CEESEN-BENDER

Building intErventions in vulNerable Districts against Energy poveRty

Deliverable 5.2, Annex 3

Task 5.3 – Feasibility Assessment of PV-Based Energy Communities in Pilot Regions Summary

Dissemination Level: Public

WP5 Creating roadmaps and support services for building energy renovations for vulnerable districts.

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CEESEN-BENDER

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1. Objective of Task 5.3

The objective of Task 5.3 was to assess the feasibility of establishing PV-based energy communities (ECs) in the pilot regions and to determine whether such solutions could realistically be integrated into building-level renovation roadmaps.

In multi-apartment buildings, the decision to install PV systems or establish an energy community is ultimately an investment decision made by apartment associations. Such investments must provide clear and measurable benefits — typically through cost savings, improved self-consumption, or long-term financial return.

Therefore, Task 5.3 did not aim to promote PV installation as a mandatory component of renovation. Instead, it aimed to ensure that:

- the option has been systematically assessed,
- feasibility conditions are clearly documented,
- and any decision not to proceed is justified and traceable.

2. Methodological Approach Applied in Task 5.3

Methodological logic applied in Task 5.3:

1. **Preliminary technical and regulatory screening** (Checklist – Step 1)
2. **Preliminary economic assessment** (StartSun Energy Community Feasibility Calculator or an equivalent local approach, using agreed country-specific variables; supported by Checklist – Step 2)
3. **Project development stage** (Design, simulations, cost estimation, permitting and construction, if pursued; supported by Checklist – Step 3)

A Task 5.3 tracker was used to document assessment results and any follow-up actions.

CEESEN-BENDER Feasibility Checklist (v1.6)

The CEESEN-BENDER Feasibility Checklist served as the preliminary screening instrument within Task 5.3. It was designed as a structured, building-level pre-assessment tool to determine whether PV installation and/or energy community development is:

- technically possible,
- regulatorily allowed,
- structurally realistic,
- and worth further economic assessment.

The checklist follows a three-step logic.

Step 1 - Preliminary Feasibility Assessment - evaluates the fundamental feasibility conditions before any economic modelling is undertaken. It covers:

1. Planning and grid conditions

- Whether the grid operator allows PV installation.
- Whether building permits or notifications are required and possible.
- Whether local planning regulations allow PV.

2. Roof condition and structural suitability

- Whether the roof has been renovated.
- Whether renovation is planned.
- Whether load-bearing capacity assessment is required.
- Whether reinforcement is planned or necessary.

3. Economic and regulatory framework

- Availability of grants or subsidies.
- Possibility of electricity sharing within the building.
- Possibility to sell electricity to the grid.
- Possibility to sell electricity to neighbours.

Each category is graded (0–5), producing an overall preliminary score.

The logic is:

- If the score is sufficiently high → it is reasonable to proceed to more detailed assessment.
- If the score is low → basic obstacles must first be addressed (structural, regulatory, planning-related).
- Reassessment can be done once conditions change.

