

An ecosystemic approach for energy transition in the Mediterranean Region

Cynthia Echave¹; Danilo Ceh²; Alexia Boulanger³ and Jennifer Shaw-Taberlet⁴

Abstract-- Energy transition will mark the political agenda for the next years in the UE Members States, not only by the commitments achieved, but also by the urgency of Climate Change hazards. The Mediterranean Region acquires a relevant role for its vulnerability to rise of temperatures, sea level rise and scarcity of water and resources. Energy supply is one of the priorities for Europe, and most of the efforts should be oriented on renewables as the principal energy source option to support.

Despite the fact that urban areas are the most densely populated, rural areas represent more extension of European territory than urban areas. In the case of the MED area, this is not the exception, an important part of the territory of Portugal, Spain, France, Italy or Greece is considered as rural typology of regions (Eurostat 2017). Currently, Rural Areas are becoming more vulnerable due to an increasing process of depopulation and aging. In most of the cases, rural areas lose attractiveness for new generations, and most of the people migrate to cities. At the same time, climate change is expected to worsen the existing vulnerability of rural areas. Accordingly to the 5th IPCC report⁵, such pressure is expected to generate conflicts in resource-dependent livelihoods.

EU Projects represent an opportunity to bring new ideas and initiatives not only at scientific field but also for economy and social development. Interreg Med Programme⁶ organizes its architecture into eight Thematic Communities grouped as well in three axes: 1) Innovation; 2) Low Carbon Economy; and 3) Natural and cultural resources.

The Renewable Energy Community⁷ forms part of the Low Carbon Economy axe and it is constituted by six Modular Projects: Compose; Forbioenergy; Local4green; Pegasus; Prismi and Stores. Then also counts with one Horizontal Project: Greencap, which has the role of capitalization and main dissemination of the community. All projects jointly

promote an energy model based on local renewable sources and sharing management through microgrids in the Mediterranean Region developing several planning, management and governance tools. Even that most of the strategies can be replicated and adapted to urban areas; RES Community focuses on rural and islands areas as a main focus.

Most of the current issues around energy transition claim for a holistic vision that finds solutions that can be able to face the complexity of implementation processes. For that reason, RES Community finds its common approach through an ecosystemic base thinking; merging the essential technical outcomes from each one of Modular Projects in an integral strategy addressed to four policy pillars: Climate Change, Energy Transition, Land use Planning and Circular Economy.

For that purpose, Greencap Horizontal Project, proposes to exemplify this integral strategy through Ecosystemic Transition Units (ETU), as a planning and management tool to boost and ensure energy transition at regional and local level authorities. The aim of this paper is to present the methodological and conceptual framework of this strategy as a basis for a new policy recommendation at Mediterranean Region.

Index Terms-- *Ecosystemic Transition Units – Energy transition policies – Energy local communities – Climate Change – Island areas – Land use Planning – Mediterranean Region – Prosumers – Renewable Energy – Rural areas*

I. NOMENCLATURE

HORIZONTAL PROJECT- “Refers to the project that has the role of manager of thematic communities according to Interreg Med Programme architecture”

MODULAR PROJECT – “Refers to the project that develops its testing or studying activities through pilot projects.”

THEMATIC MED COMMUNITY – “Refers to the joint of several Modular Projects that follow a common topic. Each thematic community counts with a Horizontal project that manages the capitalization of the community”

RE COMMUNITY – Renewable Energy Community Interreg Med Programme coordinated by Horizontal Project COMPOSE – Modular Project “Rural Communities engaged with positive energy”

ForBioEnergy – Modular Project “Forest Bioenergy in the Protected Mediterranean Areas”

LOCAL4GREEN – Modular Project “LOCAL Policies for GREEN Energy”

PRISMI – Modular Project “Promoting RES integration for smart Mediterranean islands” project

PEGASUS – Modular Project “Promoting Effective Generation and Sustainable Uses of electricity”

StoRES – Modular Project “Promotion of higher penetration of distributed PV through storage for all” project

