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PLOIEŞTI

Instrumente Structurale 2007 - 2013

Improving Energy Efficiency in PLOIEȘTI Romania

ROMANIA
REGIONAL DEVELOPMENT PROGRAM

TRACE City Energy Efficiency Diagnostic Study

Municipal Buildings | Water and Wastewater | Solid Waste Management | Public Transport | Public Lighting | Power and Heat

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Inițiativă locală. Dezvoltare regională.

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TRACE (Tool for Rapid Assessment of City Energy) was developed by ESMAP (Energy Sector Management Assistance Program), a unit of the World Bank, and is available for download and free use at: http://esmap.org/TRACE.

ROMANIA
REGIONAL DEVELOPMENT PROGRAM

ESMAP
Energy Sector Management Assistance Program

Executive Summary

Why a study on energy efficiency?

The main impetus for this report (and for the reports prepared for the other six growth poles) is a request received from the Ministry of Regional Development and Public Administration. The request came within the context of on-going preparations for the 2014-2020 Programming Period, with Energy Efficiency being one the major themes of the Europe 2020 strategy, and a critical priority for all EU Member Countries. Within Romania, local authorities that will want to access energy efficiency funds under the 2014-2020 Regional Operational Programme will need to first prepare energy efficiency strategies. The TRACE tool is specifically targeted at local authorities, and is a good instrument for drafting such strategies.

What is TRACE?

The Tool for Rapid Assessment of City Energy (TRACE) is a simple and practical tool for conducting rapid assessments of energy use in cities, The tool helps prioritize sectors with significant energy savings potential, and identifies appropriate energy efficiency interventions across six sectors—transport, municipal buildings, water and wastewater, public lighting, solid waste, and power and heat. It is a simple, low-cost, user-friendly, and practical tool that can be applied in any socioeconomic setting.

The advantages of TRACE

TRACE is one of the most powerful energy efficiency tools, specifically developed for cities. It is simple, easy to implement, and quite intuitive, and it allows a quick assessment of energy savings potential in six key public service areas: urban transport; water and wastewater; municipal buildings; street lighting, power and centralized heating; and, solid waste management. The tool can be implemented relatively quickly and is not data- or cost-intensive. Moreover it allows local authorities to get a rapid assessment of their city's energy performance, and to identify sectors that may be subjected to a more in-depth analysis.

The limitations of TRACE

The fact that TRACE is simple and easy to implement, also means that there are limitations with respect to the depth of analysis. For example, the tool may identify District Heating as the a priority sector in terms of potential energy savings, but it does not go into detail on the required costs to complete district heating rehabilitation projects. Thus, even if the energy savings potential is assessed to be high, the costs may be even higher, and an investment in the sector may not be warranted. Similarly, although TRACE specifically focuses on the service areas that fall within the purview of local authorities, the tool cannot factor in the institutional and legislative mechanisms that need to be in place to make a specific energy efficiency recommendation possible.

Boundaries of studied area

While this work focuses on the growth poles in Romania, the analysis was limited to the boundary of the center city. The reasoning for this is quite simple: it is prohibitively difficult to collect individual indicators for all the constituent localities of a metropolitan area. In most cases, this would have required in-depth discussion with over 20 localities, ensuring that all these localities had the required indicators for a particular service area, and ensuring that they used the same methodology for the calculation of these indicators. Nonetheless, the sector analysis and recommendations took the metropolitan scale into consideration, and the section on sound urban planning practices was done at the full metropolitan level.

Summary of findings

After the 1989 Revolution, Romania began its transition from a centralized system to a market-run economy. Today the country is a member of the European Union (EU) and NATO. After more than a decade of economic restructuring and political change, the country has taken significant steps towards catching up with the economic performance of more developed EU countries. Although radical reforms brought about significant changes in the recent years, the standard of living of Romanians is still behind the EU average.

Ploiești is one of cities where such disparities are less pronounced, because of its proximity to the capital-city, București (the richest area in Romania), because of its strategic trade location (along two

pan-European transport corridors) and, not in the least, because of the revenues generated by the oil refineries surrounding the city. Benefiting from the expansion of București's economic base, Ploiești has had a growing economy in the past years, although it has suffered from demographic decline as well as from the recent economic crisis. Currently, the city is part of the most densely populated and economically most well developed areas in the country, along the București-Ploiești-Brașov growth corridor.

The economic development in the transition period after the end of the communist regime has led to significant changes in the social and economic life of the residents of Ploiești. Some of these developments have positively affected people's life, whereas a few came along with some inconveniences and difficulties.

For instance, like everywhere in Romania, the increasing number of cars in Ploiești caused heavy traffic congestion, high fuel consumption, and significant greenhouse emissions. This has led to difficulties and inconveniences in commuting for both public and private transport, an area that the city government should address. The city requires more parking areas, new rolling stock for public transport with efficient fuel consumption, and more pedestrian friendly areas. Municipal buildings should be audited to identify the right measures to improve energy consumption in education and health care facilities administered by the City Hall. Despite of modernization and rehabilitation work that has been performed in the district heating sector, there are still obsolete heating pipes that generate water leaks and heat losses. On the other hand, although the water system is covering the entire city and all water connections are metered, some deteriorated parts of the water infrastructure are prompting losses in the network.

But there are significant things Ploiești has accomplished in the past few years. Perhaps the most noteworthy fact is that the district heating is among the top most efficient systems in the country, and as a consequence, residents in Ploiești pay the lowest price for heat in the country. All streets in the city are lit, and old inefficient bulbs have been replaced with modern, efficient ones. The transport network is well developed, connecting the city from one side to another, and with a number of recent upgrades of the rolling stock. The generation of solid waste is lower than in other cities in the region, selective collection is implemented at the household and residential buildings level and is going on well, and the landfill located outside the city is one of the most well performing in Eastern Europe. As elsewhere in Romania, most of the municipal buildings need rehabilitation work to decrease energy consumption and reduce heating bills. Nonetheless, thermal rehabilitation of residential buildings as well as some of the municipal buildings improved the overall energy efficiency. Electricity tariffs are regulated by the national government. The government is still subsidizing the energy price for domestic users. However, the liberalization of the energy sector has already started for the industrial users and will continue in 2013 with non-domestic clients. Subsidies are going to be gradually eliminated by the end of 2017, when the liberalization of the market will be complete. The central government is encouraging the energy production from renewable sources, and Green Certificates are provided to such producers.

The local government of Ploiești has a number of ambitious projects to develop the city, improve quality of life for its residents, and not the least, open the doors for more energy efficiency projects. Such plans include the rehabilitation of the tram lines, developing non-pedestrian networks, building park-and-ride facilities, purchasing non-polluting and energy efficiency buses, improving the street lighting system, and increasing the efficiency of the wastewater system.

The location of Ploiești along the București-Ploiești-Brașov growth corridor and its proximity to București should enable the capital of the most urbanized county to continue on a positive development path. This report is based on the implementation of the TRACE tool in February 2013, and it outlines some ideas on what the city could further do to improve its energy efficiency performance.

TRACE (Tool for Rapid Assessment of City Energy) is a simple and quick diagnostic tool that is used to assess a city's energy performance in six service areas (urban transport, municipal buildings, water and wastewater, solid waste management, public lighting, and power and heat) and to provide recommendations for improving energy efficiency. In each of the service areas, TRACE uses a benchmarking algorithm to evaluate energy cost savings potential, and factoring in the level of

influence of local authorities, it prioritizes what the authorities should do according to where the biggest savings can be achieved.

To complete data collection and to get a more comprehensive idea of issues in the city, a World Bank field trip was organized in February 2013. The implementation of TRAC in Ploiești was carried out in close collaboration with local authorities and public and private utility services providers. At the end of this quantitative and qualitative analysis, several recommendations were drawn out. These recommendations are summarized below.

Energy Efficiency Action Plan

The first recommendation suggested to the local authorities in Ploiești was the development of a proper energy efficiency strategy and action plan. The city is one of the signatories of the Covenant of Mayors, and now is in the process of preparing the Sustainable Energy Action Plan (SEAP), a document that will include concrete measures and steps towards reducing greenhouse emissions by 20% by 2020. Such plan is crucial before embarking on ambitious projects to improve energy efficiency in the city. The energy efficiency strategy can lay out vision and objectives for such work, and provide a list of activities that could help the city achieve those objectives.

District Heating Maintenance and Upgrade

The district heating system in Ploiești is perhaps the most performing system in the country, and the city residents pay the lowest price for heat. The improvements and rehabilitation work on the district heating system performed in the last period of time have made the centralized heating more efficient, with the number of clients connected to the thermal plant remaining relatively stable in the recent years (unlike what has happened in many other cities). However, there still remains much to be done. Most importantly, it is important to continue the rehabilitation and upgrade of the network, including the modernization of boilers and pipelines, in order to diminish the heat loss and improve the overall efficiency of the system. However, such investments should be weighed very carefully, to ensure that both economic and social benefits can be maintained, including lower operating costs, as well as low heating tariffs.

Non-motorized Transport

The local government should encourage non-motorized transport options in the city and step up efforts to improve and expand related infrastructure. The main priorities in this respect should be on developing more pedestrian areas and expanding the bike path network. From an energy efficiency perspective, the more people that walk or bike, translates into less people that use private vehicles, and consequently into a lower fuel consumption. Investments in non-pedestrian network can help raise the quality of life in Ploiești, and they encourage business development in and around the newly established pedestrian areas.

Public Transport Development

Although the public transport is quite well developed, only 30% of the commuters in Ploiești use buses, trolleybuses and trams for their daily trips. This figure could be improved by further developing the public transport system in the city. One of the immediate priorities of the local government is to further invest in the infrastructure of the tram network by rehabilitating and modernizing a large portion of the existing tram lines. At the same time, the City Hall is preoccupied to improve efficiency of the public transport system by replacing some of the old fleet with new energy-efficient rolling stocks that takes life-cycle costs into consideration.

Parking Restraint Measures

As the number of private cars in Ploiești has almost tripled in the last 20 years, the traffic has increased heavily and the existing parking lots cannot accommodate anymore the growing number of vehicles. Consequently, local authorities should consider measures to address this situation. One of the best ways to deal with traffic congestion is the development of “Park and Ride” facilities, which promote multimodality by linking parking to public transport. People who travel to the city drive their cars to these facilities, from where they take public transport to get to their workplace. But before such facilities are developed, one has to have a better understanding of commuting patterns in the larger metropolitan area, and the extension of public transport infrastructure should precede the development of such facilities.

Traffic Restraint Measures

As the number of private cars has gone up in the past decade, local authorities should identify ways to curb private vehicle usage and focus on more sustainable, efficient, and less costly transport alternatives, while also alleviating traffic. The city government may also consider enforcing speed limits in the downtown area, and setting-up "no driving days" (e.g. on Sundays) to allow pedestrians and bicyclists to move more freely through the city.

Municipal Buildings Audit and Retrofit

Like most of the cities in Romania, Ploiești does not have a database tracking the energy performance of municipal buildings. A municipal building data base is necessary in order to get an idea of which buildings offer the greatest saving potential. After the data base is completed, it should be followed by a full audit of the buildings administered by the city government targeting specific energy consumption for end users and activities, like computers, lighting, air conditioning, and heating systems. This would help draw a plan for how resources can be allocated to improve the energy performance of municipal buildings in the city. The results could prompt the local administration to allocate funds for energy efficiency upgrades, purchasing new equipment, and performing some renovation work on certain buildings.

Street Lighting Timing Program

In the past years the mercury lamps of the street lighting system in Ploiești were replaced with more efficient sodium vapor ones. The city government is thinking to further implement solutions for reducing energy consumption by introducing a street lighting timing program. This system would allow the light to be adjusted for specific needs in a particular area, according to varying weather and activity levels. For instance, more light is needed at 21:00 PM when more people are out than at 02:00 AM when there is less activity on the streets.

Prioritizing Recommendations

The process used by the team to get to the recommendations presented above was twofold. On the one hand, the TRACE tool has a step-by-step mechanism analysis system, which enabled the team to identify a number of priority sectors. The chosen priority sectors usually included sectors with a high energy and money savings potential, and sectors where local authorities had a high degree of control. Sectors which were either under the control of private operators, or the control of county councils or national level authorities, were usually not considered.

For each of these priority sectors, the team has chosen a number of key recommendations, based on the discussions with the public utility operators, and based on the site visits and data collection. In turn, these recommendations were discussed with local authorities, and a limited number of priority recommendations (usually around 10), were selected from the list prepared by the team.

In some cases, local authorities have chosen priority sectors and recommendations that did not necessarily offer the highest savings potential. A more in-depth discussion on each of those recommendations, including the position of local authorities is discussed in the Energy Efficiency Recommendations Section. The Matrix below provides a snapshot of the priority sectors and recommendations chosen for the City of Ploiești.

Cross growth pole comparison

Having the benefit of implementing TRACE in 7 of the largest cities in Romania, the team identified a number of common challenges, and a number of common approaches for addressing energy efficiency issues. For example, it became quite obvious that almost every city with a district heating in Romania has issues running this system in an efficient manner. District heating systems in Romanian cities were almost exclusively built before 1989, and they now have large segments of o leaky and poorly insulated pipes. Moreover, the district heating systems were not built to also serve large industrial facilities (which now are largely gone), and they were not designed for individual metering (i.e., with a vertical distribution system in apartment blocks, instead of a horizontal system). Because of the losses in the system (which ultimately get reflected in the monthly bill), because heating cannot be adjusted or turned off when not needed, and because of the high and growing price of thermal energy, many people have decided to de-branch themselves from district heating networks.

Matrix with Energy Efficiency priorities and proposed programs

PRIORITY 1 Local Authority Management	Energy spending in the sector		Potential savings	
	N/A			
	Responsible Institution	Cost	Energy savings potential	Time of implementation
1. EE Strategy and Action Plan	City Hall	$	***	< 1 year
PRIORITY 2 District Heating	Energy spending in the sector		Potential savings	
	$22,000,000		$3,000,000	
	Responsible Institution	Cost	Energy savings potential	Time of implementation
2. District heating maintenace and upgrade	Dalkia	$$$	***	> 2 years
PRIORITY 3 Private Vehicles	Energy spending in the sector		Potential savings	
	$82,000,000		$1,360,000	
	Responsible Institution	Cost	Energy savings potential	Time of implementation
3. Non-motorized transport modes	City Hall	$$$	**	> 2 years
4. Parking restraint measures	City Hall	$	**	> 2 years
5. Traffic restraint measures	City Hall	$$	**	1-2 years
PRIORITY 4 Public Transport	Energy spending in the sector		Potential savings	
	$4,700,000		$1,400,000	
	Responsible Institution	Cost	Energy savings potential	Time of implementation
6. Public transport development	RAT Ploiesti	$$$	***	> 2 years
PRIORITY 5 Municipal Buildings	Energy spending in the sector		Potential savings	
	$2,600,000		$920,000	
	Responsible Institution	Cost	Energy savings potential	Time of implementation
7. Municipal buildings audit and retrofit	City Hall	$$$	***	1-2 years
PRIORITY 6 Street Lighting	Energy spending in the sector		Potential savings	
	$1,300,000		$320,000	
	Responsible Institution	Cost	Energy savings potential	Time of implementation
8. Street lighting timing program	City Hall	$	***	< 1 year

Virtually, every growth poles has witnessed disconnections from the centralized heating system, as people have resorted to individual heating options (e.g. individual gas powered heating units). In some cities, such as Brașov, the share of people who de-branched from district heating represents a large majority of the population; in other cities, such as Constanța, the number of people who left the centralized heating system is lower.

Priority sectors for energy efficiency improvements in growth poles

	Brasov	Cluj	Constanta	Craiova	Iasi	Ploiesti	Timisoara
Private Vehicles	3	1	1	2	2	3	2
Public Transport	2	2	3	1	4	4	4
District Heating	1	5	2		1	2	1
Municipal Buildings	5	3	4	3	3	5	5
Street Lighting	4	4	5	4	5	-	3
Solid Waste Management	-	-	-	-	-	-	-
Water and Wastewater	6	-	-	-	-	-	-
Local Authority Management	-	-	-	5	-	1	-

For most growth poles, urban transport (private vehicles and public transport) was identified as a key sector, although cities like Iași and Timișoara (which have the largest tram networks in Romania outside Bucharest), generally have energy efficient public transport systems and as such have this sector lower on the priority list.

Generally, solid waste management, as well as water and wastewater, did not make it on the priority list of growth poles. For one, solid waste management systems in Romania tend to largely be operated by private companies, and energy efficiency improvements in these systems are accrued by these private operators. On the other hand, water and wastewater systems are generally run by public companies, with county councils being the majority shareholders.

Also a number of the growth poles had drafted or were in the process of drafting Covenant of Mayors SEAP reports (e.g., Brașov, Cluj-Napoca, Timișoara), while others (e.g., Ploiești or Craiova) were considering to start the process.

All in all, every growth poles that has been part of this study has undertaken energy efficiency measures in the past years, and all have good practice lessons they can share with other cities.

The importance of good urban planning for energy efficiency

While TRACE does not explicitly deal with this issue, urban planning plays a crucial role in energy efficiency. Cities that promote and encourage a dense and compact urban development pattern tend on the whole to be more energy efficient. On the whole, dense cities require less investment in public services infrastructure development and maintenance (roads, water networks, sewer lines, street lighting, solid waste management, public transport, etc.), they allow higher profitability for public transport operators (since every transit stop serves on average more people than in less dense cities), they enable walking and biking as means of commuting, they discourage car use and transport-related pollution, they can help lower greenhouse gas (GHG) emissions, they require less energy expenditures for the delivery of key public services (e.g., pump costs for water, fuel costs for garbage collection).It is estimated that the energy consumed for transport needs in a city with a density of less than 25 people per hectare may reach an annual average of 55,000 mega joules per person. By comparison, in an urban area with a density of 100 people per hectare, this figure is about three times lower.[1] Consequently, a separate section on spatial planning was introduced in the report, discussing some key related issues for each city studied. A more complete analysis of spatial planning challenges in Romanian cities is included in the *Enhanced Spatial Planning* report.

[1] European Environment Agency. 2006. *Urban sprawl in Europe: The ignored challenge.* Copenhagen: European Environment Agency (Report No. 10/2006).

Methodology

The Tool for Rapid Assessment of City Energy (TRACE) TRACE consists of three principal components: (i) an **energy benchmarking** module which compares key performance indicators (KPIs) among peer cities (ii) a **sector prioritization** module which identifies sectors that offer the greatest potential with respect to energy-cost savings, and (iii) an **intervention selection** module which functions like a "playbook" of tried-and-tested EE measures. These three components are woven into a user-friendly software application that takes the city through a series of sequential steps: from initial data gathering to a report containing a matrix of energy efficiency recommendations tailored to the city's individual context, with implementation and financing options. The steps are as follows:

1. Collection of Candidate City Energy Use Data

TRACE contains a database of 28 key performance indicators (KPIs) collected from over 100 cities. Each of the data points that make up these KPIs is collected prior to the application of the tool and, as TRACE is launched, this collection of information will grow with current and reliable data.

2. Analysis of City Energy Use Against Peer Cities

The performance of a city is compared with a range of peer cities—selected by the city based on population, climate, and human development—to determine their performance in each of the six sectors (3-6 KPIs per sector). The benchmarking process provides an overview of energy performance so the city can assess its relative rankings against peer cities in each sector. The Relative Energy Intensity (REI), or in simpler terms the percentage by which energy use in a particular sector could be reduced, is calculated using a simple formula. The formula looks at all the cities that are performing better on certain KPIs (e.g. energy use per street light), and estimates the average improvement potential. The higher the number of cities in the database, the more accurate the final result are.

3. Assessment and Ranking of Individual Sectors

During the city visit, a number of meetings and interviews are conducted to collect additional data across city departments and agencies, augmenting benchmarking results with contextual information. At the end of the first phase, a prioritization process takes place to identify sectors with the greatest technical energy savings potential. Energy costs are also weighed, as is the ability of city authorities to control or influence the outcome. Priority sectors are reviewed in detail in the second phase.

The main frame of TRACE

4. Ranking of Energy Efficiency Recommendations

TRACE contains a playbook of over 60 tried and tested energy efficiency recommendations in each of the sectors. Some examples include:

- Buildings | Lighting Retrofit Program
- Organizational Management | Energy Efficiency Task Force, Energy Efficient Procurement
- Power & Heat | Solar Hot Water Program on Buildings
- Public Lighting | LED Replacement Program for Traffic Lights
- Transport | Traffic Restraint in Congested Urban Areas, City Bus Fleet Maintenance
- Waste | Waste Management Hauling Efficiency Program
- Water & Wastewater | Pump Replacement Program

The TRACE Benchmarking Module

Recommendations are then assessed based on five different factors: *finance; human resources; data* and *information; policy, regulation* and *enforcement;* and *assets and infrastructure*. This step helps cities better rank measures that are within its capacity to implement effectively. TRACE then enables recommendations to be plotted on the basis of two attributes on a 3x3 matrix (energy savings potential and first cost), with an additional filter that enables the user to sort recommendations based on implementation speed.

Recommendations in each priority sector are quantitatively and qualitatively evaluated based on key data, including institutional requirements, energy savings potential, and co-benefits. Those recommendations carried forward will be supported by implementation options, case studies, and references to tools and best practices.

5. Report Preparation and Submission

A Final City Report records the city review, along with city background information and various aspects of the city visit included in introductory sections and annexes. The report includes:

- City background information, such as city contextual data, key city development priorities, energy efficiency drivers, barriers etc.
- An analysis of the six sectors, including a summary of the benchmarking results.
- A summary of sector prioritization based on city-owned and city-wide scales
- A draft summary of recommendations provided as the City Action Plan
- An Annex section, with a more in-depth discussion on energy efficiency recommendations and best-practice cases.

The Final City Report enables the city to move forward with the most feasible recommendations in a structured manner to allow the city to eventually improve its overall rankings, performance, and save money.

Background

The 7th largest country by population in the European Union (EU), Romania is located in Southeastern Europe, in the lower basin of the Danube river. It has a stretch of coastline along the Black Sea and also owns much of the Danube Delta. Romania borders Hungary, Serbia in the West and South West, Bulgaria in the South, the Republic of Moldova in the East, and the Ukraine in the North and East. Almost 50% of Romania's territory is part of the Carpathian Mountains range. The country has a temperate continental climate, with hot summers and cold winters. As part of the communist bloc countries for nearly half a century, Romania brought down the authoritarian regime with the 1989 Revolution, and then it began its transition from a centralized system towards democracy and market economy by implementing a series of structural changes and reforms. If initially the economy was centered on agriculture, during communism it gradually shifted to an industrial one, ultimately making significant steps towards a service-based economy over the past two decades. In 2004 Romania joined NATO and three years later it became a member of the EU.

After a period of massive economic restructuring and political change, the country has taken significant steps to catch up with the economic performance of more developed EU countries. Although government policies and radical reforms brought about significant changes, income levels of Romanians are still behind the average level in the EU countries. In addition, the disparities within Romania mean that there are significant differences in terms of standards of living between the country's regions. The country is divided into 41 counties, plus the capital city, București (Bucharest), and into eight development regions (although regions do not have formal administrative powers as of April 2013). Apart from Bucharest, each development region is organized around a growth pole center (city), and comprises four to seven counties. Despite of being among the most populous countries in Europe, Romania has experienced a decline in population in recent years. The stable population declined by 7.1% over the last decade, from nearly 22 million to 20.1 million, according to the final results of the 2012 census. However, the population decline did not necessarily come as a surprise. After Romania joined the EU, many Romanians left the country to pursue better opportunities in Western Europe. Other factors responsible for this decline are the aging of population as well as a significant rise in number of the families with no children. Romania is predominantly urban, although the urbanization level is still below that of countries in Western Europe; half of population resides in municipalities, cities and towns, while up to 10% lives in the capital city.

According to the 2012 census, the most populous cities in Romania are the following:

Table 1. Ranking of select Romanian cities by population

City	2012 census	2002 census / Rank	
București	1,883,425	1,934,449	(#1)
Cluj-Napoca	324,576	318,027	(#3)
Timișoara	319,279	317,651	(#4)
Iasi	290,422	321,580	(#2)
Constanța	283,872	310,526	(#5)
Craiova	269,506	302,622	(#6)
Brașov	253,200	283,901	(#8)
Galați	249,432	298,584	(#7)
Ploiești	209,945	232,452	(#9)
Oradea	196,367	206,527	(#11)

Source: National Institute of Statistics, 2012 Census
http://www.recensamantromania.ro/rezultate-2/

National Energy Efficiency Legislation

Romania's energy consumption per capita is almost twice as low as the average in the EU, at 1.6 toe (ton of oil equivalent). Between 1990 and 2000, energy consumption fell by an average of 5 % per year, and then increased slightly after 2000 by 1.3% per year. At the beginning of the economic crisis in 2009, energy consumption dropped by 14%, and then increased by only 1.3% in 2010. Amid the economic recession, the country's GDP followed a similar decreasing trend and fell by 8.3%. Energy efficiency at the national level has increased significantly between 1990

and 2000, from 23% to 39%. It is a consequence of the rising share of high efficiency power sources (hydropower) in the electricity mix, as well as improving efficiency of thermal power plants. However, it still remains lower than the EU average.

In the early 1990s, Romania created its first institutional framework for energy efficiency when the **Romanian Agency for Energy Conservation**, the country's main specialized body in the field of energy efficiency, was established. Ten years later Romania adopted the National Energy Efficiency Strategy, a document outlining steps to be taken to increase energy efficiency. In the 2000s, Romania ratified the Kyoto Protocol to the United Nations Conventions on Climate Change, under which the country has committed to cut its emissions of greenhouses gases, between 2008 and 2012, by 8% from 1989 levels.

The **Romanian Fund for Energy Efficiency** became operational in 2003 and ever since it has provided subsidies for investments to 27 energy efficiency projects promoted by large industrial operators, totalizing $14.4 million.[2] In order to comply with EU requirements, the Government transposed the Directive No.2006/32/EC regarding energy efficiency among the end users and energy suppliers into national legislation, requiring EU member states to undertake steps to reduce energy consumption by at least 9 % for 2008-2016, as compared to consumption for the previous five years.

The Energy Road Map for Romania was approved in 2003 during the negotiations for EU membership. Pursuant to EU Directive on energy reduction, the **First Energy Efficiency Action Plan** for the period 2007-20103 set an energy saving target of 2.8 Million toe by 2016, and it further aims for 1.5% annual reduction for the period 2008-2016. The intermediate target of 940,000 toe by 2010 was far exceeded, as Romania achieved 2.2 Million toe in energy saving. The plan document foresees great potential for energy savings for the industrial sector through voluntary long-term agreements between industrial agents and the Government, in addition to investments in equipment to oversee energy consumption. Estimates indicate that EU countries that have implemented such agreements reached 10 to 20% in energy savings. Large consumers must carry out energy audits and energy efficiency improvement programs, while an energy balance must be produced every year for those consuming 1,000 toe/year and every two years for those who use between 200 and 1,000 toe/year. From 2000 onwards an energy saving certificate has been issued for all new buildings, single-family dwellings and apartment that are sold or rented. Heat insulation work benefitted from tax breaks and co-financing was provided for renovation work.

The Second Energy Efficiency Action Plan[4] focuses on energy savings in the primary energy and power sectors, and promotion of energy from renewable sources.

