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MINISTRY OF REGIONAL DEVELOPMENT AND PUBLIC ADMINISTRATION

CONSTANȚA

Instrumente Structurale  
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# Improving Energy Efficiency in CONSTANȚA 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



*Inițiativă locală. Dezvoltare regională.*

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*The findings, interpretations, and conclusions expressed in this report do not necessarily reflect the views and position of the Executive Directors of the World Bank, the European Union, or the Government of Romania.*

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## 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 of 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-based 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 toward catching up with the economic performance of more developed EU countries. Although radical reforms brought about significant changes in recent years, the standard of living of Romanians is still behind the EU average.

Constanța is the only growth pole located on the coast of the Black Sea, a couple of hours away from București. The city is on the



Eastern border of the European Union and it hosts the Port of Constanța, which is the largest harbor on the Black Sea and the fourth biggest in Europe. Mamaia, one of the most modern and popular beaches in the region attracting millions of tourists annually, is an administrative unit of Constanța, and is located just on the outskirts of the city. At the cross roads of few important commercial transport routes, Constanța is a core commercial center connecting Europe from East to West and from South to North, ensuring a link between Eastern Europe and Central Asia. The Port of Constanța plays an important role for the transit of mineral resources, natural gas, and hydrocarbons from CIS countries, Central Asia, and Trans-Caucasus to Western and Central Europe.

The local economy is based primarily on the oil refinery industry, port-related activities, services, and tourism. For example, manufacturing of refined petroleum products makes up almost 30% of the revenues in the metropolitan area. The economic development of Constanța and the region was boosted by the dynamics of port activities and maritime transport in the mid-2000s.

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 Constanța. Some of these developments have positively affected people's lives, whereas a few came along with inconveniences and difficulties. Like many cities in the country, Constanța lost almost 9% of its residents over the last decade.

Similar to a country-wide trend, the rising number of cars in the past two decades has caused heavy traffic congestion, increased fuel consumption, and high level of greenhouse gas emissions. Commuting is not an easy task for neither private nor public vehicles. The main challenges in the transport sector in Constanța are the modernization of the rolling stock and improvement of the traffic flow. The urban transport sector has a significant potential for energy savings, requiring appropriate measures in order to decrease fuel consumption and reduce greenhouse gas emissions.

The second-highest potential savings in Constanța are related to the district heating sector. In the near future, the City Hall hopes to take over CET, the district heating plant, in order to manage the overall operations, from production to distribution of heat, and collection of revenues. The main challenges to the district heating system concern the

upgrading of the hot water/heat pipes in order to diminish hot water leakages and improve the quality of services offered to the population. Like in every city in the country, municipal buildings in Constanța demand proper measures toward improving energy efficiency – particularly health and education facilities managed by the city government. The local public administration has data about energy consumption and expenditures in municipal buildings, but the building stock under the city government needs a proper benchmarking, along with audit and retrofit measures in order to identify the highest energy savings potential and optimal interventions. Among other challenges faced by Constanța are the small percentage of recycled waste (only 3%) and the lack of dedicated bike lanes. At the same time, the city did not rehabilitate any of the residential buildings, and thus the level of comfort in some of the apartments is increasingly poor.

But Constanța has accomplished a number of positive things to date. The water sector covers the entire city and the related connections are metered. Hundreds of millions of Euros were invested in the expansion of the water network and the rehabilitation and modernization of the water plants and wastewater facilities in the city, which eventually helped reduce energy consumption. As for the street lighting sector, mercury lamps have been replaced with more efficient sodium vapor bulbs. Although Constanța relies only on buses and minibuses (the latter operated by private transport companies), the public transport connects the downtown area to all neighborhoods in the city and to Mamaia. The city government is working on addressing the issue of bike lanes once a joint project with Balchik, a city in Bulgaria, will be completed. Constanța is also developing and remodeling a number of pedestrian networks and expanding some of them. Among some of infrastructure projects under way are the rehabilitation of the historical center and the seafront promenade in Constanța and Mamaia. Some of the educational facilities have been renovated, which led to increasing the level of comfort in the buildings. Despite a low rate of recycled waste collected, the solid waste sector is performing well. Constanța metropolitan area has the first eco-framed landfill in the country, which is operational since the mid-1990s. The local government plans to renovate more schools and kindergartens in the city in the near future. In addition, the city managers want to start off the thermal insulation of residential buildings in the city. Beyond these



positive efforts, additional work needs to be completed in order to decrease energy consumption, reduce heating bills, and enable the city to become more energy efficient.

Similar to all other cities in the country, Constanța does not have a say with regards to the management of the electrical power sector. Tariffs are regulated by the national government, which is still subsidizing the energy price for domestic users. The liberalization of the energy sector is under way with industrial consumers and, starting in 2013, it will begin to affect non-domestic users as well. Specifically, the subsidies are going to be gradually eliminated by the end of 2017, when the liberalization of the market is expected to be complete. Energy production from renewable sources is encouraged, and Green Certificates are provided to producers, although the award of some certificates has been postponed until 2017.

The local public authorities are planning to carry out a number of projects aimed at reducing energy consumption in the city and, ultimately, improving the quality of life for the residents of Constanța. Some of these projects include mitigating traffic congestion, purchasing fuel-efficient rolling stock, increasing the efficiency of the district heating system, expanding the water and sewage networks, developing bike lanes, and modernizing the street lighting system.

This report is based on the implementation of the TRACE tool in Constanța in July 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 assesses a city's energy performance in six service areas (urban transport, municipal buildings, water and wastewater, solid waste management, public lighting, and power & heat) and provides 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.

In order to complete data collection and to get a more comprehensive idea of issues specific to Constanța, a World Bank field trip was organized in July 2013. The implementation of TRACE in Constanța was carried out in close collaboration with local authorities and public and

private utility service providers. At the end of this quantitative and qualitative analysis, several recommendations were formulated, as summarized below.

#### ***District Heating Maintenance and Upgrade***

TRACE identified district heating as the sector with the highest energy savings potential in Constanța. Through this recommendation, TRACE encourages city managers to consider upgrading the district heating system. The main challenges to this sector include diminishing losses in the network and maintaining an affordable tariff for the population. Therefore, the local government should pay attention to the rehabilitation and upgrading of the network, and replace the old hot water and heat pipes. In this way, losses will be reduced, the quality of services will improve, and the district heating operator will be able to maintain an acceptable heat price, keep clients happy, and even try to win back some of the lost market share and attract new customers.

#### ***Non-Motorized Transport Development***

One of the key recommendations for Constanța is to focus on the development of non-motorized commuting options in the city as a way of encouraging fuel-free means of transportation in order to raise the quality of life for the residents. Therefore, the city should expand the existing pedestrian networks and develop new areas where traffic should be restricted. The city does not have dedicated bike lanes, an issue that the city government should address. The more people walk and bike, the lower is the use of private cars, and thus less fuel is consumed. The development of the pedestrian network would also encourage business growth around the newly established pedestrian areas, including additional leisure and entertainment spots. Constanța already has a few pedestrian networks in the city center that are currently undergoing redevelopment and rehabilitation work. The pedestrian networks are good spots that can stimulate businesses (such as shops, markets, entertainment places, etc.), and are also points of attraction for many residents.



### ***Parking Restraint Measures***

This TRACE recommendation highlights the fact that the local government in Constanța should consider taking the right measures to curb the increasing number of private cars pouring into the city. To this end, “Park and Ride” facilities are one of the most appropriate ways to deal with traffic congestion. This is a very efficient method to promote multimodality by linking parking to public transport. People who travel to the city drive their cars to “Park and Ride” lots, from where they take public transport to get into the city center or to their workplace. The local public administration in Constanța should consider building more parking spots and increasing the prices for parking, especially in the downtown area. But before such facilities are developed, one has to have a better understanding of commuting patterns in the larger metropolitan area, and the expansion of public transport infrastructure should precede the development of such facilities.

### ***Public Transport Development***

One of the TRACE recommendations to the municipality of Constanța is to continue developing the public transport in the city. The authorities should carry on the modernization of the public transport fleet, purchase new, energy-efficient rolling stock, and introduce e-ticketing. At the end of the day, all these measures seek to make the public transport more attractive and increase the number of users. Another recommendation is to expand dedicated bus lanes that would allow buses to bypass traffic congestion. A reliable and comfortable public transport system provides an incentive to Constanța’s residents to leave their cars at home.

### ***Municipal Building Benchmarking Program***

This recommendation emphasizes the importance and usefulness for Constanța of keeping track of energy consumption and related expenditures for the buildings that are under the management of the city government. One of the first measures to this end is the development of a comprehensive municipal building database that would provide information on which buildings have the greatest saving potential. This can be done through a benchmarking process, using a number of key indicators. Once the database is finalized, it should be analyzed and updated on a regular basis. The city government may also think about

publishing the data, thus enabling competition among building managers, a process that could eventually lead to collaboration and a productive exchange of data and best practices for saving energy.

### ***Municipal Buildings Audit and Retrofit***

After the benchmarking process is complete, the next step recommended by the TRACE analysis is a full audit of the public building stock in Constanța. This process would help draw a plan for how resources can be allocated to improve the energy performance of municipal buildings in the city. Based on results, the local government can allocate funds for investing in energy efficiency upgrades, purchasing new equipment, and performing renovation work on certain buildings. Some of the education facilities in the city have already been renovated and the Constanța City Hall plans to carry on this work and further modernize some of the educational facilities. This recommendation encourages the city managers to continue the necessary efforts toward increasing the efficiency of the municipal building stock.

### ***Street Lighting Timing Program***

This TRACE recommendation for increasing the efficiency of street lighting targets the introduction of a lighting-timing program in Constanța. After replacing the mercury lamps with more efficient sodium vapor bulbs, the local public administration is thinking to further improve the system and reduce electricity consumption. One of the best and least costly solutions for reducing energy consumption is the street lighting timing program. Through this method, the light can be adjusted for specific needs in a particular area, according to varying weather and activity levels. For instance, more light is needed in the evenings when more people are out than in the nighttime when there is less activity on the streets.

### ***Energy Efficiency Action Plan and Strategy***

TRACE recommended to the local government of Constanța to prepare an energy efficiency strategy and action plan. As the city is planning to sign the Covenant of Mayors, the next step would be the development of the Sustainable Energy Action Plan (SEAP), a document that will include concrete measures and actions towards reducing greenhouse emissions by 20% by 2020. This plan would be of crucial importance before



embarking on ambitious projects to improve energy efficiency in the city. The energy efficiency strategy can lay out a vision and objectives for such work, and provide a list of activities that could help Constanța achieve those objectives.

#### ***Awareness Raising Campaigns***

Last but not least, this TRACE assessment advises local authorities in Constanța to invest in making people more aware of the benefits of energy efficiency and enable them to act in such a manner as to achieve increased energy savings. The aim of this recommendation is to encourage the city government to employ public education and training campaigns in order to increase citizens' awareness and understanding of the need of reducing energy use and, thus, change their attitude toward energy efficiency. The municipality should provide citizens with accessible, useful information related to energy efficiency in such a way as to determine behavior change and, eventually, and help people understand how important is to live in a less polluted, healthier city.

#### **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 Constanța.

#### **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. Virtually, every growth poles has witnessed de-branchments 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.



## Matrix with energy efficiency priorities and proposed programs

<b>PRIORITY 1</b> Private Vehicles	Energy spending in the sector		Potential savings	
	\$74,775,000		\$4,000,000	
	Responsible Institution	Cost	Energy savings potential	Time of implementation
1. Non-motorized transport modes	City Hall	\$\$\$	**	> 2 years
2. Parking restraint measures	City Hall	\$	**	> 2 years
<b>PRIORITY 2</b> District Heating	Energy spending in the sector		Potential savings	
	\$32,500,000		\$2,900,000	
	Responsible Institution	Cost	Energy savings	Time of implementation
3. District heating maintenance and upgrade	RADET; City Hall	\$\$\$	***	> 2 years
<b>PRIORITY 3</b> Public Transportation	Energy spending in the sector		Potential savings	
	\$6,650,000		\$1,780,000	
	Responsible Institution	Cost	Energy savings	Time of implementation
4. Public transport development	RAT Constanta	\$\$\$	***	> 2 years
<b>PRIORITY 4</b> Municipal Buildings	Energy spending in the sector		Potential savings	
	\$2,120,000		\$570,000	
	Responsible Institution	Cost	Energy savings	Time of implementation
5. Municipal buildings benchmarking program	City Hall	\$	**	1-2 years
6. Municipal buildings audit and retrofit	City Hall	\$\$\$	***	1-2 years
<b>PRIORITY 5</b> Street Lighting	Energy spending in the sector		Potential savings	
	\$1,800,000		\$308,000	
	Responsible Institution	Cost	Energy savings potential	Time of implementation
7. Street lighting timing program	City Hall	\$	***	< 1 year



**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.<sup>1</sup> 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.

<sup>1</sup> 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 7<sup>th</sup> 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 incorporates within its borders much of the Danube Delta. Romania neighbors Hungary, Serbia to the West and South West, Bulgaria to the South, the Republic of Moldova to the East, and the Ukraine to 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 improvements, 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 yet have formal administrative powers, as of July 2013). Apart from București, each development region includes a growth pole center (city) and comprises four to seven counties. Despite being among the most populous countries in Europe, Romania has experienced a decline in population in recent years. The stable population has gone down by 7.1% over the last decade, from 21.6 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 opportunities in Western Europe. Other factors responsible for this decline are the aging population as well as the significant rise in the number of families with no children. Romania is predominantly urban, although the urbanization level is still below that of countries in Western Europe; half of the 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
<b>București</b>	1,883,425	1,934,449 (#1)
<b>Cluj-Napoca</b>	324,576	318,027 (#3)
<b>Timișoara</b>	319,279	317,651 (#4)
<b>Iași</b>	290,422	321,580 (#2)
<b>Constanța</b>	283,872	310,526 (#5)
<b>Craiova</b>	269,506	302,622 (#6)
<b>Brașov</b>	253,200	298,584 (#8)
<b>Galați</b>	249,432	283,901 (#7)
<b>Ploiești</b>	209,945	232,452 (#9)
<b>Oradea</b>	196,367	206,527 (#11)

Source: National Institute of Statistics, 2012 Census  
([www.recensamantromania.ro/rezultate-2/](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 percent, 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.<sup>2</sup> 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 2007-2010 set an energy saving target of 2.8 Million toe by 2010, 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

<sup>2</sup> Romanian Fund for Energy Efficiency  
[http://www.free.org.ro/index.php?Itemid=112&id=96&lang=ro&option=com\\_content&task=view](http://www.free.org.ro/index.php?Itemid=112&id=96&lang=ro&option=com_content&task=view)

<sup>3</sup> First Energy Efficiency Plan for the period 2007-2010 available at:  
[http://ec.europa.eu/energy/demand/legislation/doc/neeap/romania\\_en.pdf](http://ec.europa.eu/energy/demand/legislation/doc/neeap/romania_en.pdf)

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**<sup>4</sup> 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**<sup>5</sup> 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**<sup>6</sup> 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

<sup>4</sup> Second Energy Efficiency Action Plan available at:  
[http://www.minind.ro/dezbateri\\_publice/2011/PNAEE\\_12\\_cu\\_anexe\\_2\\_11082011.pdf](http://www.minind.ro/dezbateri_publice/2011/PNAEE_12_cu_anexe_2_11082011.pdf)

<sup>5</sup> The First National Strategy for Energy Efficiency for the period 2004-2015 available at: [http://www.minind.ro/domenii\\_sectoare/H163-04.html](http://www.minind.ro/domenii_sectoare/H163-04.html)

<sup>6</sup> 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](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**<sup>7</sup> 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**,<sup>8</sup> 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**<sup>9</sup> outlining the renewable energy national

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

<sup>8</sup> 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](http://leg-armonizata.minind.ro/leg_armonizata/energie/HG_1535_2003.pdf)

<sup>9</sup> The National Renewable Energy Action Plan – available at (in Romanian)  
[http://www.minind.ro/pnaer/PNAER\\_29%20iunie\\_2010\\_final\\_AlX.pdf](http://www.minind.ro/pnaer/PNAER_29%20iunie_2010_final_AlX.pdf) English

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 7,267ktoe 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**<sup>10</sup> 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

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version is available at  
[http://ec.europa.eu/energy/renewables/action\\_plan\\_en.htm](http://ec.europa.eu/energy/renewables/action_plan_en.htm) (click on "Romania").

<sup>10</sup> Government Ordinance 22/2008 available at:  
[http://www.dreptonline.ro/legislatie/og\\_eficienta\\_energetica\\_consumatori\\_finali\\_surse\\_regenerabile\\_energie\\_22\\_2008.php#](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<sup>11</sup>.

A few years later, **Government Ordinance 18/2009**<sup>12</sup> 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**<sup>13</sup> brought some changes to the rehabilitation program coordinated by the MRDPA. According to new regulations, residential

<sup>11</sup> The guide is available at:

[http://www.mdr.ro/userfiles/constructii\\_ancheta\\_publica\\_contr429\\_contr411.pdf](http://www.mdr.ro/userfiles/constructii_ancheta_publica_contr429_contr411.pdf)

<sup>12</sup> Government Ordinance 18/2009 available at:

[http://www.mdrl.ro/\\_documente/lucrari\\_publice/reabilitare\\_termica/OUG\\_reabilitare.pdf](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](http://www.mdrl.ro/_documente/lucrari_publice/reabilitare_termica/Norme.pdf)

<sup>13</sup> Government Emergency Ordinance 63/2012 available at:

<http://www.mdr.ro/dezvoltare-regionala/programul-operational-regional-2007-2013/-8748>

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**<sup>14</sup> 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<sup>15</sup> 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

<sup>14</sup> 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](http://www.dreptonline.ro/legislatie/oug_69_2010_reabilitarea_termica_cladirilor_locuit_finantare_credite_bancare_garantie_guvernamentala.php)

<sup>15</sup> 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 31<sup>st</sup>, 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<sup>16</sup> on the promotion of the use of bio-fuels or other renewable fuels for transport. **Government Emergency Ordinance 1844/2005**<sup>17</sup> 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**<sup>18</sup> 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

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

<sup>17</sup> Government Emergency Ordinance 1844/2005 available at: [http://ngo.ro/pipermail/mediu\\_ngo.ro/2006-February/004597.html](http://ngo.ro/pipermail/mediu_ngo.ro/2006-February/004597.html)

<sup>18</sup> Government Emergency Ordinance 70/2011 regarding social protection measures in the cold season.

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<sub>2</sub> 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.

### 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.<sup>19</sup> 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, namely Complexul Energetic Oltenia,<sup>20</sup> Complexul Energetic Hunedoara,

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

<sup>20</sup> Complexul Energetic Oltenia was established in 2012 after the merger of four large energetic companies, namely Societatea Nationala a Lignitului Oltenia Tg. Jiu,



Nuclear Electrica, CE Arad, SC Electrocentrale Deva, Hidroelectrică, and OMV Petrom. CEZ, ENEL Energie Muntenia, Enel Energie, E.ON, and Electrica Distribuție (with its three branches, namely Electrica Distribuție 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)**<sup>21</sup> 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 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<sup>22</sup>. 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 new institution expected to add more consistency to the country's energy policies.

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Complex Energetic Turceni, Complex Energetic Craiova, and Complex Energetic Rovinari.

<sup>21</sup> More information on ANRE available at: <http://www.anre.ro/>

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<sup>22</sup> More information available at: [http://media.hotnews.ro/media\\_server1/document-2013-04-2-14540999-0-proiect-privind-suspendarea-schemei-sprijin.pdf](http://media.hotnews.ro/media_server1/document-2013-04-2-14540999-0-proiect-privind-suspendarea-schemei-sprijin.pdf)



### 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 Constanța

Constanța is located on the Black Sea coast, in Dobrogea region, and is on the Eastern border of the European Union. It is at a couple of hours drive east from București, and about an hour away from the border with Bulgaria. Constanța is the capital of the county with the same name and the fourth most populous city after București. The city is in the vicinity of Port of Constanța, which is the biggest harbor on the Black Sea and the fourth largest in Europe, with an area of nearly 40 square kilometers and a length of about 30 kilometers.

Mamaia, one of the most modern and popular beaches in the region attracting millions of tourists every year, is located just on the outskirts of Constanța, and is an administrative unit of the city. The beach

length in Constanța and Mamaia spans over 20 kilometers facing east. Due to its proximity to the water, Constanța is the warmest city in Romania, with hot and humid summers with a touch of tropical influences and mild winters. The average annual temperature in the region is around 11 degrees Celsius, the highest in the country.

At the cross roads of a few important commercial transport routes, Constanța is a core commercial center connecting Europe from East to West and from South to North, and ensures a link between Eastern Europe and Central Asia. The Constanța Metropolitan area is crossed by some of the most valuable natural gas networks at the European level, as well as high-voltage transmission lines interconnected to energy European systems. The Port of Constanța plays an important role for the transit of mineral resources, natural gas, and hydrocarbons from CIS countries, Central Asia, and Trans-Caucasus to Western and Central Europe.

Constanța, a city on the Black Sea coast



Source: [www.en.wikipedia.org](http://www.en.wikipedia.org)

Furthermore, Constanța is on Pan European Corridor IV connecting Western Europe from Berlin/Nuremberg to the Southern Europe, to Thessaloniki and Istanbul. It is also on the Pan European maritime corridor VII on the Danube River connecting the Black Sea to the North Sea via the Danube-Black Sea Channel, the Main, the Rhine, and Rotterdam in the



Netherlands. The city is located on several European routes: on E 60 linking Western Europe to Central Asia, on E 87 running from Odessa in Ukraine to Antalya in Turkey, and on E 70 connecting Spain to Georgia. Although the Constanța growth pole is some distance away from other urban centers in the region, the Sunshine Highway (Autostrada Soarelui), recently completed in full, is helping connect the city to the Western part of the country, going all the way to București. In addition, the city is linked to popular seaside resorts to the south. The city's location at the Black Sea allows for all means of transportations, i.e., by water using different routes (the Port of Constanța, the Danube-Black Sea Channel, the Danube), highway (via București), railway, and airport. The airport is located in Mihail Kogălniceanu, a commune approximately 24 kilometers away from the city, from where flights connect Constanța to a few cities in the country and to a couple of destinations in Turkey. Since 2009, Mihail Kogălniceanu hosts a US permanent military base, a factor that makes Constanța play an important strategic role in the region.

#### Mamaia, the most popular beach resort in Romania



Source: [www.tourismaker.com](http://www.tourismaker.com)

According to the final results of the 2012 census, there are 283,872 people living in Constanța city, a decrease by 9% over the last decade. The population of the city makes up 41% of the total number of people living

in Constanța County. The municipal area is spread over 124.8 square kilometers, and has a density of 2,273 inhabitants per square kilometer. The region is recognized for its linguistic, religious, and ethnic diversity. Around 10% of the residents belong to different minority groups, including Turks, Tatars, Greeks, and Bulgarians. The Constanța Metropolitan area gathers 425,916 inhabitants, which accounts for over 62% of the population of the county, and is spread over 1,013 square kilometers (around 30% of the total surface area of the county.) In addition to the permanent residents, there is a daily minimum average of 120,000 seasonal workers and tourists during the summer. The metropolitan area comprises a number of 14 localities: one municipal city - Constanța, five cities - Năvodari, Ovidiu, Murfatlar, Eforie, and Techirghiol - and eight communes, namely Mihail Kogălniceanu, Corbu, Lumina, Poarta Albă, Cumpăna, Agiea, Valu lui Traian, and Tuzla.

