

# Citizens Awareness Energy Park. The value of knowledge sharing and energy science in local communities.

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**Abstract:** Universities often act as a link between local communities and innovative research activities. In this context, this study explores the design of a Citizens Awareness Energy Park (CAEP) for demonstrating and disseminating knowledge to the local community. The CAEP aims in demonstrating applications of renewable energy and energy-saving technologies. Through this work, the behavioural and attitudinal change related to energy use and environmental protection issues related to the energy transition are promoted. The study was implemented in the Municipality of Ilion and consisted of three stages. Initially, a research questionnaire was developed and distributed to citizens to record their awareness on contemporary energy issues. Next, selected renewable energy technologies were sized and sited in an existing open space in the Municipality of Ilion. Finally, citizens actively participated in environmental pollution measurements in the "citizen science" practice framework. The study's results identified the possibilities and difficulties of creating an effective CAEP, while assessing the critical commitment factors of the actors (e.g., citizens, local enterprises, municipal authorities, etc.) involved.

**Keywords:** Social Attitude, Energy Transition, Citizen Science

## 1. Introduction

Local authorities plan and manage public spaces, which are considered essential components of each area and connect residents with the natural environment and with each other. The Council of Europe (Council of Europe, 1986) defines the essential characteristics of open spaces and emphasizes their role in the city as a vital part of the urban heritage and highlights their important educational role. Furthermore, open spaces are essential for social interaction, enhancing social development, and supporting economic goals and activities.

Open spaces are considered excellent areas for increasing the public energy awareness. Energy parks have been established in many cities around the world. Educating residents interactively is a process that continues to develop and enhance over time. One of the first energy parks was built in the Rangasamy region of India in 2004. This "Educational Energy Park" aimed to educate residents about the importance of energy, the different types of

energy and renewable sources, supporting the learning procedure through play. The park includes both indoor and outdoor exhibition spaces.

In this direction, the present work presents the methodological approach carried out by the Soft Energy Applications & Environmental Protection Lab research team to achieve energy awareness and engage the local community in the energy transition process. The energy park's design and operation in a public open space of Ilion municipality (West domain of Attica) is the central core of the methodology.

## 2. European Policy and Local communities in Energy Transition

Local communities are vital to achieving a "Just Energy Transition". By following the European Directives and especially the latest Council Recommendation no. 608 to Greece (24/05/2023) for local energy management and the promotion of distributed generation, the production and consumption of energy in a sustainable and reasonable way can be ensured (The Council of the European Union, 2023).

Moreover, the European Green Deal (EGD) (European Commission, 2023a) is a growth strategy that aims to transform the EU into a fair and prosperous society with a modern, resource-efficient and competitive economy. In order to introduce EGD, the policies for clean energy supply across the economy, industry, production and consumption should be reconsidered.

Following the recent Eurobarometer surveys, EU citizens clearly support the acceleration of the energy transition, notably the investments in renewable energy. They also agree that the EU should support the green transition by investing massively in renewable energies (86%). 85% of Europeans are convinced that increasing the energy efficiency in buildings, transport, and goods production will minimize dependency on energy producers outside the EU. In addition, 81% say they have taken action to reduce their energy consumption (Eurobarometer, 2023a) while 88% of EU citizens believe in a green transition that leaves no one behind. Yet, only 46% of Europeans are confident that 2050 sustainable energy, products and services will be affordable for everyone, including poorer people. 77% of Europeans feel that acting to limit climate change is a personal responsibility, and over half (53%) are confident

that they could use less energy than they do now (Eurobarometer, 2023b).

It is also important to involve in this energy transition process all stakeholders, including residents, businesses, and government officials, to ensure that everyone's needs are considered (Boulogiorgou D., Ktenidis P., 2020). Good practices in Europe (Lowitzsch J., et.al., 2023) demonstrate effective operation, strong participation, raising awareness of local communities in the fight against climate change and building resilience in multiple levels (Kaldellis J.K, et.al., 2006). The present research focuses on the local community of the Municipality of Ilion in the West domain of the Attica region in Greece and on the importance of establishing an awareness centre in a public open space of the area.