The First National Strategy for Energy Efficiency for 2004-2015[5] set an ambitious 40% target in energy intensity reduction for the period 2005-2014. Decrease in energy intensity should be achieved through programs promoting high energy standards for new installations, as following: 41% in buildings, 29% in the energy sector, 16% in industry, and 14% in transport. Few years later, the **National Strategy for Energy Efficiency for the period 2007-2020**[6] set further targets to reduce energy intensity by 41% through 2020 by advancing feasible solutions to cover the country's future energy demand at a lowest price. By then, estimated primary energy savings and reduction of losses should achieve anything between 25% and 40% (20-25% in industry, 40-50% in buildings, and 35-40% in transport), by improving efficiency in the power sector. The energy saving target was set to 3.4 Million toe by 2020. In this context, 1.9 Million toe saving is expected to come from fuel substitutions, 800 ktoe from high

[2] Romanian Fund for Energy Efficiency http://www.free.org.ro/index.php?Itemid=112&id=96&lang=ro&option=com_content&task=view

[3] First Energy Efficiency Plan for the period 2007-2010 available at: http://ec.europa.eu/energy/demand/legislation/doc/neeap/romania_en.pdf

[4] Second Energy Efficiency Action Plan available at: http://www.minind.ro/dezbateri_publice/2011/PNAEE_12_cu_anexe_2_11082011.pdf

[5] The First National Strategy for Energy Efficiency for the period 2004-2015 available at: http://www.minind.ro/domenii_sectoare/H163-04.html

[6] National Strategy for Energy Efficiency for the period 2007-2020 - updated version for the period 2011-2020 available at: http://www.minind.ro/dezbateri_publice/2011/Strategie_2007_actualizata_2011_01092011.pdf

efficiency co-generation (Combined Heat and Power), and 600 ktoe from new coal-fired units.

The main objective of the **National Strategy Regarding the Thermal Power Supply of Cities**[7] approved in 2004 addresses key issues concerning energy efficiency of the heating system. The thermal power supply system is built on obsolete technologies and old pipeline networks, with low energy efficiency, very high losses (35 % on average), in addition to high production, transport, and distribution costs. Poor insulation of buildings adds another 15% to the losses. Actions meant to increase energy efficiency include implementation of large scale co-generation plants, modernization of network, diversification of primary energy used for thermal power production, and installation of meters in residential buildings. Resource consumption for the centralized heating systems should diminish by 612,000 tons. However, the modernization of the entire heating system is very costly, and it requires investment of billions of euro.

The Strategy for Use of Renewable Energy Sources,[8] approved in 2003, encourages energy production from renewable sources in order to increase the share of electricity produced from such sources. Romania's potential of renewable energy sources is estimated at 14,718 ktoe. However, the development of such energy potential is constrained by obsolete technological limitations, economic efficiency, and environmental restrictions. Therefore, the plan is pushing for transfer of unconventional technologies from experienced companies, joint-ventures, and private public partnerships. The target shares for renewable energy sources out of the total energy consumption were set at 33% for 2010, 35% for 2015 and 38% for 2020. Use of renewable energy could result in 1.8 Million toe energy saving from primary sources by 2020. **The National Renewable Energy Action Plan**[9] outlining the renewable energy national policy was drafted in 2010, in the very difficult context of the economic crisis. It encouraged the use of liquid bio-fuels, liquid gas, geothermal and clean energy, as well as the integration of biogas into the natural gas grid and retrofitting technologies. The Directive 2009/28/EC on renewable energy set the national target for the share of energy from renewable sources in gross final production of energy at 24% for 2020. The expected total energy consumption in 2020 was set at 30,278 ktoe, of which 7,267 ktoe in renewable energy. Targets for specific industrial sectors have been designed, such as 10% for transport, 22% for heating, and 42% for electricity.

Romania received support from the European Bank for Reconstruction Development (EBRD) to help companies open credit lines for energy efficiency projects. The country receives financial support through the Operational Sector Program for Boosting Economic Competitiveness aimed at increasing energy efficiency. Small and medium-sized enterprises may receive up to 65% financial support for a period of three years to help them obtain environmental certificates for appliances and office equipment.

Government Ordinance 22/2008[10] regarding energy efficiency and promotion of energy from renewable energy sources to end consumers requires local public administrations in towns with a population greater than 20,000 people to produce action plans to generate the most efficient energy savings in the shortest period of time (3 to 6 years). Similarly, companies and local and central government units owning more than 25 vehicles must develop fuel consumption monitoring and management programs.

The National Multiannual Program for the Thermal Rehabilitation of the Residential Buildings Built between 1950 and 1990 started in 2005 and was improved each year. The program is coordinated by the Ministry of Regional Development and Public Administration

[7] National Strategy regarding the thermal power supply of cities http://www.termopitesti.ro/HG%20882-2004.pdf

[8] The National Strategy for Using of Renewable Sources was approved by Government Decision 1535/2003 available at: http://leg-armonizata.minind.ro/leg_armonizata/energie/HG_1535_2003.pdf

[9] The National Renewable Energy Action Plan – available at (in Romanian) http://www.minind.ro/pnaer/PNAER_29%20iunie_2010_final_Alx.pdf English version is available at http://ec.europa.eu/energy/renewables/action_plan_en.htm (click on "Romania").

[10] Government Ordinance 22/2008 available at: http://www.dreptonline.ro/legislatie/og_eficienta_energetica_consumatori_finali_surse_regenerabile_energie_22_2008.php#

(MRDPA) and it is developed in partnership with local authorities. It aims at increasing the energy performance of buildings, improving the quality of life for inhabitants and, not in the least, contributing to a better townscape. Public buildings and dwellings built between 1950 and 1990 are very poorly insulated and offer low thermal comfort, causing significant loss of energy. The key beneficiaries of the program are owners' associations. Thermal insulation can reduce maintenance costs for heating and hot water consumption and decrease heat loss and consumption. It can achieve up to 25% energy efficiency, while the heating bills are expected to drop by 40% during winter time. Moreover, in the summer, rehabilitated buildings can better keep the appropriate thermal comfort of the dwellings without additional costs for air conditioning. A guide regarding how the rehabilitation work should be done is available on the Ministry's website[11].

A few years later, **Government Ordinance 18/2009**[12] regarding the thermal rehabilitation of blocks of flats added more consistency to the program by specifying the minimum level of the thermal rehabilitation. The execution work is financially supported from Government's state budget (50%), the local budget (30%), and by owners' associations (20%). Since 2009 MDRAP provided funding equivalent to USD 190 million (RON 660 million) for the rehabilitation of 3,500 multi-story residential buildings in over 100 municipalities and cities. The law allows for the local city councils to grant **tax exemptions** on residential buildings for owners who have performed rehabilitation work from their own funds.

At the end of 2012, **Government Emergency Ordinance 63/2012**[13] brought some changes to the rehabilitation program coordinated by the MRDPA. According to new regulations, residential buildings within municipalities that have applied for funding through the Regional Operational Program (Priority Axis 1 Development of Growth Poles– Intervention Axis 1.2 Thermal rehabilitation of residential buildings) will not receive further support through the thermal rehabilitation multiannual program. However, the good news is that the program has been extended to houses that have been developed between 1950 and 1990. The new regulation also clears the way for local authorities to establish the so-called "thermal rehabilitation tax". This tax will be paid by buildings that did not have any financial contribution to the rehabilitation process.

Following the success of the rehabilitation program, the Government thought about reducing the public funding accessible for such projects, and loans with government guarantee were made available. According to **Emergency Ordinance 69/2010**[14] owners associations must have 10% down payment, while the rest is covered from a bank loan. The owners' associations pay back the loan from the savings obtained over the heating bills before the thermal insulation work is complete. This new program includes old buildings built between 1950 and 1990, those developed after 1990, and individual homes.

The **Directive 2010/31/EU on the energy performance of the buildings** requires[15] the Member States to adopt a methodology for calculating the energy performance of the buildings, that should include thermal characteristics, heating insulation, water supply, the air-conditioning installations, the built-in lighting installations, indoor climatic conditions, and not in the least, electricity produce by co-generation. The EU law is concerning both existing and new buildings. The law is exempting the historical buildings, worship facilities, temporary buildings, residential buildings intended for a limited annual time of use, and stand-alone buildings of which the surface area does not exceed 50 square meters. The main objective of the law is to have all new building close to

[11] The guide is available at: http://www.mdrt.ro/userfiles/constructii_ancheta_publica_contr429_contr411.pdf)

[12] Government Ordinance 18/2009 available at: http://www.mdrl.ro/_documente/lucrari_publice/reabilitare_termica/OUG_reabilitare.pdf Methodological regulations available at: http://www.mdrl.ro/_documente/lucrari_publice/reabilitare_termica/Norme.pdf

[13] Government Emergency Ordinance 63/2012 available at: http://www.mdrt.ro/dezvoltare-regionala/programul-operational-regional-2007-2013/-8748

[14] Emergency Ordinance 69/2010 approved by Law 76/2011 available at: http://www.dreptonline.ro/legislatie/oug_69_2010_reabilitarea_termica_cladirilor_locuit_finantare_credite_bancare_garantie_guvernamentala.php

[15] Directive 31/2010/EC available at http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=CELEX:32010L0031:EN:NOT

nearly zero-energy by December 2020. Same criteria are applicable by December 31st, 2018 to new buildings occupied and owned by public authorities. Member States should come up with national plans that put into practice the definition of nearly zero-energy building, and the intermediate targets for improving the energy performance of new buildings by 2015. At the same time, the Member States must issue an energy performance certificates that should include the energy performance of the building along with recommendations for cost improvements. This certificate should be available when renting and selling a building/unit. The municipal buildings with a total floor area of over 500 square meters and buildings of the same size frequently visited by public, must display the energy performance certificate in a prominent place where this could be clearly visible. After July 9, 2015 the 500 square meters threshold will lower to 250 square meters.

As part of EU requirements, Romania adopted Law 372/2005 addressing the energy performance of residential buildings. An **energy performance certificate** is issued based on the final energy consumption of buildings and apartments. The country also transposed into national legislation EU Directive 2003/30 EC[16] on the promotion of the use of bio-fuels or other renewable fuels for transport. **Government Emergency Ordinance 1844/2005**[17] established a 2% share of renewable energy in the transport sector by the date of Romania's accession to EU (2007) and a 5.75% share by 2010.

The **Government Emergency Ordinance 70/2011**[18] establishes social protection measures for the cold season, helping low-income residents pay the heating bills. The Government is supporting people who use the district heating system, as well as heating systems using a different type of fuel, be it natural gas, wood, coal, etc. The financial aid range for single people and families with low income benefitting from aid from the state budget can range between 10 and 90%. Local city budget can also provide financial support between 7% and 63% of the total heating bill.

Sixty-one cities in Romania are signatories of the **Covenant of Mayors**, the mainstream European movement involving local and regional authorities voluntarily committing to increasing energy efficiency and use of renewable energy sources on their territories, as well as reducing CO_2 emissions by 20% by 2020. Participants to the Covenant must submit a **Sustainable Energy Action Plan (SEAP)** outlining actions they plan to undertake with regard to energy savings. 22 out of 61 cities have submitted their SEAP to Brussels, namely: Aiud, Sântana, Petrosani, Făgăraș, Zlatna, Moinesti, Arad, București (District 1), Baia Mare, Timișoara, Cugir, Satu Mare, Vaslui, Alba Iulia, Bistrița, Mizil, Slobozia, Brașov, Râmnicu Vâlcea, Avrig, and more recently Cluj-Napoca. So far, eleven action plans have been approved by the Covenant of Mayors, namely the SEAPs of Moinești, Vaslui, Alba Iulia, Bistrița, Mizil, Slobozia, Brașov, Arad, Aiud, Râmnicu Vâlcea şi Baia Mare.

Energy Sector

At the end of 2012, Romania's installed capacity of electrical power plants was 18,481 MW, while the netto available power was 15,998 MW, according to Transelectrica.[19] The netto power provided was 11,424 MW, and domestic consumption accounted for 7,413 MW. In February 2013 the split of domestic consumption by types of energy production showed that the largest share is based on coal (33% - 2,593 MW), followed by hydro carbons (23.9% - 1,877 MW), hydro energy (24.8% - 1,948 MW), and nuclear (18.1% - 1,419 MW). Wind energy is almost nonexistent, with only 0.3% or 24 MW.

The electricity sector is unbundled, with several players in the field. There are quite a few companies in charge with production, a significant number of distributors, and a noteworthy number of suppliers. However, there is only one player responsible for energy transmission and who owns the entire transmission network, Transelectrica, a state-owned company. Energy production is divided into seven major producers,

[16] Directive 2003/30/EC available at: http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2003:123:0042:0042:EN:PDF

[17] Government Emergency Ordinance 1844/2005 available at: http://ngo.ro/pipermail/mediu_ngo.ro/2006-February/004597.html

[18] Government Emergency Ordinance 70/2011 regarding social protection measures in the cold season.

[19] RET Plan - Period 2010-2014, and perspectives for 2019 http://www.transelectrica.ro/PDF/Planul%20de%20Perspectiva%20al%20RET%202010-2014-2019%2013dec.pdf

namely Complexul Energetic Oltenia,[20] Complexul Energetic Hunedoara, Nuclear Electrica, CE Arad, SC Electrocentrale Deva, Hidroeletrica, and OMV Petrom. CEZ, ENEL Energie Muntenia, Enel Energie, E.ON, and Electrica Distributie (with its three branches, namely Electrica Distributie Transilvania Nord, Electrica Distribuție Transilvania Sud, and Electrica Distribuție Muntenia Nord) are the distribution companies. Energy distributors are by default energy suppliers. Accordingly, the main suppliers are Electrica Furnizare, CEZ, ENEL Energie (responsible for Dobrogea and Banat zones), ENEL Energie Muntenia, and E.ON Energie Romania. Of 177 energy suppliers registered in the country, only 20 companies are actually active.

The Romanian Energy Regulatory Authority (ANRE)[21] was established in 1999 and is the regulatory body in the field of electricity (including heat produced in co-generation) and natural gas. The Agency is dealing with licensing, issuing technical and commercial regulations, and protecting of the interests of consumers and investors. The agency regulates tariffs for energy and natural gas for domestic and non-domestic clients, approves the calculation methodology to set up tariffs and prices, and sets tariffs for captive consumers (those who cannot choose the energy provider). It also establishes tariffs for electricity companies, transmission and distribution systems and for activities associated with heat production through co-generation. **OPCOM** is the Romanian energy market operator established in 2000, as a joint stock company subsidiary of the Romanian Transmission and System Operator, Transelectrica. The company is providing the framework for the commercial trades' deployment on the wholesale electricity market; it exercises the role of Day-Ahead market operator and administrator of the Green Certificates, as well as of the greenhouses emissions certificates trading platform. **Green Certificate** is a mechanism promoting energy produced from renewable sources such as from hydro used in power plants with installed capacity up to 10 MW of wind, solar (photovoltaic), geothermal and natural gas associated, biomass, biogas, gas from the landfill waste fermentation and from fermentation of sediment from sewage treatment of used waters. Energy producers receive a Green Certificate for each MW of energy produced from renewable energy and sent to the national grid. The law is forcing suppliers to purchase a mandatory quota of green certificates from the total amount of electricity distributed to the end users. A number of certificates are annually available. The Green Certificate has unlimited validity, and it can be traded separately from the electricity associate through bilateral contracts or on the green certificates centralized market. The price varies from 27 EUR (to protect the producer) to 55 EUR (to protect the consumer). At the end of 2012, 300 Million Green Certificates were available in Romania for the period 2013-2019. The EU approved in July 2012 an additional distribution of 71.4 Million Green Certificates for greenhouse emissions for 2013-2019.

Recently, in June 2013, the Romanian government reviewed the compensation scheme granted to renewable energy producers, and cut off the number of green certificates, as a „temporary suspension" until March 2017 for hydro and solar/photovoltaic energy, and by January 2018 for wind energy[22]. The new provisions, which are effective July 1st, 2013, are amending the Law 220/2008 for promoting energy from renewable sources. The new law is cutting down the number of green certificates. For each 1 MWh produced, the new small hydro plants with an installed capacity of less or equal to 10 MW will receive one green certificate less, same for the wind energy plants. In case of solar energy facilities, the number of green certificates was cut down by two. In this way, the new small hydro plants would get 2 certificates instead of three, the solar plants would be awarded four certificates instead of six, while the wind facilities would receive one certificate instead of two.

Following the legislative elections in December 2012, the new structure of the Government includes a **Delegated Minister for Energy**, a

[20] Complexul Energetic Oltenia was established in 2012 after the merger of four large energetic companies, namely Societatea Nationala a Lignitului Oltenia Tg. Jiu, Complex Energetic Turceni, Complex Energetic Craiova, and Complex Energetic Rovinari.

[21] More information on ANRE available at: http://www.anre.ro/

[22] More information available at: http://media.hotnews.ro/media_server1/document-2013-04-2-14540999-0-proiect-privind-suspendarea-schemei-sprijin.pdf

new institution expected to add more consistency to the country's energy policies.

Liberalization of the natural gas and electricity markets

The Memorandum of Understanding agreed with the IMF, the World Bank, and the European Commission in March 2012 opens the market for electricity and natural gas. The regulated price for electricity for domestic and non-domestic consumers will be gradually eliminated by 2017, while for natural gas the same principle will be applied by 2018.

The price increase for natural gas for non-domestic consumers (economic agents and industrial consumers) is going to be 35% for years 2013 and 2014 altogether. For domestic consumers, the price will go up by 10% in 2013, by another 10% in 2014, and by 12% each year from 2015 through 2018. Electricity prices will go up gradually, in parallel with the increasing of the quota of electricity traded in the free market. The price of electricity for *non-domestic* consumers went up already starting in September 2012, when the quota traded in the free market increased by 15%, with an additional 30% in January 2013. The elimination of regulated tariffs will be complete by January 2017. *Domestic* consumers will pay more starting July 2013. By the end of 2017 when the gradual elimination of regulated price will be concluded, domestic consumers will be able to choose their energy supplier. The supplier must introduce the "competitive market component" to the final bill, providing to the clients information that should help them choose the best offer, such as prices depending on voltage, tariffs for transport and distribution, payment methods and due days, and meter readings.

Background Ploiești

The only city in Europe surrounded by four oil refineries, Ploiești is the capital of Prahova County, which is the most populous and urbanized county in Romania, with two municipalities and 12 cities, and a total of 100 localities. Prahova County has one of the largest absolute GDPs in Romania. Ploiești is located only 60 kilometers north of București and 40 kilometers from the country's largest airport.

The city is situated in the vicinity of Romania's most significant vineyards, Dealu Mare - Valea Călugărească, and has access to Valea Prahovei where many popular mountain resorts are located. According to the 2012 census, there are 209,945 inhabitants living in Ploiești. The population registered a descending trend by 10% over the 2002 census. The municipal area is spread over 58.2 square kilometers, and the population density of the built mass of the city is 61 people per hectare – down from 83 people/ha in 1992. At present, the density of population is 3,990 people per square meter. The Ploiești Metropolitan Area comprises 14 localities: one municipality (Ploiești), three cities (Băicoi, Boldești-Scăieni, Plopeni), and ten communes (Ariceștii Rahtivani, Bărcănești, Berceni, Blejoi, Brazi, Bucov, Dumbrăvești, Păulești, Târgșoru Vechi, Valea Călugărească). Brazi is home to the largest refinery in the country. The Metropolitan zone is spread over 611.6 square kilometers (148.7 square kilometers are urban areas) and accounts for a population of 327,309 residents.

Downtown Ploiești

Source: eurocars.ro

In the mid-19th century Ploiești city was one of the world's leading oil refinery and extraction sites, known as the Capital of the Black Gold. Between the two world wars Ploiești was perceived as the largest oil producer in Europe. During the Second World War, the oil refineries

suffered the heaviest bombardment in the country, and many of the nearby residential areas, industrial compounds, roads and railways were destroyed. The city had been reconstructed ever since to become today one of Romania's key economic centers. Despite of the decline of oil production nowadays, there is still a prosperous oil processing industry, linked by pipelines to București, the Port of Constanța and the Danube River Port of Giurgiu.

The Ploiești Growth Pole is located at the crossroads of two major multimodal European transportation corridors, Pan European IV and Pan European IX, respectively. (Corridor IV is connecting growth poles Timisoara, Brasov, Ploiești, Constanța via București, while Corridor IX is linking Chișinău, the capital of Republic of Moldova, Iași, Ploiești and București). Ploiești took advantage of the development of transport infrastructure that helped boost tourism and opened the way for substantial foreign investments in the region. The city experienced a swift economic growth during the transition years due to massive investments amounting to hundreds of thousands of Euros in the field of oil, tobacco, and food processing. Today, the local economy has a complex structure ranging from oil production, oil refinement, oilfield equipment, mechanical precision, petrochemical industry, rubber production to defense, tourism, food processing, textile manufacturing, and agriculture. The Metropolitan zone remains predominantly industrial, concentrating large oil platforms and major services centers. The complex industrial sector has significant shares in oil, gasoline, minerals, and oilfield equipment that are accounting for 50% of the local economy, making the area the second most important industrial infrastructure in the country. Two-thirds of Ploiești residents are economically active, and unemployment is among the lowest in the country (only 1.3%). According to the Integrated Urban Development Plan Ploiești, the metropolitan area has a great labor market potential of 13,000 jobs, out of which 12,000 in Ploiești only.

The vineyards and wine production are predominantly concentrated in Valea Călugărească, whereas vegetable crops drive the economic engine in Blejoi, Bucov, and Târgșoru Vechi. Some of the most popular mountain resorts in the country - Sinaia, Bușteni, and Azuga - are within an hour drive from Ploiești. The resorts attract a large number of domestic and international tourists, which make Prahova County the third largest tourist center in Romania, after București and Constanța. Ploiești is home to the Oil and Gas University (the largest education center in the field with 10,000 students), the National Institute of Wine and Vineyards, two soccer teams, and many cultural and historical monuments (such as the Clock Museum and the Oil Museum).

Local Energy Efficiency Laws

Ploiești has been a beneficiary of the Rehabilitation Program of Residential Buildings built between 1950 and 1989 coordinated by the Ministry of Regional Development and Public Administration. As part of this program, aimed at increasing energy efficiency in the Communist apartment blocks, the city was granted close to RON 8 million for the thermal insulation of 1,800 apartments, within 27 old multi-storey residential buildings. In accordance with the Methodological Norms for the implementation of the Government Emergency Ordinance 18/2009 on energy efficiency of residential buildings, the Local Council Ploiești is granting tax exemption for the owners who have performed rehabilitation work on their apartments on their expense. The tax exemption is established for a period of minimum seven years for the owners who have thermally insulated their buildings, and for a period of five years for those who paid for architectural rehabilitation work on buildings or apartments.

The Energy Efficiency and Renewable Energy Agency (AE3R)[23], an independent non-profit organization promoting energy efficiency was established in 2009 under the City Hall, with support from Intelligent Energy Europe, a European tool fostering rational use of new renewable energy and advancing energy efficiency in the transport sector. The agency is one of the eleven local energy associations organized in Romania benefiting from EU support. The agency is providing support to public authorities in the City of Ploiești and Prahova County to develop sustainable energy policies, and help local authorities plan energy sources for environment preservation. It is encouraging the use of non-pollutant sources and technologies, and promoting the use of renewable energy in transport, households and by public and private companies. AE3R is not only bringing stakeholders together to develop energy-related projects,

[23] More information available at: http://www.ae3r-ploiesti.ro/

but it also informs local public authorities on available funds and programs in the field of energy. The Monitoring Board of the agency has representatives from the Petrol and Gas University in Ploiești, as well as from private and public companies. The members of the organization are public institutions, including the City Hall and Prahova County Council. Most of public institutions do not have a dedicated energy department and so they rely on the agency's expertise to plan investments in the field of energy.

One of the main projects that have been developed so far by the agency is a guide for investors in the field of renewable energy. Another project currently under preparation is an energy audit of public buildings larger of equal to 500 square meters. A couple years ago the organization commissioned an energy study prepared by *Gas de France* to assess the energy saving potential of the county, especially with regard to public buildings. The plan, which includes appropriate measures with regard to energy efficiency, is yet to be approved by Prahova County Council. Finally, another area of interest for the agency is the Green House National Program. The program started in Prahova County in 2012, and is focusing on replacing classical heating systems with those using renewable energy heating systems using renewable energy**,** such as solar, biogas, or geothermal. As the program seemed to be appealing to private companies, now the agency is helping interested firms in assessing their eligibility for applying to such funds.

The Ploiești Municipality Strategy for Sustainable Development[24], better known as "Local Agenda 21", a document prepared with the support of UNDP in 2002, was the city's action plan for economic development, improved infrastructure, and environment protection. One of the objectives related to environmental protection and prevention of urban pollution presupposed the modernization of the public transport fleet and the use of eco-friendly fuels. Further referral to this document will be made in the following sections, when discussing issues pertaining to public service utilities.

[24] Ploiești Municipality Strategy for Sustainable Development available at: http://www.ncsd.ro/documents/local_agenda_21/AgLoc21_KWh_eng.pdf

Urban Growth and Energy Challenges in Ploiești

While the TRACE tool does not directly address this issue, one of the most efficient ways of encouraging energy efficiency in cities is by promoting dense development patterns and compact urban expansion. This can be done by strategically using urban and spatial planning tools. The less dense and the more scattered a city is, the larger its energy expenditure will be. Basically, without density public transportation is less viable and more people rely on private cars for commuting; commutes in private cars tend to be longer in sprawled areas and city streets tend to congested, with cars spending more time in traffic. Water and sewage networks have to cover a much wider area, requiring more energy for pumping and water delivery. Garbage trucks have to run longer collection routes and spend more time delivering waste to disposal sites. The street lighting network has to cover a greater number of streets and consume more energy. A district heating network becomes less viable in areas with small density because of the high production and distribution costs, and because heat losses are larger when the distribution network is bigger.

Of course, as a study of the World Bank has shown, the large majority of cities worldwide (whether they are located in the developed or the developing world), are losing density. As more people come to rely on cars, they are also more willing to move further away from city centers. With an increase in expandable incomes, they can also afford larger homes.

Local authorities are not powerless though in addressing those challenges. They have a number of tools they can use to ensure that the loss in density is not too pronounced, and to ensure that the city expands in an organized, compact, and sustainable fashion. Ploiești has been more adept than other cities at using these tools.

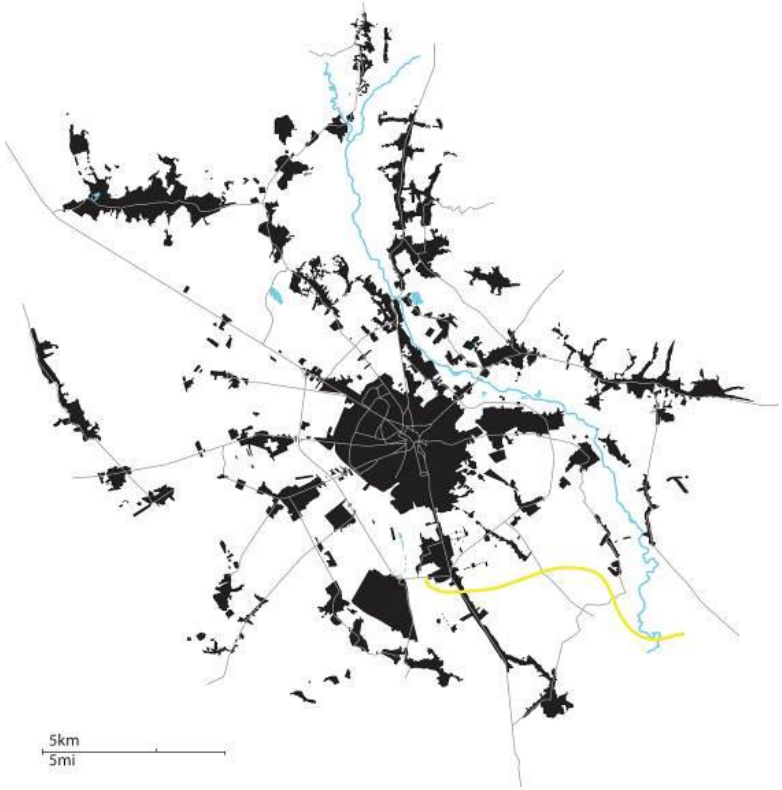
It has to be mentioned however that Ploiești has not known the same urban expansion as other cities. For example, between 1990 and 2011, only 4,400 new housing units were developed in Ploiești (around 200 units annually), and the city's urban mass has expanded by only 6,5%. Of all territorial administrative units in Romania, Ploiești has ranked only 20th in terms of new housing units built. As a comparison, one of Cluj-Napoca's suburbs – Florești, has built in 2008 (the peak of the real estate

boom in Romania) around the same number of new units as Ploiești did in 21 years.