Today, Constanța is not only Romania's second largest tourist center after București but also one of the key commercial and industrial cities in the country. The local economy has a complex structure, relying mainly on oil industry, tourism, port activities, ship building, and maritime trade and transport. A number of port-specific sectors are among the growth pole's strongest economic engines. There is a refinery north of the city, which brings an important contribution to the local economy. Manufacturing of refined petroleum products makes up almost 30% of the revenues in the metropolitan area. The dynamics of port activities and maritime transport in the mid-2000s boosted economic development throughout Constanța County, a factor that has increased the stability of the labor market. Tourism, food processing, chemical and petro-chemical, automotive, textile, energy, and wood processing are among the most active industrial sectors in the region. The private sector is fairly well developed through a number of small and medium-sized enterprises. In the mid-2000s, the level of foreign direct investments in Constanța area increased significantly compared to previous years. 60% of investments have been directed to the services sector, whereas 25% went to constructions and 16% to industry. The unemployment rate in the Constanța Metropolitan Area decreased in the 2000s, from 8.4% in 2002 to 3.6% in 2007, below the average figure of 4.4% at national level at that time.



During the real-estate boom in Romania in the mid-2000s, Constanța became one of the most expensive cities in the country. As a consequence, many of the local residents moved to the metropolitan area. In the last few years, the local authorities tried to work out solutions for bringing back people into the city. To this end, an affordable housing project was developed between 2008 and 2012 by building a large residential complex housing 1,200 apartments, dedicated primarily to young people who used to live or work in the city in the past. The City Hall contributed with the land and also set up the utilities (e.g., water, sewage, district heating, etc.). The cost of such housing is relatively affordable, as compared to the market, i.e., between EUR 475 and EUR 519 per square meter.

The landmark of the city is the Casino, a beautiful rococo style construction built in early 20<sup>th</sup> Century, located on the sea shore. The building is finally set to undergo rehabilitation work and, subsequently, will be opened to public.

The Casino in Constanța



Source: [www.all-free-photos.com](http://www.all-free-photos.com)

Constanța is home to 6 public and private universities, including the Constanța Maritime University, and five research and development facilities specialized in maritime research and viticulture. Apart of the

proximity to beach resorts and the availability of a wide variety of entertainment options, Constanța has impressive archeological treasures, historical monuments, museums, and ancient ruins. The vineyards, traditional villages, monuments and the famous Danube Delta, known for being the best preserved delta as such in Europe, add to the regional attractions. Constanța is also home to a number of museums, a mosque, and 164 monuments. Among them is the statue of Ovidius, the ancient Roman poet, which is displayed in the historical center in front of the Archeological Museum.

#### Local Energy Efficiency Laws

Constanța is the growth pole in the country that did not take part to the rehabilitation of the residential building program built between 1950 and 1990, coordinated by the Ministry of Regional Development and Public Administration (MRDPA). In addition to the money from the national budget, the program involved 30% financial contribution from the local budget. According to the city government representatives, the Constanța City Hall did not want to spend funds from the local budget for rehabilitation work, as most of the city residents are doing fairly well financially and, reportedly, have enough money to thermally insulate the buildings they live in on their own expenses. However, there are around 1,800 residential buildings in Constanța that need rehabilitation work. The city managers hope that this could be performed with support from the next financial programming of the EU structural funds. Two towns in the metropolitan area have benefitted from the program managed by the MRDPA, namely Năvodari and Eforie. Between 2009 and 2011, Năvodari received RON 5.1 million for thermal insulation of 543 apartments, while RON 729,221 was directed to rehabilitate 255 apartments in Eforie.

The Constanța City Council grants **tax breaks** for a period of seven years for apartment owners who perform rehabilitation and thermal insulation work on their expense. Following the rehabilitation process, the owners are entitled to receive an energy certificate that confirms that the apartment or the building underwent thermal insulation work. Some tax exemptions are also awarded to property owners who replace the classical heating systems with renewable energy ones by installing solar panels, heating pumps, and individual micro-heating units



running on bio-mass. Also, owners who renovate the façade of their buildings benefit from tax breaks for a period of five years.

**Constanța Municipality Strategy for Sustainable Development**, known as Local Agenda 21, was prepared in 2006 with the support of the United Nations Development Program.<sup>23</sup> The document outlines the measures that the city should undertake in the field of energy efficiency. District heating and transport were two of the sectors that have been on the agenda in order to improve energy consumption. For example, a EUR 20 million four-year project has been designed to modernize and upgrade part of the district heating network. Another EUR 35 million project was aimed at setting up micro-thermal units connected to the main district heating plant. The Environmental Protection Agency Constanța in partnership with City Hall made an assessment on using non-conventional fuel for public transport. Agenda 21 also laid down a few initiatives in support of enforcing pollution prevention and control. The “Green Forestry” project sought to reduce pollution and slow down the desertification process by setting a forest curtain of 2.5 million square meters around the city beltway.

In the mid-2000s, the City of Constanța was granted EUR 100,000 from the Norwegian Government to support economic agents assimilate what was called the “Cleaner Production and Energy Efficiency Methodology.” The project was developed between 2005 and 2006 in partnership with Norwegian Energy Efficiency Group, the Norwegian Society of Chartered Technical and Scientific Professionals, and the Pollution Prevention Center București. A number of experts have been trained on environmental issues and manuals have been developed for environment quality and environment management.

The Local Council set up a municipal **commission on energy efficiency**, in a move to comply with the provisions of the Government Ordinance 22/2008 regarding energy efficiency and promoting the use of renewable energy sources to end consumers. Constanța is involved in a national program designed to improve air, water, and soil quality by replacing conventional heating systems with those that use solar,

<sup>23</sup> Agenda Locala 21 is available at: <http://www.primaria-Constanța.ro/Fisiere/Proiecte/AL21Rom.pdf>

geothermal, and wind energy coordinated by the Ministry of Environment. For instance, the Home for the Elderly in Constanța is among the local beneficiaries of this program.

#### **Urban Growth and Energy Efficiency Challenges in Constanța**

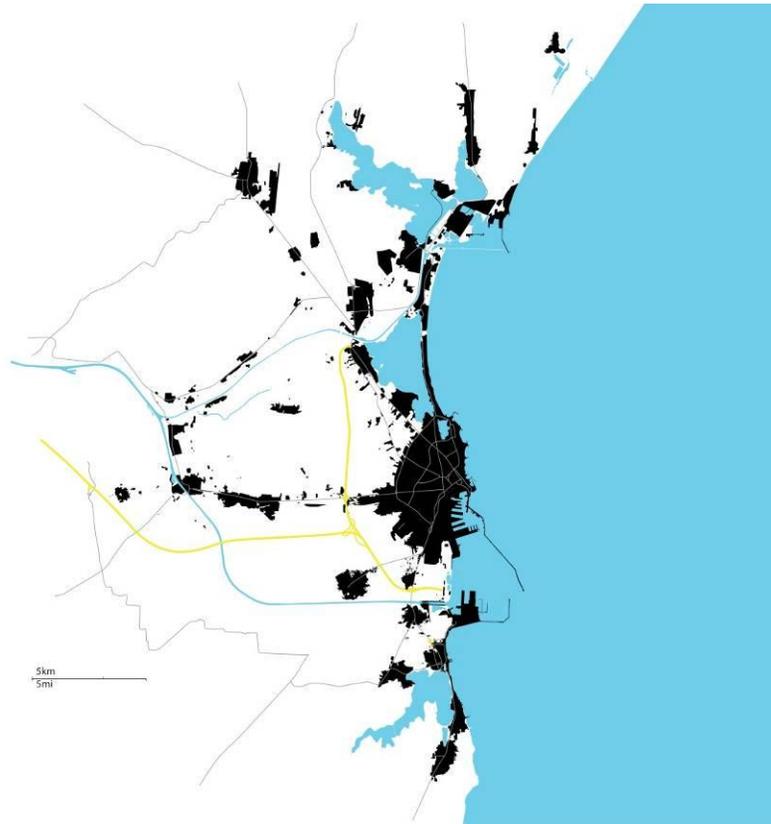
While the TRACE tool does not directly address this issue, one of the most efficient ways of encouraging energy efficiency in cities is by promoting dense development patterns and compact urban expansion. This can be done by using spatial planning tools strategically. The less dense and the more scattered a city is, the larger its energy expenditure becomes. Basically, without density, public transportation is less viable and more people rely on private cars for commuting. Also, commutes in private cars tend to be longer in sprawled areas and city streets tend to get 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. Last but not least, the district heating network becomes less viable in areas with small density because of the high production and distribution costs, and because heat losses tend to be proportional to the network size. Such examples and others suggest that there are significant benefits of compact, carefully planned urban growth and nearly every key area in the TRACE analysis is deeply tied to density patterns and trends.

As a World Bank study 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, however, are not powerless in addressing those challenges. They have a number of tools they can use to ensure that the loss in density is managed and that the city expands in an organized, compact, and sustainable fashion. The challenge is of course to do spatial planning at the metropolitan level. Even if sound planning tools are well implemented in the center city, if they are lacking or are poorly implemented in peri-urban areas, the growth pole as a whole suffers.



### The urban mass of the Constanța growth pole



The spatial expansion of the Constanța growth pole has been rather modest. Between 1992 and 2012, the area has grown by only 11%. Constanța is the locality that has registered the largest absolute built mass growth in the region, but in relative terms it was surpassed by some of the neighboring localities in the wider metropolitan area, such as Ovidiu, Cumpăna, or Năvodari, confirming a trend of moving to the sub-urbs, noticed in other large Romanian cities like Cluj-Napoca, Timișoara, Brașov, and București. In addition, none of Constanța's peri-urban localities are

very dense. Thus, there is little scope, for example, for the development of an integrated metropolitan public transport network, although within a 40-minute driving buffer Constanța has both the largest population and the largest economic density of all seven growth poles in Romania. The economic density bump can be explained by the presence of the oil refinery close to Năvodari. The relatively high population, but low population density within the built mass, may be an indication of the predominantly rural character of much of the Constanța growth pole area, but also an indication of its tourism profile (e.g., in a resort town like Eforie, much of the built mass is taken up by hotels, with few permanent residences).

Although the topography of Constanța is relatively flat, the positioning of the growth pole along the Black Sea guides development according to a longitudinal pattern. This geographic feature of the city may push the development and improvement of connective infrastructure along a North-South axis, along the banks of the Black Sea. The travel times from different points of the growth poles to the center of Constanța are likely to be higher than if the growth pole would have developed tightly around the urban core. However, this pattern of urban location and expansion makes sense from an economic point of view, because the Black Sea coast offers the most favorable locations for summer tourism and for various trade activities.

As the number of commuters grows, the city's congestion and pollution aggravate proportionally. If the quality of life is perceived to be decreasing (despite its pleasant geographic location), Constanța will be increasingly exposed to the risk of losing its most critical resource needed for continued economic growth – its people. This is why achieving sustainable development and building a highly efficient city are critical tasks for local authorities. In reaching these aims, they should deploy spatial planning as a powerful instrument for guiding the city's expansion in an adequate manner.





## Constanța Sector Analysis

### Power Sector

The main electricity company in Constanța is Enel, an Italian energy group operating in Romania since 2005. The operator is one of the largest private investors in the country in the field of energy. At present, Enel caters to 2.7 million people in three main regions in Romania - Muntenia Sud (including București), Banat, and Dobrogea - accounting for a third of the energy market in the country. Just like other important energy players in Romania, Enel is responsible for both distribution and supply of electricity. The company is currently implementing a five-year project with a total value of EUR 800 million aimed at modernizing the electricity distribution infrastructure. Enel Dobrogea supplies electricity to four counties, namely Constanța, Tulcea, Călărași, and Ialomița.

The total electricity network length in the Constanța metropolitan area is 1,654 kilometers. According to the Constanța Integrated Development Plan (IDP), a document prepared in 2010, the average monthly electricity consumption for domestic consumers in the wider metropolitan area is approximately 41,480 MWh (41,480,000 kWh). According to this figure, it can be assumed that the area uses nearly 500,000,000 kWh of electricity per year.

The Romanian electricity regulatory body, ANRE, sets the price for captive consumers, domestic clients who do not have the technical capability to choose their electricity provider or connect directly to the network. Some economic agents fall in the same category of captive consumers, so they pay the same tariffs set by ANRE. The price of electricity depends on actual consumption, time of day, type of electricity, level of voltage, and consumer category. People with low income pay the so-called *social tariffs*, available since 2005 for all domestic consumers whose monthly revenue is less than or equal to the minimum wage. They can pay as low as RON 0.1982 for 2 kWh per day, RON 0.4757 if they consume between 2 and 3 kWh a day, and RON 0.9378 if they exceed 3 kWh daily.

The domestic consumers who choose the monomial price - a single tariff regardless of the amount of energy consumed - must pay RON

0.3567 per kWh of electricity at low voltage (up to 1 kV), and RON 0.2773 per kWh at medium voltage (between 1 and 110 kV), in addition to a daily tariff of RON 0.1715. Some users may go for a monomial tariff with consumption included. In this case, the rates are the following: for low voltage electricity it is RON 0.3567 per kWh and RON 0.4927 for the daily charge, while for medium voltage energy the tariff is set at RON 0.2773 per kWh, in addition to RON 0.4214 for the daily charge. Another option is the monomial price with a reserved tariff for three different periods. This plan works well for those who use less energy in the peak-load (from 8 AM to 7 PM), and consume more during the weekends and off peak-load instead. People who prefer this plan may end up paying anything between RON 0.2113 per kWh and RON 0.8089 per kWh, in addition to the daily charge of RON 0.1715.

High voltage electricity pillars



Source: [www.gmelectric.eu](http://www.gmelectric.eu)

The captive consumers can select different tariffs for day and night. In addition to the daily reservation fee of RON 0.1715, they pay RON 0.5682 per kWh of electricity during daytime and RON 0.1848 per kWh for low voltage electricity in the nighttime; and RON 0.4491 per kWh during daytime and RON 0.1453 kWh during nighttime for medium voltage power.



As far as eligible consumers go (i.e., economic agents and industrial operators), they can pick among several plans. The differential binomial option includes three types of tariffs, namely for active and reactive electricity, as well as for intensity. Accordingly, they pay between RON 0.2070 and RON 0.6672 per kWh of active energy, a monthly plan that could range from RON 240 to RON 1,260 (depending on the type of intensity), and from RON 0.0536 to RON 0.0670 per kWh of reactive energy.

The Constanța County plays a very important role in the country's energy sector. It is home to the only nuclear plant in Romania, located at Cernavodă, about 60 kilometers away from Constanța city. The facility has been acknowledged as the most modern and safest nuclear electric power plant in Central and Eastern Europe, using one of the most advanced and efficient technologies (CANDU-type reactor based on Canadian technology). Units 1 and 2 are fully operational, while units 3 and 4 are in the early planning stages. Currently, the plant operates at 20% of its capacity. The energy produced by the units 1 and 2 amounts to 1,400 MW of electricity annually, which accounts for 20% of Romania's annual energy production. The nuclear based energy enables the country to reduce its greenhouse gas emissions by 10 million tons each year.

**Nuclear Power Plant at Cernavodă**



Source: [www.ro.wikipedia.org](http://www.ro.wikipedia.org)

Due to its geographical position on the sea shore, Constanța County has the highest potential for wind-energy production in the country. The region gathers one of the most important wind energy plants in Romania. One of them was developed in 2011 by Petrom, the country's largest oil company, at Dorobanțu, a locality about 39 km North-West of Constanța. The wind park operates with 18 turbines with a total installed capacity of 54 MW. By the end of 2012, the company was expecting to reach an annual net production of almost 144,000 MWh.

The major private investment in the field of renewable energy in Romania has been developed approximately 50 kilometers away from Constanța. In November 2012 the largest coastal wind farm in Europe located at Fântânele-Cogealac launched its operations. The EUR 1.1 billion project was developed by CEZ, an important energy producer and supplier in Central and Eastern Europe with a noteworthy market share in the southern part of Romania. The wind park has an installed capacity of 600 MW. It operates with 240 turbines with an installed capacity of 2.5 MW each. The onshore wind farm can provide energy for 1 million households annually. This energy produced by this wind farm could account for 10% of Romania's share of renewable energy market.

**CEZ's wind park at Fântânele-Cogealac**



Source: [www.finantistii.ro](http://www.finantistii.ro)



Currently, another wind park project is under way. The 264 hectares facility is located at Corbu, approximately 24 kilometers north of Mamaia, and will have 24 MW installed capacity, with 8 turbines of 3 MW capacity each. Once completed, this EUR 30 million investment should be able to produce 50,000 of MWh electricity per year.

### Street Lighting

Until February 2013, the street lighting in Constanța was operated by two private companies, Luxten and Flash Lighting Services, respectively. In 2001, the two companies signed a concession agreement with the Constanța City Hall for 12 years, covering street lighting operation, modernization, and maintenance services. Since the contracts ended in February 2013, the City Hall extended the agreements for another year only for maintenance services. Meanwhile, the local government has to organize a tender to choose the new street lighting operator. It is likely that the city managers will again select two companies, in order to enhance competitions between them, so the city would get better services. Until 2013, the street lighting management infrastructure was managed by Confort Urban, a public entity under the Constanța Local Council. Recently, the infrastructure management was taken over by special division within the City Hall.

Over the last decade, the street lighting system in Constanța has undergone serious rehabilitation work. Like in many other cities in Romania, all old mercury bulbs have been replaced with modern, more efficient sodium vapor lamps. Currently, the streets of Constanța and Mamaia are lit by 23,754 lighting poles, covering 511 kilometers of roads. At present, nearly 90% of the streets are lit. The city uses four types of lamps, with an intensity ranging from 70 Watt to 400 watt. Annually, the street lamps in the city are used for about 6,105 hours. At present, the lighting poles are the property of the City Hall. Some of them used to belong to Enel, the electricity provider, but the company has given up on them soon after the poles were rehabilitated. In addition, RAT Constanța, the local public transport company, used to own some of the poles when trolleybuses operated in the city; now they belong to the City Hall as well. Over time, the lighting poles often had to be moved from one place to another because of land/property ownership issues, which is one of the

main challenges faced by the local government. There are more lighting poles placed on the main roads in the city than on other streets. There is generally one lighting pole for traffic, which is installed on the side of the road and facing the street, and another pole located on the sidewalk, which is meant primarily for pedestrians.

Street lighting pole in Constanța

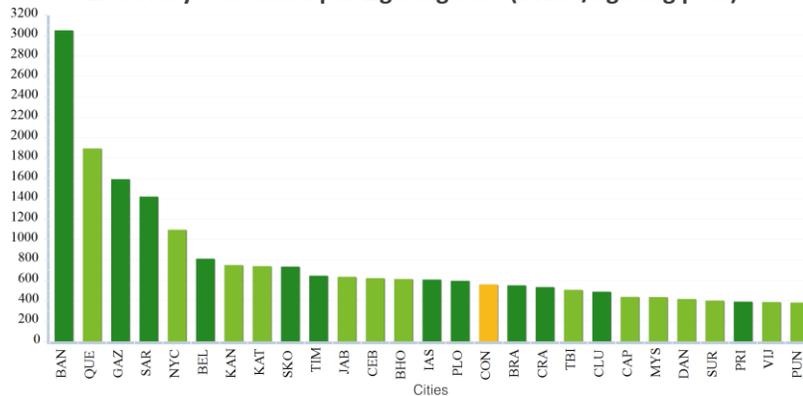


After Luxten and Flash Lighting System won the tender for the street lighting system in Constanta in the early 2000s, the companies took on a very large project designed to improve the system in the city and bring it closer to European standards. Under a EUR 18 million project (with money from the local budget), more than 2,700 new metal and concrete pillars were set up, in addition to 4,965 fiber glass poles and 15,000 lamps.

The city needs 559 kWh of electricity per lighting pole, almost like Brașov. This figure places Constanța rather in the lower of the TRACE database comparable cities with similar climate. The city is performing better than Timișoara, Ploiești, Iași, or Skopje, but it is behind Craiova.

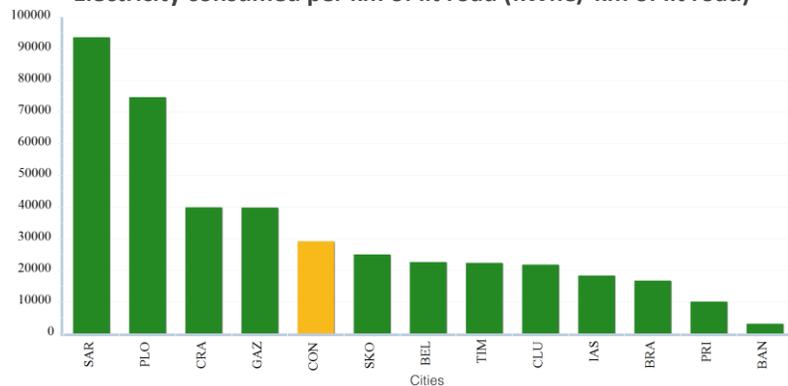


**Electricity consumed per Lighting Pole (kWh/lighting pole)**



When it comes to electricity consumed per kilometer of lit road, the city is performing reasonably well. The electricity consumption for 1 kilometer of lit road amounts to 29,110 kWh, a figure that places Constanța in the middle of the TRACE database comparable to cities with similar climate. The city is doing better than Sarajevo or Craiova, but it needs more energy than other growth poles in Romania, like Iași and Cluj-Napoca. For example, in order to light one kilometer of streets, Constanța uses twice as much energy as Brașov.

**Electricity consumed per km of lit road (kWh/ km of lit road)**



In 2012, the electricity consumed for street lighting throughout the year (including holiday lighting and building illumination) amounted to 13.2 million kWh, for which the City Hall paid RON 6.2 million.

Enel, the electricity company, is responsible for switching on the lights in the evening, through a clock-switcher, according to a schedule depending on the season and the level of brightness. As the two private operators have ended most of their responsibilities pertaining to the street lighting system in the city (pending the award of a new contract), a technical team from the City Hall checks the poles once in a while to see if there is something wrong with the connection or if the bulbs went off. In addition, some verification is done also by Comfort Urban, the public entity in charge with the management of the street lighting infrastructure. However, most of the time, the system relies on residents calling in and notifying the City Hall of any issues with the lighting poles.

Currently, the city does not have a dimming program, but the local government is thinking about introducing this system in the future. The plans include further modernization of the street lighting system, expansion of service to the newly emerged neighborhoods in the city, and rehabilitation of some of the old poles that used to belong to RAT Constanța. The local authorities also have ambitious plans to introduce LED-based street lighting in newly developed neighborhoods in the city, with support from the Regional Operational Programme.

