Transforming the Ukrainian Market for Industrial Energy Efficiency

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1 - ABSTRACT

Industry in Ukraine is among the world's most energy intensive. Energy was plentiful and cheap in Soviet times and little effort was made to conserve it. Rising energy prices have had a major impact on profits and production, which also creates a tremendous market potential for energy efficient products and services. Yet Ukrainian industry has not implemented significant energy efficiency measures in recent years.

The Ukrainian government has placed energy efficiency and industrial development at the top of its priorities. Energy efficiency can help Ukraine improve its security, economy and environment. Ukraine's energy imports represent a key national security issue because Ukraine imports over half its energy from Russia, making it vulnerable to that nation's demands. Energy efficiency can provide jobs and can help make Ukrainian industry more competitive internationally. Industrial production has plummeted as a result of economic collapse and inefficiency; some of this production and energy demand may never return because of economic restructuring. Ukraine would like to minimise the drop in production to reduce the nation's economic pains. Energy efficiency can also help protect the environment, both in Ukraine and globally. In short, Ukraine has many good reasons for improving its market for industrial energy efficiency.

This paper examines the forces influencing energy efficiency decision making in the industrial sector and suggests effective means of changing old energy habits and buying patterns. Important aspects of this issue include ownership, organisational structure, financial performance, compensation, barter, and taxation. Tax policy provides an incentive to conduct business through barter deals because such transactions can evade high taxes. Thus, a plant may not want to reduce energy purchased through barter agreements because barter can serve as a tax shelter. The paper also describes efforts at several Ukrainian manufacturers to improve energy efficiency. Specifically, the paper draws on work conducted at a glass plant, a coke and chemical manufacturer, a steel cable factory, a food processing plant, and a small metallurgical facility and provides case studies of three of these. The last section of the paper outlines strategies for encouraging industrial plants to become more efficient, based on the experience at these plants.

2 - FORCES INFLUENCING INDUSTRIAL DECISION MAKING

Industrial managers in the West usually make business decisions with the goal of advancing corporate strategic interests. Maximising profits is one of these interests. Energy efficiency can increase profits by lowering costs. It can also help meet corporate environmental goals.

Likewise, industrial managers in Ukraine try to advance strategic business goals. In the past, these goals were not driven by profits, but by production quotas, social obligations, and politics. The state paid for and allocated production output. Politics could influence the price a factory was paid and its allocation of goods and services from other producers. The state also encouraged factories to support the social infrastructure: housing, schools, hospitals, vacation resorts, and recreational facilities for its workers and their families. Because Ukraine is still transitioning to a market economy, the drivers behind equipment and facility decisions lie somewhere between those of the state-run and market models.

Ukraine is privatising its industry. Many factories have been privatised, others are in the middle of the process, and some, particularly those considered strategic national assets, will likely remain state-owned. When privatisation began, many workers' collectives decided to lease their enterprises from the state, thereby gaining control, though not ownership. These collectives were often led by the enterprise director or other top managers. Later, when the enterprises were privatised, workers' collectives were given preferential rights to purchase shares in the enterprise at low prices. Management was also given options to buy share packages. In the end, many directors and management teams ended up owning or controlling large blocks of shares. Not surprisingly, most management teams stayed in place even after privatisation. Shareholder rights have also been weak in part because enterprises were allowed initially to keep their own share registries. Even today, few employee owners would be willing to risk their jobs by challenging the management team on corporate decisions and performance. Plant management essentially obtained full corporate authority without the same kind of accountability that is common in Western public corporations. This system affects energy efficiency because a management team that is not accountable for corporate performance has little incentive to reduce costs. Furthermore, few managers will voluntarily tie their compensation to corporate earnings, so they do not have a salary incentive to reduce costs. The value of their stock should, however, reflect corporate performance, although most Ukrainian stock is thinly traded, and performance information is not widely available.

