

DELIVERABLE D.T4.2.1

Implementation of pilot actions for EE
improvement

Version 1
03/2022





D.T4.2.1: Implementation in Weiz (Austria) of EE ICT tools developed in WPT2-3 (PA1)

Activity A.T4.2 Implementation of pilot actions for EE improvements

Issued by: Gottfried Köberl Partner Nr. PP 7

Version date: 17.03.2022

Authors		
	Name (organization)	Name, e-mail
WP leader	Mazovia Energy Agency, PP3	Mateusz Kruk, m.kruk@mae.com.pl
Contributing participants	Weizer Energie- & Innovationszentrum	Gottfried Köberl, gottfried.koeberl@innovationszentrum-weiz.at



1. Introduction

The deliverable T4.2.1 belongs to the activity related to the implementation of pilot actions for EE improvement (A.T4.2). In particular, for each implemented pilot action, a document has been created reporting the information on how Pilot Action is developed, what upstreamed and downstreamed TARGET-CE tools are used in the new pilot areas and what is the overseen outcome of performed Pilot Action.

This document describes Pilot Action included in D.T4.2.1 and performed by PP7 WEIZ in TARGET-CE project.

2. Pilot Action Statement

The overall objective of the W.E.I.Z. pilot actions was to realise a replicable system for energy monitoring and management in public buildings and to generate a database which unites different source of energy data within the municipality (electrical and heating data, constructional data, mobility data, data for RES, etc.) so that all data can be accessible and updated regularly and presented in an easy and descriptive way to city officials and simplify the work of city and energy planners. The original scope of the database could not be realised within the projects budget, but the database was constructed in a modular way so that additional functionalities can be added to the database. Within the project the realisation of the data collection for energy data on building level was implemented so that new and/or updated data can be included easily into the system.

3. Pilot Action Objectives

In Weiz several pilot actions were implemented. Detailed building and energy-related data of the three pilot (public office) buildings (W.E.I.Z. 1 to 3) was implemented into the BOOSTEE-CE 3D Energy Management System (3DEMS). Also (not so detailed) building and energy-related data from almost every building in the city of Weiz was provided as input for the 3DEMS so that data can be accessed by the public and public authorities to analyse the relevant energy data within a building, a local area or the municipality included in the system. This data provides a valuable overview of the city's energy data and helps city and energy planners to develop detailed and specifically adapted plans in the future.

Another pilot action implemented in the W.E.I.Z. pilot buildings was the living EPC tool on how to reach near zero emission in public buildings (NZEB) with specific measures. Therefore, the building data of the three pilot buildings was input into the online tool and then based on these data automatically generated measures on how to reach NZEB-status with the approximate costs. As the three W.E.I.Z. pilot buildings are relatively new (the oldest building W.E.I.Z. I is just 20 years old) and were already built in a very energy efficient style the living EPC tool could not find measures to improve the pilot buildings.

The goal of the pilot actions was to improve energy efficiency in the 3 pilot buildings by additionally implementing a energy management system that monitors energy production and consumption to increase the autarky rate of the pilot buildings. Also, the energy data of the buildings in the municipality of Weiz provided for the 3DEMS was expanded into a pilot action energy and data platform.



3.1 Objective scope and targets values

The objective of the pilot actions is to improve the energy efficiency in public buildings and decrease obstacles for doing so.

One part of this objective is to monitor the energy consumption and production and based on this data improve energy usage. For example, optimise the use of renewable energy sources, as public buildings are operated generally in the daytime when energy from renewable energy sources is highest. To include a monitoring system for all public buildings within the municipality, which can improve energy efficiency, could be a convincing argument for local public authorities to implement such systems.

The second big objective of the pilot actions is the realisation of an energy database which collects data from different sources and unites them into one general platform. This platform was programmed by a technical expert who will monitor and oversee the use and can implement additional features regarding e.g., electromobility, parking, public transport, and others. This system should be used by the responsible staff of the municipality (building authority, office for mobility, district heating, and so on) so the database is always up to date.

