Project co-financed by the European Regional Development Fund

Report on the conditions required to make the business model financeable

Deliverable 3.5.3. – WP 3 “Testing”

Contents

Acronyms and abbreviations

CF	Cohesion Fund
CHP	Combined Heat and Power
EC	European Commission
EIB	European Investment Bank
ERDF	European Regional Development Fund
ESIF	European Structural Investments Funds
EU	European union
FI	Financial instruments
PV	Photovoltaics
RES	Renewable Energy Sources

1. Summary

This report is within the scope of Deliverable 3.5.3 of WP3-Testing and aims to highlight the conditions necessary to make financially viable the microgrid solutions investigated in the framework of PEGASUS project.

An overview of the incentives and financial tools supporting Renewable Energy Sources in compliance with the European growth and development strategy is given in Chapter 2.

For the available EC funding channels, the consistency and the specific objectives as well as the achievable support are described in Chapter 3 and 4.

A preliminary framework of the funding opportunities for microgrids and the conditions for their accessibility are presented in Chapter 5 while in Chapter 6 the existing main incentives applicable to Renewable Energy Sources in the EU Member States are considered.

In the last Chapter of the report the main items to be taken into considerations for each of the developed pilots within PEGASUS project are outlined, in order to make financeable the corresponding microgrids in the light of financial gaps, in capital and/or operating costs, that emerged from the pilot performed simulations.

The resulting data compiled by each of the involved partners will lead to a comprehensive view of the needed supporting tool for a successful implementation of the microgrids in the different territories.

Part A) Report on the conditions to make the business model

2. The Renewable Energy Sources in the framework of the European growth and development strategy

Article 194 of the EU Treaty states a specific energy policy aimed to promote the development of renewable energy to better align and integrate climate change objectives into the new market structure.

In this framework, the directive on the promotion of renewable energies, adopted on April 23, 2009 (Directive 2009/28/EC), established that a mandatory quota of 20% of EU energy consumption must come from RES by 2020. This directive specifies national targets for renewable energy for each country, taking into account the starting situation and the overall potential regarding renewable energy sources. Consequently, EU Member States defined how they plan to achieve these goals and the general roadmap for their renewable energy policy in the National Renewable Energy Action Plans.

Moreover, the directive has also set requirements for the different mechanisms that Member States can apply to achieve their goals: support schemes, guarantees of origin, joint projects, cooperation between Member States and third countries.

The energy issue is also considered crucial in the European 2020 strategy, defined by Communication COM (2010) 2020 of 3.3.2020, "A strategy for smart, sustainable and inclusive growth", in which the following objectives are defined for 2020 in the energy sector:

- greenhouse gas emissions 20% lower than 1990 levels
- 20% of energy coming from renewables
- 20% increase in energy efficiency.

Progress towards the above-mentioned national targets is measured every two years, when EU Member States publish national progress reports on renewable energy. From the latest Eurostat data of 2017 a patchwork Europe emerges, with virtuous examples and other countries lagging behind, in any case the EU target of 20% of energy from renewables in 2020 is still within reach. In 2017, the share of renewables in final energy consumption in the 28 member countries rose to 17.5% (from 17% in 2016) and, above all, it is doubled compared to 2004, when it was only 8.5%.

On 30 November 2016, the Commission published in the energy field a legislative package entitled "Clean energy for all Europeans" (COM (2016) 0860), as part of the broader strategy on the Energy Union (COM (2015) 0080). It includes a proposal to revise the directive on the promotion of renewable energy sources (RES) (2016/038) aimed at making the EU a world leader in the field of RES and ensuring the achievement of the goal of energy consumption from renewable sources equal to at least 27% of the total energy consumed in the EU by 2030. Subsequently, Directive 2018/2001 "**on the promotion of the use of energy from renewable sources"** was published on 11 December 2018 setting a European target of 32% RES by 2030. Since the objective of this Directive, namely to achieve a share of at least 32 % of energy from renewable sources in the Union's gross final consumption of energy by 2030, cannot be sufficiently achieved by the Member States but can rather, by reason of the scale of the action, be better achieved at Union level, the Union may adopt measures, in accordance with the principle of subsidiarity as set out in Article 5 of the Treaty on European Union.

On 11 December 2018, Regulation (EU) 2018/1999 on the Governance of the Energy Union and Climate Action was adopted. According to the Regulation, each Member State must present 'integrated national energy and climate plans', which will include national targets, contributions, policies and measures for each

of the five dimensions of the Energy Union: decarbonisation, energy efficiency, energy security, internal energy market, and research, innovation and competitiveness.

In order to meet these objectives of the European directives the 2014-2020 European Structural Investments Funds provides dedicated financial resources “Supporting the shift towards a low carbon in order to meet these objectives of the European directives the 2014-2020 European Structural Investments Funds provides dedicated financial resources “Supporting the shift towards a low carbon economy in all sectors” as stated in art.9 of the Common provisions regulation1 .

Making reference to ERDF Regulation2 the Thematic Objective 4 represents the following investment priorities:

a) promoting the production and distribution of energy derived from renewable sources;
b) promoting energy efficiency and renewable energy use in enterprises;
c) supporting energy efficiency, smart energy management and renewable energy use in public infrastructure, including in public buildings, and in the housing sector;
d) developing and implementing smart distribution systems that operate at low and medium voltage levels;
e) promoting low-carbon strategies for all types of territories, in particular for urban areas, including the promotion of sustainable multimodal urban mobility and mitigation-relevant adaptation measures.

Also, the Cohesion Fund[3] in the context of partially different investment priorities can support (a) investment in the environment, including areas related to sustainable development and energy which present environmental benefits.

The below Figures 1 and 2 show the ERDF and CF planned resources and the investment progress, respectively, distinguishing by ‘Form of intervention’.

It has to be outlined that European Commission stressed the area of investment of decentralized RES as a tool to diversify the EU energy supply, increasing security of supply and improving general economic environment. Moreover, the involvement of economic players at regional and local level together with stakeholders, is supposed to be an opportunity for socioeconomic activities especially in rural areas, inner or mountainous areas.

The financial instruments likely to be of interest for microgrids are described in the following Chapter 3 while a review of the available European funding channels is given in Chapter 4.

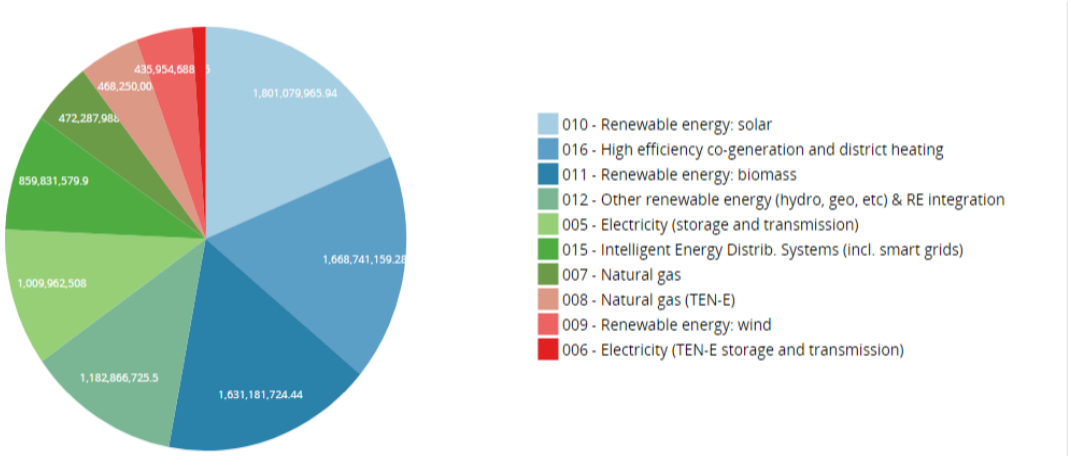
The incentives adopted by the 28 EU Member States are the subject of the following Chapter 6.

[1] Regulation (EU) No 1303/2013 of the European Parliament and of the Council of 17 December 2013 laying down common provisions on the European Regional Development Fund, the European Social Fund, the Cohesion Fund, the European Agricultural Fund for Rural Development and the European Maritime and Fisheries Fund and laying down general provisions on the European Regional Development Fund, the European Social Fund, the Cohesion Fund and the European Maritime and Fisheries Fund and repealing Council Regulation (EC) No 1083/2006.

[2] Regulation No 1301/2013 of the European Parliament and of the Council of 17 December 2013 on the European Regional Development Fund and on specific provision concerning the investment for growth and job goal.

