

**Pacific Northwest National Laboratory, US
Agency for Rational Energy Use and Ecology, Ukraine**

Energy Efficiency in the Budget Sphere of Ukraine

Final report

Under Assistance on Ukrainian Energy Efficiency Program

**Supported by:
The US Department of Energy
The US Agency for International Development**

Kyiv, 2003

Summary

The report Energy Efficiency in the Budget Sphere of Ukraine was performed under Assistance for the Ukrainian Energy Efficiency Program received from the US Agency for International Development.

The study was performed with the goal to define directions to improve Ukrainian legislation that could provide for energy efficiency improvement in buildings that receive support from State budget in Ukraine.

The report contains the results of the study of Ukraine's legislation and potential financing sources for implementing energy efficiency measures in the budget area, and analysis of the US legislation related to energy efficiency in budget area.

The report reviews priority measures and summarizes the experience on implementing energy efficiency technologies in the construction and operation of Ukraine's public buildings. These priority measures are defined based on the classification of the budget buildings of Ukraine, their quantity and characteristics, as well as an assessment of the applicability and effectiveness of these measures in buildings supported by the State budget.

Content

Summary	2
Content	3
Acknowledgement.....	5
Introduction	6
1. Analysis of Ukrainian Legislation and Potential Financing Sources for Implementing Energy Efficiency Measures in the Budget Area.....	8
1.1 Management of energy efficiency activity in Ukraine budget area.....	8
1.2 Legislative and standard provisions	9
1.3 Energy efficiency programs.....	11
1.3.1 General information	11
1.3.2 Comprehensive State Program of Energy Conservation of Ukraine	11
1.3.3. Oblast programs of energy conservation	14
1.3.4. Municipal programs of energy conservation	14
1.3.5. Programs on installing the equipment for metering and control of natural gas, water, heat and electricity consumption in residential buildings.....	15
1.4. Experience of energy saving programs implementation	16
1.5. Sources and forms of energy efficiency projects financing	17
1.5.1. General information	17
1.5.2. State budget	17
1.5.3. Local budgets.....	17
1.5.4. State Innovation Company.....	19
1.5.5. International financial institutions	19
1.5.6. Commercial banks	20
1.5.7. Issuing bonds	21
1.5.8. Leasing	21
1.5.9. Purpose funds	21
1.5.10. Energy service companies	22
2. Analysis of U.S. Legislation Related to Energy Efficiency in Budget Sphere.....	23
2.1. Energy efficiency legislation	23
2.2. Federal energy management legislation	25
2.2.1. General information	25
2.2.2. Planning, reporting and analysis	27
2.2.3. Technical assistance to federal agencies	28
2.2.4 Project financing	31
2.3. Energy efficiency legislation in states and municipalities	33
2.3.1. General information	33
2.3.2. Incentives	34
2.3.3. Financing mechanisms	35
2.3.4. Legislation of the state of Florida	36
2.3.5. Legislation of the state of Iowa	37
2.4. Interagency coordination	37
2.4.1. Interagency coordination of energy efficiency activity	37
2.4.2. Intergovernmental coordination.....	39
2.5. Deregulation of public utilities	40
2.5.1. General information	40
2.5.2. Deregulation process in the state of New Hampshire	41
2.5.3. Deregulation process in the state of Texas	43
2.5.4. Deregulation process in the state of Pennsylvania	44
3. Proposals on the Improvement of Ukraine’s Legal and Standard Framework for Energy Efficiency in the Budget Area.....	47

3.1. Establishing the financial incentives system for the specialists of institutions involved in energy efficiency	47
3.2. Implementing transparent reporting on the progress achieved in energy efficiency improvement.....	47
3.3. Implementing monitoring system for energy efficiency measures recommended based on the energy audits performed in the budget facilities.....	47
3.4. Developing a system of voluntary national certification of energy efficiency products....	48
3.5. Developing programs on determining and application of energy efficiency products that promote considerable reductions in energy consumption	48
3.6. Developing a system for buildings' energy efficiency rating.....	48
3.7. Developing energy management training program for the representatives of ministries and institutions	49
3.8. Introduction of budget appropriations to implement energy efficiency measures	49
3.9. Establishing governmental energy efficiency fund	49
3.10. Issuing limited tax bonds to finance energy efficiency measures	50
3.11. Application of energy performance contracts (EPC)	50
3.12. Application of super energy performance contracts (super EPC).....	51
3.13. Application of utility energy service contracts.....	51
3.14. Including an investment component in a tariff for energy services with the aim to implement energy efficiency measures and providing the oversight of these costs use	52
3.15. Introduction of the mechanism of consumers' payments for cost savings obtained from energy saving measures implemented by the utilities	52
3.16. Introduction in the legislation of a requirement to develop and implement energy conservation programs.....	52
4. Defining Priority (Typical) Energy Efficiency Measures, Technologies and Equipment for the Budget Buildings	54
4.1. Defining typical budget buildings	54
4.2. Typical energy efficiency measures, technologies and equipment in the budget buildings	56
4.2.1 <i>Determining typical energy efficiency measures, technologies and equipment</i>	56
4.2.2 <i>Effectiveness analysis of typical energy efficiency measures, technologies and equipment</i>	57
4.2.2.7. Windows weatherization	59
4.2.2.9. Reduction of hot water losses through installation of pressure reducers	60
4.2.2.10. Heat recovery.....	60
4.2.3. <i>Effectiveness assessment for typical energy efficiency measures, technologies and equipment</i>	60
5. Organization and Conduct of the Workshop “Energy Efficiency in the Budget Sphere of Ukraine”	62
6. Conclusions	64
References	66
Appendix 1. Classification of Main Types of Budget Buildings.....	71
Appendix 2. Estimation of Budget Buildings' Number	73
Appendix 3. Effectiveness Assessment of Implementing Priority Energy Efficiency Measures in the Budget Buildings of Ukraine	74
Appendix 4. Agenda of the workshop Energy Efficiency in the Budget Sphere of Ukraine	75
Appendix 5. List of Participants of the Workshop "Energy Efficiency in Budget Sphere of Ukraine”	76

Acknowledgement

This study was made possible owing to the support and assistance of the US Agency for International Development and the US Department of Energy.

We would like to express gratitude to Y. Shulga, Chairman of the State Committee for Energy Conservation, Mr. O. Sukhodolya, Deputy Chairman of the State Committee for Energy Conservation, S. Bevz, Head of the Department of Investments and International Cooperation, State Committee for Energy Conservation, for the comments to the proposals on the improvement of Ukraine's legislation.

We would also like to express appreciation to T. Secrest, Advanced International Studies Unit, Battelle/PNNL, V. Gershkovitch, Head of the Center of Energy Efficiency, Kiev ZDNIEP, G.Panchenko and L. Milkevitch, Agency for Rational Energy Use and Ecology for performing the study as well as to other individuals who took part in this work in different capacities: S. Surnin, O.Chumachenko, G. Fedorova, S. Nepogodiev, Y. Khomich.

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Introduction

The US Government through the US Agency for International Development (USAID) conducts activities to assist the transition countries in initiating and carrying out market reforms. One direction of the USAID activity is reformation of the energy sector, primarily improvement of energy efficiency. There is growing understanding that improving the energy efficiency of Ukraine's economy may significantly reduce Ukraine dependence on imported energy, and that reforming the economy is an important precondition for economic growth.

The goal of the Ukrainian Energy Efficiency Program is to assist Ukraine in the analysis of the Department of Energy (DOE) Federal Energy Management Program (FEMP) and develop recommendations for a similar program in Ukraine to implement energy efficiency measures and practices the budget area at the state, regional and municipal levels. Areas of interest include the legislative basis, state and organizational policies, organizational structures, and financing mechanisms with specific application of performance contracts.

This report contains the analysis results:

- Laws and other legal and standard acts, which regulate energy efficiency activity in Ukraine's budget area;
- Conditions and results of energy efficiency programs fulfilled in this area;
- Potential financing sources for energy efficiency projects;
- Acts and Executive Orders related to the energy saving sphere;
- Federal Energy Management Program legislation;
- Coordination of activity aimed at the identification and implementation of energy saving projects by the US Government at inter-sectoral and intergovernmental levels; and
- Process of utility deregulation.

A review of US legislation, policies and implementation mechanisms showed that the key provisions for federal sector energy efficiency in the USA are:

- Regulation and coordination of activities by governmental services at all levels (federal, state and municipal);
- Creation of mechanisms for financing energy saving measures in the budget sphere, to include the use of alternative financing mechanisms for energy efficiency projects; and
- Involvement of utilities in energy saving efforts.

Based on the results, ARENA-ECO identified the main directions for improving the legislation and financing state and regional energy efficiency projects. This report provides 16 proposals for improving Ukraine's legal and standard frameworks in the budget area based on the analysis of the results of two reports mentioned above. These proposals cover the three key FEMP directions:

- Planning, reporting, and analysis (proposals 1 and 2);
- Technical assistance to agencies (proposals 3-8); and
- Project financing (proposals 9-16).

Two initial actions have been taken to establish a program in Ukraine to improve the energy efficiency of buildings in the budget area. In the first, the Cabinet of Ministers of Ukraine issued a Decree [21], at the initiative of the State Committee of Ukraine for Energy Conservation that created divisions of energy saving in the ministries, institutions and oblast administrations. The main responsibility of these divisions is to increase the effectiveness of activities aimed at improving energy efficiency.

In the second, the Cabinet of Ministers of Ukraine issued Decree N 575 of 29 May, 1999, "Issues of the State Inspection of Energy Saving," for the State Committee of Ukraine for Energy Conservation and to State Inspection of Energy Saving to provide oversight for compliance with fuel and energy consumption standards. The State Inspection of Energy Saving, which structurally includes 2 regional and 23 oblast energy efficiency inspectorates, provides: oversight in the energy efficiency area, technical expertise, control of the implementation of energy efficiency technologies and insulation materials during construction and reconstruction, and other commitments related to the state oversight of fuel and energy use.

A section of the report identifies the priority energy efficiency measures for application in Ukraine's budget buildings, with a summary of available experience in implementing energy efficiency technologies in the budget buildings of Ukraine. These priority measures were defined based on the classification of the budget buildings, their quantity and characteristics as well as estimation of these measures effectiveness.

This report is concluded with information of a seminar attended by many representatives of state, regional, and local administrations that summarized the work performed.

1. Analysis of Ukrainian Legislation and Potential Financing Sources for Implementing Energy Efficiency Measures in the Budget Area

1.1 Management of energy efficiency activity in Ukraine budget area

In accordance with the Budget Code of Ukraine [1], a budget institution is defined as a body, institution or organization determined by the Constitution of Ukraine as well as institution or organization set up under the procedures established by the bodies of state power, bodies of power of the Autonomous Republic of Crimea, or bodies of local self-governance, which are fully supported by the state budget or local budgets respectively. As such, budget institutions are classified as non-profit organizations.

The general activities of budget institutions in Ukraine are regulated by Laws:

- On local self-governance in Ukraine [2];
- On the budget system of Ukraine [3];
- On financing sources of the bodies of state power [4];
- By the Budget Code of Ukraine [1]; and
- By Order of the Ministry of Finance of Ukraine “On budget classification and implementation.”[5].

The activities of budget institutions in the field of energy efficiency are performed in accordance with:

- The Laws of Ukraine, primarily the Law “On Energy Conservation” [6];
- Decrees of the President of Ukraine;
- Resolutions of the Cabinet of Ministers of Ukraine;
- Instructions of the Cabinet of Ministers of Ukraine;
- Orders of the State Committee of Ukraine for Energy Conservation;
- Methodological materials in the energy efficiency area; and
- Other legislative and legal acts.

The State Committee of Ukraine for Energy Conservation was created by the Decree of the President of Ukraine № 666/95 of July 26, 1995 to provide for the conduct of comprehensive state policy in energy efficiency, which includes operation effectiveness, and implementation of the Law of Ukraine “On Energy Conservation.” The main tasks of the State Committee of Ukraine for Energy Conservation, defined by the order of the President of Ukraine of October 6, 1995, are:

- Provide management of energy efficiency activities at the state level;
- Carry out a comprehensive state policy in the energy efficiency area;
- Improving effectiveness of activities in the energy efficiency area; and
- Coordinate the activity of ministries and other bodies of state power on energy efficiency issues as well as enterprises, institutions and organizations that are managed by the Committee.

The Cabinet of Ministers of Ukraine issued a Decree [21], at the initiative of the State Committee of Ukraine for Energy Conservation that created divisions of energy saving in the ministries, institutions and oblast administrations. The main responsibility of these divisions is to increase the effectiveness of activities aimed at improving energy efficiency.

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1.2 Legislative and standard provisions

The major Law that regulates energy efficiency activities is the Law of Ukraine “On Energy Conservation” [6]. This law defines key elements of economic mechanism of energy conservation, the role and place of expertise, and control and standardization in the energy efficiency area. Approval of this Law in 1994 played a decisive role in establishing the system of management and development of energy efficiency in Ukraine. But this Law is of declarative character, and, over recent years, several acts have been approved for the practical application of its main provisions.

The Law “On Amendments to the Code of Ukraine on Administrative Violations regarding Bringing to Account for Violation of Legislation on Energy Saving” [7] defines the responsibilities of managers of the enterprises, institutions and organizations independently of the form of ownership or individuals – facility owners that should be knowledgeable about non-compliance and not meeting requirements relating to:

- Performance of state energy efficiency expertise;
- Establishment of standards for specific fuel and energy consumption or exceeding these standards established in accordance with the legislation;
- Elimination of violations of legislation in energy conservation;
- Failure to submit, to the State Inspection of Energy Saving, relevant information as provided by Law, or providing false information on energy efficiency, or creating obstacles to access energy saving objects and equipment for metering energy consumption; and
- Alteration of building insulation, engineering sites, or entrances to residential buildings, which causes a reduction in the heat resistance of building envelopes, windows, and doors during the heating season.

Among the acts that regulate the investment activity in the budget area of Ukraine it is necessary to mention “On the Measures to Reduce Energy Consumption by Budget Institutions, Organizations and Budget Enterprises” by Order of the President of Ukraine № 662 (662-99) of June 16, 1999 [8] and four Decrees of the Cabinet of Ministers of Ukraine [9-12]. The main provisions of the five acts relate to different aspects of energy efficiency improvement in the budget area as follows:

- 1) Instruction by the Cabinet of Ministers of Ukraine to provide, within three months, specific mechanisms to reduce energy consumption in budget institutions, organizations, and budget enterprises providing for:
 - Establishment of fixed norms or standards of specific energy consumption by type of energy carriers;
 - Correction of consumed quantities or standards of specific energy consumption;
 - Creation of incentives, such as the conduct of energy audits and, specifically, to redirecting cost savings that result from energy saving measures to financing;
 - Involvement of non-budget sources to financing energy saving measures and fixing budgets over the period equal to the pay back period of these measure in order to make the required payments [8];

- 2) Assignment of tasks to the central bodies of the executive power (Council of Ministers of the Autonomous Republic of Crimea, oblast, Kyiv and Sevastopol city state administrations), to ensure a 25% (3-6%) annual reduction in energy consumption from the second half of 1999 (the base level) to 2004 [8];
- 3) Define the dynamics of energy consumption by budget institutions, organizations and budget enterprises that anticipate a reduction of less than 25% in 2004 [10];
- 4) Define that, for budget institutions and organizations, energy saving measures are aimed at reducing energy consumption, specifically reconstruction of the networks and supply systems, control and metering of water, gas, heat and electricity consumption, and modernizing a buildings' envelope, windows and doors. In addition, for budget institutions and organizations that perform economic activity, energy saving measures include modernization of the technological processes [10];
- 5) Establish the baseline energy consumption costs for a period to not exceed three years for budget institutions and organizations that have attracted energy efficiency financing for measures that have a planned pay back period exceeding [10];
- 6) Establish an approval procedure to procure services and equipment for projects that envisage involving costs from the state budget [9, 11];
- 7) Establish a procedure to select energy efficiency measures and determine the impact of taxation matters on the state budget [11, 12];
- 8) Establish a procedure for the calculation of energy cost savings in Hryvna (Hr) as the difference between the normative and actual energy costs for budget institutions, organizations and enterprises [10];
- 9) By the Order of the State Committee of Ukraine for Energy Conservation № 91 of 25 October 1999 to fulfill the Decree of the Cabinet of Ministers of Ukraine, establish the inter-sectoral norms of electricity and heat consumption for institutions and organizations of the budget area of Ukraine [13, 20];
- 10) Provide heat meters and energy consumption control equipment to budget institutions and organizations during the period 1999 – 2004 [8];
- 11) Assign tasks to the Ministry of Finance and the Ministry of Economy to prepare of state budget drafts beginning 2000 to envisage financing energy efficiency measures in budget institutions and organizations [8];
- 12) Establish norms of specific consumption in natural units and Hr by energy carrier for the production of goods, performance of work, and provision of services for the budget institutions and organizations that conduct economic activity, for the period beginning in 2000 with reductions in each of the following years [10];
- 13) Estimate state budget arrears for energy payments and organizations, and create a register of budget arrears [10];
- 14) Identify specialized organizations for conducting energy audits in budget institutions and organizations [10,18];
- 15) Approve the Comprehensive State Program of Energy Conservation [14] and related measures [15];
- 16) Define the procedures and sources for creating incentives for energy saving in the public sector [16,17];
- 17) Define penalties for excessive energy use [19,32];

The provisions mentioned above [8-15] create the legal basis to develop and implement state, oblast, and city level energy efficiency programs in the budget area because they determine the following:

- Tasks for the improvement of energy efficiency (provisions 1-3, 12);
- Programs of actions (provision 4, 14, 15);
- Methodology for selection of energy efficiency projects (provisions 6, 7);

- Quantitative and qualitative indicators for defining project effectiveness (provisions 3, 8, 9);
- Financing profiles and procedures (provisions 5, 11, 13);
- Audit execution (14);
- Performance measurement (10);
- Incentive creation (16, 17).

In particular, the analysis of energy saving practices in the budget area showed that provisions relating to project financing, incentives, and fiscal performance should be further developed. Further, the mechanism for creating targeted energy saving funds from state and local budgets through imposing economic sanctions on the entities is not available.

1.3 Energy efficiency programs

1.3.1 General information

Article 6 of the Law of Ukraine “On Energy conservation” requires the state to develop and approve state, regional, local and other programs in order to organize and coordinate actions in the energy efficiency area. Article 6 also provides that the procedure and conditions for developing state programs of energy conservation are determined by the Cabinet of Ministers of Ukraine. To date, a Comprehensive State Program of Energy Conservation of Ukraine, Program of Energy Conservation in the Autonomous Republic of Crimea, and energy conservation programs for almost all oblasts of Ukraine and some cities have been developed.

1.3.2 Comprehensive State Program of Energy Conservation of Ukraine

The Comprehensive State Program of Energy Conservation of Ukraine, as approved by the Decree of the Cabinet of Ministers of Ukraine [14], fulfills the Instruction of the President of Ukraine [22], and Decrees of the Cabinet of Ministers of Ukraine [23].

The first of five sections presents general provisions, and the main technical and economic indicators of the program. The second section contains an analysis of the current state of and forecast for the development of the economy and energy sector. The third section contains an analysis of the general potential for energy saving in the main economic sectors. The fourth section contains priority low-cost energy saving measures. The fifth section describes the economic mechanisms and conditions for energy efficiency improvement.

