Twinning project:
Improvement of energy efficiency in Turkey

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CHP and DH: important energy service

- District heating: a long tradition in Central and Eastern European countries

- CHP and DH have a large share in the heating market
  - They provide 60% of the buildings with heat and warm water
  - They account for 39% of the primary energy
    - 54% natural gas
    - 36% coal
    - 9% fuel oil and
    - 1% other forms

- Share of CHP in total heat supply varies
  - 16% in Hungary, 37% in Russia, 70% in Hungary and 96% in Slovakia
Problems associated with CHP and DH

● Inefficient
  • Cumulative heat losses in heat-only boilers and CHP during generation, transportation, distribution and end-use
  • Outdated equipment, overextended networks, overcapacities
  • Irregular peak service with subsequent shift of demand to electricity

● Unprofitable
  • Neither tariffs nor subsidies cover cost
  • Price distortions favor gas and electricity
  • Payment arrears are still a problem
  • Hence: lack of capital for repairs, meters
Problems associated with CHP and DH

**Governance problem**

- While a local service, the sector is determined by national policy (licensing, tariffs, fuel use)
- At prevailing losses, CHP not rational in terms of energy use in comparison with direct use of gas or electricity
- In CHP, the competitiveness of heat versus electricity output is biased (allocation of overheads, cross subsidies) in countries where electricity and heat markets are under different regulatory regimes
- Gas/electricity industry restructuring models cannot be replicated; access to grids must be structured and regulated according to local circumstances (Third Party Access, Single Buyer, economic merit order...).
Problems associated with CHP and DH

- **Economically not sustainable**
  - Insufficient investments/incentives to enhance efficiency
  - No full cost accounting and allocation
  - No optimization of local energy systems (= multi-fuel competition on the basis of life cycle cost)
  - Rise of tariff and distortion of gas and electricity prices led households to disconnect from DH systems and use either gas or electricity heating
Objectives

- Develop and promote tools and measures to overcome barriers
- Understanding of the problems related with upgrading and modernization of the existing systems
- Provide key actors with possible solutions to these problems

Restructuring policies following 5 lines of action

- From centralized public systems to a range of decentralized ownership and management models
- From vertical integration to unbundling and competition
- From subsidized, lump-sum tariffs to full-cost, metered tariffs
- From ad hoc decisions to internationally compatible legislation
- From DH-specific policies to local energy systems
Activities undertaken

- Understanding the organizational framework
  - In most CEEc, local government plays a key role in the DH and CHP sectors through ownership
  - Leasing, privatization and public-private partnerships to attract financial resources for system reform and refurbishment

- Price regulation and taxation
  - Independent regulatory bodies have been established to approve DH tariffs that reflect full cost recovery, including those for development and modernization

- Support and promotion mechanisms
  - DH rehabilitation and modernization financing mechanisms range from direct government support to third-party financing and capacity leasing
  - Private sector investment have an increasing importance, and in some cases, international financing bodies play a catalytic role
Activities undertaken

- Legislative and regulatory measures
  - Energy market reorganization and rule formulation for defining energy sector business activities
  - Energy sector restructuring
  - Reorganization and privatization
  - Increased energy efficiency through technological innovation

- Benchmarking
  - Comparison of technical and economic parameters amongst the different players and in different countries

- Financial options for CHP/DH development
  - Retrofitting of existing large DH companies with big capacity needs substantial investment
  - Price and tariff incentives and preferences for CHP have influenced the profitability of CHP projects
  - Different support schemes used as complimentary funding sources
Pre-accession Assistance Programme
Improvement of Energy Efficiency in Turkey, Twinning Project: TR03-EY-01

Lines of action

- From centralized public systems to a range of decentralized ownership and management models
  - such as municipal agencies, limited liability companies, joint stock companies, public/private partnerships, ESCOs, industrial self-producers
  - privatization is heralded as a means to access the capital market and expertise,
  - but impeded by old debt, receivables and political interference in tarification and investments

- From vertical integration to unbundling and competition
  - towards separation of generators and distributors even though this may complicate system operation
  - third party access to heat distribution grids is not practiced
  - competition from gas
Lines of action

- From subsidized, lump-sum tariffs to full-cost, metered tariffs
  - *despite substantial increases of heat prices, full cost coverage and elimination of producer subsidies has been attained only in the Baltic States*
  - *implications of tariff rises: social hardships, payment arrears, surge of self-production, surge of peak demand for electricity and disconnection from DH systems*
  - *cross-subsidization still prevails between industrial and residential, and small and big industrial customers*
Lines of action

- From ad hoc decisions to internationally compatible legislation
  - laws have now been enacted on energy, environment and efficiency
  - Specific DH/CHP laws exist in Hungary, Latvia, Lithuania
  - regulatory authorities (national, provincial or municipal) to deal with DH/CHP
    - Licensing, tariffs, development planning and incentives for renewables, co-generation and efficiency improvement (audit, building codes)
  - policies aim at approximation to EU policies and standards
  - the provisions of the Energy Charter Treaty on non-discrimination of foreign investors (land ownership, concessions, licenses, dispute settlement) are applied except in Bulgaria
  - assistance through PHARE, USAID, IBRD, EBRD

