An economic appraisal of the SE(C)AP public interventions towards the EU 2050 target: the case study of Basilicata Region

Abstract. Cities since the 2000s have engaged in developing actions and interventions relating to energy efficiency and mitigation/adaptation to climate change according to an environmental framework (i.e. Paris Agreement, Pact of Amsterdam, or New Leipzig Charter). In this scenario, the contribution towards the ambitious target of “net zero emissions” defined by the European Green Deal to developing interventions undertaken by the “small cities” (i.e. below 10,000 inhabitants) was considered as a separate domain compared to “big cities” (i.e. over 50,000 inhabitants): different tools and different metrics should be defined for such different categories of actors. This relevant engagement of small cities emerged in the European initiative of the Covenant of the Mayors (CoM) since 2008. This research investigates the impact of the CoM initiative in the Basilicata Region (South Italy). A quantitative research method has been proposed. Input data was derived from the official website of CoM, where each signatory uploads its SEAP/SECAP. In detail, for each of the Basilicata CoM Municipalities, the expenditure of the public investments provided for energy efficiency in SEAPs was analyzed for the period 2005-2021.

Keywords: municipal budget, Covenant of Mayors, SEAP, small municipalities, voluntary planning, public interventions

Highlights
- The study offers a financial conceptual framework for energy-efficient decision-making choices.
- Municipalities gain legitimacy by CoM involving stakeholders in achieving sustainability goals.
- Findings evidence that SEAPs boost investment fostering SDGs.
- The CoM adhesion supports virtuous behaviors in pursuing the principles of strategic planning.
1 Introduction

Climate change is one of the main issues that is being addressed globally through sustainable development initiatives which regard the "development that meets the needs of the present without compromising the ability of future generations to meet their own needs" (Brundtland Report, 1987, p.16) (UN Secretary-General and World Commission on Environment and Development, 1987).

This is the core of the European policies, started in 2008 with the “20-20-20 package” (European Commission, 2009) which ensured the European Union (EU) meets its climate and energy targets for the year 2020 on three key targets: 20% cut in greenhouse gas emissions (from 1990 levels), 20% of EU energy from renewables and 20% improvement in energy efficiency.

Following this path, in 2019, the EU presented the European Green Deal (European Commission, 2019), striving to be the first climate-neutral continent. From this perspective, the European Green Deal also represents a way out of the COVID-19 pandemic (see (Becchetti et al., 2021)) with financing of one-third the €1.8 trillion investment from the NextGenerationEU Recovery Plan, and the EU’s seven-year budget.

In supporting the achievement of the transition to climate neutrality, in 2020, the Green Deal Going Local (GDGL) started, which is a political engagement and communications campaign aimed at accelerating the green transition.

In 2008, the CoM was launched by EU policies, voluntarily bringing together local governments to achieve and exceed EU energy and climate targets. Each CoM signatories develops a plan where explain their actions. The plans are the Sustainable Energy Action Plan (SEAP) for energy efficiency interventions and the Sustainable Energy and Climate Action Plan (SECAP) for interventions on energy efficiency coupled with climate adaptation.

The aim of the research is to understand whether and how adherence to the EU CoM initiative by the municipalities of the Italian Region Basilicata has affected their expenditures in supporting and developing public energy efficiency investments (within the green transition). The authors selected the Basilicata SEAPs, approved by the Joint Research Centre (JRC) of the EU Commission during
the period 2008-2020, exploring which are the main fields of intervention, and evaluating whether the voluntary commitment of municipalities affected their investment expenditures.

Data analysis was focused on Italy because among the EU-27 CoM signatories, 49% of them came from Italy. Basilicata Region was selected because 92 on 131 municipalities are CoM signatories. The research methodology provides for two foremost steps: 1) analysis of the main fields of intervention in which the Basilicata’s Municipalities have oriented their action plans on energy efficiency, published in SEAP; 2) selection of the investment expenditure related to the fields of intervention resulting from the first analysis. Then, it compares them before and after SEAP approval to investigate whether they changed as a response to the voluntary commitment of the signatories of the CoM.

Among the SEAPs analysed sectors (public lighting, education and public buildings), the relevant result of the research is that the education sector shows the most positive impact of the CoM initiative. The education sector shows such benefits for each time period considered.

The impact of the CoM initiative on the municipalities is tangible in the increase of the public investment expenditure in the years after the CoM adhesion, energy savings deriving from technological improvements in public buildings or services, the share of public investments on energy innovation on SEAP sectors.

This research contributes to provide an analytical framework to assess the CoM impacts on local communities by the municipal budget analysis in order to demonstrate the benefit of voluntary commitment that CoM signatories affirm in downscaling global energy transition policies. It results as an innovative way to get advantages from municipal budget analysis in the complex procedure of CoM monitoring. Moreover, it improves the existing research on CoM impact assessment by providing a financial perspective on this topic to fill the gap in previous literature at local and regional levels. In addition, it contributes to exploring the elements that could lead the decision-making process on energy efficiency for the practitioners.

The paper is structured as follows: Section 2 shows the theoretical framework and the literature review on the energy efficiency policies related to Local Governments. Section 3 is based on the CoM initiative, detailing the structure of SEAP/SECAP. Section 4 provides a description of the evolution of municipal budget regulations. Section 5 illustrates the research methodology design and the dataset investigated, while the main highlights of the research are discussed in Section 6. Section 7 presents the conclusions and future perspectives of the research.
2 Theoretical framework

In an attempt to explain the evolution of the energy efficiency initiatives by municipalities within the field of CoM, this paper adopts the theoretical framework of the legitimacy and stakeholders’ theory in order to understand better the role that municipalities play in pursuing sustainability actions throughout the SEAPs and how they (should) communicate the achievement of these goals into the reporting system (Chen and Roberts, 2010; Deegan, 2002; Gray et al., 1995; Scott, 1987).

There is an increased need for entities (business entities and public administrations) worldwide to be responsible for and to society. Consequently, there is an increased need for these entities to adequately integrate their corporate approach to documenting and disclosing the Environmental Social and Governance (ESG) performance. First, this implies that entities must integrate sustainability choices/actions into their strategic planning process (Lokuwaduge and Heenetigala, 2017).

Many theories explain the reasons for entities to provide ESG information. ESG reporting motives relate to regulations, standards, legitimacy and stakeholders (Deegan, 2014). Deegan (Deegan, 2002) states that an organisation can employ the reporting information to manage or manipulate the stakeholders to gain their support and approval or to avoid opposition and disapproval to obtain legitimacy. Managers will receive an incentive to be compliant with ESG issues and report them, mainly focusing on initiatives for which stakeholders have a particular interest in the organisation to suggest that they are conforming to stakeholder expectations (Bhattacharyya and Cummings, 2015; Deegan, 2002) in the business environment. There is increasing pressure on management to report sustainability (ESG) information to its influential stakeholders (Coleman, 2011); entities need to preserve and maintain their legitimacy to guarantee their survival.

