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THE POWER PLANTS ARE REALIZING THE ADDED VALUE OF BEING SOCIALLY RESPONSIBLE BY USING THE COMBINED HEAT AND POWER TECHNOLOGY

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Abstract: *The authors present in this paper the results of an explorative study whose aim is to determine the opportunities and limitations of the combined production of heat and power (CHP) for rational use of energy and reducing CO2 emissions. In this paper, we propose a new way to look at the relationship between energy plants and society. The amounts of energy savings and CO2 – reduction by using CHP technology strongly depend on the performances of the CHP plants and of the processes to separate production of heat and power. The authors found out that the power plants are realizing the added value of being socially responsible such as environmental protection by reducing CO2 emissions.*
Key words: *CHP, CO2, environment, CSR, efficiency*

1. INTRODUCTION

Cogeneration, also known as combined production of heat and power (CHP), is inherently more energy efficient than using separate power and heat generating sources, making it an effective anti-pollution strategy. As a result, the EU in recent years has recommened countries to begin modernising their industrial and municipal cogeneration systems in order to help improve energy efficiency and curtail their emission levels.

This paper seeks to shed some light on the reducing carbon dioxide emissions in the combined heat and power plants. Based on a multi-case study approach, this paper pursues an exploratory research about the energy savings and reducing CO2 emissions. The amount of energy savings and CO2 – reduction by using CHP strongly depend on the performances of the CHP plants (efficiencies, valorization of electricity and heat, number of running hours) and of the characteristics of the reference situation with separate production of heat and power.

This study investigates the relationships between Corporate Social Responsibility (CSR) and the efficiency of combined production of heat and power. We recognized that the prevention of global warming is an important social responsibility of the electricity industry. This sector is currently a major source of atmospheric CO2 emissions. One industry challenge in the coming decades may be to profitably employ advanced technology that reduces CO2 output while maintaining generation availability and reliability. There are likely to be many different strategies applied to new generation additions. However, the numbers of viable alternatives for existing facilities are relatively limited (Porter & Kramer, 2006).

The paper is organized as it follows. After a brief introduction there is a section to explore the key concepts and literature review. The third section presents the exploratory research. Finally, the last section presents the main conclusions and the directions of the future research.

2. KEY CONCEPTS AND LITERATURE REVIEW

This section describes the theoretical underpinning of this research from the recognizing that CSR is considered a strategic issue and a key to our long-term economic success by reducing CO2 emissions and combined production of heat and power.

During electricity generation, a large amount of low-grade heat is produced. In conventional power plant this heat is lost. In CHP systems the heat produced during electricity generation is recycled rather than wasted, thereby increasing the efficiency of the system (Zvi & Alex, 2007).

Smart grid uses digital technology to manage power generation, transmission, and distribution from all types of sources along with consumer demand. The smart grid will lead to lower costs as well the more efficient use energy. It will enable the development of cross-industry platforms to manage the energy needs of cities, companies, bulding, and households.

Corporate social responsibility is a key differentiation factor that can be sustained in the longer term. The key factor is to make CSR uptake a voluntary process. A working definition of CSR may be used from the World Business Council for Sustainable Development. "CSR is the continuing commitment by business to behave ethically and contribute to economic development while improving the quality of life of the workforce and their families as well as the local community and society at large" (Collier & Esteban, 2007).

CSR has the potential to shape the strategic context for companies and can exploit longer-term opportunities. The real advantages will only be realised once CSR is tied to business strategy. Furthermore, improving abilities in creative business strategy offers new opportunities for companies to realize efficiency through collaboration (Nidumolu & Prahalad, 2009).

To achieve the target for global reduction of 50% by 2050, a reduction of emissions by 30% is required in the European Union by 2020. This reduction has to increase further in the time frame up to 2050. Legislation currently being debated calls for captures ready design of coal-fired power plants in 2015 and mandatory capture in 2020 (Militaru, 2008).

CO2 capture systems are categorized as post-combustion capture, pre-combustion capture, and oxyfuel combustion. *Post-combustion capture* refers to separation of CO2 from flue gas after the combustion capture and oxyfuel combustion. *Pre-combustion capture* increases the CO2 concentration of the flue stream, requiring smaller equipment size and different solvents with lower regeneration energy requirements. The fuel is first partially reacted at high pressure with oxygen or air and, in some cases, steam, to produce carbon monoxide (CO) and hydrogen (H2). The CO is reacted with steam in a catalytic shift reactor to produce CO2 and additional H2.

Oxyfuel combustion refers to increase the concentration of CO2 by using pure or enriched oxygen (O2) instead of air for combustion, either in a boiler or gas turbine. The O2 would be produced by cryogenic air separation, which is alredy used on a large scale industrially, and the CO2 – rich flue gas would be recycled to the combustor to avoid the excessively high flame temperature associated with combustion in pure O2. The avantage of oxyfuel combustion is that the flue gas contains a high concentration of CO2, so the CO2 separation stage is

simplified. The primary disadvantage of oxyfuel combustion is that cryogenic O2 is expensive in capital cost.

