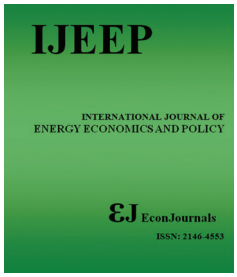

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Energy Efficiency and Sustainable Development: An Analysis of Financial Reliability in Energy Service Companies Industry

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ABSTRACT

The aim of this study is twofold: (i) At first, the authors would like to analyze the financial reliability of Energy Service Companies (ESCO) industry in Italy by using the Z'' - score model by Altman et al. (1995) and (ii) secondly, observing the trend of Z'' values from the year 2010 to the year 2014, they would try to connect these changes to specific business behaviors. An empirical research on a sample of 68 Italian ESCOs has been carried out. By analyzing balance sheet indicators, the authors identify the causes that entail the transition of firms from a specific solvency situation to another. Findings show that in most cases Z'' - score increased over the years thanks to the acquisition of White Certificates, that represents an efficient instrument to promote energy saving. Research results allow to hope in a future development of ESCO industry.

Keywords: Financial Reliability, Energy Service Companies, Z-score, Italian Companies
JEL Classifications: C20, G33, M41

1. INTRODUCTION

By sustainable growth strategies we mean the firm behaviors that in the long run tend to legitimize the social, environmental and economic expectations of both internal and external stakeholders (Donaldson and Preston, 1995).

Sustainable development represents a key element of environmental safety and it is one of the most debated topic of the last years.

The need to reconcile economic growth with a fair distribution of resources in a new development model began to appear from the seventies, after becoming conscious of the fact that the concept of classic development would have caused the collapse of natural systems.

Among all the definitions of sustainable development, one of the most important was given by the Brundtland Commission (World Commission on Environment and Development): "The development that meets the needs of the present without compromising the ability of future generations to meet their own needs."

This paper focuses on the topic of energy sustainability. Many studies were carried out in the literature: Zajicek et al. (2016) discuss the U.S. energy sector in the context of economic growth, employment conditions, manufacturing competitiveness, and trade deficits in order to expand the use of domestic energy resources to improve competitiveness in the global goods market and reduce dependency on foreign oil. The concept of energy sustainability is strictly connected to the concept of sustainable development by a tridimensional approach which considers production side (promotion of renewable energy sources), utilization side (energy efficiency) and environmental impact. Energy efficiency improvements are in many countries a key part of the strategy to reduce energy consumption and to tackle global warming (González and Ventosa, 2015).

Energy efficiency can be defined as the ability to carry out normal actions of energy operation with less energy than it was used previously, reducing consumptions and obtaining an immediate saving, not only at a monetary level.

As Enea (Italian Agency for new technologies, energy and sustainable development) states, doing energy efficiency can be translated in "doing more with less," thanks to a reliable and aware behavior in using energy and reducing waste.

Therefore, "energy efficiency" indicates a series of actions in programming, planning and realizing that allow to consume less energy, offering services being equal.

In this context the role of Energy Service Companies (ESCOs) can be introduced. They are companies specialized in energy services with a great availability of know-how, technologies and capital strongly pointed to the realization of energy requalification projects (Dayton et al., 1998; Singer and Lockhart, 2002).

ESCOs offer a service that includes finding of financial resources linked to the intervention, realization of energetic diagnosis, feasibility studies, design and realization of interventions and their future maintenance and efficiency control. In order to do this, these companies typically resort to the mechanism of the third party financing (TPF), which allows them to benefit from the results of the intervention, based on achieved energetic saving. In this way ESCOs can offer service to the client (private or public) at zero cost. However, it is not always so simple to start this type of projects. The greatest stop could be the lack of financial sources, especially in current years characterized by an evident economic crisis, during which it is very difficult to find capitals. Hence, it could be happen that ESCOs do not have available capital to finance their projects and must necessarily turn to banks to obtaining such resources. Nevertheless, lending institutions grant loans only if they are sure that granted capital will be turned within established terms.

The paper is organized as follows: Section 2 presents literature analysis on topics of (i) financial reliability and (ii) ESCOs; Section 3 describes research methodology; Section 3 illustrates the sample of companies used in the research; Section 5 shows the results of ESCOs' financial reliability and Section 6 presents results discussion and considerations on the variation of reliability on considered time horizon; in the end, last section of paper illustrates conclusions, including limits and possible developments for future studies.

2. LITERATURE REVIEW

2.1. Financial Reliability Analysis

Three different groups of models for credit risk evaluation can be identified: (i) Structural credit risk models; (ii) Reduced form models; and (iii) Methodologies taken from the field of artificial intelligence and operational research (hybrid models).

Structural credit risk models rely on the notion of claim priority and limited liability, which allows a firm's equity and debt to be viewed as contingent claims that partition the asset value of the firm. Many applications and improvements have been proposed (Iazzolino, Fortino, 2012, Iazzolino et al., 2013b).

Some difficulties in implementation motivates an alternative approach known as reduced-form (the second group), which considers corporate default as an event governed by an exogenous shock that is not based on the firm's asset value failing to cover its debt obligation.

The third group, hybrid approach, uses discriminant analysis, logistic regression, artificial neural networks and MARS and hence provides an alternative in handling credit scoring tasks. Lee et al. (2006) demonstrated the effectiveness of credit scoring using MARS, revealing that they outperform other approaches in terms of credit scoring accuracy. Very recently, MARS has been modified by constructing a penalized residual sum of squares as a Tikhonov regularization problem, providing an alternative modelling technique named CMARS (Alp et al., 2011; Weber et al., 2012). A hybrid model integrating rough set theory with support vector machines technique has been proposed by Ching-Chiang et al. (2010).

Another model that is proposed as a credit risk evaluation tool for business loan applications is data envelopment analysis model (DEA). In particular, the model incorporates uncertainty to predict the loan applicant's relative creditworthiness condensed in a single score reflecting a potential borrower's future loan performance (Bruni et al., 2014; Iazzolino et al., 2013a). Kuosmanen and Johnson (2010) establish linkages between least-squares regression and DEA models, contributing to the integration of the non-parametric regression approaches towards a unified framework of prediction of credit default. DEA approach is also used for other aims like energy efficiency, as Dogan and Tugcu (2015) demonstrate adopting input oriented DEA based on the Charnes, Cooper and Rhodes model to estimate technical and super efficiency scores of G-20 countries in terms of electricity production for certain periods.

