HEAT ENERGY MARKET ASSESMENT REPORT

January 31, 2006
This publication was produced for review by the United States Agency for International Development. It was prepared by the Residential Heating Project's Gayane Dallakyan, Edik Keryan, Robert Erickson.

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1. INTRODUCTION

This report is a required deliverable to USAID by the Residential Heating Project. The information in this report should provide the reader with a comprehensive review of the evolving heat energy sector. This information helps establish a base to commence the work of the Residential Heating Project.

The report provides a summary of the hard assets still existing in Armenia after the collapse of the district heating systems. Many of these assets still have value in that they provide housing for state of the art boilers and related equipment and they provide the external networks connected to buildings.

The heat energy market has developed rapidly over the last five years or so. There are at least four profitable suppliers of international and domestic heating equipment. The gas company has expanded to most regions of the country and by the end of 2007 will be servicing all major cities.

The report also includes safety and health statistics as well as information on market players; energy service companies, heat equipment suppliers, design institutes and lending institutions.

This report includes only summary data. The detailed information on the heat energy market is included in the heat energy sector database. The database will be posted on the Residential Heating Sector web site once the site is constructed in Spring 2006.

Additional information, such as typical load duration shapes for the various climatic regions of the country, will be included in future updates of this report.

2. MAJOR DISTRICT HEATING ASSETS IN ARMENIA

The large district heating systems in Armenia include the systems with installed thermal capacity of 100 MW and above, with heat source from large Heat-Only Boiler Houses that are located in the cities of Yerevan and Gyumri or from CHP plants (Yerevan TPP, Hrazdan TPP and Vanadzor TPP). Systems supplied by large heat-only boiler houses were designed for heat and hot water supply and some of them were operated until the 2003-2004 heating season with exception of certain interruptions associated with the energy crisis of the 1990s.

2.1 SYSTEMS SUPPLIED BY LARGE HEAT ONLY BOILER HOUSES

The systems supplied with heat by large heat-only boiler houses are equipped with the Soviet period manufactured hot water boilers PTVM type and KVGM type. The boiler house in Gyumri is additionally equipped with the medium pressure DE type steam boilers. The systems were designed and constructed with primary and secondary loops with hydraulic separation in substations. The secondary loops are designed either as three or four pipe systems.

The city of Yerevan has eight district heating systems with heat source from large heat-only boiler houses, excluding the system at the boiler house #12 that is actually the system of Yerevan TPP. These district heating systems were commissioned during the period of 1977-1987 and supplied heat to 2330 residential and 440 public buildings, delivering an annual 1500 GWh of thermal energy.

During the post-crisis period, the re-commissioning efforts of these systems faced a multitude of difficulties, apart from those associated with the interruptions of natural gas supply. Among the problems encountered were economic difficulties of the population, absence of the heat energy metering systems, lack of effective collection systems, lack of funds for proper system maintenance and upgrade, and large heat losses in the mains and the distribution networks, especially in the case of the systems with low heat load density, etc. In such circumstances the further operation of the aforementioned systems led only to the increase of the accrued debts, and gradually ceased before the 2003-2004 heating season.

For illustration purposes, during the heating season of 1990-1991, the Yerevan TPP provided heat to 4310 residential buildings and to 908 public buildings while during the heating season of 2000-2001, the number of residential buildings served was reduced to 960, and number of public buildings to 128. During the heating season of 2003-2004, which was the last season during which the system operated, the load declined and only 107 residential and 5 public buildings were served.

Thus, Phase one (“Survival in 1-2 Years) of the development program outlined in the “Armenian Residential Heat Supply Strategies” and approved by the Government of the Republic of Armenia failed, mainly due to the fact that the minimum investments required for survival were not implemented.

The main technical parameters of the district heating systems with heat-only boiler houses are summarized in Table 2.1 below.

Table 2.1 Technical parameters of the district heating systems in Yerevan and Gyumri

Heat-only boiler houses	Installed thermal capacity, (MW)	Connected load (MW)		Number of central thermal substations	Number of connected buildings	
		Heating	Hot water		Residential	Public
Yerevan #1 Terian	104,7	59,2	12,7	17	216	80
Yerevan #2 Charents	174,5	82,5	18,0	26	245	88
Yerevan #3 Davitashen	232,6	56,4	12,3	15	174	20
Yerevan #4 Nor Nork-1	139,6	83,7	17,2	13	258	48
Yerevan #5 Nor Nork-2	174,5	106,8	22,7	18	314	35
Yerevan #7a South-Western District	232,6	132,6	28,1	31	487	62
Yerevan #8 Ajapniak	232,6	126,5	26,8	26	374	60
Yerevan #11 Avan	174,5	80,7	16,9	18	260	46
Giumri-Mayisian	314	46,0	11,0	12	258	
Total	1779,6	774,4	165,7	172	2586	439

The Project Team completed an initial cost assessment for the eight large heat-only boiler houses and central thermal substations buildings and constructions, the thermal mechanical equipment, electric equipment and metering/control devices, as well as an assessment of the residual and liquidation values thereof, based on external inspections, studies and examination. The results of that research are summarized in the Tables 2.2 and 2.3 below.

The operation of the Gyumri-Mayisian heat-only boiler house, a very large facility that could have served a significant portion of Gyumri, commenced in 1992. The boiler house operated until the heating season of 2002-2003 supplying heat only to the Ani district of the city of Gyumri. The expansion of the gas supply restoration activities and installation of decentralized heating systems in the aforementioned district resulted in a decrease in the volume of sales from the boiler house until the station eventually stopped. With consideration of the boiler house's relatively "young" age, as well as the fact of its recent commissioning, the residual value of its fixed assets could be assessed in the following way: 1) at 75% of the initial value for buildings and constructions; 2) at 50% of the initial value for machines and equipment; and 3) at 25% of the initial value for metering equipment and automatic devices.

Table 2.2. Initial cost and residual values of the assets at large heat-only boiler houses in Yerevan

Heat-only boiler houses	Commissioning year	Last year of operation	Initial cost (1000 USD)	Depreciation (%)	Residual value (1000 USD)
Yerevan #1 Terian 3 × PTVM-30	1977	2002-2003	4500	65%	1575
Yerevan #2 Charents	1979	1991-1992	7500	80%	600

3 × PTVM-50					
Yerevan #3 Davitashen 4 × KVGM-50	1987	2002-2003	10000	50%	5000
Yerevan #4 Nor Nork-1 4 × TVGM-30	1971	2002-2003	6000	80%	1200
Yerevan #5 Nor Nork-2 3 × KVGM-50	1985	2000-2001	7500	50%	3750
Yerevan #7a South-Western District 4 × KVGM-50	1991	2002-2003	10000	80%	2000
Yerevan #8 Ajapniak 4 × PTVM-50	1980	1991-1992	10000	80%	800
Yerevan #11 Avan 3 × PTVM-50	1978	2002-2003	7500	80%	1500

Table 2.3. Liquidation values of the assets at large heat-only boiler houses and central thermal substations in Yerevan

Heat-only boiler houses	Liquidation value			
	Buildings and constructions, ($ 000)	Thermal mechanical equipment, ($ 000)	Electric and control devices, ($ 000)	Total, ($ 000)
Yerevan, #1 Terian ▪ Central thermal substations (17)	315 297.5	63 59.5	31.5 59.5	409.5 416.5
Yerevan, #2 Cherents ▪ Central thermal substations (26)	300 260	0 52	0 52	300 364
Yerevan #3 Davitashen ▪ Central thermal substations (15)	1000 375	200 75	100 75	1300 525
Yerevan #4 Nor Nork-1 ▪ Central thermal substations(13)	240 130	48 26	24 26	312 182
Yerevan #5 Nor Nork-2 ▪ Central thermal substations(18)	750 450	150 90	75 90	975 630
Yerevan #7a South-Western district ▪ Central thermal substations (31)	400 310	80 62	40 62	520 434
Yerevan #8 Ajapniak ▪ Central thermal substations (26)	400 260	0 52	0 52	400 364

Yerevan #11 Avan	300	60	30	390
▪ Central thermal substations(18)	180	36	36	252

Based on the data provided by Tables 2.2 and 2.3, the residual value of the major system assets constitutes only 25% of their initial value, and the approximate liquidation value represents around 50% of the residual value or about 12% of the initial value. The ratio of the boiler houses and central thermal substations in the liquidation value is around 60%:40%.

2.2 DISTRICT HEATING FROM THERMAL POWER PLANTS

Three CHP plants were built and commissioned in Armenia during the 1960s and 1970s: those in the cities of Yerevan, Hrazdan and Vanadzor. All three power plants supplied industrial steam (with a pressure of 7-13 bars), as well as hot water for residential heating. The basic technical parameters of the cogeneration units are represented in Table 2.4 below.

Table 2.4. Basic technical parameters of the TPPs

CHP plant	Electric capacity, (MW)	Thermal capacity, (MW)	Connected heating load, (MW)	Connected hot water load, (MW)	Total load, (MW)
Yerevan TPP	250	750	166	36	202
Hrazdan TPP	300	650	61	16	77
Vanadzor TPP	96	410	255	45	300
Total	646	1810	482	97	579

Starting in 1990, the TPPs within these combined heat and power plants gradually reduced their thermal energy generation from around 4.6 billion kWh to 0.6 billion kWh in 2000 and completely ceased their delivery in 2004.

The cogeneration unit of Yerevan TPP previously supplied centralized heat to the Erebouni District (49 residential buildings were supplied by five central thermal substations) and Shengavit District (463 residential buildings were supplied by 28 central thermal substations) through a double circuit scheme. The system operated until the heating season of 2003-2004. During the recent years only one 50 MW turbine installation was utilized out of the 250 MW installed capacity of the system to provide steam and hot water.

The interruption of heat supply from Yerevan TPP was conditional upon such circumstances as:

- The losses of heat energy and water in the thermal networks that were designed to meet a significantly higher heat energy demand;
- Transition of certain relatively large consumers (hospitals, schools) to feeding from their own resources (gas fired boiler houses, electric heaters, etc.) as a more reliable and higher quality heat supply option; and,
- Low collections rate.

The CHP part of Yerevan TPP was commissioned in 1963-1966 and has practically exhausted its operational resources. The accrued working hours of a portion of major steam pipes has exceeded the limit of 220 thousand hours. Given the above, a TPP rehabilitation plan was developed to build a 206 MW combined cycle gas turbine in the vicinity of the existing industrial site to produce industrial steam at the pressure of 25 and 13 bars for chemical and other nearby industrial plants, and hot water for heating purposes and technological needs. The funding of this project, if it is approved by the Government of Armenia, would be carried out under the Japanese Bank for International Cooperation (JBIC) Loan Program.

The CHP part of Hrazdan TPP was commissioned in 1966-1969 and was designed for the supply of industrial steam (at the pressure of 7 bars) and hot water. As of January 1, 2005, the accrued working hours of the energy installations fluctuated within the range of 125-210 thousand hours. In the last few years only one 50 MW turbine installation operated to supply heat to the micro-district of the city of Hrazdan. The reasons for the interruption of the city's heat supply are described in detail in Chapter 3 of this Report.

There is no information as to the intentions of the owner (the Federal State Property Management Agency of the Russian Federation) regarding the refurbishment or rehabilitation of the cogeneration unit at Hrazdan TPP.

The Vanadzor TPP, designed mainly for industrial steam supply, is furnished with back-pressure turbines enabling to supply hot water for heating purposes to the city districts. The plant ceased operation in mid-1990s when both the municipal government bodies and the crisis-struck industrial enterprises refused to purchase heat supply services by the plant. The efforts of private entrepreneurs to rehabilitate and re-commission the power plant along with two chemical enterprises had no success.

Additional assessment is required of the physical status and the assets of the heat supply system from the Vanadzor TPP, which is impossible to accommodate within the scope of this Report. Given the state of the plant, the Residential Heating Project will not investigate the assets further.

3. RESIDENTIAL HOUSING INVENTORY

One of the first initiatives of the Residential Heating Project was the investigation and inventory of the current status of residential heat supply systems in the Republic of Armenia. For that purpose, the Project Team visited various municipalities of Armenia to examine their available housing resources, the status of the previously operated heat supply systems, the currently implemented heating options, the alternative energy source market, the process of condominium formation and the level of their sustainability. During the meetings with the municipal authorities, visits were organized to the sites of the recently constructed boiler houses and informal meetings were held with the residents. Data required for realistic assessment of the opportunities for residential heat supply system development were collected through questionnaires developed for this purpose in advance.

