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ENERGY EFFICIENCY DEMONSTRATION ZONES IN ECONOMIES IN TRANSITION

Note by the secretariat 1/

1. This report has been prepared under the UNF/UNFIP Energy Efficiency Investment for Climate Change Mitigation Project (ECE-CIS-99-043) in relation to Output 2.3 Energy Efficiency Demonstration Zones. It has been implemented under UNECE contract No. PS 1204 Internet Services by the Centre for Energy Efficiency (EnEffect) for posting demonstration zone descriptions on the Project website www.ee-21.net with information provided by the National Co-ordinators from participating ECE member states.

2. This report has been prepared initially for a presentation to the Steering Committee of the Energy Efficiency 21 Project and its subsequent review. After revision to incorporate additional information from delegations, the demonstration zone descriptions will be disseminated in the framework of the Energy Efficiency 21 Project. In particular, the descriptions will be provided to interested international counterparts and posted on the project website.

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About Energy Efficiency 21

3. The ENERGY EFFICIENCY 21 Project is assisting ECE member States to implement greenhouse gas mitigation strategies and to develop related energy efficiency investment projects. EE21 is a three year project started in June 2000 at the conclusion of the third phase of the Energy Efficiency 2000 Project.

4. Energy Efficiency 21 is being implemented within the UN Economic Commission for Europe UNECE under the auspices of the Committee on Sustainable Energy. A Steering Committee determines the activities and provides guidance on the execution of the Project.

5. EE21 supports the objectives of the Committee on Sustainable Energy and its contributions to the ninth session of the UN Commission on Sustainable Development (CSD-9). By placing the UNECE's work in energy efficiency firmly in the context of global climate change and sustainable development, it may now be possible to add impetus to the efforts of the central and east European economies in transition to mobilize market forces and private sector lending and investment in energy efficiency. In the Bergen Ministerial Declaration on Sustainable Development in May 1990, governments agreed to initiate an ECE region-wide campaign, "ENERGY EFFICIENCY 2000", to enhance trade and cooperation in energy efficient, environmentally sound techniques and management practices to close the energy efficiency gap between actual practice and best technologies, and between ECE countries through national actions, bilaterally and especially through the Economic Commission for Europe.

6. The EE2000 Project assisted Central and Eastern Europe and CIS countries to enhance their energy efficiency and security to ease the energy supply constraints of economic transition. The EE2000 Project assists these countries in meeting international environmental treaty obligations under the United Nations Framework Convention on Climate Change (UN FCCC) and UN ECE.

7. The EE2000 Project has been notably successful in leveraging modest resources to achieve its stated objectives. Not only it produced direct results that are way beyond what might be expected from the resources available, but it has also been a catalyst for additional bilateral, multilateral and private initiatives, the most recent being the UNF/UNFIP Project for Energy Efficiency Investment for Climate Change Mitigation (ECE-CIS-99-043). The www.ee-21.net web site is also a result of activities within the UNF/UNFIP Project.

8. The www.ee-21.net web site has been established to enhance regional cooperation on energy efficiency market formation and investment project development to reduce greenhouse gas emissions in economies in transition. It is to assist, in particular, National Participating Institutions in economies in transition to use Internet connections, web sites and search tools for information exchanges between themselves and international partners. It is also to help disseminate the results of national energy efficiency programmes, the Energy Efficiency 21 and Energy Efficiency 2000 Projects, and other international initiatives.

9. With the support of the UNECE the www.ee-21.net web site has been developed by the EnEffect Centre for Energy Efficiency, Bulgaria, a non-profit NGO established in 1992 in Sofia.
10. An Energy Efficiency Demonstration Zone is a city-scale project, a town, district, or limited area, in which favorable conditions in every sphere are established to stimulate enterprise and initiative in market approaches to energy efficiency, in the same way as urban or regional economic development zones have been successfully established in western countries. It demonstrates, on a city-wide scale, the combined effect of energy-efficient technology; energy pricing policy; favorable tariff structures; advisory services; information campaigns; metering, monitoring and controls; measurement of changes in emission levels; energy audits; tax incentives, grants and government-guaranteed loan schemes; international technical assistance and trade development programmes. The intention is to copy successful measures nationally once proven on a limited scale.

11. Three main types of information are required for the initial presentation of a demonstration zone: general data on demographic features and the infrastructure of the proposed site together with energy and environment characteristics; information on the market economy policy transfer and financing.

12. For more details on the Guidelines for selection criteria and standard presentation of EE Demo Zones please see Annex 5 of the EE Investment Project document.
For more information on a Demonstration zone and related EE projects, the office of the related National co-ordinator at Belarus, Bulgaria, Kazakhstan, Russian Federation or Ukraine may be contacted.

13. Work is underway for the identification and evaluation of energy efficiency Projects within the Zones. Our goal is to post on the www.ee-21.net web site Project information and Updates as soon as they are submitted from the National organizations and coordinators.

BELARUS

14. Belarus has a very poor endowment of traditional energy resources, such as coal, oil and gas. The country produces only 15% of the primary energy necessary for its economy and has to import the remainder (20 million tons of oil equivalent, Mtoe, in 1998) from the Russian Federation. This dependence on imported fossil fuel creates a considerable burden for the national trade balance.