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¹ C. Echave is with Urban Ecology Agency of Barcelona, 08001 Barcelona Spain (e-mail: cynthiaechave@benecologia.net)

² D. Ceh is with Scientific Research Centre Bistra Ptuj, 2250 Slovenia (e-mail: danilo.ceh@bistra.si)

³ A. Boulanger is with Environment Park, 10144 Torino Italy (e-mail: alexia.boulanger@envipark.com)

⁴ J. Shaw-Taberlet is with Axelera, 69360 Solaize, France (e-mail: jennifer.shaw-taberlet@axelera.org)

⁵ “...rural areas are expected to experience major impacts on water availability and supply, food security, infrastructure and agricultural incomes, including shifts in the production areas of food and non-food crops around the world. These impacts will disproportionately affect the welfare of the poor in rural areas, such as female-headed households and those with limited access to land, modern agricultural inputs, infrastructure and education”.

⁶ <https://interreg-med.eu/>

⁷ <https://renewable-energies.interreg-med.eu/>

II. INTRODUCTION

Mediterranean Region is one of the 25 world's major climate change hotspots, according to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change [5]. The region acquires a relevant role for its vulnerability to rise of temperatures, sea level rise and scarcity of water and resources. Maintain well-being at MED Region will need to face the challenge of ensuring population access to basic resources in a more efficient and sustainable way.

For that reason, is necessary to encourage resilient Mediterranean territories in order to have enough capacity of adaptation on time [8]. This is a matter of aware and anticipation to hazards through organization. Territorial planning, allows thinking in an adequate physical organization, but also must induce reduction of emissions to atmosphere through sustainable mobility, energy efficiency and also responsible economy and lifestyles [4].

Territorial dynamics must be oriented into a more equity distribution of well-being. Rural areas and Islands are becoming one of the most vulnerable territories not only because of its depopulation, but also because of their lack of revitalization strategies based on sustainability [10]. Land use occupation in most of European countries show a high concentration of people in cities, but at the same time an evident dispersion of municipalities of low density. In the case of Catalonia Region, most of municipalities present population densities lower than 50 inhabitants/ha, just considering the total population in relation to the urban land use area (Fig. 1).

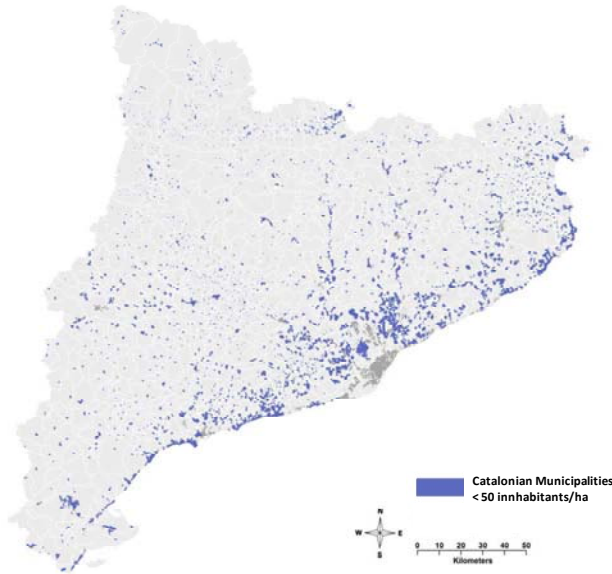


Fig. 1. Municipalities in Catalanian Region with density < 50inhab/ha considering only urban land use per municipality. Source: BCNecologia based on Regional Cartography data base.

The Interreg Med Programme through its eight Thematic Communities promotes the Mediterranean Region's social and technological innovation, actions to achieve a low carbon economy and finally the preservation of its natural and cultural resources.

The Renewable Energy Community, sums part of low carbon economy actions, and gathers six projects that promote local RES through several technical approaches

focus on rural and island areas. The aim of the Renewable Energy Community is to capitalize the results obtained by its projects in order to be able to transfer their implementation into territories in the MED area.