Lack of accountability is complicated by the fact that Ukraine's bankruptcy law is not effective at weeding out insolvent companies. A strong bankruptcy law would provide a powerful incentive for enterprise directors to carefully manage their cash flow. Instead, Ukrainian firms can purchase more than they can afford, with little fear of bankruptcy. It is only rational that non-payments have become a major problem in Ukraine: companies that have difficulty paying for labour, raw materials, or energy simply do not pay. As a result, even well-managed companies have difficulty collecting payment and managing cash flow. Energy arrears in particular have ballooned throughout the country, and a company that does not pay for energy, or pays only in part, has little incentive to invest in energy efficiency.

Another logical consequence of this situation is the rise of barter payments and tolling. Companies try to operate as best they can without cash. They trade goods for goods. This creates several disincentives for energy efficiency. First, a company that pays for its energy in goods has more difficulty establishing the value of energy and energy savings. Second, reducing energy purchases may also result in reduced sales because the company's products are traded for the energy. While most barter takes place in several steps, and often through intermediaries, ultimately, sales are linked to purchases in a way that does not occur in a monetised economy. This is particularly true in the tolling system. In the tolling system, Company A (usually an intermediary or wealthy raw material supplier) will purchase raw materials for Company B, which processes the raw materials into finished products. Company B must return the finished products to Company A, and in return, Company B gets a tolling fee for processing the materials; the fee is often paid out of the finished product. The advantage to Company B is that it can operate with minimal working capital, but tolling severely limits Company B's income and profit. Barter also limits profit by disassociating sales from production, since a «marketing» intermediary is often hired to help arrange the barter deals. Thus, a third disincentive for efficiency is that tolling and barter limit the availability of internal financing for energy efficiency.

The tax system often provides a further stimulus for barter, and disincentive for efficiency. Barter and tolling make it easier to legally discount the real value of the products and income on which taxes are levied. Taxes are very high in Ukraine, so many enterprises would prefer to avoid their taxes. Cash is easier for the government to confiscate than inventory or raw materials. High taxes reduce the potential return of energy efficiency investments. The investment itself is subject to value added and payroll taxes for the materials and labour. The increased profit from the investment is also generally subject to a 30% profit tax. This is true of any investment, not just energy efficiency. Investment in the Ukrainian economy has been very low by world and even regional standards: Ukraine received $2 billion in foreign investment from 1991 through the first quarter of 1998 according to the State Statistics Committee. By contrast, Hungary has received approximately $16 billion and Poland $20 billion over this period. While some Ukrainian energy experts have recommended lowering profit taxes on energy savings to promote efficiency, a more practical idea might be lowering value added taxes (VAT) and customs duties on energy efficiency equipment because it is much easier to value the equipment than the savings.[1]

[1]This debate has been raised at the Ukrainian Energy Efficiency and Energy Saving Work Group. Liudmila Simonova and Paul Thomas of Industrial Real Estate, a Ukrainian-American appraisal company, have recommended lowering VAT instead of the profit tax for energy

Financing is difficult to obtain in Ukraine because the high investment risks limit capital availability. The cost of capital is very high in Ukraine: annual interest rates for corporate loans can be over 100%, and few banks offer credit terms greater than six months. Development banks such as the World Bank offer lower rates and longer terms, but the time involved in preparing a project means that only large projects are financed. Enterprise managers usually prefer to limit their bank borrowing because they are keenly aware of the cost of financing. Besides, few energy efficiency investments are still profitable with 100% interest rates.

Ukrainian corporate organisational structure also affects energy efficiency decisions. Ukrainian plants tend to be very hierarchical. Decisions on most contracts are made at the top, with little delegation of authority. Because of the competing demands on a general director's time, energy efficiency may get little attention. The energy manager or operations staff may be aware of cost-effective energy efficiency opportunities at a plant, but lack the authority to make an investment decision. On the other hand, when a decision is made at the top to pursue energy efficiency, the vertical organisational structure can make it easier to implement the decision.

