Energy Efficient Cities Initiative

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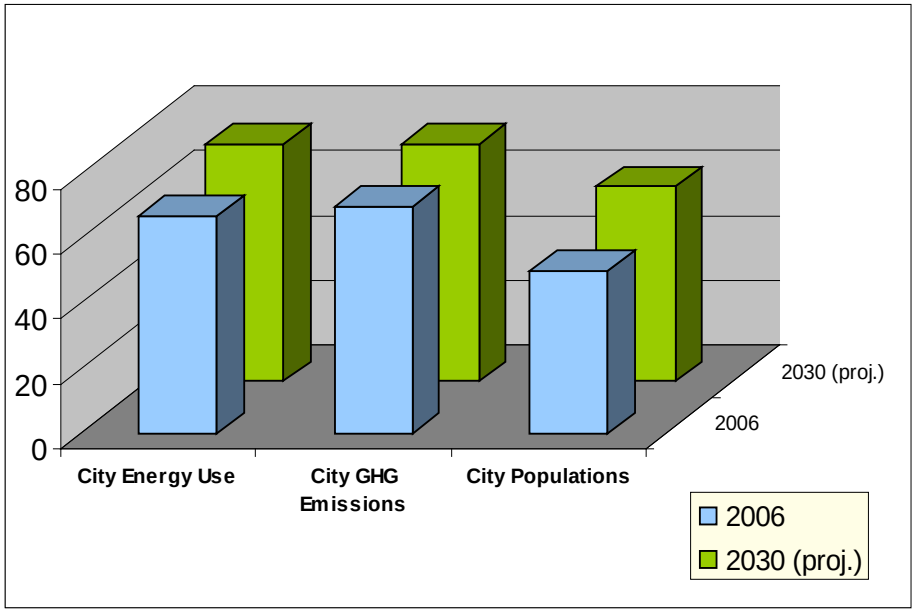
Helping Cities Meet Their Energy Challenges of the New Century

Consider the following…

By 2030:

- Almost 5 billion people (60% of world's population) will inhabit cities
- Almost ¾ of energy use and GHG emissions will come from cities
- 81% of urban energy demand increases will come from non-OECD cities
- Developing countries will triple their built-up urban areas



	2006	2030 (proj.)
City Energy Use	67%	73%
City GHG Emissions	70%	76%
City Populations	50%	60%

Source: IEA WEO, 2008.

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What is the challenge?

- Escalating energy demand puts pressures on costs, service quality, access and the environment
- Implementing EE across municipal sectors is difficult
  - *Buildings/public housing*
  - *Water/wastewater*
  - *Transport*
  - *Public lighting*
  - *Solid waste*
  - *Power/heating*
- Constrained city budgets and technical/institutional capabilities
- Priority on delivering key services and expanding access
- Growing interest in sustainable energy/“eco-cities,” but on-the-ground results have been limited

What is the opportunity?

Energy Efficiency (EE) programs at the city level can:

- Offer practical solutions to meet city energy needs without sacrificing socioeconomic development priorities
- Lower a city's fuel imports and energy costs while creating fiscal space for service improvement/expansion
- Offer win-win-win solutions – it is good for the government, private sector and environment
- Provide other socioeconomic co-benefits (e.g., improved competitiveness, job creation, quality of life)

Barriers to EE in cities

Policy / Regulatory	Public End Users	Equipment/ Service Providers	Financiers
▪ Low energy prices ▪ Rigid procurement and budgeting policies ▪ Limitations on public financing ▪ Inadequate planning and design methods ▪ Limited autonomy vis-à-vis national/ state bodies ▪ Informal settlements ▪ Election cycles	▪ Limited incentives ▪ No discretionary upgrade budgets ▪ Lack of financing ▪ Unclear ownership of cost/energy savings ▪ Weak linkages across sectors ▪ Lack of awareness and expertise ▪ Behavioral biases	▪ High project development costs ▪ High transaction costs for public sector ▪ Limited technical and risk management skills ▪ Public sector repayment concerns ▪ Limited equity	▪ High perceived risks ▪ New technologies ▪ Small sizes/high transaction costs ▪ Behavioral biases

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Municipal control of energy use

Sector Cluster Category	Subcategory	City Government Potential Leverage
Industry	Manufacture	Indirect, relatively weak
	Construction	Indirect, relatively weak
Transport	Private motor vehicles	Indirect, relatively weak
	Commercial motor vehicles	Indirect, relatively weak
	Public transit system	Direct, strong
	Government motor vehicles	Direct, strong
Municipal Services	Water supply & wastewater treatment	Direct, strong
	Solid waste management	Direct, strong
	Public lighting (street, traffic, parks)	Direct, strong
Buildings	Government buildings	Direct, strong
	Commercial buildings (non-public)	Indirect, strong in new construction
	Residential buildings	Indirect, strong in new construction

Where should a city start?

