(Projects funded under the Call 2014 onwards must use this format)

LIFE Project Number

LIFE20 CCM/HR/001616

Final report

Covering the project activities from 05.07.2021 to 31.12.2024

Reporting Date[1]

31.03.2025

LIFE PROJECT NAME or Acronym

LIFE4GREENBROADBAND

Data Project	
Project location:	Croatia
Project start date:	05.07.2021
Project end date:	31.12.2024 **Extension date:** N/A
Total budget:	2.168.772 €
EU contribution:	1.192.824 €
(%) of eligible costs:	55%

Data Beneficiary	
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[1] Include the reporting date as foreseen in part C2 of Annex II of the Grant Agreement

This table comprises an essential part of the report and should be filled in before submission

Please note that the evaluation of your report may only commence if the package complies with all the elements in this receivability check. The evaluation will be stopped if any obligatory elements are missing.

Package completeness and correctness check	
Obligatory elements	**✓ or N/A**
Technical report	
The correct latest template for the type of project (e.g. traditional) has been followed and all sections have been filled in, in English *In electronic version only*	✓
Index of deliverables with short description annexed, in English *In electronic version only*	✓
Mid-term report: Deliverables due in the reporting period (from project start) annexed Final report: Deliverables not already submitted with the MTR annexed including the Layman's report and after-LIFE plan Deliverables in language(s) other than English include a summary in English *In electronic version only*	✓
Financial report	
The reporting period in the financial report (consolidated financial statement **and** financial statement of each Individual Beneficiary) is the same as in the technical report with the exception of any terminated beneficiary for which the end period should be the date of the termination.	✓
Consolidated Financial Statement with all 5 forms duly filled in and signed and dated *Electronically Q-signed or if paper submission signed and dated originals* and in electronic version (pdfs of signed sheets + full Excel file)*	✓
Financial Statement(s) of the Coordinating Beneficiary, of each Associated Beneficiary and of each affiliate (if involved), with all forms duly filled in (signed and dated). The Financial Statement(s) of Beneficiaries with affiliate(s) include the total cost of each affiliate in 1 line per cost category. *In electronic version (pdfs of signed sheets + full Excel files) + in the case of the Final report the overall summary forms of each beneficiary electronically Q-signed or if paper submission, signed and dated originals**	✓
Amounts, names and other data (e.g. bank account) are correct and consistent with the Grant Agreement / across the different forms (e.g. figures from the individual statements are the same as those reported in the consolidated statement)	✓
Mid-term report (for all projects except IPs): the threshold for the second pre-financing payment has been reached	**N/A**
Beneficiary's certificate for Durable Goods included (if required, i.e. beneficiaries claiming 100% cost for durable goods) *Electronically Q-signed or if paper submission signed and dated originals* and in electronic version (pdfs of signed sheets)*	✓
Certificate on financial statements (if required, i.e. for beneficiaries with EU contribution ≥750,000 € in the budget) *Electronically Q-signed or if paper submission signed original and in electronic version (pdf)*	✓
Other checks	
Additional information / clarifications and supporting documents requested in previous letters from the Agency (unless already submitted or not yet due) *In electronic version only*	✓
This table, page 2 of the Mid-term / Final report, is completed - each tick box is filled in *In electronic version only*	✓

**signature by a legal or statutory representative of the beneficiary / affiliate concerned*

Instructions:

Please refer to the General Conditions annexed to your grant agreement for the contractual requirements concerning a Mid-term/Final Report.

Both Mid-term and Final Technical Reports shall report on progress from the project start-date. The Final Report must be submitted to the Agency no later than 3 months after the project end date.

Please follow the reporting instructions concerning your technical report, deliverables and financial report that are described in the document Guidance on how to report on your LIFE 2014-2020 project, available on the LIFE website. Please check if you have the latest version of the guidance as it is regularly updated. Additional guidance concerning deliverables, including the layman's report and after-LIFE plan, are given at the end of this reporting template.

Regarding the length of your report, try to adhere to the suggested number of pages while providing all the required information as described in the guidance per section within this template.

1. Table of contents

Contents

2. List of key-words and abbreviations

BTS	Base telecommunication station
CB	Coordinating Beneficiary
CO2	Carbon dioxide
CO2e	Carbon dioxide equivalent
C2M	Close-to-market
ETS	Emissions trading scheme
FC	Free Cooling
GA	Grant Agreement
GHG	Green-house gases
ICT	Information and communication technologies
kW	Kilowatt
kWh	Kilowatts per hour
kWp	Kilowatt ‘peak’
KPI	Key project level indicators
PV	Photovoltaic
RES	Renewable Energy Sources
SDG	Sustainable Development Goals
TAG	Telekom Austria Group
tCO2	Tonnes of carbon dioxide

3. Executive Summary (maximum 2 pages)

Project LIFE4GREENBROADBAND is based on implementing energy efficiency and renewable energy measures in the electronic communications network in Croatia in order to reduce energy consumption, increase the use of renewable energy sources and reduce CO2 emissions of base telecommunication stations (BTS) as an integral part of the electronic communication network. Implementation of project actions will result in the implementation of solar plants on 120 BTS locations and indoor free cooling solutions on 200 BTS locations resulting in the annual reduction of 1,721,560 kWh of energy and accompanying CO2 emission of 404 tCO2.

Overall objective of the proposed project is to contribute to the sustainable transition towards a climate neutral economy by 2050 and to reach the EU emission reduction target for 2030 by reducing GHG emissions from the telecommunication industry (non-ETS sector). **Main specific objective** of the project is increasing energy efficiency and renewable energy use of the electronic communications network in Croatia in order to reduce GHG emissions.

The project also aims to achieve the following objectives:
- implementation of best practice renewable energy and energy efficiency solutions in the electronic communications network that are suitable for being replicated, transferred and mainstreamed
- improve the knowledge base and propose measures to relevant public authorities for the development and implementation of effective climate change mitigation actions in the telecommunication sector
- improve the policies and measures for implementation of energy efficiency, renewable energy and GHG reductions in the telecommunication sector
- raise public awareness on the need to reduce GHG emissions from the telecommunication sector
- assess the feasibility of large-scale uptake of free cooling and solar plants solutions in the telecommunication sector
- set energy performance standards for base stations as an integral part of the telecom network in terms of energy used per amount of data used
- multiply the impacts of projects' solutions and mobilize a wider uptake of free cooling and solar plants in the sector and transfer knowledge, methods and practices to other telecom operators in the EU
- to inform interested stakeholders, particularly telecom operators on project activities, results and benefits to increase replicability and transfer of project methods and techniques
- promote the use of best practice RES and energy efficiency technologies in the telecommunication sector

Expected key deliverables and outputs of the project are as follows:
- prepared solar plant project technical documentation for 120 locations
- solar plants implemented on 120 BTS locations
- free cooling solutions implemented on 200 BTS locations
- continuation, replication and transfer plan
- business plan for large scale uptake of free cooling and solar plants in the telecom industry drafted and disseminated to relevant stakeholders
- summary of the business plan including benefits and financial performance indicators
- proposal of measures to decrease GHG emissions in the telecom industry
- policy brief to decrease GHG emissions in the telecom industry

- 2 meetings with relevant public authorities and proposal of measures presented
- GHG performance benchmark for the telecom industry
- GHG inventory report for the Croatian telecom industry
- awareness raised on 1 press conference with 15 media representatives present
- 10 media articles published promoting the project
- 6 online workshops held for the replication of project results within the A1 Group
- project promoted on 2 meetings of telecom assocciations on EU and national level
- project promoted on the A1 Telekom Austria Group internal information system with a reach of 20,000 people
- 5 posts on social media promoting the project with a reach of 20.000 people
- 2 articles promoting the project on A1 Hrvatska website

Key implementation activities related to the implementation of free cooling and solar plants on base stations were implemented as planned by the end of 2023, despite initial delays that were addressed by effective project management. Free cooling solutions have been installed on 200 BTS locations as planned. Solar plants have been installed on 155 BTS locations by the end of 2023, with a total installed power of 418,5 kWp. It was initially planned that solar plants will be installed on 120 BTS locations in a technical configuration of 8 panels of 450W power, amounting to a total installed power of 432 kWp, which was not suitable for most locations. Due to technical limitations, it was only possible to implement solar plants in a configuration of 6 panels of 450W power amounting to 324 kWp of installed power on 120 locations. Considering that the procurement process for the implementation of solar plants resulted in a contract with about 30% price savings compared to the foreseen budget for 120 locations, we proposed to annex the contract with the supplier to expand the scope of works to 155 locations in total, which would have enabled us to nearly meet the KPIs related to RES production. After receiving approval from CINEA in June 2023, the contract with the supplier was annexed and all 155 solar plants were built by the end of 2023. Additionally, project continuation activities started during project implementation both in the area of solar plants and Free cooling solutions, which, by the end of 2024, resulted with the additional solar plant installations on 50 BTS locations, with a total installed power of 168.35 kWp and Free cooling installations on 628 outdoor container BTS locations. The combined effect of project implementation and continuation activities resulted in surpassing KPIs for end of project related to energy savings, RES production and GHG emissions.

Smart remote energy management software, accompanied by a mobile app was developed during the project and is being used for constant monitoring of installed solutions and provides precise data on energy production and savings achieved. Full year of monitoring of the installed solutions on 355 BTS locations has been achieved and presented in the Third summary report on achieved indicators. All project activities were carried out in accordance with the foreseen dynamic and were finished on schedule, with great results in terms of visibility and impact, as awareness raising and replication activities influenced a much higher number of people than initially planned, reaching 225,886 people (209,504 excluding social media), surpassing by more than double the planned value for 3 years beyond. The CB has successfully collected and analysed data on energy use and emissions in the Croatian telecom industry and their respective groups, and proposed a GHG performance benchmark that can be used as an industry performance standard that also enables tracking of climate performance of telecom operators, which can be further used to implement targeted measures to reduce GHG emissions of the telecom sector. The CB drafted the GHG inventory report for the Croatian telecom industry and Proposal of measures to decrease GHG emissions in the telecommunication industry, that were disseminated to key stakeholders in the project implementation period.

4. Introduction (maximum 2 pages)

A1 Hrvatska, as part of the A1 Telekom Austria Group (TAG) actively assumes its ecological and social responsibility by promoting more efficient, resource-friendly, and thus more sustainable ways of working and living. The A1 Telekom Austria Group encourages the purchase of electricity from renewable sources and the realization of in-house projects in this area with the aim of reducing its ecological footprint and preventing or lowering CO_2 emissions. However, both A1 TAG and A1 Hrvatska have a long wait to go to significantly reduce GHG emissions and achieve climate neutrality. A1 Hrvatska used 77,649 MWh of energy in 2019 and was responsible for 52,800 tCO2e of direct and indirect GHG emissions. A1 TAG group used 839,567 MWh of energy (4.2% increase compared to 2018) and was responsible for 490,773 tCO2e of direct and indirect GHG emissions in 2019. Looking further at the non-ETS sector GHG emissions amounted to 2,519 Mt of CO_2e in 2015, out of which 421 MtCO2e is contributed to the Industry, energy supply and product use sector of which telecommunication industry is a part of. Looking only at the telecom sector there are no relevant research and measurements that indicate its CO_2 footprint causing a lack of knowledge and proper awareness on the need to reduce GHG emissions from this sector. This project aims to contribute to the reduction of GHG emissions from the telecommunication sector as a non-ETS sector and contribute to the development of effective national measures to reduce GHG emissions in the telecom industry in order to contribute to the Effort sharing regulation.

Expected development of the telecommunication network which is necessary due to the roll out of new technologies such as 5G and the ever-increasing demand for increased internet speeds which are a precondition to industrial development (specifically to accommodate technologies such as industry 4.0, IoT or real-time two-way communication) will bring about a much higher energy intensity in the functioning of the telecommunication network. Expected increase of energy use in the future networks will bring about a significant increase in GHG emissions if energy efficiency and renewable energy measures are not widely incorporated within the network. To decouple the future growth of the network from rising GHG emissions, it is necessary to demonstrate energy efficiency and renewable energy technologies in the telecommunication network, raise awareness on the need to reduce GHG emissions in this non-ETS sector and to propose optimal and targeted measures to increase the use of renewable energy sources and energy efficiency measures in the sector. The telecommunication industry is not in focus of the relevant EU and national policies to achieve climate targets and there is no support from EU structural and investment funds or financial instruments on both the EU and national levels to increase the use of renewable energy and implementation of energy efficiency measures in the telecommunication industry. This in turn discourages investments in energy efficiency and renewable energy measures in the telecommunication sector.