3 - OVERCOMING THE BARRIERS: CASE STUDIES

The deck seems stacked against energy efficiency in Ukraine, yet there are industrial companies that successfully implement energy efficiency projects. Corporate leadership, financing, and an understanding of the benefits of efficiency all play a key role in such projects.

As part of the energy assistance program to help Ukraine shut down the Chernobyl nuclear reactors, the U.S. Department of Energy (DOE) asked the Pacific Northwest National Laboratory (PNNL) to assist Ukrainian industrial enterprises in developing energy efficiency projects. PNNL leads a U.S.-Ukrainian team that conducts energy audits and financial analyses of industrial plants, and helps these plants to design business plans and structure financing for energy efficiency investments. PNNL's main project partners are the Ukrainian Energy Efficiency Centre (ARENA-ECO) and Industrial Real Estate (IRE). Potential industrial participants in the program are rigorously reviewed for their financial and business viability, energy efficiency potential, and interest in energy efficiency before they are included in the program. This selection process is important because the companies accepted will need to attract financing in order to implement the energy efficiency recommendations. Only the most viable manufacturers in Ukraine have a chance of receiving financing. Both engineers and financial experts on the team participate in initial site visits and plant selection. After plants are selected, IRE prepares detailed financial analyses of each of the plants and helps them structure financing for the measures they decide to implement. PNNL and ARENA-ECO jointly conduct the energy audits. The examples below--Gostomel Glass Plant, Avdeevka Coke Chemical Plant and Rosich Food Processing Plant--are drawn from the enterprises participating in this program.

3.1. Energy Efficiency at Gostomel Glass Plant

Gostomel Glass Plant produces bottles for beverages, perfumes and pharmaceuticals. Its customers have included Coca-Cola, Pepsi-Cola, Obolon (a large Ukrainian brewery), and several Ukrainian and Russian cosmetic and pharmaceutical companies. Gostomel's plant is located in the Kiev region, 25 kilometres from the city of Kiev. The plant has run almost continuously at full capacity in recent years. Much of this successful operation can be attributed to Gostomel's creative market-oriented management style. The company's management and board of directors realise that the plant uses energy very inefficiently compared with similar plants in the West. This high energy use has created high costs. The management team also knows that it could expand its market and sales if it could increase production capacity. Staff from PNNL and ARENA-ECO conducted a detailed energy audit of the plant, the findings of which are described below.

The largest energy efficiency measure considered was replacing glass furnace number 3 with a new, Western-designed furnace. This measure will produce large energy savings and will also allow Gostomel to increase the volume and quality of its production. The energy savings alone will not pay for the furnace, as indicated in Table 1. Nonetheless, the total benefits of the new furnace will likely make it a very appealing investment. In addition to the new furnace, the energy audit report recommended the following measures:

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efficiency investments.

- installing a high-efficiency compressed air system, including several new compressors, an automatic control system, and a refrigerated air dryer system;
- installing heat recovery hot water boilers in the glass furnace exhaust systems and a new hot water boiler;
- upgrading heat insulation on the hot water distribution system;
- relocating the air intake for screw-type air compressors to outside the compressor building.

Table 1 summarises the results of the energy audit and the economic analyses of the recommended energy-efficiency measures for Gostomel.

Table 1. Summary of Proposed Energy-Efficiency Measures at Gostomel Glass Plant

Measure	Cost (US $)	Annual Savings (US $)	Simple Payback (years)	Internal Rate of Return (IRR) (%/yr)
High-efficiency compressed-air system and controls	967,754	193,862	5.0	19.5
Heat recovery hot water boilers in glass furnace exhaust systems	530,900	156,395	3.4	29.3
Relocation of compressor air-intake outside compressor building	4,000	2,130	1.9	53.2
Piping insulation upgrade	39,070	14,550	2.7	25.1
Glass furnace upgrade*	18,190,000	592,900	--	--

*This measure was recommended as a modernisation project. It cannot be economically justified based on energy savings alone. As a result, the simple payback and IRR based on energy savings are not meaningful, so these calculations are not provided.