Because of this, Ploiești tends to keep a relatively compact structure, with a fewer suburbanization problems than other growth poles. Nonetheless, if one looks at the built mass of the Ploiești Growth Pole (the City of Ploiești and 13 other localities), one notes that the area as a whole is anything but well planned. Smaller localities are scattered around the center city, and the large majority follow an elongated form, following major roads leading in and out of Ploiești. Some of these localities have expanded much quicker than Ploiești (e.g., Târgșoru Vechi, Aricestii-Rahtivani, and Blejoi have grown between 1992 and 2012 by 73.7%, 41%, and 36.7% respectively), and it will be important to introduce sound spatial planning practices at the metropolitan level. More specifically, planning cannot be done anymore within a clearly delimited administrative boundary. Instead, local and regional authorities have to plan for functional urban areas.

Luckily, Ploiești benefits from being situate on a relatively flat terrain. This will allow the metropolitan area to develop in a more sustainable fashion, as there are fewer topographical constraints – e.g. being situated in a river valley, like Cluj-Napoca is, being developed along a mountain range, the way Brașov is, or being situated along a water body, the way Constanța is.

The urban mass of the Ploiești Growth Pole



Ploiești Sector Analysis

The following analysis and recommendations are primarily about how Ploiești can become a more sustainable city. Although the focus will stay on energy efficiency, the scope of the analysis goes beyond that. Energy is easy to quantify and to measure, and is a good binding element for thinking about a city in a comprehensive way. Almost everything that is done in a city requires some form of energy input. Thus, TRACE (Tool for Rapid Assessment of City Energy) is not just a tool for assessing potential energy and cost savings, but it is also an instrument that allows local authorities and policymakers to think about cities as a whole. Eventually, TRACE is a diagnostic tool that helps cities become more sustainable.

TRACE is focusing on six municipal service areas: urban transport (public transport and private transport), municipal buildings, water and wastewater, power and heat, street lighting, and solid waste. For each of these service areas, TRACE requires the collection of a number of indicators. These indicators are both energy related (e.g., the fuel consumption of the public transport fleet) and not (e.g., urban transport modal split). The indicators on energy help analyze energy and cost savings potential in each sector, while the non-energy indicators give a more clear picture of these public utility services, and help choose the most appropriate recommendations so that they go beyond just energy issues.

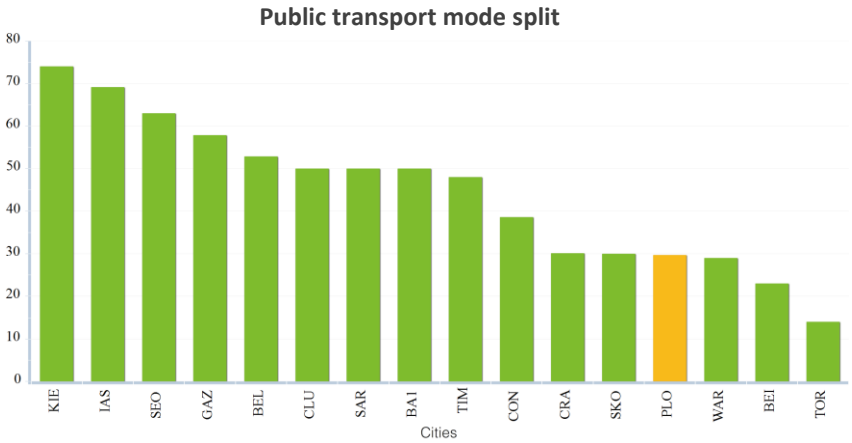
Energy and cost savings potential are assessed through a benchmarking process. Individual indicators selected for Ploiești are compared with similar indicators from other cities included in the TRACE database. There are few different ways to make this comparison. Cities can be compared based on level of development, climate, or population. Those cities that do better than Ploiești, on a particular indicator can become a benchmark that Ploiești itself can aspire to. For example, if several cities have lower energy consumption per passenger kilometer in the public transport sector, it is an indicator that city government in Ploiești could achieve energy savings in the 'Public Transport' sector (e.g., by modernizing the bus fleet, purchasing energy efficient rolling stock, etc.). The energy and cost savings potential is calculated for each of the six service areas. Subsequently, a priority list is drawn based on where the most significant cost savings could be achieved. This list is leading to a set of recommendations that are likely to have the biggest impact in terms of energy efficiency, for the lowest amount of effort and resources invested.

Preliminary on-site interviews and field visits have helped form a more accurate picture of sustainability, challenges, and opportunities in Ploiești. The following sections include a brief analysis of each of the six sectors analyzed with TRACE, along with some salient findings.

Urban Transport

Public Transport

The local transport in the city is well organized by Regia Autonomă de Transport Ploiești (RATP) - Local Transport Authority - a public company under the city government. The public transport fleet has around 230 vehicles comprising buses, trams, and trolleybuses, connecting the city from one side to another, including to some of the industrial platforms and big retailers located on the outskirts of Ploiești. There are 35 bus routes, two tram routes, and two routes served by trolleybuses. However, only around 30 percent of commuters in Ploiești use public transport, a figure which puts the city in the lower side of the TRACE database, and even so when compared to a number of cities in Easter Europe. The figure is also among the lowest from the growth poles.



Although part of the fleet has been modernized in the last decade, some of vehicles are older than 25 years. According to RATP the bus fleet has 186 buses of which 115 are operating daily. In 2002 the company purchased 50 standard diesel MAN buses, compliant with EURO 2 and 3 gas emission standards. The fleet also has 37 small BMC buses that can accommodate 45 people seating and standing. In addition, there are a number of 20 small Isuzu buses manufactured in late 1990. A third of the bus fleet is relatively old (beyond 25 years), consisting of 60 IKARUS 260 and 280 type diesel engine buses with high fuel consumption (46 liters per 100 km).

The city has 21 kilometers of single tram network serving two routes. With almost 105 meters of high transit capacity for 1,000 people, Ploiești is doing pretty well compared to other cities in the TRACE database, such as Tallinn or Belgrade. However, the tram network was built in a rather superficial way in only two years, between 1985 and 1987, at the request of the former communist regime – in observance of the national day. The tramline construction remained unfinished during the communist regime, and today the tram infrastructure is in need of rehabilitation.

The tram fleet is comprised of 32 second-hand KT4D model trams manufactured by CKD Prague in early 1980s, which were purchased from the City of Potsdam in Germany. Only 20 of them are in use daily. A dozen of these trams have undergone rehabilitation work and have been equipped with choppers that help reduce the electricity consumption.

Table 2: Public Transport Fleet in Ploiești

Type of vehicle	Amount	Length (meters)	Total capacity	Fuel Consumption l/100 km
Buses-Diesel MAN	50	12	100	33.7
Buses - BMC	51	9.5	70	28.8
Buses Isuzu	12	7.5	45	20.4
Buses IKARUS	60			46
Trams	32	18.1	120	
Trolleybuses	24	18	140	
TOTAL	229			

Source: Local Transport Authority Ploiești

Not in the least, the public transport in Ploiești is served by 18 large, new, very efficient Neoplan Mercedes trolleybuses. The trolleybuses were manufactured in 2001 on a very limited scale (of 30 pieces) for the City of Lausanne. At that time, the buses were very expensive; the Swiss city paid $1.5 million for each trolleybus. Later, after the trolleybuses incurred some minor technical problems the Swiss authorities decided to sell them to Ploiești for only $150,000 each, a tenth of their initial value. Ploiești purchased the trolleybuses in 2009, and the city has had them in use ever since. 24 trolleybuses are in operation, with three parked in the depot and used for spare parts. Each trolleybus is equipped with four 500 horsepower Mercedes engines that run on electricity, but can also run on Diesel and bio-fuel.

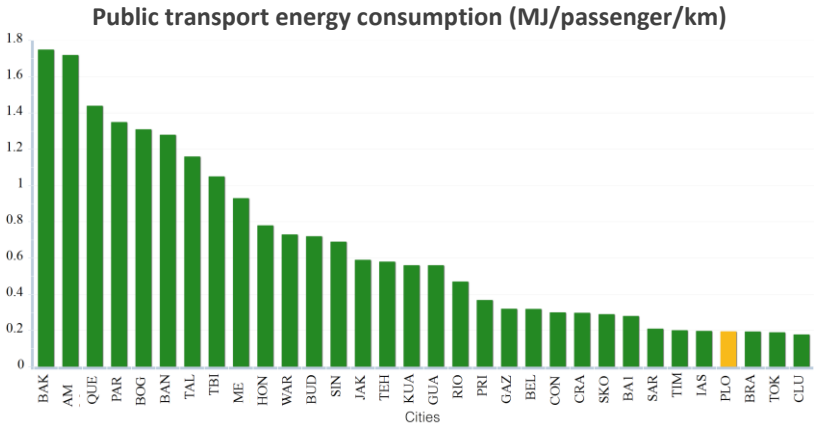
Neoplan trolleybus operating in Ploiești

If something goes wrong with the power connection, the trolleybus switches automatically from electricity fuel to Diesel. The engine is featuring military technology, as it could be used for both vehicles as well as submarines. These special trolleybuses can carry up to 140 people. The deck is lowering making the vehicle accessible for disabled people. The doors are equipped with computers that can be controlled by the driver. On average, each trolleybus runs about 200 kilometers daily. Of 24 operational trolleybuses, 16 are in use every day. But in spite of being user-friendly and very energy efficient, these trolleybuses require high maintenance costs. Apart from small minor repairs, any other serious

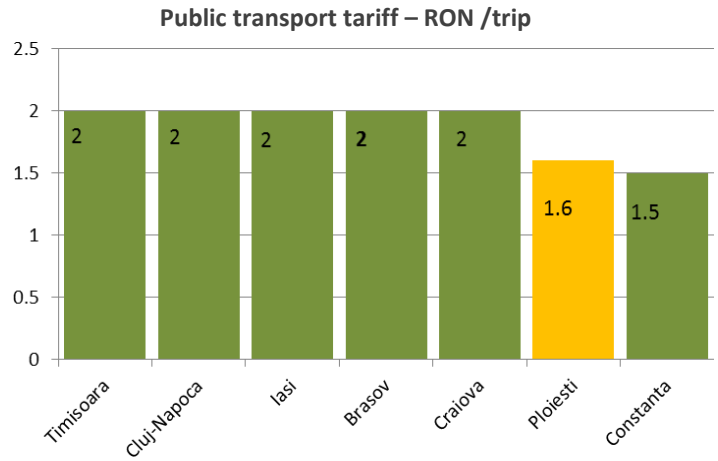
repair would require special order from the manufacturer at a high cost. Over the long term this can put a big burden on RATUC and on the city budget.

As mentioned earlier, only one third of commuters in the city rely on public transport. Worse-over, the public transport ridership is going slightly down. For instance, 6.7 million passengers relied each month on public transport in 2012, against 7 million per month in 2011.

Ploiești is doing very well in terms of energy efficiency in public transport, accounting for only 0.195 MJ passenger kilometers. This figure puts the city among the top performers in the TRACE database. Important to note is the fact that the public transport energy intensity of Ploiești is much lower comparing to other European cities with a similar Human Development Index, such as Budapest, Pristina, or Skopje. From this perspective, the city is third most efficient among the growth poles, after Cluj and Brașov.



RATP is running the public transport in Ploiești with an annual budget of RON 60 million (around USD 18 million), of which more than half (RON 35 million) represent subsidies from the City Hall. The company is operating with 1,063 employees including drivers and workers responsible for vehicle maintenance. Almost two-thirds of the operating budget goes for fuel expenses, 10% for electricity, 23% for maintenance, and only 5% for salaries. For instance, only in 2012 the fuel expenditure for the entire fleet was more than $3.5 million. In the same year, RATP paid almost RON 3 million for 9,348,260 kWh of electricity used primarily for operating the trams and trolleybuses. Passengers pay a flat tariff of RON 1.6 per trip, the lowest among the growth poles in Romania.



Source: Local transport companies in the seven growth poles

As many other cities in Romania, the city government is providing ridership incentives for certain categories of citizens. Retired people and children under the age of five ride for free, while students enjoy discounted fares. The City Hall subsidizes public transporation tickets and monthly passes. Blood donors can take advantage of a 50% discount for a monthly pass, while veterans, widows, and former political prisoners ride for free.

Over time, the city government and RATP made serious investments to improve the quality of the public transport in the city. In the past decade the city government invested more than RON 12 million to expand local transport in the city (e.g., introducing a trolleybus system) and performed some rehabilitation work on the tram lines. Promotion of non-polluting transport system in the city was also included in the Local Development Strategy, better known as “Local Agenda 21”. According to the document, EUR 8 million are going to be invested in the purchase of

clean fuel buses, with the scope of making Ploiești the first city in Romania to have a full fleet of environmentally-friendly vehicles. Ploiești was actively involved in several European and international projects that promoted a better, clean, and safe access of city residents to public transport.

One of the most important projects in this regard was CIVITAS SUCCESS. Funded by the EU, the program was developed by the City of Ploiești in partnership with RATP and the Oil and Gas University between 2005 and 2009[25]. The project focused, among other things, on building the first pedestrian and bike network in the city, a new car-free zone, and introducing of new clean fuel transport. Some of the existing old, heavily polluting buses were converted to run on clean fuel. A pilot project with a value of EUR 450,000 including VAT was developed, under which 25 of the existing old, heavily polluting buses were converted from diesel to Liquefied Petroleum Gas (LPG). RATP was the first local public transport authority in Romania to convert diesel buses to LPG.

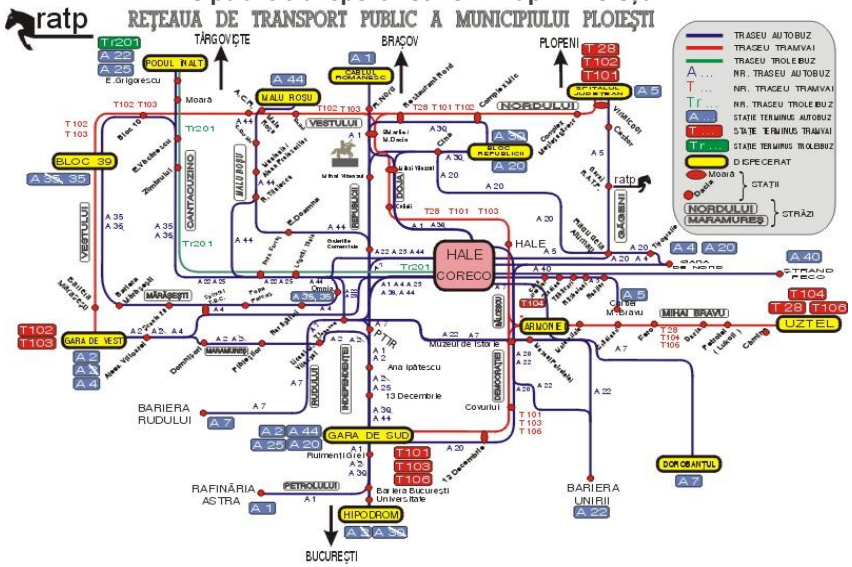
Diesel bus converted to LPG

Source: www.intergas.ro

A number of 10 bus stops were renovated and covered to protect the passengers against bad weather. Economically speaking, the conversion to clean fuel brought only a slight decrease in fuel costs. Even though LPG is cheaper than diesel, the consumption is double that of diesel buses (56 liters for LPG as opposed to 31 liters for diesel). Nonetheless, the project achieved an important success: the pollution level went down and the quality of public transport services rose as buses were completely modernized before conversion.

Other attempts to decrease energy consumption of the public transport fleet, and decrease the pollution in the city, have occurred in the last years. For instance, between 2007 and 2010 Ploesti entered into a partnership with a number of cities from Spain, Sweden, Bulgaria and the UK to promote bio-fuel as an alternative to fossil fuel.

The public transport network map in Ploiești



Source: www.transportlocal.blogspot.ro

[25] Information about CIVITAS SUCCESS KWh available at: http://www.civitas-initiative.org/index.php?id=66&sel_menu=35&city_id=11

The project, called BIONIC,[26] was designed to comply with the EU directive that called for the use of bio-fuel in a proportion of 5.75% until 2010[27]. Ploiești also received financial support to comply with the European policy on reducing energy consumption based on existing resources, under a project called PRACTISE. The project was developed between 2007 and 2009[28] and brought together four European cities - Ploiești, Alessandria, Ille-et-Vilaine, La Coruna – and a UK-based multinational company that is specialized in supporting local authorities prepare strategies for reducing energy consumption.

The municipality continued to invest aggressively in the public transport network in the past years. According to the city managers, the investments amounted to RON 81 million of which 30 million RON for maintenance of the tram network. For 2013-2016 the city government is planning to further invest 500 million RON in the public transport system, including from EU structural funds.

City authorities are considering the tram as the most efficient and cost-effective means of public transportation. Therefore, the local government is committed to invest heavily in the modernization of the existing tram network, and also expand the tramlines to some other parts of the city. Concrete steps have been done to this end. At the end of March 2013, the City Hall and RATP signed four contracts for the Rehabilitation of the Tram tracks – Phase II, under the Regional Operational Programme[29].

The total value of all these contracts is approximately EUR 60 million RON, including VAT. The City Hall's contribution was only 2% of the total value of the contracts. The implementation of the rehabilitation of tram network program will be completed in 24 months. City managers expect to have the new tram lines operational by mid-2015.

Old tramway in Ploiești

Source: www.tramclub.ro

These projects are expected to have multiple positive consequences – e.g. improve the traffic flow, reduce phonic pollution, and, not in the least, give the city a modern and less noisy tram network. First phase of the project is targeting the rehabilitation of 4.5 km of tram line single track from Bucla Nord to Republicii Boulevard intersection. A number of 11 tram stops will be adjusted to become user-friendly for people with disabilities. The rehabilitation work will include signaling, installation of automation elements and 149 electrical contact network posts, restoration of the overhead contact lines, as well as of the adjacent roads.

The second phase of the program will focus on 6.93 kilometers of single track tram line connecting Republicii Boulevard, the main street in the city, to Bucla Vest. A number of 17 stops will be modified to allow disabled people easier tram access, and 237 electrical contact network posts will be installed. The last two projects will reconstruct the infrastructure and over-infrastructure of the network, and build the moving-protection works for water network. Upon completion of this large program the city will have 20 kilometers of modernized tram network and a few new tram connections will be available. The rehabilitation and expansion of the tram network is just one leg of a more ambitious public transport investment program. Other projects are

[26] Integrated Development Plan Growth Pole KWh available at: http://www.kWh.ro/pidu042010/tot.pdf
[27] Directive 2003/30/EC on the promotion of the use of bio-fuels or other renewable fuels for transport available at: http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2003:123:0042:0042:EN:PDF
[28] Integrated Development Plan Growth Pole KWh available at: http://www.kWh.ro/pidu042010/tot.pdf
[29] City Hall Ploiești available at: http://www.kWh.ro/29.03.2013.php

looking into expanding the public transport access to some parts of the city where connections are poor or not available. For instance, a multimodal terminal is under construction in the northern part of Ploiești. Once completed, this tram terminal is expected to improve the traffic flow and also prevent large vehicles, like trucks, to enter the city.

On the long run, more projects are in the pipeline. The city government is hoping that public transport related projects in Ploiești will benefit of significant funds from the next financial programming of the EU structural funds starting 2014.

Tram network to be rehabilitated

Source: www.max-media.ro

On the other hand, RATP is planning to renew the public transport fleet and replace old vehicles with new, energy efficient ones, operating on clean fuel. To this end, a proposal has been submitted to purchase 50 non-pollutant buses, equipped with video cameras and facilities for disabled people. The City Hall financial contribution to this project is EUR 10 million. Three options of vehicles are under consideration: buses using less pollutant diesel, buses on LPG, and vehicles using Natural Gas. As the City Hall has to make the final decision, it is expected to choose the most appropriate vehicle for the city.

The transport company is hoping to perform more rehabilitation work on the transport infrastructure in the future, by purchasing modern maintenance equipment, and by developing new transport policies that would improve the overall public transport system in Ploiești.

Private transport

As with many other cities in Romania, traffic in Ploiești is a problem. The massive domestic and foreign investments that have poured in the region in the past twenty-years of transition pushed for a swift expansion of the private vehicle fleet. The oil industry, with its refineries and associated industries, the proximity to București and exposure to better opportunities have pushed development in the city and have enable more expandable income for people.

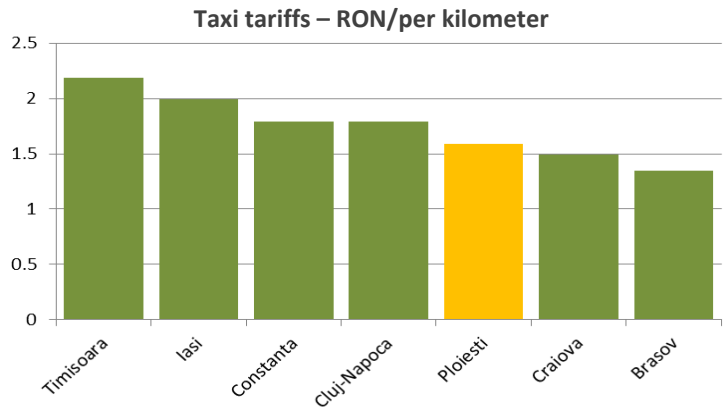
One of the visible results of these positive changes comes in the form of increased private car ownership. In the past decade people kept buying cars to use them not only to commute to their workplaces inside the city or to the industrial and oil platforms located outside Ploiești, but also for leisure. The proximity of Ploiești to the most popular and attractive mountain resorts in Valea Prahovei plays an important role in the expansion of the private vehicle fleet in the region. Nowadays there are almost 90,000 cars registered with the Traffic Police Bureau Ploiești.

Private cars waiting at the red light in downtown Ploiești

For a population of a little over 200,000, a simple math shows that there is one car available for 2.3 people. More than two-thirds of the private cars run on diesel, and a little less than one-third use petrol.

There are 1,041 mopeds, in addition to 941 taxis. Like other cities in Romania, the municipality ruled that taxi cars older than 12 years are

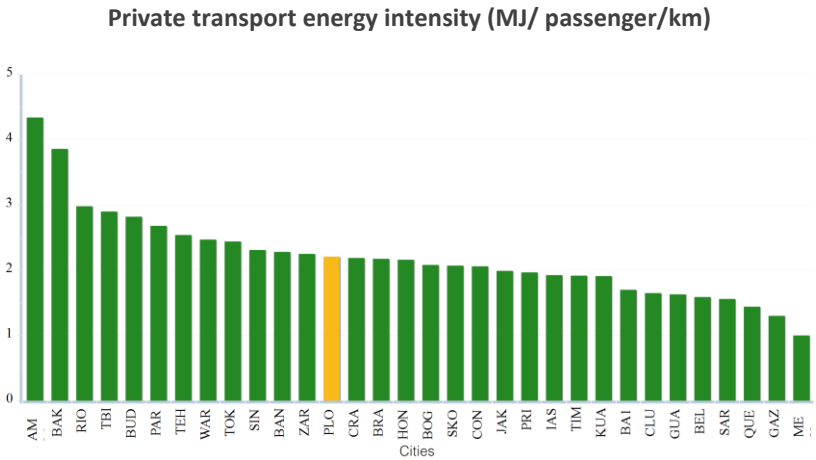
not allowed to operate. Taxis charge RON 1.59 per kilometer, a tariff lower compared to some of the growth poles, like Timisoara or Constanta, where customers must pay around RON 2 per kilometer.



Source: taxi companies in seven growth poles

The fuel consumption for the private cars in 2012 exceeded 44 million of liters of diesel and Petrol, which is the equivalent of $81 million. Given this figure, there is no wonder that the private transport energy consumption of Ploiești is pretty high, i.e., 2.208 MJ passenger kilometers, placing Ploiești in the first half of the TRACE database compared to cities with similar Human Development Index. Indeed, the energy intensity of Ploiești is lower than some of other European cities (e.g., Budapest and Warsaw), but is at least 50% higher than in others (e.g., Banja Luka or Pristina). The private transport energy consumption is comparable to some of the growth poles, such as Craiova and Constanța.

Approximately, one third of the cars are up to 10 years old and 20% are between 11 and 15 years. A fifth of the fleet is older 20 years old, while only 2% of the cars are new, up to two years old. As in other cities in Romania, Ploiești is taking part in the national scrappage program ("Programul Rabla"), which offers people who bring old cars a premium for burying a new car. The program has played an important role in helping renew the vehicle fleet in Romania.



The traffic management in Ploiești (i.e., red lights and signaling) is managed by UTI, a private. The company has an agreement with the City Hall for the monitoring and management of the traffic in Ploiești. Currently, part of the red lights use LED lamps. The city authorities plan to install a SCADA system and buy a number of video cameras to monitor traffic and accidents. The future SCADA system will be connected to public buildings in order to keep an eye on the streets, and thus, reduce the rate of crimes in the city. Once the SCADA system will be implemented, traffic monitoring and management will be coordinated from the City Hall with support from the local Police and RATP.

The increase in the number of cars not only increased traffic congestion in the city, but also posed challenges for parking. Currently, the public parking in Ploiești can accommodate 1,217 cars, a figure way too small to meet the constantly growing demand. Parking meters have been introduced in recent years to serve designated parking spots. These meters have replaced the old method, where payment was collected manually by people who showed up right after the car was parked.

The traffic signaling system in Ploiești is managed by a private company

Source: www.adevarul.ro

A more sophisticated payment method will be implemented soon, which will allow Ploiești residents to take care of parking fees using their mobile phones. The driver will send a text message with the registration number of his/her car, and will receive instantly a text message with the confirmation of the payment, including the time until the parking is confirmed. The parking time will be extended using the same method, by simply sending a text message. This easy and attractive parking payment method is already implemented in few cities in the country, such as Timișoara, Oradea, Arad, and Satu Mare.

A few ecologically friendly parking systems have been set up in the city by replacing large paved areas with green tiles that allow water to seethe through and vegetation to grow. Over 24,000 square meters of such parking lots have been already developed in the front of 15 of the city's residential buildings, and in front of a few shopping centers. There is also only one multi-story private parking structure, which has been recently opened in the city center.

Over the past years, the city government was preoccupied to develop and expand the non-pedestrian infrastructure, encouraging people to walk and cycle. Ploiești took part in SPICYCLES, a program developed under the Intelligent Energy Europe program of EU. Developed together with the cities of Barcelona, București, Berlin, Goteborg, and Rome,[30] the project encouraged the use of bicycle as an alternative transport mode through a partnership between municipalities and local investors interested in building infrastructure and logistics for cycling. SPICYCLES made cycling tools and know-how available to the cities in an attractive format.[31]

Paying by SMS parking system in Timișoara

Source: www.opiniatimisoarei.ro

The project was implemented between 2006 and 2008, and demonstrated that bicycle use can be increased in European cities with different geographic, climate and cultural conditions. In this context, Ploiești had been assigned to design a bike-sharing pilot system which eventually was promoted among commercial companies, local government institutions and educational institutions. Following an analysis of experiences and know-how in the field of bike sharing, a strategic scheme was elaborated for the set-up of a bike-sharing system with a fleet of 50 bikes resulting in building of the first eight kilometers of bike lanes. Unfortunately, private

[30] Integrated Development Plan Growth Pole Ploiești available at: http://www.kWh.ro/pidu042010/tot.pdf

[31] Newsletter Spicycles http://www2.trafikkontoret.goteborg.se/resourcelibrary/SPICYCLES%20Newsletter%201.pdf

cars are often parked on the bike lanes, blocking the access of bicyclists (see image below). This is an indication that building infrastructure is often not enough – one also needs to put the proper policy in place, and enforce that policy.

