Resilience Challenges to Climate Change in the "LIFE for Silver Coast" Project

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***Abstract*—Territorial and urban regeneration is a recurrent theme, especially with regard to ecological transformation, as a reaction to climate change. Complex impacts on cities and rural areas ecosystems come from Global Warming therefore, effective counter-measures are necessary to address such issues. External stresses put great pressure on urban and suburban frameworks. Thus, Institutions, communities, private actors and even inhabitants are involved in hard challenges with the aim of improving the resilience of their own realities. In this work, a case-study about Climate Change resilience for Tuscany Region (Italy) is presented. The "LIFE for Silver Coast" European Project realizes a Sustainable Mobility System, in the famous area known as "Silver Coast". The Project will contribute to improve the territorial resilience, in different ways. Relying on Renewable Energy Sources (RESs) and thanks to the full electric vehicles of its fleet, the "LIFE for Silver Coast" will have a direct impact on Climate Change mitigation, because of significant reductions in CO_2 emissions. This result will represent a strong preventive countermove to climate changes. The control over the environmental effects is a very remarkable aspect. The environmental monitoring activities (through several monitoring stations) and the Life Cycle Assessment (LCA) will contribute to generate consciousness about the Mobility System responses to Climate Change stresses, which is a crucial aspect for improving resilience. This way, effective and efficient reactions will come from the ecosystem, thanks to an accurate action planning, based on acquired knowledge. Moreover, the "LIFE for Silver Coast" will increase resilience, making the social-economic system more stable. New business opportunities for stakeholders will lead to more jobs and moreover local communities and Institutions will work together, in a synergistic network. It will be possible to reach a common consciousness about the territorial ecosystem by exchanging information and solutions for continuously increasing performance and benefits. This distributed knowledge and knowhow will act as an elastic tissue for external pressures adsorption, in case of sporadic punctual failures. The inner innovation and the synergistic organization of the "LIFE for Silver Coast" Mobility System will be powerful enough to strengthen the resilience of the whole area of interest, not only with regard of Climate Change effects.**

I. Introduction

Humankind has strongly influenced the increment in global temperature. In fact, a roughly 30% increment in CO2 emissions, since the Industrial Revolution, has been assessed [1]. As a reaction to Global Worming, energy production is relying more and more on Renewable Energy Sources (RESs), with the aim of breaking down emissions. Even if the RESs exploitation is only at the beginning, roughly 15% of the world total energy supply depends on RESs, with a constant growth. Indeed, a doubling of world RESs electricity generation has been predicted, by 2035 [2]. Both rural and urban areas are subject to different kind of Climate Change impacts [3]. Among the direct effects there are storms, typhoons, heat waves, sea level rise, general temperature increase and changes in rainfall patterns. Nevertheless, also indirect impacts have to be taken into account. According to [3], indirect effects bring to significant disruptions in the socio-technical networks: coastal flooding causes issues to the transport network, on the coastline; droughts have negative effects on food and agriculture.

As a reaction, rural and urban realities are involved in progressive changes and in taking smart choices about their organization and structure. Thus, cities and their neighboring lands have to work on the improvement of their resilience to face the new challenges against the Climate Change effects. The idea of resilience is used in many different disciplines, from Engineering to Psychology and Ecology but it is also increasingly applied in Economics [4]. The origin of the term comes from Engineering: "It is the property of a material (elasticity) to retain its original form (bouncing back) after being subject to temporary stress" [5]. In the Climate Change context and according to the Intergovernmental Panel on Climate Change (IPCC) definition, resilience is the ability of a social or ecological system to absorb disturbances while retaining the same basic structure and ways of functioning, the capacity of self-organization, and the capacity to adapt to stress and changes [6]. Moreover, it is worth mentioning that different time and mode in responses come from different kinds of stresses [7].