Gostomel has already implemented many of these measures with its own financing. The plant has installed three waste heat recovery boilers and now satisfies all of its space heating needs with recovered heat. It has also insulated most of its hot water pipes; the remaining pipes are scheduled for replacement in the near future. In addition, the company has relocated the compressor air intake, though not exactly as prescribed in the energy audit report. Gostomel has even gone beyond the original recommendations to invest in improving power factor. PNNL staff and their colleagues at Industrial Real Estate are now working with Gostomel to obtain financing for the remaining two measures: an efficient compressed air system and a new glass furnace. Because of the cost of the glass furnace, Gostomel hopes to attract a strategic investor to form a joint venture for this investment. The company is currently conducting negotiations with potential investors. Options for financing the compressed air system include vendor or energy service company (ESCO) financing. Alternatively, Gostomel could parcel the compressor measure into smaller pieces that it could finance on its own. Financing has been the major barrier to implementing these larger energy efficiency measures, including the new furnace, because Gostomel does not have enough liquid working capital to pay for these measures in one lump sum.

Gostomel has been able to improve its efficiency because of several factors, including management support, solid financial performance and an understanding of the benefits of efficiency. The management and staff at Gostomel are very committed to energy efficiency and product quality improvements. ARENA-ECO has been collaborating with this company since 1995, so Gostomel employees have had the opportunity to learn more about energy efficiency and its benefits. Because its financial performance has been strong, Gostomel has not fallen into the non-payment trap of many enterprises. Many of its customers are Western-owned or top performers in Ukraine, so its price and quality must remain competitive if Gostomel hopes to keep these customers. The company has identified high energy costs as one of its chief competitive disadvantages. In neighbouring Russia, for example, energy costs are lower. The recent devaluation of the Russian rouble compared to the Ukrainian hryvnia and most other world currencies makes Russian manufacturers' prices even more competitive. As a result, Gostomel staff appreciate the value of cost reductions and energy efficiency.

3.2. Energy Efficiency at Avdeevka Coke Chemical Plant

Avdeevka is located in Donetsk Oblast, just outside the city of Donetsk. It is one of the largest coke chemical plants in Europe. In recent years, the plant has sold coke to almost every Ukrainian steel mill. Its primary customer is currently Ilich Steel Plant in Mariupol, a plant with a strong export base. Avdeevka also sells over 20 types of chemicals derived from coal, including low-octane gasoline, paint additives, and sulphuric acid, and it exports 10%

of its products. Avdeevka has financed significant modernisation projects and other plant upgrades with its net profits. The company was privatised in 1992–one of the first Ukrainian enterprises to do so.

Combustion of coke-oven gas (essentially a free by-product of the coking process) and electricity purchases cover most of Avdeevka's energy demand. However, Avdeevka's combined heat and power station is very outdated; thus, it produces less electricity and steam than a more modern facility could with the available coke-oven gas. Plant management recognised this problem and commissioned a study by Mashproekt Turbine Plant[2] to assess the feasibility of installing locally designed and manufactured gas turbines with waste heat recovery boilers for meeting Avdeevka's energy needs. The feasibility study by PNNL and the Ukrainian Energy Efficiency Centre, ARENA-ECO, further reinforced the feasibility of installing a gas turbine cogeneration system and made additional recommendations for improving the energy efficiency of the plant as listed below:

- install efficient outdoor lighting;
- replace insulation on steam and hot water piping;
- modify the compressed-air system;
- identify and repair leaks in the compressed-air system;
- install steam traps.

The preliminary analysis of the electrical and steam demands at the plant confirmed that a new 15 MW gas turbine cogeneration system would be a cost-effective investment. An economic analysis was conducted for three different options involving one, two, or three equally sized gas turbine cogeneration systems. The final recommendation was that two gas turbine cogeneration systems be installed in two phases so the savings from the first phase can help pay for the second phase. However, in the short-term, the plant is only considering the first phase, installation of one gas turbine unit. The economic feasibility of the second turbine will significantly improve if selling excess electricity to the local utility in the summer becomes an option for the plant. The second turbine will also enable a more complete utilisation of the excess coke-oven gas in the plant. The PNNL analysis was based on the products of two potential vendors–Asea Brown Boveri (ABB) of Sweden and the Mashproekt Turbine Plant in Nikolayev, Ukraine. Both vendors provided performance and cost data for their products, which were used as sample data in the analysis.

