



TRACE  
Tool for Rapid Assessment of City Energy

# A Decision Support Tool for Evaluating Energy Efficiency Opportunities in Cities



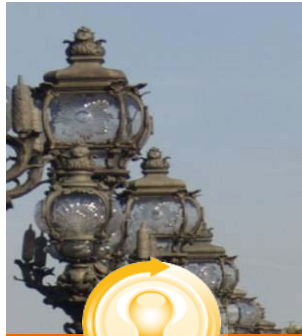
## Evaluating Energy Efficiency Opportunities in 6 Municipal Sectors



**TRANSPORT**



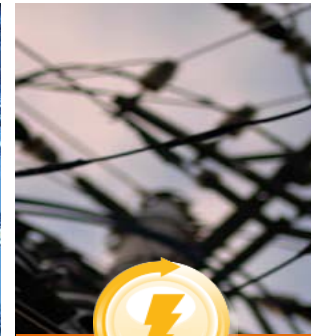
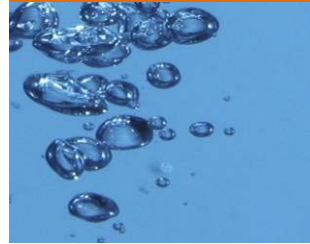
**BUILDINGS**



**PUBLIC  
LIGHTING**



**WATER &  
WASTEWATER**



**POWER &  
HEATING**



**SOLID  
WASTE**



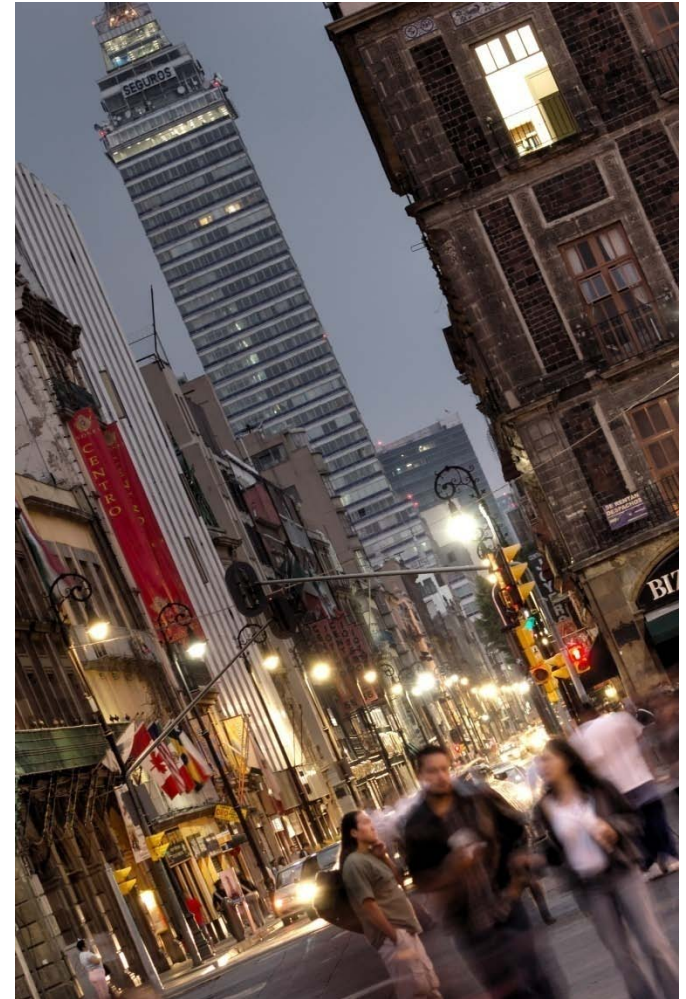
# TRACE Why TRACE?

