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Cogeneration Based District Heating Restoration Project in Avan District of Yerevan, Armenia

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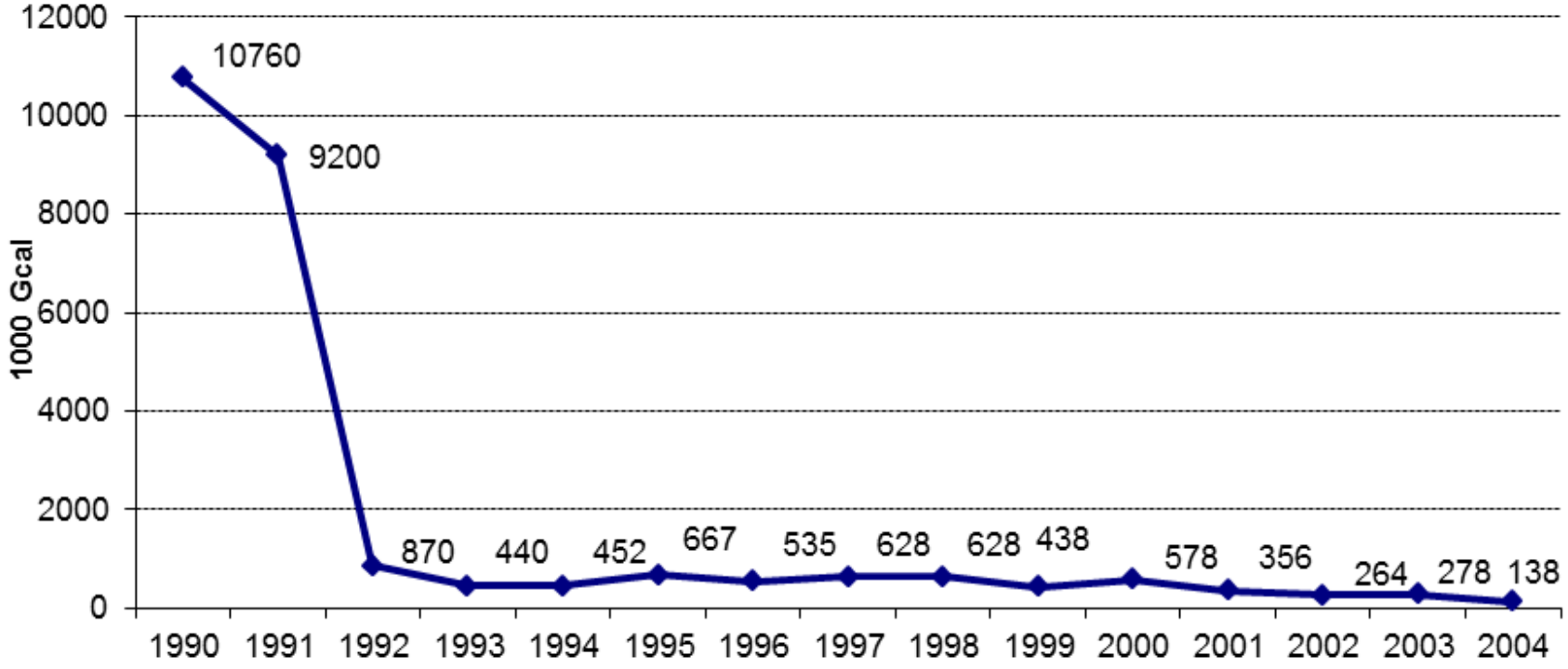
UNDP-GEF Project "Armenia – Improving Energy Efficiency of Municipal Heating and Hot Water Supply"

Heat Energy Production by District Heating Systems in Armenia, 1990-2004



State Policy on Heat Supply in Armenia

State policy on heat supply – RA Government Decision "On Reforms in Heat Supply to the RA Residential Areas", 2002

Goal - provision of affordable and high quality heat to the population by reforming the sector on the principles of:

- Energy efficiency
- Energy saving
- Reduction of negative impact to the environment

Mechanisms - creation of favorable legal framework and an environment for attracting private investments, state support and promotion

Reality - the adoption of the Strategy did not result in any significant changes in the heat supply sector and the population continued to rely on individual solutions to cover their heating needs.