Cars blocking bike lanes in Ploiești

Source: www.adevarul.ro

Another CIVITAS project promoted non-motorized transport by encouraging walking, as a way of reducing pollution from private vehicle use. The level of pollution in the city is quite high, due to the proximity of all kinds of industrial platforms and several oil refineries. This project helped build 4.3 kilometers of pedestrian zone with improved facilities, and organized a campaign to encourage positive changes in attitude and travel behavior. The first clear zone of one square kilometer in Ploiești was developed through cooperation between property developers and local planning authorities to improve life quality in the city's historical center by minimizing the impact of pollution (emissions and noise) in the downtown area. As a consequence, there has been a 20% improvement in public transport speed, in addition to a 15% reduction in pollution in the central zone of the city.

But, despite the good work the city has done with regard to non-motorized transport, the number of people who walk or bike for their daily commutes is still quite low. Basically, less than 10% of commuters in the city walk or cycle. This figure puts Ploiești among the poor performers in the TRACE database. Other cities in Romania perform better. For instance, 20% of people in Cluj walk and/or bike to work.

Pedestrian area in downtown Ploiești

Source: www.evz.ro

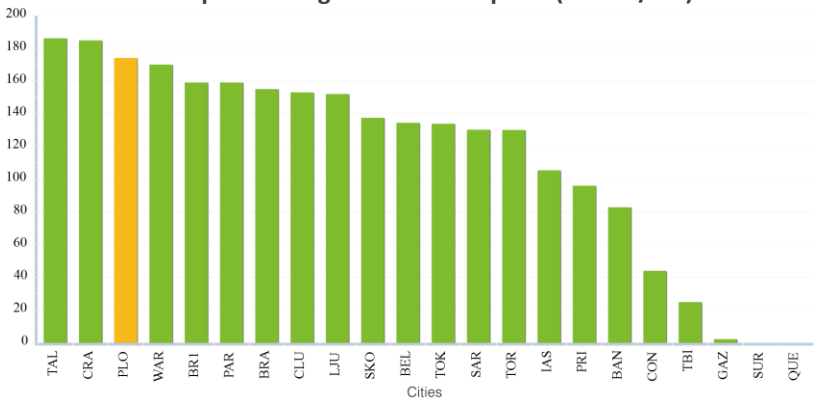
Municipal Buildings

Most of the city's municipal buildings are educational units, like schools, kindergartens, which also include additional facilities, such as sport halls, dorms, performing halls etc. Ploiești also has few medical units, commercial spaces, a stadium, and few administrative offices. The City Hall Ploiești is a tenant in the Administrative Palace located downtown area, a large building constructed during the Communist regime, currently owned by the County Council. The total area of municipal buildings that are under the management of the city government sums up to 171,321 square meters.

Like in many cities in Romania, data on municipal buildings is not complete, and some information is missing. For instance, the electricity consumption information is limited to only schools, kindergartens, and the stadium, with no data on hospitals and local public administration offices. According to the available data, the electricity consumption in 2012

amounted to 3,835,908 kWh for which the city government paid around RON 1.6 million. The overall heat consumption in all municipal buildings was almost 30,000,000 kWh thermal, which stands for an average of 174 kWh thermal per square meter. This figure is twice as high as the heat consumption in municipal buildings in neighboring European cities, such as Banja Luka and Pristina. The figure is also at the highest end compared to the growth poles in Romania.

Municipal buildings heat consumption (kWhth/m2)



In the past years, the municipality has been involved in a few projects aimed at improving energy efficiency in water and heat utilities. In 2009 Ploiești Local Council approved the participation of the city in a national program that encouraged the replacement of conventional heating systems with clean ones, using solar, geothermal and wind energy or other systems coordinated by the Ministry of Environmental Protection. Under this program, two medical care facilities (the Ploiești Municipal Hospital and the Infectious Diseases Hospital Ploiești) received financial support to switch from the classic method of producing hot water to those using conventional energy sources from solar energy.

The city is planning more programs and projects aimed at increasing the energy efficiency in public buildings. For instance, the updated list of projects included in Integrated Urban Development Plan[32] include a number of initiatives pertaining to the use of renewable sources to produce hot water for certain public facilities in Ploiești. Two of these medical units that benefit from such program are the County Hospital Ploiești and Social Care Services Complex "Sf. Andrei". The Romanian Environment Fund is set to provide financial assistance for the Emergency Hospital Ploiești to produce hot water from geothermal and solar energy resources.

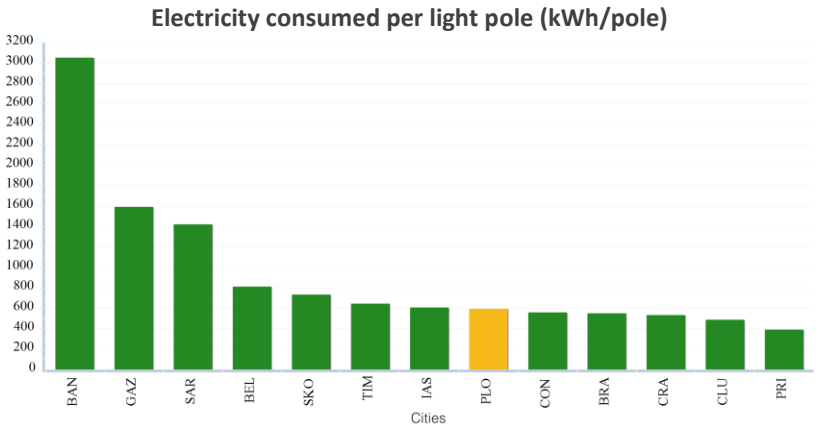
The Administrative Palace hosting the City Hall, Prahova County Council, and the Prefecture

With support from the local energy efficiency agency, the city government is preparing an application for a program that should make publicly available the data on energy performance for municipal buildings larger or equal to 500 square meters. Previously, the law required public authorities to make public the energy efficiency of all municipal buildings larger than 15,000 square meters.

[32] Integrated Development Plan Growth Pole Ploiești available at: http://www.ploiesti.ro/pidu042010/tot.pdf

Street Lighting

Some of the public utility services in the city are managed by the Public Services Authority (Regia Autonomă de Servicii Publice Ploiești - RASP), an autonomous public company under the City Hall. The company is supervising and monitoring the street lighting, solid waste collection, district heating, and wastewater treatment sector. The manager of RASP is appointed by the Mayor. The company has 100 employees.



The street lighting system in the city is doing quite well. Except for one street, all streets in the city, comprising 128 kilometers, are lit. Old mercury based lamps have been replaced with modern, more efficient sodium vapor ones. Today there are 16,000 street lighting lamps spread across the city. Following the rehabilitation and modernization process of the lamps, the electricity consumption went down drastically, to 9.5 million kWh. With a consumption of 595 kWh per lighting pole, Ploiești is doing better than most of the cities in the TRACE database with similar climate – including Sarajevo, Belgrade or Gaziantep. However, Ploiești has a slightly higher consumption comparing than cities such as Cluj or Tbilisi, but is lower than some of the growth poles in Romania, including Constanța and Timișoara.

In 2012 the municipality spent RON 4.5 million on street lighting, which was about roughly one percent of the city budget. The tariff for street lighting is depending on the time of day, and there are differences in this regards. For instance, 1 kWh of electricity cost RON 0.7 including VAT during peak time, and half price (RON 0.35) during off peak. In winter the street lighting schedule is from 5:30 PM to 7:30 AM, while in the summer the bulbs are on from 10 PM until 5:30 in the morning.

At the time of the implementation of TRACE in Ploiești, the city was in the middle of changing the street lighting provider. Luxten, the private energy and saving company responsible for the street lighting in the city for several years was to be replaced with a public company with shares from the Local Council, Serviciul Gospodărire Urbană (SGU), a company with little experience and knowledge in the field of street lighting. Luxten's contract with the City Hall was ending in mid-February.

The concession agreement with Luxten was actually extended twice, which is the maximum the law allows for. After the contract with Luxten was over, it would take another few months for the new street lighting provider to take over the system in the city. Over the course of time Luxten made several investments in the street lighting infrastructure. These investments started in 2001 and were carried out through 2012. During this period of time, nearly 90% of the old mercury lamps were replaced with more efficient sodium vapor ones.

A few years ago, the company attempted to implement an innovative, very efficient but costly lighting system, by installing several LED bulbs in one of the city parks. This was an ambitious pilot project the company took on in order to prove that street lighting can be done using a clean and efficient solution. Although the solution turned out to be appealing for the city mangers it was perceived as very costly, and soon after the pilot project was abandoned.

Replacing the mercury bulbs with sodium vapors bulbs lowered electricity consumption, and improved the overall efficiency of the street lighting in the city. Currently, the system allows for the street lighting provider to be informed in a timely manner of any problem related to street lighting pillars or bulbs by a mere phone call. Often, people call the company in the first 10 minutes after a bulb goes off. The fact that all streets in the city are lit helps in keeping down the crime rate in the city.

Street lighting poles equipped with new sodium vapor bulbs

Recently, the municipality had an attempt to employ a centralized light dimming program but unfortunately some problems occurred and few components did not work out. Some of the streets where the light dimming program was implemented reacted against this system. As it was about to end the contract with the municipality, Luxten was not interested to further pursue this program, neither to find out what went wrong and fix the system.

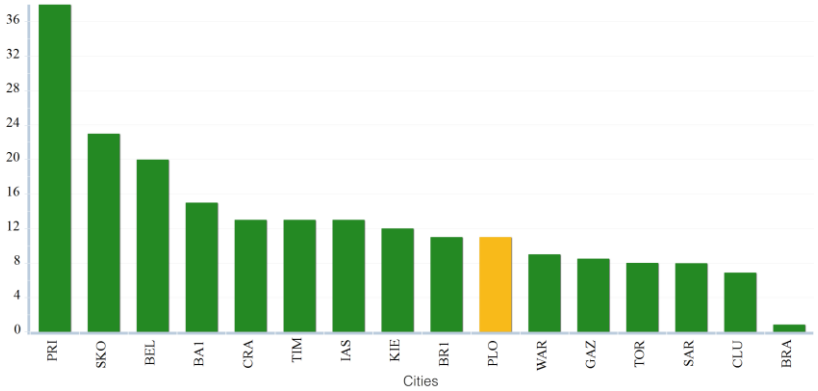
In the future, one of the RASP's very ambitious plans is to further improve the system and introduce LED-based street lighting in the city. However, for the time being, the municipality knows that the city budget cannot sustain the capital investments for such an efficient but costly solution.

Power Sector

The main electricity supplier in Ploesti is Electrica Furnizare Muntenia Nord. The company is supplying electricity to six counties: Prahova, Brăila, Galați, Dâmbovița, Buzău, and Vrancea. The power load for the entire Muntenia Nord region and its six counties is 1,000 MW, of which 30% is the peak load for Prahova County only (around 300 MW). Electrica Distrbutie Muntenia Nord is responsible for the power distribution in Prahova county and Ploiești city.

The losses in the transmission and distribution system are 11%, while the commercial losses amount to 2%. The losses in the transmission network are lower than the ones in the distribution system. According to Electrica transformer an upgrade is needed to reduce losses in the distribution network.

Percent of transmission and distribution electricity loss



In 2012, total electricity consumption for 94,521 residential consumers and some of economic agents in the city amounted to a total of 589,318 MWh. This figure does not include industrial consumption and those economic agents who fall in the eligible consumer category – i.e., clients who can choose the power supplier and have the technical capacity to connect directly to available power network. All domestic clients are captive consumers, as they do not have the technical capability to choose and connect directly to the power network. Some economic agents are captive consumers, and use the tariffs set by ANRE – the Romanian Energy Regulatory Authority. ANRE is regulating the tariffs for captive consumers – 45% of the electricity market in Romania.

A little over 92,000 clients are the domestic users or captive consumers from residential buildings and owners' associations, who are consuming about 240,000 MWh annually, with an average monthly consumption of a little over 200 kWh. The difference up to 589,318 MWh

is made of the power consumption of eligible consumers, who can choose their energy provider and the electricity tariffs.

Electric Pillars

In 2012, Electrica Furnizare purchased 124,496 kWh at the market price for RON 0.59/kWh, and 705,000 kWh for RON 0.51/kWh, the regulated price by ANRE. The price of electricity is depending on consumption, time of day, type of electricity, level of voltage, and type of consumer. For domestic consumers the tariff may range from RON 0.2810 to RON 0.4830 per kWh. People with low income pay the "social tariff", a lower tariff for electricity. Starting in November 2005, the social tariff is applying only to domestic consumers with a monthly income less than or equal to the minimum wage. The average tariff for economic agents and industrial consumers is ranging between RON 0.5436 and RON 0.878 per kWh.

There is no significant renewable energy project in Ploiești city. However, there are two photovoltaic parks in Prahova County with an installed capacity of 18 MW and 40 MW, respectively. The county and Electrica issued permits for a total of 100 MW installed capacity. A program is under implementation to install 3 KW photovoltaic capacities on each building in rural areas, in order to enable them to have electricity and hot water available at any time. So far, solar panels have been installed on hospitals and kindergartens to produce hot water. Prahova County has exhausted all available spots for installing hydro-based energy plants. In Romania, the energy produced from wind energy is the cheapest renewable, requiring an investment of EUR 1.1 million to produce 1 MW. The most expensive energy is produced from hydro-power sources, where the cost of production for 1 MW may be anywhere between EUR 4 to 5 million. Photovoltaic energy is much cheaper than hydro-power, with an initial capital investment of EUR 1.5 million to produce 1 MW electricity.

Water Sector

Potable water

The water sector in Ploiești is split between a private and a public operator. The potable water sector is managed by a private company, Apa Nova, while the waste water stays with the public sector, Regia Autonomă de Servicii Publice (RASP). The two companies are interconnected as Apa Nova is collecting the money for water services from the population and then it pays the public company.

The potable water service of Ploiești has been taken into concession by Apa Nova. Currently, administrative wise the water service is under the City Hall, but is managed by Apa Nova. ApaNova is a private company, with 73% shares from Veolia, a French public utility operator, and 27% shares from City Hall Ploiești. Veolia is also the main shareholder in Dalkia Termo Prahova, the district heating operator in Ploiești. Apa Nova is the potable water provider in Ploiești since 1997, and has a 25-year contract with the City Hall to operate the water system in the city until 2022.

The water distribution network has approximately 400 kilometers of pipeline which are the property of the City Hall. There are 18 underground water sources, 38 underground and over-ground pumps in the city with 40 to 150 water table depth, and four reservoirs. For instance, the main water pump station, called "Stația 23 August," has 4 large pumps; three pumps have an electric capacity of 132 kWh each, while one pumps runs on 90 kWh. Each pump delivers 1,000 cubic meter of water per hour. The raw water goes into the reservoir and then it gets chlorinated before it is pumped. The chlorine content in the water is 0.5 mg/ per liter.

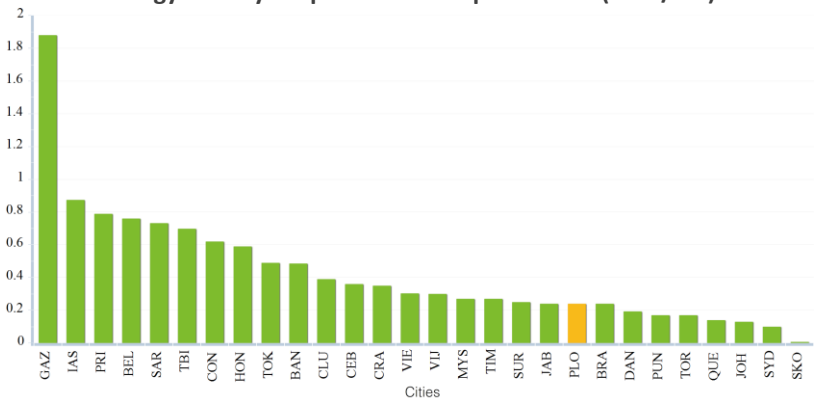
The "23 August" Water Treatment Plant in Ploiești

The maximum water capacity in the main reservoir is 20,000 cubic meters per day, a figure higher than the daily water supply in the city (between 14,000 to 15,000 cubic meters). When the big reservoir needs to be cleaned up, another reservoir with a daily capacity of 10,000 cubic meters of water is used. After the chlorine treatment the level of water pressure in the reservoir is at 3.4 bars. The water treatment plant is situated 40 meters above the city surface level. Water is brought to the city by gravity, without using any pumping. By the time water reaches the city with free flow, the pressure increases to 7.4 bars, which is more than enough to raise water vertically up to the 31 meters high water storage tanks.

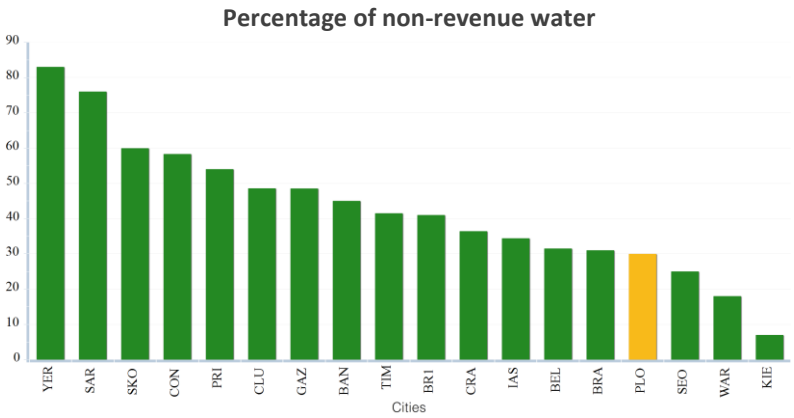
Although the network is owned by the City Hall, if something goes wrong with the pipelines or there is a leakage in the network, it is Apa Nova's responsibility to fix the problem. The modernization of the water system included the installation of water meters within the entire network. According to the agreement between Apa Nova and City Hall Ploiești, 20% of revenue is used for investment in the pipeline network and 80% is used to cover part of the cost of equipment modernization, safety, and maintenance. As a private company, Apa Nova does not have direct access to EU funds. The company is using a SCADA system to monitor water supply in the distribution network and perform upstream water pressure and distribution analysis. At the end-users (the downstream level) the company is considering installing an automatic pressure valve system in order to manage and monitor water pressure.

The annual water production for Ploiești is a little over 17 million of cubic meters, for which 4,080,000 kWh is used. The energy expenditure accounts for a small amount of the budget – only 5%. On average, approximately 0.24 kWh is necessary to produce one cubic meter of drinking water. This figure puts Ploiești in the lower side of the TRACE database, among the cities with the most efficient potable water system. From this perspective, Ploiești has a similar performance as Brașov, and it is doing better than other cities with similar Human Development Index, such as Cluj-Napoca and Vienna.

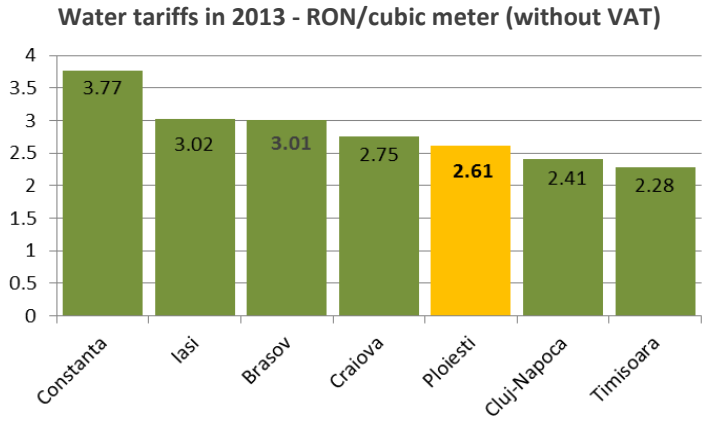
Energy density for potable water production (kWh/m3)



The city is doing also quite well in terms of water consumption, with 154 liters of water per capita. Ploiești is performing similar to Brașov, and better than most of the cities with similar climate in the TRACE database, such as Cluj, Gaziantep, or Sarajevo. Comparing to other cities, the losses in the water system in the city are not too high. With 30% percent loss in the system, Ploiești is performing better than most cities with similar climate, including Bratislava, București or Pristina. At the same, it is the best performance among all seven growth poles in Romania. However, there is room for improvement, as some European cities, like Warsaw and Kiev have even lower water losses.



The tariffs for water are based on expenditure related to production and distribution. In 2012, the households in Ploiești used to pay RON 2.26 without VAT per cubic meter of potable water, and RON 1.1 RON for one cubic meter of waste water. At the beginning of 2013, the water tariffs went slightly up. Now people in Ploiești pay RON 2.61 for a cubic meter of potable water. The water tariffs are in the lower range compared to other growth poles (see table below).



Source: www.anrsc.ro

A good point is that the city residents are paying the water bills in time and so the collection of bills is almost 100%. However, keeping the tariffs at this level turns out to be a difficult task for the company. If Apa Nova could raise the tariffs by a few percentage points, then the company may be able to generate more funds necessary to improve network. The water tariffs can be adjusted twice a year with the City Hall approval. However, the city government is reluctant to ask people to pay more for water services.

In order to improve the water loss figure, Ploiești municipality and the private company need to further invest in the water network. A large project of around EUR 140 million from European funds covering the water sector in Prahova County is currently under implementation. The project aims to improve and expand the water utility and sewage services to all localities in the county, and is implemented by Hidro Prahova, the water company under Prahova County Council catering water to a large part of the county including several municipalities. Prahova County Council and the city managers of Ploiești have done efforts to include Apa Nova in this project, but because the major shareholder is a private entity the company could not qualify. Anyway, it is expected that the project will reduce the losses of Hidro Prahova, and thus, reduce the operating cost. After completing the project, 96% of the population of Prahova County will be connected to water and sanitation services.

Wastewater

Currently, the wastewater treatment sector is coordinated by Regia Autonomă de Servicii Publice Ploiești (RASP), an autonomous public entity under the Ploiești municipality. RASP is supervising the public services in the city, including waste water, street lighting and solid waste sectors. The waste water treatment plant is located on the city outskirts. The new facility is a project of EUR 26 million, currently under construction, and it is expected to be completed and operational by the end of 2013. The new waste water plant is developed in the proximity of the old facility, and it spans over 20 hectares of land. Most of the funds necessary for this project come from the Ministry of Environment, with a small financial contribution from the city government. When completed, the new waste

water treatment plant will be one of the most modern and efficient facilities in the country.

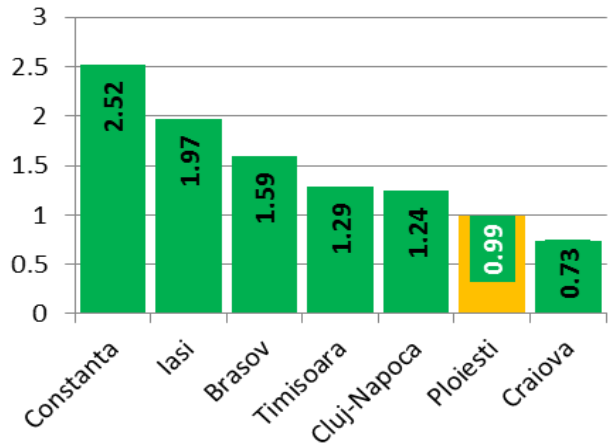
The most noteworthy aspect about the new plant is that the facility will be able to produce biogas. The waste water will be collected in two large reservoirs and then it will go through a filtration system that has capacity to generate energy from methane/biogas and produce electricity. Running the biogas plant would be a function of how efficient the collection of sewage/mud will be.

Wastewater basin (left) and biogas digester (right) at the new wastewater treatment plant

Until 2007, the waste water plant was managed by Apa Nova, the private utility company. In 2007, the facility had been taken over by the City Hall and given to RASP. Today, RASP and Apa Nova are engaged in a commercial relationship. In 2012, Apa Nova paid RON 0.24 per cubic meter of water utility for sewage, and charged RON 0.99 per cubic meter from clients without VAT, which is one of the lowest tariffs among the seven growth poles. However, ever since the waste water treatment plant was taken away from Apa Nova, the company lost RON 14.5 million over the last six year, diminishing considerably the company's annual revenues.

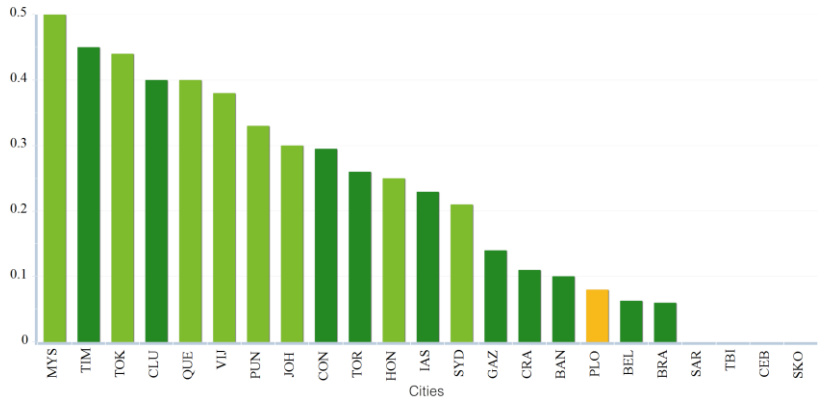
The waste water sector is very efficient because it does require a small amount of energy, only 0.08 kWh for treating one cubic meter of water. Thus, Ploiești ranks among the most efficient cities within the TRACE database, doing far better than other European cities, including Banja Luka or Gaziantep. Also, it is one of the most efficient wastewater systems among the seven growth poles.

Wastewater tariffs in 2012 (RON/cubic meter without VAT)



Source: www.anrsc.ro

Energy Density for Wastewater Treatment (kWh/m3)



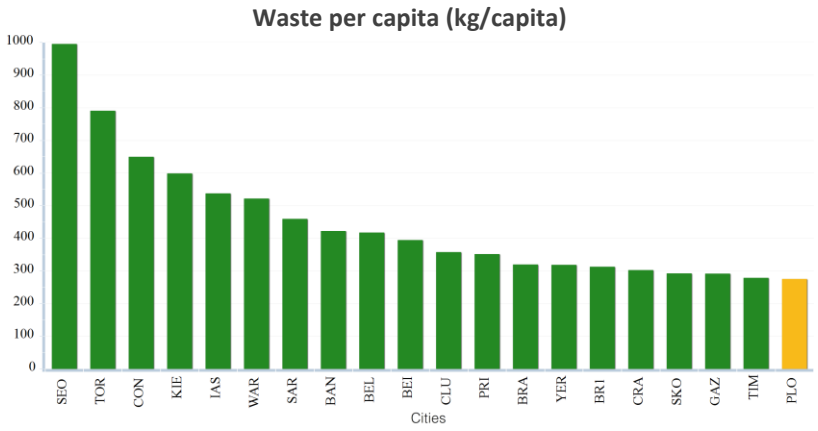
According to the agreement signed between Apa Nova and City Hall Ploiești, the new waste water treatment facility should return back to the private water operator, once the construction of new plant is completed. On the other hand, local authorities are confident that the public company will be managing the facility for the next five years, being responsible for monitoring and supervising of the waste water related activities.