Referred to the urban sphere, resilience is the capacity of a city to absorb disturbances and shocks related to Climate Change, while retaining the same basic structure and way of functioning [8]. A better explanation of resilience is provided in [9], with a specific reference to the urban case. According to Literature, urban resilience is composed by three elements: Systems, Agents and Institutions. A System is an high level infrastructure that guarantees essential services to the city.

The city electricity distribution grid is an example of System. Agents are communities an individuals in the city. They represent a crucial node because they have the power to make decisions and to interact with the Systems or, in other words, their activity concerns the management of urban Systems. Farmers, consumers, private and public sector organizations are examples of agents. Institutions act on an higher decision level. According to Social Sciences, the meaning of Institution refers to the bunch of social rules or conventions, which structure human behaviour, together with exchanges in social an economic interactions. Institutions enable or constrain Agents in the organization and engagement about decision making. With reference to the above description of resilience, the example of a water supply system will be briefly set for better understanding the idea of resilience, through a practical application. At System level, in order to guarantee flexibility in facing emergency states, pumping stations in multiple sites have to be planned together with geographically distributed water sources exploitation. Again, protection and monitoring of the source quality, under climate stress conditions and water interlinked network distribution have to be provided, in case of System failures. At the Agent level, both suppliers and users are involved in enhancing resilience. Suppliers have to monitor the System and to cherish supply sources, in order to achieve a better system responsiveness to environmental changes. Users have to develop their capacity to learn from water resource information with the aim of improving a fair water use. At the Institution level, more affordable lifeline tariffs lead to an in increment in the service usability. In addition, water allocation rules and legal procedures have to be considered to supply potable water to all citizens, even under stress conditions. Thus, achieving resilience is an hard path that goes from building concrete infrastructures to the reinforcement of communities an local governments, with reference to their power to act. Resilience to Climate Change in rural and urban areas is maintained (and when possible improved) by adopting interesting solutions. The Asian Coalition for Community Action Network is a project which concerns the grassroots level of resilience. Communities (more than 1000) visit each other city to learn how to improve resilience and the possibilities to make changes [8]. Resilience planning activities have been performed by 10 medium-size cities in the Asian Cities Climate Change Resilience Network (ACCCRN), over a period of 7 years, from 2008 [8], [7]. Health, infrastructure, water, disaster, urban planning/development are the most relevant topics, in ACCCRN [9]. In [10], a Canadian Western Arctic community social-ecological resilience is taken into account. Local environmental knowledge, inter-community trade and community experience sharing improves reactive adaptation to Climate Change effects, on the Arctic environment. For example, a better knowledge and the best practical skills about living in that specific area, spread through oral tradition, can enhance the odds people properly react to critical situations besides making the link between people and the environment evolve. An interesting case-study in Italy is described in [11]. Environmental resilience in Basilicata Region is studied, highlighting the desertification risk due to land-use, for two coastal sites. Urbanization, the increase in population, forest fires, land abandonment in rural areas and rapid expansion of tourism are relevant factors of land-use. With regard to coastal areas, soil erosion, salinisation and water pollution are some of the problems to face. In the case-study, geo-referenced land use layer maps are drawn to achieve and ordered database for analyzing annual rainfalls and defining an "aridity index". With this information, the work contributes to the integrated assessment of land vulnerability and the identification of a sensitive Mediterranean areas which need an intervention. In order to deal with Climate Change effects, performing a reduction in greenhouse gas emissions is an mandatory step. Improving buildings energy efficiency [12] is a good action to mitigate Climate Change impacts.

Moreover, green energy leads to appropriate distribution systems, which must be reliable for improving urban resilience. Information and Communication Technologies (ICTs) systems have to cope with service disruption and massive power failures as well as energy losses. In a whole sense, the role of Research is crucial in terms of resilience, for reaching a complex social and ecological systems adaptability to changes. Innovation for a sustainable future is the main purpose of Polo per la Mobilitá Sostenibile Laboratories (POMOS) of the University of Rome La Sapienza. Since 10 years, POMOS carries on Research in developing electric vehicles [13], Energy Management Systems (EMS) and Battery Management Systems (BMS) [14],[15],[16]. Moreover, POMOS has contributed to the increment of socio-ecological resilience, starting from Ventotene Island (Italy), in 2010 [13]. In 2013, the use of an electric boats fleet was planned by POMOS for Pianura Pontina (Italy), in the the Bonifica 2.0 Project [17],[18]. Since 2017, POMOS is the Coordinator of the LIFE for Silver Coast European Project (LIFE16 ENV/IT/000337), which aims at realizing a Sustainable Inter-modal Mobiliy System for the Silver Coast (Tuscany, Italy) [17], an area with naturalistic and touristic relevance.