3.2 Target indicators

Objective	Target indicator	Method of measurement and validation
Improve energy efficiency in the three W.E.I.Z. pilot buildings	Implementation of an energy monitoring system that includes energy production and consumption and energy flow	Measuring overall data consumption with comparison to previous periods Input building data into the living EPC tool to see if measures to increase the building standard are necessary
Summarise all relevant energy data of buildings within the area of the municipality of Weiz	As this is a continuous process the target is to update the database on regularly (at least once every period) and to instruct the responsible personnel within the municipality to keep data up to date	Summarise and compare provided energy related data and train the responsible personnel within the municipality in using the database



4. Pilot Action description

The relevant energy data (status quo) of the three pilot buildings was already described in detail in the deliverable D.T4.1.2 and the according appendix. To implement the energy management system a technical expert installed measuring equipment and programmed an interface in which measured data is visualised, and historic data stored.

Also, the preparation of the building and energy data for all the buildings in the Weiz municipality which were included in the 3DEMS and the Weiz pilot action energy database had to be done.

4.1 Business-as-usual

As the pilot buildings were already built in a very energy efficient way and are relatively new (the oldest building is 20 years old) constructional improvements are/were not yet necessary. But without the implemented energy management system, the use of the already implemented renewable energy sources and storage capacities cannot be optimally used in the three pilot buildings.

Without the second implemented pilot action implemented the collection of energy related data on the buildings in the municipality of Weiz would be very time and resource consuming. Several different departments are involved, and they use different datasets (with different measuring units, nomenclatures, and so on) which have to be integrated into one general system database. Also, the tracking of changes (conversion of heating systems, electricity consumption) cannot be done efficiently, if at all, and therefore the historical development of the data over time cannot be demonstrated.

4.2 Action and development scenario

For the implemented pilot actions detailed building data for the three pilot buildings had to be collected (energy certificates, already implemented measuring systems and energy management tools). Also, for the use of the 3DEMS geospatial, energy and general building data had to be collected. Based on this collected data the additional pilot actions (energy management system for the three pilot buildings and energy database for all Weiz buildings) were implemented by external experts (technician and programmer) and are in use.

The technician had to install additional measuring instruments for the three pilot buildings and create a visualisation (Figure 1) and management system. Building management received training on the system.