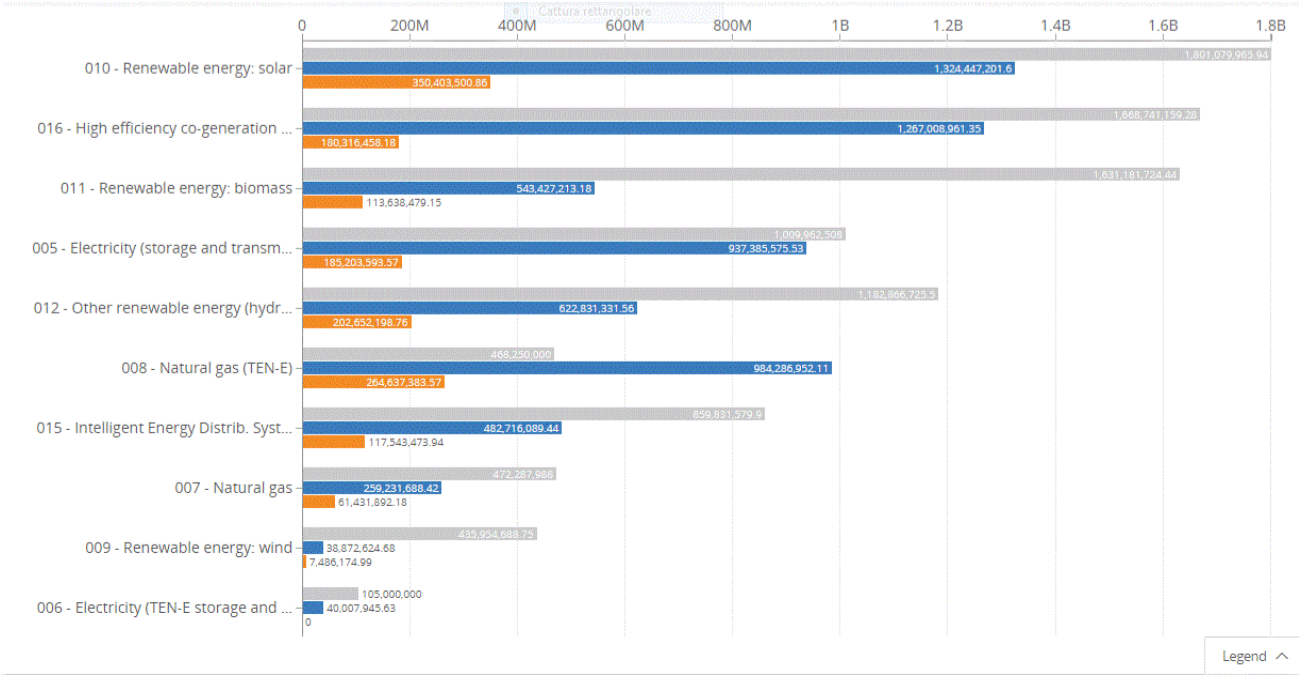
[3] Regulation No1300/2013 of the European Parliament and of the Council of 17 December 2013 on the Cohesion Fund.

Figure 1. ERDF and CF planned support in renewable energy



Source: Cohesion data platform https://cohesiondata.ec.europa.eu/

Figure 2. ERDF and CF Investment progress in renewable energy (Year 2018)



Source: Cohesion data platform https://cohesiondata.ec.europa.eu/

3. Grants and financial instruments: general description and their applicability to the issues of renewables and energy efficiency

According to the EC view, in presence of financing and /or market gaps public interventions are recommended to enhance the improvement of renewables to reach EU targets. At the same time MS are asked to promote public investments in local/regional pilot projects to substantially help the removing of existing technical and non-technical uncertainties associated with the full deployment at national/EU level.

According to the *Common provisions' regulation* (see Art.66) four forms of financial support may be considered, namely grants, prizes, repayable assistance and financial instruments, also providing a combination thereof.

Grants are defined as contributions aimed at financing an operation intended to promote an objective that is part of a community, national and regional policy or the functioning of a body that pursues a goal of general interest or an objective that falls within the framework of a community, national and regional policy.

The repayable assistance is a form of financial support granted to beneficiaries subject to implementation conditions that are linked to repayment obligations. The support via repayable assistance is an option for operations for which it is not possible to determine in an agreement ex-ante the appropriate mix of grant and loan because it depends on implementation conditions

Prizes are Financial contributions awarded as a reward following a competition that respects the principles of transparency and equal treatment; the amount of the prize is not related to the costs incurred by the winner. Main parts of ESIF have been implemented through grants.

Financial instruments are defined as financial support providing a complementary basis in order to address one or more specific policy objectives of the Union. Such instruments may take the forms below explained in Table 1 and may, where appropriate, be combined with grants.

Table 1. Financial Instruments

Financial product	Definition
Loan	An agreement which obliges the lender to make available to the borrower an agreed sum of money for an agreed period of time and under which the borrower is obliged to repay that amount within the agreed time.
Guarantee	A written commitment to assume responsibility for all or part of a third party's debt or obligation or for the successful performance by that third party of its obligations if an event occurs which triggers such guarantee, such as a loan default.
Equity investment	Provision of capital to a firm, invested directly or indirectly in return for total or partial ownership of that firm and where the equity investor may assume some management control of the firm and may share the firm's profits.
Quasi-equity	A type of financing that ranks between equity and debt, having a higher risk than senior debt and a lower risk than common equity. Quasi-equity investments can be structured as debt, typically unsecured and subordinated and in some cases convertible into equity, or as preferred equity.
Risk- sharing investment	A financial instrument which allows for the sharing of a defined risk between two or more entities, where appropriate in exchange for an agreed remuneration

Source: Fi Compass Glossary 2019

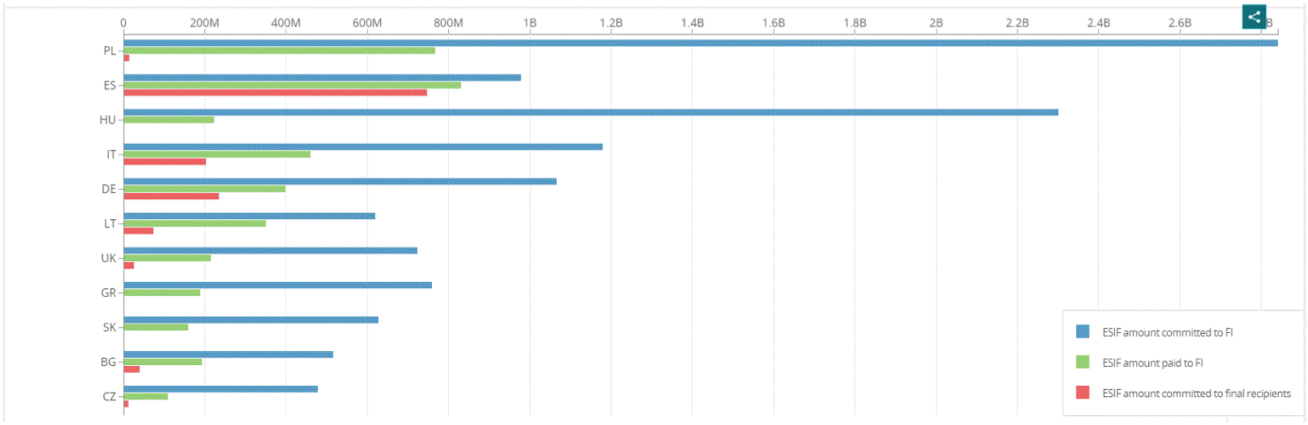
ESIF policy frameworks warmly stressed the need for an increased use of financial instruments across the territories on the basis of the following reasons:

- *support to suboptimal market situations*, giving financial support in situations of lack of financial interest (banks and other financial institutions) to widen the range of financing offers and contributing to the reduction of the identified investment gap;

- *leverage and multiplier effect on public Funds*: Financial Instruments can associate different forms of public and private financial resources to support public policy objectives and stimulate private investors; they also guarantee rotating flow of financial resources in so favouring long-term sustainable investments;
- *side support to final recipients*: possibility of using part of the resources of the Financial Instruments to provide technical assistance to the final beneficiaries for activities connected with the operation with a view to optimizing the final allocation of resources, the projects results, the return of loans or the discharge of the guarantee;

The level of experience in implementing financial instruments is very diversified across EU. Figure 3 shows progresses in the 11 Member states who launched financial instruments.

Figure 3. ESIF amounts committed/paid to financial instruments by Member States



Source: Cohesion data platform https://cohesiondata.ec.europa.eu/

The availability of resources invested in the FI presents some interesting advantages at several levels. At the level of public policymaker, it allows to create a financial critical mass of higher value on FI favouring scale economies and limit the risk of duplication of similar investments programs, in some cases not coordinated or in competition.

The involvement of private investors and financial intermediaries guarantees the application of financial and economic criteria in the selection of projects, which contribute, to the sustainability of interventions.

It has to be outlined that, in any case, *a necessary pre-requisite for financing projects is that activities supported must be judged by the financial intermediary or managing authority to be able to repay the investment. In other terms the project Cash flow must generate income or revenue, or savings on future expenditure.*

4. Funding tools with project focus

A review of the available European funding channels addressed to support projects concerning renewables and energy efficiency, and then also the microgrids, is given in the following.