Involving the public in the local energy transition process is crucial for understanding community needs and concerns. Engaging with all stakeholders ensures a transparent and inclusive process for a sustainable energy transition. More specifically, the role of participation is found:

1. in diagnosing the needs of local society/all stakeholders due to the energy transition process,
2. in the development of alternative solutions to solve issues that arise,
3. in evaluating alternatives, which will support the implementation of the final solution choice.

In this study, asking people what they think about energy is critical for public engagement (Kaldellis J.K., Kavadias K., 2004). The reasons why people participate in surveys can greatly vary. For some, it could be a general interest in the topic being explored, while for others, it could be a desire to contribute to the project. Socializing with local society and feeling part of a group can also be significant motivations, especially when the project aligns with the participants' values. However, it's important to note that everyone may have its own unique reasons for getting involved. Therefore, careful planning of each step and implementation of a project can be crucial in creating incentives for participation (Paajanen, S. et.al., 2021).

### 3. Field Research & actors involved

The local community's opinion was investigated using specially organised questionnaires as the first step of the analysis. The citizens' responses regarding their knowledge of the Municipality's renewable energy and environmental protection projects, their perception of the necessity of actions to protect the environment and the relationship between energy consumption and environmental protection were recorded. They were also asked their opinion on the acceptance of the relevant projects of the Municipality of Ilion and their intention to participate in Energy Communities. The questionnaire was distributed to citizens of the Municipality of Ilion who live or work in the area. The responses were analysed to draw the necessary conclusions on understanding:

- What is the level of knowledge on energy issues, according to age and gender and what an appropriate learning program should include?
- What is the awareness of the residents of the Municipality about actions that are already taking place

in their area to highlight the effectiveness of informing the citizens about the actions of the Municipality?

- What is the knowledge of energy-saving actions at an individual level?
- What is the level of knowledge about collective actions related to energy?

In Fig. 1, the demographic data of the responders are presented related to their sex, age, and place of residence. As one may see, the questionnaires concerned citizens have been almost equally distributed in all age categories and genders, while their houses are located and located mainly in the centre of the Municipality, close to the location of the proposed energy park. Considering the results, young people need to be sufficiently informed about energy-related actions and projects that the Municipality has carried out whereas people over 55 found to be more aware of the Municipality's actions. In general, the level of knowledge of the respondents regarding the actions concerning the energy transition of the Municipality of Ilion was found at a satisfactory level.

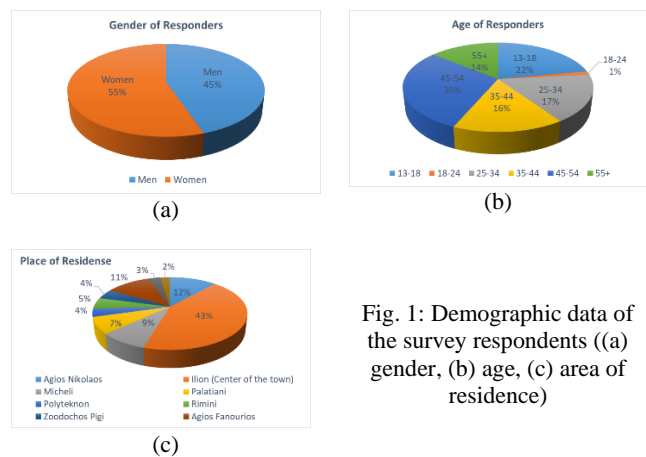


Fig. 1: Demographic data of the survey respondents ((a) gender, (b) age, (c) area of residence)

### 4. The Citizens Awareness Energy Park (CAEP)



Fig. 2: A virtual overview of the proposed CAEP

The Park was designed for the Municipality of Ilion, at 45-49 Petroupoleos Street, in the Petalouda area. The total area is 6335 m<sup>2</sup>. On the southeast side of the Park is the Municipal Dog Park of 1056 m<sup>2</sup>. The CAEP will consist of 4 sectors: the entrance-reception, the playground, the exhibition of RES technologies and the Municipal Dog Park (Fig. 2).

To obtain an engaging, interactive design environment and investigate the optimum scenarios for the position of the various energy technologies demonstration, a virtual

visualization was developed. The proposed setup is presented in Fig. 3.