At present, a few projects, including the rehabilitation of the seafront from Vraja Marii (a well-known spot for residents) all the way to Mamaia, and the redevelopment of the historical center are under way. Both projects have a component pertaining to street lighting, as new lamps and lighting pillars will be installed in designated areas. Additionally, the City Hall submitted a proposal under the 2007-2013 ROP for rehabilitation and modernization of the public lighting system in the city. If approved, this would replace 3,231 lighting poles and expand the network by 33.6 kilometers.

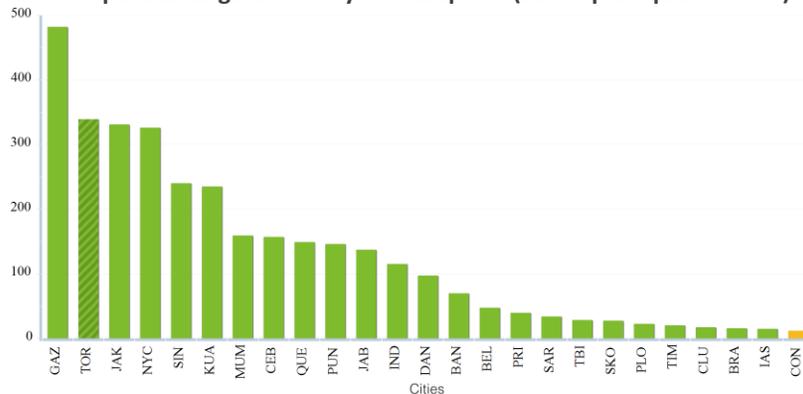


### Municipal Buildings

The total municipal building stock of Constanța comprises a few hundred units, most of them including a few facilities. Most public buildings in the city are education facilities, i.e., 87 schools, 56 kindergartens and daycares, and 28 high schools and colleges. Each of them includes additional facilities, such as sports halls, dorms, dining halls, performing arts halls, etc. The city has a few health-care facilities, a number of performing arts centers, and six public libraries. In addition, there are a number of administrative offices (including four buildings of the City Hall), a few offices headquartering the Local Police, the Local Finances, the Office for Social Assistance, the Elderly Care Home, the Folk Art Museum, the local enforcement agencies, and the Casino. The floor area of the municipal buildings in Constanța comprises 383,476 square meters.

In 2012, the total electricity consumption in these units amounted to 4.5 million kWh, which stands for 11.8 kWh per square meter. By far, this is the lowest figure in the entire TRACE database, and also compared to cities with similar population.

**Municipal buildings electricity consumption (kWh per square meter)**

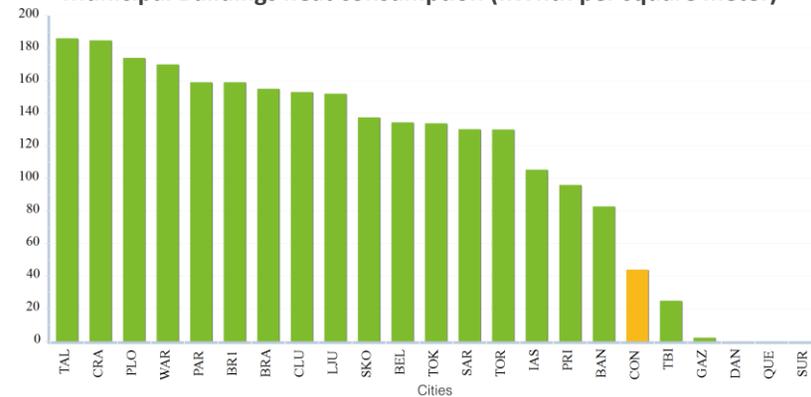


The electricity consumption in the municipal buildings in Constanța is the lowest compared to similar cities in Eastern Europe. The city is also performing better than other growth poles in Romania. For example, the amount of electricity per square meter used in the public buildings in

Constanța is twice less than in Ploiești, three times less than in Pristina, and almost 5 times less than in Belgrade.

Almost all municipal buildings in the city are connected to the district heating network. When it comes to thermal heating, Constanța is performing better than most of the cities with similar population from the TRACE database. In 2012, the city needed 16.8 million kWhth, which stands for an average consumption of 44 kWhth per square meter. This is the lowest heat consumption per square meter, among the seven growth poles.

**Municipal Buildings heat consumption (kWhth per square meter)**



These results make sense, particularly given that winters in Constanța are milder compared to the rest of the country, so the city generally needs less heat. For instance, the heat consumed in the Constanța is three times less than in Timișoara and four times less than in Cluj-Napoca or Brașov. Overall, the energy expenditure for all municipal buildings in Constanța cost the City Hall budget USD 2.1 million, which accounts for 1.62%.

Because Constanța has mild winters, this means that relatively few energy efficiency investments have been done in municipal buildings in recent years, compared to other cities in Romania. Between 2000 and 2007, the local municipality implemented rehabilitation programs in several municipal schools and kindergartens in the city. Such investments primarily included installation of new micro-heating units, replacement of old windows with new modern double-paned windows and of tiles with



modern ones, new floors, and renovation of the buildings' façade. New neighborhood thermal points were built, reducing the distance from the buildings to the central heating system.

#### Hospital for Infectious Diseases in Constanța



Source: [www.cugetliber.ro](http://www.cugetliber.ro)

In addition, some renovation work has been performed to some of the educational institutions in Constanța in 2012, when RON 1.8 million were spent from the local budget for replacing the woodwork and upgrading the façades of some of the schools and kindergartens in the city.

However, a very limited number of buildings have undergone structural rehabilitation work. For instance, one of the municipal buildings in Constanța benefited from more extensive energy efficiency investments. It received a new, more thermally efficient envelope, and all the pipes were replaced. Unfortunately, only few other public buildings have undergone such comprehensive rehabilitation work.

In the future, the decision to do energy efficiency investments in other public buildings should be carefully weighed, with an eye to costs and potential energy savings. As energy consumption in these buildings is not that high, it may pay to consider focusing energy efficiency investments in other sectors.

#### The Jean Bart School in Constanța



Source: [www.jeanbart.scoli.edu.ro](http://www.jeanbart.scoli.edu.ro)

In 2011, the municipality launched a EUR 8 million modular housing project for low-income people. The project called the “Henri Coandă Social Campus” is spread over 6 hectares in the Tomis Nord neighborhood, in the northern part of Constanța. The initial investments are made by construction companies, and subsequently the City Hall has to reimburse the money in five years upon the completion of the units. Overall, the project includes 33 buildings comprising 2,376 modular units of one, two, or three rooms. Depending on their incomes, there are three categories of residents who can benefit from such houses: people who will not pay for rent or utilities, people who will pay only for utilities, and finally, those who will pay for both rent and utilities. All housing units should be built by 2014. So far, 17 buildings were completed and the first residents moved in at the end of 2012.

The local government is looking to find funds to rehabilitate the Casino, a beautiful historical building built in 1907 with contributions from local residents, which needs serious renovation and restoration work. Upon the completion of the renovation work, the Casino will be opened for the public for a period of five years, hosting different cultural events. Consequently, a decision will be taken by city authorities on how the



building should be used in the future, whether to keep it exclusively for cultural activities or turn it into a genuine entertainment place.

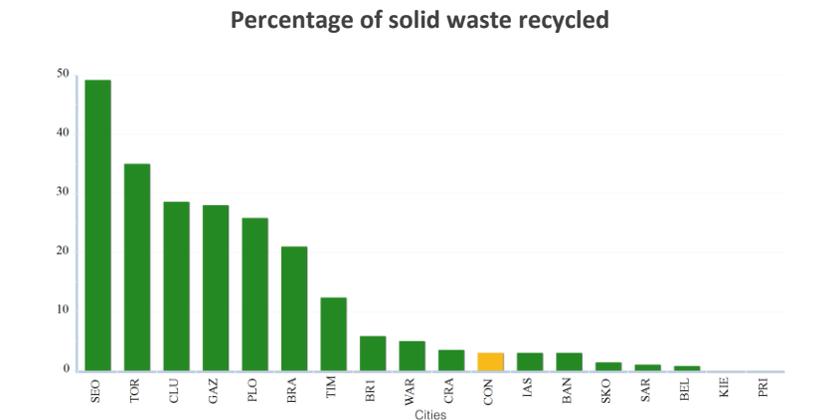
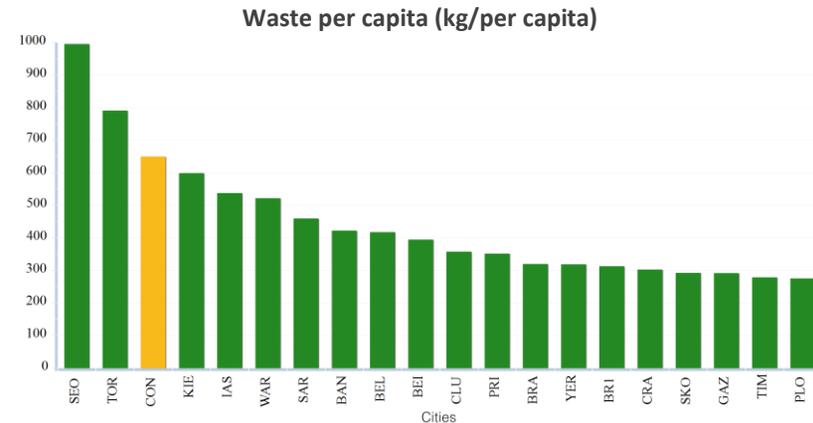
### Solid Waste

Like in Ploiești, the solid waste sector in Constanța is managed by the private sector. Polaris is in charge of the solid waste collection, while another company, Tracon, manages the landfill at Ovidiu, a locality in the wider metropolitan area. Polaris is responsible for the collection and transportation of solid waste in Constanța, including Mamaia, the beach resort that belongs to the city. The company signed a concession agreement in 2008 for a period of 25 years. This is the lengthiest contract for solid waste collection activities among all seven growth poles, as in most of the cities usually the concession agreement does not exceed 10 years. According to the Constanța Integrated Development Plan, the company caters to over 305,000 people in Constanța County, including the residents of the cities of Constanța and Mamaia. At the level of 2007, 86% of the people in Constanța city were connected to solid waste collection services. Overall, 70% of the people living in Constanța County and nearly 96% of residents in urban communities are connected to solid waste collection services.

The waste generation per capita in Constanța is among the highest in the TRACE database among cities with similar climate. With nearly 650 kilograms per capita, the amount of solid waste generated in Constanța is twice as much as some of the growth poles, like Ploiești and Timișoara. Of course, this amount includes the waste generated in Mamaia as well, where hundreds of thousands of tourists pour in during the summer months. In 2012, the solid waste generated in Constanța amounted to 185,000 tons. The amount slightly dropped between 2011 and 2012.

The entire amount of waste in the city is captured and dumped either at the landfill or at a special depot for inert garbage. The solid waste collection was implemented in Constanța in 2008. So far, this system did not seem to appeal too much to the city residents. With a selective collection rate of only 3%, Constanța is doing poorly when it comes to recyclable waste compared to other cities in the TRACE database with a similar climate, although the city’s performance is comparable to

other growth poles, like Iași or Craiova. However, the amount of recycled waste collected in the city is four times lower than in Timișoara and eight times below Cluj-Napoca’s.



The municipality and Polaris have two types of selective collection - one through special bins displaced across the city and one directly from the households. To this end, a number of 180 igloo-type bins have been placed throughout the city and Mamaia. At the same time, households



receive yellow sacks where people can separate paper, glass bottles, and metal from organic garbage. These bags are then collected directly from the households by Polaris.

Trash bins for selective collection in Constanța



However, items are not always placed in the designated compartments. For instance, glasses may be found in metal bins, or paper in PET sections. In addition, people in poor communities sometimes take out items from the trash bins. At some point, the City Hall tried to install video-cameras to monitor the bins in an attempt to prevent stealing. A project is under way through which 440 trash platforms are to be placed at the households in Constanța. Of them, 300 of them have been already distributed to houses and residential buildings.

Usually, Polaris is using two trucks for collection operations - one for recyclable waste, and one vehicle for organic garbage. One type of sorting is done directly by people, while another one is performed at the Polaris facility located on the city's outskirts.

Recyclable waste is separated at the sorting station and from here is taken to MM Recycling, a company dealing with such activities. They clean the items and then sell them. MM Recycling owns a PET recovery plant with a capacity of 450 tons per hour. Recycling activities are profitable.

In addition, there is a nuclear waste deposit at Cernavodă. The facility is dealing with waste from the nuclear power plant and is managed

by a government agency. Hazardous waste is dumped at a dedicated facility in Constanța. Medical units (other than large hospitals) receive special bags where they can dispose medical waste. Inert waste (i.e., a type of garbage that will decompose, such as concrete, drywall, sand) is dumped at Gate No.9 South in the Port of Constanța, on a 41,000 square meter facility that had been set up for such purposes. 115,000 tons of inert waste is collected annually in Constanța.

Polaris' sorting station



After the landfill for inert waste will reach its full capacity, the facility will be used for expanding the port. In addition, the municipality has taken steps to get rid of abandoned cars that have been parked for years on the streets in the city. 206 abandoned cars have been collected so far. There is a campaign the City Hall organizes a few times a year to collect electronic waste, such as old TV sets, music stations, fridges, and computers.

The residents do not have contracts with Polaris. The company has an agreement with the City Hall for the collection and transportation of waste on behalf of the city residents. Only economic agents have agreements signed with Polaris. People pay a so-called "habitat tax" that had been introduced by the city government, which covers solid waste



collection, sanitation, streets cleaning, and snow removal services. The tax in full is RON 10 per person and, respectively RON 3 per person if subsidized by the Constanța Local Council. People pay different amounts, depending on their revenues. For instance, those with low income (i.e., up to RON 300/month/person) pay only RON 3 per person.

The collection and transportation of solid waste in Constanța is handled by 24 large trucks, most of them new vehicles, equipped with European standard emission catalyst Euro 4. In 2012, Polaris used 800,000 liters of diesel for solid waste collection and transportation related activities, which is the equivalent of USD 1.3 million. The eco-framed landfill is located at Ovidiu, a locality in the metropolitan area, about 12 kilometers far from the city. The facility is managed by a private operator, Tracon. The land belongs to the municipality of Ovidiu. The landfill was developed in 1996, in partnership with a French company. It is the first eco-framed landfill in the country built entirely with private money.

**Eco-framed landfill at Ovidiu, near Constanța**



The facility is spread over 32.7 hectares, and has a life span of 50 years. There are 8 cells, and 4 of them are already filled in. If necessary, the number of cell can expand. Investments amount to approximately EUR 2 million per cell.

The landfill has a leachet treatment plant, where the dirty water resulted from the solid waste is treated. The clean water is collected in a

basin, and further is used to water the green areas in the city, such as gardens and parks. The landfill has the capacity to produce bio-gas, but so far it did not become operational in this respect.

The municipality of Constanța signed an agreement with Tracon in 1997 to use the facility for dumping and depositing the solid waste collected in the city. The landfill has similar agreements with the local governments of Ovidiu and Năvodari.

In 2012, 216,000 tons of solid waste collected from Constanța and other areas in the county were dumped at the landfill. Due to the large number of tourists, in the summer time the amount of solid waste generated is higher; sometimes it can be twice as much as the amount collected during the off-season. The tipping fee is USD 14 per ton of solid waste.

**Leachet treatment facility at Ovidiu landfill**



The landfill will be included in the Solid Waste Master Plan, which is currently under implementation through a EUR 40 million project developed with support from the Environment Sectoral Operational Program. The main beneficiary of the plan is the Constanța County



Council. Additionally, the master plan includes the landfill at Albesti, near Mamaia. Between 2011 and 2015 two non-compliant solid waste facilities at Techirghiol and Murfatlar in the wider metropolitan area will be shut down, and two new landfills will be built in Constanța County, one north of Constanța city, and one at Tortomani. The landfill at Ovidiu and the upcoming facility in Constanța are located near a stone pit, which allows for a good insulation of the waste. The master plan will have three transfer stations – at Cernavodă, in the western side of the county, in Hârșova, in the north, and in Adamclisi, in the south-east region.

### District Heating

District heating in Constanța is managed by the public sector through two entities: CET, the thermal energy producer that is a branch of ELCEN (an entity under the Ministry of Economy) and RADET, a public company under the Constanța Local Council, responsible for the distribution of hot water and heat. CET Palas produces hot water in two natural gas-based plants that could also switch to coal, if necessary. RADET is in charge with the distribution of hot water/heat in the city through 135 thermal points, and also with production of thermal energy through a number of plants and neighborhood plants operating on natural gas.

In addition to the 135 thermal points, the district heating system comprises 4 neighborhood plants based on natural gas, 39 thermal sub-plants connected directly to residential buildings, and a few hundred sub-secondary distribution pipes linking thermal points to consumers. The total installed capacity is 649 MWth for thermal points and 42.5 MWth for thermal plants.

Constanța is CET's only client in terms of heat. The facility produces electricity for different clients. Starting in 2014, the local authorities plan to take over CET, and thus take charge of heat production. In this way, the municipality of Constanța wants to place under the same roof the production and distribution of hot water/heat.

RADET caters to 85,000 apartments covering approximately 200,000 people. Almost all municipal buildings in the city are connected to the district heating network. In the 1990s, 95,000 apartments in Constanța were connected to the district heating plant. Over the course of time around 10,000 disconnected from the system and switched to

individual natural gas-based micro-heating units. In the past, CET used to cater to the Constanța Shipyard, and the Port of Constanța, but in the recent years both companies developed their own heating plants. Anyway, the primary network is still supplying hot water to a number of 70 industrial sub-plants that are connected to industrial companies.

CET Palas Constanța



Source: [www.ziuaconstanta.ro](http://www.ziuaconstanta.ro).

A natural-gas and coal plant, CET Palas is located in the industrial area of Constanța, and is operational since early 1970s. The facility comprises two steam boilers, two steam-based turbines with a total installed capacity of 100 MWe, 4 hot water boilers with an installed capacity of 465 Mwt (400 Gcal), and 2 heat exchangers able to produce 140 Mwt (the equivalent of 120 Gcal). The overall installed capacity of the plant is 100 MW (electric) and 605 MW (thermal - hot water) of which 140 MWt in co-generation.

The primary network of 82 kilometers belongs to CET, while the 900 kilometers of distribution pipes are under RADET. The primary network has two pipes that start from CET and go all the way to the thermal points. From here, the thermal energy is taken further through four pipes for both hot water and heat (two ways). One of the culprits for the losses in the system is the large number of pipes.



In 2004 the City Hall approved the Local Strategy for Centralized Thermal Power Supply of Constanța, a medium and long-term plan targeting the increase of energy efficiency of the district heating system.<sup>24</sup> The plan sought to modernize the district heating system through diminishing heat cost at end users by applying new technologies and developing a new heating system by 2012. A study commissioned by the local government drew up five technical solutions targeting the energetic modernization of residential buildings in the city. According to a feasibility study, Constanța could annually achieve between 101,330 Gcal to 236,946 Gcal in reduction of heat consumption, provided the city would invest at least EUR 130 million in the district heating system.

Over the time, RADET managed to improve part of the distribution network by replacing some of the old pipes and, thus, reducing the losses in the system. Most of investments aimed at increasing efficiency of thermal points by setting up some new pumps and equipping the facilities with so-called “expansion devices.” The company purchased a EUR 10 million SCADA system that monitors 104 of 135 thermal points from a centralized command room equipped with high-performing Siemens devices.

As of now, 104 thermal points are automated and integrated under a remote monitoring and command system (dispatcher), comprising of a central dispatcher and two operative units. In the future, all thermal points will be connected to the SCADA system. The monitoring equipment has been already purchased for 28 more thermal points, and they should be set up in the near future. In addition, RADET built two thermal points, one of the largest in the city.

In the last decade, the city government paid attention to the rehabilitation and modernization of the primary network. More than RON 62 million was spent in 2007 for the rehabilitation of the supply units and secondary distribution network. In recent years, 18 kilometers of the distribution network have been rehabilitated. RADET was able to carry out

<sup>24</sup> The local strategy on the district heating network is available at: <http://www.primaria-Constanța.ro/DownloadFileDatabase.aspx?atasamentID=1EB56639-5998-46F0-ABE5-E5E0C071683D&semnat=false&tip=2>

some energy efficiency-related projects. For example, the company replaced the old electro-pumps from 114 thermal points with new modern equipment with more efficient energy consumption. This led to a decrease in energy consumption by 2,400 MWh in 2012, as compared to 2009. 21 more electro-pumps will be installed in the near future.

SCADA system monitors the thermal points



Another project aimed at upgrading the heat production in co-generation. The co-generation facility is operating with a 30MWe natural gas based plant, and a hot water reservoir of 37 MWt, both equipments allowing for 18.5% fuel savings. The company also commissioned a EUR 7 million feasibility study to replace the heat exchangers with thermal heating modules to all thermal points in the city that belong to RADET.

In 2012, RADET bought from CET 610,924 Gcal, of which 92,174 Gcal were lost in the network. 90% of the heat distributed in the city went to population, 5.6% to public institutions and municipal buildings, and the rest to economic agents. The daily amount of heat and hot water the city needs to supply to all 135 thermal points is 250 MW during peak winter time. In the summer, the necessary amount drops by four times, to 40 MW. The overall cost of heat production for 2012 amounted to RON 177 million. Almost 80% of the operational budget goes on fuel (natural gas).

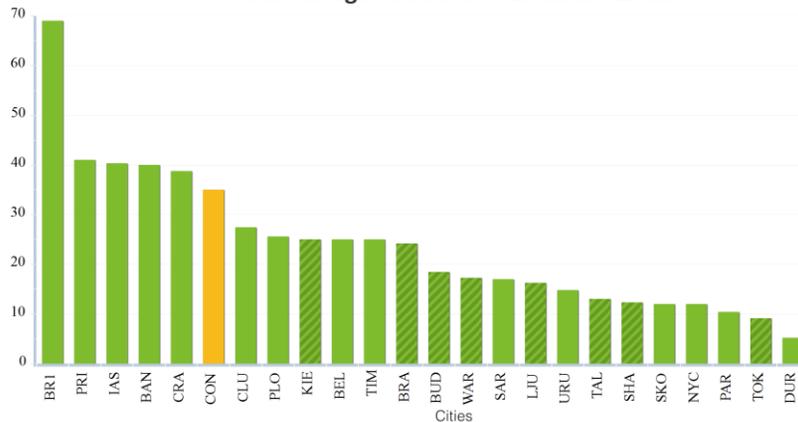


RADET employs 530 people, who are also dealing with maintenance work at the secondary network.

In 2012, the overall heat losses accounted for 35%, a figure that places Constanța in the higher side of the TRACE database. The city performs better than some of the growth poles in Romania, such as Brașov and Iași, but there is room to improve compared to other cities in the region (e.g., Timișoara, Cluj-Napoca, Sarajevo, and Ljubljana). The losses in the primary network are 15%, slightly below those in the distribution network, i.e., 18%. The non-commercial losses due to late payments account for 1-2%.

