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Improving Energy Efficiency in IAȘI România



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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Table of Contents

Executive Summary /1

Methodology /8

Background /11

National Legislation Regarding Energy /11

Background on Iași /17

Iași Sector Analysis /21

Power Sector /21

Street Lighting /23

Municipal Buildings /24

Solid Waste /26

District Heating /29

Water Sector /32

Urban Transport /36

Energy Efficiency Recommendations /47

Energy Efficiency Strategy and Action Plan /48

District Heating/49

Urban Transport /52

Municipal Buildings /59

Street Lighting /62

Annexes /65

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





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 waste water, 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.

Iași is a regional point of interest in North-Eastern Romania, located near the Eastern border of the EU, close to the Republic of Moldova and Ukraine. It is on the Pan European Corridor IX that connects



Northern to Southern Europe. The city is also a linking point from Western Europe to the Commonwealth of Independent States, as it is located on the European Route E58, connecting Vienna to Rostov in Russia. Iași is the most important academic center in the North-Eastern part of Romania. However, Iași is some distance away from București, the wealthiest region in Romania. It also suffers from being some distance away from the rich export markets in the West, which affects its business and trade opportunities. The airport is located just a few kilometers away from the city and is connecting Iași to București and a few destinations in Europe.

Iași shifted from a highly industrialized economy during the communist regime to an academic and predominantly service-based economy. The service sector has developed rapidly in the last two decades, as the number of IT and construction companies have increased five times since 2000, thus becoming the engine of the local economy. Several multinational companies in the field of IT&C have opened their businesses in the city. Today, Iași has a diverse economic base; besides service and academics, the local economy includes some industry (such as oil extraction, primary products processing, chemical, pharmaceutical, tourism), and a very small share of agriculture (especially in the wider metropolitan area).

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 Iași. 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, Iași lost almost 10% of its residents in the last decade. From the second most populous city in Romania in 2002, after the capital București, Iași fell to fourth.

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 Iași are the modernization of rolling stock and improving the traffic flow. Anyway, 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 highest potential of savings stays with the district heating sector. The former district heating operator went bankrupt, and

currently the system has been taken over by a public private partnership between the City Hall and a private district heating operator.

Today, the main challenges to the district heating system concern the upgrading of the hot water/heat pipes, in order to diminish hot water leakages, maintain the heat price at an affordable rate for the population, and gain back market share following the massive disconnections from the centralized heating network in the last 10 years. Like every other city in the country, municipal buildings in Iași demand proper measures toward improving energy efficiency – particularly in health care and education facilities managed by the city government. Although the local public administration keeps track on energy consumption and expenditures in municipal entities, 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. At the same time, although the selective collection has been implemented in the city since mid-2000s, the percentage of recycled waste is low.

The city accomplished a number of positive things to date. For one, although it incurs losses in the network, the water sector covers the entire city and the related connections are metered. Since the beginning of 2000s, hundreds of millions of euros were invested in the expansion of the water network and rehabilitation and modernization of the water plants and wastewater facilities in the city. 95% of the streets in the city are lit, and mercury lamps have been replaced with more efficient sodium vapor bulbs. Iași has a very efficient public transport system, with small energy consumption, operated by buses and trams. The tram network is one of the lengthiest in the country, and it is undergoing important rehabilitation work. A few pedestrian networks have been developed in the city in recent years, and more bike lanes are under way. A few years ago, the municipality opened a bus connection to Ciurea, a commune in the wider metropolitan area, to allow the Roma people especially pupils and students, to access opportunities (e.g., schooling, jobs, culture) in the center city. Currently, there are a number of large infrastructure projects under implementation, with the aim of improving connectivity and access of major neighborhoods in Iași to the city center. Rehabilitation work has been performed in both municipal and residential buildings as well. A number of educational facilities in Iași were renovated, which led to increasing the level of comfort in the buildings. The local government



plans to carry on with the thermal insulation of residential buildings, and renovate more schools and kindergartens in the city. Nonetheless, in parallel, additional work needs to be completed in order to decrease energy consumption, reduce heating bills, and enable the city to become more energy efficient.

As with all other cities in the country, Iași 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 Iași. Some of these projects include improving traffic flow in the city and mitigating traffic congestion, purchasing fuel-efficient rolling stock, increasing the efficiency of the district heating system, continuing expanding the water and sewage networks, developing more bike lanes, and modernize the street lightning system.

This report is based on the implementation of the TRACE tool in Iași 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 is used to assess a city's energy performance in six service areas (urban transport, municipal buildings, water and wastewater, solid waste management, public lighting, and power & heat) and to provide recommendations for improving energy efficiency. In each of the service areas, TRACE uses a benchmarking algorithm to evaluate energy cost savings potential and, factoring in the level of influence of local authorities, it prioritizes what the authorities should do according to where the biggest savings can be achieved.

In order to complete data collection and to get a more comprehensive idea of all these issues in the city, a World Bank field trip

was organized in July 2013. The implementation of TRACE in Iași was carried out in close collaboration with local authorities and public and private utility services providers. At the end of this quantitative and qualitative analysis, several recommendations were formulated, as summarized below.

Energy Efficiency Action Plan and Strategy

The first recommendation made by TRACE to the local government of Iași was the development of a proper energy efficiency strategy and action plan. As the city wants to adhere to the Covenant of Mayors, the next step would be the Sustainable Energy Action Plan (SEAP), a document that will include concrete measures and actions towards reducing greenhouse emissions by 20% by 2020. Such a plan is crucial before embarking on ambitious projects to improve energy efficiency in the city. The energy efficiency strategy can lay out vision and objectives for such work, and provide a list of activities that could help the city achieve those objectives.

District Heating Maintenance and Upgrade

TRACE identified district heating as the sector with the highest energy savings potential in Iași. Thus, through this recommendation, TRACE encourages city managers to consider upgrades of the district heating system. The main challenges of the centralized heating system include diminishing losses in the network and maintaining an affordable heat price for population. The district heating plant is undergoing a large refurbishment that is expected to improve the efficiency of the system. The next step the city managers should focus on is the rehabilitation of the network in order to diminish the losses in the hot water pipes. Therefore, the local government should continue 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 try even to win back some of the lost market and attract new customers.

Non-Motorized Transport Development

The first recommendation made by TRACE to the local public administration of Iași with regard to urban transport focuses on the



developing of non-motorized commuting options in the city (e.g. expanding the network of pedestrian paths and bike lanes). The more people that walk and bike, the lower the use of private cars, and thus less fuel is consumed. The Iași City Hall should encourage fuel-free means of transportations, as this will raise quality of life in the city. At the same time, this would also encourage business development around the newly established pedestrian areas, including additional leisure and entertainment spots. Iași already has a few pedestrian networks in the city center that have become very popular, and a number of new ones are being developed. These have attracted shops, markets, entertainment and relaxing spots, and are points of attraction for many residents. The local government could consider expanding the network of bike lanes, especially on large streets, to encourage more people to cycle.

Parking Restraint Measures

This TRACE recommendation is underscoring the fact that the local government in Iași should consider taking necessary measures to curb the increasing number of private cars pouring into the city. To this end, “Park and Ride” facilities are one the most appropriate ways to deal with traffic congestion. It is a very efficient method to promote multimodality by linking parking to public transport. People who travel to the city drive their cars to these “Park and Ride” lots, from where they take public transport to get in the city center or to their workplace. The city managers should take into consideration 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 extension of public transport infrastructure should precede the development of such facilities.

Traffic Restraint Measures

The main recommendation here is to take the appropriate measures in order to contain the use of private vehicles, whose number has increased rapidly in recent years. The City Hall should encourage people to use more efficient and less costly transport alternatives. As the beltway has been recently completed, the local government is planning to ban heavy vehicles from entering the city. But the local government could take

additional measures. Taking example from other cities in Romania, the Iași City Hall may think about limiting the access of private inter-regional bus operators to only a few stops in the city and enforce reduced speed zones in the city center. The city may consider further initiatives, such as setting up “no driving days” to educate and lead by example.

Traffic Flow Optimization

As everywhere else in the country, traffic congestion is a serious problem in Iași. It is important to tackle traffic congestion issues through a series of measures aimed at changing driving patterns, optimization of traffic signaling, and through proper information programs. Currently, a number of road links are being upgraded, and this is hoped to ease traffic in the city. The local public administration could go even further, and introduce a set of measures that would further improve the traffic flow in Iași. For example, information displayed through GPS or radio-based systems could inform drivers about route switching options and the availability of parking spaces. In line with the local government’s target to improve the quality of urban transport, a new traffic management and monitoring system is already under way.

Public Transport Development

The last recommendation made to the Iași City Hall with regard to urban transport is to continue developing the public transport in the city. The authorities should continue the modernization of the public transport fleet, and purchase new, energy-efficient rolling stock. Expanding the public transport in the metropolitan area would provide better connectivity between Iași and the neighboring localities. This will provide people living in rural communities in the metropolitan area to have better access to opportunities in the city, and also increase the number of public transport 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 Iași’s residents to leave their cars at home.

Municipal Building Benchmarking Program

The city government is trying to keep track of the energy consumption and related costs for the municipal building stock. However, the data is



not complete and not very consistent. Therefore, it may pay for the local city government to take appropriate steps to address this issue. 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 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 Iași. This process would help draw a plan for how resources can be allocated to improve the energy performance of municipal buildings in the city. The results would enable the local government to 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 Iași City Hall plans to carry on this work and modernize some of the educational and cultural facilities. This recommendation is encouraging the city managers to continue laying down the necessary efforts to increase 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 Iași. 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.

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 Iași.

Cross growth pole comparison

Having the benefit of implementing TRACE in seven 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).



Matrix with energy efficiency priorities and proposed programs

PRIORITY 1 District Heating		Energy spending in the sector		Potential savings	
		\$17,373,000		\$2,800,000	
↳		Responsible Institution	Cost	Energy savings potential	Time of implementation
	1. District heating maintenance and upgrade	City Hall+Dalkia	\$\$\$	***	> 2 years
PRIORITY 2 Private Vehicles		Energy spending in the sector		Potential savings	
		\$39,000,000		\$2,200,000	
↳		Responsible Institution	Cost	Energy savings potential	Time of implementation
	2. Non-motorized transport modes	City Hall	\$\$\$	**	> 2 years
	3. Parking restraint measures	City Hall	\$	**	> 2 years
	4. Traffic restraint measures	City Hall	\$\$	**	1-2 years
	5. Traffic flow optimization	City Hall	\$\$	***	> 2 years
PRIORITY 3 Municipal Buildings		Energy spending in the sector		Potential savings	
		\$5,450,000		\$1,800,000	
↳		Responsible Institution	Cost	Energy savings potential	Time of implementation
	6. Municipal buildings benchmarking program	City Hall	\$	**	1-2 years
	7. Municipal buildings audit and retrofit	City Hall	\$\$\$	***	1-2 years
PRIORITY 4 Public Transportation		Energy spending in the sector		Potential savings	
		\$7,200,000		\$1,000,000	
↳		Responsible Institution	Cost	Energy savings potential	Time of implementation
	8. Public transport development	RATP Iasi	\$\$\$	***	> 2 years
PRIORITY 5 Street Lighting		Energy spending in the sector		Potential savings	
		\$1,600,000		\$450,000	
↳		Responsible Institution	Cost	Energy savings potential	Time of implementation
	6. Street lighting timing program	City Hall	\$	***	< 1 year



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

Priority sectors for energy efficiency improvements in growth poles

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

For most growth poles, urban transport (private vehicles and public transport) was identified as a key sector, although cities like Iaşi 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., Braşov, Cluj-Napoca, Timișoara), while others (e.g., Ploieşti 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, they allow higher profitability for public transport operators (since every transit stop serves on average more people than in less dense cities), they enable walking and biking as means of commuting, they discourage car use and transport-related pollution, they can help lower greenhouse gas (GHG) emissions, they require less energy expenditures for the delivery of key public services (e.g., pump costs for water, fuel costs for garbage collection). It is estimated that the energy consumed for transport needs in a city with a density of less than 25 people per hectare may reach an annual average of 55,000 mega joules per person. By comparison, in an urban area with a density of 100 people per hectare, this figure is about three times lower.¹

Consequently, a separate section on spatial planning was introduced in the report, discussing some key related issues for each city studied. A more complete analysis of spatial planning challenges in Romanian cities is included in the *Enhanced Spatial Planning* report.

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



Methodology

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

1. Collection of Candidate City Energy Use Data

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

2. Analysis of City Energy Use Against Peer Cities

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

3. Assessment and Ranking of Individual Sectors

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

The main frame of TRACE





4. Ranking of Energy Efficiency Recommendations

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

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

The TRACE Benchmarking Module



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

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

5. Report Preparation and Submission

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

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

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



Background

The 7th largest country by population in the European Union (EU), Romania is located in Southeastern Europe, in the lower basin of the Danube River. It has a stretch of coastline along the Black Sea and also 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
București	1,883,425	1,934,449 (#1)
Cluj-Napoca	324,576	318,027 (#3)
Timișoara	319,279	317,651 (#4)
Iași	290,422	321,580 (#2)
Constanța	283,872	310,526 (#5)
Craiova	269,506	302,622 (#6)
Brașov	253,200	298,584 (#8)
Galați	249,432	283,901 (#7)
Ploiești	209,945	232,452 (#9)
Oradea	196,367	206,527 (#11)

Source: National Institute of Statistics, 2012 Census
(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.² In order to comply with EU requirements, the Government transposed the Directive No.2006/32/EC regarding energy efficiency among the end users and energy suppliers into national legislation, requiring EU member states to undertake steps to reduce energy consumption by at least 9 % for 2008-2016, as compared to consumption for the previous five years.

The Energy Road Map for Romania was approved in 2003 during the negotiations for EU membership. Pursuant to EU Directive on energy reduction, the **First Energy Efficiency Action Plan** for the period 2007-2010 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 Government, in addition to investments in equipment to oversee energy

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

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

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 Plan⁴ 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 2004-2015⁵ set an ambitious 40% target in energy intensity reduction for the period 2005-2014. Decrease in energy intensity should be achieved through programs promoting high energy standards for new installations, as following: 41% in buildings, 29% in the energy sector, 16% in industry, and 14% in transport. Few years later, the **National Strategy for Energy Efficiency for the period 2007-2020**⁶ set further targets to reduce energy intensity by 41% through 2020 by advancing feasible solutions to cover the country's future energy demand at a lowest price. By then, estimated primary energy savings and reduction of losses should achieve anything between 25% and 40% (20-25% in industry, 40-50% in buildings, and 35-40% in transport), by improving efficiency in the power sector. The energy saving target was set to 3.4 Million toe by 2020. In this context, 1.9 Million toe saving is expected to come from fuel substitutions, 800 ktoe from high

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

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

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



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

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

The Strategy for Use of Renewable Energy Sources,⁸ approved in 2003, encourages energy production from renewable sources in order to increase the share of electricity produced from such sources. Romania's potential of renewable energy sources is estimated at 14,718 ktoe. However, the development of such energy potential is constrained by obsolete technological limitations, economic efficiency, and environmental restrictions. Therefore, the plan is pushing for transfer of unconventional technologies from experienced companies, joint-ventures, and private public partnerships. The target shares for renewable energy sources out of the total energy consumption were set at 33% for 2010, 35% for 2015 and 38% for 2020. Use of renewable energy could result in 1.8 Million toe energy saving from primary sources by 2020. **The National Renewable Energy Action Plan**⁹ outlining the renewable energy national

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

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

⁹ The National Renewable Energy Action Plan – available at (in Romanian)
http://www.minind.ro/pnaer/PNAER_29%20iunie_2010_final_AlX.pdf English

policy was drafted in 2010, in the very difficult context of the economic crisis. It encouraged the use of liquid bio-fuels, liquid gas, geothermal and clean energy, as well as the integration of biogas into the natural gas grid and retrofitting technologies. The Directive 2009/28/EC on renewable energy set the national target for the share of energy from renewable sources in gross final production of energy at 24% for 2020. The expected total energy consumption in 2020 was set at 30,278 ktoe, of which 7,267 ktoe in renewable energy. Targets for specific industrial sectors have been designed, such as 10% for transport, 22% for heating, and 42% for electricity.

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

Government Ordinance 22/2008¹⁰ 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

version is available at
http://ec.europa.eu/energy/renewables/action_plan_en.htm (click on "Romania").

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



(MRDPA) and it is developed in partnership with local authorities. It aims at increasing the energy performance of buildings, improving the quality of life for inhabitants and, not in the least, contributing to a better townscape. Public buildings and dwellings built between 1950 and 1990 are very poorly insulated and offer low thermal comfort, causing significant loss of energy. The key beneficiaries of the program are owners' associations. Thermal insulation can reduce maintenance costs for heating and hot water consumption and decrease heat loss and consumption. It can achieve up to 25% energy efficiency, while the heating bills are expected to drop by 40% during winter time. Moreover, in the summer, rehabilitated buildings can better keep the appropriate thermal comfort of the dwellings without additional costs for air conditioning. A guide regarding how the rehabilitation work should be done is available on the Ministry's website¹¹.

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

At the end of 2012, **Government Emergency Ordinance 63/2012**¹³ brought some changes to the rehabilitation program coordinated by the MRDPA. According to new regulations, residential

¹¹ The guide is available at:

http://www.mdr.ro/userfiles/constructii_ancheta_publica_contr429_contr411.pdf

¹² Government Ordinance 18/2009 available at:

http://www.mdrl.ro/_documente/lucrari_publice/reabilitare_termica/OUG_reabilitare.pdf Methodological regulations available at:

http://www.mdrl.ro/_documente/lucrari_publice/reabilitare_termica/Norme.pdf

¹³ Government Emergency Ordinance 63/2012 available at:

<http://www.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**¹⁴ owners associations must have 10% down payment, while the rest is covered from a bank loan. The owners' associations pay back the loan from the savings obtained over the heating bills before the thermal insulation work is complete. This new program includes old buildings built between 1950 and 1990, those developed after 1990, and individual homes.

The **Directive 2010/31/EU on the energy performance of the buildings** requires¹⁵ 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

¹⁴ Emergency Ordinance 69/2010 approved by Law 76/2011 available at:

http://www.dreptonline.ro/legislatie/oug_69_2010_reabilitarea_termica_cladirilor_locuit_finantare_credite_bancare_garantie_guvernamentala.php

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



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

As part of EU requirements, Romania adopted Law 372/2005 addressing the energy performance of residential buildings. An **energy performance certificate** is issued based on the final energy consumption of buildings and apartments. The country also transposed into national legislation EU Directive 2003/30 EC¹⁶ on the promotion of the use of bio-fuels or other renewable fuels for transport. **Government Emergency Ordinance 1844/2005**¹⁷ established a 2% share of renewable energy in the transport sector by the date of Romania's accession to EU (2007) and a 5.75% share by 2010.

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

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

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

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

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 CO₂ 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.¹⁹ The netto power provided was 11,424 MW, and domestic consumption accounted for 7,413 MW. In February 2013 the split of domestic consumption by types of energy production showed that the largest share is based on coal (33% - 2,593 MW), followed by hydro carbons (23.9% - 1,877 MW), hydro energy (24.8% - 1,948 MW), and nuclear (18.1% - 1,419 MW). Wind energy is almost nonexistent, with only 0.3% or 24 MW.

The electricity sector is unbundled, with several players in the field. There are quite a few companies in charge with production, a significant number of distributors, and a noteworthy number of suppliers. However, there is only one player responsible for energy transmission and who owns the entire transmission network, Transelectrica, a state-owned company. Energy production is divided into seven major producers, namely Complexul Energetic Oltenia,²⁰ Complexul Energetic Hunedoara,

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

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



Nuclear Electrica, CE Arad, SC Electrocentrale Deva, Hidroelectrica, 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)²¹ was established in 1999 and is the regulatory body in the field of electricity (including heat produced in co-generation) and natural gas. The Agency is dealing with licensing, issuing technical and commercial regulations, and protecting of the interests of consumers and investors. The agency regulates tariffs for energy and natural gas for domestic and non-domestic clients, approves the calculation methodology to set up tariffs and prices, and sets tariffs for captive consumers (those who cannot choose the energy provider). It also establishes tariffs for electricity companies, transmission and distribution systems and for activities associated with heat production through co-generation.

OPCOM is the Romanian energy market operator established in 2000, as a joint stock company subsidiary of the Romanian Transmission and System Operator, Transelectrica. The company is providing the framework for the commercial trades' deployment on the wholesale electricity market; it exercises the role of Day-Ahead market operator and administrator of the Green Certificates, as well as of the greenhouses emissions certificates trading platform.

Green Certificate is a mechanism promoting energy produced from renewable sources such as from hydro used in power plants with installed capacity up to 10 MW of wind, solar (photovoltaic), geothermal

and natural gas associated, biomass, biogas, gas from the landfill waste fermentation and from fermentation of sediment from sewage treatment of used waters. Energy producers receive a Green Certificate for each MW of energy produced from renewable energy and sent to the national grid. The law is forcing suppliers to purchase a mandatory quota of green certificates from the total amount of electricity distributed to the end users. A number of certificates are annually available. The Green Certificate has unlimited validity, and it can be traded separately from the electricity associate through bilateral contracts or on the green certificates centralized market. The price varies from 27 EUR (to protect the producer) to 55 EUR (to protect the consumer). At the end of 2012, 300 Million Green Certificates were available in Romania for the period 2013-2019. The EU approved in July 2012 an additional distribution of 71.4 Million 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 energy²². 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.

