

# Technical Study of Energy Efficiency Opportunities in the District Heating System in Constanta, Romania

## Background

In June 1999, E<sup>3</sup> International staff completed a *Pre-Feasibility Study for Constanta Municipal Energy Efficiency Investment Program* under the auspices of the Southeastern European Cooperative Initiative (SECI) program. E<sup>3</sup> International staff developed a commercially viable energy efficiency project that was designed to attract bank financing and meet the needs of the municipal authorities and other potential beneficiaries. E<sup>3</sup> International staff examined energy savings opportunities at district heating substations and schools. E<sup>3</sup> staff recommended a package of energy efficiency measures and provided two sets of alternative financing and ownership structures for project implementation.

### Objectives

- ❖ To review and assess the efforts to date by the district heating company (RADET) to increase energy efficiency of heating substations in Constanta and formulate new options
- ❖ Assess the district heating distribution network in Constanta; make recommendations regarding sale and/or rehabilitation of specific zones throughout the city.
- ❖ Review RADET plans for the use of natural gas-fired boilers in selected substations and cost installation at the substations as an alternative to increase energy efficiency.

## Methodology

### Task 1: Assessment of District Heating Distribution Network

E<sup>3</sup> International staff completed a top-level market assessment to identify assets that appear attractive for sale and to estimate probable capital formation from the sale.

E<sup>3</sup> International staff examined the Constanta distribution pipeline network, and identified sections of severe pipe leakage. E<sup>3</sup> International staff identified “geographic zones” in the city where comprehensive improvements are required, and defined and prioritized these improvements, completed an economic analysis that took into account possible capital formation from sale of selected assets, developed cost estimates for implementation of improvements, estimated energy savings from the improvements, and completed an analysis to quantify payback and risk.

### Task 2: Installing Natural Gas Boilers at Selected Substations

E<sup>3</sup> International staff completed a cost analysis to identify specific substations where natural gas-fired boilers are a cost-effective alternative to the central district heating system.



*Aerial View of Constanta, Romania*

## Results

### Primary System and Network

The “primary system”, CHP PALAS and the primary network was assessed for its capability to deliver sufficient heating to the substations and the end users. The hydraulic calculations of the primary system show that there is sufficient capacity, and after relatively small investment in circulating pumps and system balancing, all substations will have sufficient pressure and flow. Primary metering requires calibration and maintenance.

### Substations

RADET operates 134 substations in Constanta. RADET improved the substations by installing new plate type heat exchangers and replacing some internal piping. E<sup>3</sup> International staff recommended



continuing the upgrade by necessary re-piping and installation of equipment and controls. Proposed measures cost US\$10.4 million and provide an annual savings of US\$ 3 million, which is a 3.5-year payback.

## Secondary Pipes

The condition of secondary piping is not satisfactory. However the high cost of material and installation of underground piping (233 km of channels with four pipes) is a substantial investment. While replacement of secondary pipes has a very poor payback, it is crucial for operation of the district heating system and should be considered as a 'necessary cost'. Gradual, scheduled replacement of critical pipe costs US\$ 168 thousand.

## School Buildings

The municipality of Constanta owns and operates 123 schools. The most cost effective package combines weatherstripping, building level controls, thermostatic reduction valves (TRVs) and system balancing, showerheads and aerators, and heat meters. The proposed school improvements in aggregate have a cost of US\$ 1.8 million with annual savings of US\$ 242 thousand, which is a 7.3 year payback. However, it is important to note that investments in the schools include improvements of comfort in the schools and should be considered as 'social investments'.

## RADET's Gas Boilers

RADET prepared a list of 38 substations for conversion to natural gas-fired boilers. In 1999 two substations were converted. RADET is considering disconnecting the remaining 29 substations from the primary network and installing natural gas-fired boilers. Installation of gas boilers is not warranted based on insufficient capacity of the CONEL's primary system. A reduction in the cost of heat cannot be used as a basis for a decision on whether or not to install the gas boilers. However, relatively small changes in fuel prices (heavy oil and gas) could affect this result. The measures for operational improvements to the two RADET boiler houses costs \$31,800 and does not significantly affect the overall project feasibility.



## Additional Project Benefits

E<sup>3</sup> International staff concentrated principally on the least-cost technical measures, which would provide sufficient savings for a return of investments in a reasonable time period. However, there are a number of other benefits that are less quantifiable but provide value to all parties. These benefits include:

- ❖ **Reliable heat supply to consumers.** The project will extend the life of the district heating system and increase the reliability of heat supply to users.
- ❖ **Improved heat supply to other consumers.** The project will improve conditions for consumers and especially for end-users located at the northern part of the RADET district heating system.
- ❖ **Lower long-term consumer heat tariffs.** The return on investments may allow the municipality and RADET to lower heat tariffs (or raise heat tariffs less that would otherwise be necessary);
- ❖ **Improved comfort.** The project will increase temperatures and improve comfort in schools.
- ❖ **Technology and know-how transfer.** The project will introduce modern technology to Constanta and be a demonstration for heat providers located elsewhere in Romania. Also, RADET's staff will receive valuable technical experience in proper operation, maintenance and servicing of modern and energy efficient equipment.

## Implementation Plan

The implementation schedule of the \$20 million project is based on technical merit, a logical sequence, available construction capacity and available annual financing. A three year project implementation period is proposed, based on the size of the project and on the seasonal nature of the work. Much of the construction occurs in the summer months to minimize any inconvenience to end users.

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