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ESCO business models for biomass heating and CHP: Profitability of ESCO operations in Italy and key factors assessment

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ABSTRACT

This paper describes ESCO approaches and business models for biomass heating and CHP generation. State of the art, policy measures and main barriers towards the implementation of such ESCO operations in Italy are discussed. Moreover, on the basis of the proposed framework, representative case studies in the Italian residential, tertiary and industrial market segments are compared. The case studies are referred to a 6 MWt wood chips fired plant. The case study of the industrial sector is based on a constant heat demand of a dairy firm, while in the tertiary and residential sectors the options to serve a concentrated heat demand (hospital) and a community housing by a district heating network are explored. The further option of coupling an organic Rankine cycle (ORC) for CHP is explored. The relevance of the research relies on the assessment of the main key factors towards the development of biomass-ESCO operations. The results of the techno-economic assessment show that the agro-industrial case study for heat generation is extremely profitable, because of the high baseline energy cost, the high load rate, the availability of incentives for biomass heating. The cogeneration option is also profitable, even if the higher investment cost determines a longer pay back time. The tertiary sector case study is also a profitable, for the presence of a concentrated load with high heat load rate and high energy cost. Finally, the residential sector case study is the least profitable, for the high district heating cost and the lower heat load rate, not compensated by the higher heat selling price. The higher investment cost of CHP, even if attracting further income from electricity sale, does not present higher profitability than the only heat generation plant. In addition, the heat load rate results a more influencing factor than the thermal energy selling price.

Contents

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1. Introduction

1.1. ESCO background

The increasing commitment toward climate change mitigation and the consequent implementation of policies for energy efficiency and renewable energy sources, together with the restructuring and liberalization of electricity and gas markets, are the major drivers behind increased interest in the provision of a wide range of energy services to final end users, such as energy efficiency measures, distributed generation technologies, and biomass technologies among them [1]. In this context, innovative utilities have recently moved towards offering added value through energy services, horizontally integrated and complementary to the traditional supply of energy. Other stakeholders, such as equipment and system suppliers, or installation and engineering companies, decided to enter the same market. Companies providing energy services to final energy users, including the supply and installations of energy-efficient equipment, building refurbishment, maintenance and operation, facility management, and the supply of heat/electricity, are known as Energy Service Provider Companies (ESPCs). Energy Service Companies (ESCOs) also offer these same services; however, an ESCO differs from ESPCs in one the following ways: (i) it can finance, or arrange financing for, the operation of an energy system, (ii) it guarantees the energy savings and/or the energy performances (as reflected in the contract), and (iii) its remuneration is directly tied to the results achieved [3–4]. Therefore, the ESCO risks its payments on the performance of equipment and services implemented.

The first overview of the European ESCO market was proposed in 2002 by Vine et al. [2], aimed at collecting information on the number of ESCOs, the key sectors targeted, the main barriers and the approximate value of projects conducted, in order to suggest possible actions to promote the ESCO industry. This study stated that ESCO-industry associations, financing, energy measurement and verification protocols, and information programs are some of the key factors for successful ESCO markets. Moreover, Countries putting emphasis on the removal of subsidies and privatization of energy industry are expected to lead the development of the ESCO industry. This review was followed by a series of comprehensive researches at EU level carried out by the European Commission's Joint Research Centre [3–5] and the ChangeBest project [6]. In particular, the research of Bertoldi et al. [3–5] draw attention to major differences in the development of the ESCO markets in EU to different levels of support offered by energy authorities, local market structures and rules, and variation in the definitions, roles and activities of ESCOs. It concluded that energy-efficiency projects offer a cost-effective approach to reducing greenhouse-gas emissions, and the emerging carbon markets will create new opportunities for diffusion of ESCO business. Another comprehensive insight of the European ESCO industry, trends in business practices and factors influencing their evolution was described by Marino et al. [7], on the basis of the results from a large-scale survey carried out in 2009–2010. The results show that, despite the increased awareness of energy efficiency measures, the ESCO market has only grown slowly during the past years, because of problematic access to finance, cross-subsidized energy prices, poor energy consumption data to build baselines. The relationships between ESCO activity indicators, as reported in [2], and country indicators (innovation index, GDP, energy consumption, CO_2 emission) have been assessed in [8], deriving information about size and orientation of the ESCO market. Outside Europe, the financial and cultural barriers of ESCO market in Japan and guidance for policymakers were discussed in [9], the evolution of the US ESCO industry was reviewed in [10], the barriers and opportunities of performance contracting in Hong Kong were discussed in [11], the alternative financing models for energy-efficiency performance contracting in Brazil were reviewed in [12], while the ESCO companies in northwest Russia in terms of legal issues and organizational schemes were described in [13]. In [14], Goldman et al. analyzed the US ESCO-market trends and activities over the last decade. It resulted that performance contracting overcomes market barriers for energy-efficiency investments among large,