

Republic of Moldova
Policy Note: Action Plan for the Financial Stabilization
of the District Heating Sector in Chisinau

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This Policy note was prepared by the World Bank at the request of the Government of Moldova to provide options on how to address the ongoing problems in the District Heating sector in Chisinau.

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Executive summary

The district heating problems in Chisinau reached a crisis at the beginning of the heating season in 2009 when Gazprom cut-off gas supplies due to nonpayments issues with Termocom. This action simply brought to a head the long-standing problem of Termocom's financial viability: they had been declared bankrupt in 2001 and have not been able to work themselves out of this situation since. Furthermore, the size of the DH problem has grown so big – arrears on gas payments at 2.2 billion Lei are about 3.5% of GDP in 2008– that it threatens the financial stability of Moldova, when the impacts of the global financial/economic crisis is factored in. The size of the subsidies that the Municipality of Chisinau needs to provide to the poor because of pricing distortions has exceeded its capacity to pay as well. Without concrete actions to address these unsolved issues, they will most likely resurface with the arrival of the next heating season, and threaten to leave Chisinau's residents without heat once again. The purpose of this note is to indicate options on actions and policy to urgently address this issue.

The district heating (DH) system in Chisinau provides a least-cost, environmentally-friendly source of heat to 15% of the total population in Moldova. District heating has become the heat source of choice for the most vulnerable because of the relatively high capital cost associated with other options. The continued operation of the DH system also helps maintain Moldova's energy security, by reducing the cost of supply of electricity production from Combined Heat and Power (CHP) plants –the main electricity producers: heat sold represents between 40%-50% of total revenues of CHP plants.

The DH Company in Chisinau, Termocom, is financially bankrupt – and has been under bankruptcy proceeding since 2001. Despite its efforts in improving its operational efficiency, financial difficulties continue as consequence of years of heat tariff set below cost-recovery level. The company has been generating cash flow for operations by accumulating payables to its suppliers of heat (CHP plants) and gas (Moldovagaz). As of the end 2008, Termocom's payables to their suppliers amounted to 2.2 billion Lei, or 3.2 years worth of its annual revenues.

As the arrears continued to grow despite restructuring efforts from the bankruptcy proceedings, Moldovagaz stopped gas supply to both Termocom and CHPs in the winter of 2008, leaving households without heat for more than a week. They demanded for a resolution of the situation, forcing Chisinau municipality to increase tariffs and make bulk payments for the accumulated payables.

Termocom's poor financial condition has also led to chronic under-investment and asset deterioration, thus reducing the overall efficiency of the system. About 24% of total heat produced is lost in the network, compared to 10% in modern DH systems in the EU. Service quality and system reliability have also significantly deteriorated – the number of break downs increased by 125% between 2001 and 2008. As a result, many residents have disconnected from the system.

Termocom's technical and financial condition and the substantial amount of accumulated arrears in the whole energy sector is unsustainable and requires urgent attention and commitment by the government and stakeholders to avoid the interruption of heat supply in coming heating season.

The immediate issue that needs to be addressed is for the tariffs to be increased to at least cost recovery level to allow Termocom to maintain and pay for its expenses. Two initial steps are recommended to ensure continued supply of heat and operations of Termocom this heating season:

1. **De-politicize tariff setting** by transferring tariff setting authority from the Municipal Council of Chisinau to the energy regulator ANRE and immediately raise tariffs to full cost recovery. Based on a rough calculation of Termocom's required revenue to cover its cost and investments needs during the 2009/2010 heating season, heat tariffs would be need to be increased by at least 50%.
2. **Protect the poor of such increase and set up a targeted social protection program** for low-income consumers. It is estimated that an increase of 50% in the level of heat tariff would increase the poverty rate in Chisinau by 1%: about an additional 1,800 households would fall below the poverty line. It is therefore critical to ensure close cooperation between the municipal government of Chisinau and the national authorities since the most efficient way to transfer the funds would be through the Ministry of Social Protection's new, targeted, social assistance program.

However, tariff setting is only a short-term solution that needs to be implemented as part of a comprehensive restructuring program that would also decrease the cost of supply. The program needs to also ensure: a) Termocom's recovery to financial sustainability and eventual resolution of the accumulated arrears; b) high service quality, efficiency and affordability of heating service provided to Chisinau residents; and a reduction of the cost of supply through more efficient CHP technologies, loss reduction in the networks and temperature controls as well as energy efficiency investments by households. The additional recommendations for a comprehensive restructuring plan for the DH sector in Chisinau are outlined below:

Recommended Steps for Recovery to Financial Sustainability:

1. **Rationalize the tariff setting methodology in the electricity, heat and gas sectors** to better promote **efficiency**, fairness, least-cost supply, full cost recovery and transparency. Options to introduce price caps and two-tier tariffs need to be explored. Also, the balance of price-setting for electricity and heat produced at cogeneration plants should be reviewed to ensure that the cost allocation method is fair and contributes to improving the efficiency of both the DH and electricity sectors.
2. **Improve corporate governance of Termocom** to address weak corporate governance and vaguely defined and noncommercial objectives. Ensuring that the DH company act as a commercial business entity and create the conditions for future private participation may require the implementation of the following measures: i) the Board of Directors should be given a clear mandate, identifying key issues that need to be addressed (e.g. corporate strategy, finance/accounting, ii) implementation of international financial reporting standards (IFRS), iii) improving information flows by introducing modern management information systems (MIS).
3. **Restructure Termocom** as they have not been able to emerge from the bankruptcy proceeding since 2001. The merger of Termocom with CHPs would transfer tariff setting authority to ANRE without changing the legislation, while allowing for cost

savings and efficiency gains through optimization of the heat production and distribution network. The merger can also lead to a more structured and sustainable settlement of the current negative equity (1.2 billion Lei) and accumulated arrears with CHPs (1.4 billion Lei) through a debt-to-equity swap.

Recommended Steps for Ensuring Affordability and Service:

1. **Implement a long-term investment strategy to reduce supply costs, network losses and energy consumption** thus reducing the cost of heat supply. It is estimated that a long term investment strategy required for ensuring continued operations, would require total of US\$ 318 million over 15 years. The investments were prioritized based on need and urgency, and consists of two components with different priorities and objectives:
 - a) Priority investments - focusing on reducing heat losses in the initial period (2009-2014),
 - b) Long-term investments - focusing on increasing efficiency of heat production in the later period (2015-2024)

2. **Implement demand-side energy efficiency programs** to reduce heat losses, help consumers control their use of heat and manage their energy bills and provide incentives for improving the energy efficiency of building envelopes. A strong commitment from the central government is critical to lift the barriers to the implementation of concrete EE actions. This would mean putting in place clear EE frameworks (including enacting the EE Law) and establishing financing support options for EE programs. It is recommended that the Government consider implementing the concepts outlined in the draft EU Directive on “The Energy Performance of Buildings”, including the energy performance certificate program for buildings. Chisinau could consider cooperating with the 10 cities in Ukraine that plan to implement this program, sharing in the joint knowledge acquired through implementation. The investment needs for the rehabilitation of the whole building stock in the city of Chisinau are estimated between USD 865 to 890 million.

A. Introduction

1. On November 2008, Moldovagaz halted gas supplies to the district heating and power plants in Chisinau, leaving households without heat or hot water for more than a week. The gas supply was halted due to the inability of Termocom (the district heating company in Chisinau) and the Combined Heat and Power (CHP) plants to pay for the gas supplied. Although the direct cause of the non-payment for gas was the below cost-recovery level of tariffs and failure of the municipality of Chisinau to provide subsidies for the difference, the situation has been brewing for years. The accumulated payables from Termocom and CHPs to Moldovagaz in 2008 grew to 129.8 million Lei and were growing at a daily rate of 6.5 million Lei. To resolve this situation, the municipality agreed to increase heat tariffs to allow for the eventual repayment of cumulated payables to Moldovagaz. While the agreement allowed the resumption of gas and heat supplies, it did not solve ongoing disputes over the level of cost recovery tariff or the long-standing arrears accumulated in the heating sector.

2. Considering the Termocom's financial condition and the substantial accumulated arrears in the sector, the situation requires urgent attention and commitment by the government and stakeholders to avoid similar interruption of services in the coming heating season. This note presents a comprehensive assessment of the situation of the DH sector in Chisinau and proposes a concrete set of policy options and reforms to bring the DH sector back to a sustainable path of financial and operational viability.

B. Country and energy sector background

3. **Moldova is dependent upon imports to cover 98% of its energy needs.** In 2007, the import bill for energy amounted to about \$ 645 million, equivalent to 14.6 % of GDP, or 17.5 % of total imports. Energy imports include natural gas, electricity and petroleum products. Imported natural gas dominates the country's energy balance (67% of primary energy supply). Petroleum products and electricity account for about 19% and 9% of the country's energy balance, respectively (see Table 1).

Table 1. Energy supply and demand balance in Moldova, 2006

Unit = 000 toe	Natural Gas	Petroleum Products	Electricity	Other*	Heat	Total
Supply						
Domestic Production				87		87
Imports (Net of Exports)	2268	639	302	78		3287
Total Primary Energy Supply (TPES)	2261	654	302	171		3387
Uses						
Domestic Electricity Production**	(1190)	(17)	329	(20)	355	(543)
Distribution Losses and Own Use	(433)	(1)	(189)		(68)	(691)
Total Final Consumption (TFC)	638	636	442	159	287	2154

Industrial Consumption	234	24	96	3	97	357
Transport	62	278	7			347
Residential	245	265	152	41	127	703
Other sectors	96	69	187	108	63	522
Fuel share in the primary energy balance (% of TPES)	67%	19%	9%	5%		100%

Source: Energy Balances of non OECD Countries, IEA/OECD Paris, 2008

*Includes coal, crude oil and renewables

** The electricity generation row provides data on the fuel used to generate electricity and heat (1653 Ktoe total, mainly from natural gas) and the total output (329 Ktoe in the form of electricity and 355 Ktoe in the form of heat)

4. Natural gas is exclusively imported from Russia and is the main fuel for electricity generation and heating. Natural gas demand reached 1.2 billion cubic meters (bcm) in 2008, with the electricity and heat sectors accounting for about 43% of the country's total gas consumption. Natural gas is supplied by the Moldo-Russian gas monopoly JSC Moldovagaz (*Moldovagaz*), which operates and owns the national gas transport system, most of the distribution network, as well as the transit pipelines. In 2006 more than 20 bcm of Russian gas transited through Moldova to Balkan countries: almost 17 times Moldova's domestic consumption.

5. Between 1995 and 2005, gas import prices in Moldova remained at an artificially low level (\$80/mcm), compared to a European parity price¹ of \$230/mcm in 2005. However, following the transition in gas pricing principles, initiated by Gazprom for all CIS and Baltic countries, gas prices will reach European levels by 2011. Thus, natural gas import prices have grown more than threefold: from \$80/thousand cubic meters (mcm) in 2005 to \$253/mcm in 2008. The increasing price of natural gas directly affects the cost of heat and domestic electricity production in Moldova, as it primarily based on gas-fired Combined Heat and Power (CHP) plants. In 2008, rising gas prices led to increases in the average tariff of heat produced by CHPs by 36% and the average price of domestic electricity production by 27%.

6. With a total installed power generation capacity of 490 MW, a domestic production of 0.9 TWh annually, and an annual electricity consumption 3.9 TWh, the electricity supply system is heavily dependent on electricity imports from Ukraine (2.9 TWh). In 2008, two Combined Heat and Power facilities located in Chisinau (CHP1 and CHP2) produced the bulk of installed electricity generation capacity (62%) and domestic electricity energy production (85%). The remaining generation capacity consists of one CHP located in Balti (CHP Nord), two small hydropower plants (with a total installed capacity of 64 MW) and 10 very small CHP plants within sugar factories that operate seasonally to cover energy needs at the stage of processing sugar beet.

7. Since 2001, the share of domestic electricity production has been declining (from 33% to 23% in 2008), as the wholesale price of domestic production (10 UScents/kWh in January 2008) is much higher than imports from Ukraine (3.9 UScents/kWh in April 2008). The price of electricity imports, however, started increasing and in accordance with a recent agreement between Moldova and Ukraine, the price will reach the wholesale electricity market price in Ukraine (currently about 6 UScents/kWh) by July 2009.

¹ The European parity price would be the price of natural gas supplied by the Russian natural gas monopoly, *Gazprom*, to Romania and other SEE countries net of transit costs after the Moldovan border.

8. Despite a relatively low level of energy consumption by industry, energy intensity in Moldova is relatively high. Because of the legacy of low energy prices in Moldova's economy, the energy supply structure is based on inefficient technologies. As a result, energy intensity is 0.54 tons of oil equivalent (toe/thousand - 2000 US\$ PPP) – roughly double the energy intensity of Romania and three times average energy intensity of the EU. Although differences in economic structure are a major factor in international comparison of energy intensity, the data indicates the degree to which high energy intensity poses a serious issue for Moldova's economic growth.

9. Energy dependency on imported energy and high energy intensity exposes the country's vulnerability to external price shocks. In 2006 it was estimated that an increase in energy costs would affect the country by: i) slowing economic growth by 0.5%-1.0%, ii) widening the current account deficit by around 1.5%-2.0% of GDP; and iii) widening of the fiscal deficit by 0.5%-0.8% of GDP.² Finally, high energy prices also adversely affect the budget of the poorest households. A 10 percent rise in the price of all forms of energy directly increases the poverty rate by about 0.8 percentage points.³

10. Significant institutional reforms in the late 1990s helped improve the regulatory environment, the performance of the electricity and gas sectors, and attract private investors. The steep rise in energy import prices following the collapse of the Soviet Union, and the failure of the government to fully pass such increases on to the consumers in a timely manner, led to large quasi-fiscal deficits (5% of the GDP in 1999), falling service quality and continuing lack of investments. To mitigate the escalating energy crisis, the government launched a comprehensive sector reform program. A strategy paper adopted in 2007, indicated the following strategic objectives:

- ③ ensuring security of energy supply;
- ③ promoting energy and economic efficiency, and use of renewable energy sources; and
- ③ liberalizing the energy market and restructuring of the energy industry, in accordance with the requirements for the country's integration into the European energy system .

11. The main actions taken in the reform process include: (i) the development of a new, market-oriented legal framework; (ii) establishment of an independent energy regulatory agency (ANRE) in 1997; and (iii) restructuring and corporatization of companies in the energy sectors. The country's vertically integrated electricity monopoly was unbundled and three out of five electricity distribution companies were privatized. The state sold the majority of its shares in Moldovagaz to Gazprom, and the district heating networks were transferred from the central state to the municipal governments. As a result of these reforms, payment collections increased – collection rates reached 92% for gas and 98% for electricity in 2005 and service quality improved, especially in areas outside the capital of Chisinau.

²The study assumed that natural gas prices would double – from \$80/mcm in 2005 to \$160/mcm -and, as a result, electricity prices would increase by up to 80 percent. The increase in petroleum prices was assumed to be 10%. "A Note on the Impact of Energy Price Changes in Moldova", The World Bank, April 2006

³ "Moldova: The direct link between energy prices and poverty", The World Bank

12. **However, energy sector reform is far from being complete: one of the main challenges is to address the unfinished reform agenda in the DH sector.** The two problems of accumulated payables and inadequate revenues to support the needed investments should be treated separately. The long-standing problem of inadequate heat tariffs set by the City of Chisinau necessitates that these problems are addressed differently, starting with the financial viability of Termocom in current terms, dealing with the accumulated payables separately. The delays in paying their suppliers are threatening the financial viability of CHP 1, CHP 2 and Moldovagaz, which in turn accumulated significant debts to Gazprom and hence need to be addressed urgently. The issue is also a threat to steady gas supply to the country as a whole, as illustrated by the gas supply disruption in 2008. The accumulated accounts payable problem can be addressed on a parallel track, coming to a medium-term resolution to satisfy Termocom's suppliers.

C. District Heating sector in Chisinau: sector background and issues

13. **Moldova had a difficult transition from centralized to decentralized heating options.** In the context of energy sector reforms in Moldova, the two state-owned DH utilities in the country Teromcomenegro (the state company supplying heat to the whole country outside the capital) and Termocom (the DHC in Chisinau) were restructured in 2000. Their assets and liabilities were transferred to the local governments, shifting the entire sector's financial burden to the municipalities. Most of the municipalities were financially ill-equipped to take on these responsibilities. Even with heat tariffs covering only operating costs, the cost of heat supply to public buildings accounted for as much as 12% (Soroca, Ungheni) to 40% (Cantemir) of total municipal budgets in 2003. The sharply decreasing demand in the industrial sector compounded these problems, putting most DH systems in dire financial condition. Within three years, one third of the DH companies went bankrupt and ceased operations. A decade ago centralized district heating supplied about 40 cities. Today, only 15 DH systems are in operation. Among them, only 8 supply to residential consumers.

14. **While the difficult transition created a chaotic situation in many municipalities, others managed to successfully restructure their DH systems.** Only a few municipalities adopted a strategic view on heat sector development and have made encouraging efforts to revitalize and optimize the heat supply in their cities – a good example of which is the Municipality of Ungheni (see box below). In contrast, in most other residential areas in Moldova, individual heating systems use different types of fuel and disregard minimal security. A nationwide coordinated plan for the renovation and decentralization of heat supply systems was adopted in 2003. The plan determines the key directions for securing heat supply in 36 residential areas across the country. However, only a few of these plans have been implemented to date.

Box. The decentralization of the heat sector in the Municipality of Ungheni

The municipality of Ungheni decentralized its DH system into small-scale DH systems after two years without heat in the city. The local administration developed a plan for heat system decentralization which consisted of the installation of 14 new heat-only boilers (HoBs) that would supply heat to residential, public and commercial consumers in the town. The project started with construction of eight HoBs financed by a commercial loan from a local bank. Later on, the local administration built another four HoBs, with the financial assistance of the World Bank through the Energy II Project.

This approach has proven successful:

- ③ the coverage of heat supply is high (no residential or public building is deprived of heat supply);
- ③ the local budget has no financial burden to support the heating company;
- ③ the cost of heat supply has diminished (from 350 Lei/Gcal in 1999 to 287 Lei/Gcal in 2004);
- ③ the collection rate has increased (from 35% in 1999 to 80% in 2004).

1. Overview of DH system in Chisinau

15. **The DH system in Chisinau provides a cost-effective, environmentally-friendly source of heat for a significant portion of the country's population.** Not only is heat delivered at economic least-cost, but it also delivers energy at a rate 30% lower than individual boilers, thus decreasing the carbon footprint of the energy sector. DH system operations also improve

energy security by having a positive impact on the domestic electricity production by CHPs, which also provides fuel flexibility.

16. The DH sector in Chisinau plays an essential role in meeting consumer energy needs in Moldova. Heat consumption in Chisinau accounts for about 10% of the country's total final energy consumption. District Heating is the dominant type of residential space heating in the city: about 500,000 people, roughly 17% of the population of Moldova, rely on DH for their well-being and survival. The DH system also provides heat supplies to schools and hospitals.