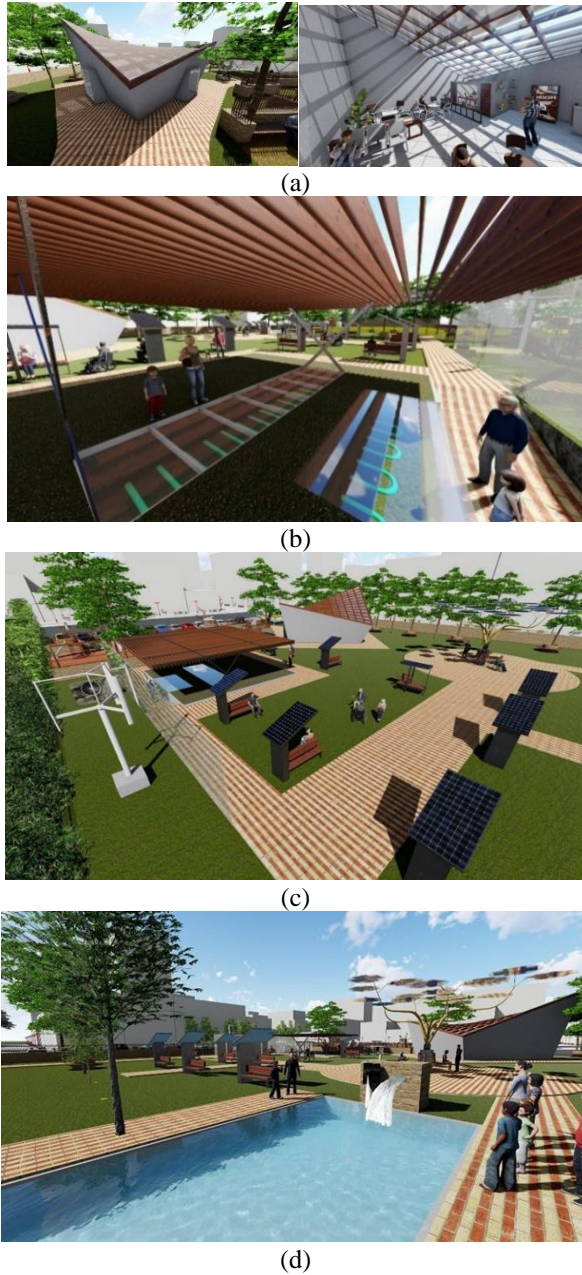


Fig. 3: Virtual presentation of the different sectors of the CAEP ((a) reception/information kiosk (b) geothermal demonstration area (c) wind and solar energy sector (d) hydro energy demonstration area)

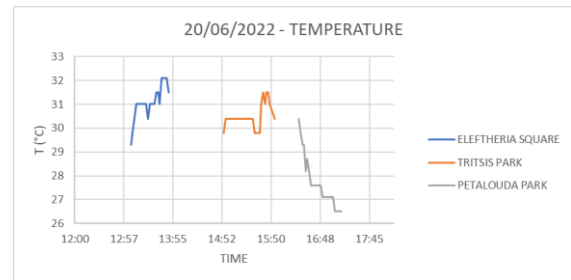
More precisely, the renewable energy and energy saving technologies, demonstrated in the CAEP, includes:

- the geothermal heat pump, presented by ground loop pipes with transparent parts so that visitors can see the heat exchanger and the temperature gradient at different depths in the ground,
- the wind energy, presented by a vertical axis wind turbine assisted by a fan embedded in the ground to be used in cases when demonstration is needed under very low wind speeds,
- solar energy, presented by photovoltaic panels on top of benches and a solar tree construction served also as a charging point,
- hydropower, presented in a fountain construction by a small water turbine supplied by a pump.

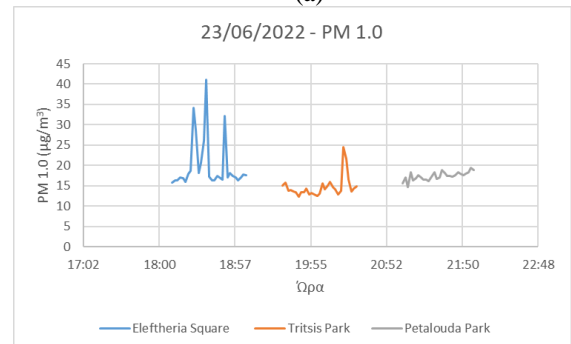
## 5. Local Community engagement and Citizen science

The first engagement process with the local community occurred in a citizen science demonstration (European Commission, 2023b). Citizens were selected according to their availability and willingness to participate in the measurements of environmental pollution and heat island effects. They were informed about air pollution and heat islands before and during the measurements process. The measurements acquired were presented to them as the final stage of the citizen science process.

