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Improving Energy Efficiency of the Belarusian Economy: an Economic Agenda

Summary

Low energy efficiency (i.e. defined as energy consumption per GDP) is a significant problem for the Belarusian economy. It indicates towards significant, so far unused potentials for cost reduction through reduced energy consumption. At times when the country seeks to reduce its dependency on energy deliveries from Russia this needs to be improved urgently. Consequently, the "Belarusian State Energy Program" intends to reduce the current level of primary energy consumption by about 25%. The program also mentions priority areas like district heating and distribution systems as well as appropriate measures such as stimulating incentives to save energy or increasing finance for energy-saving investments. However, our discussion of the present situation demonstrates that incentives for consumers to save energy are still insufficient. Despite the recent, significant price increases, especially consumer prices still fail to fully cover the corresponding costs and hence, fail to motivate energy-saving activities and behavior. Moreover, low prices also cause low operational efficiency of energy companies, which further aggravates the problem. Against this background, we argue that improving the situation requires a comprehensive **reform of the energy sector**, which includes the **corporatization** of energy companies, introduction of **independent regulation**, a sufficient **tariff reform** and – where possible – stimulation of **competition** through **liberalization**. However, reform progress along those lines has so far been very slow.

We then focus in more detail on three specific areas which all can contribute significantly to the goal of higher energy efficiency. However, in looking how to best use this potential we find that it can always best be used if supported by market-oriented reforms as described above:

- **Cogeneration** of heat and power is more energy efficient than separate production of both. We argue that the potential for Cogeneration in Belarus is significant. Given the relatively low cost of heat from cogeneration, this potential could best be used by stimulating wholesale competition for heat and obliging utilities to dispatch heat based on least costs.
- **Emissions trade** is an important area, which could develop to a significant source of finance for projects that increase energy efficiency. However, we argue that attracting green investments requires demonstrating economic viability of those projects, which also calls for a general reform of the energy sector along the lines discussed above.
- **Private Sector Participation** is not only a promising instrument to receive additional finance, it also has the potential to increase energy efficiency if private partners have an incentive to generate additional revenue due to lower energy costs. However, they all can unfold this potential only if they are allowed to operate in a profit-oriented way, which again requires that market reforms should no longer be delayed.

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1. Introduction

Despite significant improvements in recent years, energy consumption in Belarus is still rather inefficient. According to the "Belarusian State Energy Program" the level of energy input relative to GDP is still 2-3 times higher than in developed western economies. Accordingly, this situation is not efficient as there remain unused potentials for cost reduction through lower energy consumption. Such higher-than-necessary energy consumption is particularly problematic in a time where the country attempts to reduce its dependency on energy deliveries from Russia.

The reasons underlying the inefficient use of energy in transition economies in general have been widely discussed already (see e.g. *EBRD Transition Report* 2001). Prices below cost levels together with various types of cross subsidization and low collection rates fail to give incentives for an economic use of energy. At the same time, unprofitable operation of power and heat supply has resulted in a significant lack of investments. As a result, there is also no innovation and infrastructure depletes since even necessary maintenance can hardly be financed. Together with increasing overcapacities, which emerged from the economic decline in the 1990s, this causes low operational efficiency in generation of heat and electricity, as well as relatively high losses in transmission systems.

Belarusian policy makers have increasingly concentrated on the issue of low energy efficiency. The current "Belarusian State Energy Program" envisages a reduction of primary energy consumption in 2010 by around 25% of the present level.[1] To achieve this goal, the program names relevant priority areas such as district heating, distribution systems and use of local fuels together with the following intentions:

- Stimulate incentives to increase energy efficiency;
- Increase finance for energy-saving investment projects;
- Use other measures such as training, expert appraisal, energy inspections, certificates for energy intensity, installation of meters for individual consumption etc.

From the perspective of economic policy making the first two points are of the highest importance. If economic incentives are set consistently with environmental objectives and energy safety concerns, higher levels of energy efficiency can be realized without that a centrally-planned bureaucracy with all its pitfalls will be required. More importantly, it also ensures that the reduction of energy consumption is realized at the lowest economic costs and it guarantees that investments are sustainable because they are based on a solid economic fundament. In this paper we first discuss the problem of low energy efficiency and the extent, to which this is caused by insufficient incentives for energy saving. We then describe a strategy necessary for setting the right incentives. We also focus on specific areas such as cogeneration of heat and power, emissions trade and Private Sector Participation that – if utilized in the right way – have high potential to improve energy efficiency. Finally we sum up the discussion and conclude.