Based on the end-use energy-efficiency potential at Avdeevka, the audit revealed that the plant had several additional cost-effective opportunities to save energy through such measures as installing efficient outdoor lighting and replacing insulation on steam and hot water piping. The former measure recommended replacing existing low-efficiency incandescent lights with new high-efficiency lamps and lighting fixtures while maintaining a similar level of illumination at the facility. Two high-efficiency lamp options (high-pressure sodium and low-pressure sodium) were considered for the outdoor lighting retrofits. Other recommended measures include modifying the compressed-air system either by replacing the existing unit with a high-efficiency unit equipped with a load control system or installing a series of smaller compressors and automatic load management controls.

Electricity efficiency measures will reduce electricity purchases so the economic analysis of these measures is fairly straightforward. However, thermal energy (steam and hot water) is produced on site with coke-oven gas, a by-product of the coking process, so the economic analysis of thermal energy saving measures is slightly more complicated. With the cogeneration system, thermal energy efficiency measures will allow the plant to produce more electricity, which in turn will reduce electricity purchases. In some cases, thermal energy savings will reduce expenses involved in generating the steam (such as costs for maintenance and the water supply). Thermal energy savings will also prolong the life of the heat-generating equipment, thereby reducing capital expenditures. In addition, thermal energy efficiency measures like steam traps will help reduce the steam demand on the new cogeneration system, particularly in the winter months when steam demand is expected to slightly outpace coke-oven gas availability. These expected thermal energy and electricity savings were included in the analysis when the proposed cogeneration system was sized. The end-use energy efficiency measures are thus an integral part of the proposed strategy for improving energy efficiency at Avdeevka.

Table 2 lists the proposed energy-efficiency measures recommended for implementation at Avdeevka Coke Chemical Plant. These measures are all cost-effective, with returns on investment ranging from 15% to over 1000%.

[2]Mashproekt is a Ukrainian supplier of gas-fired cogeneration systems with several decades of experience in ship propulsion. It specialises in experimental or specialised power and propulsion systems.

Table 2. Summary of Proposed Energy-Efficiency Measures at Avdeevka Coke Chemical Plant

Measure	Cost (US $)	Annual Savings (US $)	Simple Payback (years)	Internal Rate of Return (IRR) (%/yr)
Cogeneration system				
-- ABB, one unit	13,000,000	5,400,000	2.4	40
-- Mashproekt, one unit	10,000,000	4,700,000	2.1	43
-- ABB, two units	26,000,000	10,900,000	2.4	40
-- Mashproekt, two units	20,000,000	9,400,000	2.1	43
Efficient outdoor lighting				
-- Low-pressure sodium	471,065	81,597	5.8	15
-- High-pressure sodium	305,868	78,381	3.9	25
Piping insulation	95,000	1,681,000	0.06	1,772
Compressed air system	139,000	47,000	3.0	36

Avdeevka has upgraded most of its outdoor lighting with more modern, efficient fixtures at a cost of approximately $250,000. It has invested $120,000 in upgrading its steam pipe insulation and has organised a dedicated team of 21 technicians to monitor and maintain the steam lines year round. The company has also hired a team of 10 specialised steam line technicians to help eliminate the insulation and repair backlog. Until the energy audit, plant staff had often considered steam a virtually free by-product of their coking process because it is produced with waste coke gas. In addition to the demand-side investments, Avdeevka's board of directors has decided to acquire one 15-MW cogeneration system. The company is seeking financing for this measure and has initiated negotiations with potential vendors.