This work, which describes the LIFE project, underlying its contribute to the resilience of the "Silver Coast", is organized as follows: the naturalistic and social relevance of the territory are described in Section II;in Section III, the main features of the "LIFE for Silver Coast" Project are presented; in Section IV, more details about the Sustainable Mobility System are shown; Sections V and VI illustrate the environmental monitoring and the Life-cycle Assessment (LCA) methodology (respectively), performed in the context of the Project; in Section VII, the involvement of local actors and the resulting benefits are explained; in Section VIII a critical analysis about the resilience increment, led by the LIFE Project, is unfolded; conclusions are in Section IX.

II. Area of interest

The "Silver Coast" is an area of touristic and naturalistic relevance, in the Southern Tuscany (Italy), near the border between Tuscany and Lazio (Fig. 1). The name "Silver Coast" comes from the peculiar silvery color of some stretches in its beaches, which are rich in Iron. The Coast comprehends Monte Argentario, Orbetello, Magliano and Isola del Giglio. The territory is quite heterogeneous, due to the presence of a peninsular subarea, (from Monte Argentario to the East and the North-East) and an insular subarea, which mainly consists of Isola del Giglio. A geographic peculiarity of the Silver Coast are the two pillows between Monte Argentario and the rest of the peninsula: the Giannella, on the Northern Occidental side and the Feniglia, on the Southern Oriental one.

Fig. 1. Map of the area of interest.

The "Silver Coast" is rich in naturalistic beauty and sightseeing places, which remark the touristic importance, in the National panorama. Orbetello, although it is not a big city, has a great historical weight. In fact, it hosts ancient Etruscan ruins, dating back to the 5th century B.C.. Furthermore, Orbetello is part of a natural reserve interested by the migration of protected birds species, for example the pink flamingo. A pristine natural habitat can be observed in the WWF Oasis and the natural reserve of Duna Feniglia, which can be accessed from the two pillows of Giannella and Feniglia. In Monte Argentario, a Panoramic Road connects Porto S. Stefano and Porto Ercole harbors. Along the road, it is possible to enjoy the view of the Tuscan Archipelago. Isola del Giglio offers a crystal clear sea, besides the charming medieval village named Giglio Castello. Least but not last, the Silver Coast comprehends a relevant part of the Maremma Natural Park, in the North and the Giannutri Island, which is a sea protected area.

III. Project overview

The "LIFE for Silver Coast" Mobility System will brought to completion according to the scheme shown in Fig. 2.

Fig. 2. Map of the LIFE Project.

The Project will cover a significant area (approximately 200 km^2) both on land and sea and also on lagoon. In fact, as it can be seen in Fig. 1, the peculiar conformation of Monte Argentario shapes two lagoons, bounded by the Giannella (North) and the Feniglia (South) pillows. The Mobility System will be connected to the Orbetello railway station, which is considered the main access transport node. The core of the land-side part of the System will be centered closely to the above node. Once arrived at the Orbetello railway station, users will find car sharing and bike sharing charging stations, thus they can start their trips towards Monte Argentario or inside Orbetello itself. In other words, it will be possible to cross the whole peninsula by e-bikes, e-cars and e-buses. In addition, into the lagoon-side and sea-side parts of the System, users will sail on the two lagoons or on sea (for brief routes) both in Monte Argentario and Isola del Giglio.