17. In a densely populated urban area such as the city of Chisinau, DH is the least cost option for providing heat. As a rule, DH can be considered is the most cost-effective heating system when heat load density - comparison of demand to network length- is higher than 3 MWh/m length of the DH network.⁴ High heat density indicates a compact distribution network with relatively low distribution costs, thus higher efficiency in delivery of heat: in the city of Chisinau, the heat load density is above 3.0 MWh/m. The modernization of the DH system would reduce the length of the network, bringing the heat density to about 4.6 MWh/m. DH is therefore the least cost solution for heating.

18. District heating is supplied in Chisinau by the DH Company, JSC Termocom. About 75% of heat supplies are purchased from the two CHPs located in Chisinau, with the remaining supplies produced by individual Heat Only Boilers (HoB) owned and operated by Termocom. The simultaneous production of electricity and heat by CHPs result in a high level of efficiency (exceeding 90%) and thus has a low environmental impact.

19. The operation of the DH sector is also key in preserving domestic electricity generation capacity, which in turn enhances Moldova's energy security. By providing the demand and revenue for the heat produced in CHPs plants, the operation of the DH system has a positive impact on the economics of electricity production. Heat sales account for 40% and 52% of CHP 1 and 2's total revenues, respectively, allowing them to decrease the economic cost of electricity supply.

20. In addition, maintaining the operation of CHPs provides Moldova with fuel flexibility in its electricity generation. CHPs can switch relatively quickly from burning natural gas to other fuels. Therefore, their operation provides Moldova with important fuel flexibility in emergency events. During the Russia-Ukraine gas disputes in January 2009, which also led to the interruption of gas supplies to Moldova, the CHP plants switched from natural gas to fuel oil, enabling short-term supply security in Moldova to be maintained.

2. The challenges of the DH sector

21. In the process of energy sector reforms, Termocom was decentralized and its ownership was transferred to the Municipality of Chisinau (72%) and to the Termocom Staff Association (28%) in 2000.⁵ By 2001, Termocom had accumulated large payables to its suppliers (1.1 billion Lei), collection rates were only 18%, network losses were 30%, and quality of

⁴ Cogeneration and District Heating. Energy Charter Secretariat, 2006.

⁵ Law on Restructuring Debt of Termocom No 1188-XIV as of 28 July 2000.

service was low. A household survey, undertaken in 2000 in Moldova,⁶ reported that more than 60% of the households considered their service quality bad or very bad, with a majority of DH customers preferring individual boilers in their apartment buildings.

22. Termocom declared bankruptcy in November 2001 and a restructuring plan was agreed. As part of the bankruptcy proceedings, the court declared Termocom insolvent and put the company under the management of a creditors' committee, consisting of creditors with voting rights proportional to the amount of debts they held against the company. A debt restructuring scheme was agreed upon with the creditors, which included a debt write-off of 840 million Lei. The remaining outstanding debts were restructured, and an administrator was appointed to operate and manage the day-to-day operation of the company on behalf of the creditors.

23. Since then, significant progress has been achieved in improving Termocom's operations, despite the difficult financial conditions. Actions oriented at improving Termocom's management and operations led to positive results. Termocom is able to track and measure about 97% of the sold heat. Heat losses in both transmission and distribution network are consequently defined more precisely, enabling better and more focused maintenance. In addition, the creation of a monitoring system, which allows precise identification of network segments with the highest losses, has enabled better metering and improved efficiency in its maintenance of the network.

24. Overall, collection rates increased to 103% thus decreasing arrears, losses in the heat network decreased by 6%, gas and electricity consumption reduced by 5% and 40%, respectively, and water loss diminished by 1/3. The productivity increased as well: the number of employees was reduced by 30%. While the above efforts resulted in efficiency improvements, Termocom's technical condition remains far from acceptable when compared to modern efficient DH systems. Additional, well-targeted investments to increase Termocom's and the CHP operational efficiency are required. These investments, however, require significant improvements to Termocom's financial position.

25. Despite the debt and corporate restructuring efforts, Termocom remained in financial difficulty due to tariffs that were kept below cost-recovery level. While the Municipal Council of Chisinau retains little management control, it still has a significant impact on the financial situation of Termocom through its authority to approve the tariffs. Applications to increase the heat tariffs to cost-recovery level were denied repeatedly by the Municipal Council. The implementation of below-cost tariff levels over a number of years resulted in Termocom continuing its accumulation of trade payables to CHPs and Moldovagaz.

26. At the root of the problems in the DH sector has been the tariff setting procedure which had become highly politicized. As part of the energy sector reform, the National Agency for Energy Regulation (ANRE) was established and was mandated to structure tariff methodologies and approve heat tariffs for CHPs and for final consumers. However, in 2000, along with the transfer of ownership of Termocom and Teromcomenegro to the local governments, the authority to approve end-user heat tariffs was transferred from ANRE to the

⁶ Households Survey 2000. Project Appraisal Document Energy II project, The World Bank, 2003.

local Municipal Councils. The Law on Local Public Administration⁷ states that the Municipal Councils in each city have the right and obligation to set the tariffs for utility services (except gas and electricity, as these are not municipal services) provided by the enterprises they own. The role of ANRE is limited to the evaluation and approval of heat-tariffs, which is currently based on a cost-plus methodology⁸, for state-owned heat suppliers: CHP Nord⁹, CHP 1 and CHP 2.

27. Heating tariffs in Chisinau were left unchanged at 233 Lei/Gcal from 1999 until 2007, while imported natural gas prices registered a dramatic rise — from USD 80/mcm in 2006 to USD 253/mcm in 2008. During the 2007/2008 heating season, the Chisinau Municipal Council disputed the inputs to the methodology set by ANRE, arguing that the cost-recovery level was lower. Finally, following a court decision, heat tariffs were set at 540 Lei/Gcal for the heating season 2007/2008, while the municipality decided to heavily subsidize households (see box below). Heat tariffs for residential consumers remained unchanged at 233 Lei/Gcal, with the difference being transferred from the municipal budget to Termocom. But since the transfer of subsidies was not implemented in a timely manner, the cash flow situation of Termocom has been further compromised, increasing the growth of accumulated arrears

Box. The chronology of a highly politicized tariff setting process

Tariff-setting during the heating season 2007/2008 shows how it has become a highly politicized, non-transparent, lengthy and inflexible procedure:

- ③ On January 25, 2007, heat tariffs were raised by the Municipal Council from 233 Lei/Gcal to 540 Lei/Gcal in accordance ANRE's methodology. However, the lei 233 consumer tariff was maintained and the difference was to be provided a subsidy from Chisinau municipality.
- ③ Several weeks later, the Municipal Council annulled its previous decision and fixed heat tariffs to their previous level of 233 lei/Gcal, and denied to pay Termocom for the subsidy. Termocom contested this decision in court.
- ③ On December 14, 2007, the court ruled in favor of Termocom, establishing a heat tariff at 540 Lei/Gcal. Termocom was to be compensated for the difference between the amount paid by households for heat and the new heat tariff ordered by the municipal budget.
- ③ In April 2008, the Municipal Council of Chisinau – in breach of earlier commitments, and the Civil Code – introduced a retroactive tariff of 456 Lei for the period of December 4, 2007, to April 14, 2008, while setting a tariff of 540 Lei from April 14. This decision was contested again in court.
- ③ In July 2008, the court ruled against the decision of the municipality and set the heat tariff to 540 Lei/Gcal for the 2007/2008 heat season.

28. While tariffs for end consumers were raised by 130% in the 2008/2009 heating season, they were still below the estimated cost-recovery level by at least 50%. During the 2008/2009 heating season, disputes over the level of cost-recovery heat tariff persisted. In mid-2008, following a joint request of the government of Moldova, the Chisinau municipality and

⁷ Law No 186-XIV of 6 November 1998.

⁸ ANRE Decision No. 147/25.08.2004

⁹ CHP Nord is situated in a regional city of Balti and supplies heat directly to end consumers.

Termocom, SIDA financed an independent technical and financial analysis aimed at obtaining an independent evaluation of the DH tariff level. The study was carried out by the Swedish consulting firm SWECO which proposed a cost level of 817 Lei/Gcal. ANRE performed a similar analysis at the request of Termocom, and proposed a similar cost level of 822 Lei/Gcal. The mayor's office, disagreeing with the above analyses, contracted a local NGO which suggested a tariff of 650 Lei/Gcal: it has since been shown that this last calculation was missing several important cost elements. In December 2008, following the incident with Moldovagaz, the Municipal Council approved a uniform tariff of 540 Lei/Gcal for all consumers and created a new social protection program to protect the poor from this tariff increase. Despite the recent tariff increase, it remains significantly below that of 786 Lei/Gcal in Balti – whose population has lower average income compared to Chisinau. The 2008/2009 heating season tariff for Balti was set by ANRE using cost plus tariff methodology.

29. There is a need to make DH affordable to poor consumers, but it must be recognized that, in relative terms, those living in Chisinau are less poor than elsewhere. On average, Chisinau residents who use central heat have a higher level of income, as measured by their spending on goods and services, than other Moldovans. The national poverty rate in 2007 was 25.8%. Only 9.5% of Chisinau residents who consume district heat spend less on consumption than the national poverty line of Lei 747 per adult equivalent (18,000 households and 46,000 people). However, the national poverty line of Lei 747 provides relatively low purchasing power at Chisinau prices. The percentage of individuals in Chisinau with expenditures below the urban subsistence minimum of slightly less than Lei 1,190 per person equivalent per month corresponds to 51.4 percent of Chisinau residents –even though Lei 1,190 provides for consumption of just more than US\$ 100 per person equivalent per month.

30. However, social protection in Chisinau was addressed by providing implicit subsidies for heat supplies in the form of across-the-board underpricing. This poorly targeted welfare system became unaffordable in Chisinau, as illustrated by the large debts accumulated by the municipality in favor of Termocom during the heating season 2007/2008.

31. In addition, the old national social protection system is badly targeted and did not reach poor DH consumers. While about 63 percent of poor households are covered by the social insurance system (which consists of pensions and unemployment insurance) and about 45 percent are covered by social assistance (see Table 10). However, the percent of benefits received by the poor is relatively low: about 16 percent for social insurance and 10 percent for social assistance.

Table 2. Social Benefits and Poor District Heat Consumers in Chisinau, 2007

		Poverty line		Subsistence minimum	
		Social insurance	Social assistance	Social insurance	Social assistance
Coverage: % of households receiving benefit	Non-poor	33.6	25.1	30.7	24.1
	Poor	63.0	45.4	41.7	29.7
Targeting: % of benefit received by poor households		15.8	10.3	52.4	46.7
Adequacy: % share of benefits in consumption expenditure	Non-poor	10.5	1.7	9.1	1.6
	Poor	37.8	3.5	16.9	2.2

Source: National Bureau of Statistics Household Budget Survey & World Bank computations.

32. **A positive development was the introduction of targeted direct subsidies for low-income groups for the heating season 2008/2009.** The municipality of Chisinau introduced a targeted social protection program (launched in October 2008) which entails a 40% subsidy of heating bills for those households whose income does not exceed the minimum subsistence income (about Lei 1,450 per month).

33. **However this approach has proven to be relatively ineffective.** However, given the extensive documentation that applicants need to submit to the municipality, and the lengthy processing of applications, a very limited number of poor DH consumers were effectively able to benefit from this program. In addition, this plan does not appear realistic, since more than half the population of Chisinau fell below the urban subsistence minimum in 2007 (of Lei 1,190 per capita per month). Therefore, the cost of the subsidy would be unaffordable to the Municipality. Yet the Chisinau government expects to pay this subsidy to about 10 percent of the population and had a budget of only about 10 MDL million for the 2008/2009 heating season, which was made financially feasible through establishing bureaucratic barriers.

3. Impact of below cost recovery level tariffs

34. **Termocom has again become financially bankrupt.** The company has been operating at negative margins for years, except for 2007 when the tariffs were raised to 540 Lei. The increase in tariff, however, only brought about a temporary relief. As gas prices soared in 2008, the company fell back into negative income as there is no pass-through mechanism to deal with unexpected rise in input prices. As a result, Termocom now has a negative equity of 1.2 billion Lei with more than 2.5 billion Lei of liabilities outstanding (see Table 3). Under normal circumstances, the company would not be able to continue its operations.

35. **Under the regulations concerning insolvency proceedings, an insolvent company has five years to go through restructuring proceedings.** After a five-year period, if the company is still insolvent, the next step is liquidation of the company with its assets and equity to be redistributed under court supervision to the creditors based on their seniority and proportions. However, since the Government sees liquidation of Termocom as a threat to the welfare of the population of Chisinau, the insolvency proceeding was extended for another three years in January 2009 by a government decree.

Table 3. Summary of Termocom Financial Statements

(thousand Lei)	2004	2005	2006	2007	2008
Net Income	(140,350)	(115,586)	(146,124)	34,448	(131,250)
Total Liabilities	1,918,790	2,040,792	2,180,989	2,329,156	2,508,667
Total Equity	(923,922)	(1,034,334)	(1,099,917)	(1,039,898)	(1,170,625)

Source: Termocom

36. **Termocom's critical financial situation also threatens the financial viability of its suppliers.** Termocom was able to continue its operations only as it financed its operations through accumulation of payables to its suppliers. The accumulated payables, the majority of which are with CHPs and Moldovagaz, has now grown to more than 2.5 billion Lei. The accumulation of payables has been the source of working capital for Termocom that allowed it to stay in operations, and is now at about 3.2 years worth of its annual revenues (see **Table 4**). The

payables are expected to continue to grow, since the current tariff levels and cash support from municipalities have shown to be inadequate and untimely.

Table 4. Selected Financial Ratios of Termocom

	2004	2005	2006	2007	2008
Net Margin	-51.9%	-34.7%	-42.0%	4.5%	-17.0%
Current Ratio	0.29	0.27	0.24	0.32	0.31
Receivables/ Revenue*	1.7	1.4	1.3	0.8	0.9
Payables/ Revenue*	6.7	5.9	6.0	3.0	3.2
Tangible Assets (000 Lei)	455,175	458,490	563,893	562,437	561,672

Source: Termocom

*Decline of receivables and payables ratio due to increase in revenues as result of increase in tariffs

37. As Termocom accumulated their payables to the CHPs, the financial burden was passed on by accumulating payables to their suppliers, principally Moldovagaz. With receivables from CHPs and Termocom growing to such proportions, Moldovagaz also accumulated payables to its supplier, Gazprom. The net total payable to Gazprom is now estimated to amount to 1.5 billion Lei, on which Moldovagaz is paying a modest penalty rate. In addition to the issue of financial inefficiency and burden on the entire value chain of energy in Moldova, the incident in 2008 has shown that this financial overhang is a potential threat to Moldova's energy supply security.

38. The lack of funds has led to asset deterioration. The DH system of Chisinau was built in the 1950's according to DH practices prevailing in the Former Soviet Union (i.e., the system is production-driven, as opposed to the demand-driven DH systems in Western Europe). As of today, most of the DH network has exceeded its expected design lifetime of twenty years: 64% of the network was built between 1959 and 1990, 16% was built between 1991 and 1998, while the remaining 20% was built during the past ten years.

39. Because of an inadequate rate of the network replacement, the reliability of the network, service quality and the system's efficiency have been decreasing. The total number of breakdowns per year as well as a specific number of breakdowns per year per km. is growing (see Table 5). A substantially higher number of absolute and specific numbers of breakdowns of the Hot Water Supply (HWS) distribution network is largely explained by the fact that there was no hot water supply during the period of 2001-2004 in Chisinau. During that period, the HWS distribution pipes have substantially corroded, which drastically reduced their reliability and efficiency. The reliability of the district heating supply in Chisinau is deteriorating. Thus, in 2001 the average specific number of breakdowns per km for the entire network constituted 0.8 breakdowns per km. While in 2008, the same indicator reached 1.8 breakdowns per km, which is about almost 4 times higher compared to the modern DH systems in the EU (about 0.5 breakdowns per km).

40. The growing number of breakdowns in absolute and specific terms also indicates a decreasing quality of service, and a significant level of heat losses. The latter constituted 24% in 2008. Although heat losses have been reduced from 29% in 2005¹⁰ to 24% in 2008, they are still above the level of about 5-10% prevailing in modern DH systems of similar size.

¹⁰ Between 2001 and 2004, there was no HWS, which resulted in the reduction of heat losses. In addition, before 2002, the heat losses were estimated based on norms and partly on heat meters located at GHSs, which neglected distribution losses. After 2002, the heat losses were defined as a difference between the measured heat output of heat sources and measured consumption (at the building level).

Table 5. Number of absolute and specific breakdowns

Year	Transmission network		Distribution SH network		Distribution HWS network	
	Absolute*	Specific*	Absolute	Specific	Absolute	Specific
2001	40	0.16	36	0.13	482	2.37
2008	302	1.19	78	0.29	927	4.56

Source: Termocom

*Units: Absolute - breakdowns per year, Specific - breakdowns per year per km

41. Poor quality of service has turned away many residents of Chisinau: most new buildings are not supplied by the DH system. About 95% of households in Chisinau are connected to the DH system.¹¹ However, the poor quality of heat supplied has encouraged wealthy customers to disconnect and turn to alternative heat sources to improve their comfort (mainly apartment-level, gas-fired, heat-only boilers and electric heaters). Between 2001 and 2004, Termocom's market share decreased precipitously: annual sales dropped by 12% as consumers switched to individual heating resources. Nevertheless, this tendency has slowed down due to the gradual improvement of the heat service quality during the last several years. In 2005, Termocom's heat sales recovered quickly by 23% and only remained stable afterwards, despite strong economic growth. In 2007, only 77% of households received their heat from the central heating network, while 19% of households are already invested in autonomous heat sources (see Table 6). However, the poor cannot afford the capital cost associated with switching to a different heat supply source.

Table 6. Distribution of Households over types of heating in Moldova and in Chisinau, 2007

	National		Chisinau city	
	Obs.	% pt freq	Obs	% pt freq
Central heat network	737	19.3	525	77.2
Individual (autonomous)	883	15.2	143	19.1
Natural gas stove	383	5.8	16	1.9
Wood, coal, oil stove	3981	58.5	19	1.6
Electric heater	56	0.9	4	0.2
None	12	0.3	1	0.1
Total		100		100

Source: 2007 National Bureau of Statistics Household Budget Survey & World Bank staff computations.

42. In addition, energy efficiency measures on the consumption side are nearly non-existent. Apart from recent increases in fuel prices, very little has been done to influence the energy consumption patterns in Moldova. Yet, the potential for improving energy efficiency at the demand side is huge. Buildings appear to be of similar construction quality in Ukraine which are roughly five times less energy efficient than those in western Europe.