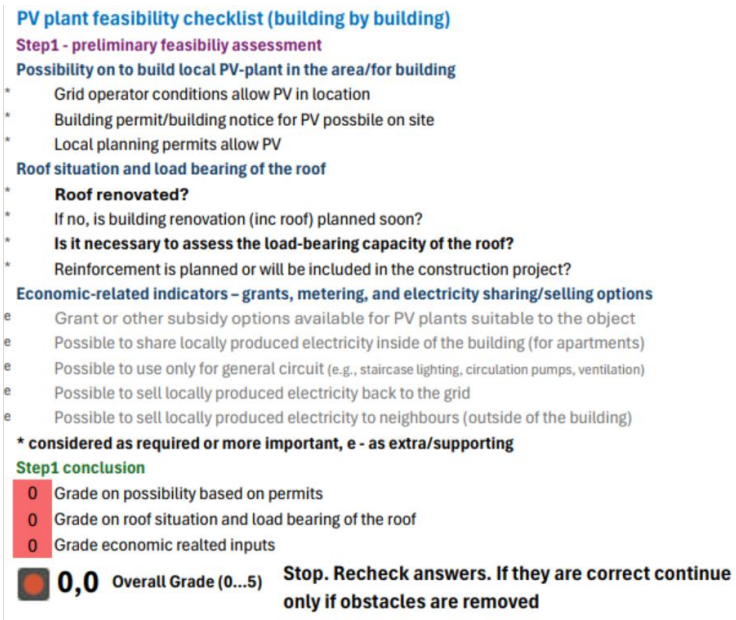

PV plant feasibility checklist (building by building)
Step1 - preliminary feasibiliy assessment
Possibility on to build local PV-plant in the area/for building
* Grid operator conditions allow PV in location
* Building permit/building notice for PV possbile on site
* Local planning permits allow PV
Roof situation and load bearing of the roof
* Roof renovated?
* If no, is building renovation (inc roof) planned soon?
* Is it necessary to assess the load-bearing capacity of the roof?
* Reinforcement is planned or will be included in the construction project?
Economic-related indicators – grants, metering, and electricity sharing/selling options
e Grant or other subsidy options available for PV plants suitable to the object
e Possible to share locally produced electricity inside of the building (for apartments)
e Possible to use only for general circuit (e.g., staircase lighting, circulation pumps, ventilation)
e Possible to sell locally produced electricity back to the grid
e Possible to sell locally produced electricity to neighbours (outside of the building)
* considered as required or more important, e - as extra/supporting
Step1 conclusion
0 Grade on possibility based on permits
0 Grade on roof situation and load bearing of the roof
0 Grade economic realted inputs
0,0 Overall Grade (0...5)
Stop. Recheck answers. If they are correct continue only if obstacles are removed

Figure 1: ECs Feasibility checklist step 1

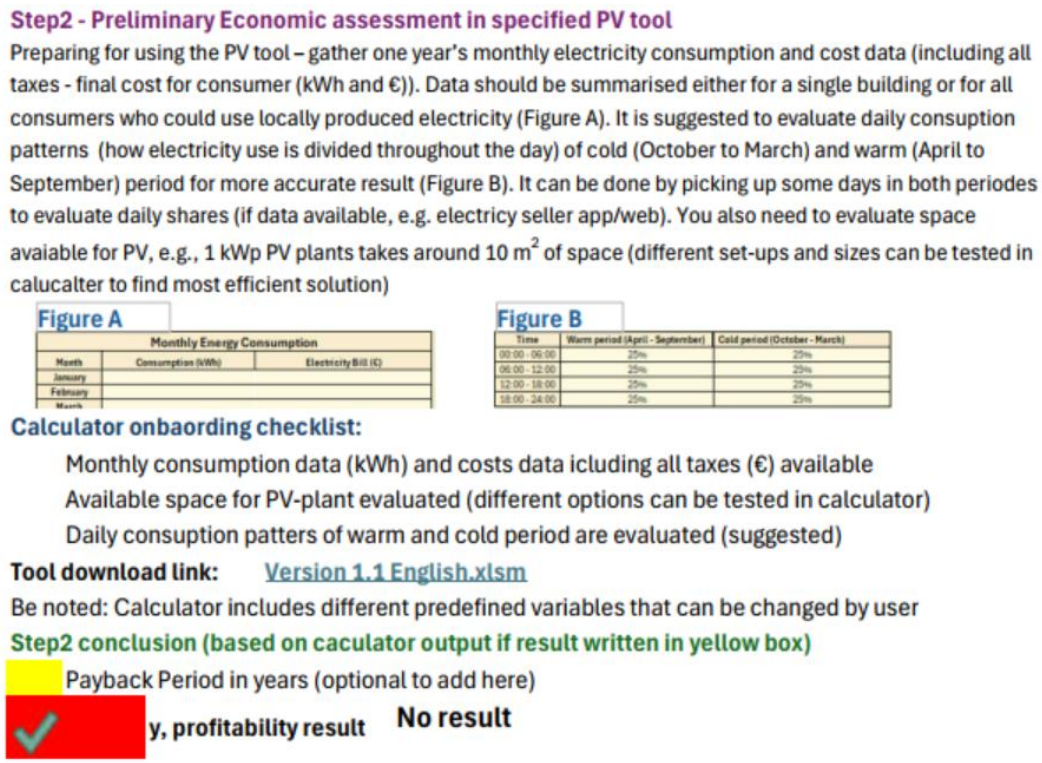
Step 1 therefore acts as a technical and regulatory gatekeeper. It helps to prevent unnecessary data collection and modelling work in cases where fundamental barriers exist.