- Retrofit existing public facilities
  - *Energy system retrofits in public buildings and services*
  - *Promote distributed generation and load reduction options*
- Implement policies and programs in non-public facilities
  - *"Green" buildings, code enforcement*
  - *Electrical equipment and appliances*
  - *Industrial process improvements*
  - *Promote "green" transport*
- Integrate energy considerations in land use planning and development
  - *Spatial densification*
  - *Integrated urban, land-use planning*
  - *Smart city designs*

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Typical public building measures

Policy

- ✓ EE product ***procurement*** (labeling & standards, bulk purchase, life-cycle costing)
- ✓ Setting EE ***targets*** in public facilities
- ✓ Promote energy savings ***performance contracts*** (ESPCs)
- ✓ Green buildings, building codes

Procedural

- ✓ Changes in ***budgeting*** to allow retention of energy/water cost savings
- ✓ Designation of ***energy managers*** and periodic ***energy audits***
- ✓ Improved ***planning***, ***recycling*** and ***O&M*** practices

Information

- ✓ ***Standard bidding documents*** and templates
- ✓ ***Guidelines*** for buildings/facility management, ***benchmarking/good practices***
- ✓ Public EE ***case studies***, newsletters, ***training***, ***demonstrations***

Incentives

- ✓ ***Funding*** for energy audits and project implementation
- ✓ ***Awards*** and competition among agencies, cities
- ✓ Publishing ***agency performance***, ranking and rating of agencies

Illustrative economics of municipal EE

Sector	Short-Term Payback (under 5 years)	Medium-Term Payback (5-10 years)	Long-Term Payback (10+ years)
Public Buildings	▪ Equipment retrofits ▪ Labeling building energy use ▪ ESCO contracting ▪ Solar water heating	▪ Building envelop measures ▪ Green roofs ▪ Training in good building O&M practices ▪ Window replacement	▪ Building codes ▪ Certification of building materials ▪ Building integrated PV ▪ Equipment standards
Public Lighting	▪ Street light retrofits (HPSV) ▪ Control systems & sensors	▪ Traffic light retrofits (LEDs) ▪ Lighting system redesign	▪ Lighting standards ▪ Chauffage contracts ▪ Street light retrofits (LEDs)
Water/ Wastewater	▪ Pumping retrofits, incl. VSDs ▪ Leak reduction ▪ Load management ▪ Pressure management	▪ ESCO contracting ▪ Wastewater methane recovery for power generation ▪ Water DSM (low-flow outlets)	▪ System redesign & optimization ▪ Management contracts/ concessions
Transport	▪ Improve traffic circulation planning ▪ Differential fuel taxation/pricing ▪ Congestion/Parking fees ▪ Promote non-motorized transport	▪ Alternative fuels for buses/ taxis ▪ BRT systems ▪ Fuel efficiency vehicle standards ▪ Promote fuel-efficient vehicles through fiscal incentives	▪ Modal shifts ▪ Vehicle I&M programs ▪ Changes in land-use patterns to promote urban densification