Solid Waste

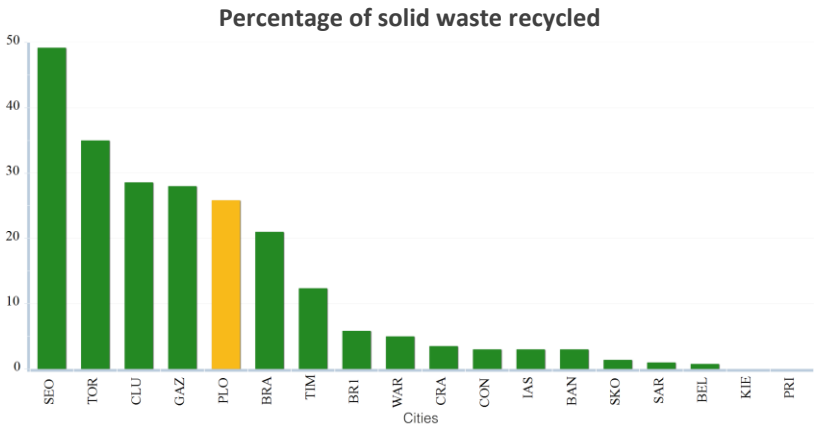
The solid waste system in Ploiești is managed by the private sector through two companies: one is in charge with the collection of solid waste, and the other is operating the landfill. Since 2010, the solid waste collection in Ploiești is managed by Rosal, a private company operating in several cities in Romania. Previously, the collection was done by Vitalia, a privately held company which originally belonged to French group with the same name operating in the public service sectors. Vitalia is currently managing and operating the eco-framed solid waste landfill located in Boldești-Scăeni, about 15 kilometers far from the city.

In 2012, the amount of solid waste generated by domestic clients (only population, without economic agents or industry) was a little over 57 million kilograms. The annual solid waste generated per capita in Ploiești is less than 300 kilograms; thus, the capital of Prahova County is performing far better than most of the cities in the TRACE database with similar climate. The figure is comparable to Timișoara and Craiova, and it is twice as low as the solid waste generation per capita in Iași or Constanța.

The selective collection started at the beginning of 2012, and is done at the source. No selective collection is done at the solid waste landfill. One year after the selective collection was implemented it already showed impressive results – now a quarter of the solid waste is recycled. Comparing to other cities with comparable climate within the TRACE data base Ploiești is performing quite well in this respect. For example, the rate of recycled waste collected in Ploiești is higher than of other cities in the region like București, Warsaw, or Banja Luka. Ploiești has also the second highest percentage of recyclable waste among the growth poles.



The selective collection process is done at two levels, at the households and at residential buildings. Households receive special bags to separate the plastic bottles, paper and metal cans from organic waste then Rosal is picking up these bags directly from the houses.



In residential buildings people put the recycled waste in bags available on each floor, and then they drop them in special containers of different colors placed in designated locations. Most of these containers are

located near the residential buildings. There are 260 selective collection points available in the city where people can dump paper, glass, and plastic bottles. In addition, there are 39 underground platforms buried in the ground, with only the lid hanging outside. People bring the trash bags to the buried containers, open the lid and drop the waste bags into the platforms that have a depth of few meters.

The selective collection rate is higher for individual homes than in residential buildings. The City Hall offers incentives to encourage people to separate recycled waste from organic waste in residential building by giving them 20% discount in collection fee if they meet the minimum amount of collected recycled waste of 3.6 km per person per month.

Information campaigns have been going on in the city since 2012 aiming to raise awareness among population to embrace the selective collection system and separate plastic bottles, metallic cans, and papers from organic waste.

Buried solid waste platforms (left) and special containers for selective collection (right)

People responded very well to these initiatives and the high selective collection rate in the city speaks for itself. The tariff for the collection of the solid waste is 6 RON per person per month.

The city government is taking steps to tackle the issue of construction waste resulted from construction sites, demolitions and other related activities. As of now, there is no regulation with regard to construction waste, neither indication where the waste should be dumped, or what are the related tariffs. The Local Council wants to pass a law requiring the constructer or the construction companies to clearly specify, prior to construction activities, what they plan to do with the construction/demolition waste and where such waste is going to be deposited.

ROSAL is operating with 16 trucks that require approximately 28,000 liters of diesel every month. The amount of solid waste collected yearly by Rosal is between 60,000 to 80,000 tons, including waste generated by economic agents. In 2012 the amount of solid waste the company dumped at Vitalia landfill amounted to 77,080 tons, which included waste collected from non-resident clients.

Since 2001 the landfill at Boldești-Scăeni situated 15 kilometers from Ploiești is operated by Vitalia. The company owns the 15 hectares of land, of which 13 hectares are the cells where the solid waste is dumped and deposited. The landfill has six cells; currently, three of them are full and one is used at 50% capacity.

Vitalia Landfill at Boldești-Scăeni

Overall, the landfill can deposit 3 million tons; as of now, 1.2 million tons have been already dumped at the facility. The landfill is managing around 80% of the waste collected in Prahova County, including the amount of solid waste collected in Ploiești by Rosal. The landfill is catering for

600,000 people. Approximately 130,000 tons are dumped annually at the landfill at a tipping fee of RON 59.22 per ton.

Vitalia landfill has the potential to produce biogas. A project of 2 EUR million is being developed nowadays to this end. Initially, the installed capacity for producing biogas will be of 0.6 MW, and later it will increase to 1 MW. The biogas plant will be operational sometimes in 2013. Vitalia is planning to further invest several millions of Euros to produce 6 to 8 MW of electricity and thermal energy through a gasification process. The cost of producing 1 kWh of biogas is less costly than that of producing energy from other renewable sources.

The landfill is one of the most advanced and well equipped facilities as such in Eastern Europe. The entire activity at the landfill is automated, performed by high technology equipment. Trucks carrying the trash are weighted at the gate, and instantly the operator is issuing the papers indicating the date and the amount of waste dumped. Monitoring of the solid waste dumped at the landfill is computerized, which allows the company to have reliable records on the solid waste deposited in the facility.

Vitalia is operating the landfill with 6-8 trucks including a compactor and a few large trucks. Currently, there is no sorting station. Such a facility is included in the solid waste master Plan, and is going to be built in the proximity of the landfill. The landfill has a reverse osmosis leachate treatment plant – a facility allowing the treatment of water for which the company invested approximately EUR 650,000 without VAT. The leachate treatment plant has a processing capacity of 3 cubic meters per hour and 70% recovery rate, while the rest of 30% is re-injected.

The Vitalia landfill will be included in the integrated solid waste management plan of Prahova County. The solid waste master plan is coordinated by the Prahova County Council through Termoelectrica, a public company owned by Prahova County. Termoelectrica is managing the other eco-framed landfill in Prahova County at Vălenii de Munte, a facility established in 2005. The landfill is catering for less than a quarter of the population in the county, collecting and dumping 48,000 tons of solid waste annually. It is equipped with a facility to produce a small quantity of energy through gasification process; but because the flow of sludge is not constant the gas concentration is not too high either.

Truck on the weighting facility at the landfill in Boldești-Scăeni

Leachate before (right) and after (left) treatment at Vitalia's leachate plant

The Master Plan is a sophisticated project of EUR 43 million funded from EU funds through Environment Operational Program, spanning over a period of 30 years. The contract for the solid waste plan was expected to be signed in 2013, and then a tender will be organized to choose the operator. The plan will include two transfer stations - one at Vălenii de Munte and one at Boldești-Scăeni – a sorting station at Boldești-Scăeni, in addition to the existing fixed station available at Termoelectrica, three compost stations (one at Boldești-Scăeni and two facilities at Urlați), and a Mechanical and Biological Treatment Plant at Vălenii de Munte. The solid waste management policy requires the tariffs for collection and dumping to be affordable and so the tariffs will be set accordingly.

In addition to the two landfills at Boldești-Scăeni and Vălenii de Munte there is another private landfill in the county, owned by the oil company Rompetrol, and an incinerator for hazardous waste (including waste generated by hospitals), which is one of the seven facilities as such in the country.

The Public Private Partnership (PPP) in the field of solid waste in Prahova County is an example that such arrangements can work in Romania. However, there remains much to be done as to improve the situation. The PPP model is not working the way it should because the legal framework is deficient and has some provisions that fail to clearly define the role of private and public entities, and how they should relate to each other. On the other hand, the most problematic factor is the duration of the PPP, and its operating timeframe. Banks are not willing to give loans for short term projects, such as 3 to 5 years, and prefer projects spanning a longer period of time.

District Heating

The district heating sector in Ploiești is managed by Dalkia Termo Prahova, a private company with 87.2% shares from Dalkia Romania which is part of Veolia, a French company very active in services and utility areas traditionally managed by public authorities. The rest of 12.8% shares are equally divided between City Hall Ploiești and Prahova County Council. Dalkia is operating the district heating of Ploiești since 2004, when a concession contract with City Hall Ploiești and Prahova County has been signed for 15 years. The agreement is valid until 2019, and it can be extended after the initial contract expires. The company is responsible for the entire operation process, from production to distribution of heat in Ploiești in combined heat and power (CHP) system. The plant is located at Brazi, 10 kilometers far from the city. The plant is the property of the city government, while the network belongs to the Prahova County Council. Dalkia Romania has been present in Romania since 1992, and currently is operating the district heating systems in four cities and the Polytechnic University of București. The overall turnover for 2011 accounted for EUR 67 million, while the total investments amounted to over EUR 32 million since early 90s, of which almost two thirds targeted the rehabilitation of the district heating system in Ploiești. For instance, new gas turbine at the thermal heating center at Brazi was put into operation in 2010 as part of RON 53 million projects intended to improve efficiency of heat production.

Dalkia Termo Prahova is operating the primary and secondary heating network in Ploiești. The company operated the heating plants even before the concession agreement was signed in 2004. Today, the company is responsible for the entire process, from production to distribution of heat and hot water in co-generation to collection of bills. Dalkia is supplying heat and hot water to 57,855 residential building apartments – of a total of around 64,000 such apartments in Ploiești. The company is catering to 105,000 people, almost half of the population of the city. In addition, the company is providing heat to 33 municipal buildings and 756 economic agents. The client structure is as following: 66.9% domestic, 31.65% industrial, economic agents and others, and only 1.38 % of the customers are public buildings.

The district heating system is made up of three large boilers that operate on gas and heavy fuel with a total installed capacity of 840 MW thermal, and three turbines of a total 260 MW electrical installed capacity to produce hot water. There is a natural gas-based turbine that can produce 25 MW electrical and 27MW thermal. Usually, the turbine is running for an average of 9 months a year, using 600,000 cubic meters of natural gas to produce hot water. In addition, the thermal points (sub-plants) in Ploiești produce 475 MW thermal. The plants operate on natural gas and coal and can use a mix technique, as they can switch from one type of fuel to another. The natural gas consumption in winter time is three times higher than in the summer.

New radiators replaced some of the old ones

Source: www.iploiești.ro

The length of the primary network is 62 kilometers, of which 62% is underground and 38% above ground. The length of the secondary network is 92 kilometers. Most of the network was built in the 1960s. As of today, half of the 88 sub-plants have been modernized. According to the contract signed in 2004 with the local public administration, Dalkia must invest EUR 25 million in the modernization of the network and modern equipment to increase efficiency of the system. Until 2010 the company invested EUR 21 million aimed at improving the overall efficiency of the system. The replacement of eight kilometers of pipelines in 2004 helped the efficiency of the system improve significantly, and since 2004 30% less gas was used in the system.

Before the efficiency program was completed 300 cubic meters were needed to produce 1 Gcal of heat, against only 200 of cubic meters required today to prepare the same amount of heat. Savings have also been made with regard to water and electricity consumption. From 2005 to 2010 the consumption of hot water went down by more than 50%, from almost 250,000 tons per year to a little over 100,000 tons per year. Similarly, the electricity consumption has been reduced drastically from 100,000 MWhe in 2005 to 60,000 MWhe in 2010.

Dalkia Termo Plant at Brazi

The energy savings and lower fuel consumption have resulted in the improvement of the overall system's performance, including boilers and turbines. For instance, the energy performance of the turbine in the cold season went up from 36.8 % in 2004 to over 43% in 2010, while the degree of continuity of the heat supply increased from 94.02% in 2004 to almost 100% in 2011.

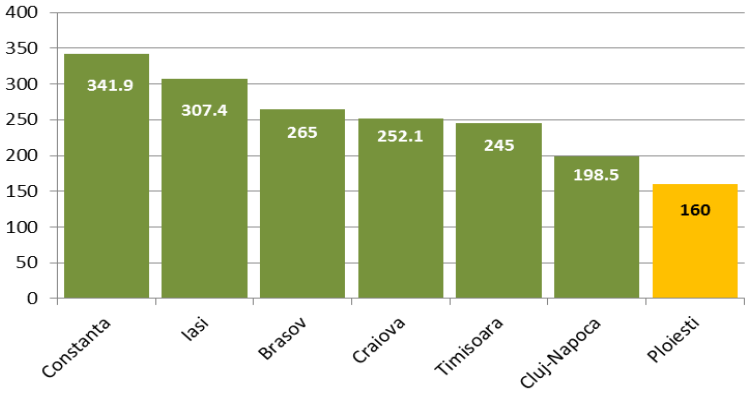
Now the district heating plant can reach 75% efficiency when the outside temperature is 0 Celsius and a maximum efficiency of 76% when the temperature is going up to 4 degrees Celsius. The maximum temperature of hot water is 110 degrees Celsius. During Communist times it used to be 120 Celsius.

The rehabilitation and modernization of the network and the energy efficiency programs developed in the past years are the main reasons behind the highly competitive heat price.

Inside the co-generation plant at Dalkia

The production cost of RON 224.33/Gcal is the lowest in the country, a fact that allows Dalkia to keep the heat tariffs down. In 2012, the domestic consumers in Ploiești paid the lowest price for heat in the country, RON 160/Gcal, including subsidies from the City Hall. The economic agents and public institution pay RON 244/Gcal, including VAT.

Heat tariff in 2012 – RON /Gcal

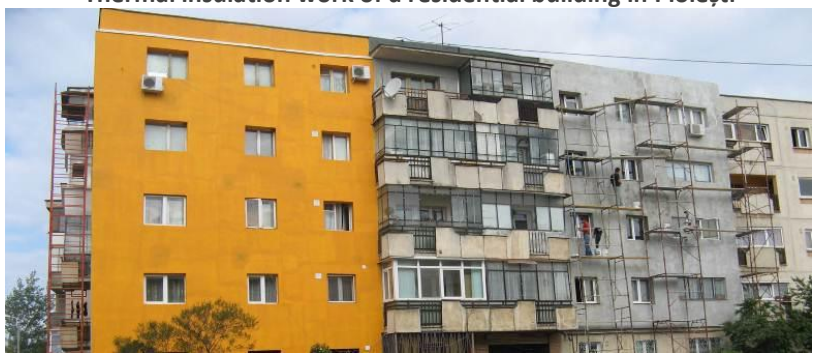


The heat is distributed during the cold season, approximately five months a year, and it is supplied only after the temperature in the night time drops to 10 Celsius for three consecutive nights. The hot water/heat distribution system is done vertically. In this case, if a client (apartment) is not paying the bill on time, then the entire residential building may face consequences, including clients who paid their bills on time. The company may decide to disconnect the building from the district heating system and so the supply of hot water and heat is put on hold to all apartments until the due payments are made.

The thermal rehabilitation of hundreds of apartments in Ploiești is helping maintain a higher level of comfort in old residential building, where people used to suffer from cold and poor services in the past.

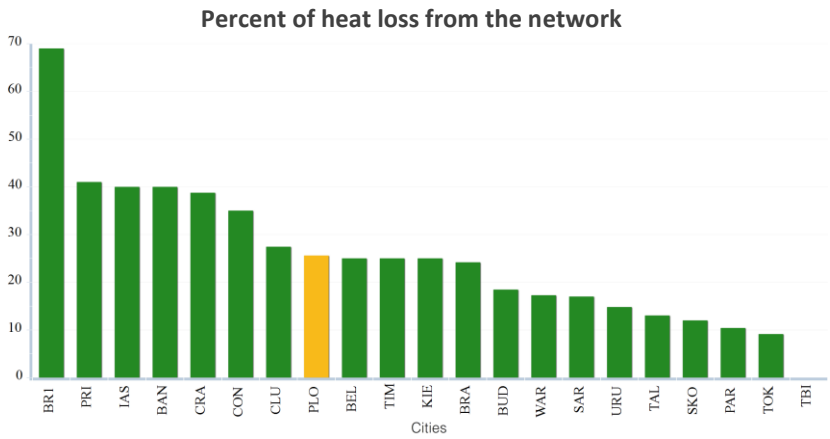
However, despite efforts that have been made to improve its efficiency and keep the heat price at the lowest level in Romania, the district heating system in Ploiești is facing challenges. Perhaps the main problems are the heat losses due to hot water leakages in the network. Currently, the technical and commercial loss of the system is accounting for 25%. The figure is among the highest in the TRACE database comparing to other European cities that operate district heating systems and have a lower level of heat losses, such as Tallinn, Skopje or Budapesta. But comparing to most cities in Romania, including other growth poles, like Brașov and Cluj-Napoca, Ploiești is performing far better.

Thermal insulation work of a residential building in Ploiești



Source: www.evz.ro

The heat loss is affecting the hot water/ heat revenue collection. The main culprit of these losses is the leakage in the network and the age of the pipelines.



Although the average age of the district heating network in Ploiești is 32.3 years, which is roughly smaller than some of other similar networks in the country, the pipelines have been made with poor quality materials. Despite the millions of euro the company invested in different programs aimed at increasing efficiency of the systems, the leakages problem in the network remains unresolved. Dalkia Termo Prahova has a SCADA system, but the tool cannot identify the problems that may occur on the network. The last assessment with regard to leakages on the network has been performed in 2010.

Energy Efficiency Recommendations

TRACE is a tool that allows the estimation of energy savings potential in different city service areas by benchmarking the performance of a city against other cities with similar characteristics, such as climate, population, or Human Development Index. For example, energy consumption per street light pole in Ploiești was compared to similar consumption of other cities within the TRACE data base with similar climate. The energy savings potential with regard to street lighting in Ploiești was calculated using a method that factored in the cities that performed better than the city, and the degree to which these cities performed better. The more information is available in the TRACE database, the better results it can provide. Currently, TRACE has data on almost 100 cities, which generally allows for good comparisons.

The energy saving potential is also determined by another key factor, i.e., the level of local control. The more control local public authorities have over a particular service area, the higher the energy saving potential. In Ploiești some public utility services are managed by the city itself, whereas some others stay with the private sector or they are regulated at the national level. Solid waste, including the landfill operation, is managed by the private sector, and so the city of Ploiești does not have any significant saying in this matter. The potable water sector and the district heating are managed through Private Public Partnerships where the private sector is the major stakeholder. The city has also a very little influence over the energy sector, as policies and regulations are decided by the Government at the national level. In addition, another service area where the local level of control was considered pretty low is “Private Vehicles”. In this sector the policies and decisions are taken by the Government, with limited scope for local involvement.

After the saving potential for each sector was calculated, TRACE performed a sector prioritization automatically, based on the amount of savings potential. The sectors with the largest energy savings potential in Ploiești are “District Heating”, “Private Vehicles”,” Municipal Buildings”, and “Public Transport”. “District Heating” is the sector with the highest potential of energy efficiency gains, even if this field is controlled by both private sector and the city government. The next sector with the second highest potential of energy saving is “Private Vehicles”, although the level of city control of this sector is quite limited. “Municipal Buildings” where education and health care facilities are under the city government control have a good energy saving potential. “Public Transport” is another important sector where the municipality has already invested in recent years, and where the level of local control is quite high. The next sector of importance with a good potential of energy savings that have been highlighted by TRACE is “Street Lighting”, which is under local municipality control. As far as “Potable Water”, “Solid Waste Management”, and “Wastewater”, these have a small reduced energy savings potential – primarily because energy efficiency improvements have already been done in recent years or are on-going, and because they are under the private sector (solid waste and potable water) with limited control from the city authority.

Sector prioritization

City Authority Sector Ranking

Rank	Sector	REI%	Spending (US $)	CA Control	Score
1	District Heating	18.8	21,827,802	0.75	3,083,237
2	Municipal Buildings	37.5	2,600,000	0.95	928,479
3	Street Lighting	25.0	1,340,753	0.95	318,428
4	Public Transportation	4.4	3,524,503	0.85	134,428
5	Potable Water	15.0	458,327	0.75	51,561
6	Wastewater	23.1	11,981	0.90	2,493

City Wide Sector Ranking

Rank	Sector	REI%	Spending (US $)	CA Control	Score
3	Solid Waste	0.0	581,280	0.65	0
1	Private Vehicles	16.6	81,998,352	0.10	1,361,192
2	Power	37.6	15,479,953	0.10	582,374

All priorities identified by TRACE were discussed with local officials to select a number of energy efficiency priorities for the municipality. Overall, a number of eight recommendations were selected by local authorities. These recommendations will be discussed in more detail in the next sections.

From the get-go it has to be mentioned that all recommendations made in this section should be seen as indicative, not as normative. While the TRACE tool enables a quick overview of key energy efficiency issues within a municipality, it does not provide an in-depth analysis of each sector. For example, in most studied cities, the sector with the highest energy savings potential was district heating. Obviously, achieving higher savings in this sector usually also entail high costs. These costs may outweigh potential benefits, and may not warrant investments in the sector. Also, if people continue to de-branch themselves from the system, any investments done to rehabilitate the network may be nothing more than wasted money.

Similarly, urban transport recommendations should ideally have an urban mobility plan at their foundation (EBRD is in fact supposed to prepare mobility plans for all seven growth poles and Bucharest). The recommendations made in this report are general in nature and draw on a pre-defined list of proposed interventions in the TRACE tool. These recommendations should be viewed by local authorities as an indication of what could be done to improve their city's energy performance and reduce the city's energy bill. The decision to actually implement a recommendation or not should be done only after a comprehensive feasibility study is completed. For example, the development of a bike network may have the adverse effect of reducing the share of people who use public transport instead of reducing the number of people who commute by private vehicles.

Lastly, energy efficiency interventions should not be viewed or conceived in a vacuum. Often, energy efficiency interventions have benefits that cross sectors. For example, improving the public transport network, will not only encourage a more energy efficient commuting options, but it could also improve quality of life, help boost local economies, and enable poor and marginalized communities better access to opportunities. In the same vein, interventions that aim to improve the energy efficiency of a municipal building could be done in tandem with retrofits that make these buildings more resilient to disasters.

Energy Efficiency and Strategy Action Plan

One of the most important recommendations made through TRACE to the Ploiești public administration was an Energy Efficiency and Strategy Action Plan for the city. Ploiești has already signed the Covenant of Mayors on September 7, 2012, and currently the municipality is working on preparing the Sustainable Energy Action Plan (SEAP). The International Projects Departments within the City Hall is coordinating the preparation of the SEAP, hoping that the document will be ready for submission to the European Commission by the end of 2013.

The Covenant of Mayors is the mainstream European movement that brings together local and regional authorities committed to increase the energy efficiency of their municipalities, as well as the use of renewable energy resources. The main target this process is to reduce local greenhouse emissions by 20% by 2020. The Covenant of Mayors was launched in 2008 after the EU Climate and Energy Package was adopted. The movement supports sustainable development efforts taken by local authorities towards making their localities more climate friendly.

Covenant of Mayors
Committed to local sustainable energy

Source: www.europa.eu

After the mayor signs the Covenant of Mayors, the local government takes steps to translate the political commitments into actions and concrete measures. A first step in this regard is the preparation of the Baseline Emission Inventory. One year after the Covenant of the Mayors was signed, the municipality must submit the action plan outlining the key

actions the city plans to undertake with regard to reducing greenhouse emissions. Apart from reducing the greenhouse emissions, the results of the signatories' actions have a socio-economic dimension too. The measures taken by the municipalities can lead to the creation of jobs, a healthier environment, and a better quality of life. At the same time, these actions can help enhance the economic competitiveness of the city. Not in the least, the plan can also open ways to a greater local energy independence.

As of April 2013, there were 4,522 signatories to the Covenant of Mayors, comprising more than 166 million inhabitants across Europe. More than half of the signatory cities have submitted their SEAPs to the European Commission. 61 small and large cities from Romania have signed the political commitment to reduce the energy consumption by 2020; of these, 22 municipalities have submitted their energy action plans to the Covenant of Mayors. So far, eleven action plans have been approved by the Covenant of Mayors, namely the SEAPs of Moinești, Vaslui, Alba Iulia, Bistrița, Mizil, Slobozia, Brașov, Arad, Aiud, Râmnicu Vâlcea şi Baia Mare.

Each SEAP should include few important sections targeting the energy consumption in the public service areas, including district heating, transport, municipal buildings, street lighting, and solid waste. The measures taken in each of these sectors should include certain indicators, such as total city energy use, total efficiency savings achieved from energy efficiency initiatives, and percentage of energy efficiency initiatives for which data is collected every year. The strategy should put together measurable and realistic targets, set out well defined timeframes, and clearly assign responsibilities. The plan should outline what specific actions should be taken in each of the targeted public service sectors to reduce energy consumption and what are the related projects that should be implemented in this regard.

Ideally, the plan should state the potential amount of greenhouse emissions that would be reduced as a result of the implementation of each project, together with the costs incurred, and the timeframe for the implementation of such projects. Not in the least, the action plan should mention the people within the local public administration responsible with the monitoring and implementation of the plan. The energy efficiency strategy for the city should be developed collaboratively by representatives from across the municipality and other groups who will be involved in the execution of the strategy, but also the stakeholders who will be affected by the strategy.

Achieving the reduction of greenhouse emissions specified in the plan requires careful monitoring, in order to ensure that intermediate targets are reached and that progress is being made towards attaining the overall strategy goals. A carefully crafted monitoring plan is necessary, as well as a host of performance indicators that can be tracked at regular intervals. All measures must be accompanied by targets that should indicate the level of expected progress over a given timeline, together with a simple but effective monitoring plan. Monitoring should take into consideration, among other things, performance indicators, means of measurement and validating measuring processes, a schedule for measurement activity, assignment of responsibilities, and means of auditing performance.

The indicators covered by TRACE offer a very good starting point, with a number of energy efficiency key performance indicators - public and private transport, municipal buildings, street lighting, water & wastewater and solid waste - that can be used to monitor the city's energy performance. But the action plan should not be limited to only these indicators. Other indicators could be also added to the list, including, but not limited to those on energy efficiency in private buildings and industrial enterprises.

Some of the priority sectors for SEAP

Sources: www.realitatea.net; www.ziarul-prahovean.ro; www.energyonline.ro

The plan would open the way to translate various initiatives into a coherent plan for city-wide energy efficiency. At the end of the day, the strategy can be used as an internal and external promotion tool for the city to gain support for their future work on energy efficiency.

Several cities in Europe and around the world have their energy action plans that set clear targets on how to reduce energy consumption, and the measures that should be implemented to help the municipalities meet the goals set in the energy action plan. For instance, in order to reduce the energy consumption by 30% by 2015, the City of Philadelphia has adopted a number of measures that helped the municipality make tremendous progress. These measures included a wide range of activities from retrofitting municipal buildings, replacing the municipal vehicle fleet, encouraging conservation among employees, installing LED light-bulbs, developing energy efficiency building guidelines to providing tax incentives to energy efficiency star performers, creating neighborhood competitions to reduce energy use, developing a citywide energy efficiency marketing campaign, and building energy efficient public housing.

District Heating Maintenance and Upgrade

Among the first recommendations made by TRACE pertains to the district heating system. Operated by a private company, the district heating sector in Ploiești is one of the most dynamic and profitable in a country where most of the systems supplying heat and hot water are running inefficiently. Losses incurred because of old and obsolete networks and because of leakages in poorly maintained pipelines lead to people paying a high price for heating and hot water.

People who live in old residential buildings in Ploiești pay only RON 180 per Gcal, the lowest price for heat in Romania. The investments the district heating operator made in the last years in the modernization and upgrading of the network makes the district heating system among the most efficient in the country. The company employs 400 people and runs on profit, with a turnover in 2012 of EUR 58 million.

The number of apartments connected to the main plant and sub-plants supplying hot water and heat to the customers in Ploiești remained quite stable in the last years, unlike in other cities where a large number of people disconnected from district heating companies and switched to micro-unit heating plants.