15. Since 1993 the State Committee for Energy Efficiency and Control of the Republic of Belarus has been undertaking great efforts to improve the situation with efficient use of energy carriers in the Republic. As a result, the energy intensity of the economy has been on the decline. From 1.34 koe/US$ in 1990, it came down to 1.14 koe/US$ in 1997 and to 0.93 koe/US$ in 1999.

16. The State Committee heads a multi-level management system to ensure the efficient control of energy saving that encompasses national agencies, regions, districts, cities, towns, municipalities and enterprises. The Committee has established a developing and adaptive system of economic, financial and legal support of energy saving and introduction of renewable energy

sources; information support for energy saving; and a system of training and continuing staff education.

17. One of the main activities of the State Committee is international cooperation. Creation of Demonstration Zones on energy efficient use is an essential part of the international cooperation. The following Demonstration zones were established within the framework of the UN ECE programme EE 2000 and the EE 21: Baranovichy, Borovlyanu, Kedyshko and Vitebsk. One of the main objectives of these zones is to demonstrate actual benefits coming from energy efficiency measures to attract both local and foreign investments into energy efficiency. Demonstration zones are also part of a national strategy for energy efficiency, which is supported by the Government.

18. The following energy saving measures will be implemented under the EE 21 project in the above mentioned demonstration zones:

- automatic control systems for heat consumers,
- reconstruction of DH system,
- reconstruction of street lighting,
- conversion of heat only boilers to co-generation plants.

19. At present all these energy saving measures are the subject of business planning and financial engineering activities within the framework of UN ECE training courses. In October 2001 business plans should be ready and will be presented for financial institutions.

BULGARIA

20. With a population of 8.2 million Bulgaria occupies 110,994 square km of the eastern portion of the Balkan Peninsula. Within a relatively small compass, the Bulgarian landscape exhibits striking topographic variety. Open expanses of lowland alternate with broken mountain country, cut by deep river gorges and harbouring upland basins. The country’s capital, Sofia, lies near the geographic centre of the entire Balkan region.

21. The major source of energy in Bulgaria is the Maritsa lignite field, which provides fuel to large thermoelectric plants at Dimitrovgrad and Maritsa-Iztok. The country's first nuclear power station, at Kozloduy, was constructed with Soviet aid and has been undergoing substantial reconstruction in the last several years.

22. For more information on Bulgaria and a survey of its energy situation see the Country profile section of the RENEUER project web site. Energy efficiency is an indicator for the utilization of all types of fuels and energy during their transformation and usage. EE is directly connected with the environmental protection and recovery. The significance of energy efficiency for the Bulgarian economy recovery is crucial, as the GDP energy intensity is several times higher than the European Union average. The energy problems of most Bulgarian towns are similar ones: the lack of DH and household gasification, ineffective street lighting, bad insulation of the buildings.

Blagoevgrad Demonstration Zone

A. General Description

23. The city of Blagoevgrad is located in the south-western part of Bulgaria at the foot of Rila Mountain, the valley of the River Struma. The city is a Centre of the Blagoevgrad municipality, which includes an additional 25 villages. The main parameters for Blagoevgrad infrastructure are given in Table 1.

Table 1: Population and Infrastructure of Blagoevgrad

Characteristic	Unit of measurement	Quantity
1. Population	Thousands	90
2. Area	Hectares	1 690
3. Floor space Surface: total	Square meters (m^2)	2 340 000
• Floor space of housing	Square meters (m^2)	1 800 000
• Industrial floor space	Square meters (m^2)	300 000
• Office buildings floor space	Square meters (m^2)	240 000
4. Dwellings	Units	23 034
5. Total final energy consumption	Petajoules (PJ) 10^{15} Joules/year	16.1
6. Energy consumption per capita	Gigajoules (GJ) 10^9 Joules per capita/year	176
7. Energy consumption per dwelling	Gigajoules (GJ) 10^9 Joules / dwelling/year	696
8. Freight transport	Megajoules (MJ) 10^6 Joules/ton km/ year	6 270
9. Passenger Transport	Megajoules (MJ) 10^6 Joules/ passenger km/year	7 460

Energy demand analysis

24. Table 2 reflects the energy consumption in Blagoevgrad municipality for the year 1997. The proposal for a demonstration zone project includes measures for energy saving for the DH, the street lighting and for the hospital. The energy demand analysis is done beneath.

Table 2: Final Energy Consumption in the Base Year before Project Operations -1997
(PJ Petajoules 10^{15} Joules per year)

Sector	Solid Fuel	Petroleum	Natural Gas	Electricity	District Heat	Total
1. Industry	0.33	2.15	-	4.21	0	6.69
2. Transport	0	2.68	-	0.08	0	2.76
3. Domestic	3.72	0.47	-	4.39	0	8.58
•Housing	3.02	0.41	-	3.37	0	6.8
•Other	0.7	0.06	-	1.02	0	1.78
4. Total	4.05	5.3	-	4.68	0	18.03

District heating: Blagoevgrad has yet no central heating, therefore 90% of the population are using solid fuel, a smaller part - electrical energy. Some large public buildings have local heating installations. The city has the challenge of building a central heat and power plant and its network, as well as household gasification, for which there are favorable opportunities. (Blagoevgrad is located 14 km away from the transit gas pipeline Russia – Bulgaria- Greece).

Street lighting: The street lighting system in Blagoevgrad is ineffective. A total of 28 165 sodium and mercury evaporating lamps are used with installed capacity of about 6095 kW, ***but the operating capacity is far less***. The length of the cable line is about 3324 km. The consumed electricity is 2 366 255 kWh.