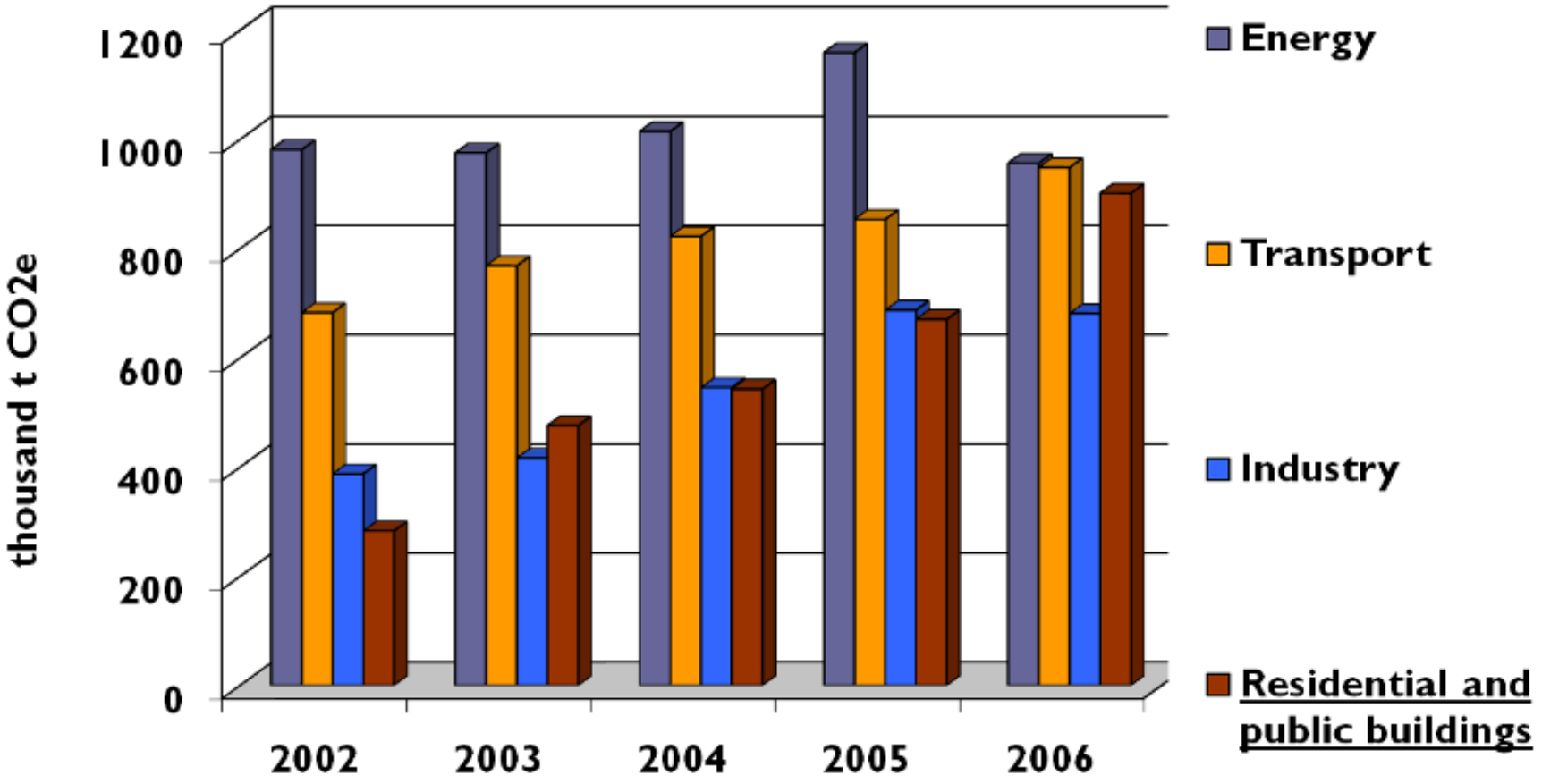
Heat Supply Sector Baseline Situation at the Project's Start

- The district heating system had actually collapsed: heat generation by district heating systems in 2005 fell to about 2.5% of that in 1990;

- There was no regulations or authorised body designated responsibility for the sector, no targeted social support and no financial support schemes;

- Expansion of the gas supply system and relaxation of safety requirements for using natural gas for heating purposes in multi-storey residential buildings stimulated the apartment level heating and hot water solutions.

GHG Emissions Dynamics in Armenia



Main Objectives of the UNDP-GEF Project in the Context of Sustainable Development

Environmental objectives

- Reduction (limitation) of GHG emissions from the heating sector

Development objectives

- Provision of affordable and high quality heat to the population
- Creation of the favorable legal framework and an environment for attracting private investments in energy efficient heat supply systems
  - Facilitating heat sector development, which responds to the current needs and market environment without jeopardizing the most effective long term development options
  - Increase responsibility of local authorities in provision of affordable utility services
  - Establishment of the solid base for GHG reduction policies in the context of the countries sustainable development

Why District Heating

District heating contributes to:

- Efficient use of fuel, which is of special importance for Armenia in the conditions of lack of domestic fossil fuel resources and increasing prices for imported natural gas,
- Reduction of hazardous substances and greenhouse gas emissions,
- Ensuring the safety and comfort in multi-apartment buildings,
- Housing stock preservation.