The results of the analysis of the data acquired during the visits and the responses from the questionnaires are summarized in Table 3.1. As of 25 January, 2006, examinations were conducted in 30 municipalities. Summarized information about these visits is provided in Annex 1 of this Report.

Table 3.1. Current status of the heat supply systems in Armenian municipalities

Marz	Municipalities	Population (thousand people*)		Centralized heat supply systems			Characteristics of multi-apartment buildings		
		De jure	De facto	Before 1992	Operated until	As of 01.01.06	Number	Bldg gasification lvl %	Apt. gasification lvl %
1	2	3	4	5	6	7	8	9	10
Aragatsotn	Aparan	6,61	5,71	1 system, 10,5 MW		Disposed	26	93	50-60
	Ashtarak	21,47	19,68	4 systems, 17,5 MW		Disposed	57	80	60
	Talin	5,61	4,98						
Ararat	Ararat	20,48	19,57	2 systems, 13 MW		Disposed	90	15	65
	Artashat	25,06	22,57	8 system, 56 MW	1995/ 1996	Disposed	126	98	70
	Masis	21,38	19,05	5 systems, 54 MW		Disposed	62	40	80
	Vedi	12,96	12,28	1 piece, 12 MW	2001/ 2002	Disposed	39	90	60
Armavir	Armavir	32,03	28,73	8 systems, 95 MW	1998/ 1999	Disposed	154	100	45
	Echmiadzin	56,39	51,28	11 systems, 100 MW		Disposed	160	100	50
	Metsamor	9,87	8,85	1 systems, 70 MW	1998/ 1999	Disposed		Gasification newly begun	0
Geghar-kunik	Sevan	21,42	18,78	10 systems, 136 MW	2001/ 2002	Bankrupt and disposed	178	98	30-35
	Gavar	26,62	23,30	17 systems, 80 MW		Dismantled and disposed	55	20	30
	Martuni	11,76	11,12	4 systems, 68 MW	1991/ 1992	Disposed	31	98	25-30
	Vardenis	12,73	11,46						
Kotaik	Abovian	44,57	38,88	1 system 116 MW, 10 systems 55MW	2002/ 2003	Disposed including the central heating systems	250	Around 95	
	Charentsavan	25,04	19,71	5 systems, 42 MW		Disposed 10x50KW TACIS boiler house	162	67	45
	Hrazdan	52,81	43,93	Hrazdan TPP 650 MW, 5 systems, 58 MW	2004/ 2005	Boiler houses and networks disposed	165 Systems in the Micro district	In process in Micro and Center	
	Nor Hajn	10,17	9,46	0			67	100	70
	Tsakhkadzor								
	Yeghvard								

Marz	Municipalities	Population (thousand people*)		Centralized heat supply systems			Characteristics of multi-apartment buildings		
		De jure	De facto	Before 1992	Operated until	As of 01.01.06	Number	Bldg gasification lvl %	Apt. gasification lvl %
1	2	3	4	5	6	7	8	9	10
Lori	Vanadzor	107,39	93,82	Vanadzor TPP 470 MW, 12 systems 82 MW		Vanadzor TPP does not operate 4 small capacity boiler houses	970	To be completed in 2006	
	Alaverdi	16,64	14,85	8 systems, 71 MW	1998/1999	Disposed	158	50	50
	Spitak	14,98	13,59			1 new, 6 MW unit			1800 apartments
	Stepanavan	16,30	13,93	7 systems, 33 MW	1992/1993	Disposed, 2 still exiting			
	Tashir	9,54	7,86						
Shirak	Giumri	150,92	140,32	1 system 315 MW, 63 Systems 418 MW	2003/2004 boiler houses were ruined	1 system, 300 KW		95	
	Artik	17,56	15,98						
	Maralik	5,78	4,99						
	Ashotsk	2,38	2,18	1 system, 15 MW	1993/ 1994	Dysfunctional	31, wooden made	0	0
	Amasia	1,88	1,69						
	Akhurian	9,70	7,73						
Siunik	Kapan	45,71	34,66	6 Systems, 195 MW	1998/ 1999	Dysfunctional	252	40	45
	Sisian	16,84	15,02	6 Systems, 120 MW		Disposed	76	70	45
	Goris	23,26	20,84	12 Systems, 75 MW		10-Á still existing but not in operation	110	40	40
	Kajaran	8,44	7,98						
	Meghri	4,81	4,51						
	Agarak	4,80	4,74						
Tavoush	Ijevan	20,2	15, 37	7 Systems, 23 MW		Still existing but not in operation	101	100	60
	Dilijan	16,2	14.8	15 Systems, 80 MW	1998/ 1999	Disposed	117	80	60
	Noyemberian	5,8	5,1						
	Berd	8.8	8.4						
Vayots Dzor	Jermuk	5,39	5,17	5 Systems, 82 MW	2000/ 2001	Disposed private	48	98	
	Vaik	6,02	5,46	1 system, 37 MW		Dysfunctional	30	100	
	Yegheg-nadzor	8,19	7,72	1 system, 16 MW		Disposed sports center	36	100	80

*) Figures with the regards to the number of population are represented per the results of the 2001 census in RA.

Table 3.1 (continued) Current status of the heat supply systems in Armenian municipalities

Marz	Municipalities	Condominiums		Other energy sources			Pilot project implemented	
		Number	Status	Electric energy	Wood	Biofuel	Number	Results
1	2	3	4	5	6	7	8	9
Aragatsotn	Aparan	10	Operating	Small amount	Yes	Basically	1	Failed
	Ashtarak	0		Yes	Yes			
	Talin							
Ararat	Ararat	0			14-16 thousand AMD			
	Artashat	0		Moderate amount	15-16 thousand AMD			
	Masis	0						
	Vedi	0	In the formation phase					
Armavir	Armavir	1	3 buildings, operating					
	Echmiadzin	0		Moderate amount	16-17 thousand AMD			
	Metsamor	0		Moderate				
Gegharkunik	Sevan	3	Operating					
	Gavar	4	Operating	Miniscule amount	17-18 thousand AMD			
	Martuni	0			17-18 thousand AMD	Moderate amount		
	Vardenis							
Kotaik	Abovian	20	Mainly operating					
	Charentsavan	4	Operating				10x50 kW boiler houses	Not operating
	Hrazdan	15	Consolidate 350 residential buildings and ¨ 7 villages					
	Nor Hajn	2	Operating		16-17 thousand AMD			
	Tsakhkadzor							
	Yeghvard							
Lori	Vanadzor	52 registered 40 operating 32actively operating	Involved 819 residential buildings					
	Alaverdi	0	In the formation phase	Small amount	7-8 thousand AMD			
	Spitak	0						
	Stepanavan					Basically		
	Tashir							

Marz	Municipalities	Condominiums		Other energy sources			Pilot project implemented	
		Number	Status	Electric energy	Wood	Biofuel	Number	Results
1	2	3	4	5	6	7	8	9
Shirak	Giumri						2x735 2x473 1x465 4x735 kW capacity	2x150 kW operating, the rest not operating
	Artik							
	Maralik							
	Ashotsk	0		Miniscule amount	16-17 thousand AMD	60%		
	Amasia							
	Akhurian							
Siunik	Kapan	0		Small amount	9-10 thousand AMD			
	Sisian	3	Registered, not operating					
	Goris							
	Kajaran							
	Meghri							
	Agarak							
Tavoush	Ijevan			Small amount	7-8 thousand AMD			
	Dilijan	0			8-9 thousand AMD			
	Noyemberian							
	Berd							
Vayots Dzor	Jermik		In the phase of formation					
	Vaik	0						
	Yeghegnadzor	0						

The data represented in Table 3.1 above provide a picture of the current deteriorated and even paralyzed state of the previously operated centralized systems in the major municipalities of the country. No significant progress whatsoever was recorded with regards to the formation process and sustainability of condominiums. In only 15 municipalities out of the investigated 30, the status of condominiums could be described as sustainable or in the process of formation or formally registered but essentially dysfunctional.

The data missing in Table 3.1 will be completed upon the receipt of the filled out questionnaires from municipalities, along with the missing data referring to the municipalities.

As of 25 January, 2006, the site visits, apart from the general assessment of the current situation, provided an opportunity for the identification of a number of potential projects that could be carried out within the scope of this Project with USAID financial support or financial support under the World Bank support R2E2 Fund. A summary of these projects are presented in the Annex 2 of this Report.

4. PILOT PROJECTS AND OPERATING HEAT SUPPLY SYSTEM OVERVIEW

Following the adoption of Decree No. 1384 of the Government of the Republic of Armenia "Urban Heating Strategy", dated 05 September, 2002, a variety of heat supply pilot projects were implemented by both domestic and international organizations, with the purpose of demonstrating which heat supply options are more stable and sustainable; what kind of difficulties and impediments can occur; and in what ways those difficulties can be overcome. The implemented pilot projects made possible the employment of various modern energy efficient technologies, the installation of metering and testing equipment, the introduction of new systems for metering of the heat energy consumed by residential customers, as well as the assessment of the necessity for the equipment regulating heat consumption at the apartment level.

The data with regard to the aforementioned eleven pilot projects implemented throughout the period of 2002-2005 are summarized in Table 4.1 below.

Table 4.1. Basic technical parameters of the pilot projects implemented during the period 2002-2005

Name of the system	Boiler house capacity, (kW)	Number of buildings	Number of apartments	Floor area (m^2)	Capital investments, (USD)	Tariff (AMD/kWh)	Notes
Yerevan , 92 Jrashat St.	800	4	114	10698	125000	14.5	Not operated
Yerevan, 33 Sayat-Nova St.	1200	3	120	7500	101400	12.5	In normal operation
Aparan, Baghramian St.	2850	10	280	27000	72000	-	
Gyumri, 157a Yerevanyan Rte.	300	1	48	2780	50000	-	In normal operation
Yerevan, Nor Nork, III micro district	1250	5	240	16000	55000	-	Not operated
Yerevan, 106 Paruir Sevak St.	590	1	72	6419	51645	7.0-8.0	In normal operation
Yerevan, 70 Avetisian St.	590	2	128	11400	80163	12.4	In normal operation
Yerevan, "MEDIC-2" building at Surenian St.	2000	6	288	23762	95045	14.0	In normal operation
Yerevan, Sayat Nova district in Avan	987	4	162	9108	122568	14.0	In normal operation
Yerevan, 17 Shengavit	-	2	114	5820	13770	-	Not operated
Yerevan, 7 Rubinian St.	-	1	36	3428	22323	-	Not operated

The USAID Residential Heating Project Team conducted a comprehensive analysis and operation assessment for each one of those projects. The lessons learnt from this analysis

will contribute to the successful implementation of future projects. Phase 1 of the project will include those pilot projects that require further technical assistance, as well as other projects that require re-commissioning or expansion.

The analysis of the pilot projects disclosed the following facts:

- The socially vulnerable groups of the population have not been able to pay their bills for heat supply; accordingly the heating of those households has been disconnected. In order to ensure the sustainability of the pilot projects and with consideration of the interests of the aforementioned society groups, it would be necessary to envision a system of targeted support;
- The heating systems could be successfully operated and collections could be ensured by means of utilization of various metering options for the system: metering by individual apartments with the use of meters or allocators; metering according to the heating surface of the central heating radiators/batteries; metering according to the total apartment premises (square meters). In the last two options, the residential customers do not regulate heat consumption, which will not contribute in any way to the energy conservation/efficiency process, both for the individual customer and for the country as a whole.
- Critically important for successful system operation are the relationships between the supplier and the consumer, the creation of an environment of reciprocal trust, as well as the organizational skills and capacities of the system operator (condominium, private building, etc.);
- The rehabilitation, reconstruction projects implemented with the consumers' contribution and participation are more sustainable, since the project success will ensure the effectiveness of the consumers' contributions;
- Some of the projects failed due to the inaccurate or incomplete assessment of the required design, in particular the superficial study of the technical status of thermal networks and thermal mechanical equipment.

The non-discriminatory and unbiased analysis of the pilot project results will help avoid the duplication of mistakes throughout the course of the implementation of future projects. Additional information learned from the past experience of boiler house operation can be found in a companion report by the Residential Heating Project, provided to USAID in January 2006.