In 2012, the residents of Constanța paid the highest price for heat among all seven growth poles, i.e., RON 341 per Gcal (approximately EUR 77). This is the tariff in full, without subsidies. According to RADET, the affordable price for people would be EUR 55 per Gcal. The production cost of heat is regulated by ANRE, the energy regulatory body, whereas the heat tariffs by ANRSC, the public utility services controlling authority. RADET is billing for the heat, whereas the water company, RAJA Constanța, is invoicing for hot and cold water.

**Percentage of heat loss in the network**



Until very recently, the heat used to be subsidized by both the central government and the local budget. In 2012, the government cut off the subsidies for heat from the national budget. In fact, these subsidies have

been taken over the local government. Currently, the City Hall Constanța pays subsidies directly to people. In addition, the local government provides heat subsidies for people with low income. The subsidies are differentiated, based on people’s income. For example, those who make up to EUR 200 per month pay the same tariff as before the removal of government subsidies. Overall, the City Hall pays annually RON 40 million in heat subsidies from the local budget.

At the beginning of each year, the City Hall used to send to the central government estimates on the heat consumption for the city and the related amount of subsidies. The City Hall used to pay its share of subsidies always in advance, unlike the central government who would often incur delays. People pay 60 days after the heating the bill is issued. However, if a customer does not pay the bill on time, RADET cannot disconnect the respective apartment from the network. As of now, 30% of the customers are owners’ associations from residential buildings. At the same time, ELCEN, the company who operates CET Constanța, would request the money from RADET regardless of whether the latter was able or not to collect the money from population and/or related subsidies. Moreover, if RADET cannot pay on time, then ELCEN would add penalties. Due to late payments, RADET started incurring debt to ELCEN. Currently, the heat distribution company still needs to receive RON 21 million in subsidies from both the national and local governments. There are historical debts between RADET and CET amounting to more than RON 280 million. After the Constanța Local Council would take over CET, the debts between the distribution and heat production companies are expected to be written off.

Most of the residential buildings in Constanța were built between the 60s and 80s, and are not in the best shape, especially when it comes to their basement, façade, roof tops, terraces, and hallways. Despite the high price of heat, the revenue collection is good, 95% on average. Between 2008 and 2012, the percentage swung between 92% and 97.7%, with a slight decrease over the last few years due to the economic crisis. Like many other cities in Romania, Constanța was challenged by the disconnection from the district heating system. However, unlike other cities, the number of people who shifted to individual micro-heating units is relatively smaller. From the mid-1990s to date, only 10,000 apartments disconnected from the centralized heating network, as compared to



50,000 units in Braşov, or 30,000 customers in Cluj-Napoca. Over the last couple of years, approximately 2,000 people have left the centralized heating network early.

City authorities are very determined to keep the district heating system alive in the future and to continue invest in the network to increase its energy efficiency. Their main concern is to maintain the district heating efficient for residential clients and improve the hot water and heat services.

**Thermal point in Constanţa**



Source: [www.cugetliber.ro](http://www.cugetliber.ro)

All new residential buildings in the city are connected to the district heating plant. New emerging residential constructions will be also linked to the centralized heating network. In addition, the City Hall took a step ahead to improve the hot water and heating services. With support from the City Hall, RADET managed to set up an efficient horizontal distribution system of heat in the residential complex built for young people. RADET installed 4 pipes in the stairwell that are connected to each apartment, i.e., two for heat, one for cold water, and one for hot water.

After CET will be taken over by the City Hall, the plan is to transform some of the thermal points into hot water/heat pumping stations to cater to residential buildings. RADET is also preparing a technical assessment in order to allow people to control the heat in their apartments, turning it on and off as they please. There are a number of

apartments/homes in the city that are used only a few weeks a year during the summer peak season. The new system could be installed initially in these units where heat could be turned on only when someone would effectively use the apartment. Meanwhile, RADET wants to make the people who disconnected from the district heating system pay for the common spaces they use. Those who are not connected to the centralized heating network still need to pay for the heat consumed in hallways, laundry rooms etc., because they benefit of such facilities (e.g., they use the hallway several times a day when they come or leave their apartment). For example, in Denmark, the residents who disconnect from the district heating system pay between 30 and 50% of the heating bills, related to the common spaces. After will take over CET, the City Hall is thinking to pursue for a public private partnership, inspired by the case of Ploieşti or Iaşi, and also put more money into the heat distribution network. The local public administration will take into consideration two solutions on the long run. They are looking at a public private partnership for the operation of the entire system, or an agreement for heat production only.

In the near future, RADET is planning to introduce the so-called “tri-generation,” as to produce air conditioning in addition to heat and electricity, a system that seems to work well in Berlin. If this would follow through, RADET would provide Mamaia with air conditioning over the summer. At present, the beach resort is not connected to the district heating network.

## Water Sector

### Potable Water

The water sector in Constanţa is performing fairly well, despite of big losses in the system. Both potable and wastewater is managed by RAJA Constanţa, a regional operator that caters to several counties in Romania. The company is one of the largest operators in Romania, catering to 143 small and large localities from 6 counties (i.e., Constanţa, Ialomiţa, Călăraşi, Ilfov, Dâmboviţa, and Braşov), covering on average 800,000 people, and up to 2.5 million people in the summer. RAJA is a public company whose shareholders are 34 municipalities and County Councils in the country. Approximately 90% of the company’s activity takes place in



Constanța County. In the immediate future, RAJA is planning to expand its businesses in the Republic of Moldova, starting with a locality near the capital Chișinău.

According to the Constanța Integrated Development Plan, as of 2007, the length of the water network in Constanța Metropolitan Area was 878.7 kilometers, while the sewage network was spread over 819.6 kilometers. The potable water network in Constanța city spans over 532 kilometers and the wastewater network a little over 585 kilometers. More than 70% of the water distribution network is beyond 50 years old, while the rest of 30% is even older (i.e., more than 70 years old). 90% of the potable water catered to Constanța County comes from underground, namely Cernavodă (Dealul Vifor) with an installed capacity of 0.2 cubic meters per second, and Galeșu, with 3.74 cubic meters per second.

Water treatment facility in Constanța



Source: [www.lideruldeopinie.ro](http://www.lideruldeopinie.ro)

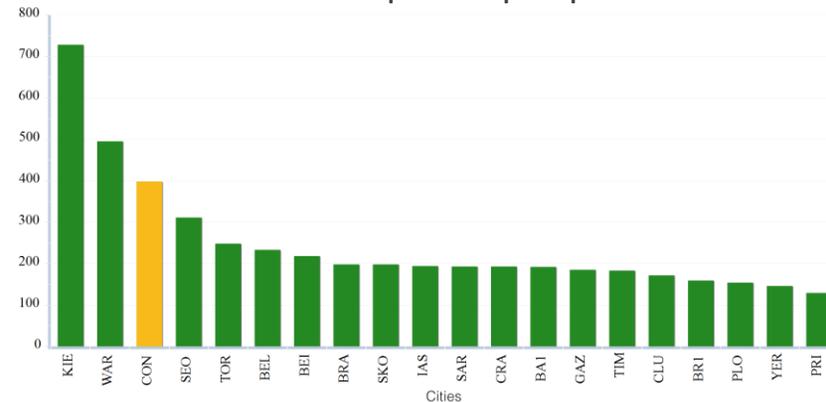
There are 38 underground sources and 306 wells in Constanța metropolitan zone with a total installed capacity of 8,530 liters per second. There is also one water connection through the Danube- Black Sea Channel, with an installed capacity of 4,514 liters per second. The potable water for Constanța city only is supplied through 80 wells. The water is good, as it needs only a little chlorination. There are 98 water

reservoirs in the Constanța metropolitan area with a total capacity of 278,000 cubic meters.

The raw water supplied to Constanța County is treated by water treatment plants, at Palas Constanța and Dealul Vifor Cernavoda, respectively. The Palas Constanța water complex is responsible for treating both potable and wastewater. It is located in the south-eastern part of the city, and has a maximum capacity of 3.73 cubic meters per second. The city's proximity to the Black Sea is a competitive advantage, as RAJA sells 5 million cubic meters more water during the summer. In the summer time due to the increase in demand for water, the company is using additional three water facilities.

In 2012, the total amount of water sold in Constanța and Mamaia amounted to 41.2 million of cubic meters. The overall water consumption in the city is 398 liters per capita per day. This figure places Constanța on the higher end of the TRACE database comparable to cities with similar climate. The city also has the highest water consumption among the seven growth poles. It is almost three times more than in Ploiești and twice as much as in Cluj-Napoca or Timișoara. At the same time, it is the highest amount of water sold among all Romanian cities, except for the capital city, București.

Water consumption liter per capita

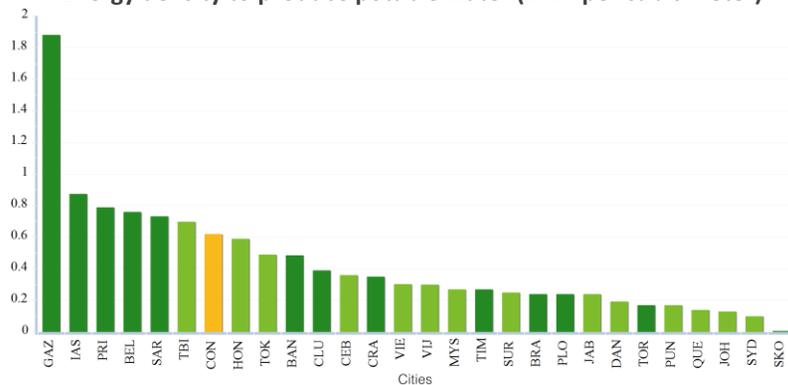




The catchment, treatment, and supply process requires 0.62 kWh of electricity per cubic meter of water. Again, Constanța is on the higher side of the TRACE database compared to cities with same climate.

Overall, in 2012, the company used 61.2 million kWh for the water production process for Constanța. The energy consumption to treat a cubic meter of potable water in Constanța is second highest (after Iași) among Romanian growth poles. It is at least two times higher than in Ploiești, Brașov, and Timișoara. The energy consumption makes up 16% of the total operational costs. It is among the highest percentage among the water companies in Romania, where figures vary from 3% in Alba County to 22% in Neamț County.

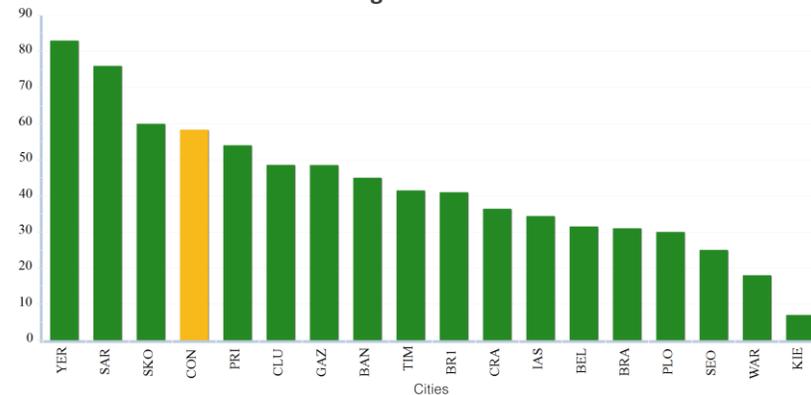
Energy density to produce potable water (kWh per cubic meter)



In 2012, for the entire water production, catchment, treatment, and wastewater treatment process for all six counties RAJA used 82, 661 MWh for which the company paid RON 36 million (EUR 8.3 million). Of this, 6,267 MWh were used for water treatment and pumping at Palas Constanța plant, which is the equivalent of EUR 514,000. The electricity consumption for water catchment activities in Constanța County amounted to 31.1 million kWh, the equivalent of RON 13.3 million (EUR 3 million). The energy consumption at the water sources, including in the suburbs, amounted to 24.2 million kWh of electricity for which RON 10 million were spent (approximately EUR 2.4 million).

When it comes to water losses in the network, Constanța's performance is at the higher end of most cities in Romania, which is between 40% and 60%. The water losses in the city account for 58.3%, a fairly high figure in the TRACE database.

Percentage of water losses



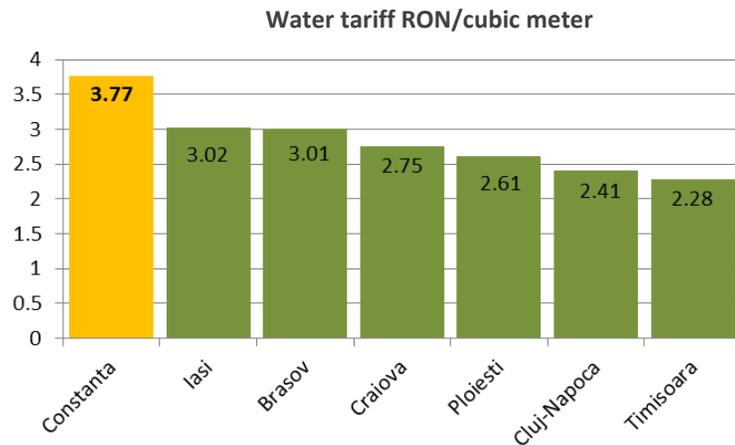
In fact, this is the highest figure among the seven growth poles. It is twice as much as in Ploiești, and 50% higher than in Brașov, for example. The main factor responsible for the high losses has to do with the leakages due to the size and age of the network. Therefore, despite the fact that it monitors the losses hourly, RAJA cannot do much about reducing the leakages unless water pipes are replaced. Water losses go down during the summer when tourists come in the city and there is an increase in water demand, and subsequently, they go up in off-season. In addition, RAJA faces some commercial losses because a number of water meters do not function properly. But, despite of the losses, the company is profitable.

The tariff for potable water in Constanța is the highest among the growth poles, with RON 3.77 per cubic meter. The water revenue collection is very high, standing at 97%. People who do not pay their water bills on time get disconnected from the network.

RAJA has a SCADA system that monitors the water connections and network in Constanța. Now the company wants to expand the system to 25 localities in Constanța County with up to 10,000 inhabitants. This is



part of RAJA’s more ambitious plan to monitor the water system for all counties where the company caters to. Subsequently, the water losses should go down by 10% and less maintenance should be required. Overall, the company has 2,600 employees, in addition to 250 people who are responsible for all water maintenance related work. Almost 40% of the operational budget goes toward salaries.



Over time, RAJA tried to increase the efficiency of the water system in spite of energy tariffs going up. To this end, the company switched from low voltage intensity to medium voltage, and has designed technical projects to switch to medium voltage. Between 2004 and 2012, RAJA installed 39 converters for the entire company’s network that are deemed to reduce energy consumption by 40%. Also, RAJA purchased 202 water pumps with a small installed capacity. The life cycle of a pump is 8 years, on average, after which it needs to be replaced. In a move meant to reduce energy-related expenditures, starting in 2006 RAJA has been buying electricity directly from the market.

During the last 15 years, RAJA was very active in investing almost RON 140 million for the rehabilitation and expansion of the water and sewage network in Constanța County. For example, with support from Municipal Utilities Development Program (MUDP), between 1998 and 2002 RAJA managed to expand the water network, install water meters in

Constanța County, and rehabilitate the wastewater treatment plants in the region. In 2010, RAJA started to work on a EUR 271 million project with support from the Environmental Sectoral Operational Program, aimed at improving the water network in 26 localities from Constanța and Ialomița Counties. The project aims to: build 4 new water reservoirs; expand the water inlets by 34 kilometers; and enlarge the distribution network by 91 kilometers. 8% of the old water pipes in Constanța city will be replaced and 7 pumping stations at Palas Constanța water treatment facility will be rehabilitated through the same project. In the near future, the company is planning to expand the water network in Constanța by 30 kilometers of modern, new pipes.

Over the long term, RAJA’s development strategy includes expanding the business in other regions in Romania, reading water meters from distance throughout the entire operation area, and expanding the existing potable water and sewage network with support from EU structural funds. Not in the least, the company wants to tackle the water losses and reduce the operation cost by using equipment aimed at increasing cold water pressure through water boosters.

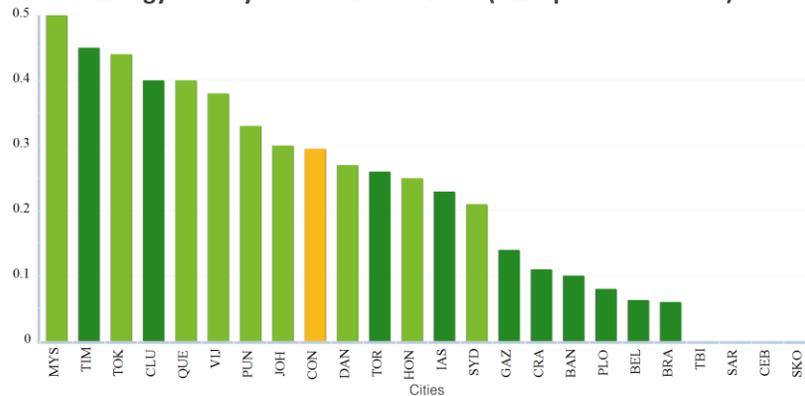
### Wastewater

There are a couple of wastewater treatment plants located in Constanța, with an installed capacity of 1,900 meters per second, catering for the city and a few localities in the wider metropolitan area. In addition, there are a few more facilities across the Constanța County, at Poarta Albă, Năvodari, Eforie Sud, and Mihail Kogălniceanu. All wastewater facilities are equipped with mechanical biological treatment units. The maximum capacity of the plants is 6,408 liters per second. The wider metropolitan area is also served by 52 wastewater pumping stations with a total capacity of 61,268 cubic meters per hour. The Constanța Sud and Constanța Nord facilities have the technical option to capture biogas. RAJA is planning to produce electricity in co-generation at the Constanța Sud facility.

The amount of electricity for treating wastewater in Constanța is among the highest in the TRACE database compared to cities with a similar climate. The city needs 0.295 kWh to treat one cubic meter of wastewater. The figure is lower than in Timișoara or Cluj-Napoca, but almost four times higher than in Ploiești or Brașov.



Energy density to treat wastewater (kWh per cubic meter)



In 2012, RAJA needed 20.1 million kWh of electricity to treat 68.4 million of wastewater, for which they paid USD 2.4 million. The company charges RON 3.35 per cubic meter of wastewater and sewage services. Wastewater treatment operations incur high costs because the sludge gets filtered through a Korean-based mechanism and then it gets dumped at the landfill.

Over time, RAJA has been preoccupied to improve the wastewater system in Constanța County. Through a RON 96.5 million project with funds from ISPA, between 2002 and 2007, the company rehabilitated and expanded the Constanța Nord and Eforie Sud facilities. In addition, water pipes for discharging wastewater to the sea from the two wastewater plants were built, and the existing sewage network in Constanța city were rehabilitated and expanded by 31 kilometers.

Currently, RAJA is in the midst of implementing a EUR 271 million program funded through EU structural funds aimed at improving the wastewater network in Constanța and Ialomița Counties. The sewage network would expand by 301 kilometers. 40 new wastewater pumping stations and 6 new wastewater treatment plants will be built in these two counties. In addition, the project includes rehabilitation of 24 kilometers of sewage network, and modernization of 7 wastewater pumping stations and 4 wastewater treatment facilities. In the future, RAJA aims to develop a few more wastewater treatment plants as to comply with the law

requiring one such facility for each locality with a population between 2,500 and 10,000 people.

Wastewater treatment plant Constanța Nord



Source: observator.ro

The company has a number of projects in the pipeline aimed at increasing the system's energy efficiency, and thus, reducing electricity consumption. To this end, in partnership with green energy companies, RAJA wants to install a few hybrids of wind and photovoltaic plants in the premises or near 8 wastewater treatment facilities. With a total installed capacity of MW 17.7, these plants should be able to produce 31,249 MWh of clean energy per year. The total investments would amount to nearly USD 60 million to which RAJA would contribute with the logistical component. If this project will follow through, RAJA will use the green energy produced for wastewater treatment. Electricity cost should be 50% lower, a fact that would allow savings of up to EUR 1 million annually. Feasibility studies are available for the Photovoltaic Plant at Fetești, the hybrid wind and solar energy at the Constanța Sud wastewater treatment station, and the electrical hybrid station at Mangalia.



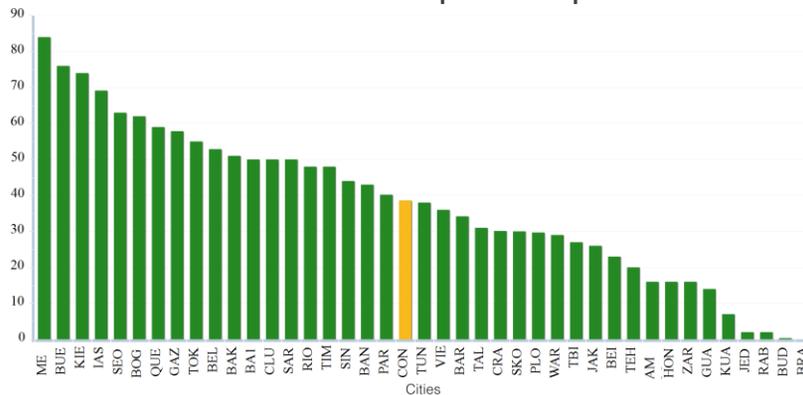
## Urban Transport

### Public Transport

The local public transport in Constanța is operated by both local and private companies. RAT Constanța, an autonomous company organized under the Local Council Constanța, is the main public transport operator in the city. There are a couple of private companies running few routes in the Constanța, in addition to another operator covering 5 kilometers in the Palazu Mare neighborhood located in the northern part of the city.

According to the TRACE analysis based on a study commissioned by the Constanța City Hall in 2007, 38.6% of the commuters in Constanța rely on public transport. This is a relative small figure compared to cities with similar Human Development Index, but also with some of the growth poles. For example, in Constanța twice fewer people use public transportation than in Iași, and 25% less than in Cluj-Napoca. However, the percentage is slightly higher than in Craiova and Ploiești.

Public transport mode split



17.6% people in the city use non-motorized means or transportation, while 43.8% rely on their private cars.

RAT Constanța operates only buses. Constanța is one of the cities who have given up on trams and trolleybuses a few years ago. The reason behind this decision has to do with related infrastructure and energy consumption. According to local managers, trams were not energy

efficient, as they required five times more energy/fuel than buses. Another decisive factor was the liberalization of the energy market, which was expected to hike electricity tariffs. The tram infrastructure had also deteriorated and maintenance work was very costly. Moreover, when the tram infrastructure was developed in the past, it had to take a portion of the streets. As a consequence, roads became narrower, leaving almost no space for pedestrians. Most of the tram lines came very close to the houses located on the streets. Because trams were old and noisy, houses would vibrate and tremble most of the time when vehicles were passing by. In addition, tram derails would happen on a daily basis. At the time when Constanța gave up on electric transport in 2004, there were 43 kilometers of tram network in the city. If it were for the entire fleet to be replaced, this would have required EUR 120 million, money that the city could not afford at that time. Therefore, local authorities thought that a better solution would be to invest money in a newer bus fleet. The local government therefore removed the tram lines, widening the boulevards and easing the pressure on traffic. Subsequently, EUR 50 million have been invested in purchasing new, modern buses.