As specifically regards the model based on financial indicators, we can distinguish the univariate and the multivariate models. The seminal works in this field were Beaver (1966) and Altman (1968).

Beaver (1966) started up the univariate models, concluding that cash flow to debt ratio was the best single ratio predictor. Univariate models often overlap with qualitative models. Many models have been generated that put in connection Ebit and interest expenses: The most known is the model by Damodaran (2002).

The multivariate models, among which the first contribution was given by Altman (1968), are based on the concept that the identification of the point of probable insolvency (cut-off) depends on the weighting of different indicators, selected within the set of the most significant financial risk indicators.

Altman's Z is one of the best known, statistically derived predictive models used to forecast a firm's impending bankruptcy (Moyer, 2005). The Z-score uses various accounting ratios

and market-derived price data to predict financial distress and future bankruptcy and the original formula was developed on a sample of 66 manufacturing firm. However, in response to requests for a measure to predict the likelihood of bankruptcy for non-manufacturing firms, Altman developed the Z" model, (Altman and Hotchkiss, 2006).

For many years after the publication, Altman's formula was the prevalent statistical technique applied to the default prediction models. It was used by many authors (Altman et al., 1977; Micha, 1984; Piesse and Wood, 1992; Lussier, 1995; Altman et al., 1995).

In recent years, advanced techniques such as neural networks (Altman and Sabato, 2007), genetic programming (Huang et al., 2004; Varetto, 1998) and support vector machine (Xu et al., 2009) have been proposed in the empirical literature. These techniques are based on data mining techniques, i.e., the design and development of algorithms that allow computers to predict behaviour based on empirical data and are able to model extremely complex functions, providing an alternative to conventional techniques.

2.2. ESCO and Energy Efficiency

ESCOs are important agents to promote energy efficiency improvements, especially in those countries experiencing increased competition and privatization in the electric utility business (Vine et al., 2003).

An ESCO is a company that fulfils all the following requirements: It provides integrated energy services to their customers (mainly large energy users, but also utilities), which may include implementing energy-efficiency projects (and renewable energy projects), frequently on a turn-key basis. In particular, they include a wide range of activities, such as energy analysis and audits, energy management, project design and implementation, maintenance and operation, monitoring and evaluation of savings, provision of services like lightning or space heating (Bertoldi et al., 2006).

An ESCO provides performance and savings guarantees, and its remuneration is directly tied to the energy savings achieved. Therefore, the company risks its payments on the performance of equipment and services implemented. It typically finances, or assists in arranging financing for the installation of an energy project it implement by providing a savings guarantee. It also retains an on-going operational role in measuring and verifying the savings over the financing term.

Many studies examine the growth and potential market for the ESCO industry in the United States (Goldman et al., 2002; Vine et al., 1999). Goldman et al. (2002), for example, analyses a database of 1500 case studies of energy-efficiency projects, estimating that ESCO industry revenues in the US increased at an average annual growth rate of 24% in the last decade.

Other studies (Bertoldi et al., 2003; Biermann, 2001; Fraser, 1996; Murakoshi et al., 2000; Poole and Geller, 1997; Vine, 2005) try to recreate ESCO industry development in many countries, identifying the origin of these companies in the early eighties for most of them, including Italy.

However, persistent barriers inhibit many cost-effective energy efficiency projects and prevent the full development of the ESCO industry internationally. Some major barriers are: Lack of information and understanding of the opportunities that energy efficiency offer; lack of culture for project financing; public procurement rules that prevent the use of ESCOs; burdensome administrative procedures that allow only very large projects to be carried out; limited understanding of energy efficiency and performance contracting by financial institutions (Westling, 2003a; 2003b).

Although some researchers are optimistic about the future of the ESCO industry, others argue that several types of strategic actions are needed for fostering the development of the ESCO industry internationally. For example, to move in this direction Europe Commission Joint's Research Centre plans to create a comprehensive list of ESCO in the European Union, including a description of their projects, capabilities, and illustrative case studies (Bertoldi et al., 2003). Other actions are to ensure that ESCOs provide a qualified and reliable service and to create more information for financial institutions in order to develop funding sources. By the way, ESCO often need working capital for marketing and project preparation and development.

Referring to performance contracting, three broad options for financing energy efficiency improvements can be distinguished: (i) ESCO financing, that refers to financing with internal funds of the ESCO and may involve use of its own capital or funding through other debt or lease instruments; (ii) energy-user/customer financing, that usually involves financing with internal funds of the user/customer backed by an energy savings guarantee provided by the ESCO and finally (iii) third-party financing (TPC), that is the most used source of financing energy efficiency projects in which project financing comes from a third party, e.g. a finance institution, and not from internal funds of the ESCO or of the customer. Large ESCOs with deep pockets and hence high credit rating have started to prefer TPF to their own funds because their costs of equity financing and long-term financing are often much greater than what can be accessed in the financial markets. In addition, if an ESCO arranges TPF, then its own risk is smaller. This would allow for lower cost of money and hence for the same level of investment more money would be assigned to the project.

Prevision of companies insolvency and, consequently, of financial reliability in the brief and long term is a theme that became more important in the current context, characterized by serious economic problems.

However, studies that examine the level of financial reliability of Italian ESCOs do not exist in the literature.

In this paper Altman Z" model is applied on a sample of Italian ESCO in order to assess their level of solvency. The model, that is an enhancement of Altman Z - score model, is based on

a fundamental financial review derived from a quantitative risk model (Altman et al., 1995).

3. RESEARCH OBJECTIVES AND METHODOLOGY

The aim of the research is two fold:

(i) To analyze the financial reliability of Italian ESCOs by using the Z'' - score model (Altman, 1995) and the trend analysis from the year 2010 to 2014;

(ii) To deeply analyze the indicators that generated the change in rating and to identify the specific organizations' behaviors related to these changes.

Objective N. 1 is presented in Section 4 (research results), whereas objective N. 2 is analyzed in Section 5, which focuses on the discussion.

As regards the first aim of research, insolvency level of organizations has been assessed through Altman Z'' - score model (revised version of 1995), because it is more suitable for the sample considered in this paper.