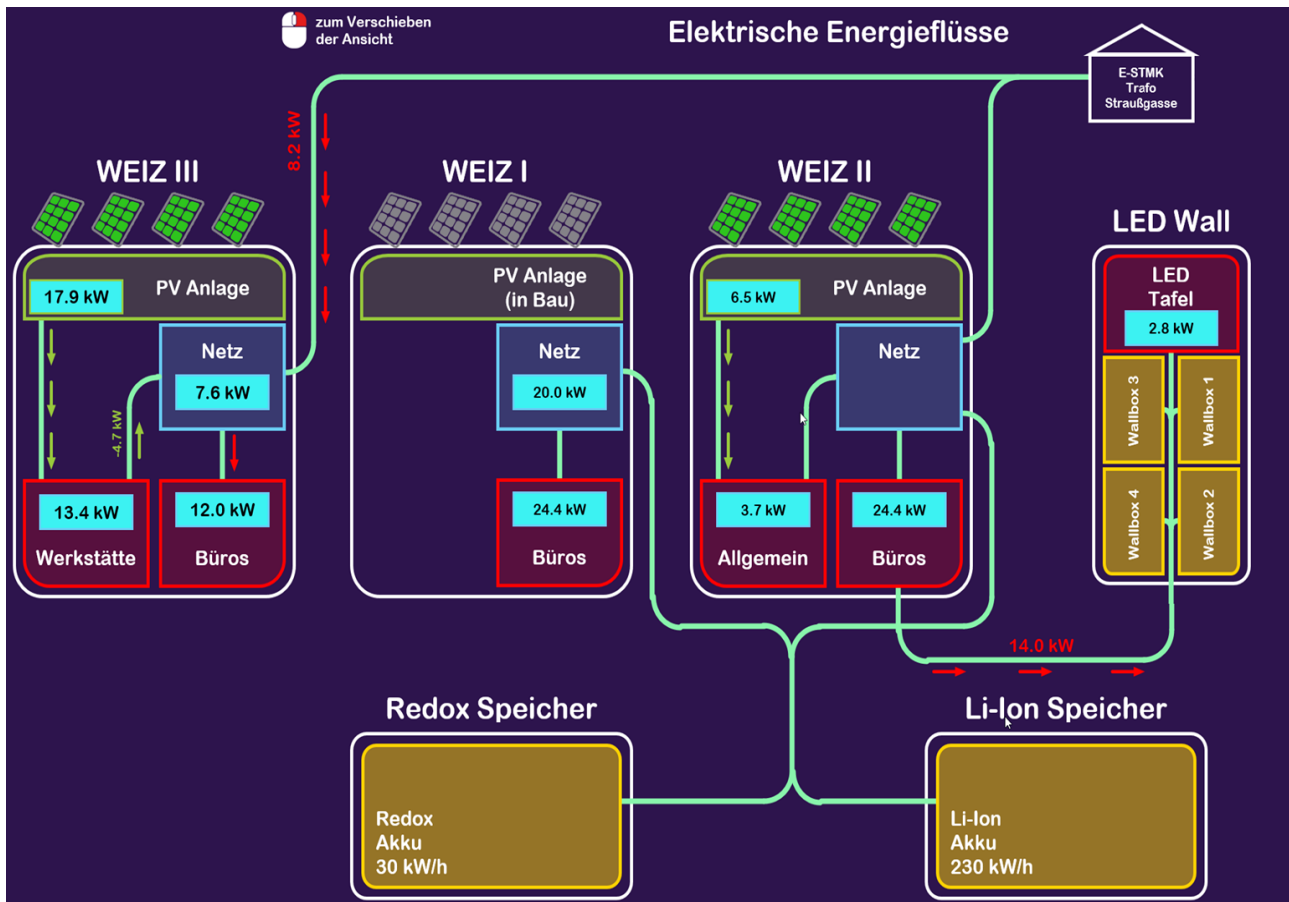


Figure 1: Visualization of the energy management system

In coordination with the Target-CE project team and members of other departments (GIS-System representative, district heating, building authority) the programmer developed a basic database system with login and import functionality so employees of the municipality can input/update/edit building data in the database. Data can be visualized in table format for the whole database (Figure 2), data on single building level (Figure 3) and tracks changes of data (Figure 4). The imported data has to be checked for plausibility by an inhouse expert and after that the data is accepted by the system. This database can also be extended with additional functionalities. The programmed system is also built for replicability so that other municipalities or public authorities can adopt it for their area/region, provided the necessary data is available.



