerant in our three pilot countries – Slovakia, Hungary and Czech Republic. In Hungary and Czech Republic such a refrigerant is declared as waste, which restricts its handling, while in Slovakia recovered refrigerant from the unit is not immediately declared as waste and represents a valuable resource. Generally, we lobby for a uniform EU regulation that recovered refrigerant should not automatically classified as a waste unless the holder declares it a waste. By not being classified as a waste, we avoid all barriers which waste regulation brings, and we would be able to stimulate circular economy of the refrigerants and open new opportunities for our project. Efforts are being made to escalate the issue of ‘refrigerant not being a waste’ to EU authorities to work towards a common EU legal frame for the recovered refrigerant, in order to support circular economy. A unified EU regulation, with a precise definition that recovered refrigerant, is not a waste unless holders decide to declare it as waste, would be a great support for the circular economy of refrigerants. By removing existing barriers to the domestic and international trading & transport of refrigerants (of course, suitable for recycling or reclaiming), we enable the reuse of existing resources, increase the amount of reclaimed refrigerant, open-up additional commercial and business opportunities for SMEs, in line with EU’s strong determination to support circular economy. Next to this, we will further stimulate business activity with used refrigerants, reduce the risk of refrigerant release into the atmosphere (reduced leakage rate, since the refrigerant will have a value) and improve cross-border refrigerant circulation in the country and in the EU and reuse of refrigerants – increasing the amount of reclaimed refrigerants and thus the success of circular economy.

A more detailed description of the current F-gas market status in the EU can be found in the deliverable: "Market study". Overall, it is expected that all the information included in the Market study deliverable report, will play guiding role in the implementation of the next deliverables of the Action C4 of LIFE 3R. These are:

- ☞ Exploitation strategy.
- ☞ Transferability and IPR analysis.
- ☞ Updated Business plan.
- ☞ Replication and transferability plan.

D. Monitoring of the impact of the project actions

ACTION D1: Monitoring of the project impact

State: Ongoing

Foreseen start date: 01/01/2021

Actual start date: 01/01/2021

Foreseen end date: 30/06/2023

Actual (or anticipated) end date: 30/06/2023

D1.1 Methodology and tools (led by DACE, M7-M12)	Status: Completed
D1.2 Performance Indicators monitoring (led by DACE, M12-M36)	Status: Ongoing

- ✓ All deliverables to be submitted in this reporting period have been completed and the milestones have been achieved. No deviations from Grant Agreement have occurred and foreseen, in terms of delays of Deliverables and milestones (see table below).

Deliverable name	deadline	status
Environmental and socio-economic impacts final report	06/2023	To be completed by DACE on 06/2023-no delay
Environmental and socio-economic impacts 2 nd report. Progress report	09/2022	To be completed by DACE on 09/2022-no delay
Monitoring methodology and tools	06/2021	Completed by DACE
Life Cycle Analysis	05/2023	To be completed by DACE on 05/2023-no delay
Environmental and socio-economic impacts 1 st report. Progress report	12/2021	Ongoing- to be completed by DACE on 12/2021- no delay

Milestone name	deadline	Status
Monitoring methodology developed	06/2021	Achieved
Initial indicators collected. Establishment of the baseline	12/2021	Ongoing- to be achieved on 12/2021-no delay
Final indicators collected and quantifications of environmental and project impact (including LCA completed and Socio-economic impact assessment)	06/2023	To be achieved on 06/2023-no delay

D1.1 Methodology and tools (led by DACE, M7-M12)

The overall performance of Life 3R will be adequately monitored during the project, thanks to the well-defined KPIs that have been established. Meanwhile, the tracking of all indicators related to environmental, socio-economic and other critical factors will be followed-up for 5 more years after the project, including both first demos and new replications/transfers. This monitoring policy is intended to enhance the effectiveness and profitability of the 3R ECOSYSTEM in the long-term. In addition, it will ensure compliance between the impacts resulting from the implementation of the Life 3R project and the targets set for a 5-year period from the end of demos.

A significant number of tools are used to collect the data required for the impact monitoring of the project. The marketplace platform itself will be the main source of information. Nevertheless, other tools such as Google Analytics, DCC, event documentations, training documentations/statistics as well as client surveys have been promoted for this purpose, too. All tools are linked with Power BI so that the output of the collected data can be performed in the form of Power BI reports (aggregated data sheets visualising the outcome). Based on these reports, it will be possible to track Life3R's progress against the imposing targets (KPIs).

Power BI Report

Power BI, information reports generated, containing the output of the data extracted from the various monitoring tools. The information is managed on a monthly and YTD (year-to-date) basis to monitor the respective LIFE 3R's KPIs. To visualize the results, custom visualizations will be created. Figure 8 illustrates an outline of how the data is sorted and displayed in this type of report.

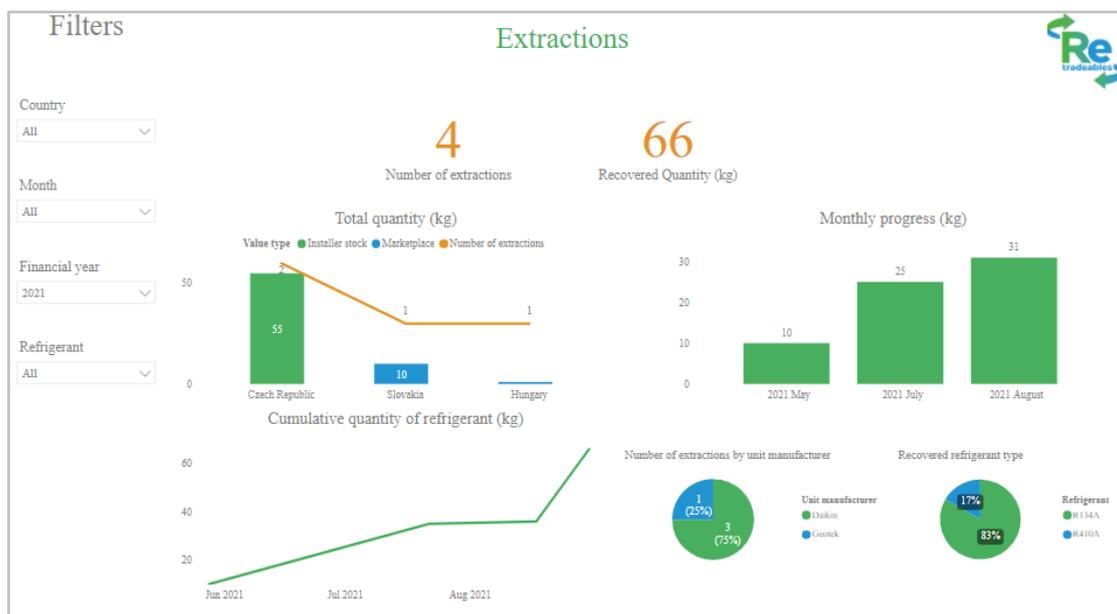


Figure 8: Example of custom data visualizations in the Power BI Report

An overview of the KPI monitoring data sources is presented in Table 11:

Table 11: Overview of the KPI monitoring data sources.

