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Improving Energy Efficiency in CRAIOVA Romania

ROMANIA
REGIONAL DEVELOPMENT PROGRAM

TRACE City Energy Efficiency Diagnostic Study


Municipal Buildings


Water and Wastewater


Solid Waste Management


Public Transport


Public Lighting


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Inițiativă locală. Dezvoltare regională.

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

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

ROMANIA
REGIONAL DEVELOPMENT PROGRAM

ESMAP
Energy Sector Management Assistance Program

Executive Summary

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.

Craiova is an important national transportation hub, located at the crossroads of three European roads passing through Romania, connecting the country to Western and South-Eastern Europe. The city is situated on the Pan-European Corridor IV connecting Romania to Western Europe, and is close to Corridor IX, linking Northern to Southern Europe. Not in the least, Craiova is just 70 kilometers far from the Danube to the South.

Once a very important heavy industrial center of Romania, focusing on the automotive, aviation, chemical and processing sectors, today the city maintains a good reputation as an industrial hub, although many of the plants and factories that operated during the communist regime have been shut down. Craiova is home to a few of the most important companies in the country, like Ford, CEZ, and Electroputere, a fact that enables the city to play an important role in the economic development of the Southern region. Today the local economy is driven by the industry and service sectors, which employ half of the city's labor force. However, like all other cities in Romania, Craiova has suffered from demographic decline, as the region faced a heavy loss of population in the mid 2000s.

The transition period after the end of the communist regime has led to significant changes in the social and economic life of the residents of Craiova. Some of these developments have positively affected people's life, whereas a few came along with inconveniences and difficulties. During the first years of transition the city attracted people from parts of Dolj County and from elsewhere in Romania. This process led to severe de-population in the rural areas of Dolj County. At the same time, due to economic constraints, some of the urban population of Craiova moved to the wider metropolitan area.

Similar to a country-wide trend, the rising number of cars in the past years has caused heavy traffic congestion, increased fuel consumption, and high level of greenhouse gas emissions. Commuting has become difficult for both private and public vehicles. The main challenges in the transport sector include modernization of the bus fleet and the development of non-motorized transport by building more bike lanes and expanding pedestrian networks. This sector has a significant potential for energy savings, requiring appropriate measures in order to decrease fuel consumption and reduce greenhouse gas emissions. The district heating sector faces challenges because of the large amount of debt Termo, the local operator, owes to CET, the main district plant responsible for producing hot water and heat in the city. In addition, some parts of these debts are overdue bills from the population. The City Hall cannot pay off these debts, nor continue to subsidize the sector in its present form. Therefore, the local government decided that the best solution for all parties involved would be to merge Termo with CE Oltenia, the owner of CET. However, in the future, the city managers should consider addressing the losses incurred in the network, as water and heat pipes are the property of the City Hall.

Like every other city in the country, municipal buildings in Craiova require proper measures toward improving energy efficiency – particularly in health care and education facilities managed by the city government. A benchmarking of the municipal building stock, along with audit and retrofit measures, should be performed in order to identify the highest energy savings potential and proper intervention measures. As for the water sector, although the system covers the entire city and most of the households in Craiova have water meters, there are high losses in the network. In addition, in order to improve the overall efficiency of the water system, oversized pumps needs to be replaced with smaller, energy-efficient ones. Finally, although selective collection has been implemented in Craiova, there is more that can be done about improving recycling rates.

There are also many positive things that Craiova has successfully accomplished recently. Almost all streets in the city are lit and the local government has ambitious plans to implement a sophisticated, high-tech

lighting system based on LED bulbs. Craiova also has a function tram system. At present, the tram lines are undergoing rehabilitation work to improve access to the industrial platforms, and the local government is considering expanding the network further. The municipal authorities have concrete plans to improve and facilitate non-motorized transport in the city by expanding dedicated pedestrian paths and building more bike lanes. The generation of solid waste is comparable to other cities in the region. The deposit of waste is at an eco-framed landfill located just on the city outskirts. In parallel, rehabilitation work has been performed in some schools, health care and social assistance facilities in the city, and in a few buildings the classical hot water systems have been replaced with renewable energy-based ones. Nonetheless, further work needs to be done in order to decrease energy consumption, reduce heating bills, and enable the city to become more efficient.

As every other city in the country, Craiova does not have any say regarding the electrical power sector, as 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. Hence, the subsidies are going to be gradually eliminated by the end of 2017, when the liberalization of the market is expected to be complete. As of now, the central government is encouraging energy production from renewable sources, and Green Certificates are provided to producers, although the award of some certificates has been postponed until 2017.

For the short and medium term, the Craiova authorities have planned and started to implement a number of projects aimed at reducing the energy consumption in the city and, ultimately, at improving quality of life for its residents. The plans include purchasing highly fuel-efficient buses, developing non-pedestrian networks, building a number of over-ground walkways and underground passages for traffic decongestion, improving the street lighting system, and improving the solid waste sector by increasing selective collection.

This report is based on the implementation of the TRACE tool in Craiova in April 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 April 2013. The implementation of TRACE in Craiova 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.

Public Transport Development

The first TRACE recommendation for the local public administration in Craiova is to develop the public transport in the city, make it more attractive to people, lower the fuel consumption, and achieve important energy savings. The city government already has plans to invest in the modernization of the public transport fleet and replace vehicles whose life cycle has reached its limits with modern, energy-efficient buses. A new traffic management and monitoring system is already under way, which is in line with city authorities' aim to improve the quality of public transport services in Craiova. Expanding e-ticketing and equipping all bus stops with screens displaying information on schedules, routes, and delays will help passengers better plan their trips. Also, this TRACE recommendation encourages additional measures, such as bus rapid transit that would give priority to public transport vehicles, and dedicated bus lanes to bypass traffic congestion. At the end of the day, a reliable and comfortable public transport system would appeal to people and make them rely more on buses and trams, and so they would leave their cars at home.

Non-Motorized Transport

This TRACE recommendation encourages City Hall to promote and develop non-motorized transport options in Craiova and expand the

related infrastructure. The aim is to have more people walking and biking and fewer using their private vehicles. In order for this to happen, the city needs to increase the number of pedestrian paths and dedicated bike lanes. The authorities are focusing on improving accessibility through fuel-free means of transportations. This will raise quality of life in the city, but also encourage business development around the newly established pedestrian areas, including additional leisure and entertainment spots, such as restaurants and shops. In the near future the City Hall plans to transform the city center into a large pedestrian network spread over a few square kilometers, with several shops, markets, and entertaining spots. In addition, the local government will build bike lanes in the city, wherever the road infrastructure allows it.

Traffic Restraint Measures

As the number of private cars has gone up in recent years, local authorities should identify ways to curb private vehicle usage and focus on more sustainable, efficient, and less costly transport alternatives. Currently, there are a few streets in Craiova where speed zones have been enforced and the local government should think about expanding such restrictions to other parts of the city. The local public administration should take the lead on initiating measures aimed at discouraging the use of private vehicles. For instance, the City Hall may consider setting up "no driving days" to educate and lead by example.

Municipal Building Benchmarking Program

Craiova, like most cities in Romania, does not have a reliable database tracking the energy performance of municipal buildings that are managed by the City Hall. One of the first steps recommended by TRACE in order to address this issue is the development of a municipal building database that should be able to inform upon which buildings could have the greatest saving potential. This can be done through a benchmarking process, using a number of key indicators. By publishing the analysis and updating the data on a regular basis, this process will enable competition among building managers and, eventually, lead to a productive exchange of data and collaboration.

Municipal Buildings Audit and Retrofit

Once the benchmarking process is complete, the next step recommended by the TRACE analysis is a full audit of the public building stock in Craiova. 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 administration to allocate funds for investing in energy efficiency upgrades, purchasing new equipment, and performing renovation work on certain buildings. So far a few schools and kindergartens which are administered by the City Hall have been rehabilitated, and the city government plans to carry on this work in the future and renovate some of the educational and cultural facilities in the city.

Energy Efficiency Strategy and Action Plan

This TRACE recommendation encourages the city's administration to develop a proper energy efficiency strategy and action plan. The ultimate goal is to reduce greenhouse emissions in the city and provide citizens with a better quality of life. The plan has to include clear targets about reducing the levels of greenhouse gas emissions and concrete steps on how to achieve these goals. The energy efficiency strategy would lay out a vision and objectives for energy-related programs, and provide a list of activities and specific projects that could help the city achieve those targets. A well designed plan with a set of concrete measures aimed to tackle energy consumption will also help enhance the economic competitiveness of the city and open ways to greater local energy independence.

Procurement Guide for New Street Lights

Craiova should produce a specific procurement guide for public lighting and choose an efficient solution based on modern, efficient technology when replacing the lighting system. The guidelines associated to a new lighting technology can tackle three things at once: deliver the same lighting levels for lower energy consumption, reduce the related carbon emissions, and achieve lower operational costs. The city government should consider preparing a manual about how to improve street lighting visibility and safety guidelines inspired by best practices elsewhere in the world, as presented by the TRACE assessment. The manual should include

parameters on illumination, pole spacing and lamp type, as well as dimming or illumination operations during night time for all types the streets in the city.

Awareness Raising Campaigns

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

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 Bucharest, 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 about 12% over the last decade, from nearly 22 million to a little over 19 million, according to the preliminary 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 preliminary results of 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	1,667,985	1,934,449	(#1)
Cluj-Napoca	309,136	318,027	(#3)
Timișoara	303,708	317,651	(#4)
Iași	263,410	321,580	(#2)
Constanța	254,693	310,526	(#5)
Craiova	243,765	302,622	(#6)
Galați	231,204	298,584	(#7)
Brașov	227,961	283,901	(#8)
Ploiești	197,522	232,452	(#9)
Oradea	183,123	206,527	(#11)

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

National Energy Efficiency Legislation

Romania's energy consumption per capita is almost twice as low as the average in the EU, at 1.6 toe (ton of oil equivalent). Between 1990 and 2000, energy consumption fell by an average of 5% per year, and then increased slightly after 2000 by 1.3% per year. At the beginning of the economic crisis in 2009, energy consumption dropped by 14% and then increased by only 1.3% in 2010. Amid the economic recession, the country's GDP followed a similar decreasing trend and fell by 8.3%. Energy efficiency at the national level has increased significantly between 1990 and 2000, from 23% to 39%. It is a consequence of the rising share of high efficiency power sources (hydropower) in the electricity mix, as well as

improving efficiency of thermal power plants. However, it still remains lower than the EU average.

In the early 1990s, Romania created its first institutional framework for energy efficiency when the **Romanian Agency for Energy Conservation**, the country's main specialized body in the field of energy efficiency, was established. Ten years later Romania adopted the National Energy Efficiency Strategy, a document outlining steps to be taken to increase energy efficiency. In the 2000s, Romania ratified the Kyoto Protocol to the United Nations Conventions on Climate Change, under which the country has committed to cut its emissions of greenhouses gases, between 2008 and 2012, by 8% compared to 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.[1] 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 2007-20102 set an energy saving target of 2.8 Million toe by 2016, and it further aims for 1.5% annual reduction for the period 2008-2016. The intermediate target of 940,000 toe by 2010 was far exceeded, as Romania achieved 2.2 Million toe in energy saving. The plan document foresees great potential for energy savings for the industrial sector through voluntary long-term agreements between industrial agents and the Government, in addition to investments in equipment to oversee energy consumption. Estimates indicate that EU countries that have implemented such agreements reached 10 to 20% in energy savings. Large consumers must carry out energy audits and energy efficiency improvement programs, while an energy balance must be produced every year for those consuming 1,000 toe/year and every two years for those who use between 200 and 1,000 toe / year. From 2000 onward, an energy saving certificate has been issued for all new buildings, single-family dwellings, and apartments that are sold or rented. Heat insulation work benefitted from tax breaks and co-financing was provided for renovation work.

The Second Energy Efficiency Action Plan[3] is yet to be approved. EU member states were supposed to submit the second energy efficiency plans by June 2011, but Romania failed to do so. The available draft focuses on energy savings in the primary energy and power sectors, and promotion of energy from renewable sources.

The First National Strategy for Energy Efficiency for 2004-2015[4] set an ambitious target of 40% 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 follows: 41% in buildings, 29% in the energy sector, 16% in industry, and 14% in transport. A few years later, the **National Strategy for Energy Efficiency for the period 2007-2020**, 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 lower price. [5] 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

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

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

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

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

[5] 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

toe saving is expected to come from fuel substitutions, 800 ktoe from high 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**[6] 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 Euros.

The Strategy for Use of Renewable Energy Sources,[7] 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**[8] outlining the renewable energy national policy was drafted in 2010, in the very difficult context of the economic crisis. It encouraged the use of liquid bio-fuels, liquid gas, geothermal and clean energy, as well as the integration of biogas into the natural gas grid and retrofitting technologies. The Directive 2009/28/EC on renewable energy set the national target for the share of energy from renewable sources in gross final production of energy at 24% for 2020. The expected total energy consumption in 2020 was set at 30,278 ktoe, of which 7,267 ktoe in renewable energy. Targets for specific industrial sectors have been set, such as 10% for transport, 22% for heating, and 42% for electricity.

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

Government Ordinance 22/2008[9]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

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

[7] 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

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

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

started in 2005 and has improved each year. The program is coordinated by the Ministry of Regional Development and Public Administration (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 homeowners' 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 heating bills are expected to drop by 40% during winter time. Moreover, in the summer, rehabilitated buildings can better keep the appropriate thermal comfort of the dwellings without additional costs for air conditioning. A guide regarding how the rehabilitation work should be done is available on the Ministry's website.[10]

A few years later, **Government Ordinance 18/2009**[11] 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 the Government's state budget (50%), the local budget (30%), and by owners' associations (20%). Since 2009, the MRDPA 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**[12] brought some changes to the rehabilitation program coordinated by the MRDPA. According to new regulations, residential buildings within municipalities that have applied for funding through the Regional Operational Program (Priority Axis 1 Development of Growth Poles– Intervention Axis 1.2 Thermal rehabilitation of residential buildings) will not receive further support through the thermal rehabilitation multiannual program. However, the good news is that the program has been extended to houses that have been developed between 1950 and 1990. The new regulation also clears the way for local authorities to establish the so-called "thermal rehabilitation tax." This tax will be paid by buildings that did not have any financial contribution to the rehabilitation process.

Following the success of the rehabilitation program, the Government thought about reducing the public funding accessible for such projects, and loans with government guarantee were made available. According to **Emergency Ordinance 69/2010**[13] homeowners associations must provide a 10% down payment, while the rest is covered from a bank loan. The owners' associations pay back the loan from the savings obtained on the heating bills after 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**[14] **on the energy performance of buildings** requires Member States to adopt a methodology for calculating the energy performance of the buildings, that should include thermal characteristics, heating insulation, water supply, air-conditioning installations, built-in lighting installations, indoor climatic conditions, and

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

[11] 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

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

[13] 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

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

not in the least, electricity produced by co-generation. The EU law concerns both existing and new buildings. The law exempts 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 buildings close to nearly zero-energy by December 2020. The same criteria are applicable by December 31, 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 a nearly zero-energy building, and the intermediate targets for improving the energy performance of new buildings by 2015. At the same time, Member States must issue 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 it can be clearly visible. After July 9, 2015, the 500 square meters threshold will be lowered to 250 square meters.

As part of EU requirements, Romania adopted **Law 372/2005** addressing the energy performance of residential buildings. An **energy performance certificate** is issued based on the final energy consumption of buildings and apartments. The country also transposed into national legislation EU Directive 2003/30 EC[15] on the promotion of the use of bio-fuels or other renewable fuels for transport. **Government Emergency Ordinance 1844/2005** 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** established social protection measures for the cold season, helping low-income residents pay the heating bills. The Government is assisting 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%. The local city budget can also provide financial support between 7% and 63% of the total heating bill.

Sixty-two cities in Romania are signatories of the **Covenant of Mayors**, the mainstream European movement involving local and regional authorities voluntarily committing to increasing energy efficiency and use of renewable energy sources on their territories, as well as reducing CO_2 emissions by 20% by 2020. Participants to the Covenant must submit a **Sustainable Energy Action Plan (SEAP)** outlining actions they plan to undertake with regard to energy savings. As of June 2013, 28 out of 62 cities have submitted their SEAP to Brussels, namely: Sfântu-Gheorghe, Sîntimbru, Ciugud, Lipova, Nădlac, Cluj-Napoca, Alba-Iulia, Târgu-Mureș, Pecica, Făgăraș, Mizil, Slobozia, Aiud, Râmnicu-Vâlcea, Sântana, Petroșani, Zlatna, Bucharest – District 1, Timișoara, Cugir, Satu-Mare, Moinești, Arad, Baia-Mare, Vaslui, Bistrița, Brașov, and Avrig. Eleven SEAPs have been approved so far – namely, the documents prepared by Moinești, Vaslui, Alba-Iulia, Bistrița, Mizil, Slobozia, Brașov, Arad, Aiud, Râmnicu-Vâlcea, and Baia-Mare.

Energy Sector

At the end of 2012, Romania's installed capacity of electrical power plants was 18,481 MW, while the net available power was 15,998 MW, according to Transelectrica. 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 relatively lacking, with only 0.3% or 24 MW.

The electricity sector is unbundled, with several players in the market. 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, Complexul Energetic Hunedoara,

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

Nuclear Electrica, CE Arad, SC Electrocentrale Deva, Hidroeletrica, and OMV Petrom. CEZ, ENEL Energie Muntenia, Enel Energie, E.ON, and Electrica Distributie (with its three branches, namely Electrica Distributie Transilvania Nord, Electrica Distributie Transilvania Sud, and Electrica Distributie 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.[16]

The Romanian Energy Regulatory Authority (ANRE)[17] 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 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.

The **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. A number of certificates are annually available. The Green Certificate has unlimited validity, and it can be traded separately from the electricity associate through bilateral contracts or on the green certificates centralized market. The price varies from 27 EUR (to protect the producer) to 55 EUR (to protect the consumer). At the end of 2012, 300 Million Green Certificates were available in Romania for the period 2013-2019. The EU approved in July 2012 an additional distribution of 71.4 Million Green Certificates for greenhouse gas emissions for 2013-2019.

Notably, the **legislation on green certificates** suffered substantial changes in June 2013, lowering incentives for green energy production and dropping the requirement that large industrial consumers pay part of their costs in the green energy sector. For every green MW produced, hydropower producers with installed capacity under 10 MW will now receive one certificate (instead of three previously), solar power producers will get four (instead of six, previously), and wind power producers will receive one (instead of two). These changes were adopted in response to pressures from large industrial consumers, who noted that Romania had one of the more generous support schemes in the EU, to the detriment of the local industry that had to bear the higher costs of energy inputs.

Finally, at the administrative level, it is important to note that following the legislative elections of December 2012, the structure of the Government includes a **Delegated Minister for Energy**, a new institution expected to add more consistency to the country's energy policies.

Liberalization of the natural gas and electricity markets

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

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

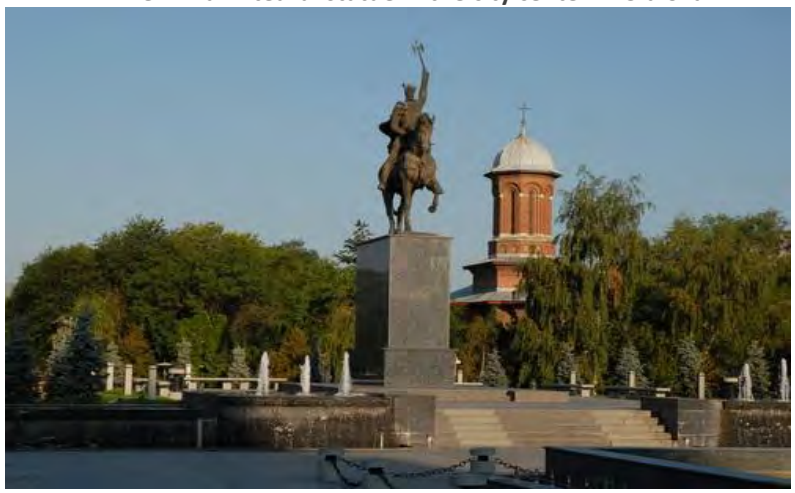
[17] More information on ANRE available at: http://www.anre.ro/

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.