Legitimacy theory states that organisations continuously try to ensure they carry out activities by societal boundaries and norms (Deegan et al., 2002). This legitimacy theory focuses on the company's interactions with society. The organisation represents just one part of the community where an organisation should pay attention to the norms that apply in the social community. Gaining legitimacy from the community around the company, this one can operate and use economic resources (natural resources and employees). Consequently, organisational behaviour must be analysed by paying attention to the environment because the boundaries set by social norms and values and reactions to these limits affect entities' choices and actions (Dowling and Pfeffer, 1975). Legitimacy is an organisation's strategic resource for survival (Dowling and Pfeffer, 1975). Previous empirical
research used this theory to study social and environmental reporting and propose a relationship between corporate reporting, strategic actions and community expectations (Deegan, 2006).

According to Lindblom (Lindblom, 1994), an entity gains legitimacy when its value system is congruent with the value system of its larger social system. Under Legitimacy theory, an organisation must consider the rights of the public at large, not merely the rights of investors.

Thus, this theory is used to explain why corporate management undertakes specific actions, such as disclosing particular items of social and environmental information as part of its business strategy (Lokuwaduge and Heenetigala, 2017), just because they need to legitimise organisations’ operations.

The stakeholder theory is based on the proposal that, according to the Corporate Social Responsibility (CSR) model, a company has a responsibility towards all its stakeholders, including the shareholders and suppliers, customers, employees, the government and society at large (Ferrell et al., 2011). Consequently, entities' social and environmental reporting refers to issues relevant to a wide range of stakeholders. These issues are not economic but can affect financial aspects (Jenkins, 2004).

Thus, since sustainability reporting and sustainability decision-making are closely connected with the stakeholders’ needs, companies are obligated to fulfill the needs of stakeholders both within and outside of the firms (Freeman and McVea, 2003). Addressing stakeholders' interests and needs in a sustainable business strategy is the primary goal of a company. The stakeholders' pressure could exert varying levels of power, legitimacy and urgency, characterising the sustainability strategy as part of the larger business strategy (Mitchell et al., 1997).

According to Chen and Roberts [9,p.653], stakeholder theory recognises the diversity of stakeholder expectations and the potential conflict between them. Therefore, organisations must be able to "balance these conflicting expectations". Managing stakeholder expectations is crucial, especially in a public context. Government is first and foremost accountable to its citizens for how it acts and performs (Barton, 2005). Accountability for such actions is expressed precisely in the need to disclose information about how the local area has been managed. This paper extends stakeholder and institutional theories by showing that municipalities use voluntary reporting to satisfy the information needs of key stakeholders and to ensure that their policies and practices are consistent with the values and expectations of the community they represent.

2.1 Local Governments and energy efficiency policies
The Fourth Assessment Report of Intergovernmental Panel on Climate Change (IPCC) (Parry et al., 2007) defined the three pillars of Sustainable Development (SD) to the adaptation to climate change: social dimension, ecological dimension and economic dimension. The latter are included in the Sustainable Development Goals (SDGs), which were launched in 2015 in the United Nations 2030 Agenda (United Nations, 2016). This Agenda is centred on 17 SDGs whose aim is the involvement of governments, businesses and society in order to end poverty, reduce inequality and protect the environment. In this context, several authors (Bouckaert et al., 2016; Guarini et al., 2021; Jones and Comfort, 2020) and international organisations as United Cities and LGs emphasised the primary role those public administrations (PA) play, in the preparation of policies, strategies and measures suitable for achieving these goals. Therefore, these SDGs could provide the normative framework to implement them at national and local levels (Guarini et al., 2022).

A relevant body of literature reviewed sustainability principles and SDGs in PA (Fiorino, 2010; Marques et al., 2021). In this field, saving energy and promoting energy efficiency are considered urgent global questions that require the strong commitment of international and national governments (Wang et al., 2017). For PA, the engagement in promoting policies and actions to improve energy efficiency is an essential step towards lasting sustainability [33,p.82]. In the last decades, government commitment is evidenced by a number of initiatives (e.g. Agenda 2021; Rio+20 “The future we want”; Agenda 2030), to improve PA’s energy and environmental performance.

Among the public authorities, LGs are the closest to citizens and therefore can promote the sustainable use of natural resources through partnerships with citizens and private-sector entities operating in high-impact sectors, such as agriculture, forests, and fisheries [29 p.4,34]. The proactive role of LGs in energy and climate change policies is necessary, they could take the lead in the innovation and implementation of sustainability policies (Wang et al., 2017).

Recently, the Paris Agreement (United Nations, 2015), the Urban Agenda 2030 (United Nations, 2016) and the European Green Deal (European Commission, 2020), have supported the efforts of local authorities to reach more ambitious targets in reduction of energy consumption and greenhouse gas emissions, decreasing dependence on non-renewable energy sources.

In recent years, many authors analysed the topic of energy efficiency in local governments (Fiorino, 2010; Saha, 2009; Saha and Paterson, 2008). Malandrino et al.(Malandrino et al., 2019), pursued the goal of critically analysing Italian PA policies and strategies on the topic of energy efficiency. Through a literature analysis, they highlighted the strengths and weaknesses of the Italian PA in its attitude towards environmental sustainability issues. Tozer (Tozer, 2018), instead, analysed the
sustainability plans of 15 Canadian municipalities to bring out the relationship between climate change and sustainability within the local government planning.

Nevertheless, some authors analysed such initiatives from a financial point of view. Financial resources and a solid financing system are crucial for the success of energy efficiency measures (Buntin, 2009; Eyraud et al., 2013; Sarkar and Singh, 2010). Wang et al. (Wang et al., 2017) explained the adoption of energy efficiency financing (EEF) strategies by US city governments.

3 The Covenant of Mayors (CoM) initiative

CoM is an initiative within European energy policies framework, started in 2008, which gathers local authorities through a voluntary adhesion, in developing local interventions related to climate change and energy efficiency, towards the ambitious target of climate neutrality.

This initiative was chosen because 67% (no. 7592) of the CoM signatories are XS municipalities (i.e. municipalities with less than 10000 inhabitants), and this aspect is relevant considering that they do not have the same technical support as medium-sized cities (over 50000 inhabitants). This gap in terms of skills and resources can be filled by the SEAPs/SECAPs, as highlighted by (Pablo-Romero et al., 2015; Reckien et al., 2015), and they can be considered as tools enabling tangible adaptation actions in the territories. These actions are designed through a standard set of sectors structured inside SEAPs/SECAPs, concerning environmental, social and urban themes rather than focusing only on specific sectors like energy (see (Diana Reckien et al., 2014)).

As remarked by recent research (Santopietro and Scorza, 2021), SEAP/SECAP introduced a renewed approach towards voluntary planning, that is relevant for those countries, similar to Italy, that are closely linked to a top-down approach for the development of urban planning (see also (Romano et al., 2018)).