2. Improving Incentives for Efficient Energy Use

2.1 How big is the Problem?

Indicators of energy efficiency for different countries are given in table 1. The first column gives the amount of oil equivalent (in kg) necessary to produce one dollar of GDP (in real 1995 prices). Apparently, energy consumption in Belarus is rather excessive, as it requires more than 10 times more energy input (1.59kg of oil equivalent) than in Germany (0.13kg) and about five times more than in the USA (0.25kg) to

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[1] More precisely, it is foreseen to reduce total consumption of fuel and energy resources from 2006 to 2010 by 900 thousand tons of *conventional fuel*.

produce the same output. Considering that cross-country comparisons of GDP are more appropriate on a Purchasing Power Parity (PPP) basis, the efficiency difference is much smaller but still significant. In particular, the figures in the second column confirm the statement of the "Belarusian State Energy Program" that Belarus's economy operates about 2-3 times less efficient than OECD countries do on average. Accordingly, a 25% reduction of the total primary energy supply relative to GPD, as envisaged in the program, would reduce the Belarusian figure to 0.38kg.[2] This appears to be a realistic goal[3] of significant political importance, also from the perspective of energy security.

Table 1. Energy Efficiency of Selected Countries

	TPES*/GDP**	TPES/GDP (PPP)
Belarus	1.59	0.51
Russia	1.32	0.59
Germany	0.13	0.18
OECD (average)	0.19	0.21
USA	0.25	0.25

*Total Primary Energy Supply (TPES) in kg of oil equivalent
**Gross Domestic Product in 1995 USD
Source: IEA: Key World Energy Statistics. Paris, 2004.

By how much do energy prices in Belarus give wrong incentives to consumers as they fail to cover their costs? In February 2005, electricity prices for industrial consumers were set to 6.7 US cent per kWh, which appears to be just high enough to cover the relevant costs.[4] For households, electricity tariffs are supposed to be set to 4 US cent per kWh by the end of 2005. Although this marks a strong increase as compared to recent years, it is still less than half of a reasonable estimate for the respective supply costs (8USc/kWh).[5]

For heat, the average tariff for households in 2004 was about USD 13.4 per Gcal, which marks a dramatic increase compared to 2001 where average tariffs accounted for USD 2.8 per Gcal.[6] But, despite such improvements, average household tariffs still cover only about 52% of the officially reported costs (USD 26 per Gcal) and even less than 40% of the costs benchmarks estimated by international experts (USD 35 per Gcal).[7] Since households consume almost 60% of the totally generated heat energy (directly and through how water)[8] such low average tariff levels indicates that district heating as a whole operates not on cost-covering price levels.[9]

For gas, the cancellation of privileged gas supplies from Russia in early 2004 has substantially increased domestic prices. In early 2004, gas prices were set at about USD 67 per tcm for industries and USD 57 for households (up from USD 58.8 and USD 9.2

[2] = 0.51*(1-0.25). To some degree, a higher energy intensity in Belarus as compared to other OECD countries can be justified by different weather conditions.
[3] For comparison, the EU has expressed its intentions to save at least 20% of its present energy consumption in a cost-effective manner (EU (2005), *Doing more with Less*. Green Paper on energy efficiency).
[4] The variable costs of power supply to industry plus investment costs in the USA and Europe account for about 8-9 US cents. In Belarus, the cost of fuel (mainly gas) is still relatively cheap (even after the recent price increases). On the other hand, the Belarusian power sector suffers from substantial under-investment and accumulated arrears, which is not the case in the US or Western Europe. Hence, our judgement.
[5] According to the *EBRD Transition Report* 2001, 8 US cent per kWh is a reasonable benchmark for variable costs of electricity supply to households plus investment costs. Considering that 11% of all consumers hold privileged status (half the price), the average price that all households eventually pay goes even down to 3.8 US cent (=4*0.89+2*0.11).
[6] Rakova, E. (2004). *Analysis of Energy Tariffs in Belarus*. Study prepared for the Committee on Energy Efficiency for the social Infrastructure Retrofitting Project.
[7] See e.g. EBRD *Transition Report* (2001).
[8] Rakova, E. (2004).
[9] In more detail, the biggest part of uncovered costs is born to utility providers operated by the Ministry of Housing and Utilities, which directly supply to consumers. In contrast, wholesale tariffs have been increased at higher rates so that the tariffs of central heat supplies from "Belenergo" cover their official costs by almost 100%.