Bus in service in Constanța

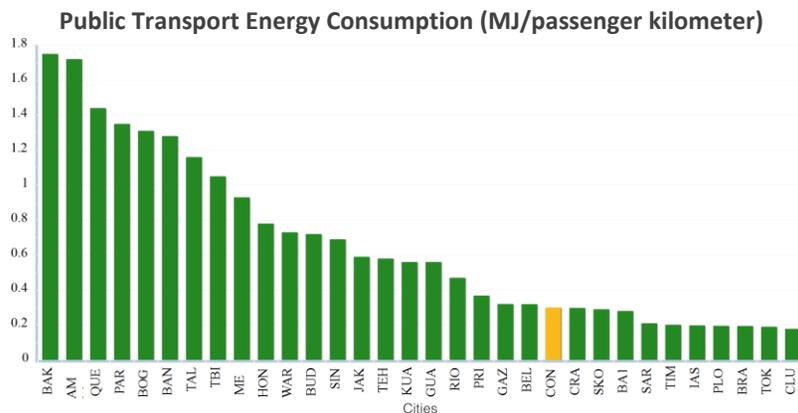


The bus fleet comprises 198 buses. Of these, 115 are MAX medium size type vehicles equipped with Renault engines. The vehicles were purchased in 2002 and have a seating and standing capacity of 98 people. In addition, there are 65 Mercedes buses; each can accommodate up to 120 people. All vehicles are equipped with European standard greenhouse emission



catalysts Euro 2 or Euro 4. The buses service 22 routes in Constanța and Mamaia beach resort during the summer. During peak hours, RAT Constanța operates with 136 buses and with 100 vehicles during off-peak time. As there are only a few types of vehicles, bus maintenance is technically easier and financially cheaper. During the summer, RAT Constanța brings in 10 double-deck buses aimed at providing tourists a better view of the city and of the beach resort. Two buses are in service during week days, and three over the weekend, when more tourists come to the city. Occupancy ratio of double-decker buses is 60% on average. They operate the route from the railway station in Constanța to Mamaia and back, for 4 RON per trip.

When it comes to energy consumption, the public transport is doing fairly well, with 0.3 MJ per passenger, a figure that places Constanța on the lower side of the TRACE database comparable with similar Human Development Index. However, the energy density is the highest among the seven growth poles.



The vehicles run at a very small frequency, almost at every other minute, in order to make the service attractive, but also to keep up with the private transport operators. On average, a bus runs 250 kilometers a day and requires 38 liters for 100 kilometers. The annual fuel consumption to operate the bus fleet is about 3,600 tons of diesel fuel, which is the equivalent of USD 6.6 million.

The public transport ridership in Constanța has dropped gradually over the last decade. If in 2000 there were 93.4 million passengers, the number fell down by almost 20% in 2005, to 77 million. The decreasing trend continued over the following years and by 2010 only 61 million passengers used buses. The figures continued to drop further, but also it seemed to stabilize during the last couple of years to around 53 million people. The main culprits for the drop in public transport commuters are the closing down of most industrial facilities, the increase in the number of private cars, and competition from private operators. According to a transport study commissioned by the Constanța City Hall in 2007, a survey based on 4,800 people shows that 68% of the passengers use public transport to commute to their work places, 11% for shopping, 3% to sort out local administration related issues, 2% to get to health-cares facilities and doctors, while 16% use buses for several other different reasons.

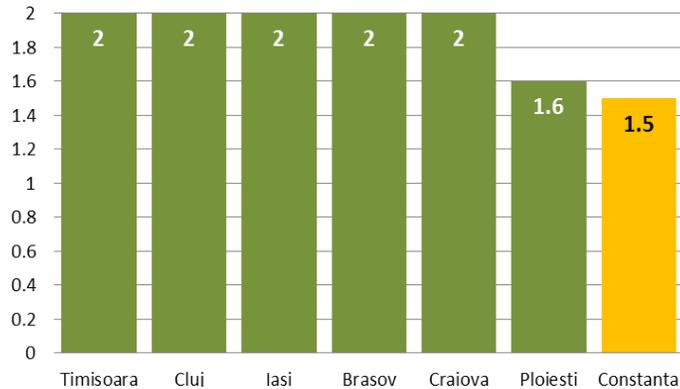
The public transport fare in Constanța is the lowest among all seven growth poles in Romania, i.e., RON 1.5 per trip. Until very recently, the tariff used to be RON 1.75 per trip, but the local government brought the price down starting July 1, 2013, in an attempt to contain competition from private operators that charge a lower tariff, but also to attract more people toward public transport.

The city government provides ridership incentives for certain categories of people. For example, about 34,000 retired people with a pension of less than RON 900 per month, along with low-income residents, ride for free. However, the city offers limited subsidies for students. In fact, Constanța is the only growth pole that does not give 50% in transport subsidies to all students in the city, but only to a very limited number. The City Hall provides discounts only to students who come from low-income families and fill in an application in this regard. According to local authorities, most students in the city come from well-off families who can afford to pay for the bus ticket in full.

Currently, at most 800 students in Constanța benefit from public transport discounts, a very small number compared to other growth poles. The public transport company receives subsidies only for retired people. Over time, RAT Constanța made efforts to decrease diesel consumption and reduce the related expenditures by offering incentives to bus drivers who manage an efficient use of fuel. They receive incentives in the form of financial bonuses, days off, or promotions.



Public Transport Tariffs in Growth Poles (RON/trip)



There are three private companies that operate on public transport routes in Constanța and Mamaia. One of the companies runs 6 routes, the other only two; both overlap the routes operated by RAT Constanța. The third company runs a few kilometers of public transport routes in Palazu Mare neighborhood. A route can span between 7 and 15 kilometers. The private companies have 72 minibuses altogether, with a seating and standing capacity of 20 passengers each. They consume between 15 and 18 liters of diesel per 100 kilometers. The number of passengers varies depending on the time of day and the routes. On average, there are 2,500 daily passengers per route; sometimes on popular routes the number can go up to 6,000. Overall, 30,000 passengers use private minibuses daily in Constanța and Mamaia.

The trip with minibuses costs between RON 1 and RON 2 and it is charged directly on the vehicle by designated people or the driver. Sometimes tariffs can be negotiable, depending on the distance travelled. Private transport operators pay for the streetscape, based on the average number of passengers per month. The fee is set to RON 230 per year, in addition to RON 130 for vehicles that could carry up to 20 people.

There are a number of regional transport entities that operate in Constanța, from the railway station to the beach resorts in the wider metropolitan area. According to the Integrated Development Plan, as of

2010, there were 133 minibuses and 24 interregional bus routes operating in the region.

Minibus in Constanța operated by a private transport company



The City Hall organized two terminals for interregional buses, one at the railway station, and another at the city’s farmers market. According to the local law, such buses should make only one stop in the city, load the passengers, and then go further to their final destination.

Bus in service from the railway station in Constanța to Mamaia



Source: www.ratc.ro

But, things are different in practice. The interregional buses can make multiple stops in the city, whenever someone asks for a ride by simply hitchhiking. This practice detours some of the passengers from the public transport company, thus diminishing the number of people using public



buses, which ultimately affects the public operator's revenues. The City Hall tried to address this issue by banning private operators from entering the city. From now on they should be allowed only to the city limits, from where passengers coming from outside the city should switch to buses operated by RAT Constanța.

Despite all the inconveniences posed by private operators, RAT Constanța admits that there is still something good out of it. Private operators help enhance competition, so people can ultimately benefit if they are being provided with transportation alternatives. At the same time, some of the streets in the city are too narrow for buses and are more suitable for minibuses.

In addition, in the summer time, the ropeway (telegondola) operates in Mamaia, crossing the resort from one side to another. The ropeway was a project developed with EU funds in 2004. Tourists can enjoy a 2.1 kilometer short journey across Mamaia for RON 15 per trip.

**The ropeway (telegondola) in Mamaia**



As in many cities in Romania, there is no dedicated priority for public transport in Constanța. Often buses get caught in severe traffic jams and sometimes must wait to pass even 10 consecutive red lights, thus increasing travel time and annoying passengers. In the future, the city managers want to boost the public transport in the city. They want to focus on a few measures such as developing dedicated bus lanes, equipping the public transport vehicles with GPS, renovating the bus stops, and introducing e-ticketing. The city managers also hope that

purchases of rolling stock will be eligible under the 2014-2020 ROP. To this end, they intend to buy small, highly-energy efficient hybrid buses that should replace the fairly old existing fleet.

The ultimate goal of RAT Constanța is to attract middle class people to the public transport. To this end, the local managers aim to develop the public transport as to become more reliable, comfortable, and safe, increase the quality of services, and ultimately, make it more appealing to the city's residents.

As of now, the national legislation does not allow the local public transport companies to operate in the wider metropolitan areas. According to the law, only a county-level established company can operate public transport routes within the county, and implicitly, in the wider metropolitan area. The law should be amended in order to establish metropolitan transport authorities that could operate public service in the region. If the law gets approved, RAT Constanța may consider widening its area of operation by expanding the public transport connections to localities within the wider metropolitan area.

### **Private Transport**

Like everywhere else in Romania, traffic in Constanța is not an easy task, neither for cars, nor for pedestrians. The city followed the same development path as the rest of the country, transitioning from a centralized command-and-control system to the market economy in the last two decades. Constanța is a port-city, where related activities and the proxy oil refineries brought lots of economic development in the region. In addition, the location on the Black Sea shore, in the vicinity of beach resorts including the most popular one, Mamaia, brings millions of tourists in the city in the summer time. This has led to an increase in the number of cars in the city, a situation which generates traffic congestion.

The Sunshine Highway connecting București to Constanța has been finalized recently, tremendously improving the traffic flow to and from the seaside. The highway facilitates people's access to the Black Sea, thus bringing more tourists to the resorts and to Constanța City.

The Constanța bypass was also recently completed, and thus people who travel to the beach resorts do not need to drive into the city to travel further and reach their destination.



The Sunshine Highway connecting București to Constanța



Source: [www.cugetliber.ro](http://www.cugetliber.ro)

At present, there are 123,099 cars registered in Constanța. In addition, thousands of vehicles transition the city in the summer time. One third of cars registered in Constanța run on diesel, while the rest use gas. A little over one-third of private cars in the city are between 6 and 10 years old, and nearly 20% are between 11 and 15 years old. 11.9% of the private vehicles registered with the local police department are between 16 and 20 years old, while almost 18% of the fleet is older than 20 years. 2.4% of the cars are new, up to two years old, and almost 13% are between 3 and 5 years old. Like all cities in Romania, Constanța takes part in the national scrappage program (“Programul Rabla”), which offers people who bring old cars a premium toward buying a new car. Since its start in 2005, the program has played an important role in helping renew the vehicle fleet in Romania. For instance, only in 2010, almost 190,000 cars were scrapped and the vouchers were used to purchase almost 60,000 new vehicles.

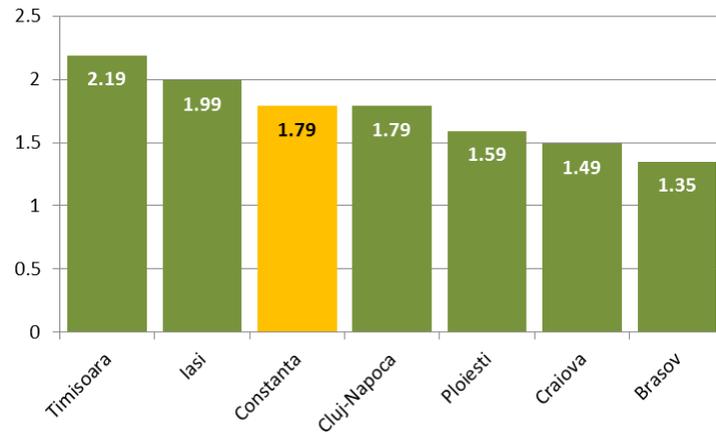
Traffic in Constanța - Mamaia



There are 1,200 mopeds and 1,784 taxis in the city. According to the law, there should be one taxi per 1,000 people. A touristic city, attracting hundreds of thousands of people in the summer, Constanța needs, in fact, more taxis, as the demand is very high. Taxis must obtain authorization from the City Hall, which also regulates the tariffs. The city government cannot issue permits for cars older than 10 years. The local public administration is also the one that set the tariffs for taxis. They cannot go beyond the ceiling established by the Constanța Local Council at RON 3.5 per kilometer. On average, most of the taxis charge RON 1.79 per kilometer, RON 2.15 per kilometer during the nighttime, and RON 2.75 per kilometer outside the city limits. However, there are a number of independent taxi operators that overcharge, asking twice as much as the average rate. The city government together with the local police stepped up efforts to contain such practices. The number of taxis using top fares has come down over the last few years. A taxi runs 100 kilometers per day on average. The vehicles use all types of fuel, e.g., diesel, gas, and LPG. Constanța has 160 designated taxi parking spots in the city, where cars can wait to be hired by customers.

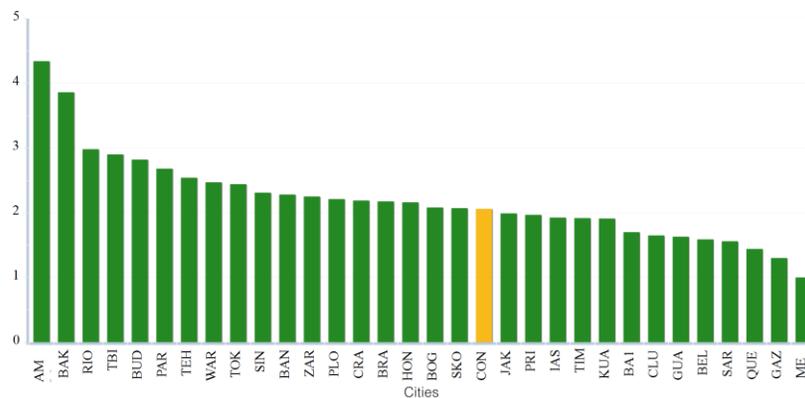


Taxi Tariffs in Constanța (RON/km)



The energy consumption for private transport stands for 2.06 MJ per passenger kilometer, a figure that places Constanța in the middle of the TRACE database comparable with cities with similar Human Development Index. The city is performing slightly better than some of the growth poles, such as Ploiești, Brașov, and Craiova, but there is room to improve, if compared to Cluj-Napoca, for instance.

Private Transport Energy Consumption (MJ /passenger/km)



In 2012, the fuel consumption for private cars in Constanța amounted to nearly USD 75 million. According to the mode split figures calculated in 2007, almost 44% of the commuters in Constanța use their private cars to travel in the city.

As of now, the city has no dedicated bike networks. Despite of that, it is fairly safe to ride the bike on the main roads. Like in many other cities in Romania, the *1 Velo* project is implemented in Constanța in partnership with a commercial bank, for the months of June through October of every year. People can rent 120 bikes for a few hours or a full day provided they can present a valid ID. The rental rate is EUR 3 for a day and it goes down if they use the bicycles for just a few hours. Students under the age of 16 and retirees can rent the bikes for free.

There are a few pedestrian networks in Constanța, most of them on the seafront of the city and in Mamaia. For example, a popular pedestrian area is located just in front of the Casino building in Constanța, where many of the city residents and tourists like to walk around. Another non-motorized network where people stroll especially in the summer time is in front of the Casino in Mamaia. Yet another popular pedestrian area is in the city center, a place with a number of shops and restaurants.

Pedestrian network in Mamaia





Pedestrian network in the downtown of Constanța



A few projects are under way, with support from the 2007-2013 ROP, aimed at expanding the pedestrian network in the city. These include the rehabilitation of the pedestrian area in the historical center in the city, redevelopment of the Piața Ovidiu located near the archeological and history museum (to be turned into an agora/plaza), and the modernization and redesign of the Mamaia promenade, a large pedestrian network covering the area from the Holiday Village, Malibu, Perla, and Casino Mamaia. In addition, the city is building three pedestrian crossovers/bridges over Mamaia Boulevard in order to improve access in the beach resort. The value of the project totals RON 10.5 million, of which RON 8.3 million comes from the ROP. One of the crossovers is to be located in Holiday Village area, the other one near Mamaia Casino, while another will be built in the vicinity of Rex Hotel.

Like everywhere else in the country, parking in Constanța is challenging. The old residential buildings built during the communist regime did not have parking lots, as cars were very few in those times. In addition, thousands of vehicles are pouring into the city during the summer, and all of them need to park somewhere. With the tremendous increase in number of private vehicles in the city, the demand for parking has gone up as well. Currently, there are parking structures on Mircea cel Bătrân and Tomis Boulevards, respectively. These are one-way roads, which allow for parking on one side of the street.

The new parking near the County Hospital in Constanța



Source: [www.lideruldeopinie.ro](http://www.lideruldeopinie.ro)

In addition, there is a 4-floor multi-story green parking that has recently been opened near the County Hospital in Constanța. The external walls are to be covered with grass and vine plants. The parking lot, whose cost totals EUR 4 million, was developed with support from EU funds, and can accommodate 300 cars, four times more vehicles than the old parking. There is an electronic screen at the entrance, showing the number of free spots on each floor, so the drivers can learn exactly where they should put their cars. The number of parking lots in Mamaia has tripled in the past few years. There are a number of public parking spots available in the area where people can put their cars free of charge.

However, parking lots in Constanța cannot accommodate the large number of vehicles pouring into the city, and the local government is set to address this issue in the near future by building more facilities. For example, the local government is considering building two over-ground parking garages in Constanța. The construction of a 7-story facility in Mamaia in the vicinity of the Casino area is already in progress. Upon completion of the construction, the facility could accommodate nearly 400 cars.

As for traffic and transportation management, Constanța introduced prioritization of traffic signaling for buses on very few intersections in the city. In 2007, the City Hall commissioned a traffic mobility study aimed to ease the flow of traffic in the city. As per the



study's findings, some streets have been turned into one-way roads, and roundabouts were set up where needed. Currently, the local public administration is working on an application through the 2007-2014 ROP for the modernization of the traffic management system, which would include a GPS-based dispatcher, screens displaying information about public transport routes, available connections, etc.

Until a few years ago, the municipality asked for a fee for entering Mamaia. The charge, set at RON 7 per vehicle, used to be applied to all cars, except for vehicles registered in Constanța County. The fee was eliminated due to public opinion pressure. According to the local government representatives, the money collected was channeled to the renovation and rehabilitation of public schools in the city. A project seeking to improve access from Constanța to the industrial platform in Năvodari, where many of the oil refineries are located, is under implementation. The EUR 13 million project developed with support from EU structural funds is expanding and upgrading the Mamaia Boulevard all the way to Năvodari.

Finally, the City Hall is planning to sign the contract for the construction of the coastal highway for a total of 15 kilometers. Initially, the city plans on building the first 4.2 kilometers at an estimated cost of EUR 10 million. The first lot should be completed by July 2015, while the remaining sections should be commissioned before 2020. The coastal road is expected to improve the traffic flow in Constanța, as cars will be able to use the highway to bypass the city.





## Energy Efficiency Recommendations

TRACE is a tool that allows for the estimation of energy savings potential in different 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 Constanța was compared to TRACE data for other cities with a similar climate. The energy savings potential with regard to street lighting in Constanța was calculated using a method that factored in the cities that performed better than the city, and the degree to which these localities performed better. The more information is available in the TRACE database, the better results it can provide. So far, TRACE has data on almost 100 cities, which allows for good comparisons.

The level of local control also determines the energy saving potential. The more control local public authorities have over a particular service area, the higher the energy saving potential. Like in many localities in Romania, some public utility services in Constanța are managed by the city government, whereas some others stay with the private sector or they are regulated at the national level. For instance, the solid waste is under the private sector. The water sector is under the County Council, and the city government has no say in this area. The city has also very little influence over the energy sector, as policies and regulations are decided at the national level.

After the saving potential for each indicator was calculated, a sector prioritization was done in TRACE, based on the amount of energy that could be saved. The sectors with the largest energy savings potential in Constanța are: “Private Vehicles,” “District Heating,” “Public Transport,” “Potable Water,” “Municipal Buildings,” “Wastewater,” and “Street Lighting.” The most promising sector is “Private Vehicles,” however, the local government has little control over this area. The second highest potential for energy savings in Constanța is “District Heating,” a sector under the direct control of the local public administration. The sector with the third highest energy saving potential is “Public Transport,” under the Constanța City Hall. “Potable Water” has a good potential as highlighted by TRACE, but the sector is managed by the County, thus the local government does not have much say. “Municipal

Buildings” and “Street Lighting,” both sectors controlled by the local authorities, can achieve good energy savings. Another sector that is controlled by the Constanța City Hall is “Street Lighting.” Two other sectors have been identified by TRACE, namely “Wastewater” (a sector under the County government) and “Solid Waste,” an area managed by the private sector.

### Sector Priority City Authority Sector Ranking

Rank	Sector	REI%	Spending CA (US \$) Control	Score
1	District Heating	15.0	32,544,013 0.60	2,928,961
2	Public Transportation	31.5	6,651,415 0.85	1,784,057
3	Municipal Buildings	30.3	2,120,183 0.90	578,173
4	Street Lighting	20.0	1,814,948 0.85	308,541

### City Wide Sector Ranking

Rank	Sector	REI%	Spending CA (US \$) Control	Score
1	Private Vehicles	21.3	74,775,648 0.25	3,999,656
2	Potable Water	56.3	7,184,008 0.40	1,618,068
3	Wastewater	45.3	2,434,170 0.40	441,736
4	Solid Waste	25.0	1,360,000 0.75	255,000
5	Power	0.0	0 0.15	0

All priorities identified by TRACE were presented and discussed with local public administration officials. A number of five sectors comprising ten recommendations were chosen by city managers, and these will be discussed in more detail in the sections below.

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.

### **District Heating Maintenance and Upgrade**

One of the TRACE recommendations made to the local government of Constanța is related to improvement and maintenance of the district heating network. This recommendation falls within the scope of the efforts that the local authorities are planning to undertake in the near future. The local district heating system is expected to undergo tremendous changes. The plan is to shift CET, the district heating plant, from the control of the Ministry of Economy to the City Hall Constanța. In this way, the local public administration managers would have control over the production and distribution of hot water/heat. After the takeover, the city managers will seek to come up with the best solution

for the future of the sector, contemplating between two alternatives in the long run. On one hand, they are thinking about entering into a public private partnership, based on the successful models implemented in Ploiești and Iași with Dalkia, a private district heating operator. On the other hand, the local government representatives take into consideration a public private partnership only for the production of heat (while keeping the distribution network with the Constanța City Hall). At the end of the day, the ultimate goal is to keep the system alive and provide the 85,000 customers (apartments) in the city with better heat and hot water services. The City Hall is preoccupied to modernize and upgrade the distribution network (secondary pipes), and also improve the hot water/heat production component.