The CoM in its first commitment period (2008-2020) focused on the interventions provided by its signatories on energy efficiency, pursuing the “20-20-20” energy and climate (European Commission, 2009) and Paris agreements targets (United Nations, 2015). Since 2017, it has included also interventions related to climate adaptation becoming the Global Covenant of Mayors after the joining of CoM with Compact of Mayors (another European initiative supporting the adaptation to climate change). This second phase is oriented toward the ambitious long-term target of “net zero
emission” set by the European Green Deal (European Commission, 2020) with the adoption of a joint approach to tackling mitigation and adaptation to climate change.

In 2022, CoM has started an ambitious initiative within the green transformation of the cities, “Cities Energy Saving Sprint”. This is a joint initiative with the European Committee of the Regions to support cities in taking measures that will immediately reduce their energy consumption. These measures are part of REPowerEU Plan (Joint Research Center (JRC), 2022) that provide through energy savings, the diversification of energy supplies, accelerating the roll-out of renewable energy to replace fossil fuels in homes, industry and power generation.

Comparing the number of CoM signatories to the accepted plans developed (see figure 1), emerges a gap: on 11183 signatories, 7068 of them have an action plan submitted and approved. This gap is narrowing, indeed in 2008 the ratio between plans approved and signatories was 10% while in 2022 is at 63%. Under an overall view it also remarks how, from the starting enthusiasm linked to the first phase of CoM adhesion by municipalities, some delays occur on the way that from political commitment brings to the implementation of actions on the territory, passing through the technical stages of plan design, validation, implementation and monitoring. This is typical in many planning frameworks and represents a weakness also for the CoM initiative.

Concerning the two phases of CoM implementation, today among the approved plans, 5980 are SEAPs (first generation) with a mitigation pillar, while only 227 are SECAPs (second generation) oriented toward the 2030 targets (CO₂ reduction of 55%) coupling the adaptation and mitigation pillars. The critical step in the SECAP life according to the CoM rules, is on the monitoring phase: on 7068 approved plans, there are only 1765 full monitoring reports.

Figure 1 Comparison between Approved Action Plans and CoM Signatories
3.1 SEAP/SECAP a voluntary planning tool designing energy and climate interventions.

In the view of the authors the SECAP is a “planning tool”. More in detail, even if it doesn’t belong to the whole of planning tools deriving from the Italian normative planning framework referring to the Italian National Planning Law 1150/1942 and the system of Regional Laws (for the Basilicata Region case the LR. 23/1999)(Regione Basilicata, 1999), it is currently adopted by municipalities as an effective operative tool to design and implement local urban development strategies and interventions in the sector of energy transition. It represents a way to overcome the weaknesses of the ordinary planning system to support effectively the territorial governance needs in downscaling the EU and global energy goals to the local implementation. We are in the case where the voluntary planning approach represents a more effective way to tackle the current planning issues despite the formal institutional spatial planning approach mainly overcharged by bureaucratic and technocratic constraints. The CoM initiative offered to the local communities a way out to affirm the principles of strategic planning in a perspective oriented to the usefulness of the results. Moreover, the CoM can support climate planning processes where national or regional guidelines are lacking as in many Southern and Eastern European countries and cities (Pietrapertosa et al., 2018; D. Reckien et al., 2014).

Many remarkable features characterize the SECAP process: CoM helps to advocate better multi-level governance on climate and energy issues linking the local level of municipalities to the national and
international decision makers, facilitating the technical and financial support (Hendriks, 2018) under the subsidiary principle in planning.

Indeed, SECAP worksheet includes two parts: the first related to the energy efficiency, while the second to assess climate risks and vulnerabilities with a Risk and Vulnerability Assessments (RVAs) (see figure 2).

Figure 2 A schema of the SECAP section

4 Municipalities budget

LGs in Italy, which are comprised of municipalities, provinces, mountain communities or associations, draw up their annual budget, which is the key tool for authorising expenditure (Manes Rossi, 2015). Decree 267/2000 (TUEL – Testo Unico degli Enti Locali) defined the overall accounting system of Italian municipalities and Districts.

In the last decade, the accounting system of Italian LGs has changed in a significant way, due to several legislative amendments that have modified its entire structure (Pozzoli and Ranucci, 2013). Between 1995 and 2015, several reforms were applied to Italian LGs, in order to prevent financial instability and to enable more transparency (Bisogno et al., 2019). Law 196/2000 started to modify the PA accounting systems, with the introduction of the principle of harmonisation, which impacts the different levels of government, as defined in the Decree 118/2011. The aim of the Decree is to use standardized statements and a single chart of accounts common to all LGs. To provide a comparison with the past, this single chart of accounts is extremely thorough and LGs are unable to
modify it unless there is an increase to the degree of detail provided. The decree was enforced in January 2015 after 3 years of experimentation (Manes Rossi, 2015).

The two main components into which the municipal budget is divided are revenue and expenditure. On one hand, revenue represents the financial resources available to the authority for the reference year. They are divided into current account revenue and capital account revenue. In the past, LG revenues were ordered according to the source of resources (titles) and the type of these resources (categories). The first three titles represented current revenue, while the next three titles contained capital revenue, which will finance investments.

Expenditure, on the other hand, represents the sum of all the appropriations approved by the Council and the City Council for the provision of services to citizens, for the functioning of the municipal entity, and for the realisation of investments during the financial year. Expenditure is divided into current expenditure; capital expenditure; expenditure for loan repayments; and expenditure for services on behalf of third parties. In this research, the authors selected only current and capital expenditure.

Current expenditure is the sum of all expenditure that the municipality incurs for the ordinary functioning of the authority, such as expenditure on personnel, utilities, purchase of consumables (e.g. stationery) or the use of third party assets (e.g. rental of buildings). Capital expenditures, also called investment expenditures, are all costs that the Municipality incurs for the purchase of real estate or the construction of infrastructure and long-term projects in the Municipality.

In turn, LG expenditure is also classified by titles, which aggregate expenditure according to its nature and economic purpose. Expenditure is also broken down according to functions (identifying expenditure related to the type of activity to be carried out), services (indicating the individual department of the organisation called upon to perform certain activities) and interventions (specifying the ultimate purpose that will be financed and the intervention represents the elementary unit of expenditure).

With the enforcement of the new Decree, the revenue items of the budget are aggregated according to the source of resources (titles) and, within the individual titles, there is a breakdown by type of revenue. According to the harmonised budget, the elementary unit is the type and thus the nature of revenue.

Expenditure has been divided into:

1. Missions, which illustrate the main functions and strategic objectives of the relevant administration;
2. Programmes, which represent the categories of activities that realise the objectives defined by the politicians. In addition, programmes are divided into titles and macro-aggregates, which refer to the sources of expenditure (Manes Rossi, 2015).

There are two systems, accrual accounting and cash accounting, for drawing up the balance sheet in public accounting. Accrual accounting considers the revenue that the municipality is entitled to collect (assessments) and the expenditure that it has committed itself to incur (commitments) during the year, regardless of whether they are actually collected and paid during the same year and in the future: these are called assessments (revenue) and commitments (expenditure). However, precisely because they are revenue or expenditure forecasts, it is not certain that the corresponding sums of money will be paid or collected during the year.