Dalkia plant at Brazi

Source: www.dalkia.ro

The amount of heat distributed annually in Ploiești does not have any major fluctuations either. For example, the company sold 501,198 Gcal in 2008, 505,446 Gcal in the following year, and then a slightly larger amount in 2010, i.e., 522,266 Gcal[33]. The good performance of the system is primarily the result of a series of rehabilitation and upgrading works in the last decade that included the upgrading of the distribution networks and pipelines, and the replacement of worn-out networks.

However, despite of the good work the company and the city government have done with regard to the modernization of the district heating network, there remains more work to be done. The district heating plant was built in 1965 and by now most pipelines are worn out and need to be replaced. The company intends to also focus on increasing the performance of the boilers and reducing losses in the primary network.

Dalkia is committed to further modernize the district heating network in Ploiești and, thus, improve the quality of the services to the population. For the next five years Dalkia plans to tackle a large project regarding the modernization of some parts of the distribution network in the city. It is an ambitious project that requires EUR 23.3 million

[33] These figures are according to the National Institute of Statistics.

investments for the primary network and another EUR 6 million for the secondary network. Dalkia and the City Hall will have to join efforts to draft the financial proposal in the next period of time.

Dalkia's modern plant

During the first year of the implementation of the project 18 kilometers of network in the Mihai Bravu neighborhood will be modernized, then the following year the target will shift towards the hot water pipelines in the downtown area. Between 2015 and 2018 the project will focus on different neighborhoods in the city.

Another project the district heating company is looking at is the optimization of the hot water distribution network, with a total value of RON 24 million. Initially, a pilot project of RON 1.5 million targeting three hot water substations and connectors located inside residential buildings will be developed. Upon completion of the project the quality of the services as well as the comfort of the consumers inside their apartments is expected to improve considerably. In order to carry out the project, Dalkia and the city government must enter into a partnership, draft the proposal and identify financial resources.

Investments will be carried through with the support of local and national initiatives. The city government may continue providing support to the district heating network and make efforts to ensure its long-term sustainability.

Residential buildings in Mihai Bravu neighborhood in Ploiești

Source: www.panoramio.ro

According to Dalkia, the city government should consider measures to discourage disconnections from the system. One way to do this could be by implementing a unitary area which should not allow installation of micro-heating units in new residential complexes if a district heating connection is available. If there is a district heating network available in the area the new building should connect to the existing network. Dalkia is also analyzing the feasibility of introducing a RON 10 per Gcal tax for a period of five years.

On the other hand, as a private company it has certain economic constraints to perform well and make profit. To this end, Dalkia should be able to plan ahead for the medium and long term, not only for the next couple of years. From this perspective, a concession contract with the city government over a longer period of time would give the company the stability the company needs in order to plan its business for the long run. A Public Private Partnership between Dalkia and the City Hall for a long period of time will not only help the company plan ahead its long-term strategy, but would also provide the incentives to continue investing in the district heating system.

Urban Transport

TRACE identified the urban public transporation as a sector with a significant potential for energy efficiency gains in Ploiești. The municipality has already a number of forward thinking initiatives with regard to public transportation, such as replacing old rolling stocks with less polluting and more efficient vehicles, and rehabilitating the tram network. The recommendations bellow fall within the scope of what the local public administration are alredy undertaking, or are planning to take on in the near future. These measures include: traffic restraint measures, parking restrain measures, improving the public transport network, and expanding the pedestrian network in the city.

Non-Motorized Transport Modes

One of the city's priorities with regard to public transportation is to improve and expand the pedestrian network. Investing in non-motorized transportation modes has several benefits. From an energy efficiency perspective, the more people that walk or bike, translates into less people that use private vehicles, and consequently into less fuel consumption. Such investments also help raise the quality of life in cities, and they stimulate business development. For example, after Piața Muzeului in Cluj-Napoca was turned into a pedestrian area, not only did pedestrian traffic go up, but the number of businesses and business activity in the area also increased substantially. Today the pedestrian area in Cluj-Napoca is gathering several leisure and entertainment places, such as restaurants, bars, shops, and service stores, and it has become one of the most attractive spots in the city.

At the same time, one has to be careful that investments in non-motorized transport options do not come at the expense of public transportation. For example, in Copenhagen, extensive investments in the bicycle network have led to a net decrease in public transport ridership, lowering the profitability of public transport operators. As such, it is important that investments in non-motorized transport options be closely coordinated with investments in public transportation. For example, new pedestrian and bike paths could ease access to public transportation hubs. More specifically, new pedestrian and bike infrastructure should make it easier, faster, more comfortable, and more convenient to reach public transport infrastructure – especially in areas outside the city center.

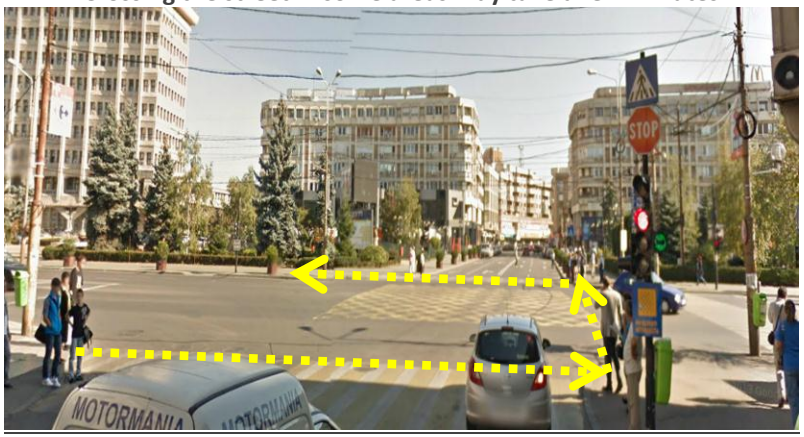
Downtown Ploiești

Source: www.bing.com/maps

Within the city center, it is particularly important to consider the development of new pedestrian areas in addition to the already existing infrastructure. In the recent years a first clear zone of one square kilometer was developed in the city's historical center within the EU-funded CIVITAS program, with the aim of lowering the level of greenhouse emissions and noise in the downtown area. However, compared to other cities in Romania (both larger and smaller) Ploiești ranks quite poorly in terms of city space dedicated to pedestrians. As the aerial image above highlights, local authorities in Ploiești have created a number of good quality pedestrian areas, but these are largely un-connected, and most of them are resumed to patches of land in front of a number of significant public buildings in the city. Walking from one of these pedestrian areas to another is sometimes a challenging feat.

For example, crossing the Republicii Boulevard, to get from Hotel Central to the Administrative Palace, may take a few minutes. Basically, once has to wait at three stop signs, and get to the destination in a round-about way.

Crossing the street in some areas may take a few minutes

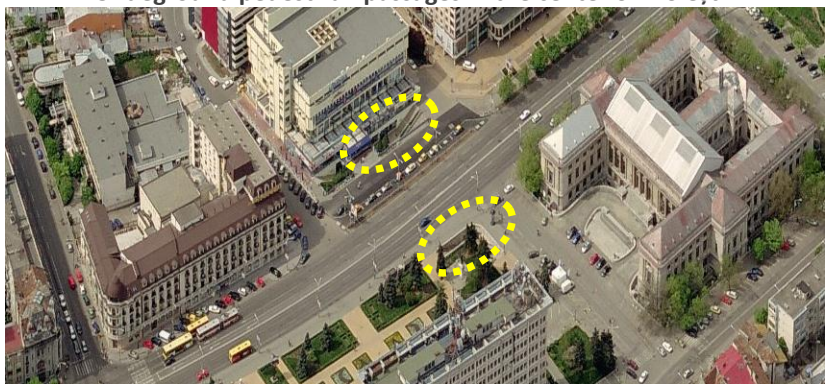


Source: Google Maps

There is indeed an underground pedestrian passage two streets down the main artery, but again, this requires extra walking time, and it is generally not considered very safe at night.

The Republicii Boulevard is the city's main artery, connecting the north of the city to the south, and it is also the city's busiest thoroughfare. Consequently, local authorities are naturally inclined to enable traffic along this main artery, by removing the number of stops cars have to stop at. This is good for private cars, but not so good for pedestrians. Given that Ploiești already has a ring road that feeds north-to-south traffic around the city, and given that the city's ring road system is currently being upgraded with Regional Operational Programme 2007-2013 funds, it pays to think about how car traffic could be further reduced on Republicii Bulevard to the benefit of pedestrians and bicyclists. For example, some cities (like Piatra Neamț) have used ROP 2007-2013 funds to create underground road passages in the city center and develop pedestrian areas over them. Ploiești may do a cost-benefit analysis to determine the feasibility of such an investment too.

Undeground pedestrian passages in the center of Ploiești



Source: www.bing.com/maps

In addition to new pedestrian areas, large thoroughfares, like the Republicii Boulevard could accommodate dedicated bike lanes. Given that Ploiești is a flat city, it will be easier for people to take on biking, than in cities with a hilly terrain. Of course, investments in dedicated bike lanes will not turn Ploiești in a biking city over night, but experience from other cities show, that people use such infrastructure once it is built. The city already has 8 kilometers of dedicated bike lanes. Sometime the bike lanes cannot be used because of the private cars that are parked along the lanes, blocking the access of bicyclists.

Investments in new bicycle infrastructure should also take into consideration traffic safety issues. People are unlikely to take this mode of transportation if they consider it to be unsafe. Bicyclists are often involved in traffic accidents as car drivers often do not notice them in traffic. To increase safety for those that cycle, new bike paths can be developed to have a 'buffer" of parked cars (see image below). In effect, on-street parking spots can be designed so as to also accommodate bike lanes – particularly on the larger corridors in the city.

Parked cars protect bicyclists

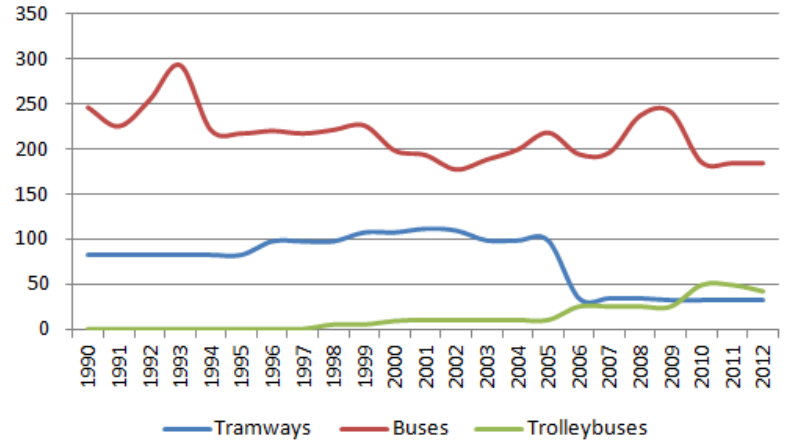
Source: www.asce.org

Public Transport Development

The public transport system in Ploiești is well developed and has managed to weather the transition years better than other growth poles. For example, in Brașov and Constanța, the tramway network was completely removed, whereas local authorities in Ploiești have been able to maintain their system, and they have attracted EU funds through the ROP 2007-1013 for the rehabilitation and upgrade of a significant portion of the network. Nonetheless, at the graph below indicates, the public system in Ploiești has suffered some losses, with the absolute number of buses and trams in operation decreasing over the years. On the other hand, the city has introduced after 1989 two trolleybus lines – an investment that only few other cities in Romania have been able to make. As a result, the loss in bus and tram traffic was to some extent recuperated by the trolleybus system.

There is no exact data on public transport ridership evolution from 1989 onwards, but the National Institute of Statistics data at the county level shows a continued decrease in the number of people using public transport. For example, the number of people using buses halved from 1989 to 2012, from around 102 million passenger to 54 million, while the number of people using trams decreased by a third, from around 30 million passengers in 1989, to 20 million in 2012. Given that Ploiești is the largest city in Prahova County, this decrease in ridership in the county is likely to reflect the situation in the county capital too.

The evolution of the rolling stock in Prahova between 1990 and 2011



Source: National Institute of Statistics

The dramatic increase in the number of private cars and the rising in the number of people who use private cars for their daily commutes have had a negative effect on public transportation networks throughout Romania. Nonetheless, some cities have been successful in keeping this decrease in public transport ridership by investing in the continuous improvement of the system, by purchasing new rolling stock, by making the system more attractive, more accessible, more comfortable and more convenient. To a large extent, local authorities in Ploiești have managed to keep the public transport system operational and in good shape, but much remains to be done.

For one, in terms of energy efficiency of public transport, there are two major things local authorities in Ploiești should focus on. On the one hand, they can invest in replacing the old rolling stock in the city, with newer more fuel efficient vehicles. Both for buses and trams, there are

new technologies that allow a lower consumption of Diesel and less use of electricity. On the other hand, energy efficiency can go up by increasing ridership, which in effect means that a lower amount of energy is used to transport one passenger.

The current investments in rehabilitating and upgrading the public transport network are likely to make the system more attractive to people and may, eventually, increase ridership. Once the rehabilitation of the tramway line will be completed under the ROP 2007-2013, local authorities want to purchase new trams.

Modern trams in Oradea

Source: www.bihorstiri.ro

There is significant interest to finance the purchase of new rolling stock through the ROP 2014-2020, and this would mean that such expenditures become eligible under the next ROP.

Local authorities are also interested in renewing the bus fleet. Currently, a third of the fleet is over 25 years old, and it is quite energy intensive and polluting. Also, given the overall decrease in ridership, some buses may be too big now – i.e., they carry on average less people than their actual capacity, and less people than when they were originally introduced into the city's public transport system. Local authorities are thinking of replacing 50 old IKARUS buses with newer, energy efficient, and low-pollution vehicles, and they have allocated EUR 10 million to this end. They are now considering what type of vehicles they will indeed purchase, given current and projected ridership numbers.

Trolleybuses operating in Ploiești

Again, the purchase of public transport vehicles should become eligible for ROP funding in order to allow local authorities throughout Romania to operate at better efficiency standards and increase overall quality of the public transport system. Of course, the renewal of the public transportation fleet should go hand in hand with the continuous rehabilitation and modernization of the public transport infrastructure. It will be easy for most local authorities to simply spend ROP money on purchasing new vehicles and doing no needed infrastructure investments. The latter are harder to do than the former, and one cannot have one without the other.

At the same time, the procurement of new rolling stock should also take life-cycle costs into consideration. More specifically, local authorities should not only consider the energy efficiency of vehicles, but also the operation and maintenance (O&M) costs over the life-time of the vehicles. For example, some buses may be more energy efficient, but may require significantly more O&M costs which in the long term will affect the overall profitability of the system.

Modern bus in București

Source: www.rtv.ro

Another type of investments that was deemed necessary under the ROP Growth Poles policy was the extension of public transport infrastructure to the metropolitan area. In effect, it was recognized that cities do not exist and operate in a vacuum, but they are part of growing and ever evolving urban areas, with peri-urban communities being increasingly connected to the economy, services, and amenities of the center city. Nonetheless, before expanding the public transport network system to peri-urban areas, local authorities have to first consider whether this can be done in an efficient way.

One of the criteria that are often considered in such instances is the actual population density of the areas where public transport could be expanded. Generally, areas with a density of over 30 people per hectare are considered to be a minimum condition for operating a bus system profitably. Currently, none of the localities adjacent to Ploiești meet this criteria and density in all growth pole localities has been actually going down over the past decade. As such, for the 2014-2020 it does not necessarily seem feasible to invest in expanding the Ploiești public transport system to peri-urban areas. It would make more sense instead to continue the rehabilitation process of the existent network.

At the same time, commuting for people living in peri-urban areas should be made easier by improving connective road infrastructure, and by possibly considering the development of park-and-ride facilities. These facilities allow people to drive their cars to the outskirts of the city, leave the cars in a parking structure, and from there take a public transport vehicle to the downtown area. Of course, a rigorous cost-benefit analysis should be done, as such investments can be quite expensive, and the proper locations should be chosen based on an in-depth analysis of traffic flows. Thus, park-and-ride facilities could be developed in areas that bring a lot of traffic into the city, as well as areas with a lot of traffic congestion.

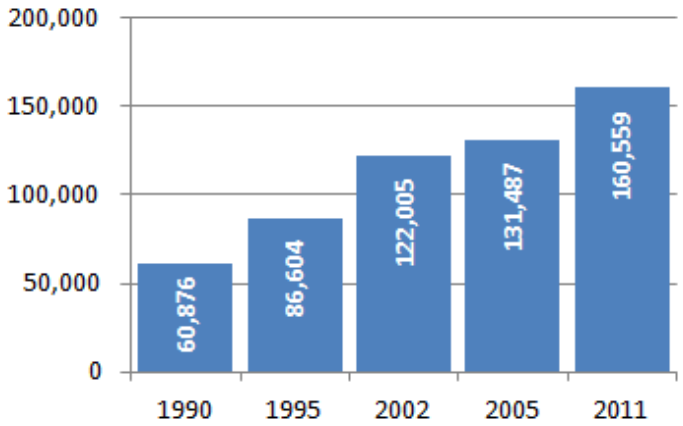
Parking Restraint Measures

The dramatic rise in private vehicle ownership has led to increasingly congested streets in all cities across the country. Ploiești has been no exception in this respect. The figure below shows that between 1990 and 2011 the number of private vehicles has almost tripled. While the number of cars has gone up, the number of parking spaces has not. This had led to a situation where streets in the city center are often congested, and public spaces in apartment block neighborhoods are overrun with cars.

Local authorities in Ploiești have already taken a number of forward thinking parking measures, and they are planning to expand on those. For example, parking meters have been already installed in central areas, and soon people will be able to pay the parking fee by using their cell-phones. However, much remains to be done in this area. For one, local authorities have to think of how they can solve the parking situation in the city center, where one is likely to have the highest number of cars during working hours. Local authorities have set aside over 1,200 parking spaces in the city, and a new private parking structure was developed in the city center.

It may pay however to do a more in-depth analysis of the parking situation in the city in order to determine what the actual needs are in this respect, and how these needs can be met. For example, several cities in Romania have used ROP 2007-2013 funds to invest in the development of underground parking structures, with the associated development of pedestrian spaces.

Number of private vehicles registered in Prahova County



Source: National Institute of Statistics

Suceava is one example in this respect, where a new underground public parking facility has already been completed, and the on-street parking spaces have been converted into a pedestrian plaza. A similar investment could be considered in Ploiești too, given the relative dearth of parking spaces in the center city, and the lack of large pedestrian areas.

New underground parking facility in Suceava

Source: www.maps.google.ro

In addition to parking solutions for the city center, local authorities have to also identify parking options for the apartment block neighborhoods. These high density neighborhoods were built predominantly in the peripheral areas of the city, and they were constructed with a relatively low car ownership rate in mind. Back in the communist days, few people actually owned a car. This situation has changed dramatically in recent years. As the image below highlights, all of the new cars that were added to the Ploiești overall rolling stock had to be parked somewhere in the city. Most often, they take over vital public spaces and pedestrian paths, literally chocking neighborhoods in a sea of cars.

Parked cars leave no space for pedestrians

Source: www.maps.google.ro

Addressing such a situation can be done in several different ways. For one, local authorities should look into charging parking fees in residential neighborhoods too. Such a measure should, of course, take social aspects into consideration. However, most people that can afford a car should normally also afford to pay for parking it on public space – especially if the public space could be used for other productive uses (like a new shop), or as recreational space (e.g., parks, playgrounds, and sports facilities).

Some cities, such as Cluj-Napoca, have decided to solve the parking situation by investing in neighborhood parking structures. However, this is done with limited local budget resources and without the collection of additional fees from those that clog streets and sidewalks. As Alain Bertaud notes in one of his articles, in most developed cities, cars take up on average, the same amount of space as an individual. However, the rent paid for parking these cars is much lower than the rent paid by individuals. For example, the monthly parking rent usually costs nothing,

whereas people have to pay for the same amount of occupied space. In addition to introducing parking fees in high-density neighborhoods, one has to also think about proper enforcement, to ensure that those that take up parking spaces also pay for them.

Traffic Restraint Measures

Ploiești has not only seen a dramatic rise in the number of registered vehicles within the city, but also a significant rise in through-traffic. The city is situated along one of the busiest transport corridors in Romania – the corridor linking București to Brașov. This means that traffic has gone up continuously in the city, and it is likely to continue to grow in the future.

Several measures have been taken to improve traffic conditions, such as the development and upgrade of the system of ring roads. Nonetheless, it is important to perform an in-depth traffic study and determine ways in which traffic conditions can be improved. The European Bank for Reconstruction and Development is planning to undertake in partnership with the Ministry of Regional Development and Public Administration mobility studies in all of Romania's growth poles. These mobility studies will provide a concrete picture of the traffic conditions in the growth poles, and will outline a number of specific measures that can be taken to alleviate traffic.

Currently, the traffic management related to red lights and signaling in Ploiești is managed by a private company, UTI. In the upcoming future, the city authorities plan to install a SCADA system to monitor the traffic in the city.

A number of video cameras will be installed in the main boulevards and streets in the city, and will help monitor traffic and accidents. The city managers intend to connect the SCADA system to public buildings in order to keep an eye on the crime rate, and thus, reduce the rate of crime in the city. Once the SCADA system will be implemented, the traffic monitoring and management will be coordinated from the City Hall, together with representatives from the local Police and Local Public Transport Authority.

Local government may take into consideration enforcing some reduced speed zones in the city center as a measure aimed at discouraging traffic in the downtown area. Reducing the speed zone for private cars may restrict the private transport and, instead, favor the flow of public transport, cyclists and pedestrians in designated areas. Private cars should be prohibited in a perimeter consisting of few streets, and if they cross into that area they should be penalized. At the same time, the City Hall may think about setting up "no driving days" to educate and lead by example. For instance, the private cars could be restricted in the downtown area on a certain day of the month.

Municipal Buildings Audit and Retrofit

Cities in Romania have made significant advances in the delivery of public services when compared to other cities in the region. However, one area where many of them are lacking is in the proper management of energy consumption in municipal buildings. Most of the local authorities interviewed for the TRACE work did not have a proper data base on the buildings they administered, with basic information such as the surface area of the buildings, the electricity and heating consumption. Although, local authorities pay the bills for all the energy consumed by these buildings (schools, kindergartens, hospitals, cultural and sports facilities, and administrative buildings), there is little knowledge on how much is spent on energy in these building, and how these expenditures could be lowered.

For the 2014-2020 Regional Operational Programme energy efficiency will be an important pillar and local authorities could take advantage of grants that could help them lower their monthly energy bills. However, to know how much they can save, the city government should first know how much these buildings actually consume and spend.

Consequently, for Ploiești, as for all other cities that will benefit from ROP funds, it will be important to have a municipal buildings data-base, where they can collect and monitor key performance indicators. This will not only allow them to determine where the biggest energy savings can be achieved for the lowest investments, but it would also allow them to benchmark individual buildings against each other. Moreover, tracking the data over recent years could provide insights into how energy efficiency improvements have helped lower energy bills. Such a data-base could also help local authorities perform an in-depth audit of the municipal building stock, and allow them to prioritize buildings for retrofit.

Andrei Mureșanu School in Ploiești

Source: www.harta.edu.ro

A small dedicated team from the City Hall or external consultants should be assigned with responsibilities to prepare such an audit, with support from departments within the local public administration, like economic and technical divisions. The municipal building database should consist of specific information that should include the type of construction, date of the construction and renovation (if it is the case), floor area, type of heating, and information on electricity and heating bills in the recent years. Publishing the findings and updating the data regularly could enable competitions among the building managers and open the paths for a productive exchange of data and cooperation. Once the database is completed it should be followed by a building audit targeting specific energy consumption for end users and activities, like computers, lighting, air conditioning and heating systems. After the audit is performed the city authorities should allocate funds for energy efficiency updates, purchasing new equipment and performing renovation work on certain buildings.

Street Lighting Timing Program

After management of the street lighting system has been outsourced for several years to an Energy Saving Company (ESCo) – Luxten, the city government is now taking the system under its own management through a public company under the City Hall, Servicii de Gospodărire Urbană (SGU). As such, it will be responsible not only for paying the electricity bills, but also for expanding and improving the street lighting system.

Overall, energy consumption in the street lighting system is relatively small, and the vast majority of light bulbs in the city have been replaced with energy efficient sodium vapor bulbs. Further improvements to the system will have to come from improved bulbs usage.

One of the simplest measures that can be taken is the introduction of an automatic dimmer system, which reduces light intensity when traffic in the city is small – e.g., on week-days at 2:00 AM in the morning when usually a small number of cars are on the streets.

Old mercury bulbs replaced with sodium vapor bulbs

An initial capital investment of 100,000 USD over a year can prompt between 100,000 and 200,000 kWh in energy savings. Introducing such system would benefit from having a central management system, which would allow all street light to be controlled from a remote location. In addition to light dimmers, local authorities can also consider the introduction of street lights with motion sensors – i.e., lights that only go on when someone is around. For example, small residential alleys which are not used very frequently can be equipped with motion sensors. Already, many apartment blocks have motion-based lighting systems installed within the interior stairwell, so it would be natural to install such systems outside the apartment blocks too.

EUROPEAN UNION

GOVERNMENT OF ROMANIA

MINISTRY OF REGIONAL DEVELOPMENT AND PUBLIC ADMINISTRATION

PLOIEȘTI

Instrumente Structurale 2007 - 2013

Annexes

Improving Energy Efficiency in PLOIEȘTI Romania

ROMANIA
REGIONAL DEVELOPMENT PROGRAM

TRACE City Energy Efficiency Diagnostic Study

Municipal Buildings | Water and Wastewater | Solid Waste Management | Public Transport | Public Lighting | Power and Heat

Regio
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Inițiativă locală. Dezvoltare regională.

Detailed Recommendations from TRACE

Improving Energy Efficiency in Ploiești, Romania

ANNEX 1: Energy Efficiency Strategy and Action Plan

DESCRIPTION

Develop a comprehensive energy efficiency strategy and action plan for the municipality. The strategy should have measurable and realistic targets, set out timeframes and assign responsibilities. It should be developed collaboratively by representatives from across the municipality and other groups who will be affected by the strategy.

A municipal energy efficiency strategy will help bring together a diverse range of initiatives into a coherent plan for city-wide energy efficiency. By presenting a single action plan, the strategy will also make it easier to monitor progress. The strategy can also be used as an internal and external publicity tool for the municipality to promote and build support for their work on energy efficiency.

ATTRIBUTES

Energy Savings Potential
100,000-200,000 kWh/annum
First Cost
US$100,000-1,000,000
Speed of Implementation
< 1 year
Co-Benefits
Reduced carbon emissions
Improved air quality
Enhanced public health & safety
Increased employment opportunities
Financial savings
Security of supply

IMPLEMENTATION OPTIONS

Implementation Activity	Methodology
Mayoral decree	The mayor issues a mayoral decree for an interdepartmental energy efficiency review and strategy.
Regulation (Annual EE Reports)	The city authority introduces regulations requiring that the public organizations report on total energy usage, measures taken to improve energy efficiency and the impact of efficiency measures on an annual basis.
Appoint EE officer	The city authority appoints a senior officer to monitor energy usage to and efficiency to within city authority departments and public organizations. Incorporate the collection and management of data into the job descriptions of those municipal employees with responsibility for energy efficiency initiatives.

MONITORING

Monitoring the progression and effectiveness of recommendations, once implemented, is fundamental to an accurate understanding of their value over the longer term. Where the CA implements a recommendation a target (or set of targets) should be defined that indicates the level of expected progress over a given timescale. At the same time a monitoring plan should be designed. The monitoring plan does not need to be complicated or time consuming but should, as a minimum, cover the following aspects: identification of information sources, identification of performance indicators, a means of measurement and validating measuring equipment or processes, record keeping protocols, a schedule for measurement activity (daily, weekly, monthly etc.), assignment of responsibilities for each aspect of the process, a means of auditing and reviewing performance and finally, establishment of reporting and review cycles.