Craiova Background

Craiova is the main commercial hub South-West of București and the most important economic and social center in the Oltenia Region. The capital of Dolj County, Craiova is located 227 kilometers from Bucuresti, and less than 70 kilometers from the Danube River and the border with Bulgaria. The city lies in the Romanian Plain, at equal distance from the Danube River (to the South) and the Carpathians Mountains (to the North). Craiova is a center for gas and petroleum, petrochemical, thermo and hydro power plants. The metropolis is known for its academic institutions, but also as a historical and cultural center with a wealth of valuable cultural and architectural heritage. Like almost everywhere in Romania, the climate in Craiova is temperate-continental; however, the city's position in the depression near the curvature of the Carpathian mountain range, allows for an overall warmer climate than in other parts of the country, with hot summers and milder winters.

The Mihai Viteazul statue in the city center in Craiova



source: panoramio.ro

According to the 2012 census, Craiova has 243,745 permanent residents, a decrease by 19 percent from previous figures recorded in 2002. The city has a surface area of 81.4 square kilometers, and a population density of 2,994 inhabitants per square kilometer. As of 2012, the Craiova Metropolitan Area comprises Craiova, two cities – Filiasi and Segarcea -, and 10 rural communities: Breasta, Ghercești, Mischii, Pielești, Predești, Șimnicu de Sus, Ișalnița, Țugui, Bucovăț, and Vârvoru de Jos. There are 293,762 people who live in the Metropolitan area, spread around 600 square kilometers. The main challenge related to demographics in the metropolitan area is the aging process. The aging population share went up so much that in a few rural communities the group of elderly people is considerably higher than other age groups (e.g., Mischii).

Craiova is an important national transportation hub, due to its location at the crossroads of three European roads passing through Romania, connecting the country to Western and South Eastern Europe (i.e., E70, E69, and E574). Craiova is also situated on the Pan-European Corridor IV that connects Romania to Western Europe, and at 200 kilometers away from Corridor IX, which links Northern to Southern Europe. Not in the least, the city is only 80 kilometers from Pan-European

Corridor VII (along the Northwest – Southeast of Danube River). Craiova has the only airport in the South-West region of Romania, a facility that has undergone rehabilitation and modernization work.

Beginning in the 1960s, Craiova became an important industrial center, as the car engineering and manufacturing, aircraft, chemical, food processing, extractive and energy sectors started to rapidly develop. During the communist regime, Craiova had gained a reputation of a heavy industrial city, one of the most important in the country. At that time, the local economy used to rely on automotive, aviation, chemical, and processing industries. Today, industry continues to play a significant role in the local economy and for the development of the metropolitan area. The city's optimal positioning on the European routes and railway hubs, as well as its accessibility to the only airport in the region, has helped Craiova become home to a large pool of industries and services. The city should take advantage of these transport connections in the future, and help create new opportunities for people by attracting more investors to the region.

Currently, Ford, the American car manufacturer, Electroputere, a large industrial electrical motors and spare parts producer, and CEZ, a Czech energy group, are a few of the key companies headquartered in Craiova. A few years ago, Ford had taken over the facilities of the former Automobile Craiova factory, previously owned by the Korean car manufacturer Daewoo. In 2012, the Energy Complex Craiova merged with three other energy players, namely the National Society of Lignite Oltenia, the Energy Complex Turceni, and the Energy Complex Rovinari, forming the largest energy group in the country, CE Oltenia. Another growing and dynamic sector in the region is represented by IT and high-tech companies whose number increased five times since the year 2000. As of 2007, 38% of the population worked in industry, 26% in tourism and trade, 16% in services, and 10% in constructions.

From a migration perspective, during the first years of the transition period after 1989, the city attracted a large number of people from other parts of the country, including from the Dolj area. This led to a severe de-population phenomenon in the rural areas of Dolj County. Subsequently, the population of Craiova decreased due to a massive relocation of people to the wider metropolitan area. In recent years, the region followed the trend set at the country level, with a significant decrease in population.

Downtown Craiova

source: http://commons.wikimedia.org/wiki/File:Craiova_-_Centrul.JPG

Between 1990 and 2006, the number of inhabitants in the county dropped by 14%. Initially, this decrease in population affected the rural area, but the phenomenon expanded gradually to the urban communities as well. Between 2001 and 2006, Craiova lost almost 11,000 inhabitants, which accounted for 41% of population loss in the entire Dolj County.

According to a study prepared by Group of Applied Economics (GEA) in 2009, the city is divided into four economic zones[18].
The largest concentration of companies is in the East of the city, on the way to the airport and to București. This area gathers a large number of industrial and service companies, most of them engaged in electro-mechanical and food processing industries, transportation, warehousing and wholesale trade. The second zone of Craiova, in the Northern part of the city, is more fragmented; the part that covers neighborhoods toward Ișalnița has an industrial and thermal energy profile; the second area toward Șimnicu de Jos is less developed, focusing on natural gas, oil

[18] Integrated Development Plan Craiova available at http://www.primariacraiova.ro/www.primariacraiova.ro/pcv/gallery/pidu/n2-pidu.pdf

exploitation, constructions, and poultry. The third zone of Craiova located in the West of the city is more engaged in light industry, such as leather and knitting. Finally, the fourth area, in the South, covers food processing and automotive service industries.

Craiova is also well known for its University and medical school, for some old, historical places, and not in the least, for Nicolae Romanescu Park, a beautiful construction whose initial design plans were rewarded the gold medal at the 1900 International Trade Fair.

The Romanescu Park in Craiova

source: www.brodyaga.com

Local Energy Efficiency Laws

Over the course of time, the local administration of Craiova took several steps deemed to reduce energy loss and improve environment conditions in the city. In 2009, Craiova received one of the smallest funds of all growth poles from the Ministry of Regional Development and Public Administration (only RON 590,000) for the rehabilitation program of residential buildings built between 1950 and 1989. Under this program, a number of only 9 buildings (140 apartments) have undergone thermal restoration work aimed at improving insulation and increasing energy efficiency. In 2007, the municipality of Craiova contributed with RON 770,000 from the local budget to thermally insulate some of the residential buildings in the city. At the end of 2012, the Regional Operational Programme 2007-2013 awarded EUR 22.8 million for thermal rehabilitation projects in all six counties of the South-West region. According to the applicant's guide, a territorial-administrative unit can receive grants up to 35% of the total value of the project. In 2013, the City Hall applied for EU funds to rehabilitate 93 residential buildings in Craiova.

The Local Council Craiova can grant **building tax exemptions** for a period of minimum seven years for owners who have thermally rehabilitated their residential 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.

As many other cities in Romania, Craiova is involved in the District Heating 2006-2015 "Heat and Comfort" program regarding the rehabilitation of district heating systems, aimed at improving heat supply to end users.[19] According to the national strategy regarding thermal power, investments of EUR 2.7 billion are needed to improve the district heating systems in the country (approximately EUR 340 million per year). Under this program, Craiova is eligible for government grants for co-financing the rehabilitation work of heat and hot water supply system. For example, in 2012 the city received RON 2.8 million in government grants and RON 1 million from the local budget.

Urban Growth and Energy Challenges in Craiova

While the TRACE tool does not directly address this issue, one of the most efficient ways of encouraging energy efficiency in cities is by promoting dense development patterns and compact urban expansion. This can be done by strategically using spatial planning tools. The less dense and the more scattered a city is, the larger its energy expenditure will be and the less efficient and profitable to public services will become. Basically, a whole range of suboptimal outcomes will result from lack of adequate density. For one, public transportation is less viable and more people need to rely on private cars for commuting. Commutes in private

[19] District and Heat Rehabilitation Program 2006-2015 available at: http://legestart.ro/Hotararea-462-2006-aprobarea-programului-Termoficare-2006-2015-caldura-confort-infiintarea-Unitatii-management-proiectului-(MzEzMDY1).htm

cars tend to take longer in sprawled areas, and city streets tend to get congested, with cars spending more time in traffic. Also, water and sewage networks have to cover a much wider area, requiring more energy for pumping and water delivery. Waste collection trucks have to run longer routes and spend more time traveling back and from disposal sites. The street lighting network has to cover a greater number of streets and consume more energy. Last but not least, a district heating network becomes less viable in areas with small density because of the high production and distribution costs, and because heat losses are larger when the distribution network is bigger. Such examples suggest that nearly every key area in the TRACE analysis is deeply tied to density patterns and trends.

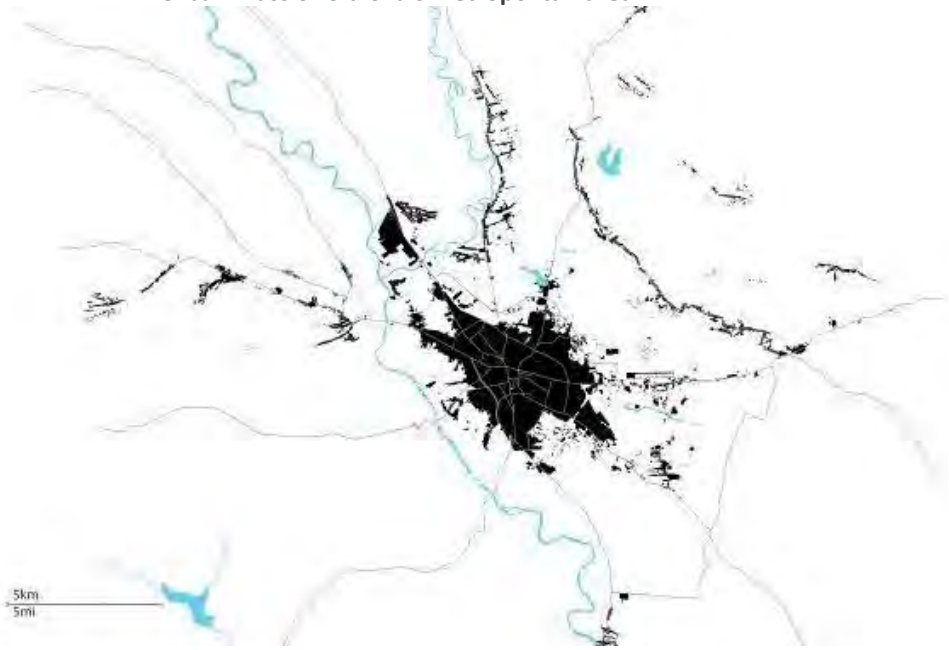
As a study of the World Bank has shown, the large majority of cities worldwide (whether they are located in the developed or the developing world) are losing density. As more people come to rely on cars, they are also more willing to move further away from city centers, in search of higher quality of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

Local authorities are not powerless 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 the city expands in an organized, compact, and sustainable fashion.

In the case of Craiova, the city's metropolitan area grew by 22% between 1992 and 2002. Craiova itself expanded significantly (27%) and some other nearby localities followed the trend (Pielești – 66%, Breasta 23%, etc.). As evident from the figure below, Craiova's urban mass has expanded primarily to the South and to the East, despite the city's relatively flat topography. This is not a particularly efficient or sustainable pattern; ideally, a circular expansion would enable smarter use of space and lower cost for extending public services to cover new neighborhoods and continue to serve already established communities.

At the same time, the structure – or lack thereof – of Craiova's city grid suggests that adequate spatial planning has not typically been deployed by the local government as a tool to manage expansion and energy use. Streets do not follow a coherent plan and, particularly in the older neighborhoods, this will be impossible to change in the near future. Unfortunately, some of the new neighborhoods and growing adjacent localities continue to grow without proper planning: it is striking to observe expansion particularly along roads and main infrastructure. This puts pressure on public service delivery, as networks need to follow an elongated pattern, without much of the circular growth that would enable improved energy efficiency.

Urban mass of Craiova's metropolitan area



To give a simple example, it is worth considering a bus operating a route along a main road. If a neighborhood looks like the one in the figure below, as a peri-urban locality by Craiova, a bus stop can only serve a few houses or high-rises, spread across a narrow perimeter on both sides of the main road. There will be many bus stops needed to cover the entire street. Compare this to a situation where there is sustainable spatial development, with side streets connecting to the main road and several rows of housing developments. The total length of the main road (and bus

route) will be shorter, *ceteris paribus,* for the same number of homes spread in a more circular manner.

Infrastructure patterns can generate suboptimal energy consumption

The risks of urban sprawl and significant energy inefficiencies are particularly high for a city like Craiova due to its geographic profile. The flat terrain allows for expansion into all directions, which – if left unguided – could result in a chaotic pattern of growth. Under the current trends, people and businesses locating further and further away from downtown areas will reduce the city's energy efficiency and further strain the delivery of public services.

Smart policies in spatial and urban planning can help promote a more compact development pattern, which means lower costs for public transportation, water, energy, heat, and gas delivery, solid waste management, etc. By contrast, chaotic expansion on green-fields outside the city will mean reduced density and higher expenditures for providing needed services to the areas' residents. As the number of commuters grows so does congestion and pollution. And if the quality of life is perceived to be decreasing, the city 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 Craiova's local authorities. In reaching these aims, they should deploy spatial planning as a powerful instrument for guiding the city's expansion.

Sustainable Craiova

The following analysis and recommendations focus on how Craiova can become a more sustainable city. Although the focus will stay on energy efficiency, the scope of the analysis goes beyond that. Energy is quite easy to quantify and measure, and is also a great binding element for thinking about a city's development in a broader manner. Pretty much everything that is done in a city needs some form of energy input. Therefore, TRACE (Tool for Rapid Assessment of City Energy) is not just a tool for assessing potential energy and cost savings, but it is also an instrument that allows local authorities and policymakers to think about cities as a whole. Simply put, TRACE is a diagnostic tool that helps cities become more sustainable.

TRACE focuses on six municipal service areas: urban transport (public and private), municipal buildings, water and wastewater, power and heat, street lighting, and solid waste. For each of these service areas, TRACE requires the collection of a number of indicators. Some of these indicators are energy related (such as the fuel consumption of the public transport fleet), while others are not (e.g., the urban transport modal split). The indicators on energy are very useful for analyzing energy and cost savings potential in each sector, while the non-energy indicators give a clearer picture of these public utility services, and help choose the most suitable recommendations so that they go beyond just energy issues.

Energy and cost savings potential are assessed through a benchmarking process. Individual indicators selected for Craiova are compared with similar indicators from other cities included in the TRACE database. This comparison can be made in different ways. Hence, cities can be compared based on level of development, climate, or population. Those cities that do better than Craiova on a particular indicator can become a benchmark that Craiova itself can aspire to. For example, if several cities have lower energy consumption per lighting pole, it is an indicator that the local government of Craiova could achieve energy savings in the 'Street Lighting' sector (by modernizing the street lighting, replacing old, high energy intensive lamps with energy efficient ones, and so forth). The energy and cost savings potential is calculated for each of the six service areas. After that, a priority list is prepared based on where the most significant cost savings could be achieved. The list leads to a set of recommendations that are likely to have the most significant impact with regard to energy efficiency, for the lowest amount of effort and resources invested.

The TRACE team completed on-site interviews and field visits that have helped form a more accurate picture of energy sustainability, challenges, and opportunities in Craiova. The sections below include a concise analysis of each of the six sectors assessed with TRACE, along with salient findings.

Street Lighting

The street lighting sector in Craiova is doing well in terms of energy efficiency, despite of fairly high electricity consumption per kilometer of lit road, as well as per light pole. Overall, street lighting is performing well and it is based on advanced technology for the system's management and control, including a street lighting program. The street lighting operator in Craiova is currently Luxten. The company signed a concession agreement with the City Hall in 2002 for EUR 20 million under which it became responsible for operation, maintenance, and expansion of the system in Craiova. The contract is ending next year and the local government has to choose a new operator.

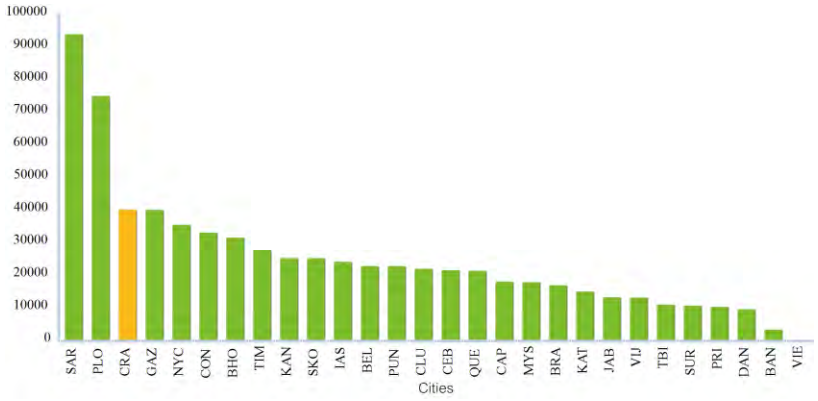
More than 95% of 261 kilometers of streets in the city are lit, a figure that helps Craiova perform better than most of the cities in the TRACE database (e.g., Banja Luka, Skopje, and Tbilisi). Currently, there are 18,600 lighting poles spread across the city, all of them equipped with sodium vapor lamps.

Sodium vapor lamp in Craiova

Each kilometer of lit road consumes almost 40,000 kWh, one of the highest figures among cities in Eastern Europe, with only Sarajevo and

Ploiești surpassing the related street lighting electricity consumption of Craiova. For instance, the lit road consumption in Craiova is four times higher than in Tbilisi, and twice higher than in Cluj-Napoca.

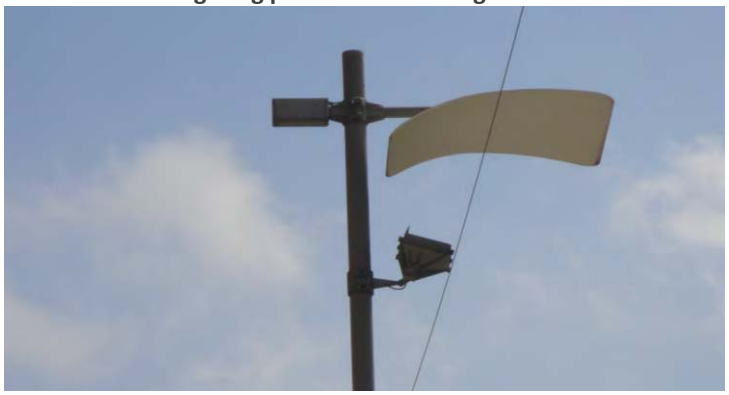
Electricity consumption per kilometer of lit road - kWhe /kilometer



But despite of that, the overall electricity consumption is comparable to other cities in the region. The street lighting in Craiova has undergone major rehabilitation in the recent years, and mercury lamps were replaced with more efficient sodium vapor bulbs. The overall yearly electricity consumption is less than 10,000,000 kWh, including lighting of buildings, holiday lighting, and operating fountains in the city. The expenditure for the entire lighting system in 2012 was USD 1.26 million, which accounts for less than one percent of the city budget. On average, the monthly bill comes to roughly RON 350,000 (approximately USD 100,000). The electricity consumed for street lighting in 2012 was roughly the same as in 2011. The amount of electricity consumed covered all kinds of lighting mentioned above, including the Christmas holiday lighting based on LED bulbs. The average consumption per light pole was 932. 37 kWh, which is a better performance than many other Eastern-European cities in the TRACE database, like Sarajevo or Banja Luka, but behind other localities, such as Cluj-Napoca or Brașov.

The street lighting program was implemented in Craiova a few years ago. It allows the light poles to starts off automatically depending on the brightness of the time of day. The city is divided into several street lighting zones. Switching timers are installed in each such zone and they managed the brightness level in a specific area by adjusting the light according to the time of the day/year. The light intensity during nighttime is diminished between 1 and 4 AM from an automated intelligent tele-management system. Electricity is supplied from a centralized system that can control all lighting poles in the city, including the level of light intensity.

Lighting pole with switching timer



The local public administration of Craiova has already approved certain indicators regarding street lighting performance. According to these indicators, the street lighting provider and/or the electricity operator should be able to solve in 24 hours any problem that it may occur in the street lighting system.

Starting in 2005, Craiova invested heavily in the rehabilitation and upgrading of the public lighting system in the city. Only in the recent years the municipality spent more than RON 13.6 million for improving, modernizing and expanding street lighting across the city. The municipality is preoccupied to further expand the service to all areas in Craiova, and cover the outskirt neighborhoods that are not currently lit.