Indicators	Means of verification	Source of monitoring
1st KPI: Improved Environmental and Climate Performance		
1. Reduction of greenhouse gas emissions (GHG)	Estimation of the F-gas recovered via 3R ECOSYSTEM (CO2 equivalent)	Platform Statistics
2. Waste reduction	The annual amount of refrigerant to be introduced in the platform – F-gas reusability levels (per year)	Platform Statistics
2nd KPI: Better Use of Natural Resources		
1. Reduced resource consumption - Raw materials (excluding energy)	Measure of the recycled or reclaimed, recovered F-gas	Platform Statistics
3rd KPI: Economic Performance, Market Uptake, Replication		
1. Employment	Jobs created	Platform Statistics
2. Replications/Transfers	Number of replications /transfers carried out	Manual Excel File
3. Expected revenues	Sales management	Platform Statistics
4. Market size in number of customers	Users and partners engaged	Platform Statistics, Manual Excel File
5. Payback time	Financial management and accounting	-
4th KPI: Communication, Dissemination, Awareness Rising		
1. Awareness rising	Number of entities/individuals reached/made aware (+training)	Google Analytics, DCC, Events documentation, Training Statistics, Client Surveys
2. Website	Visits counter	Google Analytics
3. Behavioural change	Number of entities/individuals changing behaviour	Platform statistics
5th KPI: Others		
1. Events/ Conferences	Number of events/ conferences/ workshops	Events documentation
2. Scientific Dissemination	Number of articles published	Manual Excel File
3. Networking actions	Number of networks established or preserved	Manual Excel File
4. Training campaigns	Number of training sessions and attendance list	Training Statistics

5. Monitor and Measure Indicators	KPIs on target Vs total KPIs	Power Bi Report
6. Monitor and Measure Indicators	KPIs not reaching target for three or more months	Power Bi Report

The methodologies and tools to be applied for the sufficient evaluation of Life 3R performance that will enable the comparison of the monitored results with the targeted ones are also presented in the deliverable "Monitoring methodology and tools".

D1.2 Performance Indicators monitoring (led by DACE, M12-M36)

The monitoring of the indicators started at the same time as the demos in Action C3. The project will certainly take some time to become productive. Therefore, the current pace of progress is quite slow as the demos are not yet sufficiently developed. This is mainly due to the small number of F-gas stakeholders that have so far registered on the Retradeables Marketplace, resulting in functionality issues with the platform. However, this is a rather temporary situation that will be resolved by the end of Q1 2022, given the intensification of communication and dissemination activities aimed at significantly increasing the popularity levels of the online marketplace platform.

All these above will be highlighted and reasoned in future work (Deliverable: "Environmental and socio-economic impacts 1st report. Progress report" prepared until 31/12/2021). Moreover, an indicative outline will be provided on how the targeted KPIs for the demos will eventually be reached, despite the primary discouraging results.

In any case, any significant difference between the expected impacts and the monitored ones will lead to a reassessment of the performance indicators by the Project Management Board. This task is essential in order to validate the efficiency and relevance of the innovative solution deployed.

Finally, it should be underlined that the impact monitoring process is directly linked to the Life Cycle Assessment (LCA) that will be carried out at the end of the project. The LSBTP of NTUA currently has access to software suite, namely Sima Pro, as well as several acknowledged Life Cycle Inventory (LCI) databases for up-to-date global market datasets. Sima Pro is the most widely used software among LCA practitioners.

E. Communication and dissemination of results Monitoring

ACTION E1: Public awareness and dissemination of results

State: Ongoing

Foreseen start date: 01/01/2022

Actual start date: 01/01/2022

Foreseen end date: 30/06/2023

Actual (or anticipated) end date: 30/06/2023

E1.1 Networking with other projects (led by NTUA, M7-M36)	Status: Ongoing
E1.2 Dissemination and Communication plan(led by DENV, M7-M36)	Status: Ongoing
E1.3 Training campaign (led by NTUA, M9-M17)	Status: Ongoing

All deliverables to be submitted in this reporting period have been completed and the milestones have been achieved. No deviations from Grant Agreement have occurred and foreseen, in terms of delays of deliverables and milestones with only exception the milestone "Completion of training sessions/campaign". Due to COVID 19 restrictions, the training campaign will most likely only consist of webinars (i.e., livecourses will probably be replaced by webinars) - **No impact on the project/no impact on other actions**. The training campaign will be an ongoing process and will be offered in each of the three demo countries during the next reporting period (see table below).

Deliverable name	deadline	status
LIFE 3R website	09/2020	Completed by NTUA
Dossier of the communication activities and the impact achieved. Progress report	12/2022	To be completed by DACE on 12/2022 - no delay
Training campaign structure and material	06/2021	Completed by NTUA
Dissemination and Communication plan	08/2020	Completed by DENV
Networking report	06/2023	To be completed by NTUA on 06/2023-no delay
Layman's report	06/2023	To be completed by DENV on 06/2023-no delay
Dossier of the communication activities and impact achieved. Final report	06/2023	To be completed by DACE on 06/2023-no delay

Milestone name	deadline	status
Completion of training sessions/campaign	11/2021	Ongoing/ this milestone will be achieved during the next reporting period

Project website available	09/2020	Achieved
Layman's report developed	06/2023	To be achieved on 06/2023-no delay
Dissemination and Communication plan developed	08/2020	Achieved

E1.1 Networking with other projects (led by NTUA, M7-M36)

The knowledge and experiences gained and the methodologies and best practices that have been developed during the reporting period are going to be shared electronically and/or face to face in meetings during international conferences with other ongoing projects like:

- REAL Alternatives 4 LIFE, safe use of alternatives to high GWP HFC refrigerants.
- CLIM-LOCAL2020 project, climate change mitigation actions at the local level.
- LIFE WEEE project: to maximise the collection of WEEE in Tuscany, Italy, and Andalusia, Spain.
- LIFE E-WASTE GOVERNANCE: a system for the collection and further treatment and recovery of WEEE and WPBA.

The Life 3R project team organized during the reporting period an online event to celebrate reaching the first milestone, the launch of RETRADEABLES (link: <https://www.youtube.com/watch?v=75JkedUk86Q>). All Life 3R project partners and the LIFE Programme's Monitoring & Evaluation Expert attended the online milestone meeting, each providing updates and future plans to the LIFE Programme. First examples, from our partners in selected 3 countries, give clear feedback that the value of recovered refrigerant is recognised. Further development of the relevant processes is expected. More than 100 participants from different stakeholders (installers, distributors, media, journalists, networking partners, people from other ongoing projects from the list above) participated in this event.

Network strategy

Besides the partner's network, the website represents the main access point to key information on the project (link: <https://retradeables.com/>). The homepage displays aggregated information about the main aspects of the project. It is supported by an introductory video about the project, as well as key aspects, the project's process and key partners. The homepage shows customizable blocks such as header, video, pull down menu, etc. These block regions are selectively displayed on the individual pages of the website. The Retradeables webpage provides thorough information regarding the project. Alongside the project's description, a graph is provided that helps understand the trading process, the scope is mentioned, and the project's objectives are denoted. On the bottom the European Union LIFE fund is mentioned. For communication purposes, a contact form has been created where visitors must fill in their name and an email address. The Deliverable: "LIFE 3R website" has been completed.

Regarding **Social Media**, a YouTube channel to provide informational material (link: https://www.youtube.com/channel/UC1GUPP0cqp9t_tyA9qBqoBQ) and a LinkedIn page to promote project actions and messages among policy makers and stakeholders and foster networking (link: <https://www.linkedin.com/company/retradeables>) have been operational.