Step 2 – Preparation for Economic Assessment and preliminary economic assessment

Step 2 in checklist does not yet represent full economic modelling. Instead, it ensures that the necessary input data are available before using a StartSun Energy Community Feasibility Calculator. Step 2 requires:

- One year of monthly electricity consumption data (kWh).
- Annual electricity cost data (including taxes).
- Assessment of available roof area.
- Basic understanding of daily consumption patterns (cold vs warm period).

This step ensures that economic modelling is based on realistic and building-specific input data. If data are incomplete, modelling results would not be reliable. Step 2 therefore functions as a **data readiness check** before economic evaluation.



Step2 - Preliminary Economic assessment in specified PV tool

Preparing for using the PV tool – gather one year's monthly electricity consumption and cost data (including all taxes - final cost for consumer (kWh and €)). Data should be summarised either for a single building or for all consumers who could use locally produced electricity (Figure A). It is suggested to evaluate daily consuption patterns (how electricity use is divided throughout the day) of cold (October to March) and warm (April to September) period for more accurate result (Figure B). It can be done by picking up some days in both periodes to evaluate daily shares (if data available, e.g. electricy seller app/web). You also need to evaluate space avaiable for PV, e.g., 1 kWp PV plants takes around 10 m^2 of space (different set-ups and sizes can be tested in calucalter to find most efficient solution)

Figure A

Monthly Energy Consumption		
Month	Consumption (kWh)	Electricity Bill (€)
January		
February		
March		

Figure B

Time	Warm period (April - September)	Cold period (October - March)
00:00 - 06:00	25%	25%
06:00 - 12:00	25%	25%
12:00 - 18:00	25%	25%
18:00 - 24:00	25%	25%

Calculator onbaording checklist:

Monthly consumption data (kWh) and costs data icluding all taxes (€) available
Available space for PV-plant evaluated (different options can be tested in calculator)
Daily consuption patters of warm and cold period are evaluated (suggested)

Tool download link: Version 1.1 English.xlsm

Be noted: Calculator includes different predefined variables that can be changed by user

Step2 conclusion (based on caculator output if result written in yellow box)

Payback Period in years (optional to add here)

y, profitability result **No result**

Figure 2: ECs Feasibility checklist step 2

Step 3 – Recommended Project Development Steps

Figure 3: ECs Feasibility checklist step 3

Step 3 outlines recommended next steps if the decision is taken to proceed with PV installation.

Regardless of Step 1 or Step 2 results, if PV implementation is planned, the following are required:

- PV simulations
- Design project preparation
- Construction cost quotations
- Building permit or notification (if required)
- Construction phase
- Occupancy permit (if required)
- Commissioning of the plant

This step clarifies that:

Even if preliminary feasibility and economic modelling are positive, implementation still requires formal project development, professional simulations, and regulatory compliance. The checklist therefore distinguishes clearly between:

- Screening,
- Economic exploration,
- Actual project development.

StartSun Energy Community Feasibility Calculator (Optional Tool)

The StartSun tool was offered as an intermediate pre-feasibility tool, to be used only where preliminary screening justified further assessment. Unlike simple PV yield calculators or economic calculators, the tool integrates:

- Estimated production
- Building consumption data
- Self-consumption calculation
- Energy community model (archetype) suggestion
- Economic indicators (payback period, IRR, NPV, ROI)

It allows combined technical, economic and organisational assessment before moving to:

- detailed design projects,
- professional PV simulations,
- procurement procedures.

The tool is therefore intended as a structured pre-investment screening tool rather than a final design instrument.

Country-Specific Economic Assumptions Used in Preliminary Modelling

To support consistent and comparable use of the StartSun Energy Community Feasibility Calculator across pilot areas, country-specific economic input parameters were collected and shared with partners. The calculator contains predefined default parameters, which were not modified within the tool itself. The collected values were provided as reference inputs to facilitate aligned preliminary modelling across countries. Partners could use these baseline assumptions or adjust inputs where more precise local data were available.