Therefore, the Z'' - score is calculated by the following formula:

$$Z'' = 3.25 + 6.56\,X_1 + 3.26\,X_2 + 6.72\,X_3 + 1.05\,X_4$$

Where:

X_1 = Working capital/total assets

X_2 = Retained earnings/total assets

X_3 = Operating income/total assets

X_4= Book value equity/total liabilities.

Altman and Hotchkiss (2006) identify three classification areas of insolvency risk, considering Z'' value, that are represented in Figure 1.

Figure 2 shows in detail the correspondences between Z'' values and ratings assigned to obligations by international agency standard and poor's.

The safe zone includes all situations in which insolvency risk is null; an elevate risk is identified by the distress zone, whereas the grey zone represents situations of uncertainty, for which become difficult to forecast future trend of financial reliability of the company.

Z'' value has been calculated punctually on considered years, focalizing attention on the variation of firms' number belonging to three zones, in order to understand if they improved their score or not.

Finally, relating to the second objective of research, we tried to link the causes of score variations to typical firms' behaviors.

4. DATASET

To analyze financial reliability of ESCOs, this study utilizes a sample extracted from AIDA Bureau van Dijk database, which includes all balance sheets of small, medium and large Italian companies. The sample is characterized by 68 ESCOs, shown in Table A1 in Appendix.

The companies have been classified based on following characteristics:

- Size
- Localization
- Sector.

As regards the first point, the majority of firms considered in the sample ranks as micro (38%) and small (31%) firms, with a turnover lower than 10 thousands euros and with a number of employees lower than 50. The chart represented below shows companies' size (Figure 3).

Figure 1: Classification area of risk

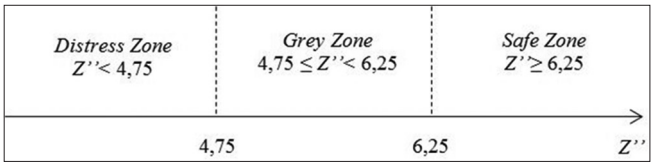
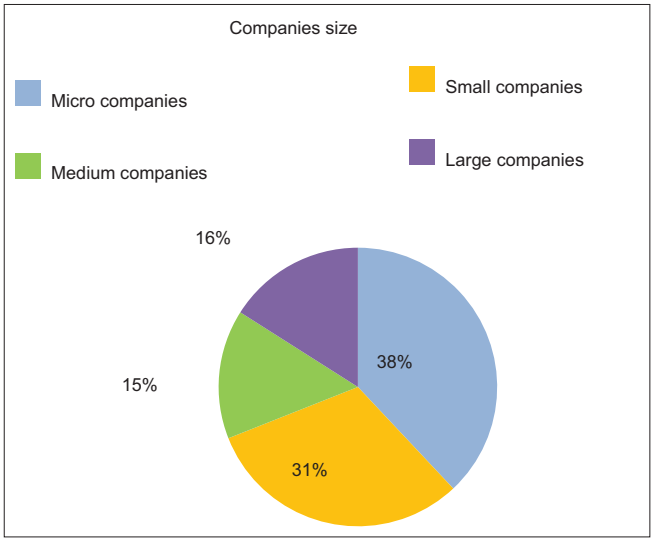


Figure 2: Correspondences between Z'' values and ratings

	Rating	Soglie	Rating	Soglie	
Safe Zone	AAA	>8,15	BBB-	5,85	
	AA+	8,15	BB+	5,65	Grey Zone
	AA	7,60	BB	5,25	
	AA-	7,30	BB-	4,95	
	A+	7,00	B+	4,75	
	A	6,85	B	4,50	
	A-	6,65	B-	4,15	Distress Zone
	BBB+	6,40	CCC+	3,75	
	BBB	6,25	CCC	3,20	
			CCC-	2,50	
			D	<1,75	

Source: Adapted by Altman and Hotchkiss (2006)

Figure 3: Companies size



ESCOs are located especially in North-Italy (26 companies in Lombardy) and they appear almost absent in the regions of South-Italy, as shown in Figure 4.

ESCOs act their energetic requalification projects in different sectors, which are indicated by ATECO codes in the Figure 5.

The chart shows that the majority of firms belongs to sector M (45.59%). Sectors F and D are relevant.

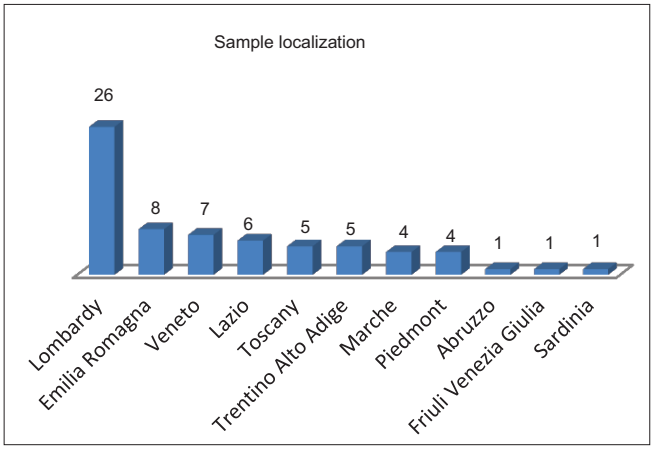
5. RESULTS OF FINANCIAL RELIABILITY ANALYSIS (OBJECTIVE 1)

Table A2, represented in the Appendix of the paper, highlights Z'' - score values for each company on every considered year, from 2010 to 2014.

The minimum absolute value of index Z'' (−4.86) is achieved on 2010, the first year of time horizon, whereas the maximum one is obtained on year 2014 and it is equal to 585.06.

The average Z'' - score trend for every year is illustrated in the Figure 6.

Figure 4: Sample localization



The average score has a constant trend on all the years from 2010 to 2013, then it shows a peak in 2014. In particular, referring to rating classes in Figure 2, the score swings from safe zone (null risk area) and grey zone (uncertain risk area). In effect:

- On 2010 the average score is 5.91 that corresponds to the rating class BBB - Which belongs to the Grey zone. However, it is a matter of a value that gets close to the null risk zone rather than the high risk area.
- On 2011 the average score is 6.26 that corresponds to the rating class BBB which belongs to the Safe Zone, that is the null risk area.
- On 2012 the average score is 6.22 that corresponds to the rating class BBB - Which belongs to the Grey Zone. As it happened for 2010, it is a matter of a value that gets close to the null risk zone rather than the high risk area.
- On 2013 the average score is 6.95 that corresponds to the rating class A which belongs to the Safe Zone, that is the null risk area.
- On 2014 the average score is 15.61 that corresponds to the rating class AAA which belongs to the Safe Zone, that is the null risk area.