In 2013, the contract with Luxten was extended by one year until 2014, for maintenance work. Meanwhile, the City Hall is preparing a tender to choose the next street lighting provider. The new agreement

should be signed for 30 years, the maximum period legally allowed by law with regard to public service utilities concessions. The future street lighting operator should be capable of assisting the local government implement a very an ambitious, but costly plan, replacing the current sodium vapor bulbs with LED lamps. A study with regard to LED-based solutions should be considered in guiding the future street provider about how the new lighting system in Craiova should look like. First, all 18,000+ lighting poles in the city should be equipped with highly energy efficient LED lamps. In addition, the lighting system should expand by 662 lighting poles, covering 20 kilometers of overhead network and 8 kilometers underground system. Second, the intensity of lamps should lower from 129.16 Watt to 94 Watt per light pole. The LED project will also cover the lighting of a number of historical buildings, monuments, and statues in the city. It is worth mentioning that a German company expressed interest in providing Craiova with electricity for street lighting at lower tariffs than the local electricity operator, CEZ. The City Hall is open to any optimal solution and lower the street lighting energy related bills.

If the LED-based street lighting will be implemented in Craiova, it will require new, better guidelines to assess the system's performances. Although LED-based technology is very costly, the local government is looking at the advantages of such a sophisticated system, including reducing the electricity consumption and the related costs. The City Hall hopes that the needed funds would come from various sources (external funds, credits, and grants).

The City Hall is planning another innovative project around placing photovoltaic panels on historical buildings in the city center. Initially, the local government will run a pilot project on a couple of old historical residential buildings and, later on, this initiative should be extended to other historical constructions in the downtown area.

Power Sector

The main electricity operator in Craiova and in the region is CEZ, a large Czech energy group. Just like the other major energy players in the country, the company is both a distributor and a supplier of electricity. CEZ supplies electricity to seven counties in the South-West region, namely Dolj, Gorj, Olt, Mehedinți, Teleorman, Argeș, and Vâlcea, catering to a total of 1,371,398 consumers and covering 3.5 million people.

High-voltage pillars

source: romanialibera.ro

The electricity is supplied at different levels of intensity, from low to high voltages, to both residential and industrial clients. CEZ has a concession agreement for 40 years to supply electricity in the South-West region. The technical losses are similar to the average at the country level, around 11%. The collection rate of electricity bills in Craiova is very high, meaning that the vast majority of people pay their bills on time.

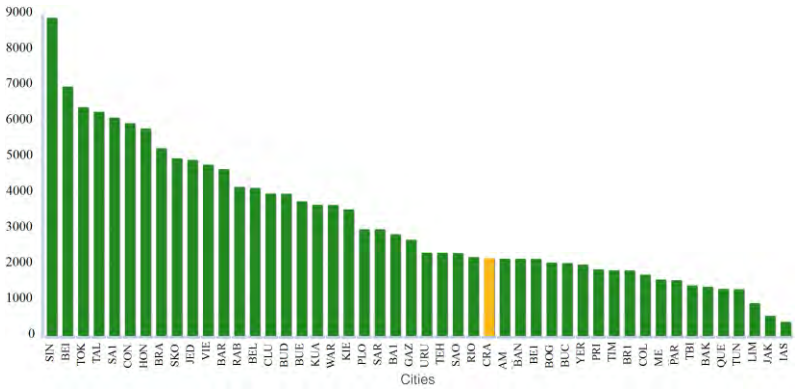
In 2007, there were 102,323 households connected to the electricity network in Craiova, while in the wider metropolitan the number of houses connected to electricity system is much lower, only a few thousands. Today, CEZ is catering to 300,000 domestic consumers in Dolj County, of which 108,119 reside in Craiova. The company provides electricity services to 6,730 economic agents in the city, 4,369 street lighting connections, and 97 public and administrative buildings.

The monthly energy consumption varies depending on the season, from 57 MW in summer to 70 MW in winter. In 2012, the overall power consumption in Craiova amounted to 531,986,920 kWh, of which 165,328,476 kWh went to residential clients, and 336,982,733 kWh to economic agents. However, this figure does not include industrial

consumption and those economic agents who fall in the eligible consumer category – i.e., clients who can choose the power supplier because they have the technical capacity to connect directly to the network. The daily average consumption in the city was 1,457,498 kWh, of which a little over 450,000 kWh was distributed to residential clients, 923,340 kWh to economic agents, and only 24,411 kWh to municipal buildings.

The city is doing well in terms of energy consumption. With an average of 2.180.5 kWh per person, Craiova performs better than other cities with a similar Human Development Index within the TRACE database (e.g., Banja Luka, Sarajevo, Ploiești, Cluj-Napoca, and Warsaw).

Primary Electricity Consumption per Capita - kWhe /Capita



The energy laws in Romania are quite restrictive and require transparency when it comes to production and tariffs. There are two markets for trading energy. One is the Bilateral Contracts Centralized Market (PCCP) that requires all energy company to sell electricity produced through an auction market; the other system is the "The Next Day Market," which is regulated by the Romanian Energy Regulatory Authority (ANRE). The energy tariffs for domestic consumers are based on the production and distribution costs, and the prices set by ANRE. The Romanian agency does regulate the price for captive consumers – households that do not have the technical capability to choose the electricity provider. Some of economic agents fall in the same category of captive consumers, so they pay according to the tariffs set by ANRE.

The price of electricity depends on consumption, time of day, type of electricity, level of voltage, and type of consumer. For instance, tariffs start at RON 0.1640 per kWh (without VAT) for low voltage electricity up to 1 kV, if reserved in advanced, and can go up to RON 0.6062 during peak times. People with low income pay the so-called "social tariff," a lower rate applied since 2005 to domestic consumers with monthly revenues less than or equal to the minimum wage. They can pay as low as RON 0.1894 for 2 kWh per day, and RON 0.8964 if they exceed 3 kWh per day. People who choose the monomial price – a single tariff regardless of the amount of energy consumed - pay RON 0.4547 per kWh at low voltage (up to 1 kV) and RON 0.3536 at medium voltage (from 1 to 110 kV). Those who want to go by a reserved tariff, depending on the time of the day, may end up paying anything between RON 0.1640 per kWh and RON 0.6062 per kWh (without VAT).

The average tariff for economic agents and industrial consumers ranges between RON 0.1698 per kWh without VAT (at high voltage) and RON 0.8908 per kWh without VAT (at low voltage). For instance, tariffs for high intensity electricity equal to or above 220 kV for average usage during peak times (RON 0.4843 per kWh) are below those for lower intensity power during the standard time of the day (RON 0.2524 per kWh).

All electricity bills include the Radio and TV taxes. The law requires each TV and radio holder to pay a monthly tax in order to support the national broadcasting companies. Each family must RON 4 for the TV tax, in addition to RON 2.5 for the radio tax. Economic agents pay RON 50 per month for both taxes. There are certain categories of people that are exempt from paying these taxes, including farmer retirees, people benefiting from social assistance, war veterans, and participants to the 1989 Revolution.

Municipal Buildings

Most of the municipal building stock in Craiova is comprised of educational units, like schools and kindergartens, which also include additional facilities, such as sport halls, dorms, performing arts halls, etc.

Overall, there are 250 education facilities in the city, including kindergartens, schools, high-schools, and national colleges. There are also three hospitals, comprising a total of 28 buildings. In addition, there are some commercial spaces, a couple of administrative buildings headquartering the City Hall, another administrative offices, cultural centers, and social assistance care facilities.

Like in many cities in Romania, data on municipal buildings in Craiova is quite incomplete.

City Hall Craiova

source: indiscret.ro

Although it knows the total number of municipal buildings, the City Hall was not able to provide information on the floor area of the overall building stock under its management, nor on the electricity consumption related to the floor area. On the other hand, some information was available regarding heat consumption in some of the municipal buildings, but such data were not so clear, as some of the buildings were not connected to the district heating plant and used natural gas for heat. Therefore, the TRACE analysis related to heat consumption is based on a sample of 55 schools and one municipal hospital.

According to data provided by the local power supplier, CEZ, the electricity consumption in 2012 in all municipal buildings in Craiova amounted to 8,910,130 kWh, with an average daily consumption of 24,411 kWh. At an average price of RON 0.5 per kWh, it could be assumed that the municipality paid around RON 4.4 million, which is approximately $1.3 million for electricity only. The TRACE analysis on heat consumption took into account a number of 55 schools and one municipal hospital, covering a total of 112,043 square meters. In 2012, the heat consumption in these units amounted to 20,698,576 kwth, which stands for an average of 184.74 kwth per square meter. This figure is comparable to other cities within the TRACE data base, such as Ploiești and Warsaw, and a bit higher than other cities in the region, such as Cluj-Napoca or Belgrade.

Municipal Buildings Heat Consumption - kWh/m2

For heating these facilities the city government paid USD 1.4 million. Overall, the district heating company distributed over 18,000 Gcal for the entire municipal building stock in the city. According to the data received from the City Hall, in 2012 the overall expenditure for electricity, heating, and fuel in all municipal buildings managed by the local government cost RON 24.2 million (approximately USD 7.2 million). Most of the money covered the energy-related costs for educational units (RON 10.2 million). The public residential housing and street lighting expenditures amounted to RON 8.1 million, and the energy for hospitals to RON 3.8 million. The energy expenditure for the public administration offices in Craiova, including the City Hall buildings, amounted to approximately RON

600,000. For energy consumed in cultural facilities and centers for elderly people the City Hall paid less than RON 1 million.

In recent years, the city government has been actively involved in several projects that sought to improve energy consumption in municipal buildings.

Voiniceii Kindergarten has been rehabilitated

Rehabilitation and renovation work has been performed in some of the schools and kindergartens in the city. The renovation work included replacing old windows with thermophane (double-glazed windows), changing the radiators, and in a few cases, thermal insulation. Photovoltaic panels were installed in a few kindergartens and schools to help with the preparation of hot water. Lately, the municipality invested more than RON 4.3 million for replacing the traditional heating systems in 22 educational units with solar, geo-thermal, and wind-based heating systems. This did not only increase energy efficiency in the buildings, but also reduced the heating bills.

One of the buildings that has been recently rehabilitated and renovated is Voiniceii Kindergarten, a two-storey building with a floor area of 1,883 square meters, located in Brazda lui Novac neighborhood. The unit hosts 200 kids in kindergarten, in addition to 50 small kids in the daycare facility. The renovation process started in 2007 with the support of the Ministry of Education but, because the Government was not able to financially sustain it any longer, City Hall Craiova took over the project. The rehabilitation was completed in 2010, will overall costs of RON 1.7 million. The heating and water network were upgraded, the sewage system was renovated, and the electrical wires and fitting were changed. The rehabilitation included replacing the old woodwork with new double glazed windows and doors, new tiles and floors, and upgrading bathrooms and kitchens. In addition, a few solar panels were installed on the roof top, which are used now to produce hot water.

Solar panels installed on the rooftop of Voiniceii Kindergarten

However, the rehabilitation process did not include thermal insulation, nor installing heat allocators, therefore, the building cannot control and adjust the heat intensity.

Although the primary focus of the rehabilitation project was not necessarily to increase energy efficiency, some improvements have been achieved in this regard. Before renovation the building was not able to get hot water and heat at appropriate temperatures and most of the time the children were suffering from cold temperatures during the winters. Now, the level of comfort in the building has significantly gone up, and heat and hot water are provided at adequate temperatures. After the project was completed, the thermal efficiency of the building improved by 10%. Before renovation, energy consumption amounted to 93 Gcal in January 2009 and 82 Gcal in February. After rehabilitation, the heat dropped to 86 Gcal in January 2010 and to 73 Gcal in February. In the winter time, heat

consumption comes to an average of 80 Gcal, which stands for approximately 256 kwth per square meter.

District Heating

The district heating sector is managed by a public company under the city government. In 1999, Termo Craiova split from Apa Oltenia, the water supplier, and became an autonomous entity – the City Hall has 95% of the shares, and the Autonomous Administration of the Public Estate (RAADPFL) has the rest of 5%. Termo is, primarily, a supply company, but also produces a small amount of heat/hot water.

The district heating company caters to 65,000 apartments from 3,700 large residential buildings in the city. There used to be 80,000 apartments connected to the district heating system, but the number has come down gradually as people switched to individual micro-heating plants. 92% of the heat supplied by Termo in Craiova is purchased from a CET II, a coal-based plant part of the largest energy group in the country, CE Oltenia.

CET II produces combined heat and power in co-generation. The fuel necessary to produce heat comes from nearby coal mines located within 50 km.

CET II District Heating Plant

source: www.panoramio

8% of the hot water and heat distributed in Craiova is produced by Termo in its 16 neighborhood-level natural gas-based sub-plants. Overall, the city has 105 thermal points and most of them receive hot water in their heat exchangers from the power plant CET II.

Seven months per year in the spring and summer, Termo produces only hot water, while during the winter it generates both hot water and heat. Therefore, the usage capacity of heat production units is lower during summer months compared to winter months, when the heat and hot water demand is going up significantly. The distribution of secondary network belongs to the City Council and is managed by Termo, whereas the transmission or primary network is under CET.

The heat production cost for CET is RON 256 / Gcal, cheaper than the heat produced by TERMO (RON 336/Gcal).

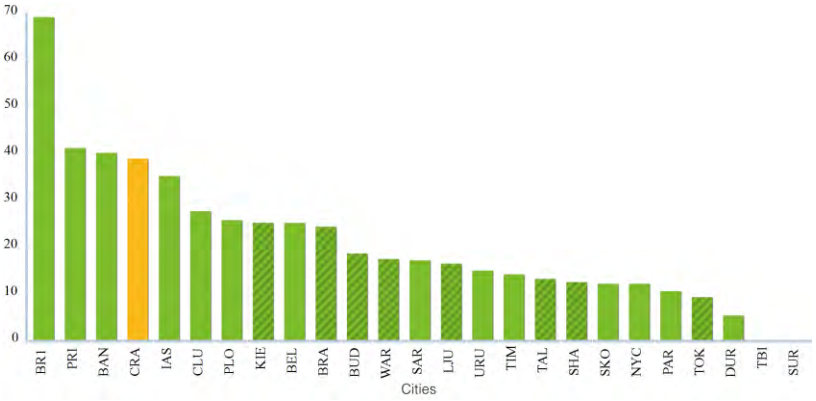
District Heating Sub-plant in Craiova

The population pays RON 220/Gcal, a price including the subsidies borne by the City Hall. Economic agents pay a slightly higher price, RON 263.41/Gcal. The municipal buildings pay RON 263.4 per Gcal, if the hot water is produced in the natural coal-based plant (CET), and almost RON 270 per Gcal if produced in Termo's facilities operating on natural gas. In 2012, Termo distributed 500,000 Gcal to Craiova, of which 450,000 Gcal was produced by CET II and only 50,000 Gcal by Termo's small natural gas-

based facilities. The annual fuel expenditure necessary to produce 500,000 Gcal of heat amounted to RON 122 million (approximately USD 33.4 million), of which RON 15 million was spent on natural gas and RON 107 million on coal.

Of the total amount of heat distributed, only a little over 400,000 Gcal reached the apartments in Craiova. Most of the heat was lost during the distribution network, and only a very small share was lost due to leakages in the transmission pipes. The overall heat loss from the network is 38.7%, one of the highest figures within the TRACE database. This figure is higher than in Cluj-Napoca and Ploiești, but almost twice smaller than losses incurred by the district heating network in Brașov.

Percentage of Heat Loss in the Network



The technical heat loss in the primary network is about 5%, while the losses from coal and gas-based plants in the secondary network account for 22.7%. The loss incurred in Termo's individual gas-based plants is even higher. Moreover, poor collection of revenues is adding to the overall losses. At present, more than 20% of residential apartments in Craiova have overdue heating bills. People simply say they do not have money and, so, the owners' associations cannot pay the heating bills in time. On top of it, sometimes the City Hall fails to pay heat subsidies in time, a fact that also aggravates the revenue collection process.

The financial situation of Termo is getting even more difficult when it comes to penalties. According to the agreement between Termo and CE Oltenia (the owner of CET II), the district heating operator must pay penalties if cannot pay in time for the heat. Although it has to pay late fees to CET, the company is not charging penalties from the population. For example, for every 100 Gcal sold, the average revenue collection covers only 77 Gcal, although Termo has to pay CET in full for 100 Gcal plus penalties, if the payment is not processed in time. Currently, the penalties that Termo has to pay to CET II stand at RON 1.5 million per month. As a result, debts incurred by Termo have gone up significantly in recent years. At present, Termo's debts to CE Oltenia amount to RON 200 million (approximately EUR 50 million), of which almost half are in overdue heating bills. Due to financial issues and reduced heat / hot water, demand, Termo employees work only four days a week in the spring and summer.

But despite the heavy losses in the system, in recent years Termo and the city government managed to make some investments by upgrading some of the thermal facilities in Craiova. For example, of the total 105 thermal points, 23 facilities have been upgraded with a SCADA system, and three others are currently undergoing rehabilitation work. Another project of over EUR 1 million deemed to upgrade the district heating network was implemented in 2012. However, because it does not own the primary source of fuel (coal), Termo was not eligible to apply for EU structural funds to rehabilitate the distribution network.

There remains much more to be done in order to increase the efficiency of the system and diminish the losses. The city needs roughly EUR 94 million to complete the modernization of the secondary network. However, this money will not cover improving the distribution system in residential buildings and switching from the vertical distribution of hot water and heat to the horizontal model. The present vertical distribution system causes several inconveniences to people, as hot water is always a problem for those living on the upper floors. Thus, poor quality of services pushes people away from the district heating system. Every month hundreds of apartments disconnect from centralized heating and switch to individual micro-heating units. In mid 2000s there used to be 80,000 apartments connected to the centralized hot water and heat network. Today, the number of customers has gone down to 65,000, as 20% of the

customers chose to leave the district heating system. This is reflected in the evolution of the Gcal distribution in Craiova. Gradually, the heat production and distribution went down. If at the end of 1990s, almost 800,000 Gcal were distributed in the city, by mid 2000s the figures came down to 645,000 Gcal. The heat demand achieved its lowest point in 2010, when only 457,111 Gcal were sold.

But this situation could be reversed and people can be attracted to reconnect to the district heating if the quality of services would improve. One way of doing this is by replacing the old, inefficient vertical distribution system with a horizontal scheme, a solution that not only would increase the quality of services, but would also lead to considerable savings in both consumption and heating bills.

Termo and City Hall Craiova joined efforts to implement a pilot project in this regard. A four-storey residential building of 14 apartments in Craiovița Nouă neighborhood has undergone major rehabilitation work with regard to hot water and distribution network.

Rehabilitated residential building in Craiova

Termo replaced the vertical distribution system with the horizontal model, while the City Hall took care of the thermal insulation of the building. New pipelines were connected to each apartment in the building, and heat allocators were installed. Now each customer is connected to four pipelines located outside the apartment in the stairwell at each floor; one pipe is for cold water, one for hot water, and two pipes for heat. As a result, the heat consumption came down by 40%. Thus, the heating bills dropped, the quality of services improved, and the level of comfort in the apartments increased. More projects as such would help gain back the market and have more people reconnecting to centralized district heating.

Horizontal distribution in a rehabilitated building Craiova

At the same time, the district heating operator is making efforts to secure new clients. For instance, 736 of the new apartments that are currently being built in Craiova will be connected to the district heating network.

However, the future of Termo remains uncertain. It owes millions of Euros to CE Oltenia and the City Hall does not have the financial capacity to pay off these debts and cannot further sustain the district heating system in Craiova in its current form. Following discussions with all interested parties, the City Hall decided that the solution would be to have Termo merged with CE Oltenia, and so the district heating operator would become part of the largest energy group in the country. This option would help write off EUR 50 million in debt, but more importantly, it will keep the centralized heating system alive. If the plans will follow through as planned, the merger process will begin in the fall of 2013.

Anyway, if Termo will merge with CE Oltenia, the city government may consider rehabilitating the district heating network and investing in upgrading the network. There is also a possibility that it may

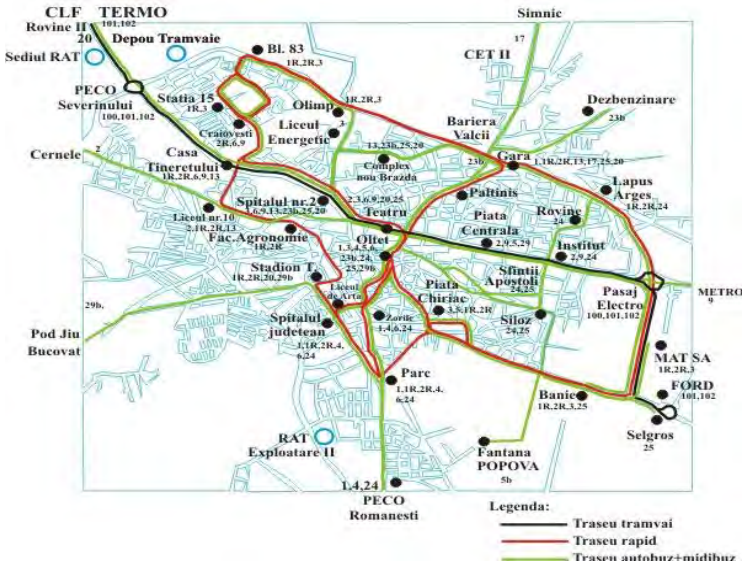
be able to apply for EU funding under the new proposed structure, where it would also own the raw material needed in production. Meanwhile, the City Hall is more preoccupied with improving the energy efficiency in residential buildings. The municipality is targeting 300 apartment buildings built during the communist regime, in addition to a few educational units. In May 2013, the local government submitted proposals for the thermal rehabilitation of 93 residential buildings in the city with financial support from the 2007-2013 Regional Operational Programme - Axis 1 Support to Sustainable Development of Cities – Growth Poles. The total value of the projects exceeds RON 37 million, of which the local government's contribution is approximately RON 16 million. In order to submit the projects, city authorities had to obtain written approval from all individual apartment owners, a lengthy process that should be simplified for the ROP 2014-2020.

