



Uncovering the multiple objectives behind national energy efficiency planning

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ABSTRACT

This work seeks to identify the fundamental objectives behind the development of energy efficiency (EE) plans for countries. It also presents a method to quantify the degree of achievement of each objective, through the identification and operationalization of attributes. This was achieved by applying Keeney's value-focused thinking approach. For that purpose, three key decision makers in EE planning were interviewed along with a bibliographic review on the subject. From this process six fundamental objectives were identified formalizing the problem as a multi-objective one: (i) to minimize the influence of energy use on climate change; (ii) to minimize the financial risk from the investment; (iii) to maximize the security of energy supply; (iv) to minimize investment costs; (v) to minimize the impacts of building new power plants and transmission infrastructures and (vi) to maximize the local air quality. The respective attributes were: (i) CO₂ emissions savings; (ii) payback; (iii) imported energy savings; (iv) investment cost; (v) electricity savings; and (vi) total suspended particles savings. To show the usefulness of the work, the objectives and attributes identified were used to show the possible outcomes from five hypothetical EE plans for Portugal.

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1. Introduction

It is nowadays widely accepted that Energy Efficiency shall play a key role in the transition to a more sustainable energy future (IPCC, 2008; McKinsey and Company, 2009). Its potential contribution is not only at the level of improved energy conversion technologies, but also at the level of the organization and management of the infrastructures in a way to avoid intensive energy needs. The EU Green Paper on Energy Efficiency shows that a key way to improve energy efficiency is through policy instruments, as national energy efficiency plans (European Union et al., 2005). In general, energy efficiency plans give guidelines to the process of achieving energy savings and reaching established quantified targets (European Parliament, 2006; Dixon et al., 2010; Resolução do Conselho de Ministros no 80/2008. DR 97 SÉRIE I, 2008). Often, besides the guidelines, the plans also include the identification of the concrete energy efficiency measures that enable achieving the plan goals.

In 2006 the European Union adopted the Directive 2006/32, also known as the energy end-use efficiency and energy services

Directive (European Parliament, 2006). This directive established that each EU country was obliged to develop a National Energy Efficiency Action Plan (NEEAP) to promote energy services and/or energy efficiency improvement measures in order to achieve formal final energy savings targets. The transposition of the Directive from the EU level to the Member State level required an effort to build NEEAPs, where Energy efficiency (EE) measures were selected and described with the expected singular and overall impacts on the final energy use of the respective Member State.

Energy efficiency measures can be seen as an activity or set of activities designed to decrease the overall energy use that a system needs to provide some service. Such decrease can be achieved through physical changes of systems and equipment (e.g., changing a motor at an industry for a more efficient one) or through changes on the management and operation of systems (e.g., turning the equipment off while they are not in use). The changes that occur in the physical world are here called physical or technical measures. In order to make EE measures operational, it is necessary to have promotion mechanisms and/or implementation processes. Such processes formalize how to encourage, or even force, the society to accept and implement the expected changes. Typical implementation mechanisms are the creation of new regulations to make mandatory minimum efficiency standards, fiscal incentives and information and education campaigns. Most measures can be implemented through many different

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mechanisms, which depend on contextual variables as well as volatile political issues and interests. This diversity of the implementation mechanisms that can be applied for each physical measure makes the problem of building energy efficiency plans even more complex than the already intricate problem of selecting the technical EE measures to be in a plan. Therefore, it may be advisable to break the problem into “the selection of physical measures” and then “the selection of implementation mechanisms” as separate stages. However, the fact of having two stages does not mean that after obtaining the results from the first stage this part is concluded as in a linear process. Instead, it is strongly recommended that an iterative process between stages one and two is performed until a final decision of a plan including the technical measures and the promotion mechanisms is achieved. This is the perspective adopted in this work.

In the challenging problem of selecting the most appropriate energy efficiency plan for a region or a country, considering here “plan” as a set of physical measures, the first issue to consider should be what does actually “most appropriate” mean? Beyond the obvious fact that energy efficiency aims to achieve energy savings, it must be understood that these savings affect the economy, the society and the environment in several different ways, helping to achieve other indirect but possibly more important objectives than actually the one explicitly stated of “saving energy”. For example, “saving energy” can have implicit the objectives of mitigating greenhouse gas emissions or increasing the security of energy supplies. Keeney refers to this issue as the differentiation between “means objectives” and “end-objectives” (Keeney, 1996a). Therefore, the problem must not be seen as a single objective decision making problem which aims to reach an often pre-defined target of energy savings, restricted to some natural constraints (as budget), but it must instead be seen as a process of making decisions in the presence of multiple, and maybe conflicting objectives (Pohekar and Ramachandran, 2004; Neves et al., 2008, 2009), such as reinforcing environmental compatibility while maintaining or decreasing the costs of energy.