E1.2 Dissemination and Communication plan (led by DENV, M7-M36)

Dissemination and Communication actions are the cornerstone to ensure high impact of results generated within the project, in terms of attracting interest of main stakeholders involved, informing and raising awareness to the general public and transferring technical information of the lessons learnt by the target stakeholders (AC sector and other F-gas users, F-gas distributors, policy makers, technological developer). The consortium promotes results and benefits for awareness raising and knowledge building within the EU ECOSYSTEM. The main goal behind these activities is to create value within the project's target communities and initiatives in the EU, while fully complying with GDPR (General Data Protection Regulation) provisions.

A dissemination and communication plan has been elaborated. Deliverable: "Dissemination and Communication plan" has been completed. The project Dissemination and Communication plan will be continuously updated. The trademark registration has been finalized. The project logo that is in use in all the internal and external communication materials has been designed. The project video (audio-visual promotional tool of LIFE 3R) has been completed

(link: <https://www.youtube.com/watch?v=zsnJeE9ET0k>). Digital media have been generated and have been distributed among the target groups and the general public. Technical publications have been already planned: NTUA and MAT4NRG are the leading entities for the planned publications during the project (demonstration phase 2021-2023). These will mainly be resulted from the laboratory tests of the prototype unit(s). A relative time estimate is that the first one will be produced in the 2nd half of 2022 and the remaining three during 2023.

All communication elements (e.g., website) that have been used as part of Action E1 include the LIFE logo and a clear reference to the financial contribution given by the LIFE Program.

E1.3 Training campaign (led by NTUA, M9-M17)

The Life 3R training campaign is a powerful tool for the purposes of attainment of the objectives set out in the Dissemination and Communication plan. For the period 2021 to 2028, during which 2 years of trials & 5 years of replication activities are planned consecutively, an aggregate minimum number of 38 training sessions, including both live courses and webinars, will be delivered in a total of 16 countries (3 demos + 13 replications). This implies the organisation of at least 12 training events (4 per demo country) as well as 26 training events (2 per replication country) during and after the end of the project, respectively. The equivalent size of participation has been estimated at 600 individuals for the first case (demos) and 2.600 individuals for the second case (replications).

Training campaign material is directly related to the proposed Methodology and Good Practice Guidelines (GPG) for the F-gas recovery/recycling process described in action C1 in this report and also in the Deliverable: "Methodology & Good Practice Guidelines" (June 2021), that includes all critical information required to build the capacity of the participating stakeholders (especially installers).

NTUA plays an overall supervisory role throughout the training program, which is dedicated to educating the involved stakeholders on how to proceed properly with the recovery and recycling of existing refrigerants (methodology and GPG). The relevant training material is not only limited to theoretical level (videos, presentations, manuals, etc.) but instead is extended to a practical level (demonstration activities). The ultimate objective is all of the participants and mainly (field) installers to become skilled enough to insert all required

information on the recovered F-gas quantity and quality in an accurate database, acting responsibly through a self-certification scheme in real-time and on-site.

The successful attendance and completion of a course by an installer will assure that the methodology and the good practice guidelines have been comprehended.

Due to COVID 19 restrictions, the training campaign (at the current stage) was agreed to consist only of webinars and to skip the live presentations. Online training – webinars – will be offered in each country. The platform supports the entire activity by developing a proper learning management online offering. During the next reporting period, an average of 50 participants per training event per demo country should be trained. Deliverable "Training campaign structure and material" - completed.

Short-description for the 1st Life 3R (Retradeables) webinar

Installers, as well as any other stakeholder related to the local F-gas sector, can register on the participation platform open for **Slovakia (SK), Hungary (HU) and Czech Republic (CZ)**. The one-day (4-hours) webinar, including a FAQ-session, is an ideal opportunity for all participants to gain a deep understanding of the fundamental methodology and Good Practice Guidelines (GPG) for the entire circular flow of refrigerants. A detailed presentation of all basic F-gas recycling and handling procedures is given, accompanied by corresponding training videos on the appropriate use of the auxiliary equipment applied (portable moisture & acidity checkers, portable composition analyzer, drier filters, vacuum cleaner, recovery machine etc.). Finally, the theory is turned into practice through a virtual demonstration of how to recover and recycle used refrigerants from HVAC-R applications, with the help of Daikin's innovative R-Cycle Unit. No participation fee is required. It is free.

F. Project management

ACTION F1: Project Management

State: Ongoing

Foreseen start date: 01/07/2021

Actual start date: 01/07/2021

Foreseen end date: >30/06/2023

Actual (or anticipated) end date: >30/06/2023

F1.1 Project Management (led by DACE, M1-M36)	Status: Ongoing
F1.2 After-LIFE plan (led by DACE, M31-M>36)	Status: Planned to be started M31

- ✓ All deliverables to be submitted in this reporting period have been completed and the milestones have been achieved. No deviations from Grant Agreement have occurred and foreseen, in terms of delays of deliverables and milestones.

Deliverable name	deadline	status
Extract of the project data from the KPI webtool	06/2023	To be completed by NTUA/DACE on 06/2023-no delay
Extract of the project data from the KPI webtool	12/2020	Completed by NTUA/DACE
Mid-term report	12/2021	The Midterm Report was due by the end of 2021. The deadline postponed by six weeks. The request accepted by PO and he expects the Midterm Report by 15 February 2022.
2 nd progress report	09/2022	The second Progress Report, due on September 2022, was discussed during the 1st monitoring visit. Since next monitoring visit will take place in May or June 2022, it is not necessary to submit a 2nd Progress Report and PO accepted deleting this report.
Minutes of final meeting	06/2023	To be completed by NTUA on 06/2023-no delay
Minutes of the Kick-off meeting	07/2020	Completed by NTUA
Final report	06/2023	To be completed by NTUA on 06/2023
Independent audit report	06/2023	To be completed 06/2023

After-LIFE plan	06/2023	To be completed by DACE on 06/2023
Progress report	03/2021	Completed by NTUA

Milestone name	deadline	status
Kick off meeting	07/2020	Achieved
Positive Mid-term report	03/2022	To be achieved on 03/2022-no delay
Positive final report. Technical and Financial	06/2023	To be achieved on 06/2023-no delay
After-LIFE plan defined	06/2023	To be achieved on 06/2023-no delay

F1.1 Project Management (led by DACE, M1-M36)

All necessary actions for the project management and coordination were undertaken. The progress has been in line with the budget, the proper implementation of the Work Plan and the achievement of project objectives. The coordination of the consortium is running smoothly with good understanding and collaboration between all partners towards the achievement of the objectives according to the Work Plan. KPIs (baseline) recorded through the KPI webtool.

- *Project Management Meetings:* An online project Kick off meeting has been organized during the first reporting period that took place on the 14th of October 2020. The main objective of the meeting was to have an overview of the project and to establish the LIFE 3R work plan for the coming months. It was also an opportunity to ensure that all 4 partners had a common understanding of the project and their roles and to get more information on the project management formalities. Thus, the **deliverable: "Minutes of the Kick-off meeting"** has been completed and the milestone: Kick off meeting has been achieved.
- *Progress meetings:* The first Progress meeting (teleconference) has been organised during the reporting period on May 28, 2021 under the organization of NTUA. Two (2) more progress meetings are to be held in M18, and M27, and the Final meeting is to be held in M36.
- *KPI Webtool:* The KPIs (Baseline) have been recorded through the KPI webtool and the relevant **deliverable: "Extract of the project data from the KPI webtool"** has been completed. The deliverable is an extract of the project data from the KPI webtool Baseline information.
- Positive Progress report 03/2021

6.2. Main deviations, problems and corrective actions implemented

Thus far, the progress has been in line with the budget, the proper implementation of the Work Plan and the achievement of project objectives with only exception a technical problem and more specifically the equipment delivery delay due to the global chip crisis (now affecting also the HVAC-R manufacturers), the Suez Canal blockage, and their subsequently impact on supply chain (e.g.: lack of containers to ship goods and consumables causing delays in project prototypes' development. As the world shut down because of the COVID-19 pandemic, many factories closed with it, making the supplies needed for chip manufacturing unavailable for months. Increased demand for consumer electronics caused shifts that rippled up the supply chain. Orders began to pile up as manufacturers struggled to create enough chips to meet the new levels of demand. The effects of the shortage are that some products were delayed.