Public Transport

The public transport in Craiova relies on buses and trams. The sector is managed mainly by the local transport authority, a public entity under the City Hall. In addition, a private transport company operates on a few routes in the city.

The primary operator in Craiova is the Local Transport Authority Craiova (RATC), an autonomous public entity under the Craiova City Council. RATC has a tram depot and two bus depots, hosting 203 pieces of rolling stock. The company is operating the public fleet, comprising 158 buses and trams in service. A private firm, Frații Bacriz, has a small share of the public transport in the city, operating 35 micro-buses on a few routes which are also served by RATC. The public company operates on 17 bus routes (of which three are fast track buses) and three tram routes connecting the city from one side to another. RATC runs a few bus charters to the industrial platforms located outside Craiova, including to Ford, the car manufacturer.

Only 30% of commuters in Craiova use public transport, a figure that places Craiova in the lower side of the TRACE database. The rate is also low compared to other cities in Eastern Europe, such as Sarajevo, Belgrade, or Kiev.



source: rat-craiova.ro

The bus fleet includes a variety of rolling stock, from very old, high-intensity buses to new, modern, energy efficient vehicles. Overall, 25% of the bus fleet is fairly old, with almost 30 years in service, and highly pollutant. 17 of the 29 standard MAN Mercedes buses are new, while 12 vehicles are old. These buses can accommodate up to 96 passengers.

MAN bus operating in Craiova

The fleet also has 12 BMC small capacity buses, with a total seating and standing capacity of 70 people. In addition, there are 27 Prestige buses that can accommodate 43 passengers and 8 small Iveco that can fit up to 28 people. One of the oldest buses in service, more than 25 years old, are BredaMeranini or Bredabus, made in Italy, with a seating and standing capacity of 66 passengers. But the oldest vehicles in the RATC fleet that have almost exhausted their life cycle of 30 years are 31 UDM buses manufactured in Romania with a capacity of 100 passengers.

UDM bus, one of the oldest in the public transport fleet of Craiova

In recent years, RATC was preoccupied to correlate the transport capacity with the passenger flow. Hence, the traffic schedules are flexible and are adjusted according to the traffic needs. During weekdays, most of the buses run from as early as 5:30 AM through 11 PM, at a frequency of 3-4 minutes during rush hour, and 7-8 minutes during off-peak traffic. The charters to the industrial platforms have a special schedule, from 5:30 in the morning through 9:30 PM.

Craiova is among the few cities in Romania that did not give up on the tram network. While some cities in the country chose to shut down the tram network and replace it with bus or trolleybus service, the local authorities in Craiova decided to keep the trams. The tram network was established in 1987 on a 34 kilometers single track. As of now, 13 kilometers have been rehabilitated, and another 12 kilometers are undergoing modernization and upgrading. The city has quite a lengthy tram track. According to the TRACE analysis, Craiova has 139.3 kilometers of high transit capacity per 1,000 people, which is more than in other cities in Romania, including București and Cluj-Napoca.

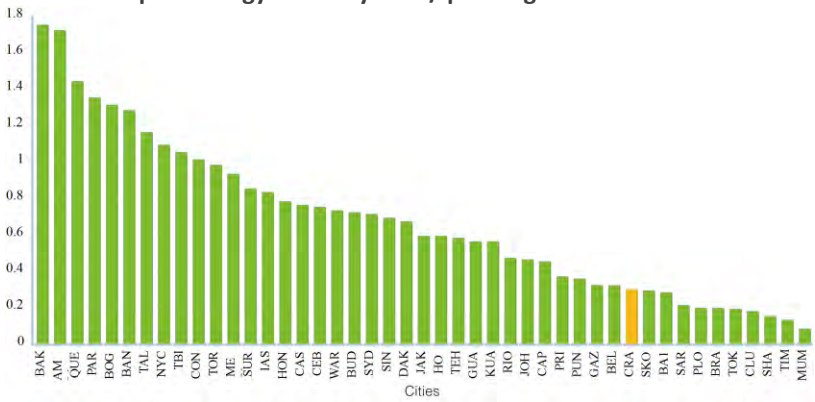
The fleet has 38 trams of which only 19 are in service. The tram cars are very old, as some of them were manufactured in the late 1970s. In the past, RATC was able to replace some of the very old trams with 16 medium size cars with low energy consumption. Some of the trams are equipped with four engines, while some have only one engine of 120 kWh each. The tram cars can accommodate up to 300 passengers, both seating and standing.

Tram in Craiova

In peak hours, from 5:30 through 8:30 PM and from 3:30 through 5:30 PM, there is a tram running every four minutes.

The public transport in Craiova is doing fairly well in terms of energy intensity. With 0.2974 MJ per passenger kilometer, the city is in the lower side of the TRACE database compared to cities with a similar Human Development Index. Craiova is performing better than most of other cities in the region, including Pristina, Belgrade, or Warsaw, although the city is slightly behind some of the growth poles in the country, including Brașov, Ploiești, and Cluj-Napoca.

Public Transport Energy Intensity - MJ / passenger kilometer



In 2012, RATC spent USD 4.6 million on fuel to operate the public transport fleet in the city. Most of expenses, around USD 4.4 million, went toward purchasing 2.4 million liters of diesel to operate the bus fleet. The company paid less than USD 200,000 for 1,600,000 kWh of electricity to run the trams.

Of 5,189,092 kilometers travelled by public transport system in 2012, approximately 10% were travelled by trams (504,438 kilometers). A simple calculation shows that 10% of the total number of kilometers run by public transport network cost less than 5% of the fuel expenditure for the entire fleet. This proves that tram continues to be the most efficient means of transportation, and, therefore, the policy makers in Craiova have all the good reasons to keep the network alive, as long as density patterns and trends make it viable.

Frații Bacriz, the private transport company, began operating in 1996, and serves three routes. These are overlapping with the ones operated by RATC, which makes Frații Bacriz a competitor of the public transport operator. The company's fleet comprises 30 IVECO minibuses, in compliance with EURO 4 and EUR 5 emission standards, with a seating and standing capacity of 29 people and an average occupancy ratio of 50%. The maintenance of these buses is very costly, as the catalysts needs to be cleaned up every three months.

Minibus belonging to Fratii Bacriz fleet

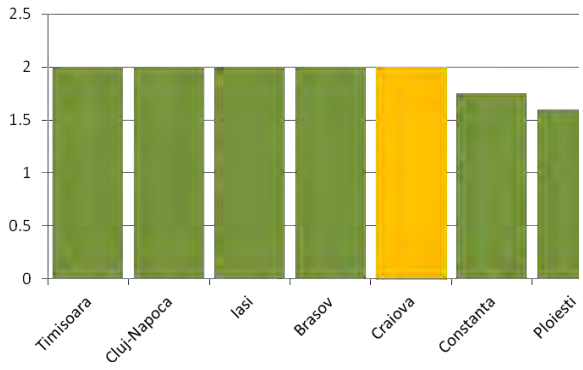
source: micapi.ro

The bus drivers operate in two shifts and each vehicle runs approximately 200 kilometers daily. On average, the company carries around 435,000 passengers annually. As Fratii Bacriz uses the same bus stops, RATC asked the private transport operator to pay for their maintenance, but the company refused to do so. Passengers in Craiova pay a flat tariff of 2 RON per trip, for both routes served by RATC and the private transport operator.

The tariff is approved by the Craiova Local Council and it is similar to most of the growth poles, except for Ploiești and Constanța, where the public transport is slightly cheaper. Tickets are available at special designated kiosks and a few stores that have agreed to sell them. In Frații Bacriz mini buses, passengers buy the tickets on the vehicle, directly from designated people. As in many other cities in Romania, the city government provides ridership incentives for certain categories of citizens. Retired people with a pension of less than RON 1,000 per month and children under the age of five ride for free The City Hall subsidizes public transportation tickets and monthly passes. School children can take advantage of a 50% discount for a monthly pass, while university students

get 75% off for monthly passes. Retired people with a pension above RON 1,000 can buy a monthly pass for one route in the city at half price.

Public Transport Tariff - RON/trip



source: Local transport authorities in the seven growth poles

Over time, the City Hall Craiova and RATC have made efforts to improve the quality of the public transport in the city, reduce the greenhouse gas emissions, and increase the overall efficiency of the system. Craiova is among the few cities in Romania who has participated to the CIVITAS program, an EU-funded instrument aimed at improving mobility and increasing the quality of public transport in cities. In 2008, Craiova joined three cities from Spain, Italy, and Portugal to take part in CIVITAS MODERN (Mobility, Development and Energy Use Reduction)[20]. The total value of the project in Craiova was EUR 2.6 million, with support from EU and local sources. It set ambitious goals for employing sustainable transport and mobility means by improving public transport efficiency and accessibility. The project was implemented by the City Hall and RATC, and it consisted of a series of actions designed for achieving a cleaner urban transport based on stakeholder engagement and a performance-led approach. The main goals of the CIVITAS program aimed at increasing the capacity of the public transport in Craiova, enhancing its attractiveness to people, improving the revenue management, introducing advanced information and communication technology, and not in the least, reducing greenhouse gas emissions.

One of the targets was introducing alternative fuel on a few buses in the city, and moving toward a clean bus fleet in the long run. The first step to this end was installing biodiesel filters on 10 buses, as follows: 7 UDM, 1 Mercedes, 1 MAN, and 1 Bredabus.

Biodiesel filters were installed on 10 buses in Craiova

source: www.civitas.eu

Special equipment for adjusting diesel engines to bio-fuel was purchased, and bus drivers were trained on how to use the system. As of 2010, a fuel mixture of up to 20% was introduced to part of the bus fleet. Introduction of bio-fuels helped lower emissions of bus engines and improved their performance. In addition, choppers (electronic driving systems) were installed on 9 old trams, resulting in reducing electricity consumption by 40%.

Another component of CIVITAS aimed at improving the bus traffic flow. Under a pilot project, 80 buses and 27 trams covering the most popular routes in the city were equipped with a GPS system allowing for the monitoring of the routes. In addition, electronic screens displaying

[20] More information about CIVITAS MODERN available at: http://www.civitas.eu/index.php?id=70&proj_id=12l and more information about the projects in Craiova available at : http://www.civitas.eu/index.php?id=66&sel_menu=35&city_id=97

information on the schedule and routes were set up in 20 of the 285 bus stops in the city. E-ticketing was introduced on the same buses and trams.

E-ticketing machine in Craiova

source: www.eltis.ro

E-ticketing can help with the collection of data on the number of passengers, their profile, and also helps with the collection of money in advance. It can help optimize the bus and tram routes, but also limit the number of passengers who free ride. The project included setting up 30 automatic ticketing machines, including 10 devices for paper tickets and for recharging cards at some of the bus stops. In addition, 20 machines where people could recharge their cards were installed at RATC ticket selling points.

At the same time, video-cameras were initially set up on 15 buses and 10 bus stops in unpopulated areas where fewer people use public transport, and in peripheral areas. This surveillance system was designated to monitor vehicles and bus stops in order to increase passenger safety and help reduce theft, vandalism, and anti-social behavior on public transport vehicles and waiting platforms. The cameras can send images and information to the dispatchers, and allow for timely intervention, if necessary.

As trams proved to be the most efficient and cost-effective means of public transportation in Craiova, the local government made serious steps for the modernization of the existing tram network to make it more attractive to people. At the end of 2012, Craiova City Hall was awarded funds for the rehabilitation of the tram tracks, under the 2007-2013 Regional Operation Programme. The rehabilitation of track lines is part of a larger project that falls under Axis 1 - Growth Poles, covering the modernization of transport infrastructure for improving workers' flow between the two industrial platforms in the city. The total value of the project is RON 60 million, of which RON 38 million in EU grants, RON 20 million from the state budget, and RON 1.1 million co-financing from the city budget. The rehabilitation of the track lines started off in spring 2013. One leg of the project seeks to modernize 1.6 kilometers of double tram track on Decebal Boulevard, from Electroputere Bridge to Caracal Street. The other component targets the rehabilitation of 11 kilometers of single track on N. Titulescu Boulevard, Severinului Street, with access to the tram depot.

Rehabilitation of tram network in Craiova

source: www.gds.ro

Once the project is complete, the tram network will make less noise and will be more attractive to people. Although the project should be finished in three years, city managers are optimistic that the new tram tracks will be operational ahead of the deadline. Meanwhile, the City Hall has to come up with a plan to modernize the trams and replace old, broken pieces with new rolling stock. The tram service has been cancelled during

project implementation and buses were introduced to serve the tram routes. Because the RATC bus fleet cannot cover travel demands on these routes, a number of 20-25 high capacity buses are to be borrowed from the local transport authority in București.

With the aim of diminishing the greenhouse gas emissions in the city, at some point RATC was considering expanding the electric transport mode by introducing environmentally-friendly trolleybuses. The total cost was estimated at RON 30 million. In 2012, the City Hall initiated feasibility and technical design studies in this respect.

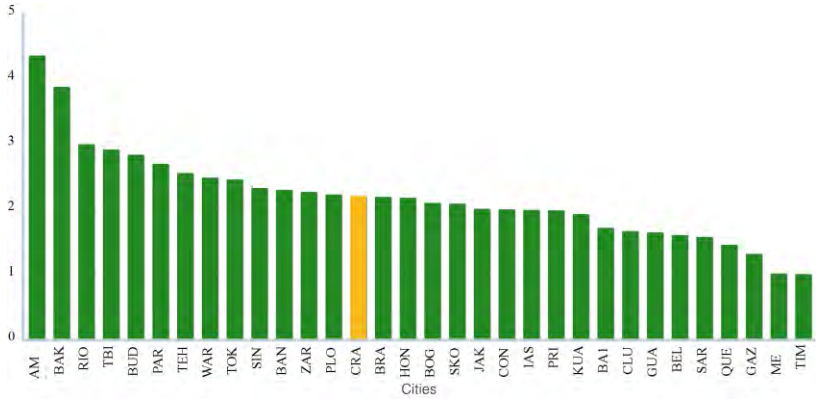
Private Transport

As in many cities in Romania, traffic in Craiova is a serious problem, as private car ownership increased after 1989, with the opening of the market. A significant rise in the number of vehicles in Craiova has been recorded particularly in recent years. Most people buy cars to use them not for leisure purposes, shopping, or vacationing, but for their daily commutes to their workplaces, including to the industrial platforms on the outskirts of the city. The increase in the number of private vehicles brought along traffic congestion and high fuel consumption, which translated into a significant increase in the level of greenhouse gas emissions, causing higher air and noise pollution in the city.

Today, there are approximately 85,000 cars in the city. For a population of 243,745, simple math shows that there is one car available for 2.8 people. 21% of private cars run on diesel, while the rest use petrol. There are 1,801 taxis and 1,227 mopeds in Craiova. The City Council ruled that taxi cars older than 10 years are not allowed to operate. The taxi tariffs are approved by the Craiova City Council. At present, the charge is RON 1.49 per kilometer.

The fuel consumption for private cars in 2012 amounted to almost 45 million liters of diesel and petrol, which is the equivalent of almost USD 81 million. It is no wonder that the private transport energy intensity in the city is 2.1789 MJ per kilometer passenger, a figure that places Craiova in the middle of the TRACE database. Although it is doing slightly better than other cities with a similar Human Development Index, like Ploiești, Budapest or Warsaw, Craiova performs worse than others in the region, such as Sarajevo, Belgrade, or Cluj-Napoca.

Private Transport Energy Consumption - MJ/ passenger kilometer



30% of the car stock in the city (30%) is between 6 and 10 years old. Almost a quarter of vehicles are between 11 to 15 years old, while another quarter is 16 to 20 years old and beyond. Only 1.6% of the cars are up to 2 years old, and around 9% are between 3 and 5 years old. As in other cities in Romania, Craiova is taking part in the national scrappage program ("Programul Rabla"), which offers people who bring old cars a premium for burying a new car. The program has played an important role in helping renew the vehicle fleet in Romania. The traffic management in Craiova, such as red lights and signaling, is managed by UTI, a private company. Recently, all the red lights in the city have been replaced with LED lamps. There is a traffic surveillance system that covers the main intersections in the city, managed by the City Hall in partnership with local police.

Craiova has only a few pedestrian networks. The main and most popular pedestrian area is in the city center. Restaurants, shops, fountains, and leisure places are spread across this area, making it the most attractive spot in the city. The upcoming rehabilitation project of the historical center includes expanding the pedestrian network.

Pedestrian network in Craiova in the city center

The city is not performing too well in terms of dedicated lanes for bicyclists. They can bike only on one dedicated network, a track cycling (velodrome) located in Romanescu Park.

Bike lanes in Romanescu Park

source: www.craiovaforum.ro

In the immediate future, the local public administration will develop specific projects aimed at encouraging non-pollutant transportation and expand on pedestrian paths and build more bike lanes in the city.

Like everywhere in Romania, as private car ownership in Craiova has gone up during the last decade, both traffic and parking have become problems for the city. There is severe traffic congestion, especially in the downtown area, and parking spots cannot accommodate the large number of vehicles pouring onto the streets. Driving in Craiova is not an easy job and sometimes it poses serious challenge not only to drivers, but to pedestrians as well. Most of the streets in the city center and adjacent neighborhoods, are very small, one way, and often full of cars parked on the road or sidewalks, leaving hardly any space for pedestrians. According to the law on public roads, cars can be parked on the side walk if they leave at least 1 meter for pedestrians. This regulation is hardly followed, and most of the time pedestrians are prevented from using the sidewalks. They have a hard time trying to squeeze between parked cars on the sidewalk and buildings, and sometimes they actually need to walk into the street around parked vehicles. This is not safe for pedestrians or for drivers.

Cars parked on the sidewalk in Craiova

Taxis are adding up to the congestion and parking challenges in the city center. For example, although the City Hall set up two designated parking zones for taxis in the downtown area (one near the so-called White House apartment block and the other next to the Carol I National College), vehicles are parked everywhere else, including on one side of the street, hampering traffic.

An underground parking in the city center on Al. I. Cuza Boulevard, behind the Marin Sorescu National Theater, could provide a solution to the chaotic parking situation in Craiova. It is a large project of RON 81 million (approximately EUR 18.3 million), with support from EU structural funds. The tender to choose the construction company was launched in April 2013. The two-level parking will cover 17.532 square meters, comprising 619 parking spots, of which 33 for motorcycles. The parking will have 240 plugs where electrical cars will be able to recharge.

At present, there is a beltway in the northern part of Craiova, connecting the airport to the former Doljchim chemical plant. The local public administration has further plans to decongest traffic by developing a ring road in the southern part of the city. Such a ring road would allow cars to bypass Craiova, and prevent vehicles from entering the city center and obstructing the already congested traffic.

Traffic congestion in Craiova

As part of the CIVITAS program, the local government has encouraged car-pooling to the industrial platforms in the Western part of the city in order to alleviate traffic congestion. This measure stimulates workers to carpool with at three passengers in each vehicle, reducing traffic, but also lowering fuel consumption and expenditures. First studies supporting the design and technical planning of the car-pooling project began in 2009.

Recently, a fly-over in the city center aimed at decongesting the traffic on Calea Bucuresti – N. Titulescu Boulevard was completed with support from the 2007-2013 ROP. The travel time has reduced by 10%, and the waiting time at the intersections has diminished. 5,300 square meters of sidewalks have been rehabilitated and 2,200 square meters of green area has been established. Also, a number of 37 electrical tram pillars and 180 road signs have been installed, in addition to 12 new cross roads for pedestrians and six new red lights.