5. LOCAL EQUIPMENT SUPPLIERS

During the transition period, a number of Eastern European countries as well as post Soviet Republics faced a number of financial and technical problems associated with their centralized heat supply systems. However, within none of those countries were the heat energy supply and the gas supply suspended for a long period of time.

In 1993 the gas supply to Armenia was terminated in the residential sector, followed by the interruptions of 24-hour electric energy supply. The Armenian residents started heating their apartments with liquid fuel and wood stoves. Along with the gradual restoration of the 24-hour electric energy supply in 1995, electric heating evolved. The market was abundant with electrical heaters and electrical water heaters of different types. However, electric heating for a country like Armenia that has limited domestic energy resources is not considered a preferable and paramount option.

From late 1990s, along with the restoration of the gas supply system in Armenia, the demand for gas heating started to escalate. During recent years, the potential heating options in Armenia were studied and presented by the experts of various projects, along with the technical and financial analysis of the aforementioned heating options.

The USAID Residential Heating Project has focused on the comprehensive analysis of the existing heat supply options in Armenia, which will enable us to make accurate and reasonable choices in terms of prospective developments. Within that context, vitally important are also the parameters of reliability, safety and energy efficiency of the equipment in use, as well as their availability on the market.

5.1 APARTMENT SIZE SYSTEMS

The uncertainty associated with the centralized heating and the mistrust against collective solutions compelled many Armenian residents to turn to individual gas heating. Those who already had a long-term experience of operating liquid fuel or wood stoves chose to buy on the market relatively affordable gas stoves for their apartments, without paying any attention to operational issues. Apartment gas heaters are about four or five times cheaper than the apartment level gas boiler heat and hot water supply systems and do not require additional equipment, operations or servicing. Additionally, in certain cases they may be used for water heating as well. However, in this particular heating option the apartment is not heated equally/evenly: the temperature near the stove is high but in the relatively remote areas it is lower than the standards require. In some instances the temperature is low to an extent that allows the condensation of the water vapor contained in the air on the internal surface of the apartment's external constructions.

In the last few years the apartment level gas heat supply systems with water heating boilers became quite popular with the Armenian population. As opposed to the gas stoves, these systems ensure a higher level of comfort ability within the heated area and provide an opportunity for regulating the temperature. Additionally they provide hot water supply. On the other hand, however, with this option the internal water supply system of the apartment needs to be completely reconstructed, requiring an increase of all necessary investments. Consumers are mainly distinguished by their requirements, preferences and financial abilities. Therefore, depending on the quality, type and price of the installed equipment, the volume of capital investments required to heat an apartment with a surface of 70-130m^2 would vary between 1500-2500 USD. The average monthly amount in USD paid for gas

consumption is normally $30-70. The consumption of gas in this particular case is 15-20% less than that in the case of a gas stove, due to high efficiency factor.

The Armenian market of heat supply equipment has an ample supply and choice of equipment and devices for apartment level gas water heating systems. In 2004, a local company called “Eurotherm” started manufacturing 15-40 kW apartment level gas boilers.

There are about 20 companies on the market, many of them official representatives of leading foreign companies in Armenia, that import and supply Italian-manufactured Baxi, Ecoflam, Biasi, Lamborghini, Beretta, Ferolli, Riello, Sime, Ariston, Fondital, German-manufactured Buderus, Vaillant, Viessmann, Spanish-manufactured Roca, Czech-manufactured Mora, Swedish CTC, Osby Parca, Chinese-manufactured Mercury and Korean Kiturami and Lotte boilers with open and closed combustion chambers; foreign manufactured steel, cast iron and aluminum batteries/radiators of various capacities, sizes and constructions; heat regulation valves; automatic and non automatic air relief valves; metal-base laminate and plastic pipes and a large variety of accessories. The stores of the representative supplier companies introduce the whole range of commodities with free of charge consultation for their clients. Many of the supplier companies also import spare parts for their equipment, provide guarantee service and post guarantee maintenance.

5.2 BUILDING SIZE SYSTEMS

In the period following the collapse of the Soviet Union, multi-apartment buildings in Yerevan were mainly constructed by private companies. For the apartment buildings constructed prior to the restoration of gas supply in the city, centralized heating systems and hot water supply systems were not included in the design. The apartment buildings that were constructed after 2000 are furnished with building centralized heating and hot water supply systems, many of them equipped with individual metering and regulating devices, and are primarily operated by private companies. European-manufactured modern and efficient equipment is installed in the heat supply systems of the newly constructed apartment buildings. Unfortunately, there a also some newly constructed apartment buildings, located in the vicinity of operating boiler houses, that do not use the services of such boiler houses since during their construction preference has been given to heating systems with individual gas heaters.

The heat supply equipment market in Armenia evolves with the pace with the demand and can offer the consumer a large variety of heating boilers of various capacity along with their accessories. Furthermore, consumers are provided the opportunity to order the manufacturer various equipment in accordance with the catalog offered by the manufacturer. There exists today in Armenia modern high efficiency boilers with automated control systems, burners, heat exchangers, expansion vessels, circulation and cold water feeding pumps, various kinds of radiators/batteries, metering and control devices, various diameter pipes, valves and accessories that make it possible to construct modern heating systems that meet international standards. Apart from the imported boilers, during the recent years the Armenian market has been offering consumers 50-1000 kW boilers manufactured by the local “Ar and Ar”, “EIICG", “Mekusich” and “GasJer Sarker” companies.

The recently constructed and reconstructed heating systems do not include water processing equipment, and since there has been no demand for such, the market today does not offer equipment for water processing.

The heat market include a wide variety of metering equipment, including gas meters, electric meters, hot and cold water meters, heat meters for apartments and apartment buildings, as well as allocators.. In 2002, the local “A-2” closed joint stock company started manufacturing allocators and heat meters that have already been installed under World Bank sponsored pilot projects. Today, “A-2” CJSC is working towards the certification of its metering devices and the development of new automated heat metering systems through telecommunication.

6. HEAT SERVICE PROVIDERS (ESCOs)

Prior to the collapse of centralized heating systems in the Republic of Armenia, construction and assembling, operation, adjustment and maintenance of those systems were implemented by large specialized companies within different departments. Parallel to the collapse of heating systems, the majority of those organizations were liquidated while others changed the range of their activities and were converted to dissimilar organizations.

Decentralization tendencies peculiar to transitional countries concerned heat supply sector just as much as other industries. The developing market relations required new approaches and principles under the influence of which Energy Service Companies ("ESCOs") were gradually formed. Many of the specialists from former specialized companies initiated the formation of ESCOs, others just got involved in those companies. The existing ESCOs render several services: energy audit, consulting, design and budgetary estimate, adjustment, commissioning, operation, guarantee and post-guarantee services.

In the initial stage of formation these companies faced several difficulties conditioned by the developing legal and legislation framework. On the other hand problems emerged with the evaluation of production and services rendered by local and foreign companies, their reliability, energy efficiency, economic and technological indicators, companies that "intruded" into Armenian market together with the rehabilitation and extension of daily power and gas supply.

The role of USAID in the process of development and capacity building of ESCOs is huge. USAID AEAI conducted several training programs and organized overseas qualification courses, besides within the framework of this Project many specialists participated in international conferences. The selected ESCOs took their part in the pilot projects implemented by AEAI, particularly in construction and assembling, monitoring and evaluation activities.

In May, 2005 a number of Armenian energy service companies established a non-governmental organization entitled Association of Energy Service Companies of Armenia. The Association aims to enhance the market of energy services, strengthen cooperation of ESCOs, advocate for the rights of its members and build stronger relationships with various structures and organizations working in energy sector both in Armenia and worldwide. The Association provides a forum for its members to share ideas, information and experience and the organizational structure through which ESCOs can raise funds for the implementation of joint projects.

Currently the ESCOs provide integrated energy services to their consumers, particularly:

- Investment grade energy audit;
- Identification of possible energy saving and efficiency improving actions;
- Comprehensive engineering and project design and specification;
- Procurement and installation of equipment;
- Project management and commissioning;
- Facility and equipment operation and maintenance for the contract period;
- Monitoring and verifications of the results;

- Operation of heating system.

List of ESCOs is reflected in Table 6.1 below:

Table 6.1 List of Energy service companies in Armenia

Company Name	Contact Name	Contact Information	Specialization
Anergo Two	Karen Khachatryan	14 Mazmanian St., apt.12 Yerevan, RA Tel.: (374 10) 251769, 258155 anergo@rambler.ru	Installation of heating, electric supply systems, renewable energy, natural gas systems, HVAC; system maintenance; weatherization.
Artstrom	Arthur Miroyan	2a Gevorg Chaush St., Yerevan, RA Tel.: (374 10) 345944, 350630 artgroup1@yahoo.com	Heating; electric supply systems; natural gas; HVAC; weatherization work and system maintenance.
Construction Engineering Services Company (CESCO), Ltd.	Ara Kocharyan	11a Isakov Ave.Yerevan, RA Tel.: (374 10) 562980, 567697, cesco@arminco.com	Construction engineering; Consulting/analysis; Supply / installation / maintenance.
Contact A	Valeri Apiyan	15/16 Charents St., Yerevan, RA Tel.: (374 10) 615726 vapiyan@yahoo.com	Solar water heating systems installation
Elektroshinarar	Hakob Khachaturyan	24 Isahakyan St., Yerevan, RA Tel.: (34710) 543842, 542977 elshin@rambler.ru	Installation of heating, electric supply systems, natural gas, HVAC; system maintenance; telecommunications.
EIICG, Energy and Industry Infrastructure Construction Group, LTD.	Ashot Gevorgyan	40a Charents Street Yerevan 375025 RA Tel.: (374 10) 556843 (374 9) 400875 eiicg@arminco.com	Civil and industrial construction Energy and mechanical engineering; Management consulting; Technical design and analysis; Energy audits; Supply/installation/maintenance svc in HVAC and communication systems.
Muzungu	Sargis Petrosyan	3 A Saroyan St., Gyumri, RA Tel.: (0410) 33874, 33862 (374 91) 49 72 27	Installation of heating systems
SolarEn, LLC.	Viktor Afyan	2/2 Shrjanayin Street Yerevan 375068, RA Tel.: (374 10) 77 71 13 Fax: (374 10) 77 71 82 info@solaren.com http://www.solaren.com	Manufactures flat solar collectors and solar water heating systems, and operates as a photovoltaic system integrator. Wind data measurement, analysis and small wind turbine installation.
South Therm, Ltd.	Asatour Grigoryan	33 Sayat Nova St., Yerevan, RA Tel.: (374 10) 541641	Heating systems construction, installation; Maintenance and operation of energy systems.
Technokom	Mikhail Martirosyan	2 Alikhanyan Eghbayrneri St., Yerevan, RA Tel.: (374 10) 34 42 55 technokom@web.am http://www.technokom.am	Installation of solar collectors and solar water heating systems; Construction and installation of heating systems
Thermoservice	Sargis Grigoryan	25/1 Gyurjyan St., Yerevan, RA Tel.: (374 10) 369246 (374 91) 481143 termoservice@list.ru	Installation of heating; electric supply systems, natural gas, HVAC; system maintenance.
HSCH	Varuzhan Hovasapyan	16 Kievyan St., Yerevan, RA Tel.: (374 10) 274307 hscn@arminco.com	Energy audits, Heating systems construction, installation.
Jerutsogh	Alexandr Harutyubyan	2, Isahakyan 3rd line , Vanadzor, RA Tel.: (374 51) 52882 alexterm79@mail.ru	Heating systems construction, installation.
Akhuryan Coopshin	Samvel Tonoyan	1 Tbilisyan Ave. Gyumri, RA Tel.: (374312) 34806, (374 91)408350	Heating systems construction, installation, maintenance

7. FINANCING OPTIONS

The Residential Heating Project Team's preliminary survey (conducted in December 2005) of financing options indicated that several banks and other entities have been interested in financing residential heating projects. For example, in a December 2005 meeting with Euroterm (a manufacturer and retail seller of residential heating equipment), the company president, Mr. Edward Harutyunyan indicated that residential customers interested in purchasing their heating units could obtain financing for the sale and installation of the equipment through Converse Bank at an interest rate of 18%.

As a second example, our December 2005 discussions with Cascade Bank, a subsidiary of Cascade Capital Holdings, revealed that they are interested in the urban heating project. They have experience in the energy sector through financing hydro-electric projects. Their loan limit is $1 million with a minimum of 30% private equity. They are willing to provide loans to individuals and institutions.