For that purpose, Greencap Project proposes a common merging approach based on the complementarities of the modular projects form part of the RE Community. The aim is to drive the capitalization of their tools and methodologies through a strategic planning and management tool based on an ecosystemic approach. These means to establish the principles and limiting factors [15] that conditions the functionality and stability on time.

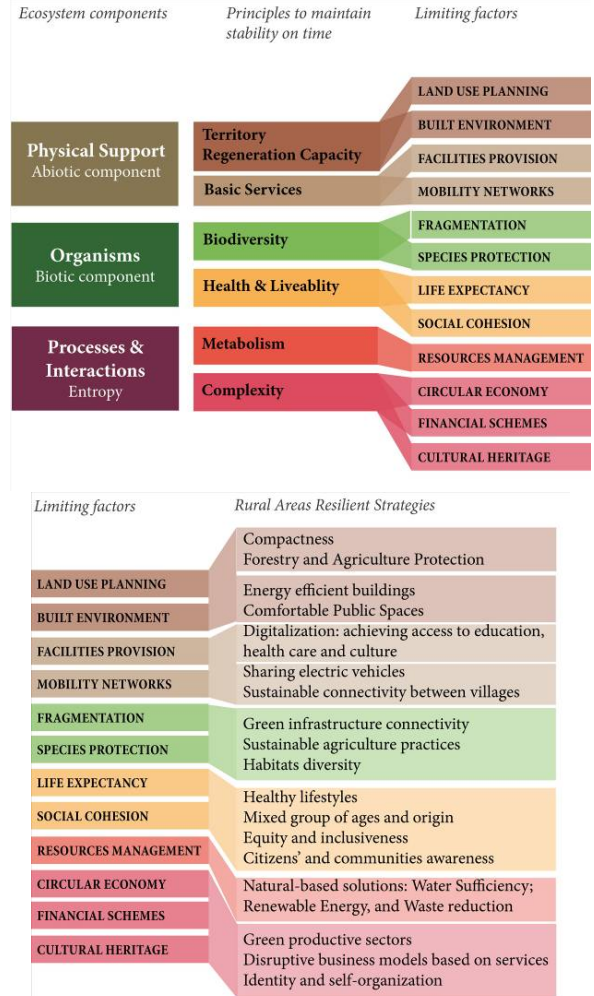


Fig. 2. Ecosystemic principles and limiting factors for rural revitalization. Source: BCNecologia

III. ECOSYSTEMIC TRANSITION UNITS

Energy transition policies will bring in a short and middle term new opportunities to renewable economic sector in EU Members. The application of Energy and Climate National Plans will carry out the reactivation of incentives to invest on clean-energy production, but most important a different way of energy planning and management. Self-sufficiency and prosumers bring part of this new way of energy production, use and storage.

Most of the existing experiences known about local energy communities [12] highlight the meaningful force that bottom-up initiatives have when people find a sense of belonging and the community is built from the basis of a

common project. This will be a revolutionary step forward on the following years, because it reclaims citizens' empowerment and active implication on behavioral change.

Moreover, urban planning will need to acquire as well also a sense of flexibility in order to be able to assume the new dynamics of cities, towns and villages.

A. Renewable Energy Community holistic approach

Most of the contributions to a resilience rural model are related to promote a new energy model based on local renewable sources and sharing management through local energy communities [13]. According to the technical and methodological approaches of all Modular Projects within the Renewable Energy Community, the different kind of contributions can be addressed to four policy pillars: *Climate Change, Energy Transition, Land use Planning and Circular Economy*. These contributions at the same time represent some parts of the ecosystem of actors and processes that shape the new energy model.