in 2000). Although average gas prices are now said to fully cover their costs,[10] household tariffs below the level of industry tariffs indicate a significant degree of cross-subsidization.[11]

To conclude, while industry prices of gas, electricity and heat have been raised towards their respective cost benchmarks, household prices are still set at far too low levels. Hence, especially household consumers do so far not have sufficient incentives to reduce their energy consumption levels. The effect of this lack of incentives is e.g. visible in residential buildings that mostly lack sufficient insulation.

In contrast to price-cost comparisons, judging on the extent of operational efficiency is more difficult since less information is available. However, some general conclusions can still be derived. **Heating systems**, for example, typically operate with Soviet-style technology under a constant flow regime, which makes it difficult to dispatch heat from different sources (e.g. based on different costs) and often leads to uneven heat distribution. Other causes for low energy efficiency in heating systems in transition countries are high losses in distribution pipes (in particular in the secondary networks between substations and the buildings they serve) and the common vertical arrangement of radiators within a building, because of which it is often not possible to control heat at the apartment level.[12] As a result of such inefficient design features, district heating systems in CIS countries operate much less energy efficient than those installed in e.g. Western Europe. For example, the Word Bank estimates state that heating one cubic meter of space in a Soviet-style district heating system requires an energy input of 70-90kWh as compared to 45-50kWh with a western-type system.[13] According to the same source, losses in production (15-40% of fuel energy) as well as in distribution (15-25% of heat supply) in Soviet-style systems are about three times as high as modern in Western systems.[14] With Heat production accounting for more than 30% of total primary energy consumption, the potential contribution of district heating for improving the economy-wide level of energy efficiency could be significant.

In the **power** sector, energy efficiency of existing coal or gas-fired generation technologies is rather low. Table 2 shows that even with modern standard technologies energy efficiency is only at about 50%, which means that half of the used energy is lost in the generation process. In Belarus, where the predominantly gas-fired electricity generation plants based on old Soviet-style technology most likely operate at even lower levels, operational efficiency is probably at around 40%. Similarly, also Cogeneration plants in Belarus operate with outdated technology. According to the World Bank estimates, efficiency of such plants is around 70-75%, as compared to 80-90% in Western Europe. Thus, modernization of the Belarusian electricity sector could potentially increase efficiency of gas-fired power generation and cogeneration plants – and thus, reduce primary energy consumption by electricity-generating plants – by at least 15%. Moreover, losses in the power grid account for about 10% of consumption, which could potentially be also reduced to the Western European standard of around

[10] Given the intransparent gas-purchasing agreements, establishing a meaningful benchmark for supply costs of gas is rather difficult, but the claim of cost coverage on average appears to be realistic, as far as variable costs (excluding investments) are concerned.
[11] Supplying gas to large industrial consumers is clearly less costly than supplying it in low quantities to a large number of private households.
[12] A detailed discussion of inefficient design features of district heating systems in transition economies can be found at Meyer, A. and W. Mostert (2000), *Increasing the Efficiency of Heating Systems in Central and Eastern Europe and the Former Soviet Union*, ESMAP Report No. 234, World Bank, Washington, DC.
[13] Meyer and Mostert (2000).
[14] For Western European systems, losses in production account for 5-15% and losses in distribution for 5-10%.

5%. In other words, modernization of the electricity sector can clearly be another significant element for raising energy efficiency in Belarus.[15]

Table 2. Efficiency of Power Generation Technology: Status and Outlook

	Coal		Gas	
	Steam Cycle	IGCC*	Steam Cycle	CCGT**
Technical Standard 1985	38%	40%	42%	48%
Technical Standard 2000	47%	49%	49%	58%
Technical Standard 2010	50%	55%	52%	60%

****I**ntegrated **G**asification **C**ombined **C**ycle.
****C**ombined **C**ycle **G**as **T**urbine.
Source: Theis, K.A. and G. Jäger (2001). *Increase of Power Plant Efficiency*. Paper presented at World Energy Council 18th Congress, Buenos Aires.