IV. The Mobility System

The Mobility System (Fig. 3) consists only of Zero Emissions Vehicles (ZEVs): 80 e-bikes, 20 e-scooters, 14 e-cars, 2 e-buses and even 4 e-boats. The main transport access node, the Orbetello railway station, is represented by the white circle, on the map (Fig. 1). Users enter the transport graph with a single ticket, for all the transport modes. Thanks to the multi-modal nature of the system itself, users can move freely on the area of interest. With reference to the map in Fig. 2, it is possible to use one of the two "Valentino" lagoon electric boat (Fig. 3) to cross the lagoons between Orbetello and the two pillows of Giannella and Feniglia. If users choose to sail to North, they can take another "Valentino" e-boat to reach Porto S.Stefano, in Monte Argentario. Charging stations for e-bikes and e-cars are distributed over the area of interest, letting users travel among every part of Monte Argentario.

Fig. 3. The Mobility System.

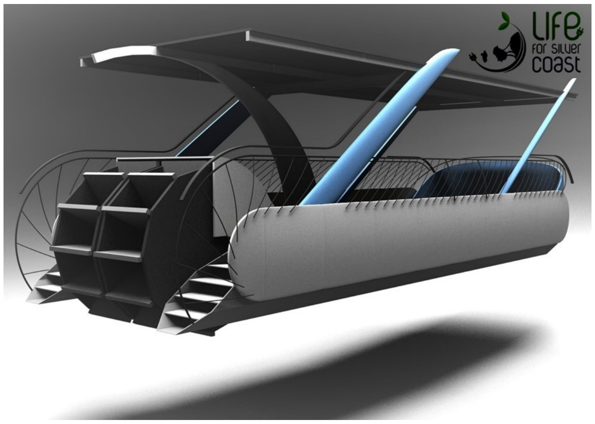

Fig. 4. The “Valentino” full-electric boat.

Another “Valentino” e-boat connects the Southern Monte Argentario with Porto Ercole. Further sea connections are covered, in the Northern Isola del Giglio. The two main innovations of the Mobility System are the “Valentino” e-boat and the “e-Hub 360” (Fig. 3). The “Valentino”, realized by POMOS, is a full-electric boat which has been designed to be inherently flexible. In fact, it can sail both lagoon and sea waters (two different models have been realized to do so). Furthermore, a Photovoltaic (PV) roof guarantees an energy supply, although the battery can be charged when the “Valentino” is docked. The “e-Hub 360” is a cylindrical e-bike charging station with a PV roof, which supplies energy for self-sufficiency. The Hub can host 14 e-bikes, with an automatic inclusion/extraction system. The Mobility System is supported by an Information Platform through which users can do so many things, like achieving information about the ticket price, for the next trip.

V. Environmental monitoring

The assessment of a project environmental impacts is a very relevant issue. Whatever project implementation, (ordinary or experimental), must take into consideration a wide range of aspects, which can lead to dangerous consequences for the environment. So many methodologies are implemented to permit the evaluation of the above impacts and each one inevitably relies on input data. The latter are sometimes called “inventory data” and they represent the fundamental informative base for the needed assessment procedures. With input data, it is possible to define the current state of the environmental implications of a project. In addition, thanks to the above information, the comparison with previous states can be performed, together with a tracking of different states, over time. Moreover, data are used to define indicators and, on an higher hierarchical level, performance indexes for a critical assessment of the impacts. The “Valentino” full electric boat. A differentiation is often done among environmental input data, depending on the type of the considered impacts. If a project was born for mitigating Global Worming (GW), the concentration of a specific set of substances, which contribute to the increment of the temperature on the global scale, has to be monitored. In this case, CO_2 is the main substance to take into consideration. In fact, with reference to the United Nations Framework Convention on Climate Change (UNFCCC), the effects on Climate Change of the greenhouse gases (CH_4, N_2O, etc...) can be expressed in CO_2 equivalent effects, through the Global Warming Potential (GWP), associated to each above gas.