According to the TRACE assessment, district heating is the sector under the local government management with the highest energy saving potential in Constanța. Therefore, the local public administration should undertake some further efforts to reduce the leakages in the hot water pipes, and improve the system's overall efficiency. This can be achieved through a maintenance program targeting the repair and upgrade of boilers, pumps, pipes, and insulation of pipes. At the same time, they should consider passing legislation that would require a minimum efficiency level for generation and supply infrastructure of the district heating network.

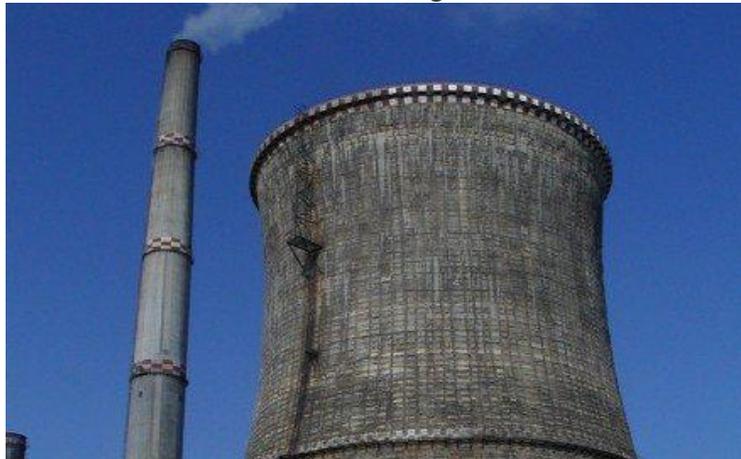
Like in many other cities in Romania, the thermal energy consumption in Constanța has dropped dramatically over the past 20 years. In recent years, some of the state-owned companies in the city were shut down and some large economic players established their individual heating system (for instance, the port of Constanța and the shipyard). This had had severe repercussions over heat production and distribution. In addition, thousands of people disconnected from the system in the last decade, although the figures are relatively smaller than in other growth poles (e.g., 30,000 in Cluj-Napoca and almost 50,000 in Brașov). However, between 1995 and 2000, the heat consumption was around 1 million Gcal per year, but, subsequently, the heat demand dropped gradually.

According to the National Institute of Statistics, the heat production in Constanța reached its peak in 1995, when 1.06 million Gcal were distributed in the city. By 2000, the amount of heat distributed in



the city dropped by over 100,000 Gcal, i.e., to 896,485 Gcal. It further went down to 760,152 Gcal in 2005 and, later on, to 610,063 Gcal in 2010. Currently, the amount of heat necessary to cater the city residents, public institutions, and some economic agents, is approximately 610,000 Gcal annually, which is half the amount used in the past.

**CET Palas - cooling tower**



Source: [www.ziuaconstanta.ro](http://www.ziuaconstanta.ro)

Over time, RADET had made some investments into the system to improve its overall efficiency. In addition to the modernization of thermal points and installation of modern equipment throughout the sub-plants in the city, local authorities managed to rehabilitate 18 kilometers of the secondary network. But this did not seem to make a difference in the entire system. Despite the rehabilitation work, the hot water losses account for 35%. In other words, of every 100 Gcal produced, 35 Gcal gets lost due to leakages in the hot water pipes. The most appropriate way to contain water losses is to further focus on network maintenance. According to feasibility studies, the rehabilitation of secondary pipes would require EUR 120 million investments. To date, the work performed to this end did not exceed EUR 3.2 million. The City Hall Constanța and RADET should identify the most suitable and cost-efficient methods to insulate and modernize the pipes to reduce hot water leakages. In

addition, the local public administration should focus on thermal insulation of the residential buildings in the city. Studies show that rehabilitation work has a great impact on energy consumption, on heating bills, and, not in the least, on residents' level of comfort. Moreover, it increases the energy efficiency of the buildings by at least 20% and it can go even beyond that. Some of the buildings that have been thermally insulated in Timișoara with support from the local budget have reduced drastically the heat consumption (i.e., by more than half). The heating bills also came down significantly.

**Horizontal distribution pipes in a rehabilitated building in Craiova**



Another way to increase efficiency of the district heating system is switch from the vertical distribution model of the heat to the horizontal model. Constanța has already applied this model in the new residential buildings built for young people. Now the city is considering expanding it to other building in the city. Anyway, this is a fairly costly solution, and the local government needs to find the financial resources in order to carry out further similar projects. This model has been also implemented in Craiova, where the municipality paid for the thermal rehabilitation of the buildings, whereas the district heating operator changed the hot water distribution system. As a result, the heat consumption came down by 40%. The heating bills dropped, the quality of services improved, and the level of comfort in the apartments went up.



At the same time, RADET and the City Hall are working out suitable ways to regain market share and increase the number of customers. One of the measures the municipality has come up with is to have new emerging residential constructions linked to the centralized heating network.

At the end of the day, an efficient district heating system must have strong support from both local and central government. There should be medium-to-long term national policies with regard to thermal energy to encourage both operators and local communities to invest in the network and heat production to increase the efficiency of the entire system. According to RADET, there are European countries where national and local policies are more favorable to district heating operators. For example, in Germany, the VAT for heat is below the value of the added tax rate generally applicable in the country (8% compared to 19%). In Romania, taxes are not differentiated, so the same VAT rate applies to all services, i.e., 24%.

### Urban Transport

Urban transportation is another sector with high potential for energy efficiency gains in Constanța, as identified by TRACE. Together with district heating, transport is one of the priority areas of intervention for the city government of Constanța. The local public administration already has a few initiatives in this sector, including improving the public transport network, expanding non-motorized networks, and a new traffic management master plan. TRACE recommendations build on the efforts that the local authorities are already undertaking, or are planning to carry out in the near future. The sections below will discuss each recommendation in more detail.

In addition, the City Hall and the local public transport authority should prepare a database with key transport indicators. These should include the basic information related to transport modal split in the city, as to document how many people use public transport, how many walk or bike, and how many rely on their private vehicles to commute. This information is vital for every city in order to prepare a comprehensive mobility plan that should be the foundation for developing a sustainable transport network. The Ministry of Regional Development and Public

Administration is working with the EBRD to prepare mobility plans for all seven growth poles and the capital city, București.

### Non-motorized Transport Modes

One of the first TRACE recommendations made to the city managers of Constanța when it comes to urban transport relates to the development of non-motorized networks. An efficient non-motorized transportation with zero fuel consumption and low infrastructure investments tackles several issues at the same time: it is good for the environment, it reduces pollution, it improves air quality, and it benefits people's health. A potential annual savings of 100,000 to 200,000 kWh can be achieved with an initial investment of USD 1,000,000 over a two-year implementation period.

The city has a few pedestrian areas, mostly on the seafront. Currently, the City Hall is carrying out a few projects with support from the 2007-2013 ROP aimed at developing more dedicated areas for pedestrians. One of the largest projects currently pending in the city is the integrated redevelopment work performed on the pedestrian area in the historical center, a project with a total value of RON 47 million. It includes the rehabilitation of 21 streets in the Peninsula area in Constanța, development and rehabilitation of the rainwater systems, and equipment of the area with urban furniture, such as new lighting poles, road signs, trash bins, and ashtrays. The area will be closed for cars and the traffic will be deviated to the coast. The city managers want to use granite stone for the modernization of the pedestrian network. This project should be completed within two years.

Another project under way is the tourist promenade in Mamaia, with an estimated budget of RON 64 million. The main objective is the modernization and rehabilitation of the pedestrian promenade between the Holiday Village (on the outskirts of Constanța) and Mamaia. The work includes rehabilitation of the main pedestrian lane in the Holiday Village, redevelopment of Perla Plaza, improvement of the promenade Malibu-Perla - the Mamaia Casino promenade, and modernization of the Mamaia Casino Plaza and pedestrian network. The rehabilitation and redevelopment of Casino Castel area is also part of the project.

At present, the local public administration is restoring and redeveloping the historical area Piața Ovidiu under a RON 14 million



project with support from EU structural funds. The project includes rehabilitation of the Piața Ovidiu, a few streets (Vasile Canarache, Marcus Aurelius, and Aleea Vasile Canarache), and building access stairs from Marc Aureliu Street to the Tomis Port and from the Vasile Canarache Street to Termele Romane Street. Urban furniture, such as benches, lamps, lighting poles, trash bins, and ashtrays will be installed in the premises of the area, in addition to setting green areas and slopes. The local authorities want to turn Piața Ovidiu into a plaza/agera, exclusively for pedestrians. Also, they want to build a parking lot where people can leave their cars and from there walk up on the stairs to the plaza. With such remodelling, it is expected that the place will turn into a great tourist attraction in Constanța.

Finally, the city government is currently restoring and redeveloping the promenade and green area between Vraja Marii, the Casino, and Port Tomis. The project is co-financed from the 2007-2013 ROP and has a total value of RON 16 million. The work consists of rehabilitation of the supporting walls, railings, and banisters, redevelopment of the seafront promenade, upgrading of the pedestrian network in the park and development of more green areas, and, not in the least, setting a number of kiosks, pavilions, benches, lamps, and fountains in Art Nouveau style. A number of new street lighting poles will be placed in the area, and designated space for brass band will be built.

The Constanța City Hall may also consider developing more pedestrian networks in the city. For example, some streets may be permanently or temporarily closed to motor vehicles traffic, allowing access only to pedestrians and bicyclists. Such networks could help raise the quality of life in the city and stimulate business development. Not only do they help pedestrian traffic go up, but they also increase substantially the businesses and leisure & entertainment activities in the area.

Not in the least, the local government should encourage more people to use bikes. The city does not have dedicated bike lanes. In order to have more people biking, the local public administration should build an appropriate network.

### Rehabilitation work of Piața Ovidiu in Constanța



Currently, Constanța is carrying out a EUR 1.4 million project in cooperation with Balchik, a city on the Black Sea shore in Bulgaria (about 60 kilometers away from Constanța), to develop bike networks and docking stations. This is part of the Black Sea Diversification of tourism services in the cross-border area Constanța-Balchik through bicycles, funded from the Cross-Border Cooperation Program Romania-Bulgaria. A bike network and 24 docking stations will be developed on Tabacariei Lake and Mamaia Boulevard. Upon completion of the project, the city residents and tourists will be able to ride for free a number of 390 bicycles, between the Peninsula area and Mamaia.

The local authorities could think about making micro credits available to people to help them buy bicycles. This would be beneficial to low-income residents. The municipality of Constanța could be inspired by the city of Lima, Peru, where the local government set up a micro-credit program to help people purchase bicycles. By commuting by bike to their workplace, people saved more than 12% of their income, once the loan was paid off.



### The area near Casino in Constanța is undergoing rehabilitation work



### Parking Restraint Measures

Another important recommendation made by TRACE to the public administration of Constanța with regard to urban transport is to consider ways for discouraging the use of private vehicles and support alternative modes of commuting. This target can be achieved by imposing more restrictive parking measures in certain areas of the city. Fewer cars on the streets would translate into lower fuel consumption and less traffic congestion.

One way of making people to put away their private vehicles and turn instead to public transport is by applying parking allowances for new residential and corporate developments, and by building “Park and Ride” facilities within the framework of promoting transport multimodality by linking parking to public transport. A maximum parking allowance with low car-to-unit ratios could discourage private-car purchases and use. This solution could be appealing because it does not require immediate investments from the city budget and it can be implemented wherever there are public transport connections available. There are a number of cities in Europe that have successfully applied such parking allowance systems. The capital city of UK is a good example in this respect. In certain

neighborhoods in London where bus connectivity is available, the local government allocates less than one parking spot per unit. However, this measure should be coordinated with expanding public transport in the city, where necessary.

One of best practices that have proven to be very useful in dealing with traffic congestion around the world is the Park and Ride concept. Although this is a costly measure that requires serious capital investment, at the end of the day, it is a very efficient way to promote multimodality by linking parking to public transport. The Constanța City Hall should consider developing such facilities in the city. People who travel to the city from the Constanța metropolitan area should drive their cars to these parking areas, from where they take public transport to get to their workplace. It is important that such facilities are built in locations where public transport is available. In addition, cheap parking should not be available in center areas. The cost of transport, including parking fees, should be lower than that of the fuel used for the entire distance. For instance, in the Washington D.C. Metropolitan area, Park and Ride facilities are available at the metro stations located on the city outskirts. People drive their cars to the parking facility, leave their vehicles in the parking lot, and from there they take the public transit (buses or metro) to their workplace. They can also use the same e-ticketing (Smartrip card) to pay for both parking and the public transportation fare.

Park and Ride sign



Source: [www.wikipedia.org](http://www.wikipedia.org)



In addition, the local government in Constanța may decide to close down to traffic a few streets in the downtown area in order to further restrict the access of vehicles and reduce parking in the area. Currently, there is work in progress to close down a few streets and turn them into pedestrian areas, so the city managers should consider identifying more arteries in Constanța where traffic could be restricted. In addition, it may be worth for city managers to look at best practices executed by some cities around the world, where the parking price in the downtown area has been hiked. This method has discouraged people to drive their cars into the city center and instead incentivized more of them to use buses or trams, or, even better, bike or walk to where they need to go.

### Public Transport Development

One of the main TRACE recommendations for the municipality of Constanța is to advance the development of a modern and safe public transport system. This would not only provide citizens with better quality services, but it would also reduce the use of private vehicles and, instead, encourage people to ride public vehicles. More people relying on public transportation would translate into a significant reduction of fuel consumption, less number of private cars in circulation, better air quality in the city, and improvement of quality of life for the residents of Constanța.

A comprehensive public transport development program should aim to ensure mobility by increasing connectivity between the city center and the outskirts, including Mamaia, and integrating the network with the traffic management system. The city of Constanța is committed to move toward a sustainable transport system. This is a lengthy process that has begun with decommissioning tram rails at the end of the 2000s. Subsequently, the municipality has given up on trolleybuses too. At present, the public transport in Constanța is operated by buses through RAT Constanța and by minibuses run by a few private companies.

Instead of investing in the rehabilitation of high capacity transit network and tram cars, the city managers decided to rather focus on improving the bus fleet. Thus, the city purchased some new, modern vehicles, in compliance with European greenhouse gas standard emissions Euro 3.

However, there are a few issues with regard to public transport system in Constanța that the city managers should address. Because buses do not have priority lanes sometimes they get stuck in traffic, creating significant delays. Thus, the travel time is longer, causing annoyance and inconveniences to passengers. The city managers plan to improve the traffic flow by introducing one-way streets and building a few roundabouts. Constanța has a several main boulevards that are fairly large to accommodate dedicated bus lanes. Priority green lights and dedicated bus lanes will boost attractiveness of public transport and cut down travel time. By giving priority to buses at intersections will enable public transport vehicles to bypass traffic congestion, enhance their reliability, and reduce travel times.

Bus lanes in Los Angeles



Source: [www.laist.com](http://www.laist.com)

Reducing the travel time is an incentive that could make people turn to public transport and leave their cars at home. Cities that have a good network of dedicated bus lanes have managed to tackle bus traffic issues in a productive way. Special infrastructure for bus-priority signaling should be expanded in order to help the flow of approaching buses either by extending green lights for them or by cutting down the cycle for cars. This system is linked to buses via transponders that use GIS information and



can help the flow of approaching buses either by extending green lights for them or by cutting down the cycle for cars. This bus-priority signaling system has been implemented on the main large streets in Cluj, allowing public transport vehicles to move easier during rush hours and keep the travel time within certain limits.

Bus signaling in Cluj-Napoca



The modernization of the traffic system in Constanța is under way, and includes, among other things, modernization and renovation of bus stops and development of e-ticketing. In the near future, the bus stops in the city will be renovated and equipped with screens from where people will be given the opportunity to figure out bus routes and waiting times. To this end, real-time bus countdown information displayed on screens at the waiting facilities will allow passengers to plan and better manage their trips, enhance attractiveness of the public transport, and thus increase the number of users.

Another way of attracting more people to use buses is by making public transport better, more accessible, and appealing. To this end, e-ticketing will be introduced in Constanța in the near future with support through the 2007-2013 ROP, as the City Hall is planning to submit an

application for fund by the end of 2013. This easy, user-friendly method of paying for public transport trips has been already applied in a few cities in Romania, such as Timișoara and București. E-ticketing can be used for many trips, and even for different means of public transportation.

Screen displaying information on tram schedule in Timișoara



The electronic ticket will not only reduce the cost of travel and help more people ride the bus and commute, but it will also provide support for revenue collection and transfers, as well as counting passengers. In Timișoara, e-ticketing also functions like a debit card, which users can use to pay for some of the entertainment services in the city, like theater or cinema. Also, it was used to pay for parking in the city until the new system by SMS was introduced. People who use e-ticketing in Timișoara get a 10% discount on the public transport fare.

People in Timișoara can pay for the ticket directly from their cell phones, from designated kiosks, and also on the bus. In Washington, D.C., e-ticketing is used for both bus and metro trips. People can put money on a card either at the metro stations or on the bus. A paid trip (one ticket) that can be used for multiple bus trips within two hours in the metropolitan area. The local transport authority in Washington D.C. encourages people to use electronic trip cards by offering a small discount when switching from metro to bus. E-ticketing could also help improve the information about the modal split in Constanța. It can keep track of the



number of passengers who use public transport on a daily basis and provide information of the structure of passengers.

#### E-ticketing in Timișoara



Source: [www.ratt.ro](http://www.ratt.ro)

The local managers should think about building an efficient mobility plan by introducing an integrated fare structure that would allow commuters traveling from the metropolitan area to Constanța to use one single ticket for their entire trip, regardless of how many buses they need to switch between to get into the city.

Although RAT Constanța purchased some new modern buses in the mid-2000s, the usage of the fleet is high, and some of the vehicles should be replaced. The city authorities are considering purchasing small, energy efficient buses with a seating and standing capacity of maximum 30 people. They also hope that purchasing of rolling stock will become eligible under the next ROP.

At the same time, the existing public transport vehicles should be equipped with GPS systems in order to allow for the monitoring of the fleet. This would allow providing useful information for passengers that could help them organize better their trips. The city authorities want to place screens in the buses to display information about routes and travel time. The next bus would be announced by an automated voice service that would also provide information on the connecting routes.

Public transport development can further be enhanced by changing some of the current planning regulations. The city government should consider establishing new rules in this respect. For instance, in

order to obtain planning permits, developers should be able to show how a new development links to the existing or planned public transport network. At the same time, allowing higher densities of development next to well-served public transport corridors can create a good base for public transport and should be used in connection with other planning measures, such as capping parking provision to residential and office buildings. In several cities around the world, high-density residential and commercial development is encouraged around and within walking distance of transit stops, with lower densities elsewhere in the locality.

Last but not the least, the local transport authority and the Constanța City Hall should organize campaigns to increase awareness about the benefits of public transport. To this end, such campaigns should focus on promoting public transport as a reliable, fast, comfortable, safe, cheap, and accessible means of transportation in comparison to other transportation modes.

## Municipal Buildings

### Municipal Buildings Benchmarking

In each Romanian growth pole where the TRACE tool has been implemented, the team recommended to the public administrations to prepare a solid municipal buildings energy database, where all energy-related information can be tracked and monitored. The same recommendation has been made to Constanța. The City Hall has some data on electricity and heat consumption and expenditure in educational units and hospitals. These data can be improved to include all buildings in the city for which the City Hall pays energy-related expenditures, and it should be kept updated at all times. This energy database could be even more useful given the fact that Constanța is planning to sign the Covenant of Mayors in the near future and, subsequently, will have to draw up an energy strategy and action plan. Municipal buildings are one of the sectors that are included in the energy action plan. Therefore, a complete, accurate, and updated data on municipal buildings will be useful not only for the city managers for monitoring consumption and expenditure, but would also serve the city's future commitment to reduce energy and related greenhouse gas emissions, once the mayor signs the Covenant.



The City Hall Constanța



Source: [www.lideruldeopinie.ro](http://www.lideruldeopinie.ro)

The energy database is very useful for the implementation of any energy efficiency program. In most Romanian cities municipalities do not keep a proper and reliable record on the energy consumption and expenditures related to the buildings they administer. Often times, the city managers do not know the actual heat or electricity consumption per square meter and the related expenditure for the given floor area. In other words, they do not know what they are paying for. Moreover, they do not know if completed energy efficiency investments were indeed effective.

This TRACE recommendation encourages local authorities in Constanța to improve the database structure and the basic indicators, expand the monitoring process to all municipal buildings in the city, and create a complete set of information with regard to energy consumption and expenditures. This will help improve the monitoring and evaluation process in order to have accurate and reliable figures that would allow for a benchmarking among the buildings in the city and, subsequently, would lead to identifying the facilities with the highest energy saving potential.

A proper, clear, well-organized database could be used to further prepare an efficient analysis of the energy saving potential of these

buildings. The database should include basic information regarding the surface area of the buildings, the annual electricity and heating consumption, and also the energy savings accomplished after renovation or thermal rehabilitation work has been performed. The City Hall Constanța should have a complete picture of energy consumption and expenditures for the buildings for which they pay electricity and heating bills. This should lay down the first step for a program that could help decrease energy expenditures in these buildings.

It is essential for the local public managers of Constanța to understand the importance of this database from the perspective of the next financial programming of the EU structural funds for Romania. The data on energy consumption will be crucial for the local government when they will apply for funds under the 2014-2020 ROP, where energy efficiency will be one of the most important pillars of the program. The next ROP will offer the opportunity for municipalities to apply for funds that could help improve the overall energy efficiency of their cities by lowering the electricity and heating bills, save money for the city budget, and thus, help the city become more efficient. From this perspective, the municipal building benchmarking process should include a database comprising a range of specific information, from type of construction, date of the construction and renovation or rehabilitation (if applicable), floor area, type of heating, etc., to information on electricity, heating, and water utility bills in recent years, as well as cooling, heating, and lighting system modes.

The municipal buildings full audit could be prepared by some of the departments in the City Hall, and could benefit of support from a few external consultants, if necessary. Other local public administration offices/divisions should assist the City Hall in this endeavor/process. Once the database on municipal buildings is complete, it should be published and updated on a regular basis to enable competition among building managers and open the path for productive exchange of information and cooperation. The database could be also used for benchmarking buildings against each other and determining the highest potential in terms of energy savings at the lowest cost. At the end of the day, the analysis should be able to lay down the appropriate energy saving options. In addition, such a database could be valuable for the local public



administration to perform an audit of the municipal buildings in the city and then to prioritize buildings for retrofitting.

There are several examples in the TRACE database that the local authorities in Constanța should consider when improving the benchmarking process. One of the cities Constanța may look at is the Ukrainian city of Lviv, which stands for a good model with regard to an efficient benchmarking targeting considerable energy savings. The city was able to reduce annual energy consumption in all its 530 public buildings by 10% and cut water consumption by 12% through a Monitoring and Targeting program to control energy and water use. As of 2010, the program achieved savings of USD 1.2 million with minimal costs. The program provided the city management with monthly consumption data for district heating, natural gas, electricity and water in all municipal buildings. This information helped set annual goals based on historical consumption and negotiations on realistic adjustments. The consumption was reviewed every month and all deviations and performances were communicated to the public through a public display campaign. Subsequently, the City Hall of Lviv established a new energy management unit and trained all personnel with responsibilities on building utility use in an administrative division, unit, or building.

