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Proposal for a unit of measurement for sustainable energy planning: Energetic Population equivalent , the EPe

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Abstract

The municipal energy plans are an essential tool for measuring power and estimation of future energy needs, the article proposes a new method for measuring according to other examples of standards that are already in use and normed by the Italian legislation.

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Keywords: Energy planning, Energetic Population equivalent, Unit of measure, Distributed Generation, Microgeneration.

1. Introduction

The standardization and the use of reference models facilitate the determination of measures usefull for the realization of any measuring. The proposed unit of measure Energetic Population equivalent (hereafter EPe) arises from the need to define the energy needs of a dweller within the urban system in order to adequately size the future energy plans in relation to future urban forecasts.

Commonly, speaking of units of measuring energy in terms of population, in reference to the conventional amount of energy kWh measured and required per person, as it is thought that the population is the most significant variable to explain the increase of energy consumption in the field residential.

The idea of the EPe arises from the need to evaluate in a more concrete and measurable way the

future energy needs within the municipal energy plans. Using tools that make it easier for local energy planning, as at the moment within the municipal energy plans, there is an approach that follows the current trend of the market

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in terms of supply and demand, whereby the energy generated is a product offered on the market that is characterized by certain peculiarities compared to other consumer goods because it is not a storable good and also can be considered a public service, as it is used in any production cycle and is, therefore, essential to the life of every citizen .

Before talking about the numerical structure that makes up the EPe, a framework of the situation of large-scale energy production should be drawn in Italian. The situation whereby the local municipal later.

2. Energy production and demand in Italy

According to the current structure of the electricity networks, it is required that in every moment the production of energy is equal to the consumption, in absence of this condition could generate imbalances which must be solved to avoid degradation of the technical characteristics of the transmitted energy, in terms of frequency and voltage.

Currently the amount of energy to produced in the various plants in Italy is calculated following the statistical models and analysis of forecasting that allow to arrive at results very close to the actual consumption values. The forecasting curve of demand of energy demand is updated in real time by Terna company and shows at the same time the expected demand curve and the real demand curve. These predictions are useful to ensure large-scale coverage of the demand curve and to assemble the national energy mix from various sources, that will meet the

effective national demand.

Today the situation of the plants dedicated to power generation is managed by 7 major players who think in terms of large-scale production and therefore with large volumes of installed capacity (Enel appears to have a total installed capacity of about 42 GW), despite the liberalization (Legislative Decree 79/99), which led to the construction of large thermal power plants mostly as Combined

Cycle Gas Turbine (400-500 MWe), also known as mid-merit plants that helped to secure the largest share of production of energy needed in Italy. From these plants in 2012 was covered for 72% of the demand, after the liberalization Italy has had a fast growth of installed capacity (more than 30% in just 10 years) and today has fairly vast thermoelectric power stations.

It is important to add that this kind of power does not find a place close to the places of consumption of energy by way of the righteous safety limits and the listing of these activities as central to risk a major accident, but despite the tough regulatory process, the construction was not discouraged . In the past however thanks to the widespread use of renewable energy sources, these plants have had significant decreases in production.

Considering the above, it is now important to mention how alternatively the planning and management to small scale is more important and this introduce the purpose of this study.

In the Italian legal framework, according to the 10/91 law it was determined that all municipalities with more than 50.000 inhabitants are obliged to adopt a municipal energy plan that sets clear strategic objectives of energy policy within their territory. However, in terms of numbers until 2012 considering 147 Italian cities (with population greater than 50.000 inhab.) only 42 of them were equipped with an energy plan, only developed with surveys and quantitative estimates of energy consumption in the area. This approach inevitably leads to the development of plans that tend to propose objectives such as reducing consumption, promotion of measures to improve green energy and analyze the state of art based only on the amount of energy consumed, often expressing itself in terms of the amount of installed capacity in a specific territory and omitting references to those that are the energy needs of the population.

The approach being proposed is based on the awareness that the energy analysis applied to urban planning affect the quality of life of the citizens. Therefore, a proper design must take into account the social context in which it operates.

Considering the population is, therefore, essential to give a proper measuring of an energy strategy to measure the actual needs of a territory. In fact, the proposal of this article is to estimate, through the analysis of the current future predictions, and then put the solutions to future energy needs.

The combination of Energy and Planning in fact it should mean predicting possible future energy production and solve any supplying problems, investigate their possible impacts, describe how to deal with, select strategies among the alternatives available, and go through a series of stages for achieving a goal

3. The calculation of EPe

To define and explain what is meant by EPe we approach the standardization already established in Italian law.
The definition adopted for determining the value of Epe has its inspiration in two definitions in particular:

• inhabitant equivalent according to the Legislative Decree. 152/06, this definition is borrowed its decomposition in resident population equivalent
• planning standards according to Ministerial Decree 1444/68 in which it is assumed a mandatory minimum of territorial allocation in terms of services to the citizen and the DM 05/07/75 where are stablished the minimum requirements as regards the housing.