The aim of a project can be also the air quality enhancement. In general, in this situation, it is not necessary to consider CO_2 but this can not be said for other greenhouse gases because they can have negative effects both on Climate and air quality (e.g.: CH_4). In order to meet the need for input data, environmental monitoring is performed, thanks to specific tools (or methodologies). The “LIFE for Silver Coast” Project is an air quality project. The air quality assessment is possible only thanks to a periodical data retrieving, for environmental performance tracking. Environmental monitoring stations (Fig. 5) will be dislocated on the area of interest.

Fig. 5. One of the environmental monitoring stations, used in the LIFE Project.

One of the environmental monitoring stations, in the Life Project. Each station can measure the concentrations in the main air pollutants, namely SO_2, PM_{10}, O_3, NO_2, H_2S, CO, NH_3 and $PM_{2.5}$. The achieved measures are then stored in a cloud platform, in charge of processing them and returning an organic representation of air quality, for each pollutant.

VI. Life Cycle Assessment (LCA)

The LCA is a required step for the Project. It is a methodology regulated by the International Standardization Organization (ISO) through two Standards (ISO 14040 and ISO 14044). The aim of the LCA is not peculiar or well defined, in fact is can be applied to assess many aspects, related to a product or a service. To set some examples, the LCA can be adopted by an actor with the purpose of enhancing the economic revenue of a product or a provided service as well as the performances of the production processes, in terms of consumed energy. Similarly, the environmental impacts of a project, in a wide sense, can be precisely assessed with an LCA.

Even if the applications can be vary variegated, the LCA is organized with expertise in subsequent phases, which can not be skipped or omitted because they depend from each other. In Fig. 6, the scheme of the LCA methodology is divided into four interconnected slots. The meaning of this inner interconnection is crucial: it represents the informative sharing process between different phases, highlighting the iterative nature of LCA itself. To be more clear, because of the fact that the LCA can be implemented in various life-cycle steps of a projects it often happens that new information will be available after an evolution in time and data at the previous step will have to be updated.

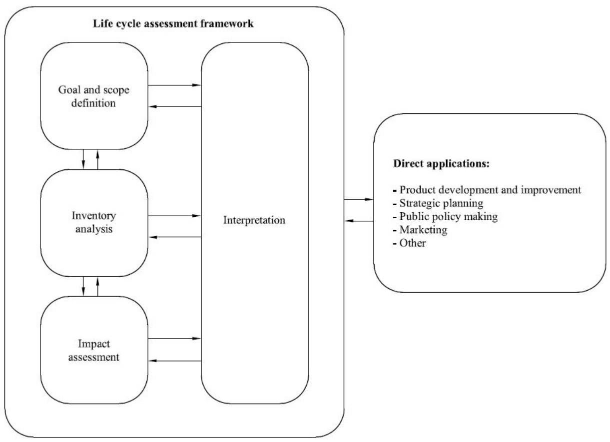

Fig. 6. Stages of an LCA (ISO 14040).

It is possible to perform an LCA referring to different lifecycle phases of a product or a provided service. For example, if the LCA involves every single step, from the production to waste disposal, it is called "cradle to grave" LCA. Instead, if the LCA refers to a particular phase (or a sequence of phases) in a life-cycle, (like the operating time of an automated machine), the LCA is called "gate to gate". It is obvious that each approach needs for different data, both in a qualitative and a quantitative way. The choice among these alternatives is strictly related to the target of the actor. Sometimes, the Analysis is focused on the actor activity who opts for a "gate to gate", according to the process he is interested to, purposely neglecting the supply of raw materials. In other cases, a wider point of view is needed for the evaluation of the complete set of a project impacts (not only the environmental ones) and a great set of data, as a consequence. The "cradle to grave" LCA is clearly more descriptive of a project but if the great quantity of efforts to obtain so many data is not justifiable and correlated with the target of the actor, it could become a resources and time waste. The first phase of the LCA is the System Definition. This is the most important phase in terms of strategic planning. More precisely, it consists of defining one or more systems that represent the whole project. A system is drawn through a boundary, which divides the the external environment from all the inner processes and flows. The former are the procedural steps through which it is possible to produce a product or to provide a service. The milling could be a process of the system that represent the hull of a boat (the product). The latter are quantities of energy, material and products between processes, both as input and output. Moreover, also polluting emissions are to be considered system flows. With reference to the previous example, the energy needed for the millining procedure is an input flow of the process and the treated hull, together with the emissions, defines its output flow. It is clear that an imprecise system definition (especially when there is a global system with numerous subsystems) will lead to a misleading quantification of the system flows and, as a consequence, a wrong overall assessment.