### **Municipal Buildings Audit and Retrofit**

Once the municipal building benchmarking is prepared, the next step the local government in Constanța should embark on is an audit followed by a retrofit process to enable cost savings and reduce the carbon footprint of the city. The building audit recommended by TRACE is targeting specific energy consumption for end users and activities, such as computers, lighting, air conditioning, heating systems, etc. After analyzing the results, the city government may come to the conclusion that it has to allocate money for energy efficiency upgrades, purchase new equipment, and perform some building renovation. The retrofit program can be done in a cost-effective manner by involving Energy Service Companies (ESCOs), which would pay for the initial cost of the upgrades and then share the savings from the retrofits. According to energy-related studies, audit and retrofit programs have a tremendous contribution regarding energy

savings, as the reductions can get to as much as 25% of the initial consumption.

**The Folk Art Museum in Constanța**



Source: [www.constanta.ro](http://www.constanta.ro)

The city should step up its efforts toward increasing energy savings and encourage both private and public buildings to be proactive and save energy in any of its forms. Some of the educational units in the city, such as high schools and kindergartens, have been renovated and modernized. However, the city is lagging behind in terms of the rehabilitation of residential buildings. Constanța is the only growth pole in Romania that did not apply for funds available from the Ministry of Regional Development and Public Administration through the program for the rehabilitation of residential buildings built between 1950 and 1990. According to city managers, the Constanța City Hall thought it would be the right thing to pay for thermal insulation for those who had enough money to support rehabilitation work from their own pocket. Nonetheless, Constanța has tens of thousands of apartments in old residential buildings that need to be rehabilitated.



In any case, the city managers hope to use financial support through the next EU structural funds for the rehabilitation of both residential and municipal buildings in the city. Thermal insulation of buildings (insulation of walls, rooftops, etc.), in addition to replacing the old windows with double-paned ones, is expected to reduce heating bills by at least 20%. Consequently, in order to further reduce utility bills for municipal buildings, local authorities may consider replacing incandescent bulbs with more efficient fluorescent ones.

Germany is one of the countries that have been very successful in improving energy efficiency in municipal buildings and reducing related costs. A number of German cities worked out solutions aimed at reducing energy consumption in municipal buildings. For example, the local government of Berlin, in partnership with the Berlin Energy Agency, managed the retrofit of public and private buildings by preparing tenders for work that would guarantee reductions in emissions. The public retrofit tenders require an average of 26% greenhouse gas emission reduction, so that winning Energy System Companies (ESCOs) must deliver sustainable energy solutions. Under this program, 1,400 buildings have been upgraded so far at no cost to owners, managing to have more than 60,400 tons per year in CO<sub>2</sub> reductions, and generating substantial savings. In another successful story, the city of Stuttgart was able to save 7,200 tons of CO<sub>2</sub> every year through an innovative form of internal contracting that makes use of a revolving fund to finance energy and water-saving measures. The city invests the savings directly into new activities, thus enabling a circle of environmental improvements and emissions reduction.

### Street Lighting Timing Program

This TRACE recommendation is focused on a lighting timing program that would reduce the light intensity according to the specific needs of a particular area. Through this inexpensive method, with a minimum investment of USD 100,000, the electricity consumption for lighting the streets in the city can be diminished substantially.

This street lighting timing program can be tailored to the specific needs for lighting of a particular area. The level of lighting can be adjusted through a monitoring system, according to varying weather and activity

levels. Usually, light systems have astronomic timers with geographic designations, and allow for adjusting the light according to the season and time of day. More light is required during winters when days are shorter and it gets dark early, whereas less light is needed in the summers when days are brighter and sunnier. Under this program, lighting and its intensity may vary based on demand at a particular time of day. For instance, at midnight, when only a few people and cars are out on the street, the light can be diminished automatically from a command center. By dimming the lights gradually, people's eyes are able to adjust to lower lighting levels, and the dimming is barely noticeable.

Several cities across the world have turned to street lighting timing programs. One good example in this respect is the city of Kirklees, UK, where the local municipality chose to dim lights to varying levels throughout the day, instead of turning off the lights at certain times of the day. The local government installed retrofit systems on each existing lighting pole and used wireless technology to monitor and dim the street lights. The retrofitting process simply requires adding a small antenna to the lamp heads, which is plugged into the electronic ballast, with no need for additional wiring. The lights are switched on at 100% at 7PM, dimmed to 75% at 10PM, and then to 50% at midnight. If the lights are still on at 5 o'clock in the morning they are increased again to 100% lighting. Light dimming programs are very efficient because they save both energy and money, reduce the brightness of bulbs at times of low road or street usage, and fluctuate bulb brightness at varying times.

In the near future, Constanța will choose the next street lighting operator. It is likely that the local city managers will choose again two operators, in order to boost competition among them, and thus encourage companies to provide better services. The next step would be modernization of the street lighting system by introducing the dimming program. This system could be employed in certain areas in the city, like neighborhoods with reduced pedestrian traffic (such as parking lots). Through a motion-sensor, the light turns on only when someone is walking by, and it stays off when nobody is present. Automatic lighting systems are implemented in some neighborhoods in București, on small alleys and paths around residential buildings.



Lighting pole in Constanța



In the near future, local government representatives want to expand the street lighting service to the new residential areas in the city that are currently connected to the system. They also plan to rehabilitate and upgrade some of the street lighting poles that used to belong to RAT Constanța in the past (where the city used to have trolleybuses). Last but not least, a more ambitious plan is to introduce street lighting based on LED bulbs in newly developed residential neighborhoods. The city managers hope that such investments would be developed with support from the ROP. Before making this move, local authorities should undertake a rigorous cost-benefit analysis. Indeed, LEDs are very efficient and have small energy consumption, but are also very costly, and require serious investments. Thus, it may pay for the municipality to consider preparing a procurement guidebook for street lighting when choosing the operator or replacing the bulbs.

### Energy Efficiency Strategy and Action Plan

One of the key recommendations to the public administration in Constanța is the development of an Energy Efficiency and Strategy Action Plan. This is in line with the local government's plans in terms of energy efficiency. In the near future, the mayor is planning to sign the Covenant of Mayors, the mainstream European movement established in 2008 that

brings together thousands of local and regional authorities across Europe, and which is committed to increase the energy efficiency of their municipalities, as well as the use of renewable energy resources.

The main target of this movement is to reduce local greenhouse gas emissions by 20% by 2020 and, thus, make the cities more climate-friendly. This would help reduce energy consumption and decrease the level of greenhouse gas emissions, and would lead to a healthier environment and a better quality of life for citizens. After the mayor signs the Covenant, the local government prepares an action plan that translates political commitments into actions and concrete measures. Currently, there are nearly 5,000 signatories to the Covenant of Mayors, comprising more than 171 million inhabitants across Europe. More than half of the signatory cities have already submitted their Sustainable Energy Action Plans (SEAP) to Brussels.

As of September 2013, 63 small and large cities from Romania have signed the political commitment to reduce their energy consumption by 2020. 30 of the cities have submitted their SEAPs to Brussels. Cluj-Napoca, Timișoara, Brașov, and Ploiești are four of the seven growth poles in Romania that have become signatories of the Covenant of Mayors. Three of them, namely Cluj-Napoca, Timișoara, and Brașov, have already submitted their SEAPs. So far, the only growth pole plan already accepted by the EU body is the one prepared by Brașov. Overall, the Covenant of Mayors approved 11 SEAPs submitted by Romanian cities, namely Moinești, Vaslui, Alba-Iulia, Bistrița, Mizil, Slobozia, Brașov, Arad, Aiud, and Râmnicu Vâlcea, and Baia Mare. A few more cities are working on their SEAPs. The cities should submit their energy action plans within two years after signing the Covenant.

The energy strategy should put together measurable and realistic targets, set out well-defined timeframes, and clearly assign responsibilities. The plan should outline what actions should be taken to reduce energy consumption and outline the projects that should be executed to this end. Ideally, the plan should state from the beginning what are the potential energy savings and the amount of greenhouse gas emissions that could be reduced in connection to each project, together with the costs incurred, and the timeframe for project implementation. The document should mention the people within the local public administration responsible with the monitoring and implementation of



the plan. Representatives from across the municipality and from other groups who will be responsible for the execution of the plan, as well as the stakeholders who will be affected by the plan, should come together and develop the energy strategy in a collaborative manner.

It is important for the plan to allow for carefully monitoring the way the city is going to achieve the reduction in emissions mentioned in the plan, in order to ensure that intermediate targets are accomplished and that progress is made towards overall strategy goals. A monitoring plan together with a host of performance indicators that can be tracked at regular intervals is required. Targets should indicate the level of expected progress over a given timeline. Monitoring should take into account performance indicators, means of measurement and validating measuring processes, a schedule for measurement activity, and assignment of responsibilities. A well-designed plan with a set of concrete and solid measures aimed to tackle energy consumption could also help enhance the economic competitiveness of the city and open ways to greater local energy independence. The plan could be a good opportunity to translate various initiatives into a coherent plan for citywide energy efficiency. In the end, the strategy could be an internal and external promotion tool for the city to gain support for future work on energy efficiency.

In line with this TRACE recommendation, the local government of Constanța seeks to reduce energy consumption and make the city become more sustainable and efficient. After the Covenant of Mayors is going to be signed, the next step the city has to focus on is the energy action plan. When preparing the plan, the city managers should have a few important sections targeting the energy consumption in 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, overall savings achieved from energy efficiency initiatives, and percentage of energy efficiency initiatives for which data is collected every year. TRACE indicators are a good starting point as they offer a number of energy efficiency key performance areas, such as urban transport, municipal buildings, street lighting, water, solid waste, power, which can be used to monitor the city's energy performance. But the plan should not be limited to these indicators only, as other barometers could be introduced in the

action plan, such as those with regard to energy efficiency in private buildings and industrial enterprises.

Several cities in Europe and around the world have prepared their energy action plans, setting clear targets on how to reduce energy consumption, and the measures that should be implemented to help the municipalities meet such goals. For example, Stockholm, one of the Covenant's signatories, has prepared an integrated city planning and management plan, with urban vision, environmental programs, and concrete actions to reduce greenhouse gas emissions and tackle climate change. The plan was implemented in the southern district of Hammarby Sjöstad, which aims to become twice as sustainable as Swedish best standards in 1995. The district integrated resource management (i.e., waste, energy, water, and sewage) through systematic stakeholder collaboration, and has transformed the linear urban metabolism into a cyclical one. The first assessment indicates that the district has achieved between 28% to 42% reductions in non-renewable energy use, in addition to 29% to 37% reductions in global warming potential. The local public administration representatives of Constanța could draw a lesson from such examples and try to work out the most suitable measures in order to replicate similar achievements in their municipality.

The City of Philadelphia is another good example of best practices in terms of improving energy efficiency. The local public administration of Philadelphia employed a series of measures that helped the municipality make progress in their endeavor to reduce energy consumption by 30% by 2015. These measures included a wide range of activities from retrofitting municipal buildings, replacing the municipal vehicle fleet, encouraging conservation among employees, switching to 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 an energy efficiency marketing campaign, and building energy efficient public housing.

### **Awareness Raising Campaigns**

The final TRACE recommendation made to the local public administration of Constanța is about making citizens become more knowledgeable about



the benefits of energy efficiency. The city government should use public education and training campaigns in order to increase citizens' awareness and understanding of the need of reducing energy consumption, as well as change their attitude with regard to energy efficiency. To this end, the municipality should provide citizens with accessible information related to energy efficiency in such a manner as to determine people to adjust their behavior and be more aware about how important is for the city to become more efficient and sustainable. With an initial investment of up to USD 1 million, public awareness campaigns could bring about 100,000 to 200,000 kWh per year of energy savings.

Energy efficiency can be promoted in several ways that could range from advertising campaigns, public events and features in the local media to dedicated websites, training programs in schools, community and businesses centers, and energy efficiency champion programs. The main benefits of such public actions would be the changing in the behavior of the city residents. The indirect payback would include reduced pressure on energy infrastructure, smaller amount of greenhouse gas emissions, better air quality, and financial savings.

One way of increasing public awareness is through specific training programs. The City Hall could think about partnering with an education and training provider to develop specific training programs that could be rolled out in schools and offices. In this case, the primary targets should be the big energy users, such as offices, manufacturing plants, and so forth. In addition, other stakeholders should be invited to join the programs, including non-profit organizations, utility companies, and businesses.

### Promoting solid waste recycling



Source: www.pcwastemgmt.com

Another way of promoting energy efficiency is through public education campaigns that could spread the word about the benefits related to less energy consumption. The local public administration should approach an advertising and marketing company to work out together a strategy for providing energy-efficiency-related information to the city residents. People can learn how to become more mindful about using energy and cut off the unnecessary consumption from a series of communication tools, such as posters, billboards, and leaflets spread across the city, but also from announcements in the local media and advertisements. Sometimes, it is useful to involve a public utility or a business company to help finance such campaigns.

### Promoting selective collection in Altamira, Mexico

**JUNTOS CAMBIAREMOS LA FORMA DE TIRARLOS...**  
**¡ES MOMENTO DE SEPARARLOS!**  
 Orgánicos Inorgánicos

¿CÓMO ENTREGAR NUESTRA BASURA?  
 Debemos de separar nuestros residuos sólidos en orgánicos e inorgánicos y entregarlos en bolsas por separado al camión recolector, con esto contribuimos a la conservación de nuestros recursos naturales.

Altamira, BASF, TLN, gtz

Source: www.factreports.revues.org



One area in Constanța that needs special attention is the solid waste collection process. The 3% pertaining to solid waste collection in the city is small. There is a good chance to make it go up if residents would be provided with minimal background information on how to separate organic garbage from recyclable waste and place items in the colored bins accordingly. Polaris, the solid waste operator, and the local public administration should organize public campaigns to teach people about selective collection through leaflets and information displayed on posters throughout the city. Such actions should improve the city’s selective collection rate.

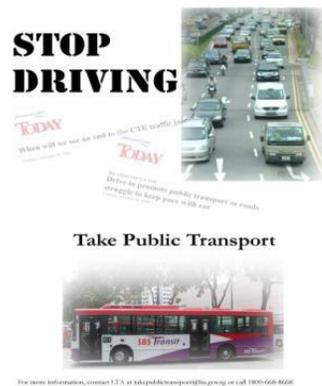
Several cities in Romania have organized campaigns promoting solid waste collection. Timișoara is one of the cities where people responded very well to such raising awareness public actions. Subsequently, the collection rate of recyclable waste in the city increased significantly, from a few percentages to over 12%.

The same approach could be used with regard to promoting public transport or non-motorized transportation. For example, once the new dedicated bike network paths will be built in partnership with the City of Balchik in Bulgaria, the Constanța City Hall should encourage people to use bicycles, and thus rely less on their private cars.

Similarly, the local authorities and RAT Constanța should join efforts to organize information campaigns to increase awareness on the benefits of public transport. Such campaigns should present public transport as a reliable, fast comfortable, safe, cheap, and accessible means of transportation in comparison to other transport modes (including private vehicles).

Another interesting and efficient method that could help raising awareness with respect to energy efficiency is through local energy efficiency champions, individuals who could teach people about the importance and benefits of this matter. The City Hall recruits and trains, on volunteer basis, individuals who could be local public authority figures or different local entities (such as non-profit organizations or businesses) to have them spread the word about the benefits of reducing energy consumption and spending. These champions become the frontline vectors in promoting reduction of energy use. They stay in touch with a designated person from the City Hall who provides them with both knowledge and logistical support, but also monitors the progress of each champion involved in the program. In addition, the local public administration would also keep an eye on the overall effectiveness of the program. As success indicators, they could consider the number of people participating in training programs, the number of hits to energy efficiency websites, articles in the media about energy efficiency in the city, and number of champions trained.

One good example of how public campaigns on energy efficiency can make people become more interested in the subject is provided by the County of Meath in Ireland. The local authorities extended its Energy Awareness Week to all residents of the County by using a dynamic campaign to raise public awareness among consumers through a variety of activities, such as visits to schools, information display, widespread media coverage, competitions, a “Car Free Day,” and an offer of CFL light bulbs. Not only did the campaign help significantly increase the number of requests for energy efficiency from people, but it encouraged the county residents to choose sustainable energy and transport options in the future. The overall cost of the campaign was under USD 5,000, in addition to prizes and sponsorships provided by local companies and other energy related entities.



Source: [www.irenesoo.wordpress.com](http://www.irenesoo.wordpress.com); [www.bangalore.citizenmatters.in](http://www.bangalore.citizenmatters.in)



EUROPEAN UNION



GOVERNMENT OF ROMANIA



MINISTRY OF REGIONAL DEVELOPMENT  
AND PUBLIC ADMINISTRATION



CONSTANȚA



Instrumente Structurale  
2007 - 2013

# Annexes Improving Energy Efficiency in **CONSTANȚA** Romania



ROMANIA  
REGIONAL DEVELOPMENT PROGRAM

TRACE City Energy Efficiency Diagnostic Study



Municipal Buildings



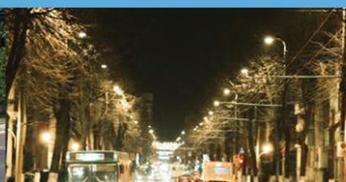
Water and Wastewater



Solid Waste Management



Public Transport



Public Lighting



Power and Heat



PROGRAMUL OPERAȚIONAL REGIONAL

*Inițiativă locală. Dezvoltare regională.*



# Detailed Recommendations from TRACE

## Improving Energy Efficiency in Constanța, Romania

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**ANNEX 1: District Heating Network Maintenance & Upgrade**

**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 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.

**IMPLEMENTATION OPTIONS**

Implementation Activity	Methodology
Feasibility Study	<p>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.</p> <p>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.</p>

**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



	<p>Each option should be appraised against the specific requirements and capabilities of the CA.</p>
Direct expenditures & procurement	<p>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.</p> <p>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.</p>
Energy Services Company	<p>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.</p> <p>See Jiamusi case study for further details.</p>
Legal or Statutory	<p>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.</p>



## 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) were 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](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 Modernization and Modernization Guide"  
[projects.bre.co.uk/DHCAN/pdf/Modernisation.pdf](http://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 summarises 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](http://www.esmap.org/Public_Procurement_of_Energy_Efficiency_Services.pdf)



## ANNEX 2: 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	The City Authority links development densities to public transport

### ATTRIBUTES

#### Energy Savings Potential

> 200,000 kWh/annum

#### First Cost

> US\$1,000,000

#### Speed of Implementation

> 2 years

#### Co-Benefits

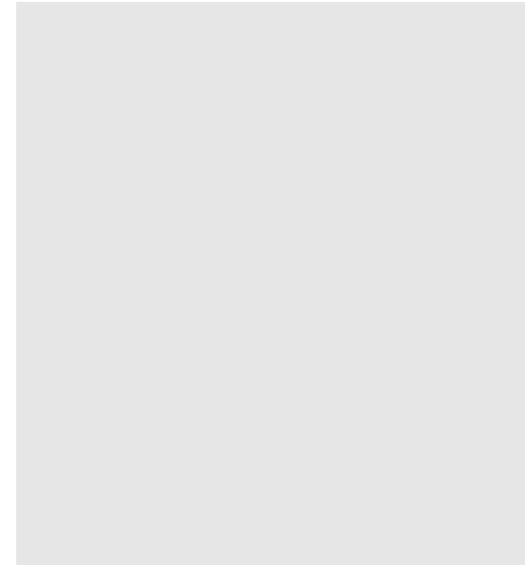
Reduced carbon emissions

Improved air quality

Enhanced public health & safety



regulations & guidelines	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 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](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 totalled 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<sup>2</sup> Cities: Ecological Cities as Economic Cities*, pages 169-182." available online from [http://www.esmap.org/esmap/sites/esmap.org/files/CS\\_Curitiba.pdf](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<sup>2</sup> 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<sup>2</sup> 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/accessible\\_bus\\_stop\\_design\\_guidance.pdf](http://www.tfl.gov.uk/assets/downloads/businessandpartners/accessible_bus_stop_design_guidance.pdf)



### ANNEX 3: 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 details.
Park & Ride facilities	The City Authority promotes multimodality by providing Park & Ride locations at key interchanges. By linking parking to public transport

#### 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



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 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](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, US**

Source: Victoria Transport Policy Institute (2010). "Parking Pricing Implementation Guidelines", available online from <http://www.vtppi.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](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](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 4: 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.

### ATTRIBUTES

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

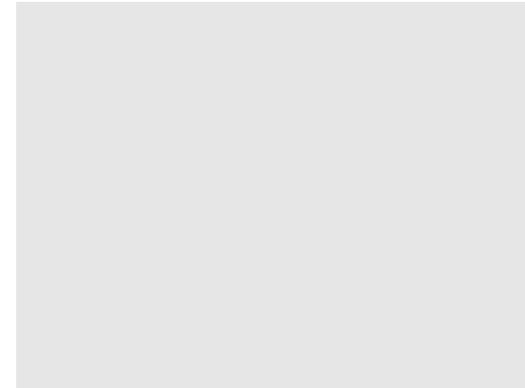
**First Cost**  
> US\$1,000,000

**Speed of Implementation**  
> 2 years

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



	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. 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](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 scheme 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](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](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 5: Municipal Buildings Benchmarking

### DESCRIPTION

Develop a municipal buildings energy benchmarking program which collects and reports on an annual basis the energy use, energy bills, water use, water bills, floor areas, and names of building facility managers (if any). The goal of the program is to identify the highest energy intensive buildings in the CA portfolio so as to focus on the best energy efficiency opportunities.

The benefits of the program are to use energy efficiency program resources most effectively and to spend time and money on the easy wins first. The program will also establish annual data for use in energy/carbon footprint for municipal operations.

This recommendation is best-suited to larger cities with the size and capacity to implement such a program. Regular monitoring and analysis of building energy consumption and identifying improvement opportunities is a good starting point for most cities. However, setting a proper benchmark requires detailed analysis because similar buildings can have significantly varying underlying factors, for example, types of tenants, occupancy density (people per square meter).

