A First Financial Assessment of SEAP Public Energy Interventions Performance Through Municipal Budget

Luigi Santopietro[1(✉)], Silvia Solimene[2], Ferdinando Di Carlo[3], Manuela Lucchese[4], Francesco Scorza[1], and Beniamino Murgante[1]

[1] School of Engineering, Laboratory of Urban and Regional Systems Engineering (LISUT), University of Basilicata, Viale dell'Ateneo Lucano 10, 85100 Potenza, Italy
{luigi.santopietro,francesco.scorza, Beniamino.murgante}@unibas.it

[2] School of Engineering, University of Basilicata, Viale dell'Ateneo Lucano 10, 85100 Potenza, Italy
silvia.solimene@unibas.it

[3] Department of Mathematics, Computer Science and Economics, University of Basilicata, Viale dell'Ateneo Lucano 10, 85100 Potenza, Italy
ferdinando.dicarlo@unibas.it

[4] Department of Economics, University of Campania "Luigi Vanvitelli", Capua, Italy
manuela.lucchese@unicampania.it

Abstract. The European volunteer initiative of local administrators Covenant of Mayors (CoM) launched in 2008, set by 2020 the first deadline in achieving the emission reduction target of 20% CO_2 compared to 1990 levels. Each CoM signatory developed a Sustainable Energy Action Plan (SEAP), designing energy efficiency interventions. This first CoM commitment period (2008–2020) has highlighted a relevant engagement (63% of the total CoM signatories) of "small" Municipalities (i.e. under 10, 000 inhabitants), particularly in Italy and Spain. The aim of the research, is to propose a monitoring methodology for the assessment of the impacts of SECAP in local Municipality comparing CO_2 emission achievements with municipal budget analysis. Focusing on three Italian small Municipalities (two CoM signatories and one no-CoM), the research explores investments related to the public energy efficiency interventions on the Municipal budget. The selected case studies allowed to verify if SECAP represents or not an effective driver to boost energy transition in small municipalities. In this view achieved results have been compared, in order to highlight the main outcomes, and emphasizes how is the impact of the CoM initiative and how are the differences in terms of expenditure allocated and interventions planned by three sample Municipalities.

Keywords: SEAP · Municipal budget · Energy efficiency · Small municipalities

© The Author(s), under exclusive license to Springer Nature Switzerland AG 2022
O. Gervasi et al. (Eds.): ICCSA 2022 Workshops, LNCS 13382, pp. 54–64, 2022.
https://doi.org/10.1007/978-3-031-10592-0_6

1 Introduction

The European initiative of Covenant of Mayors (CoM) is a voluntary initiative started in 2008, gathering European Mayors and local administrators with the ambition to tackle the "20-20-20" targets provided by 2020 climate & energy package [1]. The initiative in 2016 expanded its geographical coverage from European countries to worldwide, becoming the Global Covenant of Mayors (GCoM). GCoM is the result of the joining between CoM and Compact of Mayors, coupling energy targets with climate ones. Thus, looking at the temporal coverage of the CoM it is possible to distinguish two seasons characterized by different commitments: the first (2008–2020) pursued the targets provided by the 2020 climate & energy package, while the second (2020-ongoing) is pursuing the targets provided by the European Green Deal [2]. In this scenario, previous research [3, 4] highlighted that the majority of CoM signatories are "small" Municipalities (i.e. under 10.000 inhabitants) classified as XS Signatories by CoM; and coming from Italy and Spain. These CoM Signatories developed in the first period a Sustainable Energy Action Plan (SEAP) and now are developing a Sustainable Energy and Climate Action Plan (SECAP). These plans contain structured public and private interventions, related to energy efficiency and climate adaptation/mitigation related to a set of sectors (for example residential buildings, transport, and public lighting). In order to evaluate these interventions also from a financial perspective, the Municipalities' budgets have been analysed. In detail, this research focuses on three small municipalities in Basilicata Region (Italy): Castelsaraceno, Ginestra and Pietragalla. These are three small Municipalities, where Castelsaraceno and Pietragalla are CoM Municipalities while Ginestra is no-COM and is ongoing to become a CoM signatory. The aim of the research is to investigate the impact of the CoM initiative on Municipalities compared to non-CoM ones, in supporting and developing public energy efficiency investments. The structure of the research provided in Sect. 2, details of the databases investigated for the analysis of the Municipal budgets highlighting the share of public investments according to the CoM membership; Sect. 3 is related to the comparison of the investments planned in Municipal budgets related; Sect. 4 the main outcomes have presented an opening to the future perspectives of the research.