Table A3 in Appendix resumes both achieved Z'' - score and rating class for each year and for each company.

Starting from 2012 the number of firms belonging to the safe zone is increased, especially from 2013 to 2014. Consequently, firms characterized by a high insolvency risk decrease over the years, whereas those belonging to the grey zone increase if comparing the year 2010 with the year 2014 but they decrease if comparing 2014 with previous years.

Observing the first and the last column in Table 1, we can evaluate in percentage the number of companies in the three risk area from the first considered year to the last one. ESCOs financial reliability improved from the year 2010 to the year 2014 as the number of firms belonging to the safe zone increases whereas that belonging to the distress zone decreases. As regards the grey zone, the number of companies remains almost constant over the years.

Figure 5: Operating sectors of energy service companies

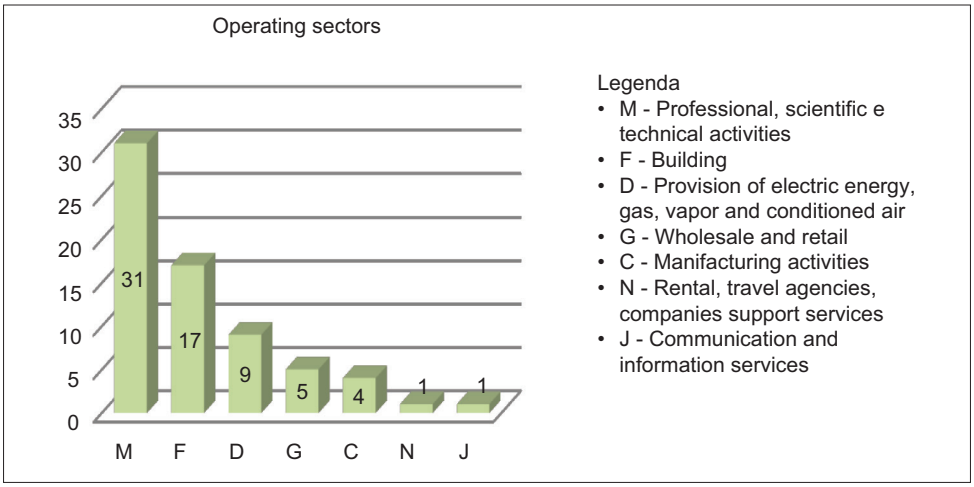


Figure 6: Average Z'' - score from 2010 to 2014

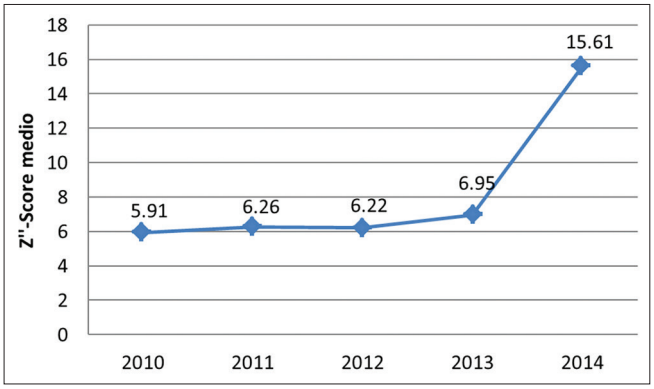


Table 1: Number of ESCOs in every risk zone from 2010 to 2014 (%)

Risk area	Year				
	2010	2011	2012	2013	2014
Safe zone	32.35	30.88	35.29	35.29	47.06
Grey zone	14.71	17.65	23.53	23.53	16.18
Distress zone	52.94	51.47	41.18	41.18	36.76

ESCOs: Energy service companies

The passage from a certain risk zone to another depends on the value of index Z'', that in turn is linked to the values of balance sheet indicators described in Section 2.

To identify the causes that allow the transition of firms from the safe zone to the distress zone and vice versa on period 2010-2014 we have observed variation of balance sheet indicators, finding in most cases that:

- The reduction of Z'' - score and the consequent passage from the safe zone to the distress zone is mainly due to the increase of short-term debts, due to an increase of notes and accounts payable
- The increase of Z'' - score and the consequent passage from the distress zone to the safe zone is mainly due to the increase of accounts receivable.

6. RESULTS DISCUSSION AND IDENTIFICATION OF FIRMS' BEHAVIORS (OBJECTIVE 2)

The application of Z'' - score model allows to characterize ESCOs industry in Italy from the financial reliability point of view. By the way, evaluating this index for every year it is possible to identify for each company their own rating class.

As described in previous section, while the presence of companies in distress zone decreases by 16.78% compared to the year 2010, companies in the safe zone increases by 14.71%.

In particular:

1. The safe zone acquires 15 companies (11 from distress and 4 from grey)
2. The distress zone loses 18 companies (11 from safe and 7 from grey).

Moreover, from the analysis of average Z'' - score we can state that ESCO industry belongs on average to the null risk area. In effect, starting from 2010 to 2013, the average score remains more or less constant, but on the year 2014 it becomes subjected to a positive increase of 8.65% compared to the previous year.

Positive or negative variation causes that have been found on considered time horizon have been studied by detailed balance sheet analysis by which we identified a relationship between score's increase and credits' increase. Reduction of Z'' is mainly due to the increase of financial and commercial debts instead.

These results can be justified by some behaviors that an ESCO typically assumes.

6.1. Rating Growth Due to Increase of Accounts Receivable

The increase of accounts receivable have a positive impact on score growth and on rating.

The item "accounts receivable" is strictly connected to the achievement of "White Certificates," that represent the most important and efficient instrument to incentivize energy saving in Italy and the mainframe of any sustainable energy strategy to contrast the threats of climate change.

In the past few years, Italy, France and Great Britain have embarked on implementing tradable certificate schemes to improve energy efficiency, so-called "Tradable White Certificate" schemes.