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

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

²²More information available at: 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 Iași

One of the largest cities in Romania, Iași is the seat of the county with the same name, located in North-East part of Romania, between the Iași Ridge (Coasta Iașilor) and the Jijia Plain, along the Bahlui River. It is the main economic center of the Romanian region of Moldova. The city is very close to the Eastern border of the country, which is also the Eastern border of the EU. Iași is close to the Republic of Moldova, from which Romania is divided by the Prut River, and to Ukraine.

Iași is a regional point of interest, connected to București and major cities of Romania, and only a couple of hours drive from Chișinău, the capital of Republic of Moldova. The surrounding area is one of uplands and woods, as the city stands partly on hills and partly in the in-between

valleys, amid vineyards, gardens, and parks. The climate in Iași is temperate-continental, with hot summer and very cold, windy winters.

Iași and its wider metropolitan area is located on the Pan European Corridor IX, linking Northern to Southern Europe. Iași is connected to București and other major cities in Romania through a couple of national roads. It is also part of the European route E58, connecting Vienna in Austria to Rostov on Don in Russia, which makes Iași the linking point from Western Europe to the Commonwealth of the Independent States. Known as the “Cultural Capital of Romania,” Iași is a strong academic and historical center. It is one of the most important higher education centers in the country, gathering over 60,000 students annually in eight public and private universities, including one of the oldest in the country. A historical center with an exquisite architecture, Iași has an impressive cultural heritage consisting of dozens of ancient churches, monasteries, bourgeois buildings, museums, and galleries.

The Palace of Culture, the landmark of Iași



Source: www.cronicadeiasi.ro

With a municipal area of 94.7 square kilometers, in 2002, Iași was the second most populous city in Romania, but fell to fourth ten years later. According to the final results of the 2012 census, currently, there are 290,422 residents living in Iași City, a decrease by 9.7% over the last



decade. The municipal area of the city has a density of 3,092 people per square kilometer. At present, the metropolitan area is spread over 808 square kilometer where 382,484 people live. It comprises the municipality of Iași and 13 communes, namely: Aroneanu, Bârnova, Ciurea, Holboca, Lețcani, Miroslava, Popricani, Reditu, Schitu Duca, Tomești, Ungheni, Valea Lupului, and Victoria. The city is a main attraction for people from across the Iași County. However, because in the last years the city imposed some restrictions with regard to local residency, a considerable number of people have settled in the adjacent localities, such as Ciurea, Holboca or Tomești, which resulted in a rise in population in the wider metropolitan area.

During the Communist times, Iași used to be a highly industrialized city, relying on pharmaceutical, chemical, metallurgical, heavy equipment, textile, food, and furniture industries. This brought into the city numerous residents from rural areas. Consequently, the urban area expanded and the population went up by 69%. After the fall of the Communist regime, the local economy shifted from an industry-based one to an academic and predominantly service-based economy. The service sector has undergone a substantial expansion over the past decade, once IT and construction companies have increased five times compared to year 2000.

Currently, the local economy in Iași city is essentially based on services, some industry (such as oil extraction, primary products processing, chemical, pharmaceutical, tourism), and very little in agriculture (in rural communities in the wider metropolitan area). The city is an important IT center, with the presence of several international companies, such as Amazon, BitDefender, Continental VDO, Ness Technologies, Bentley Siemens Systems, or Pentalog.

In addition, two universities in the city offer specific IT&C degree programs. The top 10 largest companies in Iași employ between 1,200 and 2,600 people each. Among these are three universities (i.e., the A. I. Cuza University, the Gh. Asachi Technical University, and Grigore T. Popa University of Medicine and Pharmacy), two health care facilities (the Sfântul Spiridon University Hospital, and the Sfânta Maria Children's Hospital), one pharmaceutical company (Antibiotice Iași), an IT firm (Delphi Diesel Systems), and three public utility companies in charge with water, transport, and district heating services.

The A. I. Cuza University, one of the main universities in Iași



Source: www.cronicadeiasi.ro

Overall, almost 60 percent of the active population in the city works in the services sector, 29% is employed in industry and commerce, while only 3% are involved agriculture. In the last decade, the level of active population decreased and instead the number of retirees went up. For instance, in 2002 17% of the people in the wider metropolitan area were retired; by 2008 this figure increased to 23%.

The city and its surroundings are home to 10 monasteries and over 100 old, historical churches, many listed in the National Register of Historic Monuments. Among the most popular and outstanding buildings are the Three Holly Hierarchs Monastery and the neo-gothic style Palace of Culture in the city.



The Three Hierarchs Church in Iași



Local Energy Efficiency Laws

Iași is one of the municipalities that have benefited from the **Rehabilitation Program of Residential Buildings Built between 1950 and 1990** coordinated by Ministry of Regional Development and Public Administration (MDRAP). A number of 639 apartments from 20 residential buildings have undergone thermal rehabilitation between 2009 and 2011. The Ministry covered half the rehabilitation work cost, while 30% of the money came from the local budget, and a contribution of 20% from the owners' associations.

Like everywhere else in Romania, the Local Council Iași can grant **building tax exemptions** for a period of minimum seven years for owners who have thermally rehabilitated their buildings on their own expenses. In addition, people who pay for the renovation of their building façade will benefit from **tax exemptions** from the related building taxes for a period of five years. The exemptions are granted based on the energy performance certificate or energy audit, in addition to proofs that the rehabilitation work was performed and completed in compliance with the required standards.

In 2002, the city government prepared the **Iași Municipality Strategy for Sustainable Development**, known as Local Agenda 21, with

the support of United Nations Development Program²³. The document was intended to be a vehicle for promoting sustainable development, seeking to strike a balance between economic growth, social equity, and environmental protection. One section of the strategy addresses the district heating issue, targeting to increase the energy efficiency of the sector by optimization of the heat supply network. Among the measures mentioned in the document is a monitoring system for heating plants aimed at reducing hot water losses. Eventually, this would contribute to decreasing the price for heat, into curbing the fuel needed to produce heat, as well as lowering greenhouse gas emissions. As a result, three thermal points and heating sub-plants in the city have been equipped with new, modern installations. Between 2002 and 2004, EUR 10.7 million was spent for some modernization work of the district heating plant in Iași.

Urban Growth and Energy Challenges in Iași

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

²³ Iași Municipality Strategy for Sustainable Development available at: http://www.ncsd.ro/documents/local_agenda_21/AgLoc21_Iași_eng.pdf



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.

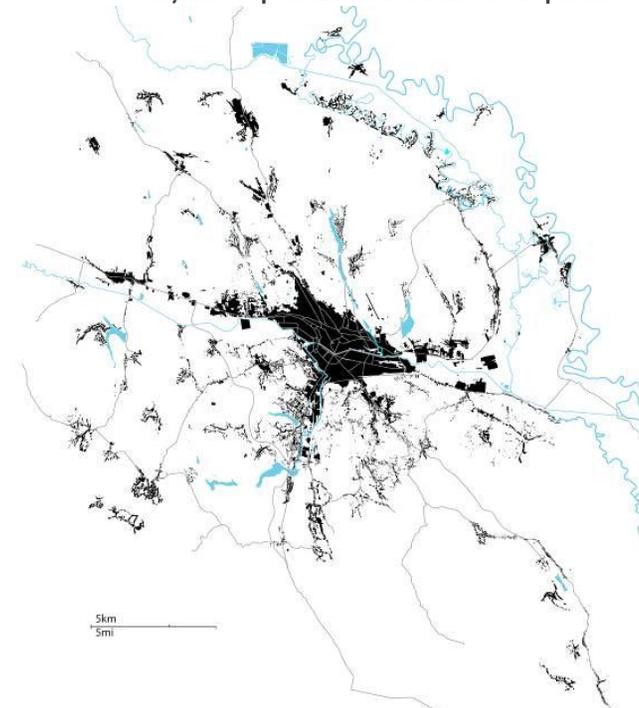
Local authorities are not powerless though in addressing those challenges. They have a number of tools they can use to ensure that the loss in density is not too pronounced and that the city expands in an organized, compact, and sustainable fashion. The challenge is of course to do spatial planning at 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.

At its own scale, Iași is part of an area with a relatively low urbanization rate (there are few towns and municipalities in its proximity) and it is surrounded by rural areas with relatively high population density (as compared to the density of all rural areas in Romania). Beyond its high urbanization potential, the city has a diverse economic base, with significant promise for the future. Iași benefits greatly from being one of the most dynamic academic centers in Romania and Eastern Europe, which has helped contribute to the emergence of an eclectic economic base.

The built mass of Iași and its metropolitan area has expanded by 17% between 1992 and 2012. Much of the absolute growth took place in the City of Iași, although a number of localities in the wider metropolitan area have grown faster in relative terms, such as Valea Lupului, Miroslava, Rediu, or Bârnova. Unfortunately, much of this new growth has not happened in a sustainable way. Most of the residential developments in the area are largely single-household, detached housing units, following a low-density development pattern.

Iași is one of the growth poles where sound spatial planning is mostly needed. Both new developments and the villages developed before 1989 follow a scattered pattern. Expanding public services to these peri-urban areas (whether it is water, sewage, roads, public transport, gas, or street lighting) will be very costly and energy intensive.

Iași metropolitan area urban development



Therefore, the city should focus on sound spatial development patterns and attempt to guide future spatial development in a sustainable fashion. For most projects, such as public services infrastructure, a simple cost-benefit analysis is likely to show that focusing on dense and compact communities will be better than doing the same investments in a more sparsely developed area.

As the number of commuters grows, so does congestion and pollution in the city. And if the quality of life is perceived to be decreasing, Iași 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.



Iași Sector Analysis

Power Sector

The main energy operator in the city as well as in the region is E.ON Moldova, a German-based company operating in the field of electricity and natural gas in Romania since 2005. Like many other players in this sector, the company is both a supplier and a distributor of electricity. The electrical wing of E.ON caters to six counties, namely Bacău, Neamț, Iași, Suceava, Botoșani, and Vaslui, covering 36,800 square kilometers and providing electricity to 1.5 million people. The company has a grid length of approximately 80,000 square kilometers. An entity with 1,582 employees, E.ON Electrica managed to have a good turnover of 153 million EURO in 2012.

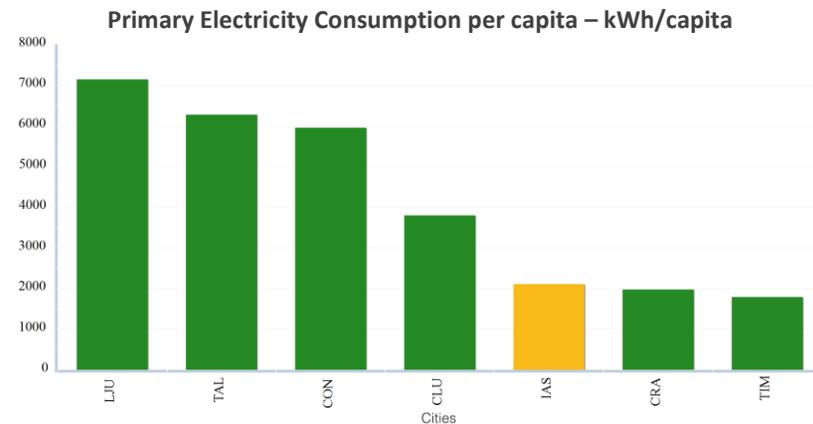
The overall energy consumed in Iași in 2012 amounted to 611,900,000 kWh. Of this, 180,692,000 kWh was consumed by domestic customers, representing around 100,000 apartments. The city's monthly energy consumption varies depending on the season, from 95 MW in summer to 110 MW in the peak-load in winter.

By far, the biggest consumers in the city are the industrial facilities and economic agents. The largest consumer is Palas Mall with 16.6 GWh electricity used in 2012. Other important clients are Romcarbon, a PET recycling company (15.9 GWh), Ceramica, a masonry materials firm (15 GWh), Fortus, a heavy equipment and large machining private entity (12.7 GWh), Antibiotice, a pharmaceutical company (13.6 GWh), Arcelor Mital, a steel plant (10 GWh), and Iulius Group, one of the two malls in the city mall (9.2 GWh).

The city is doing well in terms of energy consumption. With an average consumption of 2,106 kWh per person, Iași performs better than other cities with similar climate within the TRACE database (e.g., Ljubljana, Cluj-Napoca, or Constanța) and comparable to Craiova, but slightly behind Timișoara.

Overall, in 2012 the losses in the network for the Iași metropolitan area accounted to 13%, the equivalent of 63 million kWh. The non-technical losses were 4.3 million kWh (less than 1%). However, the total losses for the City of Iași are only slightly higher, approximately 16%. The target loss for Iași County is 13%, a figure higher compared to

the objective of 9.5% set by ANRE, the Romanian regulatory energy authority, to all energy companies in the country. The difference from 16% to 9.5% is translated into EUR 15 million losses, a figure which actually is not recognized by ANRE.



The main reasons behind the technical losses have to do with the quality of the network and the structure of energy consumption. Part of the electricity network is fairly old, from the 60s, and has not been modernized ever since. Most of the small low voltage installations have not been upgraded in years. At the same time, because the great bulk of customers are primarily residential buildings and apartments, the company must install low voltage-transforming points to convert high-voltage electricity (above 110 kV) to low voltage power (up to 1kV). High consumption at low voltage means high technical losses. In order to mitigate the losses, the company installed several distribution points of 6kV. In addition, E.ON lost some of the big industrial clients as companies closed down entirely or reduced their businesses because of the economic downturn. At the same time, the main energy generation facility is too far from the Iași area, a fact which is adding to the technical losses.

Another challenge is the underground theft of electricity. Fudged meters are installed making electricity consumption go down, and lowering electricity bills. It is assumed that the electricity stolen in such a way can be as high as 20%.



According to E.ON, most of the technical losses in Iași could be overcome if there would be a few more large consumers to use high voltage electricity. The company wants to decrease technical and commercial losses in the future and make the system more efficient. To this end, E.ON's proposed measures include modernization of the overhead lines of the low voltage system, upgrading of medium voltage network (from 6 to 20 kV), and development of a genuine SCADA system for Iași city. The company already installed an intelligent remote metering system that could tackle the theft for the network, and thus, help decrease operational expenses and losses in the national grid. In addition, E.ON plans to improve the communication related infrastructure by replacing the classical wired-based network with optical fiber.

High voltage electricity pillars



Source: www.gmelectric.eu

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 use 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 per kWh 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 plan of RON 0.1715. Some others may go for a monomial tariff with consumption included. In this case, the tariffs are as 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 it is 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 in the weekend and off peak-load instead. People who choose this plan may end up paying anywhere between RON 0.2113 per kWh and RON 0.8089 per kWh, in addition to the daily charge of RON 0.1715.

Finally, the captive consumers can opt for different tariffs for day and night. In addition to the daily reservation tariff of RON 0.1715, they pay RON 0.5682 per kWh 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 (i.e., economic agents and industry operators), they can pick among several plans. For example, 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 flat monthly plan between RON 240 and RON 1,260 depending on the type of intensity, and from RON 0.0536 to RON 0.0670 per kWh of reactive energy.



Street Lighting

Two private companies, namely Luxten, and Flash Lighting Services, respectively, operate the street lighting system in Iași. Both companies signed in 2005 concession agreements for 12 years, covering a wide range of service, from operation, design, modernization, and expansion of the street lighting system to maintenance services and reduction of energy consumption. The companies also design and ensure illumination during celebrations and holidays (such as Christmas and New Year). They are also responsible for the lighting of buildings and architectural groups in the city. The value of the contract with Luxten totals EUR 8,260,000 without VAT, while annual maintenance services amount to 143,480 EUR without VAT. The agreement signed with Flash Lighting Services is for EUR 8,415,600 without VAT; in addition, the City Hall must pay EUR 163,134 without VAT annually for maintenance services

At present, there are 19,660 lighting poles spread across the city; around two-thirds (approximately 11,500 units) are owned by E.ON, the electricity provider, while one-third is the property of the Iași City Hall.

The Local Agenda 21 indicated that beginning with the mid-2000s, the municipality of Iași spent more than EUR 9 million to improve the quality of street lighting, by replacing nearly 8,000 lighting poles, and also expanding the network to a few hundreds of streets. Perhaps one of the most important steps taken towards increasing efficiency of the system was the replacement of old mercury lamps with sodium vapor-based bulbs. As a result, the energy intensity of new bulbs dropped by almost a third, from 250 Watt to down to 100 Watt. Currently, 95% of the total 682 kilometers of streets in the city are lit. However, the lighting network does not cover the newly emerged residential neighborhoods. In 2012, the electricity consumed for street lighting throughout the year (including holiday lighting and illumination of building) amounted to nearly 12 million kWh, for which the City Hall paid almost USD 1.6 million. In the recent years, the electricity bill used to be calculated based on some sort of estimations and foresights; starting 2013, the City Hall will be billed according to actual consumption.

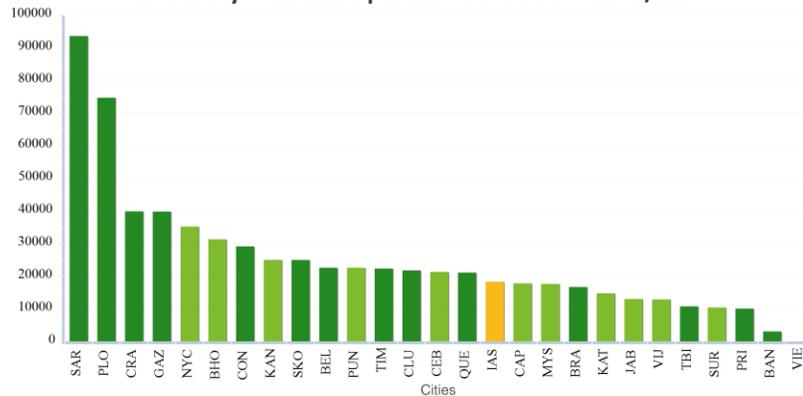
Sodium vapor bulbs in Iași



Switching from mercury lamps to sodium vapor bulbs increased efficiency of the street lighting system in Iași. However, the energy consumption per lighting pole did not go down, in fact it went up over the past few years. With a consumption of 607 kWh per lighting pole, Iași is performing slightly behind most of the growth poles in Romania, except for Timișoara. Nevertheless, when it comes to electricity consumed per kilometer of lit roads, the city is doing fairly well. Iași is placed on the lower side of the TRACE database compared to cities with similar Human Development Index. The electricity consumption per kilometer of lit road in Iași is 18,307 kWh, a lower figure than in most of the growth poles in Romania.



Electricity consumed per km of lit roads – kWh/km



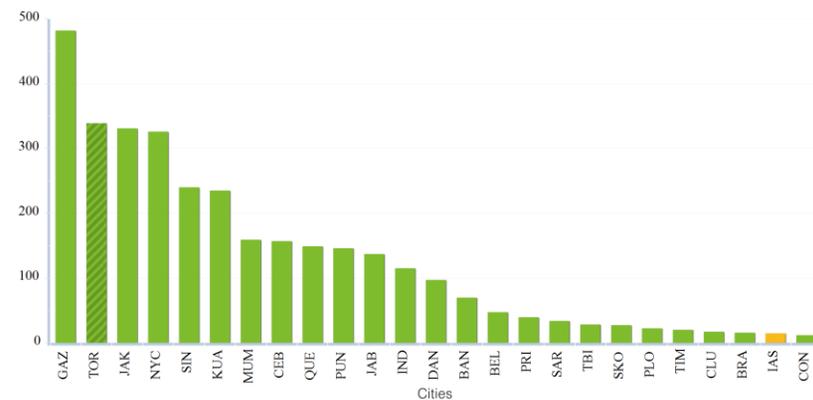
E.ON is in charge with turning on the lights in the city, based on a schedule that has been agreed upon by City Hall and which varies depending on the season. There are 1,000 electricity distribution points spread across the city that measure energy intensity of the street lighting. Over the past few years, some of street lighting related electricity meters were replaced. As a result, it has been noticed that consumption went down at some of the poles. While E.ON is also responsible for repairing the overhead electric cables when they are damaged, the two private operators must take care of various other problems they may occur to the lighting poles. Lighting the city in the nighttime require higher electricity consumption than during daytime. The city is currently implementing a street lighting dimming program based on the season and the level of brightness outside.

In the medium run, the city managers have ambitious plans to improve the street lighting in Iași and increase its overall efficiency. They want to invest in the street lighting electricity distribution network and upgrade the system. To this end, the city managers plan to introduce an automated street lighting system, and gradually switch to LED bulbs. In addition, they think about using sometimes in the future electricity generated from renewable sources, such as solar panels.

Municipal Buildings

The main building stock under the management of the Iași City Hall comprises a number of 116 buildings – 23 schools, 32 high-schools and colleges, 49 kindergartens, 9 daycares, and 3 municipal hospitals. In addition, there are a number of administrative offices, cultural and social services facilities. Some of the municipal facilities have more than one building, including dorms, sports-halls, dining-halls, etc. The total floor area of the municipal buildings amounts to 625,000 square meters. In 2012 the electricity consumption in these units was a little over 9 million kWh, which would amount for 14.7 kWh per square meter. This figure places Iași in the lower side of the TRACE database, with one of the smallest consumptions, second after Constanța.