Unfortunately the Comprehensive State Program of Energy Conservation does not require a review of energy efficiency measures for buildings in the budget area. This weakness was corrected in “Additional Measures and Specified Indicators of Comprehensive State Program of Energy Conservation Fulfillment” [33] developed to fulfill the Order of the President of Ukraine [24] and approved by the Decree of the Cabinet of Ministers of Ukraine [14]. Table 1 presents information on the priority energy saving measures in the budget area of Ukraine and Tables 2 and 3 forecasts of annual fuel and energy savings and costs required to achieve these savings in 2000 – 2004.

Table 1. Priority energy saving measures and indicators in the buildings in the budget area

N	Energy saving measure	Coordinator	Ministry (institution), at which the measure is implemented	Number of Items to be Implemented (Pieces) and Cost (million Hr)					Energy savings, (1) total in thousand tce*, including (2) conventional fuel, thousand tce*, (3) natural gas, billion m ³ , (4) heat, thousand Gcal, (5) electricity, million kWh						
				Natural units	2000	2001	2002	2003	2004		2000	2001	2002	2003	2004
	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
1	Installation of meters	Ministries and institutions	Ministries, institutions, enterprises	Pcs	1,133	67	50	50	50	(1)	18.35	1.085	0.81	0.81	0.81
				Million Hr	7.931	0.469	0.35	0.35	0.35	(4)	101.9	6.03	4.5	4.5	4.5
2	Installation of heat meters and temperature controls in budget facilities of oblast (city, district) state administrations	Oblast and local state administrations	Enterprises	Pcs	17,400	17,450	17,450	17,550	17,600	(1)	107.1	3.06	1.53	0.765	0.383
				Million Hr	121.8	0.35	0.35	0.35	0.35	(4)	595	17	8.5	4.25	2
3	A complex of low cost measures to optimize equipment operation and modernize equipment. The measures reduce heat losses, improve lighting, etc.	Ministries and institutions	Ministries, institutions, enterprises	Pcs	15	50	56	60	70	(1)	15	50	56	60	70
				Million Hr	6	18.75	21	22.5	26.25	(2)	15	50	56	60	70
4	Install hot water meters in administrative buildings of ministries and institutions	Ministries and institutions	Enterprises	Pcs	765	20	15	10	15	(1)	0.038	0.001	0.001	0.001	0.001
				Million Hr	1.1475	0.03	0.0225	0.015	0.0225	(2)	0.038	0.001	0.001	0.001	0.001
5	Install cold water meters in administrative buildings of ministries and institutions	Ministries and institutions	Enterprises	Pcs	306	24	10	10	10	(1)	0.076	0.006	0.002	0.002	0.003
				Million Hr	0.306	0.024	0.01	0.01	0.01	(2)	0.076	0.006	0.002	0.002	0.003
6	Install hot water meters in budget buildings of oblast (city, district) state administrations	Oblast and local state administrations	Enterprises	Pcs	9,073	27	25	25	50	(1)	0.453	0.001	0.001	0.001	0.003

				Million Hr	13.6095	0.0405	0.0375	0.0375	0.075	(2)	0.453	0.001	0.001	0.001	0.003
7	Install cold water meters in budget buildings of oblast (city, district) state administrations	Oblast and local state administrations	Enterprises	Pcs	15,400	25	25	25	25	(1)	3.85	0.006	0.006	0.006	0.006
				Million Hr	15.4	0.025	0.025	0.025	0.025	(2)	3.85	0.006	0.006	0.006	0.006
8	Install natural gas meters in budget buildings of oblast (city, district) state administrations	Oblast and local state administrations	Enterprises	Pcs	1,000	50	50	50	50	(1)	18	0.9	0.9	0.9	0.9
				Million Hr	24	1.2	1.2	1.2	1.2	(3)	15.517	0.776	0.776	0.776	0.776

*tce is metric tons of coal equivalent.

Table 2. Forecast of energy and fuel savings (based on [33] data)

Economic sector	Units	Savings in comparison with the previous year					2004 compared to 1998
		2000	2001	2002	2003	2004	
Budget area	Thousand tce	162.87	55.0	59.25	62.485	72.1	1,409.17
Total in Ukraine economy	Thousand tce	1,803.89	2,416.74	3,892.53	5,326.28	7,876.5	42,631.88

Table 3. Forecast of the costs requirements to achieve forecast savings of fuel and energy shown in Table 2 (based on [33] data).

Economic sector	Units	2000	2001	2002	2003	2004	Total
Budget area	Million Hr	190.19	20.888	22.99	24.487	28.282	286.837
	\$ million	35.88	3.941	4.34	4.62	5.34	54.121
Total in Ukraine economy	Million Hr	1,111.19	1,051.86	1,480.9	1,801.82	2,596.34	8,042.110
	\$ million	209.65	198.46	279.42	339.97	489.88	1,517.380

Based on the data in tables 2 and 3, and the cost of fuel and energy consumed annually in the budget area (approximately 5.2 billion Hr), we conclude that the estimated cost [33] for financing the energy efficiency measures may be insufficient to obtain the required [24] reduction of 25% in fuel and energy costs.

Based on the comparison of the data from tables 2 and 3 with the cost of fuel and energy, which is consumed in the budget area of Ukraine over the year (which is approximately 5.2 billion Hr) we may make a conclusion that estimated in [33] financing costs for energy efficiency measures in the budget area may be insufficient to reach the task [24] on the reduction of fuel and energy costs by 25%.

1.3.3 Oblast programs of energy conservation

In accordance with the Methodological guidelines [25] in the Autonomous Republic of Crimea and the 24 oblasts of Ukraine, the Comprehensive programs of energy conservation were developed and approved by the Chairman of the State Committee of Ukraine for Energy Conservation. The Methodological guidelines define the development procedure, contents, rules of agreement, approval, and fulfillment and control for implementation of regional, oblast and local energy saving programs.

The Oblast Comprehensive programs of energy conservation are developed in practically all oblasts of Ukraine and contain two main sections. The first is the data and analysis of the current state and forecast through 2010 of the development of economy's energy supply with consideration of the energy saving potential. The second is a prioritized list of saving measures in all economic sectors, including the budgetary sphere, as well as mechanisms and potential sources of financing, and program implementation issues.

1.3.4 Municipal programs of energy conservation

Currently, the practice of energy saving programs at the municipal level is not yet widespread in Ukraine. One of the main causes is absence of energy saving departments in municipal state ad-

ministrations. However, the lack of municipal programs is compensated by oblast programs that consider measures meant for implementation in the cities. But these measures are presented in the Oblast perspective and are inadequate as guidelines at the city level.

Nevertheless, there is a practice of developing municipal energy saving programs. First, it is necessary to mention the programs of energy conservation in the cities of Kyiv and Sevastopol, which are required by the city administrations. For example, the energy conservation program for Sevastopol is embodied in a 73 page document with 7 sections. This program is included in the web-site of the State Committee of Ukraine for Energy Conservation.

Recent events give hope that municipal energy conservation programs will be created as a part of the demonstration zones program administered in Ukraine by the UN Economic Commission for Europe and State Committee of Ukraine for Energy Conservation. The city of Dniprodzerzhynsk developed an energy saving program [26] in this framework and assigned the key implementation role to the specialists in the State technical university that developed this program. The legal basis for establishing and operating the energy efficiency demonstration zones was developed by the Agency for Rational Energy Use and Ecology and submitted by the State Committee of Ukraine for Energy Conservation in the form "On the amendments and addenda to the draft Law of Ukraine On Energy Conservation." These amendments were based on the analysis of the regulations of the Russian government (resolution of the Government of Russian Federation N 998 of 12.10.95 "On the State Support of Establishing in the Russian Federation of Energy Efficiency Demonstration Zones", "Charter of Russian Energy Efficiency Zones"), Belarus, and local authorities of Ukraine. The objects of the demonstration zones were defined as enterprises producing and consuming fuel and energy, public buildings, industrial, and other like objects

The city of Zaporizhzhya used the analysis to develop the draft "Model regulation of the demonstration zone of high energy efficiency" received approval from the State Committee for Energy Conservation as well as City Heads of Ivano-Frankivsk, Dniprodzerzhynsk, Zaporizhzhya and Rivne. The draft Model Regulation of the demonstration zone includes sections that cover: general provisions, objective, normative references, objects, demonstration projects, arrangements for the establishment and operation, supervisory bodies, sources of financing, development of international cooperation, and provision of access to information.

1.3.5 Programs on installing the equipment for metering and control of natural gas, water, heat and electricity consumption in residential buildings

As is common in many former centrally planned countries, energy consumers paid in accordance with consumption norms based on area or volume of the occupied space and not on the basis of actual energy consumption. This is changing with cost based energy prices and the Cabinet of Ministers of Ukraine passed four resolutions and issued one order to improve the efficiency of gas, water and heat use. The resolutions [27, 28] approved a Program for equipping the existing stock of buildings with water and heat meters and controls during the period 1996-2002, and a Schedule for equipping the objects of the budgetary sphere with water and heat meters.

Quotes from the Program are:

- "in Ukraine there are about 600 thousand of buildings of state and collective property, of which multi-storied (5 stories and more) account for 70 thousand. The annual increase in the building stock is 1.2% on average or 7,460 buildings. Currently only about 9% of the buildings are equipped with cold water meters, while hot water and heat meters are lacking everywhere."

- “about 30% of water is lost and not used rationally, which requires additional electricity consumption (1.1 billion kWh annually). Heat losses during heat transportation from supplier to consumer are up to 40% in some oblasts”.
- “The main objective of the Program is to reduce the state’s energy resource need in the areas of water and heat consumption by 15-20% at the first stage (1996 - 1998) and 30-50% in the second stage.
- “the most efficient way of reducing consumption is to implement metering.”

The Resolution of the Cabinet of Ministers [28] approves the Schedule for equipping the objects of the budgetary sphere with water and heat meters by 1999-2000. The Schedule was developed in accordance with the requirements of the World Bank and the Cabinet of Ministers regarding the issuance of a loan for the management state resources in order to promote rational water and heat use. It was expected that fulfillment Schedule would reduce water and heat consumption by 15-30%, and provide a corresponding reduction in state and local budgetary allocations for building maintenance, and debts for heat and water consumption. The schedule envisages equipping the objects of the budgetary sphere with water and heat meters of Ukrainian manufacture.

The Cabinet of Ministers also approved a Resolution [29] for the installation of gas meters in households and supported a proposal [30] of the National joint stock company “Naftogaz Ukrainy” to install gas meters in buildings owned by the Ministries and other budget institutions. The Cabinet of Ministers also approved an action plan to implement automated electricity metering system to improve the collection of payment for electricity consumption.

1.4 Experience of energy saving programs implementation

Statistics [33] for the period 1996-1999 show that 15.9 million tce were saved, of which 6.5 million tce were in 1999. Thus, the requirements of the Comprehensive conservation state program energy were fulfilled by 33.6% and 69%, respectively. Energy consumption indicators for the budgetary sphere were not included to the Comprehensive state program of Ukraine and there are no statistical data for 1996-1999 regarding efficiency improvements for measures implemented in this sphere.

The 1999 Presidential order [8] requiring budgetary institutions, organizations and enterprises to start financing energy efficiency measures in 2000 resulted in budgetary investments for the first time. This amounted to Hr 25.4 million* according to the Law of Ukraine “On the State Budget of Ukraine for 2001” and Hr 17 million in 2002. The actual investment to improve energy efficiency was larger because the state funding leveraged funding from local authorities.

Equipping the budgetary buildings with gas, water and heat meters as defined by the Resolution of the Cabinet of Ministers [28] and Order of the Cabinet of Ministers [30] was less successful. According to data [39] 32% of budgetary buildings were equipped with building level gas meters, 2.3% with building level heat meters, 17.5% with building level cold water meters, and 2.2% with building level hot water meters. Additionally, state inspectors found that many of the installed meters were not operating, a condition often created artificially.

The investment required to install the meters by 2004 is Hr 238 million. A most typical explanation given for not installing the meters is nonpayment of utility bills, but the statement is groundless when one considers that consumer overpay for estimated rather than actual consumption. For example, actual cold water consumption in the Rivnenska, Zhytomyrska and Zaporizka

* It should be noted, that these funds are issues as grants and do not undergo repayment.

oblasts is lower than the normative consumption by 90%, 40%, and 30%, respectively and a similar situation occurs in the sphere of heat energy [39].

There are means for measuring energy consumption as well, specifically by time of day. “For example, implementation of zone-based electricity metering would help to provide annual budgetary savings of Hr 3.6 million in the Derzhvodgosp system, while the payback period of such a measure would make 2.5 months” [39].

Considering the above facts, it is possible to make the following conclusions:

- The objective of the Comprehensive state program of Ukraine on energy saving in budgetary sphere [8] the installation of gas, water, and heat meters in the objects of the budgetary sphere are not being implemented in full; and
- The main reasons for the lag in implementation are the lack of financing from the state budget and the lack of incentives for implementation.

Overcoming these two barriers requires further improvements to the legal base and the creation of conditions for attracting non-budgetary funds to finance energy efficiency projects. Let us first look at the possible sources and forms for financing energy efficiency projects in the budgetary sphere of Ukraine.

1.5 Sources and forms of energy efficiency projects financing

1.5.1 General information

Financing for energy efficiency improvements in the budget area may be obtained from state and local budgets, the State Innovation Company, international financial institutions, commercial banks (domestic and foreign), bonds, leasing, and energy service companies. Investments may be provided in a form of subsidies, subventions, loans, grants, leases, and performance contracts.

The mechanism for repaying the debt from the cost savings obtained from the energy efficiency improvements may be applied practically too all investment sources except for subsidies, subventions and grants. Below we review the sources and forms of financing for the improvement of energy efficiency in the budget area.

1.5.2 State budget

The fourth section of this report provided a review of state financing for energy efficiency measures in the budget area. Although the state budget currently faces problems, it may become one of the main financing sources for these measures in the future.

Funds provided for energy efficiency from the state budget are currently provided in the form of grants. Other mechanisms should be considered, of which the following may be regarded as the most effective:

- base repayment of energy efficiency investments on the cost savings achieved; and
- grant permission to the budget institutions and organizations retain the resulting cost savings and apply the savings to the implementation of additional energy efficiency measures (capital and/or associated services and installation).

1.5.3 Local budgets

Application of the repayment mechanism for implementing energy efficiency has not been applied because of inconsistency with the Law of Ukraine “On the Taxation System” [36] and “On

Tax Deduction from Enterprises' Profit" [37]. This complicates the process of attracting energy efficiency investments in the budget area, but approval of the budget Code of Ukraine [1] may improve the situation. The Budget Code of Ukraine provides managers of budget institutions, organizations, and budget enterprises that use budget funds, more responsibilities regarding implementation of energy efficiency projects. The needed financing for these projects may be included in the budget request with relevant justification of the project goal, urgency, viability and effectiveness of the budget funds application (Article 75 of the Budget Code). After local financial bodies review these projects, they may be included in the draft decision for the local budget. The draft decision includes an Explanatory Note that lists the investment programs for the following budget period and for three following budget periods (Article 76).

The development of energy efficiency in the budget area is also reduced by constrained local budgets and requires a search for other financing sources for energy efficiency improvements. The Budget Code provides the local councils the right to obtain debt financing under conditions envisaged by the Law on the State Budget of Ukraine (Article 16). However, only councils of cities having a population over eight hundred thousand people have the right to get debt financing from foreign sources. Article 74 of the Budget Code defines that debt financing to the local budgets should be attracted for a specific purpose and should be repaid in accordance with the procedure established by the Cabinet of Ministers.

Expenditures for activities aimed at improving energy efficiency in the budget area are to be enumerated by budget classification as introduced by the Order of the Ministry of Finance of Ukraine [5]. Financing energy efficiency projects may be executed by the following articles of the budget Classification:

- Multi-purpose development projects (code 0473 of the functional classification of budget expenditures);
- Financing energy efficiency measures (code 0473 of temporary classification of local budgets expenditures);
- Expenditures for installing equipment for metering and control of water and heat consumption (code 0620 of this classification).
- Besides for financing energy efficiency projects, subventions on the fulfillment of investment projects (code 0180 of temporary classification of local budgets expenditures).
- Revenues from implemented energy efficiency projects may be used for payments to investors and further energy savings may be accumulated in a fund set up by the local bodies of executive power (code 50110000 of classification of budget revenues).

The bodies of local self-governance may also use authorities provided to them by the Law "On Local Self-Governance in Ukraine" [2] to implement energy efficiency projects, specifically the right to independently determine the use of local budget funds (Article 61 of the Law). Energy efficiency projects may be included in social and economic development programs, which should be developed by the executive bodies of villages', settlements' and cities' councils (Article 27). The bodies of local self-governance are also in charge of encouraging performance of the investment activity on an appropriate territory (Article 28). Besides, article 70 of the Law of Ukraine "On Local Self-Governance in Ukraine" provides the bodies of local self-governance the right to participate in these credit-financing relations:

- The council, or upon its decision, other bodies of local self-governance may issue bonds, lotteries, and securities, and obtain loans from banking institutions;
- The bodies of local self-governance may create communal banks, other financial, or lending institutions to become guarantors of the loans for the enterprises, institutions and organizations of communal property of territorial communities, and obtain interest from

their revenues according to the Law with the revenues accruing to the relevant local budgets.

Article 22 of the Law “On the Budget System of Ukraine” [3] also “fixes responsibilities of the Verkhovna Rada of Ukraine, Verkhovna Rada of the Autonomous Republic of Crimea, local councils of People’s Deputies, and state bodies of the executive power and executive bodies of local councils on formation of the expenditures of the budget.” Specifically, this article defines that budget costs may be directed “to investments” of various forms -- own target programs as well as joint programs with the bodies of state power of other administrative and territorial units, foreign economic activity, environmental measures, renewal of natural reserves, and cultural wealth, located under the authority of the relevant executive bodies, improvement of cities’, settlements’ and villages’ environment, maintenance and capital repair of residential stock and communal facilities, roads network, educational establishments, health-care institutions, scientific and cultural institutions, as well as physical training and sports institutions, mass media subordinated to the bodies of the state power and local self-governance bodies, consumer protection and other purposes.”

Based on the foregoing analysis of Ukrainian legislation, we conclude that the possibility exists to establish and introduce a mechanism of attracting energy efficiency investments in the budget area with repayment from energy savings. This mechanism, however, must be approved by the Cabinet of Ministers of Ukraine.

1.5.4 State Innovation Company

The State Innovation Company is the successor to the State Innovation Fund, which has been liquidated. The responsibility of the State Innovation Company performs is to develop a new investment policy [40], which could allow financing for energy efficiency programs.

1.5.5 International financial institutions

The most well known international financial institutions (IFIs) that provide financing for energy efficiency projects in the budget area are the European Bank for Reconstruction and Development (EBRD) and International Bank for Reconstruction and Development commonly known as the World Bank. The World Bank provides loans under a comparatively low interest rate but requires a sovereign guarantee for the loan repayment. An example project financed by a loan from the World Bank is the Ukraine the Kiev Public Buildings Energy Efficiency Investment Project, which is currently undergoing implementation. EBRD prefers to cooperate with the private sector and does not require a sovereign guarantee, but the interest rate for these loans is significantly higher than for the World Bank loans. EBRD loans have predominately supported projects on the reconstruction of water supply systems.

A common lending IFI feature is the coverage of only part of the project costs (as a rule, 60% for the World Bank and 40% for EBRD) and a minimum project cost of \$5-10 million. Only energy efficiency projects for the budget area in large cities of Ukraine could be of this size.