Energy		myEnergy -											
1752	506390	6Ackerlstr	50622Ackerlstr	50622Ackerlstr	Kessel: Stan	Heizöl	Extral	159	100	173	33801945 bis 196	Gebäude mit keine	130
1753	506392	1Landgasse	90613Landgasse 1	2169Landgasse 1	Wärmepum	Strom		357	292	36	12852	Bürogebäudekeine	279
1754	506394	11Brentengass	39102Brentengass	492Brentengass	Kessel: Bren	Heizöl	Extral	364	230	0	01945 bis 196	Gebäude mit keine	131
1755	506396	6Hugo-Wolf-	39151Hugo-Wolf-	1814Hugo-Wolf-	Kessel: Bren	Erdgas		165	120	133	219451961 bis 197	Gebäude mit EFS	131
1756	506398	23Gleisdorfer S	39128Gleisdorfer S	1344Gleisdorfer S	Nahwärme (	Erdgas		454	454	0	0Vor 1919	sonstiges Ba keine	131
1757	506400	12Birkfelder St	39097Birkfelder St	377Birkfelder St	Kessel: Bren	Erdgas		598	598	167	998661945 bis 196	Groß- und Ei EFS	131
1758	50640227a	Raabgasse	39187Raubgasse 2	2685Raubgasse 2	Wärmepum	Strom		372	304	0	0	Gebäude mit keine	284
1759	5064041a	Feldweg	39113Feldweg 1a	1069Feldweg 1a	Wärmepum	Strom		291	221	44	12804	2012Gebäude mit keine	265
1760	506408	5Hausweg	3398Hausweg 5	1645Hausweg 5	Wärmepum	Strom		590	244	0	0	2013Gebäude mit keine	281
1761	506410	4Felberweg	3388Felberweg 4	1037Felberweg 4	Kessel: Stan	Scheitholz	351.85	351.85	0	0	01919 bis 194	Gebäude mit keine	130
1762	506412	34Flurgasse	39115Flurgasse 34	1120Flurgasse 34	Nahwärme (	Heizöl	Extral	161	160	93	149731945 bis 196	Gebäude mit keine	130
1763	506414	8Leutholdgass	39173Leutholdgass	2276Leutholdgass	Fernwärme	Hackschnitze		210	155	110	17160	2007Gebäude mit keine	221
1764	506416	23Goethegasse	39129Goethegasse	1391Goethegasse	Fernwärme	Hackschnitze		1096	823	36	466561961 bis 197	Gebäude mit keine	131
1765	506418	6In der Erlach	39153In der Erlach	1837In der Erlach	Fernwärme	Hackschnitze		1359	443	68	924121991 bis 200	Gebäude mit keine	213
1766	506420	14Sackgasse	56995Sackgasse 14	2809Sackgasse 14	Raumheizge	Scheitholz		56	56	0	01971 bis 198	sonstiges Ba EFS	130
1767	50642234d	Krottendorfj	39167Krottendorfj	2132Krottendorfj	Fernwärme	Hackschnitze		175	173	0	0	2019Gebäude mit keine	284
1768	506424	1Rathausgass	39190Rathausgass	2737Rathausgass	Fernwärme	Hackschnitze		401	401	59	63189	sonstiges Ba keine	221
1769	506426	18Brunnfeldga	39103Brunnfeldga	525Brunnfeldga	Fernwärme	Hackschnitze		1056	834	52	342161945 bis 196	Gebäude mit keine	131
1770	506428	17Gartengasse	56988Gartengasse	1260Gartengasse	Fernwärme	Hackschnitze		434	180	100	434001971 bis 198	Gebäude mit EFS	130
1771	506430	70Bundesstraß	3381Bundesstraß	606Bundesstraß	Kessel: Stan	Heizöl	Extral	91	90	189	171991945 bis 196	Gebäude mit keine	130
1772	506432	37Wiesengasse	39223Wiesengass	3535Wiesengass	Fernwärme	Hackschnitze		91	90	102	92821945 bis 196	Gebäude mit keine	131
1773	506434	32Johannes-Hy	39155Johannes-Hy	1857Johannes-Hy	Wärmepum	Strom		124	116	15	1860	2007Gebäude mit keine	234
1774	506436	8Elingasse	39110Elingasse 8	911Elingasse 8	Fernwärme	Hackschnitze	186.16	157	0	0	01991 bis 200	Groß- und Ei keine	288
1775	506438	4Leutholdgass	39173Leutholdgass	2273Leutholdgass	Kessel: Bren	Erdgas		238	75	160	380801945 bis 196	Gebäude mit EFS	131
1776	506440	6Dorfstraße	3365Dorfstraße 6	698Dorfstraße 6	Kessel: Stan	Scheitholz		161	140	225	362251981 bis 199	Gebäude mit keine	130
1777	506442	24Brentengass	39102Brentengass	497Brentengass	Kessel: Stan	Heizöl	Extral	372	215	152	565441971 bis 198	Gebäude mit EFS	131
1778	506444	21Kapellenstra	90612Kapellenstra	1904Kapellenstra	Kessel: Bren	Erdgas		103	102	180	185401945 bis 196	Gebäude mit EFS	130
1779	506446	28Ludwig-Schl	39174Ludwig-Schl	2292Ludwig-Schl	Fernwärme	Hackschnitze		1288	962	56	1011921971 bis 198	Gebäude mit keine	131
1780	506448	14Siedlungsgas	39203Siedlungsgas	2971Siedlungsgas	Kessel: Stan	Heizöl	Extral	94	85	93	87421945 bis 196	Gebäude mit keine	131
1781	506450	8Am Eberfeld	107831Am Eberfeld	87Am Eberfeld	Nahwärme (	Hackschnitze	487.84	400	442	1464.96	2010Gebäude mit keine	261	
1782	506452	8Wiesengasse	39223Wiesengass	3556Wiesengass	Fernwärme	Hackschnitze		4556	746	112	5102721961 bis 197	Gebäude mit keine	187
1783	506454	7Koschatgass	39166Koschatgass	2037Koschatgass	Fernwärme	Hackschnitze		196	195	115	225401919 bis 194	Gebäude mit keine	131
1784	506456	7Gaulhoferga	39124Gaulhoferga	1275Gaulhoferga	Kessel: Stan	Heizöl	Extral	206	205	150	309001971 bis 198	Gebäude mit keine	131
1785	506458	8Rehweg	90622Rehweg 8	2764Rehweg 8	Wärmepum	Strom	323.35	259.64	59	19078	Gebäude mit keine	280	
1786	506462	15Fadingergas	39111Fadingergas	961Fadingergas	Kessel: Stan	Scheitholz		196	160	0	01971 bis 198	Gebäude mit EFS	131
1787	506464	12Almweg	112589Almweg 12	38Almweg 12	Nahwärme (	Hackschnitze		330	262	0	0	2009Gebäude mit keine	256