TABLE I
POLICY PILLARS OF RENEWABLE ENERGY MED COMMUNITY PROJECTS

POLICY PILLARS	RE COMMUNITY CONTRIBUTIONS	MODULAR PROJECTS
CLIMATE CHANGE	Mitigation: Increasing RES production Adaptation: Prevention of energy facilities provision	PRISMI/ FORBIOENERGY/ COMPOSE/STORES
LAND USE PLANNING	Planning tools: RES potential Modeling for planning	PRISMI/ FORBIOENERGY/ COMPOSE/STORES
ENERGY TRANSITION	Planning, governance and management tools	LOCAL4GREEN/ COMPOSE/ FORBIOENERGY
CIRCULAR ECONOMY	Fiscal energy policies for local level application. Microgrids management alternatives	LOCAL4GREEN/PEGASUS/STORES/ FORBIOENERGY

The contribution of RE Community to Climate Change mitigation and adaptation is to promote local RES production and energy facilities provision. The increment of electric uses will require by one side, the improvement of storage systems that make more feasible microgrids management, on the other hand, urban planning will need to assume in different scales a minimal space (area) for energy facilities and infrastructure provision.

The contribution from RE Community to land use planning is in the development of several software and assessment tools that contribute for a more precise estimation of RES potential in local level.

People are one of the essential targets of energy transition organized through energy communities. This requires of several governance tools in order to achieve citizen's awareness and engagement. RE Community Projects promote bottom-up strategies to encourage the use and access of clean energy through several governance tools. These tools enable implementation of greener energy rural policies.

RE Community contributes to circular economy with new management tools that can help to implement new business models based on services and value chain. For one side, energy biomass value chain based in reuse of forest management materials; energy fiscal policies that incentive the investment on local RES production including economic activities; and microgrids for energy sharing business models.

The sum of all contributions, bring out the possibility of capitalize them as an ecosystem of tools and methods that can provide an integral roadmap to be implemented on territories. For that reason, the Renewable Energy Community proposes Ecosystemic Transition Units for this alternative roadmap whose principles are define according to Mediterranean needs and facing their main concerns.

The roadmap consists of an integral territorial planning and management process for a disruptive energy model, based on fiscal policies and diversified renewable production, scaling storage scenarios for the economic and environmental optimization of local, clean energy sources.

B. Principles of ETU Model

The Renewable Energy Community aims to drive its capitalization strategy through ETU's implementation into National regulatory framework in order to recognize rural and islands areas as potential resilient territories. An ETU should ensure a set of basic components that will allow them to obtain the application to green fiscal policies and subsidies in order to accelerate their energy self-sufficiency, job creation and social development. The basic components are classified in four groups: *energy community; energy planning; energy facilities and energy governance* (Fig. 3).

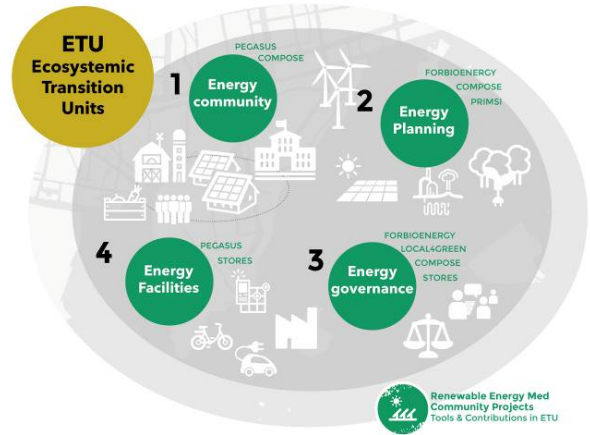


Fig. 3. Ecosystemic Transition Units conceptual scheme. BCNecologia

TABLE II
ETU'S PRINCIPLES, COMPONENTS AND TOOLS

PRINCIPLES	COMPONENTS	TOOLS RE Community
EMPOWERED ORGANIZATION	ENERGY COMMUNITIES An ETU must count with an engaged energy local community able to boost their sharing systems management	COMPOSE /Rural empowered communities Citizens' Awareness tools
RESILIENT ANTICIPATION	ENERGY PLANNING An ETU must ensure that it counts with energy assessment studies about potential local RES and energy efficiency future scenarios.	PRISMI/ Energy PlanTool ForBioEnergy/Biomass value chain assessment tool COMPOSE/Planning Tool
FAIR MAINTENANCE	ENERGY GOVERNANCE An ETU must count with local policies that ensure its maintenance on time, establishing incentives and energy local communities regulatory framework	LOCAL4GREEN/Green fiscal and tax policies COMPOSE/Citizens' Awareness tools ForBioEnergy /Biomass Forest regulatory framework
GREEN EFFICIENCY	ENERGY FACILITIES An ETU requires of equipment and energy infrastructure to make function energy sharing systems based on self-production and self-consumption.	PEGASUS/Microgrids infrastructure STORES/ Storage systems and community storage systems

The aim of an Ecosystemic Transition Unit as a model and is to establish a methodological unit of organization able to integrate a multilevel coordination in order to help accelerate clean energy transition planning and implementation at local levels.