The micro finance credit organization, Aregak, has expressed interest in providing financing for heat projects. The involvement of micro finance institutions in heating projects is for the internal networks of the heating systems, that is, the radiators and piping within the apartment of a heat consumer. The heat consumer will be expected to provide the funding for their internal network construction and the micro finance institutions are interested in this part of the heating project (lending to individuals at small amounts - $100. to $500.)

The Renewable Resources and Energy Efficiency Fund (R2E2) will provide World Bank provided funds to qualified commercial banks which will re-loan the money to eligible borrowers to include: heat providers, municipalities, Home Owners Associations, Condominium Associations, and individual apartment owners. In addition, grants will be available to households meeting income requirements (i.e., poor families) and grants will be available for specified schools.

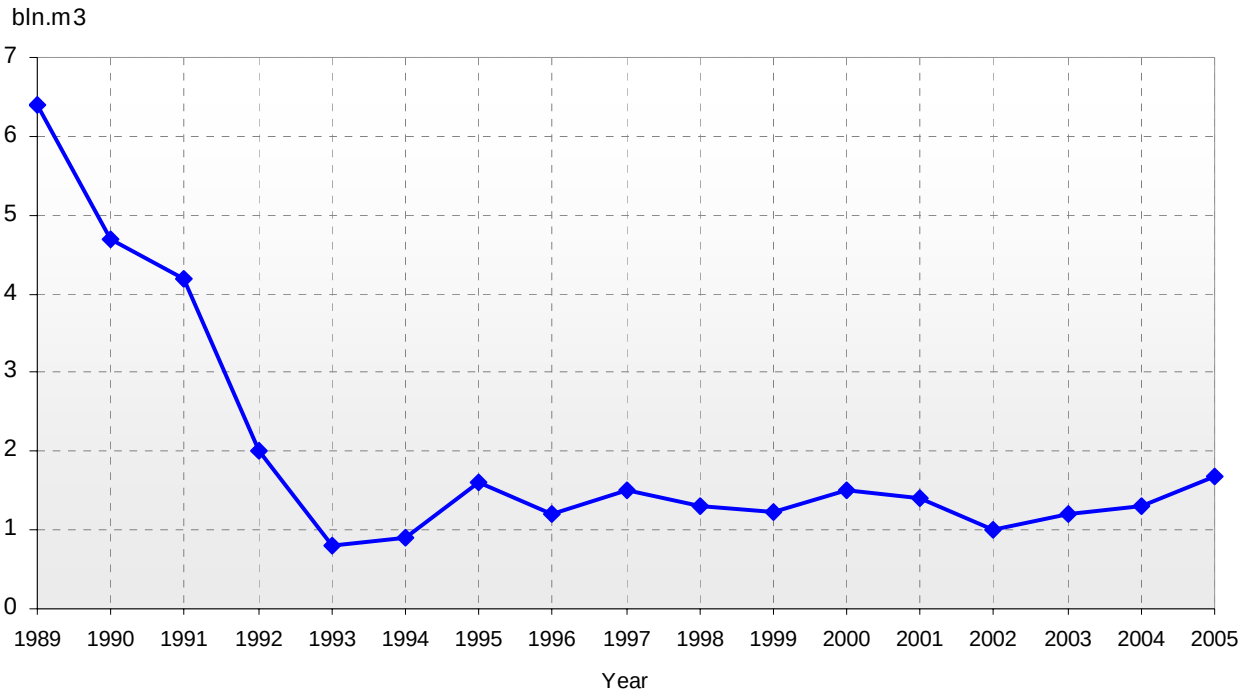
Several entrepreneurs have voiced their interests in participating in the heat energy market. For example, TEP Invest is promoting the sale of heat energy to apartment building residents from reciprocating engines to be installed in abandoned district heating boiler houses and substations.

8. NATURAL GAS SYSTEM EXPANSION

The gas supply system of Armenia formed and commenced operation in the early 1960s. The import of natural gas into Armenia was transported through the former unified Soviet gas supply system via Georgia and Azerbaijan in three directions: Gruztransgas-Alaverdi; Aztransgas-Ijevan; and Aztransgas-Goris. These systems were capable of receiving and distributing an annual amount of up to 16 billion cubic meters of gas or a daily amount of around 47 million cubic meters. The primary consumers of natural gas in the country were the energy sector, the industrial sector, the utility customers and the residential consumers. The level of gasification within the residential sector in Armenia was 83% as of 1989.

The gas main that ran through Azerbaijan was shut down in 1990. Hitherto, the only operating gas main is the one that runs via Georgia.

Figure 8.1. Modifications in natural gas import levels by years



Due to the drastic reduction in the imported gas volumes (Figure 9.1), frequent explosions at the gas mains and the energy crisis of the early 1990s, the residential gas supply was paralyzed reducing to zero by 1993. During the successive years, restoration of the residential gas supply was progressing slowly. The unfavorable operation conditions throughout the crisis years, the critically low level of prevention and reparation operations and the nonfunctioning of electrochemical corrosion protection systems led to the deterioration of the entire natural gas system. The situation was even more aggravated by the absence of the gas consumption metering system, the inferior collection system and the insolvency of population.

During recent years, “ArmRusgasprom” closed joint stock company made substantial investments in the rehabilitation/reconstruction of the country’s gas distribution system and the introduction of a metering system. Due to those developments, the average growth rate of the number of residential gas customers throughout the period of 2000-2005 amounted to around 29%. Effective 2002, the level of collections rose to reach the mark of 100%. The

dynamics of the growth rate of the number of natural gas customers is reflected in Table 8.1 below.

Table 8.1. Dynamics of the natural gas customer growth

	Total number of customers	Number of residential customers	Growth rate (%) of customers within residential sector
1999	70162	69760	-
2000	101613	101003	44.7
2001	113259	112494	11.7
2002	132925	132160	17.4
2003	187918	185690	40.9
2004	272127	268316	44.8
2005	364115	360637	33.7

During the period of 2006-2007, ArmRusgasprom plans to gasify around 797 multi-apartment buildings that were previously using solely electricity in several districts of the city of Yerevan, namely Davitashen, South-Western district, Nor Nork-7, 8 and 9, Avan, Avan-Arinj and Shahumian, as well as 35 thousand individual homes that previously used liquid gas.

During the past three years, certain growth was recorded in average gas consumption per residential customer, which was mainly conditional upon the installation of gas appliances for heating and hot water supply by residential customers.

According to the “ArmRusgasprom” CJSC forecasts for 2006-2007, the level of residential gasification in Armenia will exceed the indicators recorded during the Soviet period.

9. LIFE AND HEALTH SAFETY

During the recent years, the spontaneously developed individual gas heating, the use of gas stoves and water heaters that were not in use for more than ten years and the deteriorated condition of exhaust pipes had grave repercussions for the Armenian population. Violation of safety rules by the population that had grown used to liquid gas and electric energy, unawareness in many instances of the gas appliance operation regulations, as well as the poor level of service quality by gas companies led to 52 accidents during the period of 1999-2005, with 68 fatalities. In addition, a number of intoxication casualties were recorded due to gas leak and CO escape. The number of accidents and fatalities in the country throughout the period of 1999-2005 is reflected in Table 9.1 below.

Table 9.1. Statistics of gas sector accidents

Year	Number of residential customers	Number of casualties		Number of fatalities	
		Absolute	Per 100.000 customers	Absolute	Per 100.000 customers
1999	69760	3	4.30	3	4.30
2000	101003	3	2.97	4	3.96
2001	112494	4	3.56	7	6.22
2002	132160	5	3.78	6	4.54
2003	185690	8	4.30	8	4.30
2004	268316	17	6.33	25	9.33
2005	360637	12	3.33	15	4.16

Source: “Armrusgasprom” CJSC

Following the analysis of the causes and consequences of the recent accidents in the country, the Government of the Republic of Armenia and the Public Services Regulatory Commission of the Republic of Armenia undertook a number of activities aimed at the enhancement of residential gas supply safety within the country. In particular, on 8 July, 2005, the Public Services Regulatory Commission adopted its resolution No. 92-N, “Rules for Natural Gas Supply and Use”, establishing the rules and conditions for natural gas supply, gasification, restoration of gas supply system, connection to the gas supply network, and operation and technical maintenance of the gas distribution system.

In conformance with the aforementioned resolution, effective November 1, 2005 “ArmRusgasprom” closed joint stock company is responsible for the inspection and testing of the in-house gas consumption systems throughout the country, calibration of gas appliances and technical servicing of the gas distribution system. During the period of November-December 2005, the “ArmRusgasprom” employees completed about 277500 inspection visits and drafted corresponding documents/acts.

According to the Public Services Regulatory Commission’s resolution No.199, dated 8 December, 2005, the model form of the “Gas Supply Contract for Residential Consumption between the Supplier and the Customer” was ratified. Along with a number of other provisions, this contract includes a bulletin called “Safety Rules and Requirements for In-house System Use and Routine Residential Gas Use”, which requires from the customer to observe the safety rules and requirements. In addition, the contract comprises an agreement for technical service of the in-house gas consumption system by the supplier.

Hopefully, the measures undertaken will eventually contribute to the enhancement of gas consumption safety in the country by withdrawing random low qualified companies from the in-house gas consumption system servicing market and increasing awareness and responsibility among the population.

10. DESIGN INSTITUTES

The period of 1960-1990 was marked by intensive and extensive construction activities in the cities and other municipalities of the country. To provide those activities with design and budget documents and to carry out copyright control, capacity building activities were carried out at a number of small capacity design organizations, and new entities were created.

Back in the Soviet period years, all design works for residential, public, administrative buildings, as well as industrial buildings and constructions were carried out by the following design institutions: “Haypetnakhagits” (Armenian State Design Institute), “Yerevannakhagits” (Yerevan Design Institute) and “Hayardnakhagits” (Armenian Industrial Design Institute), as well as small capacity institutes, design and construction offices/bureaus operating within the structure of individual ministerial departments. Following the collapse of the Soviet Union, the aforementioned three major design institutes survived the unprecedented decline of construction activities in the country, although their work load decreased by several times.

At present, in parallel with the increase of the volume of construction activities in municipalities across the Republic of Armenia, many private design offices were formed. However, all the currently functioning design institutions have one common deficiency: shortage of information about modern equipment, metering/control devices, regulating devices and automated systems.

Under the existing market conditions, designers of heat systems and engineering equipments for buildings have to encounter other important problems: mainly the problem of comfort, cost estimation and the capability of supporting the customer in its choice of final design. There are many heating technologies in Armenian market that are absolutely obscure for the costumer. Analysis and comprehension of distinctions and specifications of those technologies is an additional task for the designer.

The heat energy and gas supply department of “Yerevannakhagits” Institute carries out design of heat supply systems and copyright control throughout the course of construction of the facility. Because there are no multiple orders for heat supply systems, the level of design work is minute. The normal work for designers are one-time designs for individual heating systems and reconstruction of gas supply systems.

The “Yerevannakhagits” Institute experts are not proficient in designing modern and efficient heat supply systems. Neither do they have sufficient information about the contemporary equipment and devices employed in heat supply systems.

“Gasotherm” Ltd has been on the market for four years. The company is involved in the design activities for heat supply as well as gas supply systems.

In 2002-2030, “Gasotherm” Ltd participated in the World Bank tender “Advance Payment for Preparatory Works for the Proposed Municipal Heat Supply Project” and was recognized as the winning bidder. The company carried out the design work for four heat supply systems, three of which have been completed and are in operation.

11. CONDOMINIUM ASSOCIATIONS

Up to 1993 the multi-apartment housing market in Armenia was broken down by categories to include: residential houses that were owned, operated and funded by the Government, residential housing cooperatives, and private houses. Government funded residential housing comprised more then 70% of the residential market and was funded and maintained through local government and central governmental departments. During the Soviet Period, apartment blocks were maintained and managed by district executive committees, known as "zhek".

After the privatization, 1993, Government of Armenia started structural reform in multi-apartment building management. Change of the ownership of apartments and lack of resources from the state demanded new regulation to maintain and operate these buildings. The main issues that required specification included: common area, plot of the land with undefined status, yards, exteriors, elevators, and municipal services.