Master plan of the City of Yerevan for 2005-2020 provides for district heating restoration in five large residential areas of the city

Concept
of a UNDP-GEF Demonstration Project

- Recognizing the important role of the state in creating appropriate legal and regulatory framework, it was obvious that ***only the private sector participation will allow restoring the district heating.***

- ***In terms of the existing and forecasted prices for natural gas, district heating systems on the basis of heat-only boilers become noncompetitive*** compared to the individual heat supply solutions – ***hence the idea of cogeneraton was most economically and environmentally attractive .***

- The critical issue is to ensure investor confidence that he will get an adequate return on his investment. Therefore, the Project's efforts during development of the feasibility study were ultimately focused ***at reducing commercial risk while ensuring competitive and affordable level of heat energy for consumers.***

Brief Description of the Demonstration Project

Avan residential area was selected among those envisaged by Master Plan as the most feasible and prospective one due to high heat density. Avan cogeneration-based DH restoration project includes:

- Construction of green field autonomous energy centers with cogeneration units and heat only boilers to meet peak space heat load,
- Full reconstruction of main and distribution networks,
- Redesign of the internal distribution system in the buildings (from vertical distribution into horizontal one)
- Installation of new heating and hot water supply network and radiators equipped with regulators in the apartments
- Installation of apartment level heat and hot water meters for introducing consumption based payment system,

Approach: stage-by-stage implementation of the Avan DH system restoration. The first stage includes 76 buildings (3,350 apartments and more than 10,000 residents).

Reducing commercial risk (1)

- ***Pricing approach is*** based on Directive 2004/8/EC on the promotion of useful heat demand based cogeneration.
- Firstly, competitive and affordable heat tariff was determined on the ground of market research (comparison was done with the cost of heat from apartment level gas fired appliances).
- The revenue from heat sales were first taken into account and then the electricity tariff was calculated as the "left over" costs associated with running the cogeneration system and ensuring 12% IRR on the investments.
- The purchase tariff for electricity produced from cogeneration units was close to the calculated one-part tariff of the marginal Thermal Power Plant of the Armenian Power System.

Reducing commercial risk (2)

The adopted pricing approach reduced the commercial risk for investors by ensuring:

- a guaranteed revenue from electricity sold to the grid at the favourable tariff;
- competitive and affordable heat tariff ensuring high connection rate of the residents and consequently high revenue from heat sales.

During the 2011-2012 heating season, the heat tariff for Avan district heating system was 16 AMD/kWh, while the cost of heat produced by apartment-level boilers was about 23 AMD/kWh (investment and operation costs), and for closed chamber gas-fired heaters only the gas costs amounted to 17 AMD/kWh.

State Support to the Implementation of the Demonstration Project

- Using these calculations as a basis, a special Decision of the Government of Armenia No.509-N was adopted on 13 April, 2006, which recommended to the Public Services Regulatory Commission to set a favorable purchase price for all electricity produced from the cogeneration units of the Avan pilot project during the first five years after commissioning of the cogeneration units.
- It specifically influenced the investment decision of a Russian investor and in August 2006, a heat supply company, “ArmRusCogeneration” CJSC, was founded with the majority of shares owned by one Russian investor and the minority held by the Municipality of Yerevan.

Municipal Support to the Implementation of the Demonstration Project

- ***The public-private partnership scheme*** justified by the Project led to hand over the heat supply assets of Avan district from Yerevan Municipality to the new heat supply company for the free use.
- **The Autonomous Thermal Power Plant was commissioned on 15 December 2009.** As of 2012, one CHP unit and one peak boiler had been installed to supply 30 apartment buildings, one school and two kindergartens.
- By 2012, approximately USD 9 million had been invested in the Avan district heating restoration project.
- Financing for the follow-up phase (connecting the remaining 46 buildings of 76 under the first phase of the project) is already approved by the investor.

Avan District Heating Pilot Project

Greenfield energy center

Cogeneration units:
2x2MW(e) and 2x2.18 MW(t)