As an alternative to financing only projects having a minimum value, IFIs apply credit lines. Under this scheme the Borrower gets the loan from the IFI through a domestic bank, but the borrowing institution may face a higher interest rate tied to the LIBOR rate, which equaled 6% in September-October 2002. An analysis of banks requirements shows the average interest rate obtained is about 16% in dollars and 25% in Hr.

The company UkrESCO set up by the European Bank for Reconstruction and Development and the European Union provides a unique opportunity for obtaining the loan to finance projects, but this company does not yet operate in the budget area.

1.5.6 Commercial banks

Commercial banks can be considered one of the most real sources of energy efficiency investments in budgetary sphere organizations. This section provides results of studies of Ukrainian banks that are able to finance long-term investment projects, and that possess high net assets ratings [41].

Commercial banks can provide short-term loans (one year) in national and foreign currencies depending on the project aims and company's activity. The credit terms are characterized by the payback period, interest rate, commission payment, collateral, guarantee, and loan amount.

Attention was given to banks that provide long-term lending (more than 1 year). The following Ukrainian banks provide lending for up to three years - JS Postal-Pensionary Bank Aval and Vabank (own resources). Kredyt Bank, Vabank (through an EBRD credit line), NADRA (through EBRD and World Bank credit lines) provide loans for up to five years. Other banks consider the possibility of lending for the entire term of project implementation.

The interest rate is dependent on the economic situation in the financial market and the borrower's credit rating. This rate depends on the client's credit history, level of credit risk, character and economic parameters, objectives of crediting, and type of collateral. One of the most important of these factors is financial state of the borrower, which determines whether a loan will be made and what the interest rate and other terms will be.

Many banking institutions require commissions or payments for some or all of the following items:

- Application (0.1% of the loan amount);
- One-time commission payment for arranging a credit line (0.125% - 3.0% of the loan amount);
- Administering/servicing a credit line;
- Amendments and/or additions to the Lending Agreement at a client's request;
- Insufficient use of the approved credit line limit; and
- Extension of the credit line term.

Some banks such as Big Energy, Aval, Privat Bank, Marine Transport Bank do not require commission payments for long-term loans.

Collateral is also an important requirement, with a majority of banks requiring collateral up to 200% of the loan amount. The company may use the following items as collateral:

- Movable and stationary property (preferred);
- Securities;
- Commodities in circulation (less preferable), raw materials (not more than 25% of the loan amount);
- Vehicles; and
- Jewelry and non-ferrous metals scrap.

In addition or alternatively, the loan may be secured by a guarantee from a bank or a third party.

An important consideration of most banks is the borrowers' participation in project financing and opening account in the lending bank. Some banks are interested in project co-financing in order to share project risks between different lenders.

The analysis revealed that the following banks would agree to provide loans for municipal projects:

- Big Energy;
- Privat Bank;
- JSB Pivdenny (these three banks do not reject the idea of lending to municipal enterprises and companies with partial state ownership);
- Kredyt Bank (through the World Bank credit line);
- Nadra (through the World Bank credit line);
- Marine Transport Bank (for all enterprises).

The banks can provide loans in UAH or in USD and then convert them in UAH, with a minimum interest rate of 12% on loans in USD and 20% on loans in UAH. While the interest rate on loans issued in USD is much lower than on loans, the loan must be repaid in USD.

Municipalities and enterprises can work with most of the banks as the majority of banks have affiliated branches throughout the country.

1.5.7 Issuing bonds

Government and the local authorities (According to the Law of Ukraine "On Local Self Government in Ukraine" [2] can issue bonds to finance activities. The interest rate may be lower because the investors/lenders are released from taxes on interest from municipal bonds. Unlike the classical form of credit with one or a few lenders, the bonds belong to a number of lenders.

1.5.8 Leasing

Leasing is a more complicated form of financing. According to the agreement, the lessee makes a periodic payment to the lesser periodical for the use of the equipment use to cover the difference between the initial and residual value of the equipment. A profit is built into these payments to compensate the lesser for 'providing' a loan as embodied in the subject equipment.

The main difference between a lease and a loan is the residual value of the property, which leads to the fact that payments for the use of the similar equipment within the same period of time will be lower through a lease rather than a loan. The lesser does have to state the value equipment or liabilities for the balance owed. Rather, the payments can be recorded as operational costs. The relations between the lesser and lessee are regulated by the Law of Ukraine "On leasing" [34].

1.5.9 Special purpose funds

Article 13 of the Law of Ukraine "On Energy Conservation" envisages creation of the state extra-budgetary fund of energy conservation. However, on the basis of the Law of Ukraine "On the Sources of Financing of the State Authority Bodies" [36], the above-mentioned article is not in force.

Local purpose funds created by the bodies of the self government can be used for financing energy efficiency improvement projects in the budgetary sphere, but currently, there is not a mechanism for creating such funds.

Besides the Ukrainian special purpose funds, the possibility of attracting funds of foreign and joint purpose funds, like, for example, German-Ukraine fund should be considered.

1.5.10 Energy service companies

The performance contracting mechanism is already well known in Ukraine. According to this contract the client pays to the energy service company (ESCO) for energy services provided using money obtained from the achieved energy savings. In addition to UkrESCO, there are several other companies that include the word “ESCO” in their name. However, due to lack of legal basis for the performance contract mechanism in Ukraine, Ukrainian ESCOs do not use a payment mechanism based on the energy savings.

The use of the ESCOs concept in Ukraine would seem to make a good fit based on several aspects of energy supply:

- Comparatively low energy efficiency of energy consuming equipment;
- Personnel lack experience in the development and implementation of investment projects;
- Short payback period of the typical energy saving measures; and
- Lack of own funds for implementing energy saving measures.

In addition, ESCOs participation in the implementation of energy saving measures will increase investors trust (i.e. reduce risk), which should lead to increased investment.

2. Analysis of U.S. Legislation Related to Energy Efficiency in Budget Sphere

2.1 Energy efficiency legislation

The United States has made significant achievements in energy efficiency improvement by using market mechanisms introduced by legislation and laws. The United States has passed over 42 Federal energy acts over the last 20 years, half of which address energy saving problems [56].

Since the 70s, both Congress and the executive branch have strived to cut federal expenditures by promoting energy efficiency within Federal agencies. Important drivers for national energy policy were pieces of legislation passed by Congress and Executive Orders signed by the President, which have incorporated the benefits of past experiences, and new technologies and approaches to the federal demand-side management and energy distribution.

DOE set up the Federal Energy Management Program (FEMP) to effectively lead and coordinate Federal agencies' energy saving efforts. The main acts of Congress regarding Federal energy management legislation include:

- Energy Policy and Conservation Act, 1975 (PL 94-163) [46]
- National Energy Conservation Policy Act, 1978 (PL 95-619) [47]
- Federal Energy Management Improvement Act, 1988 (PL 100-615) [48]
- Energy Policy Act, 1992 (PL 102-486) [49]

The main goal of Energy Policy and Conservation Act is to increase domestic energy supplies and availability of energy, restrain energy demand, and prepare for energy emergencies. The Act identifies the main provisions for Federal Energy management and directs the President to develop mandatory standards for Federal agency energy efficiency procurement policies and develop and implement 10-year plan for energy conservation in Federal buildings.

The National Energy Conservation Policy Act promotes the use of life-cycle costing in operating Federal buildings, and the use of solar and other renewable energy sources. The law defines the Federal Energy Initiative, establishes use of life-cycle cost methods, publication of Energy Performance Targets, and requires life-cycle cost audits and retrofits of Federal buildings.

The Federal Energy Management Improvement Act promotes efficient use of energy by the Federal Government, amends the Federal Energy Initiative, establishes a goal for a 10% improvement in Federal buildings by 1995 against 1985, and directs agencies to establish incentives for energy conservation.

The Energy Policy Act amends the National Energy Conservation Policy Act and establishes a goal for a 20% reduction in Federal agencies energy consumption by 2000. It also contains provisions regarding energy management requirements, budget treatment for energy conservation measures, incentives for Federal facility energy managers, reporting requirements, new technology demonstrations, agency surveys of energy-saving potential, and training programs.

The first Executive Order addressing federal energy efficiency was issued in 1976 and more followed through time, with the main orders being:

- Executive Order 12759 "Federal Energy Management", 1991 [50]
- Executive Order 12902 "Energy Efficiency and Water Conservation at Federal Facilities, 1994 [51]

- Executive Order 13123 “Greening the Government Through Efficient Energy Management”, 1999 [52]
- Executive Order 13221 “Energy Efficient Standby Power Devices [53]

Executive order 12759 requires a 20% reduction in federal energy consumption by 2000 in comparison with 1985, minimization of petroleum use, procurement of energy efficient goods and products, participation in demand side management services, and procurement of alternative fueled vehicles.

Executive Order 12902 includes requirements for a 30% reduction in Federal energy consumption by 2005 relative to 1985, regular energy audits of federal facilities, use of innovative financing and contractual mechanisms, and strict procurement policy related to energy efficient products.

Executive Order 13123 requires a 35% reduction in energy use by Federal agencies by 2010 in comparison with 1985, a 30% reduction in GHG emission by 2010 against 1990, and the promotion of renewable energy use and implementation of related projects.

Executive Order 13221 was issued to encourage Federal agencies to purchase products that use minimal standby power.

The Energy Policy Act issued in 1992 contains 20 Titles that covers the energy efficiency issue in exhaustive detail. The first title on Energy Efficiency underscores the that energy efficiency is a priority direction of US federal energy policy and contains 7 Subtitles: Buildings (A), Utilities (B), Appliance and Equipment Energy Efficiency Standards (C), Industrial (D), State and Local Assistance (E), Federal Agency Energy Management (F), Miscellaneous (G).

Subtitle A (“Buildings”) contains requirements related to updating state building energy efficiency codes and determination whether the codes meet the CABO (Council of American Building Officials) Model Energy Code. At the same time states may establish energy efficiency standards that exceed the Model Energy Code and the Federal Government provides incentive funding to states to improve or implement building energy efficiency codes. The Secretary of energy is required to consult with the appropriate Federal agencies, CABO, the National Association of Home Builders, the American Institute of Architects, the National Conference of the States on Building Code and Standards, and other institutions in the development of federal building energy standards that require implementation of the technologically feasible and economically justified energy efficiency measures. Federal agencies may spend Federal funds for construction of new Federal buildings only if these buildings meet the established energy standards.

Subtitle B (“Utilities”) presents a definition of the term “integrated resource planning”^{*} and requires all utilities to implement integrated resource planning. This Section also requires that the rates allowed to be charged by the state electric utilities shall be enough for utility to invest in energy conservation, energy efficiency measures, and other demand side measures. The Secretary is authorized to provide grants to state authorities in an amount not exceeding \$250 000 for encouraging demand-side management.

^{*} “...a planning process for new energy resources that evaluates the full range of alternatives, including new generating capacity, power purchases, energy conservation and efficiency, cogeneration and district heating and cooling applications, and renewable energy resources, in order to provide adequate and reliable service to its electric customers at the lowest system cost. The process shall take into account necessary features for system operation, such as diversity, reliability, dispatchability, and other factors of risk; shall take into account the ability to verify energy savings achieved through energy conservation and efficiency and the projected durability of such savings measured over time; and shall treat demand and supply resources on a consistent and integrated basis” [8]

Subtitle C (“Appliance and Equipment Energy Efficiency Standards”) gives an example of a voluntary national rating program (for windows), as well as mandatory standards for various equipment types: electric motors, conditioners, water heaters, lighting systems and others.

Subtitle D (“Industrial”) authorizes the Secretary to make grants to industry associations to support programs to improve energy efficiency in industry, provided that the grants not exceed \$250 000 and 75% of the total cost of the project for which the grant is made. The Secretary after consultation with utilities, industrial energy consumers, and representatives of the insulation industry, shall establish guidelines for the conduct of energy efficiency audits of industrial facilities to identify cost-effective opportunities to increase energy efficiency, and installation of insulation.

According to Subsection E (“State and Local Assistance”), the Federal Government provides \$1,000,000 to states to deposit into a revolving funds for the purpose of financing energy efficiency improvements in state and local government buildings.

Subtitle F (“Federal Agency Energy Management”) incorporates energy performance requirements for federal buildings. This Section is reviewed in more detail below.

2.2 Federal energy management legislation

2.2.1 General information

The Federal Energy Management Program was set up in 1973 to improve the energy efficiency in Federal buildings by more than 20% against a 1985 base [54]. The analysis presents general information on FEMP activities -- in particular, strategic performance goals and objectives, program activity, tasks and resources, as well as expected performance and achieved results.

The main FEMP goals determined in Acts and Executive Orders are to:

- Reduce Federal Government energy costs;
- Increase energy security;
- Ensure a leading role for the United States among other countries in resource management;
- Increase economic competitiveness;
- Stimulate markets and create local jobs;
- Improve productivity and workplace conditions; and
- Decrease the environmental impact of Federal facilities.

FEMP activities aimed at achieving energy efficiency goals may be grouped into the following areas:

- Planning, reporting and analysis;
- Technical assistance to Federal agencies; and
- Project financing.

In the context of the main areas of activity, FEMP carries out the following tasks for planning, reporting and analysis:

- Prepares plans;
- Frees up resources for other agency needs;
- Creates incentives for Federal agencies to progress in the energy efficiency area;
- Helps provide emergency power during outages;
- Enhances energy supplies and improves reliability through distributed energy resources;

- Performs analysis and prepares reports; and
- Disseminates information related to the successful implementation of energy efficiency projects.

Within the technical assistance activity, seven tasks are identified:

- Improve federal energy management;
- Ensure guaranteed energy cost savings;
- Reconstruct and retrofit federal buildings and infrastructure at the minimal agencies' costs;
- Protect air quality;
- Conserve water resources;
- Promote renewable energy use;
- Increase market demand for advanced energy technologies; and
- Educate federal workers and the public about smart energy choices.

Within the project financing activities FEMP carries out tasks aimed at the optimal use of funds, including:

- Direct appropriations;
- Grants of Federal Energy Efficiency Fund; and
- Alternative financing mechanisms for Federal energy efficiency projects.

FEMP maintains the following resources to carry out the above tasks:

- website FEMP (<http://www.eere.energy.gov/femp>) [45]
- FEMP help Desk (tel. in USA: 800-36-3732);
- FEMP Focus Newsletter
- FEMP HQ Office: (tel. in USA 202-586-5772);
- DOE Regional Office FEMP team
- DOE National Laboratory Liaisons
- Budget (see Table below)

Table 4. FEMP Budget Federal Energy Management Program Highlights FY 2000 – 2003

Key Investments	FY 2000	FY 2001	FY 2002	FY 2003
	Appropriations	Appropriations	Enacted	Request
Planning, Reporting, and Evaluation <i>Supports program reporting and outreach activities.</i>	\$4.4M	\$4.6M	\$2.3M	\$2.8M
Technical Guidance and Assistance <i>Supports audits, design and implementation assistance for general and renewable projects, training, analytical tools, distributed energy resources, combined heat and power projects at Federal facilities, and assessments to identify peak load reduction opportunities.</i>	\$7.5M	\$8.1M	\$7.0M	\$11.0M
Project Financing <i>Support to agencies for projects implemented through energy savings performance contracts and utility energy service contracts.</i>	\$9.9M	\$10.0M	\$8.7M	\$8.7M
Departmental Energy Management <i>Reduce energy and water consumption, improve energy efficiency, and reduce utility cost in DOE facilities and operations.</i>	\$0M	\$2.0M	\$1.5M	\$3.0M
Program Direction <i>Staff expenses and support services for FEMP program efforts.</i>	\$2.2M	\$3.0M	\$5.3M	\$5.3M
Total*	\$23.9M	\$27.7M	\$24.8M	\$30.8M

Source: FEMP Budget www.eere.energy.gov/femp/aboutfemp/fempbudget.html

2.2.2 Planning, reporting and analysis

The U.S. legislation related to planning discusses in greater detail agency incentive, planning, and reporting programs.

The creation of incentives for agencies to conserve and use energy more efficiently is regulated in Section 546 (“Incentives for Agencies”), Subtitle F (“Federal Agency Energy Management”) of the Energy Policy Act. A financial incentive is provided for the Federal agencies to set up financial bonus program for energy managers supported by an appropriation of \$250,000 for fiscal years 1993, 1994, and 1995. The following criteria are used in selecting outstanding energy managers [5]:

- Improved energy performance through increase energy efficiency;
- Implemented proven energy efficiency and energy conservation techniques, devices, equipment, and procedures;
- Developed and implemented training programs for facility energy managers, operators, and maintenance personnel;
- Success in creating and implementing utility incentives, shared energy savings contracts, and other federally approved energy performance contracts (EPCs); and
- Other accomplishments.

The Secretary shall establish a Federal Energy Efficiency Fund to provide grants to agencies to assist them in meeting the energy management requirements. The Federal government appropriation for this purpose was \$10M in 1994 and \$50M in 1995. Each agency shall establish an incentive program for efficient energy use as a result of applying alternative financial mechanisms.

Agencies are also encouraged to participate in energy efficiency and water conservation programs, and the management of electricity demand conducted by gas, water and electric utilities.

Federal agencies reporting requirements are presented in Section 548 (“Reports”), Subtitle F of the abovementioned Act. Each Federal agency shall transmit an annual report to the Secretary, who then reports to the Congress. The annual reports submitted to the Secretary shall incorporate information related to the agency’s progress in achieving the goals established in the Act, cost savings achieved, the number of energy performance contracts entered into, the difficulties encountered in attempting to enter into such contracts, and the proposed solutions.

The Secretary shall submit annual report to the Congress that provides the:

- Federal agencies progress in achieving energy performance goals;
- Amount of funds awarded to each agency and their use;
- A list of energy efficiency measures installed and savings realized;
- Projected savings that were not realized and the reasons for this;
- Proposals for, and projected costs of, achieving such projected savings in the future;
- Number of EPCs entered into by all agencies; and
- Extent and nature of interagency exchange of information concerning the conservation and efficient utilization of energy.

In addition to the above mentioned reports the Secretary in consultation with the Administrator of General Services shall conduct a study and evaluate legal, institutional, and other constraints to connecting Federal buildings to district heating and district cooling.

2.2.3 Technical assistance to federal agencies

FEMP helps Federal energy managers identify, design, and implement new construction and facility improvement projects, including energy efficiency, renewable energy, distributed energy, and water conservation technologies.

FEMP experts provide technical assistance in the followings areas:

- Energy and water audits for buildings and industrial facilities;
- Peak load management;
- Whole-building design and sustainability;
- Renewable energy technologies;
- Distributed energy resources;
- Combined heat and power technologies; and
- Purchase of energy-efficient products.

As part of this assistance, FEMP prepares and conducts presentations of the performance-technologies, helps with project implementation, and in applying different financing mechanisms. FEMP also conducts training workshops, annual the FEMP conference, and participates in trade expositions, all of which attract many federal mangers, engineers, and decision makers.

To help Federal agencies achieve the energy saving goals set in the Energy Policy Act, FEMP's SAVEnergy Program identifies and implements energy efficiency, renewable energy, and water

conservation measures. The SAVEnergy Team assists with key aspects of energy management such as arranging for a building audit, identifying technologies for cost-effective retrofits, reviewing funding alternatives, and helping develop monitoring strategies.

FEMP's assistance programs help Federal agencies develop Super Energy Saving Performance Contracts (Super ESPCs) that are technically excellent, contractually and legally sound, and financially smart. For this purpose FEMP Offers various training programs, including Super-ESPC workshops that enables Federal energy managers to learn how to use this procurement process to allow energy service companies to assume the capital costs of installing energy and water conservation equipment and renewable energy systems at Federal sites.