Avdeevka has long been interested in using its waste coke gas in a gas-turbine cogeneration facility. Its current boilers and steam generators are very old, and must be replaced soon. They are also very inefficient. A more efficient installation would allow the plant to reduce or eliminate its electricity purchases. In addition to saving money, this would provide Avdeevka with a more reliable power supply. The unreliable supply of purchased electricity is a major business threat. Rolling blackouts result in downtime and significantly decreased product quality.

When PNNL first began working with Avdeevka, the plant staff were very interested in cogeneration, but they were not concerned about demand-side energy efficiency. Avdeevka management knew it would need financing for the recommended measures, and wanted to limit this financing to that needed for the cogeneration project. Also, Avdeevka staff did not believe energy efficiency could benefit their plant as much as cogeneration would. PNNL staff spent time explaining the advantages of demand-side efficiency to Avdeevka management. The energy audit also demonstrated that many demand side efficiency investments could provide the plant with a very high rate of return. The strong rationale for energy efficiency eventually convinced the plant management to begin implementing the recommended measures. Avdeevka still, however, needs financing for the large cogeneration project.

3.3. Energy Efficiency at Rosich Food Processing Plant

Rosich Food Processing Plant is situated in the Kiev region in the town of Belaya Tserkov. The enterprise produces apple juice, non-alcoholic drinks, macaroni, bread, and candy. It is a small enterprise, with about 350 employees. The plant exports a significant portion of its products, primarily to Germany. It has used export earnings to purchase modern apple distilling equipment to produce more juice concentrate for export. The plant works intensively during the apple processing season from June to November; the rest of the year, the plant works one shift per day.

Rosich meets its energy demand by purchasing electricity and natural gas. Table 3 shows ARENA-ECO's recommendations for improving energy efficiency, based on the energy audit at the plant.

Table 3. Summary of Recommended Energy Efficiency Measures at Rosich Food Processing Plant

Measure	Cost (US $)	Annual Savings in Natural Gas or Electricity	Annual Savings (US $)	Payback Period (years)
Condensate recovery	600	5,769 m^3	1,284	0.56
Process steam condensate recovery	1,300	35,400 m^3	4,370	0.3
Elimination of air leaks in exhaust ducts	-	19,520 m^3	1,784	Immediate
Automatic selection of fuel/air ratio	8,800	45,428 m^3	4,152	2.1
Use of variable frequency drives for exhaust control	8,400	92,738 kWh	3,710	2.3
Total	19,100	105,797 m^3; 92,738 kWh	15,300	1.25

PNNL and ARENA-ECO designed the analysis to focus on low-cost measures that the plant could implement on its own.[3] In the months since the audit, the plant has implemented all but one of the recommendations from the energy audit report. The one outstanding measure is installing variable frequency drives for exhaust control; Rosich has not been able to find a domestic supplier. Importing the equipment would raise the costs, making the project unprofitable. The measures Rosich has implemented to date will save the plant over $11,000 per year.

Rosich's managers are very committed to improving the environment, even beyond regulatory requirements. For example, the plant was considering using solar energy for heating, though it does not have the resources to carry this idea forward. Not surprisingly, Rosich staff were enthusiastic about the energy efficiency recommendations. The company's reasonable cash flow and access to foreign currency from export earnings has made it easier for the plant to implement measures. Financing was not a major barrier because the audit was designed to target low-cost measures; had larger measures been considered, financing would have been a greater obstacle. On the other hand, the energy audit revealed that the irregular production schedule at Rosich makes many potential measures uneconomic and others less profitable.

3.4. Lessons Learned

Financing and economic conditions are the greatest barriers to energy efficiency in the eyes of the management at Gostomel, Avdeevka, and Rosich. Each plant approved the entire list of recommended efficiency measures, but most need financing to fully implement it. Lack of understanding of efficiency's benefits was also a barrier in some cases, though the energy audit teams were able to convince most staff of the merits eventually. The low cost of energy, particularly when energy is purchased through barter, reduced the cost-effectiveness of many measures. This is particularly true of electricity efficiency measures and is one of the key reasons that more efficient motors were not generally recommended.