2 Dataset Investigated

Italian Local Governments (these include municipalities, provinces, mountain communities or associations) draw up their annual budget, which is the main vehicle for authorising expenditure [5]. However, in the last decade, several legislative initiatives have profoundly changed the accounting system of Italian Local Governments (LGs), first among equals, the Decree 118/2011. In order to achieve the aim of this research, the authors analysed the budget data in two different time frames: the first for the years from 2005–2015 and the second from 2016–2021. Although the reform has largely changed the presentation of balance sheet items, we have identified some similarities between macro-categories, allowing comparisons to be easily made (see Table 1).

The authors selected three databases detailing the public interventions and investments for Castelsaraceno, Ginestra and Pietragalla. Databases are:

Table 1. Comparison of municipalities budget items (Source: "Open Bilanci" database)

Categories in the first-time frame (2005–2015)		Categories in the second time frame (2016–2021)	
Education	Expenditure for school services and maintenance of buildings owned-excluding kindergartens	*Education and the right to study*	Amount of all expenditure on education and school buildings (excluding kindergartens)
Public lighting	Expenses for public lighting installations	*Energy and diversification of energy sources*	Expenditure on administration and operation of activities and services relating to the use of energy sources, including electricity and natural gas
Public buildings	Expenditure on public housing, on the operation of offices, on the provision of benefits to citizens in need, and on the construction and maintenance of facilities	*Public and local housing and social housing plans*	Expenses for the construction, purchase and renovation of public and social housing

1. "Open Bilanci" a public web-database with a temporal coverage from 2005–2021 where Italian municipal budgets are collected and detailed in terms of investments, expenditure and interventions related to several sectors (road maintenance, public lighting and public buildings.)
2. "Open CUP" a public web-database with a temporal coverage since the 1990s, where there are all public investments planned by Italian Municipalities. These investments are detailed in terms of financial support (public and private), and sectors
3. CoM database, provided by CoM official website, where it is possible to examine CoM signatories and perform advanced searches on them such as the region of origin, population, SECAP sectors, and CO_2 emissions target.

Examining the "Open Bilanci" database, the cash management principle has been selected for data collection. It considers the revenue and expenditure that the municipality has received (collections) and paid (payments) during the year, regardless of the year in which the receivables (assessments) and payables (commitments) arose. In particular, we have chosen to analyse the investment expenditure item, which details the payments actually made for each mission or intervention, i.e. it consists of all the costs that the municipality incurs for the purchase of real estate or the construction of infrastructure and long-term projects in the municipality. The result also includes the

so-called *residual liabilities*, which represent the debts of the municipal authority, i.e. expenditure committed but not paid during the year.

"OpenCUP" makes data available to all public and private bodies, in an open format. This data relates to public investment decisions obtained with national, community or regional public funds or with private resources registered with the Unique Project Code (CUP). The CUP is the code that identifies a public investment project and is the key tool for the functioning of the Public Investment Monitoring System (MIP).