At the start of the project, in the A1 network in Croatia 44 base telecommunication station (BTS) are running from renewable sources like wind and solar. 10 years ago, A1 Hrvatska was leader in this filed using innovative technology of a hybrid eco model using sun, wind and hydrogen fuel cells for powering BTS. These pilot projects have shown that the best practice solution is solar plants that is economically the most viable and provides best climate results for BTS. Furthermore, A1 Hrvatska implemented a new model with another innovative energy efficiency solution called free cooling which reduces the need for air conditioning on BTS and consequently reduces energy consumption. A1 network in Croatia includes 1800 BTS, where a number of them have outdoor free cooling system which was implemented as part of a pilot project. This innovative solution can be used to reduce power demand by up to 30% compared to conventional cooling systems. Implementation of free cooling on BTS as part of the pilot

project has shown an average of reduction of energy use by 4,071 kWh and GHG reduction of 1 tCO2. Implementation of free cooling solutions on BTS reduces the annual energy use on average by 6,050 kWh and CO2 emissions by 1.42 tCO2 and the implementation of solar plants on BTS locations reduces the use of electricity from the grid by 4,263 kWh and CO2 emission by 1 tCO2. The impact of climate change depends on a number of parameters and the intensity of the impact will be different depending on the geographical location, the development status and vulnerability. According to the international results of climate modelling, the Mediterranean region is recognized as a climatic "hot spot" and an average increase of 1.5 ° C has already been achieved with particularly pronounced effects of climate change (extreme weather events, expansion of arid areas, sea level rise). Croatia is part of the Mediterranean region and with its position enters the category of highly sensitive to climate change. In April 2020, Republic of Croatia adopted the Strategy for Low Carbon Development in the Republic of Croatia until 2030, which highlighted among the impacts and challenges the increase in electricity consumption for cooling due to increasing average air temperature. On the other hand, the strategy states that the average number of summer sunny days by 2040 will increase by 6-8 days a year, and the average annual temperature in the mentioned period will increase by 1-1.4C and the state undertakes to provide an incentive legal framework for the use of renewable sources energy to reduce the impact on the climate. This project directly contributes to the implementation of the Croatian Integrated National Energy and Climate Plan, which sets the target of at least 7% reduction in GHG emissions from the non-ETS sector by 2030, pursuant to the Effort Sharing Regulation, as well as the objectives to increase the share of RES in energy consumption by 36.4%, in electricity consumption by 63.8% and in energy consumption for heating and cooling by 36.6% by 2030.

Following the Green deal strategy according to which a set of deeply transformative policies should be designed for clean energy supply across the economy, industry, production and consumption, largescale infrastructure, transport, food and agriculture, construction, taxation and social benefits and LIFE programme objective to Help move towards a resource-efficient, low carbon and climate resilient economy, improve the quality of the environment and halt and reverse biodiversity loss LIFE4GREENBROADBAND project was conceived in order to promote much needed climate transition in the telecommunication sector. As is highlighted digital technologies are a critical enabler for attaining the sustainability goals of the Green deal in many different sectors such as artificial intelligence, 5G, cloud and edge computing and the internet of things can accelerate and maximise the impact of policies to deal with climate change and protect the environment. Digitalisation also presents new opportunities for monitoring and optimising how energy and natural resources are used. At the same time, Europe needs a digital sector that puts sustainability at its heart which this project aims to contribute to.

Overall objective of the proposed project is to contribute to the sustainable transition towards a climate neutral economy by 2050 and to reach the EU emission reduction target for 2030 by reducing GHG emissions from the telecommunications industry (non-ETS sector). Specific objective of the project is increasing energy efficiency and renewable energy use of the electronic communications network in Croatia in order to reduce GHG emissions. The project also aims to contribute to the improvement of the knowledge base for development and implementation of effective climate change mitigation actions in the telecommunications sector and to the implementation of best practice renewable energy and energy efficiency solutions that are suitable for being replicated, transferred and mainstreamed.

5. Administrative part (maximum 1 page)

Project management is organised around a 7-member core project team and 30 field engineers having all the necessary competencies to carry out project activities. Internal procedures were organised for efficient project implementation and according to reporting and audit requirements. Core project team consists of Project Manager, EU Funds Expert, Media Coordinator, Strategic Purchasing Expert, Technical coordinator for solar plants, Technical coordinator for free cooling and Senior Area Controlling Specialist, supported by the HR and accounting departments pertaining to data on costs, salaries and travel. Core project team have a fixed contractual percentage of time working on the project defined by Annexes to their employment contracts, while field engineers work less than 2 days per month on average on the LIFE project, which is why the CB is exempt from the obligation of keeping time sheets during project implementation. During project implementation, several project team members have been replaced due to departures from the company, including the Project Manager. However, adequate and competent new team members ensured that this change does not in the least affect effective project management and implementation.

As the CB is a digital company with minimal paper use in its business the originals of most documents are in electronic form. Several program solutions are used during project implementation such as the enterprise software SAP, human resources software HR NET and the procurement software Ivalua. Several modifications had to be made to the HR NET software to accommodate for easy reporting on project costs, particularly travel costs. These modifications enable the exporting of reports on project travel costs with all relevant information such as kilometres travelled, per diems, additional costs, etc. All project accounting documentation and information is stored digitally on forementioned software solutions and company's servers and are available on demand at any time. Furthermore, all documentation and information related to the project is archived on a separate server location. When the originals of documents are signed in paper form, they are kept in a special registry relating to the project at company's headquarters in Zagreb.

Key implementation activities related to the implementation of free cooling and solar plants on base stations were implemented by the end of 2023 as planned. Free cooling solutions have been installed on 200 out of 200 foreseen locations (100%) by the end of 2023. Solar plants have been installed on 155 out of 155 foreseen locations (100%) by the end of 2023, even the initially 120 locations were planned to be finished by this deadline. Smart remote energy management software and an accompanying mobile app was developed during the project and is being used for constant monitoring of installed solutions. Communication with the Agency and Monitoring team is very effective, and the CB is getting great support during project implementation. Other than the Kick-off meeting, there have been 3. monitoring visits and subsequent submission of all documents on request to the Monitoring team, without any comments or issues noted. There were a few comments received after the Mid-term report on technical and administrative and financial issues that were resolved through the LIFE monitoring helpdesk or directly in contact with the Monitoring officer and the Project adviser. Some information requested as follow up to these comments is included in the Final report or as one of the annexes to the Final report. There have been no amendments to the Grant Agreement. There were two budget reallocations, the information on which is included in the Annex and the delivered Costs summary with the Payment request. Budget shift is under 20%.

All other project activities were carried out in accordance with the foreseen dynamic and were finished on schedule, with great results in terms of visibility and impact.

6. Technical part (maximum 25 pages)

6.1.Technical progress, per Action

Action C1. Preparation of project technical documentation for solar plants

Foreseen start date: 5.7.2021	Actual start date: 5.7.2021
Foreseen end date: 30.7.2023	Actual end date: 31.12.2023

The purpose of this activity was to prepare project technical documentation necessary for the construction and implementation of 120 photovoltaic (PV) solar plants on base telecommunication stations (BTS) locations. Implementation of this activity was planned to result in complete project technical documentation for implementation of solar plants according to applicable legislation.

Solar plants were planned to be implemented on rooftops of containers located by the telecommunication towers, on the ground next to the BTS or on the telecom towers themselves. Works are being conducted in accordance with the applicable Construction Act and the Ordinance on simple and other buildings and works. In accordance with the applicable legislation when constructing solar plants on existing structures, a construction permit is not required, and the works can be carried out based on the main construction design project drafted and verified by a certified Civil Engineer and Electrical Engineer authorised by the respective Chambers of Engineers. Therefore, it was necessary to contract certified Civil and Electrical engineers to draft the main design projects for each of the 120 locations of the solar plants. It takes on average at least five working days to prepare the project technical documentation for each site, which is why this action was envisaged to cover a period of 2 years and was being implemented parallel to the action C3 Implementation of solar plants on base station locations. As soon as the main design project is drafted the implementation activities can take place.

The action started with the survey of locations where solar power plants can be constructed by the Technical coordinator for solar plants and field engineers. The Technical coordinator for solar plants then prepared a shortlist of 148 potential project locations where solar plants can be implemented according to their suitability for solar power production. The conclusion of the survey was that the project technical solution for a solar plant setup with 8 panels of 450 Wp foreseen during project preparation was not feasible for almost all BTS locations, even though it was previously piloted by the CB on ideal locations. Therefore, it was decided that the technical solution to be procured and implemented on all solar plant locations would be a 6 solar panel setup with power of 440-460 Wp.

The CB decided to procure these services as part of a design and build contract with a single provider as this was the most efficient method to design and build solar plants on a large number of locations. The procurement process started with the preparation of procurement documentation and drafting of technical specifications by the Project Manager, Technical coordinator for solar plants and Strategic Purchasing Expert. Procurement documentation foresaw two technical solutions, solar panels on the roof of the container and on ground next to the BTS, and it was estimated that 75% of solar plants were to be on the container's roofs and 25% would be on the ground, and that the implementation would be even across the 4 defined regions of Croatia. From December 2021 to February 2022, a competitive bidding procedure was carried out in three phases and the contract was awarded to the company E.oN Solar d.o.o. After receiving the approval to increase the number of sites where solar plants were

to be implemented to 155, further suitable locations were chosen and the contract with the supplier annexed to include project documentation for the additional 35 locations. During contract implementation, in June 2023, the contractor changed the company name to E.ON Energy Infrastructure Solutions d.o.o. of which the CB was dully notified.

Until the end of 2023, all 155 main design projects for 155 solar plant locations have been prepared according to the applicable Construction Act and the Ordinance on simple and other buildings and works. Main design projects relate to the Technical solution 1 – solar plants on roofs of containers on BTS or Technical solution 2 - solar plants on BTS towers. Initially foreseen Technical solution 2 – solar plants on the ground next to the BTS has proved to be unfeasible and/or ineffective due to the lack of space on the ground around BTS, the shading of solar panels from various obstacles, the uncertain outcome of the process of obtaining the necessary construction permits and the expensive lease prices of the space for ground solar plant implementation. Furthermore, for some of the selected solar plant locations, based on detailed analysis and calculations of statics and wind stability, the Technical solution 1 – solar plants on roof of container was not feasible due to the constructional integrity limitations of containers with solar plants implemented at higher wind speeds (over 25 km/h). Therefore, it was necessary to change the technical solution for some of the plant locations. The contractor proposed to substitute the procured Technical solution 2 – solar plants on ground next to the BTS for a new Technical solution 2 – solar plants on BTS towers. The CB, the contractor and the supervision have validated the feasibility of the newly proposed technical solution. The proposal was approved by the supervision and the CB, and the contractor proceeded with the preparation of main design projects for solar plants on BTS towers for some of the solar plant locations.

In the project application and when calculating KPIs it was foreseen that each of the 120 base station locations where solar plants were to be implemented will be equipped with 8 solar panels of 450W power amounting to 432 kWp of overall installed power on all locations. However, due to technical limitations it was only possible to implement solar plants in a configuration of 6 panels of 450W power amounting to 324 kWp of installed power on 120 locations. Considering that the configuration with 6 panels could not enable the CB to achieve expected installed power and the KPI for the production of energy from RES if limited to 120 locations, the CB proposed to expand the number of solar plant locations to 155, i.e., by an additional 35 locations within the same project budget, and received no objections to do so from Monitoring expert and Project adviser in June 2023. The contractor was prepared to carry on with the implementation to further 35 locations according to contracted unit prices which were well below the current market prices, so it was a great opportunity to meet KPIs in a timely and cost-effective manner. When the change was approved by CINEA and the external monitoring team, the contract for solar plant implementation was annexed to include additional 35 locations, and the contractor drafted additional 35 main design projects, without affecting the contractual deadline for contract implementation by end of 2023.

Preparation of technical documentation for solar plants had been initially delayed compared to the foreseen dynamic due to above mentioned technical difficulties encountered during project implementation. However, through effective project implementation main design projects for all 155 solar plant locations were drafted and solar plants implemented by the end of 2023. After the main design projects were prepared, the commission composed of members of the project team verified that the construction and electrical project have been made in accordance with the technical solutions. If the commission had no objections to the project documentation, the contractor could start performing works according to the projects under the action C3.

Action C.2: Implementation of free cooling on indoor base station locations

Foreseen start date: 1.10.2021	Actual start date:	1.10.2021
Foreseen end date: 31.12.2023	Actual end date:	31.12.2023

The purpose of this action was to implement free cooling solutions on 200 base telecommunication stations (BTS) locations to reduce the electricity consumption by an estimated amount of 6,050 kWh per station, amounting to an annual saving of 1.21 GWh of electricity and the reduction of 284.12 tCO2. This action entails the implementation of free cooling solution on 200 indoor BTS locations, replacement of 30% of energy inefficient AC units which cannot be connected to free cooling because of technical incompatibility and the implementation of smart metering and remote energy management in order to reduce energy use and CO2 emissions from energy at BTS locations.

The action started with the survey and selection of 200 location where the FC will be installed, after which 200 locations were selected. Market research prior to the start of the procurement process showed a significant increase in prices of equipment and installation, which is why the procurement was carefully planned and optimized in order to reduce costs. This caused minor delays to the procurement process which was finalised in April 2022. Procurement was carried out by Project Manager, Technical coordinator for free cooling and Strategic Purchasing Expert through a single competitive negotiating procedure divided into 3 lots, Lot 1 – Efficient cooling systems - equipment, Lot 2 – Installation of efficient cooling systems – Continental region and Lot 3 - Installation of efficient cooling systems – Adriatic region. Lot 1, i.e., the supply of equipment was awarded to the contractor MB Frigo Grupa d.o.o. Lot 2, i.e., installation works in the Continental region was awarded to the company V.V.G d.o.o. and the Lot 3, i.e., installation works in the Adriatic region was awarded to the company VERTRON d.o.o. The contracts with contractors were signed in April and May 2022.

There was an administrative and financial issue raised after Mid-term report on this procurement, Issue 5. Procurement. As a follow-up, the CB explained the issue to the Monitoring expert, that was content with the explanations and asked for the same explanation to be included in the Final report. The following paragraphs explain the issue and the clarification provided.

Raised issue 5. Procurement in the Annex to the letter after Mid-term report:

Issue 5. Please provide the procurement documentation on the selection of MB Frigo Grupa d.o.o. (Equipment) before the next monitoring visit. Based on the information obtained during the previous monitoring visits, you follow the national procurement legislation. Considering that you have indicated the "multiple bids" option in your financial statement, you are requested to demonstrate that the award was fully in line with the respective binding national procurement regulation and submit relevant supporting documentation.