From these two definitions, now become benchmarks for the implementation of planning tools, which are the "Piani d'Ambito" and urban plans, want to start to make even the energy can be measured in a unit that also match with the other planning instruments .

To calculate numerically the EPe another important tool is the energy performance certificate APE (Law 90/2013) determining that the homes that are located in the A energy class (the class to which it tends towards improvement) is to have a maximum power consumption of 30 kWh/m^2, as required in accordance with the assumption that in the Ministerial Decree 5/7/75 it is determined that a surface per inhabitant is established between 30 and 50 m^2/inh and because of the housing situation in the Italian cities (the difference between the city and the country) will be placed the average per capita value of 40 m^2.

Given these parameters, the purpose is to use them to calculate the final value of the Epe and thus give a dimension of energy consumption in relation to the square meters regularized by urban standards, currently adopted for the design of a municipal plan.

The calculation that is then proposed to find the corresponding value of EPe measured in kWh /inhabitant is the following:

$$EPe = 30\ kWh / m^2 \bullet 40\ m^2 / inh$$

Consequently, the average consumption would be 1.200 kWh / inhabitant per year, this value turns out to be basically in line with the low average consumption per - capita household current that are around 1.190 kWh (Istat 2012) and it can be used as the unit of reference for the estimated municipal energy planning. For planning purposes, within energy plans is proposed to use a parameter for every dweller of the entire population living in a specific territory, quantified in terms of EPe where, however, to every resident inhabitant according to ISTAT data, is attributed a population equivalent energy.

So within a plane energy value associated with each AEe will be "1".

4. Future municipal energy plans.

The housing stock in the entire national territory has more than 13 million buildings and about 87% of them are residential. According to the current national energy planning it is essential to bring this heritage to a better energy sustainability, not only realizing improvement on windows and on the casing but also implementing the self-energy production.

The trend is that one day there will be a system of small-scale energy production, understood as a micro capillary in the service of a distributed generation. This will change the way we think the electricity distribution network and this innovation process is currently supported by a number of economic incentives that governments have planned to finance the massive investment needed to transform the current network.

In fact, the distribution network can no longer be seen as a simple passive network having the purpose of supplying energy to consumers, but an active network that allows a bidirectional flow of energy, where in addition to ensure a secure supply, economic and sustainable, the generation of energy is more widespread in the area and then in closer proximity to the final consumer. This fact would lead to a significant reduction of network losses,

currently estimated to be around 21.000 GW Another advantage of micro-service networks of distributed generation is the best sizing and energy requirements for this aspect of the EPe might find its proper use.

Afterwards the idea of measuring the future energy plans according to the logic of micro distribution structure is in fact becoming increasingly popular field, especially in the United Kingdom countries, where now the energy generator is seen as an appliance included in new houses.

5. Conclusions

The use potentiality within the EPe in municipal energy plans as is explained can be vital, it is precisely for this reason that, starting from the estimating of the residential EPe there is also interest in studying the measure to determine the Industrial EPe and also floating EPe as currently being considered in the Piani d'Ambito. Finally, as there is only one definition of inhabitant equivalent in Legislative Decree 152 of 2006 and subsequent amendments, the following is proposed what could be the definition of EPe in the Italian legal framework: Energy population equivalent EPe is the amount of energy to be produced to meet the energy needs of every single person permanently resident in a city centre, the required amount is equivalent to 1.200 kWh / inhabitant per year, intended as a maximum value in a perspective of housing progressive improvement towards energy sustainability.

To extend this definition could also be taken inspiration from a model developed by Delft University of Technology, which serves as a guide to pursue sustainable energy in residential buildings.

In the proposed model there are in fact three steps that must be followed to reach the path of sustainable energy. The first step is highlighted the target to reduce energy demand; in the second step particular attention is focused to the integration of systems of energy production from renewable sources, so reduce might also be re-interpreted for the purposes of the definition of EPe to define limits that should not exceed and promoting the use of renewable energy such as small diffuse energy production systems, accessible via the microgeneration of energy from renewable sources.

Finally, the third step proposes the inclusion of this unit of measurement for sizing power: it would give a twist to the Italian energy policy, still far behind in terms of legislation, as the delays in the transposition of European directives and how controls on the energy certification of building currently managed; but it is also hoped that in this way the municipal energy plans could be drawn up in the most efficient manner, pointing to the goal of maintaining and increasing awareness of energy consumption.

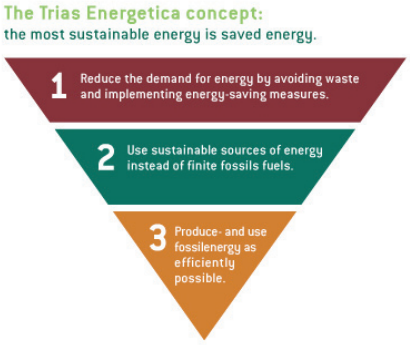

Fig. 1. Energetic triad, University of Delf

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