43. The housing stock of Chisinau consists primarily of soviet-era apartment buildings with low thermal efficiency. By January 2008, Chisinau's housing stock consisted of a total of 4,349 buildings of different sizes, totalling some 15 million square meters, with an average apartment size of 49 square meters. Constant lack of investment in both capital and current repairs over the past decade have led to a critical deterioration of the housing stock and a continuing decline in the level of housing related services (water, energy services, district heating). High thermal losses in residential buildings arise due to low quality construction materials, leaking roofs, obsolete installations, and poor wall insulation. Additional thermal

¹¹ About 2,400 blocks, comprising about 200,000 flats, are connected to the heating system. Of the 2,400 blocks, only 1,600 to 1,700 are supplied with hot tap water.

losses are due to internal heating pipes characterized by a lengthy operation life, high degree of wear, with destroyed or non-existent insulation.

44. **International experience across the region¹² shows that significant energy savings potential (between 20% to 40%) can be realized at the level of the final consumer at relatively low cost.** Promoting energy efficiency in the residential sector generally involves two main elements: i) upgrading the internal DH piping system of buildings to allow the installation of cost allocators and heat regulators at the apartment-level; and by ii) energy efficiency retrofitting in buildings such as roof and basement insulation, wall insulation, window and door replacement.

45. **However, DH consumers in Chisinau have no effective incentive to implement any energy saving measures.** Based on a recent consultancy study on demand side energy efficiency measures in the DH sector in Chisinau, the main barriers to their implementation are:

- ③ Limited technical possibilities and lack of incentives for economical use of heat in multi-apartment buildings due to the building heat system design;
- ③ lack of policies and programs to promote energy efficiency in Moldova;
- ③ weak institutional capacity and cooperation to develop and implement any EE measure at the national and local level;
- ③ lack of financing support;
- ③ inability of low-income consumers to pay for EE improvements in their apartments and;
- ③ poor public awareness. In a recent survey, only 15% of consumers were aware of DH internal system improvement measures.

4. **Summary of Issues in DH sector in Chisinau**

46. The assessment above indicates that the DH system is in a deteriorating technical and financial situation that if not reversed, may result in the collapse of the district heating system in Chisinau. If the CHP plants did not have a viable source of heating revenues, they may not be commercially viable as their “must run” status during the winter would no longer be justifiable. A broad-based fundamental reform in the heating sector in Chisinau is therefore critical to bring the sector financial and social viability. The reform needs to address the following interrelated issues:

- ③ **Inadequate DH tariffs and a highly politicized tariff setting procedure.** Heat tariffs remain at well-below the cost recovery level. Tariff setting is highly politicized and has become a non-transparent and lengthy procedure, including recourse to courts.
- ③ **Unsustainable accumulated payables in the DH sector.** As a consequence of tariffs set below cost recovery, Termocom’s operations have been financed through accumulation of large payables to CHP plants and Moldovagaz which have grown to unsustainable proportions. Termocom’s payables are about 2.5 billion Lei, or 3.2 years worth of its annual revenues. This situation puts Moldova’s energy sector at risk.
- ③ **Inadequate protection for poor DH consumers.** The social protection program implemented by the municipality was, and still is ineffective in making DH services

¹² E.g. from World Bank supported projects in Lithuania, Poland and Bulgaria.

affordable for the poor. During the last heating season, the number of recipients of such protection program was very low due to high bureaucratic barriers.

- ③ **Lack of supply-side energy efficiency (EE) measures.** Chronic under-investment and deteriorating infrastructure operating well beyond its design life results in decreasing reliability of heat supply, poor service quality and increased heat losses, reducing the overall efficiency of the system. About 24% of total heat produced is lost in the network, compared to 10% in modern DH systems in the EU. Service quality and system reliability has significantly deteriorated over the past eight years, as the average specific number of breakdowns grew by 125% and it is now about almost four times higher compared to the west European DH systems. Furthermore, the CHP plants are old and inefficient, operating well past their design life and need to be upgraded or replaced.
- ③ **Almost non-existent demand-side EE measures.** The potential for improving energy efficiency at the demand side is huge in Chisinau. However, this potential remains largely unrealized due to the technical, financial, economic, and institutional barriers to EE implementation. Until now, the government has failed to develop concrete EE frameworks (such as the adoption of the Law on EE) to help address these barriers.

D. Recommendations and Action Plan

47. **The immediate challenge in Moldova is to prevent the collapse of the DH sector in Chisinau and ensure that heat services will be available to consumers during the next heating season, while at the same getting it back on a path of long-term sustainability.** To respond to this challenge, summarized below are: 1) policy options that address urgent and immediate issues for continuity of DH operations; and 2) more comprehensive reform and restructuring options to be considered in the next 1-2 years (see Table 7).

Table 7. Policy Sequencing

Recommendations for immediate actions	
<ol style="list-style-type: none"> 1. De-politicize tariff setting by transferring tariff setting authority from the Municipal Council of Chisinau to the energy regulator ANRE and immediately raise tariffs to full cost recovery. 2. Set up a targeted social protection program for low-income consumers by ensuring a close cooperation between the municipal government of Chisinau and the national authorities. The most efficient way to transfer the funds would be through the Ministry of Social Protection's new, targeted, social assistance program. 	
Recommendations for a comprehensive restructuring of the DH sector (Medium Term)	
Steps for making DH financially viable	Steps for making DH services affordable
<ol style="list-style-type: none"> 1. Rationalize the tariff setting methodology in the electricity, heat and gas sectors to better promote efficiency, fairness, least-cost supply, full cost recovery and transparency. 2. Improve corporate governance of Termocom to ensure that the DH company act as a commercial business entity and create the conditions for future private participation. 3. Restructure Termocom through merger with CHPs to increase efficiency of the system and transition to a more structured long-term resolution of negative equity and accumulated arrears through debt-to-equity swap. 	<ol style="list-style-type: none"> 1. Implement a long-term investment strategy to reduce network losses and energy consumption thus reducing the cost of heat supply. 2. Implement demand-side energy efficiency programs to reduce heat losses, help consumers control their use of heat and manage their energy bills.

1. Recommendations for Immediate Action

48. The first key step to ensure that heating services will be available during the next heating season is to hand over the tariff setting authority from the Municipal Council of Chisinau to the regulator and raise tariff to full cost recovery level. Based on a rough estimate (see annex 3 for further details on cost-recovery tariff calculation), heat tariffs would need to increase by about 50%. Increased tariffs will cause financial burden for many poor and vulnerable households as the poverty rate may increase by 1.2%. Overall at least 10.7% of the population of Chisinau would need to be protected from unaffordable DH prices. Therefore there is a need to put in place an effective social protection program to offset the welfare losses suffered by the poor.

De-politicize tariff setting by transferring authority from the Municipal Council to ANRE and immediately rise tariffs to cost-recovery

49. Transfer of the tariff setting power to an independent regulator is the first –and most important– step to establish a transparent and predictable price setting process to support investments needed in the. Regulatory independence limits the influence of short-term political pressures on regulation and

avoids conflicts of interest, which arise since the municipality is both the owner of the DH Company and the regulator. Considering also the resources and capacities required for efficient regulation, transfer of tariff setting authority to ANRE is recommended.

50. The transfer of authority to ANRE has already been implemented in the Municipality of Balti and the process has worked well to date. Following the restructuring of the DH sector in Moldova, the DH Utility and the CHP Plant merged into one company (CHP Nord). Because CHP Nord is no longer a municipal-owned Company, ANRE sets tariffs for heat supplied through the DH system to end consumers, as well as wholesale prices.¹³

51. Transfer of tariff-setting from the Municipal Council of Chisinau to ANRE would require either of the following legislative actions:

- ③ Modification of the Law on The Law on Local Public Administration¹⁴ which states that the Municipal Councils in each city have the right and obligation to set the tariffs for utility services provided by the enterprises they own.
- ③ Change the ownership of Termocom by merging it with CHPs. This would automatically shift tariff-setting to the National Regulator.

While either option may lead to transfer of tariff-setting to ANRE, it should be noted that the first option would require increasing the capacity of ANRE to adequately assess the tariff calculations submitted to them. ANRE would need to strengthen its technical capacities and collect all relevant information for heat tariffs in all localities in Moldova.

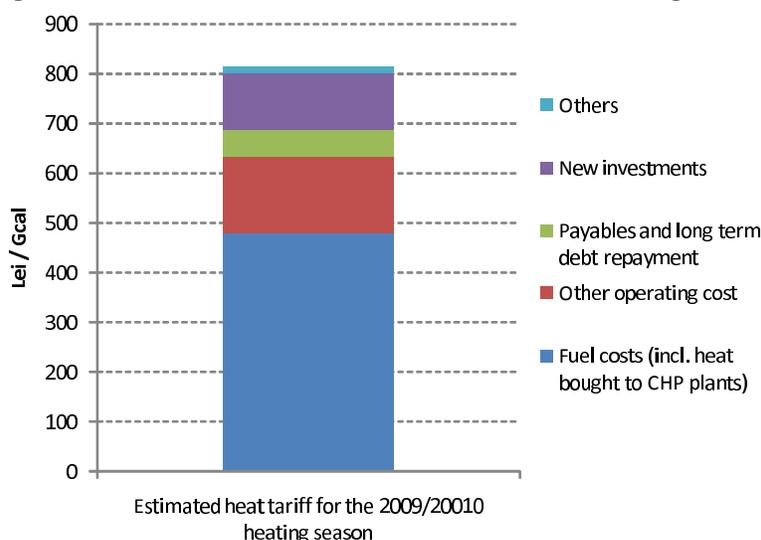
52. Analysis of Termocom's revenue requirement to achieve cost-recovery was conducted by constructing a financial model based on assumptions made on the future sales, operational cost and investments needs. (Main assumptions are provided in Annex 3.) The analysis indicated that the heat tariff needs to be increased by 50% or *814 Lei/Gcal for the 2009/10 heating season*.¹⁵ This is the minimum tariff at which Termocom will be able to fully recover all its costs and have enough cash flow to maintain its operations (see Figure 1) . Although the tariff projections indicate that the tariff increases can be moderated once the efficiency gains from the proposed investments start to materialize, the initial period of tariff increase will require an establishment of social safety net for the vulnerable population. (See following section for details.)

¹³ Government Decision 1511/31.12.2008 Approving the Regulation of ANRE. Monitorul Oficial 7-9/24, 20.01.2009

¹⁴ Law No 186-XIV of 6 November 1998.

¹⁵ The analysis was based on a forecasted gas price of USD 295 per thousand cubic meters in early 2009. Very recently, Moldovagaz disclosed the gas price for the third quarter of 2009. If current petroleum prices in the fourth quarter don't change, the average price of gas supplied to Moldova will be of USD 257 per thousand cubic meters in 2009, about 10% lower than that forecasted in the financial model. This would imply a variation in the range of 1-5% for the estimated heat tariff for the 2009/2010 heating season.

Figure 1. Estimated heat tariff for the 2009/2010 heating season



Source: World Bank staff estimates

Ensure social protection for the vulnerable population

53. The levels of poverty in Chisinau require the design and implementation of a social protection program to support the poorest segments of the population against tariff increases. The required tariff increase to at least 814 Lei/Gcal from the 540 Lei/Gcal for 2008/2009, constitutes 50% increase in tariffs. Although similar tariff levels are already being implemented for other cities in Moldova with less income levels, the transition will have a significant impact on the population of Chisinau; especially on the most vulnerable. The situation requires that the government consider providing a social safety net to mitigate some of this impact.

54. Such an increase in DH prices would increase the poverty rate by 1% or about 4,500 people would slip below the poverty line (see Table 8). However, this increase in poverty may be overstated, since the simulation assumes that consumers do not reduce consumption of heat when its price rises.

Table 8. Direct impact on poverty among Chisinau DH consumers of an increase in the DH tariff from 540 Lei/Gcal to 817 Lei/Gcal

In percentage points	Before increase in heat price: 2007 actual		After increase in heat tariff	
	Poverty rate	# Poor people	Poverty rate	# Poor people
Percent below poverty line (poverty rate)	9.5	46,493	10.7	51,972
Percent below urban subsistence minimum	51.4	250,563	52.6	256,493

Source: National Bureau of Statistics Household Budget Survey & World Bank staff computations.

55. It is recommended that the municipal government of Chisinau and the national authorities closely cooperate regarding the new subsidy program for poor DH consumers. The Ministry of Social Protection launched in October 2008, a new social assistance program that targets the poor. This program selects beneficiaries, in part, on the basis of their declarations of income,

and importantly, uses proxies for income to screen out relatively rich applications.¹⁶ The most efficient instrument for transferring resources to poor DH consumers to offset heat price increases is therefore through the new social assistance program implemented by the central government.

56. The municipal government of Chisinau could work with the new social protection office since the social protection personnel who process applications for the new social assistance program are located within the municipality. The proposed action plan is summarized below:

- ④ The Chisinau government would determine the amount of the subsidy per beneficiary household. This would depend on the Chisinau government's budget and the estimated number of qualified applicants.
- ④ The Chisinau government would invite recipients of the new social assistance programs to submit their Termocom billing number.
- ④ Finally, the Chisinau government would pay the subsidy directly to Termocom, rather than to the poor households, to assure that the subsidy reduces Termocom's deficit.

2. Recommendations for Medium Term

57. In the medium term, broad-based fundamental reform is needed to make DH financially viable and affordable for the population of Chisinau. Targeted efforts to achieve this objective are outlined below.

Rationalize tariff setting methodology in Energy

58. Efficient tariff regulation should be designed according to set of clear pricing criteria. Ideally, heat tariff should follow the principles listed below:

- ④ Full cost coverage: the tariff should include all justified costs predicted for the near future and a reasonable profit margin;
- ④ Cost structure reflective: the tariff components should be based on the real cost structure. The variable fee should cover variable costs, such as fuel and energy purchase costs and the fixed fee capital and staffing costs;
- ④ Competitiveness: the heat tariff should offer a competitive option for those customers which are economically attractive for district heating;
- ④ Incentive to cost reduction: for the DH Company, there should be an incentive to reduce costs by competing against gas/oil heating, or by regulatory means;
- ④ Incentive to energy conservation: for the heat customer, there should be an incentive to reduce the required water pressure, supply and return water temperature and the water flow, which all add up to energy conservation; and,
- ④ Simplicity: the heat tariff should be easily understandable to the customers.

59. It is difficult to meet all the above criteria simultaneously and, therefore, priorities must be made in the tariff design. The current legislation for tariff calculation methodology (cost-plus) has the basic principles to ensure an adequate level of service to end-users. A heat tariff calculation should allow for asset depreciation and a reasonable return on capital. The current tariff methodology includes a 5% rate of return on profits and an agreed return for new investments only (the return rate varies depending on whether the investment is financed by internal cash or by commercial loans). The criteria should be

¹⁶ The proxies are, for example, ownership of houses, vehicles, and consumer durables. (In contrast, the municipal government does not have any alternative way to verify the income declared by applicants for district steam heat subsidies.)

revisited to establish an incentive for possible future private sector participation through a management contract, leasing arrangements or privatization.

60. However there are some issues that require further refinement. In particular, the current tariff does not provide incentives for cost reductions (but rather to overspend or overstate cost). The regulator may therefore consider using incentive-based regulation: for example price caps which are better at improving efficiency. Price capping requires reasonable efficiency improvements over time; this regulatory approach has been used very successfully to improve system efficiencies in many Western countries and transition economies such as the Czech Republic and Lithuania. In addition, the tariff structure consists of only one component despite available metering at the building level. The transition to a two-part tariff directly linked to both energy (variable) and capacity (fixed) charges may also be considered, as they provide incentives to suppliers and consumers to use resources efficiently.

61. Another important issue is the balance between price-setting for power and heat produced at cogeneration plants, as it determines the competitiveness of the products in their respective markets. Since both markets are regulated, the regulator can balance tariffs by setting a viable cost allocation methodology. Different approaches to costs allocation exist, as it is difficult to determine accurately which share of costs that are common for cogeneration plants are attributable to each of its products. Currently, the heat allocation method in Moldova seems to discriminate against electricity. Most of the benefits of cogeneration are allocated to heat; therefore electricity produced at CHP plants is relatively expensive. A careful analysis is needed to make sure that cost allocation method is fair and contributes to improving the efficiency of the district heating and electricity sectors. Any change in the existing methodology will have a significant impact on the power side, so both the heat and electricity markets should be taken into account.

Improve Corporate Governance / Corporate Restructuring

62. As Termocom has been unable to operate in a sustainable manner, comprehensive restructuring of its corporate governance and structure should be considered. In addition to the immediate need to reconcile the 1.2 billion lei of negative equity accumulated, improvement of service quality and sustainability of the operations needs to be taken into consideration as well. But as Termocom has not been able to emerge out of the bankruptcy proceedings after eight years, comprehensive restructuring of the DH sector in Chisinau is necessary to ensure a sustainable resolution to the current situation. As a prerequisite for the restructuring, the improvement of corporate governance of Termocom is critical in any case, but a merger with CHPs is an attractive solution that can contribute to the improvement of the financial and operational efficiency of the whole DH sector.

Improving Corporate Governance of Termocom

63. Termocom operates within a weak corporate governance structure, which leads to vaguely defined and noncommercial objectives, and ineffective monitoring. Improvements in corporate governance are necessary to assure that Termocom operates according commercial principles, to attract the interest of commercial lenders and financial and strategic investors in the medium term. Following are some of the measures to address these issues:

- ③ Strengthen corporate governance by adopting company mandates that reflect commercial objectives and introduce commercial control mechanisms (strategic planning, business planning). The Board of Directors should be given a clear mandate, identifying key issues that need to be addressed (e.g. corporate strategy, finance/accounting), establish committees to address these issues and select Board members with a skill set consistent with these issues.
- ③ Implementation of international financial reporting standards, through the adoption and implementation of a new Accounting Law which will require, inter alia, that state-owned utilities adopt IFRS standards for financial statements prepared for 2010,
- ③ Improving information flows by introducing modern management information systems (MIS) that can provide timely information on all budgeted activities and that can highlight (preferably in advance) where managers should take remedial action.

Restructuring Options for Termocom

64. *Merger between Termocom and CHPs* - One of the options for a comprehensive restructuring of the DH sector is to merge Termocom with CHPs. As seen in the example of Balti, where the DH company was merged with the CHP Nord, merger with CHP 1 and 2 will transfer tariff setting authority to ANRE as the combined company will fall under their regulatory authority. By using debt-to-equity swaps in the merger, the issues of negative equity (1.2 billion Lei as of 2008) and accumulated arrears (1.4 billion lei between Termocom and CHPs as of 2008) can also be addressed in a more transparent and structured manner, rather than managing it under the creditors' committee.

65. In addition, from the technical stand point, savings in required investments and efficiency improvements can be expected from a merger of Termocom and CHPs. A major advantage would be the optimization of the district heating (DH) system, which, in turn, would allow for a more energy efficient DH supply. CHPs are the most energy efficient mean of producing heat and electricity, with CHP efficiency ranging from 50 to 85 percent, depending upon the age and the type of equipment. At the same time, a separate generation of heat (in heat-only boilers or HOBs) and electricity (in condensing power plants) has a 20 to 40 percent lower efficiency, compared to that of CHP. Therefore, a maximum feasible utilization of CHP capacity is always desired, as it results in increased energy efficiency, and therefore reduced emissions of Green House Gases.