Federal buyers are directed by Executive Orders 13123 and 13221 to purchase products that are ENERGY STAR labeled or products that are designated to be in the upper 25% of energy efficiency in their class as well as products with low standby power. FEMP's Buying Energy Efficient Products program identifies the buying power of the Federal market and works with vendors to coordinate demand and supply, reduce prices, and expand the overall market for energy-efficient products. Product Energy Efficiency Recommendations helps Federal purchasers to identify the highly efficient products.

The Energy Policy Act also requires improving Federal energy management, with attention to standardization, development of guidelines, requirements to energy audits, purchasing policy, and certification. Subtitle A ("Buildings") of the Energy Policy Act sets requirements for Federal agencies to coordinate the update of building energy codes with federal standards.

The Secretary consults with the appropriate Federal agencies, CABO, the National Association of Home Builders, the American Institute of Architects, the National Conference of the States on Building Code and Standards, and other institutions to establish Federal building energy standards that require implementation of technologically feasible and economically justified energy efficiency measures. Federal agencies may spend Federal funds for construction of new Federal buildings only if these buildings meet the established energy standards.

Subtitle C ("Appliance and Equipment Energy Efficiency Standards") pertains to the development of mandatory standards for various equipment types: electric motors, conditioners, water heaters, lighting systems and others. An example is for a voluntary national window rating program whereby the Secretary, after consultation with the National Fenestration Rating Council, industry representatives, and other appropriate organizations shall provide financial assistance to support a program. This rating program shall include:

- Testing procedures and labels that allow window buyers to make more informed decisions about energy efficiency of windows; and
- Information that will allow buyers to assess the energy consumption and potential cost savings of alternative window products. This information may be disseminated through catalogs, trade publications, labels and other mechanisms.

Subtitle F of the Energy Policy Act requires the Secretary to consult with the Secretary of Defense and Administrator of General Services to develop guidelines for the implementation of energy management requirements presented in the Act. Also, the Secretary and Interagency Energy Management Task Force shall develop recommendations on cost-efficient measures and determine constraints to achieving energy management goals.

This Subtitle also includes requirements for the establishment and use of life cycle cost methods and procedures. The Secretary, in consultation with the Director of the Office of Management and Budget, the Secretary of Defense, the Director of the National Institute of Standards and

Technology, and Administrator of the General Services Administration shall establish practical methods for estimating life cycle costs for Federal buildings that uses the sum of all capital and operating expenses associated with the energy system over the expected life of such systems during a period of 25 years, using average fuel costs and the prescribed discount rate [5].

Another guideline requirement is energy audits to identify energy saving potential in Federal buildings presented in Section 550 (“Survey of Energy Saving Potential”) of Subtitle F. In one case, the Secretary is responsible for assembling one or more energy audit teams and each Site that has utilized an energy audit team must develop a program to monitor the implementation of energy efficiency improvements based on the energy audit teams’ recommendations. In another case, the Secretary together with the task Force shall conduct an energy survey to determine the maximum potential cost effective energy savings for Federal buildings in different areas of the country. The energy survey is conducted in the following building classifications: housing, storage, office, services, schools, research and development, industrial, prisons, and hospitals.

Section 161 (“Procurement and Identification of Energy Efficient Products”) of Subtitle F provides requirements for Federal agencies related to the procurement of energy efficient products. The Administrator of General Services, the Secretary of Defense and other related institutions shall undertake a program to identify energy efficient products that offer significant energy saving potential. The Administrator for Federal Procurement Policy together with Administrator of General Services, the Secretary of Energy and other agencies shall issue guidelines to encourage use of energy efficient products.

Section 549 (“Demonstration of New Technologies”), Subtitle F certifies market demand for modern energy efficient technologies. The Secretary and the Administrator of General Services shall establish a demonstration program to install modern energy efficiency technologies in Federal buildings. Proposals from agencies are selected based on the following criteria:

- Cost-effectiveness;
- Technical feasibility and system reliability;
- The potential needs of the proposing Federal agency for the technology;
- Energy efficiency potential; and
- Projected reduction of GHG emissions and other criteria.

Federal agencies shall submit proposals for projects to be funded under the demonstration program to the Secretary on an annual basis to include:

- A description of the proposed projects and innovative use of technologies in the Federal sector;
- Technical reliability and cost–effectiveness data;
- Identification of the potential needs of the Federal agencies for the technologies; and
- Schedules and milestones for installing new technologies.

For carrying out this demonstration program Federal Government appropriated \$5,000,000 for the 1993, 1994 and 1995 fiscal years.

The Secretary is also responsible for conducting a study to evaluate the potential use of the purchasing power of the Federal Government to promote the development and commercialization of energy efficiency products. The study shall be performed together with utilities, manufacturers, and appropriate nonprofit organizations concerned with energy efficiency.

Section 157 “Federal Agency Energy Management Training”, Subtitle F of the Act includes requirements related to energy management training programs for Federal energy managers. The Environmental Protection Agency, the General Services Administration and other organizations

shall participate in the creation and realization of this training program. The abovementioned agencies shall encourage employees to participate in energy manager training courses.

Section 156 “Intergovernmental Energy Management Planning and Coordination” of Subtitle F requires holding regular conferences and workshops in each of the 10 standard Federal regions on energy management, conservation, efficiency, and planning strategy. Energy managers and other interested parties from DOE, state and local officials should participate in these workshops and discuss the following topics:

- Strategies among Federal, state, and local governments to coordinate energy management Policies and maximize available intergovernmental energy management resources;
- Design, construction, maintenance, and retrofit of governmental facilities to incorporate energy efficient techniques;
- Procurement and use of energy efficient products;
- Dissemination of energy information on innovative programs, technologies, and methods, which have proven successful in government; and
- Technical assistance to design and incorporate effective energy management strategies.

2.2.4 Project financing

FEMP proposes the utilization of four primary options for financing energy efficiency projects in Federal agencies: direct appropriated funding, grants from the Federal Energy Efficiency Fund, EPCs, and utility sponsored demand-side management incentives [11]. The latter two options utilize non-government sources of funding and can be used to supplement Government funding.

Direct appropriations are ratified in Section 545 (“Budget Treatment for Energy Conservation Measures”), Subtitle F, of Energy Policy Act, which requires each agency, in support of the President’s annual budget request to Congress, to set forth and identify funds requested for energy conservation measures. This direct financing is provided to implement the very best projects that bring new products and services to the Federal marketplace. These projects can provide leadership in the Federal sector in the specific technology, and financing and constructing mechanisms to overcome the initial reluctance of the Federal sector market to try new methods and products despite their potential. This approach helps manage the risk of new products and services ensures more rapid introduction of all appropriate energy and cost saving mechanisms.

According to Section 155 of Energy Policy Act Federal, agencies may enter into energy performance contracts (EPCs) for the purpose of achieving energy savings and related benefits. This Section describes procedures for realizing these contracts. The EPC program was created to provide agencies with a fast and cost-effective way to increase the energy efficiency of Federal buildings.

Generally, the Energy Service Company (ESCO) proposes an EPC as an alternative financing option, which allows Federal agencies to involve private funds into federal energy saving projects. Under an EPC a private ESCO assumes the design, construction, and financing aspects of the project. The client organization works only with the ESCO, which, in its turn, communicates with vendors, subcontractors and financial institutions. The ESCO, also responsible for project implementation, covers its costs from the achieved cost savings. The ESCO guarantees that project savings will be enough to reimburse the efficiency investments within the specified period, as well as the project preparation costs that have not been covered. The ESCO also provides the financing from its own funds or through a loan from a lending institution.

There are three main forms of EPCs:

- 1) *Guaranteed Savings*. This form of the contract establishes fixed payments that satisfy the debt service requirements for the equipment, building modifications and the ESCO's fees. The ESCO guarantees that the energy savings will cover the customer's obligation. The investor typically retains ownership of the improvements until the loan is paid off, but ownership may pass to the customer at the beginning of the project implementation.
- 2) *Shared Savings*. In a shared savings arrangement, payments to the ESCO are calculated as a share of the energy savings generated from the installed equipment. The ESCO assesses the customer's energy savings potential and provides the capital for the cost-effective measures. The customer and the ESCO share in the savings on an established basis negotiated at the time of the contract, but since the payment varies with the level of savings and the price of energy, the customer assumes a greater risk than in a guaranteed savings arrangement.
- 3) *Fast Payout*. In this form of the contract, the contractor receives all the energy savings until either the end of a specified time period, or the cost of the project is paid off. Unlike shared savings contracts, this arrangement requires preliminary identification of the project costs.

In 1995 DOE published a final rule in the Federal Register that set forth the regulations for energy performance contracting. An application process for pre-qualification of ESCOs to work with federal agencies on an expedited basis was provided in the announcement and ESCOs wishing to be on the list must submit an application to DOE showing evidence of required experience and expertise. Only firms on the Qualified List may receive an EPC award through the expedited process and the List is continually updated.

In 1998 U.S. President signed the Energy Conservation Reauthorization Act, which made several significant changes to Energy Policy Act and National Energy Conservation Policy Act. It extended the authority of Federal agencies to enter into ESPCs through September 30, 2003 in place of the April 10, 2000 expiration date.

In 1999 the President signed Executive Order 13123 "Greening the Government through Efficient Energy management". Part 4 (Promoting Federal Leadership in Energy Management), Section 403 states: "Agencies shall maximize their use of available alternative financing contracting mechanisms, including Energy Saving Performance Contracts. Energy Saving Performance Contracts... provide significant opportunities for making Federal facilities more energy efficient at no net cost to taxpayers" [52]. Inherent to implementation of the Energy Saving Performance Contracts (ESPC) is the necessity for Federal agencies to place priority on using ESPCs, implement training programs and accountability for results.

Awarding a stand-alone ESPC can be very complex and time consuming. Recognizing this, FEMP created streamlined Regional and Technology-Specific Super ESPCs. Both Regional and Technology-Specific Super ESPC share the same general terminology and provisions as contracts with conventional EPCs.

They present several significant advantages. Super-ESPC contracts extend over a large geographic territory, while conventional ESPCs are used for a specific site. Secondly, they allow multiple Federal agencies to undertake energy projects under the same contract or a single agency to undertake several energy projects in different locations. Thirdly, Super ESPCs substantially reduce the lead time to contract with an ESCO by avoiding the need to start the contracting process from scratch. Demand on agency resources to develop and award contracts, as well as lead times, is greatly reduced and energy savings are realized more quickly.

The Mid-Atlantic Regional Super ESPC was awarded to six ESCOs in 1999, covering Delaware, Maryland, New Jersey, Pennsylvania, Virginia, West Virginia and the District of Columbia. In the same year the Northeast Regional Super ESPC was awarded to seven ESCOs, covering Connecticut, Maine, Massachusetts, New Hampshire, New York, Rhode Island, and Vermont. Each Regional Super ESPC has a contract ceiling of \$750million.

Technology-Specific Super ESPCs emphasize a particular advanced energy efficiency or renewable energy technology emerging in the Federal market. They cover entire the nation, and carry the same agency resource and time saving benefits as Regional Super ESPCs. ESCOs chosen for these awards have unique capabilities and experience in providing energy savings through installation of the technology, reducing the risks of misapplying emerging technologies.

Changes in energy markets require Federal agencies to find effective ways to meet the challenge of increased electric and gas rates. One of these ways for Federal agencies is to enter into the utility energy service contracts (UESCs) and participate in the energy efficiency projects together with utilities. The Energy Policy Act authorizes and encourages Federal agencies to participate in utility energy efficiency programs offered by electric and gas utilities. These programs range from equipment rebates and other incentives, to delivery of a complete turnkey project.

UESCs are the most common method used when Federal agencies work with a utility to implement energy efficiency projects. With a UESC, the utility typically arranges financing to cover the capital costs of the project. Then the utility is repaid over the contract term from the cost savings generated by the energy efficiency measures. The net cost to the Federal agency is minimal, and the agency saves time and resources by using the one-stop shopping provided by the utility.

There are three types of UESC contracting mechanisms: area wide contracts, basic ordering agreements, and model agreements [45]. Many agency sites procure electricity services under a contract with the local utility, and most of these contracts have provisions that can cover energy efficiency projects as well.

Through these and other efforts, FEMP brings agencies and utilities together to enhance and foster partnerships between Federal agencies and their servicing utilities to:

- Identify, develop, and implement cost-effective energy efficiency, water conservation, and renewable projects at Federal sites;
- Stimulate communication between agencies and utilities regarding energy management; and
- Discuss changes in the electric utility industry and technological developments in the areas of energy efficiency, water conservation, and wastewater reuse.

2.3 Energy efficiency legislation in states and municipalities

2.3.1 General information

Although the Federal government provides research, development, and implementation assistance for energy efficiency objectives of general national interest, the states and municipalities play a fundamental role in addressing energy use, the deployment of energy efficiency measures, and providing incentives that foster advanced technology options both at the state and local levels. Many states have enacted legislation to require energy saving retrofits and pollution prevention efforts in state-owned buildings. This has resulted in complementary actions in their respective energy bills and, in many cases, improving productivity and workplace conditions.

2.3.2 Incentives

Initiatives introduced in states and municipalities fall into three categories [57]:

- Tax incentives, which provide exemptions from or reductions in tax obligations relating to energy efficiency efforts. A tax incentive can be a deduction against the income tax a person owes, or deductions from property value assessments used to calculate property tax, or an exemption from paying sales tax on a certain item;
- Grants and loans to provide funding for specific purchases; and
- Limited tax bonds to provide up-front capital by attracting investment in creditworthy institutions.

Due to increases in energy prices, state policymakers introduced legislative to create incentives for energy efficiency improvements. To overcome the price barrier, several legislatures have established funds that provide grants and loans only for purchasing approved energy efficient products and services. Grants and loans are more effective than tax incentives because participants need not pay the actual cost of the item and receive greater reimbursement immediately.

The State of California passed an Act (Cal. Public Resources Code §25410) in 1979 that established a commission to administer a state energy conservation assistance account. The purpose of the account was to provide grants and loans to local governments and public institutions to maximize energy savings, provide technical assistance, demonstrations, identification, and implementation of cost-effective energy efficiency measures and programs. The Act also required that the commission provide energy audits for local governments and public institutions, and publishing the availability of state energy conservation assistance account funds.

Law of the State of Maine passed the Efficiency Partners Program Act (Me.Rev. Stat. Tit.30-A, §5953-C) in 1993 that allowed the provision of loans for energy efficiency improvements in municipal and school buildings. Through the Program, the Maine Municipal Bond Bank finances cost-effective improvements to heating and cooling systems, windows, insulation, lighting and equipment. The law also requires energy audits to be conducted by professional engineers to identify cost-effective strategies. The bank requests proposals from ESCOs and vendors to participate in the projects, with preferences given to in-state companies. Loans in this program must ensure that the cost savings achieved by the energy efficiency improvements are sufficient to cover the loan plus an additional amount. The rate of the interest charged for the loans must be below the currently available rate charged on commercial loans of equivalent term and use.

The State of Texas passed a law In 1993 (Tex. Government Code Ann. §2305.32) that was related to the establishment of Texas LoanSTAR (Saving Taxes and Resources) Program that provided financing from the state funds. Energy efficiency projects financed by the program include lighting systems, high-efficiency heating, ventilation and air conditioning systems, computerized energy management control systems. Eligible applicants include state agencies, institutions of higher education, school districts and municipalities. At least 85% of the loans must be awarded to state agencies, institutions of higher education, and public schools. The Texas State Energy Conservation Office (SECO) administers LoanSTAR Program and the program's revolving loan mechanism enables borrowers to repay loans through the stream of cost savings generated by the funded projects.

The LoanSTAR Program is legislatively mandated to be funded at a minimum of \$95 million, with \$123 million loaned under the program to date. SECO estimates that energy bill savings by these public institutions have provided more than \$63 million in savings to Texas taxpayers since the program began.

Limited tax bonds are often issued by state and local governments on behalf of non-tax-exempt parties. In the United States this type of borrowing is often used by school districts as limited tax bonds allow the districts to refinance lease purchases, which is a standard method to finance energy efficiency and retain the associated interest expenses.

According to a law of State Missouri (Mo. Rev. Stat. §8.8.803), the Board of Public Buildings and the State Environmental Improvement and Energy Resources Authority shall authorize a sale of bonds or other financing arrangements for energy efficiency projects in state buildings. The joint committee on capital improvements approves each project, along with the projected amount of the financing arrangement. In the first three years after a project's completion – if energy savings are more than sufficient to fulfill the financing obligations, the energy savings are divided equally between the General Revenue Fund and an Energy Analysis Account. In conjunction with all state agencies, the Energy Analysis Account establishes the criteria by which the project's savings are determined.

The Missouri Energy Analysis Account is administered by the state treasurer and the Department of Natural Resources uses funds from this account to perform energy analyses of state buildings before efficiency projects are carried out. This account also receives funds from interest income generated on money in the account, General Assembly appropriations, and other sources. The Office of Administration and the Department of Natural Resources submits an annual report to the governor on energy and environment for each agency that contains an assessment of the identification of, planning for, and implementation of energy efficiency projects in state buildings.

2.3.3 Financing mechanisms

State and municipal governments use several financing mechanisms for energy efficiency measures:

- Own revenues;
- Direct borrowing; and
- Third party financing.

States and municipalities may use their own revenues to finance energy efficiency measures from their operating and capital budgets.

Through direct borrowing, state and local governments can usually obtain long-term debt at a cost of roughly 5.75- 7% through the issuance of General Obligation Bonds (GOs). GOs represent the "full faith obligation" of the borrower, which can be the state or municipality. GOs typically necessitate going to the electorate for a public referendum to incur and back such debt. A good example of how a state wide program was established is in the State of Iowa, where GO bonds issued by the State of Iowa Facilities Improvement Corporation were used to finance the retrofit of state facilities.

Besides, loans are an obvious method for which states and municipalities could draw on available funds from financial institutions with the certain interest.

Perhaps the easiest way for states and municipalities to undertake comprehensive building energy retrofits is to allow third party to provide the capital and to take the financial risk. Third party financing may be based on the EPC, Lease Purchase Agreements, and UESC mechanisms discussed in the federal sector section above. The US has many examples of the successful use of performance contracting to improve energy efficiency in state and municipal buildings by state and local governments.

Michigan law allows all state and municipal agencies to enter into multi-year performance contracts for energy efficiency. Since the creation of the programs in the mid-1980s, the state has participated in several performance contracting projects. One of the largest undertakings occurred between 1991 and 1994 at the state mental health facility in Coldwater. Total savings for the 32-month project period, ending in January 1994, amounted to \$1,186,852 [58].

Lease Purchase Agreements (LPAs) are a flexible financing mechanism for investment projects that are medium term, tax exempt, and offer fixed rate financing instruments to state, and municipal entities. LPAs are deemed to be "operating" not debt instruments, so they are not considered as debt. Further advantages of lease purchase agreements are that they have no negative impact on cash flow, avoidance of costly and time intensive bond issues, do not require referendums and budget restructuring, ownership benefits are retained, financing can be obtained in amounts as low as \$50,000, and there is no added pressure on the debt limitations of state and local governments.

The experience of the States of Florida and Iowa in developing energy efficiency legislation is discussed in more detail below.

2.3.4 Legislation of the state of Florida

State Florida was one of the first to ratify an energy efficiency policy with the passage of the Energy Efficiency and Conservation Act [59] in 1980. This Act requires that Energy Public Service Commission to adopt goals to reduce and control the growth rates of electric consumption and peak demand, reduce petroleum use by power plants, increase the efficiency and cost-effectiveness of electricity and natural gas production and use, encouraging the use of renewable energy sources, especially solar energy, and further develop cogeneration and load-control systems. The Act also stipulates that the Commission not approve any rate or rate structure that discriminates against any class of customers on the basis of energy use or efficient systems.