Many of these financial tools are managed by the European Investment Bank (EIB) that is one of the most active players among European credit institutions in energy efficiency financing. It has to be noted that EIB finances only large projects (minimum targets are usually between EUR 5 and 25 million) and does not fully cover all costs that are incurred (therefore, a share of equity is always required by the Public administrations involved). However, EIB provides credits to national credit institutions which make them available at market rates.

European Local Energy Assistance (ELENA)

ELENA (European Local Energy Assistance) is the tool managed by the European Investment Bank in collaboration with the European Commission. It is designed to provide economic subsidies for technical assistance activities to regional and local authorities. ELENA's aim is to support European Public Administrations in making their energy efficiency programmes and projects easier to bank. This tool covers up to 90% of the costs incurred for the implementation of one or more of the following preparatory activities:

- feasibility studies and market analysis;
- structuring of energy policies and programmes;
- energy audits;
- tender procedures for public procurement.

Typically, ELENA supports programmes above EUR 30 million with a 3-year implementation period for energy efficiency and 4-year for urban transport and mobility. Smaller projects can be supported when they are integrated into larger investment programmes.

In the Energy efficiency and building integrated renewable energy field ELENA may co-finance:

- public and private buildings (including social housing), commercial and logistic properties and sites, and street and traffic lighting to support increased energy efficiency
- integration of renewable energy sources (RES) into the built environment – e.g. solar photovoltaic (PV) on roof tops, solar thermal collectors and biomass
- investments into renovating, extending or building new district heating/cooling networks, including networks based on combined heat and power (CHP), decentralized CHP systems
- local infrastructure including smart grids, information and communication technology
- infrastructure for energy efficiency, energy-efficient urban equipment and link with transport

European Energy Efficiency Fund (EEEF)

The European Energy Efficiency Fund (EEEF)[4] is an 800 million Euro fund launched in 2011 and managed by a public-private partnership (European Investment Bank, Deposit and Loan Fund, Deutsche Bank AG and European Commission) that finances, at broad category of actions targeting energy efficiency and

[4] https://www.eeef.eu/home.html

renewable energy. The final beneficiaries of the EEEF are local and regional public bodies, as well as public and private companies that serve local authorities. The main interventions that can be financed are:

- efficiency interventions on public and private buildings, which pay special attention to the use of Information and Communication Technologies;
- investments in combined and energy-efficient electricity and heat (CHP) production, including micro-cogeneration and heating and cooling networks;
- local infrastructure (public lighting, energy storage, smart metering, smart grid);
- renewable energy production plants.

Allowed investments must be between 5 and 25 million euros in size.

The final beneficiaries of EEEF are the institutions at the level and regional (e.g. the municipalities) as well as companies and private individuals that work in the service of the premises (such as energy services companies or ESCo, utilities, public sector providers, social housing etc.).

In order to have the final beneficiary, EEEF will be able to have two types of investment:

1. Direct investment

They are aimed at project developers, energy service companies (ESCO), companies that provide services for energy efficiency markets and small renewable energy in target countries.

- Investments in energy efficiency and renewable energy projects range from EUR 5 million to EUR 25 million.
- Financial instruments include senior debt, mezzanine, leasing and forfaiting tools (in cooperation with industrial partners).
- Investments in equity for renewable energy in the life cycle of projects or participation in venture capital of project companies, either in direct cooperation with public bodies or in collaboration with public companies or acting on behalf of these institutions.
- Medium- to long-term loans can last up to 15 years, venture capital investments can be adapted to the needs of the various project phases.
- The Fund can co-invest as part of a consortium and share the risk with a local bank.

2. Investments in lenders

This type includes investments in local commercial banks, leasing companies and other selected financial institutions that finance or commit to financing Final Beneficiaries by meeting the eligibility criteria of EEEF.

- The selected partner financial institutions will receive provisions expiring at 15 years.
- The possible tools are: senior debt, subordinated debt, guarantees
- Equity investments are not allowed.
- Financial institutions provide funding to beneficiaries who meet the eligibility criteria of the Fund for Energy Efficiency and Renewable Energy Projects.

The investment process consists of the following steps:

- Initial screening
- Due diligence
- Preparing for the conclusion of the financing contract
- Monitoring and reporting

Private Finance for Energy Efficiency (PF4EE)

PF4EE[5] is a tool jointly devised by the European Commission and the European Investment Bank to facilitate access to credit for energy efficiency interventions. In addition to small and medium-sized enterprises, private individuals and public administrations, this instrument is aimed at small and medium-sized enterprises. The loans provided may vary depending on the type of project that is intended to be carried out from 40,000 to 5 million euros. These loans will be provided directly by the banks that will be accredited to manage these funds.

The PF4EE instrument's two core objectives are:

- to make energy efficiency lending a more sustainable activity within European financial institutions, considering the energy efficiency sector as a distinct market segment.
- to increase the availability of debt financing to eligible energy efficiency investments.

The instrument is managed by the EIB and funded by the Programme for the Environment and Climate Action (LIFE programme).

The LIFE Programme committed EUR 80m to fund the credit risk protection and expert support services. The EIB will leverage this amount, making a minimum of EUR 480m available in long term financing.

The PF4EE instrument will provide a portfolio-based credit risk protection provided by means of cash-collateral (Risk Sharing Facility), together with long-term financing from the EIB (EIB Loan for Energy Efficiency) and expert support services for the Financial Intermediaries (Expert Support Facility).

European Regional Development Fund (ERDF)

The ERDF focuses its investments on several key priority areas:

- Innovation and research,
- The digital agenda,
- Support for small and medium-sized enterprises (SMEs),
- The low-carbon economy.

The ERDF allocated resources to these areas will depend on the category of region:

- in more developed regions, at least 80 % of funds must focus on at least two of these priorities;
- in transition regions, this focus is for 60 % of the funds;
- this is 50 % in less developed regions.

The ways in which the ERDF can finance the interventions, including investments in the energy sector, are diversified and depend on the nature of the beneficiary and the choices of the programmer. Therefore, a plant like the creation of a local energy network could potentially be 100% financed if presented as an investment by a public operator or instead constitute a state aid if considered private investment. In this second case it could take the form of a grant (and be financed according to the percentages provided for by the applied aid regulations and the type of company) or the forms of a financial instrument (loan, guarantee, equity, quasi-equity, urban fund, etc).

[5] https://pf4ee-webcheck.eib.org/

Cohesion Fund

The Cohesion Fund is aimed at Member States whose Gross National Income (GNI) per inhabitant is less than 90 % of the EU average. Like other Funds ERDF and ESF it aims to reduce economic and social disparities and to promote sustainable development. In fact, it is subject to the same rules of programming, management and monitoring as the ERDF and ESF though the Common Provisions Regulation.

Considering the analogy with the ERDF, the use of resources to support investments for microgrid intervention follows the same considerations reported for the ERDF in the previous paragraph.

In any case, with regard to the partnership of the Pegasus project, it is applicable only in Slovenia, Greece and Cyprus.

European Agricultural Fund for Rural Development (EAFRD)

EAFRD policy helps EU rural areas to meet the wide range of economic, environmental and social challenges of the 21st century. In particular the Action 7.2.2 of the Rural Development Plans “Investments in the supply and use of energy from renewable sources for self-consumption" supports investments aimed at energy efficiency in rural areas. The beneficiaries are public entities with a capital contribution equal to 100% of eligible expenses.

5. Funding opportunities for the microgrids

An extended use of microgrid systems can generate a quite large range of benefits both on the side of energy savings and in economic terms for the consumers.

So European funds may support part of the required investments as microgrids are able to effectively contribute to achieving the EU and national objectives in terms of renewables and energy efficiency. After the assessment of the existing financial gap it is convenient to implement suitable tools for overcoming the barriers for the establishment and successful operation of the planned microgrids.

It must be said, that it's not easy to investigate the financing support to achieve a reliable cash flow and thus viable solutions of microgrids. In many cases there are limited options for cost recovery because of local regulations. Finally, there is no "one-size-fits-all" business model for microgrids in the European territories.

In fact, there is limited experience of investments in intelligent distribution systems and microgrids through financial instruments given the limited experience and in light of the fact that they are still in progress.

With a view of proposing criteria to strengthen financial possibilities for microgrids, a first option could be the process through grants for projects supposed to present a higher level of risk, or, on the other side using Financing Instruments for interventions with a lower risk margin. Grants seem more appropriate in cases where the return on investments is not compatible with the project risks or the return period of the investment exceeds the expected time of the amortization plan. A second criterion is the financial sustainability of projects which suggests to target support through grants projects which costs are overcoming incomes.

The public sources may come from financial institutions at EU level as well as from the Financing Instruments operated by the State Members for supporting projects not ready for financial market but expected to repay the investment.