Table 1. Country-Specific Economic Assumptions for Preliminary PV Assessment

Country	Electricity selling price (€/kWh)	Maintenance (%)	Inflation (%)	Discount rate (%)	Estimated PV cost (€/kWp)	Estimated storage cost (€/kWh)
Estonia	0.11 €	3%	3%	5%	700.00 €	300.00 €
Croatia	0.07 €	1-3%	3%	5%	1,200.00 €	1,280.00 €
Poland	0.08 €	3%	3%	5%	1,176.00 €	1,054.15 €

Romania	0.03 €	3%	3%	5%	1,000.00 €	2,000.00 €
Slovenia	0.05 €	3%	3%	5%	1,100.00 €	400.00 €

3. Checklist-Based Results by Country and Pilot Area

3.1 Croatia

The Croatian pilot buildings share similar structural characteristics and are subject to the same local planning framework. Grid connection for PV installation is allowed, and no building permit is required under current conditions. Roof renovation is planned, and structural reinforcement is foreseen where load-bearing assessment indicates necessity.

Electricity sharing within the building is currently not possible. Electricity may be sold to the grid, but not to neighbouring buildings.

Preliminary checklist grading:

- 5 – permits
- 5 – roof & structure
- 3 – economic inputs
- Overall grade: 5.0

Feasibility Assessment:

From a technical and regulatory perspective, PV installation is feasible. Structural constraints are manageable, particularly in coordination with planned roof renovation.

However, the absence of internal electricity sharing mechanisms limits the possibility of developing a building-level energy community model. The economic framework remains moderate, reducing investment attractiveness.

At this stage, the project remains at screening level.

3.2 Estonia

In Estonia, feasibility assessment was conducted for two distinct building typologies within the pilot area: large, prefabricated panel apartment buildings (Annelinn) and smaller wooden apartment buildings (Karlova). Due to structural differences, separate checklists were completed

3.2.1 Annelinn

Grid connection and local planning conditions allow PV installation. Roof renovation is planned, and structural assessment is required before installation. Electricity sharing within the building is not currently possible, while sale to the grid is allowed.

Preliminary checklist grading:

- 5 – permits
- 5 – roof & structure
- 3 – economic inputs
- Overall grade: 5.0

3.2.2 Karlova

Grid and planning conditions allow PV installation. However, roof renovation is not planned in the near term, and load-bearing capacity requires assessment. Electricity sharing within the building is not currently possible. Preliminary checklist grading:

- 5 – permits
- 3 – roof & structure
- 3 – economic inputs
- Overall grade: 4.2

Feasibility Assessment:

Across the Estonian pilot areas, PV installation is technically feasible in principle. Grid and planning conditions allow installation in both typologies.

In Annelinn, structural conditions are favourable due to planned roof renovation, and PV integration could be aligned with renovation works. In Karlova, structural readiness is weaker, as roof renovation is not foreseen in the near term and additional structural verification would be required prior to installation.

A key limitation across both pilot areas is the absence of internal electricity sharing mechanisms, which restricts the development of a full building-level energy community model.

In the Estonian renovation context, comprehensive upgrades significantly reduce heating demand but increase electricity consumption due to mechanical ventilation systems and other modern building technologies. While total final energy demand decreases, electricity consumption increases and may result in higher operational emissions due to the comparatively higher emission factor of electricity. Rooftop PV could partially offset this additional electricity demand.

However, PV investment must remain financially justified within the overall renovation budget. Given competing renovation priorities and moderate economic incentives, implementation has not progressed beyond preliminary screening stage.

3.3 Poland

For buildings with existing PV installations, systems are connected to common areas and operate under the net-billing system. Electricity is not shared directly with apartment-level meters.

For buildings without PV, grid and planning conditions allow installation. Structural feasibility is generally positive, although roof load-bearing assessment is required for certain buildings due to roof construction characteristics.

In one case (Wolumen 6), preliminary sizing calculations demonstrated that covering the entire electricity demand of the building would require significantly more surface area than available roof space, indicating that full self-sufficiency is unrealistic.

Preliminary checklist grading (across buildings):

- 5 – permits
- 5 – roof & structure
- 3 – economic inputs
- Overall grade: 5.0

Feasibility Assessment:

Technical feasibility across the Polish pilot buildings is strong. Structural constraints are manageable, subject to verification.

For buildings with existing PV installations, the main interest lies in optimisation rather than initial deployment. Potential pathways include increasing self-consumption through battery storage or adjusting the billing model to involve residents.

However, the current regulatory framework for energy clusters and citizen energy communities does not provide significant financial incentives in urban contexts. As a result, while optimisation and expansion are technically possible, implementation depends heavily on financing conditions and organisational readiness.