New fly-over in Craiova

source: gds.ro

A few additional large projects seeking to tackle traffic congestion and ease transport flow in the city are under way. The city authorities are currently implementing a new traffic management system, covering 16 of the most crowded intersections in the city. This is a component of a larger project developed with support from the 2007-2013 ROP, aiming to improve access of the labor force to the two industrial platforms by modernizing public transportation.

The traffic management system in Craiova is expected to improve

source: www.adevarul.ro

A project aimed at ameliorating traffic congestion in the city center is under way, New signaling, red lights, automated traffic routings, and road signs will be installed. A number of video-cameras will be set to monitor the intersections. The traffic management department and the local police will be notified upon any traffic issues and accidents,, allowing for a rapid intervention on site. Upon completion of the project, the city managers hope that the waiting time at intersections will come down significantly, the travel time by car and tram on the East-West axis in Craiova will be reduced by 17%, and more people will use public transport. This will also lead to increasing safety of both passengers and cars, decreasing greenhouse gas emissions, lowering maintenance costs for cars, and increasing safety for traffic participants.

The rehabilitation of road infrastructure on the North-South axis will improve the traffic and urban transport to the industrial platforms. The project is developed with support from 2007-2013 ROP funds, with a total cost of RON 83.8 million. The main works include the rehabilitation and modernization of a few streets (Bariera Vâlcii, Caracal Street, and Râului streets), building new bike paths, and expanding on the public utility infrastructure.

Rehabilitation of infrastructure in Craiova

source: www.oradedolj.oradestiri.ro

It is expected that the travel time to the industrial area will come down by 30%, while the public transport ridership should increase by 6%.

There is another project with support from 2007-2013 ROP that aims to tackle the traffic congestion on the North-West axis in Craiova. A number of 8 kilometers of roads (i.e., Olteniei and Tineretului Boulevards, and Pelendava, Brestei, Amaradia, Toamnei streets) will be rehabilitated and upgraded. It is expected that travel time will go down by 12%, boosting instead the public transport commuters by 8%. A number of 14 stops will be modernized, 800 parking spots will be set up, in addition to six dedicated parking spots for taxis.

Finally, an underground passage of 405 meters developed with support from 2007-2013 ROP funds between the intersection of Arieș, Cuza, and Împăratul Traian streets will improve the traffic in the city center.

Work in progress at the underground passage in downtown Craiova

source: www.gds.ro

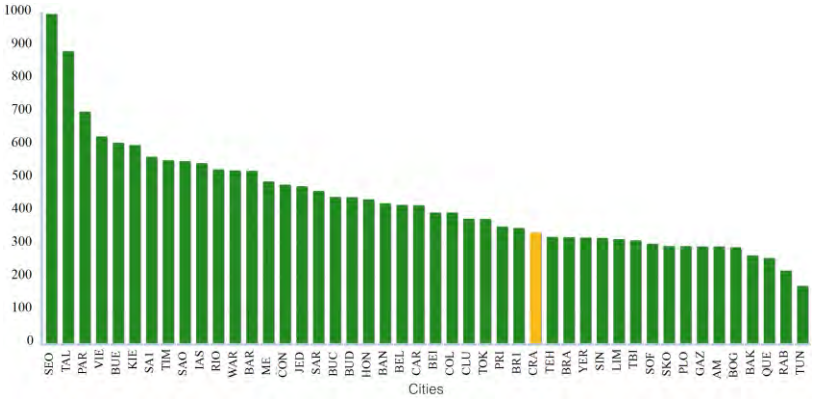
The underground passage will reduce the travel time by 14%, will make a clear separation of lanes and travel directions, and will also improve the number of people using public transport by 7%.

Solid Waste

The solid waste service in Craiova is under the public and private sectors. The solid waste collection is managed by Salubritate, a company under the city government, while the landfill is operated by Ecosud, a private entity.

Salubritate was established in 2011 under the Craiova Local Council, and it is in charge with the collection of solid waste in Craiova and in a few localities in Dolj County, as well as with the transportation to the eco-framed landfill in Mofleni, located on the city outskirts. Salubritate caters to approximately 200,000 people in Craiova, of which 162,000 in residential buildings and 42,000 residing in houses. By the end of 2012 the company had 19,617 contracts households, 438 with residential buildings, 2,750 with economic agents, and 185 agreements with municipal buildings. In 2012, the solid waste collected in Craiova amounted to 81,665 tons. Each citizen in Craiova produces 334.7 kilograms of waste annually. Craiova generates less garbage than some cities in the region, such as Belgrade, Banja Luka, București, or Brașov, but this more compared to other localities in Eastern Europe, including Ploiești, Sofia or Belgrade.

Waste per capita - kg/person



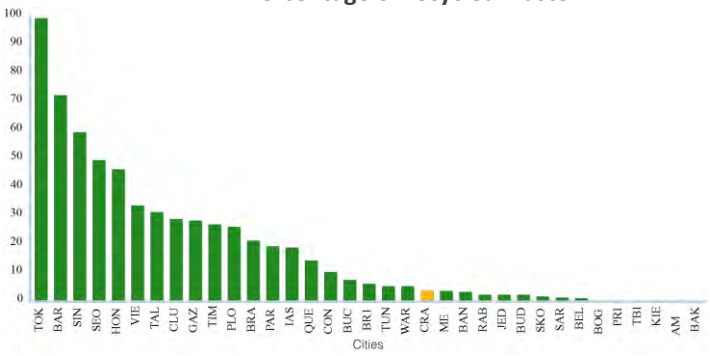
Solid waste is collected daily in the downtown area and every other day elsewhere in the city. On average, a truck collects daily from 20,000 people in residential buildings. At present, Salubritate picks up the garbage from the households once a week, but it plans to increase the frequency to two times in the future. The solid waste is collected every day from farmers markets, hospitals, and economic agents.

The city government made great efforts to implement selective collection in the city in 2011. At that time, Salubritate placed 136 igloo-type containers of 2.5 cubic meters capacity throughout the city, where people could dump plastic, paper and metal waste. There have been 62 bins designated for paper, 62 for plastic and metal, and 12 for glass. In the second half of 2012, the number of containers increased by 114 igloos. Today, selective collection is done through 250 containers (100 for paper, 119 for plastic and metal, and 31 for glass), placed in 87 locations around the city. In addition, 20 streets in Craiova are directly involved in the selective collection process. The solid waste operator distributes plastic bags to people, so they can separate organic waste from recyclable garbage.

Containers for solid waste selective collection

But despite such efforts, the percentage of recycled waste is not very high. Residents living in households are more reluctant to separate organic waste from recyclable garbage than those living in residential buildings. At the same time, people in poor communities sometimes steal from the trash bins up to 75% of their content. Therefore, when trucks come to pick up the garbage, containers are almost empty. Only 16,000 tons of recyclable waste was collected in 2012, which accounts for only 3.5% of the total amount of garbage generated in the city. Craiova has one of the lowest selective collection rates from the TRACE database compared to cities with similar Human Development Index. This figure is twice as low as in București, six times less than in Bratislava, and about eight times less than in Cluj-Napoca.

Percentage of recycled waste



Most of the recycled waste was paper and cardboard, i.e., 168 tons. 27 tons of plastic have been recycled, in addition to 24 tons of metals and aluminum. Collection of glass is the most problematic. The city has tons of glass bottles that need to be recycled, but Salubritate cannot sell them because of lack of demand in this respect. There are only a handful of companies in the country where glass bottles could be recycled. However, the requirements (only colorless bottles) and high transport-related costs are discouraging Salubritate to send the bottle glasses away.

Hazardous waste from hospitals is collected separately by two private companies. Construction and demolition waste poses serious challenges to the solid waste operator. As there is no law regulating this matter, so construction companies simply dump the construction waste at the city limits. In 2012, around 800 tons of construction waste was disposed near the landfill at Mofleni. The city government plans to tackle this problem in the near future.

As per EU regulations and the national environment legislation, cities should recycle 15% the solid waste. If this target is not met, penalties are applied (RON 100 per ton). In 2012, Craiova managed to achieve the required target, as the soil and biodegradable waste collected from parks and gardens and loam soil used for cemetery was accounted as recyclable waste. The good news is that Craiova has been actively involved in collecting electronic equipment, such as radios, TV sets, fridges, computers etc. The municipality organizes such collection campaigns a few times a year, to make sure that Craiova is able to meet the target set

to 4.5 kilograms per person per year. Incentives are awarded to people who win the competition of delivering the highest amount of electronics. One of the last campaigns was relatively successful – the city managed to collect 17.4 tons of electronics.

In April 2013, the Craiova Local Council approved the increase of solid waste collection monthly tariffs in order to help Salubritate to overcome financial problems. The new tariffs, effective as of the summer of 2013, are RON 7 (VAT included) for customers in residential buildings, and RON 76.8 including VAT per cubic meter of solid waste for economic agents.[21] Individual households pay different tariffs - EUR 2 per 100 kilograms of waste. Salubritate faces some challenges in collecting the tax revenues from the population; only 85% of the domestic customers pay the solid waste dues in time. The tipping fee at the landfill is EUR 21 per ton.

The company operates with approximately 30 trucks and big dump trucks, of which 20 compacting trucks, each of them loading up to 20 cubic meters of waste. The trucks are equipped with GPS systems that help optimize the pick-up and transportation process. In addition, the company has 5 dump trucks that are used to pick-up construction and demolition waste, as well as biodegradable trash from parks and gardens. The compactor fleet comprises of 7 DAF trucks of seven years old, 7 Renault of five years old, and 6 old Romanian trucks manufactured at the now-defunct Roman Brasov factory. Part of the truck fleet has reached the limit of the life cycle and needs to be replaced. The company has the financial potential to modernize only four trucks in 2013.

The company uses almost 280,000 liters of diesel annually (on average 23,000 liters per month), the equivalent of USD 500,000, to operate the truck fleet covering collection and transportation activities. The monthly expenditure to run the company is RON 2.1 million, of which 6.5% is spent on fuel, 39% on salaries, while 50% goes for the tipping fee at the landfill.

Garbage truck in Craiova

The recycling activities are not bringing too many revenues because the tariffs for recyclable items are fairly low. The company sells PET bottles for RON 0.92 per bottle, and it receives RON 3 per kilogram of metal, and RON 0.21 per kilogram of paper of cardboard. At the end of 2012, Salubritate managed to sell 96 tons of paper and 17.4 tons of plastic.

In the future, the city government plans to modernize the solid waste sector and provide better services to city residents. One of the main actions included in the Solid Waste Master Plan is installing underground platforms. This innovative trash bins have been already installed in Ploiești. Craiova plans to spread 759 buried platforms of 3 and 5 cubic meters capacity across the city, covering 438 ecological household platforms. 509 platforms would be dedicated to organic waste, 110 to plastic (PET), 110 for paper, and 30 to glass. A number of 30 platforms will make available 4 types of containers for organic waste, paper, PET, and glasses. Once the buried platforms will be implemented in Craiova, the city government must find a solution for dealing with the construction and demolition waste, and prevent such trash from being dumped into the new garbage bins. At the same time, the local public administration wants to improve the selective collection rate in the city by organizing public campaigns to raise awareness in this regard.

The landfill is located at Mofleni, just a few kilometers from the city center, and is managed by Ecosud, a private company that has signed concession agreement with the City Hall Craiova to operate the facility for 39 years. The landfill was built in 2005 in partnership with the City Hall, which provided the 54 hectares of land. The solid waste deposit is included in the Solid Waste Master Plan for Dolj County, a project of EUR

[21] More information on the new tariffs for solid waste collection and transportation are available at: http://www.salubritate-craiova.ro/tarife.html

50 million developed with support from the Environment Operational Programme and coordinated by the Dolj County Council. Half the investments will be channeled to the Craiova area. When the project will be completed it will cater for all 111 localities within Dolj County.

The landfill has 30 cells of which three have been already filled. Currently, Ecosud is using the fourth cell. Each cell is spread over of 1.3 hectares, and is takes up to two years to reach its filling capacity. The construction of each cell requires EUR 500,000 investments.

The landfill in Mofleni

Approximately 94,000 tons of solid waste was dumped at the landfill in 2012. About 90% comes from Craiova and some other localities. On average, there are 260 tons dumped daily at the landfill, a figure that came down jn recent years. Until 2009, 350 tons of solid waste used to be disposed daily in the landfill. This has to do with the decrease of solid waste generation due to the economic crisis, as people have less money to spend on food and other goods. Approximately 60 trucks come to the landfill site to discharge the waste collected from Craiova and other areas.

Although the landfill does not have a sorting station or a composting facility yet, approximately 35 to 40 tons of plastic items (including plastic bottles) are collected manually by 15 employees every month. The people are incentivized to keep some of recyclable items after they met the target. The Master Plan includes compost and sorting stations. Just like the Vitalia landfill in Ploiești, the dumping facility at Mofleni has a reverse osmosis leachate treatment plan where the treated wastewater that comes from the landfill is discharged.

Leachate treatment plant at the landfill

The landfill is currently developing a biogas station facility. Experts have already assessed the biogas potential capacity of the three cells that are already filled. At present, it is too early to know the potential installed capacity of the biogas station. Anyway, it has been already planned that once the plant will be operational part of the electricity produced will be sold to the district heating plant in the city. Four transfer stations should be built in the wider metropolitan area, including one in Işalnița and one in Vârvor, to improve the solid waste operations in the region. Upon signing the contract for the Master Plan, the Dolj County managers will launch the tender to choose the operator of the solid waste integrated program.

Potable Water

The water sector in Craiova, both potable and wastewater, is managed by Apa Oltenia, a public company whose main shareholder is the Craiova City Hall with 75% of shares. 15% of shares belong to Dolj County Council, 7% to Filiași (a city in the metropolitan area), whereas the rest of shares belong to other localities to which Apa Oltenia caters.

Apa Oltenia is a regional water operator responsible for the distribution of treated potable water and management of sewage wastewater in Craiova and surrounding localities. The company caters to 10 localities from the wider metropolitan area, grouped under an Intercommunity Development Association. It is expected that a few more localities will be joining this group in the near future. Besides Craiova, the company is delivering water to other communities in Dolj County. Some of the large industrial plants in Craiova (such as Ford) are taking water directly from Apa Oltenia or from the water source, as it is the case of CE Oltenia. The length of the water network is 475 kilometers of pipelines made of steel and carbon. Most of the pipelines are old, some even from the beginning of the 20th century.

The water catered to Craiova comes from both overground and underground sources. Since 1976, the over-ground water source for Craiova is Jiul river- Ișalnița, amounting to 42% of the total water delivered to the city. The flow capacity is 900 liters per second. The water is taken from Jiul river and further moved into the reservoir at Ișalnița, from where it is transmitted to Șimnic where is getting mixed with other waters. The underground sources are mostly drains and spring waters. 38% of the water in Craiova comes from a large spring water source, Izvarna, located in Gorj County, about 117 kilometers from Craiova.

Izvarna water source

source: apaoltenia.ro

Izvarna has supplied water to Craiova since 1967, currently with a flow of 760 liters per second. Because it springs straight from the mountains, Izvarna is very good quality water that requires only a little chlorination. The water comes through a gravitational system to the reservoir at Șimnic where the chlorination process takes place. The other 20% of the water catered to Craiova comes from small underground sources, such as small depth drains and wells. The water captured from the drains is chlorinated at Făcăi and then is gets pumped into the distribution system of Craiova.

There are five reservoirs at Simnic, each of them with 5,000 cubic meters capacity, in addition to three large storages of 10,000 cubic meters each. Overall, the maximum water stored in these reservoirs can go up to 55,000 cubic meters. Around 10,000 cubic meters of water are normally in stand-by. On average, the water flow for gravitational water can reach to 1,600 cubic meters per hour and 2,000 cubic meters per hour through pumping. Most of the water catered to Craiova needs to be pumped.

Expanding water network performed by Apa Oltenia

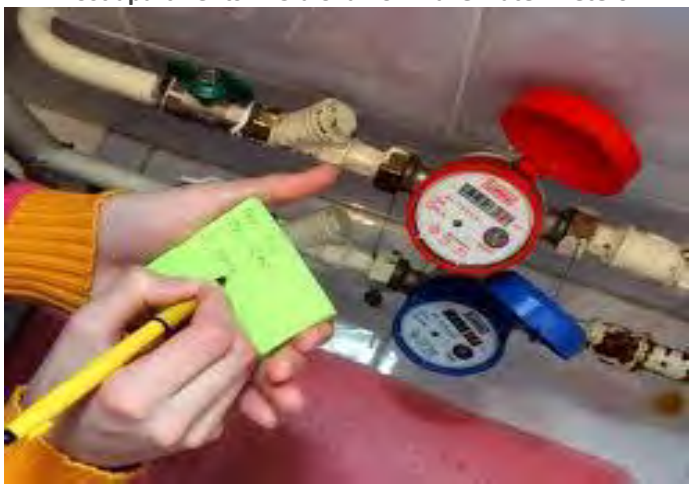
source: www.apaoltenia.ro

Currently, the company operates with several pumps of different sizes, varying from 3 kWh to 400 kWh. There is one oversized pump in Işalnița, in addition to few smaller pumps ranging from 3 to 160 kWh. There are a number of four pumps at Șimnic of 90 kWh capacity each; two of them are used only during the nighttime about four times a month. The water station at Făcăi has an oversized pump of 160 kWh that runs for about 10 hours day, and few smaller pumps of 37 kWh and 2.2 kWh capacities. The water station at Secui operates with five pumps between 55 kWh to 90 kWh capacities.

Over time, Apa Oltenia was able to upgrade and expand the water system with support from ISPA funds and EBRD loans, totalizing over EUR 70 million. Overall, more than 61 kilometers of water pipes have been rehabilitated in the last decade and meters have been installed in most of the residential buildings in Craiova.

Currently, almost 90% of the customers have water meters and can control the water consumption from their apartments. As a result of metering, pumping efficiency has improved by 43%. For instance, the pumping activity at the Işalnița water station came down from four oversized pumps to only two pumps.

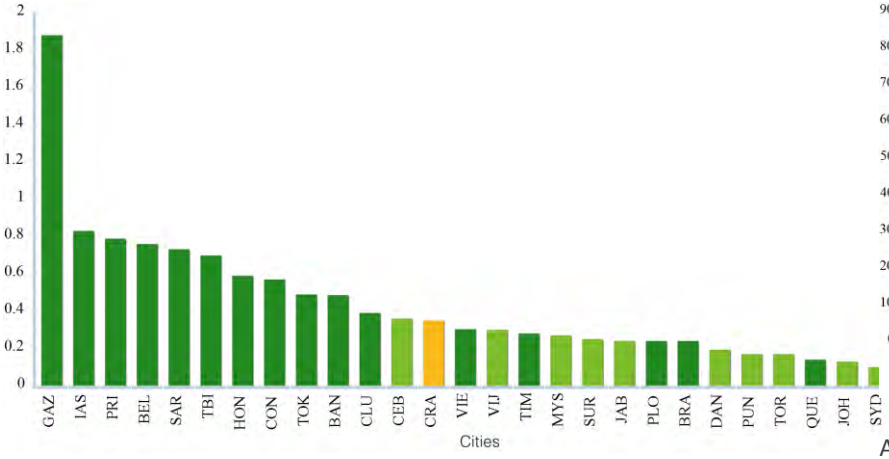
Most apartments in Craiova now have water meters



source: apometre.wordpress.com

The water consumption in Craiova amounts to 213 liters per person per day. In 2012, the annual water production for Craiova was 25.5 million cubic meters, which required 9,281,531 kWh of electricity. On average, 0.35 kWh is necessary to produce one cubic meter of drinking water. This figure places Craiova in the middle of the TRACE database compared to cities with a similar climate. For example, Craiova performs better than Warsaw, Belgrade or Kiev and has similar figures to Cluj-Napoca or Tbilisi.