Economic public support for the development of microgrids not financeable by private market condition might concern the issue of state aid. State aid means any transfer of public resources that can grant a selective economic advantage, distort or threaten to distort competition.

As a general rule, state aid is prohibited by European legislation and the Treaty on the Functioning of the European Union which regulates the matter in Articles 107 and 108, as they are detrimental to the principle of free competition in the internal market. It is state aid every time that an intervention by the State or through State resources (e.g. grants, interest and tax reliefs, guarantees, etc):

- gives the recipient an advantage on a selective basis (for example in the case of inside consumers in relation to all other consumers);
- competition has been or may be distorted (for instance the power sources of microgrid are advantaged in comparison to other power suppliers)
- the intervention is likely to affect trade between Member States.

Therefore, funding for the construction of an energy network could potentially constitute state aid and fall back into European constraints. It has to be outlined that the state aid may be allowed when it make possible the achievements of common interest objectives, such as services of general economic interest, social and regional cohesion, employment, research and development, sustainable development (see Article 107/2 of the Treaty on the Functioning of the European Union). Therefore, according to the rules of

the European Union, where there is an overarching common interest it is possible to proceed with the granting of aid.

6. The European microgrid incentive system

In order to meet the objectives of the European directives on RES, Member States have implemented strategies based on economic incentives. Making reference to the Renewable Sources used in the microgrids, these main economic incentives can be classified as follows:

Net metering allowing consumers who generate some or all of their own electricity to use that electricity anytime, instead of when it is generated. This is particularly important with renewable energy sources like wind and solar, which are non-dispatchable. Monthly net metering allows consumers to use solar power generated during the day at night, or wind from a windy day later in the month.

Feed in tariffs: incentives supporting investment in renewable energy including priority access to grid, long term energy exchange contracts and trading at market prices for owners. Then, this incentive purchases the investment risk and the price risk related to competition in the market. In the EU, a well-adapted FIT regime is considered as the most efficient and effective scheme to promote renewable energy sources.

Market Premium: provides extra revenues to RES producers above energy prices defined by the market. In this way a certain compensation for the investment made is ensured for RE generators. Differently from Feed in tariffs the market premium eliminates price risk but not purchase risk.

Green Certificates: in connection with annual renewable energy targets defined by each Member State additional revenues above those from power sales are established for renewable producers to comply with these goals. Green certificates can be traded so that companies comply with regulatory energy obligations.

Most Member States have developed their own plans and targets to stimulate the penetration of renewable energy into the energy mix and to overcome key financial and economic barriers as shown in Table 2. However new challenges and barriers arise, such as the differences in national policies and regulation of each Member state, which highlights that the EC directives cannot be transposed and implemented uniformly.

Table 2. Renewable Energy Electricity Support Instruments in EU 28 Member States

Country		Incentives																							
		FIT			Quota System									Premium						Net Metering			Tax Exemptions		
		PV	Wind	Hydro	% of Quota			No. of Certificates According to Tech.			Minimum Price per Green Certificate			Amount			Cap			PV	Wind	Hydro	PV	Wind	Hydro
					PV	Wind	Hydro	PV	Wind	Hydro	PV	Wind	Hydro	PV	Wind	Hydro	PV	Wind	Hydro						
Austria	AT	✓	✓	✓	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Belgium	BE	x	x	x	✓	✓	✓	✓	✓	✓	✓	✓	✓	x	x	x	x	x	x	✓	✓	✓	x	x	x
Bulgaria	BG	✓	✓	✓	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Croatia	HR	✓	✓	✓	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Cyprus	CY		x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	✓	x	x	x	x	x
Czech Republic	CZ	✓	✓	✓	x	x	x	x	x	x	x	x	x	✓	✓	✓	✓	✓	✓	x	x	x	x	x	x
Denmark	DK	x	x	x	x	x	x	x	x	x	x	x	x	✓	✓	✓	x	x	x	✓	✓	✓	x	x	x
Estonia	EE	x	x	x	x	x	x	x	x	x	x	x	x	✓	✓	✓	✓	✓	✓	x	x	x	x	x	x
Finland	FI	x	x	x	x	x	x	x	x	x	x	x	x		x	x	✓	x	x	x	x	x	x	x	x
France	FR	✓	✓	✓	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	✓	✓	✓
Germany	DE	✓	✓	✓	x	x	x	x	x	x	x	x	x	✓	✓	✓	x	x	x	x	x	x	x	x	x
Greece	GR	✓	✓	✓	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	✓	✓	x	✓	✓	✓
Hungary	HU	✓	✓	✓	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	✓	✓	✓	x	x	x
Ireland	IE	x	✓	✓	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	✓	✓	✓
Italy	IT	x	x	x	x	x	x	x	x	x	x	x	x	✓	✓	✓	✓	x	x	✓	✓	✓	✓	✓	✓
Latvia	LV	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	✓	✓	✓	x	x	x
Lithuania	LT	✓	✓	✓	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	✓	✓	✓
Luxembourg	LU	✓	✓	✓	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	✓	x	x
Malta	MT	✓	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Netherlands	NL	x	x	x	x	x	x	x	x	x	x	x	x	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Poland	PL	x	x	x	✓	✓	✓	✓	✓	✓	✓	✓	✓	x	x	x	x	x	x	x	x	x	✓	✓	✓
Portugal	PT	✓	✓	✓	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Romania	RO	x	x	x	✓	✓	✓	✓	✓	✓	✓	✓	✓	x	x	x	x	x	x	x	x	x	x	x	x
Slovakia	SK	✓	✓	✓	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	✓	✓	✓
Slovenia	SI	✓	✓	✓	x	x	x	x	x	x	x	x	x	✓	✓	✓	✓	✓	✓	x	x	x	x	x	x
Spain	ES	x	x	x	x	x	x	x	x	x	x	x	x	✓	✓	x	x	✓	✓	x	x	x	x	x	x
Sweden	SE	x	x	x	✓	✓	✓	✓	✓	✓	x	x	x	x	x	✓	✓	x	x	x	x	x	x	✓	x
UK	GB	✓	✓	✓	✓	✓	✓	✓	✓	✓	x	x	x	x	x	x	x	x	x	x	x	x	✓	x	✓

Source: "*Overview of Current Microgrid Policies, Incentives and Barriers in the European Union".* Amjad Ali, Wuhua Li, Rashid Hussain, Xiangning He, Barry W. Williams and Abdul Hameed Memon.

Part B) Evaluation Report on the viability of the microgrids

7. An enhanced framework for the financing of the investigated microgrids within PEGASUS project

Seven pilots have been developed within Pegasus project in different territories with the aim to evaluate the real and effective conditions for the implementation of microgrids.

For each pilot, the number and type of relevant consumers have been defined and the related electricity demand (in some cases also the needed thermal energy) has been measured over large periods of time in order to make available reliable data. The renewable sources (PV, high efficient CHP) and the amount of electricity to be generated have therefore been defined to meet, in part or in whole, the demand. For some pilots Energy Storage Systems have been taken into consideration with the aim to increase the energy self-sufficiency of pilot or to allow the off-grid operation of the corresponding microgrid.

The operation of the microgrid was then simulated according to the rules of the local regulatory Authority.

The achievable benefits for the consumers inside the microgrid have been assessed and the required investments as well as the operating costs of the microgrid have been evaluated.

So, a complete cost-benefit analysis in energy, environmental and economic terms is available for each of the investigated microgrids.

Taking into account the possibility of availing of the financial tools and incentives described in the previous Chapters each Partner involved in the pilot development is asked to integrate the current cost-benefit analysis in order to improve the financing of the investigated microgrid.

To this purpose three main items to be taken into considerations are defined below. Through the results of the related answers it is expected to overcome the financial gaps, in capital and/or operating costs, that emerged from the microgrid performed simulations.

The proposed items are:

A. **Which incentives related to the use of RES within the microgrid are allowed by the existing regulations in the territory and which additional incentives are deemed to enhance the economic-financial frame of the microgrid**. For instance these incentives may concern the exemption of the payment of certain levies or tax on the electricity produced inside the microgrid or the compensation of the energy fed into the grid by the micro-grid.

B. **Which financial instruments among those described in the previous chapters (grants, lower interest rates on loan, etc.) are activated in the territory and can be applied to the investigated microgrid. And what are the conditions that would make the financial instrument applicable and sustainable.**

C. **Quantitative analysis of the benefits to be gained from the considered incentives at point A and from the financial instruments referred to in point B in order to overcome the existing economic and financial critical points of the microgrid.** The results of the analysis must be translated into greater benefits for consumers and/or an enhanced cash flow.

ITEM A.

Which incentives related to the use of RES within the microgrid are allowed by the existing regulations in the territory and which additional incentives are deemed to enhance the economic-financial frame of the microgrid. For instance, these incentives may concern the exemption of the payment of certain levies or tax on the electricity produced inside the microgrid or the compensation of the energy fed into the grid by the microgrid.