The delays encountered or foreseen can be seen in Table 12. All the above-mentioned deviations are independent of the other Project Actions. Consequently, they will have no impact on the project.

- **No Financial or Organizational problems or difficulties** encountered or foreseen.

- The deviations from Grant Agreement that has occurred and foreseen, in terms of delays of deliverables and milestones are shown in the Table 12. **All deviations have no impact on the project. The project remains on schedule.**

Table 12: Deviations from Grant Agreement

Action Description		Justification and impact
F1	Deliverable: Minutes of the Kick-off meeting Milestone: Kick off meeting Delayed by less than 2.5 months	Internal issues of the coordinator – No impact on the project
C2	Milestone: Prototype unit for identification and removal of Oil and Moisture foreseen delay: 12-17 months <u>Foreseen Delays:</u> - D1: Prototype unit that can identify R32, R134a (pure HFC), and performance assessment -D2: Prototype unit that can identify blends (R410A, R404A, R407C) and performance assessment Expected delay: 12 months	Global chip crisis, the Suez canal blockage, and their supply chain impact-lack of containers to ship goods and consumables - No impact on the project

Other deviations:

Action E1:

- Regarding Social Media, it was agreed to create a LinkedIn page and YouTube channel and skip the Twitter Account.

Why: Twitter is a quite time-consuming platform as there is a quite different use in the different markets/countries – especially when it comes to languages and target groups. On LinkedIn the common language is English and if not, translations are available. People connect there more internationally, and we can reach a broader audience. So, we want to

focus on doing LinkedIn right instead of splitting the resources to two Social Media Platforms.

- Regarding the training campaign, it was agreed to consist only of webinars, and skip the live presentations.

Why: Unfortunately, the current situation regarding the Covid-19 mutations and the vaccination progress did not provide enough reliability to organize live presentations. Hopefully, things will be better and safer in the future for live presentations. A modification has also been made regarding the duration of the webinar. In the GA (see page 92/130), there is a reference to webinars lasting 3-4 days, 2 hours each day. We felt that this was not realistic and thus we agreed to turn them into one-day webinars (duration: 4 hours).

Action F1: Due to the global COVID-19 pandemic measures, the physical progress meetings have been replaced by teleconferences.

Amendment to the Grant Agreement:

In the next reporting period (December 2021), one Amendment to the Grant Agreement (change of the project acronym) will be requested. The project acronym will change from "LIFE 3R" to "LIFE Retradeables". The change of the acronym from LIFE 3R to LIFE Retradeables is necessary to align with the official name of the online trading platform, the social media accounts, and other marketing activities. 3R stands for Recover, Reclaim & Re-use and was more of a working title during the application phase. This modification will not impact the normal running of the project.

6.3.Evaluation of Project Implementation

The project is advancing satisfactorily in all sectors. The progress has been in line with the budget, the implementation of the Work Plan and the achievement of project objectives. To maintain a permanent flow of action with the aim of achieving the objectives set, the following project coordination actions have been carried out:

- ✓ Preparation of the Partnership Agreement
- ✓ Coordination & Monitoring meetings
- ✓ Organisation of different phone and online meetings between some partners in order to plan and monitor the project technical activities
- ✓ Continuous contact between all project partners for monitoring project activities
- ✓ Management of the financial aspects of the project
- ✓ Regular communication with the LIFE external monitor on the evolution of the project
- ✓ Project coordinator sent a monthly indication of operative activities to be done to all the partners

The following table compares the results achieved at the end of the LIFE 3R project against the objectives of the proposal:

Action	Foreseen in the revised proposal	Achieved at project Mid-term report	Evaluation
C1: Self-certification & Self-declaration schemes	1. Development of a methodology & Good practice Guidelines (GPG) 2. Database design and development	1. Methodology and GPG developed 2. Design of the database. The development of the database will be completed on May 2022	1. In line 2. In line
C2: F-gas identification & recycling prototypes	1. Requirements of prototype units for F-gas identification & recycling 2. Intercomparison tests, validity measurements and performance of the equipment 3. Upgrade units with IOT	1. - Definition of minimum requirements of equipment and analysers was assessed - Development of innovative prototypes for F-gas identification and recycling is an ongoing process 2. Intercomparison tests designed and performed / validity of measurements /	1. The foreseen delays in the prototypes development will have no impact on the project 2. In line 3. -

		proposed equipment 3. Not yet started	
C3: Demos: Go-live and Roll-out to EU markets	1. Development of the Marketplace platform 2. Slovakia (SK) 3. Czech Republic (CZ) 4. Hungary (HU) 5. Validation of the 3R ECOSYSTEM	1. Marketplace ready for testing 2. Started 3. Started 4. Started 5. Not yet started	1. In line 2. In line 3. In line 4. In line 5. -
C4: Exploitation & Replication and transferability plans	1. Exploitation plan 2. Replication & Transferability plan	1. - Market feasibility study completed - Exploitation strategy and Transferability and IPR analysis will be completed on January 2022. 2. Not yet started	1. In line 2. -
D1: Monitoring of the project impact	1 Methodology and tools 2. Performance indicators monitoring	1. Methodology and tools (monitoring schedule and specifications for the lifetime of the project) have been defined 2. The monitoring of the indicators just started (M16) at the same time as Demos in action C3.	1. In line 2. In line
E1: Public awareness and dissemination of results	1. -Networking - website, YouTube, LinkedIn 2. Dissemination and communication plan 3. Training campaigns	1. -networking actions (1) - website, YouTube and LinkedIn are continuously updated 2. Dissemination and communication plan has been	1. In line 2. In line 3. Satisfactory

		developed and will be continuously updated -Project logo, website, project video, attendance to workshops, conference, events, newsletters 3. Training campaign structure and material completed / webinars prepared and will be organised during the next months	
F1: Project Management	1. Management of project activities 2. After LIFE plan	1. Continuous contact between all project partners and project coordination and monitoring meetings 2. Not yet started	1. Great beneficiaries collaboration 2. -

It is clearly evident from the above table that the work carried out during the mid-term period of the LIFE 3R project is in line with what was expected in the LIFE 3R proposal.

– **Policy impact**

LIFE 3R caused adjustments to the legal interpretations of some incomplete legislation (recovered refrigerant is not a waste until it is declared as waste) and enabled additional interpretations of existing legal frameworks. Additional efforts are being made to escalate the issue of ‘refrigerant not being a waste’ to EU authorities to work towards a common EU legal frame for the recovered refrigerant, in order to support circular economy.