Some suggested measures that relate specifically to this recommendation are as follows:

- Total city authority energy use, total efficiency savings achieved from energy efficiency initiatives, percentage of energy efficiency initiatives for which data is collected every year.
- Total city authority energy use
- Total efficiency savings achieved from energy efficiency initiatives
- Percentage of energy efficiency initiatives for which data is collected every year
- Set targets for the city authority for each KPI, for example, improve KPI performance by 20% in 5 years. Produce annual reports on progress towards set targets. Monitor and update the action plan on a regular basis.

CASE STUDIES

Municipal Initiatives to address Climate Change, Bridgeport, Connecticut, USA

Connecticut General Assembly "Municipal Initiatives to address Climate Change" http://www.cga.ct.gov/2010/rpt/2010-R-0300.htm
Regional Plan Association, Copy of Mayor's Executive Order http://www.rpa.org/bgreen/BGreen_2020_Executive_Order.pdf
Regional Plan Association "BGreen 2020: A Sustainability Plan for Bridgeport, Connecticut" http://www.rpa.org/bgreen/BGreen-2020.pdf

In 2008, the mayor issued an executive order that established a goal for the city government to reduce its annual GHG emissions from a 1990 baseline by 7% by 2012 and 20% by 2020, in accordance with the city's Plan of Conservation and Development. In order to meet this goal, the executive order required the city to obtain at least 25% of its electricity from renewable resources by 2012 and for all new major city construction and major renovation projects to earn at least a silver rating under the Leadership in Energy and Environmental Design (LEED) program, or its equivalent under similar rating systems.

The order established a Sustainability Community Advisory Committee, which is charged with:

- overseeing the completion of a city-wide and municipal government GHG inventory,
- making recommendations to the mayor and the city on how to meet the city's sustainability goals,
- preparing educational materials for households and businesses describing climate change and actions they can take to promote sustainability, and
- identifying economic and workforce development opportunities associated with green jobs.

The city, in collaboration with the Bridgeport Regional Business Council, has developed a program to promote sustainability. The program includes specific measures around auditing energy use, reducing total building footprint within the city, using advanced waste treatment techniques, and analyzing the feasibility of installing renewable energy systems on public and private buildings.

Since the order was issued, the city and the Regional Business Council have also developed a comprehensive sustainability plan, BGreen2020. The plan was developed following an 18-month planning process with a Community Advisory Committee and five technical subcommittees. The process involved over 200 participants from city, state, and federal governments, businesses, and civic and neighborhood groups. The plan is a comprehensive strategy to improve the quality of life, social equity, and economic competitiveness while reducing GHG emissions and increasing the community's resilience to the impacts of climate change.

Energy Efficiency Strategy, Spain

European Commission - Saving & Energy Efficiency Strategy in Spain http://ec.europa.eu/energy/demand/legislation/doc/neeap/es_neeap_en.pdf

Evaluate Energy Savings http://www.evaluate-energy-savings.eu/emeees/en/countries/Spain/index.php
Spain's Energy Saving and Energy Efficiency Strategy 2008-2012 (E4), which constitutes its National Energy Efficiency Action Plan (NEEAP), aims to achieve security of supply in terms of quantity and price with some basic levels of self-sufficiency, taking into consideration the environmental impact and economic competitiveness.
The plan identifies 7 sectors including: agriculture, buildings, domestic and office equipment, industry, public services, transport, and energy transformation. Within each of these sectors, it sets out sets out strategic objectives as well as the route that energy policy should take to achieve these objectives. The Plan establishes a primary energy saving of 24,776 ktoe in 2012 as quantified energy objective in opposition to the scenario which was used as the base for the initial Plan 2004-2012, involving 13.7%. The plan also monitors progress against previous action plans, identifies investment and the potential for improvement in each sector, and sets targets for the immediate future.
The financing of the Plan is via investments in the private sector and in public services, and are therefore passed on to the end-users (consumers) and employers, who make investments which improve the processes or equipment that they bring to the market, so the services that they provide are carried out with less consumption of energy.

Energy and resource saving program, Brisbane, Australia
Good Practices in City Energy Efficiency: Eco^2 Cities: Energy and Resource Saving Program in Brisbane, available online
http://www.esmap.org/esmap/node/1225
Brisbane's population is expected to continue to grow over the next two decades. In 2007, the Brisbane City Council issued Brisbane's Plan for Action on Climate Change and Energy, which delineates the selected actions to be achieved in the short term (about 18 months) and the long term (more than five years). Brisbane has three major challenges: climate change, high peak oil demand, and greenhouse gas emissions. Analyses suggest that, if Brisbane responds intelligently to these challenges, the city may generate significant economic benefits by developing sustainable industries, while saving resources. Brisbane is actively introducing various approaches to sustainable development. In addition, in the city's "Our Shared Vision: Living in Brisbane 2026" policy document, authorities have committed to cutting greenhouse gas emissions in half, reusing all wastewater, and restoring 40 percent of the natural habitat by 2026.

Integrated resource planning and management, Stockholm, Sweden
Good Practices in City Energy Efficiency: Eco^2 Cities - Integrated Resource Management in Stockholm, available online
http://www.esmap.org/esmap/node/1228
The City of Stockholm, the capital of Sweden, has pursued integrated city planning and management to become a sustainable city. The city has a comprehensive urban vision, environmental programs, and concrete action plans to reduce greenhouse gas emissions and tackle climate change. It implements integrated urban planning approaches that consider ecological benefits and efficient resource use.
The ongoing redevelopment in the city's southern district, Hammarby Sjöstad, is a good model for understanding integrated approaches to sustainable urban planning and redevelopment. The area aims to be twice as sustainable as Swedish best practice in 1995. The area implements integrated resource management (waste, energy, water, and sewage) through systematic stakeholder collaboration and has transformed the linear urban metabolism into a cyclical one known as the Hammarby Model.
According to Grontmij AB, a private consultancy firm in Stockholm, primary assessments of the initially developed districts of Hammarby Sjöstad show that the area has achieved, for example, 28 to 42 percent reductions in nonrenewable energy use and 29 to 37 percent reductions in global warming potential.

TOOLS & GUIDANCE

Tools & Guidance
N/A

ANNEX 2: District Heating Network Maintenance & Upgrade Program

DESCRIPTION

Many cities already have established district heating networks. The primary plant (boilers), may be operating at low efficiencies, or the pipework distribution networks may have poor or no insulation thereby losing thermal energy or considerable amounts of water through leakage. Advances in materials, boiler design or alternative system configuration (for example, improved heat exchange) mean that higher efficiencies can be achieved, and there are various different methods for detecting leaks. More energy can be delivered to the end user through primary plant upgrades, pipework repair and replacement and better insulation.

The aim is of this recommendation is to develop a program for maintenance and retrofits to upgrade boiler plant, pumps, pipework or insulation.

District energy networks are inherently more efficient than individual systems, but further energy efficiencies could be gained through repairing pipework and upgrading insulation, delivering more resource, operational cost and carbon emission savings.

ATTRIBUTES

Energy Savings Potential
> 200,000 kWh/annum

First Cost
> US$1,000,000

Speed of Implementation
> 2 years

Co-Benefits
Reduced carbon emissions
Efficient water use
Improved air quality
Financial savings
Security of supply

IMPLEMENTATION OPTIONS

Implementation Activity	Methodology
Feasibility Study	The City Authority establishes appropriate partnerships to undertake a feasibility study. The CA should engage a team that includes network planners, power and heat engineers, environmental specialists and financial advisors to ensure the feasibility study captures all pertinent aspects. The feasibility study establishes the technological and financial viability, as well as procurement and policy options. It establishes the baseline city energy expenditure associated with power and heat supply and the efficiency of their distribution across the network(s). Technical ability, procurement methodology, incentives and taxes should also be given consideration. Each option should be appraised against the specific requirements and capabilities of the CA.
Direct expenditures & procurement	The City Authority invests in the maintenance of the network as well as upgrades of the infrastructure where necessary. The main expenditures associated with a replacement program are the capital cost of plant and the civil works to access

	networks where the pipework is buried. The City Authority can pay for these items directly out of the city budget, and recoup the investment through lower primary fuel costs. The City Authority invests in the maintenance of the network as well as upgrades of the infrastructure where necessary. The main expenditures associated with a replacement program are the capital cost of plant and pumps and the civil works to access networks where the pipework is buried. The City Authority can pay for these items directly out of the city budget, and recoup the investment through lower primary fuel costs.
Energy Services Company	The City Authority contracts with an Energy Services Company (ESCO) to assume management of the district heating network, and maintain and investing in repairs to ensure consistent and efficient supply to users. The benefit of this approach is that the CA does not have to commit to significant financial investment in the project or retain ownership of the project related risks. There are a number of potential ESCO contractual structures and it is recommended that if the City Authority explores the various advantages and disadvantages of each. See Jiamusi case study for further details.
Legal or Statutory	The City Authority passes legislation or creates policy that requires minimum efficiency levels in both the generation and supply infrastructure of the district heating network. The efficiency levels should be set to ensure that the replacement program is staggered, targeting the worst performing assets first.

MONITORING

Monitoring the progression and effectiveness of recommendations, once implemented, is fundamental to an accurate understanding of their value over the longer term. Where the CA implements a recommendation a target (or set of targets) should be defined that indicates the level of expected progress over a given timescale. At the same time a monitoring plan should be designed. The monitoring plan does not need to be complicated or time consuming but should, as a minimum, cover the following aspects: identification of information sources, identification of performance indicators, a means of measurement and validating measuring equipment or processes, record keeping protocols, a schedule for measurement activity (daily, weekly, monthly etc.), assignment of responsibilities for each aspect of the process, a means of auditing and reviewing performance and finally, establishment of reporting and review cycles.

Some suggested measures that relate specifically to this recommendation are as follows:

- Establish baseline energy losses due to pipework and pumps(kWh/annum);
- Establish baseline water losses due to pipework and pumps(l/annum);
- Establish the City Authority goal for losses (kWh/annum) due to potential network upgrades ;
- Compare actual program performance with targeted performance.

CASE STUDIES

District heating network pipe maintenance, Seoul, Korea

DBDH, Direct Access to District Heating Technology "Seoul Metropolitan District Heating Network", http://www.e-pages.dk/dbdh/12/

Established in 1985 by a public corporation, the district heating network in Seoul supplies 10,604 GWh of district heating and cooling to 832,000 households, commercial buildings and public buildings. During its first five years of operation, the network suffered from service interruptions caused by construction failures as pre-insulated pipe construction had only just been introduced in Korea and construction skills were too low to assure a good quality pipe construction. By the mid-2000s, 300 km of pre-insulated pipelines (20% of the total length) was around 20 years old, and investigation into pipe construction failure showed that these were mainly caused by loose casing joints (51%) and the use of improper materials (21%). In order to improve the reliability of the supply network, and thereby reduce the cost of water and energy losses, the company invested in improving pipe construction skills and used a leak detection system which enables them to locate 'defaults'. As the leak detection system does not work well with the old pipes, faults are also located by means of "thermal graphic camera" and "injection gas to pipelines" methods.

District heating network upgrade, Jiamusi, China

DBDH, Direct Access to District Heating Technology "Dalkia Management of Jiamusi Urban Heating Network" http://dbdh.dk/images/uploads/pdf-news/hotcool_1_2010_low.pdf

Due to a chronic lack of funds, the Jiamusi district heating network had for many years suffered from reduced maintenance, which had resulted in large energy and water losses. As interruption of service and low in-door temperature were the norm, the operator of the network, Jiamusi Heating Company (JHC), experienced increased dissatisfaction from its users. In May 2007 JHC, which was owned by the municipality, signed a 25-year agreement with an energy services company to take responsibility for the management of the network. A large-scale initiative to improve performance and upgrade the network's facilities was implemented. The heat supply temperature was raised; 90 new substations were built; and a SCADA (Supervisory Control and Data Acquisition) system was installed, enabling real-time management of the substations and the network, and resulting in improved optimization of

energy efficiency and user's comfort. As a result, water losses were reduced by 30%, and energy consumption by 13.5%. By improving service quality, the company improved its customer relationships and was able to reduce the bad debt rate from 7% to 2%. The network has begun expansion and after two years of operation, it has increased its supply from 5.5 million sq. m (29% of the total heating surface) by 56% to 8.6 million sq. m.

TOOLS & GUIDANCE

Tools & Guidance
DHCAN "District Heating System Rehabilitation and Modernisation and Modernisation Guide" projects.bre.co.uk/DHCAN/pdf/Modernisation.pdf. A guidance document for technical improvements resulting in higher energy efficiency and reduction of primary energy use. It attempts to set out a range of solutions from low-cost to high-cost, with consideration of financial circumstances, and links this to the fundamental need for a strategic view.
IEA "Coming in from the Cold- Improving District Heating Policy in Transition Economies" http://www.iea.org/textbase/nppdf/free/2004/cold.pdf. A document which summarizes the institutional experiences of district heating rehabilitation, with focus on delivering clear policy on district heating.
ESMAP Public Procurement of Energy Efficiency Services - Guide of good procurement practice from around the world. http://www.esmap.org/Public_Procurement_of_Energy_Efficiency_Services.pdf

ANNEX 3: Non-motorized Transport Modes

DESCRIPTION

Non-motorised transport modes have zero operational fuel consumption and require low capital costs for implementation. In addition to improving the health of users, their use reduces noise pollution and improves air quality. Benefits include improved air quality, lower operating costs for users and providers, and lower infrastructure requirements.

IMPLEMENTATION OPTIONS

Implementation Activity	Methodology
Pedestrianization	The City Authority pedestrianizes networks of streets or larger city areas. Either permanent or temporary, the closure of streets to motor vehicles increases public awareness of non-motorised modes and removes noisy and polluting vehicles, as well as creating opportunities for street markets and other initiatives. The City Authority researches the feasibility and probable take-up from origin and destination surveys, existing mode splits, and subsequently designs networks to suit commuting patterns and local/neighbourhood travel. See Oxford case study for further details.
Dedicated networks	The City Authority includes dedicated cycle / walking route networks in its transportation or city land use plans. Replacement or reservation of rights-of-way in new-built areas creates the necessary conditions for adopting non-motorised modes that may otherwise be less favoured if roads cater to cars only. The key to success is the linkage of cycle and pedestrian networks at local level, and the quality of the environment provided, that requires good drainage and adequate lighting and shading. See Bogota case study for further details.
Microcredits	The City Authority makes micro credits available which can be used to increase the ownership of bicycles. Increased cycle ownership can have significant financial benefits to low-income workers who may no longer be dependent upon expensive, inefficient and infrequent public transport. See Lima case study for further details.
Rental programs	The City Authority introduces bicycle rental programs which provide bicycles on demand for a fee. The key factor for success to is the setting of tariffs that encourage use as well as security procedures that avoid and penalise theft.

ATTRIBUTES

Energy Savings Potential
100,000-200,000 kWh/annum

First Cost
> US$1,000,000

Speed of Implementation
> 2 years

Co-Benefits
Reduced carbon emissions
Improved air quality
Enhanced public health & safety

	Registered-user schemes require a credit card or bank details of users, but are not necessarily open to all. Non-registered user schemes are more flexible, but more open to abuse. Branding of bicycles and facilities can create revenue for local authority. See Paris case study for further details.

MONITORING

Monitoring the progression and effectiveness of recommendations, once implemented, is fundamental to an accurate understanding of their value over the longer term. Where the CA implements a recommendation a target (or set of targets) should be defined that indicates the level of expected progress over a given timescale. At the same time a monitoring plan should be designed. The monitoring plan does not need to be complicated or time consuming but should, as a minimum, cover the following aspects: identification of information sources, identification of performance indicators, a means of measurement and validating measuring equipment or processes, record keeping protocols, a schedule for measurement activity (daily, weekly, monthly etc.), assignment of responsibilities for each aspect of the process, a means of auditing and reviewing performance and finally, establishment of reporting and review cycles.

Some suggested measures that relate specifically to this recommendation are as follows:

- Perform surveys of the number of cycles in circulation by using traffic counters on roads and cycle lanes.
- Determine the mode share of people travelling in the area or city.
- Determine KPIs such as % non-motorized transport mode, modal shift, km of dedicated cycle/walking infrastructure, take-up of cycle promotion schemes by analyzing registers of subsidies

CASE STUDIES

Pedestrianization with road closures, Oxford, England European Commission, Directorate General for the Environment (2004). "Reclaiming city streets for people: Chaos or quality of life?", available online from http://ec.europa.eu/environment/pubs/pdf/streets_people.pdf The main retail streets have been fully pedestrianized, while other through roads in the central area are only accessible to buses and pedestrians. The adoption of a step by step, integrated approach to the implementation of the road closure program has been seen as critical to the success of the significant road space reallocation element of the scheme. Opposition to the USD 6 million schemes was raised most notably on the basis that traffic congestion on two key routes in the city would worsen, as well as from retailers concerned about delivery access and trade levels. These concerns were attended to via an extensive consultation process and an effective publicity campaign prior to the implementation of the scheme. This included leaflets, advertisements on buses, city-wide poster boards, and a series of press releases
Dedicated cycle network, Bogota, Colombia C40 Cities (2010). "Bogota, Colombia: Bogota's CicloRuta is one of the most comprehensive cycling systems in the world", available online from http://www.c40cities.org/bestpractices/transport/bogota_cycling.jsp

CicloRutas is considered a unique cycling network where design has taken the topography of the city into consideration in order to create maximum flow and function (manmade and natural features, hills, waterways, parklands, essential facilities). In a period of just 7 years, following an investment of USD 50 million, the use of bicycles on the network increased by more than 268%. CicloRutas plays an important role for lower income groups, as more than 23% of the trips made by the lowest income group in the city are by walking or by bike. The development of CicloRutas has also helped to recover public space along riverbanks and wetlands, as for many years the city's wetlands were occupied by illegal settlements.
Bicycle micro-credits, Lima, Peru ICLEI (2009). "Case study 46: Assistance to purchase bicycles - Lima, Peru" in Sustainable Urban Energy Planning: A handbook for cities and towns in developing countries, available online from http://www.unhabitat.org/pmss/listItemDetails.aspx?publicationID=2839 In 1990, the Municipality of Lima set up a micro-credit programme to help low income citizens purchase bicycles. By saving on daily public transportation costs, workers can see their income effectively rise more than 12% once the loan is paid off. In order to enhance the success of the program, efforts have been made at standardizing the use of bicycles in the city. Actions to achieve this have so far consisted of the development of a manual of technical standards for the design and planning of cycle ways.
Bicycle rental, Velib, Paris, France C40 Cities (2010). "Paris, France Velib - a new Paris love affair", available from http://www.c40cities.org/bestpractices/transport/paris_cycling.jsp Paris launched a 24/7 cycle hire scheme through Velib; a public private partnership between the city of Paris and a company led by a major advertising group. Users must purchase a subscription by day, week or year, and bike rental is free for the first half hour of every individual trip, after which it costs a fixed rate. The increasing price scale ensures the bikes are kept in circulation. Notably, the City of Paris generates revenues from the project without any investment (which cost USD 108 million). The public-private partnership is the reason for this success, with the private company paying operating costs plus rights to advertising space to the City, funded by advertising revenues.

TOOLS & GUIDANCE

Tools & Guidance
Sustrans (2007). "Technical guidelines for the development of cycle facilities" A series of guidance documents for professionals on the details of bicycle network design. Available online from http://www.sustrans.org.uk/resources/design-and-construction/technical-guidelines
Transport for London (2010). "London Cycling Design Standards" A guidance document for designing to reduce barriers to cycling, in order to support road safety targets. Available online from http://www.tfl.gov.uk/businessandpartners/publications/2766.aspx

ANNEX 4: Traffic Restraint Measures

DESCRIPTION

Discouraging potential drivers from using their cars leads to fewer cars in circulation. This encourages people to use alternative modes, which in turn will increase their viability (increased public transport patronage for example).

Removing vehicles from circulation reduces fuel use and reduces the need for road space.

ATTRIBUTES

Energy Savings Potential
100,000-200,000 kWh/annum
First Cost
US$100,000-1,000,000
Speed of Implementation
1-2 years
Co-Benefits
Reduced carbon emissions
Improved air quality
Enhanced public health & safety

IMPLEMENTATION OPTIONS

Implementation Activity	Methodology
Blanket bans	The City Authority imposes blanket bans. Possible types of blanket bans include vehicle-type bans which exclude entire vehicle categories from circulation; or licence plate bans, by which certain number plates are banned from circulation. A weakness of licence plate bans are that they tend to result in wealthier residents purchasing second cars, not only negating the aims of the ban, but thereby also disadvantaging those with lower incomes. See Guangzhou case study for further details.
Licensing	The City Authority rations permits. The establishment of quotas for private vehicles allows for only a certain number of vehicle registrations over a given period of time. However, as demand for cars tends to be inelastic, this often results in very high purchase prices for the licenses - a mechanism which favours the wealthy and marginalizes the lower income brackets of society. See Singapore case study for further details.
Civic initiatives	The City Authority sanctions and encourages 'no-driving days' to educate and lead by example. Participation in these initiatives is voluntary, however, and therefore not enforceable. See Puerto Princesa case study for further details.

MONITORING

Monitoring the progression and effectiveness of recommendations, once implemented, is fundamental to an accurate understanding of their value over the longer term. Where the CA implements a recommendation a target (or set of targets) should be defined that indicates the level of expected progress over a given timescale. At the same time a monitoring plan should be designed. The monitoring plan does not need to be complicated or time consuming but should, as a minimum, cover the following aspects: identification of information sources, identification of performance indicators, a means of measurement and validating measuring equipment or processes, record keeping protocols, a schedule for

measurement activity (daily, weekly, monthly etc.), assignment of responsibilities for each aspect of the process, a means of auditing and reviewing performance and finally, establishment of reporting and review cycles.

Some suggested measures that relate specifically to this recommendation are as follows:

- Perform traffic surveys of the number of vehicles in circulation pre- and post-implementation.
- Determine the mode share of people travelling in an area or the city.
- Collate registration data of users to paid schemes or voluntary schemes.
- Perform statistical analysis of rate of growth of car registration data.

CASE STUDIES

Vehicle bans: Motorcycle ban, Guangzhou, China Institute for Transportation and Development Policy (2008). "Case study: motorcycles in Guangzhou", available online from http://www.itdp.org/documents/Guangzhou%20Case%20Studies%20-%20Motorcycles%2015-Sep-08.pdf Motorcycles have been completely banned in the City of Guangzhou. The ban was implemented in phases, beginning with a moratorium on new licenses, extending to various roads and time periods. Gradual implementation has been crucial to allow time for the public to adapt, and efficient supply of additional infrastructure/services has supported the induced modal shift. Many motorbike riders have shifted to bicycles and buses, and cycle rickshaws have also emerged as a popular substitute. Road accidents have dropped by 40% since the initial implementation of the ban.
Rationing, Singapore, Singapore Sustainable Urban Transport Project (2010)."The Vehicle Quota System in Singapore", available online from http://www.sutp.org/index2.php?option=com_content&do_pdf=1&id=1582 Singapore fixes the number of new vehicles allowed for registration. Potential buyers need to bid for a non-transferable license, which entitles them to own a vehicle for a fixed number of years. The scheme had to be modified soon after implementation to safeguard against speculative action. The licenses used to be transferable and within the first two months of the first round of release, 20% changed hands in "buy and sell" transactions with speculators making sizable profits of up to S$5000. As the rationing system does not control annual mileage, the success of the rationed registration in limiting vehicle usage has been dependent on support from other traffic restraint measures, such as high road tolls, parking fees, and electronic road pricing.
No-driving days, One Day Rest, Puerto Princesa, Philippines ICLEI (2001). "Vehicular Reduction Strategy for Air Pollution Prevention and Climate Change Mitigation; A Case of Puerto Princesa City, Philippines", available online from http://www.iclei.org/index.php?id=1193 Introduced as part of a zoning and rerouting, this program stipulates a one day rest for tricycle drivers in the central business district. Regulation of illegally operated tri-cycles is a major impediment, as enforcement irregularities pose questions of inequality between illegal and legal tri-cycle taxi drivers. Furthermore, the income potential of those who comply with the rest day is lost to the illegal operators

TOOLS & GUIDANCE

Tools & Guidance
Sierra Club of Canada (2001). "How to Stage a Car Free Day In Your Community" A guidance document for preparing and planning a community-driven car free day. Available online from http://www.worldcarfree.net/wcfd/documents/cfd_howto.pdf

ANNEX 5: Parking Restraint Measures

DESCRIPTION

Restricting parking availability discourages car use and provides an incentive to use more sustainable modes of transport, including public transport. Removing vehicles from circulation reduces fuel use and reduces congestion effects.

IMPLEMENTATION OPTIONS

Implementation Activity	Methodology
Planning measures	The City Authority introduces planning measures which determine car parking provision for residential and office developments. Introducing maximum parking allowances with low car-to-unit ratios discourages private-car acquisition and use. Such measures do not affect the existing parking provision, however, and so need to be supported by additional measures. While areas of intervention can be defined, larger coverage is more effective as it has less potential to overwhelm surrounding areas. A gradient approach solves this by making requirements less stringent from the centre to the periphery. These measures safeguard energy use and efficiency in design and thereby bear no immediate cost to the city authority. See London case study for further details.
Parking fees	The City Authority charges for on-street parking. Implementing a charging regime for car parking and formalizing parking arrangements will enable the parking stock to be controlled and generate a revenue stream for sustainable transport measures. This type of approach requires a supporting system for enforcement, e.g. traffic wardens who issue fines to perpetrators, and are politically very sensitive measures. See San Francisco case study for further details.
Park & Ride facilities	The City Authority promotes multimodality by providing Park & Ride locations at key interchanges. By linking parking to public transport use, the necessities of non-inner city residents are considered. The success of Park & Ride is linked to availability of public transport and unavailability of cheap parking in central locations. The perceived cost should be lower than that of driving the entire way. Measures of this kind often require major capital

ATTRIBUTES

Energy Savings Potential
100,000-200,000 kWh/annum

First Cost
< US$100,000

Speed of Implementation
> 2 years

Co-Benefits
Reduced carbon emissions
Improved air quality
Enhanced public health & safety
Increased employment

	investment in infrastructure by the city authority with respect to 'Park & Ride' locations on the periphery of the city, bus terminals and additional buses. See Oxford case study for further details. Complementary implementation activity: Planning measures	

MONITORING

Monitoring the progression and effectiveness of recommendations, once implemented, is fundamental to an accurate understanding of their value over the longer term. Where the CA implements a recommendation a target (or set of targets) should be defined that indicates the level of expected progress over a given timescale. At the same time a monitoring plan should be designed. The monitoring plan does not need to be complicated or time consuming but should, as a minimum, cover the following aspects: identification of information sources, identification of performance indicators, a means of measurement and validating measuring equipment or processes, record keeping protocols, a schedule for measurement activity (daily, weekly, monthly etc.), assignment of responsibilities for each aspect of the process, a means of auditing and reviewing performance and finally, establishment of reporting and review cycles.

Some suggested measures that relate specifically to this recommendation are as follows:

- Perform surveys of parking stock and usage;
- Perform traffic surveys of number of vehicles in circulation by using traffic counters;
- Determine the average travelling speeds on the main transport corridors;
- Determine the mode share of people travelling in the area or city;
- Perform statistical analysis of rate of growth of car registration data.