66. Under the DH supply structure presently in place in Chisinau, whereby Termocom (owning HOBs and DH network) and CHP plants 1 and 2 are separate entities, the ratio between HOBs and CHPs utilization is not optimal, resulting in an over-utilization of HOBs. Currently Termocom produces about 24% of total heat supplied. The over utilization of HoBs reduces the utilization of the CHP capacity, which, in turn, results in a reduced efficiency of the overall heat and electricity supply and, therefore, a need for an increased import of natural gas, which is the major fuel for heat and electricity generation in Moldova.

67. To the contrary, a merger of Termocom and CHPs and a creation of a single entity managing both sources of heat generation, HOBs and CHPs, would eliminate the above described problem and allow for the optimal balanced use of CHP and HOB capacities, resulting in an increased energy efficiency, improved energy security and reduced emissions of Green House Gases. In addition, under the merged structure of DH and CHP, it is possible to further optimize the perspective design of the entire DH supply system so that an additional CHP capacity could be sized to cover the off-heating season heat demand (primarily hot water supply), resulting in a year-round operation of CHP at a rated capacity, thus maximizing efficiency and reducing the cost of heat and electricity supply. Taking into account a considerable age of existing HOBs and CHPs, an introduction of the state-of-the-art CHP equipment, such as Combined Cycle Gas Turbine (CCGT), will allow for an increased reliability of heat and electricity supply, while achieving even higher efficiency and reducing the cost of supply.

68. *Liquidation of Termocom* - Another option is to simply liquidate Termocom and transition Chisinau into decentralized heating boilers and appliances for individual buildings and dwellings. However, past analysis on the DH system indicates that the DH system is the most economically efficient option for Chisinau, and that as much as 50% of heating requirements in the city would go unmet if the heating services are discontinued.¹⁷ This would have much more negative impact for the well-being of the population than other options, especially for the most vulnerable.

Reduce cost of supply and improve service by implementing maintenance and investments

69. Upgrading the DH system is necessary to decrease the cost of supply since it would not only alleviate the burden on the energy supply system as a whole, but it would also mitigate some of the impact of tariff increase by lowering the energy bills to the consumers. Some of measures to reduce cost of supply are as follows:

¹⁷ "Strategic Heating Options for Moldova – Economic Analysis", 2001, World Bank, Swed Power and FVB

- ④ Reducing DH network losses;
- ④ Improving the efficiency of heat supply; and
- ④ Providing improved customer service through improved metering and controls.

70. Although cost increases that lead to increases in tariffs need to be avoided as much as possible to minimize the impact on the affordability of heating services, resources need to be provided to improve efficiency and maintain service quality and maintain the asset base. The sustainability of the operations must be improved to ensure continuity of heating services.

71. In order to assess the investment needs for the rehabilitation of the DH system of Chisinau, a comprehensive long-term strategy was developed with the goal of achieving a sustainable, reliable, economically competitive and affordable DH system in Chisinau. This strategy is based on the analysis of the technical data as well as the investment plans provided by Termocom. It includes the following items: (See annex for further details)

- ④ Conversion of the group heat substations to individual heat substations , along with necessary rehabilitation and adjustment of the distribution network
- ④ Replacement of the unreliable and inefficient heat transmission capacity, and its optimization and resizing, following the optimization of the entire DH system
- ④ Finalizing the installation of meters and automation of the DH system
- ④ Conversion from constant to variable flow of operation by installing the variable frequency drives and new pumps (following the full conversion from GHS to IHS)
- ④ Improving efficiency of the old, inefficient CHPs
- ④ Conversion of some HOBs into CHPs
 - ④ Construction of mini CHPs on the bases of distributed HOBs, distributed large GHSs and pump stations
 - ④ Replacement of the above-the-ground pipelines insulation

72. The investment strategy consists of the priority investment plan (5 years) and a long-term investment plan (10 years). The priority investment plan is designed to ensure the stable and secure operation of the DH system in the short and medium term, increased energy efficiency as well as enabling the implementation of the long-term development strategy. The long-term investment plan complements the priority investment plan and addresses the long-term development objectives described above. A preliminary assessment of the potential benefits from the implementation of such investment program indicates substantial economic and environmental savings (see Table 9).

73. The cost-benefit analysis indicates that the priority investment plan is economically viable. Over the assumed lifetime of 10 years, the priority investment plan achieves the positive Net Present Value (NPV) of about US\$ 25 million and Internal Rate of Return (IRR) of 24 percent without considering the environmental benefits of the plan implementation. With the consideration of the environmental benefits, the NPV becomes US\$ 32 million and IRR increases to 28 percent

Table 9. Estimated cost and savings from Termocom investment plan

	Priority Investment Plan (2009-2014)	Long-term Investment Plan (2015-2024)
Estimated cost (million USD)	76	242.9
Estimated savings		
Cumulative fuel consumption reduction (thousand cubic meters of natural gas)	142,000	1,400,000
Reduction in heat losses (%)	1.6	7.2
Cumulative reduction in electricity consumption (million kWh)	4	46.4

Reduction in make-up water consumption (thousand tons)	615.4	3,709
Repair cost reduction (million USD)	0.5	2.2
Reduction of emissions (tons of CO ₂)	267,015	2,619,923

Source: Bank staff calculations

Implement demand-side energy efficiency programs

74. A study – commissioned for this policy note, developed a comprehensive demand-side energy efficiency strategy (see Annex 4). The main elements of the strategy are shown in Table 10. The cost assuming a market penetration of a 100% is roughly estimated between EUR 666 to 683 million. Drawing on lessons learned in other countries, it is unlikely that market penetration would exceed 25% over the next 10 years, resulting in annual costs of roughly EUR 17 million. It should be noted however, that these investment needs are estimated given a limited size of the market for equipment, which leads undoubtedly to higher costs. The scale-up of this program would expand the market considerably and reduce investment costs.

Table 10. Demand-side energy efficiency strategy for the city of Chisinau

Investment Component	Estimated cost* (Euro/m ²)	Total investment cost* (million Euro)
Rehabilitation of the building internal heat piping project <ul style="list-style-type: none"> ① Demolition of old heating and DHW systems in the residential buildings, ① Reconstruction of main pipes in the basement starting with the new substations, ① Installation of balancing valves on risers, ① Installation of common vertical main risers for heating, DHW and DHW recirculation in the common area of the buildings, ① Installation of distribution boxes in the common area on each floor with shut-off and balancing valves, heat and DHW meters for each apartment, ① Reconstruction of the internal heating systems in apartments, with new pipes and radiators with automatic thermostats; the new systems in apartments – two-pipe horizontal, connected to the distribution boxes, ① DHW pipes to the apartments from the distribution boxes, ① Automatic metering data (heating and DHW) transmission, processing and billing system for the HOA(s). 	39.40	454
Building envelope retrofits <ul style="list-style-type: none"> ① Insulation of the roofs and basement ① External insulation of the blind walls ① Replacement of windows, balconies and entrance doors 	26.29	212-228**

* This estimate is based on an average floor space per dwelling in urban areas of 47,8 m² and based on a pilot project implemented in 2007 under the “Activities for Technical Development of Termocom” financed by SIDA.

** The estimate is based on a 5 floors building of a total of 60 apartments, assuming market prices in Chisinau. The EUR 228 million estimate corresponds to building retrofit investments for the entire building stock in the city of Chisinau. The EUR 212 million estimate considers only investments in multifamily buildings supplied by the DH system.

75. International experience shows that investing in energy efficiency is the most cost-effective and efficient way of helping the consumers meet the growing energy needs, manage their bills and comfort, and reduce greenhouse gas emissions. However, experience in the region shows that energy efficiency improvements in multi-apartment buildings are a challenging undertaking, which requires a concerted effort by the national and local governments, homeowners, and the private sector to successfully scale-up energy efficiency programs.

76. Implementing an effective energy efficiency program in Moldova would therefore need the adoption of a supportive government policy and a regulatory framework that may include the following specific actions:

- ③ Adoption of the legislative and regulatory framework including primary and secondary legislation for energy efficiency, drawing on EU standards for guidance;
- ③ Institutional reforms and capacity building including the creation of an Energy Efficiency Agency in charge of recommending, developing, promoting, implementing and monitoring the national EE undertakings;
- ③ Financial mechanisms. Establishment of the Energy Efficiency Fund created in 2007 by the Law on Renewable Energy to complement the funds that could be used from commercial banks. Other financing supportive mechanisms may include: fiscal or tax policies to financially support investment in energy conservation, as well as financial remediation measures, where the government or energy providers would create special channels for end users to access financing. However, the primary focal point for a sustainable energy efficiency investment program would be local commercial banks;
- ③ Public awareness strategy. This strategy should be designed in a manner that provides broad coverage and convinces energy consumers of the short-, medium-, and longer-term financial, health, and environmental benefits.

Annex 1. Country background and energy sector overview

I. Country background

1. Moldova is a small, landlocked, and densely populated country. It covers an area of 33.8 thousand square kilometers. Although very close to the Black Sea, Moldova is a landlocked country, located between Romania and Ukraine. About two-thirds its 3.6 million people live in the rural areas. The only significant urban area, the capital city of Chisinau is home to about 22% of the population. Moldova is one of the poorest countries in Europe, with a gross national income per capita of \$1,210 in 2007 (GNI, Atlas method).

2. Since 2000, Moldova's performance in achieving macroeconomic stability and the resumption of growth has been good: real GDP growth averaged 5.8% for the past eight years. Such economic recovery moved 40% of the population out of poverty between 1999 and 2004, the largest decline among ECA countries. In 2007, the national poverty rate stood at 25.8%.

3. Economic growth was linked to a massive inflow of migrant worker's remittances, (amounting to over 30 percent of GDP in 2007). As a result, Moldova has weathered a number of economic shocks over the last few years. In spite of severe terms of trade shocks (in the form of substantially higher energy prices), Russia's export bans on its main export (wine), and a significant drought that devastated the agriculture sector, economic growth slowed to 3 percent in 2007, but reached 7.2% in 2008.¹⁸

4. However, the global economic downturn has significantly worsened its economic outlook. Like most countries in the region, Moldova has been hit hard by the global economic crisis. Real GDP is projected to shrink by at least 9% in 2009. With Moldova's main economic partners experiencing a significant slowdown,¹⁹ exports and remittances have already fallen sharply. The current account deficit is expected to remain large despite the rapid import contraction. A large external financing shortfall is emerging due to low capital inflows. Without additional measures, the budget deficit will increase to above 11% of GDP in 2009, a level which cannot be financed without putting severe strains on the economy.²⁰

5. Reducing the prospects for a long deep and prolonged recession will depend on maintaining macroeconomic stability. Ensuring that the entities providing energy services are financially viable –not a drain on the state budget. Improving energy efficiency by reducing waste, will thus be an important element to help reduce the country's energy expenses. In 2008, the energy import bill accounted for about \$900 million, which is equivalent to 16% of GDP, and 16% of total imports. The analysis presented on this Policy Note has therefore a direct relation to Moldova's medium and long-term objective of achieving macroeconomic sustainability and promoting sustainable growth.

¹⁸ The World Bank, 2008. Moldova Country Economic Brief.

¹⁹ In 2009, the IMF forecasts EU economic growth to be negative (-3.3%), while Russian and Ukrainian economies are expected to register real GDP growth rates of -6% and -8%, respectively. International Monetary Fund (IMF), World Economic Outlook Database, April 2009.

²⁰ Statement by an IMF Mission at the end of a visit to Moldova. Press Release No. 09/206. June 10, 2009

II. Energy sector overview

6. Key challenges:

- ③ High dependency on imported energy
- ③ High energy intensity
- ③ Energy balance dominated by imported natural gas from a single source
- ③ High vulnerability to external gas price shocks
- ③ Limited and outdated domestic electricity generation capacity

A. Energy supply and demand

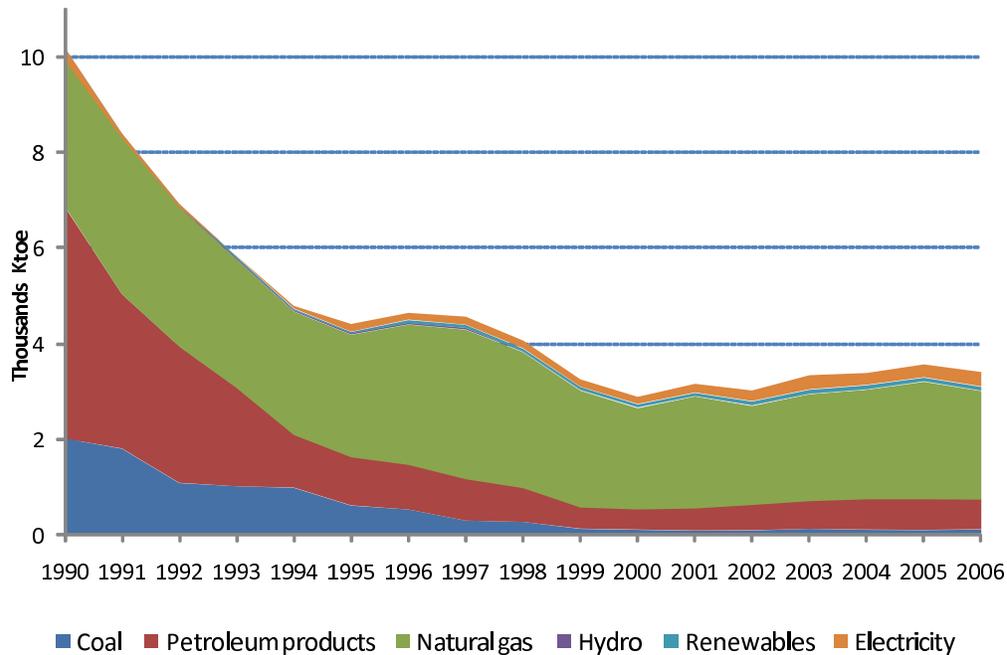
7. Moldova has few natural resources and is entirely dependent upon imports for its primary energy requirements, as well as for inputs for its manufacturing industries. In 2008, energy imports covered 97% of the total primary energy needs.

8. In 2006, total primary energy supply (TEPS) reached 3.4 Mtoe, or almost 35% of the 1990 level. This 16-year period was characterized by an important change in the country's energy mix, as well as in the sectoral breakdown of consumption at end-uses (see Figure 1). Natural gas now dominates the energy balance, with 67% of TEPS, followed by petroleum products (19%), electricity (9%), and minor quantities of coal (2.5%) and renewables (2.2%).

9. Moldova's total final energy consumption (TFC) was 2.2 Mtoe in 2006, about one third of the 1990 level. Between 1993 and 2006, the largest consumer in the country was the residential sector, which increased its share of TFC from 26% to about 39%, respectively. During the same period, the agriculture's sector share dropped precipitously from 13% to 4%, along with the decline in production and export of food and agricultural products. Industry and transport's share of TFC remained relatively modest,²¹ of between 20% and 15%.

Figure 1. Moldova total primary energy supply by fuel, 1990-2006 (000's Ktoe)

²¹ By comparison, industry consumes over 40% of TFC in Ukraine and Romania and 30% in Germany.



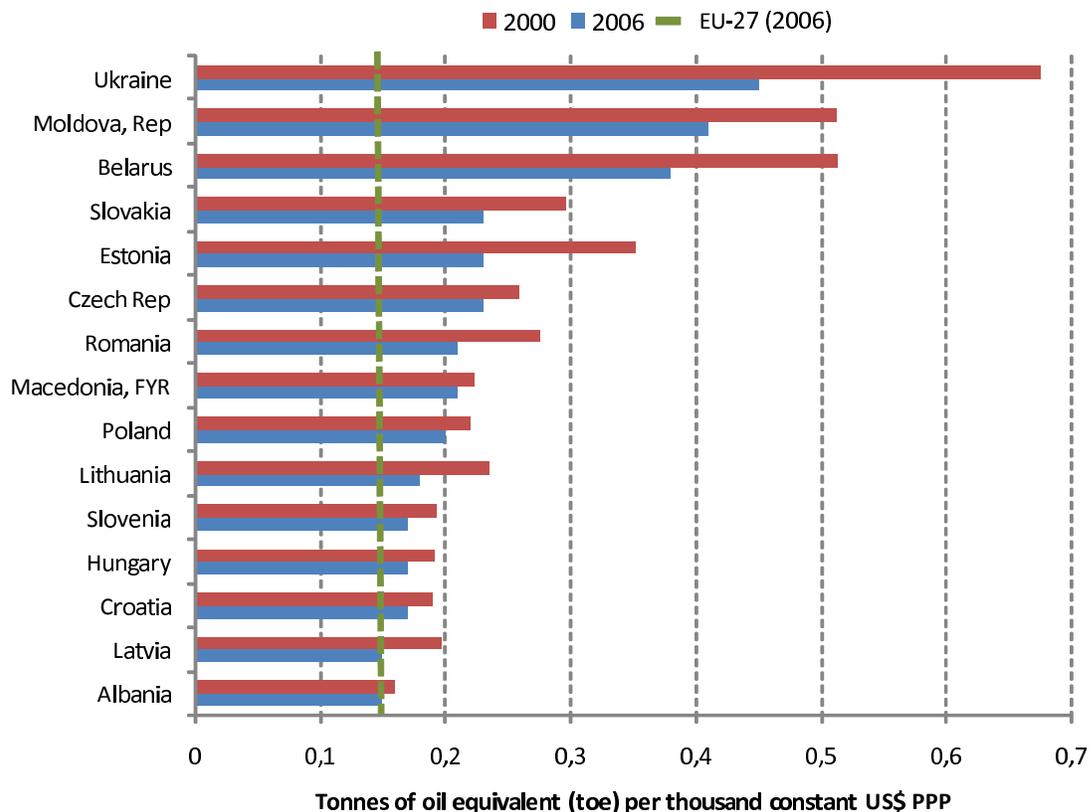
Source: International Energy Agency. Energy Balances of Non-OECD countries.

B. Energy intensity

10. Energy intensity was almost halved since 1990. However, it is still amongst the highest in the region. In 2006, it stood at 1.8 toe per thousand USD of GDP (in year 2000). Measured at purchasing power parity (PPP), energy intensity was 0.41 toe per thousand USD of GDP (PPP year 2000), about two times energy intensity of Romania and almost three times energy intensity of EU-27 (see Figure 2). On the other hand, per capita consumption of energy in Moldova (0.77 toe per capita) is significantly below energy consumption in Romania (1.86 toe per capita) and EU-27 (3.69 toe per capita), which indicates a relative “energy poverty” of Moldova.

11. Moldova's strategic choices regarding the mix of energy imports, technological options for energy generation, transportation and use were developed during the Soviet era. They are driven by economic development objectives and conditions, in which inexpensive energy and central planning were major elements. This led to high levels of energy intensity, which in turn reduces the competitiveness of national industries and poses a bottleneck to growth.