Analyzing the CoM database, in May 2022, it counts 10977 Signatory and 71% of them have submitted to CoM an Action Plan. Considering the Signatories with an Action Plan submitted, 67% of them are classified by CoM as XS Municipalities (i.e. with a resident population under 10000 inhabitants). This majority of XS Municipalities is proved considering that Italy is at first place among CoM Countries in terms of XS CoM Signatories (no. 3999), followed by Spain (no. 2288). Italy and Spain both represent over 90% of the whole XS Municipality class. However, this relevant engagement of XS Municipalities has set a CO_2 emissions target reduction in the range of 20–30%, close to the 20% of 20-20-20 target, but far from the current target (55%) provided by the European Green Deal. In order to understand how the relevance of public interventions is planned by the CoM signatories, the authors evaluated the occurrences of the SEAP/SECAP sectors. Results from the CoM database, highlight that XS Signatories have a preferential interest in developing actions related to sectors basically "public" like public lighting or municipal building equipment facilities. Instead, considering "private" sectors (involving not only public actors but also a private company, stakeholders etc..), there is a relevant development of interventions related to the improvement of the energy production (including r.e.s. technologies) and energy efficiency of the buildings toward the green transition.

3 The Comparison of the Public Investments in the Municipal Budget

The authors have selected three small municipalities Castelsaraceno, Ginestra and Pietragalla, located in Basilicata Region, Southern Italy (see Fig. 1).

These Municipalities have been selected according to specific features:

- Castelsaraceno is located in an inland area of Basilicata Region between two National parks (Pollino and Appennino Lucano Val d'Agri Lagonegrese National Parks) linked since August 2021 by the "The world's longest Tibetan bridge". It is a CoM signatory since 2012 and it developed its SEAP in 2013. In 2016 has developed its monitoring report while now is working on its SECAP.
- Ginestra is a "young" Italian Municipality founded in 1965. It is an ethnic-linguistic Italo-Albanian (Arbëreshe) minority in Basilicata and one of the Italian "Wine City" characterized by the production of three certified Italian wines from the local grapes of Aglianico. It is engaged in developing public interventions related to energy efficiency and now it is signing to CoM intending to develop its SECAP
- Pietragalla is a CoM signatory since 2013 and in 2019 has submitted its SEAP. Despite it is a small municipality, it has one of the main industrial areas in the Basilicata Region,

characterized by the food industry (olive oil and pasta) and building materials industry. Now it is working on its monitoring report, checking the interventions provided, and at the same time it is working on its SECAP.

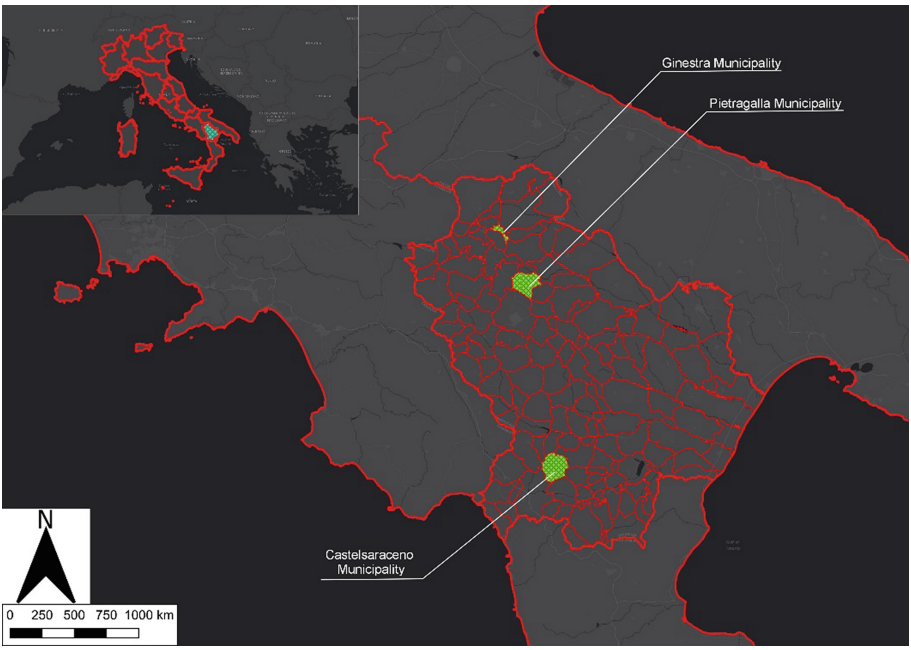

Fig. 1. The three small municipalities selected

Public investments have been analyzed through municipal budgets of the three Municipalities, moreover for CoM Municipalities (Castelsaraceno and Pietragalla) such investments have been identified in their SEAPs, in order to make explicit the link between the planning dimension (the SEAP) and the financial one. Furthermore, for Castelsaraceno Municipality it was possible to verify the implementation of the public interventions planned through the Monitoring Report submitted in 2016.

