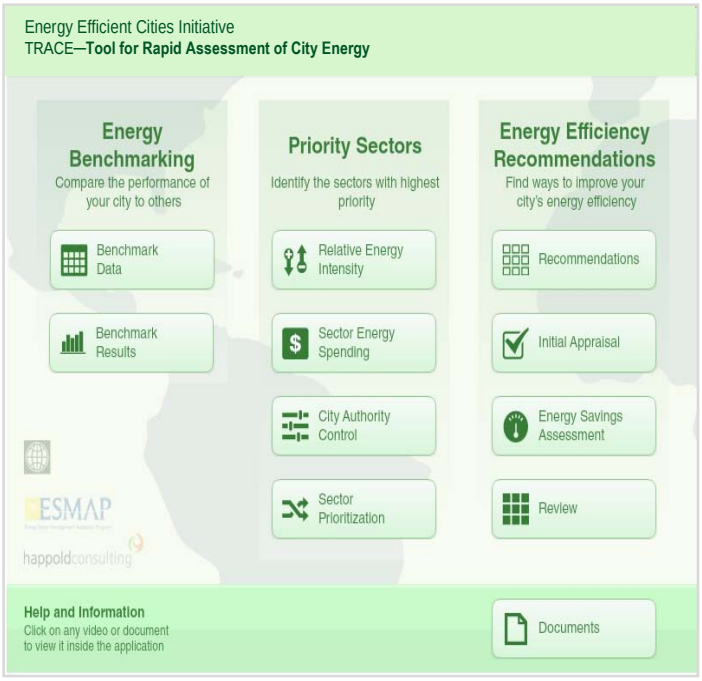
ENERGY EFFICIENT CITIES INITIATIVE

TRACE | A Tool for Rapid Assessment of City Energy

An innovative new approach to assessing energy efficiency in cities

The Tool for Rapid Assessment of City Energy (TRACE) offers cities a quick and easy way to assess their energy efficiency and identify sectors to improve. This tool prioritizes sectors with significant energy savings potential, and identifies appropriate energy efficiency interventions across six sectors—transport, buildings, water and waste water, public lighting, solid waste, and power and heat. It is a simple, low-cost, user-friendly, and practical tool that can be applied in any socioeconomic setting.



TRACE consists of two principal components: (i) a city energy benchmarking tool and (ii) a 'playbook' of tried and tested energy efficiency interventions. These two components are woven into a user-friendly software application that takes the city through a series of sequential steps: from initial data gathering to a report containing a matrix of energy efficiency recommendations tailored to the city's individual context, with implementation and financing options. The steps are as follows:

1. Collection of Candidate City Energy Use Data

TRACE contains a database of 28 key performance indicators (KPIs) collected from 50 cities. Each of the data points that make up these KPIs is collected prior to the application of the tool and, as TRACE is launched, this collection of information will grow with current and reliable data. Table 1 shows a list of KPIs by sector.

2. Analysis of City Energy Use Against Peer Cities

The performance of a city is compared with a range of peer cities—selected by the city based on population, climate, and human development—to determine their performance in each of the six sectors (3-6 KPIs per sector). The benchmarking process provides an overview of energy performance so the city can assess its relative rankings against peer cities in each sector.

TABLE 1: TRACE KPIS

CITY WIDE KPIS

CW-1	Electricity consumption (kWhe/capita)
CW-2	Electricity consumption (kWhe/GDP)
CW-3	Primary energy consumption (MJ/capita)
CW-4	Primary energy consumption (MJ/GDP)

TRANSPORTATION KPIS

T-1	Total transport (MJ/capita)
T-2	Public transport (MJ/passenger km)
T-3	Private transport (MJ/passenger km)
T-4	Transportation Non-Motorized mode split (%)
T-5	Public Transportation mode split (%)
T-6	Kilometers of high capacity transit per 1000 people

BUILDINGS KPIS

B-1	Municipal buildings (kWhe/m2)
B-2	Municipal buildings heat consumption (kWhth/m2)
B-3	Municipal buildings energy spend as percentage of municipal budget

POWER & HEAT KPIS

PH-1	Percentage heat loss from network
PH-2	Percentage total T & D losses
PH-3	Percentage of T & D loss due to non-technical

STREET LIGHTING KPIS

SL-1	Electricity consumed per km of lit roads (kWhe/km)
SL-2	Percentage of city roads lit
SL-3	Electricity consumed per light pole (kWh/pole)

WATER & WASTEWATER KPIS

WW-1	Water consumption (L/capita/day)
WW-2	Energy density of potable water production (kWhe/m3)
WW-3	Energy density of wastewater treatment (kWhe/m3)
WW-4	Percentage of non-revenue water
WW-5	Electricity cost for water treatment (potable- and wastewater) as a percentage of the total water utility expenditures

WASTE KPIS

W-1	Waste per capita (kg/capita)
W-2	Percentage capture rate of solid waste
W-3	Percentage of solid waste recycled
W-4	Percentage of solid waste that goes to landfill

3. Assessment and Ranking of Individual Sectors

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

4. Ranking of Energy Efficiency Recommendations

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

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

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

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

5. Report Preparation and Submission

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

- City background information, such as city contextual data, key city development priorities, energy efficiency drivers, barriers etc.
- A summary of the benchmarking results, along with analysis of city performance
- A summary of sector prioritization based on city-owned and city-wide scales
- A draft summary of recommendations provided as the City Action Plan

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

6. Design and Development | Field Testing | Assessment City Reports (by City/Country)

A final assessment report has been completed for the first global pilot city, Gaziantep, Turkey. Also, additional work is being planned in different regions throughout the Bank for the deployment of the tool. Upcoming work in the following cities is currently underway in Da Nang, Vietnam; Cebu, Philippines; and Surabaya, Indonesia.

ESMAP is a global program administered by the World Bank and funded by bilateral donors—representing Australia, Austria, Denmark, Finland, France, Germany, Iceland, Lithuania, Norway, Sweden, The Netherlands, and the United Kingdom—that assists low- and middle-income countries to increase know how and institutional capacity to achieve environmentally sustainable energy solutions for poverty reduction and economic growth
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ESMAP
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