Figure 2. Energy Intensity of Moldova and selected countries



Source: International Energy Agency

C. Energy sector reform

12. Moldova responded slowly to the rapidly increasing prices of energy imports after independence in 1991. The Government, acting simultaneously as policy maker, regulator, owner, and utility manager, was slow in passing the increase to energy consumers and was not able to pay the difference between the supply costs and consumer tariffs. This resulted in large energy-related quasi-fiscal deficit (estimated to be at about 5% of GDP in 1998 and 1999), financed in large part through asset consumption and accumulation of debt (mainly in the form of payment arrears). As result, the country accumulated large external debts. In parallel, financial discipline in the sector weakened, quality of management deteriorated, and corruption became widespread. The companies had increasing difficulty in maintaining supply and shortages in electricity and gas supply developed.

13. To avert the escalating energy crisis in the mid 1990s, Moldova embarked on an ambitious set of reforms in the energy sector, whose main objective was full commercialization of energy supply, accompanied by appropriate social policies implemented through fiscal instruments to protect the most vulnerable groups. The main elements included:

- ① the development of a new, market-oriented legal framework;
- ② establishment of an independent energy regulatory agency (ANRE), in 1997;
- ③ restructuring and corporatization of the industry whereby the country's vertically integrated electricity monopoly was unbundled;

- ④ privatization of three out of five electricity distribution companies covering about 70% of the market;
- ④ divestiture of state share in the gas industry with the majority share in the country's monopoly gas supplier sold to Russia's Gazprom in exchange for a portion of debt; and,
- ④ adjustment to the level and structure of tariffs where tariffs for all consumers were increased and equalized.

14. As a result of these reforms, payment collections increased, especially in the electricity sector. Collection rates reached 92% for gas and 98% for electricity in 2005. Further, the quasi-fiscal deficit has been significantly reduced and the government stopped accumulating external debt for gas and electricity imports.

D. Electricity sector overview

Electricity consumption

15. After a significant drop in demand between 1992 and 2001 that followed the country's long economic recession, electricity consumption has been recovering by a very strong growth rate of 6% per year. It increased from 2.2 TWh in 2001 to 3.2 TWh in 2008.

16. Demand growth has been fuelled by a significant increase of residential and commercial consumption. It should be noted however, that residential consumption grew from a very low level. Between 1997 and 2003, monthly household electricity consumption averaged 61–84 KWh. (Sixty KWh a month was enough to run only a refrigerator for 5.5 hours a day and three 75-watt light bulbs for 4 hours a day.) In the early 2000's, many Moldovans –especially the poor– were extremely restricted in their electricity consumption and had to cope by consumption reducing measures, such as unplugging appliances.²² From 2004, substantial income growth and improved electricity supply, particularly to rural areas, led to an increase of household's consumption by nearly 50%.

17. In 2008, the structure of electricity demand shows that residential and industrial consumers are the largest categories, with 42% and 32% of total consumption. The commercial sector constituted only 13%, the government 9% and other sectors the remaining 4%.

Power generation and supply

18. Of a total installed capacity of 496.5 MW in 2005, two Heat and Power Cogeneration (CHP) plants located in Chisinau accounted for 62% of total, two hydropower plants for 13%, one CHP plant in the city of Balti for 5% and 10 CHP plants within sugar factories for the remaining 2%. All generation companies are state-owned and supply electricity only to the domestic market.

Table 1. Installed generation capacity in Moldova

²² People and Power Electricity Sector Reforms and the Poor in Europe and Central Asia. ESMAP, 2003.

	Right Bank of the Dniestr river					Left Bank of the Dniestr river	
	CET-1	CET-2	CET-Nord	Hydro Power Pant Costesti	CHPs in sugar factories (SFPP)	MRPS*	HPP Dubasari
Electric Capacity (MW, 2005)	66	240	28,5	16	98	2520	48
Availability (hours/year, 2005)	8542	8011	3990	6137	720	NA	NA
Electricity produced (GWh, 2008)	120,7	640,7	55,2	81,8	6,6	NA	NA
Type of fuel used	gas, HFO	gas, HFO	gas, HFO		gas, HFO	gas, coal, HFO	
Year of construction	1951	1976	1956				

* Moldovan Regional State Power Station (in the Transnistria Region): Since November 2005, MRPS has been covering demand of the left bank of Nistru River and currently it supplies electricity to Russian Federation. No data are available regarding the operation of this power plant in 2005.

Source: Energy Strategy of the Republic of Moldova to the year 2020, 2007

19. The capacity use of existing CHP plants is very low due to their extreme worn-out condition. CHP 1 and CHP 2 have been in operation for more than 55 years, and CHP1 for more than 35 years; most notably, without any major upgrading.

20. Electricity is produced by CHPs plants simultaneously with heat, which supplies the centralized district heating systems in the cities of Chisinau and Balti. The main fuel of electricity generation is natural gas. Heavy fuel oil is only used occasionally, as for example during gas supply disruptions.

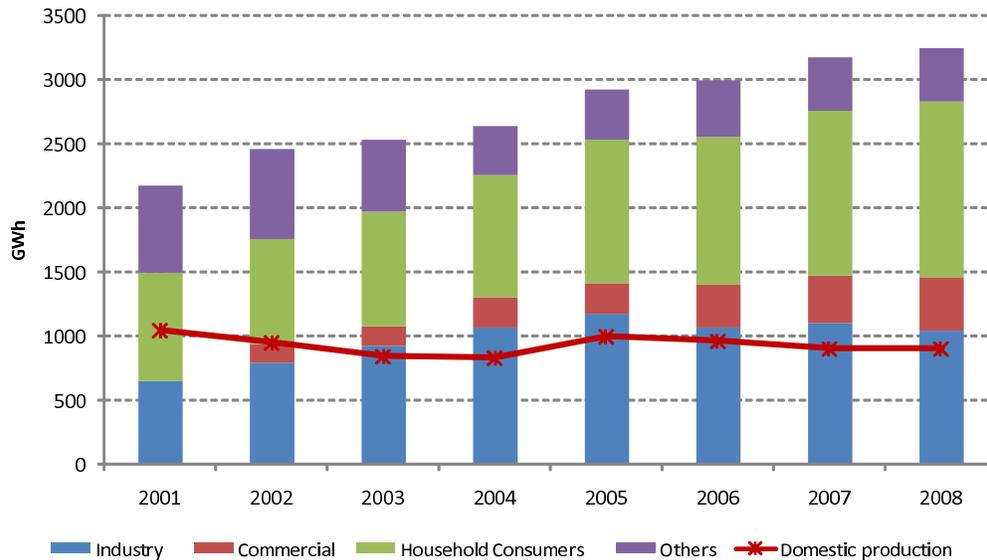
21. Domestic electricity production stood at 0.9 TWh in 2008. It declined by 25% from its 1997 level of 1.2 TWh. During the past year, it covered only 23,4% of electricity demand, compared to 37.6% in 1999 (see Figure 3). The declining share of internal production in total electricity consumption is explained by a decrease in available generation capacity due to the worn-out conditions of CHP plants. In addition, the recent increase in the cost of power production from CHPs (about 10 USDcents/KWh in 2008) has also reduced the competitiveness of CHP plants production vis-a vis low cost imports from Ukraine (3.9 UScents/kWh in April 2008).

22. The bulk of domestic electricity production is from CHP plants located in Chisinau (0.76 TWh). In 2008, the share of domestic electricity generation from CHP 2 and CHP 1 was of 71%, and 13%, respectively. Hydropower plant's share stood at 9%, or 82 GWh. However, depending on annual hydrology, hydropower generation can vary greatly: from 33 GWh (2007) to 121 GWh (2002). The CHP plant Nord accounts for about 5% of domestic production and sugar factories power plants are operated mostly seasonally to cover energy needs at the stage of processing sugar beet. (They account for about 1% of total domestic generation.)

23. All electricity demand in excess of domestic production is met by imports. These represent today about 80% of the electricity supplied at the wholesale electricity market. Electricity is brought essentially from Ukraine, and some minor quantities from Romania. Imported electricity reached a maximum of 3,54 TWh in 1997. During 2000-2005, electricity

supply from Moldova Regional State Power Station (MRPS) situated in the Left Bank of the Dniestr river, and imports from Ukraine, stabilized around 2,5 TWh/year. Since November 2005, MRPS has not been supplying electricity to the Moldova (Right Bank)

Figure 3. Electricity consumption by sectors and domestic electricity production, 2001-2008



Source: Energy Balance of the Republic of Moldova, 2007 and ANRE

Electricity network

24. Moldova operates a transmission system consisting of 4411 Km of 400KV-35 lines. The electricity system in Moldova operates synchronously with the Ukrainian electricity system. Interconnexions to adjoining countries can ensure electricity transit at a level of 4-5 TWh per year. They include six high voltage electric lines of 330 kV with Ukraine, one 400 kV overhead power line with Romania and Bulgaria and three overhead power lines of 110 kV with Romania. Transmission losses of 3.8% in 2006 are considered reasonable, since the system also includes 35KV lines.

25. The distribution network is extensive (a total of 58,763 Km of low voltage lines) with more than 98% of the population having access to electricity. The distribution system is divided into five regions, namely the Capital, Central, South, North and West.

26. Distribution losses have reduced considerably over the past five years. It was estimated in 2002 that losses were between 25% and 35% percent. While perhaps about 12-15% was technical, the remaining losses resulted mainly of theft through meter tampering and illegal connections bypassing meters. Significant efforts at strengthening payment discipline and at upgrading physical infrastructure have brought total losses down. In 2008, distribution losses, both technical and commercial stood at about 15% (see table 2).

27. Overall, the efficiency of the electricity system has improved significantly. Total system losses dropped from over 40% in 2001 to about 19% in 2006. However, this is still high compared to western European standards (not higher that 10%)

Electricity market

28. Along with the energy sector reform, the electricity sector in Moldova has been functioning on the basis of a bilateral contracts model since 1999. Under this trading regime,

distribution companies are responsible to buy electricity needed for their regional franchise from domestic generators, foreign generators or import agencies. They are also obliged to absorb domestic electricity production.

29. Electricity is transported under a non-discriminatory open access regime by the Independent Transmission System Operator, Moldelectrica, which owns and operates the transmission network.

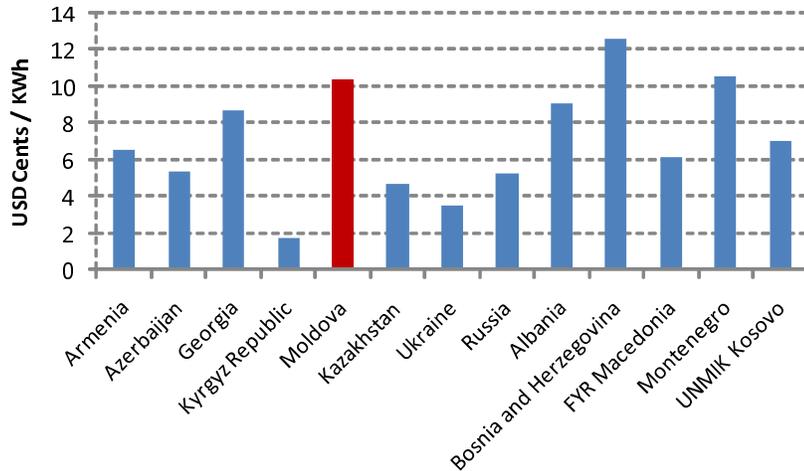
30. Moldova's electricity market has been partially liberalized since 2003. Eligible customers have the right to contract electricity directly with any supplier, including from abroad. In a first stage, power market has been liberalized up to 10 % of domestic electricity consumption. Eligible customers are those consumers connected to the transmission network of 35-110 kV years. However the liberalized market is very small. In 2008, it accounted for only 3.6% of electricity demand.

31. The main participants in the electricity market are:

- ④ four state-owned generation companies: CHP1, CHP2, CHP Nord, and one thermal power producer MRPS;
- ④ one state-owned transmission and dispatch company, Moldelectrica, acting as a system operator. It owns and operates the transmission network;
- ④ three distribution companies. One owned by Spanish company RED Union Fenosa (UF), operating the three regional distribution networks (Chisinau, Centru and Sud) which cover 70% of the population. Two are state-owned: RED Nord and RED Nord-West. All companies hold licenses for distribution and supply of electricity at regulated tariffs, and have exclusive rights to supply power to all non eligible customers within their authorized territory;
- ④ 12 companies hold licenses for supply of electricity at non-regulated tariffs

32. The electricity market is regulated by an independent energy regulator, ANRE, which is responsible for licensing, establishing quality of service standards, and consumer protection. The regulator also develops the methodology and sets tariffs of electricity and heat produced by CHPs as well as tariffs for end-consumers supplied by distribution companies.

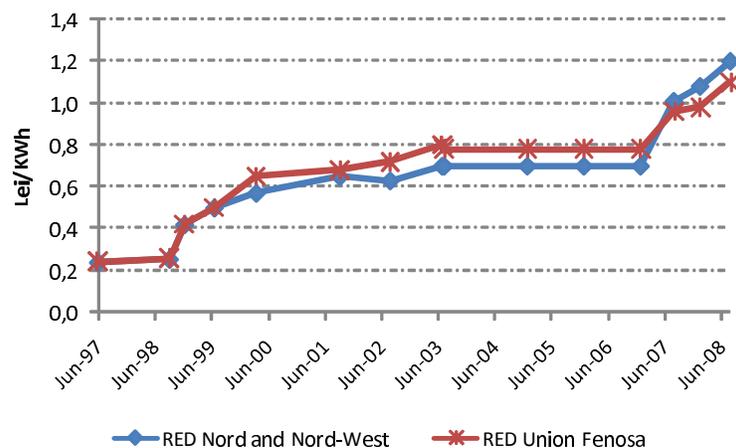
Figure 4. Weighted average electricity tariffs for residential consumers, 2008



Source: ERRA tariff database

33. ANRE's methodology for electricity and heat produced by CHP plants is based on a cost-plus approach. Tariffs for CHPs are composed of four main elements: allowed normalized production cost, profit element, return on investments and adjustments from deviations of past period. In August 2008, tariffs were adjusted as a result of a significant increase in gas prices. Electricity tariffs grew on average by 22% (see figure 5), while tariffs for heat sold increased on average by 36.4%.

Figure 5. Electricity tariffs for end-consumers, 1997-2008



Source: ANRE

34. The average electricity tariff for end-consumers in Moldova is relatively high by regional standards. In 2008, the average residential tariff was of 10.3 USD cents/KWh, compared to 3.5 USD cents/KWh in Ukraine, and 12.5 USD cents/KWh in Romania (see figure 4).

35. End user electricity tariffs are set according to a cost plus methodology for customers supplied by RED Union Fenosa and a single tariff for RED Nord and RED Nor-West. After a long debate on the new tariff methodology, which was adopted by ANRE in August 2007, Union Fenosa (UF) and ANRE reached a “Conciliation Agreement” on June 20, 2008. The agreement resolved main outstanding issues related to:

- ③ the rate of return on investments (about 15% for 2008). This compares to RoR of 23%, which was agreed in the privatization agreement for the period 2000-2007, and the RoR of 13% which ANRE adopted in August 2007;
- ③ the applicable capital base and the value of new assets (investments) put into operation after the privatization.

36. This is a major step in improving transparency in the electricity market and the harmonization of the regulatory environment with international experiences and practices in this domain. Under the agreement UF is obliged to invest at least US\$14 million annually, which is considered a minimum level of investments needed given a high level of depreciation (75%) of the power distribution assets operated by UF, and a relatively high level of distribution losses. Reducing distribution losses remains a priority for UF since the tariff methodology allowed for “normative” (technical) distribution losses up to 14.4% in 2007 (see table 2). UF estimates that it can save more than 60 million Lei annually by eliminating its “over-normative” (commercial) losses.

37. In 2008, tariffs for electricity supplied to consumers by RED Union Fenosa are 0.79 Lei/kWh for consumers connected to 110 kV networks and 0.110 Lei/kWh, for all other categories of consumers. RED Nord and RED Nord-West apply a unified tariff – 0.12 Lei/kWh for all categories of consumers. Application of unified tariffs for electricity supply is motivated

by the fact that it is necessary to remove the cross-subsidization for household consumers using electric cookers.

Table 2. Regulated tariff for CHP plants and distribution companies, 2008

Tariff for electrify and heat supplied by CHP plants			
	CHP1	CHP2	CHP Nord
Electricity supplied by CHP (Lei/KWh)	1.3838	1.0428	1.0656
Heat supplies by CHP (Lei/Gcal)	512.05	410.44	786
Distribution tariffs (Lei/KWh)			
	RED Union Fenosa	RED NORD/ RED Nord-West	
Clients of the 10KV lines	0.79		
All other consumers	1.10	1.20	

Source: ANRE Decision No. 300 of July, 30 2008

E. Natural gas sector overview

Gas consumption and uses

38. Natural gas consumption in Moldova reached 1.1 billion cubic meters (bcm) in 2008. The energy sector (CHP plants and other thermal stations) is the largest gas consumer, with about 43% (0.4 bcm) of total demand; residential sector is the second largest consumer with more than 28% (0.31 bcm). The remaining (27%) is consumed by the industrial sector and commercial and public services.

39. Gas consumption declined for two consecutive years in 2007 and 2008, by 8.6% and 6.5%. The drop is due to a significant decline in gas consumption by households and the energy sector. Their cumulated drop in demand was of 13% and 9% for households and thermal utilities. Besides climatic factors (warm winter) the gas price increase (as we will see latter) was obviously a major factor for this reduction. By the time being it is not clear whether this will have a lasting effect on gas consumption.

40. In the residential sector gas is mostly used for cooking. The share of gas used for heating purposes is relatively small, but increasing. The major bottleneck is to its development is insufficient distribution capacities. In the public sector, gas is mostly used for heating produced by building boilers, which are typically outdated and have low efficiencies. In the industrial sector gas is used for industrial process and heating.

41. Natural gas supply is highly uneven during the year; consumption during the cold season is 8-10 times higher than in the summer season. However, Moldova does not have any storage facility. To cover seasonal consumption peaks natural gas is stored at the Bogorodceni (Ukraine) underground storage facility.

Gas supply

42. Natural gas is entirely imported from Russia by the state-owned gas monopoly Gazprom.

43. The national natural gas system is pretty extensive. Two major upstream gas pipelines supply Russian gas Moldova through Ukraine. Total high-pressure network length is about 1,400 km, there are four compressor stations, 74 distribution stations and several low pressure

distribution networks. At the end of 2006 the total length of high, medium and low pressure gas pipelines was about 14,400 km.

44. Moldova is also an important gas transit country. In 2006, more than 20 bcm of gas (18 times the country's domestic consumption) transited through the Republic of Moldova to Balkans countries. In 2008, transit fees were of about 2,5 USD per thousand cubic meters per 100 Km, compared to 1.7 USD per thousand cubic meters per 100 Km in Ukraine in 2009.