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Commercial financing

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Public financing

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Commercial financing

Public financing

Climate change funds

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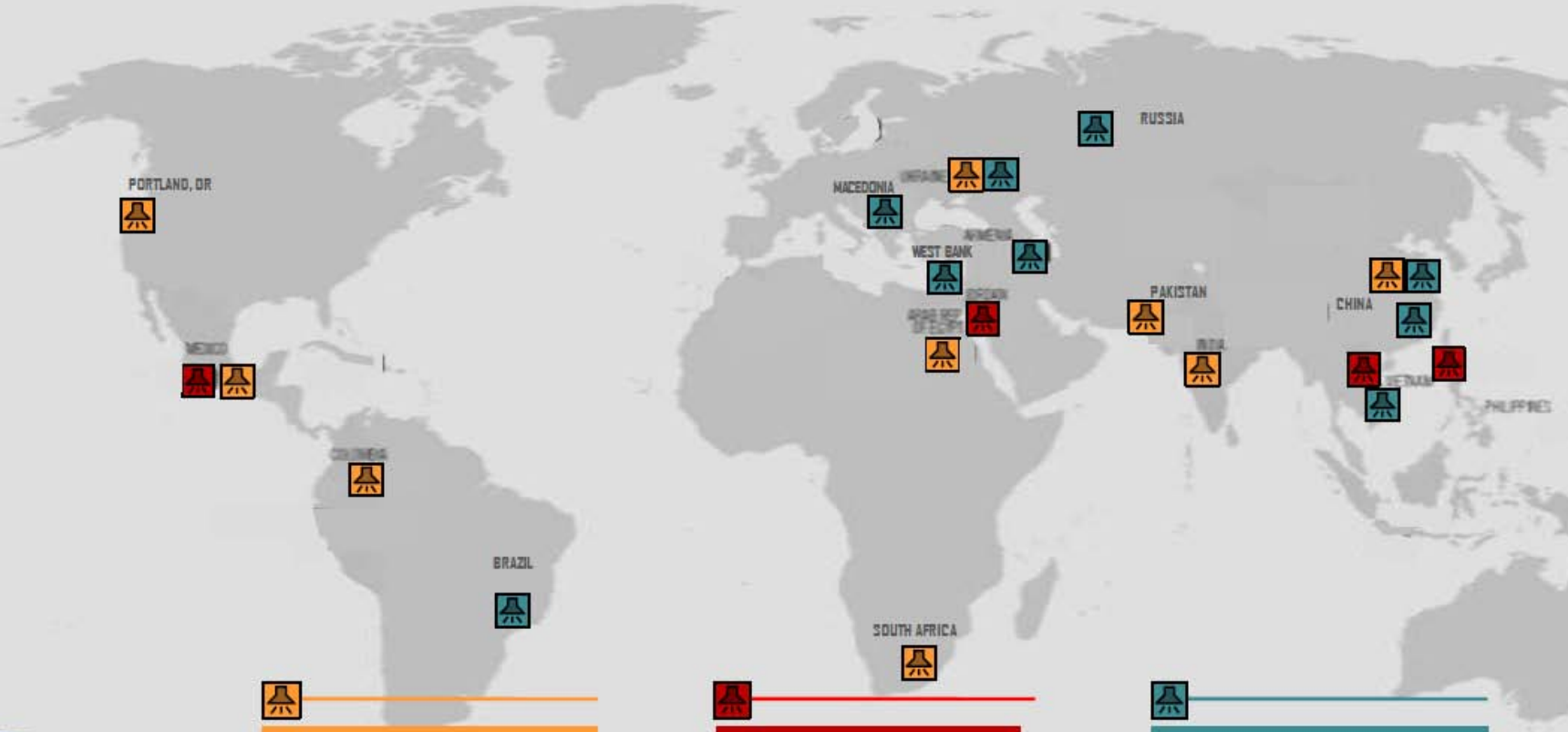
What is ESMAP?

- The Energy Sector Management Assistance Program (ESMAP) is a multi-donor trust fund, administered by the World Bank established in 1983
- ESMAP provides policy advice and TA on sustainable energy development developing countries
- ESMAP suggests innovative and strategic “cutting edge” solutions to governments, in the areas of both traditional and non-traditional energy use, complementing other donors and the private sector

Energy Efficiency Cities



Case Studies
Akola, India
Bogota, Colombia
Emfuleni, South Africa
Kiev, Ukraine
Monclova, Mexico
Portland, Oregon, USA
Tianjin, China
Cairo, Egypt
Lahore, Pakistan