- From DH-specific policies to local energy systems
  - Poland and Romania oblige municipalities to develop policies for local energy system
Highlights of some national features

- Highlights of selected countries
  - In Belarus, DH/CHP was operated centrally; households covered only 10% of costs
  - In Bulgaria, producer subsidies were withdrawn in 2005; dual tariffs (for capacity and use) were advocated to improve payment discipline
  - In the Czech Republic, heat supply was decentralized, but suffered from cross subsidies in favor of gas and electricity for small consumers; a cost-effectiveness audit was necessary for new or rehabilitated CHP projects
  - In Estonia, no subsidies for heat suppliers, but only for low-income customers
  - In Hungary, the District Heating Law stipulated that household customers can only cancel a heat supply contract if all flat users (owners) concur; full metering was expected by 2005, with estimated savings of 15 - 25%
Highlights of some national features

- **Highlights of selected countries**

  - In Latvia, most DH facilities were owned by municipalities; privatization was hampered by receivables, old debt and insolvency

  - In Lithuania, a first effort at privatizing Kaunas CHP on the basis of a lease agreement failed for lack of compliance of bidders with the terms of the tender; in 2001 another tender was launched by way of selling assets

  - In Macedonia, the privatization of the DH company serving Skopje was successfully launched on the basis of a workers-buy out, with shares now traded on the stock market

  - In Poland, about 3000 companies supplied heat to customers; the major issue was the setting of prices below cost thereby impeding competition and market entry of private investors
Highlights of some national features

• Highlights of selected countries
  - In Romania, losses exceed 50%; DH and CHP plants were decentralized for reducing the number of operators, attracting private capital and forming public-private partnerships; old debt was eliminated or postponed; three agencies regulated the grid-based energies
  - In Russia, CHP saved 15 million toe per year; small wood- or peat-based cogeneration units of 0.3 - 6 MW capacity were made available to serve small, remote cities
  - In Slovakia 1200 heat suppliers operated with a tendency towards mergers; heat supply subsidies for households were to cover the difference between costs and tariffs if they were regularly paid
  - In Slovenia, CHP was expected to contribute, by 2010, to the major part of a doubling of electricity production from plants with high efficiency or utilizing waste or renewable sources
Russia’s transition to EE district heating

• **District heating statistics**
  
  • *Huge market for DH as it supplies over 70% of Russian households with heat and hot water*
    
    • DH equivalent of 2.7 million GWh per year
    • 485 CHP plants
    • More than 190,000 large boilers
    • 600,000 individual heat generators and boilers
    • Network with a total length of 1.8 million km

• **Main problems**
  
  • High production price of heat due to considerable losses
  • Major part of the network consists of uninsulated pipes
  • No use of decentralized thermostatic heating regulators in public buildings or residential homes
Russia’s transition to EE district heating

- **Overall challenge**
  - *How to speed up the modernization of the DH system?*
    - In the past, municipalities subsidized district heating to make the service affordable to the users
    - Consumers were not motivated to save or reduce energy

- **Main challenge**
  - Creation of a transparent market where there is
    - a clear distribution of responsibilities,
    - clear ownership of networks and installations, and
    - a clear incentives for seeking the most energy-efficient heating applications
  - Things are moving in the right direction but there are still many **technical, legislative and cultural** obstacles
Russia’s transition to EE district heating

- Technical challenge
  
  *Present status*
  
  - Hot water circulated at high pressure and temperature (140-150°C into distribution stations)
  
  - Direct distribution of heated water into the buildings at 120°C
  
  - Little or no control of pressure or flow in the network
  
  - In case of leaks, the damage can be considerable
  
  *Western European practices*
  
  - Distribution temperature is a lot lower
  
  - Pressure and flow are under strict control
  
  - There is normally a primary network for heat distribution to the buildings and a secondary network for heat distribution within the building
Russia’s transition to EE district heating

- **Technical challenge**
  - *Introduce dynamic solutions for pressure control*
    - In sub-stations which connect buildings to the district heating network
    - In the buildings and networks themselves
  - **Expected outcomes**
    - Stabilize the systems and drastically reduce the heat loss
    - Stable pressure and flow control will help in
      - **precise measurement of individual heat consumption**
      - *Improving awareness of energy efficiency among people*
Russia’s transition to EE district heating

- Technical challenge

  - *Problems with the existing systems*
    - In case of leaks, the damage can be considerable
    - End-users often feel tempted to draw hot water for household purpose directly from the radiators instead of water taps because it is the cheapest and fastest access to boiling water
    - Lack of pressure and flow control system makes the heat supply unstable and inconvenient