Municipality of Potenza – Italy

In Italy there is no legal frame concerning microgrid: in particular, there is no possibility for a producer to sell electricity directly to consumers. Only registered distributors are entitled to supply electricity.
Supporting scheme to renewable sources have been practiced since 1992, through different forms: feed-in premium, feed-in tariff, net-metering, fiscal discount. which have gradually followed over time.

Currently the single prosumer equipped with RES of relatively small power (usually up to 20 kW) can access to:

- Fiscal discount over a period of ten years for an amount equal to 55% of the incurred cost;
- Net-billing scheme, named "Scambio sul posto": the bill of the electricity withdrawn from the network is discounted depending on the quantity of energy exchanged with the network in input and output.

For plants of higher power the law entered into force on August 10 th , 2019 provides incentives for the following types of RES:

- Group A: including "on-shore" wind (newly built, integral reconstruction, reactivation or upgrading) and new photovoltaics plant;
- Group A-2: including new photovoltaic systems installed on buildings and rural buildings roofs and replacing existing roofs using eternity or asbestos;
- Group B: including new hydroelectric plants and plants making use of residual gas from treatment processes (newly built, integral reconstruction, reactivation or upgrading);
- Group C: includes on-shore wind, hydroelectric and residual gas treatment plants subjected to a partial or total remaking.

The assignment of incentives for a total of 8 GW occurs through calls for tenders: for RES plant with power up to 1 MW the incentives are pre-defined while for plants with power higher than 1 MW the tenderers requesting lower incentives are awarded.

University of Cyprus – FOSS Research Centre for Sustainable Energy, Department of Electrical and Computer Engineering - Cyprus

In the case of the microgrid pilot in Cyprus the utilization of RES is incentivized via the net billing policy. Net billing is an electricity policy that enables grid-connected customer-generators, typically homes or businesses that own a PV or other generation technology connected to the grid, to offset some or all their electricity consumption and get paid for excess energy injected into the grid. This however, has an upper

limit of the annual energy consumed by the microgrid. This means that if more energy is generated than the annual consumption then the surplus energy is not remunerated, thus it has zero value. All the energy exported to the grid is sold to the utility at the wholesale price (or "avoided cost" price) and all the energy imported from the grid is bought at retail rate. The economical evaluation (calculation of net present cost) of the electricity consumed by the FOSS microgrid (owning a PV and a Battery system) under net billing policy has been described in the cost-benefit analysis deliverable of WP3. In general, the profitability of PV net metering or net billing mainly depends on the modality, on the price and the inflation of the energy imported from the grid and on the cost of the PV systems and inverter. The most profitable modalities for the microgrid operation is net metering, while net billing modalities is generally less profitable than net-metering. The profit of the net-billing system is related to the price at which exported energy is valued and compensated by the utility. For example, the effect of adding or subtracting 2 cents/kWh in the price of the exported energy can affect the profitability of the investment.

The investment of the microgrid could be further incentivized by provisioning an exemption of tax on the electricity that is generated by the microgrid and is fed to the grid. In this case, the energy sold to the grid will be benefited by a reduced VAT (i.e. 5% instead of 19% VAT). Furthermore, additional benefits can come by zeroing the levies that are paid for every kWh produce. Levies charged include: green tax and support to handicapped families.

Furthermore, tax cost forms a substantial part of engineering procurement and construction (EPC) project costs in a microgrid, which in the case of Cyprus range at 19% of the total renewable energy project cost. Considering the special focus on renewable energy by the European Union and the commitment of Cyprus to increase the share of RES in total electricity consumption to 16 per cent by the year 2021, another incentive for developing microgrids is the incentive in the form of a VAT exemption for setting up the projects (meaning i.e. that the solar panel installations will be tax exempt).

MIEMA – Malta Intelligent Energy Management Agency - Malta

As discussed in the cost benefit analysis presented by MIEMA, the deployment of a functioning micro-grid is not yet possible in Malta since there is no regulation that allows its implementation. Additionally given the current energy tariffs in Malta the investment in additional RES and equipment for the micro-grid implementation cannot be carried out without the availability of grants or subsidies. It is not possible to identify existing incentives that can be related directly to the use of RES within the micro-grid. Therefore RES-related incentives which are currently active and that may be adapted to micro-grids in the future given presence of the relevant policies and regulations have been identified and are described in this section.

Feed-in tariff

Feed-in tariffs (FiT) for energy generated through photovoltaic systems and fed into the main grid have been introduced in Malta in 2010. The presence of FiT makes the investment in PV systems quite attractive both for residential and commercial buildings. Prior to the establishment of the FiT regulations a *net metering* arrangement was offered by the national energy supplied, Enemalta. The net metering arrangement was more economically favourable for high electricity consumers. Customers that had PV systems commissioned prior to the establishment of the FiT regulations in 2010 had the option to either retain their existing contract with Enemalta or migrate to the new FiT scheme. After the establishment of the FiT regulations it was no longer possible to apply net metering arrangement for new PV installations.

The Feed-in Tariff contract has two options as follows:

- Option 1: **full export** of the electricity generation from the PV installation at an agreed FiT during the time of contract
- Option 2: **partial export** i.e. generation for own with the possibility of exporting electricity generated and not being consumed in *real-time* to the grid at the feed-in tariff.

The option of partial-export with primary generation for own use is different from the previous net-metering arrangement. Net-metering measures the difference between the number of kWh imported and the number of kWh exported over a defined period of time. An import/export meter was used to record the energy transactions with the grid.

The partial export system with generation for own use allows the electricity that is generation through PV installation to be either consumed on site at the **instant when it is generated** and thus reducing the amount of electricity that needs to be imported from the grid. If the generated electricity is not consumed on site in real-time it is exported to the grid at the feed-in tariff stipulated in the contract between the customer and grid operator.

In the case of the previous net metering the calculation of the customer was billed as follows:

$$Billed\ consumption_{net-metering} = I - E$$

Where I = Imported electricity; E = exported electricity

Option 1 (full export) favours consumers with lower electricity consumption that would be importing energy from the grid at feed-in tariffs that are lower than the feed-in tariff e.g. importing electricity with a maximum cost per kWh of €0.1298 (band 2 – residential) and selling electricity to the grid at €0.1550 (FiT available for contracts signed in 2019).

For the option of PV generation full-export, the customer is billed as follows:

$$Billed\ consumption_{full-export} = G + I - E$$

Where G = electricity generation from PV; I = Imported electricity; E = exported electricity

Option 2 (partial export) is usually selected by consumers with a higher consumption since this would reduce the amount of energy that needs to be imported from the grid that falls within higher tariff bands. This option would make most sense when the high consumption occurs during the time of PV generation.

New feed-in tariff are usually announced every year and the rates may vary depending on whether the customer applying for the FiT benefited from any grants in relation to the capital investment of the PV system.

Micro Invest – Tax Credit for investment in alternative energy

Micro Invest is a scheme by Malta Enterprise which is designed for undertakings (including start-ups, family businesses, self-employed etc) which encourages investment to innovate, expand and develop their operations. Undertakings are supported through a tax credit which is calculated as a percentage of eligible expenditure. The current Micro Invest scheme is available until the 31st December 2020.

The scheme covers different types of investment costs, including "systems intended to produce alternative energy" are specific in the incentive guidelines[6]. A tax credit equivalent to 45% of eligible the eligible expenditure is granted, with an additional 20% bonus which applies Gozitan undertakings (i.e. 65%). The maximum eligible tax credits per single undertaking are capped at €50,000 over any period of three (3) consecutive fiscal years, starting from eligible expenses incurred and paid for during the period. This capping specified above is increased by €20,000 (to a total of €70,000) for undertakings operating from Gozo.

In order to be eligible for the tax credit, the undertaking must registered with the VAT department and shall not employ more than fifty (50) persons on Full Time (FT) contracts.

Auvergne-Rhône-Alpes Énergie Environnement (AURA-EE)- France

On the pilot territory of Saint-Julien-en-Quint, the following incentives are already available :

- subsides from the regional council on investment in PV plant, since the project is managed by an energy community;
- public subsidies on additional studies to improve the business model by taking into consideration the ancillary services the microgrid could provide to the network

Additional incentives could enhance the business model :

- Exoneration of the CSPE tax, which represents a contribution that all the consumers pay for the national equalization (and which serves for feed-in tariff, energy precariousness, etc.)
- Exoneration of the local taxes, due to local municipalities
- Reduction of the TURPE, grid fees that are paid pay all the users of the electricity network.
- Reduction of the VAT which is paid on the various components of the electricity tariff. Now the VAT is 5.5% on the fixed component and 20% on the variable components. We could imagine a 5.5% tax on all the components.