To conclude this assessment, we consider the Belarusian intention to reduce primary energy consumption by 25% realistic. However, such ambitious intentions can hardly be realized on the basis of small-scale and local-community oriented projects alone. Instead, especially district heating and the power sector, two main consumers of primary energy that both operate on fairly low levels of energy efficiency, will have to be modernized. Hence, investments of USD 2.6 bn (slightly above 10% of the Belarusian GDP) over a period of five years as foreseen in the “Belarusian State Energy Program” will certainly be necessary. Financing such huge investments (which will account for more than 10% of annual gross investments) requires sound economic calculations based on a sufficient institutional and regulatory environment. However, as the above discussion of tariff and cost levels shows, this is difficult at present. In the following we will discuss the general principles of economic and institutional reform necessary to ensure profitable operations in the energy sector and to stimulate incentives to increase energy efficiency, as stated in the “Belarusian State Energy Program”.

2.2. Aggregate supply

Reform agendas for the energy sector have been widely discussed and recommended in the literature.[16] In short, such reforms should consist of the following elements:

- Corporatization;
- Regulation;
- Tariff reform;
- Liberalization.

Corporatization is needed to unbundle the current energy complex into separate independent firms. This is necessary to take control away from government and enable firms to make their own, profit-oriented decisions. **Regulation** means to move key powers such as price and cost control, licensing etc. away from direct government interference to a public but independent authority. Necessary elements of independency are a clearly defined legal status, financial autonomy, fixed term of office, prespecified appointment criteria, and sufficient resources. **Tariff reform** must achieve that variable costs of production plus investment costs should be covered by consumer tariffs, while at the same time no firm can exploit its market power. Tariff setting and price/cost control must be the main task of the regulator. Ideally, tariffs are set in a way to stimulate cost-covering investments such as energy-saving technolo-

[15] Heat and power generation are linked through cogeneration to a significant degree, so that potential energy savings cannot be simply added up.
[16] A general guideline for such reforms is e.g. given in the EBRD *Transition Report* 2001. For Belarus, several papers of GET and IPM have already discussed reform agendas for different energy sectors, such as PP/03/05 (*Reforms in the Belarusian electricity sector: how to reduce costs and dependence on imported resources*), PP/15/04 (*The state, problems and directions of gas sector restructuring in Belarus*) or PP/03/04 (*Belarus as a Gas Transit Country*).

gies.[17] Finally, **Liberalization** opens up certain market segments to competition, e.g. through ensuring non-discriminating Third Party Access (TPA) to energy networks. This further stimulates efficiency and cost reductions, improves economic performance of enterprises (and thereby also profitability of energy-saving investments) through e.g. improved payment collection, creates better finance opportunities etc.

Despite significant price increases during recent years, the reform progress in Belarus along the lines described above has been very slow. In particular, the most important firms in the energy sector such as *Belenergo*, *Beltopgaz* or all *Oblenergos* remain still non-corporatized. As a result, none of them has the possibility for independent, profit-oriented decision making. Moreover, tariff regulation is in the responsibility of several Ministries and thus under direct control of the government. Finally, there have so far been no serious commitments towards liberalizing energy markets and stimulating competition.

3. Key areas for improvement

In addition to the general reform agenda, several areas deserve special attention with regard to potential contributions to higher energy efficiency. Three important parts are discussed in this section.