The factors that helped the plants successfully undertake energy efficiency improvements include:

- management support of the effort;
- internal financing, made possible because of the plants' overall financial health;
- assistance in preparing energy audits, business plans, and financing plans; and
- constant visibility of energy efficiency's profitability because of the U.S.-sponsored project.

Because the plants in this program were selected for their financial viability and interest in energy efficiency, they had a head start compared to other Ukrainian manufacturers. Nontheless, the plants probably would not have undertaken a comprehensive energy efficiency program without the DOE-sponsored assistance and the plant managements' commitment to efficiency.

[3]Rosich's debt burden will make it difficult for the plant to attract financing for the next two to three years.

4 - STRATEGIES FOR ENERGY EFFICIENCY

These individual case studies show that industrial energy efficiency improvements are feasible in Ukraine, though they require consistent support from top management and solid project preparation and planning. Eliminating the market inefficiencies and barriers laid out in the first section of this paper will significantly increase industry's interest and ability to tap such energy efficiency opportunities on a larger scale. Updating tax policy, bankruptcy law, and securities regulations could have a positive impact on energy efficiency. Financing for energy efficiency could also significantly improve project feasibility: plants short on cash can use savings to pay back their initial efficiency investments. Training on energy auditing, business planning, and project implementation could also help plant staff better understand and prepare for energy efficiency investments. Specific recommendations are made on policy, financing and training in this section.

4.1. Policy

Several of the biggest hurdles to energy efficiency in Ukraine are outgrowths of the economic conditions in the country. Well-designed policy measures can help bring down these hurdles and improve the economic ground for efficiency investments. Among the most important policy measures are those that would reduce the non-payment crisis. More effective contract and bankruptcy laws could play an important role: companies need stronger contract laws to be able to enforce their contracts and payment under them in court. Bankruptcy law could hold out liquidation as the final threat for companies that are insolvent and incapable of restoring their finances to order. While bankruptcy is not a popular option in any country, the lack of such a regime means that the non-payment problem can continue to grow as insolvent companies consume more than they can afford. Growing non-payments will render a larger and larger circle of companies insolvent until the core of the problem is solved.

Security law could be strengthened to make investments more transparent. Investors should have easy access to accurate and complete information on the financial condition of any publicly traded company. Lack of such transparency scares off investors and gives enterprises limited options for raising capital. In the same vein, improved shareholder rights will boost investor confidence and capital investments. Improved shareholder rights will also serve as a strong stimulus for corporate managers to improve corporate performance and cut energy costs.

Tax policy could also be modified to encourage fiscally sound corporate management, investment, and energy efficiency. Current tax policy allows enterprises engaging in barter to underreport earnings. Lower tax rates will encourage enterprises to pay the taxes they owe and will reduce their incentive to resort to barter as a means of lessening their tax burden. Lower tax rates will also encourage private investment. Of course, the government cannot lower tax rates without reducing government expenditure, at least in the short run. This is bitter medicine for a government used to a large state apparatus, but one that ultimately is necessary to return Ukraine to economic health. Taxing profits rather than income also provides a disincentive against lowering costs and improving profitability. Thus, Ukraine should consider returning to a corporate income tax regime. Finally, two specific tax policies may encourage energy efficiency investments in Ukraine. The first is applying VAT to energy sales. Ukraine has cancelled VAT on energy over the past year or so, which lowers the cost of energy and thus promotes its use. This is not a very effective means of reducing energy arrears. The second policy is reducing VAT and customs duties on the purchase of energy efficiency equipment. Lowering the total cost of energy efficiency investments will reduce the cash necessary for such investments and improve their economic results. This should stimulate demand for efficient technologies and benefit the economy through reduced energy imports.