Energy Agency of Podravje – Institution for Sustainable Energy Use - Slovenia

In Slovenia a system of net-metering is established. It means that consumers (still connected to the main grid) can use own RES for electricity for free. The balances between own production and the use from the grid are done once a year. Net metering can be used for installations of the capacity up to 0,8 multiplied by connecting power.

Centre for renewable energy sources and saving - CRES - Greek

The "Net metering" and the "Virtual net metering" incentives related to the use of RES within the microgrid are allowed by the existing regulations in the territory of the Thessaly region where the Greek pilot is going to be installed.

[6]https://www.maltaenterprise.com/sites/default/files/Micro%20Invest%20Incentive%20Guidelines%20%28for%20information%20purposes%20only%29.pdf

According to the Greek “Energy communities” Law in the case of PV projects owned by energy communities, (the proposed solution for the Megalo Evidrio pilot) the minimum capacity threshold that would trigger the obligation to participate in auctions are set at 1 MW. The energy community projects that fall under these ranges of capacities (i.e. 0.5-1 MW for PV) will receive their operating aid in the form of a sliding premium.

ITEM B.

Which financial instruments among those described in the previous chapters (grants, lower interest rates on loan, etc.) are activated in the territory and can be applied to the investigated microgrid. And what are the conditions that would make the financial instrument applicable and sustainable.

Municipality of Potenza – Italy

The investigated pilot developed by the Municipality of Potenza made use of a particular form of the "Scambio sul posto" regulation allowing that two or more sites owned by the same Municipality are assimilated to a single site (as they had a single common connection point to the grid) under the condition that:

- at least one of the sites generates electricity from renewable sources with a power not exceeding 200 kV,
- the inhabitants of the Municipalty are less than 20.000.

From the above the two or more involved sites are therefore considered as a single prosumer with obvious benefits in terms of billing reduction.
Such regulation, than in a certain way approximates to microgrid, in spite of the achievable advantages, is little used.

For this reason the pilot has taken into consideration this specific regulation, named "Scambio sul posto Altrove", in order to demonstrate its easy applicability, the related benefits for the Municipality and the lack of effectiveness of the constraint on the number of inhabitants. This requirement aims to prevent disturbances or imbalances on the network in the event the involved sites are very far between them. More appropriate to this purpose to request the involved sites belong to the same electrical substation.

The Municipality of Potenza has more than 60.000 inhabitants and the selected sites was two energy-intensive infrastructure: a swimming pool and an escalator 600 meters long, able to transport up to 9000 people/hour from the outskirts to the city centre.

University of Cyprus – FOSS Research Centre for Sustainable Energy, Department of Electrical and Computer Engineering - Cyprus

In the case of Cyprus, one potential financial instrument for microgrid investments could be the Operational Programme 'Sustainable Development and Competitiveness', which Is a program co-funded by Cohesion Fund (CF) and European Regional Development Fund (ERDF). This programme involves European Community support for Cyprus within the framework of the "Convergence" and "Regional Competitiveness and Employment" objectives. This foresees investments in necessary environment and energy infrastructure, in order to ensure that the country is able to meet its obligations to the EU i.e. for RES targets. This financial instrument concentrates mainly on infrastructure that is necessary to reduce the reliance of fossil fuels through the increased use of renewable energy sources. This programme could provide loans for the development of a microgrid by offering zero or low interest rate and grace period for the implementation of the project.

Moreover, the European Investment Bank, which is partially funded by the EU, could provide funding to in order to encourage investments in energy efficiency and environmental projects for higher education and

municipal infrastructure in Cyprus, (similarly to what has been recently decided for Ukraine Universities and municipalities). In this category we can also see a lot of support through the European Energy Efficiency Fund (EEEF) which ESCOs can secure and operate on the efficiency cycle of the investments in microgrid communities that can pay back the loans to be secured through the positive economic benefits that can be generated by the use of lower cost electricity generation through RES when compared to the retail price coming from a combination of conventional generation.

MIEMA – Malta Intelligent Energy Management Agency - Malta

Financial instruments which are currently available in Malta have been investigated in order to assess the potential use of such instruments for the implementation of a micro-grid. Similarly to the situation of incentives it is not possible to define the exact applicability of these financial instruments to micro-grids since there are no proven models of such financing in Malta. Government grants related to domestic PVs and loans that may be used to finance RES are presented in this section.

PV Grant Scheme

The PV Grant Scheme is a national scheme for renewable energy systems. This is funded through national funds and administered by the Regulator for Energy and Water Services (REWS). The grant is aimed at supporting RES deployment, notably in the residential sector.

The PV grant scheme is issued periodically – usually on a yearly basis. The most recently issued scheme was issued in the beginning of 2019 and had a budget allocation of €2M. Private individuals (natural persons) making use of space on their residential properties, and organizations that are not carrying out an economic activity are eligible for the scheme. Applicants who have received a grant for a similar system since 2006 are not eligible for another grant.

The grant covers 50% of the eligible PV system costs up to a maximum of €2300 per system and Euro 757/kWp and (kWp times €3800) minus eligible cost.

Such a grant is more applicable for investment by the individual community members within the micro-grid rathen than for the community as a single entity.

Green Loans

Commercial banks are recently offering green loans which can be used for the investment in RES. A green loan package which is currently offered in Malta by HSBC bank has a fixed rate of 3.99% per annum for the whole duration of the loan. The green loan is capped up to a maximum of €50,000, which can be used for the purchase of electric cars, hybrid cars, solar panels, thermal insulation and other eco-friendly products.

Tailor-made loans through the Malta Development Bank

The Malta Development Bank (MDB), owned by the Government of Malta, is currently in the process of offering specific schemes to support energy efficiency initiatives. The MDB engages in direct lending, including co-financing, or as guarantor for commercial banks or other intermediaries. Such operations are typically directed at:

- Physical infrastructure projects carried out by the private sector, public entities and/or public-private partnerships;
- Social infrastructure projects including those associated with health sector, long term care, education, affordable housing and similar initiatives. In such instances, social returns may not be fully internalised by the private investor;

- Syndicated lending which crowds in a group of banks and other funding sources to enable large scale investment projects.

One of the main commercial banks in Malta, Bank of Valletta, recently launched '**BOV SME Invest**' in collaboration with the Malta Development Bank (MDB). The product is aimed at SMEs planning new capital investment projects and provided financing up to a maximum of €750,000. It is foreseen that this financial instrument shall provide €50 million financing to local SMEs through a €10 million guarantee provided by the Malta Development Bank. BOV SME Invest will. The Guarantee by MDB allows the commercial bank to reduce its collateral obligations together with a reduction in interest rate of 2% below market rate.

Another facility which may be adapted for use by a larger micro-grid community/co-operative which required a very large investment is the "**Tailored Facility for SMEs**" which aims to assist SMEs, including start-ups, by enhancing their access to finance. The facility is designed to address the following major barriers to lending:

- Insufficient value or type of collateral;
- Innovative business ventures, economic sectors or technologies which fall outside the risk appetite and tolerance of commercial banks;
- Other factors for which commercial banks may not be willing or able to provide the required financing in whole or part.

The required loan is co-financed by a commercial bank and the MDB in such portions as may be agreed between the parties. The size of such a loan ranges from a minimum of €750,000 to a maximum of €5 million. On a case-by-case basis, the MDB may offer a guarantee on part of the commercial bank's share of the loan. The minimum term of the loan is 24 months. The maximum term depends on the life-time of the asset being financed, to be agreed on a case by case basis.

Auvergne-Rhône-Alpes Énergie Environnement (AURA-EE)- France

The pilot territory will benefit from

- grants on the investment in the PV plant
- equity investment from local municipalities but also from the national public investor Caisse des Dépôts

Grants are definitely useful to make the project viable and could be replicated until the business model becomes enough reliable without any subsidy.

Since this project is rather small and since it has been presented to the bank together with other PV plants benefitting from the feed-in tariff (in a same global project), no specific guarantee has been asked. But if the project was bigger and consisted only of one PV plant for collective self-consumption, the financial risk would be probably higher and some more guarantees would be asked. In that case, any financial instrument which would provide stronger guarantees would be appreciated and would enable a **better replication of the model.**

Energy Agency of Podravje – Institution for Sustainable Energy Use - Slovenia

Slovene regulator publish yearly call for subsidizing the RES electricity production but microgrids do not have any benefits or priority. There is the competition within the call and the lowest electricity prices win**.**

For smaller grids households can use subsidies from national Eco fund (max of 25 % of investments and VAT is not eligible). There are no other financial instruments for studies or preparatory works.

CENTRE FOR RENEWABLE ENERGY SOURCES AND SAVING - CRES - Greek

i) The Greek "development law" and the "National Strategic Reference Framework (NSRF) 2014-2020" provides financial instruments that can be applied to the investigated microgrid.