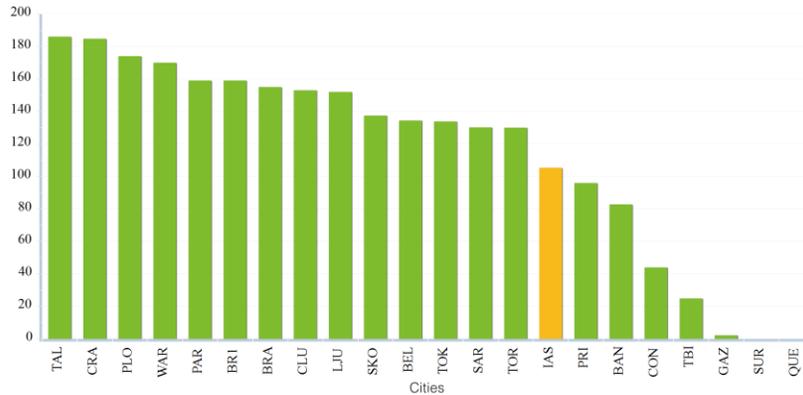
Municipal Buildings Electricity Consumption - kWh/m2



When it comes to heating, the municipal buildings consume 105.3 kWh/m2 per square meter, a figure that again places Iași in the lower side in the TRACE database. The heat consumption in Iași is lower than in comparable cities in Eastern Europe, such as Cluj-Napoca, Brașov or Ploiesti, but it is higher than in Constanța or Banja Luka.



Municipal Buildings Heat Consumption – kWh/m²



One explanation for such small consumption is that educational units do not operate the entire year. They are closed several months a year, for winter and summer breaks. Not all buildings under the city management receive hot water and heat from the district heating plants; some of them have switched to natural gas-based individual micro-heating units. In the near future, the local government wants to re-connect some of the kindergartens and schools to the centralized heating system. Overall, the energy expenditures for the municipal buildings cost USD 5.45 million, which accounts for 2.46% of the city budget.

A department within City Hall monitors the electricity and heat consumption and related expenditure in the municipal buildings in Iași. Energy consumption monitoring lays the foundation for the upcoming energetic studies on municipal buildings the City Hall is currently working on. According to new regulation, municipal buildings must prepare a so-called monthly/yearly electricity “consumption plan”.

Over the course of time, the local administration has undertaken steps to improve energy efficiency of the public building stock. To this end, the city managers focused on two issues: renovation of buildings, and monitoring energy consumption. Some of the kindergartens and schools in the city have been renovated. The renovation work included thermal and hydro-insulation, replacement of old woodwork with double-glazed windows and new doors, refurbishment of technical installation, and

insulation of rooftops. The façade of almost a third of the municipal buildings was renovated and replaced. The city authorities hope to do similar renovation work for health-care facilities.

One of the newly renovated education facilities in Iași is the Emil Racoviță High-school, an education facility built in 1963. The school, which accommodates 670 students, is connected to the centralized heating system. The renovation work was completed in 2009 and required RON 2.7 million from the local budget. In addition, the school benefited from private donations for furniture and equipment for IT labs. The renovation work included, primarily, installation of double-glazed (thermopane) windows and replacement of the woodwork. Upon completion of work, a significant improvement of the level of comfort in the school was observed. The temperature went up in the wintertime, while the level of noise coming from outside decreased. Similar renovation work was performed to the “Otilia Cazimir” School, which accommodates 700 students.

Newly renovated Otilia Cazimir School



The project was completed in 2009, and it included new double-glazed windows, new floor tiles and woodwork, painting, and thermal insulation.



Although old radiators have not been replaced, in terms of heat the level of comfort has increased substantially.

But despite of the city government’s efforts, some educational buildings are still in bad shape and need to undergo serious renovation work. Because of financial constraints, the Ministry of Education and the Government cannot help too much with the renovation of schools, so the responsibility in this regard rests almost entirely with the local government and the city budget.

In the future, the city managers will try to identify financial resources to rehabilitate more buildings in Iași and increase their energy efficiency. They also plan to replace the classical hot water systems in some of the municipal buildings with those based on renewable sources (such as geo-thermal).

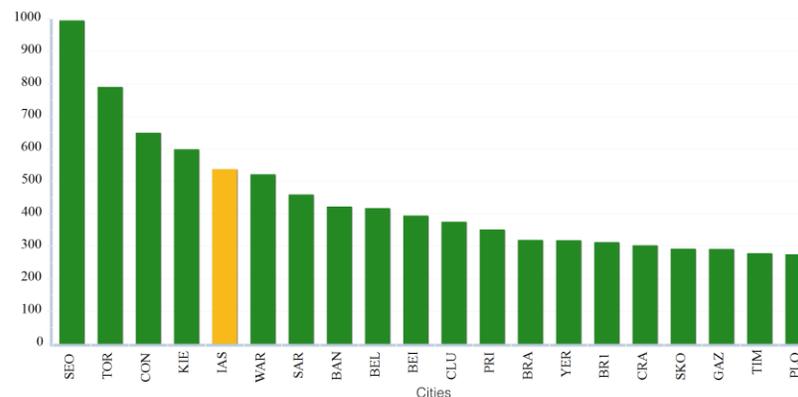
Solid Waste

The solid waste domain in Iași is managed by the public sector, through Salubris, a public company with 100% of its shares owned by the Iași City Council. Salubris is in charge of solid waste collection and is the operator of the landfill at Țuțora, located 8 kilometers away from the city. The company caters to 350,000 people in the City of Iași and Iași County, being responsible for the solid waste collection and transportation related service for half of the people in the county.

In 2012, the solid waste in Iași amounted to 156 million kilograms. The city generates 537 kg of waste per capita annually, a high amount compared to the cities within the TRACE database with similar climate. The figure is one of the highest among the growth poles in Romania, as it is almost twice as high as in Timișoara and Ploiești, and 50% higher than in Brașov or Cluj-Napoca.

Around 96% of the solid waste goes to the landfill. Despite of the fact the selective collection system has been implemented a few years ago, Iași is doing poorly well when it comes to recyclable waste. Only 3% of the solid waste collected in the city gets recycled. The city’s performance is similar to some of the growth poles in Romania, such as Constanța and Craiova, eight times lower than Cluj-Napoca, and four times below of the recycled waste collected in Timișoara.

Waste per Capita – kg/capita



The selective collection was implemented in Iași in 2005, when recycling containers were distributed to some households to separate the organic waste from plastic, glass bottles, paper, and metal. In 2008, such bins were placed throughout the city. One sorting is done directly by people, and subsequently, another one is performed at sorting station at the landfill.

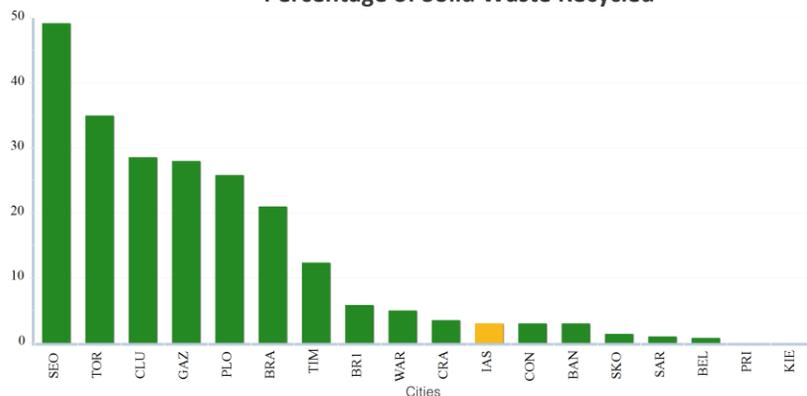
Recyclable waste containers in Iași





One of the reasons behind such a small recyclable waste rate has to do with removal of recyclables from containers, by informal collectors. Often, poor people take out stuff from the recyclable waste containers placed in the bins and sell the bottles and papers to the companies in charge with recycling activities. In this way, the amount of the recyclable waste that actually gets to the sorting station is relatively small.

Percentage of Solid Waste Recycled



According to Salubris, recycling activities should be regulated in such a manner as to allow solid waste collection companies to be in charge of the recovery process of recyclable items. The Romanian Parliament is currently working on a bill to regulate the recycling process activities accordingly.

Anyway, recycling activities are not very profitable. Recycling operators pay between RON 0.95 and RON 1.5 per kilogram of PET (plastic bottles), and RON 2 per 1 kilogram of metal. There is no demand for glass bottles. As per the Environmental Protection Agency Iași, the entire quantity of glass bottles collected in Iași Count (8.7 tons) is in a depot, waiting for prospective buyers. In 2012, at the level of Iași County, 4,802 tons of paper, 680 tons of PET, and 3.3 tons of metal were collected.

People who live in residential buildings pay RON 7.2 per person for services related to collection and transportation of solid waste. Those who live in residential houses pay RON 12 per person. Two people living in the same house must pay RON 19 per month, whereas three people will

pay RON 22 per month. Economic agents pay RON 75 per ton per month of solid waste collected. According to a law approved by the Iași City Council, city residents who generate waste but do not have agreements with Salubris must also pay a monthly fee for solid waste collection and transportation related services. This fee is RON 10.8 per month per person and RON 111 per cubic meter of waste for economic agents. The company manages construction and demolition waste too. They rented a storage facility where construction and demolition waste is dumped.

Since Salubris also operates the landfill, the company does not pay the tipping fee. For all other solid waste operators the tipping fee is RON 38 per cubic meter waste. Salubris handles the collection and transportation of solid waste in Iași with a number of 40 trucks equipped with GPS systems. One-third of the trucks are quite old, between 15 and 20 years, while the rest of the fleet is relatively new, up to 5 years. Due to daily usage, the average life cycle of the trucks is about 10 years. The annual diesel consumption amounts to 680 tons, which is the equivalent of a little over USD 1 million

Salubris truck



In the future, Salubris wants to improve the truck fleet maintenance in order to be able to use the vehicles even during cold winters when temperatures may easily drop to 25 degrees Celsius below zero. At the same time, the company plans to expand the client portfolio and, if the



legislation will be changed in support of solid waste operators, to get more involved in recycling activities.

The eco-framed landfill at Țuțora, about 8 kilometers far from the city, caters to Iași and the metropolitan area. Currently, most of the localities in the Iași County dump the waste at the landfill at Roman, about 90 kilometers far from Iași. Starting with 2018, the landfill at Țuțora will be catering for the entire county. In parallel, four non-compliant deposits will be closed. The landfill has two large cells, both of them divided into 3 compartments of 2 million cubic meter capacity each. The first compartment of the first cell has been already filled in; the second one is currently in use, while the third is under construction. There are 70 trucks driving daily to the landfill to offload waste; some of them take two or three trips. The amount of solid waste dumped at Țuțora is higher during celebrations and holiday season, and it goes down during summer breaks.

The sorting station at Țuțora landfill



The landfill belongs to the Iași County Council and is managed by the City Hall through Salubris. The landfill is included in the Solid Waste Management Plan, a EUR 85 million project with support from the Environment Sectoral Operational Programme. The local managers initially planned to have the landfill serve only the City of Iași, and substantial funds were invested in this respect from the local budget. But in 2007 the City Hall signed an agreement with the Iași County Council to

include the landfill into the Solid Waste Master Plan. Subsequently, the project was taken over by the County, and so the EU reimbursed to the Iași Local Council the money they spent prior the change of ownership. After it was put on hold for a few years due to some financial issues, the project was re-launched in 2012. Implementation of the master plan should be done in 34 months and should be completed by the end of 2015. Upon completion of the project the Iași County Council will organize a tender to choose the new operator of the landfill. Starting 2015, the facility will cater to 93 communities in Iași County that have been grouped under a specific Intercommunity Development Association.

The master plan set some specific targets for the next few years. Among these is the provision of sanitation services to all people in the county, improving the recyclable waste rate (up to 60% for cardboard and glass, 22.5% for plastic, and 15% for metal), and reducing the amount of biodegradable garbage by 35% by 2016, as compared to 1995 figures. There will be four collection areas designated in the county – in Ruginoasa, Bălțați, Iași City, and Hârlau. Two transfer stations are going to be built at Ruginoasa and Bălțați. The large, modern existing sorting station at Țuțora will be expanded and one more similar facility will be built. The compost station at Țuțora will expand in order to process the organic waste collected from the entire county. After expanding the compost station, the percentage of recyclable waste collected waste from gardens and parks is expected to rise from 15% to 40%.

Recyclable waste at Țuțora landfill





The landfill will also have a Mechanical Biological Treatment plant. The County Council will purchase and distribute throughout the county thousands of containers for organic and recyclable waste. Currently, ten tenders in connection to different components of the master plan are under way including the one for the Mechanical Biological Treatment plant. Local and county managers plan to capture biogas from the old non-compliant landfills and use the energy produced to operate the facility at Țuțora. However, capturing biogas is not a stringent priority, as this involves serious additional investments. At present, the landfill is profitable, and Salubris makes some good revenue out of the tipping fee. In the future, the solid collection and transportation related tariffs will go up. According to the master plan, starting 2014 tariffs could amount to RON 8.04 per person per month in Iași city, RON 7.69 per person in urban areas outside Iași, and RON 3.56 per person for people living in rural areas. Economic agents will also have to pay more as well, i.e., RON 365 per ton of solid waste collected.

District Heating

The district heating sector in Iași is under a public private partnership between the Iași City Hall and Dalkia Termo Iași, which is part of Dalkia Romania, a private entity operating a few centralized heating systems in the country. Dalkia Romania is owned by the efficiency branch of Veolia, a large transnational French company operating public and utility services in 35 countries worldwide, related to district heating/cooling, industrial utilities, and energy services. Dalkia Veolia is the efficiency branch of Veolia, which operates 800 district heating and cooling systems around the world in Europe and North Africa, employing more than 50,000 people, and making almost EUR 9 billion in revenues in 2012. The company is managing 5,000 district heating systems in Europe, catering to 16% of people living on the continent. Dalkia began doing business in Romania in 1992, when it opened its main subsidiary in the county, in Ploiești.

Dalkia Termo Iași is responsible for the production, distribution of hot water and heat in the City of Iași. 90% of the company's shares belong to Dalkia, while the rest of 10% to the Iași City Council. The company started operating in the city in the winter of 2011, soon after CET, the

former district heating plant, went bankrupt. The City Hall Iași took over the plant and organized an emergency tender in the middle of the winter to choose a company to operate the plant. After a short-term contract, in 2012 Dalkia signed a 20-year concession agreement with the City Hall to operate the district heating system in Iași. It is a performance-based agreement until 2032 that clearly sets the targets the company must achieve.

At present, Dalkia caters to 36,000 apartments, more than one-third of the total number of suites in the city. The company has heat supply contracts with approximately 26,000 apartments in residential buildings grouped under owners' associations, in addition to 10,000 individual units. Dalkia took over the CET infrastructure, namely the heating plans in Iași and Holboca. The CET facilities can operate on both coal and natural gas. Currently, 90% of heat production is based on coal, and only 10% on natural gas.

The CET I plant in Iași



The hot water and heat are distributed in Iași through 250 thermal points (sub-plants) that are connected to 80 km of primary network. One of the advantages is that the primary network is located very close to the city, only about 12 kilometers away. The secondary network (distribution network) has 253 kilometers. 120 sub-plants are connected to a SCADA



system furnished with thermo-vision equipment that can monitor the facilities. If there is a technical problem, the company can immediately send out the technical team to fix the issue. In the future, Dalkia plans to install an advanced system that would allow hot water/heat meters to be read from distance. Currently, a number of 50 people read monthly the meters in each apartment in the city. However, this system is not the most efficient, as it is prone to human error.

Iași is part of “the third climate zone” with very cold winters, requiring a large amount of heat in the winter season, i.e., about 260,000 Gcal per year. However, heating needs have dropped almost three times in the last two decades, from more than 1 million Gcal per winter season. The main factor responsible for this decline is the disconnections from the system. In the last two decades, because of poor quality services, many residents switched to natural gas-based individual micro-heating units. On average, 3,000 to 4,000 apartments in the city disconnect from the system annually.

The price of heat paid by population, including subsidies from the City Hall, is RON 265 per Gcal. The production cost of heat is RON 360 per Gcal. The revenue collection is good, going up from 75% to 93% in the last couple of years.

Inside CET I district heating plant



Over time, City Hall made serious efforts to modernize the old water pipes. Part of the network has undergone rehabilitation work in recent years. A strategy prepared in 2004 with support from the European Bank for Reconstruction and Development (EBRD) has identified some of the main problems pertaining to the district heating system in Iași. The document also outlined the steps the city needs to take in order to reduce heat loss on both transmission and distribution pipes, diminish the fuel consumption for hot water/ heat production, and cut down the electricity consumption. The strategy also indicated that a complete modernization process of the district heating system would require investments of up to EUR 180 million.

With loans from EBRD, a grant from the Swiss Government, and some financial support from the local budget, totalizing EUR 31.4 million, Iași began in 2007 the modernization of the district heating network. The primary (transmission network) and part of the secondary (distribution pipes) have been rehabilitated and upgraded.

At present, a large refurbishment project of both CET Iași and CET Holboca of approximately EUR 60 million (part of the Environment Sectoral Operational Programme) is under implementation. The main goals are improving the overall efficiency of the heating plants and upgrading part of the hot water transmission and distribution pipes.

Rehabilitation of hot water pipes in progress in Iași

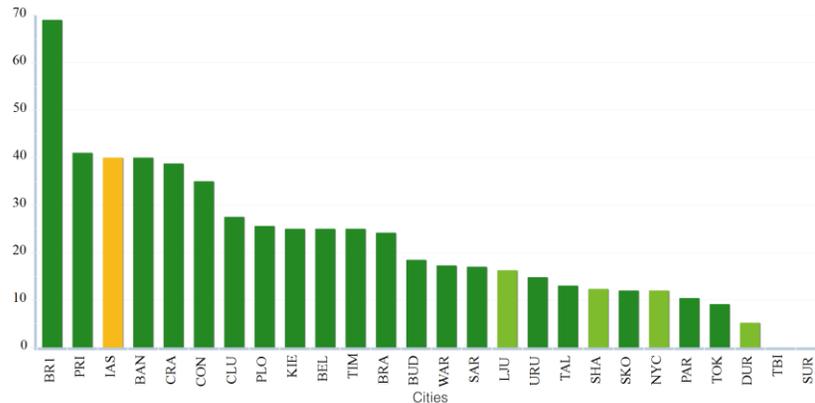




A turbine to produce heat and electricity in co-generation at CET Holboca will be purchased. Thus, the heat production cost will go down, and so Dalkia will be able to keep the price for heat at a low level. Other investments include rehabilitation of pumps and hot water boilers, modernization of 5 kilometers of hot water network, construction of a few facilities for collection of slag and ashes resulted after the desulphurization process. The project should be completed by 2015. In addition, another project of EUR 25 million is going to expand one kilometer of network from CET to the landfill at Țuțora, replace some of old, leaking, non-performing pipes, and purchase a high-efficiency turbine. The good news for customers is that five year upon the completion of the project they will not have to pay anymore for losses in the network, which are currently included in the heating bill.

Following rehabilitation works, the heat losses in primary network dropped significantly. However, they are still at 40%, one of the highest figures in the TRACE database, and the second highest among the seven growth poles, after Timișoara. Dalkia hopes to diminish the leakages in the network by adjusting the pressure in the hot water pipes.

Percentage of Heat Loss in the Network



A tender has been launched recently for purchasing and installing individual heat monitoring equipment in 50,000 apartments in the city.

Meters and heat allocators will be installed with support from EU funds, the City Hall, and a small contribution from the apartment owners. A pilot project will be initially implemented in a couple of buildings. In parallel, a communication campaign aimed at educating people on how to control the heat in their apartments and understand the advantages of such system will be organized. Once the heat meters are installed, Dalkia will be able to cut the heat supply to those customers who do not pay their bills in time. Today, the system does not allow disconnecting bad-payers from the district heating network.

Recently, Dalkia started billing a number of 10,000 individual clients for heat used in the common spaces of their given residential buildings, although they disconnected from the system. People 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). Another important decision taken by Dalkia was to create a commercial team dedicated exclusively to monitoring and improving the relationship with the customers. Call centers were launched where people call and get information about bills, heating/hot water pipes, and so forth.

One of Dalkia’s major challenges in the near future is to regain back the market. At present, the company is focused on providing good, efficient services in order to keep people connected to the centralized heating system, and re-connect some of former customers to the network. The local public administration is backing Dalkia’s efforts, for the district heating is the top priority for the city managers. The city managers are approaching ANRE, the energy regulatory authority, and ANRSC, the public service regulatory body, to continue support the district heating system and discourage people disconnecting from the network. Some of the former customers have re-connected back to the system. The re-connection fee is RON 800. New buildings in the city should be encouraged to connect to the district heating system, wherever such network is available.