Hospital: The buildings and the heating system of the United Regional Hospital- Blagoevgrad are heated by a local thermal plant on heavy oil. There is significant heat loss through the construction shells due to infiltration and insufficient isolation.

From the environmental point of view one can say that Blagoevgrad is a clean city.

B. Market economy, energy policy transition and finance

25. Preliminary estimate of the cost for all EE technical measures in the demonstration zone DH: The solution of the DH and/or household gasification for Blagoevgard is forthcoming. Central heating for 60% of the dwellings in Blagoevgrad:

- Construction of heat and power plant with capacity of 70 MW - $90 million.
- Heating and power supply network - $250 million

Household gasification - $9.7 million.
Street Lighting - $1.4 million
Rehabilitation of United Regional Hospital - preliminary measures require $0.2 million.

C. Site identification, selection and management

26. The city of Blagoevgrad is proposed to become a EE demonstration zone according to the current project as a typical Bulgarian industrialized city of the second group (with a population between 40,000 and 120,000 citizens) without DH. Preliminary forecast for the results of the energy saving measures is shown in Table 3.

Table 3: Projected Final Energy Consumption at the End of the Project
(PJ Petajoules 10^{15} Joules per year)

Sector	Solid fuel	Petroleum	Natural gas	Electricity	District heat	Total
1. Industry	0.22	1.45	6.45	2.71	0	10.7
2. Transport	0	0.59	0	0.08	0	0.72
3. Domestic	0.08	0.35	0	0.28	0	0.408
•Housing	0.06	0.31	0	0.21	0	0.27
•Other	0.02	0.04	0	0.07	0	0.138
4. Total	0.31	2.39	6.45	3.07	0	12.2

As a result of the implemented energy efficiency measures, the reduction of harmful emissions is estimated to be as shown in Table 4.

Table 4: Projected environmental impact of energy EE improvements (tonnes per year)				
Emissions	Industry	Transport	Domestic	Total
Carbon Dioxide CO_2	n.a	1 052	10 052	11 104
Sulphur Dioxide SO_2	n.a	19	90	109
Nitrogen Oxide NOx	n.a	7.4	18.2	25.6

Burgas Demonstration Zone

A. General Description

27. Burgas is the fifth largest city and the biggest seaport in Bulgaria.

The main parameters of Burgas infrastructure are illustrated inTable1. Burgas is a large international tourist centre with a total number of 6 000 beds, of which 1600 in hotels and motels and 5000 private lodgings. Burgas has 4 hospitals.

Table 1: Population and Infrastructure of Burgas		
Characteristic	Unit of measurement	Quantity
1. Population	Thousands	209
2. Area	Hectares	2 487
3. Floor space Surface: Total	Square meters (m^2)	n.a
• Floor space of housing	Square meters (m^2)	4 275 041
• Industrial floor space	Square meter (m^2)	n.a.
• Office buildings floor space	Square meter (m^2)	n.a.
4. Dwellings	Units	69 055
5. Total final energy consumption	Petajoules (PJ) 10^{15} Joules/year	27.2
6. Energy consumption per capita	Gigajoules (GJ) 10^9 Joules per capita/year	130
7. Energy consumption per dwelling	Gigajoules (GJ) 10^9 Joules / dwelling/year	391
8. Freight transport	Megajoules (MJ) 10^6 Joules/ton km/ year	5 990
9. Passenger Transport	Megajoules (MJ) 10^6 Joules/passenger km/year	6 980

Energy demand analysis

Table 2 illustrates the demand of energy agents in Burgas municipality.

Table 2: Final Energy Consumption in the Base Year before Project Operations - 1997
(PJ Petajoules 10^{15} Joules per year)

Sector	Solid Fuel	Petroleum	Natural Gas	Electricity	District Heat	Total
1. Industry	0.14	8.4	5.85	1.52	-	14.8
2. Transport	0	0.79	0	1.23	-	2.02
3. Domestic	0	4.2	0	1.6	0.05	5.85
•Housing	0	3.1	0	0.4	0.03	3.53
•Other	0	1.1	0	1.2	0.02	2.32
4. Total	0.14	12.9	5.85	4.35	0.1	23.38

District heating: The heating system of Burgas includes a boiler station (heat capacity of 255MW based on natural gas), transmission network (total length 60 km), and 840 subscriber stations. About 35 469 apartments are connected to the central heating system, of which 6302 are administrative and public premises. There is a project (at a feasibility study level) for the combined generation of heat and electricity for 4MWt.

Street lighting: The street lighting system in Burgas is ineffective. It has 3900 units of mercury lamps and 8700 units with metal halogen lamps of 400W. The total length of the cable lines is 1075 km. The total installed capacity of the street lighting is in the range of 5305 KW, but the operating capacity is 3 times less. The annual electricity consumption of the street lighting is 5 200 000 KWh.

Hospitals: The building fund and the heating system of the 4 hospitals in Burgas do not correspond to the requirements of the heating characteristics according to current standards expenses for energy and environmental protection. There is a big reserve for energy savings by improvement of the heating characteristics of the buildings.