Summary of refrigerant barriers:

During the LIFE 3R project preparation and launch of Retradeables platform, we encountered different interpretations in our three pilot countries – Slovakia, Hungary and Czech Republic. Generally, **we suggest that recovered refrigerant should not automatically classified as a waste unless the holder declares it a waste.** By not being classified as a waste, we avoid all barriers which waste regulation brings, and we would be able to stimulate circular economy of the refrigerants and open new opportunities for our project. The legal assessment about refrigerant handling barriers can be found below.

Legal assessment about refrigerant handling barriers for EC support

After initial legal assessments in 3 pilot countries and available information from some other EU countries, the legal barriers for LIFE 3R are mostly connected to used refrigerant handling (transporting, warehousing, trading, recycling, reclaiming). When a refrigerant is recovered from the unit, and it is not processed yet, we lack unified definition, across EU, how to define and handle such refrigerant. In many EU countries (we know for sure in 2 pilot countries Czech Republic and Hungary but also Spain, Netherlands, Poland and Germany) such refrigerant is, after recovery, declared a hazardous waste. By such definition, potential of such used refrigerant in circular economy is significantly reduced. Furthermore, it does not support wide scale refrigerant reuse in single EU countries, and almost blocks cross EU trading, since hazardous waste handling requires different, very strict approach.

Such status doesn't fully block the project implementation in any of our 3 pilot countries, but there are limitations like: transport, trade and recycling – buying party has to possess the licence for hazardous waste, which only larger refrigerant distributors possess.

Problems also arise because the incomplete regulations leave too much space for different interpretations – this creates confusion in the market (e.g.: an installer could transport own quantities of recovered refrigerant, intended for reuse, without a hazardous waste licence?).

Our analysis shows that in Spain such platform would most probably not be feasible. A recovered refrigerant is, in any case, considered a hazardous waste, and complex procedures are required to obtain licences and authorisations for handling such refrigerant. Obtaining all the necessary authorizations, takes time - a realistic estimation is between 12 to 24 months. The cost only for the paperwork needed would be around 25.000 €. This is not all that needs to be done, but only this would represent a serious barrier for refrigerant re-use, recycling or similar actions which are necessary for enabling F-gas circular economy.

Netherlands, Poland and Germany have the similar problem, special waste licences are necessary recovered refrigerant handling (transport, trade, recycling, reclaiming) without exception.

In Slovakia, situation is positively different. Recovered refrigerant from the unit is not immediately declared as a waste, and represents a valuable resource. It can be re-used, traded with and recycled, without legal barrier, only standard records and log books must be properly maintained. Next to it, transport of such re-usable refrigerant, does implicate special licences, and recovered refrigerant may be freely transported to the recycling or collecting points, and from collecting points to recycler. Refrigerant becomes waste once it is declared as waste, in which case it must be properly disposed and records about it kept. The key point is that **recovered refrigerant is not automatically a waste unless the holder decides to dispose of it.**

A unified EU regulation, with a precise definition that recovered refrigerant is not a waste unless holders decide to declare it as waste, would be a great support for the circular economy of refrigerants. By removing existing barriers to the domestic and international trading & transport of refrigerants (of course, suitable for recycling or reclaiming), we enable the reuse of existing resources, increase the amount of reclaimed refrigerant, open-up additional commercial and business opportunities for SMEs, in line with EU's strong determination to support circular economy. Next to this, following the good example of Slovakia, we will further stimulate business activity with used refrigerants, reduce the risk of refrigerant release into the atmosphere (reduced leakage rate, since the refrigerant will have a value) and improve cross-border refrigerant circulation in the country and in the EU and reuse of refrigerants – increasing the amount of reclaimed refrigerants and thus the success of circular economy.

6.4. Evaluation of Project Implementation

For the reporting period an analysis of benefits is provided below. The benefits will also be presented in future work (Deliverable entitled "Environmental and socio-economic impacts 1st report. Progress report" that is planned to be completed on 31/12/2021).

1. Environmental benefits

Improved environmental and climate performance

The project strongly promotes circular economy of refrigerants. It raises awareness of a need to re-use our resources, and creates a value on recovered, used refrigerant, which would otherwise, in most cases, become a waste. First examples, from our partners in selected 3 countries, give clear feedback that the value of recovered refrigerant is recognised, and further development of the relevant processes, are expected. Thus, the value of recovered refrigerant is a reality, and volumes are expected to increase even more in the near future. After that, the recognition of a value for the recovered refrigerant is directly linked to a reduction in leakage rates. Especially, given the growing interest of companies in recovered refrigerants, leakage rates will be gradually reduced either by paying more attention to the quality of an installation (tightness) or by taking care of the refrigerant collection at the end of a lifecycle. This will prevent the illegal release of such refrigerant into the atmosphere (**Prevention of direct CO2 emissions**).

The specific impact of the project in this topic is reflected in the 1st KPI: "Improved Environmental and Climate Performance".

1 st KPI: Improved Environmental and Climate Performance (Demonstration phase: 2021-2023)				
Indicators	Mean of verification	Estimated impact		Comments
		Absolute values *	Change (%) **	
1. Reduction of greenhouse gas emissions (GHG)	Estimation of the F-gas recovered via 3R ECOSYSTEM (CO2 equivalent)	1,5 million Tons CO ₂ eq/year	98%	For the 3 demo countries a calculation was made over the installed base - number of units sold per year multiplied by the average life time of the equipment. Then, assumptions were made over the renovation rate per different sector. The total amount is 3,1 million Tons of CO ₂ eq. reduced during the demos (2 years) so an average of 1,5 million Tons eq./year has been estimated. This means a 98% change estimation, since the previous reduction rate was zero.

2. Waste reduction	The annual amount of refrigerant to be introduced in the platform - F-gas reusability levels (per year)	742 Tons/year	98%	The amount of the F-gas recovered, expressed in Tons/year. Since the total recovery will be 1.485 Tons of F-gas at the end of the project, the average per year (2 years for the demos) will be 742,5 Tons of F-gas recovered. This means a 98% change estimation, since the previous reduction rate was zero.
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The first effect after the development and rolling out of the online marketplace into the 3 trial countries, Hungary, Czech Republic and Slovakia is shown below. The tracking of targets has been changed from monthly progress over the whole project period to the numbers listed in the following table. The target for the end of the project remains the one from the Grand Agreement.

TARGET END OF PROJECT	06/2021	10/2021	12/2021	06/2022	12/2022	06/2023
<i>Estimated impact Absolute values</i>						
1,5 million Tons CO _{2,eq} /year	0	214	404	1,499,743	2,249,721	3,000,000
742 Tons/year (2 years for the demos)	0	106	200	742,447	1,113,724	1,485,000

In addition, thanks to the additional quantities of refrigerant legally available on the market (refrigerant collected through the platform, recycled or reclaimed and then reused), there should be less space for illegal refrigerants, which is one of the issues the EU combats with. This effect is hard to measure, but will be observed by all market players on a high priority level anyways.

Better Use of Natural Resources

Recycling machines will play a key role, as they are being strongly introduced in all 3 markets through the LIFE 3R project, thus allowing both the capacity of companies and the overall production capacity to be increased. Actually, it is the introduction of recycling machines that will open up new opportunities for companies to introduce recycling on their

own, on top of the platform volumes, contributing to the achievement of the project's ultimate goal – the reuse of all available recovered refrigerants on the market (increase in the total amount of recycled/re-used refrigerant).

This Impact of the project is reflected in the 2nd KPI: "Better Use of Natural Resources".