The letter after the Mid-term report, stated regarding this Issue 5, that based on the information obtained during the previous monitoring visits that, in procurement, we follow the national procurement legislation. However, this is factually not true, as A1 Hrvatska is a private entity not obliged to carry out public procurement and does all procurement procedures according to own procurement procedures in accordance with Article II.10 of the Grant Agreement, i.e., in accordance with its usual purchasing practices. We have provided information on this procurement framework following the 1st monitoring visit. Furthermore, regarding the

procurement procedure for free cooling equipment we hereby present the clarification on the implemented procurement process. Free Cooling equipment and installation works procurement was carried out as a multiple bids procedure with 3 lots and 3 bidders, where all 3 bidders had the capacity to offer all of the lots based on market research and contact with the bidders prior to the procurement process. The result of the procurement procedure was that bidders applied for the lots that they were most suited to deliver and where they had a competitive edge over other bidders and the contracts were awarded to all 3 bidders for different lots that they applied for. The complete procurement documentation related to the Free Cooling procurement was sent to the Monitoring expert before the next monitoring visit as instructed.

Implementation of the free cooling solutions was completed by end of 2023, in a dynamic of 100 installations in 2022 and 100 installations in 2023. Smart remote energy management software was developed during the project and is being used for constant monitoring of installed solutions. For each installation, after the contractors install the solutions and notify the CB, field engineers remotely connect to the location and setup, optimise and put into operation the FC solutions. Smart remote energy management software enables the operators to monitor in real time the operation of cooling equipment and its electricity use. Full year of measurements of energy savings have been observed and monitored in 2024 and the results are presented in the delivered Third summary of achieved indicators. The annual savings from the 200 project sites where free cooling solutions were installed fell a bit short of the expected 1.21 GWh/year, and amounted to 1.13 GWh/year. We believe that the reason for this is that in some locations we had poorer air quality of incoming air, and in several locations we had a problem with noise and had to use night mode during the day, which has lower efficiency. We believe in the following years we'll be able to achieve higher energy savings at these sites through equipment optimization and airflow adjustment to further decrease share of AC operation.

During the project we started continuation activities and added FC installations to a total of 628 container locations (excluding project sites) by the end of 2024. On these locations, the savings per station is significantly lower because these are locations that already had highly efficient cooling systems, where the radio equipment was modernized, and the heat dissipation of the radio device could be thrown out of the container to a greater extent. Regardless, FC devices showed significant savings even in these circumstances. The observed savings in 2024 per station were 1,912.78* kWh/yearly, amounting to 1,200,842.49 kWh/yearly from the additional 628 sites where FC devices were installed.

Overall, achieved energy savings from project sites and continuation sites by the end of the project amount to 2.33 GWh/yearly, or 2,326,407 kWh/yearly, which is the value of the KPI achieved at the end of the project, surpassing the expected value of 1.21 GWh/yearly.

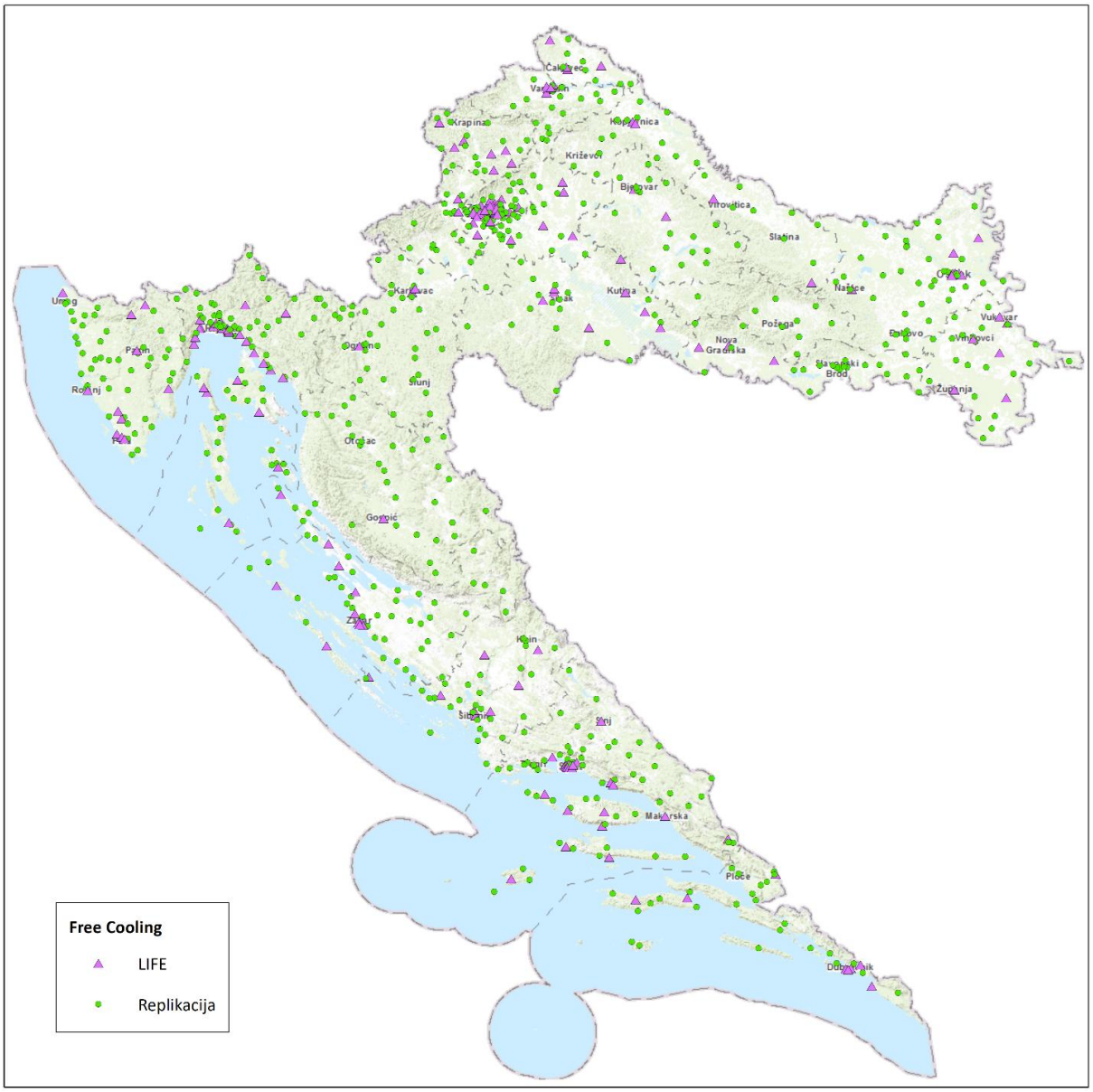
Implementation of free cooling solutions has been initially delayed compared to the foreseen dynamic due to delayed procurement process which needed to be carefully planned due to rising market prices. The project milestones were set to achieve implemented free cooling solutions on 40 BTS locations by June 2022, on 120 BTS locations by end of 2022 and 200 locations by end of 2023. In reality, 100 free cooling solutions were implemented by the end of 2022 and 100 by end of 2023, meeting the deadline for 200 locations with FC solutions implemented by end of 2023.

Several locations where installations were carried out had to be relocated to different BTS because several site owners terminated lease contracts with A1 Hrvatska for sites where the

equipment was installed. The costs of relocation are completely covered by the CB and the equipment was promptly put into operation on substitute project BTS locations.

Installed Free cooling solution on indoor base station locations:

Free cooling - Map of project locations (marked with purple triangle) and continuation sites (marked with green circle):



Action C.3: Implementation of solar plants on base station locations

Foreseen start date: 5.7.2021	Actual start date: 5.7.2021
Foreseen end date: 31.12.2023	Actual end date: 31.1.2024

The purpose of this action was to implement 120 photovoltaic (PV) solar power plants on 120 base telecommunication stations (BTS) locations which reduce the electricity consumption by an initially estimated 4,263 kWh per station, amounting to an annual saving of 511,560 kWh of electricity and the reduction of 120.12 tCO2. Solar plants were planned to be implemented on rooftops of containers located by the telecommunication towers, on the ground next to the BTS or on the telecom towers themselves. As part of this action, it was necessary to conduct the procurement of equipment and materials, construction and electrical installation works contractors and construction supervisor. Solar plant equipment and materials, installation works and technical documentation were procured under one design and build contract with a single contractor, while the solar converters and shelves were procured through a direct award procedure due to special technical requirements that had to be met to ensure compatibility of DC solar inverters with DC power supplies and other equipment in the A1 Hrvatska mobile network. Supervision of works was procured separately.

The CB decided to procure the solar plant equipment, materials and installation works as part of a design and build contract with a single provider as this was the most efficient method to design and build solar plants on a large number of locations. The procurement process started with the preparation of procurement documentation and drafting of technical specifications by the Project Manager, Technical coordinator for solar plants and Strategic Purchasing Expert. Procurement documentation foresaw two technical solutions, solar panels on the roof of the container and on ground next to the BTS, and it was estimated that 75% of solar plants were to be on the container's roofs and 25% would be on the ground, and that the implementation would be even across the 4 defined regions of Croatia. From December 2021 to February 2022, a competitive bidding procedure was carried out in three phases and the contract was awarded to the company E.oN Solar d.o.o. After receiving the approval to increase the number of sites where solar plants were to be implemented to 155, further suitable locations were chosen and the contract with the supplier annexed to include solar plant implementation for the additional 35 locations. During contract implementation, in June 2023, the contractor changed the company name to E.ON Energy Infrastructure Solutions d.o.o. of which the CB was dully notified.

In the project application and when calculating KPIs it was foreseen that each of the 120 base station locations where solar plants were to be implemented will be equipped with 8 solar panels of 450W power amounting to 432 kWp of overall installed power on all locations. However, due to technical limitations it was only possible to implement solar plants in a configuration of 6 panels of 450W power amounting to 324 kWp of installed power on 120 locations. Considering that the configuration with 6 panels could not enable the CB to achieve expected installed power and the KPI for the production of energy from RES if limited to 120 locations, the CB proposed to expand the number of solar plant locations to 155, i.e., by an additional 35 locations within the same project budget, and received no objections to do so from Monitoring expert and Project adviser in June 2023. The contractor was prepared to carry on with the implementation to further 35 locations according to contracted unit prices which were well below the current market prices, so it was a great opportunity to meet KPIs in a timely and cost-effective manner. When the change was approved by CINEA and the external monitoring team, the contract for solar plant implementation was annexed to include additional

35 locations, and the contractor implemented the additional 35 solar plants by the original contractual deadline for contract implementation, i.e., by end of 2023.

All necessary solar converters and shelves for the implementation of solar plants on 155 locations have been procured and delivered. Solar converters and shelves were procured in phases, consisting of Phase 1 where 70 hybrid solar converters and 65 shelves with support for hybrid use concluded in April 2022; Phase 2 where 50 hybrid solar converters and 55 shelves with support for hybrid use concluded in November 2022; and Phase 3 where 35 additional hybrid solar converters and shelves with support for hybrid use where procured in October of 2023. Supervision of works was procured in September of 2022 and was implemented regularly following the dynamic of solar plant implementation. Installation of solar plants, preparation of all necessary documentation for the handover of works and the handover of works was finished by the end of 2023. After the contractor implemented the solar plants CB field engineers would do the final commissioning of the plant. Implementation of solar plants had been initially delayed compared to the foreseen dynamic due to mentioned technical difficulties encountered during project implementation. However, through effective project implementation all 155 solar plant locations were implemented by the end of 2023. Even though all solar plants were implemented by the contractor by the end of 2023, only 136 locations have been put into operation by that date, while the commissioning of the rest took place during January 2024 by our field engineers, which were prevented to do it sooner due to other activities in the field. Therefore, the activity lasted 1 month longer than expected and was finished by the end of January 2024, when all 155 locations were put in operational use.

Implementation of solar plants had been initially delayed compared to the foreseen dynamic due to several technical difficulties encountered during project implementation. Firstly, the selection of locations for solar plant implementation was delayed, as it proved to be difficult to find suitable locations looking at the key parameters for successful solar energy exploitation. Secondly, the project technical solution for a solar plant setup with 8 panels of 450 Wp foreseen during project preparation proved unfeasible on almost all locations, and the CB had to opt for a 6-panel setup per location. Lastly, the design of the construction and technical solutions has proven challenging due to several limiting factors such as weather conditions on specific BTS locations, panel placement in relation to the BTS, available technologies of sub-constructions for placement of panels, permitting procedures, etc. However, CB devised and proposed effective solutions to tackle these difficulties, and the installation of solar plants on 155 locations was implemented on schedule by end of 2023.

Until the end of 2023, all 155 solar plants were installed. Initially foreseen Technical solution 2 – solar plants on the ground next to the BTS has proved to be unfeasible and/or ineffective due to the lack of space on the ground around BTS, the shading of solar panels from various obstacles, the uncertain outcome of the process of obtaining the necessary construction permits and the expensive lease prices of the space for ground solar plant implementation. Furthermore, for some of the selected solar plant locations, based on detailed analysis and calculations of statics and wind stability, the Technical solution 1 – solar plants on roof of container was not feasible due to the constructional integrity limitations of containers with solar plants implemented at higher wind speeds (over 25 km/h). Therefore, it was necessary to change the technical solution for some of the plant locations. The contractor proposed to substitute the procured Technical solution 2 – solar plants on ground next to the BTS for a new Technical solution 2 – solar plants on BTS towers. The CB, the contractor and the supervision have validated the feasibility of the newly proposed technical solution. The proposal was approved

by the supervision and the CB, and the contractor proceeded with implementation of solar plants on BTS towers for some of the solar plant locations.