Dalkia is running a public campaign presenting the advantages of the heating system, emphasizing the long-term benefits. The system is long lasting (unlike individual micro-heating units whose life cycle is 8 years on average), it does not pose any risk to environment, is not noisy, it



does not pollute, and perhaps most importantly, it is safe. Another argument in favor of district heating is the price of heat. When the liberalization of natural gas market will be completed by 2018, people who have individual micro-heating units will end up paying more for hot water and heat than those connected to the centralized system. For example, 7 Gcal of hot water and heat produced in natural gas-based micro-plants will cost RON 2,400, against RON 1,885, if the heat was produced in the centralized heating system and provided the related subsidies borne by the city government will still apply.

At the same time, the local public administration is committed to support the system by continuing the thermal rehabilitation of residential buildings in the city. The city has completed thermal insulation work to a number of 36 residential buildings, and more apartment complexes are expected to undergo rehabilitation work with EU support in the next years. One of the buildings in Iași that have been rehabilitated with financial support from the Ministry of Regional Development is located on Decebal Street.

Rehabilitated residential building in Iași

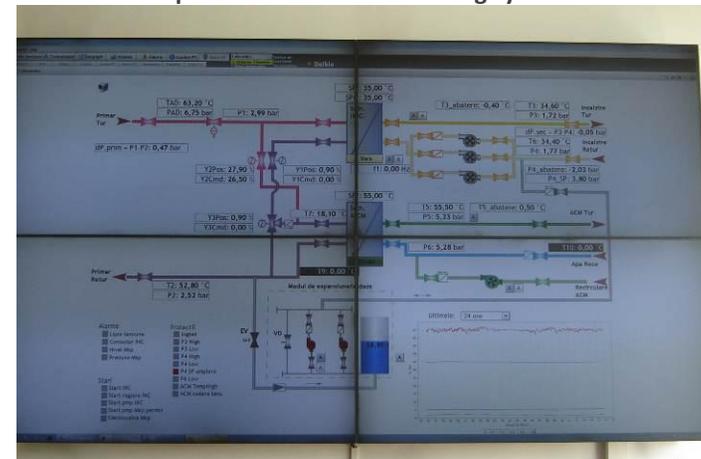


Last but not the least, Dalkia and Iași City Hall want to raise the level of comfort inside the apartments in residential buildings. However, this would require more heat and fuel consumption. For instance, increasing the temperature indoor by one degree would require 7% more Gcal.

Water Sector Potable Water

The water sector in Iași city performs fairly well. Both potable and wastewater are managed by Apa Vital, a regional operator under the Iași County Council, who is also the main shareholder with 99.7% of shares. The company supplies water and sewage services to approximately 50 of 93 communities living in Iași County, catering to 600,000 people. Apa Vital employs 1,040 people who deal with water and sewage related services and maintenance works. The company operates with 20 wastewater treatment plants, 9 water treatment facilities, and 130 pumping stations throughout the county.

Apa Vital's SCADA monitoring system



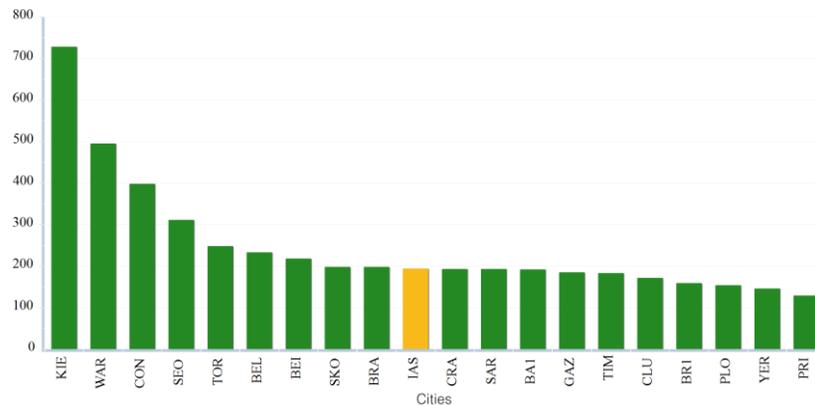
The potable water sources for Iași city are both underground and surface water points. There are two major water sources, Timișești and Prut, respectively. 70% of the water distributed to Iași comes from Timișești, an



underground source located in the neighboring Neamț County, with a flow capacity of 2,500 cubic meters per second. Almost one-third of the water comes from Prut, an over-ground water source, with a capacity of 2,800 cubic meters per second. Timișești provides good quality water that needs just a little chlorination. The water is captured at a station, about 110 km far from Iași city. This facility was built in 1911 and expanded in 1975. The water comes by gravity to Iași, where it needs to be pumped four times, requiring a large amount of electricity. Prut River, the overground water source, is located about 15 kilometers from Iași, and requires treatment and chlorination. A 4 million cubic meters capacity lake caters to industrial clients only. It is also used in case of flood advisory on the Prut River. Both the water and wastewater treatment facilities that service Iași are located on the outskirts of the city. A 17-year old radio and GSM-based SCADA system had been implemented in the mid-1990s with support from the Dutch government. It is used primarily for monitoring the network and for water advisories. Apa Vital has a call center where customers can learn 24/7 about water interruptions in the city, billing, etc.

In 2012, the amount of potable water sold in Iași amounted to 20.5 million cubic meters. The water consumption is 194 liters per capita per day, a figure that places Iași in the middle of the TRACE database.

Water Consumption per Capita – Liters/capita/day

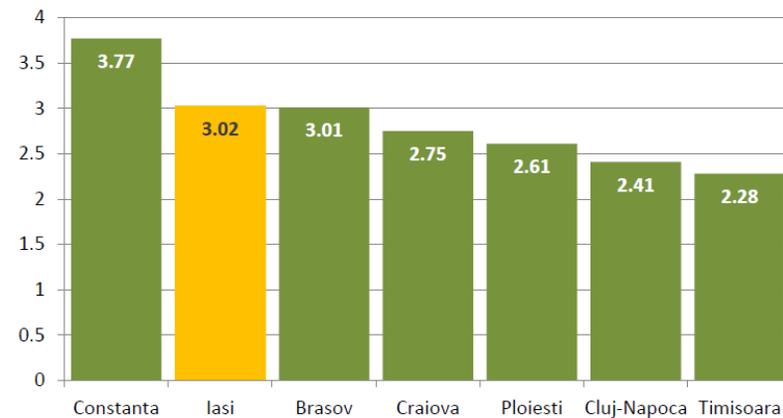


The water consumption in Iași is comparable to other cities with similar population. Iași’s performance is next to Craiova’s and similar to most of other growth poles in Romania, like Cluj-Napoca and Timișoara.

After water meters were installed in residential buildings and apartments starting 2000s, the water consumption per capita went down dramatically – from 500 liters daily (or 12 cubic meters per person monthly in residential buildings) to less than 200 liters per day. Today, the annual amount of water sold in Romanian cities varies from 2.5 million cubic meters in Pașcani to over 40 million cubic meters in Constanța. Approximately 60% of water sold in Iași is distributed to people living in residential buildings, while 40% to industrial customers, economic agents, and public institutions.

The water tariffs in the city are the second highest among the seven growth poles, after Constanța. Until very recently, one cubic meter of potable water cost RON 3.02 without VAT.

Water Tariff RON/cubic meter (without VAT) - 2013



Source: www.anrsc.ro

From July 2013 onwards, the potable water tariffs went slightly up by 5%. Now the residents of Iași pay RON 3.20 per cubic meter of water. The cost of water includes the raw water, energy, and treatment process. If people

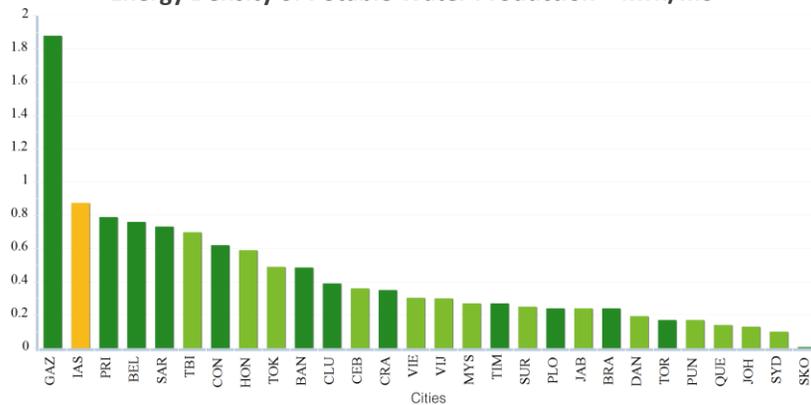


do not pay their bills in time, they get disconnected from the system. Those who want to re-connect to the water network must pay a fee.

The overall process of catchment, treatment, and water supply in Iași requires 0.8737 kWh of electricity per cubic meter of water. This is one of the highest figures in the TRACE database among cities with similar Human Development Index and, by far, the highest among the growth poles in Romania. Iași needs three times more electricity to treat one cubic meter of water than Timișoara or Ploiești, and twice as much as Cluj-Napoca and Craiova

course of time the company managed to reduce the energy consumption. Large pumps have been replaced with small devices, and batteries have been installed to cut down the reactive energy. The electricity tariff depends on voltage (i.e., the higher the energy intensity the smaller the electricity tariff). Salaries make up 31% of annual operational costs, below the average of 50% spent by most of water companies in the country. Apa Vital was able to create two brand-new jobs in the water sector - electrician for pumping station, and water and sewage operator, respectively.

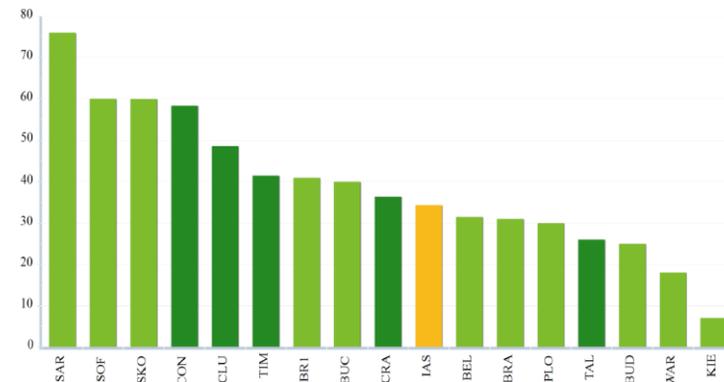
Energy Density of Potable Water Production – kwh/m3



When it comes to water losses, Iași’s performance falls within the range of most cities in Romania, i.e., between 40% and 60%. In 2012, the non-revenue water in Iași accounted for 34.4%, a figure on the lower side of the TRACE database. When compared to cities with similar Human Development Index, Iași is doing better than other cities in the region, including the Romanian growth poles. In fact, the city has the second lowest loss, after Ploiești (25%). In addition, Apa Vital is a profitable company.

Overall, the electricity consumption for the entire water process in Iași accounts to 13% of Apa Vital’s operational costs. It is above the 10% average at the level of Romania, where water energy related costs varies from 2% (in Alba County) to 18% (in Neamț County). Anyway, over the

Percentage of Non-Revenue Water



In the last decade, a number of projects totaling EUR 300 million, with support through ISPA and EU funds, have been implemented with the aim of modernizing and expanding the water system throughout Iași County. Currently, Apa Vital is working on a few projects to expand and improve the water system in the region. Some of them are implemented in Iași - such as upgrading the Chirița water treatment (RON 37 million) and the pumping station (RON 19 million), and upgrading the Aurora, Păcurari, and Mijlociu pumping facilities (RON 3 million). Other projects focus on a long-term sludge processing strategy, ensuring the maximum ecological protection for all hydrographical basins downstream from Iași. In 2012, the company completed the expansion of potable and sewage system in



Iași, a RON 71 million project under the Environment Sectoral Operational Program.

Between 2000 and 2006, large pumps have been replaced with smaller units, through a large project funded by the Municipal Utilities Development Program (MUDP). Modern equipment measuring the water flow, pressure, and capacity has been purchased, tackling the leakages in the network. Before, there used to be around 50 complaints daily about water leakages and all sorts of maintenance problems; now the number of technical issues has come down to merely 3 per day.

The water plant in Iași has been modernized with ISPA funds



Source: www.eptisa.com

More projects pertaining to the modernization of the water sector in Iași are under way. For example, replacement of water network covering the section from Copou neighborhood to the Palace of Culture is a project developed with support from the Environment Sectoral Operational Program. Replacement of water pipes would help reduce water losses in the network to only one cubic meter per night. More projects amounting to RON 550 million will be developed in Iași with support from EU funds. At the same time, Apa Vital hopes to receive approximately EUR 200 million funds in the 2014-2020 EU funds programming period to expand water and sewage services to all communities in Iași County. Over the course of time, Apa Vital organized several information campaigns to

teach the residents of Iași how to use water wisely. Campaigns are also run in schools to teach students about the importance of saving water.

Wastewater

The wastewater plant is located on the outskirts of Iași, and is spread across 32 hectares. The facility was built in 1963 and it had been continuously modernized and upgraded since. The first treatment line has become operational in 1995; the second line was completed in 2010. As of now, its flowing capacity had reached nine cubic meters of water per second. In the past, the wastewater plant used to be the largest in the country, with a capacity of 4.2 cubic meters per second.

Currently, Apa Vital is developing the third line of water treatment, aimed at reducing the amount of phosphorus and nitrogen. The modernization of the wastewater treatment plant in the city looked to increase the quality of water collected from the Bahlui River, and was developed with the help of a RON 93 million ISPA fund.

Wastewater treatment plant in Iași



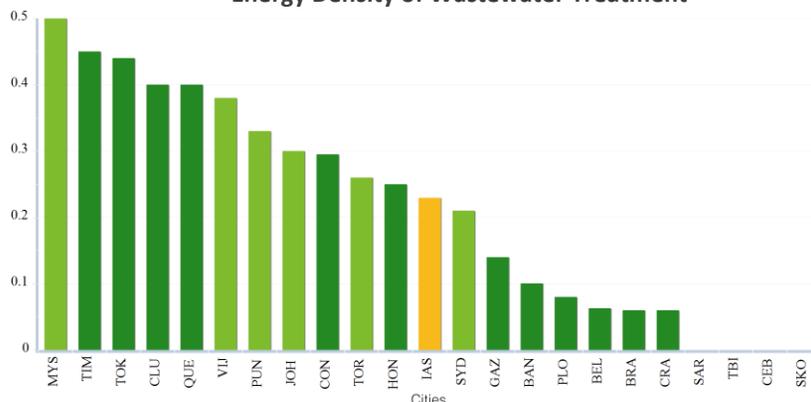
Source: www.adevarul.ro

The wastewater facility has the capacity to produce biogas, and it can make up to 730 kWh of electricity. The electricity is used for internal use, and it accounts for 40% of the total amount necessary to run the plant.



Iași needs 0.22 kWh to treat one cubic meter of wastewater. This is a rather high figure, compared to other cities with a similar Human development Index within the TRACE database. It is lower than in Timișoara, Constanța, and Cluj-Napoca, but higher than in Craiova or Ploiești.

Energy Density of Wastewater Treatment



The wastewater treatment station in Iași is using one-third of the total energy consumption of Apa Vital. Although the amount of electricity necessary for wastewater treatment in Iași is high, the process is in compliance with EU standards.

The water companies in Romania use between 0.03 kWh (in Gorj County) to 0.90 kWh of electricity (in Neamt County) to treat one cubic meter of wastewater. On average, they need 0.40 kWh per cubic meter. Until recently, Apa Vital used to charge RON 2.20 per cubic meters of wastewater. Starting July 1st, 2013, the tariff has gone slightly up, to RON 2.33 per cubic meter.

Urban Transport

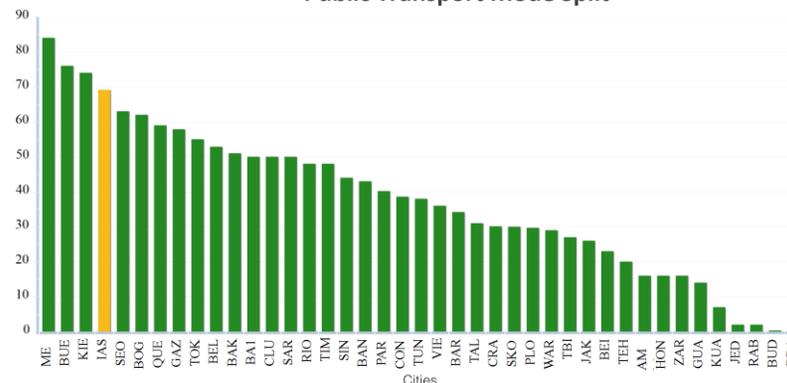
Public Transport

Both public and private companies operate the public transport in Iași. RATP Iași is the main transport operator in the city, a public company under the City Hall, while the private operator is Unistil. RATP Iași and

Unistil have an agreement under which the former allows the latter to operate a few routes in the city. Over the course of time, RATP Iași accumulated large debts to the national budget, and at present it is nearly bankrupt. In fact, plans are to dissolve the company by the end of 2013, with a new public entity to be established as public transport operator within the City of Iași, and potentially within the larger metropolitan area.

RATP Iași operates 21 routes, while Unistil 6 routes (4 bus routes and 2 operated by minibuses). The public company operates by buses, trams, and minibuses, covering a total of 363.4 kilometers of network. A third of the network is operated by trams, 40% by buses, and almost a quarter by minibuses. The public transport fleet includes 136 buses, 150 trams, and 25 minibuses. The city also used to have 38 trolleybuses, but the local government decided to remove trolley lines in 2006. The most popular routes are those connecting the city center to the Copou neighborhood, where universities and academic institutions are located. According to the TRACE analysis, nearly 70% of the commuters rely on public transportation, one of the highest percentages in the database. It is also the highest rate compared to the other growth poles in the county.

Public Transport Mode Split



The tram is the most popular means of transportation in Iași. More than 50% of the commuters travel by trams, 36% use buses, and 14% use minibuses.



With an energy consumption of 0.1976 MJ per passenger kilometer, the public transport in Iași is efficient. It falls in the same range as most of the growth poles in Romania, performing comparable to Ploiești and Brașov, and better than Timișoara, Constanța, and Craiova.

Trams are the most popular means of public transportation in Iași



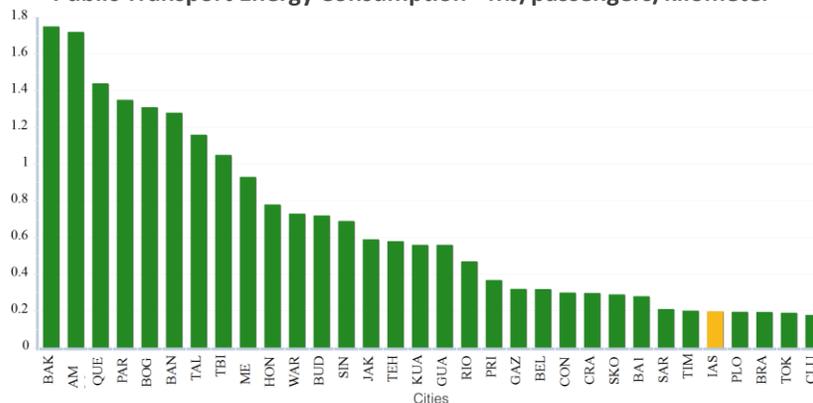
standard greenhouse gas emissions, and consume 35 liters of diesel per 100 kilometers.

MAZ bus operating in Iași



Source: www.iasi.stfp.net

Public Transport Energy Consumption - MJ/passengers/kilometer



The bus fleet comprises of different types of vehicles. The newest are 50 MAZ buses manufactured in 2005. They are compliant with EURO 3

Some of the Vanhool A-500 type buses are almost 20 years old, and use 40 liters of diesel to travel 100 kilometers. RATP Iași has also 8 Mercedes Benz from 1995 with a fairly high fuel consumption of 40 for 100 kilometers. In addition, there are 20 DAF type buses manufactured in 2000 that require 46 liter to run 100 kilometers. All buses use EURO 5 diesel. A number of 30 Renault buses manufactured in early 1990s run on EURO 5 LPG, consuming around 100 liters of non-pollutant fuel for 100 kilometers. These vehicles were converted from diesel to LPG, under CIVITAS, a program funded by the European Union.

18 vehicles from the entire bus fleet are not in service anymore, as they need capital repair. 10 of the 25 minibuses have been remodeled and adjusted in order to allow access to people with disabilities.

Tram is the most popular and efficient means of transportation in Iași. The tram network is one of the most extensive in the country, with 82.6 kilometers of single track, of which 32.8 kilometers have been rehabilitated. 15 kilometers were modernized with support from EBRD,



and another 17 kilometers were modernized with Regional Operational Programme 2007-2013 funds. In addition, the tramlines were expanded by 8 kilometers to Nicolina neighborhood. Currently, 9.1 kilometers of the network are undergoing rehabilitation work under a EUR 20 million project with EU money. In the near future, another 13 kilometers of tramlines will be upgraded.

tram routes. In addition, 100 video cameras were set in 64 buses and 36 trams. This system allows the local transport authority and the local police to learn about traffic congestions and bottlenecks, and address the problems timely. However, most of the time they are overwhelmed by the level of traffic congestion and bottlenecks especially during rush hour.