## Strong Demand from Cities

- Strong desire to reduce energy costs through EE improvements
- A lack of decision-support tool to identify major EE interventions across urban sectors
- Desire to learn from peer cities' and international best practices

## Key Advantages of TRACE

- Cross-sectoral
- Focuses on areas under the control of the city authority
- Relatively low data requirements, low cost, intuitive and quick to implement
- Strong ownership of cities





# TRACE How it Works

Energy Efficient Cities Initiative  
Tool for Rapid Assessment of City Energy

Save

## Energy Benchmarking

Compare the performance of your city to others

Benchmark Data

Benchmark Results

## Sector Prioritization

Identify the sectors with highest priority

Relative Energy Intensity

Sector Energy Spending

City Authority Control

Sector Priority Results

## Energy Efficiency Recommendations

Find ways to improve your city's energy efficiency

Recommendations

Initial Appraisal

Energy Savings Assessment

Review

User Guide & Documents

TRACE helps cities identify under-performing sectors, evaluate improvement and cost-saving potentials, and prioritize sectors and EE interventions.

TRACE

Tool for Rapid Assessment of City Energy








TRACE has a simple user interface for entering data

Home

## Benchmark Data



Data collated during the pre-mission phase, using the templates provided should be entered here. Go through each of tabs on the left to access each sector. Don't forget to add the year and source of the data. If a proxy has been used (e.g. national data), check the box on the right and enter the year and source

	Data Point	Year	Source	Proxy	
	Electricity Consumed per km of Lit Roads [kWh/km]	<input type="text" value="39783"/>	<input type="text" value="2010"/>	<input type="text" value="Gaziantep Metro Municipality"/>	<input type="checkbox"/>
	Percentage of City Roads Lit [%]	<input type="text" value="85"/>	<input type="text" value="2010"/>	<input type="text" value="Gaziantep Metro Municipality"/>	<input type="checkbox"/>
	Electricity Consumed per Light Pole [kWh/pole]	<input type="text" value="1591"/>	<input type="text" value="2010"/>	<input type="text" value="Gaziantep Metro Municipality"/>	<input type="checkbox"/>
					
	Lighting				
					

Visual depiction of how a city compares with peer cities

Home
**Benchmark Results**
Export
Save

Choose a Sector and a Key Performance Indicator from the menu to compare your city to others on the chart below. Uncheck a city in the table to remove it from the chart. Striped bars are proxy data. To generate a PDF file of a chart, click on Export.

**Select a KPI**




- Electricity Consumed per km of Lit Roads
- Percentage of City Roads Lit
- Electricity Consumed per Light Pole**
- Water Consumption per person
- Waste Recycled per person
- Greenhouse Gas Emissions per person
- Lighting
- ...

**Electricity Consumed per Light Pole [kWh/pole]**

City	Value
QUE	~1800
GAI	~1500
NYC	~1000
CAP	~1000
KAN	~750
SKO	~700
JAB	~600
CEB	~600
BHO	~600
MYS	~450
DAN	~450
SUR	~400
VIJ	~400
PUN	~400
POK	~350

Selected	City	Value
<input checked="" type="checkbox"/>	Cape Town	1069
<input checked="" type="checkbox"/>	Kanpur	749
<input type="checkbox"/>	Kathmandu	738
<input checked="" type="checkbox"/>	Skopje	733

Comprehensive sector prioritization with quantified potential benefits

 Home
**Sector Prioritization**
 Export
 Save

Based upon the answers to the sector prioritization questions, two separate lists of sectors have been created: CA Control and City-wide. 6 of 8 selected

### City Authority Sector Ranking

Rank	Sector	REI%	Spending CA (US \$) Control	Score	Check to Select
1	Potable Water	86.1	20,046,760 0.80	13,819,468	<input checked="" type="checkbox"/>
2	Municipal Buildings	54.8	13,836,029 1.00	7,586,851	<input checked="" type="checkbox"/>
3	Solid Waste	48.2	500,000 0.75	180,803	<input checked="" type="checkbox"/>
4	Wastewater	5.0	1,194,840 0.90	53,767	<input type="checkbox"/>

### City Wide Sector Ranking

Rank	Sector	REI%	Spending CA (US \$) Control	Score	Check to Select
1	Public Transportation	40.6	53,775,872 0.55	12,015,546	<input checked="" type="checkbox"/>
2	Private Vehicles	36.5	199,442,747 0.15	10,930,996	<input checked="" type="checkbox"/>
3	Street Lighting	51.2	12,999,355 0.90	5,998,875	<input checked="" type="checkbox"/>
4	Power	31.5	538,517,487 0.01	1,701,657	<input type="checkbox"/>

A matrix of recommendations based on savings potential, first cost, and speed of implementation

Home
**Recommendations Matrix**
Export
Save

The matrix below shows all recommendations from prioritized sectors sorted by First Cost and Energy Efficiency. The check boxes allow the user to alter the display based on Speed of Implementation.