2nd KPI: Better Use of Natural Resources (Demonstration phase: 2021-2023)				
Indicators	<i>Mean of verification</i>	<i>Estimated impact</i>		<i>Comments</i>
		<i>Absolute values</i>	<i>Change (%)</i>	
1. Reduced resource consumption - Raw materials (excluding energy)	<i>Measure of the recycled or reclaimed, recovered F-gas</i>	594 Tons/year	80%	During the recycling or reclamation of the recovered gas (742 Tons/year), a maximum of 20% of mass loss is envisaged due to the chemical procedure used (i.e.: 594 Tons/year → 1.188 Tons in total at the end of the project). Hence, an 80% improvement is foreseen.

The reason for the current status of the 2nd KPI, as seen in the next table, is caused of the fact that the impact of the project in better use of natural resources can only start after the development and roll-out of the Retradeables platform. Therefore, the distribution of the target numbers has been shifted to the second half of the project period, as seen below:

2nd KPI: Better Use of Natural Resources		TARGET END OF PROJECT	10/2021	12/2021	06/2022	12/2022	06/2023
1. Reduced resource consumption -	<i>Measure of the recycled or reclaimed, recovered F-gas</i>	594 Tons/year	85	160	593,958	890,979	1,188,000

2. Economic Performance, Market Uptake, Replication

Furthermore, the LIFE 3R project will also increase economic activity and create new jobs. There is an interest by some companies, outside of standard pool of companies, to engage themselves in the process as refrigerant recyclers. This will increase the market coverage and remove barriers to the availability of refrigerant recycling centres. Also, the more companies are involved in the process, the more refrigerant will be re-used and healthier competition will be established on the market.

The specific impact of the project in this topic is reflected in the 3rd KPI: "Economic Performance, Market Uptake, Replication".

3rd KPI: Economic Performance, Market Uptake, Replication (Demonstration phase: 2021-2023)				
Indicators	<i>Mean of verification</i>	<i>Estimated impact</i>		<i>Comments</i>
		<i>Absolute values</i>	<i>Change (%)</i>	
1. Employment	<i>Jobs created</i>	72 FTEs	98%	This calculation is based in 3 direct jobs (3 FTEs) in DENV for the operation of the platform itself + an assumption of involving 1.369 installers as users in the demos, with a dedication of 0,05 FTE = 68,5 FTEs, both at the end of the project. This means a 98% change estimation, since the previous reduction rate was zero.
2. Replications/ Transfers	<i>Number of replications /transfers carried out</i>	3 replications	N/A	3 demo countries (SK, CZ, HU) completed at the end of the project.
3. Expected revenues	<i>Sales management</i>	135.214 euros	N/A	For more information, see Section B3 – Figure 3 of Grant Agreement.
4. Market size in number of customers	<i>Users and partners engaged</i>	1.407 customers	N/A	Assumption based on 1.369 dedicated Daikin installers + 4 Chemical Producers + 14 Gas Distributors + 6 Manufacturers of HVAC-R + 14 Wholesalers involved in the demo countries at the end of the project.
5. Payback time	<i>Financial management and accounting</i>	N/A	N/A	Payback period (PBP) is estimated in a longer-term basis. PBP = Capital invested / Net income.

The progress of the KPI as per October 2021 is shown in the following table, as well as the planned progress towards achieving the set end of project target:

3rd KPI: Economic Performance, Market Uptake, Replication		TARGET END OF PROJECT	10/2021	12/2021	06/2022	12/2022	06/2023
1. Employment	<i>Jobs created</i>	72 FTEs	6	7	35	53	72

2. Replications/Transfers	<i>Number of replications/transfers carried out</i>	3 replications	3	3	3	3	3
3. Expected revenues	<i>Sales management</i>	135.214 euros	8	10	1,000	10,000	135,214
4. Market size in number of customers	<i>Users and partners engaged</i>	1.407 customers	66	71	655	1,019	1,407

3. Communication, Dissemination, Awareness Rising, policy implications

Many presentations and introductions of the LIFE 3R project have been done so far. There is full support from experts; various involved companies and request roll out to additional European countries. This raises **public awareness of the recycling potential and gives credence to new technologies that have the circular economy at their core**. It also creates a public pressure on technology development to always keep in mind the reuse of resources (circular economy).

Ministries and governmental agencies have expressed clear support for the project. It also raises awareness that circular economy of refrigerants can be supported by setting such conditions in tenders, forcing the industry to produce less waste and recycle as much as possible. **LIFE 3R also caused adjustments to the legal interpretations of some incomplete legislation (recovered refrigerant is not a waste until it is declared as waste) and enabled additional interpretations of existing legal frameworks**. These interpretations have made the process clearer and also cheaper for the client holding the recovered refrigerant. **Additional efforts are being made to escalate the issue of ‘refrigerant not being a waste’ to EU authorities** to work towards a common EU legal frame for the recovered refrigerant, in order to support circular economy.

The monitoring figures of the "Communication, Dissemination, Awareness Rising" are based on the 4th KPI as below:

4th KPI: Communication, Dissemination, Awareness Rising (Demonstration phase: 2021-2023)				
Indicators	<i>Mean of verification</i>	<i>Estimated impact</i>		<i>Comments</i>
		<i>Absolute values</i>	<i>Change (%)</i>	

1. Awareness rising	<i>Number of entities/individuals reached/made aware (+training)</i>	<i>30.600 individuals</i>	<i>98%</i>	30.000 individuals reached combining the demos and the Dissemination and communication actions: Calculation based on the amount of Installers/Service Companies and total amount of other stakeholders. 600 individuals involved in training campaigns: 200 persons per demo country. Overall, this means a 98% change estimation, since the previous reduction rate was zero.
2. Website	<i>Visits counter</i>	<i>10.000 visits</i>	<i>N/A</i>	At least 10.000 visits are expected for the project website at the end of the project, as a result of the Dissemination and Communication actions
3. Behavioural change	<i>Number of entities/individuals changing behaviour</i>	<i>1.369 individuals*</i>	<i>80%</i>	The installers that participate in the platform will focus more and more efforts on the recovery compared to the past. In the relevant countries we assume that only 20% of them were already active in recovery today.

*Installers who are Daikin partners.

The progress of the KPI as per October 2021 is shown in the following table, as well as the planned progress towards achieving the set end of project target:

4th KPI: Communication, Dissemination, Awareness Rising		TARGET END OF PROJECT	10/2021	12/2021	06/2022	12/2022	06/2023
1. Awareness rising	<i>Number of entities/individuals reached/made aware (+training)</i>	<i>30.600 individuals</i>	2,065	6,780	16,250	24,659	30,600
2. Website	<i>Visits counter</i>	<i>10.000 visits</i>	1,000	1,500	5,000	7,500	10,000
3. Behavioural change	<i>Number of entities/individuals changing behaviour</i>	<i>1.369</i>	65	70	650	1,009	1,369

However, progress on the project target of awareness rising is also reflected through the 5th KPI: "Others" (indicators):

5 th KPI: Others (Demonstration phase: 2021-2023)				
Indicators	Mean of verification	Estimated impact		Comments
		Absolute values	Change (%)	
1. Events/ Conferences	Number of events/ conferences/ workshops	2 events	N/A	At least 2 workshops will be organised by the project partners. Additional participation in events is also expected.
2. Scientific Dissemination	Number of articles published	4 publications	N/A	At least 4 publications will be done during the project.
3. Networking actions	Number of networks established or preserved	2 actions	N/A	At least 2 networking actions with current projects are envisaged before the end of the project.
4. Training campaigns	Number of training sessions and attendance list	12 training campaigns	N/A	(1 live training session + 3 webinars) per demo country (3 in total) = 12 campaigns at the end of the project.