Partnership Programs

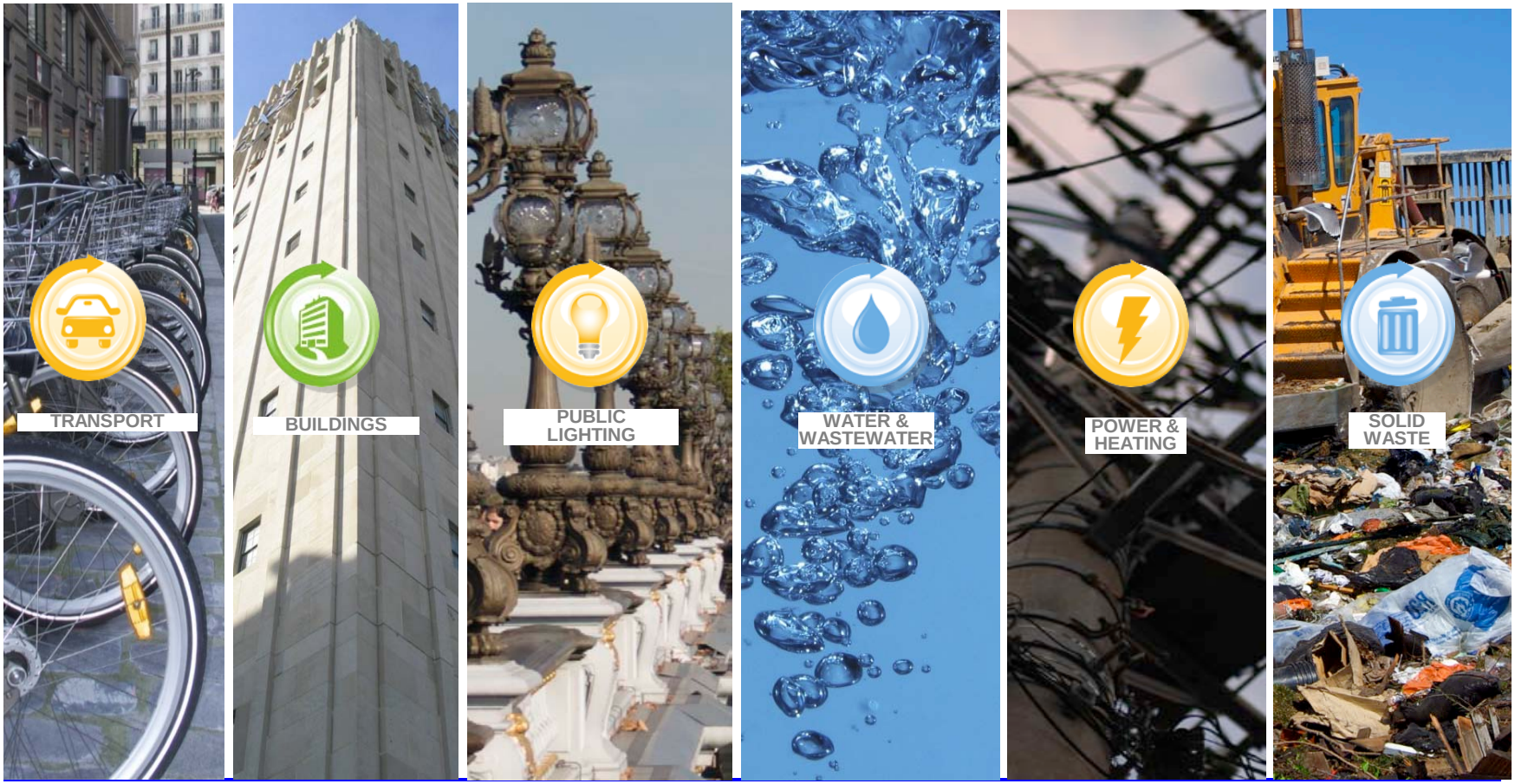
City Alliance CDS
Quezon City, Philippines
Zarka City, Jordan

IBNET
Mexico
Vietnam

World Bank Urban Projects
Armenia
Ningbo, China
Tianjin, China
Macedonia
Ukraine
West Bank, Palestine
Brazil
Russia
Vietnam

Rapid Assessment Framework - RAF

A diagnostic tool for analyzing energy use in cities, that prioritizes sectors and suggests specific actions to save money and improve performance