More specifically the Greek development law (Law no 4399/2016) provides the following types of aids for investment projects:

a. Tax exemption consisting of the exemption from paying income tax on earnings before tax;
b. grant, which consists of the free provision by the governments of funds to cover part of the aided expenditure of the investment project and is determined as a percentage thereon;
c. leasing subsidy, which consists of the payment by the government of part of the instalments paid for the leasing agreement concluded for the acquisition of new machinery and other equipment. The grant of the lease may not exceed seven (7) years;
d. the job creation cost subsidy, which consists of the coverage by the government of part of the wage costs for new jobs created and associated with the investment project, which do not receive any other state aid;
e. stabilisation of income tax rate (tax system);
f. risk finance through equity fund in accordance with Article 21 GBER.

All the above types of aids shall be provided **separately** or **combined** and are accounted for in determining the total aid amount for each investment project.

ii) The "National Strategic Reference Framework (NSRF) 2014-2020" under the Operational Program "Competitiveness, Entrepreneurship and Innovation (EPANEK)" has foreseen the action "Strengthening the Establishment and Functioning of Energy Communities".

Under the Action, projects with a total budget of € 250,000 to € 1,000,000 are supported. The rates of aid for investment projects for the periphery of Thessaly shall be as follows: 75% for small and very small enterprises, 65% for medium and 55% for large enterprises.

ITEM C.

Quantitative analysis of the benefits to be gained from the considered incentives at point A and from the financial instruments referred to in point B in order to overcome the existing economic and financial critical points of the microgrid. The results of the analysis must be translated into greater benefits for consumers and/or an enhanced cash flow.

Municipality of Potenza – Italy

The pilot including:

- the municipal swimming pool equipped with an high-efficiency Combined Heat and Power system able to supply a share of the thermal energy for pool water and ambient air heating as well electricity used to supply pumps, funs and lighting being the surplus fed into the network,
- the escalator located about 500 meters from the swimming pool, has been designed on the basis of electric and thermal parameters measurements performed over the whole 2018 year.

The analysis of the energy and environmental benefits lead to the following results:

- a saving of about 38.000 smc/year of natural gas corresponding to a reduction of 364 MWh/year in primary energy consumption;
- a consequent avoided CO2 emission of 80 t/year.

The achievable economic benefits according to Italian regulation "Scambio sul posto" have been estimated in 73 k€/year.

The evaluated financial indicators are:

- payback period equal to 3,26 years,
- net Present Value discounted at 3,5 % equal to 0,48 M€ against a Capital Expenditure amounting 245,8 M€,
- internal Return Rate equal to 24,7%,

These results make evident the financial sustainability of the pilot that can be replicated in similar situations.

Moreover this model, in the presence of a financial grant (e.g. ERDF fund), can therefore constitute a significant operational reference for the public administration system in the establishment of microgrids able to improve the energy efficiency of public assets in full compliance with the EU directive on Renewable Energy Communities.

University of Cyprus – FOSS Research Centre for Sustainable Energy, Department of Electrical and Computer Engineering - Cyprus

Through the detailed analysis of the collected data from the university of Cyprus microgrid and extrapolated to cover the whole of the university campus the following financial results are estimated using the current net billing tariff that is implemented in Cyprus for Commercial end users as the University of Cyprus that can act as an Energy Community using the planned microgrid architecture:

Description	Annual energy cost in €	PV in kWp	Storage in kWh	Savings in mil €	capital cost in mil €	Generation in kWh
Without PV and S	2,413,969	0	0	0.000	0.000	0
With PV and without S	1,213,483	5,000	0	1.200	5.000	8,100,000
With PV and without S	1,008,058	6,000	0	1.406	6.000	9,720,000
With PV and without S	807,759	7,000	0	1.606	7.000	11,340,000
With PV and without S	609,486	8,000	0	1.804	8.000	12,960,000
With PV and S	1,398,670	4,000	2,350	1.015	5.410	6,480,000
With PV and S	1,286,764	4,500	2,350	1.127	5.910	7,290,000
With PV and S	1,179,485	5,000	2,350	1.234	6.410	8,100,000
With PV and S (licensed sizes)	1,075,717	5,500	2,350	1.338	6.910	8,910,000
With PV and S	974,060	6,000	2,350	1.440	7.410	9,720,000
With PV and S	773,761	7,000	2,350	1.640	8.410	11,340,000
With PV and S	674,425	7,500	2,350	1.740	8.910	12,150,000
With PV and S (Generated energy equivalent to load)	575,488	8,000	2,350	1.838	9.410	12,960,000

It can be seen that the benefits of the installation of the PV system outweigh its investment cost in all scenarios, resulting in a positive NPV. The real IRR of the studied configurations ranges from 6.7% to 13.42%. The savings to the electricity bill due to the operation of the microgrid is the main factor that is considered for the profitability of the investment, in a pure economical point of view. By taking into consideration the IRR and NPV of the investment, the obtained results point to the direction of the installation of **a PV installation of 8 MWp and a battery capacity of 2.35 MWh**. A payback period of less than 7 years is evaluated with the current electricity prices giving a strong positive message for the opted solution and the adapted microgrid architecture. It should be noted that, in this analysis, the BESS has only been considered for supplying PV generated energy to the university microgrid. Other uses of battery, such as tariff arbitraging, ancillary services and power balancing services that would increase the BESS's cost-effectiveness are not considered. These ancillary services will be profitable for the UCY campus microgrid, when the electricity market will move into a liberalized form.

Moreover, quantifying the benefits of the DSO through the potential for the microgrid to act as an alternative DSO option by providing an assessment of the deferral benefits. Obtained results show that the microgrid operation can defer the upgrade of transmission and distribution grids and is able to lower their capacity demand. Furthermore, the electricity benefit brought by the reduction of grid losses provides another indirect benefit for the environment and the DSO as well. Through a detailed calculation, the operation of the microgrid results in monetary benefits of 1,002,282.4 € for the DSO. The gains obtained

under this scenario are derived from the reduction of distribution grid losses and the deferral of grid investments. It is assumed in this calculation that the DG and BESS investment can be a direct substitute to the "wires and poles" assets; thus, the same discount rate has been applied to both cases. Nevertheless, it is apparent from the obtained results that the microgrid operation would be both beneficial and profitable for the DSO with added benefits to the owner of the microgrid, thus further reducing the payback period. Of course implemented tariffs should be cost reflective and may be these benefits will indirectly appear in the net billing tariff at some point in the future. The resulting data for each of the investigated microgrids will lead to a comprehensive view of the needed supporting tool for a successful implementation of the microgrids in the different territories.

MIEMA – Malta Intelligent Energy Management Agency - Malta

As highlighted in the conclusion of the cost-benefit analysis in relation to the pilot micro-grid in the locality of San Lawrenz, Gozo, a grant is required to finance part of the investment required for the installation a new PV system which will enhance the operation of the micro-grid. Such a grant is presently not available in the context of the micro-grid. A hypothetical "hybrid" financing model based on merging together grants which are presently available in Malta and incentives/loans which may be accessed by a local co-operative can be evaluated.

A feed-in tariff is definitely necessary for the economic feasibility of the proposed micro-grid. In fact a FiT of € 0.155 features in all the scenarios assessed in the cost benefit analysis.

Residents within the micro-grid community may install de-centralised PV systems to increase the RES capacity within the micro-grid and apply for a grant of a maximum of €2300 per residence. Considering 12 residences in the pilot, that maximum grant that may be obtained is €27,600 (for an investment of €55,200 – approx. 44kWp).

The capital investment which is not covered through grants may be covered through a green loan or through a tailored facility that may be elaborated according to the particular needs of the project. Additionally the local co-operative may apply for the micro-invest scheme which can provide a tax credit of up to €70,000 (65% of an investment of €107,692). The challenge related to maximising the benefit of the Micro Invest scheme is that profit must be generated in order to be able to utilise the tax credit.

Auvergne-Rhône-Alpes Énergie Environnement (AURA-EE)- France

The CBA which was led on the pilot site included a sensitivity analysis where the variation of numerous parameters has been assessed.

Regarding taxes, the application of a 5.5% VAT rate on all the components of the electricity price would improve the model and decrease the consumer's bill of a few percent but it would not change the global economic balance of collective self-consumption for consumers.

Regarding the exoneration of CSPE and local taxes, the CBA showed that it would cancel the increase of the bill for some consumers, making it equal to a situation without microgrid, but it would not make the bill lower than before.

Regarding grid fees, the present price scale makes it more expensive mainly for people using electric heating. In the other cases, the fee is more or less the same with or without microgrid. A significant

exoneration of some components of this fee could clearly improve the model and decrease the consumer's bill. The impact is difficult to quantify, since it depends a lot on the consumer's profile.