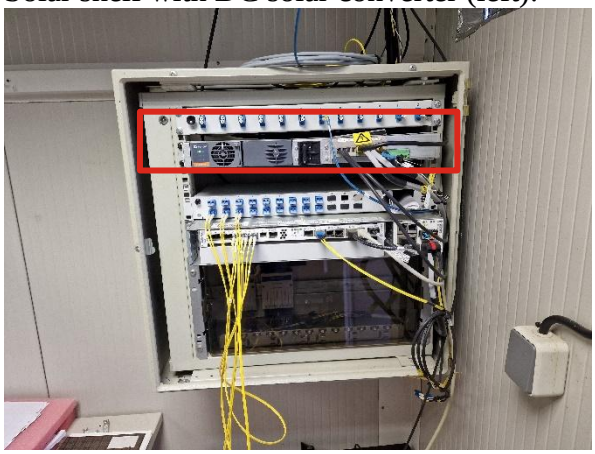
All solar plant locations are equipped with smart meters and connected to the remote energy management software developed as part of the project. This provides precise measurements on the renewable energy produced from solar plants, which is provided for a full year of monitoring installed sites in the Third summary report on achieved indicators.

Initially, 120 locations were planned with a technical solution of 8 solar panels, with an estimated installed power of 432 kWp. The 8-panel configuration proved not suitable for most of the sites, so we opted for a 6-panel configuration and increased the number of sites to 155 location that we received approval for. Therefore, 155 BTS sites were equipped with solar plants as part of the project, with total installed power of 418.5 kWp. Measured renewable energy production and use in 2024 for the 155 project solar plant locations was 438,005 kWh/year, falling a bit short of the planned 511,560 kWh/year.

During the project, continuation activities already started with own funding, which resulted in the implementation of solar plants on additional 50 locations in different configurations with a total installed power of 168.35 kWp and a production of 202,358.59 kWh in 2024.

Overall, through project actions and continuation actions by the end of the project a total of 640,363 kWh/year of renewable energy production and use from solar plants has been achieved which is the achieved value for the end of the project, surpassing the initially planned 511,560 kWh/year.

Solar shelf with DC solar converter (left):



Solar subrack with DC solar converter (right):

Solar plant installation site in Tovarnik, Slavonia:

Technical solution 1 – Container roof (left):

Technical solution 2 - BTS tower (right):

Solar plants - Map of project locations (triangles) and potential continuation sites (circles):

Action C.4: Development of a continuation, replication and transfer plan

Foreseen start date: 1.1.2022	Actual start date: 1.1.2022
Foreseen end date: 31.12.2022	Actual end date: 31.12.2022

The purpose of this action was to draft a feasible and effective continuation, replication and transfer plan that will devise measures and activities for the continuation, replication and transfer of project results after the end of the project implementation period. The continuation, replication and transfer plan was drafted by the project team until the end of 2022 in line with the foreseen project schedule. This activity resulted in a drafted continuation, replication and transfer plan which sets the measures and activities to be carried out after the end of the project to promote the use of project results in telecom sector and other sectors and promote the use of RES and EE solutions in order to contribute to the achievement of a competitive low-carbon EU economy.

The plan defined the next steps after the completion of the project that were divided into two groups:

The first group of activities relates to the operational expansion of project technologies to a larger scale. In this group of activities, the organization of activities will go mainly as in the implementation of the project.
- The maintenance of the Free cooling systems is planned to be done twice a year, during these visits the filters are replaced, and key parameters of the system are checked. During the year, one intervention in average is required in case there are problems with the system. The price per location at the annual level for emergency and preventive maintenance is €250 per year per location. Maintenance of the solar systems is reduced to a minimum because the system is quite robust, the experience so far is such that there was no need for intervention except when there was vandalism. The surveillance through the developed smart energy management system is complex in such a way that it notifies that something is happening at that location and after that, an intervention will be performed at those locations.
- To continue the installation of free cooling and solar panels, the CB needs to mobilize additional funding through EU funds. Solar panels at BTS locations are currently not an attractive investment and it is of great importance that through the promotion of this project we ensure that the local community is made aware of the importance of renewable energy and CO2 reductions in the telecommunication sector, and that we manage to mobilize additional funds aimed at increasing energy efficiency and renewable energy use in the telecommunication sector. Despite extensive efforts during project implementation, including preparing and promoting the policy proposal for targeted measures for decreasing GHG emissions in the telecommunication sector and a proposal of a call for proposals, no political will or further activities were observed in the relevant public authorities to publish such a measure.

The second group of activities refers to the organization of the sharing of good practice within (to all stakeholders, Ministry, Public, TAG, CME User Group, GSME, etc.)
- For the 6 workshops that will be held virtually, presentation materials will be prepared for the needs of all presentations that will be held after the completion of this project. Special attention will be paid to the presentation of performed works and the amount of energy savings and CO2 savings
- In the period after the completion of the project, we will actively promote free cooling and solar panels in the telco sector in Croatia, through HUP ICT Croatia

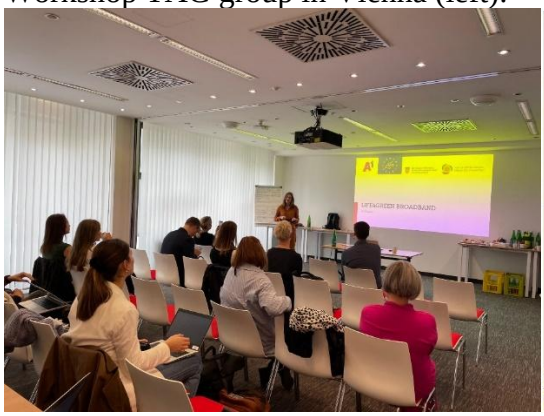
- Through HUP ICT Croatia, workshops will be organized with the aim of introducing the telecommunications market in Croatia to the benefits of implementing project solutions in order transfer the use of project results to other telecom operators. In order to ensure the continuity of the project, workshops will be organized to present the project.
- one workshop will be held in Croatia in Osijek where this solution will be presented on site. The on-site presentation will be performed in order to better present the solution, how to install the equipment and manage the free colling and air conditioning units.
- in cooperation with HUP ICT Croatia, a presentation of free cooling and solar panels will be held
- The CME user group meeting was planned to be used to present this solution to operators in Europe using Ericsson equipment. However, the CME user group has stopped working and alternative channels will need to be devised to promote the solutions to other operators in Europe. During project implementation, conferences of telco professionals have proven an effective communication channel for reaching many telecom operators across Europe.

Activities implemented during project implementation for the purpose of continuation, replication and transfer are as follows:

- Meeting held with A1 Bulgaria (8 NOV2021, 11 participants) with the purpose of replicating project activities in Bulgaria
- Meeting held with Austrian Chamber of Commerce, Croatian Chamber of Commerce, Austrian Ambassador to Croatia, Representative of Austrian investors and the Advisor for EU funds of the Croatian Government (17 NOV 2021, 11 participants) with the aim to enable support for increasing energy efficiency and renewable energy use in the telecommunication sector
- Participation in the Good Energy Festival in Zagreb where the project was promoted (5-7 MAY 2022, 100+ participants)
- Participation in the Green Future Conference 2022 in Split where the project was promoted (9-10 JUN 2022, 900+ participants)
- Project presented to representatives of all members of the Telekom Austria Group in Vienna (4-5 OCT 2022, 18 participants)
- Conference on green energy organized in Osijek to promote replication of project solutions with esteemed speakers from the public, academia and private sector (15 NOV 2022, 94 participants)
- Presentation of the project at the ETIS COMMUNITY GATHERING 2022 of telecom professionals in Rome (2-3 June 2022, 200+ participants)
- Presentation of the project at the ETIS COMMUNITY GATHERING 2023 of telecom professionals in Berlin (6-7 June 2023, 230+ participants)
- Presentation of the project at the EMEA Telecoms Energy Efficiency Forum in Berlin (30 JAN 2024, 50 participants)
- Online workshop held with A1 Macedonia with the purpose of presenting the business plan and replicating project activities in Macedonia (3 JUL 2024, 11 participants)
- Online workshop held with A1 Slovenia and A1 Serbia with the purpose of presenting the business plan and replicating project activities in Slovenia and Serbia (10 JUL 2024, 9 participants)
- Online workshop held with A1 Bulgaria with the purpose of presenting the business plan and replicating project activities in Bulgaria (24 OCT 2024, 14 participants)
- Online workshop held with A1 Austria with the purpose of presenting the business plan and replicating project activities in Austria (19 NOV 2024, 4 participants)

- Workshop held with Hrvatski Telekom with the purpose of presenting the business plan and replicating project activities in HT network in Croatia and Deutsche Telekom group (25 JAN 2024, 13 participants)
- Workshop held with Telemach with the purpose of presenting the business plan and replicating project activities in Telemach network in Croatia and United group (29 SEP 2024, 7 participants)

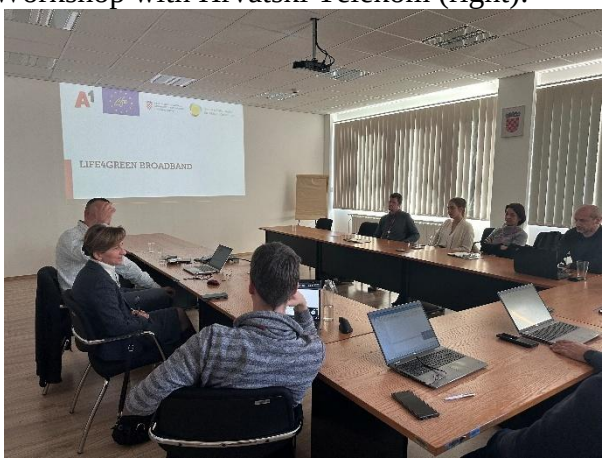
Workshop TAG group in Vienna (left):



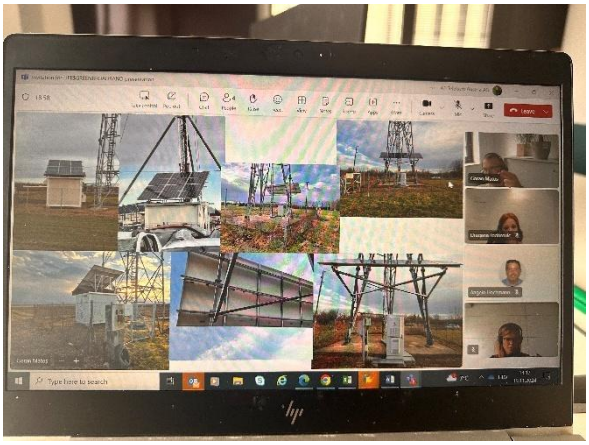
ETIS gathering 2022 in Rome (right):

Workshop with Telemach (left):

Workshop with Hrvatski Telekom (right):



Online Workshop A1 Austria (left):



Online Workshop with A1 Bulgaria (right):

Action C.5: Preparation of a business plan for large scale uptake of free cooling and solar plants in the telecom industry

Foreseen start date: 1.1.2023	Actual start date: 1.1.2023
Foreseen end date: 30.6.2024	Actual end date: 20.9.2024

The purpose of this activity was to create a valid business plan for large scale replication of energy efficiency (free cooling) and renewable energy use (solar plants) on all base sites of the company as part of the Croatian telecommunication network and integrate it into the company's strategy for further infrastructure development in order to decrease GHG emissions and to decouple necessary expected growth of the telecommunication network from rising GHG emissions. In order to increase the implementation of energy efficiency and renewable energy measures in the telecommunication sector a business plan for large scale uptake of free cooling and solar plants in the telecommunication industry was drafted. The key target audience is the management of the company which can evaluate and decide on whether to invest in the large-scale uptake of these measures on all companies base station sites in Croatia. The key findings of the business plan, particularly financial performance indicators and GHG emissions benefits will be disseminated to all members of the A1 group (Austria, Slovenia, Serbia, North Macedonia, Bulgaria and Belarus) and key Croatian competitors in order to encourage and support them in the development and implementation of these measures within their own telecommunication networks. First stage of the action was the development of a detailed business plan that was prepared by OCT 2023 and its presentation to the companies' management, which was held on 4 DEC 2023. Second stage included the drafting of the summary of expected benefits and financial performance indicators and presenting them through 6 online workshops for the members of the A1 Group. As the last online workshop during project implementation was held on 20.9.2024 this is the date that marks the end of this action.

Achievement of expected energy savings was a key technical and financial factor which needed to be proven in the project. It is a key variable conditioning project's profitability and large-scale uptake. It is dependent on climate conditions, solar radiation, technologies being implemented and the optimization to maximize energy savings on BTS sites. Key factor is also the market price of FC and solar equipment that might vary in the EU. It is also important to consider the effects of economy of scale on the procurement of solar and FC technologies for large-scale roll out that will be considered in the business plan. During the project, energy savings were closely monitored using smart metering and remote energy management software and the average results were included in the business plan. ROI for implementation of the business plan was calculated and considered in the business plan. Installation and maintenance costs were also monitored and considered in the plan. Cost of electricity is also an important factor to consider as it directly effects the profitability of large-scale uptake. Different scenarios for cost of electricity were included in the business plan to calculate profitability in all EU energy markets.