28. The environment of the region: Burgas Refinery, bus and air transport, as well as the enterprises in the South and northern industrial zones are the major sources of harmful emissions, contaminating the atmosphere of the region. The lack of enough purification plants for the industrial waste water or their inefficiency have a serious harmful impact on the water resources of the region. The availability of large volumes of solid, liquid and gas waste substances on the territory of Burgas defines this municipality as an "ecologically hot point".

B. Market economy, energy policy transition and finance

29. Preliminary estimate for the cost of all EE technical measures in the demo zone :
District heating reconstruction $5.2 million (including co-generation reconstruction for the thermal plant for $4 million.)
Household gasification - Gas pipeline for both industrial and household - $10.8 million.

Street Lighting: Replacement of the old lighting illuminants with new energy efficient: $2.5 million; Double tariff electrical meters and automatic system control: $1 million;
EE lighting in the housing estates Izgrev and Vusrazhdane: $0.9 million.
Hospital rehabilitation: - $0.6 million.

C. Site identification, selection and management

30. The city of Burgas is proposed to become a demonstration zone for energy efficiency according to the current project as a typical Bulgarian industrialized city of the first group (with population of more than 200 000). An estimate for EE measures in Burgas is shown in Table 3.

Table 3: Projected Final Energy Consumption at End of the Project (PJ Petajoules 10^{15} Joules/year)

Sector	Solid Fuel	Petroleum	Natural Gas	Electricity	District Heat	Total
1. Industry	0.11	7.5	5.2	1.37	-	14.18
2. Transport	-	0.71	-	1.09	-	1.8
3. Domestic	-	3.1	-	1.5	0.04	4.64
•Housing	-	2.8	-	1.03	0.02	3.12
•Other	-	0.3	-	1.2	0.02	1.51
4. Total	0.11	11.3	5.2	2.96	0.04	20.62

As a result of the implemented energy efficiency measures the reduction of the harmful emissions is estimated to be as shown in Table 4:

Table 4: Projected environmental impact of energy efficiency improvements (tones/year)

Emissions	Industry	Transport	Domestic	Total
Carbon Dioxide	9 628	0	7 677	17 305
Sulfur Dioxide	76	0	54	130
Nitrogen Oxide	18	0	14	32

Pernik Demonstration Zone

A. General Description

31. The town of Pernik is located only 32 km west of Sofia on the banks of the Struma River. It crossed by transport corridors of national and international importance, like the railway and highway Sofia-Blagoevgrad-Thesaloniki and Sofia-Skopje. The main parameters for Pernik infrastructure are presented in Table 1, while Table 2 reflects the consumption of the energy agents in Pernik municipality.

Table 1: Population and Infrastructure of Pernik		
Characteristic	Unit of measurement	Quantity
1. Population	Thousands	96
2. Area	Hectares	2 402
3. Floor space Surface: total	Square meters (m^2)	9 819 552
• Floor space of housing	Square meters (m^2)	2 485 455
• Industrial floor space	Square meters (m^2)	3 525 837
• Office buildings floor space	Square meters (m^2)	3 808 260
4. Dwellings	Units	34 835
5. Total final energy consumption	Petajoules (PJ) 10^{15} Joules/year	13.4
6. Energy consumption per capita	Gigajoules (GJ) 10^9 Joules per capita/year	140
7. Energy consumption per dwelling	Gigajoules (GJ) 10^9 Joules / dwelling/year	478
8. Freight transport	Megajoules (MJ) 10^6 Joules/ton km/ year	6 050
9. Passenger Transport	Megajoules (MJ) 10^6 Joules/ passenger km/year	7 930

Table 2: Final Energy Consumption in the Base Year before Project Operations - 1997 (PJ Petajoules 10^{15} Joules per year)						
Sector	Solid fuel	Petroleum	Natural gas	Electricity	District heat	Total
1. Industry	3.12	0.83	3.52	1.39	-	8.86
2. Transport	0	0.64	0	0.09	-	0.73
3. Domestic	3.08	0.37	0	0.31	0.04	3.76
•Housing	3.06	0.22	0	0.2	0.03	3.56
•Other	0.02	0.15	0	0.1	0.01	0.2
4. Total	6.2	1.81	3.52	1.79	0.08	13.35

District heating: Pernik was one of the first centrally heated towns in Bulgaria. The heat transmission network and equipment operating on local coals is obsolete. The attached load is about 350 Gkal/h, as the household sector consumes about 215 Gkal/h. About 18 790 dwellings (55%) are included in the DH system of the town. Pernik is challenged to make a decision due to the depletion of the local coal field. There is a good possibility for household gasification.

Street lighting is ineffective and extremely insufficient. The losses in the starter-regulating system and the feeding network are enormous. The total number of operated illuminants is 3 430, the (installed) operating capacity is 735 kW. The cable length is 63 km. The annual consumption of electrical energy for lighting is 2 600 million kWh.

Hospital: The buildings and the heating system of the United Regional Hospital in Pernik do not correspond to the requirements for the heating characteristics requirements at the current expenses for energy and environment protection standards.

32. The environment of the region. The data for the status of the air is collected from the monitoring and control stations of the Ministry of environment and the Institute of Hygiene. Infringement of the norms for the air pollution is observed, like non-toxic dust, SO_2, NO_X. The emission levels are dynamically modified, which requests their measurement and comparison before and after the energy efficiency measures.

B. Market economy, energy policy transition and finance

33. Preliminary estimate of the cost for all EE technical measures in the demo zone:
By preliminary calculations the necessary funds are:

- Heating system reconstruction - $5 million.
- Gasification distribution urban network - $10 million.
- Street Lighting - $0.3 million.