### IMPLEMENTATION OPTIONS

Implementation Activity	Methodology
Appoint Benchmarking Leader	Appoint, or allocate 1-2 staff with the skills, experience and personality required to be able to gather a wide variety of data from many departments across the city administration. Alternatively hire an external consultant as a leader for the below activities.
Identify Benchmarking Requirements	Define essential and desirable information useful for an energy benchmarking database. Electricity bills are only one part of the benchmarking database, and many other key data points are required to contextualize the information. Data may include: <ul style="list-style-type: none"> <li>• building name and address</li> <li>• electrical, gas, water utility account numbers</li> <li>• electrical, gas, water utility bills for past 3 years</li> <li>• building floor areas</li> <li>• energy and water meter locations and associated floor areas</li> </ul>

### ATTRIBUTES

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

**First Cost**  
< US\$100,000

**Speed of Implementation**  
1-2 years

**Co-Benefits**  
Reduced carbon emissions  
Efficient water use  
Improved air quality  
Financial savings



	<ul style="list-style-type: none"> <li>• date constructed and date of major renovation</li> <li>• building facilities manager (if any)</li> <li>• building heating, cooling, lighting system types</li> </ul>
Set data collection strategy	Set up an efficient process to collect data for the database. Identify which department and which individuals are likely to have access to desired information. Define which data should be collected every year and set up a method to receive the data every year. Set up a method to check and verify data and allow time for validation. Some data may not exist in CA departments, and if so, primary data must be collected by Benchmarking Team (i.e. floor areas, areas allocated to meters)
Begin collecting data	<p>Appoint junior staff to begin the arduous process of requesting data, receiving data, checking data, and collecting primary data from the source.</p> <p>Alternatively write an RFP and award a contract with a specific scope of work to gather energy benchmarking data for all municipal buildings. Data can be stored in spreadsheets or dedicated energy software tools. Care should be taken to ensure quality checks are undertaken at a detailed level to ensure accuracy of data entry.</p>
Analyze and Interpret Data	<p>Conduct an analysis of collected data to ensure accuracy and begin to identify opportunities. Some examples of analysis include:</p> <ul style="list-style-type: none"> <li>• compare kWh/m<sup>2</sup>/yr electricity consumption by building type</li> <li>• compare kWh/m<sup>2</sup>/yr heating energy by building type</li> <li>• compare total \$/m<sup>2</sup>/yr energy consumption by building type</li> </ul> <p>Starting with buildings with the highest and lowest performance, verify the floor areas allocated to the utility meters and note any special situations which may increase or decrease energy use (server rooms, unoccupied space, renovations, etc.)</p>
Formulate a Bespoke Benchmark	The results of the analysis stage must be used to formulate a benchmark suitable for the underlying factors affecting energy use in the city. This is required as these factors may vary significantly from city to city and



	<p>between different buildings. These factors could include:</p> <ul style="list-style-type: none"> <li>• types of tenants</li> <li>• occupancy density (persons/m2)</li> <li>• building energy management</li> </ul> <p>This benchmarking is usually done for the purposes of building labeling. See Singapore case study for further details.</p>
Present Benchmarking Internally	<p>One of the most significant motivators for energy efficiency in building operations is peer pressure as no building owners or operators want to be seen as having the worst performing buildings. So sharing building energy intensity internally across departments and operators will inherently improve energy consumption. This will also allow operators to share experiences to allow knowledge sharing across the CA.</p>
Publish Benchmarking Publically	<p>The boldest statement to show leadership in building energy efficiency is to publish energy performance data to the public, press, voters, and potential political opponents. This last stage of the benchmarking program may be many years after the commencement of the program when the data shows improvements and tells a good story of progress toward efficiency in government operations. The CA could then challenge (or require as some cities have begun to do) private building owners to benchmark their buildings and publish their results.</p>

**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:

- kWh/m<sup>2</sup> - annual electrical energy intensity by type of building (Schools, Offices, Residential, Hospital, Misc);
- kWh/m<sup>2</sup> - annual heating energy intensity by type of building;
- \$/m<sup>2</sup> - annual energy cost intensity by type of building.

## CASE STUDIES

### **Energy Efficiency in Public Buildings, Kiev, Ukraine**

Source: ESMAP (2010). "Good Practices in City Energy Efficiency: Kiev, Ukraine - Energy Efficiency in Public Buildings", available online from <http://www.esmap.org/esmap/node/656>

Under the Kiev Public Buildings Energy Efficiency Project, 1,270 public buildings in the city of Kiev—including healthcare, educational and cultural facilities—were retrofitted with cost-effective, energy-efficiency systems and equipment. The project focused on the supply-side, such as automation and control systems, and demand-side measures, including installation of metering and weatherization, as well as a sound heating tariff policy. The project was undertaken by the Kiev City State Administration (KCSA). Savings from the retrofitting were estimated at 333,423 Gigacalories (Gcal)/year by 2006—normalized by degree/days in the base-line year—or about a 26% savings compared to the buildings' heat consumption before the project. These upgrades also improved the buildings' comfort level, helped foster an energy efficiency services industry, and raised public awareness of the importance of energy efficiency.

The project cost US\$27.4 million and was financed through a World Bank loan, Swedish Government grant, and KCSA funds. Based on the project's success, many other cities in Ukraine have requested information on the project and expressed interest in implementing similar ones for their public buildings.

### **Building Energy Efficiency Master Plan (BEEMP), Singapore**

[http://www.esu.com.sg/pdf/research6\\_greece/Methodology\\_of\\_Building\\_Energy\\_Performance\\_Benchmarking.pdf](http://www.esu.com.sg/pdf/research6_greece/Methodology_of_Building_Energy_Performance_Benchmarking.pdf)

[http://www.bdg.nus.edu.sg/BuildingEnergy/energy\\_masterplan/index.html](http://www.bdg.nus.edu.sg/BuildingEnergy/energy_masterplan/index.html)

The Inter-Agency Committee on Energy Efficiency (IACEE) report identified strategic directions to improve the energy efficiency of the buildings, industries and transport sectors. The Building Energy Efficiency Master Plan (BEEMP), formulated by the Building & Construction Authority (BCA), details the various initiatives taken by the BCA to fulfill these recommendations. The plan contains programmes and measures that span the whole life cycle of a building. It begins with a set of energy efficiency standards to ensure buildings are designed right from the start and continues with a programme of energy management to ensure their operating efficiency is maintained throughout their life span. The BEEMP consists of the following programmes:

- Review and update of energy standards
- Energy audit of selected buildings
- Energy efficiency indices (EEI) and performance benchmark
- Energy management of public buildings



- Performance contracting
- Research and development

#### **Energy Smart Building Labeling Programme, Singapore**

<http://www.e2singapore.gov.sg/buildings/energysmart-building-label.html>

The Energy Smart Building Labeling Programme, developed by the Energy Sustainability Unit (ESU) of the National University of Singapore (NUS) and the National Environment Agency (NEA), aims to promote energy efficiency and conservation in the buildings sector by according recognition to energy efficient buildings. The Energy Smart Tool is an online benchmarking system that can be used to evaluate the energy performances of office and hotel buildings. It enables building owners to review the energy consumption patterns within their buildings and compare them against the industry norms. An Energy Smart Building Label, reviewed every three years, is awarded to winners as part of an annual awards ceremony.

Apart from helping to reduce energy consumption and carbon emissions within the buildings sector, Energy Smart Buildings stand to:

- Reap energy savings due to active energy management
- Enjoy higher satisfaction levels by occupants
- Enhance the company's corporate image

#### **Municipal Energy Efficiency Network, Bulgaria**

<http://www.munee.org/files/MEEIS.pdf>

Thirty-Five Bulgarian cities have established the Municipal Energy Efficiency Network (MEEN). EnEffect is the Secretariat of the Network. Since April 2001, MEEN has admitted four municipal associations as collective members. In order to create a successful municipal energy plan, MEEN promotes the development of two key elements: an energy database and a training program for municipal officials.

General information is collected into municipal "Passports". This information is gathered through surveys of various organizations and entered into a database, or energy efficiency information system (EEIS). The EEIS has two layers: database and analysis. The database, a Microsoft Access application, contains objective, technical information, and the analysis contains non-technical information, such as financial, institutional and regulatory documents generated at the national level. This information is organized into three categories: municipality-wide consumption, site-specific consumption, and municipality-wide production.

#### **Energy Management Systems in Public Building, Lviv, Ukraine**

Source: ESMAP (2011). "Good Practices in City Energy Efficiency: Lviv, Ukraine - Energy Management Systems in Public Buildings", available online from [http://www.esmap.org/esmap/sites/esmap.org/files/Lviv%20Buildings%20Case%20final%20edited%20042611\\_0.pdf](http://www.esmap.org/esmap/sites/esmap.org/files/Lviv%20Buildings%20Case%20final%20edited%20042611_0.pdf)

The Ukrainian city of Lviv was able to reduce annual energy consumption in its public buildings by about 10 percent and tap water consumption by about 12 percent through a Monitoring and Targeting (M&T) program to control energy and water consumption. This generated an estimated net savings of 9.5 million UAH (US\$1.2 million) as of 2010. The M&T program was launched in December 2006 and became fully operational by May 2007. It provided the city management with monthly consumption data for district heating, natural gas,



electricity and water in all of the city's 530 public buildings. Under the program, utility use is reported and analyzed monthly; targets for monthly utility consumption are determined annually based on historical consumption and negotiations on an adjustment (in cases of foreseeable changes in consumption patterns). Actual consumption is reviewed monthly against the target, with deviations spotted and acted upon immediately and the performance of buildings is communicated to the public through a display campaign. The M&T program achieved significant savings with minimal investment and recurring program costs. These utility bill reductions have been valuable in light of fiscal constraints and increasing energy prices. The program benefited from a crucial initial condition where most of the city's public buildings were already metered for energy and water consumption and that the city had been collaborating with international aid programs in municipal energy since the late 1990s.

Strong city government leadership and commitment were key success factors of Lviv's public buildings energy and water M&T program. A new Energy Management Unit (EMU) was established within the city administration and resources were mobilized to train all personnel with line responsibility on building utility use in an administrative division, unit, or building. The M&T system established responsibility, created transparency, and enabled informed control of energy and water use in public buildings, laying a solid foundation for sustained improvements in energy and water efficiency.

#### **Public Building Energy Management Program, Lviv, Ukraine**

<http://www.ecobuild-project.org/docs/ws2-kopets.pdf>

As part of the Energy Efficiency Cities of Ukraine initiative, launched in 2007 as initiative of 4 cities, supported by MHME, NAER and European Association of local authorities "Energie-Cites", Lviv has promoted sustainable energy policy and action plans at a local level.

The city has developed a Public Building Energy Management Program through the Energy Efficiency Cities of Ukraine initiative. These involve regular data gathering through various agencies and a subsequent monitoring and analysis of building energy consumption in order to identify easily achievable improvement opportunities.

#### **SMEU Software, Romania**

<http://www.munee.org/files/SMEU-romania.pdf>

The SMEU software was created to set priorities for municipal energy action plans and to assess global energy costs and consumption. The goal of this software is to gather, organize and use energy data so that decision-makers could analyze trends in energy use by consumers and by resources and accurately predict the energy budget for the following period.

The SMEU software divides data into individual and interacting modules to collect data on various aspects of the energy cycle. The Locality Module collects information on an annual basis, including area, population, and average temperature, as well as general information on the municipality such as number of buildings and number of dwellings per building.



### NYC Greener Buildings, USA

[http://council.nyc.gov/html/releases/prestated\\_4\\_22\\_09.shtml](http://council.nyc.gov/html/releases/prestated_4_22_09.shtml)

New York City Municipal Buildings were benchmarked for Energy Efficiency. The project, initiated on December 9, 2009 with the passage of the "Greener, Greater Buildings Plan" (formally known as Intro. No. 476-A, Benchmarking Energy and Water Use), puts the city at the head of a national effort to improve building energy efficiency aimed at reducing America's carbon footprint and its use of highly polluting fossil fuels to generate electricity.

The project used the U.S. Environmental Agency's (EPA's) Energy Star Portfolio Manager energy management tool, which is integral to the LEED (Leadership in Energy and Environmental Design) certification process, as established and managed by the U.S. Green Building Council, or USGBC.

The Plan aims to reduce the city's total carbon footprint by 30 percent by 2030 (originally 2017), with five percent of that reduction coming from government, commercial and residential building. After the initial phase is completed, building owners will be required to benchmark yearly.

### TOOLS & GUIDANCE

#### Tools & Guidance

Target Finder helps users establish an energy performance target for design projects and major building renovations.

[http://www.energystar.gov/index.cfm?c=new\\_bldg\\_design.bus\\_target\\_finder](http://www.energystar.gov/index.cfm?c=new_bldg_design.bus_target_finder)

Portfolio Manager is an interactive energy management tool to track and assess energy and water consumption across the entire portfolio of buildings. [http://www.energystar.gov/index.cfm?c=evaluate\\_performance.bus\\_portfoliomanager](http://www.energystar.gov/index.cfm?c=evaluate_performance.bus_portfoliomanager)

A presentation by Berlin Energy Agency on Berlin's Energy Saving Partnership - "a Model of Success" , June 29th, 2010.

[http://siteresources.worldbank.org/INTRUSSIANFEDERATION/Resources/305499-1280310219472/CARce\\_BEA\\_ENG.pdf](http://siteresources.worldbank.org/INTRUSSIANFEDERATION/Resources/305499-1280310219472/CARce_BEA_ENG.pdf)

Energy Efficient City in Russia: Workshop Proceedings, June 2010. A guidance document for Preparing, Financing and Implementing Municipal Energy Efficiency Programs.

<http://www.esmap.org/esmap/sites/esmap.org/files/Russia%20EE%20Cities%20Proceedings%20ENG%20080210.pdf>



**ANNEX 6: Municipal Buildings Audit and Retrofit**

**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: <ul style="list-style-type: none"> <li>• lighting systems</li> <li>• air conditioning systems</li> <li>• heating systems</li> <li>• computers</li> </ul>

**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



	<ul style="list-style-type: none"><li>• server rooms and cooling of servers</li><li>• appliances (water cooler, fridge, vending machines)</li></ul> <p>The Municipal Offices EE Spreadsheet includes estimation methods for energy efficiency potential for offices which includes equipment retrofits, behavioral changes (turning lights off, heating set points, time of operation, etc.) and procurement guidelines.</p>
Set Budget and Requirements	<p>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.</p>
Design Retrofits / Upgrades	<p>Considering the benchmarking data, detailed energy audits and budgetary constraints, design retrofits, equipment replacement and renovation upgrades specifically for each building.</p>
Hire Contractor to Implement Retrofits	<p>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.</p>
Verify Retrofit and Performance	<p>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.</p>



## 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:

- \$/m<sup>2</sup> - Benchmark annual energy cost on a per-square-meter basis for all municipal office buildings;
- kWhe/m<sup>2</sup> - Benchmark annual electrical energy consumption on a per-square-meter basis for all municipal office buildings;
- kWht/m<sup>2</sup> - 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](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. CO<sub>2</sub> 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 CO<sub>2</sub> reductions of more than 60,400 tons 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](http://www.c40cities.org/bestpractices/buildings/stuttgart_efficiency.jsp)

Stuttgart saves around 7200 tons of CO<sub>2</sub> 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](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 CO<sub>2</sub>-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 CO<sub>2</sub> 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](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 7: Street Lighting Timing

### 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.

### 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



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 energy savings	Measure on an annual basis the energy savings achieved by this program 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 Kirklee can save up to 30% of the electricity used annually. By replacing 1,200 lights, Kirklee 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 increased economies of scale will yield a payback period of less than five years.

**Motorway intelligent lights retrofit, Kuala Lumpur, Malaysia**

[http://www.lighting.philips.com.my/v2/knowledge/case\\_studies-detail.jsp?id=159544](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 telemanagement control was employed. Telemanagement 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 8: 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.

**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.

**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



## 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](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](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 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<sup>2</sup> 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<sup>2</sup> 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 9: Awareness Raising Campaign

### DESCRIPTION

Public education and training campaigns will increase the public's awareness and understanding of the benefits of energy efficiency and can help change attitudes towards energy efficiency. Providing information on easy ways to be more energy efficient can help modify citizen behavior and contribute to overall energy-savings. This can be achieved through:

- Advertising campaigns;
- Public events;
- Articles in the local press;
- User-friendly website providing information about energy efficiency;
- Training programs in schools, community centers and businesses;
- An 'energy efficiency champion' program.

Key benefits are more efficient energy behaviors by residents leading to reduced energy consumption within the city. Indirect benefits include reduced pressure on energy infrastructure, reduced carbon emissions and better air quality.

### IMPLEMENTATION OPTIONS

Implementation Activity	Methodology
Targeted training programs	Working with an experienced education/training provider, the city authority develops training programs which can be rolled out in schools and offices. These programs should target big energy users, for example, offices. These programs can also be implemented through a partnership with other organizations, such as utility companies, businesses and NGOs.
Public education campaigns	Working with an advertising and marketing company experienced in public education campaigns, the city authority develops a strategy for providing information on energy efficiency to all residents. This can include posters, billboards and leaflets, as well as public media announcements and advertisements. A partnership can be created with a business or utility company to help finance this.

### 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  
Financial savings  
Security of supply



Energy efficiency champions	<p>The city authority recruits local energy efficiency champions and trains them to teach people about the importance and benefits of energy efficiency. Champions can be anyone interested in spreading the message about energy efficiency, for example, local authorities, businesses, local community groups, NGOs, health trusts, school children and other individuals. This implementation activity can be carried out in a number of ways:</p> <ul style="list-style-type: none"><li>• Ask champions to come to a 'train the trainer' course and provide them with support to run sessions within their own community.</li><li>• Teach champions about simple ways to save energy, and then give them leaflets to distribute in their community. Ensure that champions inform people that they are the local contact for any energy efficiency questions.</li></ul> <p>Since energy efficiency champions are often volunteers, an officer should be appointed to provide support and encouragement, conduct regular follow ups and monitor progress of each energy efficiency champion program.</p>
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## 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:

- Number of people participating in training programs annually;
- Number of hits to city energy efficiency website monthly (if developed) or number of requests for energy efficiency measures;
- Number of articles in the press about energy efficiency in the city;
- Number of energy efficiency champions trained (if this option is chosen).

## CASE STUDIES

### **PlaNYC, New York**

PlaNYC <http://www.nyc.gov/html/planyc2030/html/plan/energy.shtml> ;

[http://www.nyc.gov/html/planyc2030/downloads/pdf/planyc\\_energy\\_progress\\_2010.pdf](http://www.nyc.gov/html/planyc2030/downloads/pdf/planyc_energy_progress_2010.pdf)

PlaNYC is a comprehensive sustainability plan for the city's future. The plan puts forth a strategy to reduce the city's greenhouse gas footprint, while also accommodating a population growth of nearly one million, and improving our infrastructure and environment. Recognizing the importance to reduce global carbon emissions, and the value of leading by example, New York has set the goal of reducing its citywide carbon emissions by 30% below 2005 levels.

Within the Energy sector of the plan, the city has an initiative to undertake extensive education, training, and quality control programs to promote energy efficiency. By 2010, the city launched an energy awareness campaign, and set up training, certification, and monitoring programs. The plan proposes that these measures will be delivered through a series of partnerships until an Energy Efficiency Authority is established.

### **Energy Efficiency Office, Toronto, Canada**

City of Toronto [http://www.toronto.ca/energy/saving\\_tips.htm](http://www.toronto.ca/energy/saving_tips.htm)

The Energy Efficiency Office in Toronto provides energy saving tips for households, businesses and developers on the city's website. As an example, the Energy Efficiency Office conducts the Employee Energy Efficiency at Work (E3@Work), an awareness program designed to save money and promote energy efficiency practices by managing office equipment power loads. Developed and implemented by the City of Toronto in 2002, the program is being promoted to business establishments and offices across the city. The goal is to reduce energy consumption and building operating costs, improve energy security and reliability and help preserve the environment.

### **Low Carbon Singapore, Singapore**

Low Carbon Singapore <http://www.lowcarbonsg.com>

"Low Carbon Singapore" is an online community dedicated to help Singapore reduce its carbon emissions and move towards the goal of a low carbon economy. The project aims to educate individuals, communities, businesses and organizations on issues relating to climate change, global warming and clean energy, providing information, news, tips and resources on various ways to reduce carbon, including



adoption of clean energy and energy efficient behaviors and technologies.

Low Carbon Singapore is published by Green Future Solutions, a Singapore-based business that promotes environmental awareness and action for a green future through a network of green websites, events, presentations, publications and consultancy.

#### **Carbon Management Energy Efficiency (CMEE) Programme, Walsall Council, UK**

Walsall Council [http://www.walsall.gov.uk/index/energy\\_awareness\\_staff\\_presentations.htm](http://www.walsall.gov.uk/index/energy_awareness_staff_presentations.htm)

Walsall Council has been rolling out energy awareness training by with the Carbon Trust under their funded Carbon Management Energy Efficiency (CMEE) programme, including:

- Energy surveys of the council's least energy efficient buildings
- Evaluating feasibility of combined heat and power (CHP) generation at the council's leisure centers
- Raising staff awareness through a number of energy presentations to senior managers, building managers, school caretakers and a number of the council's general staff. A total of 226 staff were trained in this round using presentations developed by the Carbon Trust and adapted, with the help of some of the environmental champions, to reflect Walsall Council's needs.

The aim of the CMEE programme is to identify and achieve significant carbon savings throughout the council and as a consequence financial savings too. By reducing their energy spend, the council will also reduce the number of carbon credits it has to buy under the Carbon Reduction Commitment, which comes into force in 2010.

#### **Siemens Energy Efficiency Academy, Brisbane, Australia**

Siemens [http://aunz.siemens.com/EVENTS/ENERGYEACADEMY/Pages/IN\\_EnergyEfficiencyAcademy.aspx](http://aunz.siemens.com/EVENTS/ENERGYEACADEMY/Pages/IN_EnergyEfficiencyAcademy.aspx) ;

[http://www.siemens.com/sustainability/report/09/pool/pdf/siemens\\_sr\\_2009.pdf](http://www.siemens.com/sustainability/report/09/pool/pdf/siemens_sr_2009.pdf)

The Siemens Energy Efficiency Academy brings together some of the leading international and local experts to share their insights on government policy, emerging technologies, market drivers and best practice implementation.

Apart from adopting and showcasing its own energy efficient practices, it runs regular training programs for businesses across topics such as:

- Incentive schemes: Market mechanisms, grants and funding explained
- Building winning business cases for energy efficiency
- Energy Efficiency Policy in Australian Governments
- Next generation technology - What's next?
- Best practice implementation for variable speed drives and power quality
- Energy monitoring in Industrial and Commercial facilities

#### **Energy Awareness Week, Meath, Ireland**

ManagEnergy "EU LOCAL ENERGY ACTION: Good practices 2005" <http://www.managenergy.net/download/gp2005.pdf>

In 2004, the Meath Energy Management Agency's (MEMA) extended its Energy Awareness Week to everyone who lived or worked in the



County of Meath, Ireland, using a concentrated burst of media campaigning to raise energy awareness among consumers. Visits to schools, information displays, widespread media coverage, competitions, a 'Car Free Day' and an offer of free CFL light bulbs encouraged participation at all levels. The campaign dramatically increased requests for information from the energy agency. The competitions and promotions also improved local knowledge of energy efficiency, and encouraged people to choose sustainable energy and transport options in the future.

Energy Awareness Week activities were coordinated and carried out by MEMA with the support of the Environment Department of Meath County Council. The direct costs for the campaign were US \$ 4,470. This covered printing and copying of promotional materials, prizes, and provision of reflective jackets for walking bus participants. Additional prizes and sponsorship were provided by local companies and by Sustainable Energy Ireland (SEI).

## TOOLS & GUIDANCE

### Tools & Guidance

"EU LOCAL ENERGY ACTION: Good practices 2005" <http://www.managenergy.net/download/gp2005.pdf>



**ANNEX 10: List of abbreviations for cities in the TRACE database**

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



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