Presentation of the business plan to the companies' management:

Action C.6: Increasing knowledge and awareness on GHG emissions with proposed measures at the state level

Foreseen start date: 1.1.2022	Actual start date: 1.1.2022
Foreseen end date: 31.12.2023	Actual end date: 3.12.2024

The purpose of this activity was to increase knowledge on GHG emissions in the telecommunication industry in Croatia and provide relevant stakeholders with information and proposed measures to decrease GHG emissions, which will contribute to the decoupling of the necessary expected growth of the telecommunication network from rising GHG emissions. Currently, as the telecommunication industry is not included in the ETS sector, telecommunication companies do not have an obligation to track their GHG emissions which creates a knowledge and awareness gap, which on one side discourages companies in the sector to reduce their GHG emissions, and prevents relevant public authorities to create targeted measures to reduce GHG emissions in the sector on the other. Expected development of the telecommunication network which is necessary due to the roll out of new technologies such as 5G and the ever-increasing demand for increased internet speeds which are a precondition to industrial development (specifically to accommodate technologies such as industry 4.0, IoT or real-time two-way communication) will bring about a much higher energy intensity in the functioning of the telecommunication network. Expected increase of energy use in the future networks will bring about a significant increase in GHG emissions if energy efficiency and renewable energy measures are not widely incorporated within the network. In order to decouple the future growth of the network from rising GHG emissions it is necessary to demonstrate energy efficiency and renewable energy technologies in the telecommunication network, raise awareness on the need to reduce GHG emissions in this non-ETS sector and to propose optimal and targeted measures to increase the use of renewable energy sources and application of energy efficiency measures in the sector.

In order to increase knowledge on GHG emissions in the telecommunication industry in Croatia targeted research was carried out analysing the GHG emissions from the key telecommunication companies in Croatia and their respective groups. The activity started with a complete and detailed in-house research on GHG emissions carried out by the project team, and then further developed to include key companies in Croatia, while acquiring data directly from the telecom companies, which proved difficult, and publicly available information, such

as annual ESG reports. On the basis of the research a GHG inventory report for the Croatian telecommunication industry was drafted and was in the later stages of the project presented to key stakeholders. Key benchmarks were defined relating to the amount of GHG emissions per amount of data which can be used as a climate change performance benchmark for the industry, and to be used in the development and monitoring of targeted measures by public authorities to increase the climate performance of telecommunication companies. The proposal for this benchmark enables targeted national energy efficiency and renewable energy measures aimed at this sector while also considering the necessary development of the telecommunication networks. Once the GHG inventory of the networks is assessed, proposal of measures, including the proposal for a grant call from the European structural and investment funds and a policy brief were drafted and presented to the Ministry of Economy and Sustainable Development (currently Ministry of Economy) and the Ministry of Environment and Green Transition as the key stakeholders in charge of developing and implementing climate change measures and actions. The project team provided and will provide continued support to the targeted stakeholders in drafting the Call for Proposals if there will be political will to implement it and implementing other measures, particularly awareness raising activities about the need for GHG emissions reduction in the telecommunication industry at national and EU level and the means to achieve it through the implementation of energy efficiency and renewable energy measures. Findings of the report were also disseminated to other telecommunication companies through dissemination and awareness activities.

This action was implemented by the project team in coordination with the relevant stakeholders. This action contributed to the increase of knowledge on GHG emissions in the telecommunication industry and to decreasing the GHG emissions in the telecommunication industry in Croatia. GHG emissions report for the Croatian telecommunication industry was prepared, communication activities were carried out and meetings with key stakeholders, Ministry of Economy and Sustainable Development, Croatian telecommunication networks operator (Odašiljači i veze d.o.o.), and Ministry of Environmental Protection and Green Transition were held that contributed to raised awareness on the need for green transformation of telecommunication industry and discussions were held on the possible measures to be devised for the telecom sector and available funding programmes. Proposal of measures to decrease GHG emissions in the telecommunication industry and a Policy brief for the relevant stakeholders was finalised and disseminated to key stakeholders, with the last meeting with Ministry of Environmental Protection and Green Transition held on 3 DEC 2024, marking the end of this action.

The following meetings with public authorities were held during project implemenation:

- Meeting held with Ministry of Economy and Sustainable Development, Austrian Chamber of Commerce, Croatian Chamber of Commerce, Austrian Ambassador to Croatia, Representative of Austrian investors and the Advisor for EU funds of the Croatian Government, on the REPowerEU measures in RRF (10 FEB 2022, 13 participants)
- Meeting with the Ministry of Economy and Sustainable Development and the Croatian telecommunication network operator (Odašiljači i veze d.o.o.) (26 JAN 2023, 14 participants)
- Meeting with the Ministry of Environmental Protection and Green Transition (3 DEC 2024, 6 participants)

Meeting with the Ministry of Economy and Sustainable Development on the REPowerEU measures in RRF:

Meeting with the Ministry of Economy and Sustainable Development and the Croatian telecommunication network operator (Odašiljači i veze d.o.o.):

Meeting with the Ministry of Environmental Protection and Green Transition:

Action D.1: Monitoring of the impact of implemented energy efficiency and renewable energy measures

Foreseen start date: 5.7.2021		Actual start date:	5.7.2021
Foreseen end date: 31.12.2024		Actual end date:	31.12.2024

The purpose of this activity was to actively monitor the impact of project actions during project implementation and to verify the implementation of project activities and the achievement of project deliverables and benefits. The key objective was to report on the outputs and impact of the project considering the LIFE Key project level indicators.

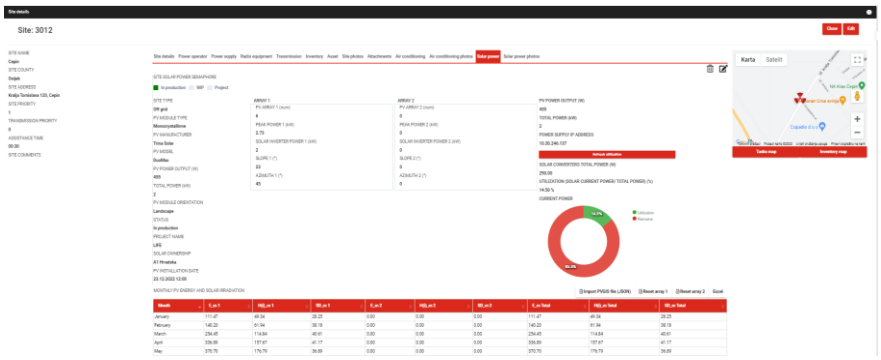
Energy use and related GHG emission at all of the 355 base telecommunication stations (BTS) locations were regularly monitored during project implementation, as well as any of the locations where continuation activities have been implemented. The project team developed a methodology for monitoring of energy savings and production of energy from renewable energy sources and developed an IT solution - smart energy management solution, which precisely measures FC and solar plant operation and can configure them and adjust them for optimal performance. Mobile application was also developed for energy management, FC and solar plant deployment and maintenance. The project team monitors the energy performance and GHG emissions of the base stations locations using smart metering and remote (smart) energy management, and the collection of information from internal sources (utility bills, internal collaboration software, etc.) with a particular focus on sites where the measures have been implemented. Semi-annually the project team performs an analysis and verification of energy use and GHG emissions at all sites where the implementation has been carried out to track progress and verify the achievement of key project level indicators, namely, GHG emissions, energy use and production from renewable energy sources. Measured energy production, savings and accompanying GHG emissions were correlated to the amount of data traffic at base site locations in order to gather comparable data using the value of GHG

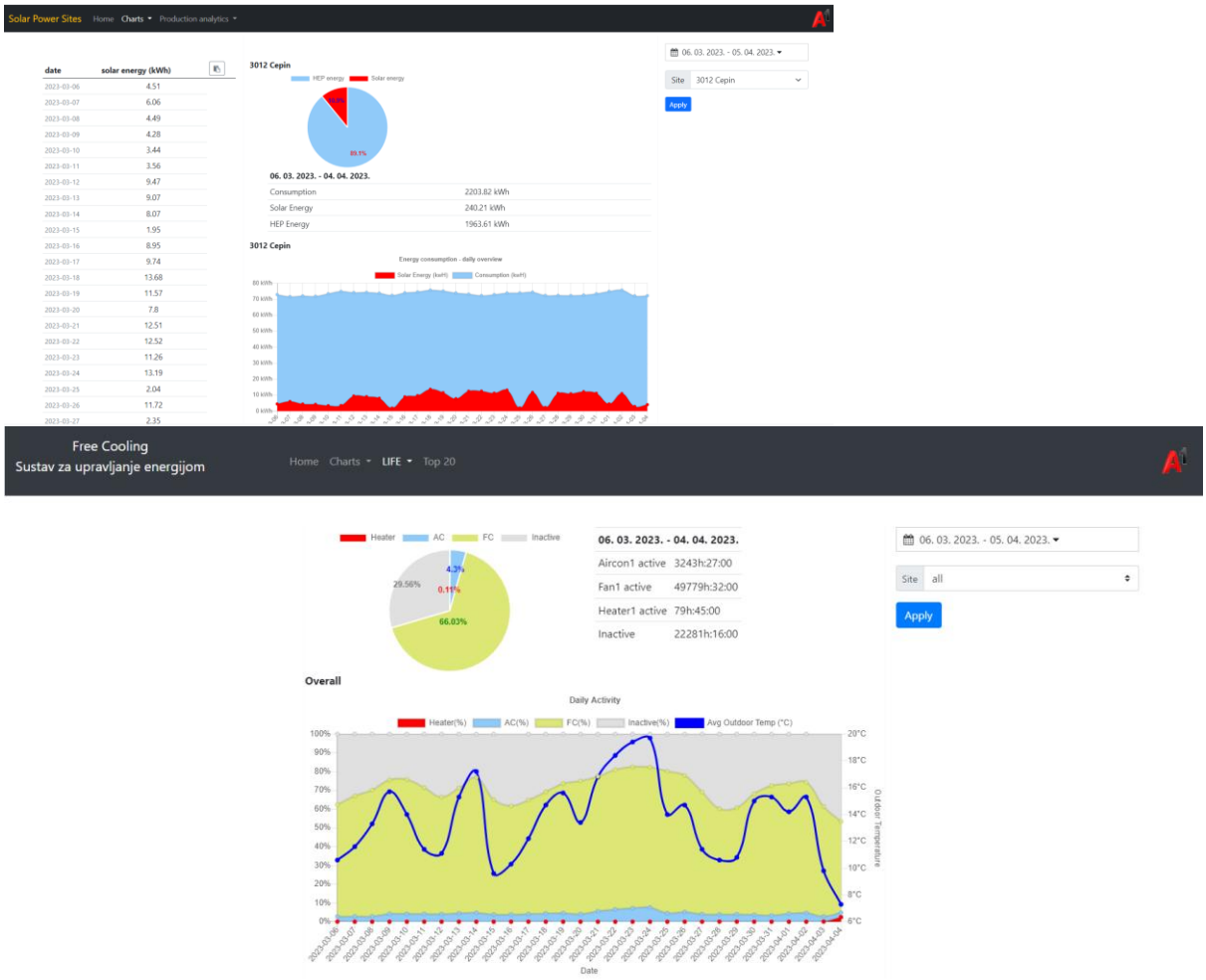
emissions in tCO_2 per GB of data traffic. Three reports were drafted summarizing the achieved indicators and the relation to their respective values. This was continuously done during project implementation, with data included in three summary reports, and it will be carried on after the project implementation period until the end of the reporting period (3 years after the project ends). This method ensures accurate and timely reporting on LIFE Key project level indicators and the achieved project benefits, as well as enables more detailed information on GHG emissions from the telecommunication industry that was considered in the drafting of the business plan for large scale uptake of project results, as well as in the preparation of a GHG inventory report for the telecommunication industry in Croatia. As all solar plants and FC solutions were implemented by the end of 2023 there was a full year of monitoring energy savings in 2024 which validates the achievement of project key performance indicators at the end of the project.

An assessment of the socio-economic impact of the project actions on the local economy and population was carried out in order to consolidate the data and results over the project lifetime.

The action is completely conducted by the A1 project team during the whole project implementation period with foreseen activities after the end of the project. Smart remote energy monitoring and management solution was implemented on each of the 355 project locations where free cooling and solar plants were implemented. In addition to providing more energy savings and reduction of CO2 emissions, these systems will prove as a dependent and accurate monitoring and reporting tool during the course of the project. Three analyses of energy use and GHG emissions at sites where measures have been implemented and summary reports of achieved indicators were prepared and delivered. The company's management decided that the smart energy management system will not be further developed beyond internal use and for commercialization, considering that it is dependent on hardware configuration of the network, and it would be too costly to develop it in a manner to ensure operability with all the available network equipment used in telecommunication networks. Because of this, the CB decided not to use the services of LIFE close-to-market team but has however completed the online survey, the so-called C2M checklist.

Screenshots of the developed smart energy management software:





Action E.1: Communication and dissemination of results

Foreseen start date: 5.7.2021		Actual start date:	5.7.2021
Foreseen end date: 31.12.2024		Actual end date:	31.12.2024

The purpose of this activity is dissemination of project results to all relevant stakeholders. To promote project results and to ensure wider outreach to all relevant stakeholders, A1 Hrvatska carried out numerous communication and dissemination activities during project implementation. Media coordinator was responsible for coordinating and implementing this action with the support of the rest of the A1 Hrvatska project team.

At the beginning of the project a press conference was held on which the project was promoted to 14 media representatives and 14 expert and public stakeholders, press releases were prepared and handed out which resulted in solid media coverage of the project and its objectives, which contributes to raising awareness on the need for GHG reductions in the telecommunication sector. We achieved 17 online articles, 3 press articles, 2 publications on the LIFE programme Croatia site and Ministry of economy and sustainable development, as a result of the conference. The LIFE4GREENBROADBAND page was designed and implemented, and two articles were prepared and posted on the website in order to further promote the project objectives and benefits and the need for GHG reductions in the telecommunication sector.

Video for project promotion was filmed and published on the project website, and another video from the opening conference has been published on Novimilenij Youtube channel.