In this system, electricity and gas suppliers or distributors are obliged to undertake the promotion of energy efficiency among final uses, and to show that they implement, each year, interventions designed to save an amount of energy that is a given percentage of the energy they supply or distribute. This amount is certified through certificates (the ''White Certificates'') that are generated when the obligated parties themselves, or other actors, introduce energy saving measures. Such certificates can be exchanged and traded on the market. Obligated parties unable to submit their share of certificates are subject to pecuniary sanctions exceeding the estimated market value of the missing certificates.

The application of the mechanism of WHC involves in any case an increase of the investments in new technologies for energy utilisation. The low target scenario implies for the year 2020 an increase of 7% in investments in energy demand technologies for the residential and service sectors relative to the Business-As-Usual scenario, while the average unit cost of the energy system is decreased. For the more ambitious medium and high scenarios, investments in technology grow much more: For the year 2020 by 30% and 80% respectively. Therefore, even when there is a trade-off between cost of saving and value of the energy saved, there will be a displacement from expenditure for fuels to investment in new technology, which in itself is likely to have a positive effect on the economy as a whole.

Recent developments in European energy policy reveal a growing interest in creating markets aiming to boost energy efficiency cost-effectively. More in-depth descriptions are provided in Lagniss and Praetorius (2006), Farinelli et al. (2005).

6.2. Rating Reduction Due to the Increase of Short-term Debts

Balance sheet analysis conducted on the dataset highlights that the increase of short-term debts strongly influences score reduction and Rating, because it entails the increase of total debts hence the reduction of variable X_4. In particular, short-term debts may be classified in two groups:

- Notes payable
- Accounts payable.

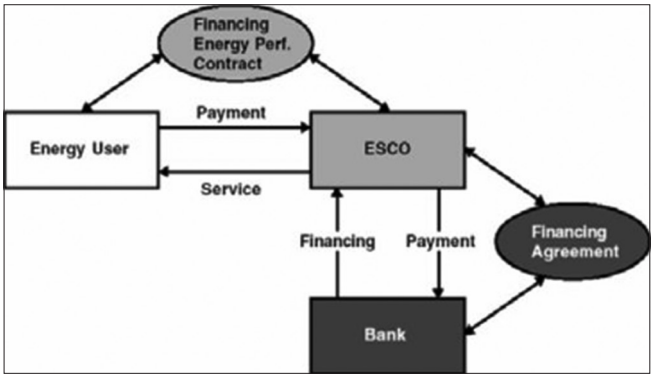
The increase of the former can be explained by the fact that ESCOs often resort to the TPF, that expects to require financial sources to lending institutes (i.e., banks) to realize energetic requalification projects. Figure 7 illustrates the relations existing in this type of performance contracting.

Hence it is clear that in most cases ESCOs, and not clients, directly establish contractual agreements with banks. When the ESCO is the borrower, the customer is safeguarded from financial risks related to the project technical performance because the savings guarantee provided by the ESCO is either coming from the project value itself or is appearing on the balance sheet of the ESCO.

Both public and private customers can benefit from off-balance sheet financing because the debt service is treated as an operational expense and not a capital obligation. For highly leveraged companies this is important because the obligation not showing up on the balance sheet as debt means that company borrowing capacity is freed up (Dixon, et al., 2010).

Accounts payables are mainly due to the purchase of equipment, that are expected in ESCO interventions. By the way ESCO does not produces internally all the materials and machinery that are necessary to the requalification project, but it chooses to buy them externally preferring a buy strategy to a make one.

Figure 7: Third party financing with energy service companies borrowing



Source: Adapted from Bertoldi, 2006

7. LIMITS, FUTURE DEVELOPMENT AND CONCLUSIONS

The main aim of the study is to provide a general description of the degree of financial reliability of ESCOs in Italy, in order to give also a measure of their work on the territory. ESCOs represent one of principal instrument to promote energy efficiency in final uses. Through the plan and the realization of specific energetic requalification projects, ESCOs support their own clients in achieving social and economic objectives.

The energetic requalification interventions as power factor compensation, routine or emergency maintenance, realization of plants build according to rules, entail evident economic savings in bill and decrease environmental impact of production processes by reducing waste and noxious emissions and utilizing optimally the resources.

However, to carry out all activities of core business ESCOs do not always have the possibility to manage their own work only by their capital, but they are forced to turn to lending institutes that grant them necessary financial sources. Several possible funding sources should be investigated: Private banks and lending institutions; financial institutions that are already familiar with energy performance contracting; multi-lateral funders and donor agencies (Vine, 2005).

Hence, it is important to identify as far as possible the exact degree of reliability of such companies as banks agree to activate the funding only once assured of their solvency.

For this reason, research methodology takes into account 68 companies on Italian territory, whom balance sheet have been extracted from AIDA Bureau Van Dijk database.

First of all, starting from Altman revised model (1995), a mapping of dataset has been carried out based on Z'' - score value; in this way each company has been placed in a specific risk area for every year, from 2010 to 2014. Then, we put attention on the variation of score value between the first and the last year of time horizon, observing as consequence the movement of many firms from a specific risk zone to another one.

The increase of companies that pass from a situation characterized by an elevate insolvency risk (distress zone) to a state of financial safety (safe zone) has been major than that of companies that have been subjected to the inverse passage.

Financial reliability of such companies has been grown over the years, showing an important improving of financial conditions that allow the possibility to obtain funds to apply energetic requalification projects.

Finally, we tried to identify the main causes related to the improvement and to the worsening of financial reliability conditions through a detailed balance sheet analysis from which we demonstrated that the increase of accounts receivables (related to white certificates) positively influence Z'' - score, whereas the

increase of total debts contributes to a reduction of the score and, consequently, to an increase of insolvency level.

The results of research could be improved if considering a sample with a larger size. Another limit of the study can be identified in the decision to choose Altman model as statistic prevision method. Early scholars criticized Altman's formula as having a poor record as predictor despite Altman's explanation for a bankrupt (Hayes et al., 2010). In a test of Altman's Z Grice and Ingram (2001) found inconsistent results because the formula was not suitable for predicting distress in contemporary firms.

In general, the result of research shows that in recent years ESCOs have been subjected to a strong improvement in their financial situation, achieving a higher probability in obtaining necessary resources.