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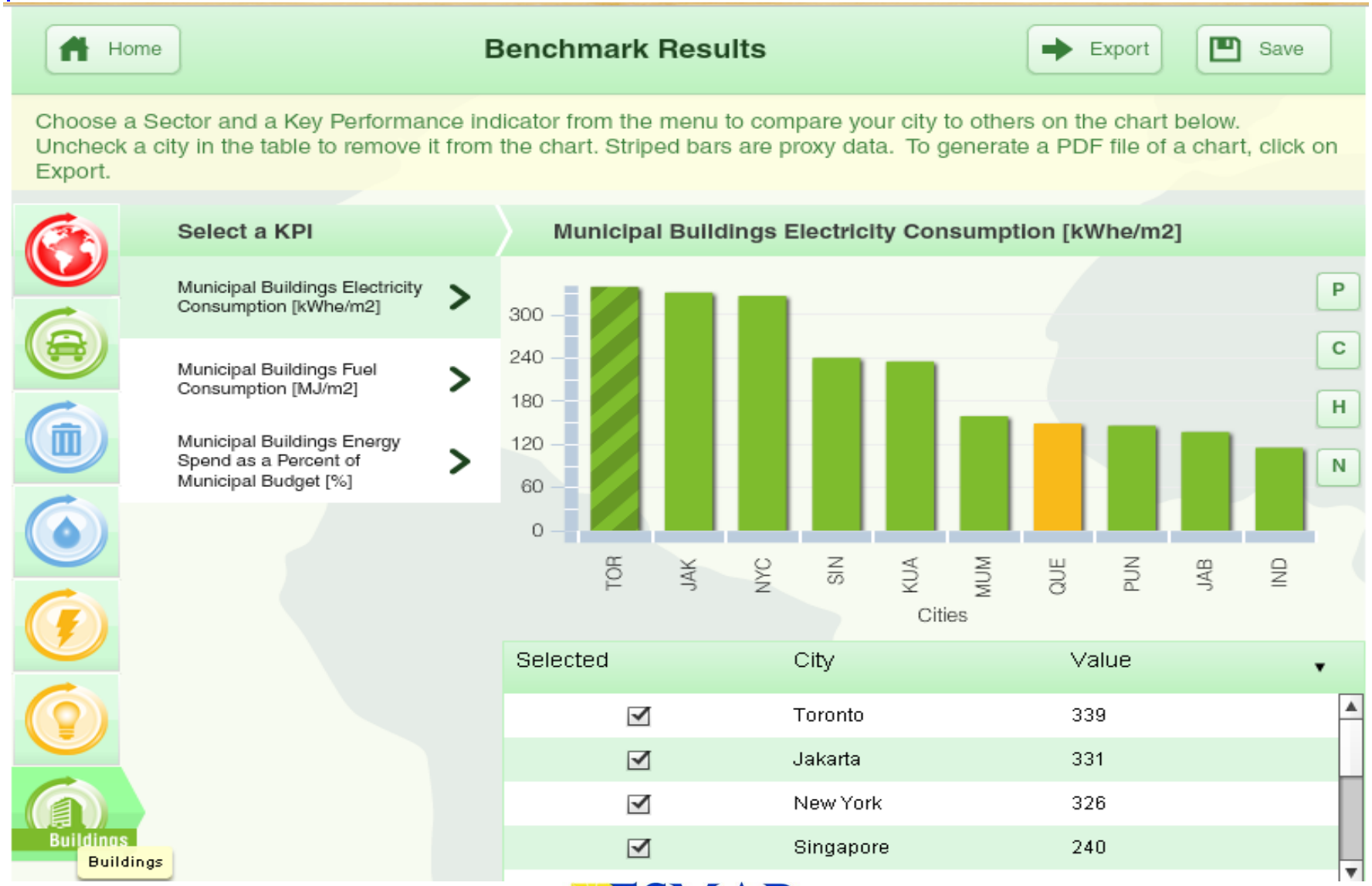

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DIRECTIONS IN DEVELOPMENT
Energy and Mining

Public Procurement of Energy Efficiency Services

Lessons from International Experiences

The World Bank

How ESPCs can help

Public Sector Barriers	ESPCs Can…
High perceived risks	better define the benefits/ costs upfront, assign some project risks away from the public agency and financier.
Inflexible procurement procedures	allow high IRR projects by evaluating the best value to the agency, bypassing multiple procurements.
Limited annual budgets for capital upgrades	facilitate project financing, usually with repayments derived from project savings.
Small projects with high project development/ transaction costs	allow smaller projects to be bundled, streamline audits/M&V for similar types of facilities, reduces hassle factor for public agencies.
Inadequate information and technical know-how	solicit technically competent private sector firms to compete based on their qualifications, experience and best project ideas.