Energy policy goals are also defined in the Florida State Comprehensive Plan [16]. The main goal is: "Florida shall reduce its energy requirements through enhanced conservation and efficiency measures in all end-use sectors, while at the same time promoting an increased use of renewable energy resources."

Florida passed the Energy Conservation in Buildings Act [61] in 1987 that declared one of directions of the state's energy policy is to finance buildings designed and constructed in a manner, which meet the state's building code, as well as modernization if the existent buildings. The state's energy policy authorizes state agencies, municipalities and public institutions to involve private financing by entering into EPCs, and that the formation of such contracts may be funded from the operating budget. The Act also requires mandatory use of energy performance indices and analysis of life-cycle costs while developing building codes for educational institutions.

This Act also requires each state agency, municipality and public institution to collect data on energy consumption and energy costs. These data are used in the computation of the effectiveness of the state energy management plan and the effectiveness of the energy management program of each agency. Each state agency, the Florida Public Service Commission, the Department of Military Affairs, and the judicial branch must appoint energy management coordinators.

One of the unique aspects of Florida building code is an energy performance index (EPI), which is a number that describes the energy requirements at the building boundary, of a facility, or per square foot of floor space, as appropriate under defined internal and external ambient conditions over an entire seasonal cycle. It is calculated as relationship of energy consumption of the build-

ing to energy consumption of the standard building and multiplies the quotient by 100. Buildings, which meet the standard, have the index equal to or below 100.

In 1990 the State of Florida implemented the Energy Program for Local Governments, whereby local governments hired an energy engineer, who developed and implemented energy efficiency measures for the city or region. If the energy savings do not exceed the engineer's salary expenditures over a two year period, the state government will cover the difference. None of the cities that participated in the Program applied for repayment of the deference between generated savings and expenditures on the salary of energy engineer.

2.3.5 Legislation of the state of Iowa

The Iowa Energy Efficiency Act passed in 1990 initiated a number of measures:

- Statewide building energy efficiency rating system;
- Renewable energy demonstration programs;
- Establishment of Iowa Energy Center;
- Requirements for utilities to ensure not less than 2% of sales income to finance energy efficiency programs; and
- Investigation of energy problems in the transport system.

The main provisions of Iowa's energy efficiency legislation [62] are:

- State agencies are authorized to enter into leasing agreements for energy efficiency projects. Under these agreements, the private sector determines, develops and finances energy efficiency programs, and state agencies pay for the services based on the lease provisions.
- Requirements to establish an energy bank program to use moneys from the petroleum overcharge fund for conducting energy audits and comprehensive engineering analyses for school districts, state agencies and nonprofit organizations. The energy bank program provides loans, leases, other alternative financing methods, and consultation services.
- Requirements for education agencies to consult with the Iowa Department of Natural Resources to determine and implement energy efficiency measures.
- Requirements to provide energy certification for buildings and for implementation of the statewide building energy efficiency rating system.
- Economic analysis of constriction and modernization projects for public buildings based on life-cycle costs.

2.4 Interagency coordination

2.4.1 Interagency coordination of energy efficiency activity

The Deputy Director for the Office of Management and Budget (OMB) is responsible for evaluating each agency's progress in improving energy management. OMB, in consultation with DOE and other agencies, develops agency energy scorecards and a scoring system to evaluate each agency's progress.

Under FEMP, the Federal Interagency Energy Policy Committee (FIEPC) and Federal Interagency Energy Management Task Force (FIEMTF) took part in developing of federal energy management policy, defining consumers' needs, and setting priority tasks for the development and coordination of efforts of different federal agencies in energy efficiency improvement. The activities of these organizations are regulated by the Executive Order N13123 [52] and section 91 of the National Energy Conservation Policy Act (42 U.S. Code 8251) [47].

FIEPC was established in accordance with section 656 of the Department of Energy Organization Act, 1977 [99]. The Committee is chaired by the Assistant Secretary for Conservation and Renewable Energy and consists of Assistant Secretaries and senior officials of the Agencies. The committee fulfills the following goals:

- Encourages implementation of energy efficiency programs by federal agencies, and
- Provides Effective interagency coordination in the energy efficiency area.

The committee's activities in achieving these goals are focused at the national level.

FIEMTF was established as part of the Federal Energy Management Improvement Act in 1988 with the goal of improving energy efficiency in federal facilities [48]. In fact, it serves as a technical consultant for FIEPC to coordinate the Federal government energy efficiency activities.

The FEIMTF is chaired by the Director of the Federal Energy Management Program (FEMP). The FIEMTF creates special work groups to evaluate agency progress in energy conservation activities, and collects and disseminates information to governmental institutions on new technologies and innovative programs and guidelines for energy efficiency projects. It also makes recommendations on measures for improving the effectiveness of agency operation for coordinating and implementing energy efficiency measures.

FEMP has appointed a Technical Assistance Team to provide Federal agency energy managers with a wide range of information and practical support in resolving problems related to energy efficiency improvements. A particular focus is evaluating the state of facilities, identification and design of specific measures, and verification of energy efficiency projects.

In accordance with the Executive Order 13123 "the Secretary of Energy appoints an advisory committee consisting of representatives from Federal agencies, State governments, energy service companies, utilities, equipment manufacturers, construction and architectural companies, environmental ... and other energy-related companies" [52]. The Committee assists in resolving practical energy management problems at a Federal level.

In accordance with Executive Order 13212, actions to expedite Energy -Related Projects [65] should recognize the importance of environmentally sound production and transmission of energy and that all federal agencies should accelerate their actions on the review of permits for energy-related projects. The order established a Federal Interagency Task Force (Task Force) that "works with and monitors federal agencies" to expedite their review of permits or take other actions as necessary to accelerate the completion of energy related projects. This Task Force also helps agencies "create mechanisms to coordinate Federal, State and tribal and local permitting" in relation to energy efficiency projects. The Task Force is chaired by the Chairman of the Council of Environmental Quality and consists of representatives of Departments and Federal executive Agencies.

The Task Force works on an operational approach that encourages effective interagency coordination through removing barriers to expedite Federal agencies permits for energy-related projects. The Task Force assists Federal facilities in prioritizing and planning activity in accordance with these priorities, determining requirements in personnel and other resources as well as expediting the decision-making process. The Task Force evaluates the achievements of the Federal agencies in fulfilling tasks stated in order 13212 and resolves the issues of cooperation and coordination of activities involved in this process (State organizations, local communities, tribal, business and non-governmental institutions). In addition, the Task Force identifies "regional federal personnel responsible for prioritizing and implementing expedited permitting and establishes cross-agency regional teams."

2.4.2 Intergovernmental coordination

The Intergovernmental Review of Federal Programs in Executive Order 12372 is intended to foster an intergovernmental partnership by relying on State and Local governments to coordinate review of proposed federal financial assistance or direct federal development [66] to allow States to define the organizations that will perform these activities. Under this Executive Order, the Federal agencies will provide “opportunities for consultations by elected officials of those State and local governments that would provide the nonfederal funds, for, or, that would be directly affected by, proposed federal financial assistance from, or direct federal development by, the Department.”

General regulations that pertain to the intergovernmental process require the federal government to perform the following actions for developing new and/or improving the existing mechanisms for application of federal financial assistance or participation in projects of direct federal assistance:

- Use state processes to determine official views of state and local elected officials;
- communicate with State and local elected officials as early in a program planning cycle as is reasonably feasible to explain specific plans and actions;
- Make efforts to accommodate State and local elected official’s concerns with proposed federal financial assistance and direct federal development that are communicated through the state process;
- Allow the States to simplify and consolidate existing federally required State plan submission;
- Seek the coordination of views of affected state and local elected officials in one state with those of another state when proposed federal financial assistance or direct federal development has an impact on interstate metropolitan urban centers or other interstate areas;
- Support state and local governments by discouraging reauthorization or creation of any planning organizations, which is federally funded, which has a limited purpose, and which is not adequately representative of, or accountable to, state or local elected officials.

In accordance with the Executive Order, new rules and procedures have been developed for the review of Federal financial assistance for federal sector projects. In addition, Title 31, Chapter 65 “Intergovernmental cooperation” (31 U.S. Code 6506) defines that during preparation and implementation of national development programs and projects that involve Federal agencies, it is necessary to consult and coordinate the aims and purposes of Federal agencies with State and local governments [67].

Practical application of Executive Order N12372 dealing with the interaction of governmental bodies of different on energy efficiency activities is based on the provisions of Section 10 of the Department of Energy of the Federal Code (10 CFR 1005) [24]. The Executive Order describes how the federal agencies, and state and local governments are to cooperate to reach acceptable conditions for all of the Parties to use Federal financial assistance and implement federal development projects.

The Energy Policy Act of 1992 establishes that the General Services Administration, in consultation with the Secretary of Energy and a specialized intergovernmental Commission, provides seminars every two years in the 10 federal regions on energy management, energy efficiency, and energy planning in this area [49]. As well as Department of Energy experts, representatives of the State, local and tribal governments should take part. A goal of these seminars is the development of a cooperative strategy among levels of government to coordinate energy manage-

ment activities and increase the available inter-governmental resources that could be used to improve operation of government facilities and buildings.

Title 77, chapter 42 of the U.S. Code 6321 [69] states that the Federal Government is responsible for fostering and promoting “comprehensive energy conservation programs and practices by establishing guidelines for such programs and providing coordination, technical assistance and financial support for specific State initiatives in energy conservation.” This is complemented by the statement that “the development and implementation of energy conservation programs by States will most efficiently and effectively minimize any adverse economic or employment impacts of changing patterns of energy use and meet local economic, climatic, geographic and other unique conditions and requirements of each State.”

Section 6322 of Title 77 establishes mandatory features for State energy conservation plans to enable eligibility for Federal assistance. These features include:

- Mandatory lighting efficiency standards for public buildings;
- Programs to promote availability and use of carpools, vanpools and public transportation;
- Mandatory standards relating to energy efficiency for state procurement practices;
- Coordination procedures local, State and Federal energy conservation programs;
- An Energy Technology Commercialization Services Program.

The purpose of the Energy Technology Commercialization Services Program is to provide assistance to small and start-up businesses in information, production and technological areas relating to energy efficiency.

Section 6323 determines the conditions, types, and amount of Federal assistance to be provided to the State for developing and implementing energy conservation plans. Upon the request of the Governor of any State, the Secretary will provide information and technical assistance, including model State laws and proposed regulations relating to energy conservation. The Department of Energy may grant financial assistance to the States. To fulfill these provisions the Secretary will consult with appropriate departments and Federal agencies [69].

The Federal Trade Commission will “cooperate and assist State agencies, which have primary responsibilities for the protection of consumers in activities aimed at preventing unfair and deceptive acts or practices affecting commerce which relate to the implementation” of energy efficiency measures.

The State Energy Advisory Board (Board) within the Department of Energy consists of officials who serve as Directors of state agencies or divisions if such agencies responsible for developing State energy conservation plans, representatives of the private sector, utilities, public utility commissions, educational and financial or research institutions [69]. The Board gives recommendations to the Assistant Secretary for Conservation and Renewable Energy, encourages transfer of the results of research and development in energy efficiency activities, and serves “as a liaison between the States and such Department on energy efficiency” in activities aimed at reaching energy conservation goals.

2.5 Deregulation of public utilities

2.5.1 General information

Deregulation of the utility market is characterized by reducing governmental influence on the activity of companies considered to be natural monopolies and implementing competitive principles on the electricity and natural gas markets that supply consumers. “The push to deregulate the US utility industry formally began with the passage of the Energy Policy Act of 1992 and the

subsequent release of the April 24, 1996, Federal Energy Regulatory Commission Order Number 888, which required electric utilities to open their transmission systems to power generated by other companies" [70]. However, the utility deregulation process in the United States is largely set by state-level decisions and not driven by an overarching national policy.

As a result, state policies vary. For example, New Hampshire, New York and California began deregulating markets earlier than other states (at the beginning of 1998) [71]. California was the first state to completely deregulate its utilities, but faced power supply problems and slowed the deregulation activity. As of the end of February 2003, the deregulation process is being pursued in 17 states and the District of Columbia. The relevant legislation was adopted in 5 states and paused to observe how California will overcome the difficulties it has encountered. 27 states followed California's lead to slow and review their deregulation process [72].

The implementing energy efficiency technologies became more difficult without the influence exerted through regulation. In addition, companies cut energy efficiency programs and other costs to compete with the new low cost small power generating companies that appeared. But, energy prices did not fall significantly because the established companies had to recover "stranded costs" incurred for purchasing fixed assets, which were expected to have been recovered in the form of depreciation and/or a cost-effectiveness rate. This put further pressure on energy companies to reduce other costs that included energy efficiency.

As a result, the newly created companies could get an immediate advantage over existing companies by basing their activities on energy efficiency technologies.

In an attempt to level this disparity, many states established legislative conditions to continue the existing and implement new energy efficiency programs by companies that provide public services. The legal framework of three of these states is reviewed in more detail below.

2.5.2 Deregulation process in the state of New Hampshire

New Hampshire was among the pioneers in designing legislation and implementing utility deregulation, primarily for power markets. About 88% of the State's consumers currently receive services at the open power market.

The legal basis for implementing the changes was House Bill 1392 (Revised Statutes Annotated 374-F) approved in May 1996 [73]. Chapter 374-374-F:3 X of the Bill highlights the role that energy efficiency should play in a restructured marketplace, with restructuring designed to:

- Reduce market barriers to investments in energy efficiency;
- Provide incentives for appropriate demand-side management; and
- Not reduce cost-effective customer conservation.

Energy efficiency programs financed by utility companies should set a goal of implementing cost-effective measures, which otherwise could be ignored due to the impact of negative market incentives. The New Hampshire Public Utilities Commission issued a series of orders that established rules and requirements for utility energy efficiency activities. Order 22875 "Electric Utility Restructuring," issued on March 1998 [74], approved the restructuring plan for electric utilities. Among other items, this order established incentives for energy efficiency measures based on a detailed analysis of the possible negative impacts of deregulation.

The Commission considers it necessary to develop market mechanisms for implementing energy efficiency programs based on a strategy of defining and meeting consumers' requirements that will not be financed by the utilities or consumers if the cost of their services increases as a result

of a rate increase. Existing programs that utilize a rate based financing mechanism will be gradually reduced and completed, as these programs do not comply and delay the development of competitive market conditions. The term for completing these programs is 2 years after the de-regulation has been established.

Order 23574, Guidelines for Post-Competition Energy Efficiency Programs, November 2000 [75], of the Public Utilities Commission, details the requirements for energy efficiency projects and programs. This order defines the effectiveness criteria for energy efficiency projects and programs, specifically requirements for programs design and principles, in particular:

- Available long-term benefits for the process of establishing opportunities and incentives to further market transformation;
- Guarantee that energy efficiency programs financed through consumer payments are developed in a way to increase and promote, not prevent, private sector energy efficiency programs, services, and products, and to provide incentives for an energy efficiency market that will be effective without additional consumers financing;
- Guarantee that there is a well-developed exit strategy or market transformation after completion of the program. This strategy may include a gradual increase of the consumers' contribution to financing measures under the program, application of discounts, and measures focused on the retail sale of services with the help of catalogs.

The Public Utilities Commission also provided for coordination of utility activities by establishing a set of "core" energy efficiency programs that would be offered in addition to company level energy efficiency programs.

The Public Utilities Commission also approved a unique pilot program called "Pay-As-You Save" intended to eliminate market barriers that inhibit consumers from purchasing energy saving products. Under this program, the utility company purchases energy efficiency equipment from the manufacturer and installs it for the customer. "A customer [then] pays for [the] efficiency products through payments on their electric bill. The payments are designed to be lower than the estimated savings from the measure and the costs for the infrastructure, financing and marketing are included in the price of the products." In this way the company recovers the cost of the installed equipment. This pilot program was implemented by two electric utilities companies and is scheduled to run through the end of 2003.

Order No 23850 of the Public Utilities Commission titled "Joint Petition for Approval of Core Energy Efficiency Programs," issued on November, 2001 [76], approved the first stage of an agreement of six New Hampshire utilities to implement energy efficiency programs. The first stage directed the state's electric utilities to work together on the development of a set of core energy efficiency programs and allocated financing for this purpose. The core set of programs included:

- Energy Star Homes;
- Low-income Energy Efficiency;
- Home Energy Ratings;
- Energy Star Appliances; and
- Commercial and Industrial Programs.

Order No 23982 of the Public Utilities Commission titled "Joint Petition for Approval of Core Energy Efficiency Programs," issued on May, 2001 [77], completed the second stage for preparation of the state's Core Energy Efficiency Programs by defining utilities' final commitments under the Program, the aims of each company of participating in the Program, and the incentives for companies' owners to take part in the Agreement. Fulfillment of the Core Energy Efficiency Programs began in June 2002.

In particular, the energy efficiency program targeting low income households will run for 19 months. All six companies will fulfill projects and programs under this Program, which they may do with their own funds or by entering into third party contract. Households eligible for this program (those with income not exceeding 150% of the federal poverty level) may obtain \$3,600 to implement energy efficiency measures.

The Core Energy Efficiency Program is financed by a benefit charge of \$0.0012 per kWh that is included in consumer electricity bills.

As for gas utilities, the Public Utilities Commission reviews the proposals and recommendations regarding implementation of energy efficiency programs in the gas sector. The programs are intended to create market incentives for more efficient gas usage and eliminate market barriers for application of energy efficiency technologies.

2.5.3 Deregulation process in the state of Texas

Texas, the state with the highest rate of energy conservation in the US, began its deregulation activity in 1995. After reviewing this Program in June 1999, a Senate Bill 7 “Restructuring of Electric Utility Industry” was approved [78]. This Act is contained in Chapter 39 of the Public Utility Regulatory Act, which is a constituent part of the Utilities Code [79]. According to this Act, a competitive market in the public power sector would be introduced for part of consumers beginning in January 1, 2002.

The legislation establishes the right of any customer to choose the electricity supplier. Further, no supplying company should decline a consumer’s proposal to provide services on the grounds that the latter operates or intends to operate energy efficiency equipment or equipment (Subsection 39.101).

The Act defines energy conservation goals (Subsection 39.905) that should be achieved by January 1, 2004 that include:

- Public utilities will administer programs establishing incentives for application of energy saving technologies, in a market neutral and non-discriminative way, but not proposing basic services, that could create competition for such programs;
- All consumers may choose any energy saving measures available on the market and reduce their energy bills;
- Each public utility company, through the market-oriented Standard Offer Programs or Market Transformation Programs, will create incentives for retail power suppliers and their competitors to obtain additional power savings of at least 10% of annual demand growth.

The Public Utilities Commission needs to establish necessary rules and procedures to promote this process.

Separate provisions of the Bill require establishing special programs aimed at assistance to low-income consumers. These programs should contain targeted energy efficiency projects that will be administered by the Department of Housing and Community Affairs (subsection 39.903).

A household may apply for assistance to improve the energy efficiency in their building according to these programs if its annual income does not exceed 125% of the federal poverty level.

The low-income programs are financed from the System Benefit Fund, which accumulates funds from a fee of \$0.065 per kWh [78].