Renault bus converted to LPG



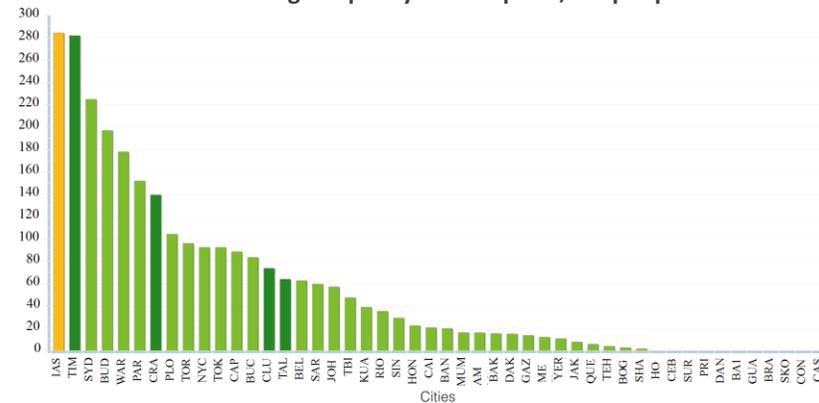
Source: www.viitorinmiscare.ro

The density of the Iași tram network is the highest in the TRACE database, i.e., 282.4 kilometers per 1,000 people. It is a figure similar to Timișoara, and fairly higher than other Romanian growth poles.

The tram fleet comprises of 150 old, second-hand trams; 103 wagons were manufactured in the 1960s, and rest of them in the 1970s. The trams were modernized at the time of purchase, at the end of the 1990s. RATP Iași and the City Hall plan to upgrade some of the coaches at a tram facility in Pascani (Iași County). Trams run every other minute, especially to Copou neighborhood, to allow students to get easily to universities and academic institutions in the area. There are fewer trams in service during the summer school break.

With EU support, RATP Iași has developed a traffic management system for public transport. Several video cameras have been installed in 28 locations in the city, allowing for a real time monitoring of bus and

Meters of High Capacity Transit per 1,000 people



The public transport fare in Iași is similar to that of other growth poles in Romania, i.e., RON2 per trip.

Public Transport Tariffs – RON/trip



Source: Local transport authorities in growth poles



In addition to dedicated kiosks and vending machines, passengers in Iași can purchase their tickets using an innovative, easy method through a text message. People send a text message with the letter representing the type of ticket they want to buy or the route they want to ride. For a ticket valid for an hour they will send a text message with the relevant bus or tram route number, at a cost of EUR 0.4 (plus VAT). Those who want to purchase a 90-minute valid pass will have to send a SMS with the letter “L” for which they will be charged EUR 0.8 plus VAT. The daily pass costs EUR 1.55 plus VAT, and can be validated with a text message including the letter “A”. A message will be received with the confirmation of the payment and a code for the trip and its period of validity.

Under CIVITAS, 10 vending ticket machines have been installed throughout the city from where people can purchase tickets at any time. This encouraged the use of public transport, increased the number of students and pupils using buses and trams, upgraded the passengers’ comfort, and changed travel behavior. The CIVITAS program included e-ticketing too, but according to RATP Iași, the related tender was challenged in court, and so the project was never implemented.

As everywhere else in the country, some categories of citizens ride for free. The City Hall offers discounts to city residents and students. People over 65 years old and those with low incomes ride for free. University students pay only RON 13 for a monthly pass, instead of RON 60 in full; half of subsidies are covered by the Ministry of Education, and some by City Hall. School students get 50% discount, the same as blood donors and war veterans. According to RATP Iași, every year 40,000 retirees, 23,000 students enrolled in public universities (those who receive merit scholarships or have low incomes), 6,000 disabled people and their caregivers, ride for free. As of 2007, 52.2% of the commuters travelled for free, 12.7% benefitted from discounts, and only 35% paid the ticket in full. This, of course, affects the bottom-line and the overall profitability of RATP.

The number of public transport riders went up in recent years. In 2007, 96.1 million passengers used public transport, of which 50 million travelled by tram, 32.7 million rode the bus, and 13.4 million used minibuses. Between 2008 and 2012, the number of passengers increased by 14%, from 119.5 million to 136.1 million.

Instructions for paying the ticket by text message



REGIA AUTONOMA DE TRANSPORT PUBLIC IASI

BILET DE CĂLĂTORIE

DIRECT DE PE
TELEFONUL MOBIL

Trimite un **SMS** la
și îți plătești instant călătoriile cu RATP-Iași

Valabil în rețelele Vodafone și Orange
Pentru regulamentul complet de utilizare va rugăm
accesați <http://sms.ratp-iasi.ro>

7494

Trimite **NUMĂRUL LINIEI** pentru **O CĂLĂTORIE SIMPLĂ**
Valabilitate: 1 oră. Tariful mesajului este de 0,4 EUR + TVA

Trimite **L** pentru abonamentul **LIBER LA PURTATOR**
Valabil 90 de minute pe TOATE liniile RATP Iași. Tariful mesajului este de 0.8 EUR + TVA

Trimite **A** pentru **ABONAMENTUL DE O ZI**
Valabil pe TOATE liniile RATP Iași. Tariful mesajului este de 1,55 EUR + TVA
SMS-ul de comanda este gratuit pentru clienții Vodafone și costa 0,05 EUR + TVA pentru clienții Orange

Source: www.ratp-iasi.ro

Passengers getting in a microbus in Iași



Source: www.evz.ro

The ticketing system can validate electronically paper tickets only, not the monthly passes. Unfortunately, the system cannot provide information about the number and structure of passengers or the mode split. As of now, estimations are made based on the number of tickets and monthly



passes sold, the number of people who benefit from facilities and discounts, as well as based on surveys. There are a few factors responsible for the increase in number of passengers, including improvements of the service, the modernization of the bus stops, and the operation of new routes (to Ciurea, in the wider metropolitan area. However, the number of kilometers travelled went down, from 14.8 million to 12.7 million. In 2012, 4.1 million kilometers were travelled by trams and 8.6 million by buses and minibuses.

The overall revenues of RATP Iași in 2012 amounted to RON 89.2 million of which salaries made 46%. 20% of the revenues went for the purchase of fuel, the equivalent of RON 22.4 million (approximately USD 7.2 million). The company used 2,313 tons of diesel, 20 tons of petrol, 141 tons of LPG, and 11.96 GWh of electricity. In recent years, the electricity bill went up. After the cost of green certificates was included in the electricity tariff, it affected the overall cost of electricity consumption. Over the course of time, RATP Iași made efforts to reduce fuel and electricity consumption. Some of the steps to this end included the modernization of the electrical traction system, the reduction of line voltage from 750 Vcc (continuous current) to 600 Vcc, monitoring electricity use during specific hours, monitoring diesel consumption, and training bus and tram drivers to use less fuel and energy.

Some of the trams in Iași use less electricity



The monthly operational costs of RATP Iași amount to RON 7 million, while the revenues, including subsidies from the City Hall, amount to RON 6.5 million. Due to a lack of money, the company receives only a third of the amount of the subsidies the transport authority is entitled to from the local budget, i.e., RON 1 million. According to RATP Iași representatives, the company also gets fewer subsidies from the national government than many local transport operators in the country (20% as compared to 60% in some cases). This led to an accumulation of large, and now RATP Iași is on the verge of bankruptcy. Currently, the company has the largest amount of debts to the national budget among all local public transport operators in the country.

Iași benefited from the EU-funded CIVITAS Initiative program. The fundamental objective was to provide support for ambitious transport measures towards a sustainable urban mobility and intermodal integration through innovative technologies and policy-based strategies²⁴. CIVITAS Plus Archimedes was implemented from 2008 to 2012 in partnership with RATP Iași and “Gheorghe Asachi” Technical University, through a EUR 4.7 million project, with the assistance of EU funds and some support from the local budget. The program included the development of 11 kilometers of bike lanes, audio warning devices for people with visual impairment, remodeling of 50 bus stops to allow access to people with disabilities, and conversion of 30 high capacity buses with LPG. Other components of the CIVITAS program focused on improving the ticketing system, providing special discounts for students and pupils, and giving priority to buses through a traffic light system. In addition, a system providing real time information about bus routes and schedule has been implemented, a project developed with RATP Iași funds.

One of the components of the CIVITAS program focused on priority bus routes, giving green light priority to buses and converting some of the road spaces to dedicated public transport lanes. In 2010, priority routes were established and, subsequently, light priority systems for buses were implemented in 15 intersections in the city.

²⁴ http://www.civitas-initiative.eu/index.php?id=66&sel_menu=35&city_id=84



Dedicated bus lanes in Iași



Source: www.viitorinmiscare.ro

They helped reduce travel time differences between private cars and public transport, and improved the traffic flow of the latter. No special priority had been granted to public transport in the city before. Moreover, road condition communication for buses was rudimentary, with merely an antenna with a signal repeater that would receive and transmit information about the conditions of traffic. The priority routes are designated for buses but are open to taxis as well. As a result of priority corridors, the travel schedule for public transport vehicles improved, and average vehicle speed went up. According to CIVITAS surveys, more and more vehicles arrived on time in stations, e.g., 78% in 2010, and 88% in 2011. From 2009 to 2011, the average speed of buses in peak hours has improved by 5.93% (15.9 km/hour) and in off-peak hours by 7.78% (19.4 km/hour). However, the objective set at 10% could not be achieved, because the tramline rehabilitation work affected the bus operation.

Another project developed through CIVITAS was a common platform for an integrated surveillance and control of 100 trams and buses equipped with GPS devices. The main scope was to optimize the transport schedule, and subsequently, increase the number of users, reduce waiting times at red lights, and cut down the incidents involving public transport vehicles. RATP Iași opened a maintenance facility center and modules for incident management and specific equipment. The maintenance facility

center is equipped with management, recording and storage systems from where an employee supervises the GPS-tracked vehicles, records and forwards complaints through a toll-free line. The incident management modules are integrated with the toll-free phone line and deal with all events that occur during the operation of the traffic management system. Results revealed that more buses and trams stuck to the timetable. At the same time, there was a positive increase in the perception of people who thought that that the public transport in Iași improved.

With support from CIVITAS, RATP Iași opened a school bus link to Ciurea, a locality in the metropolitan area, to encourage of the Roma community living in the area to use public transport, as a means of increasing social inclusion and access to education and opportunities. Ciurea has the largest Roma community in the region, and it was poorly served by public transport system. Many of the Roma students enrolled in education facilities in Iași were not able to get into the city and attend classes, and some even had to abandon school. The new 41b bus route service from Iași to Ciurea allows the 1,000+ Roma students enrolled in schools in Iași to come to the city and attend classes on a regular basis.

New bus route to Ciurea



Source: www.iasi.stfp.net

Surveys carried out at the beginning of 2009 observed that 9 out of 10 potential passengers in Ciurea use this new public transport line. The City Hall signed an agreement with RATP Iași to issue special passes for



students residing in Ciurea, in order to help and encourage them to use the public transport service and commute to the city. The surveys conducted after the bus service was operational indicated that by 2011, over 70% of Ciurea's residents were aware of such transport facility, and 86% of them were satisfied with the new public transport service. The new transportation connection allowed them easier access to schools, universities, public and cultural institutions in the city. Consequently, the monthly journeys made with the buses operated on the new route have progressively increased, from 542,997 in 2009 to 603,330 in 2011.

Transport studies shows that one of the main contributors to traffic congestions problems are private cars with low occupancy ratio traveling to business districts. In an attempt to address traffic issues and have more people use public transport, RATP Iași opened a shuttle service to the business district, connecting the city to a couple of large companies, namely CET, the district heating plant, and METRO, a retail and wholesale firm situated on the city's outskirts. Buses transport the workers of these two companies daily, according to a certain time schedule. The number of public transport users increased significantly; conversely, the number of people relying previously on their private cars has decreased.

The public local transport operator installed 40 audio warning devices for visually impaired people at 16 main intersections in the city. 10 minibuses were transformed so that they could be accessed by physically disabled people. 50 stations and stops were also converted to provide easy and safe access to public transport for users with disabilities. CIVITAS also introduced a new, user-friendly system by which passenger can call a toll free line ("telverde") that would connect to a dispatching center from where they can find out information on public transport before or during their journey in the Iași. The toll free number became operational in February 2010, and it provided support to people to choose the optimal travel route to their destination. At the end of the day, users received relevant information about public transport and were able to plan better their trips.

Between the fall of 2010 and summer of 2012, the municipality of Iași engaged in a large public campaign to make the city residents aware of the benefits of using bio-fuels. Flyers and brochures explained what alternative fuels and the related benefits. For example, the city

managers organized an event called "Through the city without my car" where 5,000 leaflets were handed out.

Toll free line for public transport information



Source: www.civitas.eu

Not only citizens learnt about the benefits of bio-fuels, but also they were encouraged to use alternative means of transportation when moving around the city, like bikes and walking. During meetings at schools and universities, students were informed about alternative fuels; a couple of workshops were organized in this respect, targeting stakeholders and NGOs. The local government plans to organize such campaigns in the near future to sustain bio-fuels and ecological means of transportation.

Currently, a large project of nearly RON 90 million targeting rehabilitation of tramlines in the city is under way, covering tens of kilometers of electric transport network.

The city managers have ambitious plans with regard to local public transport in Iași in the future. They plan to expand the bus and tram service to the wider metropolitan area (to Ciurea, Tomești, and Valea Lupului), continue rehabilitation of tram network, and renew the bus and tram fleet by purchasing new energy efficient vehicles. The city government is also thinking about expanding electric transport outside Iași by trolleybuses or electric buses.



Tram network modernization work in progress



Source: www.bzi.ro

As of now, the national legislation does not allow the local 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. The Iași County Council wants to get involved in the public transport in the Iași metropolitan area in the near future. An Intercommunity Development Association on transport gathering Iași and several localities from Iași County has already been set to this end. At the same time, after RATP Iași will go bankrupt, a brand-new company will be established to operate the public transport in Iași city.

Private Transport

Traffic is not an easy task in Iași, neither for drivers nor for passengers. Iași's proximity to the Eastern border of EU, to the Republic of Moldova and Ukraine, and the investments poured in the last 20 years have brought some development into the region. More and more people bought cars that are used most of the time for the daily commutes to their workplace. This led to a rise in the number of cars in Iași, traffic congestions, and increased amount of greenhouse gas emissions.

The number of cars has significantly gone up in the last two decades. At present, there are 88,109 private cars registered with the

Local Vehicle Registration office in the city, i.e., one car for 3.2 people. 30% of cars registered in Iași run on diesel, while 70% use gas.

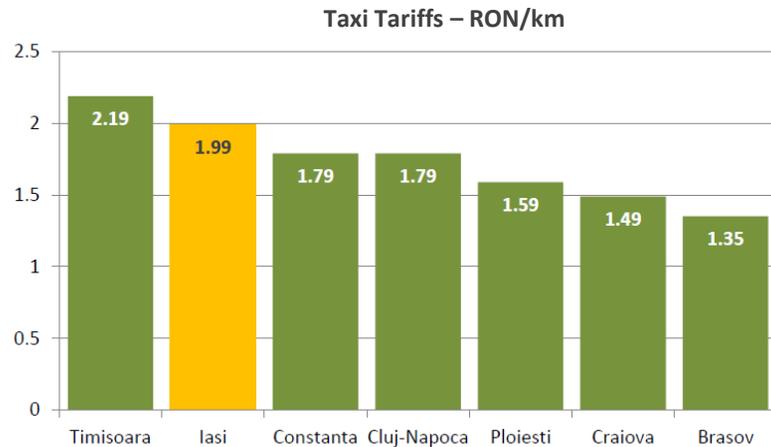
Traffic in Iași



Source: www.adevarul.ro

More than one-third of private cars are between 6 and 10 years old, and almost a quarter between 11 and 15 years old. 14.5% of the private vehicles are between 16 and 20 years old; same is the percentage for cars older than 20 years. 2.2% of the fleet is new, up to two years old, while a little over 11% are between 3 and 5 years old. Like all cities in Romania, Iași 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.

There are 2,110 mopeds and 1,760 taxis in the city. 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. Taxis charge RON 1.99 per kilometer, the second highest tariff among growth poles, after Timișoara.



The private transport energy consumption in the city is 1.925 MJ per passenger kilometer. Iași performs better than most of the cities with a similar Human Development Index within the TRACE database. The consumption is similar to Timișoara, better than in Constanța and Ploiești, but higher than the private transport sector in Cluj-Napoca. In 2012, the fuel consumption for private cars cost nearly USD 39 million.

The city authorities have been supportive of non-motorized transport and developed some relevant infrastructure, encouraging people to bike and walk. The first major project in this respect was developed in 2009 through CIVITAS when 11 kilometers of dedicated bike lanes were built. After that, the city government organized a campaign to promote this non-pollutant means of transportation and encourage people to take up cycling. The campaign included maps, guides, brochures, positive bicycle images, and articles in the local media. Dignitaries and public service employees used bicycles, in order to lead by example.

Subsequently, campaigns promoting cycling were organized periodically in order to increase awareness of people regarding this easy, healthy means of commuting. Later, the local public administration built more cycling lanes. Today, there are 25 kilometers of bike lanes. However, some cycling lanes not in the best shape. For instance, the bike network on campus in the Tudor Vladimirescu area is poorly maintained and needs

to be rehabilitated. There are four docking stations in the city from where people can rent bikes.

Bike lane in Iași



Iași is one of the cities in Romania that is included in the “I velo” scheme, a project implemented in partnership with a commercial bank. One of the “I velo” docking station is located near Copou neighborhood, from where people can rent bikes for a few hours or a full day, provided they can present a valid ID. The rental fee is RON 3 per hour and RON 15 for 24 hours.

Another docking station is in the Tudor Vladimirescu neighborhood, where most students live. This renting facility stays closed in the summer because most of the students are out of town. Student-O-bike is another rental station in the city located near the university area, from where students can take bicycles and ride them for free to commute on campus. The number of bike users increased significantly in recent years. Overall, the bike lanes helped reduce traffic congestion, pollution and improved air quality throughout the city.

Iași has a few pedestrian areas in the downtown area. The one located on Ștefan cel Mare și Sfânt Boulevard was recently set up. The street was closed for the traffic and turned into a pedestrian network, covering the area from the Iași County Council (near the Palace of Culture) to Piața Unirii. During weekends, a handful of tables displaying anything



from old paintings, photos, and books to new modern scarves and decoration items are organized under a small antique flea market.

I Velo docking station in Copou



Antique flea market on Ștefan cel Mare și Sfânt pedestrian network



Piața Unirii is a small walking network located in front of the Unirea Hotel. One of the most popular pedestrian areas in the city is the newly developed Palas Mall, near the Palace of Culture, the city's landmark.

Pedestrian network at Palas Mall in Iași



Source: www.palasi.ro

Next to the Palas Mall, a green area was developed, with benches, lamps, fountains, and urban furniture. The place is surrounded by the palace of Culture on one side, and by the mall on the other. Restaurants, shops, bars, movie theaters, and other entertainment places are adding to the attractiveness of this popular spot in Iași.

The parking in the city is organized by public and private facilities. The largest private parking is located at the Palas Mall; it is a multi-story facility, accommodating up to 2,500 cars.

Unlike in other cities that use LED lamps, the red lights and the signaling in Iași are based on regular bulbs. As of now, the signaling and traffic monitoring is managed by the City Hall. A EUR 20 million project developing a new traffic management system project is in progress. The project is executed with support from ROP 2007-2013 funds, and will monitor 90 intersections through video cameras installed throughout the city.

Several road infrastructure projects are under way with support from EU through the 2007-2013 ROP. Most of the main roads in Iași are undergoing rehabilitation and modernization work. The local public administration is building a couple of passages to improve the traffic flow



in the city. For example, the 286 meter-long Mihai Eminescu underground passage is part of a large modernization project of the East-West axis, totalizing RON 91 million.

Work in progress at Mihai Eminescu underground passage in Iași



The passage was supposed to be finalized in July 2013, but the work has been delayed because of the discovery of archeological ruins at the work site. The city managers hope to complete the passage by the end of the year. The project also includes the rehabilitation of four major arteries in the city center (Independenței Boulevard, Șoseaua Păcurari, Păcurari Street, and Elena Doamna Street), the roundabout near the Central University Library, and the development of a few bike networks and of 10,000 square meters of green area. The tramlines on Elena Doamna Street will be rehabilitated too.

Another important road infrastructure construction work is the Octav Băncilă project, a one-way half-kilometer over-ground passage in the Țigareta area. The project is meant to improve connection between the Dacia and Alexandru cel Bun neighborhoods and the city center. It is part of modernization work of the North-South axis, a large project of RON 87.8 million with support from the 2007-2013 ROP. The over-ground passage should be completed by the end of 2015. A number of 9 adjacent streets comprising 6.3 kilometers and 40,000 square meters of sidewalks will be rehabilitated. In addition, bike networks will be developed on the

sidewalks. The project also includes rehabilitation of 7 kilometers of tram tracks.

Another project in progress is the expansion of an existing over-ground passage in the Nicolina neighborhood, on the South Axis, covering the section from Podu Roș to CUG. The RON 87.6 million project is developed with EU funds, and includes the replacement of 8 kilometers of single track tram line, the rehabilitation of 66,000 square meters of streets, the modernization of 30,000 square meters of sidewalks, and the development of 4 kilometers of biking network.