11.1 THE CREATION OF A CONDOMINIUM STRUCTURE FOR APARTMENT MANAGEMENT

The changes in the Armenian economy generated spontaneous managements in few multi-apartment buildings. With the respect to old regulation, residents appointed "authorized" person to deal with the building related issues. In general, the person that was appointed by the Government kept the position. Also, there had been few cases when residents were pro-active and dealt with the person they had more respect. However, no regulation was in place and, thus, these appointments did not have a legal basis.

The official change in management of multi-apartment building launched with the Decision of the Government of Armenia #295 on "The establishment of legislation of Condominiums", 1995. It was transformed into Law on Condominium in 1996 by the National Assembly. Later, in 1998, this law was modified and, hence, clarified the transfer of common property of the building from Government to Condominiums.

In 2002, two new laws were adopted:

- Law on Condominiums
- Law on Management of Apartments (modification in 2003 and 2005)

These laws with Decision of the GoA # 2625 (2002), "The establishment of the norms of protection of communal ownership in apartment buildings", replaced all previous regulations.

11.2 THE FORMATION OF CONDOMINIUMS

As a legal entity, the formation of Condominiums was started in Yerevan in 1995 and were officially registered in 1996. By the end of 1996, the total number of Condominiums was 60 and included 300 buildings with 1600 apartments in total. The ownership of these Condominiums included: common use areas, common infrastructure services (water system, heating system, and power substations). The legal status gave the right to maintain and supervise the public services and geared the responsibility of cost control and good service provision.

The recent number of Condominiums formed and registered are reflected in Table 11.1 below:

Table 11.1 Number of formed and registered Condominiums in Armenia

N	City Community	Number of Condominiums	Number of buildings included	Average Number of Building per Condo	Number of the population
1	Yerevan	523	4374	8.36	289855
	– Arabkir	135	594	4.40	31390
	– Adgapnjak	81	365	4.51	19821
	– Davitashet	34	162	4.76	8102
	– Malatia-Sebastia	42	527	12.55	26229
	– Nor-Nork	132	621	4.70	31645
	– Avan	16	210	13.13	9826
	– Kanaker-Zejtun	35	336	9.60	15002
	– Centre	33	691	20.94	29741
	– Erebuni	14	228	16.29	11985
	– Shengavit	44	515	11.70	105220
	– Nubarashen	1	25	25.00	894
2	Gyumri	27	605	22.41	18270
3	Vanadzor	54	918	17.00	24197
4	Kapan	19	315	16.58	12347
5	Abovyan	27	233	8.63	11727
6	Edgmiatsin	11	56	5.09	2453
7	Aparan	26	26	1.00	1040
8	Charentsavan	5	166	33.20	6664
9	Hrazdan	9	301	33.44	11560
10	Sevan	3	33	11.00	982
11	Idgevan	3	34	11.33	1389
12	Tashir	3	21	7.00	530
13	Vardenis	1	43	43.00	1552
14	Noyemberyan	2	18	9.00	468
15	Nor Hachen	5	67	13.40	2692
16	Eghvard	1	13	13.00	529
17	Eghegnadzor	2	6	3.00	199
18	Sisian	3	30	10.00	253
19	Spitak	1	4	4.00	162
20	Ashtarak	2	81	40.50	515
21	Armavir	2	15	7.50	532
22	Artashat	1	2	2.00	110
23	Artik	2	93	46.50	1264
24	Goris	1	4	4.00	120

Actually, the functioning of Condominiums is questionable. In majority, the information link among residents and Condominiums is weak. Inhabitants treat Condominiums more as Soviet “zheks” than the multi-apartment building management body. However there are several cases of residents’ satisfaction with the Condominium leadership.

Condominiums are financed by the fees from residents. The fee for 1 m^2 of dwelling space per month is in the range of AMD 6-25. The average fee is about AMD 8/m^2/month. However, even for this amount the collection rate is low. The best case seen is 50% of collection rate, while in general it is 20%.

Besides covering administration expenses, the fee was structured to cover the expenses for following obligatory services:

- Inhabitant and solid waste disposals (with the period of 3 days at least);
- Elimination of rats and disinfection of garbage stores and hoses in common area (3 month least period);
- Sanitarian cleaning (2 days least period);
- Chimney cleaning (one year least period);
- Critical maintenance;
- Technical Condition Monitoring (10 years least period).

The following is a sample of current issues relating to condominiums:

Present condominiums are faced with the problems persuaded from formal vs. natural establishment, conflict between the law interpretation and practice, and lack of awareness.

The formation of condominiums was passed mostly in a formal manner. The local governments, executing the law created new communities by converting the legal status of “zhek” into “condominium”. As a result residents did not have clear understanding of the process, could not recognize the importance of it, and were not initiators of requirement to establish the condominium. Therefore, there is a lack of participation and confidence in these organizations. The new law on Condominiums (January 2004) disbanded some condominiums only due to improper registration or bylaws. There is no information on restructuring or termination of condominiums by residents’ initiative.

The “term” common area is not clearly accepted by residents when it concerns the roof and basement of an apartment building. Opposing the legal framework, these areas are treated as owned by last floor residents for roof and first floor for basement. However, the residents have a strong opinion that common areas as roofs, entrances of building, and other should be maintained by Government (a.k.a “ZHEK”).

ANNEX 1. CURRENT CONDITIONS OF RESIDENTIAL HEATING SYSTEMS IN ARMENIA

USAID Residential Heating Project started in September, 2005 and it aims at providing assistance to the Republic of Armenia in implementing the GoAm heat strategy, in particular demonstrating the full range of heat supply alternative for different regions of Armenia. The Project will also provide solutions to institutional problems which will make grounds for improved level of management of heating systems and improved quality of services rendered to the customers.

One of the first steps of the Residential Heating Project is the review of the existing situation of heat supply sector in the Republic of Armenia. As a result of field visits our experts have explored housing recourses of different regions, conditions of heating systems that were operational in the past, heating options currently used and procedures of creation and establishment of Condominiums. The decisive role of local governments in the rehabilitation of heating systems was defined during the meetings held in the Municipalities. Besides our experts have visited boiler-houses that were recently built and have had town meetings with residents.

Parallel with the development of gasification networks increases the number of apartments heated by comparatively cheap gas heaters. As a result of poor social condition of population people have to choose the most inexpensive heat options. Unfortunately there are still regions with considerable number of apartments heated by firewood. These solutions cannot be considered options of sustainable development of heat sector neither from the point of internal comfort, nor from the point of safety, efficiency and environmental protection.

This report includes data about the results of visits made to 55 cities in Armenia (with former central heating systems) as well as preliminary evaluation of heat supply sector rehabilitation options.

ARAGATSOTN MARZ

ASHTARAK

12.01.2006: meeting held with the newly-elected Mayor, Mr. Tamazyan, and other members of the Municipality.

Being located in a relatively mild climatic zone the city of Ashtarak has never been distinguished for well-developed central heating systems. There were 4 boiler-houses equipped with cast-iron boilers that used to supply heat to 76 residential buildings. All the boiler-houses have been alienated and destroyed.

Population registered in the city is 23 000, number of multi-apartment buildings is 57. Almost 80% of the buildings are gasified, while only 60% of apartments have gas. In addition to natural gas residents of Ashtarak use firewood (same price as in Yerevan) and electricity for heating purposes.

There are no Condominiums formed in Ashtarak. The Mayor of the city believes that this Project will support the creation and establishment of Condominiums. The load component of the Project is also considered realistic, of course after clarification of the load conditions.

The Municipality will provide us with a detailed description of the districts (20.01.06) after which feasibility study will be conducted and the decision made about its inclusion in the Project.

APARAN

08.09.2005: meeting with the Mayor, Mr. Petrosyan.

Population of the city is 10000, number of multi-apartment buildings is 26, empty apartments make 10 % , number of Condominiums functioning in the city is 10. Gasification of multi-apartment buildings is mainly completed.

Multi-apartment buildings in the city of Aparan used to be provided with heat from a single boiler-house, which has been destroyed.

Initiated by the Municipality, supported by the GoAm and financed by “Hayastan” foundation 8 boiler-houses were built during 2002-2004, but only 4 of them operate now supplying heat to 4 residential buildings. The rest of the boiler-houses seized operation because of the low rate of payment calculation. Apartment owners have actively participated in the construction of boiler-house and rehabilitation of external and internal networks. Boiler-houses are operated by Condominiums. Cost of central heating is calculated based on factual expenditures and surface of the apartments.

ARARAT MARZ

ARARAT

07.12.2005: meeting held with the City Mayor, Mr. Tovmasyan and Deputy Mayor Mr. Khurshudyan.

Population of the city is 25000, 10-15% have left the city.

There are 90 multi-apartment buildings in the city, 74 out of which are in the city itself, while 16 in the working suburb. All the buildings in the working suburb are gasified, while only 15% of the city buildings is gasified. Former heating system of the city does not exist now. Market price for firewood is 14-16 th. AMD. The attempt of creating Condominiums was unsuccessful.

Our Project team has visited several districts of the city. As opportunities for future pilot projects two districts were identified (surrounded by Khanjyan and Komitas Streets), each of which comprises five 5-storey buildings (200 apartments).

ASHTARAK

21.10.2005: meeting held with the City Mayor, Mr. Muradyan and Deputy Mayor, Mr. Grigoryan.

Population of the city is 25000, number of multi-apartment buildings-126, number of empty apartments is 5000-6000. All the buildings are gasified. There are no Condominiums, but there are public service companies.

There were 6 boiler-houses that operated in the past and stopped in 1992. In 1995 two boiler-houses were restarted but seized operating in a year because of the low rate of payment calculation.

The Mayor expressed his readiness to support the Residential Heating Projects in its activities and suggested that we implement a project in the district (12 multi-apartment buildings) next to the wine factory after market analysis completed.

VEDI

12.01.2006: meeting with the Mayor if the city, Mr. Barseghyan and other members of the Municipality.

Population of the city is 15000, 2000 people are out of the city, number of multi-apartment buildings is 39 (mainly 5-storey buildings).

There are no Condominiums in the city but there are certain measures taken to organize Condominiums. 90 % of the buildings and 60% of apartments are gasified.

Central heating used to be provided from a single boiler-house. The boiler-house stopped operating in 1999-2000 heating season as a result of non-payments and is now alienated. There are 3 schools in the city and 2 of them have central heating.

The city produces plastic pipe, and there is also a stone working factory.

According to the Mayor heating system rehabilitation is practically impossible in the city because of the poor social condition of the residents and unacceptable loan conditions.

MASIS

18.01.2006: meeting with the Deputy Mayor, Mr. Gabrielyan and other members of the Municipality.

Population of the city is 23000, 3000 people are out of the city.

Number of multi-apartment buildings is 62 (mainly five-storey buildings). Almost 40% of buildings and 554 apartments are gasified.

Five boiler-houses of different capacities used to provide central heating to the city. None of the boiler-houses exists now.

The Deputy Mayor expressed their interest in the rehabilitation of heating systems through loans but detailed study should be conducted in district with relatively small number of empty apartments. Our specialists expressed their readiness to take part in the surveys and analysis.

There are agricultural product, carpet making, stone working, and textile productions in the city. It also produces non-alcoholic drinks. “Masis Tabak” is situated in the city.

ARNAVIR MARZ

ARMAVIR

21.10.2005: meeting held with the city Mayor, Mr. Khlghatyan.

Population of the city is 45000, whereas 7000 is absent, number of multi-apartment buildings is 154, all the multi-apartment buildings are gasified. There is only one Condominium functioning in the city that serves 3 residential buildings. One central boiler-house (60Gcal/h) and 7 small-scale boiler-houses used to provide heat to the city.

The Mayor expressed his willingness to assist the Residential Heating Project in its abilities. It was suggested to analyze heat supply market in districts with multi-apartment buildings and after that make a project implementation proposal.

ECHMIADZIN

21.12.2005: meeting held with the Head of the department of communal services, Mr. Mirzakhanyan.

All the 11 centralized heating systems with total installed capacity of 100 MW that were operating in the past were sold and are inoperative now. Those systems equipped with steam and cast-iron water-boilers used to provide heat to 140 buildings.

Population of the city is about 30 000, number of multi-apartment buildings -160. All the residential buildings are gasified, though only 50% of the apartments have gas. Market price for firewood is almost the same as in Yerevan: 16-17 th. AMD/m^3

According to Mr. Mirzakhanyan, who has been appointed on that position only a month ago and whose opinion does not mean Municipality’s opinion, the loan component (preliminary identified

loan conditions: 10% interest rate and 10 years of return period) of the project is practically impossible, taking into consideration poor social conditions of the residents.