Rehabilitation of United Regional Hospital, preliminary measures require $0.4 million.

C. Site identification, selection and management

34. The city of Pernik is proposed to become a demonstration zone for energy efficiency according to the current project as a typical Bulgarian industrialized city of the second group (with a population of up to 100 000).

Forecast for the results of the energy saving measures in Pernik is shown in Table 3.

Table 3: DZ Pernik – Projected Final Energy Consumption at the End of the Project (PJ Petajoules 10^{15} Joules per year)

Sector	Solid Fuel	Petroleum	Natural Gas	Electricity	District Heat	Total
1. Industry	2.51	0.79	3.2	1.21	-	7.71
2. Transport	-	0.56	-	0.07	-	0.63
3. Domestic	3.01	0.31	-	0.25	0.035	3.6
•Housing	2.5	0.22	-	0.2	0.029	2.9
•Other	0.51	0.09	-	0.05	0.06	0.7
4. Total	5.52	1.65	3.2	1.53	0.035	11.94

As a result of the implemented energy efficiency measures the reduction of the harmful emissions is estimated to be as shown in the Table 4.

Table 4: Projected Environmental Impact of Energy Efficiency Improvements (tonnes/year)

Emissions	Industry	Transport	Domestic	Total
Carbon dioxide CO_2	38 460	n.a.	2 474	40 934
Sulphur dioxide SO_2	150	n.a.	16,3	166,3
Nitrogen oxide Nox	70	n.a.	4,6	74,6

KAZAKHSTAN

35. Kazakhstan's 2,724,900 square kilometres make it by far the largest state in Central Asia and the ninth largest in the world. The country possesses abundant natural resources.

36. Kazakhstan is working with foreign investors for the development of oil and natural gas from the Tengiz (one of the world's largest oil fields), Zhusan, Temir, and Kasashyganak wells.

37. An Energy Sector Analysis report on Kazakhstan prepared by the Energy Information Administration (EIA) at the US Department of Energy provides summary information and further links.

38. With over 1 million people living in more than 370 thousand apartments Almaty is the largest city in Kazakhstan. The Department of Energy Conservation of Almaty is hosting Demonstration zone descriptions of the proposed energy efficiency projects and the region at the city web site.

Almaty Demonstration Zone

A. General Description

39. The city of Almaty, founded by migrants from Russia in 1854, is the largest city of the Republic of Kazakhstan. Until 1998, the city of Almaty was the capital of Kazakhstan. Now it is the largest political and administrative, scientific and economical and cultural Centre of the country. The city is located in the south-eastern part of the Republic.

Table 1. Population and infrastructure of the city of Almaty

Characteristics	Measurements	Total quantity
1. Population (for 1.01.99)	Thousand people	1 080.5
2. Area	Square meters (m2)	286.03
3. Total dwelling space:	Thousand square meters (m2)	20 540.8
A. Dwelling space	Thousand square meters (m2)	12 975.5
4. Apartments	Units	372 153
5. Freight transport	Thousand tons Thousand ton/kilometer	3 113.8 332 598.5
6. Passenger transport	Thousand people Thousand passenger/ Kilometer/year	282 330.2 2 129 545.7

Energy demand - Table 2. Consumption of energy resources of the city Almaty

Kinds of fuel	Consumed, including the fuel, sold to the enterprises and to the population in 1998
Coal, tones	3 154 000
Natural Gas, thousand m3	725 078
Coke, tones	1 749
Petrol, tones	74 151
Kerosene, tones	91 202
Diesel Fuel, tones	115 197
Black oil, tones	416 385
Propane and butane, liquefied, tones	26 237
Other kinds of equivalent fuel	2 847

40. The city of Almaty in 1998 produced for its needs 2 468,4 million kW/h electricity and 5 057,3 thousand Gcal thermal energy. The energy supply of the city is carried out by a power system consisting of 3 thermal power stations, Kapshagai hydroelectric power station, Almaty stage of hydroelectric plants out of 11 hydroelectric stations and over 250 substations. The northern regions of Kazakhstan are connected with the power system of Central Asia at the voltage of 500 kilovolt.

41. The environment of the region. The level of contamination of the air basin of the city of Almaty is very high, because of its position and climatic conditions. The total level of contaminant ejection was 216 000 tons in 1998.

B. Energy policy

42. In December 1997 the President of the Republic of Kazakhstan signed the Law “About energy saving”. In 1998 the Mayor of the city of Almaty established a Department of Energy Conservation and assigned to it the control for the project of the Demonstration zone. The total sum of investments for implementing the EE-21 project is $ 4 589 300.

C. Site identification, selection and management

43. The following sites were selected and recommended as Demonstration zones: NorthEastern Thermal Complex (NETC), Kazakh Scientific Research Institute of Power Engineering (KazSRIPE) named after the academician Sh. Ch. Chokin; Street lighting of the city of Almaty; Hospital complex.

44. Each site has its own programme of energy saving. Each of the demonstration zones is a typical entity not only for the city of Almaty, but also for Kazakhstan. The experience of operating these sites after introduction of the energy saving equipment and technologies will possibly spread not only to similar enterprises of the city of Almaty, but also to related enterprises of the other regions of Kazakhstan.