Findings let us imagine in a possible development of this industry. Moreover, companies operating in energy efficiency certificates market are able to obtain more credits than others, achieving a high rating.

In conclusion, this study provides an important description of ESCOs industry in Italy from a financial point of view, because it does not only highlights the importance of their work that promotes sustainable development on territory but tries to give an contribute related to a sector that is still new in Italy.

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Appendix

Table A1: ESCO considered in the research

ESCO	
A2A Calore E & Servizi	Fostini S.R.L.
Adria Energy E.S.CO S.R.L.	G.M.T. S.P.A.
Aice S.C. A R.L.	Geetit S.R.L.
Amga Calore & Impianti S.R.L.	Global Power Service S.P.A.
Area Engineering S.R.L.	Hera Comm S.R.L.
Aura Energy S.R.L.	Innowatio S.P.A.
Avvenia S.R.L.	Interesco SRL
Axopower S.R.L.	JPE 2010
Azzero CO2 S.R.L.	Menowatt GE S.P.A.
Bartucci SPA	Meridionale Impianti S.P.A.
BIT Energia S.R.L.	NESCO - NORTH ENERGY SERVICE COMPANY S.R.L.
C.E.I. S.P.A. - Calore Energia Impianti	Newen S.R.L.
CARBOTERMO S.P.A.	NRG. IT S.R.L.
Casadei & Pellizzaro - S.R.L.	OM.E.G. SRL
Centoraggi Societa' Cooperativa	OROS P&R SRL E Oros Progetti SRL
Centro Calor S.R.L.	Pagano E Ascolillo Energy and Technology S.P.A.
CO.Meta Societa' Cooperativa Consortile	Polo Tecnologico Per L'energia S.R.L.
Cofely Italia S.P.A.	Ranzato Impianti S.R.L.
Consul System S.P.A.	Restiani S.P.A.
Cremonesi Consulenze S.R.L.	Sangalli Technologies ESCO S.R.L.
Cristoforetti Servizi Energia S.P.A.	Saras Ricerche E Tecnologie S.P.A.
Dedalo ESCO S.P.A.	SEA - Servizi Energia Ambiente S.R.L.
DIDDI Dino E Figli S.R.L.	Seaside S.R.L.
E.ON Energia S.P.A.	Sime Energia S.R.L.
Energest S.R.L.	Siram S.P.A.
Energon ESCO S.P.A.	SOF S.P.A.
Energynet S.R.L.	Solgen S.R.L.
E.S.CO. BERICA S.R.L.	Studio Botta & Associati SRL
E.S.CO. Comuni S.R.L.	Studio MPS Engineering S.R.L.
ESCO Italia S.R.L.	TEA Servizi S.R.L.
E.S.CO. Primiero S.R.L.	TEP Energy Solution
ETS Life S.R.L.	Tera Energy S.R.L.
Eureka E.S.CO. S.R.L.	Ulteria S.R.L.
Fedabo S.P.A.	Universal Sun S.R.L.

ESCOs: Energy service companies

Table A2: Z" - score of every company on every year of time horizon

Company	Z" (2010)	Z" (2011)	Z" (2012)	Z" (2013)	Z" (2014)
A2A Calore E & Servizi	4.14	4.4	4.18	4.35	3.08
Adria Energy E.S.CO S.R.L.	7.87	10.38	11.58	7.99	10.14
Aice S.C. A R.L.	11.4	5.54	3.48	3.36	3.34
Amga Calore & Impianti S.R.L.	2.12	2.97	3.8	4.05	4.23
Area Engineering S.R.L.	5.07	4.13	4.67	3.4	6.33
Aura Energy S.R.L.	3.45	3.69	2.42	6.64	5.57
Avvenia S.R.L.	14.57	14.8	13.07	14.65	16.8
Axopower S.R.L.	4.49	4.01	3.79	4.03	4.17
Azzero CO2 S.R.L.	4.58	3.74	2.94	4.46	5.43
Bartucci SPA	13.23	12.36	11.51	13.75	11.3
BIT Energia S.R.L.	10.7	13.64	12.12	10.19	11.06
C.E.I. S.P.A. - Calore Energia Impianti	6.56	4.88	5.53	5.58	6.33
Carbotermo S.P.A.	4.83	5.39	5.54	5.55	5.76
Casadei & Pellizzaro - S.R.L.	8.65	9.33	12.52	10.69	9.31
Centoraggi Societa' Cooperativa	4.17	15.41	11.33	18.86	11.42
Centro Calor S.R.L.	3.79	2.64	2.08	1.89	1.15
CO. Meta Societa' Cooperativa Consortile	3.56	2.64	2.8	3.6	4.11
Cofely Italia S.P.A.	5.29	6.7	6.27	4.83	5.28
Consul System S.P.A.	8.3	6.1	7.23	9.28	7.51
Cremonesi Consulenze S.R.L.	3.17	3.08	5.43	4.68	5.63
Cristoforetti Servizi Energia S.P.A.	4.34	4.28	3.68	4.2	4
Dedalo ESCO S.P.A.	3.69	0.76	1.6	0.6	0.61
Diddi Dino E FIGLI S.R.L.	4.69	4.57	8.36	7.8	8.14
E.ON Energia S.P.A.	2.41	2.99	4.82	5.04	5.14
Energest S.R.L.	18.33	13.25	16.85	16.65	14.36
Energon ESCO S.P.A.	3.38	4.99	5.7	6.03	6.89
Energynet S.R.L.	5.75	6.77	7.91	4.18	4.62
E.S.CO. Berica S.R.L.	1.55	3.29	3.98	3.48	3.41
E.S.CO. Comuni S.R.L.	6.38	4.34	3.4	4.73	3.66
ESCO Italia S.R.L.	7.17	3.04	3.27	4.35	6.1
E.S.CO. Primiero S.R.L.	24.35	14.05	8.26	4	4.3
ETS Life S.R.L.	7.99	8.87	8.96	9.49	9.49
Eureka E.S.CO. S.R.L.	−1.83	5.39	4.19	14.32	6.37
FEDABO S.P.A.	3.86	5.98	5.64	7.51	8.32
Fostini S.R.L.	4.35	4.65	4.89	4.93	5.43
G.M.T. S.P.A.	4.13	5.02	4.73	4.87	7.3
Geetit S.R.L.	5.2	2.41	3.44	3.56	2.83
Global Power Service S.P.A.	4.13	5.17	5.82	6.13	6.72
Hera COMM S.R.L.	3.78	4.2	4.13	4.3	4.5
Innowatio S.P.A.	8.12	13.21	13.25	16.04	12.37
Interesco SRL	4.05	4.83	4.09	2.87	1.23
JPE 2010	5.18	4.43	6.22	23.66	6.35
Menowatt GE S.P.A.	4.65	4.22	6.03	3.78	3.56
Meridionale Impianti S.P.A.	6.77	8.38	8.02	10.09	10.16
NESCO - North Energy Service COMPANY S.R.L.	4.12	3.6	12.5	14.12	585.06
Newen S.R.L.	2.24	2.82	4.88	3.34	4.1
NRG. IT S.R.L.	17.72	20.56	3.66	5.77	8.13
OM.E.G. SRL	0.64	1.62	6.88	17.52	65.95
OROS P&R SRL E OROS Progetti SRL	3.15	6.07	5.89	5.72	6.71
Pagano E Ascolillo Energy and Technology S.P.A.	3.54	3.72	4.87	5.47	5.83
Polo Tecnologico per L'energia S.R.L.	5.23	4.44	5.15	4.03	4.02
Ranzato Impianti S.R.L.	2.49	3.16	3.42	4.97	5.06
Restiani S.P.A.	3.36	3.35	3.72	4.38	4.28
Sangalli Technologies ESCO S.R.L.	3.05	3.06	3.9	10.46	6.47
SARAS Ricerche E TECNOLOGIE S.P.A.	7.64	6.62	6.79	8.95	7.35
SEA - Servizi Energia Ambiente S.R.L.	5.53	7.22	9.81	5.93	6.68
Seaside S.R.L.	10.36	11.9	6.65	6.62	6.69
Sime Energia S.R.L.	2.42	2.52	2.47	2.59	2.44
Siram S.P.A.	5.82	4.72	4.87	6.11	6.3
SOF S.P.A.	4.4	4.31	3.68	4.35	4.31
Solgen S.R.L.	3.95	3.84	4.69	3.47	3.79
Studio Botta & Associati SRL	12.46	5.24	6.49	5.26	6.47
Studio MPS Engineering S.R.L.	−4.86	2.65	3.72	5.12	4.52
Tea Servizi S.R.L.	12.03	22.01	9.27	6.9	4.45