Once the system is correctly defined, it is time to quantify every system flow in the next LCA phase, called Life-Cycle Inventory (LCI). It is important to note how this phase and the previous one are strictly related to each other, in the way that the former is the qualitative organization of the methodology and the latter the quantification contribute. Every flow must be referred to a Functional Unit, which could be a specific time interval in the exercise of a boat (in a Gate to Gate LCA). In this case, the system flows units would be $kWh\Delta t$ and/or $g\Delta t$, where Δt is the aforesaid interval. Once the LCI is completed, the system is filled with the needed information about input and output and it is possible to pass to the next step.

In the economy of an LCA, the LIFE-Cycle Impact Assessment (LCIA) is always a fundamental step. To be more precise, every system must not do without the environmental impacts, strictly speaking. All the information coming from the LCI are elaborated considering a set of Impact Categories. These are compartments in which the negative effects of pollution are insulated, according to their nature, like Acidification (of waters). For every single Category, it is necessary to quantitatively assess the impacts through Key Performance Indicators (KPIs). To set and example, for the Acidification category, the KPI is the Proton Release (H^+). The choice of both Category and KPI is not trivial. In fact, only with a good consciousness about the system and its targets (said that the LCA is an iterative procedure) it is possible to choose the most relevant Categories. Moreover, each Category implies a scientific explanation of its KPIs, related to the physical phenomenon of reference. That is, the Acidification depends of the concentration in NO_x, SO_2 and other substances but the direct cause of the phenomenon is the Proton Release, which becomes the correct KPI, for this category.

At this point, all the descriptive information about the system and its impacts are complete. All that remains is to interpret the results. In the phase of Life-Cycle Interpretation, a kind of inference on data is performed, in order to contextualize information and to provide a pondered assessment, useful to take decisions. In this context, information is expressed in percentage, in relation to a reference value taken from Literature or compared to the same at a reference state of the system; comparisons between similar systems can be done; average, standard deviation, outlier points in data are calculated and reported. In other words, the overall performance of the system is estimated. At the end of this last phase, the LCA is generally revised by experts, who control all the steps of the methodology.

The LIFE for Silver Coast Project is a system which involves different sub-systems: e-bike, e-scooter, e-car, e-bus, e-boat, "e-Hub360", Informative Platform and dissemination material. Among the various steps of the LCA, it is relevant that the Impact Category (Global Warming) KPI is the emitted Equivalent CO_2 (in $kgCO_{2eq}$), according to the UNFCCC definition. The CO_{2eq} counts the effects of all of the previously cited greenhouse gases, reported in CO_2. Results in emissions have been compared with ordinary internal combustion powered vehicles emissions, with good results.

VII. Local realities involvement

Some aspects of the LIFE for Silver Coast Project have to be thought as Research and experimentation while other ones, as mobility services provision to inhabitants and tourists in the Silver Coast. These aspects are strictly connected to each other with the aim of providing a sustainable and innovative mobility service to be used when the project is active and also when the project will finish. In fact, at the end of the project (2021), the mobility system will be available for investors that will continue to manage and maintain the services. In this context, it is important to create connections between the Project, local stakeholders and organizations. Local actors represent the inner functioning grid of the territory and can offer many services to a Project like the "LIFE for Silver Coast", firstly by supporting the Project spreading (they can promote the offered services). The link to the stakeholders can favor the Mobility System growth also after the end of the Project. In fact, in the phase of handover, investors for the system will be found and the local stakeholders could represent a potential pool, with this perspective. In other words, the Project involves local actors in the overall activities, aiming at a penetration of the Mobility System in the territory.