Figure 2: Database with all Weiz buildings (and according building and energy data)

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Collapsible Group		<table border="1"> <thead> <tr> <th>Nummer</th> <th>Typ</th> <th>Bezeichnung</th> <th>Adresscode</th> <th>Straße</th> <th>Nr.</th> <th>PLZ</th> <th>Ort</th> </tr> </thead> <tbody> <tr> <td>01000001</td> <td>EFH</td> <td>Einfamilienhaus, Fam. Maier</td> <td>6028499</td> <td></td> <td></td> <td></td> <td></td> </tr> <tr> <td>10000001</td> <td>VB</td> <td>(Verbraucher) Ölheizung</td> <td></td> <td></td> <td></td> <td></td> <td></td> </tr> <tr> <td>10000002</td> <td>VB</td> <td>Gasheizung</td> <td></td> <td></td> <td></td> <td></td> <td></td> </tr> <tr> <td>12000001</td> <td>VB</td> <td>Fernwärmeanschluss</td> <td></td> <td></td> <td></td> <td></td> <td></td> </tr> <tr> <td>01000002</td> <td>EFH</td> <td>Einfamilienhaus, Hr. Müller</td> <td>7122547</td> <td></td> <td></td> <td></td> <td></td> </tr> </tbody> </table>										Nummer	Typ	Bezeichnung	Adresscode	Straße	Nr.	PLZ	Ort	01000001	EFH	Einfamilienhaus, Fam. Maier	6028499					10000001	VB	(Verbraucher) Ölheizung						10000002	VB	Gasheizung						12000001	VB	Fernwärmeanschluss						01000002	EFH	Einfamilienhaus, Hr. Müller	7122547				
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Figure 3: Data of single building (information on heating, consumption, ...)