To meet the requirement of the Bill, the Commission for Utilities Regulation developed a series of rules and procedures, which are contained in Texas Administrative Code. They include §§25.181-25.183 of division 2 Energy Efficiency and Customer-Owned Resources of subchapter H Electrical Planning, chapter 25 Substantive Rules Applicable to Electric Service Providers of the Administrative Code [36]. These rules provide a detailed review for achieving tasks set forth by Bill 7 and define measures to fulfill them.

The utilities should implement energy conservation programs that allow them to meet the requirements for reducing energy consumption as established by the legislation. The rules contain requirements to these programs and criteria for the effectiveness of energy efficiency projects.

The rules define that each company should submit a detailed energy efficiency plan for meeting the provisions of the Bill to the Public Utilities Commission for approval. Each utility should submit an annual report on the fulfillment of this plan to the Public Utilities Commission.

Stranded costs are covered by the tariff for power transmission and supply services. These costs should be placed in financial reports as a separate item and should be included in the annual utilities' reports. Costs not used over a certain year should be transferred for financing energy saving measures during the following year.

There were established two types of energy conservation programs that could be implemented by the utilities' [80]:

- 1) Standard Offer Program based on a Standard offer contract between public utilities and companies that supply energy efficiency services. This contract envisages standard payments based on:
 - Power consumption and maximum energy savings (defined at peak power demand) that may be achieved by installation of energy efficiency equipment by the consumer;
 - Agreements on measurement and verification of power consumption;
 - Other conditions in accordance with the programs' requirements.
- 2) Market Transformation Programs, which are long-term structural changes in the market that lead to the growth of energy efficiency technology and services application.

In addition, the Public Utilities Commission initiated the Energy Efficiency Program Implementation Docket aimed at disseminating best practices for the preparation and implementation of Standard Offer Programs and Market Transformation Programs [80].

A program also exists for providing grants for energy efficiency projects financed from the state budget and private and municipal power utilities can be recipients of these grants.

2.5.4 Deregulation process in the state of Pennsylvania

Pennsylvania is one of the first states that introduced restructuring practices for public utilities -- "As of January 1, 2000, all consumers in Pennsylvania have retail access to competitive electricity suppliers" -- and no other state succeeded in deregulated its market as quickly. Pennsylvania also became one of the first states that introduced deregulation at the natural gas market [81].

The legal basis for the public utilities deregulation process was the General Assembly of Pennsylvania House Bill N1509 "Electricity Generation Customer Choice and Completion Act approved in December 1996 [82]. The House Bill established continuation of the activities and energy conservation programs that have been performed and financed by public utilities earlier

(subsection 2802:17). The law guarantees that energy conservation programs will be available to all consumers in each electric distribution territory (Subsection 2804:9).

The costs for implementing these programs will be recovered in the power tariff. These obligatory additional costs recovered in the tariff should not make any impact on the competition between companies and provide full reimbursement of costs for performing energy conservation programs. (Subsection 2802:17, 2804:8-9).

It is also noted that Pennsylvania Public Utility Commission will support the activities of public institutions for promoting energy efficiency technologies and equipment aimed at assisting public utilities in implementing energy conservation programs. The Public Utilities Commission will provide administrative oversight to ensure that the programs are operated in a cost-effective manner. (Subsection 2804:9).

Public utilities should present the Public Utilities Commission an initial plan that sets forth how the company will meet its universal service and energy conservation obligations and that should be an integral part of the restructuring plan. (Subsection 2804:15).

Separately, the House Bill (Subsection 7409:A) defines the necessity to continue companies' activity to assist low-income households (with the income not exceeding 150% of federal poverty level) in implementing energy efficiency measures.

In addition, the Public Utility Code determines energy conservation goals to be achieved by the companies through the implementation of their energy efficiency programs (Section 54 §54.73) [39]:

- Protect safety and health of consumers, and assist low-income consumers in maintaining the power supply system in operational conditions;
- Provide low-income consumers with relevant affordable services;
- Assist low-income consumers in reducing their energy consumption and consequently energy bills;
- Implement cost-effective energy conservation programs.

The Code also establishes requirements for the companies to plan for the implementation of energy conservation programs (item 54 §54.74) [83]. These plans should be compiled every three years, and each following plan should be based on the analysis of results and experience from the implementation of the previous plan.

The state policy relating to energy conservation activities for supply utilities is nearly identical to the policy described above for power utilities. This is based on the House Bill 1331 Natural Gas Choice and Competition Act approved in April 1999 [84].

Like power utilities, gas supply utilities should continue implementing their energy conservation programs and stranded costs will be covered by an obligatory surcharge on the tariff, which should not make any impact on the competition between companies (§2203:6) [84]. No part of the law presents a barrier to providing financing for energy efficiency programs from any source.

The Public Utilities Commission provides oversight of deregulation programs to ensure that they are cost-effective and do not influence in, any way, the availability of utilities' energy conservation programs for the states' consumers (§2203:8) [84].

Each company presents its initial plan to the Public Utilities Commission that defines company's commitments to implement energy conservation programs (§2203:9). There also exist special projects for assisting low-income consumers in implementing energy conservation programs.

3. Proposals for Improving Ukraine’s Legal and Standard Framework for Energy Efficiency in the Budget Area

3.1 Establishing financial incentives system for specialists of institutions involved in energy efficiency

Implementation mechanism. The Head of the State Committee of Ukraine for Energy Conservation and Heads of Oblast Administration’s divisions on energy efficiency annually provide premiums to the specialists of institutions involved in energy efficiency. The incentive funds are obtained from the target budget item based on defined criteria for energy efficiency with an announcement of those who were awarded premiums and amount of the premiums.

There is a need to make amendments in the Law of Ukraine “On Energy Conservation” [1].

Precedent in US legislation. Financial incentives for employees are regulated by Article 546 (“Incentives for Agencies”), Subtitle F (“Federal Agency Energy Management”) of the Energy Policy Act, which defined the total amount (at a level of \$250 thousand over 1993 –1995) and criteria for granting these incentives. The Secretary of Energy and the Federal Interagency Task Force are charged with fulfilling this item.

3.2 Implementing transparent reporting on the progress achieved in energy efficiency improvement

Implementation mechanism. The Heads of Oblast Administration’s divisions on energy efficiency submit an annual report to the State Committee of Ukraine for Energy Conservation in an approved format of progress achieved in energy efficiency activity as a whole and in the budget area in particular. The report will be based on indicators approved by the Oblast for energy conservation programs with an analysis of the legal, institutional, and other barriers to energy efficiency in district heating and cooling systems in federal buildings with recommendation for overcoming these barriers.

The Head of the State Committee of Ukraine for Energy Conservation submit an annual report to the Verkhovna Rada in an approved format of the progress achieved in energy efficiency as a whole and in the budget area in particular. The report will be based on indicators approved in the Comprehensive State Program of Ukraine on Energy Conservation.

There is a need to make amendments in the Law of Ukraine “On Energy Conservation” [1].

Precedent in US Legislation. Federal agency reporting requirements on the implementation of energy efficiency measures and achievement of results are presented as defined in Section 548 (“Reports”), Subtitle F of the Energy Policy Act.

3.3 Implementing monitoring system for energy efficiency measures recommended based on the energy audits performed in the budget facilities

Implementation mechanism. Inclusion of reports on the results of monitoring of energy efficiency measures recommended based on the energy audit of budget entities in the annual reports of the State Committee of Ukraine for Energy Conservation and relevant divisions of Oblast Administrations.

There is a need to make amendments in the Law of Ukraine “On Energy Conservation” [1].

Precedent in US legislation. According to Section 550 (“Survey of Energy Saving Potential”) of Subtitle F of the Energy Policy Act, each agency in which energy audit was conducted should create a program for monitoring the implementation of energy efficiency measures recommended by the energy audit.

3.4 Developing a national voluntary certification system for energy efficiency products

Implementation mechanism. The system of voluntary national certification of energy efficiency products may be developed under the financial support of the State Committee of Ukraine for Energy Conservation, Ukrainian Union of Businessmen and Industrialists and other institutions. This system should include procedures for testing and marking of products as well as information that could allow the buyers of energy efficiency products to evaluate the potential for energy efficiency and costs savings that result from installation. This information may be distributed through the relevant catalogues, commercial publications, products marking etc.

There is a need to make amendments in the Law of Ukraine “On Energy Conservation” [1].

Precedent in US legislation. Subtitle C (“Appliance and Equipment Energy Efficiency Standards”) of the Energy Policy Act provides a sample of a voluntary products’ rating program, specifically windows.

3.5 Developing programs for determining and application of energy efficiency products

Implementation mechanism. Define a list of energy efficiency equipment that should be procured by the state for implementing energy efficiency projects in the budget area based on certification and marketing studies of the products.

There is a need to make amendments in the Laws of Ukraine “On Energy Conservation” [1] and “On the Procurement of Goods, Work and Services Using Budget Funds” [2].

Precedent in US legislation. Section 161 (“Procurement and Identification of Energy Efficient Products”), Subtitle F of the Energy Policy Act incorporates requirements for Federal agencies related to the procurement of energy efficient products.

3.6 Developing a buildings’ energy efficiency rating system

Implementation mechanism. The system for buildings’ energy efficiency rating may be developed under financial support of the State Committee of Ukraine for Energy Conservation, the State Committee of Ukraine of Housing and Communal Services and other institutions. This system should include the procedure for testing and certification, and information needed for budget enterprises and institutions to develop effective plans to improve building energy efficiency.

There is a need to make amendments in the Law of Ukraine “On Energy Conservation” [1].

Precedent in US legislation. Measures on the development of buildings’ energy efficiency rating were initiated in accordance with the Energy Efficiency Act of the state of Iowa approved in 1990.

One of the unique aspects of the Florida building code is an energy performance index (EPI). “EPI means a number describing the energy requirements at the building boundary of a facility, per square foot of floor space, as appropriate under defined internal and external ambient condi-

tions over an entire seasonal cycle.” It is calculated as the relationship of actual energy consumption of the subject building to an energy consumption standard for the building type multiplied by 100. Buildings that meet the standard have the index equal or less than 100 and state authorities issue relevant certificates to such buildings.

3.7 Developing energy management training program for representatives of ministries and institutions

Implementation mechanism. The State Committee of Ukraine for Energy Conservation should develop an energy management training program for energy conservation specialists of the executive committees of ministries, oblast and cities. Managers of ministries, oblast and cities’ executive committees should create incentives for the specialists to advance their qualifications and help with the target program.

There is a need to make amendments in the Law of Ukraine “On Energy Conservation” [1].

Precedent in US legislation. Training for Federal energy managers is provided in accordance with Section 157 “Federal Agency Energy Management Training”, Subtitle F of the Energy Policy Act.

3.8 Introduction of budget appropriations to implement energy efficiency measures

Implementation mechanism. To provide a mechanism for submittal of requests to finance energy efficiency projects to the Ministry of Finance of Ukraine from companies to include suppliers of communal and energy efficiency services, energy equipment manufacturers, construction and architecture companies, associations of consumers, environmental, non-governmental and other organizations involved in energy efficiency.

There is a need to make amendments in the Laws of Ukraine “On Energy Conservation” [1] and “On the Budget System of Ukraine” [3].

Precedent in US legislation. Direct appropriations are ratified in Section 545 (“Budget Treatment for Energy Conservation Measures”), Subtitle F, of the Energy Policy Act, which requires each agency, in support of the President’s annual budget request to Congress, to set forth and identify funds requested for energy conservation measures. This direct financing is provided to implement the very best projects that bring new products and services to the Federal marketplace. These projects can provide the leadership in the Federal sector in the specific technology, financing and constructing mechanisms to overcome the initial reluctance of the Federal sector market to try new methods and products despite their potential. This approach to managing the risk of new products and services ensures the speedy introduction of all appropriate energy and cost savings mechanisms.

3.9 Establishing a governmental energy efficiency fund

Implementation mechanism. The State Energy Efficiency Fund may be established at the State Committee of Ukraine for Energy Conservation as an off-budget fund for energy efficiency (that was established in 1996 and further consolidated in the state budget) or the state fund of environmental protection (operated by the Ministry of Ecology and Natural Resources of Ukraine).

There is a need to make amendments in the Laws of Ukraine “On Energy Conservation” [1] and “On the Budget System of Ukraine” [3] and the Budgetary Code of Ukraine [4].

Precedent in US legislation. A Federal Energy Efficient Fund was established by the Secretary of Energy in accordance with the Energy Policy Act to provide grants for federal agencies implementing energy efficiency measures. For this purpose \$10 million were allocated in 1994 and \$50 million in 1995. Each agency has to develop a program of incentives for effective energy usage in federal buildings.

3.10 Issuing limited tax bonds to finance energy efficiency measures

Implementation mechanism. To amend the Law “On the Local Self-Governance in Ukraine” to allow local councils to issue limited tax bonds to finance energy efficiency measures or issue these bonds on behalf of tax-exempt institutions.

There is a need to make amendments in the Laws of Ukraine “On the Local Self-Governance in Ukraine” [5], “On the Taxation System” [6], and “On Taxation of Enterprises’ Revenues” [7].

Precedent in US legislation. The state and municipal governments may issue limited tax bonds on behalf of non-tax-exempt parties. In the United States limited tax bonds are often used by the school districts to refinance lease purchases - a standard method to finance energy efficiency from the interest savings obtained.

3.11 Application of energy performance contracts (EPC)

Implementation mechanism. The State Committee of Ukraine for Energy Conservation prepares and submits “Regulation on attracting investments in the budget area for implementing energy efficiency measures with formation of the repayment mechanism based on energy savings” to the Cabinet of Ministers of Ukraine.

There is a need to make amendments in the Laws of Ukraine “On Energy Conservation” [1] and “On the Budget System of Ukraine” [3].

Precedent in US legislation. The most suitable mechanism for the states and municipalities to finance complex modernization to improve energy efficiency is to involve third parties that will assume all costs and risks related to the project. Financing by the third party may be performed based on the EPC, a leasing agreement, and/or contracts with the utilities.

According to section 155 of Energy Policy Act, Federal agencies may enter into energy performance contracts. This section describes procedures for realizing these contracts. The EPC program was created to provide the agencies with a fast and cost-effective way to improve the energy efficiency of Federal buildings.

In 1995 Department of Energy published a final rule in the Federal Register that sets forth the regulations for energy performance contracting. An application process for a Qualified List of ESCOs was also released with the EPC regulations. Only firms on the Qualified List may receive an EPC award. Firms that wish to be on the List must submit an application to DOE and possess the required experience and expertise. The List is continually updated.

The President signed Executive Order 13123 In 1999, the “Greening the Government Through Efficient Energy Management.” Part 4 (Promoting Federal Leadership in Energy Management), Section 403 states: “Agencies shall maximize their use of available alternative financing contracting mechanisms, including Energy Saving Performance Contracts...Energy Saving Performance Contracts provide significant opportunities for making Federal facilities more energy efficient at no net cost to taxpayers” [52]. Inherent to implementation of the regulation is agency

priority on employing EPCs, action by Federal agency officials, development and maintenance of trained and dedicated personnel, and accountability for results.

The US has many examples of state and local governments successfully using benefits from performance contracting to improve energy efficiency in state and municipal buildings. The State of Kentucky entered into a \$2.5 million guaranteed energy savings performance contract to retrofit several municipal buildings with boilers, air infiltration and heating, ventilation and air conditioning controls, and lighting systems. Energy savings totaled \$530,000 in 1992.

A Michigan Law approved in 1980 allowed municipalities, villages, and community authorities as well as educational institutions to enter into multi-year performance contracts. Since introduction of the Law, the state has participated in several performance contracting projects. One of the largest undertakings occurred between 1991 and 1994 at the state mental health facility in Coldwater with total savings for the 32-month project period, ending in January 1994, of \$1,186,852.

Finally, the State of Hawaii requires all agencies to estimate energy efficiency potential and implement the EPC-based mechanism for cost-effective energy efficiency projects.

3.12 Application of super energy performance contracts (super EPC)

Implementation mechanism. The State Committee of Ukraine for Energy Conservation should develop and approve a Decree on the EPC Regulations.

There is a need to make amendments in the Laws of Ukraine “On Energy Conservation” [1] and “On the Budget System of Ukraine” [3].

Precedent in US legislation. To facilitate the often long and complicated process of concluding EPC contracts, Regional and Technology-Specific Super EPCs were created. These "umbrella" contracts enable agencies to undertake multiple energy projects under the same contract. Both the Regional and Technology-Specific Super EPC share the same general contract terminology and provisions with conventional EPCs, but they present several significant advantages to Federal agencies.

A Super-EPC covers a large geographic territory while conventional EPCs are used for a specific site. The second benefit to agencies is that Super EPCs substantially reduce the lead time to contract with an ESCO without having to start the preliminary contracting process. Demand on agency resources to develop and award contracts, as well as lead times are greatly reduced and energy savings are realized more quickly.

Application at the Federal level of EPC under the FEMP to resolve specific technological problems assists in implementing advanced energy efficiency technologies through the training of utilities managers and demonstration of the economic effectiveness of these technologies.

EPC application at the Federal level under the FEMP program resolves specific technical problems, assists in implementing advanced energy efficiency technologies through training for utility managers, and demonstrates the economic effectiveness of these technologies.

3.13 Application of utility energy service contracts

Implementation mechanism. Local authorities should involve local utilities, on mutually beneficial basis, in concluding energy performance contracts.

There is a need to make amendments in the Laws of Ukraine “On the Local Self-Governance in Ukraine” [5], “On the Taxation system” [6], and “On Taxation of Enterprises’ Revenues” [7].

Precedent in US legislation. The Energy Policy Act authorizes and supports Federal agencies to enter into the utility energy service contracts and participate in energy efficiency projects with utilities.

3.14 Including an investment component in a tariff for energy services with the aim to implement energy efficiency measures and providing the oversight of the use of these costs

Implementation mechanism. To make amendments to the legislation to allow local authorities to include surcharge for energy services in a tariff to collect funds for implementing energy efficiency measures.

There is a need to make amendments in the Laws of Ukraine “On the Local Self-Governance in Ukraine” [5], “On the Taxation System” [6], and “On Taxation of Enterprises’ Revenues” [7].

Precedent in US legislation. Subtitle B (Utilities) of “Energy Policy Act” defines requirements to the state authorities to establish a tariff to facilitate investment to improve the energy efficiency of energy generation, transmission and consumption.

3.15 Introduction of the mechanism of consumers’ payments for cost savings obtained from energy saving measures implemented by the utilities

Implementation mechanism. The Decree of the State Committee of Ukraine for Energy Conservation develops and approves Regulations on consumer payments for cost savings obtained from energy saving measures implemented by the utility.

There is a need to make amendments in the Laws of Ukraine “On the Local Self-Governance in Ukraine” [5], “On the Taxation System” [6], and “On Taxation of Enterprises’ Revenues” [7].

Precedent in US legislation. The state of New Hampshire is implementing a unique pilot program called “Pay-As-You Save” that is intended to eliminate the market barriers that currently inhibit consumers from purchasing energy saving technologies. In accordance with this program, the utility company purchases energy efficiency equipment from the manufacturer and installs it at the customer and the customer pays for the efficiency products through their electric bill. The payments are designed to be lower than the estimated savings from the measure with the costs for the infrastructure, financing, and marketing included in the price of the measures. In this way the company recovers the cost of the installed equipment.

3.16 Introduction in the legislation of a requirement to develop and implement energy conservation programs

Implementation mechanism. The State Committee of Ukraine for Energy Conservation develops and submits to the Cabinet of Ministers of Ukraine amendments to the Laws that allow the local bodies of executive power to establish requirements for energy suppliers on the development and implementation of energy conservation programs.