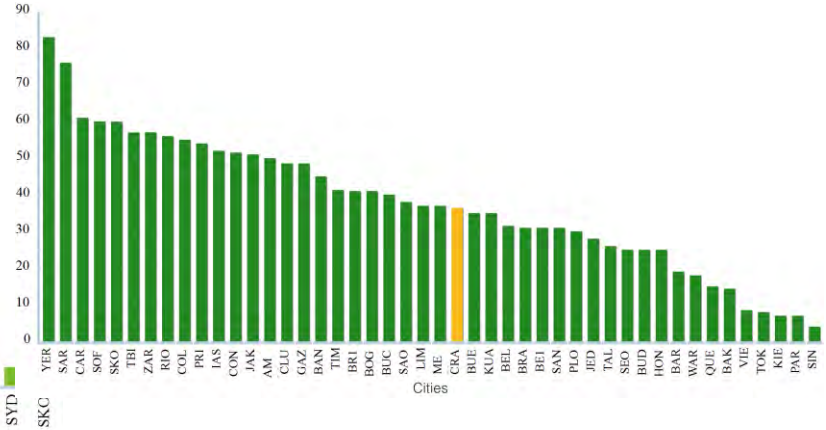
Energy density to treat potable water - kWhe/m3



Most of the water pumps operate during the nighttime because the electricity is cheaper by 60%. On average, Apa Oltenia spends RON 90,000 monthly on electricity to pump the water. The overall expenditure for water utility amounted to a little over USD 13 million. 63% of the overall expenditures cover the salaries for the company's 1,030 employees.

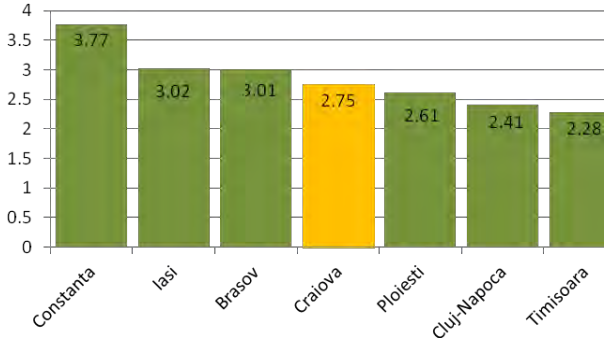
The percentage of water losses (36.4%) places Craiova on the lower side of the TRACE database. Craiova performs better than other cities in the region, such as Cluj-Napoca or Brașov, but there is room for improvement compared to other localities, including Ploiești and Belgrade. One of the culprits for the water losses is the old network, but also the lack of a SCADA system. Currently, the monitoring of the network distribution pipes is done manually, which makes harder to notice all the leakages that may occur on the pipes and respond promptly. A SCADA system would facilitate better monitoring the water network and increase the overall efficiency of the system. The company hopes that such a system would be purchased with support from the next financial programming of structural funds.

Percentage of non-revenue water



As everywhere else in the country, the water tariffs are proposed by the company and approved by the Local City Council and the Public Service Utility Regulatory Authority (ANRSC). The tariffs must take into account the degree of affordability to the people. At present, people pay RON 2.75 per cubic meter of potable water (without VAT). This figure is comparable to most of the growth poles in the country (see below). The tariff for wastewater is RON 1.65 per cubic meter, of which 0.7 RON is due for sewage.

Water tariffs RON/cubic meter (without VAT) - 2103



source: ANRSC

In the past, there have been some difficulties in collecting water revenues from the Intercommunity Development Association, but this issue has been sorted out recently as the communities started paying some of their debts. Now the bill collection rate went up to 90%. However, there are still some issues, as some clients do not declare the actual amount of water consumed. At the same time, many customers do not pay according to the amount of water they consumed, but based on the overall consumption in the building, which is equally divided among all users. The average consumption of potable water in residential buildings is 4 cubic meters of water per month, and 6.3 cubic meters including sewage. The city needs on average about 1,700 cubic meters to cover the daily water needs.

Rehabilitation of water network performed by Apa Oltenia

source: www.apaoltenia.ro

Currently, the company is implementing a large project of RON 630 million with support from EU structural funds targeting the rehabilitation and expanding the potable and wastewater and sewage network in Dolj. Among the projects covered: building 15 kilometers of new water network in the metropolitan area, 35 kilometers of pipes from Işalnița to Filiași, rehabilitation of Işalnița waste water plant, and upgrading of sludge collection in Craiova. Anyway, more money is needed for the company to become a truly regional operator, able to provide water services to both Dolj and Gorj.

In the short term, the company will be focusing looking to improve the efficiency of the water pumps. Most of the pumps are oversized and require high-energy intensity. Hence, they need to be replaced with smaller pumps with 3.5 kWh and 7.5kwh electrical capacity, a fact that would facilitate bringing down the overall energy consumption. The company is thinking to partner with an Energy Service Company (ESCO), willing to invest in the new pumps and recover the investments later. The water pumps are not very expensive and so the ESCO could recover the investments in a year or two. At the same time, Apa Oltenia is also thinking to focus on educating people on how to use water more efficiently.

Wastewater

The wastewater treatment plant belongs to the City Hall and is managed by Apa Oltenia. The facility is spread over 20 hectares and is located at the city outskirts, in Făcăi. The new wastewater treatment facility was completed in 2012, as part of a EUR 35 million project funded through ISPA. The facility caters to about 70% of the people in Dolj County. However, not all households in the county are connected to the sewage system. The water flow on dry days amounts to 129,600 cubic meters per day, while the maximum water flow per hour is 9,000 cubic meters. The maximum water flow in rainy days is 18,000 cubic meters per hour.

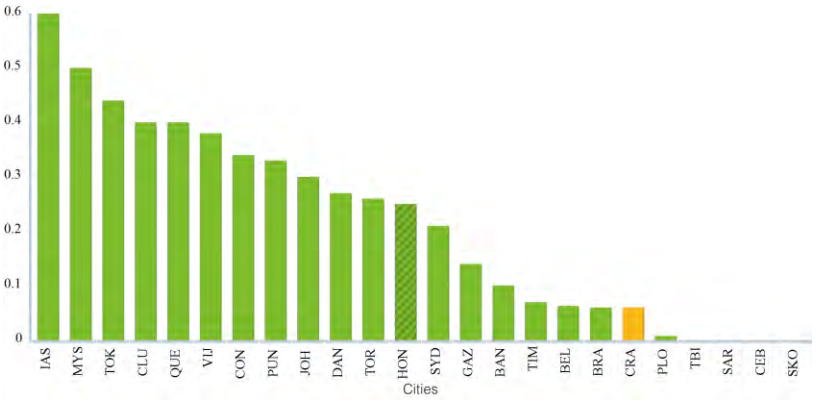
In 2012, the wastewater consumption in Craiova was 34 million cubic meters, by 8 million cubic meters more than the amount of potable water produced. The difference is explained by the fact that the company does not have storm water drainages, and so rainwater goes straight into the system without any separation. The industrial plants have their own drainages and sent the wastewater directly to the wastewater treatment plant. The new wastewater facility is equipped with a SCADA system that allows for a very efficient monitoring of the wastewater network

Waste water treatment plant at Făcăi

source: www.apaoltenia.ro

Craiova performs better than most of the cities within the TRACE database compared to the same climate. Apa Oltenia needs only 0.06 kWh of electricity to treat one cubic meter of wastewater, a figure that places Craiova in the lower side of the TRACE database. In 2012, the company consumed almost 4 million kWh of electricity for treating 34 million cubic meter of wastewater.

Energy density to treat wastewater - kWhe/m3



Perhaps the most noteworthy aspect about the new wastewater treatment plant is its capability of producing biogas. Running the biogas plant would be a function of how efficient the collection of sewage/mud will be.

Biogas digester at the wastewater treatment plant near Craiova

The biogas digester has a capacity of 10,000 cubic meters and can potentially generate up to 600 kW of electricity – 27 cubic meters per hour of biogas.

In the future, Apa Oltenia plans to continue investing in expanding the wastewater network in Dolj and Gorj counties, in order to be able to increase access of people to sewage services. Likewise, the company is interested to rehabilitate and upgrade the existing wastewater pipes, a fact that would significantly contribute to reducing the overall losses in the water system.

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

The level of local control also determines the energy saving potential. The more control local public authorities have over a particular service area, the higher the energy saving potential. Like in many cities in Romania, in Craiova 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, solid waste is managed both by the City Hall and the private, as the collection of waste is under the city government, whereas the landfill belongs is operated by private company. The city has very little influence over the energy sector, as the Government at the national level decides policies and regulations. "Private vehicles" is another service area where the local level of control was considered low. In this sector the Government takes the policies and decisions, with limited scope for local involvement.

After the saving potential for each sector was calculated, a sector prioritization was done in TRACE, based on the amount of savings potential. The sectors with the largest energy savings potential in Craiova are "Private Vehicles," "District Heating," "Public Transportation," "Street Lighting," "Potable Water," and "Municipal Buildings." The sector with the highest potential of energy savings in Craiova is "Private Vehicles", although the local public administration does not have much control over this area. Although "District Heating" has the second highest potential of energy savings, the City Hall decided not to take it into consideration for now because of the upcoming merger of the heating supply company with CE Oltenia. After the merger will be completed and the debts will be written off, the City Hall will look into ways to improve the secondary pipelines performances. "Public Transport," a domain under the Craiova City Hall, can achieve the third highest potential savings. Another area with a good potential of energy savings as highlighted by TRACE is "Street Lighting," a sector under the municipality control. The "Water" sector has some energy saving potential but the city managers believe that modernization of the water infrastructure throughout Dolj County will be able to help improve the overall system's performances. Also, TRACE has identified some saving potential regarding "Solid Waste," which is both under a mixed private and public management.

Sector prioritization

City Authority Sector Ranking

Rank	Sector	REI%	Spending (US $)	CA Control	Score
1	Public Transportation	36.1	4,699,799	0.86	1,463,021
2	Street Lighting	52.0	1,261,261	0.95	623,754
3	Potable Water	42.2	1,369,411	0.90	520,454
4	Municipal Buildings	10.6	7,200,000	0.58	442,655
5	Solid Waste	32.8	500,000	0.95	155,972
6	Wastewater	20.0	759,535	0.90	136,716

City Wide Sector Ranking

Rank	Sector	REI%	Spending (US $)	CA Control	Score
1	Private Vehicles	22.4	84,120,143	0.25	4,718,555
2	District Heating	20.1	33,437,500	0.50	3,360,468
3	Power	43.7	0	0.10	0

All priorities identified by TRACE were presented and discussed with local public administration officials. A number of eight recommendations have been highlighted, and these will be discussed in more detail in the sections below.

Urban Transport

One of the main areas of intervention with significant potential for energy savings for Craiova, as identified by TRACE, is urban transportation. A series of initiatives promoted by the local government that are to be implemented in the immediate future aim to improve the public transport in the city and make it more attractive to the residents of Craiova. From purchasing fuel efficient and less polluting rolling stock and expanding on the non-motorized public transport network to improving traffic flow in the city –these efforts would fall mostly within the scope of what the local public administration is already undertaking, or is planning to carry out in the near future.

In addition, relevant stakeholders in the city should establish 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 București.

Public Transport Development

One of the main TRACE recommendations made to the city of Craiova is to advance the development of a modern and safe public transport. 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 buses and trams. Relying more on public transportation would significantly reduce the fuel consumption, improve air quality in the city, and overall, increase the quality of life for the residents of Craiova.

This ambitious goal can be achieved by implementing a set of measures, such as giving priority to public transport vehicles over private cars, creating special signaling for buses, introducing e-ticketing, providing passengers with useful information about bus schedules, and establishing better urban planning policies and regulations. Some of these measures are already in implementation, while city managers should consider putting into practice additional tools that could bring up the public transport ridership.

The local transport authority has sought to improve the public transport conditions in the city and reduce the fuel consumption, trying to optimize the public transport network, but also striking a balance between transport capacities and passengers flow. The economic development of the city influenced passenger flows and, thus, the company established optimal bus routes, adjusted to meet the demand. One of the main priorities for the local government is renewing the bus fleet. The current public transport fleet managed by RATC is on average 30-35 years old. Most of the buses are old, very polluting, and fairly uncomfortable. Some buses are second-hand and their life cycles were already almost exhausted at the time of purchase. Moreover, maintenance costs of such old rolling stock are very high, and the public transport company spent a lot over the years for repairing the fleet. The local public authorities are committed to invest in the modernization of the public transport fleet and they are encouraged to follow through with such initiatives in order to make the public system more accessible, more attractive, and more comfortable for the city residents.

In the short run, city managers should focus on replacing those buses that had reached the end of their life cycle. In the long run, the ambitious goal is to develop a clean bus fleet by replacing the old stock with 200-250 new, modern, energy-efficient vehicles.

Natural gas buses operating in the Washington, D.C. Metropolitan Area

source: www.fastcoexist.com

Some concrete steps have already been taken toward this end. Recently, the Craiova Local Council approved the funds (about RON 6 million) for purchasing the first batch of new buses. These will be operating on natural gas and will be equipped with air conditioning systems. The city government hopes that purchasing new rolling stock would become eligible under the financial programming of the ROP for the period 2014-2020, as other EU Member States have been able to use structural funds for such purposes.

Still, EU funds will not be enough for the entire fleet, and the local policy makers should figure out some alternative options. Moreover, the renewal of the public transport fleet should be coordinated with the modernization and rehabilitation of the public transport infrastructure. In this way, local authorities will not only increase the overall efficiency of the system, but also its attractiveness to people. The ultimate goal is to have more people using the public transport. In order to make things happen, public transportation must be accessible, comfortable, and safe. For the next procurement of buses it is important to look into enforcement of vehicle emissions standards. New vehicles should comply with high-level European emission standards, such as Euro 4 or Euro 5. Such criteria should not only help improve local air quality, but also lower fuel consumption. The higher the vehicle emission standard, the less fuel it is likely to consume and the higher the reductions in the emission of fine particles, nitrogen dioxide, ozone, CO2, and other pollutants. Lower emissions result in higher air quality and lower the risk of respiratory diseases associated with air pollution.

Another priority for Craiova is to keep the tram network alive. Trams are the most efficient means of transportation, as they operate on low costs, require small energy consumption, and can carry a large number of passengers. Currently, a large project regarding the rehabilitation of 11 kilometers of tram network, connecting the industrial platforms in the city, is under implementation. Once the rehabilitation of the tram network will be completed, the City Hall is planning to buy new, modern, efficient trams. The local government hopes to be able to initially buy about 20 tram cars. In the future, the plan is to expand the tram network to the airport.

New trams operating in Oradea

source: www.realitatea.net

Also, the local government is considering introducing trolleybuses, another efficient and less costly means of transportation. Not in the least, the City Hall wants to expand the public transportation in the wider metropolitan area, and link Craiova to the neighboring communes, up to Pielești, about 30 kilometers far from Craiova.

In addition, there are a few other ways to increase the use of public transportation and attract more people to ride buses and trams. The local authorities have already begun implementing the e-ticketing system, as part of a pilot project under the CIVITAS program. Initially, the e-ticketing was introduced on a few bus routes in the city, but the local government is thinking of expand it for the entire public transport fleet. E-ticketing is not only reduces the cost of travel and help more people ride the bus and commute, but also provides support for revenue collection and transfers, as well as for counting passenger. A few cities in Romania, including București, Arad, and Timișoara, have implemented this accessible, modern, efficient way of paying for public transport. Under CIVITAS, a few dozen bus stops in Craiova have been equipped with electronic screens displaying useful information about the bus route, schedules, delays, etc.

Screen displaying information about bus routes in Craiova

source: www.tramclub.org

This TRACE recommendation encourages the local government of Craiova to expand such displaying screens to all bus stops in the city, as to help passengers to better plan their trips. RATC is considering rehabilitating the bus stops in a cost-effective manner by involving advertising companies, who would be interested in investing in the waiting platforms. This approach should be beneficial for both parties. The advertising companies will place ads and posters in the bus stops, while RATC will have of new, modern waiting platforms.

Another way of improving the public transport is by establishing dedicated bus lanes. These will give priority to buses at intersections and enable them to bypass traffic congestion and, thus, reduce the travel time. In addition, special infrastructure for bus-priority signaling should also be considered. This system is linked to buses via transponders that use GIS information, and can help the flow of approaching buses either by extending green lights for them or by cutting down the cycle for cars.

Dedicated bus lanes in Los Angeles

source:www.laist.com

Not in the least, city authorities in Craiova may consider changing some of the current planning regulations. 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. Some cities around the world, including Curitiba, Brazil, encourages high-density residential and commercial development around and within walking distance of transit stops, with lower densities elsewhere in the city.

Non-Motorized Transport Modes

One of the main TRACE recommendations made to city managers in Craiova is to encourage and expand the non-motorized transport infrastructure by building pedestrian networks and dedicated lanes for bicyclists. An efficient non-motorized transportation with zero fuel consumption helps reducing pollution, improves air quality, and is good for people's health. With an initial investment of USD 1,000,000 over a

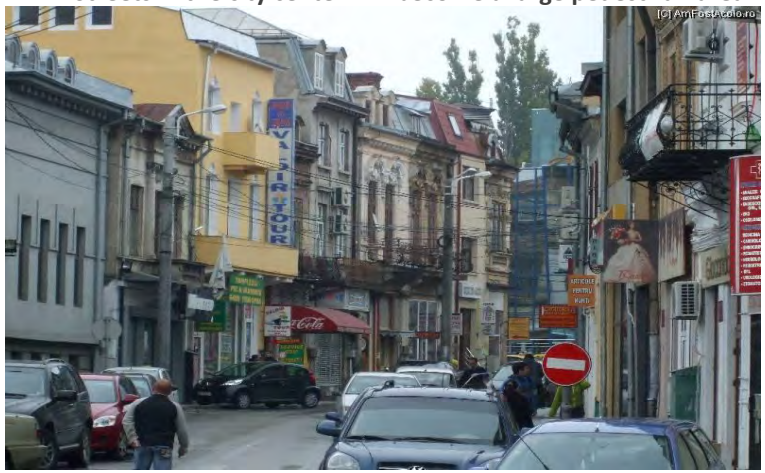
two-year implementation period of time, such programs can achieve energy potential savings between 100,000 and 200,000 kWh per year.

This TRACE recommendation aims to help the city government to encourage and promote the use of fuel free means of transportation, helping people become more open toward a healthier, more efficient, and more prosperous environment by walking and biking, and, gradually, enable them to rely less on their private vehicles. Pedestrian areas not only provide city residents with better and healthier alternatives of means of transportation, but they also stimulate local business by increasing the number of restaurants and shops in dedicated areas.

The local government is already pursuing some of these measures recommended by TRACE. A large project targeting the rehabilitation of the historical center, including the development of a large pedestrian walk, is currently under implementation. The total value of the project is EUR 48 million with support from ROP 2007-2013, of which the city government contribution amounts to EUR 3.5 million. One of the main components of this project, spanning over 12.5 hectares, is the development of pedestrian area comprising 11 streets (i.e., Nicolaescu-Plopșor, Th. Aman, Panait Moșoiu, Frații Buzești, Roman Rolland, România Muncitoare, Traian Demestrescu, Olteț, Lipscani, Dreptății, and România Muncitoare alley). 2.3 hectares of streets and sidewalks will be modernized. In addition, the Lipscani street will become a venue for exhibitions, trade fairs, arts, cultural and sports events, while two new markets will be set up in Buzești and Femina streets. 43 video-cameras will be installed to monitor the area, ensuring safety of people.

A series of amenities will be installed, including fountains, mobile green-flower pots, benches, street lighting lamps, public restrooms, and trees. The City Hall plans to offer substantial tax exempt to owners of private historical buildings located in the neighborhood, who would be willing to rehabilitate and renovate their houses on their expenses. Municipalities that invested in pedestrian network helped raise the quality of life in the cities, and also stimulated business development. Cluj-Napoca is a good example in the regard. After Piața Muzeului in the city center was turned into a pedestrian area, not only did pedestrian traffic go up, but the number of businesses and business activities in the area also increased substantially. Today this pedestrian area in Cluj-Napoca is gathering several leisure and entertainment places, such as restaurants, bars, shops, and service stores, and it has become one of the most popular spots in the city.

Streets in the city center will become a large pedestrian area



source: www.craiovaforum.ro

Piața Muzeului, before (left) and after (right) pedestrianization

source: http://arhitectura-1906.ro/2011/10/planwerk/

Encouraging citizens to use bicycles by expanding on the existing bike lanes is the second main priority of the local public administration when it

comes to non-motorized transport. Building a new bike network is part of a EUR 8.2 million (VAT included) project developed on the East-West axis of the city. Bike lanes will be built on the route from Peco Severinului to Electroputere Passage via Severinului and Calea București streets. The bike networks will be set up on the sidewalks, and will have one meters width for double paths, and one meter for one lane. The width of sidewalks will be reduced, maintaining the trees and street lighting pillars alignment. In this way, the bike lanes will look like small alleys bounded by curbs. The tender for choosing the construction company to implement the project is under way. In addition, there are plans to build 11,000 square meters of bike network along Râului and Caracal streets, as part of the project aimed at improving the traffic on North-South axis in the city. Local authorities may think about organizing a docking station in the city center, from where people could rent bicycles. The „I velo" model has been developed in partnership with a commercial bank by a few municipalities in Romania, such as Timișoara, Cluj-Napoca, and București, and it runs very successfully, especially in the summer time.