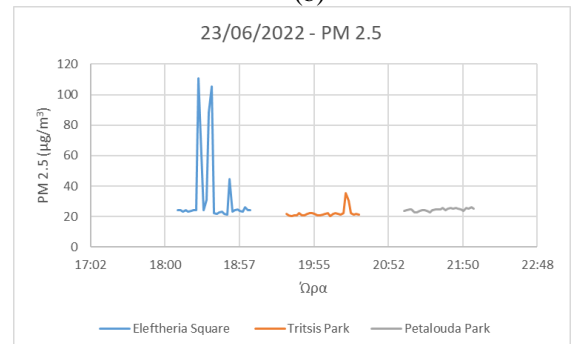
Measurements started at the Eleftheria Square, Antonis Tritsis Park, and Petalouda Park. The aim was for the citizens to understand the Citizen Science process. They have examined the air quality, in the centre of Ilion City, on a working day at noon at the end of working hours, compared to a day characterized as a holiday, and the traffic on the streets is remarkably reduced. Fig. 4 presents an example of the measurements obtained regarding the temperature, the PM 2.5 and PM 1.0 particles, which are particularly harmful to human health. It was indicated that traffic was the main reason for increased values on the measured parameters. At that early demonstration stage, it was observed that Petalouda Park presented the lowest temperatures compared to the rest of the areas by an average of 1 -2.5° C.



(a)



(b)



(c)

Fig. 4: Daily on-site measurements with remote equipment carried by local citizen

Close cooperation with the Municipality of Ilion was required during the park planning. The positive attitude of employees and elected officials was essential for the successful completion of this pilot project. However, difficulties familiar to all European Municipalities were also recorded (Faye, C., Macharia, P., 2022). In particular, more than the number of employees is needed for the work they are called to carry out. We noticed that there needs to be more expertise in energy matters in a large percentage of the employees in the technical service. We faced time-consuming procedures for accessing documents. Also, access to finance is difficult and time-consuming, even for a municipality with its own budget.

During the implementation of the study it was confirmed that the Municipality's cooperation with the University's researchers was a two-way transfer of knowledge (Reichert S., 2019), a process that is also necessary for the following stages of construction and operation of the project. The Municipality has knowledge on the processes of the public administration and has information about the needs of the local community. On the other hand, researchers know the technologies and policies shaping the modern energy transition. Combining these two is essential for effective planning and implementing local energy transition strategies.

## 6. Conclusions

An integrated study was carried out to design a CAEP to inform and increase the residents of the Municipality of Ilion knowledge regarding environmental quality, through the rational use of energy. Initially, it was examined the process required to map:

- citizens' existing knowledge in matters related to Energy and the Environment,
- the citizens' level of knowledge of the projects and actions carried out by the municipal authority,
- the citizens' behaviour for energy consumption and production
- as well as the intention of citizens to participate in joint municipality future actions of the energy transition.

What is really encouraging is that despite the lack of detailed information regarding energy communities from society, the percentage of the willingness to participate or information in such actions exceeds 80%, reinforcing the arguments in favor of the CAEP implementation. Note that the Park will be an information point on energy transition issues that will act as an accelerator of knowledge transfer/sharing, as well as a place for the local community to interact and implement participatory actions concerning energy transition and environmental protection.

Public acceptability of sustainable energy innovations and policies is crucial in enabling the transition and meeting the critical climate targets of the Paris Agreement (United Nations, 2015), which is the primary motivation goal of EGD. The design of the strategic plan for the energy transition at the municipal level is a participatory process to obtain/gain the acceptance of the local society and exploit the potential of the entities involved.

The proposed methodology for developing a CAEP can be a pilot program for studying and accelerating the just local energy transition and promoting a collaborative model in the context of contemporary scientific approaches developed in order to optimum planning and applying the appropriate energy policy.

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