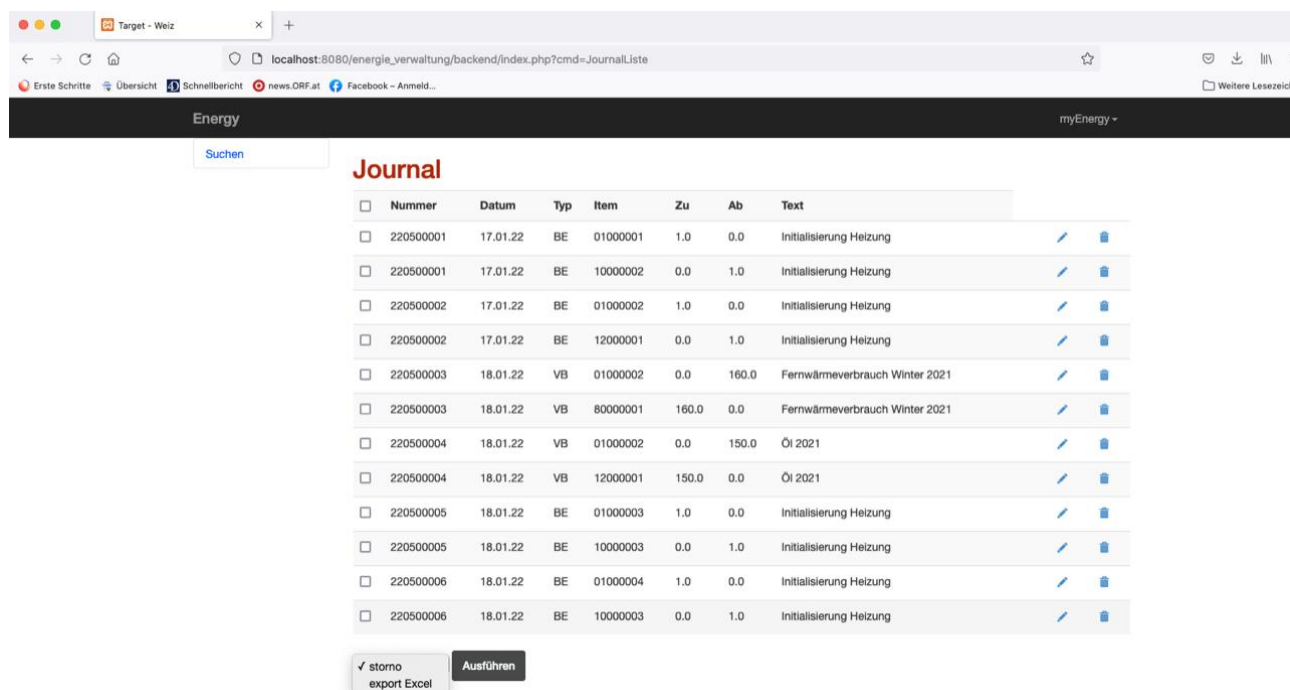


Figure 4: Tracking of data history (consumption, change of heating system, renovation, ...)

4.3 Time schedule and milestones

BOOSTEE-CE, Living EPC Tool (eCentral)					
No.	Phase	Phase description	Start of phase	End of phase	Resources needed
1.	Data collection	Collection of data to be implemented	April 2020	September 2020	Internal expert
2.	Planning of PA's in pilot buildings	Designing a monitoring system for the PA buildings	September 2020	December 2020	Internal & External Expert
3	Input data into Living EPC tool	Data collection and input of Pilot building data into Living EPC tool	December 2020	March 2021	Internal Expert
4	Selection of external expert by public procurement to purchase the equipment and install it in the chosen buildings	Installation and implementation phase for the PA monitoring system	December 2020	December 2021	External Expert



5	Selection of external expert by public procurement to implement the energy database for the buildings of the municipality Weiz	Programming the energy database and importing already collected energy data (preparing the database to be expanded with other energy, spatial data or other relevant inputs)	March 2021	March 2022	External Expert
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5. Pilot Action imported solutions

No.	Name of building	Type of building (school, public utility ect.)	Tools used in PA	Scope of tool usage (<i>what will be done by using the tool (training, visualizations, behavior change ect.)</i>)
1	W.E.I.Z. 1	office building / tertiary building	- BOOSTEE-CE - eCentral Living EPC Tool - CitiEnGov Energy Dashboard	- Visualisation and query of energy audits - evaluation of NZEB status (and measures to implement) - Implementation of building data into 3DEMS
2	W.E.I.Z. 2	office building / tertiary building	- BOOSTEE-CE - eCentral Living EPC Tool - CitiEnGov Energy Dashboard	- Visualisation and query of energy audits - evaluation of NZEB status (and measures to implement) - Implementation of building data into 3DEMS
3	W.E.I.Z. 3	office building / educational building	- BOOSTEE-CE - eCentral Living EPC Tool - CitiEnGov Energy Dashboard	- Visualisation and query of energy audits - evaluation of NZEB status (and measures to implement) - Implementation of building data into 3DEMS