4.2. Financing

Many Ukrainian industrial companies would like to improve efficiency, but do not have the cash in hand to pay the capital and service costs of the improvements. General improvements in the economic climate will likely increase the availability of capital and lower interest rates. In the interim, though, there is much that multilateral development banks (MDBs) and export credit agencies could do to finance energy efficiency projects in Ukraine. Both MDBs and export credit agencies provide subsidised financing and have economic development goals in their charters. While MDBs have invested some money in energy efficiency in Ukraine, they have invested much more in energy supply, which effectively subsidises energy use.

The World Bank has invested in hydropower and in several other coal and power sector projects in Ukraine. The World Bank has also agreed to provide a $200 million loan for supply-side district heating improvements in Kiev. This latter loan is particularly interesting because the World Bank began the loan without considering demand-side heating measures, although World Bank policy requires analysis to determine the least-cost energy option. At the request of the Ukrainian government (specifically, the State Committee for Energy Conservation), the World Bank agreed to add a demand-side component to the loan.

The European Bank for Reconstruction and Development (EBRD) has established a unit dedicated to energy efficiency, and this unit has signed a $30 million loan for an energy service company. On the supply side, EBRD is investing over $100 million in a Ukrainian fossil-fired power plant and $7 million in oil and gas extraction. EBRD is also considering financing the completion of two nuclear power plants in Ukraine.

While publicly funded international financial institutions have made overtures to efficiency, they could do more. For example, the World Bank or EBRD could set up a revolving loan for small energy efficiency projects. The small size of many energy efficiency projects typically deters MDB lending. MDBs prefer large projects of at least $10 million, and often over $100 million. The most cost-effective energy efficiency projects, however, tend to be smaller projects at small or medium-sized enterprises with limited energy staff. A revolving fund would allow an MDB to tap these smaller projects. The fund could work much like a credit line through a local bank, except that a portion of the loan payments could be reused to finance new projects. Alternatively, MDBs could make a point of including energy efficiency in other loans or investments. EBRD, for example, has provided financing to numerous Ukrainian manufacturers for expansions and modernisations. Assessing opportunities to improve energy efficiency during the investment appraisal could provide a win-win opportunity. It is much less expensive to design for efficiency than to retrofit later, so this strategy would provide a very cost-effective way of promoting energy efficiency. Manufacturers would also save money because of reduced energy bills, making loan repayment easier.

4.3. Training

Ukrainian companies have difficulty attracting financing, in part because they have limited experience in writing business plans and structuring financing. Likewise, some manufacturers are not interested in efficiency because they lack knowledge of the potential opportunities. Training can help these companies better prepare themselves for developing and implementing energy efficiency projects.

Energy audits are an excellent method of designing cost-effective energy efficiency measures because they involve a detailed review of plant processes and energy costs, as well as an economic and technical analysis of each proposed measure. Few Ukrainians have training in energy auditing, which makes it harder for plants to identify the best opportunities for energy savings. On the other hand, poorly planned measures that do not perform as anticipated will serve as a disincentive for future investment in energy efficiency.

Once a manufacturer has identified and assessed the energy efficiency investments it would like to make, it must find financing to implement them. Convincing a financier to lend money or invest in the project usually requires a solid business plan. A financier wants to be sure that the company is viable and has thought through the implementation and contingency plans for the project. Obtaining financing also usually requires an understanding of how to put a financing package together with the necessary guarantees, collateral, and insurance.

Training in energy auditing, business planning, and financing can help Ukrainian manufacturers improve both the quality and quantity of their energy efficiency projects. In essence, training can address the core drivers behind industrial decision making and provide industrial managers with the knowledge and tools necessary to successfully implement energy efficiency projects.

5 - CONCLUSION

Ukraine has tremendous potential for energy efficiency. Transforming this potential into a real market has proven difficult because of the contradictory incentives built into the Ukrainian economic system. Gostomel Glass Plant, Avdeevka Coke Chemical Plant, and Rosich Food Processing Plant have shown that it is possible to invest in energy

efficiency profitably in Ukraine. Economic reforms, energy efficiency financing, and targeted staff training will help industry tap this potential on a larger scale.

6 - REFERENCES

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