METSAMOR

21.12.2005: meeting with the Deputy Mayor, Mr. Galstyan.

The city used to receive heat from the only large-scale boiler-house with installed capacity of 70 MW, which has been sold and does not operate now.

Population of the city is about 11 000, and 1600 people work in the Armenian Nuclear Power Plant. From the point of employment rate Metsamor is in better conditions than many other cities. Approximately 3-4 thousand inhabitants of the city have gone abroad.

Gasification in Metsamor has just started, but according to the Deputy Mayor the city will be gasified during the next year. The city is capable of operating a heating system equipped with modern technologies by its own skilled workers.

The visit to the micro-district close to the Municipality showed that rehabilitation activities can be quite effective taking into consideration high density of heat demand, positive attitude of the Municipality, comparatively good socio-economic conditions and the high employment rate in the city. From that respect the abovementioned micro-district can be included into our Project on the basis of technical support.

GEGHARKUNIK MARZ

SEVAN

04.10.2005: meeting with the city Administration held in the Municipality building.

Central heating in the city used to be provided by 6 large-scale boiler-houses with installed capacity of 98 MW and 4 medium-scale boiler-houses with 38MW installed capacity. Those heating systems supplied heat to 232 buildings, including 147 residential buildings. Until the year 2002 three centralized heating systems were operated in the city, which were later considered bankrupt by the decision of the Economic court only for having a 300 million AMD dept for natural gas.

Registered population of the city is 28 000, number of multi-apartment buildings equals to 178, almost 98% of the buildings are gasified, though gasification level of apartments is considerably lower because of the poor economic state of residents.

There are three Condominiums that try to find financial means for rehabilitating centralized heating systems in the city. Taking into consideration the majority of sunny days in the region several project have conducted surveys in the direction of giving heat using solar energy, in particular by the use of annual accumulators.

Both the Municipality and the Condominiums expressed their readiness to cooperate with the the Project.

Sevan building-line is characterized with high density of heat demand (4.5-5.0 kW/m). Each of the Micro-districts in Sevan comprises 6 multi-apartment buildings with approximately 1.2-1.3 MW design heat demand and with 250-300 m length of inter-district heating networks.

It is possible to consider the options of both an autonomous boiler-house and a small-scale CHP in those micro-districts. Construction of a new boiler-house in one district can be considered a potential project.

MARTUNI

18.10.2006: meeting held with the City Mayor, Mr. Mheryan.

Heating in the city was provided from 3 boiler-houses which have stopped since 1992 and were sold to cover the depts. Construction of a large-scale boiler-house which was predestined to provide heat to the whole city has not been completed (intended to be finished in 1995), one of the three DE-25 boilers was sold. There are only two running boiler-houses in the city each with one boiler that supply heat to the police station and the cadastre.

Almost all the 31 multi-apartment buildings in the city are gasified, though gasification level of apartments is low, irrespective of the fact that the price for firewood (the only alternative fuel) is too expensive in Martuni: 17-18 thousand AMD/m³.

Population of the city is 14.5 thousand, employment rate can be considered satisfactory in comparison with other regions of the country. Small and medium business is run there: food, agricultural products etc. The motorway through the mountain gate Selimi that connects with Vayk and Syunik has created work places.

There is only one Condominium in the city that serves only two multi-apartment residential buildings. The main function of the Condominium is related to repair services.

The Municipality expressed its readiness to cooperate with the Project even in providing financial means for rehabilitation of the boiler-house. Besides City Administration suggested that the local TV can be used as a tool for public awareness about the Project:

GAVAR

18.10.2005: meeting held with the acting Mayor. Later on 15.11.2005 Project experts met with the newly-elected City Mayor, Mr. Martirosyan and other members of the Municipality.

In 1980s heating in the city was provided from 17 small and medium size boiler-houses with 80 MW total installed capacity. The boiler-houses were equipped with cast-iron boilers. It supplied heat to 94 buildings (52-residential). All the equipments from the boiler-houses are demounted now and the boiler-house building is destroyed.

Population registered in the city is 35 000, almost 20% of the population is not in the city. Number of Condominiums is 3-4; its main occupation is repair services (roofs and entrances of the buildings).

Number of multi-apartment residential buildings is 55, factual number of residents in those buildings is 8-10 thousand people, social conditions are quite low. Only 20 % of the multi-apartment residential buildings are gasified, it is hard to predict the gasification level of apartments. The main fuel type is firewood, which is quite expensive (16-17 thousand AMD per cubic meter). The inhabitants cannot afford themselves to use electricity for heating purposes.

The attitude of the Mayor towards our project is positive and he expressed his willingness to cooperate with us, which gives the hope for a successful implementation of the Project in Gavar.

The mayor advised us to visit the district called “Cable-men” district which is in a relatively good social condition (next to Boshnaghyan St.). The district comprises 7 multi-apartment buildings with 260 apartments and it has high density of heat demand – 3,6-3,8 kW/m. The town meeting conducted by our specialists show the interest of the residents both for the load and technical assistance projects.

Rehabilitation of the autonomous heating system with 1.2 MW installed capacity can be considered as a technical assistance project in the “Cable-men” district of Gavar.

Project experts visited the central boiler-house which is located at a considerable distance from the main consumption centers. Miserable condition of the system proves the obvious inexpediency of rehabilitation of the centralized heating system.

Micro-district close to the building of refugees was of interest to us, since it had high density of heat load and the school building next to it could also be connected to the system. It can be considered a technical support potential project.

KOTAYK MARZ

ABOVYAN

24.10.2005: meeting with the Deputy Mayor, Mr. Muradyan.

Population of the city is 50000, 5000 people are out of the city. Number of multi-apartment buildings is 250 (mainly 5-14 storey buildings), number of Condominiums in the city is 20 that serve 1-25 buildings.

11 boiler-houses used to provide heat to the city: 1 large-scale, 6 medium-scale and 4 small-scale boiler-houses. Centralized heating in the city was finally stopped in 2002-2003 heating season as a result of non-payment (only 30% of the payments were collected). All the boiler-houses and central heating networks have been alienated.

Multi-apartment buildings are mainly gasified.

According to the Mayor the re-commissioning of central heating system in Abovyan is possible only through rehabilitation of small-scale boiler-houses.

HRAZDAN

04.10.2005: meeting held with the Municipality staff.

Central heating of the city involved three large districts (“Center”, “Micro-district”, “Old Hrazdan”) of the city and was provided from Hrazdan TPP (HrazTPP open joint stock company) and 5 boiler-houses with 58 MW installed capacity, which were equipped with small-scale steam and cast-iron water-boilers. TPP served the districts of “Center” and “Micro-district” as well as neighboring 7 villages and the big greenhouse.

HrazTpp is the only system that operates nowadays and it has delivered 480 million AMD heat energy during 2004/05 heating season calculated by the tariff imposed by PSRC (Public Services Regulatory Commission)(the collection of payments didn’t exceed 30%).

Mains lying from the Central Power plant to the heating substations are on the balance of HrazTPP and are maintained and operated by the personnel of TPP. Equipments and distribution networks of substations are on the balance of “Hrazdan city district heating” closed joint stock company and the Municipality is 100% stockholder.

In 2005 the aforementioned company was considered bankrupt by the decision of the Superior Court of Kotayk. It was the wholesale customer of HrazTPP. The administration of the company was discharged and a manager of insolvency was assigned.

In district “Center” equipments of distribution networks, heating substation and pump stations are being demounted. Gasification of the district is in process due to measures taken by the Municipality.

Population of “Micro-district”, which is 3 km far from HrazTPP, is about 30 000. The residents are inclined to refuse centralized heating. Debt for consumed heat was 350 million AMD in the end of 2004/05 heating season. HrazTPP will provide heat only on condition that the debts will

be paid and the prepayments for the forthcoming heating season will be collected (50% of the annual payments).

For 2004/05 heating season heat was provided only to 165 buildings in “Micro-district” working with one circuit. Mains were connected directly to distribution networks, leaving out sub-station equipments. A full understanding of technical and operational conditions of the heating system can be maintained regarding the capacity of make-up water pumps: 700m³/h. The district is being intensively gasified.

Registered population of the city is 70 000. There are 15 Condominiums that serve 350 residential buildings and 7 villages, the farthest of which is only 25 km far from the Power Plant.

Taking into consideration distinctive features of the city: existence of the large-scale combined cycle plant in the neighborhood, severe weather conditions, its industrial importance, the number of population and the neighboring rest areas etc; it is necessary to do assessment of alternative heating options.

CHARENTSAVAN

Population of the city is 25400, number of multi-apartment buildings is 162, empty apartments make 10%, number of Condominiums functioning in the city is 4, and number of gasified buildings is 110, the rest of the buildings will be gasified by Autumn 2006.

5 small and medium scale boiler-houses used to provide heat to the city, which were 5 years ago alienated because of tax depts.

There are 6 schools in the city and 5 of them have central heating, there is also one kindergarten with central heating.

After the collapse of the heating system in the city in 1998 a small-scale autonomous boiler house was built and operated for two years and it supplied heat to buildings 40 and 41 in Micro-district 2. According to the representative of the Municipality the boiler-house seized operating because of the several technical defects. The boiler-house is currently inoperative: there are no burners, circulation pumps and other auxiliary equipments.

In the same year a 500 kW boiler-house was built in Micro-district 6 financed by TACIS. It was designed to provide heat to building 2 but it stopped operating after two years because of non-payment. The boiler-house is currently inoperative.

NOR HACHN

28.12.2005: meeting with the Mayor of the city, Mr. Avetisyan, Chairmen of the three Condominiums that function in the city and the Head of the Department of communal services. There are three autonomous heating systems in the city but only one of those systems operates. It was equipped with two boilers of Ar & Ar production each with heat capacity of 900 MW.

Population of the city is about 13 000, number of multi-apartment buildings is 67, employment rate is approximately 60%, 100% of residential buildings have been gasified, and 70% of have gas.

Condominium Chairmen and the Mayor himself consider the condominiums to be well-established and fully-functioning.

One of the boiler-houses in the city, which was equipped with a homemade boiler, used to provide heat to 3 buildings for 3-4 years. Rehabilitation activities are considered inexpedient.

The only operating boiler-house supplies heat to 4 buildings on Charents Street, each building has 36 apartments and all the apartments are gasified. The boiler-house is operated by the

Condominium, the chairman of which has left an impression of a hard-working and efficient man, always ready to take the initiative. Payments are calculated each month according to the factual consumption. Heat cost for 1m² is 370 AMD. From the two boilers installed in the boiler-house runs only one, the other is not used because of the lack of contractual relations with the residents of other buildings. Measurable investments are required to rehabilitate the boiler-house. Four other buildings close to the boiler-house can also be connected to the system but the residents seem to have lower rate of solvency.

Commissioning the 2nd boiler of the boiler-house that supplies heat to buildings 19, 21 and 25 on Charents Street and connecting the abovementioned buildings to the system can be considered a restart project.

11.01.2006: Our experts visited the boiler-house on Charnets Street accompanied with the city Mayor and the Condominium Chairman. Together with the expatriate specialists our experts checked the scheme and parameters of the boiler-house, had town meetings with residents and defined technical, economic and financial possibilities of commissioning the 2nd boiler.

LORI MARZ

STEPANAVAN

02.12.2005: meeting with the Mayor, Mr. Gharakeshishyan and heads of the corresponding services held in the Municipality building that reminded a hutment.

None of the 7 boilers-houses with 33MW total installed capacity that used to serve 94 residential buildings operates now. Registered population of the city is 18000, 40% of which is absent. The attitude of the city Administration towards the project became rarely pessimistic after they were informed of the load conditions.

The Mayor advised our specialists to visit the district inhabited by refugees, which consists of 24 2-storey wooden houses with 296 apartments. Those temporary dwellings were built in 1990 and are in extremely bad conditions now. The use of any autonomous or centralized heating system in that district is practically impossible and irrational, irrespective of the existence of a boiler-house at a distance of 20-25 meters. It was built in 1990 and operated for two heating seasons after which it was stopped. It is not an easy task to evaluate the physical conditions of boilers in metal boxes, but it is easy to imagine. According to the Deputy Mayor there are 100 poor families only in that district. Implementation of Pilot projects in Stepanavan is considered irrational.