Cash management considers the revenue and expenditure that the municipality has actually collected (collections) and paid (payments) during the year, regardless of the year in which the receivables (accruals) and payables (commitments) arose. These are called collections (revenue) and payments (expenditure). The differences between revenue and expenditure recorded according to accrual and cash management are called residual assets or residual liabilities and represent the receivables and payables of the municipal authority.

5 Research design and methodology

The study was conducted in four stages with a descriptive analysis and quantitative research method (see figure 3).

The first stage of the descriptive analysis was performed on the SEAPs deriving from the MyCovenant platform (Melica et al., 2022; Treville et al., 2022). The analysis is based on a sample of 81 municipalities from the Basilicata region (Italy). Specifically, it focused on the SEAPs developed and approved by the JRC in the first CoM commitment period (2008-2020) for several reasons. Firstly, to provide homogeneity in the analysis allowing for easy temporal comparison between the pre- and post-approval period. Secondly, the majority of municipalities in Basilicata adopted the SEAP plan during the first CoM commitment period to the initiative. Thirdly, the SECAPs represents a minority over the whole picture of Basilicata SEAPs.

Basilicata municipalities were divided into three groups: CoM signatories with a SEAP approved, CoM signatories without a SEAP approval and non-CoM signatories.
The second stage considered the plans (SEAPs) published and approved by CoM. Among the technical contents of the plans, an assessment of proposed actions per intervention sector had been delivered to point out the main municipalities' areas of intervention. This phase aimed to identify the most frequent actions on energy efficiency and to analyse the sectors representing a priority for municipal investments according to SEAPs sections.

The third stage is the alignment between most frequent SEAP sectors and municipal budget items, considering the changes occurred between the pre- and post-public accounting reform.

The fourth stage is based on a quantitative analysis (Franzese and Iuliano, 2019) involving the investment expenditures, current expenditures and investment ratio of Basilicata SEAPs approved. The investment ratio was calculated as the ratio of investment expenditure to current expenditure. This index has been used previously in the literature (Bisogno et al., 2023) in order to represent the relevance of long-term projects. A paired t-test was conducted for investment expenditures, current expenditures and the investment ratio.
Generally, the paired sample t-test was conducted in situations in which “the measurement scores in one group correlate with the scores in the other group, as seen when two measures are taken in each individual (e.g. before and after the intervention), which confirmed that the two groups are no longer independent”. In this research, the paired t-test was used to compare the difference in the average investment expenditures, current expenditures and investment ratio, ante and post SEAP approval period. (Casella and Berger, 2021)

Thus, the paired t-test was conducted according to two periods: pre-approval of the SEAP (pre-SEAP) and post-approval of the SEAP (post-SEAP). The years structuring the two periods were selected because of public investment follows a different logic from the private sector. The evolution of financial data does not immediately capture the evolution of public works in the country, as this expenditure is only recorded after the various stages of execution of the works. Therefore, financial data are the basic variable for observing the arrival of resources in the territory, but they only capture the behaviour of the entities with a certain delay.

Three tests are carried out for all sectors involved in the analysis and were performed through the Statistical Package for the Social Science (SPSS) version 28.0.1.1. These tests are:

α. absolute value of investment expenditure, current expenditures and investment ratio in the year following of SEAP approval of each Municipality as the post-SEAP period (t+1) and the expenditure in the years of approval of the action plan as the pre-SEAP period (t0).

β. averages of investment expenditures, current expenditures and investment ratio choosing as the as the post-period the average of the three following years (t+3), and as the pre-approval period the average of the last three years, including the year of approval (t-3).

γ. averages of investment expenditures, current expenditures and investment ratio choosing as the as the post-period the average of the five following years (t+5), and as the pre-approval period the average of the last five years, including the year of approval (t-5).

Moreover, two additional paired t-tests were conducted in order to provide further validity to the analyses:

δ. averages of investment expenditure, current expenditure and the investment ratio by choosing the average of the years after 2016 (post2016) as the next period and the average of the years 2005 to 2016, excluding the year 2016 (pre2016) as the period before approval.
ε. averages of investment expenditure, current expenditure and the investment ratio by choosing the average of the years after 2017 (post2017) as the next period and the average of the years 2005 to 2017, excluding the year 2017 (pre2017) as the period before approval.

The years 2016 and 2017 were chosen because about 92% and 95% of the municipalities receive SEAP approval in those years, respectively.

Exploring the impact of SEAPs on municipal investment expenditures, current expenditures and investment ratio, the authors tested two explorative hypotheses: the null hypothesis (H0) and the alternative hypothesis (H1).

H0: "The adoption of the SEAP has no effect on investment expenditures, current expenditures and investment ratio in the Basilicata Municipalities";

H1: "The adoption of the SEAP has an effect on investment expenditures, current expenditures and investment ratio in Basilicata Municipalities".

The probability (p) for statistical significance was determined as p < 0.05 (Casella and Berger, 2021).

The authors selected as data source the “Open Bilanci” database (“Open Bilanci” database, n.d.). It is an Italian public platform where each Municipality can publish its balance sheet collecting and detailing their investments expenditures and interventions related to several sectors (road maintenance, public lighting and public buildings). Currently, the coverage is from the years 2005-2021.

5.1 An Italian CoM NUTS3 Region: the case study of Basilicata Region

The authors selected Italy as country because it is the first country per number of signatories, and as highlighted by (Santopietro et al., 2021) over 70% of the total CoM signatories are related to the “smaller” cities (i.e. under 10,000 inhabitants). Furthermore, the focus was on inland areas (Laura Curatella and Scorza, 2020; L Curatella and Scorza, 2020), where an insularity effect (Garau et al., 2020) can be a measure of spatial segregation (Torre et al., 2015). Thus, it was selected as case study, a Southern Italian region, the Basilicata region (see figure 4), because of the relevant number of CoM signatories (92 CoM signatories out of 131 total municipalities) 92% of which are XS municipalities.
Analysing the Basilicata CoM signatories (see table 1), 81 municipalities have an approved SEAP by JRC, with only two yet to begin the update process towards the SECAP, which includes the climate component. Thus, a detailed analysis of the SEAPs approved in the first commitment period (2008-2020) was performed in order to achieve a comprehensive assessment of the public investments selected in the SEAP sectors.

<table>
<thead>
<tr>
<th>Status of commitment</th>
<th>No. of Municipalities</th>
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<tbody>
<tr>
<td>CoM signatories with a SEAP approved</td>
<td>81</td>
</tr>
<tr>
<td>CoM signatories without a SEAP</td>
<td>11</td>
</tr>
<tr>
<td>Non CoM signatories</td>
<td>39</td>
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6 Results

Analysing the MyCovenant platform, SEAPs of Basilicata Region have been detailed according to the occurrences of the SEAP’s sectors, and it emerged that there are three sectors selected by almost all the signatories: local electricity production, residential building and public lighting. The
occurrences related to the remaining sectors, remark the relevance of public interventions planned by the CoM signatories.