3.1 Cogeneration of Heat and Electricity

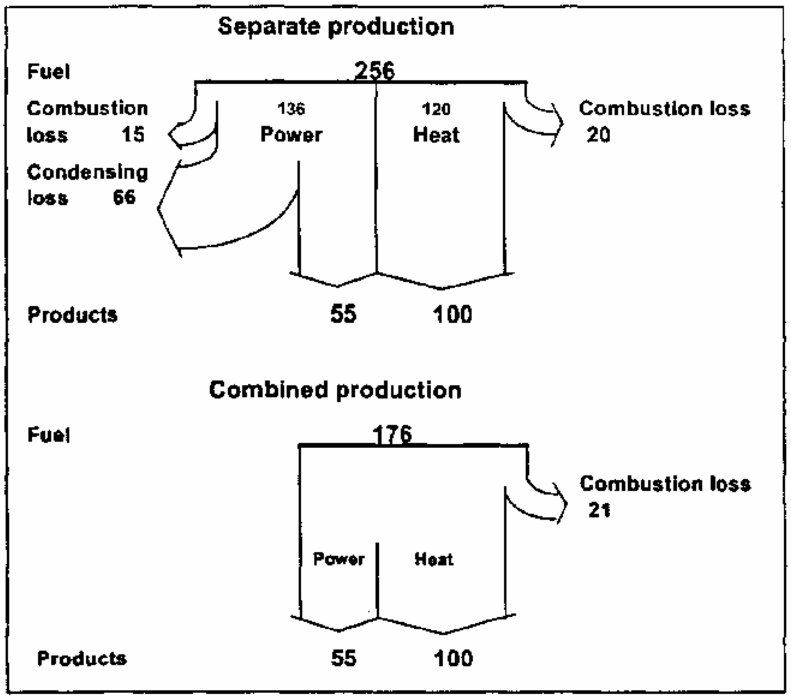
The joint generation of district heating and electricity in Combined Heat and Power plants (CHPs) is significantly more energy efficient than separate generation. As the *Sankey diagram* in figure 1 shows, combined production of 100 units of heat and 55 units of electricity requires 176 units of fuel inputs (88% energy efficiency) while the separate production of the same output requires together 256 units of energy input (with 40% efficiency for power and 83% for heat).

Despite their higher levels of energy efficiency, conditions under which CHPs operate and compete with other plants – especially with respect to allocation of variable costs – need to be specified in a way that avoids possible distortions. In principle, three ways for cost allocation are possible:

- *Energy method*: allocation of variable costs in relation to energy output (roughly 2/3rd to heat, 1/3rd to electricity).
- *Alternative heat (power) production*: costs for heat (power) are determined by alternative costs of separate heat (power) production.
- *Benefit distribution method*: allocation of variable costs in relation to energy input that would be necessary for separate production of heat and electricity (about 1 to 1.1 (120 to 136) in figure 1).

[17] The simplest way to do this is by setting maximum tariffs (*Price Caps*), so that producers can increase their profits by reducing costs. For more on tariff regulation of utilities see e.g. *EBRD Transition Report* 2004 or Coelli, T., A. Estache, S. Perlelman and L. Trujillo (2003). *A Primer on Efficiency Measurement for Utilities and Transport Regulators*. World Bank Institute, Washington, D.C.

Figure 1. Energy Balance of Separate and Cogeneration of Power and Heat (for Solid Fuels)



Source: Meyer and Mostert (2000), appendix C.

The *Energy method* is typically used in transition economies. However, it tends to discriminate against heat, which typically accounts for larger shares in output. Accordingly, a more appropriate cost allocation is to allocate the benefit of cogeneration as described in the *Benefit distribution method*.

In addition to price and cost regulation, many governments use additional policy instruments to support the use of cogeneration. The simplest way is by providing *state aid, grants, bonus payments* etc. However, this can be expensive and easily creates more distortions than benefits. A more appropriate instrument is providing *tax incentives*. These, however, should be justified on socially accepted grounds (e.g. environmental concerns) and granted to all energy saving technologies in a fair and transparent way linked to performance goals rather than to specific technologies. *Feed-in-tariffs* such as the German Cogeneration Act of 2002, which guarantees unlimited access to the power grid at a rather high minimum price, are another possibility. However, they distort competition and create additional costs that are typically transferred to consumers. Another instrument is to issue *Least-cost purchase requirements* that oblige district heating companies to first purchase the least-cost heat. Provided the cost allocation rules do not discriminate against heat this benefits cogeneration. It is also easy to be implemented, non-distorting and thus, in line with the efficiency goal (again, provided that cost allocation is set accordingly, e.g. by the *Benefit Distribution Method*). However, such Least-cost requirements require that heating providers are technically able to dispatch based on costs, which is not always possible under the standard constant flow regime.