ALAVERDY

02.12.2005: meeting with the newly-elected Mayor, A. Nalbandyan and heads of the departments that manage heat sector. The meeting was held in the Municipality building which was under capital repair. Former centralized heating systems with 71 MW total installed capacity and mainly with steam and cast-iron boilers are inoperative nowadays.

Registered population of the city is 22 000, number of multi-apartment buildings - 158. The majority of population of the former industrial city was from the neighboring villages and they had to return to their villages, since it is easier there to overcome communal problems.

Only one shop of the mining-metallurgical factory works now and with limited capacity and about 550 workers.

Approximately 50% of the city has been gasified. According to the Mayor 100 % of the city will be gasified till mid 2006. Residents use even firewood for heating purposes, which costs comparatively less money there: 7-8 th.AMD/m³. The city Administration expressed its positive

attitude towards the Project and willingness to closely cooperate with the Project team, even financially.

G. Hovvanyan, head of the Project's department, was assigned as a contact person from the Municipality.

Our specialists visited a district close to the Municipality building. There is a boiler-house with heat capacity of 1.5- 2.0 MW and construction of an autonomous heating system on its basis is thought quite realistic, taking into consideration the Municipality's willingness to cooperate with the Residential Heating Project.

VANADZOR

20.10.2005: meeting held with the Mayor of the city, Mr. Danielyan.

Population of the city is 106000, number of multi-apartment buildings-970, empty apartments make 25%. Gasification of the city will probably be completed during 2006.

There are 52 registered Condominiums from which function only 40 and 32 condominiums function actively serving 819 multi-apartment buildings. The biggest Condominium serves 154 buildings.

Municipal heating used to be provided from Vanadzor TPP and 12 boiler-houses of different capacity.

There are some buildings in Vanadzor that receive central heating, these are: a few schools and educational institutions, Municipality and Local Government buildings. The last two are supply from the boiler-house situated in the yard of the Municipality. There is also one multi-apartment buildings connected to that system. Taking into account the fact the boiler-house is not operated in all its capacity, it is possible to connect neighboring 4-5 multi-apartment buildings to the boiler-house.

It is necessary to study the system in details and make technico-ecomonic calculations.

In 2003 Local Governments and the Municipality made an effort of solving the heating issue of Taron district. A boiler-house with (3.6 Gcal/h) and external heating networks were built was built by the financial means allocated from the national budget, besides defects of the internal networks were eliminated. According to the head of the department of communal services, 50 residential buildings (600 apartments) of the district were supplied with heat for 45 days, but the system stopped operating because of the lack of payments.

Recommissioning of the abovementioned system can be included into the list of Pilot projects and implemented before next heating season.

SPITAK

1.11. 2005: meeting held with the City Mayor, Mr. Asatryan and other Municipality members.

The devastating earthquake of 1998 ruined all the multi-apartment buildings and destroyed all the heating systems of the city. In 2001-2003 LINCI Foundation has financed the construction of multi-apartment buildings in the city.

Population of the city is about 15600. Number of empty apartments is not large. Almost 1800 apartments are gasified. Unemployment rate in the city is quite high. The majority of apartments are heated by individual gas heaters, except from the apartments of a few recently built buildings heated by individual water-boilers installed in the apartments.

There is a boiler-house with external heating networks in one of the districts built by the LINCI Foundation. Construction of the boiler-house was completed in 2003, but it has not been tested

and operated.23 multi-apartment 4-storey buildings are connected to the system, each of the buildings consists of 12 apartments (total number of apartments - 276).

Besides central heating the boiler-house is designed to provide hot tap water to the buildings. For that reason the boiler-house is equipped with water-heaters and pumps.

There are 6 “Face”l boilers installed in the boiler-house, each with 1MW installed capacity. The burners are of Russian production and are quite outdated. Heat demand of the administrative and public buildings situated in the centre of the city was taken into consideration while calculating the boiler-house capacity. External heating networks were not built for those buildings.

The abovementioned heating system can be included into the list of pilot projects implemented by the Residential Heating Project, since it requires relatively small investments and once rehabilitated it will provide heat to 23 residential buildings. The School building not far from the boiler-house (50m) should also be connected the central heating system.

To operated the heating system it is advisable to replace the burners of two boilers with new modern ones, install feed-pumps, extension tanks, manometers, safety valves,a heat meter, replace some of the pipes, do repair of all the equipments and conduct a hydraulic test of the external and internal heating networks.

TAVUSH MARZ

IJEVAN

25.10.2005: meeting with the Deputy Mayor, Mr. Otaryan. Population of the city is 20300, number of multi-apartment buildings is 101, empty apartments make 25%.

There are no functioning Condominiums in the city, but there are communal services companies.

All the multi-apartment buildings are gasified and gasification level of apartments is 60%. Apartments are heated with natural gas and firewood.

There are 6 boiler-houses that used to provide heat to the city. Four schools receive heat from central system.

The Municipality suggested that our specialists should visit a district with 4 buildings the residents of which are solvent, according to the Mayor.

DILIJAN

01.11.2005: meeting with the Mayor of the city, Mr. Santrosyan and other Municipality members.

Population of the city is 16200, number of multi-apartment buildings is 117, empty apartments make 25%. There are no Condominiums in the city, but there are communal service companies.

Almost 80% of the multi-apartment buildings are gasified, and 60% of apartments use gas. Apartments are heated by gas and local firewood. Market price for firewood is 8000-9000 AMD per cubic meter.

Heating in the city used to be provided from 8 boiler-houses a part of which are alienated, others- destroyed.

3 from the 6 schools in the city receive heat from boiler-houses.

The Mayor keeps to the opinion that the current socio-economic conditions do not allow to think about rehabilitation of heating systems through load projects.

SHIRAK MARZ

GYUMRI

3.11.2005: meeting with the City Mayor, Mr. Ghukasyan and Head of Staff, Mr. Mazmanyan. The destructive earthquake of 1988 ruined all the multi-apartment buildings and heating systems of the city. Construction of new multi-apartment buildings began in 1989 and continues up to this day. The population of the city is 150 000. 15 % of the apartments are closed.

Until 2004 the newly-built district “Ani” received central heating. In the rest of the districts apartments were heated by homemade or Iranian gas heaters. In 2004 after gasification of “Ani” district central heating was stopped there too. In some of the buildings constructed by the LINCI Foundation during 2001-2003 individual boilers were installed. There were also intentions to construct central heating systems. Boiler-houses and external heating networks were built but were neither tested nor ever operated. Such systems were built for 4 districts which were designed to supply heat tp 14 multi-apartment buildings.

1. KHRIMYAN HAYRIK ST.

The system was built to provide heat to buildings 3a and 5a in Khrimyan Hayrik St (160 apartments). There are two Ekoflam boilers (735 kW) with duel-fuel burners of the same production installed in the boiler-house.

To start up the system it is necessary to install a heat meter, an extension tank, safety valves, manometers, a gas meter, to adjust all the equipments, conduct a hydraulic test of external and internal heating networks.

2. KHRIMYAN HAYRIK 4 ST.

The system was designed to provide heat to buildings 4.4a and 6 in Khrimyan Hayrik Street (200 apartments).

There are 2 “Ecoflam” boilers (473kW) with duel-fuel burners of the same production installed in the boiler-house.

To start up the system it is necessary to install a heat meter, an extension tank, safety valves, manometers, a gas meter, to adjust the equipments, conduct a hydraulic test of external and internal heating networks.

3. SHAHINYAN 4 STREET

The system is designed to provide heat to 4 multi-apartment buildings (60 apartments) in Shahinyan Street.

A single boiler of Iranian production with (400000 Kcal/h) and a burner are installed in the boiler-house. To start up the system it is necessary to install an extension tank, safety valves, manometers, a heat meter, to adjust the equipments and conduct a hydraulic test of external and internal networks.

4. KAMO DISTRICT

The system was designed to provide heat to 8 multi-apartment buildings (465 apartments) in Kamo district.

There are 4 “Ecoflam” boilers (735 kW) with duel-fuel burners of the same model installed in the boiler-house.

To start up the system it is necessary to install extension tanks, safety valves, manometers, a heat meter, to do repair of all the equipments and conduct hydraulic test of the external and internal networks.

Internal networks have serious defects: a part of the internal pipeline is laid under the floor of the first-floor apartments, which does not allow to repair or maintain that definite part of the pipeline.

The 4 abovementioned heating systems can be listed among the pilot projects implemented by the Residential Heating Project, since it is possible to provide heat to 14 multi-apartment buildings with minimum investment.

Central heating system in “Mush” district close to “Ani” can also be added to the pilot projects. There are 8 boilers of “Facel” model with 8MW total capacity installed in the boiler-house.

The system operated only 45 days during 2004-2005 heating season and stopped because of non-payments. The system was operated by a private company. It has several technical defects and only after eliminating those defects it will be possible to restart the boiler-house and ensure sustainable operation of the system.

ASHOTSK

01.12.2005: meeting held in the administration buildings of the town with the Head of the community Mr. Abreyan.

This region has the most severe weather conditions in Armenia (Degree days of heating is the greatest in Armenia-4918) and it used to be heated from the only boiler-house with15 MW installed capacity which supplied heat to 51 buildings, including 31 two-storey, wooden multi-apartment buildings. It was operated until 1994. This system is absolutely invalid now and we can foresee no probability of rehabilitation.

Population of Ashortsk is 2.8 thousand. It has not been gasified yet, it is anticipated that gasification activities will start in late 2006. People have found individual solutions to heating problems, mainly using manure (approx. 60%) and firewood (approx. 30%). Use of electricity for heating purposes makes less than 10 %. Market price for firewood is 16 thousand AMD per/ m^3.

Main occupation of the inhabitants is cattle-breeding as well as farming (agriculture) to get silage. Socio-economic conditions are extremely low.

Taking into consideration the existing situation which is conditioned by the lack of natural gas, poor social conditions, lack of functioning condominiums etc, it is obviously pointless to implement either technical assistance or rehabilitation projects in Ashotsk.

SYUNIK MARZ

KAPAN

Meeting held with the Mayor of the city, Mr. Karapetyan.

Population of the city is 45000, number of multi-apartment buildings – 252.

Until 1992 multi-apartment buildings of the city received heat from 2 boiler-houses that practically don’t exist today. About 40% of the buildings are gasified, the rest of the buildings are being gasified.

Our Project team has visited many districts and identified districts with possibility of implementing pilot projects there:

1. District next to Mushegh Harutyunyan Street: comprises six 9-storey buildings (216 apartments). The district is gasified and there is a convenient place for constructing a boiler-house. There is a school in the neighborhood and it doesn't have a central heating system.
2. District close to the aforementioned one: comprises five 7-storey multi-apartment buildings (approx. 300 apartments) and is gasified.
3. Railroad district: comprises four 9-storey and one 5-storey multi-apartment buildings (approx. 240 apartments). Gasification of the district will be completed by he 3rd quarter 2006.
4. Melik Stepanyan district: comprises six 9-storey multi-apartment buildings (216 apartments) and is gasified.

GORIS

Meeting held with the Deputy Mayor Mr. Ter-Mkrtchyan.

Population of the city is 23400, number of multi-apartment buildings-110, mainly 4-5 storey buildings. Empty apartments: 20-25%. 40% of the apartments are gasified. There are no Condominiums in the city. "Goristnt" close joint stock company renders communal services to multi-apartment buildings (rubbish disposal, lighting etc.)

There are 12 boiler-houses that belong to the Municipality.

The Mayor of the city promised to discuss the issue with the rest of the Municipality members and to provide us with the list of buildings with possibility of inclusion into the list of pilot projects.

SISYAN

22.11.2005: meeting with the Head of the Municipality staff, Mr. Dadashyan.

Population of the city is 15000, number of multi-apartment buildings-76. 70% of buildings are gasified. 20% of apartments are empty. There are 3 Condominiums officially registered, which unfortunately don't function.

There used to work 5 boiler-houses in the city, which are alienated at the moment.

According to the Municipality members socio-economic condition are extremely low and it is obvious that the implementation of the loan project is impossible.

Lilit Margaryan, a business lady from Sisyan got interested in the heating projects and promised to submit an exact proposal after market analysis.

VAYOTS DZOR MARZ

EGHEGNADZOR

28.10.2005: meeting with the City Mayor, Mr. Babayan and Head of the department of communal services.