(Contd...)

Table A2: *(Contd....)*

Company	Z" (2010)	Z" (2011)	Z" (2012)	Z" (2013)	Z" (2014)
TEP Energy Solution	6.49	7.09	8.37	9.52	9.14
TERA Energy S.R.L.	9.65	9.83	13.31	10.28	11.1
Ulteria S.R.L.	4.25	3.98	4.2	3.92	5.49
Universal Sun S.R.L.	3.73	6.37	5.14	3.55	3.07

ESCOs: Energy service companies

Table A3: Sample rating on every observation year

ESCO	2010		2011		2012		2013		2014	
	Z"	Rating	Z"	Rating	Z"	Rating	Z"	Rating	Z"	Rating
A2A Calore E & Servizi	4.14	CCC+	4.4	B-	4.18	B-	4.35	B-	3.08	CCC-
Adria Energy E.S.CO S.R.L.	7.87	AA	10.38	AAA	11.58	AAA	7.99	AA	10.14	AAA
Aice S.C. A R.L.	11.4	AAA	5.54	BB	3.48	CCC	3.36	CCC	3.34	CCC
AMGA Calore & Impianti S.R.L.	2.12	D	2.97	CCC-	3.8	CCC+	4.05	CCC+	4.23	B-
Area Engineering S.R.L.	5.07	BB-	4.13	CCC+	4.67	B-	3.4	CCC	6.33	BBB
Aura Energy S.R.L.	3.45	CCC	3.69	CCC	2.42	D	6.64	BBB+	5.57	BB
Avvenia S.R.L.	14.57	AAA	14.8	AAA	13.07	AAA	14.65	AAA	16.8	AAA
Axopower S.R.L.	4.49	B-	4.01	CCC+	3.79	CCC+	4.03	CCC+	4.17	B-
Azzero CO2 S.R.L.	4.58	B+	3.74	CCC	2.94	CCC-	4.46	B-	5.43	BB
Bartucci SPA	13.23	AAA	12.36	AAA	11.51	AAA	13.75	AAA	11.3	AAA
BIT Energia S.R.L.	10.7	AAA	13.64	AAA	12.12	AAA	10.19	AAA	11.06	AAA
C.E.I. S.P.A. - Calore Energia Impianti	6.56	BBB+	4.88	B+	5.53	BB	5.58	BB	6.33	BBB
Carbotermo S.P.A.	4.83	B+	5.39	BB	5.54	BB	5.55	BB	5.76	BB+
Casadei & Pellizzaro - S.R.L.	8.65	AAA	9.33	AAA	12.52	AAA	10.19	AAA	9.31	AAA
Centoraggi Societa' Cooperativa	4.17	B-	15.41	AAA	11.33	AAA	18.86	AAA	11.42	AAA
Centro Calor S.R.L.	3.79	CCC+	2.64	CCC-	2.08	D	1.89	D	1.15	D
CO. Meta Societa' Cooperativa Consortile	3.56	CCC	2.64	CCC-	2.8	CCC-	3.6	CCC	4.11	CCC+
Cofely Italia S.P.A.	5.29	BB	6.7	A-	6.27	BBB	4.83	B+	5.28	BB
Consul System S.P.A.	8.3	AAA	6.1	BBB-	7.23	A+	9.28	AAA	7.51	AA-
Cremonesi Consulenze S.R.L.	3.17	CCC-	3.08	CCC-	5.43	BB	4.68	B	5.63	BB
Cristoforetti Servizi Energia S.P.A.	4.34	B-	4.28	B-	3.68	CCC	4.2	B-	4	CCC+
Dedalo ESCO S.P.A.	3.69	CCC	0.76	D	1.6	D	0.6	D	0.61	D
DIDDI DINO E FIGLI S.R.L.	4.69	B	4.57	B	8.36	AAA	7.8	AA	8.14	AA
E.ON Energia S.P.A.	2.41	D	2.99	CCC-	4.82	B+	5.04	BB-	5.14	BB-
Energest S.R.L.	18.33	AAA	13.25	AAA	16.85	AAA	16.65	AAA	14.36	AAA
Energon ESCO S.P.A.	3.38	CCC	4.99	BB-	5.7	BB+	6.03	BBB-	6.89	A
Energynet S.R.L.	5.75	BB+	6.77	A-	7.91	AA	4.18	B-	4.62	B
E.S.CO. Berica S.R.L.	1.55	D	3.29	CCC	3.98	CCC+	3.48	CCC	3.41	CCC
E.S.CO. COMUNI S.R.L.	6.38	BBB	4.34	B-	3.4	CCC	4.73	B	3.66	CCC
ESCO Italia S.R.L.	7.17	A+	3.04	CCC-	3.27	CCC	4.35	B-	6.1	BBB-
E.S.CO. Primiero S.R.L.	24.35	AAA	14.05	AAA	8.26	AAA	4	CCC+	4.3	B-
ETS Life S.R.L.	7.99	AA	8.87	AAA	8.96	AAA	9.49	AAA	9.49	AAA