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 Iași was compared to similar TRACE data for other cities with a similar Human Development Index. The energy savings potential with regard to street lighting in Iași 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. In Iași, like in many localities in Romania, some public utility services are managed by the city itself, whereas some others stay with the private sector or they are regulated at the national level. For instance, district heating is under a public private partnership between the City Hall and a private company. 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 Iași are: “District Heating,” “Private Vehicles,” “Municipal Buildings,” “Public Transportation,” and “Street Lighting.” The most promising sector is “District Heating”. The second highest potential for energy savings in Iași is “Private Transport,” a domain in which the local government does not have full control. “Municipal Buildings” is a sector fully under city government control, and it can achieve the third highest expected savings. “Public Transportation”, under the local public administration, is another area with a good potential of energy savings as highlighted by TRACE. Another sector which is controlled by the Iași City Hall is “Street Lighting”.

Two other sectors have been identified by TRACE, namely “Solid Waste,” (a sector under the city government), and “Water,” an area managed by the Iași County Council.

Sector Priority

City Authority Sector Ranking

Rank	Sector	REI%	Spending CA (US \$) Control	Score
1	Municipal Buildings	35.0	5,455,656 0.95	1,814,005
2	Public Transportation	16.7	7,233,781 0.85	1,027,378
3	Street Lighting	36.9	1,596,194 0.75	442,070
4	Solid Waste	33.2	1,073,481 0.80	285,946

City Wide Sector Ranking

Rank	Sector	REI%	Spending CA (US \$) Control	Score
1	District Heating	25.0	17,373,850 0.65	2,823,250
2	Private Vehicles	22.6	38,988,580 0.25	2,204,843
3	Potable Water	22.0	2,768,132 0.20	121,797
4	Wastewater	20.1	1,505,046 0.20	60,502
5	Power	43.7	0 0.05	0

All priorities identified by TRACE were presented and discussed with local public administration officials. A number of five sectors comprising ten recommendations have been chosen by the 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 București). The recommendations made in this report are general in nature and draw on a pre-defined list of proposed interventions in the TRACE tool. These recommendations should be viewed by local authorities as an indication of what could be done to improve their city's energy performance and reduce the city's energy bill. The decision to actually implement a recommendation or not should be done only after a comprehensive feasibility study is completed. For example, the development of a bike network may have the adverse effect of reducing the share of people who use public transport instead of reducing the number of people who commute by private vehicles.

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

Energy Efficiency Strategy and Action Plan

One of the key recommendations to the public administration in Iași is the development of an Energy Efficiency and Strategy Action Plan. According to the city managers, the City of Iași adhered to the Covenant of Mayors, the mainstream European movement established in 2008 that brings together thousands of local and regional authorities across Europe, 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 the 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 the political commitments into actions and concrete measures.

Currently, there are nearly 5,000 signatories to the Covenant of Mayors, comprising more than 170 million inhabitants across Europe. More than half of the signatory cities have already submitted their Sustainable Energy Action Plans (SEAP) to Brussels.

As of August 2013, 63 small and large cities from Romania have signed the political commitment to reduce the 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 to the Covenant of Mayors. Three of them, namely Cluj-Napoca, Timișoara, and Brașov, have already submitted their SEAPs. So far only the SEAP prepared by Brașov was accepted by the EU body. 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.

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 implemented to this end. Ideally, the plan should state from the beginning what is 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. It is good if the document could 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.

The plan should monitor carefully the way the city is going to achieve the reduction of emissions mentioned in the plan, in order to ensure that intermediate targets are reached 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 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. At the end of the day, the strategy could be an internal and external promotion tool for the city to gain support for future work on energy efficiency.



Source: www.europa.eu

In line with this TRACE recommendation, the local government of Iași seeks to reduce energy consumption and make the city become more sustainable and efficient. When preparing the energy action plan, the city managers should have a few important sections targeting the energy consumption in the public service areas, including district heating, transport, municipal buildings, street lighting, and solid waste. The measures taken in each of these sectors should include certain indicators, such as total city energy use, overall savings achieved from energy efficiency initiatives, and percentage of energy efficiency initiatives for which data is collected every year. The TRACE indicators offer a very good starting point, with 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. In addition, other indicators 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. Stockholm is one of the signatories to the Covenant of Mayors. The capital of Sweden 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 practices 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. According to the first assessment, 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 city managers of Iași could learn from such examples and try to apply the most suitable measures in order to replicate similar achievements in their municipality.

Another good example of best practices is provided by the City Of Philadelphia, where the local public administration executed a series of measures that helped the municipality make progress in their endeavor of reducing the 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.

District Heating Maintenance and Upgrade

One of the first TRACE recommendations is to consider performing maintenance and upgrade work on the district heating network. This recommendation falls within the scope of the efforts the local authorities



are already undertaking in this respect. District heating is the top priority for the Iași City Hall, thus the city managers are committed to lay down all necessary efforts to keep the system alive and provide people with better heat and hot water services.

According to TRACE assessment, district heating has the highest energy saving potential in Iași. Some of the key objectives could be 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. The local authorities should also consider passing legislation that would require a minimum efficiency level for generation and supply infrastructure of the district heating network.

CET Iași has been modernized



The district heating system in Iași had undergone tremendous changes in the past few years. CET, the district heating plant went bankrupt in 2011, and a year later was taken over by a private entity, Dalkia Termo, under a 20-year concession agreement based on a public private partnership with the City Hall. The private operator is determined to step up efforts to achieve a set of goals, such as improving the performance of the system, increasing the quality of services to people, keeping the heat price low, diminishing the leakages in the network, and gaining back some of the lost market.

Like in many other cities in Romania, the thermal energy consumption in Iași has dropped dramatically over the past 15 years. Closing down many of the state-owned companies and the disconnection of a number of apartments from the district heating structure are the main reasons behind the drop in heat demand. According to the National Institute of Statistics, the heat production in Iași reached its peak in 1998, when 1.3 million Gcal were distributed. Subsequently, the heat demand went gradually down. The following year, it dropped to 1.1 million, and by 2002 went down to only 739,594 Gcal. The heat consumption continued its descending trend in the following years, as in 2008 less than 400,000 Gcal were sold in Iași. The figure slightly went up the following year, to 451,453 Gcal, only to drop a few years later, to 232,083 Gcal in 2010. Currently, the amount of heat necessary to cater to 36,000 apartments is approximately 260,000 Gcal, which is only a fifth of the amount that used to be distributed in the past.

In the recent years, many customers disconnected from the district heating plant and switched to natural gas-based individual micro-heating units. On one hand, they were attracted by the low price of natural gas at that time. On the other hand, the heat and hot water supply and related services provided by the centralized heating system were poor, and so people looked for better alternatives. On average, 3,000 to 4,000 apartments in Iași disconnect from the system annually. Today, the main main challenges for Dalkia are related to improving the quality of services, convincing people to stop disconnecting from the network, and re-connecting some of the former customers back to the centralized distribution of heat and hot water. At some point, Dalkia could turn into its advantage the liberalization of natural gas market by 2018, in an attempt to bring back some of the lost customers. The price for natural gas will go up, which will drive up heating costs for heat produced in individual heating plants. Conversely, the price for the heat produced in the centralized plant will be the same in the next years. (District heating providers throughout the country rightly point out that large gas consumers in Romania pay an en-detail price for gas, while individual households pay an en-gross price, which has lowered the profitability of district heating companies.) Provided the City Hall will continue support the system through subsidies, people will end up paying the same price



for heat for the next few years (RON 1,885 for 7 Gcal (the average heat consumption per apartment in Iași)).

Both Dalkia and the City Hall should make efforts to contain the 40% losses in the system by focusing on network maintenance. They should identify the most suitable and cost-efficient methods to insulate and modernize the pipes to reduce the hot water leakages. The local government managed to rehabilitate the primary network and of some the secondary pipes, and more work is still in progress. In line with this TRACE recommendation, a large refurbishment program of CET is under way, aimed at improving the overall efficiency of the system by 2015. This includes purchasing of a co-generation turbine, rehabilitation of pumps and hot water boilers, and improving de-sulphurization process. In addition, Dalkia plans to burn solid waste at Țuțora landfill and use the recovered energy to operate the hot water boilers. Meanwhile, the district heating operator wants to develop a strategy to bring the secondary pipes (the distribution network) all the way to the residential buildings. In this way, the hot water and heat pipes will be linked to a main connector located in the building, and then further to apartments.

The local government also plans to switch from the vertical distribution model to the horizontal model. A tender has been already launched for purchasing and installing individual heat monitoring equipment (heat meters and allocators) for thousands of apartments in the city. This would allow people to easily control the level of heat. In parallel, Dalkia is preparing feasibility studies for the horizontal distribution of heat. A pilot project will be developed to this end that will include a few residential building that have been thermally insulated. A pilot project as such was implemented in a couple of residential buildings in Craiova. The Craiova City Hall 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.

Horizontal distribution pipe in a rehabilitated building in Craiova



In addition, continuing the thermal rehabilitation of residential buildings would provide net efficiency benefits to the Iași district heating system. Not only will this help increase the overall energy efficiency of the district heating system, but it will also push up the level of comfort in apartments. Hundreds of apartment buildings in Iași need rehabilitation work. Iași has been awarded money to begin rehabilitation of 11 residential buildings in the city, and more funds are expected to come in the near future. The local public administration hopes that the next programming period of the ROP will enable to continue such projects, and more residential buildings will be thermally insulated.

Finally, Dalkia is currently working on a strategy to regain the lost market and make city residents leave behind the micro-heating units and reconnect to the centralized heating system. The company has a very appealing proposal to cover most of reconnection related costs. In parallel, Dalkia is installing on its expense equipment for hot water recirculation from the thermal point to the basement of the building, and further to the top floor in a number of 15 residential buildings in the city. This will allow people to have an optimum hot water temperature at any time of day.



Urban Transport

Urban transportation is the sector with the second highest potential for energy efficiency gains in Iași, as identified by TRACE. Together with district heating, transport is one of the priority areas of intervention for the city government of Iași. 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. This recommendation is building on the efforts 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. Such indicators 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

Development of non-motorized networks should be at the top of list for the local government of Iași when it comes to urban transport. 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, reduces pollution, improves air quality, and 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.

Iași already has a few good pedestrian networks in the downtown area. The Palas Mall area, the Ștefan cel Mare și Sfânt Boulevard (where two of the most famous churches in the region are located), and Piața Unirii are the most popular leisure and entertainment spots in the city. Ștefan cel Mare și Sfânt Boulevard has recently become pedestrian.

Walkways have been rehabilitated, and lamps and urban furniture have been installed along the street.

Ștefan cel Mare și Sfânt Boulevard turned pedestrian



On the weekends, part of the street becomes the venue of a small antique flea market, where people can purchase antiques, or simply window-shop.

Currently, the city has 25 kilometers of bike lanes but local authorities are planning to expand the network. Some bike lanes will be built on the sidewalks along the future passage connecting Alexandru cel Bun and Dacia neighborhoods (on the North-South axis) to the downtown area.

Iași will have more bike lanes





Another 4 kilometers of bike lanes are going to be built on the South Axis. By building these networks, the local public administration hopes to provide an incentive for people and encourage them to do more walking and cycling. In addition, the local government may think about expanding the “I Velo” model rental program along the future bike network.

More “I Velo” docking stations could be created



In order to encourage people cycling, the local government could make micro credits available to people to help them buy bicycles. This would be beneficial to low-income people. The municipality of Iași 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 city managers of Iași may also consider developing more pedestrian networks in the city. 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. It is not a surprise that perhaps the most attractive pedestrian network in the city is the Palas Mall. The green area overlooking the Palace of Culture gathers

several leisure and entertainment places, such as shops, restaurants, bars, shops, in addition to fountains and benches where people can enjoy and relax.

Parking Restraint Measures

An important recommendation made by TRACE to the public administration of Iași is to consider solutions for discouraging the use of private vehicles and support alternative modes of transportation. This target can be accomplished by imposing more restrictive parking measures in certain areas in the city. Fewer cars on the streets would translate into lower fuel consumption and less traffic congestion.

One way of doing that is by setting parking allowances for new residential and corporate developments, and by developing park and ride facilities within the framework of promoting transport modality 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 is quite convenient because it does not require immediate investments from the city budget, and it can be implemented wherever there is public transport connection available. Several cities in Europe have successfully implemented such parking allowance system. For instance, in certain areas in London where there is bus connectivity the local government allocates less than one parking spot per unit. However, this measure should be coordinated with expanding public transport in the area, if necessary.

By far, one of best practices that have proven to be very useful in dealing with traffic congestion is the Park and Ride concept. It is, indeed, a costly measure that requires serious capital investment, but at the end of the day, it is a very efficient way to promote multimodality by linking parking to public transport. The Iași City Hall should consider developing Park and Ride facilities in the city. People who travel to the city drive their cars to these facilities, from where they take public transport to get to their workplace. It is crucial 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.



Park and Ride sign



Source: www.wikipedia.org

In addition, the city 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. The city managers may look at best practices implemented by some cities around the world, where the parking price in the downtown area has been hiked. This method discouraged people to drive their cars into the city center, and instead, use buses or trams, or even better, bike or walk.

Traffic Restraint Measures

An important recommendation made by TRACE to the public authorities of Iași is about curbing private car usage and replacing it with more sustainable, efficient, and less costly means of transportation. Like elsewhere in Romania, the number of cars in Iași will continue to rise in the future. As a result, fuel use will go up, and so will greenhouse gas emissions. City authorities should take the right steps to reduce private vehicle usage and substitute it with more sustainable, efficient, and less costly measures. Some of these methods can reduce the increase in the use of private vehicles. Instead, they can encourage people to use other means of transportation, e.g., buses, trams, biking, and walking. Such options would lead to traffic decongestion, less fuel consumption and reduced costs, as well as to a cleaner, healthier environment. To this end, traffic can be restrained in many ways.

Currently, several road infrastructure rehabilitation projects are in progress in Iași, looking to improve traffic in the city. An underground passage and one over-ground fly-over - are just a few projects under way that could better the traffic flow and reduce the travel time for private vehicles. Another way to curb traffic is by imposing taxes to enter the downtown area. For example, the city of Stockholm in Sweden imposed a “congestion charge” during weekdays from 6:30 AM through 6:30 PM, and cars that want to get into the city center during these hours must pay a fee that can vary from EUR 1.2 to EUR 7.2. Following the introduction of the tax, the city has seen traffic reduced by 15-20%, travel time cuts by 50%, and vehicle emission-based air pollution significantly reduced. On the short run, the main target of the congestion pricing program can be to reduce traffic jam and raise funds for a large infrastructure project designed to improve public transit in the city.

Congestion charge sign in Stockholm



Source: www.sustainablecitiescollective.com

The municipality of Iași may think about introducing some restrictions for inter-regional buses. Such vehicles should not be allowed to enter the



downtown area and should be limited to only a couple of stops inside the city. Such restrictions are enforced in Cluj, where local authorities restricted private inter-regional operators to only three “legal” stops in the city. This is meant to protect local public transport providers, and ease traffic congestion in the city. The good news is that since the Iași’s beltway has recently been completed, the city managers are already thinking of banning heavy vehicles from entering the city.

In addition, the local government could apply some reduced speed zones in the city center as an additional measure aimed at discouraging traffic in the downtown area. For example, the City Hall in Craiova has restricted the speed to up to 40 kilometers per hour in some areas in the city center. The local public administration in Iași may go even beyond that and reflect on enforcing limitations should throughout entire the downtown area, a measure which would have a good chance to discourage traffic. Reducing the speed limit in some zones could be just one component of a bigger plan the local government may take into consideration in view of restricting private car use and favor the flow of public transport, cyclists, and pedestrians in designated areas, by establishing the so-called “environmental islands”. An “environmental island” could be a few streets in certain parts of the city, which can be the result of some measures conceived to prohibit and penalize the access of private vehicles access in designated areas, and diminish the amount of space available for private cars.

Last, but not the least, traffic can also be restrained by a number of civic initiatives taken up by the city managers. The Iași City Hall may think about setting up “no driving days” to educate and lead by example, actions to which people could participate voluntarily. For example, the city of Puerto Princesa in the Philippines is a good example in this respect, where the municipality is restricting vehicles in the downtown district on certain days of the week.

Traffic Flow Optimization

Traffic congestion is causing several inconveniences for the residents of Iași. As the city is an important academic center, traffic becomes an issue especially during school sessions, when more kids and students are in the city and commute daily to schools and universities. In addition, the airport

located just a few kilometers away from Iași is bringing more traffic into the city. The Iași County managers plan to rehabilitate and expand the runway and, subsequently, operate more flights to European cities.

Good practices around the world revealed that cities managed to improve the traffic by taking up some solutions aimed at minimizing the distance traveled, and, thus, reducing fuel consumption. With a minimum investment up to USD 1 million, driving patterns can be changed by traffic signaling or by means of information, resulting in 200,000 kWh in energy saving annually.

Under CIVITAS, a project funded by the EU, Iași implemented an integrated surveillance and control system by which GPS devices were installed on 100 buses and trams. A maintenance facility center was equipped with management, recording and storage systems, where RATP Iași supervises the GPS-tracked vehicles, records and forwards complaints through the toll-free line. In addition, modules for incident management are integrated with the toll-free phone line, and manage all events that occur related to traffic management. As a result, more buses and trams stuck to the timetable, and thus, helped improve with the traffic flow in the city. Consequently, in the spring of 2012, the Iași City Hall and the local public transport authority launched the system informing the passengers upon the arrival time at their destination. Electronic screens displaying information on arrival time were installed in 50 buses on two of the most popular routes in the city.

Iași is currently developing over-ground and underground passages aimed at improving the traffic flow in the city. At the same time, the local government is working on a traffic management system designed to decrease traffic congestion in the city. It is a RON 91 million project (approximately EUR 20 million) with support from EU funds, and it is implemented by UTI, a company in charge with similar projects in other growth poles. The project is expected to be completed by the summer of 2015, and will achieve several targets: increase efficiency of the public transport, better regulate traffic along public transport corridors, increase speed of public transport, improve traffic safety, and reduce greenhouse gas emissions.



A passage will connect the downtown area to the eastern side of Iași



A traffic command and control center will be developed, where information collected through various communication systems will be introduced in a database. 90 intersections and crossroads in Iași will be equipped with red lights, signaling devices, automatic traffic monitoring systems, and video cameras to monitor traffic, especially during rush hours. Acoustic systems for people with vision disabilities will be installed.

Traffic center in Iași



Source: www.civitas.eu

In the first year after the completion of the project, the city managers trust that the travel time will be reduced by 17%, while the public transport riders will go up by 5%. The project includes setting up 59 traffic monitoring equipment in intersections, 1,242 new red lights, and 1,979 traffic signs. 72 devices for automatic monitoring of traffic will gather real time information about accidents, derails, traffic congestion, and send it to the command center, allowing for timely intervention. From the command center, monitoring agents will keep an eye on intersections, and inform the local police whenever traffic congestion is detected. The new traffic management system will create 27 new jobs.

In order to enhance attractiveness of public transport, the city managers may think about expanding the GPS-based integrated surveillance and control system to more buses and trams from the public transport, and introduce information on available connections to more public transport routes. At the same time, they should look at other cities in Romania, like Timișoara, the local transport company has installed electronic screens displaying information on buses and trams routes, and real time countdown were installed at the waiting facilities. This would allow passengers to plan and better manage their trips.

In addition, private vehicle drivers can receive real-time information by means of Variable Message Signing (VMS) or telecommunication about route switching options, clear directional signing to destination, and direction to nearest available parking spaces.

Variable Signing Messages System



Source: www.en.academic.ru



Such systems help choose the most suitable means of transportation, decrease travel time and delays, and cut down the number of accidents.

Public Transport Development

One of the main TRACE recommendations 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. If more people would rely on public transportation, this would significantly cut down fuel consumption, diminish the number of private cars in circulation, improve air quality in the city, and increase the quality of life for the residents of Iași.

A comprehensive public transport development program should aim to ensure mobility by increasing connectivity between the city center and the outskirts, and integrating the network with the traffic management system. Currently, the public transport in Iași is operated by trams, buses, and minibuses, and connects the downtown area to all parts of the city. There are a few shuttles services to some of industrial areas in the outskirts of the city. A special school bus link is connecting Iași to Ciurea, a commune in the wider metropolitan area, to facilitate access of Roma community to public transport, allowing Roma students to attend classes in the city, and thus increasing their access to opportunities.

Since mid-2000, the local transport authority and the City Hall joined efforts to modernize the public transport, by undertaking a number of initiatives to make it more efficient and more attractive. New buses have been purchased; tickets can be purchased in easy, user-friendly ways; passengers get better information about their trips; clean fuel has been introduced; and a transport connection has been opened to some of the socially deprived communities living in the wider metropolitan area. Many of these initiatives were developed under CIVITAS program. For example, a few streets, such as Nicolina Street (between Podul Roș and Nicolina passage), Independenței Street, and Vasile Lupu Street, have designated bus priority lanes.