Trigeneration is the simultaneous production of electricity, heat and cooling from a single heat source. This configuration can increase the overall efficiency of the system. This method has been very important, due to the increased costs of fuels, particularly oil based fuels, and due to environmental concerns, particularly climate change (Heizer & Render, 2006).

3. EXPLORATORY RESEARCH

Our research design is based on investigation of social responsibility initiatives involved the power plant and their investments in corporate social responsibility by using multiple data collection methods including interviews, document analysis, Web research, observation, and critical incident reports. Interviews were conducted with technical staff and managers from power plants located in Bucharest.

The increased fuel efficiency of GHPs gives them a potentially useful role in helping to combat global warming by decreasing carbon dioxide emissions. The reducing can be as much as 50%, depending on the fuel being replaced by CHP.

For example, Romania's carbon market has been in operation for over a year and local stock exchanges and Romania's state-owned power market operator (OPCOM) are wising up to the opportunities of building platforms for trade. OPCOM intends to set up a new platform as early as this year, while the Bucharest Stock Exchange has also expressed interest in opening a facility for trading carbon dioxide emissions credits. Since 2009, Romania has been part of the EU's scheme for carbon trading, where up to 12,000 industrial and energy polluters buy and sell CO2 emissions.

Energy losses in power generation represent a huge and growing source of carbon emissions during a period in which the countries will be seeking to reduce total emissions. Approximately 67% of the energy contained in the fuel for conventional electrical generation is rejected as waste heat into the environment. By recycling the termal energy, cogeneration systems can overall increase efficiencies of 50% to 85% (Heizer & Render, 2006).

Combined heat and power systems generate electricity and thermal energy in a single, integrated system (see Figure 1). Because CHP captures the heat that would be otherwise be rejected in traditional separate of electric or thermal energy, the total efficiency of these integrated systems is much greater than from separate systems.

Absorption chillers can convert hot water or steam into chilled water for air conditioning. A dehumidifier can be utilized to remove moisture from the air and provide better indoor air quality.

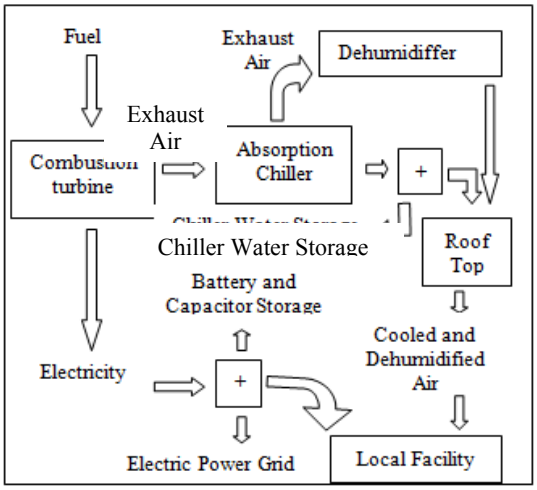

Fig.1. Components of a CHP System

4. DISCUSSION AND CONCLUSIONS

The contribution of this paper is to aid academics and researchers to better understand how power plant can provide electricity, heat and cooling by reducing carbon dioxide emissions and thus generate a competitive position on the market. Excess electricity will be deliverd to the national grid of each country, thereby supplying them with greener power.

A power plant can invest in a project to reduce carbon emissions and then the Government can grant to the firm Certified Emission Reductions (CER), which represent the amount of tonnes of CO2 saved by the investment. One tonne of CO2 saved is equal to one CER.

Our findings illustrate that power plants can take a competitive advantage from maximizing their contributions to social causes and to have a more visible, long-term engagement with the community. The findings confirm that the power plants are realizing the added value of being socially responsible such as environmental protection by reducing CO2 emissions.

This paper offers a number of contributions. First of all, there is a weak relationship between CSR and profitability because firms invest in socially responsible projects until the marginal returns decline to the overall market rate of return. However, companies that are profitable are more likely to engage in more CSR activities.

Second, there are some limites to use of CHP. Depreciation for CHP investments may not reflect the true economics lives of the equipment. The market is unaware of technology developments that have expanded the potential for CHP.

Third, Carbon Reduction Commitment (CER) will have a positive impact on the market for CHP. The use of low or zero emission technologies will take time and existing reserves of fossil fuels will continue to play an important role in creating the energy neede to drive societies.

Finally, the performance of separate systems for the production of electricity and heat, electricity production by combined cycle plants (efficiency $\geq$ 50%) and heat production by high efficiency boilers (efficiency $\geq$ 90%), are strongly improving. The required performances of CHP plants being preferable to separate systems for the production of heat and power have to be tightened.

In the future, only companies that make sustainability a goal will achieve competitive advantage. However, many companies are convinced that the more environment-friendly they become, the more the effort will erode their competitiveness.

Therefore, future research may be directed toward examine the exploratory factors and the correlation between them by experimental research.

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