The main results from the analysis of the CoM database, highlight that Basilicata CoM signatories have a preferential interest in developing actions related to sectors managed through “public” investment like public lighting or municipal building equipment facilities. Instead, considering “private” sectors investments (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 (i.e. photovoltaics and wind power) and energy efficiency of the buildings.

In order to proceed with the analyses concerning the investment expenditures, current expenditures and investment ratio of the municipalities in the sample, it was necessary to find an alignment on two fronts. Firstly, it was aligned the chosen budget items with the sectors in which most of the Basilicata municipalities designed SEAPs actions. Secondly, (Santopietro et al., 2023, 2022b) have founded an alignment between the pre- and post-reform budget items. In detail, the authors find an alignment of three budget items (see table 2) with two SEAP's sectors ("public lighting" and "municipal building, equipment/facilities") where signatories have collected mainly public interventions. Specifically, the investments related to the education item of the municipal budgets have been included by CoM signatories in the SEAP sector “municipal building, equipment/facilities”.

Taking into account these considerations, the authors have chosen as focus area of the analysis the macro-categories listed in table 2, based on the sector in which the CoM Basilicata municipalities designed their interventions, in enabling them to achieve their energy efficiency objectives.

<table>
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<tbody>
<tr>
<td><strong>Education</strong></td>
<td><strong>Education and the right to study</strong></td>
</tr>
<tr>
<td>Expenditure for school services and maintenance of buildings owned - excluding kindergartens</td>
<td>Amount of all expenditure on education and school buildings (excluding kindergartens)</td>
</tr>
<tr>
<td><strong>Public lighting</strong></td>
<td><strong>Energy and diversification of energy sources</strong></td>
</tr>
<tr>
<td>Expenses for public lighting installations</td>
<td>Expenditure on administration and operation of activities and services relating to the use of energy sources, including electricity and natural gas</td>
</tr>
<tr>
<td><strong>Public buildings</strong></td>
<td><strong>Public and local housing and social housing plans</strong></td>
</tr>
<tr>
<td>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.</td>
<td>Expenses for the construction, purchase and renovation of public and social housing</td>
</tr>
</tbody>
</table>

(Source: “Open Bilanci” Database)
In figure 5, it is presented a geographical distribution of the Basilicata CoM signatories, that have developed in their SEAPs interventions related to the public lighting and municipal building, equipment/facilities sectors. Expenditures related to the “Education” item in table 2 were included in “Municipal buildings, equipment/facilities” SEAP sector by the CoM Signatories.

**Figure 5 Geographical distribution of CoM Signatories with interventions related to the public lighting or Municipal buildings, equipment/facilities.**

To provide a general overview of the municipalities' budget data, investment expenditure, current expenditures and the investment ratio were analysed considering absolute values over the time period covered.

Descriptive statistics were calculated for each expenditure item and sector considered. The assessment covered the years prior to the SEAP’s approval, i.e. from 2005 to 2016, and the post-approval years from 2016 to 2021 (see Table 3, 4, 5).

**Table 3 Descriptive statistics calculated based on investment expenditure for each sector.**

<table>
<thead>
<tr>
<th>INVESTMENT EXPENDITURE</th>
<th>Means</th>
<th>Std. Dev.</th>
<th>Min</th>
<th>Max</th>
<th>Median</th>
</tr>
</thead>
<tbody>
<tr>
<td>Public lighting_pre2016</td>
<td>38094,150</td>
<td>35062,109</td>
<td>0</td>
<td>144125,188</td>
<td>33618,602</td>
</tr>
<tr>
<td>Public lighting_post2016</td>
<td>23783,492</td>
<td>28864,251</td>
<td>0</td>
<td>103704,452</td>
<td>9471,760</td>
</tr>
<tr>
<td>Education_pre2016</td>
<td>123685,53</td>
<td>194661,223</td>
<td>0</td>
<td>1308623,87</td>
<td>64936,030</td>
</tr>
</tbody>
</table>
### Table 4 Descriptive statistics calculated based on current expenditure for each sector.

<table>
<thead>
<tr>
<th>CURRENT EXPENDITURE</th>
<th>Means</th>
<th>Std. Dev.</th>
<th>Min</th>
<th>Max</th>
<th>Median</th>
</tr>
</thead>
<tbody>
<tr>
<td>Public lighting_pre2016</td>
<td>159908,77</td>
<td>8</td>
<td>0</td>
<td>1439660,908</td>
<td>98968,830</td>
</tr>
<tr>
<td>Public lighting_post2016</td>
<td>78236,947</td>
<td>216669,805</td>
<td>0</td>
<td>1346516,586</td>
<td>1319,400</td>
</tr>
<tr>
<td>Education_pre2016</td>
<td>698118,75</td>
<td>3240632,39</td>
<td>0</td>
<td>27724342,090</td>
<td>141542,97</td>
</tr>
<tr>
<td>Education_post2016</td>
<td>465734,07</td>
<td>2075490,20</td>
<td>17686,</td>
<td>1869469,868</td>
<td>145455,40</td>
</tr>
<tr>
<td>Public building_pre2016</td>
<td>17357,098</td>
<td>88150,262</td>
<td>0</td>
<td>749950,426</td>
<td>0</td>
</tr>
<tr>
<td>Public building_post2016</td>
<td>17116,973</td>
<td>118129,949</td>
<td>0</td>
<td>1053681,048</td>
<td>0</td>
</tr>
</tbody>
</table>

### Table 5 Descriptive statistics calculated from the investment ratio for each sector.

<table>
<thead>
<tr>
<th>INVESTMENT RATIO</th>
<th>Means</th>
<th>Std. Dev.</th>
<th>Min</th>
<th>Max</th>
<th>Median</th>
</tr>
</thead>
<tbody>
<tr>
<td>Public lighting_pre2016</td>
<td>0,350</td>
<td>0,472</td>
<td>0</td>
<td>2,087</td>
<td>0,159</td>
</tr>
<tr>
<td>Public lighting_post2016</td>
<td>0,448</td>
<td>2,574</td>
<td>0</td>
<td>23,024</td>
<td>0</td>
</tr>
<tr>
<td>Education_pre2016</td>
<td>0,606</td>
<td>1,001</td>
<td>0</td>
<td>7,515</td>
<td>0,317</td>
</tr>
<tr>
<td>Education_post2016</td>
<td>1,460</td>
<td>1,444</td>
<td>0</td>
<td>9,872</td>
<td>1,049</td>
</tr>
<tr>
<td>Public building_pre2016</td>
<td>15,450</td>
<td>56,293</td>
<td>0</td>
<td>445,541</td>
<td>0</td>
</tr>
<tr>
<td>Public building_post2016</td>
<td>1,888</td>
<td>8,006</td>
<td>0</td>
<td>60,248</td>
<td>0</td>
</tr>
</tbody>
</table>
From the descriptive statistics, education is the sector that shows, on average, an increase in the post-approval period for the category of investment expenditure. All sectors experienced for the current expenditure, on average, a decrease in the period after SEAP. Public Lighting and Education presented an increase in the post-approval period in term of investment ratio. Only the Public Building sector registered a sharp decrease in the years following 2016.