  - *Use of water elevator to control temperature and flow of water circulated into a building’s heating system*
    - Reduce the temperature of heated water entering the building by mixing the incoming hot water at 120°C with water exiting the system, resulting in design temperatures of 95 to 105°C
Russia’s transition to EE district heating

• Case study: Renovation project in Moscow

  • Situation prior to renovation
    • No equipment for pressure control in the system connected to a 7-storied 83-apartment building
    • Users suffered from overheating and tried decreasing the indoor temperature by opening windows

  • Renovation process
    • Substation installed with heat exchangers, circulating pumps and electronic weather compensator to adjust hot water temperature according to the outside temperature
    • Adoption of balancing valves, control and measuring devices in each apartment for billing individual apartments
    • Thermostatic regulator installed on the supply pipe of every convector
Russia’s transition to EE district heating

- **Case study**: Renovation project in Moscow
  - **Main results after renovation**
    - Better thermal comfort due to automatic weather compensation and the use of thermostat to suit the needs of the end-users
    - Decrease in the household heat consumption by an average of 30-40%
    - Corresponding decrease in the amount paid by the end-users

- **Relevant solution for the future**
  - Move away from large, centralized substations
  - Use pre-fabricated modern substations in one block, with
    - Heat exchangers, weather compensators, dynamic pressure controls and metering equipment
District heating in Romania

- Heat supply in Romania
  - Some statistics
    - Approximately 31% of the country’s building stock receives its heat and hot water from DH systems (it is 58% in urban areas)
    - DH accounts for 30% of the country’s total heat and hot water demand
    - DH market in Romania is sub-divided into DH by CHP and heat-only plants
    - Biggest heat producer is the Romanian power supplier Termoelectrica (10 000 GWh, representing 32.2% of the total)
    - Termoelectrica does not operate in the DH market; DH operator RADET Bucharest (under the Ministry of Industry) holds a 33.4% share of the total DH market
    - 36 heat operator (of a total of 179) cover 90.4% of the market
District heating in Romania

- Heat supply in Romania
  - Some statistics
    - Total installed capacity: 29 GW (actually used: 17 GW)
    - 76% of heat generating plants are equipped with heat meters
    - DH network of 11400 km out of which 3450 km (29%) are primary networks
    - Fuel for district heating
      - Coal (46%), natural gas (39%) and heavy fuel oil (7%)
    - Peak demand for DH produced by heat-only boiler while base load is met by
      - CHP installations
      - Back-pressure steam turbines delivering steam mainly to industrial consumers
      - Extraction-condensing steam turbines delivering hot water
District heating in Romania

- Heat market and the role of DH
  - Romania’s DH network
    - Constructed when energy price was low
    - Technology now is outdated and are incompatible with the objectives of minimizing losses
    - Insufficient provision of essential municipal infrastructure and services
    - Inadequate financial performance and significant inefficiency in service provision
    - Deteriorating facilities due to under-investment in maintenance and replacement
District heating in Romania

- **Heat demand and consumption**
  - *Continuous decrease of heat consumption by households*
    - In 2001, 2.94 million apartments representing 6.9 million inhabitants were connected to DH systems.
    - By the end of 2003, the number had gone down to 1.92 million connected apartments representing 5.5 million inhabitants.
    - High disconnection rate is due to the
      - *Poor customer experience with the supply of district heating in the past*
      - *Strong competition with natural gas which is available at a low price for domestic cooking*
  - Gas-based single-unit heating systems are on the rise due to the aggressive commercial activities of the producers.
District heating in Romania

- Some drawbacks of the present system
  - Very large and inefficient electrical and thermal capacities, which are not flexible and cannot be customized to individual users
  - Poor match between heat demand and heat generated
  - Low technical efficiency and high energy losses
  - Inadequate consumption-based heat billing
  - Transport pipes with high heat losses
  - Poor quality of district heat water, corroding the pipes
  - Inefficient heat exchangers
  - No means for the consumers to control their consumption level
  - Lack of monitoring system for regulating system operation
  - Poorly designed buildings with high heat losses
District heating in Romania

- **Need of the hour**
  - *To make DH cost-effective*
    - Investment needed to modernize heat generation facilities, renovate distribution networks, and install equipment such as regulators and meters at substations
    - To meet environment and public health standards, investment needed to convert boilers from running on coal to other fuels
  - *Developments with positive impacts*
    - Romania’s accession into the European Union
    - Rapidly emerging municipal interest in bringing private involvement into municipal and environmental infrastructure
    - Reform of the financial system for the municipal infrastructure
District heating in Romania

- Institutional framework & private sector participation
  - Municipal energy plan
    - Local administration and government ministries showing interest in developing municipal energy plan with the aim of
      - Identifying potential investment project
      - Strategic measures in the development of DH systems and their techno-economic optimization
  - Key market players
    - State authorities and relevant regulating bodies
    - DH companies, associations (including COGEN Romania) and promoters
    - Housing associations
    - Housing associations