The follow-up of the individual indicators of the 5th KPIs is planned as shown in the table below:

5 th KPI: Others		TARGET END OF PROJECT	10/2021	12/2021	06/2022	12/2022	06/2023
1. Events/ Conferences	Number of events/ conferences/ workshops	2 events	1	1	1	2	2
2. Scientific Dissemination	Number of articles published	4 publications	0	0	0	1	4
3. Networking actions	Number of networks established or preserved	2 actions	1	1	1	2	2
4. Training campaigns	Number of training sessions and attendance list	12 training campaigns	0	0	3	9	12

7. Key Project-level Indicators

The project's progress towards achieving the Key Project-level Indicator (KPI) targets has been assessed. Together with this report, a table with a compilation of the indicators referred in this report will be sent. **The monitoring of the indicators has started (on M16, at the same time as the demos in Action C3).** The project will certainly take some time to become productive. Therefore, the results of impact monitoring are not as desired in the first months of the demonstration phase. This will be highlighted and reasoned in future work (Deliverable: Deliverable entitled "Environmental and socio-economic impacts 1st report. Progress report" prepared until 31/12/2021). Moreover, an indicative outline is provided of how the targeted KPIs for the demos will eventually be reached, despite the primary discouraging results.

Any significant difference between the expected impacts and the monitored ones (if any) will lead to a reassessment of the performance indicators by the Project Management Board to validate the efficiency and relevance of the innovative solution deployed.

8. Comments on the financial report

8.1. Summary of Costs Incurred

The following table shows the project costs incurred compared to the approved budget.

PROJECT COSTS INCURRED			
Cost category	Budget according to the grant agreement in €*	Costs incurred within the reporting period in €	%**
1. Personnel	2.047.873,0	616964,12	~30
2. Travel and subsistence	84.800,0	6.278,57	~7,4
3. External assistance	337.000,0	362.786,25	~ 107,6 ^{*1,2}
4. Durables goods: total <u>non-depreciated</u> cost	132.500,0	0,0	0,0
- <i>Infrastructure sub-tot.</i>	0	0,0	
- <i>Equipment sub-tot.</i>	27.500,0	0,0	
- <i>Prototype sub-tot.</i>	105.000,0	0,0	
5. Consumables	21.976,0	5.040,75	~23
6. Other costs	80.500,0	32.372,84	~40,2
7. Overheads	189.055,0	51.388	~27,2
TOTAL	2.893.704,0	1.074.830,53	~37,1

*) If the EASME has officially approved a budget modification through an amendment, indicate the breakdown of the revised budget. Otherwise this should be the budget in the original grant agreement.

***) Calculate the percentages by budget lines: e.g. the % of the budgeted personnel costs that were actually incurred

The overall costs incurred until the end of October represent ~37,1% of the total costs of the project budget. This period of time is roughly 44% of the 3 years of the project, which means that the budget is being spent within the foreseen limits and there is no discrepancy with regard to initial estimations. The main budget changes for some beneficiaries are defined below:

Changes in Roles

^{*1}The following roles moved to the category “**External Assistance**” due to the fact that DENV could not provide internally a legal consultant. 10,880 Euros will be used to cover the invoice of the external partner.

Beneficiary	Action	Type of contract	Short Role	Category/Role in the project	Daily rate (rounded to the nearest	Number of person-days	Direct personnel costs (€)

DENV	C1	Additional staff	Legal Consultant	Legal Consultant - Elaboration of the Good Practices and self-declaration	340	12	4,080
DENV	F1	Additional staff	Legal Consultant	Legal Consultant - All legal issues related to the management of consortium, IPR issues and partnership agreement with stakeholder.	340	20	6,800

For the following roles, the “Category/Role in the project” changed:

Before:

Beneficiary	Action	Type of contract	Short Role	Category/Role in the project	Daily rate (rounded to the nearest)	Number of person-days	Direct personnel costs (€)
DENV	C1	Additional staff	Senior Technology Expert	Senior Technology Expert - Definition and development of the methodology the Self-certification and Self-Declaration	910	48	43,680
DENV	C1	Additional staff	EU Legislation Expert	EU Legislation Expert for the development of the Self-certification in line all EU policies in EU countries	680	12	8,160
DENV	E1	Additional staff	Senior Technology Expert	Senior Technology Expert - Coordination of all dissemination and	910	60	54,600

				communication actions and elaboration of the Communication Plan and strategy with all stakeholders			
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After:

Beneficiary	Action	Type of contract	Short Role	Category/Role in the project	Daily rate (rounded to the nearest)	Number of person-days	Direct personnel costs (€)
DENV	C1	Additional staff	Senior Technology Expert	Alignment of industry definitions over recovered products	910	48	43,680
DENV	C1	Additional staff	EU Legislation and Standard Expert	EU Legislation and Standard Expert - Advise in EU legislation and revise standard for the project	680	12	8,160
DENV	E1	Additional staff	External communication expert	External communication expert-Senior Technology Expert - Coordination of all dissemination and communication actions and elaboration of the Communication Plan and strategy with all stakeholders	910	60	54,600

Changes between beneficiary

All Emakina's invoices dated after 1/3/2021 invoiced to DENV due to the fact that DENV became the owner of the platform. It was originally foreseen that DACE will be the owner of the platform and will also be responsible for the organised services but after 1/3/2021 it has been decided that the DENV will be the owner of the platform and be responsible for the services (*DENV External assistance costs were not foreseen in the Grant Agreement as DACE was the owner of the platform*).

Between 1/7/2020 and 28/2/2021, DACE spent^{*2}:

- a. 141.103,75 euros under the description: "IT Development of the Marketplace" consuming all the 100k budgeted, the rest will be covered by personnel costs.
- b. 15.000 euros under the description "IT Development of Self Certification / Declaration" leaving unused 75k euros.

Therefore, the following transactions will be paid by DENV:

- c. 75k from description "IT Development of Self Certification / Declaration"
- d. 47k from description "Connectivity of Self Certification / Declaration with"

Beneficiary	Action	Procedure	Description	Costs (€)
DaikinDACE	C1	Multiple offers	IT Development of Self Certification / Declaration	90,000
DaikinDACE	C1	Multiple offers	Connectivity of Self Certification / Declaration with	47,000
DaikinDACE	C2	Direct treaty	IOT implementation in tools development	20,000
DaikinDACE	C3	Direct treaty	IT Development of the MarketPlace	100,000
DaikinDACE	E1	Multiple offers	Marketing activities for the dissemination of LIFE 3R; video of the project, notice board	60,000
DaikinDACE	E1	Direct treaty	Logo design	1,000
DaikinDACE	F1	Direct treaty	Web of the project	13,000
DaikinDACE	F1	Direct treaty	Catering in the meetings hosted by DACE	6,000

Part of the travel expenses budgeted by DENV (16,800 euros) moved to the category "External Assistance" due to the fact that the platform development expenses were higher than what was budgeted and in addition travel expenses were not consumed in the first part of the project due to the COVID situation. Therefore the meetings were organized online.