No building has progressed to full energy community formation within the project scope. The regulatory environment for urban energy communities remains in transition. While different prosumer and community models exist in legislation, practical financial incentives remain limited. This regulatory uncertainty contributes to the gap between technical feasibility and implementation

3.4 Romania

In Romania, one checklist was completed for the representative pilot building. Grid and planning conditions allow PV installation. Roof renovation is planned, and structural assessment is foreseen. Electricity sale to the grid is possible; however, internal electricity sharing is not currently allowed.

Preliminary checklist grading:

- 5 – permits
- 5 – roof & structure
- 3 – economic inputs
- Overall grade: 5.0

Feasibility Assessment:

Technical feasibility is strong, particularly in coordination with planned renovation works. Structural constraints are manageable and do not constitute a barrier to PV integration.

However, the absence of internal electricity sharing mechanisms limits the development of a building-level energy community model. Economic incentives remain moderate under current conditions.

According to partner input, the forthcoming Building-Level Roadmaps and investment strategies (Task 5.4) are expected to consider the integration of PV systems together with mechanical ventilation measures for the selected pilot multi-apartment buildings. Final investment decisions will depend on detailed design, cost assessment and financial feasibility analysis.

3.5 Slovenia

Context and Building Conditions

In Slovenia, the pilot building demonstrates highly favourable structural and regulatory conditions. The roof has been renovated, load-bearing capacity is sufficient, grid connection is available, and internal electricity sharing is legally possible. Sale to neighbours is also feasible.

Preliminary checklist grading:

- 5 – permits
- 5 – roof & structure
- 5 – economic inputs
- Overall grade: 5.0

Feasibility Assessment:

From a structural and regulatory perspective, conditions for PV installation and energy sharing are very favourable.

However, cultural heritage protection requirements impose specific technical constraints. PV modules must match the roof colour, significantly increasing investment costs. Under optimistic assumptions (approximately €1,800 per kWp), the

estimated payback period increases to around 21 years compared to approximately seven years under standard market conditions.

Although technically feasible, economic feasibility is substantially weakened by these additional requirements. Given parallel renovation priorities, investment attractiveness is currently limited.

4. Cross-Country Assessment

4.1 Regulatory Context: Enabling Frameworks for Energy Communities

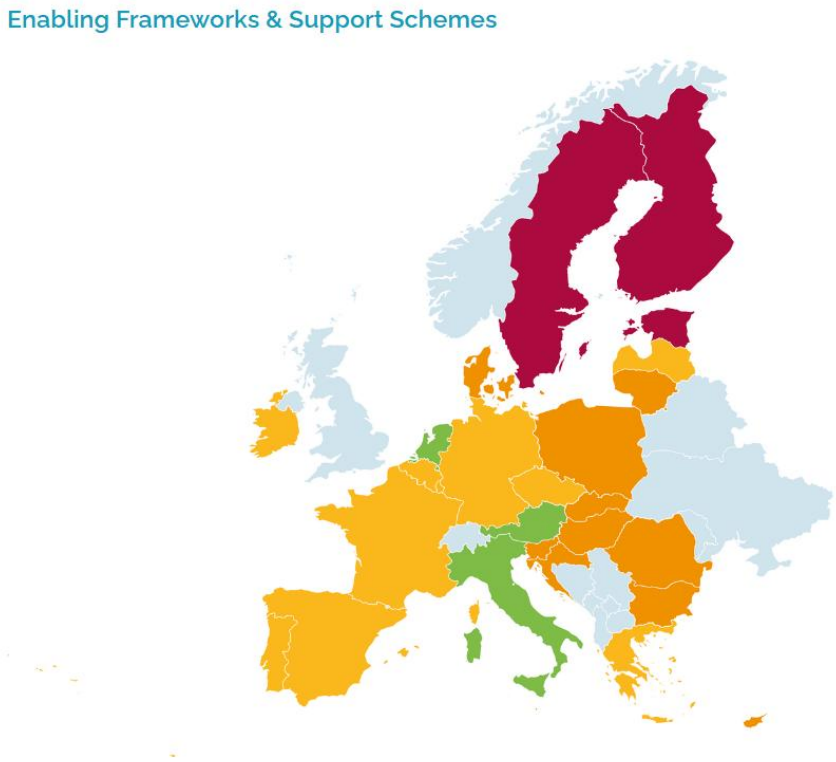


Figure 4. Enabling Frameworks and Support Schemes for Renewable and Citizen Energy Communities in Europe Source: REScoop Transposition Tracker – Enabling Frameworks & Support Schemes (https://www.rescoop.eu/policy/transposition-tracker/enabling-frameworks-support-schemes)

The figure presents the current status of national transposition of EU provisions related to Renewable Energy Communities (RECs) and Citizen Energy Communities (CECs), based on the REScoop Transposition Tracker.