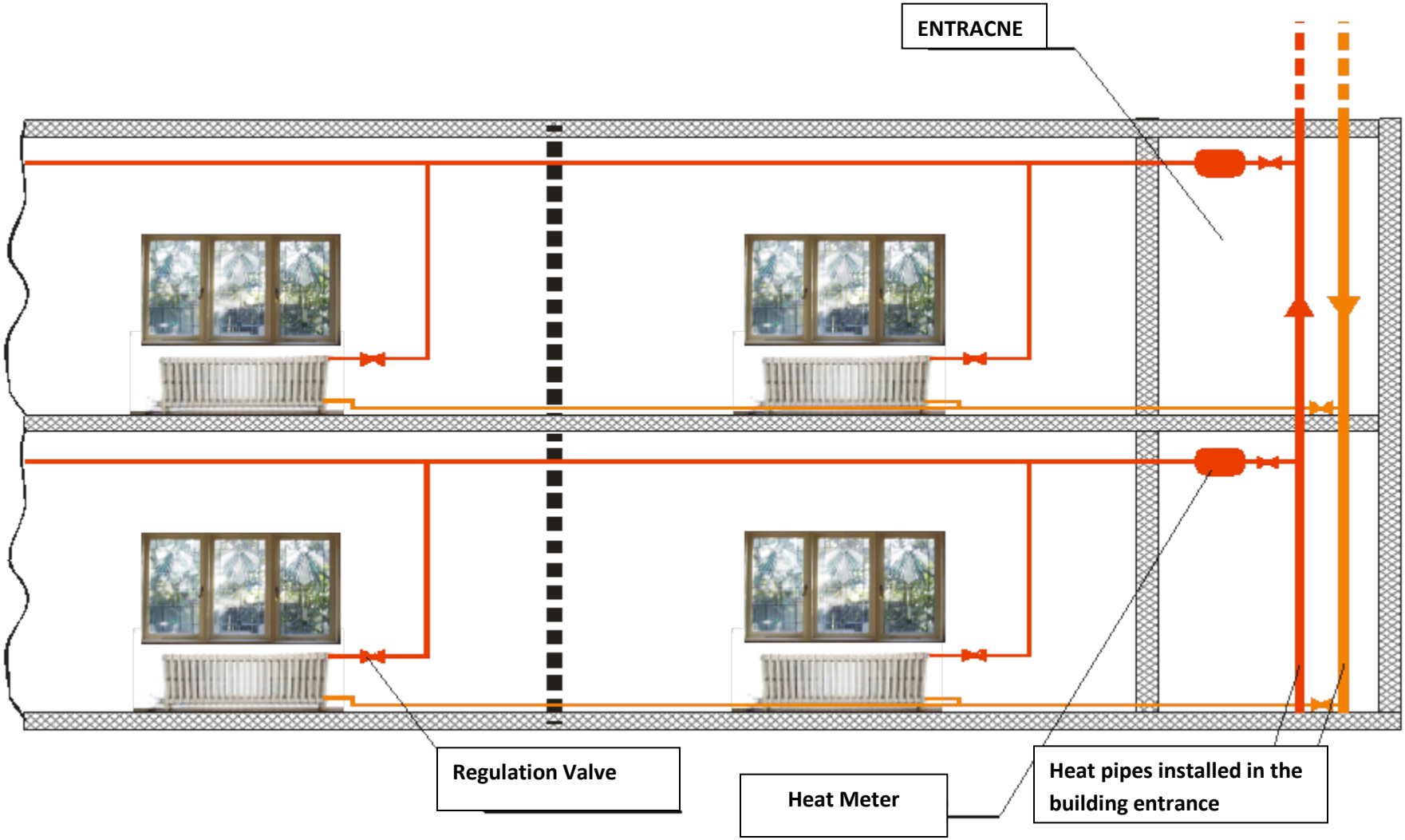
Peak heat-only boilers: 2x7.56 MW

Energy Saving and Mitigation of Commercial Risks

- ***The demand side regulation and consumption-based heating utility billing system*** was a first time introduced in Armenia. The payment system created incentives for saving heat energy and fostered economic relations between the supply company and consumers.

- ***A multi-part tariff*** system for heat and hot water mitigated the risks associated with a reduction in heat consumption. The system created incentives for demand-side energy savings, while simultaneously ensuring that the heat supply company recovers its fixed costs regardless of the consumption level.

Horizontal Internal Heat Distribution Network



Building Confidence and Expansion of Heat Supply Market

- ***Financing of the construction of internal networks*** in the apartments by the supply company was proposed by the Project with the aim to attract consumers to the DH system.
- This was considered as a soft loan to the house owners and should be recovered by a separate tariff rate. The experience of the last 2 years of the Avan project implementation confirmed the correctness of this arrangement. This measure contributed to the reduction of commercial risk through expansion of heat supply market and ensuring utmost revenue from heat sale.
- Project conducted awareness-raising activities on benefits of the new system and assuring residents that the associated lower tariff for heat energy would continue in the future.
- The dynamics of the connection rate: 18% in 2010; 25% - 2011; 37% - 2012; mid 2013 -45%

GHG emissions reduction potential

- Project emissions ensures 10,200 t CO_{2eq} /year for the first phase of the project (76 buildings) compared with the baseline scenario: of 75% apartment level natural gas-fired appliances and 25% electric appliances.

- The role of a Avan pilot project is of special importance for development opportunities of cogeneration based district heating projects in Armenia and attraction of private sector finance.

Thank you

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