Astana Demonstration Zone

A. General Description

45. Astana is the capital of Kazakhstan. It is situated in the northern part of the country in the forest-steppe zone, on the banks of Ishim River and is the centre of historical ties of Europe and Asia. The main transport freight traffic of Southern and Central Kazakhstan, Western Siberia and Ural, Povolje and Far East go through the city. The Climate is sharply continental with a cold winter and a hot summer.

46. The main specifications of Astana's infrastructure are given in Table 1.

Table 1. Population and infrastructure of Astana

Characteristic	Unit of measurement	Quantity
1. Population	Thousands	318.1
2. Area	Sq. km	256.4
3. Total floor space surface	Square meters (m^2)	No data
The dwelling floor space	Square meters (m^2)	58 006 401
Industrial floor space	Square meters (m^2)	No data
office buildings space	Square meters (m^2)	No data
4. Dwellings	Units	21502
5. Total energy consumption per year	Gigajoules (GJ)	8096264.5
6. Energy consumption per person	Gigajoules (GJ) GDj/person	25.45
7. Energy consumption per dwelling	Gigajoules (GJ) GDj/house	376.5
8. Transport	Gigajoules (GJ) Joules/ton km/year	332514
9. Passenger transportation by trolley bus	Gigajoules (GJ) GDj/passenger per year	0.01246

47. The electric power supply for consumers implements by HEC-2 with 240 MWt capacity, through district substations (quantity 60) and transformer substations (quantity 1000), which are connected between themselves by high-voltage and low-voltage power networks.

48. The district heat supply, operating the whole year, has in balance 211,58 km of main and distributive heating networks, to which 5300 consumers of heating energy are connected.

Energy demand analysis

49. Table 2 gives the demand of energy consumers in Astana for 1999. The presentation of the demonstration zone project mainly includes measures of energy conservation for heat supply and street lighting.

Table 2: Power consumption per basis year before project – 1999 (Giga joule)				
Sector	Solid fuel	Fuel-oil, Diesel	Electricity	Heat supply
1. Industry	19809.9	1564.6	369803	617614
2. Transport			127062	205452
3. Municipal				
Dwelling			405954	3503435
Other consumers			702259	2143311
4. Total	19809.9	15664.6	1605078	6469812

District heating. The sources of electric and heating supply of the city are HEC-1, HEC-2. The electric capacity of sources is 490 MVt.

50. As in many cities of Kazakhstan, in Astana, gas supply with consumers of dwelling sector for 98,5% implements with liquid gas through gas fill station.
The government of Kazakhstan has signed a protocol with Russia's "Gasprom" on natural gas supply to Astana. It will allow for transferring the sources of heat supply HEC-1 and HEC-2 from Ekibastuz coal to natural gas.

51. Street lighting: The lighting system of Astana streets is not efficient. Street lighting consists of 3074 units of ultraviolet and sodium lamps by single capacity of 125, 250, 400 Wt. Total length of air energy networks is 115 km, cable 22,1 km. The total installed capacity of street lighting constitutes 896kw. The annual consumption of electricity for street lighting is 2,888 MWt.

52. The greatest source of harmful emissions are the source of heat supply of Astana air and land transport, and also plants situated in the industrial zone of the city. At the result of emissions of sulfur oxides, nitrogen, silicon dioxide and ash. The aeration station of sewage waters is too close to the southwest region of the city, therefore considered the project of expansion and reconstruction of sewerage and refining facilities of Astana, which are considerably far from the city. The project cost is $117 million.

B. Transition and financing of energy policy to market economy

53. Astana energy conservation policy is based on the national law on "Electric Energy". Energy conservation policy in Astana implements mainly JSC "Astanaenergoservice" by developing the annual programmes approved by the Akimate of the city.

54. Preliminary estimate of the cost for all EE technical measures that will be implemented in the zone include:
DH reconstruction first stage - transfer of hot water-supply and ventilation to independent heating systems - $2.25 million; building of thermal points - $3 million.
Gasification of heating supply - transit gas pipeline Omsk – Astana.

55. For gasification of HEC, industry and dwellings – about $2 bln.
Street lighting: replacement of old lighting - $3 million; implementation of EE lighting in central part of the city - $1 million; automated control system - $1 million.

56. The department of economy and development of small businesses of Astana and "Astana-Finance" will grant 75% of the necessary facilities to reimburse expenditures during the establishment of the demonstration zone.

C. Site identification, selection and management

57. Astana, now the capital of the republic, was proposed to become an energy efficiency demonstration zone according to this project, as a typical Oblast centre of the northern region of Kazakhstan with a population of 300 000, which is now the capital of the Republic. Therefore, the proposed measures by the Akimate of Astana for the demonstration zone can be utilized on a large scale in all the republic as designed model, and it will simplify the problem of its duplication to another similar oblasts of northern region.

58. The main results anticipated as a result of the implementation of the EE technical measures in the demonstration zone are given in Table 4 below.

Table 4: Consumption and expenditures decrease for the development of district heat supply of introduction of energy efficiency measures

Sector	Expenditures decrease in $	Expenditures decrease gcal/year	Maximum load decrease
1. Industry	400 000	38 147 gcal/year	
2. Domestic 3. Heat supply	2 372 000 74 000 000	226 213 gcal/year	
4. Lighting		2.475 MWt/year	
Total:			

An estimate for harmful emissions decrease, which will appear as a result of measures implementation is given in table 5.