This work proposes to use the value-focused thinking approach (Keeney, 1996a) to identify the real objectives behind the will to introduce EE plans or measures, to transpose such objectives into operational attributes, and to evaluate EE measures or plans testing the use of those hidden objectives in aiding decisions when selecting the most fitted EE measures to adopt in a plan for a country.

2. Identification of the objectives

2.1. The value focused-thinking approach

Generally, decision makers start their decision process thinking of possible alternatives or comparing alternatives that are already shaped as possible problem solutions, and only afterwards they address objectives and criteria to help to evaluate and/or choose such alternatives. This fact turns this process of thinking on the objectives in a reactive process in relation to the alternatives. Keeney refers to this standard problem-solving approach as alternative-focused thinking and defends that focusing on alternatives is a limited way to think through decision situations because it “solves” decision problems, but does not identify desirable decision opportunities that can be only reached if the decision maker starts by thinking on what he/she values (Keeney, 1996b). According to Keeney, values are principles used for evaluation. Such principles can be articulated qualitatively by stating objectives, which are something that one wants to achieve in a specific decision process. Therefore they should be the driving force for the decision making process, while alternatives are only

relevant because they are means to achieve values. Keeney names this process of thinking as “value-focused thinking” (VFT), and it is based on having significant effort to make values explicit by applying logical and systematic concepts to qualitatively identify and structure the values that best fit a decision situation.

Following the VFT approach, four procedures must be performed to guide the way of thinking in order to obtain the objectives. First, one must compile an initial list of objectives. Second, these objectives must be categorized as means or ends objectives and then be logically structured. Ends objectives concern the ends that decision makers value in a specific decision context, and means objectives are objectives that will lead the way to achieve the ends. Third, the objectives must be used to create alternatives. Fourth and last, the objectives should be examined to identify worthwhile decision opportunities (Keeney, 1996b).

The most obvious way to identify objectives is to engage in a discussion with the decision makers about the decision situation (Keeney, 1996a). The process requires creativity and hard thinking, and it can begin by asking the decision maker “What would you like to achieve in this situation?” The responses provide a list of potential objectives and a basis for further questioning. The next section presents the proposed interview structure that can be applied to decision makers to find the objectives for EE plans following this approach.

2.2. Interview structure

Following the VFT approach, the process is initiated by introducing the problem and the reasons why understanding objectives is important. It is recalled that the problem is building/developing energy efficiency plans. Those are conceived in a natural multi-criteria environment, where the end-objectives are hidden behind the stated means objective of “reducing the total energy use”. To uncover such objectives, an interview process can develop along the following sequence:

1. Ask for a wish list of objectives for an energy efficient plan. Emphasize that this list has no ranking or priorities and should be done without any restriction, as if all the intents could be reached.
2. Explore the list to select only the objectives. Generally, decision makers do not have a clear definition of what is an objective and introduce other items of different nature in the list. For the non-objectives that may be included, as attributes, constraints, goals and guidelines, go through them to see if they are in fact “hiding” objectives.
 - 2.1. If items falling in the category of decision alternatives (i.e., possible problem solutions) are found, compare them with each other in order to find the best alternative or the best “facts” (future objectives) in each one. The reason why some alternatives are better than others can reflect an objective. Also try to push further, asking for a “perfect” and for a “terrible” alternative and redo the comparison.
 - 2.2. If items falling in the categories of constraints or goals are found, their aim may indicate an objective. If the decision maker also intends to go further than the goal or the constraint in a way of minimizing or maximizing, the constraint or goal can also be used as an objective.
 - 2.3. If items falling in the categories of guidelines are found in the list, one has to have in mind that they are less definitive than goals or constraints, but if the decision maker wants to go further than the guideline, or really enforce it, it can also be seen as an objective.
 - 2.4. If criteria or attributes are found, one should ask what the decision maker will gain from that and how he/she wants

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