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Original Research Article

An assessment model for energy efficiency program planning in electric utilities: Case of Northwest U.S.

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ABSTRACT

Energy efficiency stands out with its potential to address a number of challenges that today's electric utilities face. These challenges include increasing and changing electricity demand, shrinking operating capacity, and reducing system reliability and flexibility. Being the least expensive and risky resource, share of energy efficiency programs in utilities' energy portfolios has been on the rise since 1980 s and its increasing importance is expected to continue in the future. Despite holding great promise, ability to select and invest only the most prospective program alternatives plays a key role in successful use of energy efficiency as a utility wide resource. This issue becomes even more significant doe to the vast number of available potential energy efficiency programs, rapidly changing business environment, and the existence of multiple stakeholders. This paper introduces a hierarchical decision modeling framework which was used for the case of 13 high priority emerging energy efficiency program alternatives identified in the Northwest U.S. The results of the study revealed that energy savings potential (35.6%) is the most important program management consideration in selecting emerging energy efficiency programs. Market dissemination potential (25.7%) and program development and implementation potential (24.6%) are the second and third most important, whereas ancillary benefits potential (14.1%) is the least important program management consideration. Results imply that program value considerations (49.7%); comprising of energy savings potential and ancillary benefits potential; and program feasibility considerations (51.3%); comprising of program development and implementation potential and market dissemination potential; have almost equal impact on assessment of emerging energy efficiency programs.

Introduction

New objectives have been added to the utilities' decision making processes beyond cost minimization, requiring utilities to address environmental and social issues that may emerge as a result of their operations [13]. Inclusion of social and environmental externalities led recognition of societal and environmental perspectives which eventually enabled a large number of energy efficiency programs, which were previously infeasible, to be feasible [36]. A review of existing energy efficiency program management practices reveals that there are four major components associated with energy efficiency program evaluation and deployment. These are program screening, evaluation, characterization, and deployment. Aforementioned process starts with screening of energy efficiency technologies, which have savings potential for a given case. Criteria for screening practices are mostly technical considerations. Following the screening phase, candidate technology applications are defined and evaluated based on their potential benefits. Evaluation phase mostly employs multiple perspectives considering technical, economical, and environmental impacts. Those technology applications, which pass evaluation phase, are moved to characterization phase where field tests are conducted for quantification of costs and benefits associated with them. Based on the quantified data cost benefit ratio tests are conducted, reimbursement levels are determined for specified cases. Lessons learned are documented and used as input for creating measure implementation procedures for ensuring reliable energy savings. Those measures, which pass cost benefit ratio tests, are moved to deployment phase where energy efficiency measures are officially released and marketed through various channels. See Fig. 1 below for a simple review of existing energy efficiency program evaluation and deployment practices.

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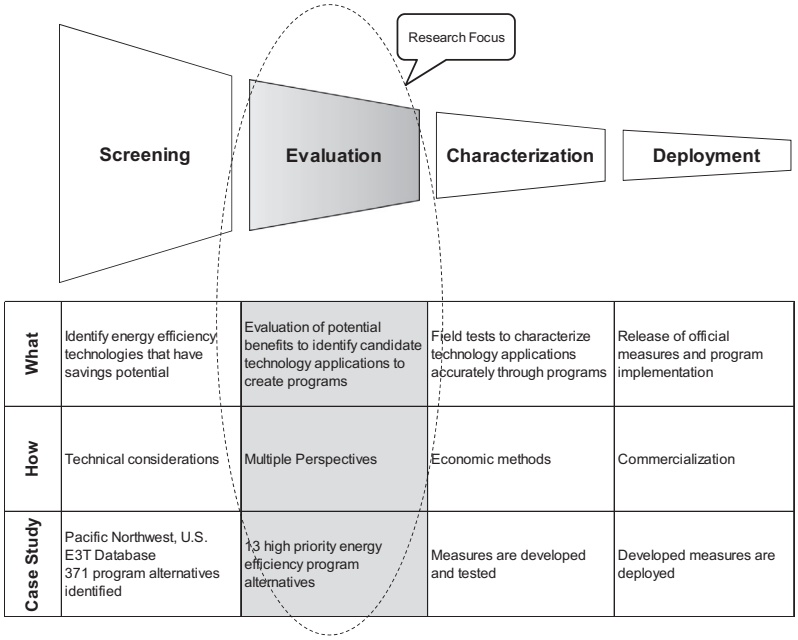

Fig. 1. Energy efficiency program evaluation and deployment framework.

At this point it is worth mentioning that this research is not intended to replace conventional economic analysis methods, which are very strong in cases where there is sufficient quantitative data. Parallel to that, in the context of energy efficiency these methods are heavily used in decisions dealing with program feasibility and determination of reimbursement levels. However, in today's fast changing world it should be taken into consideration that the number of potential energy efficiency programs is very large due to the existence of numerous energy efficiency technologies and end use types. Most of the time energy savings data for the emerging energy efficiency technologies are not in place, and data collection becomes a serious issue, especially in cases where the number of savings variables is significantly large. Accordingly, it has been observed that there is a need for a systematic evaluation that can bridge program screening and characterization phases. Proposed research approach is intended to utilize expert judgment and provide a comprehensive way of evaluating energy efficiency program alternatives. This approach is expected to save resources by filtering those alternatives, which have the highest potential to pass cost benefit ratio test, and contribute to decision practices of energy efficiency program planning.

The objective of this research is to develop a holistic assessment framework for emerging energy efficiency programs. The proposed approach is to expand the existing assessment models by incorporating energy efficiency program management considerations rather than only the quantifiable variables that are largely employed by economic decision analysis methods. Incorporation of program management considerations is expected to enable a strategic perspective on technology planning practices in electric utilities and lead to more comprehensive decision making practices.

U.S. Pacific Northwest case

Energy efficiency has been traditionally a significant part of Pacific Northwest's energy portfolio and its increasing contribution is expected to continue in the future. In the last 30 years, energy conservation programs in the Pacific Northwest have achieved 4000 average megawatts of electricity savings, meeting the half of the region's demand growth between 1980 and 2008. Conserved amount of electricity is expressed as being enough to power the states of Idaho, Western Montana and city of Eugene for 1 year; avoiding 8–10 new coal or gas fired power plants and saving ratepayers $1.8 billion. Energy efficiency savings have been contributing to the region's power system in a number of ways by keeping electricity rates low, avoiding new construction projects, reducing environmental footprint, and contributing to regional economic growth. Recent increases in cost of energy resources, increasing electricity demand and straining the limits of the existing power system, potential carbon policies have increased the importance of energy conservation more than ever before. Accordingly, region's resource plan demands 80% of the load growth in the next 20 years to be met by energy efficiency efforts. In order to meet the aggressive energy efficiency goals Pacific Northwest's public power, investor-owned utilities and other energy efficiency organizations have restarted technology management initiatives in 2008. Collaborating with universities, national labs, and utility experts a task force named "E3T emerging technologies" was formed within Bonneville Power Administration's (BPA) energy efficiency group. The goal of the effort was defined to contribute to the Pacific Northwest's medium and long term energy savings targets by providing a robust pipeline of energy efficiency technologies. E3T program has been identifying emerging energy efficiency technologies through a number of channels. The group has currently identified 371 program alternatives, some of which are at different stages along the program management life cycle. In order to successfully manage its technology portfolio, the group has been developing a management framework that can identify high priority technologies from a large number of alternatives with limited quantitative information. Currently, 13 high priority program alternatives have been identified as having the most program actualization potential for Pacific Northwest. These program alternatives were moved to next stage of evaluation phase which is the