In the quantitative analysis, the authors performed three paired t-test on public lighting, education and public buildings sectors.

The first paired t-test $\alpha$ (see table 6) conducted on investment expenditures show a significant difference in the mean values of the three sectors after and before the approval of SEAP. The effect of SEAP adoption is statistically significant in the education $t(80)= 2.607$, $p=0.011$ and public lighting sectors $t(80)= -2.906$, $p=0.005$. However, in the third sector, the public buildings, the difference between the averages was not statistically significant, $t(80)= -0.316$, $p=0.753$.

The second paired t-test $\beta$ remarked the statistics significance of education sector $t(80)=3.610$ $p=0.001$. In public lighting sector, the mean differences after and before the SEAP are not statistically significant with $t(80)=-1.662$ $p=0.100$. In contrast to the short-term analysis, the third sector, public buildings, has a statistically significant difference between averages, $t(80)=-3.634$, $p=0.000$.

The third paired t-test $\gamma$ showed values for the education sector equal to $t(80)=5.040$, $p=0.000$, the public lighting sector obtains values of $t(80)=2.305$, $p=0.024$; the public building sector has values of $t(80)=-2.990$, $p=0.004$. As comprehensive results, when the analysis is conducted over a longer time span all sectors turn out to be statistically significant, showing an impact of the CoM initiative on investment expenditures.

The three paired t-tests ($\alpha$, $\beta$ e $\gamma$) were also conducted on current expenditure and the investment ratio using the same time references. The analysis conducted on current expenditure (see table 7) shows inconsistent results. However, the only sector whose current expenditures are statistically significant, over the periods considered, is the Public Lighting sector. The education and public building sectors in most of the analyses conducted are not statistically significant.
Table 6 Results of the paired-sample t-test conducted on investment expenditures.

<table>
<thead>
<tr>
<th>Investment expenditures</th>
<th>Mean</th>
<th>Std. Dev.</th>
<th>Std. Err. Mean</th>
<th>Lower</th>
<th>Upper</th>
<th>t</th>
<th>df</th>
<th>Sig. (2-tailed)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Public lighting α test</td>
<td>-31421,451</td>
<td>97304,532</td>
<td>10811,615</td>
<td>-52937,250</td>
<td>-9905,652</td>
<td>-2,906</td>
<td>80</td>
<td>0,005</td>
</tr>
<tr>
<td>Public lighting β test</td>
<td>-11148,279</td>
<td>60362,961</td>
<td>6706,996</td>
<td>-24495,626</td>
<td>2199,068</td>
<td>-1,662</td>
<td>80</td>
<td>0,100</td>
</tr>
<tr>
<td>Public lighting γ test</td>
<td>-12715,883</td>
<td>49639,308</td>
<td>5515,479</td>
<td>-23692,035</td>
<td>-1739,730</td>
<td>-2,305</td>
<td>80</td>
<td>0,024</td>
</tr>
<tr>
<td>Public lighting δ test</td>
<td>-15860,772</td>
<td>60105,040</td>
<td>6678,338</td>
<td>-29151,088</td>
<td>-2570,456</td>
<td>-2,375</td>
<td>80</td>
<td>0,020</td>
</tr>
<tr>
<td>Public lighting ε test</td>
<td>-10907,872</td>
<td>65098,214</td>
<td>7233,135</td>
<td>-25302,269</td>
<td>3486,525</td>
<td>-1,508</td>
<td>80</td>
<td>0,135</td>
</tr>
<tr>
<td>Education α test</td>
<td>93234,121</td>
<td>321907,637</td>
<td>35767,515</td>
<td>22054,497</td>
<td>164413,744</td>
<td>2,607</td>
<td>80</td>
<td>0,011</td>
</tr>
<tr>
<td>Education β test</td>
<td>78494,775</td>
<td>195692,420</td>
<td>21743,602</td>
<td>35223,628</td>
<td>121765,923</td>
<td>3,610</td>
<td>80</td>
<td>0,001</td>
</tr>
<tr>
<td>Education γ test</td>
<td>121640,514</td>
<td>217222,522</td>
<td>24135,836</td>
<td>73608,671</td>
<td>169672,358</td>
<td>5,040</td>
<td>80</td>
<td>0,000</td>
</tr>
<tr>
<td>Education δ test</td>
<td>218313,533</td>
<td>264615,041</td>
<td>29401,671</td>
<td>159802,343</td>
<td>276824,723</td>
<td>7,425</td>
<td>80</td>
<td>0,000</td>
</tr>
<tr>
<td>Education ε test</td>
<td>234134,307</td>
<td>315351,097</td>
<td>35039,011</td>
<td>164404,453</td>
<td>303864,161</td>
<td>6,682</td>
<td>80</td>
<td>0,000</td>
</tr>
<tr>
<td>Public building α test</td>
<td>-4931,906</td>
<td>140385,910</td>
<td>15598,434</td>
<td>-35973,780</td>
<td>26109,968</td>
<td>-0,316</td>
<td>80</td>
<td>0,753</td>
</tr>
<tr>
<td>Public building β test</td>
<td>-42931,709</td>
<td>106312,042</td>
<td>11812,449</td>
<td>-66439,232</td>
<td>-19424,186</td>
<td>-3,634</td>
<td>80</td>
<td>0,000</td>
</tr>
<tr>
<td>Public building γ test</td>
<td>-65860,305</td>
<td>198219,464</td>
<td>22024,385</td>
<td>-109690,227</td>
<td>-22030,382</td>
<td>-2,990</td>
<td>80</td>
<td>0,004</td>
</tr>
<tr>
<td>Public building δ test</td>
<td>-62101,429</td>
<td>263675,751</td>
<td>29297,306</td>
<td>-120404,925</td>
<td>-3797,932</td>
<td>-2,120</td>
<td>80</td>
<td>0,037</td>
</tr>
<tr>
<td>Public building ε test</td>
<td>-66952,945</td>
<td>325298,346</td>
<td>36144,261</td>
<td>-138882,316</td>
<td>4976,426</td>
<td>-1,852</td>
<td>80</td>
<td>0,068</td>
</tr>
</tbody>
</table>
Table 7 Results of paired-sample t-test conducted on current expenditure.