45. Natural gas supply infrastructure has developed significantly over the past years with important state support. Under the National Program for the Gasification of the Republic of Moldova, the government financed the construction of gas networks of over 8000 km length with an approximate value of 100 mln. USD between 2000 and 2007. These networks are state property, though this has not increased the state share (36.6%) in the "Moldovagaz" JSC (as we will see latter on). The main investments were the following:

- ③ Connexion of 2007 all towns and over 500 rural settlements to the gas system.
- ③ Commissioning of the Tocuz-Cainari-Mereni (TCM) pipeline, with a transportation capacity of 1.8 bcm. It enhances supply security of the country by increasing delivery capacity to Chisinau, where electricity production facilities are located. This pipeline has been financed by the state budget (65%) and "Moldovagaz" (35%).

Gas market

46. Natural gas supplies are imported by the Russian-Moldovan joint venture JSC Moldovagaz (*Moldovagaz*), which is owned by "Gazprom" of Russia (50%), by the Republic of Moldova (36.6%) and by the Transnistria region (13.4%). Moldovagaz is the sole importer of natural gas and the owner and operator of: the transit upstream pipelines that deliver gas to Balkan countries, the transmission network, as well as of most of the distribution network.

47. The corporate structure of Moldovagaz includes the following companies, which are registered registered as Limited Liability Companies and perform different functions:

- ③ two transmission companies: "Moldovatrangaz" (operating in the Right Bank) and LLC "Tiraspoltrangaz" (operating in the Transnistrian region);
- ③ 12 distribution companies in the Right Bank, with branches in every regional centre and 6 distribution companies in the Transnistrian region, which operate distribution networks and supply natural gas to end consumers on a contract basis; and
- ③ a company specialized in importing and distributing liquefied gas.

48. There are several other distribution license holders, which build and operate their own networks. However, their market share is very modest (only about 1% of total gas supplied in the country). Moldovagaz is the de-facto gas monopoly in the country.

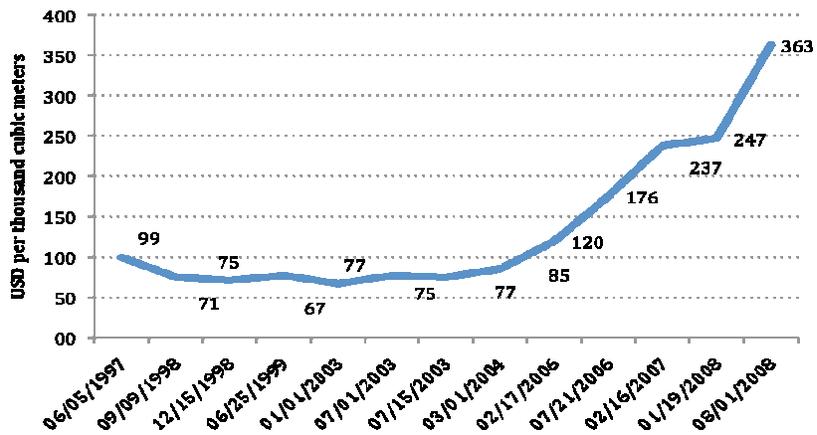
49. Moldovaz and the other distribution companies supply natural gas to consumers at regulated prices. ANRE sets the methodology and tariffs for gas consumers accordingly to a cost-plus methodology. Prices are linked to the long-term gas supply agreement with Gazprom.

50. During several years, gas tariffs in Moldova were relatively low, compared to other countries in South East Europe, reflecting significant discount at which Moldova was able to

secure gas supplies relative to the European parity price.²³ Natural gas import prices remained unchanged (at \$80/mcm) for ten years until 2005, compared to an European parity price in the order of \$230/mcm (World Bank 2006). However, at the end of 2005, Gazprom announced that it was going to increase the price of natural gas supplied to Moldova. Following several months of discussion, an agreement between Moldova and Russia was finally reached about a gradual introduction of pricing principles used by Gazprom for exports to the EU. According to the agreement, the price of natural gas in Moldova will reach the EU parity level by 2011. Between 2005 and 2008, gas prices passed from \$80/mcm to \$253/mcm.

²³ The European parity price would be the price of natural gas supplied by Gazprom to Romania and other SEE countries net of transit costs after Moldovan border.

Figure 6. Evolution of average gas tariff for end-consumers 2001-2008.



Source: ANRE

51. Increasing price of imported natural gas directly affected gas prices for end-consumers and for gas supplied to CHP plants. In 2008, ANRE approved a significant increase in gas tariffs. The average tariff for end-consumers doubled in nominal terms from 1,553 Lei/mcm in 2006 (120 USD/mcm) to 3523 Lei/mcm (363 USD/mcm) in August 2008 (see figure 6).

Annex 2. How to mitigate the consequences for poverty of a rise in the price of District Heat in Chisinau

I. Background.

1. The purpose of this annex is to present basic facts about poverty among consumers of district heat in Chisinau, to estimate the likely consequences for poverty of an increase in the price, and to discuss ways to mitigate the impact on the poor.

Data

2. The source of information for this note is the Moldovan National Bureau of Statistics' (NBS) Household Budget Survey (HBS) for 2007.

Table 1. Distribution of households over types of heating in Moldova and in Chisinau, 2007

	National		Chisinau city	
	Obs.	% pt freq	Obs	% pt freq
District heat network	737	19.3	525	77.2
Individual (autonomous)	883	15.2	143	19.1
Natural gas stove	383	5.8	16	1.9
Wood, coal, oil stove	3981	58.5	19	1.6
Electric heater	56	0.9	4	0.2
None	12	0.3	1	0.1
Total		100.0		100.0

Source: National Bureau of Statistics Household Budget Survey & World Bank computations.

Types of heat in Chisinau

3. District heat is the dominant type of heat consumed in Chisinau, and is especially important in the supply of heat to apartment blocks. Over three-quarters of households and of individuals in Chisinau receive their heat from the central heating network, compared to less than 20 percent at the national level (Table 1). About 185,000 households and 487,000 individuals in Chisinau receive district heat.

Poverty rate among Chisinau district heat consumers

4. On average, Chisinau residents who consume district heat experience a higher level of well-being, as measured by their spending on goods and services, than other Moldovans. The national poverty rate in 2007 was 25.8 percent. Only 9.5 percent of Chisinau residents who consume district heat spend less on consumption than the national poverty line of MDL 747 per adult equivalent (Table 2). The 9.5 percent poverty rate translates into about 18,000 households and 46,000 people.

Table 2. Poverty Rate & Number of Poor among District Heat Consumers in Chisinau, 2007

	Less than poverty line	Less than that urban subsistence minimum
Percentage of poor individuals	9.5	51.4

Note: number poor individuals	46,444	250,563
Note: number poor households	17,953	85,512

Source: National Bureau of Statistics Household Budget Survey & World Bank computations.

5. The national poverty line of MDL 747 per adult equivalent per month provides relatively low purchasing power at Chisinau prices. An alternative measure of lack of well-being is the percentage of individuals in Chisinau who consume district heat and who spend less than the urban subsistence minimum for 2007 of slightly less than MDL 1,190 per capita per month. This is 51.4 percent of Chisinau residents –even though MDL 1,190 provides for consumption of just more than US\$ 100 per person equivalent per month (Table 2).

6. Age is a potential criterion for targeting. The population aged 60 years old and over has a poverty rate of nearly 24 percent, the highest of any age group (Table 3). About 36 percent of poor central heat consumers are over 60, while about 42 percent are 26 to 59 years old.

Table 3. Poverty & Age among District Heat Consumers in Chisinau, 2007

	0-17 y.o.	18-25 y.o.	26-59 y.o.	60+ y.o.	Total
Poverty line					
% below line (poverty rate)	7.4	3.8	8.2	23.7	9.5
% distribution of the poor	16.0	6.6	41.6	35.8	100.0
Urban subsistence minimum					
% below line (poverty rate)	59.7	39.9	49.1	60.7	51.4
% distribution of the poor	23.9	12.9	46.2	17.0	100.0

Source: National Bureau of Statistics Household Budget Survey & World Bank computations.

Poverty among pension and social assistance recipients

7. In Chisinau, poverty among people who consume central heat is concentrated among pensioners (42 percent) and salary-earners (27 percent). About 24 percent of pension recipients who consume central heat are poor and only about 9 percent of people who depend on social assistance are poor (Table 4). Almost 65 percent of pension recipients spend less than the urban subsistence minimum; and about 54 percent of social assistance recipients spend less than the urban subsistence minimum.

Table 4. Poverty by main source of income among district heat consumers in Chisinau, 2007

Sources of income, of which:	Paid non-agric work	Self-employed	Pensions	Social payments	Maintenance	Remittances
Poverty line						
% below line (poverty rate)	5.9	3.0	24.3	9.3	8.4	0.0
% distribution of the poor	26.6	1.1	42.0	2.8	24.9	0.0
Urban subsistence minimum						
% below line	44.9	39.2	64.9	54.4	59.8	18.2
% distribution of the poor	37.6	2.6	20.8	3.0	33.0	0.7

Source: National Bureau of Statistics Household Budget Survey & World Bank computations.

8. About 63 percent of poor households are covered by the social insurance system (which consists of pensions and unemployment insurance) and about 45 percent are covered by social assistance (Table 5). However, the percent of benefits received by the poor is relatively low: about 16 percent for social insurance and 10 percent for social assistance.

Table 5: Social Benefits and Poor District Heat Consumers in Chisinau, 2007

		Poverty line		Subsistence minimum	
		Social insurance	Social assistance	Social insurance	Social assistance
Coverage: % of households receiving benefit	Non-poor	33.6	25.1	30.7	24.1
	Poor	63.0	45.4	41.7	29.7
Targeting: % of benefit received by poor households		15.8	10.3	52.4	46.7
Adequacy: % share of benefits in consumption expenditure	Non-poor	10.5	1.7	9.1	1.6
	Poor	37.8	3.5	16.9	2.2

Source: National Bureau of Statistics Household Budget Survey & World Bank computations.

II. Impact on poverty of an increase in the price of district heat

9. The price of district heat at the time of collection of the HBS for 2007 was 223 MDL per gigacalorie. A simulation of an increase from 223 to the estimated cost recovery price of 817 MDL per gigacalorie yields a 5 percentage point increase in the poverty rate as about 24,000 people slip below the poverty line (Table 6).

10. This increase in poverty may be overstated, since the simulation assumes that consumers do not reduce consumption of heat when its price rises. This is realistic over the near-term, since billing for heat is assessed from the apartment block meter and there are no individual meters in apartments. However, consumers tend to substitute into cheaper forms of heating over the medium and long-term. Furthermore, the simulation assumes that nominal consumer income does not change when the price of district heat rises.

Table 6. Direct impact on poverty among Chisinau district heat consumer of an increase in the price of the district heat from 233 to 817 MDL per gigacalorie (in percentage points)

	Before increase in heat price: 2007 actual		After increase in heat price	
	Poverty rate	# Poor people	Poverty rate	# Poor people
Percent below poverty line (poverty rate)	9.5	46,493	14.5	70,651
Percent below urban subsistence minimum	51.4	250,563	57.8	281,826

Source: National Bureau of Statistics Household Budget Survey & World Bank computations

11. The simulation of an increase of the price of district heat from the present price of 540 to 817 MDL per gigacalorie assumes that the distribution of the expenditures of district heat consumers in Chisinau in 2008 is similar to that of 2007. The result shows a 1.2 percentage point increase in the poverty rate as nearly 4,500 people slip under the poverty line (Table 7).

Table 7. Direct impact on poverty among Chisinau district heat consumer of an increase in the price of the district heat from 540 to 817 MDL per gigacalorie (in percentage points)

	Before increase in heat price: 2007 actual		After increase in heat price	
	Poverty rate	# Poor people	Poverty rate	# Poor people
Percent below poverty line (poverty rate)	9.5	46,493	10.7	51,972

Percent below urban subsistence minimum	51.4	250,563	52.6	256,493
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Source: National Bureau of Statistics Household Budget Survey & World Bank computations.

III. Options for subsidy or transfer programs

Chisinau municipal assistance program

12. The Chisinau municipal government organized a subsidy program for poor district heat consumers. The program requires that applicants submit a form declaring that their income is below the present urban subsistence minimum for 2008, which stands at 1,450 MDL per person.

13. This plan does not appear realistic, since more than half the population of Chisinau fell below the urban subsistence minimum in 2007. This means that the subsidy would be expensive. Yet the Chisinau government hopes to pay this subsidy to about 10 percent of the population and has as a budget of only about 10 MDL million at present.

14. A subsidy program for poor Chisinau consumers of district heat may be a necessary component of any financial work-out for Termocom that involves raising the price of heat.

15. The social assistance system would have been an inefficient instrument for subsidizing district heat in 2007. However, the Ministry of Social Protection launched a new social assistance program that targets the poor in October 2008. This program selects beneficiaries, in part, on the basis of their declarations of income, and importantly, uses proxies for income to screen out relatively rich applications. The proxies are, for example, ownership of houses, vehicles, and consumer durables. (In contrast, the municipal government does not have any alternative way to verify the income declared by applicants for district heat subsidies.) The most equitable instrument to address poverty is therefore through the new social assistance program.

16. The municipal government of Chisinau can work with the new social protection office since the social protection personnel who process applications for the new social assistance program are located within the municipality.

17. The process would work as follows:

- ① The Chisinau government would determine the amount of the subsidy per beneficiary household. This would depend on the Chisinau government's budget and the estimated number of qualified applicants.
- ② The Chisinau government would invite recipients of the new social assistance programs to submit their Termocom billing number.
- ③ Finally, the Chisinau government would pay the subsidy directly to Termocom, rather than to the poor households, to assure that the subsidy reduces Termocom's deficit.

Annex 3. Assumptions on the Tariff Calculations

18. In order to calculate the required revenue (and tariff increase) for Termocom during 2009/2010 heating season, financial model was constructed based on assumptions made on revenue, expense and investments. The construction of the model was implemented by SWECO, with the financial assistance from Sweden and ESMAP.

Objective of the model

19. Based on the prediction on the future sales, operational cost and investments needs, the financial model constructed calculates the tariff that will generate adequate cash flow to cover all the required out flow of cash for the year, including the prioritized investments required for maintenance of service quality. The model output is the minimum required tariff at which cost-recovery can be achieved.

Assumptions in the model

20. Below are summaries of the assumptions made in the model. The details are provided in the Appendix:

Exchange Rate and Inflation – The projections on macroeconomic indicators are based on World Bank economic projections. It should be noted that with under the current circumstances of a global economic downturn, the projections made are only indicative and subject to change.

Gas Prices – Three scenarios were made for projections of the future gas prices - Reference, Low growth, High growth. The gas price projection was based on base case prices of World Bank gas price indicator database. For the calculation of required tariffs, the reference case scenario was used.

Heat Demand – Assumptions on heat demand were based on past trends and discussions with Termocom. Out of three scenarios – Average, Low and High – the Average case was used to calculate the tariff.

Restructuring of Payables – Assumption was made for accumulated trade receivables to be restructured into long-term debt (Maturity: 20 years, Interest Rate: 5%). The assumption was made solely for calculation purposes, and the terms indicated here, therefore, are only indicative.

Investment Strategy

Investments – Investment strategy used in the model is based on extensive consultation between Termocom and Bank staff. The investment is prioritized as follows: i) Priority investments – investments that address the immediate need for maintenance and sustained service levels, and ii) Long-term investments – investments that addressed the long-term goal of improvement in

efficiency to reduce the cost of supply. The prioritized investment plan is expected to yield IRR of 27% and reduction of heat losses by 7.2% from 2010 to 2024. (details given in Appendix and Table 7 of report).

Benefits from the investment strategy – The cost-benefit analysis indicates that the priority investment plan is economically viable. Over the assumed lifetime of 10 years, the priority investment plan achieves the positive Net Present Value (NPV) of about US\$ 25 million and Internal Rate of Return (IRR) of 24 percent without considering the environmental benefits of the plan implementation. With the consideration of the environmental benefits, the NPV becomes US\$ 32 million and IRR increases up to 28 percent.

Estimated cost and savings from Termocom investment plan

	Priority Investment Plan (2009-2014)	Long-term Investment Plan (2015-2024)
Estimated cost (million USD)	76	242.9
Estimated savings		
Cumulative fuel consumption reduction (thousand cubic meters of natural gas)	142,000	1,400,000
Reduction in heat losses (%)	1.6	7.2
Cumulative reduction in electricity consumption (million kWh)	4	46.4
Reduction in make-up water consumption (thousand tons)	615.4	3,709
Repair cost reduction (million USD)	0.5	2.2
Reduction of emissions (tons of CO ₂)	267,015	2,619,923

Source: Bank staff calculations

Output – Required Tariffs for Cost Recovery

As indicated in the main text, the required tariff for cost recovery is calculated as ***814 Lei/Gcal for 2009/10 heating season***. The tariff projections indicate that the tariff increases can be moderated once the efficiency gains from the proposed investments start to materialize.