4	W.E.I.Z. 1, 2 & 3	Office building complex	- energy management system	The energy management system measures, collects and visualizes energy production and consumption of the three pilot buildings and provides an overview of the necessary improvements on the energy management and the use of RES and storage systems
5	All buildings of Weiz municipality	All types of buildings	- Based on the CitiEnGov Energy Dashboard	Collecting all relevant energy (and other) data on buildings from different departments of the city to provide a single platform with all data which can be updated regularly and provides the possibility to generate historical data in changes in energy data occurred

6. Pilot Action barriers

Collecting relevant energy related data, especially for private buildings, is difficult and time and resource consuming. The creation of a database that can be used by all relevant actors (authorities, energy planners, etc.) therefore offers a simple solution in which the data is kept up to date and changes can also be tracked over time. This provides new possibilities for energy planning (identify possibilities for renewable energy sources and improvements for decreasing green house emissions within one simple tool). Public awareness could also be improved through simple, graphically prepared data showing problems and potentials. The possibility of transferring the database solution to other areas/regions also offers comparability among each other and could lead to a competitive situation in which the regions want to outperform each other.

The benefits of an energy management system in public buildings can be shown through the implementation in the three pilot buildings. Although the three pilot buildings already had measuring devices in place and therefor investment costs were minimal, simple monitoring systems and devices are not unaffordable and can help provide necessary change in the use of energy in public buildings.

7. Pilot Action Monitoring

For the implementation of the energy database there is no monitoring phase planned as the relevant energy and building data is constantly changing. But as data has to be updated regularly to guarantee that the database can provide added value for the public authority and other stakeholders, the responsible persons from the different departments (office for environment and mobility, building office, etc.) should include/update new data regularly (at least every year). This should be monitored and, if necessary, reminders to perform the tasks send to all responsible parties.



The monitoring of the energy management system in the three W.E.I.Z. pilot buildings was delayed as the installation of the necessary equipment was delayed a few months due to Covid-19 restrictions and concluded in May 2021. The monitoring and evaluation phase are therefore shortened and comparability with the detailed data in the same timeframe, for example March 2021 vs. March 2022, is not given and therefore significant changes cannot be shown. Although the relevant date cannot be provided (yet) the implemented system already shows that the consumption of self-produce energy (through different RES) was already increased and therefore less energy from the grid was consumed. Provided that this energy saving can be proven by statistical data, it would be easier to convince the authorities to introduce energy management systems in more public buildings (if the possibility exists).

8. Conclusions

The capitalized tools within the Target-CE project (eCentral Living EPC tool & BOOSTEE-CE 3DEMS) and the modified pilot actions (energy management system & energy database) have proven that, if adapted to the needs of the pilots, can increase energy efficiency.

The living EPC, although could not find measures to improve the W.E.I.Z. pilot buildings, is a good tool which can be extremely helpful in providing at least a summarized data collection of detailed building data and in the best case can provide solutions/simple measures to increase the building standard to nZEB status.

Geospatial data provided by the 3DEMS tool for energy-related data can help authorities and other stakeholders identifying weaknesses and potentials in several areas (potentials for district heating, unused PV potentials, etc.).

The two additional pilot actions developed for Weiz (the energy management system for the pilot buildings and the building & energy database) can be very useful in the future to convince public authorities to improve energy efficiency in public buildings (through the implementation of other energy management systems) and help city planners and other relevant stakeholders (Identifying and mitigating weaknesses and exploiting previously unused potentials). Also, in the case of the building & energy database, reusability in other areas/regions, with small adaptations, should easily be possible which could lead to a competitiveness between regions/municipalities and therefore increase sustainability of implemented solutions.