<table>
<thead>
<tr>
<th>Current expenditures</th>
<th>Mean</th>
<th>Std. Dev.</th>
<th>Std. Err. Mean</th>
<th>Lower</th>
<th>Upper</th>
<th>t</th>
<th>df</th>
<th>Sig. (2-tailed)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Public lighting α test</td>
<td>-46006.356</td>
<td>196408.549</td>
<td>21823.172</td>
<td>-89435.853</td>
<td>-2576.860</td>
<td>-2.108</td>
<td>80</td>
<td>0.038</td>
</tr>
<tr>
<td>Public lighting β test</td>
<td>-63603.711</td>
<td>232453.522</td>
<td>25828.169</td>
<td>-115003.406</td>
<td>-12204.017</td>
<td>-2.463</td>
<td>80</td>
<td>0.016</td>
</tr>
<tr>
<td>Public lighting γ test</td>
<td>-86795.609</td>
<td>177547.110</td>
<td>19727.457</td>
<td>-126054.499</td>
<td>-47536.720</td>
<td>-2.463</td>
<td>80</td>
<td>0.000</td>
</tr>
<tr>
<td>Public lighting δ test</td>
<td>-115603.678</td>
<td>243587.339</td>
<td>27065.260</td>
<td>-169465.261</td>
<td>-61742.094</td>
<td>-2.463</td>
<td>80</td>
<td>0.000</td>
</tr>
<tr>
<td>Public lighting ε test</td>
<td>-105051.299</td>
<td>218528.845</td>
<td>24280.983</td>
<td>-153371.995</td>
<td>-56730.604</td>
<td>-4.326</td>
<td>80</td>
<td>0.000</td>
</tr>
<tr>
<td>Education α test</td>
<td>-60545.327</td>
<td>1099001.859</td>
<td>122111.318</td>
<td>-303554.593</td>
<td>182463.940</td>
<td>-0.496</td>
<td>80</td>
<td>0.621</td>
</tr>
<tr>
<td>Education β test</td>
<td>-127370.449</td>
<td>929618.207</td>
<td>103290.912</td>
<td>-332925.914</td>
<td>78185.017</td>
<td>-1.233</td>
<td>80</td>
<td>0.221</td>
</tr>
<tr>
<td>Education γ test</td>
<td>-229468.714</td>
<td>1318541.589</td>
<td>146504.621</td>
<td>-521022.201</td>
<td>62084.774</td>
<td>-1.566</td>
<td>80</td>
<td>0.121</td>
</tr>
<tr>
<td>Education δ test</td>
<td>-391934.109</td>
<td>2607698.854</td>
<td>289744.317</td>
<td>-968543.676</td>
<td>184675.458</td>
<td>-1.353</td>
<td>80</td>
<td>0.180</td>
</tr>
<tr>
<td>Education ε test</td>
<td>-372275.540</td>
<td>2456982.653</td>
<td>272998.073</td>
<td>-915559.018</td>
<td>171007.938</td>
<td>-1.364</td>
<td>80</td>
<td>0.177</td>
</tr>
<tr>
<td>Public building α test</td>
<td>5769.816</td>
<td>44162.435</td>
<td>4906.937</td>
<td>-3995.300</td>
<td>15534.932</td>
<td>1.176</td>
<td>80</td>
<td>0.243</td>
</tr>
<tr>
<td>Public building β test</td>
<td>1899.453</td>
<td>33292.514</td>
<td>3699.168</td>
<td>-5462.126</td>
<td>9261.032</td>
<td>0.513</td>
<td>80</td>
<td>0.609</td>
</tr>
<tr>
<td>Public building γ test</td>
<td>1268.993</td>
<td>37182.873</td>
<td>4131.430</td>
<td>-6952.816</td>
<td>9490.801</td>
<td>0.307</td>
<td>80</td>
<td>0.760</td>
</tr>
<tr>
<td>Public building δ test</td>
<td>-2611.870</td>
<td>27180.451</td>
<td>3020.050</td>
<td>-8621.961</td>
<td>3398.221</td>
<td>-0.865</td>
<td>80</td>
<td>0.390</td>
</tr>
<tr>
<td>Public building ε test</td>
<td>-3102.965</td>
<td>24365.659</td>
<td>2707.295</td>
<td>-8490.654</td>
<td>2284.725</td>
<td>-1.146</td>
<td>80</td>
<td>0.255</td>
</tr>
</tbody>
</table>
Table 8 Results of paired-samples t-test conducted on investment ratio.

<table>
<thead>
<tr>
<th>Investment ratio</th>
<th>Mean</th>
<th>Std. Dev.</th>
<th>Std. Err. Mean</th>
<th>95% confidence interval of the difference</th>
<th>t</th>
<th>df</th>
<th>Sig. (2-tailed)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Public lighting α test</td>
<td>-0.254</td>
<td>1.016</td>
<td>0.113</td>
<td>-0.479, -0.030</td>
<td>-2.252</td>
<td>80</td>
<td>0.027</td>
</tr>
<tr>
<td>Public lighting β test</td>
<td>0.037</td>
<td>1.453</td>
<td>0.161</td>
<td>-0.285, 0.358</td>
<td>0.227</td>
<td>80</td>
<td>0.821</td>
</tr>
<tr>
<td>Public lighting γ test</td>
<td>0.108</td>
<td>2.652</td>
<td>0.295</td>
<td>-0.478, 0.695</td>
<td>0.367</td>
<td>80</td>
<td>0.714</td>
</tr>
<tr>
<td>Public lighting δ test</td>
<td>0.278</td>
<td>3.486</td>
<td>0.387</td>
<td>-0.493, 1.049</td>
<td>0.717</td>
<td>80</td>
<td>0.475</td>
</tr>
<tr>
<td>Public lighting ε test</td>
<td>0.379</td>
<td>4.174</td>
<td>0.464</td>
<td>-0.544, 1.302</td>
<td>0.816</td>
<td>80</td>
<td>0.417</td>
</tr>
<tr>
<td>Education α test</td>
<td>0.413</td>
<td>1.454</td>
<td>0.162</td>
<td>0.092, 0.734</td>
<td>2.557</td>
<td>80</td>
<td>0.012</td>
</tr>
<tr>
<td>Education β test</td>
<td>0.480</td>
<td>1.757</td>
<td>0.195</td>
<td>0.091, 0.868</td>
<td>2.456</td>
<td>80</td>
<td>0.016</td>
</tr>
<tr>
<td>Education γ test</td>
<td>0.850</td>
<td>1.635</td>
<td>0.182</td>
<td>0.488, 1.211</td>
<td>4.676</td>
<td>80</td>
<td>0.000</td>
</tr>
<tr>
<td>Education δ test</td>
<td>1.494</td>
<td>1.805</td>
<td>0.201</td>
<td>1.094, 1.893</td>
<td>7.446</td>
<td>80</td>
<td>0.000</td>
</tr>
<tr>
<td>Education ε test</td>
<td>1.588</td>
<td>2.105</td>
<td>0.234</td>
<td>1.123, 2.054</td>
<td>6.791</td>
<td>80</td>
<td>0.000</td>
</tr>
<tr>
<td>Public building α test</td>
<td>-21.853</td>
<td>234.093</td>
<td>26.010</td>
<td>-73.615, 29.909</td>
<td>-0.840</td>
<td>80</td>
<td>0.403</td>
</tr>
<tr>
<td>Public building β test</td>
<td>-16.267</td>
<td>83.062</td>
<td>9.229</td>
<td>-34.633, 2.100</td>
<td>-1.763</td>
<td>80</td>
<td>0.082</td>
</tr>
<tr>
<td>Public building γ test</td>
<td>-11.791</td>
<td>51.531</td>
<td>5.726</td>
<td>-23.185, -0.397</td>
<td>-2.059</td>
<td>80</td>
<td>0.043</td>
</tr>
<tr>
<td>Public building δ test</td>
<td>-1.589</td>
<td>145.885</td>
<td>16.209</td>
<td>-33.847, 30.669</td>
<td>0.098</td>
<td>80</td>
<td>0.922</td>
</tr>
<tr>
<td>Public building ε test</td>
<td>0.900</td>
<td>169.939</td>
<td>18.882</td>
<td>-36.676, 38.477</td>
<td>0.048</td>
<td>80</td>
<td>0.962</td>
</tr>
</tbody>
</table>
Several considerations can be made in relation to the investment ratio (see table 8). It is interesting to note that, regardless of the significance of the statistical test (which again shows satisfactory results in the education sector), the coefficient of the averages calculated by the software is mostly positive. This means that, on average, the ratio of investment expenditure to current expenditure increases in the post-SEAP period. With a higher ratio in the post-SEAP period, it is reasonable to assume that investment expenditure is proportionally higher than in the pre-approval period. This may indicate a willingness on the part of municipalities to devote more financial resources to long-term projects, thus effectively reducing their current operating costs.