APPENDIX

Assumptions in the Tariff Calculation Model

	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
Macroeconomic Projections (%)														
Inflation rate, LEU	7.9%	7.9%	7.9%	7.9%	7.9%	7.9%	7.9%	7.9%	7.9%	7.9%	7.9%	7.9%	7.9%	7.9%
Inflation rate, EUR	2.0%	2.0%	2.0%	2.0%	2.0%	2.0%	2.0%	2.0%	2.0%	2.0%	2.0%	2.0%	2.0%	2.0%
Inflation rate USD	3.0%	3.0%	2.0%	2.0%	2.0%	2.0%	2.0%	2.0%	2.0%	2.0%	2.0%	2.0%	2.0%	2.0%
Nominal value depreciation against EUR	5.8%	5.8%	5.8%	5.8%	5.8%	5.8%	5.8%	5.8%	5.8%	5.8%	5.8%	5.8%	5.8%	5.8%
Nominal value depreciation against USD	4.8%	4.8%	5.8%	5.8%	5.8%	5.8%	5.8%	5.8%	5.8%	5.8%	5.8%	5.8%	5.8%	5.8%
Nominal Risk-free rate of return, Moldova	8.4%	8.4%	8.4%	8.4%	8.4%	8.4%	8.4%	8.4%	8.4%	8.4%	8.4%	8.4%	8.4%	8.4%
Projections on GAS PRICES (USD/1000m3)														
Low growth	222.93	178.34	160.51	147.67	132.90	119.61	107.65	102.27	100.22	99.22	98.23	98.23	98.23	98.23
Reference	295.19	191.28	184.50	183.86	183.20	182.51	181.80	188.61	188.13	187.64	187.14	186.64	186.12	185.59
High growth	350.31	385.35	404.61	424.84	446.09	463.93	473.21	482.67	492.32	497.25	502.22	507.24	512.31	517.44
Heat Demand (1000 Gcal/Year)														
Low	1,223	1,183	1,144	1,106	1,069	1,034	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000
Average	1,655	1,600	1,547	1,496	1,447	1,399	1,353	1,353	1,353	1,353	1,353	1,353	1,353	1,353
High	1,439	1,391	1,346	1,301	1,258	1,217	1,177	1,177	1,177	1,177	1,177	1,177	1,177	1,177
Revenues and Required Tariffs based on Reference Case														
Required Revenues (million Lei)	1,094	1,162	1,185	1,218	1,127	1,136	1,963	1,858	1,306	1,313	1,196	1,244	1,288	1,322
Required Tariffs (Lei/Gcal)*	814	868	921	907	923	1462	1604	1242	1114	1045	1046	1084	1116	-

Prioritized Investments Plan

(million USD)	Priority Investment						Secondary Priority Investment										
	2010	2011	2012	2013	2014	Total priority investments	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	Total secondary investments
Conversion of group heat substations (GHSs) into individual heat substations (IHSs)	5	5	5	5	5	25	5										5.0
Modernization of the distribution network, connection of IHSs	5.8	5.8	5.8	5.8	5.8	29	5.8										5.8
Replacement of the transmission network, including the installation of modern valves	5	5.2	7.1	1	1.7	20	4	5	6	7	8	10	12	12	13	13	90.0
Installation of variable frequency drives			0.5	0.5		1	1	1									2.0
Metering and Automation of the DH system	0.3	0.3	0.4			1	0.5	1.5									2.0
Improving energy efficiency at the existing CHP capacity																	
Conversion of major HOBs into CHPs							52.0	52.0									104.0
Construction of mini CHPs on the bases of distributed GHSs, distributed HOBs, pump stations									14.4	12.0	0.9						27.2
Construction of mini CHPs on the bases of distributed HOBs							2	0.2									2.2
Switching from electric engines to gas engines at the pump stations							1.0	1.9	0.8								3.6
Replacement of the above-the-ground pipelines insulation							1.1	1.1	1.1	1.1	1.1	1.1					6.9
TOTAL INVESTMENTS	16.1	16.3	18.8	12.3	12.5		69.4	60.6	21.5	20.1	10.0	11.1	12.0	12.0	13.0	13.0	

Total priority investment	76.0
Total secondary investment	242.9
Total investment	318.9

Annex 4. Energy Efficiency at Demand-Side: Investment Needs and Public Awareness Strategy

I. Preface

1. This annex is composed of two sections: (i) Energy Efficiency Investment Needs at Demand Side for Chisinau Municipality and (ii) Recommendations for the Public Awareness Strategy targeted towards raising the final consumers' awareness on energy efficiency.
2. The annex has been developed based on, but not limited to:
 - ④ Previous energy efficiency implemented projects and/or attempts to improve the energy efficiency at the building level in the Republic of Moldova;
 - ④ Case studies from Latvia, Bulgaria, Romania, Lithuania, Poland, etc.
 - ④ Meetings and consultations with the key stakeholders and experts, including “Gestionarul” National Union of Home-Owners Associations, National Agency for Energy Regulation, State Energy Inspectorate, Termocom Chisinau DH Supplier, Ministry of Economy and Commerce, Ministry of Construction and Territorial Development, Chisinau Municipality Statistics Direction, Urban Institute, Energy Audit Center under the Technical University of Moldova, private construction companies, investors building extra-floors on old building stock in Chisinau, etc.
 - ④ A survey of final consumers' priorities for energy efficiency and preferred awareness tools was conducted for the purpose of this paper.
 - ④ Thermal rehabilitation estimates for a 60 apartments building in Chisinau, based on current market prices.
3. The investment estimate covers:
 - ④ Costs related to individual heat points, usually installed to service one or more buildings. In Moldova this is an expense of the supplier. However, there are countries where Individual Heat Points have been passed onto the balance of Home-Owners Associations;
 - ④ internal distribution system costs; and
 - ④ thermal rehabilitation of the building.
4. The recommendations for the Public Education Strategy have been developed given the lessons learned from prior success stories and failures in the Republic of Moldova and EU countries, likewise the opinion of Chisinau residents expressed in 120 filled in questionnaires as part of the EE demand-Side Survey conducted for the purpose of this project.

II. Energy Investment Needs at Demand-Side in Chisinau

A. Introduction

5. Apart from the increasing fuel prices, very little or almost nothing has been done to influence the energy consumption behavior in Modlova. There are not known cases of comprehensive EE projects implemented in Chisinau to assess the energy saving potential. However, given the experience across Europe, one could say the energy saving potential in the building sector of Moldova could reach 60%, specifically in the old stock. The Baltic countries demonstrated a potential of energy savings in buildings within a range of 20% and 60%, depending on the package of measures implemented, i.e. low-cost, medium-cost, and high-cost. Bulgarian EE projects implemented in Sofia, Gabrovo, and Pleven showed measured energy savings of 26% to 60% and a return of investment of 4 to 6.2 years.

6. Demonstration projects in most countries proved that investing in EE is the most cost-effective and efficient way of helping the consumers meeting their growing energy needs, manage their bills and comfort, and reduce greenhouse gas emissions.

7. As a consequence thereof, in a series of countries like Latvia, Lithuania, Bulgaria, Romania, Czech Republic, Poland, Estonia, Slovakia, etc. the governments launched national thermal rehabilitation programs to preclude housing degradation, social segregation, and ecological worsening.

8. Croatia launched an EE in Central thermal system (KUENcts) with an estimated energy consumption reduction target of 25% and KUENZgrada with a technical saving potential of activities estimated at 20 PJ of useful energy till 2025. To reach that, strict regulations have been included for new buildings, for example 50 kWh/m² and 30% insulation improvements in the existing housing stock.

9. The most successful programs for promoting residential energy efficiency included financing solutions, such as lending to households and housing associations, as it is the case in Poland, Latvia, and Romania. However, given the fact that there existed a large numbers of low-income households, targeted grants or softer loans were provided.

10. Romania launched a National Thermal Rehabilitation Program for condominiums aimed at improving the energy performance of the multi-family blocks built during 1950 - 1990. The financing sources were:

- ④ energy audit – 100% national budget;
- ④ design documentation – 100 % local budgets (local governments councils);
- ④ thermal rehabilitation measures – 34% national budget, 33% local budget, and 33% owners' associations.

11. Poland implemented a Thermo-Modernization Programme to protect the households against the impact of liberalized heat prices. State funds have been made available to provide credits to householders for thermal improvement of their houses and to the owners of the local

heating networks under 5.8 MW willing to modernize their systems. The funds covered the 25% of the loan repayment and provided up to 50% guarantee for loans aimed at financing EE investments.

12. The Lithuanian Government has signed in 1996 a 10 mln. USD Loan Agreement with the World Bank to finance the EE at demand-side of which 4.7 mln. USD were allocated for renovation of public buildings, while the 5.3 mln. USD were used for energy conservation measures in residential buildings. Another 30% of the required funding for project implementation was allocated by the Government; while the Danish Ministry of Housing and Urban Development Affairs and Dutch Ministry of Economy provided the TA support in this effort.

13. The Lithuanian housing associations were offered soft loans as part of the EEHP for a period of 10 years, 11% interest rate. A precondition was to have the association contribute no less than 10% of the investment project value. The Government provided a 30% grant to the associations participating in the project, as well as VAT exemption for labor and materials involved. The first Lithuanian EEHP was a success and ended in 2001, so in September 2004, the Government approved another Program for Refurbishment of Multi-Family Buildings.

14. Some governments employed additional supporting mechanisms. Thus, the Czech Republic provides state subsidies in form of direct funding in the amount 2000 Euro per apartment in panel buildings that are in poor condition and require immediate repair. There is also a possibility to get indirect funding through PANEL program, which made available 30 m Euro for reconstruction of panel buildings.

15. A more recent government EE support in the region was demonstrated by Latvia, which launched in June 2008 a state program “Promotion of Renovation of Multi-family Houses 2008-2009”. The program provides state support for implementation of 962 energy audits in multi-family buildings and 20% state support for renovation of 233 multi-family dwellings.

B. Heat Supply in Residential Sector of Chisinau

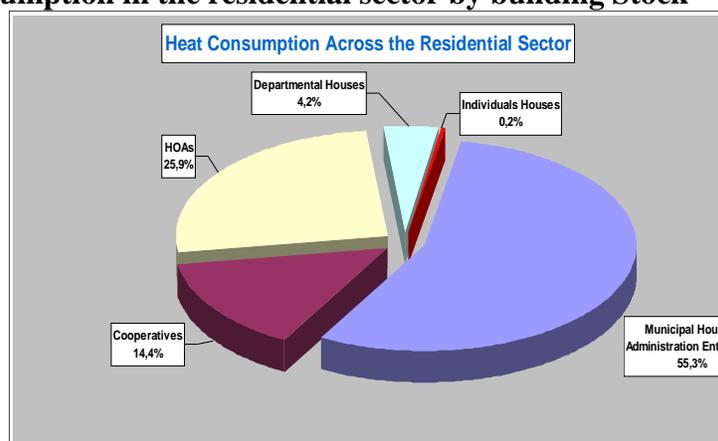
16. One of the challenges faced by the DH supplier is the increasing number of apartments switching to apartment-level gas-fired boilers. By now, some 19712 individual boilers have been installed in Chisinau municipality, both in individual houses and apartments. This tendency has been noticed to slow down in recent years, most likely due to improved DH services and/or an increase in gas price.

DH Consumption

17. The residential sector is Termocom’s largest heat consumer covering 74%, while businesses reach 10%, followed by municipal and state institutions with 9% and 7%, correspondingly.

18. Within the residential sector, the buildings in administration of Municipal Housing Administration Enterprises (MHAE) account for 55,3%, followed by the Home Owners Associations (HOAs) with 25,9% and the Cooperative Associations with 14,4%. Individual houses are less than 1%.

Figure 1: DH Consumption in the residential sector by building Stock



Source: Termocom 2007

19. DH supplies 97% of total apartments in Chisinau, of which approximately 1% are relatively new buildings; approx. 93% of the total apartment area in Chisinau municipality.

20. The number of connected individual houses is relatively small, i.e. 268 units. There is no data as to what total area these 268 units occupy. However, considering the average individual house floor is 150 sq. m the assumed total area DH supplied is 40200 sq.m. or 0,6% of the total individual houses area supplied by Termocom.

Table 1: Extent Housing Stock and DH Supply

<i>Surface floor</i>	Area, sq. m.	DH ,%	Other heating, %
Total residential area	15,272,900	53	47
Total residential area multi-family buildings	8,701,723	93	7
Total residential area individual houses	6,571,176		
Total residential area, DH supplied	8,088,181		
Total apartment area, DH supplied	8,047,981	92.5	7.5
Total individual houses area, DH supplied	40,200 ²⁴	0.6	99.4
<i>Housing Units</i>			
Total apartment buildings	4,349		
Total apartments, Chisinau municipality	178,543		
Total apartments, DH supplied	173,454	97	3
Total individual houses			
Total individual houses, DH supplied	268		

Source: Statistics 2008; Municipal Statistics 2008, Termocom data 2008.

21. Some 16,883 apartments, i.e. 9,5% are municipal ownership as reported by Chisinau municipal Statistics.

²⁴ Estimated floor area.

C. Metering and Internal Distribution System

Metering

22. In Chisinau practically all buildings connected to DH are equipped with heat meters and flow meters for DHW. This measure helped reduce the heat energy demand by an estimated 30% and the heat load by an estimated 15%.

23. Most consumers do not have individual controls (thermostatic valves²⁵) and heat cost allocators that would allow cost distribution per individual consumption within the buildings.

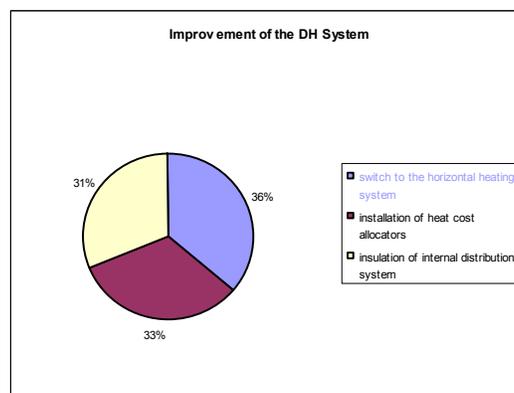
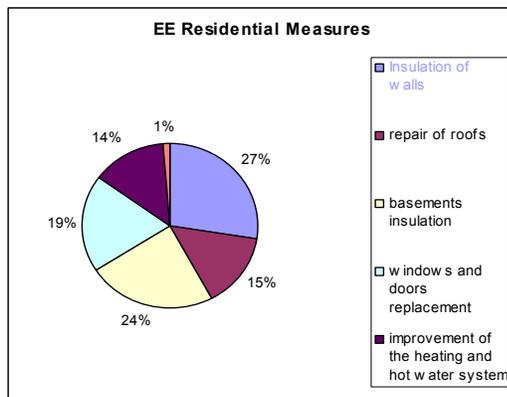
24. Distribution of costs within multi-party buildings with heat cost allocators (evaporation devices or individual heat meters) showed good saving results and a change in consumers' behavior in many countries. The pay-back period for such devices generally depends on the heat prices, but typically would fall within a range of 2-5 years. In Chisinau there have been a couple of attempts to install heat cost allocators by DANFOS Company, as well as under a SIDA-financed program. Irrespective of the obvious benefits, the attempts failed for a series of organizational, ownership-related, and poor awareness issues.

25. The EE Demand-Side Survey completed by the Consultant for the purpose of this project showed that only 15% are aware of the DH internal system improvement measures, of which 33% are willing to install heat cost allocators or thermostatic valves.

**Figure 2: Necessary EE Measure
According to Residents**

**Figure 3. Internal Heating System
Improvement**

²⁵ Thermostatic valves are often recommended to be used together with the heat cost allocators. This allows the consumers to reduce bills and/or improve comfort.



Source: Demand-Side EE Survey, May 2008

26. Metering has however proved to pay back in case of water and electricity supply, as well as to improve the paying discipline.

Internal Distribution Systems

27. There is only one known case of a multi-family building (10 floors) with a horizontal heat distribution system, supplied by DH.

28. Thirty six (36%) percent out of 15% of respondents would switch to the horizontal heat distribution system, while the other 31% would rather insulate the existing heating system. This shows the awareness is very low. It is worth mentioning that, a rehabilitation project to change the vertical heat distribution system into a horizontal one, or alternatively installing the second vertical pipe, as to enable individual consumption based billing would make sense only if measuring devices are installed in all apartments.

29. Individual financial capacity of the consumers would be a serious obstacle, in which case government participation, as practiced in the Baltic countries, Romania, Bulgaria, Czech Republic, etc. will be recommendable for Moldova.

30. Another essential step would be creating an environment for private service companies' participation that would pre-finance such works and service the internal systems. The return in this case could be guaranteed from the savings.

D. The Condition of the Residential Stock

31. By January 2008, Chisinau's housing stock consisted of a total of some 15272,9 mln m². There are about 4349,0 separate buildings of different sizes. Available data indicate that most of Chisinau housing stock was built after the WWII. The oldest part of the city, built before 1934 is only 5% in the total housing stock.

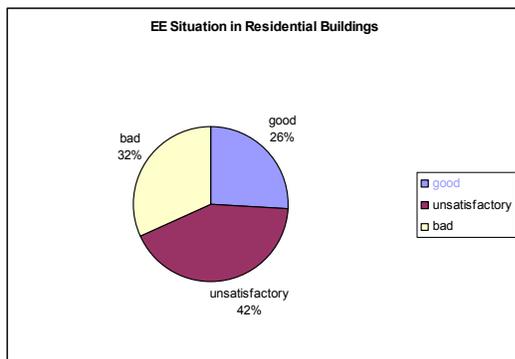
32. During the Soviet times, particularly as of 1960s, a new wave of construction started to meet the urban growth challenge. Half of the buildings in Chisinau are 35 years old, which is not old in terms of construction. However, because of the lack of systematic maintenance it has substantively eroded.

33. Some previous studies suggest the multi-family buildings account for nearly half of the housing stock, with two thirds being panel construction, mostly applied in the 1980s as to allow a rapid expansion of urban areas. The buildings erected during this time are either large pre-fabricated slab buildings, or concrete in-situ, or cut stone ones. In 1995, aprox. 49% of total apartments belonged to the buildings with nine and more floors.

34. About 70% of the dwellings are 2- and 3-rooms. The National Human Development Report 1999 reports an average flat size of 47,8 m² in urban areas.

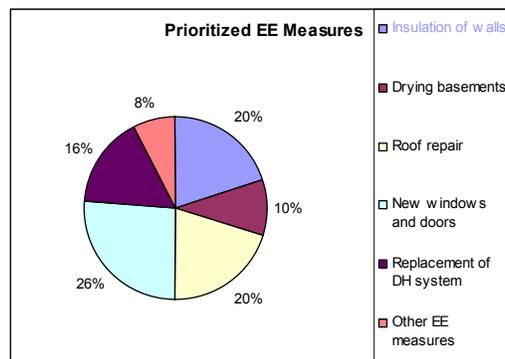
35. Most buildings in Chisinau are characterized by high heat losses caused by construction and later, by insufficient or even lacking maintenance and repair works. Interviews with the tenants of Chisinau²⁶, as well as desk review of available studies indicate a wide consensus about three groups of problems related to housing quality: deteriorating housing quality in the existing stock, quality of the available service infrastructure and lack of effective management in multi-family housing stock.

Figure 4. EE Situation in Buildings



Source: Demand-Side EE Survey, May 2008

Figure 5. Priority EE Measures



36. The EE Demand-Side Survey showed 42% residents are not satisfied with the dwellings they live in. Only 26% find the quality of their dwellings good, while 32% consider it bad.

37. Most of the respondents stated their multi-family building needed general renovation and improvement. Chart 8 above reflects the breakdown of priority EE measures according to the respondents. Most of respondents prefer windows and doors to be changed with 26%, followed by roof repair and wall insulation each and 16% replacement of DH internal system from vertical to horizontal with heat consumption individual control.

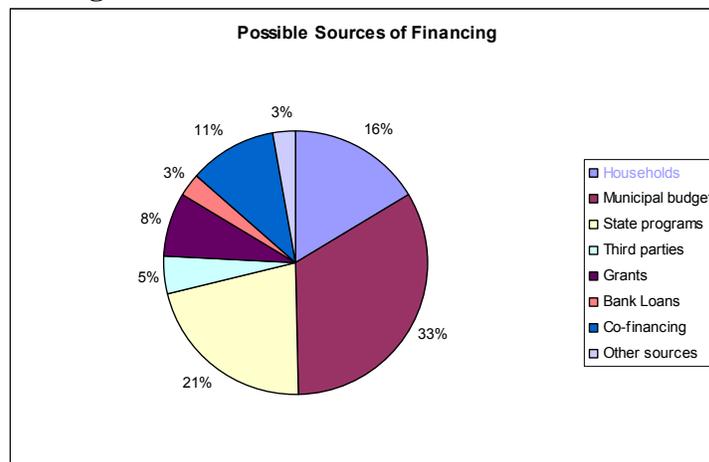
38. Other measures mentioned by the respondents were change of elevators, electricity in common spaces, public awareness campaign. A reason for such a low priority given to the efficient heat distribution and heat metering systems is the poor awareness.

EE Financing:

²⁶ Out of 200 distributed questionnaires, only 120 households agreed to participate in the EE Demand-Side Survey.