The collaboration with many local actors is not so easy to achieve, especially considering that the Project is in its development phase. More precisely, there is not a current product or service to exchange with a potential stakeholder in order to stimulate him to participate. More wide sense agreements are needed to involve the actors with the perspective of benefit. A suitable tool is the Memorandum of Understanding (MoU), which defines an agreement in principle, focusing on the most important aspects of a future contract or more defined agreement. Many MoUs have to be signed in the "LIFE for Silver Coast" and currently some of them have already signed.

VIII. Resilience to climate change

The LIFE Project will contribute to a better territorial resilience, in different ways. Relying on Renewable Energy Sources (RESs) and thanks to the full electric vehicles of its fleet, the LIFE for Silver Coast will have a direct impact on Climate Change mitigation, because of reduction in CO_2 missions (1200 t over 3 years, expected). That result will represent a strong preventing countermove to climate changes, with the purpose of making the area of interest less vulnerable to the deterioration of its naturalistic beauty and natural reserves. Reductions in air pollutant emissions will give to inhabitants and tourists a more healthy environment to live in. This will lead to a more livable territory, suitable for a better tourist attraction. It is also interesting to underline the importance of control over the environmental effects, in the context of the Project. The monitoring activities and the LCA studies will contribute to generate consciousness about the system responses to Climate Change stresses, which is a crucial aspect for resilience improvement. This way, effective and efficient reactions will come from the ecosystem, thanks to an accurate action planning, based on acquired knowledge.

Resilience is thus enhanced by performing a more detailed control over the area of interest, tracking its evolution in the desired indicators. The LIFE for Silver Coast will increase resilience of the territory also making the social-economic system more stable. Many stakeholders will be involved, with the perspective of an improved tourist attraction capacity and possible profits will come from that. This will grant a more stable economy in the Silver Coast, with consequent effects on population. In fact, the Project predicts new jobs both in the mobility system itself and in the contingent business environment (local stakeholders). Local communities and Institutions will work together, in a synergistic network. It will be possible to reach a common consciousness about the territorial ecosystem by exchanging information and solutions, to continuously increase performance and advantages. This distributed knowledge and know-how will act as an elastic tissue for external excitation adsorption, in case of sporadic punctual failures. In other words, the territory will progressively become like an organic system with an accurate sensitivity towards the external stimulation and a proper reaction architecture for stability maintenance.

IX. Conclusion

The Mobility System of the LIFE Project will be implemented with many advantages for the Silver Coast. First of all, the naturalistic beauty preservation of Silver Coast will be achieved. As a consequence, tourist flows will be improved, with new business opportunities for stakeholders and, therefore, more jobs. In addition, Institutions, local communities and even users will cooperate to take care of the whole system reliability. These features make the LIFE Project be more than an innovative Mobility System but an efficient engine for resilience enhancement. The Project will fulfill the EC expectations by enhancing air quality and mitigating Climate Change impacts, in the Silver Coast. The inner innovation and synergistic organization of its Mobility System will be powerful enough to strengthen the resilience of the whole area, not only with regard of Climate Change effects. To conclude, the "Life for Silver Coast" European Project is not only an innovative implementation of sustainable technologies but also a powerful tool for achieving the "Silver Coast" preservation, with a view to the territory regeneration.

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REFERENCES

[1] N.L. Panwar, S.C. Kaushikb and S. Kotharia, Role of renewable energy sources in environmental protection: A review, *Renewable and Sustainable Energy Reviews*, vol. 15, no. 3, pp. 1513-1524, 2011.

[2] O. Ellabban, H. Abu-Rub, F. Blaabjerg, Renewable energy resources: Current status, future prospects and their enabling technology, *Renewable and Sustainable Energy Reviews*, vol. 39, pp. 748-764, 2014.