Belarus has a significant potential for generation of power and heat in CHPs, since there exist markets for both, power and heat. Consequently, cogeneration accounts already for 50% in power and 40% in heat generation and the "Belarusian State Energy Program" envisages renewal and additional investments. To support these investments, policy makers should utilize the existing structure in the following way:

At present, all CHPs sell heat (40% of heat consumption) at the wholesale level to municipal utilities that deliver it to final consumers. The remaining heat stems from heat-only boiler plants operated by municipal utilities (50% of heat consumption) and other local sources (10%). Since even under the current allocation system the costs of heat generation in CHPs are lower than in the municipal boiler plants, CHPs could benefit from cost-oriented wholesale competition for district heating, which would favor cogeneration and hence increase energy efficiency. Eensuring a workable system along these lines requires:

- A *Least-cost purchase requirement* to ensure that municipal utilities dispatch heat based on the lowest costs before they use their own heat or buy from other sources. This might also require investments at the municipal level to ensure that utilities are technically able to dispatch heat.
- An appropriate and transparent formula for cost allocation in CHPs. Among the methods discussed above, the *Benefit distribution method* appears to be the most appropriate one.
- All enterprises that legally operate in the energy sector should be allowed to construct CHPs (no discrimination), also on smaller scales.

Finally, to avoid potential discrimination against newly build CHPs (not operated by *Belenergo*) on the power market, a similar framework should be implemented in the electricity sector consisting of undiscriminating access to the power grid, least cost dispatch and the permission for small-scale CHP operators to sell power directly to industrial consumers through the power grid at pre-specified and equal transmission tariffs. Obviously, all such measures could best be implemented within a market-oriented reform of Belarus's energy sectors along the lines described in section 2.2 above.

3.2 Emissions trade

The possibility to trade permits for greenhouse gas (GHG) emissions offers a promising opportunity for Belarus to finance the installation of energy-saving technologies. One of the objectives of the global framework for emissions trade, the *Kyoto Protocol*, is to ensure that the envisaged reduction of global GHG emissions will be achieved at the lowest economic costs. Therefore, emissions permits are tradable and emissions reductions should first be undertaken in countries and at installations where marginal abatement costs are the lowest. Therefore, the *Joint Implementation* (JI) mechanism lays out the rules and standards under which emissions reductions from modernization of industrial and municipal installations in developed and transition economies, which have ratified the Kyoto protocol, can be certified and traded as GHG emissions permits.[18] Obviously, such a scheme is especially rewarding for countries in transition, given their low levels of energy efficiency and the huge need for modernization of key sectors such as energy and municipal service providers.[19] To give an illustrative example, Table 3 highlights the contribution of sales of emissions certificates to the financial indicators of a typical rehabilitation project of a regional district heating system. Total investment costs amount to USD 8.2 m and lead to annual fuel savings in the amount of USD 1.6 m and annual reductions of GHG emissions in the amount of 68 thousand t of CO_2-equivalent. Selling these emission permits during the relevant commitment period of the Kyoto protocol from 2008-2012[20] will – assuming prices between EUR 5 and 10 per t of CO_2e – generate additional returns between EUR 1.7 m and EUR 3.4 m. Financing this project over a period of 10 years yields an internal rate of return (IRR) between 14.5% (without sales of emission rights) and up to 20% (with

[18] Among all countries that have ratified the Kyoto protocol, the biggest demand for emission certificates is expected to come from EU members (who already face a emission trading scheme) and Canada.
[19] The mechanisms of the Kyoto Protocol as well as the potential of emissions trade for Belarus have already been the topic of an earlier seminar of GET/IPM, see PP/06/03 (*Belarus and the Kyoto Protocol. Opportunities and Challenges*).
[20] Further emissions trading schemes beyond 2012 are currently discussed, but so far nothing concrete has been decided.

emission certificates sold at EUR 10 per t of CO_2e). Accordingly, if the discount rate of capital is above 15%, which is not uncommon in transition economies, the project yields a positive Net Present Value (NPV) only if revenues form sales of emission certificates are included.

Table 3. Rehabilitation of a Regional District Heating System: Project Characteristics and Key Figures

Inhabitants of Region (in million)	**1.3**
Number of boiler houses	**175**
Length of distribution network (in km)	**380**
Project start	**2007**
Project lifetime (in years)	**10**
Total investment (in thousand EUR)	**8,200**
thereof investments in boiler plants	2,200
thereof investments in distribution network	6,000
JI-Project development costs (in thousand EUR)	**300**
Annual energy savings (net, in thousand EUR)	**1,600**
thereof fuel savings in boiler plants	800
thereof fuel savings in distribution networks	800