I Velo docking station in Parcul Herăstrău in București

source.www.freerider.ro

Traffic Restraint Measures

Another important recommendation made by TRACE to the public authorities of Craiova is about curbing private car usage and replacing it with more sustainable, efficient, and less costly means of transportation. The increase in the number of private cars in the city should be contained by measures that would induce people to turn to other means of transportation, such as buses, trams, biking, and walking. Such options would lead to traffic decongestion, less fuel consumption, and make a cleaner, healthier environment.

Craiova is currently implementing a number of large infrastructure projects aimed at improving traffic in the city. Among these, a tunnel is aimed at decongesting traffic in the city center, and a few road infrastructure rehabilitations are planned to cover the connections to the industrial platforms in the city outskirts. The rehabilitation of the roads on the North-South axis will improve traffic and urban transport to the industrial platforms, while a similar project is designed to alleviate traffic between the North and West parts of Craiova. At the same time an underground passage will improve the traffic in downtown area as well as in other parts of the city. Once these projects will be completed, the waiting time at intersections will be eliminated, greenhouse gas emissions will decrease, and maintenance cost of vehicles will be lowered. It is likely that the travel time to the industrial areas in the city outskirts will come down by 10 to 30%, while the public transport ridership would increase by up to 12%.

One way to deal with traffic congestion is by enforcing certain speed limits. The public administration in Craiova has already restricted the speed to 30-40 kilometers per hour in some areas in the city center. Such limitations should be enforced throughout the downtown area, a measure which would perhaps discourage traffic. At the same time, the local administration could take into consideration hiking the parking tariffs in the center of Craiova. By increasing the parking fee, some people would be discouraged to drive their cars in the downtown area.

Sign limiting the speed limit to 30 kilometers

source: lorencic.ro

The local government could think about restricting access of inter-regional buses in the city. A ban as such is enforced in Cluj-Napoca, where local authorities limited the buses operating in the wider metropolitan area to only three "legal" stops in the city. The Craiova City Hall should look at this model and consider banning the old, polluting inter-regional buses too, or at least limiting their access to peripheral areas. Another efficient way of dealing with traffic congestion is by establishing the so-called "environmental islands, an area where private cars are restricted, and instead, the flow of public transport, cyclists and pedestrians is encouraged. Such "environmental islands" consist in a few streets in certain parts of the city, where some measures are conceived to prohibit and penalize the access of private vehicles in designated areas, and reduce the amount of space available for private cars.

Not in the least, a number of civic initiatives organized by the local government may also contribute in curbing the use of private cars. The City Hall may think about setting up "no driving days" to educate and lead by example, actions to which people could participate voluntarily. Craiova could learn from best practices from other cities around the world, such as city of Puerto Princesa in the Philippines, where the local government has restricted tricycles in the downtown district on a certain day of the week.

Municipal Buildings Benchmarking Program

One of the main recommendations the TRACE team makes to most public administrations in Romania where the tool has been implemented is the need for a municipal buildings energy database, where all energy-related information can be tracked and monitored. Craiova is no exception. Without a proper energy database in place, it is very difficult to implement any energy efficiency program. One cannot know if energy efficiency investments were indeed effective if it is not clear how much energy buildings consumed before and after the interventions. Most of local authorities in cities where TRACE has been implemented do not have a proper and reliable database on the buildings they administer (e.g., schools, kindergartens, hospitals, public administration offices, cultural centers, social assistance and sport facilities), on electricity and heat consumption, in addition to floor area.

Like many other cities in Romania, Craiova does not collect basic indicators on the municipal buildings that are managed by the City Hall, data that would allow identifying where energy efficiency programs are most suitable.

Victor Babeș Hospital is under the management of the City Hall

source: www. vbabes-cv.ro

For instance, the city was able to provide data on the expenditure for the total energy consumption related to municipal buildings, but there was

not a split between electricity and heating, the amount of kWh and Gcal that has been actually consumed associated to expenses, nor information about the floor area in connection to such costs. Although some information on energy consumption on schools and hospitals was available, these data were scarce, incomplete, somewhat unreliable, and, poorly organized.

This issue can be addressed through setting up a proper, clear, well-organized database that could be used to further prepare an efficient analysis on the energy saving potential of these buildings. The database should include some 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. Although local authorities in Craiova pay for electricity and thermal energy bills, they do not have a clear, easily accessible picture about the amount of energy actually consumed in these buildings and about how these energy expenditures could be decreased.

Frații Buzești National College in Craiova

source: www.editie.ro

Moreover, the data on energy consumption will be very useful for the local government when they will apply for ROP 2014-2020 funds, where energy efficiency will be one of the most important pillars of the program. The next ROP financial programming will allow municipalities to apply for funds that could help improve the overall energy efficiency of their cities by lowering the energy bills, save money for the city budget, and thus, help the city become more efficient.

The municipal building benchmarking process should include a database consisting of 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 the recent years, as well as cooling, heating and lighting system modes.

Petrache Poenaru School in Craiova

source: www.gds.ro

A small dedicated team within City Hall and a few external consultants could be assigned with responsibilities to prepare this full audit of municipal buildings, with support from several departments within the local public administration. The data should be published and updated on a regular basis to enable competitions among building managers and open the path for productive exchange of information and cooperation. Such a database is also valuable in benchmarking buildings against each other and determining where is 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 analysis includes several different models that the local government should look at when organizing the benchmarking process (see Annexes). The Ukrainian city of Lviv is a good example that an efficient benchmarking could achieve considerable energy savings. The city was able to reduce the annual energy consumption in its all 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 display campaign. Subsequently, the City Hall of Lviv established a new energy management unit and trained all personnel with responsibilities on building utility use in an administrative division, unit, or building.

Municipal Buildings Audit and Retrofit

Once the municipal building benchmarking is prepared, the next step the city management in Craiova should take into consideration is an audit and retrofit process. This could enable cost savings in municipal buildings, while also reducing the carbon footprint of the city.

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 local public administration may have to allocate money for energy efficiency upgrades, purchase of new equipment, and some building renovation. The retrofit program can be executed in a cost-effective manner by involving Energy Service Companies (ESCOs), which will pay for the initial cost of the upgrades and will share in the savings from the retrofits. Audit and retrofit programs make a great impact on energy savings, as studies show that the reductions can go down to as much as a 25% of the initial consumption.

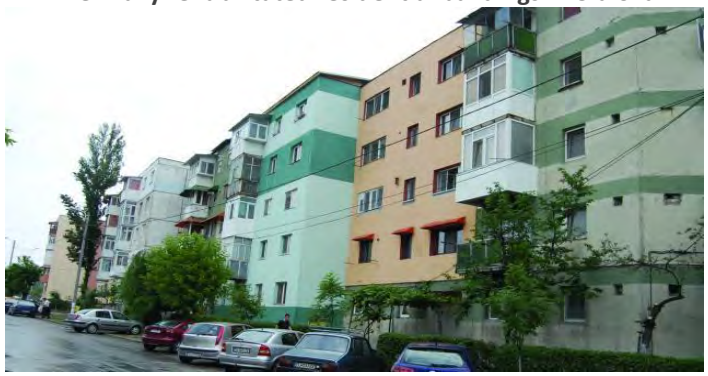
In recent years, the city government of Craiova has actively supported energy savings and encouraged both private and public buildings to be proactive and save energy in any of its forms. Quite a few steps have been taken in this respect – e.g., renovation and thermal rehabilitation work and the replacement of classical heating systems with green energy-based equipment. Rehabilitation work has been performed on a number of education facilities in the city. A few municipal buildings, including social assistance facilities, have replaced their classical heating system with those using solar and geothermal energy, a process that has led to significant reduction in energy bills. Some of this rehabilitation work has been done with support from the 2007-2013 ROP. In the near future, the local government is planning to rehabilitate and renovate some of the municipal buildings in Craiova with support from EU structural funds. One of the main priorities is the rehabilitation of an historical building in the city center hosting the Carol I National College and the Elena Teodorini Lyric Theater.

Carol I National College & E. Teodorini Lyric Theatre in Craiova

At the same time, the local authorities have applied for ROP 2007-2013 funds to thermally rehabilitate 93 residential buildings in the city. The City

Hall hopes that similar projects will become eligible for EU funding in the 2014-2020 programming period.

Thermally rehabilitated residential buildings in Craiova



source: www.gds.ro

Germany provides a couple of successful examples in improving energy efficiency in municipal buildings and reducing related costs. The city 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 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 generate substantial savings.

In another successful story, the City of Frankfurt signed a contract with a private company to install and operate an energy-management system for three main municipal buildings to diminish the energy and water expenditures and decrease the greenhouse gas emissions. The company invested USD 680,000 in control equipment. The capital invested was recovered from energy savings (54%) over a period of eight years, while the remaining 46% was expected to reduce the operating costs for the buildings. Compared to the previous annual costs of USD 1.7 million, the potential annual cost reduction was estimated to USD 217,000.

Energy Efficiency Strategy and Action Plan

One of the recommendations made through TRACE to the public administration in Craiova is to develop an Energy Efficiency and Strategy Action Plan. 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. 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 city-wide energy efficiency. At the end of the day, the strategy can be used as an internal and external promotion tool for the city to gain support for future work on energy efficiency.

In line with this TRACE recommendation, the local government of Craiova seeks to reduce energy consumption and make the city become more sustainable and efficient. To this end, the city managers are determined to prepare a SEAP sometimes next year. This 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.

source: genesys-project.eu

The strategy should put together measurable and realistic targets, set out well defined timeframes, and clearly assign responsibilities. The plan should outline what specific actions should be taken to reduce energy consumption and what are the projects that should be implemented to this end.

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

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

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 - that can be used to monitor the city's energy performance. But 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. For instance, in order to reduce the energy consumption by 30% by 2015, the City of Philadelphia has adopted a number of measures that helped the municipality make tremendous progress. These measures included a wide range of activities from retrofitting municipal buildings, replacing the municipal vehicle fleet, encouraging conservation among employees, installing LED light-bulbs, developing energy efficiency building guidelines to providing tax incentives to energy efficiency star performers, creating neighborhood competitions to reduce energy use, developing a citywide energy efficiency marketing campaign, and building energy efficient public housing.

Thousands of cities in Europe have become signatories to the Covenant of Mayors, the mainstream European movement established in 2008 that brings together local and regional authorities committed to increase the energy efficiency of their municipalities, as well as the use of renewable energy resources.

source: europa.eu

The main target of this process is to reduce local greenhouse gas emissions by 20% by 2020 and, thus, make the cities more climate-friendly. After the mayor signs the Covenant of Mayors, the local government prepares actions plans that translate the political commitments into actions and concrete measures. Currently, there are 4,759 signatories to the Covenant of Mayors, comprising more than 169 million inhabitants across Europe. More than half of the signatory cities have already submitted their Sustainable Energy Action Plans (SEAP) to Brussels. As of June 2013, there are 62 small and large cities from

Romania who have signed the political commitment to reduce the energy consumption by 2020. 28 of these cities have submitted their SEAPs to the Covenant of Mayors.

Four of the seven growth poles in Romania have become signatories to the Covenant of Mayors, namely Cluj-Napoca, Timișoara, Brașov and Ploiești. Three of them - Cluj-Napoca, Timisoara, and Brașov - have submitted their SEAPs to Brussels, and so far only the plan prepared by Brasov has been approved. 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.

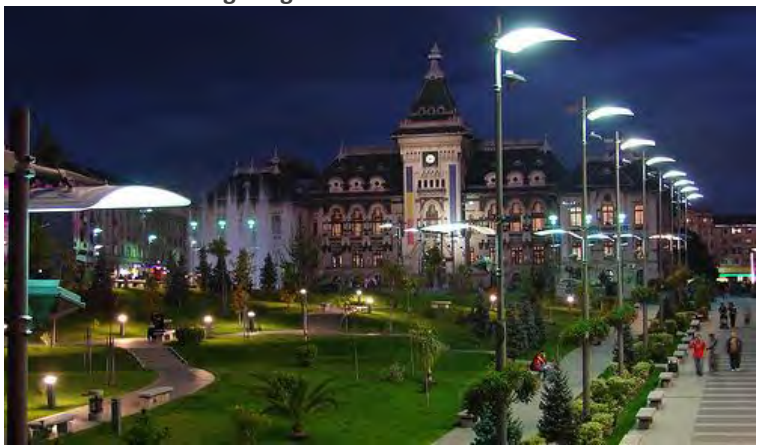
The capital of Sweden is one of the signatories to the Covenant of Mayor. The city of Stockholm has prepared an integrated city planning and management plan, with comprehensive urban vision, environmental programs, and concrete actions to reduce greenhouse gas emissions and tackle climate change. The 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. The first assessments show that the Swedish district has achieved 28% to 42% reductions in non-renewable energy use, in addition to 29% to 37% reductions in global warming potential. Such positive results could be replicated in Craiova, provided that policymakers follow through with the right measures.

Procurement Guide for New Street Lights

This TRACE recommendation is meant to help the city produce a specific procurement guide for the street lighting system. The guidelines associated to a new lighting technology can help deliver the same lighting levels for lower energy consumption, reduce related carbon emissions, as well as the operational costs. The improved design life also lowers maintenance requirements and costs and decreases interruptions to service, thereby improving public health and safety. 200,000 kWh in energy savings per year could be achieved with an initial investment of less than USD 100,000.

This recommendation builds on the city's current steps of selecting the new street lighting provider as such guidelines will help design a better, efficient solution for Craiova. In the near future, the local public authorities have ambitious plans to change the existing sodium vapor-based lamps with LED bulbs, which are more efficient but also more costly. To this end, the city needs to prepare guidelines that will set clear, strict rules about what the street lighting provider should follow through, as to improve the overall efficiency of the system and reduce the related costs.

Street lighting in downtown area in Craiova



source: www.panoramio.ro

The city government could consider preparing a manual about the street lighting design, inspired by IESNA (Illuminating Engineering Society of North America) best practices for visibility and safety guidelines. This should set up certain parameters regarding illumination, pole spacing and lamp type, as well as dimming or illumination operations during night time for all types the streets in the city.

Subsequently, the tender for choosing the new street lighting provider should include specific requirements with regard to design,

installation, maintenance, and operational costs. The future concession agreement should be signed for a period of more than 10 years, as to give the street lighting operator enough time to recover the investments. The contract should have strict requirements for illumination, and should entice competition in the private sector to provide the lowest operational cost possible. Finally, the procurement submissions should include very important criteria of providing a seven year life cycle analysis of first equipment cost, maintenance expenses, and energy expenditures.

The Midlands region in the United Kingdom is a good example about improving energy efficiency by using best practice procurement network. Nine councils from Midlands partnered with the Midlands Highways Alliance to achieve energy efficiency savings for major and medium highways and professional civil engineering services, by sharing best practices in maintenance contracts and by joint procurement of new technologies for street lighting and signaling. The procurement guideline outlined the minimum and desired specifications for street lighting technologies in order to achieve the carbon emissions and cost reductions required. The project was expected to save the region GBP 11 million (almost EUR 13 million) across highways maintenance and improvements by 2011.

Awareness Raising Campaigns

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

Promoting energy efficiency can be done in several ways, from advertising campaigns, public events and features in the local media to dedicated websites, training programs in schools, community and businesses centers, and an energy efficiency champion program. While the main benefits of such public actions would be the changing in the behavior of the city residents, the indirect payback would be translated into reduced pressure on energy infrastructure, smaller amount of greenhouse gas emissions, better air quality, and financial savings.

Promoting selective collection in Altamira, Mexico

source: factreports.revues.org

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

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

Promoting solid waste recycling

source: www.pcwastemgmt.com

One area in Craiova that could be among the main targets of such campaigns is the solid waste selective collection process. Once the buried trash bins will be installed, the city residents should be educated to separate organic garbage from recyclable waste, and place the items in the colored bins accordingly. The Craiova City Hall and Salubritate, the solid waste operator, should organize public campaigns and teach the people about selective collection through leaflets and information displayed on posters throughout the city. This is expected to improve the city's selective collection rate.

The same approach could be used with regard to promoting non-motorized transportation. For example, once the new dedicated paths will be built, people should be encouraged to rely more on bicycles and use less their private cars. The City Hall and RATC should organize information campaigns to increase awareness on the benefits of the public transport. Such campaign should focus on promoting public transport as a reliable, fast comfortable, safe, cheap, and accessible means of transportation in comparison to other transport modes (private vehicles).

Promoting public transport

source: www.irenesoo.wordpress.com; www.bangalore.citizenmatters.in

www.keepcalm.o-matic.co.uk

Another interesting and efficient method that could help raising awareness with regard to efficiency is through local energy efficient champions, individuals who could teach people about the importance and benefits of this matter. The City Hall recruits and trains, on volunteer basis, individuals, local public authority figures or different local entities (e.g., non-profit organizations, businesses, or health trusts) to have them spread the word about the benefits of reducing energy consumption and spending. These champions become the frontline vectors in promoting

energy efficiency, and they make presentations and deliver speeches during dedicated sessions, or distribute leaflets and inform people about simple ways to save energy.

Promoting water efficiency in Miami

source: miamidade.gov

The energy efficiency champions should be in touch with a designated person from the City Hall who should provide them with both knowledge and logistical support, but also monitor progress of each champion involved in the program. In addition, the local public administration should also monitor the overall effectiveness of the program. They should take into account the number of people participating in training programs, number of hits to energy efficiency websites, articles in the media about energy efficiency in the city, and number of champions trained.

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

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Instrumente Structurale
2007 - 2013

Annexes

Improving Energy Efficiency in CRAIOVA Romania

ROMANIA
REGIONAL DEVELOPMENT PROGRAM

TRACE City Energy Efficiency Diagnostic Study


Municipal Buildings


Water and Wastewater


Solid Waste Management


Public Transport


Public Lighting


Power and Heat

Regio
PROGRAMUL OPERAȚIONAL REGIONAL

Inițiativă locală. Dezvoltare regională.

Detailed Recommendations from TRACE

Improving Energy Efficiency in Craiova, Romania – to change the order at buildings below

Annex 1: 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	The City Authority links development densities to public transport

ATTRIBUTES

Energy Savings Potential
> 200,000 kWh/annum

First Cost
> US$1,000,000

Speed of Implementation
> 2 years

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

regulations & guidelines	availability and funding. The City Authority reviews the city's zoning ordinances and considers making the following changes: Increase the permitted floor area ratio/ plot ratio on sites located near public transport hubs. In areas where it is appropriate re-zone single-use lands to allow multiple uses on the same site. Allowing higher densities of development along well-served public transport corridors creates a patron base for public transport and can be used in combination with other planning measures, such as capping parking provision to residential and office buildings, thus discouraging car use. Developers are required to show how a new development links to the existing or planned public transport network in order to gain planning permission. See the Curitiba case study for further details.
Subsidies	The City Authority subsidizes travel on public transport. In certain areas this can provide an incentive for people to use public transport.

MONITORING

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

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

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

CASE STUDIES

BRT system, Bogota, Colombia

Source: ESMAP (2009). "Good practices in city energy efficiency: Bogota, Colombia - Bus Rapid Transit for Urban Transport Energy",

available online from http://esmap.org/esmap/sites/esmap.org/files/Bogota_Case_Study_020310.pdf
With the completion of its first two phases, the TransMilenio BRT system serves about 1.5 million passengers every day and has city-wide fuel consumption by 47%. Key success factors have been city-wide comprehensive planning of infrastructure, use of state-of-the-art technologies, implementation of a variety of design features to accommodate high volumes of passengers, and the use of a simple single price faring system. It does not require subsidies for operation - these are fully covered by fares. The project's capital cost totalled USD 240 million. The system is managed by a company which was set up by the Mayor, but runs independently from the city administration. While the company is in charge of all planning, maintenance and construction of infrastructure as well as organizing of schedules of bus services, buses and drivers are contracted through private firms, resulting in a complex but innovative management structure.