The overview demonstrates that the regulatory landscape across Europe remains heterogeneous. Several Member States show partial or developing implementation of enabling frameworks, while only a limited number demonstrate more comprehensive

and structured support conditions. This variation is visible across different regions, including both Western and Northern Europe, as well as Central and Eastern Europe.

For the CEESEN-BENDER pilot areas, this broader regulatory context is relevant. While building-level feasibility assessments frequently indicate positive technical potential for PV-based energy communities, implementation depends not only on structural conditions but also on the maturity of national regulatory frameworks, clarity of rules for electricity sharing, and availability of support mechanisms.

The transposition status therefore provides important background for understanding why feasibility screening results do not automatically translate into project development or investment decisions.

4.2 Structural and Technical Feasibility Patterns

Across pilot areas, preliminary technical feasibility is generally positive. Grid access and planning conditions do not constitute major barriers in most cases. Structural limitations are present in selected buildings but are not prohibitive where renovation is planned.

However, electricity sharing within buildings is not universally possible. This limitation directly affects the potential for energy community formation and reduces the economic attractiveness of collective self-consumption models.

4.3 Investment Readiness and Implementation Gap

Despite high preliminary feasibility scores, no pilot area has progressed to construction stage at the time of reporting.

High checklist grades reflect structural and regulatory possibility — not investment readiness. In several pilot areas, PV installation was not originally included in renovation strategies. Economic attractiveness remains moderate in multiple cases, and final investment decisions depend on apartment association priorities and detailed design outcomes.

The gap between feasibility and implementation is therefore not primarily technical, but institutional and financial.

5. Overall Conclusion

Task 5.3 ensured that PV-based energy community potential has been:

- systematically screened,
- technically evaluated,
- and transparently documented across all pilot regions.

While feasibility in principle is often positive, practical implementation remains conditional on:

- financial return,
- apartment association decision-making,
- and strategic prioritisation within renovation plans.

The assessment provides a documented basis for either:

- integrating PV/EC into building-level roadmaps, or
- justifying non-implementation under current conditions.

6. Status of Task 5.3 (as of M30)

By M30, the feasibility assessment phase under Task 5.3 has been completed. All pilot areas have conducted at least Step 1 (preliminary technical and regulatory screening), and in several cases preliminary economic assessment has also been carried out.

Preliminary feasibility results indicate that technical potential is generally positive at screening level. However, final investment decisions require detailed project design, structural verification, and site-specific simulations.

The current status across pilot areas is summarised in Table 2 below.

Table 2. Status of PV / Energy Community Feasibility Assessment (as of M30)

Item	Croatia	Estonia	Poland	Romania	Slovenia
Preliminary feasibility evaluated (at least checklist step 1)	Yes	Yes	Yes	Yes	Yes
BAU installing PV if renovating (general trend)	Rather no	Rather yes	Hard to say	New projects	Rather no
Number of pilots MABs, pcs	6	6	6	6	6
Pilot MABs with existing PV/EC, pcs	0	0	3	0	0

Number of MABs considering PV/EC, pcs	0	4…5	4	?	0
Number of PV (design) projects, pcs	0	1	4	-	0
Designed PV capacity, kW	0	15	91,92	-	0
Need further help from TREA in T5.3 activity? Comment	No, help is not required.	No	No	No	No
Results (to be updated later):					
Installed PV plants, pcs	0	0		0	0
Installed PV, kWp	0	0		0	0
Formed energy communities (buildings), pcs	0	0		0	0

Building-level renovation roadmaps, including detailed reconstruction planning, will be finalised by M36. Final decisions regarding PV installation or energy community formation may therefore still evolve during the remaining project period, and any additional developments will be reflected under the relevant project KPIs.

Beyond the current reporting period, project partners now have a structured methodological toolset — including the feasibility checklist, economic input framework and preliminary modelling approach — which can be applied both during the remaining project phase and after project completion to reassess PV and energy community potential under changing technical, regulatory or financial conditions.

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