On the contrary, the subsidies have a high impact on the economic balance. For instance a 15% subsidy on the investment would allow the producer to commercialize the local electricity at 7.5 c€/kWh instead of 12 c€/kWh, which makes a very high difference. Nevertheless, these results are valuable only in the case where the producer both invests in the PV plant for the microgrid and in other plants for the feed-in tariff (scale effect). If he had to invest only in the self-consumption plan, much more subsidies would be necessary for the project to be viable (more than 50% of the investment).

The equity investment has few impact on the economic balance since the local company could also find private investors or rely on more numerous citizens as investors. Moreover, the fact that a big public fund becomes a shareholder of the local company generates other questions to solve in terms of governance.

The parameter which has one of the biggest impact on the business approach is, apart from financial instruments and incentives, the evolution of the electricity price. Actually although in a feed-in tariff scheme, the viability can be easily calculated from the CAPEX and OPEX of the operation, in a microgrid, the economic balance becomes relative: the viability can only be assessed compared to the case where consumers keep on buying their electricity from the grid. And it is very difficult to know how this price will evolve.

In the CBA of the pilot site, we could make various simulations and it comes that with a slight increase of 3% of the commercialization component of the electricity price from the grid (which represents even a slighter increase of the whole price), the collective self-consumption becomes nearly always more valuable for all the consumers, on a 20 years observation period.

The resulting data for each of the investigated microgrids will lead to a comprehensive view of the needed supporting tool for a successful implementation of the microgrids in the different territories.

Energy Agency of Podravje – Institution for Sustainable Energy Use - Slovenia

In Slovenia the financial subsidies are quite good but the price of electricity is low therefore the payback periods are long (8 or more years). At the governmental level there are talks about green tax policy but the regulation is not prepared yet.

The results of the analysis must be translated into greater benefits for consumers and/or an enhanced cash flow.

The resulting data for each of the investigated microgrids will lead to a comprehensive view of the needed supporting tool for a successful implementation of the microgrids in the different territories.

Centre for renewable energy sources and saving - CRES - Greek

In order to be the Greek pilot microgrid economically competitive the overall cost of generating power locally must be below the grid parity. The project is going to have a positive payback because the average levelized costs of all energy resources, combined in proportion to their consumption, is below the cost of grid power at that location. The Greek pilot will become increasing popular as the cost of renewables decreases and/or the cost of utility power increases.

Four scenarios were investigated in the frame of the PEGASUS project for the Greek pilot. The most profitable scenario is the one without the batteries for energy storage and without the 147 private pumps

for irrigation. These pumps consume electricity from the main grid in a very low tariff much lower than the tariff in which the micro-grid is going to buy electricity from the main grid.

The total capital expenditure (CAPEX) of the Greek pilot is about 300,000 euros and is divided as follows:

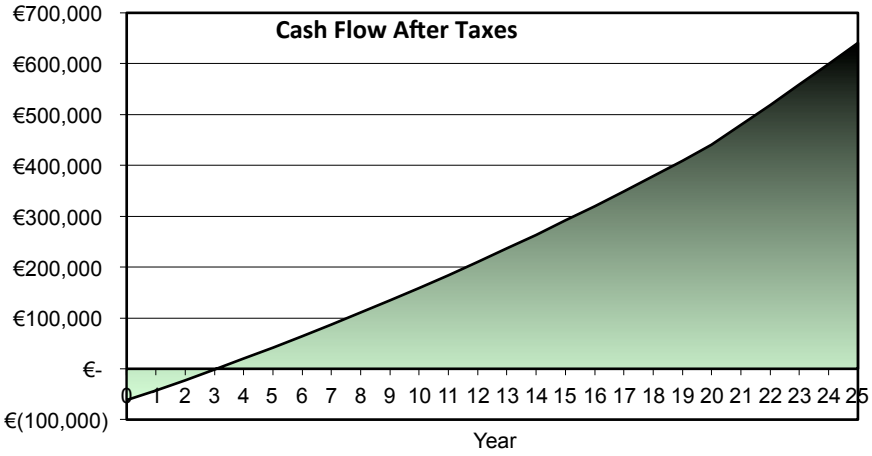
CAPEX financing

Total CAPEX	302,926.50 €	
Equity	62,048.55 €	20%
Grants	150,000.00 €	50%
Loans	90,877.95 €	30%
- interest on loan	7.00%	
- loan term (years)	20 years	

The "Microgrid – Energy Community" under these conditions will earn 57,422 Euros/year and the economic results of the activity are presented in the next table.

Business Case Results for the Greek pilot

NPV of Cash Flow	204,388
IRR	34.2%
Simple Payback period	3 Years 1 Months
Discounted Payback	3 Years 8 Months



Cash flow after taxes

In this case the net present value (NPV) of Cash Flow is positive and the internal rate of return (IRR) is much higher than the discount rate (34.2 > 8.00), which means that the investment is very profitable.

8. Final considerations

Item A

Which incentives related to the use of RES within the microgrid are allowed by the existing regulations in the territory and which additional incentives are deemed to enhance the economic-financial frame of the microgrid.

The conditions represented on the territories, through the analyzes conducted through the pilots, do not appear uniform, with rather diversified regulatory situations and stages of development in the sector.

In some territories the legislation provides that the possibility of activating net billing or net metering policies capable of supporting the development of smart grids. However, this possibility is not uniform, with markets such as the Maltese one where it is not applicable. In general, although it depends on the type of consumption, between the two policies the experience conducted by the partners leads to consider that net metering policy is preferable.

However, as these policies are not common heritage between all territories, in some cases they are not contemplated and therefore do not allow in some contexts an extraordinary incentive action for the development of micro grids.

Furthermore, in two cases the interventions the energy exchange policies with the grid, even if envisaged, find a territorial limit, correlated to the choice of the national programmer to facilitate only certain delimited areas of the single country.

In addition to the above, a positive consideration is given by the territorial analyzes, assigned to the possibility of receiving investment support for the construction of the plants, which is practiced in some areas, although this requirement does not appear to be a primary requirement.

It is probably considered more interesting to use the tax lever (in particular acting on VAT), used in some cases and indicated by the partners as an operational proposal in others, an instrument which, in integration with net metering policies, appears to be in able to facilitate the profitability of the investment and therefore the diffusion of the use of smart grid systems powered by renewable sources.

Item B

Which financial instruments among those described in the previous chapters (grants, lower interest rates on loan, etc.) are activated in the territory and can be applied to the investigated micro grid. And what are the conditions that would make the financial instrument applicable and sustainable

With reference to financial instruments available at territorial level, the panorama outlined by partners in their contributions highlights a quite limited range of instruments, especially those financed by ESI Funds. On the other side, however, partners stressed the need for a comprehensive and holistic set of measures, not all of repayable nature, to speed up or enhance the development of investments in the area explored through pilot cases.

An in depth analysis of answers, cross checked with a survey on EC platforms containing data about Financial instruments al EU level can be summarized as follows.

There is not a prevalent source of public support to investments in micro grids now in different UE areas in which Pegasus project has been implemented.

In a couple of cases, grant schemes are available on annual basis, but only in one case the grant is relevant for micro grids even if beneficiaries are persons and not economic organization. The other one is a co-investment measure, which covers only 25% of the investment at household level.

In another case, a national development law sets out a comprehensive set of financial measures, including grants (also to cover job creation), leasing costs coverage, tax exemption and tax system, risk sharing.

On the side of financial products, currently it seems there are no Funds available from Operational programmes even if Financial Intruments are foreseen or have been activated in previous and present programming period but not covering this area of energy policy.

On private side, Commercial banks offer capped small loans with a quite high interest rate to buy eco friendly products, while a National Promotion bank, seems to be developing very interesting financial schemes in the field of Energy efficiency both on the side of direct loans and on the level of guarantees, especially to finance infrastructural investments. These products are somehow linked with another financial operation implemented with a commercial local bank to provide loans up to 750k with low interest rate, benefitting from a guarantee by the national bank. Also products tailor made for SMEs may support innovative business or technologies not currently the usual coverage of commercial banks.

ITEM C

Quantitative analysis of the benefits to be gained from the considered incentives at point A and from the financial instruments referred to in point B in order to overcome the existing economic and financial critical points of the microgrid.

In the cases analysed, the quantifications of possible benefits are mainly related to the savings in user bills.

From the cases analysed, the impact of these benefits depends on the intensity of the subsidy and the cost of making the microgrid.

In fact, it is the intensity of the subsidy that determines the impact on the economic balance of the microgrid.

If it were to invest only in the self-consumption plan, much more subsidies would be needed for the projects to be viable (more than 50% of the investment).

For example, in the case of partner French, a 15% investment subsidy would allow the producer to market local electricity about 30% less. Which makes a very big difference.

However, these results are only valuable if the manufacturer invests in both the photovoltaic system for the microgrid and other power tariff (scale effect) systems.

In short, the financial benefits depend on the value of the subsidy and the cost of the investment. It should be noted that the level of subsidy affects the market of the microgrid. A high subsidy tends to keep investment costs high. Right balance is determined by the pay-back of the investment.