ESCO Models

High service/risk

- *Full service ESCOs* design, implement, verify and get paid from actual energy saved (aka “Shared Savings”)
- *Energy supply contracting*, take over equipment O&M and sell output at fixed unit price (aka “Chauffage”, “Outsourcing”, “Contract Energy Management”)
- *ESCOs w/third party financing*, design/implement project, and guarantee minimum level of savings (aka “Guaranteed Savings”)
- *ESCOs w/variable term contract*, act as full service ESCO, but contract term varies based on actual savings (e.g., “First Out Contract”)
- *ESCOs w/1-year contract*, design/implement project, receives 60-70% of payment upon successful commissioning and the rest within 6-12 months
- *Supplier credit*, equipment vendor designs, implements and commissions project and is paid lump-sum or over time based on estimated savings
- *Equipment leasing*, similar to supplier credit except payments are generally fixed (based on est. energy savings)
- *Consultant w/performance-based payments*, agent assists client to design/ implement project and receives payments based on project performance (fixed payment w/penalties or bonuses)
- *Consultant w/fixed payments*, where consultant helps the client design and implement the project, offers advice and receives a fixed lump-sum fee

Low service/risk

Source: World Bank 2010.

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Results from select countries

Country	Market Size	Results	Projects
United States (FEMP)	US$3.8 billion	- 18 trillion BTU/yr (2006) - US$7.1 billion energy cost savings	460 ESPC projects
Canada (FBI)	Can$320 million	- 20% energy intensity reduction - Can$40 million energy cost savings - 285 kt CO_2 reduction	85 EPC projects (7,500+ buildings)
Germany	~€200 million	- 20-30% energy cost reduction - €30-45 million energy cost savings/yr	2,000 properties
Japan	~10 billion yen	- 12% reduction energy intensity - 265kt of CO_2 reduction	50 ESPC projects in FY06
South Korea	~220 billion Won	n/a	~1,400 public ESCO projects

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Emerging Public ESPC Models

Model	Examples
Indefinite Quantity Contract (IQC)	U.S., Hungary
Public ESP	Ukraine (Rivne City)
Super ESP	U.S. (NYPA), Belgium (Fedesco), Philippines (EC^2), India (EESL)
Utility ESP	U.S. (UESC), Croatia (HEP ESCO), Uruguay (USCO-UTE)
Utility DSM ESP	Brazil
Internal ESP (PICO)	Germany (Stuttgart)
Energy Supply Contracting	Germany, Austria, France
Procurement Agent	Germany, Austria, U.S., Czech Republic, Slovakia
Project Bundling	Austria, Germany, India, S. Africa, U.S.
Nodal Agencies	U.S. (USDOE), S. Korea (KEMCO), India (BEE), Japan (ECCJ)
Ad Hoc	Brazil, China, Egypt, Mexico, Poland, S. Africa

Designing the Right Process

Budget	Audit	Financing	Model	Contract
Progressive	Prescriptive	Commercial	High ESP risk	Performance based
agency's full retention of EE benefits after reform	detailed energy audit and resulting predefined project	bank lending and project financing to ESPCs	full service—shared savings	multiyear contract and periodic payments based on M&V assessment
certain autonomy or fixed budget provisions of agency	mandate audit	vendor financing or leasing	energy supply contracting —chauffage, outsourcing, contract energy management	multiyear, flexible term contract until ESP's agreed return met
noncash refund to agency from ESPs with retention of EE benefits	detailed audit from similar, representative facility	credit or risk guarantee	ESPs with third-party financing—guaranteed savings	partial payment upon commissioning and balance paid 3–6 months
partial EE benefits assigned to agency by Ministry of Finance (MOF)	walk-through audits/evaluation	carbon financing to boost IRR or extend ESPC duration	ESPs with variable-term contract—first out contract	multiyear contract and fixed payments with periodic M&V, equipment warranty, and bonus provisions
no agency retention, MOF upfront subsidy/grant/special financing	institution-led low- or no-cost audit	financing and packaging by Public-private partnership (PPPs)	supplier credit	full payment upon commissioning with some recourse for outer years
no retention but other incentives (e.g., awards, competitions)	completed audit template	financing and packaging by public entities (e.g., super-ESPs)	equipment leasing	full payment upon commissioning
no retention; MOF mandate on agency EE implementation	equipment inventory/ bill summary	public revolving fund	consultant with performance-based payments	Traditional
no retention; ESP procurement by MOF/parent agency	audit by preselected ESPs under Indefinite quantity contract (IQC) approach	public financing through public bonds, etc.	consultant with fixed payments	
Restrictive	no upfront audit; detailed audit by bidders prior to bid submission	government budget for EE projects	Low ESP risk	
	Flexible	Public		

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Thank you!

For more information on EECI,

please visit: www.esmap.org

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