However, the public transport system has some issues that the local government needs to address. Some of the trams and buses operating in the city are fairly old and need to be replaced. Efforts should

continue to this end, and keep improving the public transport system to increase its level of comfort, accessibility, and use. RATP Iași received money from the EBRD to prepare a study to optimize the public transport in the city on medium and long run. After the new public transport company will be established (by the beginning of 2014), the local government wants to focus on an array of issues, including expanding the service in the wider metropolitan area, and reducing the fuel consumption by purchasing new, energy efficient vehicles. The city managers hope that purchasing of rolling stock will become eligible under the next ROP.

Lately, City Hall has focused a great deal on the tram network. Investments of millions of Euros from EU structural funds have been poured into the rehabilitation of the tramlines, and a number of similar projects are currently under way. Upon completion of the rehabilitation work, the next step will be purchasing of new and modern, trams. At the same time, the city authorities plan to continue the modernization of the network in the future and expand it to a couple of communes located on the outskirts of the city, namely Holboca and Târnești. The ultimate goal is to increase the number of tram riders to 70% of the total passengers travelling by public transport means.

More people in Iași are expected to use trams



The City Hall is contemplating expanding the bus service to a few communes in the wider metropolitan area, such as Tomești and Valea Lupului.



The city managers are looking into options to reduce fuel consumption and related expenditures. One way of doing that is by switching more buses from diesel to LPG. Another choice could be expanding the electric transport system in the city, by introducing trolleybuses or electric buses. Electric buses are energy efficient and environmental-friendly, but very pricey.

Another way of attracting more people to use buses, trams, and minibuses and is by making public transport better, more accessible, and attractive. The city managers should consider introducing the electronic ticket that could be used for more trips and means of transportation within a given amount of time. Some of the cities in Romania, like Timișoara and București, have already turned to this easy, user-friendly method of payment for public transport trips.

E-ticketing 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 some of the entertainment services in the city, like theater or cinema. The electronic card was used to pay the parking in the city until the new system by text message was enforced. People who use e-ticketing in Timișoara get a 10% discount on the public transport fare.

E-ticketing in Timisoara



Source:www.ratt.ro

They can pay the ticket directly from their cell phones, from designated kiosks, and also on the bus. In other cities around the world, like Washington, D.C., e-ticketing is used for both bus and metro trips. They can put money on a card, either at the metro stations or in the bus. People pay one trip (one ticket) and use it for multiple bus trips within two hours in the metropolitan area. There is a small discount when switching from metro to bus.

E-ticketing could help address the lack of data regarding public transport in Iași. As of today, the city does not have complete information on the transport mode split, as there is no data regarding the number of people who use public transport, who use private cars and how many walk or bike. Estimations on public transport users in Iași are made according to the number of tickets and monthly passes sold, the number of people who benefit of transport facilities and discounts, and surveys. However, this way of counting of passengers cannot provide information of the number of people who use public transportation on daily basis, nor of the structure of passengers or the mode split.

In addition, 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 Iași to use one single ticket for their entire trip, regardless of how many buses they need to change to get into the city. Today, someone commuting from Miroslava, for example, must pay for one ticket to get to the outskirts of Iași, and for one more ticket to get to the downtown area.

In order to boost attractiveness of public transport and cut down travel time, the local public administration could develop more bus priority green lights and dedicated lanes. More dedicated lanes and giving priority to buses at intersections will enable buses to bypass traffic congestion, enhance their reliability, and reduce travel times.

This, of course, will be another incentive for people to turn to public transportation. Moreover, cities that have a good network of dedicated bus lanes have managed to tackle in a productive way bus traffic issues. Special infrastructure for bus-priority signaling can help the flow of approaching buses either by extending green lights for them or by cutting down the cycle for cars. Passengers should be informed on trips about 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.

Bus lanes in Los Angeles



Source: www.laist.com

Public transport development can 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 Iași City Hall should organize information 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.

Screen displaying information on tram schedule in Timișoara



Municipal Buildings

Municipal Buildings Benchmarking Program

The TRACE team recommended to the public administrations in Romania where the tool has been implemented to prepare a municipal buildings energy database, where all energy-related information can be tracked and monitored. The same recommendation has been made to Iași. The City Hall already has an energy efficiency department that could keep track of the energy consumption and expenditure in the educational units and hospitals in the city (including electricity, heating, and water). The database with municipal buildings energy use is currently not complete. For example, the data received from the City Hall does not include floor area for municipal hospitals, nor information about administrative offices, sports-halls, social services and cultural centers managed by the local government.

The energy database is very useful for the implementation of any energy efficiency program. In most of the Romanian cities where TRACE has been implemented the local public managers do not keep a proper and reliable record on the energy consumption and expenditures related



to the buildings they administer. Often time, the city managers do not know the actual heat or electricity consumption per square meter and the related expenditure for the given floor area. Thus, they do not know if completed energy efficiency investments were indeed effective.

The Emil Racoviță High-School in Iași has been renovated



Through this recommendation, TRACE is encouraging the local government of Iași to improve the database structure and the basic indicators, expand the monitoring process to all municipal buildings in the city (including cultural centers, local public administration offices, social assistance services, sports halls), and create a complete set of information with regard to energy consumption and expenditures. This will help improve the monitoring and assessment 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.

Therefore, 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 comprise of basic information regarding the surface area of the buildings, the annual electricity and heating consumption, and the energy savings accomplished after renovation or thermal rehabilitation work has been performed. It is important for the local public managers in Iași to have a complete picture

of energy consumption and expenditures for the buildings for which they pay electricity and heating bills. This is the first step for a program that may aim to decrease energy expenditures in these buildings.

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 financial programming period will open ways 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. The municipal building benchmarking process should include a database comprising a series of specific information including type of construction, date of the construction and renovation or rehabilitation (if applicable), floor area, type of heating, information on electricity, heating, and water utility bills in recent years, as well as cooling, heating, and lighting system modes.

The full audit of municipal buildings could be prepared by the existing energy departments in the City Hall, with support of a few external consultants, if necessary. This process should benefit from the assistance of several divisions within the local public administration. After the database on municipal buildings is completed, 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 is also valuable in 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 identify the most appropriate energy saving options. Also, the database could be very useful for the local public administration to perform an audit of the municipal buildings in the city and then to prioritize buildings for retrofitting.

The TRACE examples database has several different models that could be considered by local government when improving the benchmarking process. The Ukrainian city of Lviv is a good example that an efficient benchmarking could achieve 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 was able to determine annual goals based on historical consumption and negotiations on an adjustment. 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.

Once the municipal building benchmarking is prepared, the next step the Iași City Hall should consider is an audit and retrofit process to enable cost savings, and also reduce the carbon footprint of the city.

Municipal Buildings Audit and Retrofit

Another recommendation pertaining to municipal buildings is to prepare an audit followed by a retrofit process. The building audit is targeting specific energy consumption for end users and activities, such as computers, lighting, air conditioning, and heating systems, etc. Depending on results, the city government may have 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 in the savings from the retrofits. Studies revealed that audit and retrofit programs have a tremendous contribution regarding energy savings, as the reductions can go down to as much as 25% of the initial consumption.

The municipality of Iași is engaged in supporting energy savings, and encourages both private and public buildings to be proactive and save energy in any of its forms. Several schools, high-schools and kindergartens have been rehabilitated and renovated with EU support, and, as a result, the comfort level in these buildings increased. 639 apartments in 20 buildings have been thermally insulated under a program coordinated by the Ministry of Regional Development and Public Administration (MRDAP). Although the number of renovated apartments that have benefitted from governmental support in Iași is smaller than in other cities

(e.g., 4,000 in Timisoara, and nearly 5,000 in Cluj-Napoca), the local government plans to thermally insulate more buildings in the city in the near future. In the next period, the Iași City Hall will begin insulation work on a number of 11 residential buildings, as part of a larger project comprising 80 blocks of flats. In addition, the MDRAP allotted recently approximately EUR 30 million for the rehabilitation of residential buildings in the entire Moldova region. The City Hall Iași submitted a proposal for 16 residential buildings, which would require EUR 5 million.

The city government plans to replace some of the classical hot water systems in some of buildings with those based on renewable sources. Among the first municipal buildings where such changes should occur is the Recovery Hospital where hot water should be produced from geo-thermal sources.

The local government hopes to be able to use financial support through the next EU structural funds for the rehabilitation of both public and residential buildings. Thermal insulation of buildings (insulation of walls, rooftops, etc.), in addition to replacing the old windows with double-glazed ones, is expected to reduce heating bills by at least 20%. At the same time, in order to further reduce utility bills for municipal buildings, local authorities may consider replacing the incandescent bulbs with more efficient fluorescent ones.

The Recovery Hospital in Iași



Source: www.curierul-iasi.ro



Germany provides a few successful examples in improving energy efficiency in municipal buildings and reducing related costs. 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 CO₂ reductions, and generating substantial savings.

In another successful story, the city of Stuttgart was able to save 7,200 tons of CO₂ 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 the electricity consumption for lighting the streets in the city can be diminished substantially.

This program can be tailored to the specific needs for lighting in 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, 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 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.

Local authorities in Iași have plans to improve the street lighting in the city and reduce related electricity consumption. To this end, they want to upgrade the system by introducing an automatic lighting system.

Street lighting lamp in Iași





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 there. Automatic lighting systems are implemented in some neighborhoods in Bucharest, along small alleys and paths around residential buildings. In the medium run, the local public administration looks at more ambitious options as to gradually switch from sodium-vapor lamps to LED bulbs. Local authorities should undertake a rigorous cost-benefit analysis before making this move though. LEDs are very efficient indeed, 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.



EUROPEAN UNION



GOVERNMENT OF ROMANIA



MINISTRY OF REGIONAL DEVELOPMENT
AND PUBLIC ADMINISTRATION



IAȘI



Instrumente Structurale
2007 - 2013

Annexes Improving Energy Efficiency in IAȘI România



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 Iași, Romania

- Annex 1: Energy Efficiency Strategy and Action Plan /68**
- Annex 2: District Heating Network Maintenance & Upgrade /72**
- Annex 3: Non-Motorized Transport Modes /76**
- Annex 4: Parking Restraint Measures /79**
- Annex 5: Traffic Restraint Measures /82**
- Annex 6: Traffic Flow Optimization /85**
- Annex 7: Public Transportation Development /88**
- Annex 8: Municipal Buildings Benchmarking /92**
- Annex 9: Municipal Buildings Audit and Retrofit /99**
- Annex 10: Street Lighting Timing /103**
- Annex 11: List of abbreviations for cities in the TRACE database /106**



ANNEX 1: Energy Efficiency Strategy and Action Plan

DESCRIPTION

Develop a comprehensive energy efficiency strategy and action plan for the municipality. The strategy should have measurable and realistic targets, set out timeframes and assign responsibilities. It should be developed collaboratively by representatives from across the municipality and other groups who will be affected by the strategy. A municipal energy efficiency strategy will help bring together a diverse range of initiatives into a coherent plan for city-wide energy efficiency. By presenting a single action plan, the strategy will also make it easier to monitor progress.

The strategy can also be used as an internal and external publicity tool for the municipality to promote and build support for their work on energy efficiency.

IMPLEMENTATION OPTIONS

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

MONITORING

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

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



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/bggreen/BGreen_2020_Executive_Order.pdf

Regional Plan Association "BGreen 2020: A Sustainability Plan for Bridgeport, Connecticut" <http://www.rpa.org/bggreen/BGreen-2020.pdf>

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

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

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

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

Since the order was issued, the city and the Regional Business Council have also developed a comprehensive sustainability plan, BGreen2020. The plan was developed following an 18-month planning process with a Community Advisory Committee and five technical subcommittees. The process involved over 200 participants from city, state, and federal governments, businesses, and civic and neighborhood groups. The plan is a comprehensive strategy to



improve the quality of life, social equity, and economic competitiveness while reducing GHG emissions and increasing the community's resilience to the impacts of climate change.

Energy Efficiency Strategy, Spain

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

Evaluate Energy Savings <http://www.evaluate-energy-savings.eu/emeees/en/countries/Spain/index.php>

Spain's Energy Saving and Energy Efficiency Strategy 2008-2012 (E4), which constitutes its National Energy Efficiency Action Plan (NEEAP), aims to achieve security of supply in terms of quantity and price with some basic levels of self-sufficiency, taking into consideration the environmental impact and economic competitiveness.

The plan identifies 7 sectors including: agriculture, buildings, domestic and office equipment, industry, public services, transport, and energy transformation. Within each of these sectors, it sets out 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: Eco² 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. Analysts 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: Eco² Cities - Integrated Resource Management in Stockholm, available online <http://www.esmap.org/esmap/node/1228>

The City of Stockholm, the capital of Sweden, has pursued integrated city planning and management to become a sustainable city. The city has a comprehensive urban vision, environmental programs, and concrete action plans to reduce greenhouse gas emissions and tackle climate change. It implements integrated urban planning approaches that consider ecological benefits and efficient resource use.

The ongoing redevelopment in the city's southern district, Hammarby Sjöstad, is a good model for understanding integrated approaches to sustainable urban planning and redevelopment. The area aims to be twice as sustainable as Swedish best practice in 1995. The area implements integrated resource



management (waste, energy, water, and sewage) through systematic stakeholder collaboration and has transformed the linear urban metabolism into a cyclical one known as the Hammarby Model.

According to Grontmij AB, a private consultancy firm in Stockholm, primary assessments of the initially developed districts of Hammarby Sjöstad show that the area has achieved, for example, 28 to 42 percent reductions in nonrenewable energy use and 29 to 37 percent reductions in global warming potential.

TOOLS & GUIDANCE

Tools & Guidance

N/A



ANNEX 2: District Heating Network Maintenance & Upgrade

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. 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>

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



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

MONITORING

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

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

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



CASE STUDIES

District heating network pipe maintenance, Seoul, Korea

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

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

District heating network upgrade, Jiamusi, China

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

Due to a chronic lack of funds, the Jiamusi district heating network had for many years suffered from reduced maintenance, which had resulted in large energy and water losses. As interruption of service and low in-door temperature were the norm, the operator of the network, Jiamusi Heating Company (JHC), experienced increased dissatisfaction from its users. In May 2007 JHC, which was owned by the municipality, signed a 25-year agreement with an energy services company to take responsibility for the management of the network. A large-scale initiative to improve performance and upgrade the network's facilities was implemented. The heat supply temperature was raised; 90 new substations were built; and a SCADA (Supervisory Control and Data Acquisition) system was installed, enabling real-time management of the substations and the network, and resulting in improved optimization of energy efficiency and user's comfort. As a result, water losses were reduced by 30%, and energy consumption by 13.5%. By improving service quality, the company improved its customer relationships and was able to reduce the bad debt rate from 7% to 2%. The network has begun expansion and after two years of operation, it has increased its supply from 5.5 million sq. m (29% of the total heating surface) by 56% to 8.6 million sq. m.

TOOLS & GUIDANCE

Tools & Guidance

DHCAN "District Heating System Rehabilitation and Modernization and Modernization Guide" projects.bre.co.uk/DHCAN/pdf/Modernisation.pdf. A guidance document for technical improvements resulting in higher energy efficiency and reduction of primary energy use. It attempts to set out a range of solutions from low-cost to high-cost, with consideration of financial circumstances, and links this to the fundamental need for a strategic view.

IEA "Coming in from the Cold- Improving District Heating Policy in Transition Economies" <http://www.iea.org/textbase/nppdf/free/2004/cold.pdf>. A document which summarizes the institutional experiences of district heating rehabilitation, with focus on delivering clear policy on district heating.

ESMAP Public Procurement of Energy Efficiency Services - Guide of good procurement practice from around the world.



Tools & Guidance

http://www.esmap.org/Public_Procurement_of_Energy_Efficiency_Services.pdf



ANNEX 3: Non-motorized Transport Modes

DESCRIPTION

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

IMPLEMENTATION OPTIONS

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

Attributes

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

First Cost
> US\$1,000,000

Speed of Implementation
> 2 years

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



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

MONITORING

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

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

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

CASE STUDIES

Pedestrianization with road closures, Oxford, England

European Commission, Directorate General for the Environment (2004). "Reclaiming city streets for people: Chaos or quality of life?", available online from http://ec.europa.eu/environment/pubs/pdf/streets_people.pdf

The main retail streets have been fully pedestrianized, while other through roads in the central area are only accessible to buses and pedestrians. The adoption of a step by step, integrated approach to the implementation of the road closure program has been seen as critical to the success of the significant road space reallocation element of the scheme. Opposition to the USD 6 million schemes was raised most notably on the basis that traffic congestion on two key routes in the city would worsen, as well as from retailers concerned about delivery access and trade levels. These concerns were attended to via an extensive consultation process and an effective publicity campaign prior to the implementation of the scheme. This included leaflets, advertisements on buses, city-wide poster boards, and a series of press releases

Dedicated cycle network, Bogota, Colombia

C40 Cities (2010). "Bogota, Colombia: Bogota's CicloRuta is one of the most comprehensive cycling systems in the world", available online from http://www.c40cities.org/bestpractices/transport/bogota_cycling.jsp

CicloRutas is considered a unique cycling network where design has taken the topography of the city into consideration in order to create maximum flow



and function (manmade and natural features, hills, waterways, parklands, essential facilities). In a period of just 7 years, following an investment of USD 50 million, the use of bicycles on the network increased by more than 268%. CicloRutas plays an important role for lower income groups, as more than 23% of the trips made by the lowest income group in the city are by walking or by bike. The development of CicloRutas has also helped to recover public space along riverbanks and wetlands, as for many years the city's wetlands were occupied by illegal settlements.

Bicycle micro credits, Lima, Peru

ICLEI (2009). "Case study 46: Assistance to purchase bicycles - Lima, Peru" in Sustainable Urban Energy Planning: A handbook for cities and towns in developing countries, available online from <http://www.unhabitat.org/pmss/listItemDetails.aspx?publicationID=2839>

In 1990, the Municipality of Lima set up a micro-credit program to help low income citizens purchase bicycles. By saving on daily public transportation costs, workers can see their income effectively rise more than 12% once the loan is paid off. In order to enhance the success of the program, efforts have been made at standardizing the use of bicycles in the city. Actions to achieve this have so far consisted of the development of a manual of technical standards for the design and planning of cycle ways.

Bicycle rental, Velib, Paris, France

C40 Cities (2010). "Paris, France Velib - a new Paris love affair", available from http://www.c40cities.org/bestpractices/transport/paris_cycling.jsp

Paris launched a 24/7 cycle hire scheme through Velib; a public private partnership between the city of Paris and a company led by a major advertising group. Users must purchase a subscription by day, week or year, and bike rental is free for the first half hour of every individual trip, after which it costs a fixed rate. The increasing price scale ensures the bikes are kept in circulation. Notably, the City of Paris generates revenues from the project without any investment (which cost USD 108 million). The public-private partnership is the reason for this success, with the private company paying operating costs plus rights to advertising space to the City, funded by advertising revenues.

TOOLS & GUIDANCE

Tools & Guidance

Sustrans (2007). "Technical guidelines for the development of cycle facilities" A series of guidance documents for professionals on the details of bicycle network design. Available online from <http://www.sustrans.org.uk/resources/design-and-construction/technical-guidelines>

Transport for London (2010). "London Cycling Design Standards" A guidance document for designing to reduce barriers to cycling, in order to support road safety targets. Available online from <http://www.tfl.gov.uk/businessandpartners/publications/2766.aspx>



ANNEX 4: Parking Restraint Measures

DESCRIPTION

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

IMPLEMENTATION OPTIONS

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

Attributes

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

First Cost
< US\$100,000

Speed of Implementation
> 2 years

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



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

MONITORING

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

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

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

CASE STUDIES

Parking standards, London Plan, London, UK London (2010). "Chapter 6: Transport" in The London Plan, available from <http://www.london.gov.uk/shaping-london/london-plan/docs/chapter6.pdf> pp.160-161.

The London Plan establishes maximum parking guidelines for residential development. It stipulates that all developments in areas of good public transport accessibility should aim for significantly less than 1 parking space per unit. The main challenge continues to consist of ensuring that these standards are supported other measures which reduce car dependency, both within the development and in the surrounding area, e.g. improved and increased public transportation accessibility.

SF park curbside parking, San Francisco, USA

Institute for Transportation and Development Policy (2010) "U.S. Parking Policies: An Overview of Management Strategies", available online from http://www.itdp.org/documents/ITDP_US_Parking_Report.pdf

San Francisco Municipal Transit Agency's (SFMTA) installed new electronic, multi-space meters in 2009 and will activate parking spot sensors attached to the pavement sometime in 2010. The aim is to use pricing to help redistribute the demand for parking. The heart of SFpark is a Data Management



System which sorts a tremendous amount of data collected from the networked array of remote sensors in all 6,000 parking spots. These wireless sensors can detect whether a spot is occupied by a vehicle and report parking occupancy information in real time to a central computer. The project will produce valuable data about the effect of meter pricing on occupancy. By 2010 the project will encompass 6,000 of San Francisco's 25,000 metered curbside parking spots in seven pilot neighborhoods.