Table 5: Projected Environmental Impact of Energy Efficiency Improvements

Emissions	T/per year	Domestic t/per year	Total t/per year
Carbon dioxide	1259	1258	1259
Sulfur dioxide	2557	2557	2557
Nitrogen dioxide	1353	1353	1353
Dust	333	333	333

RUSSIA

59. Russian demonstration zones are testing area for the development of federal and regional legal and regulatory framework for energy saving, creation of institutional and financial mechanisms for project implementation and introduction of energy efficient technologies and equipment.

60. In 1994 the Russian Energy Efficiency Demonstration Zones (RUSDEM) was established with the support of two of the Russian Federation's ministries, the Ministry of Fuel & Energy and the Ministry of Science & Technology with the following main objectives:

- Formation of legal, economic and organizational conditions for presentation and approval of demonstration zones and projects;
- Provision of energy efficiency participants' interaction with international, governmental, public, production and banking institutions.

61. One of RUSDEM's main activities is the implementation of the UN ECE Energy Efficiency Investment Project. For latest information on the development of the EE Zones and Projects in Russia please visit the website of RUSDEM.

62. An Energy Sector Analysis report on Russia prepared by the Energy Information Administration (EIA) at the US Department of Energy provides summary information and further links.

UKRAINE

63. The Table below gives some basic information on the Energy Efficiency demonstration zones established in Ukraine:

EE-21 Project: Ukraine Demonstration Zones Statistical Information

Characteristics	Dnipro-dzerzhynsk	Zaporizhia	Mariupol	Slavutych
Population, thousand people	278.8	33.739	516	26.365
Total area, hectares	13779	260.0	16750	2082.4
Total building space, thousand m2:	13 519.4	488	6100	537,5
· residential	5 833.4	488	4500	447,5
· industrial	7 686	N/A	1400	37
· administrative	-	-	200	53
Number of:				
· enterprises	41	19	6700	10
· institutions of higher education	1	-	3	-
· schools	45	4	80	4
· kindergartens	28	4	170	8
· cultural institutions	31	1	21	4
· hospitals	19	1	-	-
· project institutes	-	1	-	-
· hotels	-	1	-	-
Total amount of final energy consumption, PJ	84.19	2.58	0.22	2.57
Annual energy consumption per capita, GJ	301.97	74.5	0.37	97.47

Total annual energy resources consumption is:				
. natural gas, million m3	2008.13	33.6	2600	29.06
. electricity, million kWh	271.6	11.4	1448	52.6
. water, thousand m3	52084	124	155120	3855
Total annual heat energy consumption, Gkal	241379	242502	3477000	277622
Heat Energy Consumers, %				
· companies	9	-	-	5.5
· municipal facilities	14		31	35.8
· households	77	70	69	56.7
· other consumers	-	30	-	2

64. An Energy Sector Analysis report on Ukraine prepared by the Energy Information Administration (EIA) at the US Department of Energy provides summary information and further links.

Dniprodzerzhynsk Demonstration Zone

65. Dniprodzerzhynsk is located in Dnepropetrovsk oblast. Dniprodzerzhynsk is situated on the both sides of the Dnipro River, 35 km to the west from Dnipropetrovsk. The city connects Kryvy Rig Iron Ore Basin and Donetsk Coal basin by means of the railway road. The town is divided into three administrative and territorial districts: Bagliysky, Dniprovsky and Zavodsky. The town occupies the area of 13 799 hectares including 2010 hectares of the settlement Karnaukhivka. The city statistic data is presented in Table 1.

66. Transport infrastructure includes passenger, automobile transport, including private, municipal trams and also electric train which connect the left and right parts of the city. Five design and research institutions function in the town.

67. Heat energy supply companies are Dniprodzerzhynsk CHP, Dniprodzerzhynsk District Heating Networks, JSC "DniproAzot".

68. Heat supply problems include: the use of barter in payment for heat power that has decreased greatly real cash flow in the city budget; the lack of heat metering equipment and the ineffective system of charging residents of the city according to the living area. These barriers provide no incentive to achieve the 30-40% potential power savings. They have lead to increased budget costs for heat supply of municipal institutions and local authorities.

69. Dniprodzerzhynsk is an important industrial center with over 40 enterprises, mainly metallurgical, chemical, machine-building and construction materials plants.

70. Preliminary research identified a tentative list of the most energy efficiency projects:

- Introduction of automated metering and control sub-system for electricity consumption by daytime at SC "Dniprovsky Metallurgical Enterprise" (DME).
- Introduction of the metering and control system for oxygen production in oxygen-compressor shop of SC DME and oxygen supply for the consumers.
- Introduction of control for natural, blast furnace and coke-oven gas rational use in boiler units N 10 and Nil in HPCP of SC DME.
- Introduction of the metering and control system for rational consumption of heat and electric power by hospitals and educational institutions.
- Introduction of the metering and control of consumption of electric power for lighting of the bridge and streets by day and nighttime.

Mariupol Demonstration Zone

71. The city of Mariupol is located on the coast of the Sea of Azov. The city is a large industrial centre of Donetsk region. There is a trade port, metallurgical enterprises (JSC"Azovstal", JSC "Il'ich"), machine-building enterprises (JSC "Azov", JSC "Azovobschemash", JSC "Stalkon" and others), enterprises for light manufacturing and food industries. The city produces 7 million ton of steel annually, exports of which amounts to 8 per cent of Ukrainian export total. The city statistical information is presented in the Table above. Building types include: high-rise apartment blocks (5-story, 9-story and 12-story), administrative, hospitals, schools and industrial facilities).