Filter by speed of implementation
 < 1 year
  1-2 years
  > 2 years

Energy Savings Potential	First Cost		
	> \$1,000,000	\$100,000 - \$1,000,000	< \$100,000
>200,000 kWh/annum	Municipal Offices Audit & Retrofit Program Municipal Residential (Public Housing) ... Municipal Hospitals Audit & Retrofit Prog...	Improve Efficiency of Pumps and Motors Improve Performance of System Network 2-Stroke Engine Replacement or Retrofit Street Lights Audit and Retrofit Program Public Spaces Lighting Audit and Retrofit	
100,000 - 200,000 kWh/annum		Active Leak Detection and Pressure Man... EE Sorting and Transfer Facilities Traffic Restraint Measures Travel Planning	Buildings Benchmarking Program Waste Composting Program
<100,000 kWh/annum		Water Meter Program Municipal Schools Audit & Retrofit Progr... Traffic Signals Audit and Retrofit Program	Waste Vehicle Fleet Maintenance Audit a... Street Signage Lighting Audit and Retrofi...





## 02 ACTIVE LEAK DETECTION & PRESSURE MANAGEMENT PROGRAM

### DESCRIPTION

Develop a leak detection and pressure management program to minimise losses along the following systems:

- Extraction works and pipelines
- Long distance water transmission mains
- Distribution networks
- Sewage pumping mains
- District cooling networks
- Irrigation networks

It is anticipated that most systems would already be subject to passive leak detection, i.e. identifying leaks through visual observation, but that provides limited information and benefits. This recommendation therefore focuses on a pro-active and more thorough leak detection program to locate and repair leaks. The following techniques could be used:

- Ground microphones
- Digital leak noise correlator
- Acoustic logger
- Demand management valves, meters and zoning
- Mobile leak detection programs
- Basic acoustic sounding techniques

In addition excess pressure can be reduced by installing:

- Flow modulating valves on gravity networks
- Pump controls and/or pressure sensors to modulate a pump's relative performance to suit the daily variation in flow demand, thus maintaining maximum efficiency and minimum energy use.

A leakage detection program can facilitate the provision of minimal pressures and encourage, through less wastage, a more sustainable use of water resources. In sewerage systems, identification and elimination of leaks can also significantly reduce risk of ground contamination. Pressure management can cost-effectively reduce treatment and pumping costs by minimizing the required delivery pressure and leakage. It is particularly suited to pumped mains and may require estimates of how demand changes over the day. Appropriately rated pressure reducing valves will in turn reduce the flow through leaks and the total flow that must be delivered by the pump upstream at the source/treatment works. This solution may be particularly appropriate in gravity flow networks. The key advantage of pressure management over leak detection is the immediate effectiveness. It is most appropriate where the network is expansive and features multiple small leaks that would be difficult and expensive to locate and repair.

### IMPLEMENTATION OPTIONS

### 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

Efficient water use

Enhanced public health & safety

Increased employment opportunities

Financial savings

Security of supply

- 59 recommendations in total
- Mix of strategic programs and specific sector activities
- 191 case studies with hyperlinks to other resources and tools
- Each recommendation 'rated' on three attributes: *Energy Savings Potential, First Cost, Speed of implementation*
- 23 "technical" recommendations include energy savings calculators

TO GET MODEL | Download from ESMAP Website  
<http://esmap.org/esmap/TRACE>

TRAINING | E-learning course available at:  
<http://vle.worldbank.org/moodle/course/view.php?id=605>.  
login: lcd01; password: lcd

SUPPORT | User guides available in software & from ESMAP Staff

FOR ADDITIONAL SUPPORT, CONTACT:  
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202.473.9371

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# Thank You.

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