CASE STUDIES

Parking standards, London Plan, London, UK London (2010). "Chapter 6: Transport" in The London Plan, available from http://www.london.gov.uk/shaping-london/london-plan/docs/chapter6.pdf pp.160-161. The London Plan establishes maximum parking guidelines for residential development. It stipulates that all developments in areas of good public transport accessibility should aim for significantly less than 1 parking space per unit. The main challenge continues to consist of ensuring that these standards are supported other measures which reduce car dependency, both within the development and in the surrounding area, e.g. improved and increased public transportation accessibility.
SF park curbside parking, San Francisco, USA Institute for Transportation and Development Policy (2010) "U.S. Parking Policies: An Overview of Management Strategies", available online from http://www.itdp.org/documents/ITDP_US_Parking_Report.pdf San Francisco Municipal Transit Agency's (SFMTA) installed new electronic, multi-space meters in 2009 and will activate parking spot sensors attached to the pavement sometime in 2010. The aim is to use pricing to help redistribute the demand for parking. The heart of SFpark is a Data Management

System which sorts a tremendous amount of data collected from the networked array of remote sensors in all 6,000 parking spots. These wireless sensors can detect whether a spot is occupied by a vehicle and report parking occupancy information in real time to a central computer. The project will produce valuable data about the effect of meter pricing on occupancy. By 2010 the project will encompass 6,000 of San Francisco's 25,000 metered curbside parking spots in seven pilot neighborhoods.
Parking fees, Aspen, USA Source: Victoria Transport Policy Institute (2010). "Parking Pricing Implementation Guidelines", available online from http://www.vtpi.org/parkpricing.pdf The city used to suffer from high levels of congested on-street parking. In order to reduce the effects of the "ninety-minute shuffle" (where locals and downtown commuters moved their vehicles every 90 minutes to avoid a parking ticket), the city introduced charges for on-street parking using multi-space meters. Parking fees are highest in the center and decline with distance from the core. The city had a marketing campaign to let motorists know about the meters, including distribution of one free prepaid parking meter card to each resident to help familiarize them with the system. Motorists were allowed one free parking violation, and parking control officers provide an hour of free parking to drivers confused by the meters.
Park-and-Ride, Oxford, United Kingdom Oxford City Council (2009). "Park and Ride Transfer", available online from http://www.oxford.gov.uk/PageRender/decTS/Park_and_Ride_occw.htm Oxford city has five Park-and-Ride sites serving the city's shoppers, visitors and commuters. These sites used to charge for parking to provide income to cover operational costs, but were not able to generate additional money for repairs or improvement. In order to achieve savings, the management of the Park-and-Ride sites was transferred to Oxfordshire county, resulting in efficiency savings of 250,000 GBP per year for the city administration. These savings were achieved primarily through economies of scale, and by sharing the cost of providing the service with taxpayers across the County, and not just those in the city - both of which used the facilities.

TOOLS & GUIDANCE

Tools & Guidance
Victoria Transport Policy Institute (2010). "Parking Management: Strategies, Evaluation and Planning" A comprehensive guidance document for planning and implementation of parking management strategies. Available online from http://www.vtpi.org/park_man.pdf
Victoria Transport Policy Institute (2010). "Parking Pricing Implementation Guidelines" A guidance document for implementation of parking pricing with details on overcoming common obstacles. Available online from http://www.vtpi.org/parkpricing.pdf
Spillar, R. (1997). "A Comprehensive Planning and Design Manual for Park-and-Ride Facilities" A guidance document for the planning and design of Park-and-Ride facilities. Available online from http://www.pbworld.com/library/fellowship/spillar

ANNEX 6: Public Transport Development

DESCRIPTION

Develop or improve the public transport system and take measures to increase its accessibility and use. Public transport achieves lower emissions per capita than private cars, and has the potential to provide equitable transport network. A reduction in the number of private vehicles in circulation can lower emissions and improve air quality.

IMPLEMENTATION OPTIONS

Implementation Activity	Methodology
Bus priority	The City Authority establishes dedicated bus priority measures. This enables buses to bypass traffic queues enhancing their reliability and journey times. There are a range of measures including bus lanes and priority at junctions that could be implemented. See the Bogota case study for further details.
Signaling	The City Authority invests in the necessary infrastructure for bus-priority signaling. Such systems are linked to buses via transponders which use GIS information, and favor the circulation of approaching buses either by extending green lights for buses or by shortening cycle for cars.
Information	The City Authority provides good quality passenger waiting facilities and as well as good information services. The provision of real-time bus countdown information allows users to understand and manage waiting times. These services enhance the attractiveness of public transport.
Operations	The City Authority invests in the necessary infrastructure for electronic ticketing. This allows for use of multiple buses within a given amount of time with one ticket, reducing the cost of travel, putting buses within the reach of the poorest, while attracting a wider patron base, when in combination with other modes, such as heavy rail or metro.
Planning regulations & guidelines	The City Authority links development densities to public transport availability and funding. The City Authority reviews the city's zoning ordinances and considers making the following changes: Increase the permitted floor area ratio/ plot ratio on sites located near public transport hubs. In areas where it is appropriate re-zone single-use lands to allow multiple uses on the same site. Allowing higher densities

ATTRIBUTES

Energy Savings Potential
> 200,000 kWh /annum

First Cost
> US$1,000,000

Speed of Implementation
> 2 years

Co-Benefits
Reduced carbon emissions
Improved air quality
Enhanced public health & safety

	of development along well-served public transport corridors creates a patron base for public transport and can be used in combination with other planning measures, such as capping parking provision to residential and office buildings, thus discouraging car use. Developers are required to show how a new development links to the existing or planned public transport network in order to gain planning permission. See the Curitiba case study for further details.
Subsidies	The City Authority subsidizes travel on public transport. In certain areas this can provide an incentive for people to use public transport.

MONITORING

Monitoring the progression and effectiveness of recommendations, once implemented, is fundamental to an accurate understanding of their value over the longer term. Where the CA implements a recommendation a target (or set of targets) should be defined that indicates the level of expected progress over a given timescale. At the same time a monitoring plan should be designed. The monitoring plan does not need to be complicated or time consuming but should, as a minimum, cover the following aspects: identification of information sources, identification of performance indicators, a means of measurement and validating measuring equipment or processes, record keeping protocols, a schedule for measurement activity (daily, weekly, monthly etc.), assignment of responsibilities for each aspect of the process, a means of auditing and reviewing performance and finally, establishment of reporting and review cycles.

Some suggested measures that relate specifically to this recommendation are as follows:

- Perform surveys of public transport passenger numbers;
- Determine mode share of people travelling in area or city.

CASE STUDIES

BRT system, Bogota, Colombia

Source: ESMAP (2009). "Good practices in city energy efficiency: Bogota, Colombia - Bus Rapid Transit for Urban Transport Energy", available online from http://esmap.org/esmap/sites/esmap.org/files/Bogota_Case_Study_020310.pdf

With the completion of its first two phases, the TransMilenio BRT system serves about 1.5 million passengers every day and has city-wide fuel consumption by 47%. Key success factors have been city-wide comprehensive planning of infrastructure, use of state-of-the-art technologies, implementation of a variety of design features to accommodate high volumes of passengers, and the use of a simple single price faring system. It does not require subsidies for operation - these are fully covered by fares. The project's capital cost totaled USD 240 million. The system is managed by a company which was set up by the Mayor, but runs independently from the city administration. While the company is in charge of all planning, maintenance and construction of infrastructure as well as organizing of schedules of bus services, buses and drivers are contracted through private firms, resulting in a complex but innovative management structure.

Land Use and Public Transport Planning, Curitiba, Brazil
Source: World Bank (2010). "Curitiba, Brazil -- Cost Is No Barrier to Ecological and Economic Urban Planning, Development, and Management . In ECO^2 Cities: Ecological Cities as Economic Cities, pages 169-182." available online from http://www.esmap.org/esmap/sites/esmap.org/files/CS_Curitiba.pdf
The case of Curitiba, Brazil, shows that cost is no barrier to ecological and economic urban planning, development, and management. Curitiba has developed a sustainable urban environment through integrated urban planning. To avoid unplanned sprawl, Curitiba directed urban growth linearly along strategic axes, along which the city encouraged high density commercial and residential development linked to the city's integrated master plan and land use zoning. Curitiba adopted an affordable but innovative bus system rather than expensive railways that require significant time to implement. Curitiba's efficient and well-designed bus system serves most of the urban area, and public transportation (bus) ridership has reached 45 percent. The city now has less traffic congestion, which has reduced fuel consumption and enhanced air quality. The green area has been increased, mainly in parks that have been created to improve flood prevention and through regulations that have enabled the transfer of development rights to preserve green areas and cultural heritage zones.

Linking development densities to public transport availability, Curitiba, Brazil
Source: Rabinovitch, J. (1992) "Curitiba: towards sustainable urban development", Environment and Urbanization, Vol.4 (2) pp. 62-73
Curitiba's Master Plan integrated transportation with land use planning. Zoning laws are used to direct linear growth by attracting residential and commercial density along a mass transportation lane. High-density residential and commercial development is permitted within walking distance of stops, with much lower densities elsewhere in the city. The city's central area is partly closed to vehicular traffic, and pedestrian streets have been created. In addition, a strict street hierarchy safeguards the right of way for the current BRT, which has significantly contributed to the success of the transportation network.

Integrated urban planning and efficient resource use, Singapore
Good practices in City Energy Efficiency: Eco^2 Cities - Land and Resource Management in Singapore, available online
http://www.esmap.org/esmap/node/1230
Singapore is an island city-state at the southern tip of the Malay Peninsula. With a limited land area of 700 square kilometers and a population of 4.8 million, Singapore has become developed because of innovative urban planning integrated with the efficient use of land and natural resources. Singapore's small size poses challenges related to the availability of land and natural resources. To optimize land use, Singapore promotes high-density development not only for businesses and commercial entities, but also for residential structures. High density lends itself to higher economic productivity per unit of land and facilitates the identification of green spaces and natural areas for preservation.
Furthermore, high-density development has translated into greater use of public transportation as major business, commercial, and residential areas are well connected to an integrated public transportation network. In 2004, public transportation as a share of all transportation modes during morning peak hours reached 63 percent. The significant use of public transportation helps reduce greenhouse gas emissions. High public transportation ridership also means Singapore has been able to recover all public transportation operating costs from fares, a feat achieved only by Hong Kong, China, and by Singapore among modern, highly developed cities.

Integrated regional urban planning, Auckland, New Zealand
Good Practices in City Energy Efficiency: Eco^2 Cities - Integrated Regional Urban Planning in Auckland, available online
http://www.esmap.org/esmap/node/1227

The interconnectedness of national and local Auckland issues (such as housing and education) with growth and innovation and the major required investments (particularly in land transport) have created complex and difficult issues among multiple authorities. Despite Auckland's importance to the New Zealand economy and the areas of common interest, such as transportation and energy provision, the national government did not initially play a close role in directing regional and local government planning. Concern emerged that, without agreement on an overarching regional strategy and framework, decision making in the region could become ad hoc and adversarial if each stakeholder tried to have a say from a narrow perspective and without viewing the region as a whole. As a result, there was a clear need for coordinated strategic planning across the Auckland Region to ensure that Auckland would be able to remain competitive in today's globalized world. The response involved the preparation in 2001 of a regional growth strategy that aimed to provide a vision of what Auckland could be like in 50 years.

TOOLS & GUIDANCE

Tools & Guidance
Public Transport Authority Western Australia (2009). "Bus Priority Measures Principles and Design" A guidance document for planning bus priority methods and approaches. Available online from http://www.pta.wa.gov.au/PublicationsandPolicies/DesignandPlanningGuidelines/tabid/109/Default.aspx
Transport for London (2006). "Accessible bus stop design guidance" A guidance document for designing bus stops which help make boarding easier for passengers. Available online from http://www.tfl.gov.uk/assets/downloads/businessandpartners/accessibile_bus_stop_design_guidance.pdf

ANNEX 7: Municipal Buildings Audit and Retrofit Program

DESCRIPTION

Develop an audit and retrofit program focused on all Offices to survey and implement opportunities for energy efficiency retrofits and upgrades. The benefits of the program will be cost savings for municipal government offices and reduction in carbon footprint of the CA. The program will identify immediate savings opportunities, and implement rapid payback items to yield cost savings that can go to other municipal services.

IMPLEMENTATION OPTIONS

Implementation Activity	Methodology
Identify Offices Program Leader	Identify a CA staff position or hire a new position to be responsible for execution and delivery of energy efficiency projects in municipal office buildings. This individual must be able to work across agencies, understand building systems and manage subcontractors.
Identify Preliminary Opportunities	Using results from the Benchmarking Program or data collected on office buildings by Office Program staff, identify preliminary opportunities for energy efficiency such as: new lighting systems, new air conditioning systems, new heating systems, new computers, server cooling opportunities, etc. Offices buildings can be more complex buildings and can have a high variety of system types, for example some may have simple window A/C (or no A/C) and others may have larger central A/C systems with chillers, cooling towers, air handlers and ductwork.
Perform Detailed Energy Audits	Walk through a variety of office buildings to identify specific energy efficiency opportunities across the following end-uses and activities: • lighting systems • air conditioning systems • heating systems • computers • server rooms and cooling of servers • appliances (water cooler, fridge, vending machines) The Municipal Offices EE Spreadsheet includes estimation methods for energy efficiency potential for offices which includes equipment retrofits, behavioural

ATTRIBUTES

Energy Savings Potential
> 200,000 kWh/annum

First Cost
> US$1,000,000

Speed of Implementation
1-2 years

Co-Benefits
Reduced carbon emissions
Improved air quality
Enhanced public health & safety
Increased employment opportunities
Financial savings

	changes (turning lights off, heating set points, time of operation, etc.) and procurement guidelines.
Set Budget and Requirements	Allocate budgets for energy efficiency upgrades in municipal office buildings. Combining upgrades with natural building renovations tends to be the best use of limited financing. For example if a new roof is required due to leaks, this is a good time to add insulation and white roof; or if new windows are being installed they could be upgraded to highly insulated windows using Office Building Energy Efficiency Program funds. Alternatively contracts may be set up with Energy Service Companies (ESCOs) who will pay for the first cost of the upgrades and will share in the savings from the retrofits.
Design Retrofits / Upgrades	Considering the benchmarking data, detailed energy audits and budgetary constraints, design retrofits, equipment replacement and renovation upgrades specifically for each building.
Hire Contractor to Implement Retrofits	Prepare an RFP for mechanical or electrical contractors to bid on the retrofit projects. Combining a large number of similar retrofits across dozens of office buildings will allow the CA to obtain economies of scale and quality assurance with lower overheads. Alternatively prepare a RFP and award an energy service contract to a private company (ESCO) who will guarantee energy savings, put forward the initial investment, and share future savings with the CA.
Verify Retrofit and Performance	Walk through and verify each construction project has been performed per the specifications in the energy efficiency retrofit RFP. Continue to collect electricity and heating bills for each building with improved systems and compare to historical data.

MONITORING

Monitoring the progression and effectiveness of recommendations, once implemented, is fundamental to an accurate understanding of their value over the longer term. Where the CA implements a recommendation a target (or set of targets) should be defined that indicates the level of expected progress over a given timescale. At the same time a monitoring plan should be designed. The monitoring plan does not need to be complicated or time consuming but should, as a minimum, cover the following aspects: identification of information sources, identification of performance indicators, a means of measurement and validating measuring equipment or processes, record keeping protocols, a schedule for measurement activity (daily, weekly, monthly etc.), assignment of responsibilities for each aspect of the process, a means of auditing and reviewing performance and finally, establishment of reporting and review cycles.

Some suggested measures that relate specifically to this recommendation are as follows:

- $/m2 - Benchmark annual energy cost on a per-square-meter basis for all municipal office buildings;
- kWhe/m2 - Benchmark annual electrical energy consumption on a per-square-meter basis for all municipal office buildings ;
- kWhth/m2 - Benchmark annual heating energy consumption on a per-square-meter basis for all municipal office buildings;
- $/yr saved - Aggregate total energy savings generated through the life of the program.

CASE STUDIES

Model for Improving Energy Efficiency in Buildings, Berlin, Germany http://www.c40cities.org/bestpractices/buildings/berlin_efficiency.jsp The City of Berlin in partnership with Berlin Energy Agency (BEA) has pioneered an excellent model for improving energy efficiency in buildings. They project manage the retrofit of public and private buildings, preparing tenders for work that will guarantee reductions in emissions. CO2 reductions of an average 26% are written into the public retrofit tenders so that winning Energy Systems Companies (ESCOs) must deliver sustainable energy solutions. 1,400 buildings have so far been upgraded, delivering CO2 reductions of more than 60,400 tonnes per year - these retrofits cost the building owners nothing - and the buildings make immediate savings.
Internal Contracting, Stuttgart, Germany http://www.c40cities.org/bestpractices/buildings/stuttgart_efficiency.jsp Stuttgart saves around 7200 tons of CO2 each year through an innovative form of internal contracting, making use of a revolving fund to finance energy and water-saving measures. The city is able to reinvest savings directly into new activities, creating a virtuous circle of environmental improvements and emissions reductions.
EU and Display Campaign Case Studies http://www.display-campaign.org/page_162.html The European Display Campaign is a voluntary scheme designed by energy experts from European towns and cities. When started in 2003 it was initially aimed at encouraging local authorities to publicly display the energy and environmental performances of their public buildings using the same energy label that is used for household appliances. Since 2008 private companies are also encouraged to use Display for their corporate social responsibility CSR activities.
Energy Management System, Frankfurt, Germany http://www.managenergy.net/download/r164.pdf In 1996 the City of Frankfurt (Building department) entered into a contract with a private company to install and operate an energy-management system (EMS) for the city hall (Romer), Paulskirche and Museum "Schirn". The goal of the project is to reduce the costs for energy- and water as well as the CO2-emissions. Based on the annual costs of 2.6 Million DM in 1992/1993 the potential cost reductions were estimated to be approximately 320,000 DM per year. To reach these cost savings an investment of 1 Million DM for control equipment was necessary. Repayment of the invested capital will be provided from the energy savings (54%) over a period of 8 years. The remaining 46% will reduce the operating costs for the buildings.

Energy Efficient Office of the Future (EoF), Garston, UK
http://projects.bre.co.uk/envbuild/index.html
The new Environmental Building at Garston was built as a demonstration building for the Energy Efficient Office of the Future (EoF) performance specifications, drawn up by a number of companies representing the manufacturers, designers and installers of building components and the fuel utilities, as part of the EoF project run by BRECSU.
A key part of this specification is the need to reduce energy consumption and CO2 emissions by 30% from current best practice. Air conditioning is not used in the new building - the major energy consumer in many existing office buildings. Other savings will be made by making better use of daylighting and by using the building's 'thermal mass' to moderate temperatures.

TOOLS & GUIDANCE

Tools & Guidance
EU LOCAL ENERGY ACTION Good practices 2005 - Brochure of good practice examples from energy agencies across Europe. http://www.managenergy.net/download/gp2005.pdf
ESMAP Public Procurement of Energy Efficiency Services - Guide of good procurement practice from around the world. http://www.esmap.org/Public_Procurement_of_Energy_Efficiency_Services.pdf
Energy Conservation Buildings Code provides minimum requirements for the energy efficient design and construction of buildings and their systems. http://www.emt-india.net/ECBC/ECBC-UserGuide/ECBC-UserGuide.pdf

ANNEX 8: Street Lighting Timing Program

DESCRIPTION

Public lighting usually only has two states of operation, i.e. 'on' and 'off', and only switches between these states in the early evening and early morning. The demand for lighting varies significantly throughout the day, however, with periods of very little use of public space during the middle of the night. A program with strategic timing and/or dimming tailored to the specific needs for lighting in specific areas can significantly reduce energy consumption whilst still delivering appropriate levels of lighting for e.g. providing safety and sense of security in public areas. An intelligent monitoring system can be used to adapt the levels of lighting according to varying weather and activity levels. The aim of this recommendation is to identify public space usage patterns and adjust the lighting system levels accordingly. Often lighting timing programs are integral to a full audit and retrofit program, but for cities that already have energy efficient public lighting systems, a lighting timing program may still be a small and effective program.

Lighting timing programs can reduce energy consumption, and subsequent carbon emissions as well as operational costs. Such programs often also increase the design life of light bulbs, reducing maintenance requirements and associated costs. The use of intelligent monitoring systems also enables quick detection of faults, allowing for quick replacement, enhancing the quality of the public lighting service.

IMPLEMENTATION OPTIONS

Implementation Activity	Methodology
Study illumination timing alternatives	Prepare a study to estimate the types of streets and luminaires that have the opportunity to have reduced timing and dimming during late night hours.
Install timers and dimmers on existing street lights	Allocate funding to implement upgrades and retrofits for dimming and timing opportunities. Roll out upgrades over the course of multiple years to achieve 100% coverage of all city public lighting and street lighting installations. See Kirklees and Oslo case studies for further details.
Standards for new lighting	Set up timing and dimming standards for new installations of public illumination and street lighting that confirm to global best practice for energy efficiency and IESNA illumination guidelines.
Monitor and publish	Measure on an annual basis the energy savings achieved by this program

ATTRIBUTES

Energy Savings Potential
> 200,000 kWh/annum

First Cost
< US$100,000

Speed of Implementation
< 1 year

Co-Benefits
Reduced carbon emissions
Enhanced public health & safety
Increased employment opportunities
Financial savings

energy savings	and encourage private sector owners to follow the model of the CA.

MONITORING

Monitoring the progression and effectiveness of recommendations, once implemented, is fundamental to an accurate understanding of their value over the longer term. Where the CA implements a recommendation a target (or set of targets) should be defined that indicates the level of expected progress over a given timescale. At the same time a monitoring plan should be designed. The monitoring plan does not need to be complicated or time consuming but should, as a minimum, cover the following aspects: identification of information sources, identification of performance indicators, a means of measurement and validating measuring equipment or processes, record keeping protocols, a schedule for measurement activity (daily, weekly, monthly etc.), assignment of responsibilities for each aspect of the process, a means of auditing and reviewing performance and finally, establishment of reporting and review cycles.

Some suggested measures that relate specifically to this recommendation are as follows:

- Hours per year street lights are illuminated at maximum output;
- Hours per year street lights are illuminated at less than 50% of maximum output.

CASE STUDIES

Control system for public lighting, Kirklees, UK

http://www.kirklees.gov.uk/community/environment/green/greencouncil/LightingStoryboard.pdf

Instead of switching off street lights at certain times of the day, as has been done by other CAs, the Kirklees CA decided instead to dim lights to varying levels throughout the day. This was done partly because not switching public lighting off completely during times of low activity would provide increased safety in the community by preventing crime. Retrofit systems were installed on each existing lighting pole which used wireless technology to monitor and dim the street lights. The retrofitting of these systems simply required the addition of a small antenna to the lamp heads, which plugged into the electronic ballast with no need for additional wiring. Generally the lights are switched on 100% at 7pm, thereafter dimmed to 75% at 10pm, and then to 50% at midnight. If the lights are still on at 5am, they are increased again to 100% lighting. By dimming the lights gradually, eyes are able to adjust to lower lighting levels, and the dimming is barely noticeable. The remote monitoring system also provides accurate inventory information and enables street lighting engineers to identify failed lamps quickly and easily. This reduces the need for lighting engineers to carry out night scouting and has also reduced other on-site maintenance costs. A dimming of lights as implemented in Kirklees can save up to 30% of the electricity used annually. By replacing 1,200 lights, Kirklees CA estimates savings of approx USD 3 million in energy costs per year.

Intelligent outdoor city lighting system, Oslo, Norway

http://www.echelon.com/solutions/unique/appstories/oslo.pdf

An intelligent outdoor lighting system has replaced PCB and mercury containing fixtures with high-performance high-pressure sodium lights. These are monitored and controlled via an advanced data communication system which operates over the existing 230V power lines using specialist power line technology. An operations centre remotely monitors and logs the energy use of streetlights and their running time. It collects information from traffic and weather sensors, and uses an internal astronomical clock to calculate the availability of natural light from the sun and moon. This data is then used

to automatically dim some or all of the streetlights. Controlling light levels in this way has not only saved significant amount of energy (estimated at 62%), but has also extended lamp life, thereby reducing replacement costs. The CA has been able to use the monitoring system to identify lamp failures, often fixing them before being notified by residents. By being able to provide predictive failure analyses based on a comparison of actual running hours versus expected lamp life, the efficiency of repair crews has been increased. 10,000 replacements have cost the CA approx. USD 12 million. Currently the program saves approx. USD 450,000 in running costs per year. However, it is estimated that if the program is rolled out to the entire city, the economies of scale will yield a payback period of less than 5 years.
Motorway intelligent lights retrofit, Kuala Lumpur, Malaysia http://www.lighting.philips.com.my/v2/knowledge/case_studies-detail.jsp?id=159544 The project implemented a lighting solution for highways leading to Kuala Lumpur International Airport. The total length of the dual carriage highway covers 66 km. The main requirement for the project was that each individual lamp along the entire 66 km stretch of highway should be independently dimmable. This called for a network linking all 3,300 positions to a central control facility. There was also a need for greater maintenance efficiency while ensuring optimal visibility without compromising on visual comfort on the road. An intelligent lighting system that uses tele-management control was employed. Tele-management makes it possible to switch or control every individual light point in the system from a central PC. It also enables specific dimming profiles adjusted to suit conditions on the road for different lamps, instant reception of failure messages, and the creation of a database where all system data is stored. It allows a significant reduction in energy consumption in addition to the 45% savings as a result of the use of dimming circuits.

TOOLS & GUIDANCE

Tools & Guidance
N/A

ANNEX 9: List of abbreviations for cities in the TRACE database

	City	Country	City Abbreviation		City	Country	City Abbreviation
1	Addis Ababa	Ethiopia	ADD	38	Karachi	Pakistan	KAR
2	Amman	Jordan	AMM	39	Kathmandu	Nepal	KAT
3	Baku	Azerbaijan	BAK	40	Kiev	Ukraine	KIE
4	Bangkok	Thailand	BAN	41	Kuala Lumpur	Malaysia	KUA
5	Belgrade	Serbia	BE1	42	Lima	Peru	LIM
6	Belo Horizonte	Brazil	BEL	43	Ljubljana	Slovenia	LJU
7	Bengaluru	India	BEN	44	Mexico City	Mexico	MEX
8	Bhopal	India	BHO	45	Mumbai	India	MUM
9	Bratislava	Slovakia	BRA	46	Mysore	India	MYS
10	Brasov	Romania	BR1/BRA	47	New York	USA	NEW
11	Bucharest	Romania	BUC	48	Odessa	Ukraine	ODE
12	Budapest	Hungary	BUD	49	Paris	France	PAR
13	Cairo	Egypt	CAI	50	Patna	India	PAT
14	Cape Town	South Africa	CAP	51	Phnom Penh	Cambodia	PHN
15	Casablanca	Morocco	CAS	52	Ploiesti	Romania	PLO
16	Cebu	Philippines	CEB	53	Pokhara	Nepal	POK
17	Cluj-Napoca	Romania	CLU	54	Porto	Portugal	POR
18	Colombo	Sri Lanka	COL	55	Pune	India	PUN
19	Constanta	Romania	CON	56	Quezon City	Philippines	QUE
20	Craiova	Romania	CRA	57	Rio de Janeiro	Brazil	RIO
21	Dakar	Senegal	DAK	58	Sangli	India	SAN
22	Danang	Vietnam	DAN	59	Sarajevo	Bosnia and Herzegovina	SAR
23	Dhaka	Bangladesh	DHA	60	Seoul	South Korea	SEO
24	Gaziantep	Turkey	GAZ	61	Shanghai	China	SHA
25	Guangzhou	China	GUA	62	Singapore	Singapore	SIN

26	Guntur	India	GUN	63	Sofia	Bulgaria	SOF
27	Hanoi	Vietnam	HAN	64	Surabaya	Indonesia	SUR
28	Helsinki	Finland	HEL	65	Sydney	Australia	SYD
29	Ho Chi Minh	Vietnam	HO	66	Tallinn	Estonia	TAL
30	Hong Kong	China	HON	67	Tbilisi	Georgia	TBI
31	Iasi	Romania	IAS	68	Tehran	Iran	TEH
32	Indore	India	IND	69	Timisoara	Romania	TIM
33	Jabalpur	India	JAB	70	Tokyo	Japan	TOK
34	Jakarta	Indonesia	JAK	71	Toronto	Canada	TOR
35	Jeddah	Saudi Arabia	JED	72	Urumqi	China	URU
36	Johannesburg	South Africa	JOH	73	Vijaywada	India	VIJ
37	Kanpur	India	KAN	74	Yerevan	Armenia	YER