Extensive communication and dissemination activities have been implemented, of which we can highlight the following:

- Press conference for the promotion of the project at start of project (14 media representatives and 14 expert and public stakeholders)
- Project closing conference for the promotion of the project (60 participants)
- LIFE4GREENBROADBAND website developed with a blog designed to inform on project activities and results
- 42 articles published on online media and 7 in print media (166,884 people reached)
- 3 articles on the project published on company website
- 3 videos on the project published on online media
- 1 of the videos promoting the project was sponsored to air in the TV show Poslovni plan on HRT 2 Channel (40,293 people reached)
- 21 posts published on social media (16,382 people reached)
- Project presented in article in daily newspaper Jutarnji list in special print edition Best EU projects in Croatia in 2022 (OCT 2022)
- Conference on green energy organized in Osijek 15 NOV 2022, 94 participants) - 44 media articles from the conference in total (3 print, 3 radio, 2 TV, 36 online)
- Noticeboards were designed and procured and are placed on all project site locations

Overall reach of project communication and dissemination activities, including continuation and replication activities is tracked to be at 225,886 people influenced by the end of the project (209,504 people excluding people influenced by social media posts). Seeing as the project planned to reach 40,000 people until the end of the project, and 100,000 people 3-years after the project, this is a great achievement for the project. Large part of this success is related to organisation of and participation in conferences with high visibility in the media, press news articles with large circulation, online articles in media with a high number of average daily users and strategic placement on TV. All the above-mentioned activities ensured strong project promotion and dissemination of results, as well as enable large scale replication and transfer of project results to other countries and different telecom operators.

The project envisaged networking with other LIFE projects on different networking events at least once a year during project implementation. There have been 3 presentations of the project at LIFE networking events (LIFE programme conference, 30 years of LIFE programme conference and networking event of LIFE beneficiaries in Croatia). Costs related to this action entail the cost of visibility materials such as noticeboards on project site locations, development of a project website, stickers for equipment, conference organisation costs, fees for sponsored articles in print, online and TV media, content creation and promotional costs. Project website was designed and implemented, stickers, panels and noticeboards have been procured and were implemented at project locations and promotional materials were also procured and shared at held conferences.

All of the above-mentioned activities ensured strong project promotion and dissemination of results, that enables large scale replication and transfer of project results to other countries and different telecom operators.

Conference in Osijek:

Ni zeleno i digitalno ne može bez kvalitetnog kadra

15. studenoga 2022.

Like 2

GOSPODARSTVO

FERIT – Do energetske neovisnosti uz domaće prirodne resurse

Cilj konferencije je približiti javnosti niskougljičnu energiju i modele sufinanciranja kroz jedinstvene primjere u zemlji i regiji te potaknuti na promjene...

Objavljeno 16.11.2022
Darija Kovačić

Na Fakultetu elektrotehnike, računarstva i informacijskih tehnologija (FERIT) u Osijeku održana je LIFE konferencija pod nazivom Za gigaBITNU zelenu energiju koju su zajednički organizirali A1 Hrvatska i FERIT. Cilj konferencije je približiti javnosti niskougljičnu energiju i modele sufinanciranja kroz jedinstvene primjere u zemlji i regiji te potaknuti na promjene regulatornog okvira u provedbi ambicioznih ciljeva Zelenog plana za Europu do 2050. i ciljeva održivog razvoja.

Nakon primjera dobrih praksi koje su predstavile kompanije i institucije A1 Hrvatska, MICO, Zelena energetska zadruga i Fakultet elektrotehnike iz Ljubljane,

Project presented at LIFE conference in SEP 2024:

Photo from the featured video on TV show Poslovni plan:

Action F.1: Project management

Foreseen start date: 5.7.2021		Actual start date:	5.7.2021
Foreseen end date: 31.12.2024		Actual end date:	31.12.2024

Project management facilitated all project activities to be implemented in accordance with LIFE regulations and project implementation standards, project deliverables achieved, and project monitoring actions conducted, in other words, the result of this actions is the effective implementation of project activities.

Thus, a team of 7 members, applicant full-time employees, has been formed and was assigned to the project for a fixed percentage of their time. The broader team includes 30 field engineers who work less than 2 days per month on average on the project in all project years. The project team was formed on the basis of the anticipated needs of the project, i.e., the required range of expertise and competencies for each segment in order to ensure its adequate implementation within the planned deadline, achievement of the set results and efficient use of the funds. The project team included experts who have the necessary expertise and experience in implementation of projects of comparable type and size. At the start of the process project management structure, financial and risk management procedures were organised and communicated to relevant company departments. Weekly coordination meeting of the whole project team are held regularly.

Based on the amount of investment and the various elements of the project, responsibilities of each team member were defined to ensure that the performance of activities and their coordination run optimally. The team was responsible for the successful implementation of all project activities and coordination of all departments and external contractual partners in the project. The organizational structure of the project team is one-dimensional, and the project team at the start of the project consisted of the following members: Tomislav Mesarić as Project Manager, Miroslav Đurić as Technical coordinator for solar plants, Goran Matoš as Technical coordinator for free cooling, Iva Turčin as Media Coordinator responsible for communication and dissemination of results, Maja Dumbović as Senior Area Controlling Specialist in charge of project financial management and coordination, Snježana Vrkljan as a Strategic Purchasing Expert in charge of procurement coordination and Nevenka Crneka-Čudina as an EU Funds Expert in charge of project coordination. At the end of 2021, Maja Dumbović left the company and was replaced in the role of Senior Area Controlling Specialist by Edina Civić, who has the same level of expertise and job position (Area Controlling Expert). In July 2022, Project Manager Tomislav Mesarić left the company and his position on the project was taken over by Goran Matoš, previously Technical coordinator for free cooling, and Vjekoslav Kordić, a Field Engineering Manager by position, replaced Goran as the Technical coordinator for free cooling. Vjekoslav Kordić left the company in Augus 2023, and was replaced by Andrija Pleh. Miroslav Đurić left the company in January 2023, and was replaced by Krunoslav Stjepan Šimunec.

A1 Hrvatska has all the necessary technical capacities to achieve the planned results of the project. The technical sector of A1 Hrvatska manages all technical aspects of business and ensures the development and implementation of technical systems for the provision of telecommunications services which includes the experience of last ten years in the development and maintenance of base telecommunication stations equipped with solar and wind energy, outdoor free cooling, experience with piloting hybrid energy use at base stations using sun,

wind and hydrogen fuel cells. After every FC or solar plant implementation, some of the experienced 30 field engineers under the coordination of technical coordinators did the final configuration and put into operation the installed solutions.

As the CB is a digital company with minimal paper use in its business the originals of most documents are in electronic form. Several software were used during project implementation such as the enterprise software SAP, human resources software HR NET and the procurement software Ivalua. Several modifications had to be made to the HR NET software to accommodate for easy reporting on project costs, particularly travel costs. These modifications enabled the exporting of reports on project travel costs with all relevant information such as kilometres travelled, per diems, additional costs, etc. All project accounting documentation and information is stored digitally on these software solutions and company's servers and are available on demand at any time. Furthermore, all documentation and information related to the project are archived on a separate server location. When the originals of documents are signed in paper form, they are kept in a special registry relating to the project at company's headquarters in Zagreb.

There were 3 visits of the monitoring team during the project and the project implementation was assessed to be well managed. There were no outstanding clarifications or requests requested from the external monitoring team after the visits. The project team developed a methodology for monitoring of energy savings and production of energy from renewable energy sources and developed an IT solution - smart energy management solution which precisely measures FC and solar plant operation and can configure them for optimal performance. Mobile application was developed for energy management, FC and solar plant deployment and maintenance. The project team monitors the energy performance and GHG emissions of the base stations locations using smart metering and remote (smart) energy management, and the collection of information from internal sources (utility bills, internal collaboration software, etc.) with a particular focus on sites where the measures have been implemented. This enables easy reporting on energy savings from FC solutions and energy produced by solar plants implemented as part the project.

Comments on the resolution of administrative and financial issues raised in the letter from CINEA received after the Mid-term report:

Issue 1. – All activities were sped up and implemented on schedule and deliverables uploaded
Issue 2. – Clarification was given under resolved ticket TCK003316 in the LIFE Monitoring Helpdesk
Issue 3. – Documentation for Tomislav Mesarić was provided before the next monitoring visit
Issue 4. - Clarification was given under resolved ticket TCK003318 in the LIFE Monitoring Helpdesk and D1 and D2 columns in the Financial statement were filled according to the agreed – Clarification on calculating travel costs containing clarification on rates used in line with company policy annexed to the final report
Issue 5. Clarification provided to the Monitoring officer and in this report under description of action C.2
Issue 6. – Sample of three highest invoices across all costs categories (except for Personnel and Travel) along with the proofs of payment per each beneficiary was delivered before the next monitoring visit

There were two budget reallocations, the information on which is included in the Annex to the Final report and the delivered Costs summary with the Payment request. Budget shift is under

20%. First reallocation was delivered through the LIFE Monitoring Helpdesk under the ticket TCK005683, while the other is presented in the final report as agreed.

Project team at the LIFE4GREENBROADBAND opening conference in Zagreb:

Project team at the LIFE4GREENBROADBAND closing conference in Zagreb:

6.2. Main deviations, problems and corrective actions implemented

Implementation of solar plants was initially delayed compared to the foreseen dynamic due to several technical difficulties encountered during project implementation. Firstly, the selection of locations for solar plant implementation was delayed, as it proved to be difficult to find suitable locations looking at the key parameters for successful solar energy exploitation. Secondly, the project technical solution for a solar plant setup with 8 panels of 450 Wp foreseen during project preparation proved unfeasible on almost all locations, and the CB had to opt for a 6-panel setup per location. Lastly, the design of the construction and technical solutions has proven challenging due to several limiting factors such as weather conditions on specific BTS locations, panel placement in relation to the BTS, available technologies of sub-constructions for placement of panels, permitting procedures, etc. However, CB devised and proposed effective solutions to tackle these difficulties and managed to install solar plants on 155 locations on schedule by end of 2023. Furthermore, considering the 6-panel setup which contributed to about a 30% cost savings for solar plant implementation on 120 locations, the CB proposed to expand the number of solar plant locations within the budget to meet the set targets. The approval of the proposal was received and the CB managed to implement solar plants on an additional 35 locations by the end of 2023 and within the project budget.

Until the end of 2023, all 155 solar plants were installed. Initially foreseen Technical solution 2 – solar plants on the ground next to the BTS has proved to be unfeasible and/or ineffective due to the lack of space on the ground around BTS, the shading of solar panels from various obstacles, the uncertain outcome of the process of obtaining the necessary construction permits and the expensive lease prices of the space for ground solar plant implementation. Furthermore, for some of the selected solar plant locations, based on detailed analysis and calculations of statics and wind stability, the Technical solution 1 – solar plants on roof of container was not feasible due to the constructional integrity limitations of containers with solar plants implemented at higher wind speeds (over 25 km/h). Therefore, it was necessary to change the technical solution for some of the plant locations. The contractor proposed to substitute the procured Technical solution 2 – solar plants on ground next to the BTS for a new Technical solution 2 – solar plants on BTS towers. The CB, the contractor and the supervision have validated the feasibility of the newly proposed technical solution. The proposal was approved by the supervision and the CB, and the contractor proceeded with implementation of solar plants on BTS towers for some of the solar plant locations.

In the project application and when calculating KPIs it was foreseen that each of the 120 base station locations where solar plants were to be implemented will be equipped with 8 solar panels of 450W power amounting to 432 kWp of overall installed power on all locations. However, due to technical limitations it was only possible to implement solar plants in a configuration of 6 panels of 450W power amounting to 324 kWp of installed power on 120 locations. Considering that the configuration with 6 panels could not enable the CB to achieve expected installed power and the KPI for the production of energy from RES if limited to 120 locations, the CB proposed to expand the number of solar plant locations to 155, i.e., by an additional 35 locations within the same project budget, and received no objections to do so from Monitoring expert and Project adviser in June 2023. The contractor was prepared to carry on with the implementation to further 35 locations according to contracted unit prices which were well below the current market prices, so it was a great opportunity to meet KPIs in a timely and cost-effective manner. When the change was approved by CINEA and the external monitoring team, the contract for solar plant implementation was annexed to include additional 35 locations, and the contractor implemented the additional 35 solar plants by end of 2023.

Key lessons learned is that there are a number of complexities in selecting BTS sites suitable for solar plant installation and that different technical solutions need to be considered to arrive to the optimal technical solution for solar plant implementation.

6.3. Evaluation of Project Implementation

Methodology applied to the project, based on the selection of a competent team of experts in different fields with clear actions and objectives, proved successful as efficient project management processes were setup, effective procurement processes have been carried out and all deliverables were achieved as planned. The visibility of the project is above expected and all key preconditions for successful implementation and achievement of results and deliverables are met. Even though there were significant increases of equipment and material costs on the market due to instabilities and high inflation during project implementation, efforts of the project team made it possible to achieve good prices and the implementation of all actions are expected to be within the overall project budget. All actions have a satisfactory dynamic and, even though some of them were initially delayed, they were all finished on schedule. Continuation activities within the company already showed significant results enabling the surpassing of expected KPIs. Replication activities are also already showing promising results during project implementation with strong interest in Macedonia, Bulgaria, Slovenia and Serbia, and we are confident that project results will be replicated both within Croatia and other countries.

As the CB is a digital company with minimal paper use in its business the originals of most documents are in electronic form. Several software are used during project implementation such as the enterprise software SAP, human resources software HR NET and the procurement software Ivalua. Several modifications had to be made to the HR NET software to accommodate for easy reporting on project costs, particularly travel costs. These modifications enable the exporting of reports on project travel costs with all relevant information such as kilometres travelled, per diems, additional costs, etc. All project accounting documentation and information is stored digitally on these software solutions and company's servers and are available on demand at any time. Furthermore, all documentation and information related to the project is archived on a separate server location. When the originals of documents are signed in paper form, they are kept in a special registry relating to the project at company's headquarters in Zagreb.