The data concerning investments in Municipal budgets from "Open Bilanci" and those related to public energy efficiency interventions from "Open CUP", have been classified in the three macro-categories previously defined: education, public lighting and public buildings. Education includes investments in energy efficiency interventions in schools related to the installation of Renewable Energy Sources (RES) technologies and improvements in building energy performance; public lighting is referred to as the expenditure's investment of street lamps and public buildings are related to the investments on the renovation (including energy efficiency interventions) of the public buildings. All these technological solutions produce a territorial impact, that should be take n into account in order to balance the different interventions sector according to territorial characteristics [6–8].

Data related to the investments have been collected for the period (2005–2021) and presented in Fig. 2. Comparing the stock of investments, Castelsaraceno and Pietragalla have managed an averagely over 100, 000 € per year, while Ginestra is on averagely under 100, 000 € per year. Considering the two CoM Municipalities (Castelsaraceno since 2012 and Pietragalla since 2013), the effects of the SEAP actions are remarked by the increase in the investments related to education and public lighting.

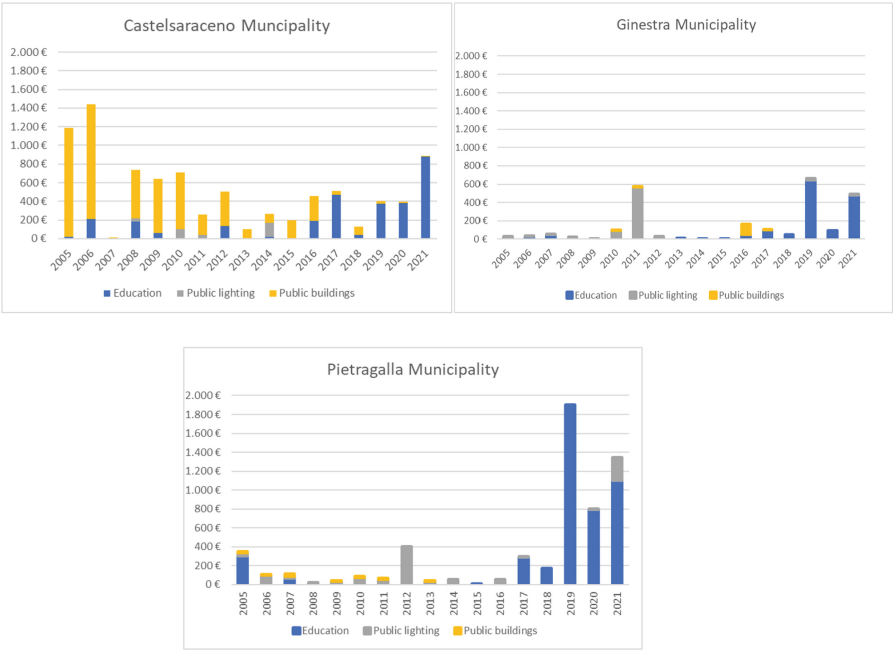

Fig. 2. Investments per year (for the period 2005–2021) expressed in thousand euros for the three municipalities

For the cases of Castelsaraceno and Pietragalla, the public interventions related to energy efficiency that increased the stock of investments related to the public energy efficiency interventions are included in the SECAPs These energy efficiency interventions can be distinguishable in four SEAP sectors (local electricity production, public lighting, building equipment facilities and transport). These sectors are reported in Table 2, structuring the overall targets of interventions provided in terms of CO_2 emission reduction expected [ton/year], energy reduction expected [MWh] and the total amount of investments [€].