39. The biggest majority thinks the EE measures in residential areas should be financed from other than their own pocket. Thus, 33% considers the municipal budgets should finance EE improvements, 22% - state programs, 16% think it is the households themselves, while 11% are in favor of co-financing. Third parties financing, grants and bank loans are among the lowest priorities with 5%, 8% and 3%, correspondingly.

Figure 6. EE Financing Sources



Source: Demand-Side EE Survey, May 2008

40. It is noteworthy that only 5% would accept third party financing, which recently, has become a known practice in Chisinau.

41. When asked separately about the readiness to co-finance, 52% of the respondents stated they could participate in co-financing of EE measures in their buildings, while only 48% have no financial possibilities at all. A very small number from those ready to co-finance, i.e. 12% would contribute between 500 and 1000 Euro, while another 88% can make available up to 500 Euro.

Figure 7. Co-Financing

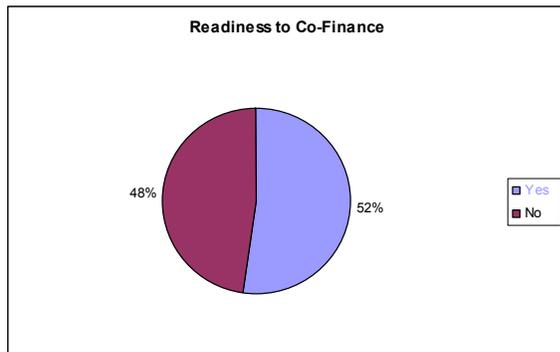
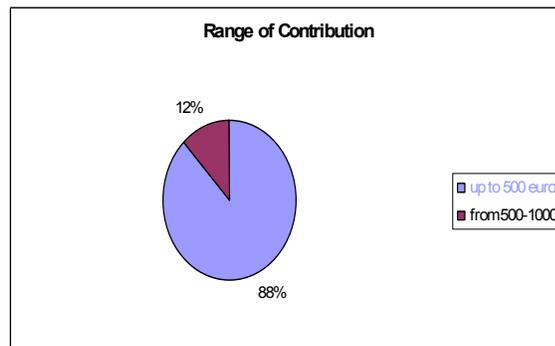


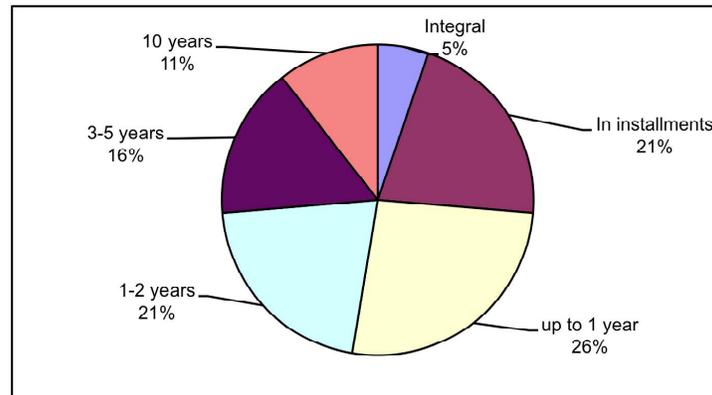
Figure 8. Financial Contribution



Source: Demand-Side EE Survey, May 2008

42. Only 5% of the respondents would make a lumpsum contribution, while 26% are ready to make the contribution in installments up to 1 year. Another 21% find the co-financing possible within 1 and 2 years, while 11% prefer to make the contribution during 10 years.

Figure 9. Co-Financing Term



Source: Demand-Side EE Survey, May 2008

43. The poor condition of the housing stock, plus the low awareness and inability of low income households to pay for EE improvements is a serious obstacle to improving the building stock and energy use. The most common responses to these are switching to relatively cheaper fuels, reducing consumption, and not paying the bills.

E. Review of Current Demand-Side EE Initiatives in the Region and in Moldova

Moldova

44. *Households' private efforts:* There is no quantity or quality data as to the apartment level EE improvements undertaken by the residents themselves. However, one can easily notice a large number of windows have been replaced in buildings, sometimes ranging between 10 and 30%. The same applies to insulated balconies and apartments from inside.

45. *Municipal Initiatives/TPF:* A few attempts were made in Chisinau to rehabilitate the residential sector. Some HOAs have accepted third-party financing, which proposed glazing all balconies, insulating the pipes in the basements, repairing the staircases and fixing the roofs by building extra-floors on the top of the buildings. Some 25 such buildings are known to have joined the Municipal Mansarda Program by 2009. The measures listed above are financed by the investor solely, without contributions from the municipality or households. The process has been troublesome because of the many legal papers involved and troublesome negotiation with the residents to give *No Objection* to buildings' partial reconstruction.

46. *National Government Efforts/Donor Support:* An Attempt to reconfigure the internal heat distribution system has been made in 2007 under the SIDA Energy Programme "Activities for Technical Development of SA "Termocom" District Heating Company".

Case Study 1. Chisinau

47. The first attempt of thermal rehabilitation of buildings envelopes, passing to a horizontal heating distribution and apartment level metering failed for organizational and low awareness reasons. The estimates however showed an approximate investment need of 1883 Euro per flat is required as compared to the 1500 Euro for an individual gas-fired boiler/flat.

Five residential buildings from Chisinau, totaling 362 apartments have been selected as part of this demonstration program:

- ☐ Str. Drumul Schinoasei 1/3, 9 stories, 54 apartments (2 entrances, supplied from 1 substation);
- ☐ Str. Drumul Schinoasei 1/4, 9 stories, 54 apartments (entrances 1 and 2, supplied from 1 substation);
- ☐ Str. Drumul Schinoasei 1/4, 9 stories, 54 apartments (entrances 3 and 4, supplied from 1 substation);
- ☐ Str. Drumul Schinoasei 1/1, 5 stories, 60 apartments (3 entrances, supplied from 1 substation);
- ☐ Str. Drumul Schinoasei 1/2, 5 stories, 60 apartments (3 entrances, supplied from 1 substation);
- ☐ Str. Grenoble 104/6, 17 stories, 80 apartments (1 entrance, supplied from 1 substation).

Activities proposed:

Restructuring of the old internal heating system, including design, demolition of existing, supply, installation, testing and commissioning of new internal heating and DHW Systems and of heat and DHW metering system for the 5 residential buildings were planned, estimated at SEK 6,150,000. Only one bid was received quoting a price approx. 20% higher.

The package of the proposed works included:

- ☐ demolition of old heating and DHW systems in the residential buildings;
- ☐ reconstruction of main pipes in the basement starting with the new substations; installation of balancing valves on risers;
- ☐ installation of common vertical main risers for heating, DHW and DHW recirculation in the common area of the buildings;
- ☐ installation of distribution boxes in the common area on each floor with shut-off and balancing valves, heat and DHW meters for each apartment;
- ☐ reconstruction of the internal heating systems in apartments, with new pipes and radiators with automatic thermostats; the new systems in apartments – two-pipe horizontal, connected to the distribution boxes;
- ☐ DHW pipes to the apartments form the distribution boxes.
- ☐ automatic metering data (heating and DHW) transmission, processing and billing system for the HOA(s).

Source: MEPIU, Moldova 2009

Experience in Europe

Case Study 2: Lithuania

48. The Lithuanian monitoring showed a 46% saving potential with an investment cost of 45 EUR/ m²

Monitoring Results/100 renovated buildings

- ③ Average simple payback period for 100 monitored buildings - 10.5 years;
- ③ Some 60 % out of 250 surveyed families indicated that loan repayment represents an insignificant or negligible burden on their family budgets;
- ③ 56% of the surveyed families reported reduced heat bills;
- ③ 48% reported an improved indoor comfort;
- ③ 30% mentioned improved building appearance.

EXAMPLE: Renovation of one multifamily building

Year of construction: 1986

Number of apartments: 64

Heated area: 4864 m²

Total project investment: 220 000 EUR

Measures implemented: Wall insulation, roof, new windows, glazing of balconies, modernization of heating substation;

Energy Savings: 617 MWh/year v.s 330 MWh/year = 46 %

Investment – 45 EUR/m²

Case Study 3. Latvia

49. A Latvian case demonstrated a 25 USD investment per m² in case of a limited set of measure to the building envelope. Unfortunately, the energy savings have not been measured to assess the benefit, while the cooperative planned for further measures and a prior energy audit to asses the real situation.

A Cooperative of flat owners, 30 Mucenieku street, Kuldiga, Latvia borrowed in summer 2001, an amount of 63 000 LVL (approximately 100 000 USD) from the Mortgage bank for a term of 12 years at an annual interest rate of 10%.

- The 5 levels building is made of aerocrete, sidewalls –bricks and reinforced concrete panels, basement - reinforced concrete panels;
- ③ Length of the building is 64 m, width – 12,76 m, height – 17,5 m;
- ③ No hot water supply;
- ③ 135 inhabitants.

Measures implemented:

- ③ Attic isolation with mineral wool, 20 cm;
- ③ External walls insulated, polystyrol 8 cm;
- ③ Ceiling of the basement insulated with polystyrol, 5 cm;
- ③ Staircases have been reconstructed;
- ③ Draught lobbies have been rebuilt;
- ③ Aluminum electrical wires have been replaced with copper ones;
- ③ Windows partially replaced with double glazed plastic windows.

Some inhabitants partially replaced old windows with new windows in their apartments before the loan.

Heat consumption reduced from 245 MWh/year to 213 MWh/year, the average room temperature increased, and the heat bill decreased by 0,3 LVL/m².

Source: Municipal Network for Energy Efficiency “MUNEE”

Case Study 4. Pleven, Bulgaria:

50. There is no date as to what investment per m² was in this project, however, the energy savings reached 658MWh/year while the cost savings US \$15,300/year, which is over 30% energy consumption reduction.

DH Energy Efficiency at Demand-Side, Pleven, Bulgaria

The project “Energy Efficiency for End Users of District Heating in Bulgaria” showed that residential heat consumers who had been disconnected from DH because of inability to pay their heat bills were able to afford re-connection and pay lower heat bills after they made energy efficiency improvements.

Pleven, a city of 140,000 residents, had 47%³ the DH supply area (4,369,120 m³) disconnected.

Disconnected Radiators in Multi-Apartment Buildings Before Project

Housing block	% disconnected
Block “Buria”	65
Block “G. Kotchev”	58
Block “Uragan”	61
Block “Spartak”	50
Block “Neofit Rilsky”	47
50 – 52 “Ivan Vazov” Street	47
54 – 56 “Ivan Vazov” Street	56
56 – 58 “Ivan Vazov” Street	38

Bulgarian Government supported a project implementation in 2000 within the framework of the Dutch Program for Co-operations with Countries in Central and Eastern Europe, financed by the Dutch Ministry of Economic Affairs (SENTER PSO).

The heat demand in Pleven exceeded production due to profound heat losses in residential buildings. This demand-supply imbalance resulted in high district heating costs and made the basic comforts of heating unaffordable for many of the city’s residents. The high heat loss resulted from:

- deteriorated condition of building envelopes and in-house space heating systems;
- lack of knowledge and experience among DH consumers about the financial and EE measures related to space heating and DHW consumption;
- no metering and consumption-based regulation of energy consumption;
- lack of interest and motivation for the consumers to accept available heat control and measurement methods;
- no billing methods to encourage more efficient demand-side consumption.

EE measures implemented in residential buildings:

- installation of individual heat cost allocators and thermostatic valves for radiators;
- fitting aluminum foil reflector screens behind the radiators;
- weather-stripping drafty areas in the apartment buildings;
- thermal insulation of the hot water pipes;
- installation of water-saving shower taps in all apartments;
- installation of heat cost allocators and hot water meters allowing remote consumption reading.

These measures were implemented in five of the six apartment blocks in 2000-2001.

Neophit Rilski, a typical apartment block, was designated as a baseline reference site. The above-mentioned measures were implemented in this building in April-May 2001 to establish a benchmark for energy savings.

Key outcomes:

- Energy savings: 658MWh/year
- Cost savings: US \$15,300/year
- metering of heat consumption increased by 96 percent;
- residents were reconnected to the heating network;
- monitoring in 2004-05 heating season revealed an energy cost savings of 30-35%;
- energy used for heating 1 m³ was reduced by more than 30%, amounting to approximate savings of 658 MWh and US \$15, 300.1;
- indoor temperatures improved significantly on all premises;
- DHW parameters improved to comply with regulations.

Before the project, some 50-60% radiators were disconnected in the participating buildings. After project completion, there was no need to disconnect radiators if consumers could not afford paying the heating bills because they could control the consumption by closing valves. Subsequently, all radiators were reconnected after the project; although many consumers still choose not to use one or several radiators.

Lessons learn:

- EE measures are technically feasible and cost-effective;
- heat metering combined with thermal regulation valves and consumption-based billing allows the consumers to control their costs for space heating and regulate the indoor temperature levels;
- heat accounting reduces the tension between the supplier and consumer.

Source: Municipal Network for Energy Efficiency "MUNEE"

F. NECESSARY INVESTMENTS

Internal heating system

51. Extent calculations for SIDA pilot effort in Chisinau were taken into account while calculating the investment needs for the internal heating systems.

52. The estimated cost will reach 136,367,00 Euro/building; 1883.53 Euro/flat or 39.40 Euro/m²²⁷

Table 6. Investments Internal Heating System

²⁷ There is no data as to the total surface floor for the 5 buildings included in the project. For the purpose of this estimate, the average floor space per dwelling in urban areas of 47,8 m² quoted by National Human Development Report in 1999 was used.

EE Measures/Costs, Euro	Total Project	Building	Flat	m ²
Demolition of old heating and DHW systems in the residential buildings				
Reconstruction of main pipes in the basement starting with the new substations				
Installation of balancing valves on risers				
Installation of common vertical main risers for heating, DHW and DHW recirculation in the common area of the buildings				
Installation of distribution boxes in the common area on each floor with shut-off and balancing valves, heat and DHW meters for each apartment	681833*	136367	1883,52	39,40**
Reconstruction of the internal heating systems in apartments, with new pipes and radiators with automatic thermostats; the new systems in apartments – two-pipe horizontal, connected to the distribution boxes				
DHW pipes to the apartments from the distribution boxes				
Automatic metering data (heating and DHW) transmission, processing and billing system for the HOA(s).				

Source: MEPIU input data, 2009

*Estimated SEK 6,150,000 contract value. 1 Euro=9,0198 SEK

** 47,8 m² average floor space in urban areas, National Human Development Report, 1999

53. The estimates above would result in a 454 mln. Euro investment need for the DH supplied buildings as compared to 175 mln USD calculated by Termocom.

Building thermal rehabilitation

54. EE packages implemented in different European countries showed a broad range of investment costs from 13 to 45 Euro/m². The amounts involved depended on the available funds and priority measures selected by the residents. There has not been identified one single project to include the exhaustive set of measures from energy audit down to complete thermal rehabilitation of a building. Therefore, for the purpose of this project an estimate has been made for a 60 flats building located in Chisinau and based on local market prices.

Building, Series 102 5 floors 4 staircases 15 apartments per staircase 60 total apartments	One staircase has: 5 flats - 3 rooms, 5 flats - 2 rooms and 5 flats - 1 room. Flats surface areas according to the official documents from "Cadastre": Flat with 3 rooms: S = 66,9 m ² ; Flat with 2 rooms: S = 53,3 m ² ; Flat with 1 room: S = 29,3 m ²
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Table 7. Investments Building Envelopes

	area/m ²	USD/m ²	USD/flat	USD/building
Insulation of the roofs	730	15	182.5	10,950
Insulation of the floor above the basement	700	10	116.67	7,000
External insulation of the blind walls	1,570	25	654.17	39,250
Replacement of windows, balconies	750	60	750	45,000
Replacement of entrance doors				
Total	34.18		1,703.33	102,200

55. The total investment per m2 would be 34,18 USD or 26 Euro/m2 of the living floor.

	area/m ²	Euro/m ²	Total
Total, DH supplied buildings	8,047,981 ²⁸	26.29	211,581,420
Total residential area multi-family buildings	8,701,723	26.29	228,768,309

56. Nevertheless, the 211/228 mln. Euro total investment needs for thermal rehabilitation of the residential sector might be reduced if taking into consideration that a large number of population has already replaced their windows, the entrance doors to the building and weatherized their balconies.

57. The situation and the investment cost will also vary from building to building, while the thermal rehabilitation will be recommended to be made based on prior *energy audit results, the cost of which has not been included in this investment.*

58. Given the financial capacity of the population, as well as the legal and organizational issues involved, the rehabilitation of the old stock is proposed as part of a program co-financed by more stakeholders.

G. BARRIERS AND RECOMMENDATIONS

59. Barriers to implementation of EE measures at demand-side vary from country to country, though, most of them for which solutions have been already found and applied are common for Moldova, too. The main barriers in Moldova are:

Imperfect legal and regulatory framework:

- ④ Moldova has no primary legislation requiring energy performance of buildings. The new technical energy efficiency requirements set in the national energy efficiency standards in 2006 mostly apply to the newly built buildings;
- ④ There is no Heat Law. A draft was prepared with USAID assistance years ago brought into discussion a two-tier tariff, heat cost allocation for collective heating systems, creation of a heat guarantee fund, but has not been approved yet.
- ④ DH tariffs are below cost-recovery. Earlier WB recommendations suggested a period of 3 years for the gradual tariff increase, coupled with elimination of the cross-subsidies across the energy sector and passing to a targeted social assistance system;
- ④ Condominium legislation and public utilities regulations require improvement in the part concerning co-ownership, ownership borders, co-owner's rights and obligations.
- ④ No EE targets and indicators calculated and set.

Weak institutional capacities and lack of cooperation:

- ④ No institutional cooperation in promoting EE improvements.
- ④ No energy efficiency capacities within the government to develop and promote the EE policies and programs;
- ④ Lack of cooperation between the policy makers and technical universities, energy and

²⁸ Estimated figure. No available statistic data.

design institutes;

- ④ Home-Owners Associations are very weak and need strengthening in order to become bank clients. There is a clear need for a legal framework allowing housing associations to form; to serve as utility customers and collect customer payments and fees; and to borrow to make improvements to the building;
- ④ No housing advisory agencies to build the necessary skills within the housing associations;
- ④ Municipalities' understanding of EE concept and support is feeble. They often own heat companies; provide housing management and maintenance services to residential buildings; are frequently responsible for providing subsidies to vulnerable households;
- ④ Mass media also needs capacities competent to understand and promote EE. It is one of the key players in public awareness. The Serbian experience proved a nation-wide weatherization and consumer awareness campaign provides a good example that produced measurable results.

Lack of financial and fiscal incentives

- Most consumers have limited debt capacity and will tend to focus on more appealing purchases than double-glazing and insulation and would be more inclined to purchase cheaper, less efficient boilers than consider the life cycle benefits of more efficient equipment;

Poor public awareness:

- ④ EE awareness among consumers is sporadic and weak, mostly limited to a few articles and commercial spots. A consolidated awareness campaign would translate into the market, help individuals incorporate energy efficiency into their lives and contribute to national energy savings.