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

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

Integrated urban planning and efficient resource use, Singapore
Good practices in City Energy Efficiency: Eco^2 Cities - Land and Resource Management in Singapore, available online http://www.esmap.org/esmap/node/1230
Singapore is an island city-state at the southern tip of the Malay Peninsula. With a limited land area of 700 square kilometers and a

population of 4.8 million, Singapore has become developed because of innovative urban planning integrated with the efficient use of land and natural resources. Singapore's small size poses challenges related to the availability of land and natural resources. To optimize land use, Singapore promotes high-density development not only for businesses and commercial entities, but also for residential structures. High density lends itself to higher economic productivity per unit of land and facilitates the identification of green spaces and natural areas for preservation.
Furthermore, high-density development has translated into greater use of public transportation as major business, commercial, and residential areas are well connected to an integrated public transportation network. In 2004, public transportation as a share of all transportation modes during morning peak hours reached 63 percent. The significant use of public transportation helps reduce greenhouse gas emissions. High public transportation ridership also means Singapore has been able to recover all public transportation operating costs from fares, a feat achieved only by Hong Kong, China, and by Singapore among modern, highly developed cities.

Integrated regional urban planning, Auckland, New Zealand
Good Practices in City Energy Efficiency: Eco^2 Cities - Integrated Regional Urban Planning in Auckland, available online http://www.esmap.org/esmap/node/1227
The interconnectedness of national and local Auckland issues (such as housing and education) with growth and innovation and the major required investments (particularly in land transport) have created complex and difficult issues among multiple authorities. Despite Auckland's importance to the New Zealand economy and the areas of common interest, such as transportation and energy provision, the national government did not initially play a close role in directing regional and local government planning. Concern emerged that, without agreement on an overarching regional strategy and framework, decision making in the region could become ad hoc and adversarial if each stakeholder tried to have a say from a narrow perspective and without viewing the region as a whole. As a result, there was a clear need for coordinated strategic planning across the Auckland Region to ensure that Auckland would be able to remain competitive in today's globalized world. The response involved a process undertaken in 2001 to prepare 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

Tools & Guidance
http://www.tfl.gov.uk/assets/downloads/businessandpartners/accessibile_bus_stop_design_guidance.pdf

Annex 2: 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.

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

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. 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-motorised transport mode, modal shift, km of dedicated cycle/walking infrastructure, take-up of cycle promotion schemes by analysing 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 scheme was raised most notably on the basis that traffic congestion on two key routes in the city would worsen, as well as from retailers concerned about delivery access and trade levels. These concerns were attended to via an extensive consultation process and an effective publicity campaign prior to the implementation of the scheme. This included leaflets, advertisements on buses, city-wide poster boards, and a series of press releases.

Dedicated cycle network, Bogota, Colombia
C40 Cities (2010). "Bogota, Colombia: Bogota's CicloRuta is one of the most comprehensive cycling systems in the world", available online from http://www.c40cities.org/bestpractices/transport/bogota_cycling.jsp
CicloRutas is considered a unique cycling network where design has taken the topography of the city into consideration in order to create maximum flow and function (manmade and natural features, hills, waterways, parklands, essential facilities). In a period of just 7 years, following an investment of USD 50 million, the use of bicycles on the network increased by more than 268%. CicloRutas plays an important role for lower income groups, as more than 23% of the trips made by the lowest income group in the city are by walking or by bike. The development of CicloRutas has also helped to recover public space along riverbanks and wetlands, as for many years the city's wetlands were occupied by illegal settlements.

Bicycle micro credits, Lima, Peru
ICLEI (2009). "Case study 46: Assistance to purchase bicycles - Lima, Peru" in Sustainable Urban Energy Planning: A handbook for cities and towns in developing countries, available online from http://www.unhabitat.org/pmss/listItemDetails.aspx?publicationID=2839
In 1990, the Municipality of Lima set up a micro-credit programme to help low income citizens purchase bicycles. By saving on daily public transportation costs, workers can see their income effectively rise more than 12% once the loan is paid off. In order to enhance the success of the program, efforts have been made at standardizing the use of bicycles in the city. Actions to achieve this have so far consisted of the development of a manual of technical standards for the design and planning of cycle ways.

Bicycle rental, Velib, Paris, France
C40 Cities (2010). "Paris, France Velib - a new Paris love affair", available from
http://www.c40cities.org/bestpractices/transport/paris_cycling.jsp
Paris launched a 24/7 cycle hire scheme through Velib; a public private partnership between the city of Paris and a company led by a major advertising group. Users must purchase a subscription by day, week or year, and bike rental is free for the first half hour of every individual trip, after which it costs a fixed rate. The increasing price scale ensures the bikes are kept in circulation. Notably, the City of Paris generates

revenues from the project without any investment (which cost USD 108 million). The public-private partnership is the reason for this success, with the private company paying operating costs plus rights to advertising space to the City, funded by advertising revenues.

TOOLS & GUIDANCE

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

Annex 3: 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 licences 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 4: Municipal Buildings Audit and Retrofit

DESCRIPTION

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

IMPLEMENTATION OPTIONS

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

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

	• server rooms and cooling of servers • appliances (water cooler, fridge, vending machines) The Municipal Offices EE Spreadsheet includes estimation methods for energy efficiency potential for offices which includes equipment retrofits, behavioural 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 in the city.
- kWht/m2 - Benchmark annual heating energy consumption on a per-square-meter basis for all municipal office buildings in the city.
- $/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 tonnes 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.

Tools & Guidance
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 5: Building 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 metre).

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

IMPLEMENTATION OPTIONS

Implementation Activity	Methodology
Appoint Benchmarking Leader	Appoint, or allocate 1-2 staff with the skills, experience and personality required to be able to gather a wide variety of data from many departments across the city administration. Alternatively hire an external consultant as a leader for the below activities.
Identify Benchmarking Requirements	Define essential and desirable information useful for an energy benchmarking database. Electricity bills are only one part of the benchmarking database, and many other key data points are required to contextualize the information. Data may include: • 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	Set up an efficient process to collect data for the database. Identify which department and which individuals are likely to have access to desired information. Define which data should be collected every year and set up a method to receive the data every year. Set up a method to check and verify data and allow time for validation. Some data may not exist in CA departments, and if so, primary data must be collected by Benchmarking Team (i.e. floor areas, areas allocated to meters)
Begin collecting data	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.
Analyse and Interpret Data	Conduct an analysis of collected data to ensure accuracy and begin to identify opportunities. Some examples of analysis include: • 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 Starting with buildings with the highest and lowest performance, verify the floor areas allocated to the utility meters and note any special situations which may increase or decrease energy use (server rooms, unoccupied space, renovations, etc.)
Formulate a Bespoke	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

Benchmark	required as these factors may vary significantly from city to city and between different buildings. These factors could include: • types of tenants • occupancy density (persons/m2) • building energy management This benchmarking is usually done for the purposes of building labelling. See Singapore case study for further details.
Present Benchmarking Internally	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.
Publish Benchmarking Publically	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.

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:

- kWhe/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 fulfil these recommendations. The plan contains programmes and measures that span the whole life cycle of a building. It begins with a set of energy efficiency standards to ensure buildings are designed right from the start and continues with a programme of energy management to ensure their operating efficiency is maintained throughout their life span. The BEEMP consists of the following programmes:

- Review and update of energy standards
- Energy audit of selected buildings

- Energy efficiency indices (EEI) and performance benchmark
- Energy management of public buildings
- Performance contracting
- Research and development

Energy Smart Building Labelling Programme, Singapore
http://www.e2singapore.gov.sg/buildings/energysmart-building-label.html
The Energy Smart Building Labelling 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, sopported by MHME, NAER and and European Associationof 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
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.

Tools & Guidance
http://siteresources.worldbank.org/INTRUSSIANFEDERATION/Resources/305499-1280310219472/CArce_BEA_ENG.pdf
Energy Efficient City in Russia: Workshop Proceedings, June 2010. A guidance document for Preparing, Financing and Implementing Municipal Energy Efficiency Programs. http://www.esmap.org/esmap/sites/esmap.org/files/Russia%20EE%20Cities%20Proceedings%20ENG%20080210.pdf

Annex 6: 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 organisations 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 organisations.

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

	Incorporate the collection and management of data into the job descriptions of those municipal employees with responsibility for energy efficiency initiatives.

MONITORING

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

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

- total city authority energy use, total efficiency savings achieved from energy efficiency initiatives, percentage of energy efficiency initiatives for which data is collected every year.
- total city authority energy use
- total efficiency savings achieved from energy efficiency initiatives
- percentage of energy efficiency initiatives for which data is collected every year

Set targets for the city authority for each KPI, for example, improve KPI performance by 20% in 5 years. Produce annual reports on progress towards set targets. Monitor and update the action plan on a regular basis.

CASE STUDIES

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

Connecticut General Assembly "Municipal Initiatives to address Climate Change" http://www.cga.ct.gov/2010/rpt/2010-R-0300.htm

Regional Plan Association, Copy of Mayor's Executive Order http://www.rpa.org/bgreen/BGreen_2020_Executive_Order.pdf

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

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

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

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

The city, in collaboration with the Bridgeport Regional Business Council, has developed a program to promote sustainability. The program includes specific measures around auditing energy use, reducing total building footprint within the city, using advanced waste treatment techniques, and analysing 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 neighbourhood groups. The plan is a comprehensive strategy to improve the quality of life, social equity, and economic competitiveness while reducing GHG emissions and increasing the community's resilience to the impacts of climate change.

Energy Efficiency Strategy, Spain

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

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

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

The plan identifies 7 sectors including: agriculture, buildings, domestic and office equipment, industry, public services, transport, and energy transformation. Within each of these sectors, it sets out sets out strategic objectives as well as the route that energy policy should take to achieve these objectives. The Plan establishes a primary energy saving of 24,776 ktoe in 2012 as quantified energy objective in opposition to the scenario which was used as the base for the initial Plan 2004-2012, involving 13.7%. The plan also monitors progress against previous action plans, identifies investment and the potential for improvement in each sector, and sets targets for the immediate future.

The financing of the Plan is via investments in the private sector and in public services, and are therefore passed on to the end-users (consumers) and employers, who make investments which improve the processes or equipment that they bring to the market, so the services that they provide are carried out with less consumption of energy.

Energy and resource saving program, Brisbane, Australia

Good Practices in City Energy Efficiency: Eco^2 Cities: Energy and Resource Saving Program in Brisbane, available onlinehttp://www.esmap.org/esmap/node/1225

Brisbane’s population is expected to continue to grow over the next two decades. In 2007, the Brisbane City Council issued Brisbane’s Plan for Action on Climate Change and Energy, which delineates the selected actions to be achieved in the short term (about 18 months) and the long term (more than five years). Brisbane has three major challenges: climate change, high peak oil demand, and greenhouse gas emissions. Analyses suggest that, if Brisbane responds intelligently to these challenges, the city may generate significant economic benefits by developing sustainable industries, while saving resources. Brisbane is actively introducing various approaches to sustainable development. In addition, in the city’s “Our Shared Vision: Living in Brisbane 2026” policy document, authorities have committed to cutting

greenhouse gas emissions in half, reusing all wastewater, and restoring 40 percent of the natural habitat by 2026.
Integrated resource planning and management, Stockholm, Sweden Good Practices in City Energy Efficiency: Eco^2 Cities - Integrated Resource Management in Stockholm, available online http://www.esmap.org/esmap/node/1228 The City of Stockholm, the capital of Sweden, has pursued integrated city planning and management to become a sustainable city. The city has a comprehensive urban vision, environmental programs, and concrete action plans to reduce greenhouse gas emissions and tackle climate change. It implements integrated urban planning approaches that consider ecological benefits and efficient resource use. The ongoing redevelopment in the city's southern district, Hammarby Sjöstad, is a good model for understanding integrated approaches to sustainable urban planning and redevelopment. The area aims to be twice as sustainable as Swedish best practice in 1995. The area implements integrated resource management (waste, energy, water, and sewage) through systematic stakeholder collaboration and has transformed the linear urban metabolism into a cyclical one known as the Hammarby Model. According to Grontmij AB, a private consultancy firm in Stockholm, primary assessments of the initially developed districts of Hammarby Sjöstad show that the area has achieved, for example, 28 to 42 percent reductions in nonrenewable energy use and 29 to 37 percent reductions in global warming potential.

TOOLS & GUIDANCE

Tools & Guidance
N/A

Annex 7: Procurement Guide for New Street Lights

DESCRIPTION

Traditionally used incandescent bulbs in street lights, are highly inefficient in that they produce little light and much heat energy from their significant power consumption. They are often also poorly designed, emitting light equally in all directions unnecessarily, including the sky above, which further increases their energy inefficiency. New bulb technologies, can often significantly increase their efficiency as well as extending their design life. Traditionally used luminaires usually have short design lives of about five years, requiring frequent replacement. The aim of this recommendation is to produce a guide to inform the procurement of new bulbs when replacing faulty ones.

The replacement of lighting technology can deliver the same lighting levels for lower energy consumption, reducing associated carbon emissions as well as operational costs. The improved design life also reduces maintenance requirements and costs and further reduces interruptions to service, thereby improving public health and safety.

IMPLEMENTATION OPTIONS

Implementation Activity	Methodology
Improved Street Lighting Design Manuals	Prepare a design manual for public street lighting which follows best practice IESNA public lighting for visibility and safety guidelines. The design manual should include parameters for illumination, pole spacing recommendations, luminaire and lamp type recommendations and dimming or time of night illumination operations for all types of typical streets in the city.
Energy Service Contracts for new street lighting installations	Prepare an RFP for energy service companies (ESCOs) to bid on providing street lighting illumination for the city. The requirement should include design, installation, maintenance and operational (energy) costs. The contracts should be for a long time period (more

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

Financial savings

	than 10 years) and include strict requirements for illumination (minimums and maximums). The goal of the contracts will be to entice competition in the private sector to provide the lowest operational cost possible.
Life Cycle Cost analysis component in procurement submissions	Require all procurement submissions for purchasing of new street lighting installations, lamp replacement purchases, or maintenance costs to provide a life cycle analysis of first cost, maintenance costs and energy costs over the span of 7 years.

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:

- Lumens / Watt - efficacy of illumination for the current design standards for lamp procurement
- Watts / km - averages for different street widths and types

CASE STUDIES

Midlands Highway Alliance (MHA), UK

http://www.emcbe.com/Highways-general/idea%20case%20study.pdf

Working under the East Midlands Improvement and Efficiency Partnership (EMIEP), the Midlands Highways Alliance (MHA) will save the region GBP11 million across highways maintenance and improvements by 2011.

Supported by Constructing Excellence, the nine councils in the region and the Highways Agency have been making efficiency savings through a best practice procurement frameworks for major and medium sized highways schemes and professional civil engineering services, sharing best practice in maintenance contracts and by the joint procurement of new technologies such as street lighting and signage. The document outlines the minimum and desired specifications for street lighting technologies in order to achieve the carbon emissions and cost reductions required.

"Lighting the Way" Project, Australia

http://www.iclei.org/fileadmin/user_upload/documents/ANZ/CCP/CCP-AU/EnergyToolbox/lightingtheway.pdf

Australia is committed to reducing its growth in greenhouse emissions. Currently initiatives are underway at all levels of government to improve the efficiency of public lighting, including State and local government trials of more efficient public lighting. Public lighting of minor roads is a major source of greenhouse gas emissions for local government. There are many opportunities to improve the quality of the lighting while reducing both the costs and greenhouse emissions.

The various stakeholders have produced a procurement guide, "Lighting the Way", which provides information to assist local governments in improving the public lighting of minor roads in their communities while reducing their greenhouse emissions, lowering their costs and decreasing their liability and risk. These outcomes can be achieved through use of energy efficient solutions that provide better service in street lighting and comply with Australian Standards (AS/NZS 1158).

It outlines technical and other issues related to energy efficient lighting. It also provides some guidance for councils on techniques to improve their ability to negotiate public lighting issues with distribution businesses. A number of lamp types offer considerable advantages over the standard 80 watt mercury vapour lamps in terms of power consumption, lumen depreciation, light output, maintenance, life span, aesthetics and performance in various temperatures.

TOOLS & GUIDANCE

Tools & Guidance

Tools & Guidance
European Lamp Companies Federation. "Saving Energy through Lighting", A procurement guide for efficient lighting, including a chapter on street lighting. http://buybright.elcfed.org/uploads/fmanager/saving_energy_through_lighting_jc.pdf
New York State Energy Research and Development Authority. "How to guide to Effective Energy-Efficient Street Lighting" Available online from http://www.rpi.edu/dept/lrc/nystreet/how-to-officials.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

Annex 8: Awareness Raising Campaigns

DESCRIPTION

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

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

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

IMPLEMENTATION OPTIONS

Implementation Activity	Methodology
Targeted training programs	Working with an experienced education/training provider, the city authority develops training programs which can be rolled out in schools and offices. These programs should target big energy users, for example, offices. These programs can also be implemented through a partnership with other organisations, such as utility companies, businesses and NGOs.
Public education	Working with an advertising and marketing company experienced in public

ATTRIBUTES

Energy Savings Potential

100,000-200,000 kWh/annum

First Cost

campaigns	education campaigns, the city authority develops a strategy for providing information on energy efficiency to all residents. This can include posters, billboards and leaflets, as well as public media announcements and advertisements. A partnership can be created with a business or utility company to help finance this.
Energy efficiency champions	The city authority recruits local energy efficiency champions and trains them to teach people about the importance and benefits of energy efficiency. Champions can be anyone interested in spreading the message about energy efficiency, for example, local authorities, businesses, local community groups, NGOs, health trusts, school children and other individuals. This implementation activity can be carried out in a number of ways: • Ask champions to come to a 'train the trainer' course and provide them with support to run sessions within their own community. • Teach champions about simple ways to save energy, and then give them leaflets to distribute in their community. Ensure that champions inform people that they are the local contact for any energy efficiency questions. Since energy efficiency champions are often volunteers, an officer should be appointed to provide support and encouragement, conduct regular follow ups and monitor progress of each energy efficiency champion program.

US$100,000-1,000,000

Speed of Implementation

< 1 year

Co-Benefits

Reduced carbon emissions

Improved air quality

Enhanced public health & safety

Financial savings

Security of supply

MONITORING

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

aspects: identification of information sources, identification of performance indicators, a means of measurement and validating measuring equipment or processes, record keeping protocols, a schedule for measurement activity (daily, weekly, monthly etc.), assignment of responsibilities for each aspect of the process, a means of auditing and reviewing performance and finally, establishment of reporting and review cycles.

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

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

CASE STUDIES

PlaNYC, New York PlaNYC http://www.nyc.gov/html/planyc2030/html/plan/energy.shtml ; http://www.nyc.gov/html/planyc2030/downloads/pdf/planyc_energy_progress_2010.pdf PlaNYC is a comprehensive sustainability plan for the city's future. The plan puts forth a strategy to reduce the city's greenhouse gas footprint, while also accommodating a population growth of nearly one million, and improving our infrastructure and environment. Recognizing the importance to reduce global carbon emissions, and the value of leading by example, New York has set the goal of reducing its citywide carbon emissions by 30% below 2005 levels. Within the Energy sector of the plan, the city has an initiative to undertake extensive education, training, and quality control programs to promote energy efficiency. By 2010, the city launched an energy awareness campaign, and set up training, certification, and monitoring programs. The plan proposes that these measures will be delivered through a series of partnerships until an Energy Efficiency Authority is established.
Energy Efficiency Office, Toronto, Canada

City of Toronto http://www.toronto.ca/energy/saving_tips.htm

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

Low Carbon Singapore, Singapore

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

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

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

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

Walsall Council http://www.walsall.gov.uk/index/energy_awareness_staff_presentations.htm

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

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

Trust and adapted, with the help of some of the environmental champions, to reflect Walsall Council's needs.

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

Siemens Energy Efficiency Academy, Brisbane, Australia

Siemens http://aunz.siemens.com/EVENTS/ENERGYEACADEMY/Pages/IN_EnergyEfficiencyAcademy.aspx ; http://www.siemens.com/sustainability/report/09/pool/pdf/siemens_sr_2009.pdf

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

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

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

Energy Awareness Week, Meath, Ireland

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

In 2004, the Meath Energy Management Agency's (MEMA) extended its Energy Awareness Week to everyone who lived or worked in the County of Meath, Ireland, using a concentrated burst of media campaigning to raise energy awareness among consumers. Visits to schools, information displays, widespread media coverage, competitions, a 'Car Free Day' and an offer of free CFL light bulbs encouraged participation at all levels. The campaign dramatically increased requests for information from the energy agency. The competitions and

promotions also improved local knowledge of energy efficiency, and encouraged people to choose sustainable energy and transport options in the future.

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

TOOLS & GUIDANCE

Tools & Guidance
"EU LOCAL ENERGY ACTION: Good practices 2005" http://www.managenergy.net/download/gp2005.pdf