Beneficiary	Action	Explanations of assumptions	Travel and subsistence rate	Number of travels	Total travel and subsistence costs	Beneficiary NEW	Description/Category NEW	Costs (€)
DENV	C1	EU Knowledge exchange and development direction, at NTUA, 2 persons 2 times	1,000	4	4,000	DENV	External Assistance	-1,500

DENV	C2	Inside EU Knowledge exchange, development follow up and trial in factory in Italy and NTUA, 2 persons	1,000	4	4,000	DENV	External Assistance	-1,500
DENV	E1	EU Networking and visit in different fairs and events	600	12	7,200	DENV	External Assistance	-7,200
DENV	C4	Inside EU Business Plan development and implementation of different local requests, 2 persons	500	10	5,000	DENV	External Assistance	-5,000
DENV	D1	EU Overview of the results, 1 person to Vienna	800	2	1,600	DENV	External Assistance	-1,600

DACE comments on financial statement:

Since we couldn't travel, due to Covid, we had to use more of (local) external assistance and switched the budget from Travel to External Assistance, as well. The same is with the moving of personnel costs to external assistance.

8.2. Accounting system

- All beneficiaries respect the procedure of the best value for money for selecting all the project costs.
- All the beneficiaries approved only the costs:
 - ✓ directly linked to, and necessary for, carrying out the LIFE 3R project;
 - ✓ reasonable, justified and comply with the principles of sound financial management, in particular in terms of economy and efficiency;
 - ✓ compliant with applicable tax and social legislation; and
 - ✓ actually incurred during the lifetime of the project, as defined in the grant agreement, and which could be identifiable and verifiable
- All the beneficiaries charged to the project only invoices contain a clear reference to the LIFE 3R project.
- All beneficiaries have defined the following internal specific code which identifies the project and all costs and income related to the project:
 - ✓ **DACE:** cost center in DACE: 4000027
 - ✓ **DENV:** Cost Center 100058 with Project Code F10005820004
 - ✓ **MAT4NRG:** The code at the accountants office for the LIFE 3R project is 100 (Projektkosten).

✓ **NTUA:**accounting system code for the LIFE 3R project is 63235100

- ☞ Every payment is put in the excel sheet of the financial report of LIFE
- ☞ The project expenses are all recorded with the respective cost center and are validated monthly by the finance department.

Time recording system

All beneficiaries are using LIFE timesheet model for monthly time recording, only the ones that are full time in the project didn't fill timesheets. Team members fill in hours worked in the project, and the information is subsequently checked by the person in charge of keeping track of scheduled/completed activities.

8.3.Partnership arrangements

DACE, as coordinating beneficiary, carried out all the appropriate LIFE 3R payments to the other beneficiaries without unjustified delay in accordance with the agreements concluded with the associated beneficiaries in the Partnership Agreement (will be sent with this report). In the beginning of the next reporting period some changes in the Partnership Agreement will be discussed and an updated version of the Partnership Agreement will be signed by all beneficiaries on February 2022. The updated Partnership Agreement will be included in the final report.

All the beneficiaries entered directly the information in the financial excel sheets of the LIFE 3R project. The procedure to collect the financial data is the following:

- ✓ Monthly, each Beneficiary performs an update of the expenses on the individual financial statement sheets.
- ✓ Every six months, the Project Manager reviews the updated LIFE excel sheets and check if the reporting is being developed according to the EC requirements and if any incoherence is found talks with the beneficiaries and ask for modifications or corrections.
- ✓ Each partner fills in their own financial statement and the Consolidated Cost Statement is made by the project manager of DACE based on the individual financial statement documents by each beneficiary.
- ✓ Each beneficiary has a separate cost account where all LIFE 3R expenditures are registered. After filling in the excel files each beneficiary send the files to its finance department for an internal check.

8.4.Certificate on the financial statement

N/A – the audit will be conducted after the project end.

8.5.Estimation of person-days used per action

Since the beginning of the project, the partnership is not having in concern the days per action. It would be very difficult and not realistic if this table was filled. So, the partnership chose not to fill this table.

The following documents will be sent with this report

1. Project Deliverables to be submitted with the Midterm report

Action C1:

- Methodology & Good Practice Guidelines

Action C2:

- Intercomparison tests / validity of measurements / proposed equipment & analysers

Action C3:

- Marketplace platform
- Face to face interviews with key users and online survey with the rest of the users

Action D1:

- Monitoring methodology and tools

Action E1:

- Training campaign structure and material

2. Financial statement to be submitted with Midterm report

- The Consolidated Financial statement
- The financial statement of the Individual beneficiary

3. Partnership Agreement

4. Key Project-level Indicators

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10. Annexes

10.1 Overview of follow up of KPI targets

October 2021 – June 2023

1st KPI: Improved Environmental and Climate Performance		TARGET END OF PROJECT	10/2021	12/2021	06/2022	12/2022	06/2023
1. Reduction of greenhouse gas emissions (GHG)	<i>Estimation of the F-gas recovered via 3R ECOSYSTEM (CO2 equivalent)</i>	<i>1,5 million Tons CO₂,eq /year</i>	214	404	1,499,743	2,249,721	3,000,000
2. Waste reduction	<i>The annual amount of refrigerant to be introduced in the platform - F-gas reusability levels (per year)</i>	<i>742 Tons/year (2 years for the demos)</i>	106	200	742,447	1,113,724	1,485,000
2nd KPI: Better Use of Natural Resources		TARGET END OF PROJECT	10/2021	12/2021	06/2022	12/2022	06/2023
1. Reduced resource consumption - Raw materials (excluding energy)	<i>Measure of the recycled or reclaimed, recovered F-gas</i>	<i>594 Tons/year</i>	85	160	593,958	890,979	1,188,000

3rd KPI: Economic Performance, Market Uptake, Replication		TARGET END OF PROJECT	10/2021	12/2021	06/2022	12/2022	06/2023
1. Employment	<i>Jobs created</i>	<i>72 FTEs</i>	6	7	35	53	72
2. Replications/Transfers	<i>Number of replications/transfers carried out</i>	<i>3 replications</i>	3	3	3	3	3
3. Expected revenues	<i>Sales management</i>	<i>135.214 euros</i>	8	10	1,000	10,000	135,214
4. Market size in number of customers	<i>Users and partners engaged</i>	<i>1.407 customers</i>	66	71	655	1,019	1,407
4th KPI: Communication, Dissemination, Awareness Rising		TARGET END OF PROJECT	10/2021	12/2021	06/2022	12/2022	06/2023
1. Awareness rising	<i>Number of entities/individuals reached/made aware (+training)</i>	<i>30.600 individuals</i>	2,065	6,780	16,250	24,659	30,600
2. Website	<i>Visits counter</i>	<i>10.000 visits</i>	1,000	1,500	5,000	7,500	10,000
3. Behavioural change	<i>Number of entities/individuals changing behaviour</i>	<i>1.369</i>	65	70	650	1,009	1,369

5th KPI: Others		TARGET END OF PROJECT	10/2021	12/2021	06/2022	12/2022	06/2023
1. Events/ Conferences	<i>Number of events/ conferences/ workshops</i>	2 events	1	1	1	2	2
2. Scientific Dissemination	<i>Number of articles published</i>	4 publicatio ns	0	0	0	1	4
3. Networking actions	<i>Number of networks established or preserved</i>	2 actions	1	1	1	2	2
4. Training campaigns	<i>Number of training sessions and attendance list</i>	12 training campaign s	0	0	3	9	12
5. Monitor and Measure Indicators	<i>KPIs on target Vs total KPIs</i>	0.85					
6. Monitor and Measure Indicators	<i>KPIs not reaching target for three or more months</i>	<1					