Parking fees, Aspen, US

Source: Victoria Transport Policy Institute (2010). "Parking Pricing Implementation Guidelines", available online from <http://www.vtpi.org/parkpricing.pdf>

The city used to suffer from high levels of congested on-street parking. In order to reduce the effects of the "ninety-minute shuffle" (where locals and downtown commuters moved their vehicles every 90 minutes to avoid a parking ticket), the city introduced charges for on-street parking using multi-space meters. Parking fees are highest in the center and decline with distance from the core. The city had a marketing campaign to let motorists know about the meters, including distribution of one free prepaid parking meter card to each resident to help familiarize them with the system. Motorists were allowed one free parking violation, and parking control officers provide an hour of free parking to drivers confused by the meters.

Park-and-Ride, Oxford, United Kingdom

Oxford City Council (2009). "Park and Ride Transfer", available online from http://www.oxford.gov.uk/PageRender/decTS/Park_and_Ride_occw.htm

Oxford city has five Park-and-Ride sites serving the city's shoppers, visitors and commuters. These sites used to charge for parking to provide income to cover operational costs, but were not able to generate additional money for repairs or improvement. In order to achieve savings, the management of the Park-and-Ride sites was transferred to Oxfordshire county, resulting in efficiency savings of 250,000 GBP per year for the city administration. These savings were achieved primarily through economies of scale, and by sharing the cost of providing the service with taxpayers across the County, and not just those in the city - both of which used the facilities.

TOOLS & GUIDANCE

Tools & Guidance

Victoria Transport Policy Institute (2010). "Parking Management: Strategies, Evaluation and Planning" A comprehensive guidance document for planning and implementation of parking management strategies. Available online from http://www.vtpi.org/park_man.pdf

Victoria Transport Policy Institute (2010). "Parking Pricing Implementation Guidelines" A guidance document for implementation of parking pricing with details on overcoming common obstacles. Available online from <http://www.vtpi.org/parkpricing.pdf>

Spillar, R. (1997). "A Comprehensive Planning and Design Manual for Park-and-Ride Facilities" A guidance document for the planning and design of Park-and-Ride facilities. Available online from <http://www.pbworld.com/library/fellowship/spillar>



ANNEX 5: Traffic Restraint Measures

DESCRIPTION

Discouraging potential drivers from using their cars leads to fewer cars in circulation. This encourages people to use alternative modes, which in turn will increase their viability (increased public transport patronage for example). Removing vehicles from circulation reduces fuel use and reduces the need for road space.

IMPLEMENTATION OPTIONS

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

Attributes

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

First Cost
US\$100,000-1,000,000

Speed of Implementation
1-2 years

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

MONITORING

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



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

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

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

CASE STUDIES

Vehicle bans: Motorcycle ban, Guangzhou, China

Institute for Transportation and Development Policy (2008). "Case study: motorcycles in Guangzhou", available online from <http://www.itdp.org/documents/Guangzhou%20Case%20Studies%20-%20Motorcycles%2015-Sep-08.pdf>

Motorcycles have been completely banned in the City of Guangzhou. The ban was implemented in phases, beginning with a moratorium on new licenses, extending to various roads and time periods. Gradual implementation has been crucial to allow time for the public to adapt, and efficient supply of additional infrastructure/services has supported the induced modal shift. Many motorbike riders have shifted to bicycles and buses, and cycle rickshaws have also emerged as a popular substitute. Road accidents have dropped by 40% since the initial implementation of the ban.

Rationing, Singapore, Singapore

Sustainable Urban Transport Project (2010). "The Vehicle Quota System in Singapore", available online from http://www.sutp.org/index2.php?option=com_content&do_pdf=1&id=1582

Singapore fixes the number of new vehicles allowed for registration. Potential buyers need to bid for a non-transferable licence, which entitles them to own a vehicle for a fixed number of years. The scheme had to be modified soon after implementation to safeguard against speculative action. The licenses used to be transferable and within the first two months of the first round of release, 20% changed hands in "buy and sell" transactions with speculators making sizable profits of up to S\$5000. As the rationing system does not control annual mileage, the success of the rationed registration in limiting vehicle usage has been dependent on support from other traffic restraint measures, such as high road tolls, parking fees, and electronic road pricing.

No-driving days, One Day Rest, Puerto Princesa, Philippines

ICLEI (2001). "Vehicular Reduction Strategy for Air Pollution Prevention and Climate Change Mitigation; A Case of Puerto Princesa City, Philippines", available online from <http://www.iclei.org/index.php?id=1193>

Introduced as part of a zoning and rerouting, this program stipulates a one day rest for tricycle drivers in the central business district. Regulation of illegally operated tri-cycles is a major impediment, as enforcement irregularities pose questions of inequality between illegal and legal tri-cycle taxi drivers. Furthermore, the income potential of those who comply with the rest day is lost to the illegal operators



TOOLS & GUIDANCE

Tools & Guidance

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



ANNEX 6: Traffic Flow Optimization

DESCRIPTION

Traffic can be positively managed to ensure the most efficient operation of the transport system. Management techniques will seek to minimize distance travelled between origin and destination, ensure the efficient flow of traffic and encourage multiple occupancy vehicle travel. Encourage the efficient use of vehicles and minimize journey lengths, reducing fuel use.

IMPLEMENTATION OPTIONS

Implementation Activity	Methodology
Flow optimization	The City Authority changes driving patterns either by technical optimization of traffic signaling, or by means of the provision of information. Real-time information can be provided by means of Variable Message Signing (VMS) or telecommunication where drivers are provided with route switching options, clear directional signing to destinations, and directions to nearest available car parks. This minimizes journey length and reduces congestion. Messaging systems have also been used to counter crime by providing information on e.g. kidnappings and terrorist attacks. See Portland and Milton Keynes case studies for further details.
Regulatory	The City Authority establishes high-occupancy vehicle lanes (HOV), producing an incentive for car sharing. The pairing of users can be left to civic initiatives, or driven by city authorities either separately or in combination with its other initiatives (in the latter case initiatives can be communicated to users using the same platform). Achieving a minimum number of users is crucial, as insufficient use results in reduced available road space and increased congestion. The implementation of an effective enforcement and penalties system are equally important, as the lane will otherwise attract an unacceptably high level of non-HOVs, which also reduces effectiveness. See Madrid case study for further details.

ATTRIBUTES

Energy Savings Potential

> 200,000 kWh/annum

First Cost

US\$100,000-1,000,000

Speed of Implementation

> 2 years

Co-Benefits

Reduced carbon emissions
Enhanced public health & safety

MONITORING

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



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

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

- Perform traffic surveys of number of vehicles in circulation by using traffic counters.
- Determine mode share of people travelling in the area or city.

CASE STUDIES

Arterial 'green wave' traffic flow optimization, Portland, USA

C40 Cities (2010). "Portland, USA: Optimizing traffic signal timing significantly reduces the consumption of fuel", available online from http://www.c40cities.org/bestpractices/transport/portland_traffic.jsp

The City Authority optimized traffic signal timing at 135 intersections on 16 of some of Portland's most congested thoroughfares. 'Optimization' of traffic signals consists of re-timing the traffic signals to improve their synchronization across a road traffic network. The cost of an intersection synchronization varied USD 1,000-3,000. The resulting reductions in the frequency by which vehicles accelerate and decelerate, as well as the reductions in the time vehicles spend with idling engines, yielded annual fuel savings of 1,750,000 gallons of gas. This is the equivalent of removing 30,000 passenger vehicles from the road for an entire year. The city went a further step by measuring and eliminating CO₂ through the purchase of carbon credits.

Variable Message Signs, Milton Keynes, UK

Department for Transport (2010). "Case Study: Milton Keynes Integrated Traffic Management", available online from: <http://www.dft.gov.uk/itstoolkit/CaseStudies/milton-keynes-integrated-traffic-management.htm>

In order to achieve a more efficient usage of car parks and encourage shoppers into the central retail area of Milton Keynes, as well as reduce congestion caused by cars looking for parking, the city administration invested in Variable Message Signs which display the location and availability of parking spaces to road users. Installation costs were lowered by making use of existing ducted network in Milton Keynes used by the Police for CCTV. This created the added benefit of providing a large capacity network for future growth in data transmissions. The reduction in congestion and delays resulting from the system are estimated to save motorists and bus passengers in the central area more than GBP 3 million over a 10-year period.

High-Occupancy Vehicle lane, Madrid, Spain

Monzon, A. (1999) "Managing long term congestion in HOV lanes. Effect of 2+ vs 3+ limit on the Madrid N-VI corridor", paper presented at the European Transport Conference, Cambridge, Jan 1st 1999, available online from <http://www.etcproceedings.org/paper/download/2493>

High environmental standards, low housing density, and high motorization rates influenced the decision of implementing an HOV lane scheme on the median of the N-VI motorway into Madrid. The cut off limit for the lane is 2+ passengers and the facility is separated from the mix-flow lanes by a concrete barrier along the whole length of it. A successful design aspect is the reversible basis on which the system operates to match peak flows, serving the inbound trips during the morning peak, and the outbound trips during the evening peak. Rather than increase ridesharing, the lanes have attracted a growth in public transport mode share (40% in the period 0700-1000 in the year following implementation), resulting in increased frequencies of services.



TOOLS & GUIDANCE

Tools & Guidance

Colorado Department of Transportation (2005). "CDOT Guidelines on Variable Message Signs (VMS)", A guidance document for the design of Variable Message Sign (VMS) messages. Available online from <http://www.cotrip.org/its/whitepapers/VMSGUIDE-rev-2005.pdf>

Alabama Department of Transportation (2007). "Traffic Signal Design Guide & Timing Manual" A guidance document with detailed guidelines and recommendations for the designing and timing of traffic signals in the State of Alabama. Available online from <http://www.dot.state.al.us/dsweb/Traffic/pdf/AldotTrafficSignalManual122007.pdf>



ANNEX 7: 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.
Signalling	The City Authority invests in the necessary infrastructure for bus-priority signalling. Such systems are linked to buses via transponders which use GIS information, and favour the circulation of approaching buses either by extending green lights for buses or by shortening cycle for cars.
Information	The City Authority provides good quality passenger waiting facilities and as well as good information services. The provision of real-time bus countdown information allows users to understand and manage waiting times. These services enhance the attractiveness of public transport.
Operations	The City Authority invests in the necessary infrastructure for electronic ticketing. This allows for use of multiple buses within a given amount of time with one ticket, reducing the cost of travel, putting buses within the reach of the poorest, while attracting a wider patron base, when in combination with other modes, such as heavy rail or metro.
Planning regulations & guidelines	The City Authority links development densities to public transport availability and funding. The City Authority reviews the city's zoning ordinances and considers making the following changes: Increase the permitted floor area ratio/ plot ratio on sites located near public transport hubs. In areas where it is appropriate re-zone single-use lands to allow multiple uses on the same site. Allowing higher densities

ATTRIBUTES

Energy Savings Potential

> 200,000 kWh/annum

First Cost

> US\$1,000,000

Speed of Implementation

> 2 years

Co-Benefits

Reduced carbon emissions
Improved air quality
Enhanced public health & safety



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

MONITORING

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

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

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



CASE STUDIES

BRT system, Bogota, Colombia

Source: ESMAP (2009). "Good practices in city energy efficiency: Bogota, Colombia - Bus Rapid Transit for Urban Transport Energy", available online from [http://esmap.org/esmap/sites/esmap.org/files/Bogota Case Study 020310.pdf](http://esmap.org/esmap/sites/esmap.org/files/Bogota_Case_Study_020310.pdf)

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

Land Use and Public Transport Planning, Curitiba, Brazil

Source: World Bank (2010). "Curitiba, Brazil -- Cost Is No Barrier to Ecological and Economic Urban Planning, Development, and Management . In ECO² Cities: Ecological Cities as Economic Cities, pages 169-182." available online from http://www.esmap.org/esmap/sites/esmap.org/files/CS_Curitiba.pdf

The case of Curitiba, Brazil, shows that cost is no barrier to ecological and economic urban planning, development, and management. Curitiba has developed a sustainable urban environment through integrated urban planning. To avoid unplanned sprawl, Curitiba directed urban growth linearly along strategic axes, along which the city encouraged high density commercial and residential development linked to the city's integrated master plan and land use zoning. Curitiba adopted an affordable but innovative bus system rather than expensive railways that require significant time to implement. Curitiba's efficient and well-designed bus system serves most of the urban area, and public transportation (bus) ridership has reached 45 percent. The city now has less traffic congestion, which has reduced fuel consumption and enhanced air quality. The green area has been increased, mainly in parks that have been created to improve flood prevention and through regulations that have enabled the transfer of development rights to preserve green areas and cultural heritage zones.

Linking development densities to public transport availability, Curitiba, Brazil

Source: Rabinovitch, J. (1992) "Curitiba: towards sustainable urban development", [Environment and Urbanization, Vol.4 \(2\) pp. 62-73](#)

Curitiba's Master Plan integrated transportation with land use planning. Zoning laws are used to direct linear growth by attracting residential and commercial density along a mass transportation lane. High-density residential and commercial development is permitted within walking distance of stops, with much lower densities elsewhere in the city. The city's central area is partly closed to vehicular traffic, and pedestrian streets have been created. In addition, a strict street hierarchy safeguards the right of way for the current BRT, which has significantly contributed to the success of the transportation network.

Integrated urban planning and efficient resource use, Singapore

Good practices in City Energy Efficiency: Eco² 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: Eco² 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



ANNEX 8: 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.

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



Identify Benchmarking Requirements	<p>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:</p> <ul style="list-style-type: none">• building name and address• electrical, gas, water utility account numbers• electrical, gas, water utility bills for past 3 years• building floor areas• energy and water meter locations and associated floor areas• date constructed and date of major renovation• building facilities manager (if any)• building heating, cooling, lighting system types
Set data collection strategy	<p>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)</p>
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. 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">• compare kWh/m²/yr electricity consumption by building type• compare kWh/m²/yr heating energy by building type• compare total \$/m²/yr energy consumption by building type <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,</p>



	etc.)
Formulate a Bespoke Benchmark	<p>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 between different buildings. These factors could include:</p> <ul style="list-style-type: none"> • types of tenants • occupancy density (persons/m2) • building energy management <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/m² - annual electrical energy intensity by type of building (Schools, Offices, Residential, Hospital, Misc);
- kWht/m² - annual heating energy intensity by type of building;
- \$/m² - 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.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 program 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 program of energy management to ensure their operating efficiency is maintained throughout their life span. The BEEMP consists of the following programs:

- 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

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

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 pollutive 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



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

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

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

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 9: 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, it identifies 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"> • lighting systems • air conditioning systems • heating systems • computers • server rooms and cooling of servers • appliances (water cooler, fridge, vending machines) The Municipal Offices EE Spreadsheet includes estimation methods for energy efficiency potential for offices which includes equipment retrofits, behavioral

ATTRIBUTES

Energy Savings Potential

> 200,000 kWh/annum

First Cost

> US\$1,000,000

Speed of Implementation

1-2 years

Co-Benefits

Reduced carbon emissions

Improved air quality

Enhanced public health & safety

Increased employment opportunities

Financial savings



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

MONITORING

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



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

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

CASE STUDIES

Model for Improving Energy Efficiency in Buildings, Berlin, Germany

http://www.c40cities.org/bestpractices/buildings/berlin_efficiency.jsp

The City of Berlin in partnership with Berlin Energy Agency (BEA) has pioneered an excellent model for improving energy efficiency in buildings. They project manage the retrofit of public and private buildings, preparing tenders for work that will guarantee reductions in emissions. CO₂ reductions of an average 26% are written into the public retrofit tenders so that winning Energy Systems Companies (ESCOs) must deliver sustainable energy solutions. 1,400 buildings have so far been upgraded, delivering CO₂ reductions of more than 60,400 tonnes per year - these retrofits cost the building owners nothing - and the buildings make immediate savings.

Internal Contracting, Stuttgart, Germany

http://www.c40cities.org/bestpractices/buildings/stuttgart_efficiency.jsp

Stuttgart saves around 7200 tons of CO₂ each year through an innovative form of internal contracting, making use of a revolving fund to finance energy and water-saving measures. The city is able to reinvest savings directly into new activities, creating a virtuous circle of environmental improvements and emissions reductions.

EU and Display Campaign Case Studies

http://www.display-campaign.org/page_162.html

The European Display Campaign is a voluntary scheme designed by energy experts from European towns and cities. When started in 2003 it was initially aimed at encouraging local authorities to publicly display the energy and environmental performances of their public buildings using the same energy label that is used for household appliances. Since 2008 private companies are also encouraged to use Display for their corporate social responsibility CSR activities.

Energy Management System, Frankfurt, Germany

<http://www.managenergy.net/download/r164.pdf>

In 1996 the City of Frankfurt (Building department) entered into a contract with a private company to install and operate an energy-management system (EMS) for the city hall (Romer), Paulskirche and Museum "Schirn". The goal of the project is to reduce the costs for energy- and water as well as the CO₂-emissions.

Based on the annual costs of 2.6 Million DM in 1992/1993 the potential cost reductions were estimated to be approximately 320,000 DM per year. To reach these cost savings an investment of 1 Million DM for control equipment was necessary. Repayment of the invested capital will be provided from the energy savings (54%) over a period of 8 years. The remaining 46% will reduce the operating costs for the buildings.



Energy Efficient Office of the Future (EoF), Garston, UK

<http://projects.bre.co.uk/envbuild/index.html>

The new Environmental Building at Garston was built as a demonstration building for the Energy Efficient Office of the Future (EoF) performance specifications, drawn up by a number of companies representing the manufacturers, designers and installers of building components and the fuel utilities, as part of the EoF project run by BRECSU.

A key part of this specification is the need to reduce energy consumption and CO2 emissions by 30% from current best practice. Air conditioning is not used in the new building - the major energy consumer in many existing office buildings. Other savings will be made by making better use of daylighting and by using the building's 'thermal mass' to moderate temperatures.

TOOLS & GUIDANCE

Tools & Guidance

EU LOCAL ENERGY ACTION Good practices 2005 - Brochure of good practice examples from energy agencies across Europe.

<http://www.managenergy.net/download/gp2005.pdf>

ESMAP Public Procurement of Energy Efficiency Services - Guide of good procurement practice from around the world.

http://www.esmap.org/Public_Procurement_of_Energy_Efficiency_Services.pdf

Energy Conservation Buildings Code provides minimum requirements for the energy efficient design and construction of buildings and their systems.

<http://www.emt-india.net/ECBC/ECBC-UserGuide/ECBC-UserGuide.pdf>



ANNEX 10: 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.
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.

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



MONITORING

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

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

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

CASE STUDIES

Control system for public lighting, Kirklees, UK

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

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

Intelligent outdoor city lighting system, Oslo, Norway

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

An intelligent outdoor lighting system has replaced PCB and mercury containing fixtures with high-performance high-pressure sodium lights. These are monitored and controlled via an advanced data communication system which operates over the existing 230V power lines using specialist power line technology. An operations centre remotely monitors and logs the energy use of streetlights and their running time. It collects information from traffic and weather sensors, and uses an internal astronomical clock to calculate the availability of natural light from the sun and moon. This data is then used to automatically dim some or all of the streetlights. Controlling light levels in this way has not only saved significant amount of energy (estimated at 62%), but has also extended lamp life, thereby reducing replacement costs. The CA has been able to use the monitoring system to identify lamp failures,



often fixing them before being notified by residents. By being able to provide predictive failure analyses based on a comparison of actual running hours versus expected lamp life, the efficiency of repair crews has been increased. 10,000 replacements have cost the CA approx. USD 12 million. Currently the program saves approx USD 450,000 in running costs per year. However, it is estimated that if the program is rolled out to the entire city, the 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

The project implemented a lighting solution for highways leading to Kuala Lumpur International Airport. The total length of the dual carriage highway covers 66 km.

The main requirement for the project was that each individual lamp along the entire 66 km stretch of highway should be independently dimmable. This called for a network linking all 3,300 positions to a central control facility. There was also a need for greater maintenance efficiency while ensuring optimal visibility without compromising on visual comfort on the road.

An intelligent lighting system that uses tele-management control was employed. Tele-management makes it possible to switch or control every individual light point in the system from a central PC. It also enables specific dimming profiles adjusted to suit conditions on the road for different lamps, instant reception of failure messages, and the creation of a database where all system data is stored. It allows a significant reduction in energy consumption in addition to the 45% savings as a result of the use of dimming circuits.



ANNEX 11: List of abbreviations for cities in the TRACE database

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



25	Guangzhou	China	GUA	62	Singapore	Singapore	SIN
26	Guntur	India	GUN	63	Sofia	Bulgaria	SOF
27	Hanoi	Vietnam	HAN	64	Surabaya	Indonesia	SUR
28	Helsinki	Finland	HEL	65	Sydney	Australia	SYD
29	Ho Chi Minh	Vietnam	HO	66	Tallinn	Estonia	TAL
30	Hong Kong	China	HON	67	Tbilisi	Georgia	TBI
31	Iasi	Romania	IAS	68	Tehran	Iran	TEH
32	Indore	India	IND	69	Timisoara	Romania	TIM
33	Jabalpur	India	JAB	70	Tokyo	Japan	TOK
34	Jakarta	Indonesia	JAK	71	Toronto	Canada	TOR
35	Jeddah	Saudi Arabia	JED	72	Urumqi	China	URU
36	Johannesburg	South Africa	JOH	73	Vijaywada	India	VIJ
37	Kanpur	India	KAN	74	Yerevan	Armenia	YER