In 1980s there was one centralized heating system in the city with 16 MW installed capacity and two steam-boilers. It supplied heat to 31 residential buildings as well as several administrative buildings. The boiler-house has later been totally scrapped and converted into a gymnasium. There are no running boiler-houses in the city nowadays.

Registered population in Eghegnadzor is 10.2 thousand; number of residential multi-apartment 2-5 storey buildings is 36, number of condominiums – 2.

Multi-apartment buildings are 100% gasified, and almost 80% of apartments are gasified. There are three kindergartens and 6 educational institutions. The main forms of occupation of residents are agriculture, wine-making and cheese-making.

During our visit to the site of the former boiler-house the Project team identified 2-3 comparatively small micro-districts with the possibility of running an autonomous system, especially if taking into account the existence of schools and kindergartens in the neighborhood. Additional surveys are needed for the final conclusion.

VAYK

28.10.2005: meeting with the members of Municipality.

The city used to receive heat from one boiler-house with 37 MW installed capacity, equipped with 3 steam-boilers. It supplied heat to 63 buildings, 30 out of which were residential. It does not operate now.

Number of population registered in the city is 7000. Multi-apartment buildings are totally gasified, but it is hard to estimate the gasification level of apartments (meeting appointed with the members of ARG branch in Eghegnadzor didn't take place.)

As a result of the visit to the district with multi-apartment buildings, which used to receive heat from a central boiler-house through a substation located there, our specialists found out that neither a centralized system not an autonomous boiler-house could be appropriately operated in that district with low density of heat demand. It is inexpedient both from the economically and from the point of affordability. Rehabilitation of heating systems in Vayk should be directed towards individual heating options.

JERMUK

13.12.2005: meeting held with the Mayor of the city, Mr. Markosyan and other members of the municipality responsible for communal services.

Until 1980s the city was provided with heat from two large-scale and three medium-scale boiler-houses with 82 MW total installed capacity. These boiler-houses were equipped with medium scale steam-boilers and cast-iron water-boilers and used to supply heat to 48 residential buildings. Central heating was gradually stopped in 2000/01 heating season.

All the 5 boiler-houses, including the largest one with its two sub-stations were privatized.

Municipality bought 907 gas heaters of Iranian production and gave them to the residents without any compensation in order to escape deforestation in that region famous for its sanatoriums.

Condominiums are on the state of establishment.

Residents are well-aware of the importance of nature protection in their region, since the prosperity of their city is highly dependent on nature as a health resort city. Respectively, the residents are for the rehabilitation of centralized or autonomous heating systems, though they showed no enthusiasm in having their commitment for the implementation of the project.

In the current stage it is considered premature and pointless to make any business proposition for rehabilitation of heating systems in the city of Jermuk.

ANNEX 2. POTENTIAL USAID SUPPORTED HEAT ENERGY PROJECTS

No	City	Address	Project Name	Description of Restart Project with Minimum Investment	Investment Estimate	Expected Results	
					$	Description	Number of apts
USAID Financially Supported Identified Restart Projects with Minimum Investment							
1	Gyumri	Khrimyan Hayrik Street , 5a, 3a	Heat Supply Startup	Recently build boiler houses for two residential building was never commissioned. Project will assist residents with legal issues related to the ownership and operation, to deal with municipality as an owner, and to deal with gas and water utilities. Project will assist with organizing final testing and commissioning of the system, setting correct and transparent accounting and setting the payment collection mechanism. Education of residents about heating and its costs, benefits and disadvantages, as well as need to pay for the services will be a substantial part of this effort.	8,100	- Ownership and contractual issues established (transfer, contracts, Charter, etc) - Condominium created and functional, capable of sustainable operation of the heating system - Operation of the system established (technical, management, accounting, collection, etc.) - - Heat supply system operation sustainable with high collection rate and proper service.	160
2	Gyumri	Kamo District	Heat Supply Startup	This project similar to the boiler house starting in Khrimyan Hayrik Str. except that it is substantially larger, serves total of 8 buildings and emphasis will be put on working with the condominium.	18,050	Same	465
3	Gyumri	Shahinyan	Heat Supply Startup	This boiler house serves only one building with 80 apartments. This	2,750	Same	80

No	City	Address	Project Name	Description of Restart Project with Minimum Investment	Investment Estimate	Expected Results	
					$	Description	Number of apts
				project will attempt to organize the heat supply startup with substantial involvement of the residents (condominium), providing only necessary support. Using the (hopefully) success story from the previous projects as motivation, it is expected that our project team will assist with technical and legal help as needed.			
4	Gyumri	Khrimyan Hayrik Street , Bldgs 4, 6,6a	Heat Supply Startup	This project will assist residents of three buildings to obtain heat by the same approach as used for the previous project	8,850	Same	140
5	Spitak	Central District No. 1	Heat Supply Startup	This relatively large BH was built and never commissioned. It is excessively large and limited technical information exists. Project will perform technical audit of the system, locate its technical documents, asses the current load and corresponding capacity requirement. Based on results, BH capacity will be reduced by disconnecting boilers not needed (potential to move them to other location where boilers are needed), work with the users and establish the operation. This project will require reduction of the BH capacity in order to operated without a	27,100	- Project would assist the community to better understand the heating issues and steps which need to be taken - Project would develop community heating strategy to guide the system owners, residents, and operators	267

No	City	Address	Project Name	Description of Restart Project with Minimum Investment	Investment Estimate	Expected Results	
					$	Description	Number of apts
				special license (required over 5 MW) and it will also be very demanding on working with the users, as it serves large number of buildings.			
6	Chatentsavan	District No. 6 Building No. 2	Heat Supply Restart	During the previous activities of demonstration projects (by EU agencies), boiler house was constructed and operated for some period of time by ARG. Most likely due to poor management (technical and financial), the BH seized to operate. This project would attempt to provide technical and management support to the residents to restart the boiler house and provide heat to the connected building. Project will aim at setting up a sustainable management scheme and proper and efficiency operation and maintenance. The installed capacity of the boiler house it is enough to connect neighboring similar type building.	TBD	This project will result in restarting the heat supply to one building and in sustainable operation.	46
7	Vanadzor	Tigran Mets Str.	Heat Supply Restart	Boiler Houses is located close to municipality building and providing heat 3 administrative and one residential building.(including town hall, marzpetaran headquarter) Installed capacity 3.6MW. Two Russian made boilers each with capacity of 1.8 MW. This capacity is	TBD	This project will result in expanding the heat supply to several buildings and in sustainable operation.	TBD

No	City	Address	Project Name	Description of Restart Project with Minimum Investment	Investment Estimate	Expected Results	
					$	Description	Number of apts
				more than enough to provide at least 6 residential buildings. This project will provide technical assessment and financial support.			
8	Aparan	Buildings No 8,10 Bagramyan Str	Restart	Boiler house build previously is now not in operation mainly due to non payment. Two buildings were heated during heating season 2003, After that season ARG disconnected gas supply.	TBD	This project will result in restarting the heat supply for building, in more efficient operation and improved maintenance of equipment, as well as in sustainable financial management	56
9	Nor Hachn	City Center	Re-connection	Boiler Houses is located close to municipality building and providing heat for four 9-story residential buildings with 144 apartments. Total installed boiler capacity in BH is 1.8MW. (Two Russian - made boilers each with capacity 0.9). This capacity is sufficient for heat supply to additional three 5-story residential buildings with about 140 apartments, which were supplied by heat from this BH until 2004 and disconnected due to non – payment by residents. This project will provide technical, management and financial support.	16,600	This project will result in restarting the heat supply for three building, in more efficient operation and improved maintenance of equipment, as well as in sustainable financial management.	140

USAID Financially Supported Identified Restart Projects with Considerable Investment

1	Gyumri	Mush District	Restart	The boiler house serving the Mush District is an older facility equipped	TBD	This project will result in upgrading the boiler house	500

No	City	Address	Project Name	Description of Restart Project with Minimum Investment	Investment Estimate	Expected Results	
					$	Description	Number of apts
				with eight Russian-made boilers with oversized capacity of 1 MWt each (total of 8 MWt). This boiler house was operated by the municipality until the last heating season (2004/2005) and due to a high level of non-payment, it was shut down. The Project Team will attempt to reinstate the heat supply to the served buildings through a comprehensive assessment of the available options, retrofit of the BH with limited number of boilers, and installation of modern high efficiency burners and operational controls (temperature, flow).Apparently, this project offers multiple solutions and will require thorough investment feasibility assessment to arrive at the most economical heating option for the community.		with modern control, efficient burners and pumps and other miscellaneous equipment and in providing heat to apartments at lowest attainable cost of heat.	
2	Vanadzor	Taron 4	Restart	This boiler house built in 2003 to provide heat to 52 residential buildings was operated by the municipality for only one season and the operation ceased due to non-payment. The residents are not organized in a formal condominium association. The project has an excessively large boiler house structure (former	TBD	This project will result in upgrading distribution system, the boiler house upgrades with modern control, efficient burners and pumps and other miscellaneous equipment and in providing heat to apartments at lowest attainable cost of heat.	600

No	City	Address	Project Name	Description of Restart Project with Minimum Investment	Investment Estimate	Expected Results	
					$	Description	Number of apts
				central heating system substation). With two 1.8 MWt Russian made hot water boilers, and one steam boilers with capacity of 1 t/hr of saturated steam. The steam boiler is not usable for space heat supply, as the efficiency is very low. The two hot water boilers are in relatively good condition (operated for only one season), burners, pumps and basic safety components need to be upgraded. However, the majority of technical work is expected to be in audit, rehabilitation and commissioning of the distribution system serving 50 connected buildings. Substantial effort is expected also to mobilize the residents.			
3	Charentsavan	Bldg. No 40 and 41	Restart	The boiler house was built by the municipality to provide heat to two residential buildings ceased operation several years ago and is now in a deteriorated state. All equipment was removed except for the boiler's main body which remains in the boiler house. Original construction was very poor, even without concrete floor under the boiler. The Project Team will have to		This project would result in completely retrofitted boiler house and improved distribution system, improved management and sustainable operation.	80

No	City	Address	Project Name	Description of Restart Project with Minimum Investment	Investment Estimate	Expected Results	
					$	Description	Number of apts
				provide substantial technical assistance and investment into the boiler house equipment, assessment of the current load. Substantial work needs to be done to educate the users about their heating options and their respective advantages and disadvantages, so they can make educated decision about receiving heat from the BH. The work with residents is very important on this project, as such attempt to provide heat already failed before.			
4	Aparan	Bagramyan Str. No 12	Completion and Commissioning	This boiler house was built by the municipality under Government assistance funds but was never completed and commissioned. Some components such as pump, burner and even stack pipe are supposedly in storage to prevent theft. The condition of distribution pipes and radiators within the building are unknown and need to be inspected and, if necessary, repaired. In order to bring the boiler house and the heating system into normal operating condition, a substantial technical effort and investment are anticipated. This building is supposedly managed by functioning condominium.	TBD	This project will result in upgrading the boiler house with modern control, efficient burners and pumps and other miscellaneous equipment and in providing heat to apartments at lowest attainable cost of heat.	32

No	City	Address	Project Name	Description of Restart Project with Minimum Investment	Investment Estimate	Expected Results	
					$	Description	Number of apts
				The project effort will include design and technical specification of required parts and materials, implementation support to bring the heat energy system to standard condition, work with the condominium association to mobilize the residents and introduce a workable financial management model for efficient heat supply operation, and support in training the operators and accountant.			
5	Aparan	Bagramyan Str. No 14		This project is virtually the same as the one on Bagramyan Str 12	TBD	Same as previous	40
6	Aparan	Bagramyan Str. No 46a, 46b		This project is very similar to the previously described projects, except for it large size. The boiler house has two boilers and serves larger number of apartment in two adjacent buildings	TBD	Same as pervious	50
7	Nor Hachn	Gay Street No. 3 and 5		This boiler house used to serve two residential building and one smaller commercial building and ceased its operation two years ago due to non payment. Project will require technical audit of the boiler house equipment, external distribution network and mainly the assessment of internal heating system, which may require total replacement.	TBD	This project will result in retrofitted system and its sustainable operation	80

No	City	Address	Project Name	Description of Restart Project with Minimum Investment	Investment Estimate	Expected Results	
					$	Description	Number of apts