Analyzing Energy Efficiency Barriers in the Commercial and Industrial Sectors in Ukraine

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Introduction: Ukraine, an Eastern European country located between Russia and Europe, is facing two big challenges in terms of its energy supply. First, it is highly dependent on imports for its energy supply and most imports come from Russia with whom its relationship has been highly deteriorated since 2014. Second, most of its energy supply and utilization infrastructures were built during the Soviet era and are highly inefficient because of aging and outdating (Ogaranko & Hubacek, 2013). The inefficiency is sustained due to prolonged distortions in the energy markets, such as low and subsidized energy prices, and resistance to energy price reforms (ECS, 2013). Improvement of energy efficiency is one of the key instruments to address these challenges. However, realization of significant improvement in energy efficiency are constrained by several barriers, such as financial, information and institutional and behavioral barriers. Although a large number of empirical studies examining barriers to energy efficiency are available for various countries, no such study exists for Ukraine. This study aims to contribute in filling this research gap.

Methodology: We designed a cross-sectional survey and implemented over 509 commercial and industrial firms throughout Ukraine in 2013. The survey separates barriers to the adoption of energy efficiency into five categories: (i) economic or financial barriers, (ii) information barriers, (iii) technical barriers, (iv) institutional barriers, and (v) split incentives whereby firms are not accountable for their energy use and thus have no incentive to improve energy efficiency. We chose the firms using a two-stage quota sample, focusing energy-intensive firms in both industrial and commercial sectors. At the first stage, we determined the location of potential samples. Three statistical indicators used for sample selection criteria are: (i) number of working age population by region, (ii) number of subjects of Unified State Register of Enterprises and Organizations of Ukraine by region, and (iii) gross regional product by region. At the second stage, we formed quotas for sample selection by economic sectors in each region. The target ratio of industrial and non-industrial firms (or commercial firms) was determined based on two criteria: the percentage of gross value added in Ukraine of industrial firms vs. commercial firms and their respective share in total CO_2 emissions in the country. We used filters at the second stage of sample development to ensure the inclusion of large energy consuming firms. They include firm size, floor size (especially for the commercial firms). The final sample size included 62% industrial firms and 38% commercial firms. We sent the survey instruments to several experts for review. We implemented the survey via face-to-face interviews as well as by mail. The survey data are publically available at the World Bank website.

Results: Our study finds that that almost all of the surveyed firms reported energy efficiency as a high priority. The degree of importance varies slightly, however. To further confirm the firms' perception of the importance of energy efficiency improvements we asked them if they had invested in energy efficiency improvements in the past five years and, if so, how much. The results showed that more than 70% of the firms had made some investments in energy efficiency improvements over the last five years. Moreover, 80% of industrial firms and 73% of commercial firms intend to invest in the next five years. The study also confirms that energy audit helps improve energy efficiency by making the firms better informed regarding the cost saving benefits of energy efficiency measures. This result is consistent with existing literature such as Annunziata et al. (2014), Delmas et al. (2013) and Thollander et al. (2007).

We also ranked the barriers based on the survey results. The results suggest that both industrial and commercial firms perceive economic or financial barriers as the main obstacles to adopt energy efficient technologies. They rank the high upfront investment requirement and higher costs of capital due to the higher interest rate charged by financial institutions as the key financial barriers to energy efficiency improvements. On a scale of 0 to 3, with 0 being no barriers and 3 being the highest level of barriers, industrial firms rate the upfront investment barrier 2.14 on average. Similarly, commercial firms rate this barrier 1.94 on average. The average ratings of capital cost or high interest rate barrier are 1.93 and 1.77 for the industrial and commercial firms, respectively. Similar results are also reported by some existing studies (Liu, 2014 and Fleiter et al. 2011). The survey results also reveals that the institutional barrier represented by the lack of effective government policies to facilitate energy efficiency programs is equally as strong as the upfront investment financial barrier. Other important barriers to energy efficiency with a rating higher than the mid-point of the scale (i.e., > 1.5) reported by the industrial firms, on average, are lack of local supplies for equipment

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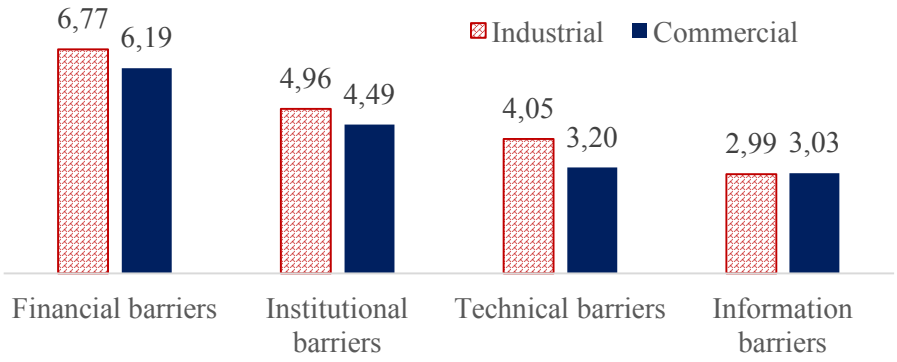
parts and very expensive purchasing from abroad; also, long lead time to get equipment parts and government permits to deploy energy efficient devices and processes. We also employed a principal component analysis to determine aggregate ranking of barriers. Figure 1 presents the results.

Figure 1. Aggregate ranking of barrier types based on principal component analysis



Firms also consider opportunity cost of the investment or the rate of return of the same investment that could be secured elsewhere as an important barrier, with an average rating of 1.42. Most existing literature analyzing marginal abatement cost of GHG mitigation has shown that energy efficiency options are negative cost options, or "win-win" options, or low hanging fruits as savings from energy efficiency measures are higher than the associated investments at a given discount rate (e.g., de Gouvello et al. 2010; World Bank, 2011 and Timilsina et al. 2000). Our analysis suggests that even if energy efficiency measures have negative costs and provide a net benefit to consumers, there is no guarantee that firms will adopt these measures because they do not perceive the benefits as attractive enough. This is because firms expect a higher return from the investment than the return from energy savings.

Conclusions: Improvement of energy efficiency is an important element of energy policy for a sustainable supply of energy in Ukraine. However, the country is facing several challenges to the large-scale deployment of energy efficient technologies. We conducted a two-stage quota sample survey of 509 commercial and industrial firms of all regions of Ukraine to understand the barriers to energy efficiency improvements. Our study finds that more than two-thirds of the commercial and industrial firms in the country view improvement of energy efficiency very important to their business. However, due to several barriers they are unable to realize the improvements of energy efficiency. Among the 19 potential barriers investigated in the study, the survey results show that high upfront investment requirement, lack of government policies to support energy efficiency improvements, higher cost of capital, and lack of information and awareness are the most critical barriers to the improvement of energy efficiency in the industrial and commercial sectors in Ukraine.

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