Considering the only monitoring report available for Castelsaraceno Municipality, on 20 energy efficiency interventions planned, in 2016 only one was completed while four interventions were partially completed (i.e. 25% of the interventions have been realized).

Table 2. Targets related to public interventions provided for Castelsaraceno and Pietragalla SEAPs

Municipality	Castelsaraceno municipality			Pietragalla municipality		
Sector	CO_2 emission reduction expected [ton/year]	Energy reduction expected [MWh]	The total amount of interventions [€]	CO_2 emission reduction expected [ton/year]	Energy reduction expected [MWh]	The total amount of interventions [€]
Local electricity production	69.24	108	315, 000	239.68	560	n.a.
Building equipment facilities	237.01	214	251, 954	22	2	73, 710
Transport	161.85	554	69, 000	0	0	0
Public lighting	0	0	0	141	330	250, 000

A simple way to better distinguish differences among the Municipalities selected as case studies is to consider the per-capita intensity of investments and the territorial density of the investments, as presented in Table 3 and Fig. 3.

Table 3. Territorial indexes of investments for the three Municipalities

Municipality	Municipal surface [Km^2]	The total amount of investment for the period 2005–2021 [thousand €]	Yearly average investments per inhabitant for the period 2005–2021 [€/inhabitant]	Investments per Municipal surface for the period 2005–2021 [€/Km^2]
Castelsaraceno	75	8,878	7,142	118,717
Ginestra	13	2,451	3,400	184,015
Pietragalla	66	5,872	1,494	88,833

In addition to the static assessment of investment expenditure in absolute values, a dynamic analysis of investment expenditure was also conducted. The percentage variation of investment expenditure was analysed using two distinct time frames as a reference: the first from 2005 to 2012 and the second from 2013 to 2021. The year 2012 was chosen because it is the year of adhesion to the CoM of the Municipality of Pietragalla and for comparative purposes, the same period was also used for the Municipality of Castelsaraceno (signatory of the CoM the following year) and for the Municipality of Ginestra.

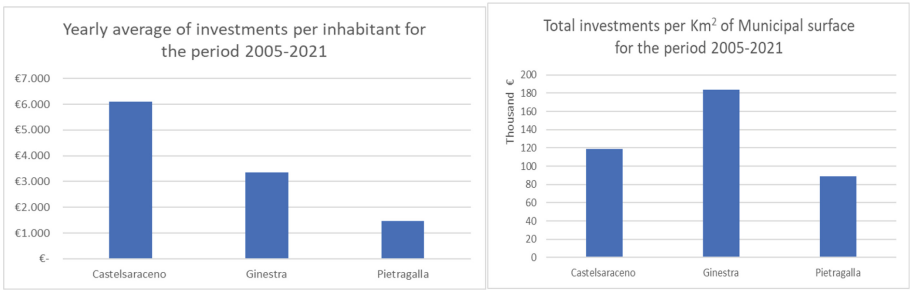

Fig. 3. The yearly average of investments per inhabitant and total investment per Km^2 of municipal surface for the period 2005–2021

This evaluation also confirms the positive impact of the CoM adhesion for the first two Municipalities:

- On average, the Municipality of Pietragalla, from an investment expenditure growth of 75% from 2005 to 2012, increased its investment expenditure by 263% after their CoM adhesion;
- On average, the Municipality of Castelsaraceno, from a decrease in investment of − 6% in previous years, increased its investment expenditure by about 50%.
- For the Municipality of Ginestra, considering the same time frame although it is not a signatory of the CoM, it was identified that investments decreased from 4.56% to 3.50%. It is important to note that the values considered are influenced by significant revenues from external financing.

4 Discussions and Conclusions

In order to achieve the research aims, an assessment of the investment expenditure of the selected Municipalities was carried out by selecting the year of adhesion to the CoM as the reference year.

In the case of Pietragalla Municipality the year selected as a reference is 2012.