There were 3 visits of the monitoring team during the project and the project implementation was assessed to be well managed. There are no outstanding clarifications or requests requested from the external monitoring team after the visits. The project team developed a methodology for monitoring of energy savings and production of energy from renewable energy sources and developed an IT solution - smart energy management solution which precisely measures FC and solar plant operation and can configure them for optimal performance. Mobile application was developed for energy management, FC and solar plant deployment and maintenance. The project team monitors the energy performance and GHG emissions of the base stations locations using smart metering and remote (smart) energy management, and the collection of information from internal sources (utility bills, internal collaboration software, etc.) with a particular focus on sites where the measures have been implemented. This enables easy reporting on energy savings from FC solutions and energy produced by solar plants implemented as part the project.

(Projects funded under the Call 2014 onwards must use this format)

Results achieved

Action	Foreseen in the revised proposal	Achieved	Evaluation
C.1. Preparation of project technical documentation for solar plants	Objectives: Increasing energy efficiency and renewable energy use of the electronic communications network in Croatia in order to reduce GHG emissions Expected results: Prepared solar plant project technical documentation for 120 locations	Prepared solar plant project technical documentation for 155 locations	Action, even though initially delayed, was implemented on time to implement all the solar plants on 155 locations by end of 2023. The result was achieved with a few months of delay, by end of 2023.
C.2. Implementation of free cooling on indoor base station locations	Objectives: Increasing energy efficiency and renewable energy use of the electronic communications network in Croatia in order to reduce GHG emissions Expected results: - Implement free cooling solutions on 200 (BTS) locations - Reduced energy consumption by 1,210 MWh/year (2024) - Reduced energy consumption by 10,477 MWh/year (2027)	- Implemented free cooling solutions on 200 (BTS) locations - Reduced energy consumption by 1,126 MWh/year (2024) from project FC sites - Implemented free cooling solutions on additional 628 container locations (project continuation) - Reduced energy consumption by 1,201 MWh/year (2024) from continuation sites - Overall reduced energy consumption by 2,326 MWh/year (2024) from project and continuation sites	Action implemented on schedule by end of 2023, costs above planned project budget, reallocated costs to this action. Result achieved and surpassed for end of project
C.3. Implementation of	Objectives: Increasing energy efficiency and renewable energy use of	- Implemented solar plants on 155 (BTS) locations	Action implemented on schedule, increased the

solar plants on base station locations	the electronic communications network in Croatia in order to reduce GHG emissions Expected results: - Implement solar plants on 120 (BTS) locations - Energy from RES increased by 511 MWh/year (2024) - Energy from RES increased by 4,428 MWh/year (2027)	- Energy from RES increased by 438 MWh/year from 155 project BTS locations (2024) - Implemented solar plants on additional 50 (BTS) locations (project continuation) - Energy from RES increased by 202 MWh/year from BTS continuation sites (2024) - Overall Energy from RES increased by 640 MWh/year from project and continuation sites	number of sites from 120 to 155 to meet KPIs, project continuation on additional 50 sites. Result achieved and surpassed for end of project.
C.4. Development of a continuation, replication and transfer plan	Objectives: - multiply the impacts of projects' solutions and mobilize a wider uptake of free cooling and solar plants in the sector and transfer knowledge, methods and practices to other telecom operators in the EU - inform interested stakeholders, particularly telecom operators on project activities, results and benefits to increase replicability and transfer of project methods and techniques - promote the use of best practice RES and energy efficiency technologies in the telecommunication sector Expected results: - Continuation, replication and transfer plan drafted - 1 other telecom operator implementing energy efficiency and renewable energy use measures as a result of project actions (2024)	- Continuation, replication and transfer plan drafted - 3 other telecom operator implementing energy efficiency and renewable energy use measures as a result of project actions (2024)	Action implemented on schedule, results achieved as planned

	- 2 other telecom operators implementing energy efficiency and renewable energy use measures as a result of project actions (2027)		
C.5. Preparation of a business plan for large scale uptake of free cooling and solar plants in the telecommunications industry	Objectives: - assess the feasibility of large-scale uptake of free cooling and solar plants solutions in the telecommunication sector Expected results: - business plan for large scale uptake of free cooling and solar plants in the telecom industry drafted and disseminated to relevant stakeholders - summary of the business plan including benefits and financial performance indicators	- business plan for large scale uptake of free cooling and solar plants in the telecom industry drafted and disseminated to relevant stakeholders - summary of the business plan including benefits and financial performance indicators	Action implemented on schedule; results achieved as planned
C.6. Increasing knowledge and awareness on GHG emissions with proposed measures at the state level	Objectives: - improve the knowledge base and propose measures to relevant public authorities for the development and implementation of effective climate change mitigation actions in the telecommunication sector - improve the policies and measures for implementation of energy efficiency, renewable energy and GHG reductions in the telecommunication sector - raise public awareness on the need to reduce GHG emissions from the telecommunication sector - set energy performance standards for base stations as an integral part of the telecom network in terms of energy used per amount of data used - multiply the impacts of projects' solutions and mobilize a wider uptake of free cooling and solar plants in the sector	- GHG inventory report for the Croatian telecommunication industry - Proposal of measures to decrease GHG emissions in the telecommunication industry - Policy brief for the relevant stakeholders - Development of a GHG performance benchmark for the telecommunication industry - 3 meetings with relevant public authorities held and proposal of measures presented	Action implemented on schedule, results achieved as planned other than: - 1 policy and/or measure implemented to promote energy efficiency and renewable energy use in the telecom sector implemented as a result of project actions; Even though there were significant efforts to implement a policy or measure to promote energy efficiency and renewable energy use in the telecom

	and transfer knowledge, methods and practices to other telecom operators in the EU - promote the use of best practice RES and energy efficiency technologies in the telecommunication sector Expected results: - GHG inventory report for the Croatian telecommunication industry - Proposal of measures to decrease GHG emissions in the telecommunication industry - Policy brief for the relevant stakeholders - Development of a GHG performance benchmark for the telecommunication industry - 2 meetings with relevant public authorities held and proposal of measures presented - 1 policy and/or measure implemented to promote energy efficiency and renewable energy use in the telecom sector implemented as a result of project actions		sector, such as the policy proposal containing draft of a targeted Call for proposals, there was no political will to introduce such a targeted policy or measure. There were some joint communication actions with relevant public authorities on the need to raise awareness and promote the green transition in the ICT industry, but nothing more than that was achieved during project implementation.
D.1. Monitoring of the impact of implemented energy efficiency and renewable energy measures	Objectives: - Increasing energy efficiency and renewable energy use of the electronic communications network in Croatia in order to reduce GHG emissions Expected results: - First Summary report of achieved indicators - Second Summary report of achieved indicators - Assessment of the socio-economic impact of the project actions	- First Summary report of achieved indicators - Second Summary report of achieved indicators - Third Summary report of achieved indicators - Assessment of the socio-economic impact of the project actions	Action implemented on schedule; all results achieved. Additionally, third summary report of achieved indicators was prepared containing measured savings for a full year (2024).

E.1. Communication and dissemination of results	Objectives: - improve the knowledge base and propose measures to relevant public authorities for the development and implementation of effective climate change mitigation actions in the telecommunication sector - improve the policies and measures for implementation of energy efficiency, renewable energy and GHG reductions in the telecommunication sector - raise public awareness on the need to reduce GHG emissions from the telecommunication sector - multiply the impacts of projects' solutions and mobilize a wider uptake of free cooling and solar plants in the sector and transfer knowledge, methods and practices to other telecom operators in the EU - promote the use of best practice RES and energy efficiency technologies in the telecommunication sector Expected results: - awareness raised on 1 press conference with 15 media representatives present -10 media articles published promoting the project - 6 online workshops held for the replication of project results within the A1 Group - project promoted on 2 meetings of telecom assocciations on EU and national level - project promoted on the A1 Telekom Austria Group internal information system with a reach of 20.000 people - 5 posts on social media promoting the project with a reach of 20.000 people - 2 articles promoting the project on A1 Hrvatska website	- awareness raised on 1 start of project press conference with 14 media representatives present - awareness raised on 1 closing conference with 60 participants - 42 articles published on online media and 7 in print media (166,884 people reached) - 8 workshops held for the replication of project results within the A1 Group - project promoted on 3 conferences of telecom associations on EU level (ETIS Conferences Rome and Berlin, and EMEA Berlin) - project promoted on the A1 Telekom Austria Group internal information system with a reach of 13,699 people - 21 posts on social media promoting the project with a reach of 16,382 people - 3 articles and 2 videos promoting the project on A1 Hrvatska website - 225,886 individuals/entities made aware of the project and the need to reduce GHG emissions in the telecom industry (209,504 people excluding people influenced by social media posts)	Action implemented on schedule; results far surpass the planned results, best effects achieved from media conferences in Zagreb and Osijek, print media articles with high circulation, and the TV coverage

	- 40,000 individuals/entities made aware of the project and the need to reduce GHG emissions in the telecom industry by 2024 - 100,000 individuals/entities made aware of the project and the need to reduce GHG emissions in the telecom industry by 2027 - Layman's report prepared - 320 noticeboards posted on location sites - 3 formal surveys conducted with public policy makers and other telecom operators	- 355 noticeboards posted on location sites - Layman's report prepared - 3 formal surveys conducted with public policy makers and other telecom operators	

Project results related to solar plant and FC solution implementation in terms of energy saved and produced became apparent and monitored during 2024 so a full year of measurements can take place. Results related to increasing awareness, communication and dissemination are immediately visible. Substantial progress has been made in replication and transfer activities with recorded interest to replicate energy efficiency and renewable energy in the telecommunication industry in Macedonia, Bulgaria, Slovenia and Serbia. The project team is holding talks with interested telecom companies and will collect information on measures implemented in other companies which contribute to the replication deliverables. Effectiveness of the dissemination activities is at a high level, particularly related to conferences, print media articles and TV coverage which enabled a high reach of 225,886 people (209,504 people excluding people influenced by social media posts). Posts on the internal social platform in the TAG group had a good reach with 13,699 views.

Project achievements which support policy developments were achieved during project implementation. Meetings with key Ministries were held, and the proposal of measures for decreasing GHG emissions in the telecommunication industry was presented. Talks were held about inclusion of the telecom sector in the new REPowerEU measures under the Recovery and Resilience Facility, but without any results during project implementation. Project actions contribute to LIFE CCM specific objectives related to improving the knowledge base for the development, assessment, monitoring, evaluation and implementation of effective climate change mitigation actions and measures and to enhance the capacity to apply that knowledge in practice, and contributing to the development and demonstration of innovative climate change mitigation technologies, systems, methods and instruments that are suitable for being replicated, transferred or mainstreamed. According to the LIFE Work Programme 2018-2020 project addresses the EU policy area - MS efforts to reduce greenhouse gas emissions in the sectors not covered in the EU Emission Trading System but covered by the Effort Sharing Decision (EU) 406/2009 and subsequent legislation in so that it reduces GHG emissions from a non-ETS industry sector - telecommunication industry, improves the knowledge base on GHG emissions in the telecommunication industry and proposes measures for improving the policy and funding options for the reduction of GHG emissions in the telecommunication industry through the implementation of energy efficiency and renewable energy solutions.

6.4. Analysis of benefits

The project aimed to achieve 404.24 tCO2/year by the end of the project (2024) and 3,500 tCO2/year 3 years after the end of the project (2027), and thus contribute to the reduction of GHG emissions from the telecommunications industry (non-ETS sector). Until the end of the project, 696.63 tCO2 / year reduction of GHG emissions has been achieved. Combination of free cooling, solar plants and smart energy management software in order to reduce energy use of the telecommunication sector is an appropriate, cost-effective, state-of-the-art technique and approach demonstrated by the project, which can be easily replicated in any moderate and Mediterranean climate which covers most of the EU countries. These technologies and methods are readily available to all potential stakeholders and can be replicated easily anywhere.

Project actions contribute to LIFE CCM specific objectives related to improving the knowledge base for the development, assessment, monitoring, evaluation and implementation of effective climate change mitigation actions and measures and to enhance the capacity to apply that knowledge in practice, and contributing to the development and demonstration of innovative climate change mitigation technologies, systems, methods and instruments that are suitable for being replicated, transferred or mainstreamed. According to the LIFE Work Programme 2018-2020 project addresses the EU policy area - MS efforts to reduce greenhouse gas emissions in the sectors not covered in the EU Emission Trading System but covered by the Effort Sharing Decision (EU) 406/2009 and subsequent legislation in so that it reduces GHG emissions from a non-ETS industry sector - telecommunication industry, improves the knowledge base on GHG emissions in the telecommunication industry and proposes measures for improving the policy and funding options for the reduction of GHG emissions in the telecommunication industry through the implementation of energy efficiency and renewable energy solutions.