7 Discussions and conclusions

This first assessment of investments related to public energy efficiency measures showed an overall positive impact of the CoM initiative on small municipalities.

The sector that has benefited most in terms of financial allocation is the education sector. This is due to the fact that public buildings in the small municipalities of Basilicata are either municipal or educational. For this reason, municipal governance is oriented towards selecting efficiency interventions mainly in school buildings. The public lighting and public building sectors also seem to have benefited from participation in the CoM initiative, albeit to a lesser extent than the education sector. The increase, in this case, in investment expenditure is especially evident when the object of analysis is the investment ratio.

The trend of financial data, in the public sector, is the fundamental variable for observing the arrival of resources in the territory, however, it only captures the behavior of entities with a certain delay (Ferretti et al., 2021). Since the financial crisis of 2009, public investment has been progressively shrinking. According to Ferretti et al. (Ferretti et al., 2021), decentralised authorities are responsible for 56% of public gross fixed capital formation, a higher percentage than in many European countries. Local authorities, in order to cope with the crisis, have had to review their spending, preferring to reduce investment rather than the provision of services to citizens (Ferretti et al., 2017). In 2018, local government investment spending shows signs of recovery, but the trend reversal is still weak. This may provide an explanation for the limited allocation of financial resources of municipalities to investment expenditure in recent years. In this context, the National Recovery and Resilience Plans (NRRP) represent a financial push in the national, regional and local budget availability of municipalities, boosting the stock of investment expenditure.
The increase in investment expenditure shows the benefit in joining CoM, in terms of achieving financing opportunities for SEAP’s projects, contributing not only to achieving sustainability goals but also to promoting territorial and social development. The positive impact can be explained not only by observing the increase in investment expenditure by signatory municipalities in the post-adhesion period, but also because this confirms the economic advantage in terms of “better opportunity” in obtaining public funding, including European funding. According to (Malandrino et al., 2019) in order to improve the energy performance of the PA, effective detection systems must be implemented and adequate data and information must be available to assess the results obtained in order to identify possible areas for improvement. In this scenario, the CoM initiative could be a valuable tool to provide useful information and guide energy efficiency actions.

The behaviour of municipalities appears to be consistent with Legitimacy and Stakeholder theory. The large number of municipalities in Basilicata that have signed CoM clearly explains the need to gain legitimacy. The climate emergency and consequently energy efficiency are a must that municipalities, as all other entities, can no longer ignore. CoM signatory shows how municipalities choose to increase their legitimacy by taking part in a European initiative where a community of similar organisations are employed for the same sustainability goal.

Under the Stakeholders theory, municipalities are including in their strategic sustainability plans objectives considered relevant by a wide number of stakeholders’ categories. Among them, there are not only citizenship and employees but also government Institutions, Regulatory and policy makers at the forefront involved in global warming.

Accountability and reporting are also crucial in Legitimacy and Stakeholder theory. The slight delay of a part the municipalities in providing the SE(C)APs and reporting could due to the lack of resources (mainly human) able to do that.

Furthermore, the CoM initiative promoted investment policies in energy efficiency, supporting the weaknesses in terms of technical capacity of small Municipalities as well as implementing CO₂ reduction interventions oriented toward the EU 2050 targets. Considering the voluntary approach pursued by CoM, the increase of investments marks a positive impact in terms of incentives to plan interventions in reducing energy consumption and support the building of a “green awareness” of citizens through these interventions. Moreover, data on municipal budgets is a meaningful tool to improve the monitoring capacity for SECAP implementation and could be considered as additional indicators to be included in the CoM Monitoring Reports.
In a planning perspective, SEAP/SECAP design long-term period targets, offering to the municipalities a way out to affirm the principles of strategic planning in a perspective oriented to the usefulness of the results. Furthermore, SEAP/SECAP could fill the lack of framework for strategic planning, performance measurement, and reporting according to performance indicators, targets, and milestones.

By utilizing municipal budget analysis, this research introduces an innovative approach to monitoring and assessing the impacts of the CoM. It leverages existing budgetary data to evaluate the effectiveness of energy investments and their contribution to the overall objectives of the CoM. This novel approach offers valuable insights into the complex process of monitoring and assessing the impacts of the CoM. Moreover, this research contributes to the existing body of knowledge on CoM impact assessment by providing an economic perspective. It fills a gap in previous literature at the local and regional levels by exploring the economic implications and benefits of CoM participation. Additionally, it offers insights that can inform decision-making processes related to energy efficiency for practitioners involved in the CoM. It investigates how the voluntary commitment of municipalities in the framework of CoM is the view of a pervasive approach toward sustainability that the weakest EU territory demonstrates through a new season of municipal energy planning and effective changes in the municipal budget.

Limitations related to this research are: 1) the focus on the public investments related only to three categories (education, public lighting and public buildings); 2) the economic assessment focused on CoM municipalities; 3) the selection of a specific municipalities’ population size (i.e. below 10,000 inhabitants); 4) the small size of the sample investigated.

Future developments of the research are the following. Firstly, the extension to other private and public sector in order to achieve an “urban vision” (see also (Scorza and Santopietro, 2021)) of the SEAP impact, it is also useful to investigate other intervention categories including private investments (i.e. the transport sector is one of the main SEAP sectors (Croci et al., 2017; Kona et al., 2017) especially for those small Municipalities with tourism specialization (Santopietro et al., 2022a)). Secondly, a comparison of the economic assessment between CoM and non-CoM signatories in order to define a performance evaluation in terms of expenditure reduction and consumption reduction achieved. Thirdly, the extension of the sample with medium-large population size municipalities (over 10000 inhabitants). Al least, CoM offer the possibility to join in group of municipalities and this is a furthermore field of research useful to investigate forms of collaboration that could remove both financial obstacles through the subdivision of transaction costs and the exchange of know-how and best practices currently available(Malandrino et al., 2019).

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An economic appraisal of the SE(C)AP public interventions towards the EU 2050 target: the case study of Basilicata Region

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