- Considering Fig. 2, investment expenditure related to education shows an increasing trend. In detail, this macro-category contains an item called 'Assistance, transport and canteen', which for this municipality is one of the drivers for investment decisions in this sector. This can be a support in providing more public services from Municipalities to citizens;
- The public lighting sector, shows a clear increase in the year of CoM adhesion. In the previous year, on average, investment expenditure did not exceed 100, 000, whereas in 2012, more than 400, 000 euros were invested. Investment expenditure decreases and it has increased only since 2021;
- In the area of public buildings, there is an increasing trend in the years before the CoM, and in the opposite direction in subsequent years there is a lack of investment in this category.

In the case of Castelsaraceno Municipality, the year selected as a reference is 2013.

- In the education sector, according to the Fig. 2, the trend has increased since the year of CoM adhesion, and the highest figure was reached in 2021;
- In the Public Lighting sector, there was a discontinuous trend. The year of highest investments turns out to be 2014, the year after joining the CoM. While in the years from 2015 to 2021, no investment expenditure related to this sector is recorded;
- In the public buildings sector, there was an inverse trend to the CoM signature. Indeed, it was an upward trend pre-CoM signature and a reduction in investment expenditure in the public buildings sector after the CoM signature.

In the case of Ginestra Municipality, ongoing submitting to CoM, it was compared with Castelsaraceno and Pietragalla, in order to highlight any differences.

- In the education sector, since 2018 it has significantly increased investments compared to the previous years;
- In the public lighting sector, the trend shows that 2011 is the only year in which the amount invested is particularly significant, in the years before and after these figures, investments are rather low;
- the public building sector has a trend near to the public lighting sector. Indeed, 2016 is the year with the largest investments stock.

This first assessment of investments related to public energy efficiency interventions highlighted a positive impact of the CoM initiative on small Municipalities, as remarked by the Castelsaraceno Municipality. Furthermore, the CoM initiative promoted investment policies in energy efficiency, supporting the weaknesses in terms of technical capacity of small municipalities and implementing CO_2 reduction interventions oriented toward the EU 2050 targets. Considering the voluntary approach pursued by CoM, the increase of investments remarks a positive impact in terms of incentive to plan interventions in reducing energy consumption and support the build of a "green awareness" of citizens through these interventions. On the other hand, the data on municipal budges are a meaningful tool to improve the monitoring capacity for SEAP implementation and could be considered as additional indicators to be included in the CoM Monitoring Reports.

The comparison of two CoM Municipalities with one non-CoM remarked also some interesting future perspectives to be investigated:

- The research focused on the public investments related to three categories (education, public lighting and public buildings) but in order to achieve an "urban vision" (see also [9]) of the SEAP impacts, is useful to investigate also on other intervention categories (including private investments (i.e. the transport sector (see also [10–12] that is one of main SEAP sector [13, 14], especially for those small Municipalities with tourism specialization [15, 16]);
- This assessment can be extended to other CoM and non-CoM Municipalities in order to understand what categories (public or private) drive the investments toward the EU2050 targets and whether other EU funded programs contributes[17, 18];

- Considering the same investments stock, a comparison among CoM signatories of other population sizes (i.e. over 10,000 inhabitants) can define a performance assessment in terms of expenditure reduction and consumption reduction achieved.