Eureka E.S.CO. S.R.L.	−1.83	D	5.39	BB	4.19	B-	14.32	AAA	6.37	BBB
Fedabo S.P.A.	3.86	CCC+	5.98	BBB-	5.64	BB	7.51	AA-	8.32	AAA
Fostini S.R.L.	4.35	B-	4.65	B	4.89	B+	4.93	B+	5.43	BB
G.M.T. S.P.A.	4.13	CCC+	5.02	BB-	4.73	B	4.87	B+	7.3	A+
Geetit S.R.L.	5.2	BB-	2.41	D	3.44	CCC	3.56	CCC	2.83	CCC-
Global Power Service S.P.A.	4.13	CCC+	5.17	BB-	5.82	BB+	6.13	BBB-	6.72	A-
Hera Comm S.R.L.	3.78	CCC+	4.2	B-	4.13	CCC+	4.3	B-	4.5	B
Innowatio S.P.A.	8.12	AA	13.21	AAA	13.25	AAA	16.04	AAA	12.37	AAA
Interesco SRL	4.05	CCC+	4.83	B+	4.09	CCC+	2.87	CCC-	1.23	D
JPE 2010	5.18	BB-	4.43	B-	6.22	BBB-	23.66	AAA	6.35	BBB
Menowatt GE S.P.A.	4.65	B	4.22	B-	6.03	BBB-	3.78	CCC+	3.56	CCC
Meridionale Impianti S.P.A.	6.77	A-	8.38	AAA	8.02	AA	10.09	AAA	10.16	AAA
NESCO - North Energy Service Company S.R.L.	4.12	CCC+	3.6	CCC	12.5	AAA	14.12	AAA	585.06	AAA
Newen S.R.L.	2.24	D	2.82	CCC-	4.88	B+	3.34	CCC	4.1	CCC+
NRG. IT S.R.L.	17.72	AAA	20.56	AAA	3.66	CCC	5.77	BB+	8.13	AA
OM.E.G. SRL	0.64	D	1.62	D	6.88	A	17.52	AAA	65.95	AAA
OROS P&R SRL E OROS Progetti SRL	3.15	CCC-	6.07	BBB-	5.89	BBB-	5.72	BB+	6.71	A-
Pagano E Ascolillo Energy and Technology S.P.A.	3.54	CCC	3.72	CCC	4.87	BB+	5.47	BB	5.83	BB+
Polo Tecnologico PER L'energia S.R.L.	5.23	BB-	4.44	B-	5.15	BB-	4.03	CCC+	4.02	CCC+
Ranzato Impianti S.R.L.	2.49	D	3.16	CCC-	3.42	CCC	4.97	BB-	5.06	BB-
Restiani S.P.A.	3.36	CCC	3.35	CCC	3.72	CCC	4.38	B-	4.28	B-

(Contd...)

Table A3: ***(Contd....)***

ESCO	2010		2011		2012		2013		2014	
	Z”	Rating	Z”	Rating	Z”	Rating	Z”	Rating	Z”	Rating
Sangalli Technologies ESCO S.R.L.	3.05	CCC-	3.06	CCC-	3.9	CCC+	10.46	AAA	6.47	BBB+
SARAS Ricerche E Tecnologie S.P.A.	7.64	AA	6.62	BBB+	6.79	A-	8.95	AAA	7.35	AA-
SEA - Servizi Energia Ambiente S.R.L.	5.53	BB	7.22	A+	9.81	AAA	5.93	BBB-	6.68	A-
Seaside S.R.L.	10.36	AAA	11.9	AAA	6.65	A-	6.62	BBB+	6.69	A-
SIME Energia S.R.L.	2.42	D	2.52	CCC-	2.47	D	2.59	CCC-	2.44	D
SIRAM S.P.A.	5.82	BB+	4.72	B	4.87	B+	6.11	BBB-	6.3	BBB
SOF S.P.A.	4.4	B-	4.31	B-	3.68	CCC	4.35	B-	4.31	B-
SOLGEN S.R.L.	3.95	CCC+	3.84	CCC+	4.69	B	3.47	CCC	3.79	CCC+
Studio Botta & Associati SRL	12.46	AAA	5.24	BB-	6.49	BBB+	5.26	BB	6.47	BBB+
Studio MPS Engineering S.R.L.	−4.86	D	2.65	CCC-	3.72	CCC	5.12	BB-	4.52	B
TEA Servizi S.R.L.	12.03	AAA	22.01	AAA	9.27	AAA	6.9	A	4.45	B-
TEP Energy Solution	6.49	BBB+	7.09	A+	8.37	AAA	9.52	AAA	9.14	AAA
TERA Energy S.R.L.	9.65	AAA	9.83	AAA	13.31	AAA	10.28	AAA	11.1	AAA
Ulteria S.R.L.	4.25	B-	3.98	CCC+	4.2	B-	3.92	CCC+	5.49	BB
Universal Sun S.R.L.	3.73	CCC	6.37	BBB	5.14	BB-	3.55	CCC	3.07	CCC-

ESCOs: Energy service companies