There is a need to make amendments in the Laws of Ukraine “On the Local Self-Governance in Ukraine” [5], “On the Taxation System” [6], and “On Taxation of Enterprises’ Revenues” [7].

Precedent in US legislation. Legislation of some US states establishes requirements to utilities to reach energy conservation goals.

In accordance with the rules and procedures contained in Senate Bill N7 “Restructuring of Electric Utility Industry”, which is a constituent part of the “Texas Administrative Code,” utilities should implement energy conservation programs. This allows them to fulfill their commitments on reductions in energy consumption established by the Law. The Bill’s rules provide detail on the direction and fulfillment of tasks, and on effectiveness criteria to include in energy efficiency projects and programs.

Pennsylvania law N1509 (Electricity Generation Customer Choice and Completion Act) establishes that energy conservation activities and programs that have been performed and financed by public utilities should be continued in future. The Law guarantees that energy conservation programs will be available to consumers in each electric distribution territory. The Obligatory additional costs recovered by the tariff should not make any impact on the competition between the companies and provide full reimbursement of costs for performing energy conservation programs. These plans should be developed each three year and each following plan should be based on the analysis of results and experience of the previous plans’ implementation.

Pennsylvania law N1509 (Electricity Generation Customer Choice and Completion Act) establishes that energy conservation activities and programs that have been performed and financed by public utilities should be continued in future. The Law guarantees that energy conservation programs will be available to consumers in each electric distribution territory. The energy efficiency and other surcharges on the tariff should not impact the competition between the companies and provide full reimbursement for energy conservation program costs. These plans should be developed every three years and each following plan should be based on the analysis of results and experience of the implementation of the previous plan.

An interesting example of cooperation in the energy conservation area is Joint Petition of six New Hampshire utilities that concluded a joint agreement on implementing energy conservation programs. This Agreement was approved by Order N23850 of the Public Utilities Commission Joint Petition for Approval of “core energy efficiency programs.” By this agreement, the companies stated their readiness to operate jointly within the state to implement energy efficiency programs and provide relevant financing for this purpose. The cost for these programs is covered in the tariff by a surcharge for the transmission and distribution of electricity. The costs are provided in a separate line in the companies’ annual report and costs not used over a certain period of the year should be transferred to financing energy saving measures during the following year.

4. Defining Priority (Typical) Energy Efficiency Measures, Technologies and Equipment for the Budget Buildings

4.1 Defining typical budget buildings

Budget buildings include buildings financed from the state and local budgets in the following building types:

- Defense of the state;
- Protection of law and order;
- Education;
- Health-care;
- Culture;
- State management;
- State administrations' activities;
- Self-governance bodies' activities.

The buildings, in which services providing defense of the state and protection of law and order are located (barracks, prisons etc) were constructed under closed designs and they have special operational modes and are not covered by this report. The remaining six types of budget buildings are viewed in accordance with their purpose and characteristics.

Educational institutions are the largest (by quantity) group of budget buildings, in which energy efficiency potential was estimated as high. Presently these buildings face the need to be modernized, in particular, enhancing the comfort level that could consequently result in an increase in energy consumption.

A special group of budget buildings, which is not often mentioned, are buildings of children's creativity. These buildings are former pioneer palaces, which still operate and involve many children in their activities.

The cultural institutions covered by this classification do not include cinemas and clubs, because they are not currently financed from the budget.

The main feature in resolving energy efficiency issues the main feature for classifying a building is its purpose. The purpose of a building defines the character of its use that provides for determining the most suitable energy efficiency measures for a specific class of buildings. Educational buildings are divided into 10 types by their purpose, health care institutions into 4 types, cultural institutions by 3 types, buildings of state administrations by 4 types and buildings of self-governance bodies by 4 types.

The proposed classification of budget buildings is:

1. Educational institutions.
 - 1.1 Kindergartens.
 - 1.2 General secondary schools.
 - 1.2.1 Schools.
 - 1.2.2 Lyceums.
 - 1.2.3 Specialized schools.
 - 1.3 Secondary educational institutions.
 - 1.3.1 Vocational schools

- 1.3.2 Technical schools.
- 1.4 Higher educational institutions.
 - 1.4.1 Institutes.
 - 1.4.2 Universities.
 - 1.4.3 Academies.
- 1.5 Houses of children's creativity.
- 2. Health protection institutions
 - 2.1 Hospitals.
 - 2.2 Polyclinics.
 - 2.3 Ambulance stations.
 - 2.4 Out-patients stations.
- 3. Cultural institutions.
 - 3.1 Museums.
 - 3.2 State academic theaters.
 - 3.3 Libraries.
- 4. Central governance bodies
 - 4.1 The Building of Verkhovna Rada and the Cabinet of Ministers.
 - 4.2 Buildings of Ministries and State Committees.
 - 4.3 Tax Institutions.
 - 4.4 Bodies of Justice.
- 5. Bodies of local self-governance.
 - 5.1 Local state administrations.
 - 5.1.1 Oblast administrations.
 - 5.1.2 City administrations.
 - 5.1.3 District administrations.
 - 5.2 ZhEKs.

Within one class, budget buildings may be distinguished by:

- Capacity;
- Number of floors;
- Year of construction;
- Available specific premises;
- Location within the city structure.

Appendix 1 contains characteristics of typical budget buildings and Appendix 2 provides an estimate of the number of budget buildings in Ukraine. Based on the analysis of Appendices 1 and 2, 10 typical budget buildings were defined (Table 1) that present the most representative types of budget buildings in Ukraine.

Table 5. List and characteristics of typical budget buildings in Ukraine

Type of building	Characteristics of a building type					Estimated Number of buildings in Ukraine
	Capacity	Number of floors	Year of construction	Available specific premises	Location	
Kindergartens	200 infants	2	1958-80	--	Separate	6,050
General secondary schools	1,000 pupils	3	1958-80	Assembly hall and gymnasium	Separate	7,010
Secondary educational institu-	1,000 students	4	1958-80	Laboratories	Compact location	5,400

Type of building	Characteristics of a building type					Estimated Number of buildings in Ukraine
	Capacity	Number of floors	Year of construction	Available specific premises	Location	
tions						
Hospitals	600 beds	5	Before 1957	--	Separate	7,200
Policlinics	800 visits	4	Before 1957	--	Within the city constructions	4,400
Theaters	1,000 seats	4 circles	Before 1913	One stage	On a square	50
Central governance bodies	Area of 2,000 m ²	4	After 1980	Assembly hall	Within the city constructions	80
Bodies of local self-governance	200 infants	2	1958-80	--	Separate	1,200
ZhEKs	1,000 people	3	1958-80	Assembly hall and a gymnasium	Separate	2,500

4.2 Typical energy efficiency measures, technologies and equipment in budget buildings

4.2.1 Determining typical energy efficiency measures, technologies and equipment

Presently there are many energy efficiency measures for buildings that have proven their effectiveness in European conditions. Experience in Ukraine shows the measures related to the reduction of energy consumption in buildings connected to the district heating system have the greatest energy efficiency potential. The main factor is that district heating systems are wide spread in Ukraine and have the greatest energy efficiency potential. As a result, we primarily reviewed energy efficiency measures for buildings that are connected to the district heating systems.

A summary of recommendations [107-114] for reducing heat consumption in buildings connected to the district heating systems and classification of these measures [115] allowed us to define energy efficiency measures for the budget buildings of Ukraine (Table 2).

Table 6. Typical energy efficiency measures for budget buildings of Ukraine

N	Measure	Short description
1	Meter heat consumption	Install heat meters to create incentives for energy efficient behavior
2	Insulate building envelopes	Install external heat insulation to increase building thermal resistance
3	Heating system controls	Install controls capable of reducing heat consumption in warm weather and during non-working hours

4	Balance heat system risers	Install balancing valves in order to reduce excessive heat consumption in one portion of the premises and improve heat conditions in other portions of the premises
5	Improve radiator effectiveness	Install radiator reflectors to reduce heat losses
6	Pipe insulation	Repair/replace existing insulation on heat pipes
7	Window weatherization	Install insulation materials to reduce heat losses
8	Reduce hot water consumption	Install energy efficient shower heads and aerators
9	Reduce water pressure	Install pressure controls at water pipe inlets in low-rise buildings
10	Heat recovery	Install refrigeration systems with recuperators to recover waste heat

4.2.2 Effectiveness analysis of typical energy efficiency measures, technologies and equipment

4.2.2.1 Meter heat consumption

Installation of heat meters is not purely an energy efficiency measure because it does not lead directly to reduction in heat consumption, but heat metering provides an incentive for improving household behavior with respect to energy efficiency and for monitoring results of all energy efficiency measures in a building. Installation of heat meters should accompany any reconstruction in accordance with the governmental resolutions. It is recommended that this measure be implemented without a feasibility study.

4.2.2.2 Insulate building envelopes

Building envelope insulation is one of the most critical measures that could significantly reduce building heat consumption. However, the cost of this measure is high as evidenced by an estimation of this measure's cost-effectiveness.

According to Building Regulations, the estimated heat flow through 1 m² of the wall designed in 1960-70 when wall heat transfer ratio was about 24 kcal/m²K per day or 0.086 Gcal/m² over the 3,572 of the heating season. Covering the wall with insulation according to the advanced construction standards, the heat transfer ratio could be reduced by a factor of 3 and the annual heat flow will be 0.027 Gcal/m². So, for each square meter of an isolated wall $0.086 - 0.027 = 0.059$ Gcal during the year will be saved and with the tariff \$16/Gcal annual cost savings for each square meter will be about one dollar.

Based on a simple payback of ten years pay, wall insulation should cost less than \$9.40/m² for this measure to be cost-effective. Based on the advertisements of well-known manufacturers, low-cost wall insulation technologies are not less than \$25/m², which means that the payback wall heat insulation is 25+ years.

4.2.2.3 Heating system controls

Centralized weather control is provided at the boiler plant and under conditions of unsatisfactory heat supply in the majority of Ukraine cities. As a result, the energy saving potential that could be actually realized is not significant. However, the potential of temperature and timer based control systems in budget buildings with fixed working hours is significant.

The cost of a weather and timer control system in a building substation, based on similar installations in Ukraine, will not exceed \$1,100 [118]. A building with a heating system capacity of 200

kW, consumes about 350 Gcal a year. The weather and timer controls will reduce heat consumption by 15–35% [12], depending on the number of non-working hours of this institution over the week. At a reduction of 20%, heat consumption will be reduced by $0.2 \times 350 = 70$ Gcal and at a tariff \$16/Gcal, the annual cost savings will be \$1,120 for a simple payback period that will not exceed one year[†].

4.2.2.4 Balance heat system risers

Heating systems are often unbalanced, which results in temperature differences in different locations of the building. If the general heat flow of a heat system is oriented to demands in the coldest locations, there is an opportunity to reduce overheating in other locations and the overall heat flow through balancing. As can be seen, the savings associated with this measure depends on the extent to which the heating system is unbalanced. Although this is an important measure to consider, its feasibility may only be determined based on an energy audit for each specific building.

4.2.2.5 Improve radiator effectiveness

The installation of heat reflectors behind radiators may reduce heat losses. However, the calculations presented below indicate that this measure is not feasible for the existing budget buildings.

The heat capacity of a 6-section cast-iron radiator is approximately 870 kcal per hour with a size of 60 x 50 cm or 0.3 m². With the heat transfer coefficient of the wall of about 1 kcal/hr, the average outdoor temperature of minus 0.6°C, the minimum outdoor temperature of minus 22°C, and the temperature of the internal wall of +50°C, which is practically impossible, maximum losses would be $0.3 \times 1.0 \times (50 - (-22)) = 22$ kcal per hour. Assuming that after installation of a very efficient reflector, the temperature of the internal wall will be reduced to the ambient temperature of the room to +18°C and maximum losses to will be reduced to $0.3 \times 1.0 \times (18 - (-22)) = 13$ kcal per hour. The reduction in losses with adjustment for the average outdoor temperature, provides savings over the heating season of approximately 0.018 Gcal.

With annual cost savings of \$.29 compared to the cost of the reflector of \$3.75 and about \$11.55 for installation, the simple pay back period exceeds 50 years.

4.2.2.6 Pipe insulation

The quality of insulation on heat and hot water pipes is unsatisfactory in most buildings. The reduction of heat consumption by improving the insulation on heat pipes is one of the simplest measures and does not require application of advanced technologies. Estimations prove that this measure is feasible for the existing budget buildings.

Due to the poorly insulated heat pipes that transport water with an average temperature of 50°C through building basements where the temperature does not exceed 10°C in the heating season, pipeline diameter of 50 mm and total length of 400 m, the annual heat losses are estimated to be:

$$3.14 \times 0.05 \times 400 \times 10.5 \times 0.5 \times (50-10) \times 24 \times 180 \times 10^{-6} = 57 \text{ Gcal}$$

Other assumptions include a heat flow of 10.5 kcal/m²/h°C, a heat transfer coefficient of current pipe insulation of 50%, and 180 days in a heating season.

[†] It should be indicated that the effectiveness of the weather and timer control system is based only on the application of domestic equipment capable to operate effectively without the full replacement of existing heat substations. Pay back periods for the heat substations with the full replacement of equipment and installation of advanced equipment of European manufacturer is 3-7 years depending on the building type.

In addition, hot water pipes that transport domestic hot water with an average temperature 45°C through building basements where the temperature does not exceed 15°C in the calendar year, an average diameter of 40 mm, and total length of 200 m, the annual heat losses are estimated to be:

$$3.14 \times 0.04 \times 200 \times 10.5 \times 0.5 \times (45-15) \times 24 \times 365 \times 10^{-6} = 35 \text{ Gcal}$$

Total heat and hot water pipe heat losses are then $57 + 35 = 92$ Gcal per year. If pipelines are insulated with an effectiveness of 80%, heat losses will be $92 * (1 - 0.8)/0.5 = 37$ Gcal per year for a reduction of $92 - 37 = 55$ Gcal.

To get these savings it is necessary to install 88 m^2 of insulation on the pipes:

$$3.14 \times (0.05 \times 400 + 0.04 \times 200) = 88 \text{ m}^2$$

The cost of heat insulation materials per square meter is approximately \$21 and with a labor cost of about 20% this amount, the cost to improve the heat insulation improvement in one building will equal:

$$88 \times \$21 \times 1.2 = \$2,218$$

The energy cost savings will be about \$880 with the tariff \$16/Gcal, and the simple pay back period will be about 2.5 years. This result practically does not depend on physical size of the pipelines because heat losses and heat insulation depend directly on the heat pipeline diameter.

This measure should be implemented in all budget buildings in which the heat and/or hot water pipes have no or damaged insulation and are located are in the basement or attic.

4.2.2.7 Window weatherization

Window weatherization should be considered, especially if window system insulation and leakiness is unsatisfactory, but, as a rule, budget buildings lack air conditioning systems and fresh air is needed maintain indoor air quality. There is a balance between the need to weatherize windows and maintain a healthy indoor environment, so this measure is not considered feasible for general implementation.

This measure does not require significant investments but its effectiveness should be estimated together with the installation of air conditioning systems. Such implementation requires both funds and additional energy, so this measure should be implemented if needed but reconstruction of this kind should not necessarily be considered as an energy saving measure.

Having said that, weatherization is a very important energy efficiency measure and is provided by the housing services in preparation for the winter period. This work is performed yearly according to orders of local administrations, thus implementing this measure would not require additional investments.

4.2.2.8 Reduce hot-water consumption

Installation of low-flow shower heads and aerators leads to reduction in tap water consumption. It is obvious that this measure is feasible for hotels and recreation centers, although such buildings are not support by the budget. Consumers in budget buildings accept this measure as a compulsory limitation and counteract the effectiveness of this measure. In the case of low-flow de-

vices, energy saving can only be successful through a conscientious effort on the part of users and they have shown unwillingness to conserve water and energy as intended. As a result, installation of low-flow shower heads and aerators is not recommended.

4.2.2.9 Reduce water pressure

The pressure of the water supplied to the districts is determined by the demand of the highest building(s). This pressure is excessive for low buildings and leads to water losses. In these cases, water pressure can be reduced by installing a pressure regulator in the pipeline inlet to the building.

The cost of a DN 50 pressure regulator is approximately \$500, based on a 5 year payback period, is cost-effective if the annual savings are not less than \$100. At a tariff of \$16, it is necessary to save 0.02 Gcal per building, so even if savings reach only 10%, this measure should be considered effective if heat consumption for the building exceeds 0.2 Gcal. Thus, the installation of a pressure regulator is always feasible at locations where pressure in the pipeline exceeds the system demand (mainly in low buildings).

4.2.2.10 Heat recovery

Many modern buildings, including those supported by the state budget, are equipped with air conditioning systems and public catering establishments that own refrigeration equipment also occupy many of these buildings. Experience has shown that heat recovery from the exhaust heat of air conditioning and refrigeration systems provides significant energy savings.

Implementation of heat recovery systems applied to air conditioning and refrigeration systems is generally low cost and effectiveness is defined by the net savings obtained by not having to obtain hot water from external suppliers. For example, a refrigerating machine with capacity of 100 kW is capable of producing about 230 Gcal of heat over three summer months. This provides costs savings of about \$3,700 as compared to the cost of the heat recuperators for a 100 kW system estimated to be \$800 – a payback period of less than 5 months. This measure is obviously effective in applications where air-conditioning and hot-water systems operate simultaneously.

4.2.3 Effectiveness assessment for typical energy efficiency measures, technologies and equipment

The analysis of subsections 4.2.2.1.- 4.2.2.10 enables us to conclude that the most effective typical energy efficiency measures, technologies and equipment feasible to implement in budget buildings of Ukraine are:

- Heat consumption metering;
- Heating system controls;
- Pipe insulation;
- Water pressure reduction;
- Heat recovery.

The first heat metering is not an energy saving measure, but it promotes the implementation of other energy saving measures, which is why it is feasible to implement this measure in any case without a feasibility study.

The results of the effectiveness assessment of four other most effective typical energy efficiency measures, technologies and equipment in the budget buildings are summarized in Table 3.

The original data and results of effectiveness assessment of these measures, technologies and equipment are located in Appendix 3.

Table 7. Technical and economic indicators of energy efficiency measures in budget buildings

Indicator	Kindergartens	General secondary schools	Secondary educational institutions	Hospitals	Polyclinics	Theatres	Central government institutions	Local administrations	Housing and communal Services	Total
Heating system controls										
Costs, \$ million	6.66	10.5	8.10		4.84	0.13	0.10	1.44	2.75	34.52
Savings, 10 ⁶ Gcal/year	0.35	1.84	1.67		0.48	0.03	0.01	0.13	0.07	4.57
Benefits, \$ million/year	5.61	29.4	26.7		7.75	0.47	0.12	2.01	1.05	73.16
Pipe insulation										
Costs, \$ million	2.56	12.35	13.32	6.09	4.96	0.18	0.06	0.85	0.44	40.78
Savings, 10 ⁶ Gcal/year	0.06	0.31	0.33	0.15	0.12	0.01	0.01	0.02	0.01	1.02
Benefits, \$ million/year	1.02	4.94	5.33	2.43	1.98	0.07	0.02	0.34	0.18	16.31
Reduce water pressure										
Costs, \$ million	3.03	3.51		3.60						10.13
Savings, 10 ⁶ Gcal/year	0.06	0.31		0.15						0.52
Benefits, \$ million/year	1.02	4.92		2.42						8.36
Heat recovery										
Costs, \$ million				5.76			0.06	0.96		6.78
Savings, 10 ⁶ Gcal/year				0.76			0.00	0.05		0.81
Benefits, \$ million/year				12.12			0.06	0.84		13.02
Total										
Costs, \$ million	12.24	26.37	21.42	15.45	9.80	0.30	0.22	3.25	3.19	92.22
Savings, 10 ⁶ Gcal/year	0.48	2.45	2.00	1.06	0.61	0.03	0.01	0.20	0.08	6.93
Benefits, \$ million/year	7.65	39.25	32.08	16.98	9.73	0.54	0.20	3.19	1.22	110.9

Analysis of Table 3 shows that about \$100 million should be spent to implement the most effective typical energy efficiency measures, technologies and equipment in budget buildings with a simple payback of one year. The expected heat savings consumed by these buildings is about 7 million Gcal annually. Currently about 1 billion m³ of gas is combusted for generation of this amount of heat.