References

1. European Commission: 2020 climate & energy package | Climate Action. https://ec.europa.eu/clima/policies/strategies/2020_en (2020). Accessed 1 Dec 2020
2. European Commission: The European Green Deal. Brussels (2020)
3. Santopietro, L., Scorza, F., Rossi, A.: Small municipalities engaged in sustainable and climate responsive planning: evidences from UE-CoM. In: Gervasi, O., et al. (eds.) ICCSA 2021. LNCS, vol. 12957, pp. 615–620. Springer, Cham (2021). https://doi.org/10.1007/978-3-030-87013-3_47
4. Santopietro, L., Scorza, F.: The Italian experience of the covenant of mayors: a territorial evaluation. Sustain. **13**, 1–23 (2021). https://doi.org/10.3390/su13031289
5. Rossi, F.M.: Public sector accounting and auditing in Italy. In: Brusca, I., Caperchione, E., Cohen, S., Rossi, F.M. (eds.) Public Sector Accounting and Auditing in Europe. ISGPM, pp. 125–141. Palgrave Macmillan UK, London (2015). https://doi.org/10.1057/9781137461346_9
6. Saganeiti, L., Pilogallo, A., Faruolo, G., Scorza, F., Murgante, B.: Energy landscape fragmentation: Basilicata region (Italy) study case. In: Misra, S., et al. (eds.) ICCSA 2019. LNCS, vol. 11621, pp. 692–700. Springer, Cham (2019). https://doi.org/10.1007/978-3-030-24302-9_50
7. Saganeiti, L., Pilogallo, A., Faruolo, G., Scorza, F., Murgante, B.: Territorial fragmentation and renewable energy source plants: which relationship? Sustainability **12**, 1828 (2020). https://doi.org/10.3390/su12051828
8. Scorza, F., Saganeiti, L., Pilogallo, A., Murgante, B.: Ghost planning: the inefficiency of energy sector policies in a low population density region. Arch. DI Stud. Urbani E Reg. **127**, 34–55 (2020)
9. Scorza, F., Santopietro, L.: A systemic perspective for the Sustainable Energy and Climate Action Plan (SECAP). Eur. Plan. Stud. 1–21 (2021). https://doi.org/10.1080/09654313.2021.1954603
10. Scorza, F., Fortunato, G.: Active mobility oriented urban development: a morpho-syntactic scenario for mid-sized town. Eur. Plan. Stud. **30**, 1–25 (2022) https://doi.org/10.1080/09654313.2022.2077094
11. Scorza, F., Fortunato, G.: Cyclable cities: building feasible scenario through urban space morphology assessment. J. Urban Plan. Dev. **147**, 05021039 (2021). https://doi.org/10.1061/(asce)up.1943-5444.0000713
12. Fortunato, G., Scorza, F., Murgante, B.: Cyclable city: a territorial assessment procedure for disruptive policy-making on urban mobility. In: Misra, S., et al. (eds.) ICCSA 2019. LNCS, vol. 11624, pp. 291–307. Springer, Cham (2019). https://doi.org/10.1007/978-3-030-24311-1_21
13. Croci, E., Lucchitta, B., Janssens-Maenhout, G., Martelli, S., Molteni, T.: Urban CO_2 mitigation strategies under the Covenant of Mayors: An assessment of 124 European cities. J. Clean. Prod. **169**, 161–177 (2017). https://doi.org/10.1016/j.jclepro.2017.05.165
14. Kona, A., et al.: Covenant of Mayors in figures: 8-year assessment. Publications Office of the European Union, Luxembourg (2017). https://doi.org/10.2760/64731

15. Santopietro, L., Scorza, F., Murgante, B.: Multiple components in GHG stock of transport sector: Technical improvements for SECAP Baseline Emissions Inventory assessment. TeMA J. L. Use Mobil. Environ. **15**, 5–24 (2022). https://doi.org/10.6092/1970-9870/8391
16. Pilogallo, A., Saganeiti, L., Scorza, F., Las Casas, G.: Tourism attractiveness: main components for a spacial appraisal of major destinations according with ecosystem services approach. In: Gervasi, O., et al. (eds.) ICCSA 2018. LNCS, vol. 10964, pp. 712–724. Springer, Cham (2018). https://doi.org/10.1007/978-3-319-95174-4_54
17. Scorza, F.: Improving EU cohesion policy: the spatial distribution analysis of regional development investments funded by EU structural funds 2007/2013 in Italy. In: Murgante, B., et al. (eds.) ICCSA 2013. LNCS, vol. 7973, pp. 582–593. Springer, Heidelberg (2013). https://doi.org/10.1007/978-3-642-39646-5_42
18. Scorza, F., Casas, G.L.: Territorial specialization in attracting local development funds: an assessment procedure based on open data and open tools. In: Murgante, B., et al. (eds.) ICCSA 2014. LNCS, vol. 8580, pp. 750–757. Springer, Cham (2014). https://doi.org/10.1007/978-3-319-09129-7_54