Emission reductions and revenue from emissions trade:				
	in t of CO_2e	**in 1,000 EUR (at different prices)**		
		5 EUR/t	7 EUR/t	10 EUR/t
per year	68,000	340	476	680
total (2008-2012)	340,000	1,700	2,380	3,400

Financial indicators (IRR and NPV)				
	-----	**Price (EUR/t)**		
		5	**7**	**10**
IRR	**14.5%**	**16.9%**	**18.2%**	**20.0%**
NPV (in 1,000 EUR) at:				
10.0%	**1,483**	**2,330**	**2,756**	**3,395**
15.0%	**-148**	**525**	**869**	**1,386**
17.5%	**-749**	**-147**	**164**	**632**
20.0%	**-1,243**	**-704**	**-421**	**2**

Source: averages over several project descriptions taken from the ERUPT Program of the Netherlands.

What can be done to ensure that this mechanism will also benefit Belarusian projects in the way outlined in table 3? It is important to understand that Belarus will have to compete with other transition economies for potential buyers of emission certificates. Two aspects deserve special attention. First, JI emission credits are certificates for emissions reductions that a specific project will deliver in a future period. Obviously, this is a risky transaction. Hence, the more credible all aspects of the project are, including financial planning and economic viability, the higher the price that a Belarusian seller can expect to get. This again calls for institutional reforms in the energy sector (see 2.2) in order to improve the economic condition of energy companies. Second, the Kyoto protocol so far foresees only one commitment period over five years between 2008 and 2012. Only during this time can emissions certificates be sold to investors. Hence, Belarusian policy makers are well advised to proceed with all necessary steps as soon as possible. Otherwise, Belarus might have established well-functioning and credible conditions for JI projects at a time where demand for such projects has long expired.

3.3 Private Participation

In accordance with the current "Belarusian State Energy Program" the need in financial resources to implement energy saving activities is determined as USD 2600 million for 2006-2010 years. The bulk of these resources should come from own means of enterprises (38%), Innovation Fund of the republican state governing bodies (24.3%), republican and local budgets (19.5%), Innovation Fund of the Ministry of

Energy (11.3%). Yet, the preliminary results of financing energy serving activities in 2004 revealed the problems with raising the resources especially from enterprises and local budgets that managed to finance only 49% and 31.4% of targeted amounts respectively. This evidence put some doubts with regard to possibility to meet the required volumes of financing for 2006-2010 years. The other potential sources of funds such as bank credits and resources of international financial institutions unlikely will be sufficient to cover the substantial investment needs. Thus, in 2004 the investment from these two sources was 21% and 4% of planned activities respectively. All this presuppose the need to look beyond traditional funding alternatives and attract private sector in delivery and financing of energy services.
Last decades was characterized by rush towards private participation in the provision of infrastructure, including energy services. The most obvious motives for private sector participation (PSP) are as follows:

- it enables to rise funds from privatisation. Over the period 1992-2003 all transition countries obtained about USD 40 billions as the result of infrastructure privatisation of which USD 6.2 billions came from privatisation in CIS[21];
- the introduction of the private sector leads to improvements in efficiency, operating performance and, very often, the quality of service. The evidence suggests that efficiency improvements brought about by private provision reduces costs in order of 10 -30%[22]. Even in very difficult environments, e.g. energy sector in Georgia, private sector can substantially improve efficiency and quality of services.

PSP implies any private sector involvement ranging from ownership to management contract and take wide range of contractual forms. Nevertheless they can be combined into three main types:

Divestiture presupposes that all assets, operations and investment obligations are transferred to the private operator. This contractual arrangement is widely used in electricity generation and transmission, as well as electricity and gas distribution. Most commonly it requires the provision of the government guarantees for future tariff increases to achieve full costs recovery or return on capital invested.

Concessions and build-operate transfer (BOT) contract implies the investment obligations in new capacity (equipment) or the replacement of the existing infrastructure. Under this form the level of tariff is not so crucial, as it can be compensated by lower lease payments for the assets, but however revenues should be sufficient to cover the long-term costs of services. This type of arrangement is used in electricity generation.