72. District heating is provided by regional and district boiler houses. Most heat supply is provided though district heat substations for hot water preparation. Heat supply problems include:

- High corrosiveness of primary water (2.5 times higher than limiting configuration) results in early removal from operation of DH networks as well as heating surface of boilers: hot water supply networks - the second year of operation, DH networks serve 10-12 years.
- Development of Mariupol heat supply system through construction of large district boiler plants (capacity 100 Gkal/year and more) results in unsatisfactory heat supply of end consumers, heat supply interruption of whole city districts in case of boiler plants shutdown.
- Unstable fuel (natural gas) supply of boiler houses.
- Obsolete and worn-out metering equipment on energy supply and demand sides.

Slavutich Demonstration Zone

73. Slavutich is located on the bank of the river Dnipro, 50 km to the east of Chernobyl Nuclear Station, 50 of Chernigiv, 200 km from Kyiv, 12 km from the Belorussian border and 100 km of Russian border. The city Slavutych belongs administratively to Kiev oblast, but due to its geographical location it belongs to Chernihiv oblast. Statistical information of the city is shown in the Table above.

74. The city construction is diverse. Of 7,600 residential apartments, 456 are located in one to two story multi-apartment buildings of varying design. The buildings of educational, cultural and trade institutions are generally one to three stories in height.

75. Local industry in the city includes: heating boiler plants, water treatment facilities, bakeries, a food processing factory, a bakery plant and local a transport company. The industrial zone and hospital complex are separated from residential quarters and are completely independent in relation to heating, water and electricity supply. Electricity for a significant number of residential buildings, kindergartens, sporting and trade institutions is supplied by Chernobyl station. All these facilities of the town will be transferred to the State Property Fund after Chernobyl is shut down. The allocations for covering the associated costs will be withheld which means that the problems of energy efficiency will become increasingly urgent for local residents.

76. The heat supply to the city is provided by a local boiler house with three water-heating boilers KBFM-50 for heat distribution, two steam boilers JBE-IO/H for local needs and 10 central heat substations. The problem of the existing system is the lack of quick reaction to the maximum and minimum water temperature cycles, overheating or underrating of heat distribution and hot water supplies. Inefficiencies arise from the unresponsiveness of boilers when the ambient air temperatures change. This leads to the worsening of the service quality as well as to the waste of gas.

77. In the framework of recent government policies, municipal programs for the support of "small businesses" are being implemented. Currently private companies engage 15% of the employed population. In Slavutich there are seven registered joint ventures. Private trade companies provide 30 per cent of retail goods turnover.

78. A special economic zone "Slavutich" is functioning in the city. In the zone businesses benefit from the following fiscal and regulatory conditions and will continue to do so until 1 January 2010:

- Exemption from taxation of profit, 100 % for first two years - 100% and 50% for the following three years
- Exemption from the payment for the land - 100%
- Exemption from taxation of equipment importing
- Exemption from the dues to the State Innovation Fund
- Exemption from the dues to the obligatory social employment insurance purposes.

Propositions regarding energy efficiency measures:
- implementation of automatic heat supply system for Slavutych;
- creation of additional electricity and heat energy sources in Slavutych.

79. The residential district "Yuzhny" which is situated in the northern left-bank part of the city of Zaporozhia accounts for 33,739 residents and 9,500 apartments in 9-story and 13-story buildings with a total living space being 488,021 m2. The lack of heavy industry apart from "Radioprylad" factory as well as a pleasant geographical location gives this residential district good prospects for development in the coming years. The statistics for the city are given in the summary Table above.

80. The current heat supply of residential buildings is provided by the boiler houses of "Radioprylad" company and "Yuzhny" district; total length of pipelines is 73 km; one heat substation.

81. Creation of demonstration zone "Yuzhnaya" in the future foresees its transformation into free economic demonstration zone (FEDZ) that will make favorable conditions for the Project funding.

82. SC "Demonstration Zone "Yuzhnaya" was registered as a legal entity in the beginning of May 2000. At the same time, with the completion of the organizational structure for the development of SC "Demonstration Zone "Yuzhnaya", SC "Rassvet" has completed a specific energy saving programme for the residential district "Yuzhny". Investment plans, business plans and feasibility studies have been developed on the following directions:

- Introduction of co-generation on boiler house of "Radioprylad" and boiler house of "Yuzhnaya" (with the use of gas turbine generators and gas diesel generators),
- Recovering of the waste gases heat at three boilers in the boiler house of "Yuzhnaya",
- Installation of control electric drives transformers based on semi-conductor converters,
- Replacement of heating mains pipes with preliminary insulated ones,
- Introduction of unit-type heat substations,
- Creation of automatic control system in boiler house of "Yuzhnaya",
- Providing metering devices for heat power and water use in dwellings, schools and other budget institutions,
- Heat insulation of residential buildings and institutions.

83. At present, energy saving solutions are being developed on improvement of lighting systems and operation of turbo-expander units at the main heat distribution stations and main distribution substations. The projects for the installation of co-generation units on boilers of SC "Komunarske Enterprise of Heating Networks" are at the stage of implementation.