From the point of view of RE Community capitalization, ETU represents a method where projects can offer their expertise, tools and methodologies in an integral thinking basis to other territories.

C. ETU Scale

A territorial unit should be able to maintain its functionality based on a green sustainable economy, but to achieve this, requires of a minimal critical mass of persons and activities with an adequate equilibrium of land use distribution. Rural and remote areas have as one of their main constraints the lack of critical mass in a same geographical area. In order to know which should be the optimal ETU scale on Mediterranean Area, a first analysis has been done for Municipalities in France, Italy and Spain and it is expected to apply for the rest of Regions in MED countries (see Appendix).

D. Building a common MED ETUs denomination

With the objective to take into account the needs and will of the Interreg MED local territories, the GREENCAP project will organize 6 regional consultation, to consensus the concept and build a common denomination of “Ecosystemic Transition Units” at MED/EU level. The consultation will include all the relevant stakeholders related to Renewable Energy and territorial planning of 6 Interreg MED countries: Spain, France, Italy, Slovenia, Greece and Bosnia-Herzegovina. The shared and consolidated results of these consultations will allow creating dedicated policy papers that will be presented at EU level.

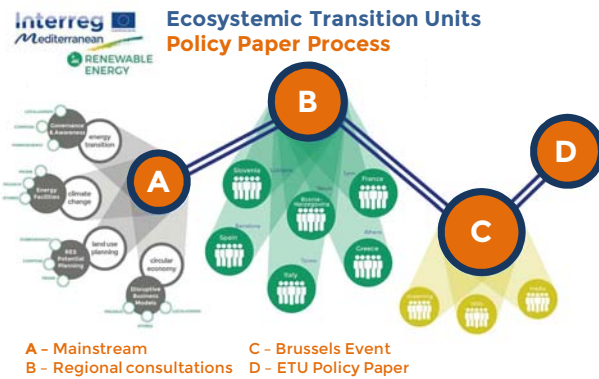


Fig. 4. Scheme of Policy Paper Process of the Interreg Med Renewable Energy Community.

E. Transferability to Interreg Med Cooperation Area and other similar areas

Current territorial planning requires of tools and cross-cutting methodologies that guide local authorities to incorporate a holistic vision into resources management linked as well with social and economical development.

Regarding to rural contexts, revitalization strategies must be implemented taking into account limiting factors such as land use planning, facilities provision, connectivity, life expectancy, risk of social exclusion and resource management, within others.

Energy transition can provide a starting point of revitalization process in rural and island areas. The new energy model based on prosumers and energy local communities should encourage rural development, boost job creation through an alternative green economy.

The opportunities that Ecosystemic Transition Units can bring to energy efficiency and urban metabolic challenges such as water, food and waste management, are promising and can represent an effective integral transition process that also serves of reference to transferring it to other contexts. Seeing the similar characteristics of territories also outside of the Interreg MED Cooperation Area, this model could be adapted and transferred into other contexts as for instance the whole MED basin, including also the south shore of the Mediterranean Sea and also the rural areas of the Central Europe and Balkan territories.

IV. APPENDIX

Territorial occupation analysis presents a different dispersion patterns in three countries analyzed: France, Italy and Spain according to population densities respect urban land use areas.