5. Organization and Conduct of the Workshop “Energy Efficiency in the Budget Sphere of Ukraine”

ARENA-ECO prepared and conducted the workshop “Energy Efficiency in the Budget Sphere of Ukraine” on October 29, 2003 to inform specialists of ministries, administration, and oblast state organizations about the project results.

The workshop brought together representatives of Ukrainian Parliament, the Ministry of Economy of Ukraine; the State Committee of Ukraine for Energy Conservation, the State Committee of Ukraine for Housing and Communal Services, the State Committee for Construction, Architecture and Housing Policy, the State Inspection for Energy Conservation, U.S. Agency for International Development; Association of Ukrainian Cities, Oblast State Administrations of Ukraine, other institutions and organizations (see attached list of participants).

5.1 Opening and conducting workshop

The workshop was held at the State Committee of Ukraine for Energy Conservation, 1 Gonty Str., Kyiv. Y.I.Shulga, Head of the State Committee of Ukraine for Energy Conservation, opened the workshop by addressing the urgency of the workshop topics, and informed the workshop participants about the status of the State Program for Energy Conservation. He also emphasized the importance of increasing the role of regional authorities in solving energy efficiency issues.

M.V. Raptsun, President of Agency for Rational Energy Use and Ecology, presented the goal of the program “Energy Efficiency in the Budget Sphere of Ukraine” and the results that were achieved. Mr. Raptsun compared the budget expenditures on energy in USA and Ukraine, and said that Ukraine will be able to reach a 30% reduction in energy consumption by 2005 by implementing the energy efficiency measures detailed in section 4.

T.M.Kornilova, the USAID representative, underlined the importance of creating a favorable investment environment for energy efficiency projects in Ukraine. She also presented brief information on USAID activities in Ukraine.

The workshop agenda and attendees are contained in Attachments 4 and 5, respectively.

5.2 Discussions

Representatives of the State Committee of Ukraine for Energy Conservation, oblast state administrations, Agency for Rational Energy Use and Ecology participated in a discussion of the workshop results.

O.V. Boiko, Representative of the Vinnitsa Oblast State Administration, Deputy Head of Economic Department, emphasized importance of creating energy efficiency departments at the oblast state administrations. He informed workshop participants about 6 energy efficiency projects being implemented at the oblast enterprises, and mentioned the problems related to budget appropriations made by oblast state administrations for energy efficiency programs.

V.D. Bilodid, Head of Department of the State Committee of Ukraine for Energy Conservation, addressed barriers to financing energy efficiency projects.

V.A. Zhovtyanskiy, Deputy Head of the State Committee of Ukraine for Energy Conservation, reviewed opportunities and weaknesses of financing energy efficiency in Ukraine.

S.M. Bevz, Head of Department of the State Committee of Ukraine for Energy Conservation underlined the importance of the program's results and the need to create incentives for energy saving efforts.

5.3 Conclusions:

Y.I Shulga, Head of the State Committee of Ukraine for Energy Conservation, summarized the results of the workshop discussion and stated the:

- Urgency of the discussed issues;
- Importance of the legislative framework and cooperation with regional authorities for solving energy efficiency problems;
- Significance of results achieved by the Agency for Rational Energy Use and Ecology while implementing the program "Energy Efficiency in the Budget Sphere of Ukraine."

5.4 Workshop proposals

- To take into consideration the proposals for improving the Ukrainian legislation and creating a standard framework for energy efficiency in the budget sphere to develop legislation at the state and regional levels;
- To continue this work at the regional level with consideration of regional aspects and specific features.

6. Conclusions

1. The report contains an analysis of laws, and other legislative and standard documents that regulate the activity of budget institutions to improve their energy efficiency as well as conditions and results of performance of energy efficiency programs in the budget area.
2. Analysis of Ukrainian legislation enables us to conclude that the broad legislative framework and standard basis for developing and implementing state and regional energy efficiency programs in the budget area has mainly been created.
3. Tasks for improving energy efficiency in the budget area are performed in accordance with the Comprehensive State Program of Energy Conservation of Ukraine and oblast energy efficiency programs.
4. Programs for equipping budget facilities with natural gas, water and heat meters, which is currently underway, also encourage energy efficiency programs in the budget area.
5. Analysis of potential financing sources showed that investments for the improvement of energy efficiency in the budget area may be obtained from the state and local budgets or from the State Innovation Company, international financial institutions, commercial banks (domestic and foreign), issuing bonds, leasing, and energy service companies. Investments may be provided in a form of subsidies, grants, loans, leasing and performance contracts.
6. Analysis of conditions and results of the performance of energy efficiency programs showed that they are currently not fulfilled.
7. The main reason for delays in the performance of these programs is insufficient financing from the state budget and absence of relevant incentives for the executors.
8. To improve energy efficiency in the budget area, it is necessary to improve legislation to:
 - Establish systems for monitoring and performance of existing legislative acts and standards;
 - Create conditions for attracting non-budget funds to financing energy efficiency projects;
 - Create incentives for reaching specific levels of performance and results of these programs.
9. The U.S. is a leader in energy resource management achieved through through legislation, executive orders, and other means to provide legal principals and market mechanisms to support national energy efficiency policy.
10. The U.S. experience will be extremely useful in development of proposals for improving Ukrainian energy efficiency legislation related to the budget sphere.
11. The main legislative provisions for energy saving and reduction of energy costs in the U.S. are:
 - Regulation and coordination of activities by governmental services at all levels (federal, state and municipal);
 - Creation of financing mechanisms for energy saving measures in budget sphere, including use of alternative financing mechanisms for energy efficiency projects;
 - The use of utility deregulation opportunities to improve energy efficiency.
12. U.S. Government coordinates activities target identification and implementation of energy saving projects at all levels (federal, state and municipal).
13. The DOE Federal Energy Management Program (FEMP) was created in 1973 to encourage energy saving in federal buildings. The main spheres of FEMP's activities are:
 - Planning, reporting, and analysis;
 - Information and technical assistance to federal agencies;
 - Project financing.
14. The main financing sources used under FEMP are:
 - Direct appropriations;

- Federal Energy Efficiency Fund grants;
 - Alternative financing mechanisms for federal energy efficiency projects, including Super Energy Saving Performance Contracts and Utility Energy Service Contracts.
15. Initiatives introduced in the states and municipalities fall into three categories:
 - Tax incentives, which provide exemptions from or reductions on tax obligations relating to energy efficiency efforts;
 - Grants and loans for specific purchases;
 - Bonds to provide up-front capital.
 16. The U.S. initiated utility deregulation to reduce energy costs and increase reliability of energy supply. Deregulation of the utility market is characterized by the significant reduction of government influence on the activities of companies, which are considered natural monopolies, and by implementing competitive principles on electricity and natural gas supply markets. The report presents examples of the deregulation process in the States of New Hampshire and Pennsylvania.
 17. A classification of Ukraine's budget buildings resulted in the definition of 10 buildings types, their number, and characteristic features that included their capacity, number of floors, year of construction, presence of specific premises and location within the city.
 18. An analysis of energy efficiency measures, technologies and equipment applied for improvement of energy efficiency in budget buildings provided identification of the five most effective measures:
 - Meter heat consumption;
 - Heating system controls;
 - Pipe insulation;
 - Reduce water pressure;
 - Heat recovery.
 19. Metering is not an energy efficiency measure, but it promotes the implementation of other energy efficiency measures. It is feasible to implement heat consumption metering in all situations without a feasibility study.
 20. It is estimated that about \$100 million should be invested to implement five types of measures, technologies and equipment in budget building, which will have a simple pay-back one year. The expected heat consumed savings is about 7 million Gcal annually. Currently about 1 billion m³ of gas is combusted for generation of this amount of heat.

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Appendix 1. Classification of Main Types of Budget Buildings

№	Types	Characteristic Features				
		Capacity	Number of floors	Year of construction	Presence of specific premises	Location within the city
1.1	Kindergartens	Up to 50 infants	one	Before 1957	Swimming pool	Separate
		50-100 infants		1958-80		
		100-200 infants	two	1981-91	Gymnasium	In-built
		More than 200 infants		After 1991		
1.2	General secondary schools	Up to 100 pupils	one	Before 1957	Assembly Hall	Within the city constructions
		100-500 pupils	two	1958-80	Gymnasium	
		500-1,000 pupils	three	1981-91	Swimming pool	In a separate area
		More than 1,000	four	After 1991	Workshops	
1.3 and 1.4	Secondary and higher educational Institutions	Up to 500 students	1-2	Before 1957	Laboratories	Compact
		500-1,000 students	3-4	1958-80	Sporting complex	
		1,000-5,000 students	1-7	1981-91	Club complex	In different locations
		More than 5,000	8 and more	After 1991		
1.5	Houses of children's creativity	With halls up to 500 sitting places	1-2	Before 1980	Sporting complex	Within the city constructions
		More than 500	3 and more	After 1980		In a separate area
2.1	Hospitals	Up to 100 beds	1-2	Before 1957		Within the city constructions
		100-500 beds	3-4	1958-80		
		500-1,000 beds	5-9	1981-91		On the separate area
		More than 1,000	10 and more	After 1991		
2.2	Polyclinics	Up to 100 visits	1-2	Before 1957	Laboratory	Within the city constructions
		500-1,000	3-4	1958-80		In conjunction with the hospital
		More than 1,000	5 and more	After 1980		

№	Types	Characteristic Features				
		Capacity	Number of floors	Year of construction	Presence of specific premises	Location within the city
3.1	Museums	Area up to 100 m ²	1-2	Before 1913		Within the city constructions
		100-2,000	3-4	1913-80		In a separate area
		More than 2,000	5 and more	After 1980		
3.2	State Academic Theatres	With halls up to 500	1-2 circles	Before 1913	One stage	In the street
		500-1,000	3-4	1913-80	Two stages	On a square
		More than 1,000	5	After 1980	Three stages	
3.3	Libraries	Area up to 100 m ²	1-2	Before 1913	Reading hall	Within the city constructions
		100-2,000	3-4	1913-80	Two halls	In a separate area
		More than 2,000	5 and more	After 1980	Not less than three halls	
4.2	State authorities	Area up to 1,000 m ²	1-2	Before 1913	Session hall	Within the city constructions
		1,000-2,000	3-4	1913-80	Two halls	In a separate area
		More than 2000	5 and more	1980	Not less than three halls	
4.3	Tax administration	Area up to 1,000 m ²	1-2	Before 1957		Adapted building
		1,000-2,000	3-4	1957-94		Specially built
		More than 2,000	5 and more	After 1994		
5.1	Local authorities	Area up to 1,000 m ²	1-2	Before 1913	Assembly hall	Adapted buildings
		1,000-2,000	3-4	1913-80	Two halls	Specially built
		More than 2,000	5 and more	after 1980	Not less than three halls	
5.2	ZhEKs	Area up to 200 m ²	1	Before 1957	Session hall	Adapted building
		200-1,000	2	1957-80		Specially built
		More than 1,000	3	After 1980		In-built

Appendix 2. Estimation of Budget Buildings' Number

We had to extrapolate the results of this analysis to all budget buildings of Ukraine to determine the total technical and economic indicators for the buildings throughout Ukraine. Determination of the number of budget buildings in Ukraine used available information [13]. In the city of Rivne with the population 240 thousand people there are 44 kindergartens, 51 general educational schools, 74 secondary educational institutions. Extrapolating this information to Ukraine with a total population is 49 million, of which 33 million are city residents, we obtain the following information on the number of budget buildings (Table D.2).

Table D.2. Tentative number of budget buildings in Ukraine

Building types	Number of buildings
Kindergartens	6,050
General secondary schools	7,010
Secondary educational institutions	5,400
Hospitals	7,200
Polyclinics	4,400
Theatres	50
Central governmental institutions	80
Local authorities	1,200
ZhEKs	2,500
Total	33,890

Appendix 3. Effectiveness Assessment of Implementing Priority Energy Efficiency Measures in the Budget Buildings of Ukraine

Appendix 4. Agenda of the workshop Energy Efficiency in the Budget Sphere of Ukraine

October 29, 2003

1, Gonti St., assembly hall, State Committee of Ukraine for Energy Conservation

1:30 – 2:00 p.m.

Registration of the participants

2:00 – 2:20 p.m.

Opening the workshop

Yu.Shulga, Chairman of the State Committee of Ukraine for Energy Conservation

2:20 – 2:50 p.m.

Welcome address

M.Rapsun, President, Agency for Rational Energy Use and Ecology

T. Kornilova, Program Management Specialist-Energy, US Agency for International Development

2:50 – 3:10 p.m.

Analysis of Ukrainian legislation and potential financing sources for implementing energy efficiency in the budget sphere

G. Panchenko, Agency for Rational Energy Use and Ecology

3:10 – 3:30 p.m.

Analysis of U.S. legislation for developing proposals to improve Ukrainian legislation on energy efficiency in the budget sphere

L. Milkevitch, Agency for Rational Energy Use and Ecology

3:30 – 3:50 p.m.

Ukraine's legal framework and existing opportunities for financing energy efficiency programs in the budget sphere

V. Zhovtyansky, Deputy Chairman, State Committee of Ukraine for Energy Conservation

3:50 – 4:10 p.m.

Break

4:10 – 4:30 p.m.

Proposals for improvement of the Ukrainian legislation and standard framework for energy efficiency in the budget sphere

G. Panchenko, Agency for Rational Energy Use and Ecology

4:30 – 4:50 p.m.

Defining priority energy efficiency measures, technologies and equipment in the budget buildings

V. Gershkovitch, Center of Energy Efficiency, Kiyv ZDNIIEP

4:50 – 5:20 p.m.

Discussion

5:20 – 6:20 p.m.

Reception

Appendix 5. List of Participants of the Workshop "Energy Efficiency in Budget Sphere of Ukraine"

October 29, 2003

State Committee of Ukraine for Energy Conservation

	Participant	Institution, organization, enterprise
1.	Yuriy Orobets, Head	Subdivision of the Cabinet of Ministers of Ukraine
2.	Lyudmyla Vasyliyeva, Chief Consultant	Committee of Verkhovna Rada of Ukraine for fuel and energy sector, nuclear policies and safety
3.	Petro Kharchenko, Head of Department	The Ministry of Economy
4.	Yuriy Shulga, Chairman	The State Committee of Ukraine for Energy Conservation
5.	Victor Zhovtyanskiy, Deputy Head	The State Committee of Ukraine for Energy Conservation
6.	Oleksandr Sukhodolya, Deputy Head	The State Committee of Ukraine for Energy Conservation
7.	Sergiy Bevz, Head of Department	The State Committee of Ukraine for Energy Conservation
8.	Victor Bilodid, Head of Department	The State Committee of Ukraine for Energy Conservation
9.	Victor Bortsov, First Deputy Director	The State Committee of Ukraine for Energy Conservation
10.	Volodymyr Aliokhin, Deputy Director of Department	The State Committee of Housing and Communal Services
11.	Volodymyr Shostak, Senior Specialist	The State Committee of Construction of Ukraine
12.	Iryk Vakilov, Deputy Head of Inspection	The State Inspection of Energy Conservation
13.	Mykola Raptsun, President	Agency for Rational Energy Use and Ecology
14.	Tatiana Kornilova, Program Management Specialist-Energy	The U.S. Agency for International Development
15.	Oleksandr Ponomarenko	The Association of the Cities of Ukraine
16.	Zarema Ramazanova, First Deputy Minister for Fuel and Energy	Crimea Oblast State Administration
17.	Yuriy Plyashevskiy, Head of Department	Volyn Oblast State Administration
18.	Volodymyr Merzlikin, Head of Department for Energy Conservation	Volyn Oblast State Administration
19.	Roman Selynyna, Director of Energy Efficiency Center	Volyn Oblast State Administration
20.	Victor Volkov, Deputy Head of Department	Dnipropetrovsk Oblast State Administration
21.	Ivan Dmytruchenko, Senior Specialist	Ivano-Frankivsk Oblast State Administration
22.	Anna Olezhko, Head of Energy	Kyiv Oblast State Administration

	Department	
23.	Vyacheslav Perevoznyuk, Senior Specialist	Kyiv Oblast State Administration
24.	Stanislav Khaitov, Head of Energy and Energy Saving Department	Mykolayiv Oblast State Administration
25.	Victor Riznyk, Deputy Head of Regional State Administration	Poltava Oblast State Administration
26.	Mykola Zakladniy, Senior Specialist	Poltava Oblast State Administration
27.	Volodymyr Shevchenko, State Inspector for Energy Conservation	Poltava Oblast State Administration
28.	Volodymyr Synytsya, Senior Specialist of Industrial Department	Poltava Oblast State Administration
29.	Gennadiy Kurylov, Director of Affiliation of Western Regional Center for Energy Conservation	Poltava Oblast State Administration
30.	Valeriy Guz, Head of Department for Energy Conservation	Rivne Oblast State Administration
31.	Oleg Gorkunov, Head of Administration of Economy	Rivne Oblast State Administration
32.	Mykola Propin, Head of Territorial Administration of the State Inspection	Rivne Oblast State Administration
33.	Mykola Mykhalskiy, Deputy Head of Administration	Ternopil Oblast State Administration
34.	Boris Romanyuk, Head of Department of Education	Ternopil Oblast State Administration
35.	Raisa Levchenko, Head of Department	Sumy Oblast State Administration
36.	Nataliya Inshyna, Chief Economist of Economic Department	Sumy Oblast State Administration
37.	Victor Tykhonov, Lead Specialist of Central Economic Administration	Sumy Oblast State Administration
38.	Raisa Zheludnaya, Head of Department	Sumy Oblast State Administration
39.	Grygoriy Karpenko, Head of Department for Energy Resources	Kherson Oblast State Administration
40.	Valentyna Aldoshyna, Deputy Head of Department for Gas Market and Energy Conservation	Donetsk Oblast State Administration
41.	Sergiy Popruga, Chief Senior Specialist of Economic Department	Vinnitsa Oblast State Administration
42.	Olexandr Boiko, Deputy Head of Economic Department	Vinnitsa Oblast State Administration
43.	Victor Gershkovych, Head of Center, Chef Project Engineer	Energy efficiency center
44.	Yevgen Nikitin, Director	International Center of Energy Efficient Technologies

45.	Yuriy Blavdzevych, Deputy Director	International Center of Energy Efficient Technologies
46.	Andriy Shulga, Director	National Informational Network of Ukraine for Energy Conservation, Central Coordination Office
47.	Anna Dekhtyarenko, Head of Center	Energy Efficiency Center, Corporation "Ukrbudmaterialy"
48.	Sergiy Parasochka, Head of Board of Directors	Company "Teplo Komplekt", heat-and-power engineering, gas supply, automation
49.	Yuriy Stepanenko, Chief Engineer	Company "Proviterm"
50.	Olexandr Romenskiy, Assistant Professor	Dniprodzerzhynsk Technical University