Project activities were carried out in accordance with the foreseen dynamic and are finished on schedule, with great results in terms of visibility and impact, as awareness raising KPIs have been achieved ahead of the planned schedule, with more than double value achieved for the value 3 years after the project with a reach of 225.886 people. The CB has successfully collected and analysed data on energy use and emissions in the Croatian telecom industry and their respective groups, and proposed a GHG performance benchmark that can be used as an industry performance standard that also enables tracking of climate performance of telecom operators, which can be further used to implement targeted measures to reduce GHG emissions of the telecom sector. The CB drafted the GHG inventory report for the Croatian telecom industry, which was disseminated to key stakeholders in the project implementation period. Replication activities have been carried out and there is recorded interest to replicate and transfer project solutions. It is estimated that all replication and transfer activities will contribute to the implementation of free cooling and solar plant solutions in the telecommunication sector of at least 2 other telecom operators, reduce energy use from non-renewable energy by more than 14 million kWh annually, and consequently decrease CO2 emissions by at least 3,500 tons/year. Energy savings and production on project sites fell a bit short of the planned values in 2024. RES production and use on project 155 locations amounted to 438,005 kWh/year and reduced energy consumption from Free Cooling on 200 locations amounted to 1,125,565 kWh/year. Project continuation activities resulted in additional 202,358.59 kWh/year of RES production and use, and 1,200,842.49 kWh/year reduced energy consumption from Free Cooling solutions. We are aware of 3 telecommunication companies already replicating project solutions, namely solar plants on BTS, in Serbia, Macedonia and Bulgaria. Smart remote energy management software was developed during the project and is

being used for constant monitoring of installed solutions and energy use optimization. Mobile application was also developed for energy management, FC and solar plant deployment and maintenance.

Implementation of solar plants has been delayed compared to the foreseen dynamic due to several technical difficulties encountered during project implementation. However, CB devised and proposed effective solutions to tackle these difficulties, as described previously.

7. Key Project-level Indicators

KPIs	Estimated impact (2024)	Achieved (31/12/2024)
Reduction of greenhouse gas emissions (GHG)	404.24 tCO2 / year	696,63 tCO2 / year
Energy from Renewable Energy Sources	511,560 kwh / year	640,363 kwh / year
Reduced energy consumption	1,210,000 kwh / year	2,326,407 kWh/year
Number of entities/individuals reached/ made aware	40,000	225,886 (209,504 people excluding people influenced by social media posts)
Formal surveys conducted with public policy makers and other telecom operators	3	3
Policies and/or measures implemented to promote energy efficiency and renewable energy use in the telecommunication industry by target public stakeholders as a result of project actions	1	0
Other telecommunication operators implementing energy efficiency and renewable energy use measures are implemented as a result of project actions	1	3 (Serbia, Macedonia, Bulgaria)

All project key KPIs were achieved for the end of the project value, except a policy and/or measure implemented to promote energy efficiency and renewable energy use in the telecommunication industry by target public stakeholders as a result of project actions. Energy savings and production on project sites fell a bit short of the planned values in 2024. RES production and use on project 155 locations amounted to 438,005 kWh/year and reduced energy consumption from Free Cooling on 200 locations amounted to 1,125,565 kWh/year. Project continuation activities resulted in additional 202,358.59 kWh/year of RES production and use, and 1,200,842.49 kWh/year reduced energy consumption from Free Cooling solutions. We are aware of 3 telecommunication companies already replicating project solutions, namely solar plants on BTS, in Serbia, Macedonia and Bulgaria. Despite extensive efforts during

project implementation, including preparing and promoting the policy proposal for targeted measures for decreasing GHG emissions in the telecommunication sector and a proposal of a call for proposals, no political will or further activities were observed in the relevant public authorities to publish such a measure. Efforts will be continued after the project to encourage a targeted policy or measure for decreasing GHG emissions in the telecommunication industry. Some GHG emission reduction awareness activities have been jointly implemented with public stakeholders and several regulatory improvements have been observed as a result of the proposals for removing regulatory barriers for RES, such as no need for EIA for small wind plants or no need for a construction permit for solar plants on existing structures. However, a targeted policy and/or measure such as those proposed have not been implemented.

8. Comments on the financial report

8.1. Summary of Costs Incurred

PROJECT COSTS INCURRED				
	Cost category	Budget according to the grant agreement in €*	Costs incurred within the reporting period in €	%**
1.	Personnel	302.028,00	391.388,40	129,59%
2.	Travel and subsistence	34.190,00	17.509,74	51,21%
3.	External assistance	214.593,00	154.737,55	72,11%
4.	Durables goods: total non-depreciated cost	1.434.002,00	1.499.101,70	104.54%
	- *Infrastructure sub-tot.*	804.015,00	771.810,68	95,99%
	- *Equipment sub-tot.*	629.987,00	727.291,02	115,45%
	- *Prototype sub-tot.*	0,00	0,00	
5.	Consumables	0,00	0,00	
6.	Other costs	42.077,00	36.847,66	87,57%
7.	Overheads	**141.882,00**	**141.882,00**	100,00%
	TOTAL	**2.168.772,00**	**2.241.467,05**	103,35%

*) If the Agency 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

There have been two reallocations in the project budget under the 20% budget shift so no amendments to the Grant agreement were necessary.
Tables outlining the budget reallocations are annexed to the Final report.

8.2. Accounting system

A1 Hrvatska uses SAP ERP system. In working with the SAP program there is an obligation to define special keys in order for all transactions to be recognized and posted, so for the LIFE project we have defined special cost centres (orders and WBS; materials) which, in addition to having LIFE in the name, enable detailed records and monitoring of these same expenses. Also, in the agreements with key suppliers, we ensured that the description of LIFE is clearly stated on the documents (PO and invoices).

Core project team have a fixed contractual percentage of time working on the project defined by Annexes to their employment contracts, while field engineers work less than 2 days per month on average on the LIFE project, which is why the CB is exempt from the obligation of keeping time sheets during project implementation and therefore there is no time recording system used for project reporting. The CB uses electronic system HR NET for travel procedures and related expenses and time spent on travel, which was modified for easy reporting on travel.

All related activities and the administration itself of the organization of business travels was carried out through the HR application within the Business Travel Management module. The superior sends an employee on a business travel. Therefore, the business travel request in the HR application has to be filled in by the employee and approved by the superior before the starting date of the business travel. Upon the approval, an employee could print out his/hers travel order from HR application. However, employees are not obliged to have it during their business travels. Ordering and booking travel arrangements were carried out pursuant to a created and approved business travel order bearing the mention of the necessary travel arrangements. For business travel within Croatia the company employees use official company vehicles or, in exceptional cases, own personal vehicles. When company vehicles are used the costs of petrol, depreciation and other vehicle expenses are borne by the company as separate expenses. For the purposes of reimbursement of these expenses as part of the LIFE4GREENBROADBAND project it would be difficult to provide relevant invoices and calculations of depreciation and maintenance for each separate travel, therefore, the reporting on these expenses would be strenuous for the company, if not impossible to differentiate (e.g., which gas invoice is related to which individual travel and in what ratio, etc.).

In other case, when own personal vehicles are used, the company's usual practice is to reimburse car expenses calculated as set reimbursement in currency value per kilometre, in accordance with the Ordinance on income tax (OJ, 10/2017) and widely applied by companies and institutions in Croatia, as well as A1 Hrvatska d.o.o.

To be able to reimburse travel costs related to the use of official company vehicles for travel in the project LIFE4GREENBROADBAND effectively, the value of usual reimbursement per kilometre was used and calculated for each travel related to the project and included in the financial statement for reimbursement. These travel expenses are therefore in line with the usual practices of the company on travel, and should, therefore, be reimbursed. This make it easier to calculate expenditure related to individual project travel and to report and justify the costs related to travel when official company vehicles are used.

During the project the following renumeration amounts per kilometre, as per company policy and usual practices on travel, were as follows:

Applicable from	Applicable to	Currency	Value of reimbursement
01.01.2017.	30.09.2022.	HRK	2,00
01.10.2022.	31.12.2022.	HRK	3,00
01.01.2023.	31.01.2024.	EUR	0,40
01.02.2024.	-	EUR	0,50

Clarification on travel costs is annexed to the Final report.

Invoice verification is a mandatory process step in the Procure-to-Pay process, which has to ensure that vendors are charging A1 correctly, completely and according to agreements (contracts or PO's). All Invoices are received centrally and uploaded to eFlow, which is integrated in SAP. Invoice verification is done by crosschecking the invoices received against the contract/purchase order and delivery receipt and/or to be approved by authorized person(s).

Goods receipt has to be posted accurately within ERP system as soon as possible (immediately) after goods or services are received, based on the delivered quantity, supported by proper documentation and attached accordingly. Documentation has to be archived in a way that allows auditing. Goods receipt confirmation is done by relevant or Business Unit that received goods/services, or warehouse responsible in case of goods on stock. Invoice verification and Payment are under responsibility of Accounting and Treasury, and will be executed based on Purchase order where Goods receipt has been confirmed, or where invoice has been approved by the responsible party (for the cases when Direct Booking is allowed and in accordance with Invoice Verification Process).

8.3. Certificate on the financial statement

Certificate on the financial statement was prepared by an independent auditor following the format of the 'Terms of reference for the certificate on the financial statements' available on the LIFE website under the LIFE Reporting / Templates section and is delivered as part of the final report.

8.4. Estimation of person-days used per action

Action type	Budgeted person-days	Estimated % of person-days spent
All projects when applicable Action A: Preparatory actions		
NAT and CLIMA projects Action B: Purchase/lease of land and/or compensation payment for payment rights		
ENV projects Action B: Implementation actions		
GIE projects Action B: Core actions		
NAT projects Action C – Concrete conservation actions		
CLIMA projects Action C: Implementation actions	1,464	100%
ENV and GIE projects Action C: Monitoring of the impact of the project action		
NAT and CLIMA projects Action D: Monitoring and impact assessment	105	100%
ENV and GIE projects Action D: Public awareness/communication and dissemination of results		
NAT and CLIMA projects Action E: Communication and Dissemination of results	211	100%
ENV and GIE projects Action E: Project management		
NAT and CLIMA projects Action F: Project management (and progress)	544	100%
TOTAL	2,324	100%

Annex I - LIFE4GREENBROADBAND – Deliverables index

Deliverables	Short description	Deadline	Date of completion
Awareness raised on 1 press conference with 15 media representatives present	Awareness was raised on the start-of-the-project press conference with 14 media representatives present and 14 experts. Deliverables include pictures, attendees list, press release and social media posts.	15/12/2021	7/7/2021
Development of a GHG performance benchmark for the telecommunication industry	Key benchmark was developed defined as the amount of GHG emissions per GB of data which can be used as a climate change performance benchmark for the industry, and to be used in the development and monitoring of targeted measures by public authorities to increase the climate performance of telecommunication companies. The benchmark is presented in the delivered GHG inventory report.	20/10/2022	14/3/2023
GHG inventory report for the Croatian telecommunication industry	In order to increase knowledge on GHG emissions in the telecommunication industry in Croatia targeted research was carried out analysing the GHG emissions from the key telecommunication companies in Croatia. GHG inventory report is attached, which will be disseminated to key stakeholders in the next phase of project implementation.	20/10/2022	14/3/2023
Continuation, replication and transfer plan	Continuation, replication and transfer plan was drafted and is attached, which devises measures and activities for the continuation, replication and transfer of project results after the end of the project implementation period.	31/12/2022	20/12/2022
Mid-term report	It was agreed with the EC LIFE Project Manager to postpone the submission of the mid-term report until 31st May 2023 to enable the Coordinating Beneficiary to fully use the 1st pre-financing payment.	31/01/2023	31/05/2023

First Summary report of achieved indicators	The document was drafted to evaluate FC and solar plant measures implemented, energy and GHG savings in relation to the project's KPIs.	31/03/2023	20/05/2023
10 media articles published promoting the project	The deliverable was achieved already with the successful start-of-the-project conference that resulted in 17 articles published on online media and 3 in print media. List of published articles and reach has been delivered during project implementation.	09/11/2023	7/7/2021
2 articles promoting the project on A1 Hrvatska website	The LIFE4GREENBROADBAND page was designed and published and 3 articles, 2 promotional videos and descriptions of the project and key technologies implemented as part of the project were published on the website. Website with published deliverables: https://www.a1.hr/tko-smo-mi/eu-projekti/life4greenbroadband	15/11/2023	8/7/2022
6 online workshops held for the replication and transfer of project results within the A1 Group	6 workshops and 2 meetings were held for the replication and transfer of project results within the A1 Group and beyond (Meeting and online workshop with A1 Bulgaria; Telekom Austri Group meeting in Vienna; Online workshop with A1 Macedonia, Online workshop with A1 Slovenia and A1 Serbia, Online workshop with A1 Austria, Workshop with Hrvatski Telekom and Workshop with Telemach)	21/11/2023	29/09/2024
2 meetings with relevant public authorities held and proposal of measures and policy brief presented	3 meeting with relevant public authorities were held and proposal of measures and policy brief presented (Ministry of Economy and Sustainable Development, Ministry of Environment and Green Transition, Croatia telecommunication network operator – Odašiljači i veze d.o.o.)	30/11/2023	03/12/2024
Built solar power plants at 120 BTS locations	Built solar power plants at 155 BTS locations	31/12/2023	31/12/2023
Implemented free cooling solutions on 200 BTS locations	Implemented free cooling solutions on 200 BTS locations	31/12/2023	31/12/2023
320 notice boards posted on location sites	355 notice boards posted on location sites	30/06/2024	31/01/2024

Layman's report prepared	Layman's report prepared and delivered	30/06/2024	11/12/2024
Assessment of the socio-economic impact of the project actions	Assessment of the socio-economic impact of the project actions prepared and delivered	31/12/2024	21/03/2025
Second Summary report of achieved indicators	Second and Third Summary reports of achieved indicators prepared and delivered	31/12/2024	21/03/2025
After-LIFE and exploitation plan created	After-LIFE and exploitation plan prepared and delivered	31/03/2025	31/03/2025
Audit report created	Audit report – Certificate on financial statements prepared and delivered	31/03/2025	31/03/2025
Final report drafted	Final report prepared and delivered	31/03/2025	31/03/2025