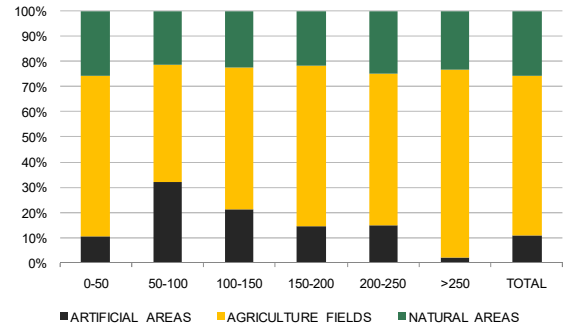


Fig. 5. Distribution of land uses by ranges of population density (inhabitants/ha of urban land use) in French Municipalities.

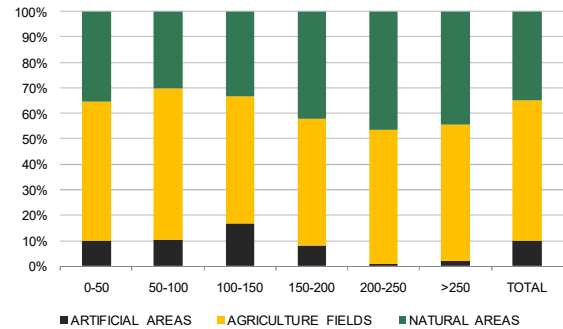


Fig. 6. Distribution of land uses by ranges of population density (inhabitants/ha of urban land use) in Italian Municipalities.

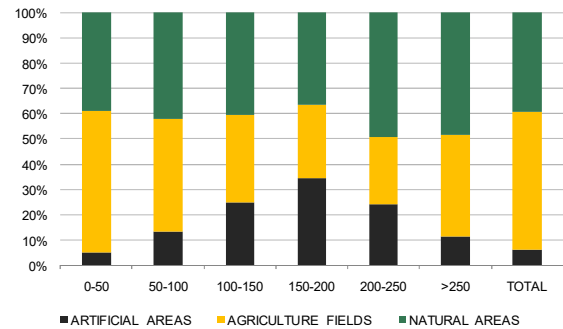


Fig. 7. Distribution of land uses by ranges of population density (inhabitants/ha of urban land use) in Spanish Municipalities.

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VII. BIOGRAPHIES

Cynthia Echave has architecture background specialized in urban ecology. She holds a Doctoral degree in Energy and Environment from Polytechnic University of Catalonia UPC. Since the last 15 years she is at Urban Ecology Agency of Barcelona where she is currently Lead Project Manager. She coordinates projects of urban transformation based in a holistic vision, developing assessment methodologies and implementation strategies. She has a wide experience coordinating multidisciplinary teams leading projects at national and international level with different scopes such as mobility plans, public space, energy planning and ecological urbanism. She has co-authored several publications and serves as a Professor at the Architecture School of University La Salle in Barcelona.

Danilo Čeh have economical background specialize in the development and implementation of the EU project and political initiatives. He holds a master of management from University of Primorska and B.A of Economy from University of Maribor. He work more than 12 years in the Scientific Research Centre Bistra Ptuj. He is currently Head of project office for national and EU projects. He has wide experience in developing and implementing EU project focus on European transnational cooperation. He works also as expert for municipalities on different scopes as town management, urban mobility, development of tourism and renewables-focus on waste management.

Alexia Boulanger is born in France, on April 21, 1982. She graduated from the National School of Engineers of Limoges (ENSIL), in 2006. She is actually employed in Environment Park, a scientific and technology park, dedicated to Environment and clean technologies, in Turin, Italy as project developer. She has a huge experience in implementing project in the MED area, both in the south and in the north shore of the MED Sea, on topics related to industrial water treatment, industrial areas management, waste management and renewable energy. She is currently the representative of the partner Environment Park in the GREENCAP project, horizontal project of the Interreg MED programme, managing the RES Community.

Jennifer Shaw-Taberlet is a PhD chemist who performed research for 5 years in fields ranging from hydrogen fuel cells to molecular devices to targeted drug delivery. She has 12 years' experience in setting-up and managing large-scale open innovation projects. She is currently the European Mission Coordinator at Axelera, a network of 375 members in chemistry and eco-technologies. She helps set-up eco-efficient, clean, innovative and circular value chains supported by European policies and funding.