[3] J. da Silva, S. Kernaghan and A. Luque, A systems approach to meeting the challenges of urban climate change, *International Journal of Urban Sustainable Development*, vol. 4, no. 2, pp. 125-145, 2012.

[4] L. J. Vale, The politics of resilient cities: whose resilience and whose city?, *Building Research and Information*, vol. 42, no. 2, pp. 191-201, 2014.

[5] A. Mehmood, Of resilient places: planning for urban resilience, *European Planning Studies*, vol. 24, no. 2, pp. 407-419, 2015.

[6] S. Tyler and M. Moench, A framework for urban climate resilience, *A framework for urban climate resilience, Climate and Development*, vol. 4, no. 4, pp. 311-326, 2012.

[7] E. Giovannini, L'utopia sostenibile(The Sustainable Utopia) , *Laterza*, 2018.

[8] D. Satterthwaite, The political underpinnings of cities accumulated resilience to climate change, *Environment and Urbanization,*, vol. 25, no. 2, pp. 381-391, 2013.

[9] Evans J., Resilience, ecology and adaptation in the experimental city, *Transactions of the Institute of British Geographers*, vol. 36, pp. 233-237, 2011.

[10] F. Berkes and D. Jolly, Adapting to climate change: social-ecological resilience in a Canadian western Arctic community, *Conservation Ecology*, vol. 5, 2001.

[11] L. Salvati, A. De Angelis, S. Baiocco, A. Ferrara and M.P. Barone, Desertification Risk, Long-Term Land-Use Changes and Environmental Resilience: A Case Study in Basilicata, Italy, *Scottish Geographical Journal*, vol. 129, no. 2, pp. 85-99, 2013.

[12] S. Hallegatte, J. Corfee-Morlot, Understanding climate change impacts, vulnerability and adaptation at city scale: An introduction, *Climatic Change*, vol. 104, pp. 1-12, 2010.

[13] G. Fabbri, C. Boccaletti, L. Anniballi, M. London, F. Calenne, F.M.F. Mascioli, and A.J.M. Cardoso, Adding ICT to Transportation Systems: Monitoring and Management System for the Electric Vehicle Fleet on the Island of Ventotene, *International Journal of Computer Theory and Engineering*, vol. 5, no. 2, 2013.

[14] M. Luzi, M. Paschero, A. Rossini, A. Rizzi and F. M. F. Mascioli, Comparison between two nonlinear Kalman Filters for reliable SoC estimation on a prototypal BMS, *IECON 2016 - 42nd Annual Conference of the IEEE Industrial Electronics Society, Florence*, pp. 5501-5506, 2016.

[15] S. Leonori, M. Paschero, A. Rizzi and F. M. F. Mascioli, An optimized microgrid energy management system based on FIS-MO-GA paradigm, *2017 IEEE International Conference on Fuzzy Systems (FUZZ-IEEE), Naples*, pp. 1-6, 2017.

[16] S. Leonori, E. De Santis, A. Rizzi and F. M. F. Mascioli, Optimization of a microgrid energy management system based on a Fuzzy Logic Controller, *IECON 2016 - 42nd Annual Conference of the IEEE Industrial Electronics Society, Florence*, pp. 6615-6620, 2016.

[17] G. Fabbri, M. Dess, F.M. Frattale Mascioli, M. Paschero, S. Sgreccia, L. Anniballi, Luigi, S. Nardecchia, Bonifica 2.0: An Integrated Territorial System of Sustainable Mobility and Micro Smart Grids, *2014 IEEE 23rd International Symposium on Industrial Electronics (ISIE)*, pp. 1622-1627, 2014.

[18] F.M. Frattale Mascioli, F. Spano, M. Dess, M. Paschero, Bonifica 2.0 - A sustainable mobility network based on the Agro Pontino land reclamation waterways, *Procedia Environmental Science, Engineering and Management*, vol. 2, pp. 63-72, 2015.