Management and outsourcing contracts is the simplest form of PSP that does not include any investment obligations. This type of contract is important when it is difficult or even impossible to attract private investment as services have a tradition of pricing below costs, and government in its turn is reluctant to set a cost-covering tariff (district heating), or the companies is too small to rise an interest of investors. Management and outsourcing contracts can improve labor productivity, increase operating performance and standards of services, but they have some drawbacks compared to deeper forms of private participation. As a rule they are short term, and might not lock in improvements in efficiency and productivity

One of the mechanisms of attracting private sector investments is involving energy service companies (ESCOs) to implement energy efficiency projects in industry, public and commercial buildings and the housing sector. ESCO provides the bulk of the financing needed to implement a project, either by borrowing from a financial institution or investing its own money, consequently

[21] EBRD. Transition Report 2004.
[22] Clive Harris (2003). Private participation in infrastructure in developing countries. Trends, Impacts and Policy Lessons. World Bank Working paper No 5.

Another instrument to involve private participation in projects that seek to raise energy efficiency is the use of energy service companies (ESCOs). An ESCO is a separate company that provides integrated solutions for achieving energy cost reductions so that the client – e.g. the municipality as owner of a boiler plant – can deal with a single entity for all project components and throughout all stages of the project cycle. ESCOs can be owned privately (for example, Siemens owns the Landis & Staefa ESCOs in the Czech Republic) or publicly (for example, the State Committee on Energy Conservation owns UkrEsco in Ukraine). An ESCO's responsibilities can, but do not necessarily have to, include also financing. Moreover, the ESCO's responsibilities can include services like:[23]

- Energy analysis and auditing.
- Project design and development.
- Engineering and installation.
- Facilitation or provision of financing.
- Management and operation.
- Monitoring of energy savings.
- Performance guarantees.

Obviously, a company that specializes on providing such services – or at least some of them – for a wide range of projects and that operates in a competitive environment without subsidies or state guarantees needs to develop a deep expertise in energy service operations in order to be profitable. In fact, since ESCO's need to increase energy efficiency in their projects to generate their profits, they are an interesting instrument of how to set incentives for increasing energy efficiency in a market environment without that utilities and technical installations need to be privatized.

It should be noted, however, that private participation does not automatically bring about improvement of the energy sector performance. Rather, it requires that markets have achieved a certain level of development towards competition and free market operations so that – at least to some degree – profitable operations are possible and private participants can be attracted. Table 4 presents perceptions for the prospects of different financial sources for financing investment into district heating, depending on maturity of the market for several countries. Obviously, the market environment in Russia and Ukraine is still perceived to be at the earliest stages of development. A similar conclusion can be drawn for Belarus. Accordingly, for attracting private funds, management expertise and other types of private participation the government needs to start with market-oriented reforms in the energy sector, as described in section 2.2.

Table 4. Possibility Rating* for the use of different Financing Sources

	Hungary	Czech Rep.	Poland	Russia	Ukraine	Romania	Bulgaria
Local banks	4	4	4	2	2	2	2
Foreign banks	4	4	4	2	1	2	2
ESCOs	4	3	2.5	1	1	2.5	2.5
PSP	3	4	4	2	2	2.5	2
National funds	3	3	3	1.5	1.5	2	2

* 4 = relatively mature market, 1 = little or no possibility to use the financing sources.
Source: Alliance to Save Energy.

4. Conclusions

Belarusian policy makers rightly focus their attention on the economy's low level of energy efficiency. However, all undertaken actions – in particular the significant increases of energy tariffs in recent years – have not been sufficient so far. In particular household tariffs are still below their costs and thus, fail to give incentives to save en-

[23] OECD (2004). Coming in From the Cold. Improving District Heating Policy in Transition Economies

ergy. Even worse, low profitability of operations in the energy sector caused by too low tariffs has also caused low levels of operational efficiency in the energy sector as a whole. Overcoming this situation and achieving higher levels of energy efficiency requires a comprehensive reform along the lines of corporatization, regulation, tariff reform and liberalization. This has so far not happened in Belarus, and it is also not foreseen in the “Belarusian State Energy Program”.

In our discussion of specific key areas for increasing energy efficiency we find that their high potential can always best be used if supported by such market-oriented reforms. For example, Belarusian policy makers focus on district heating and cogeneration to increase the level of energy efficiency. But, given low generation costs, the potential of cogeneration could best be utilized through introducing wholesale competition. Similarly, other instruments such as *Emissions Trade* or *Private Sector Participation* for planning, implementing and operating energy-saving projects all require as precondition that the economic viability of such projects can be ensured. Again, this can best be realized through market-oriented reforms of the energy sector.

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