ANALYTICAL TOOLS FOR LOW CARBON DEVELOPMENT PLANNING
Agenda

- **Overview**

- **META** | Help countries choose electricity supply options

- **EFFECT** | Build development scenarios and forecast their impact on GHG emissions

- **MACTool** | Identify the marginal abatement costs associated with each scenario

- **TRACE** | Assess energy efficiency opportunities at the city-level
Why Low Carbon Development Planning?

Strong demand from countries

- Accessing energy
- Accessing finance
- Reducing energy costs
- Improving energy security
- Participating/creating carbon markets
- Developing industrial advantage
ESMAP’s LCD Planning Tools

META | EFFECT | MACTool | TRACE

- ESMAP is building upon its LCD work:
  - ESMAP Mandate – help developing countries “achieve environmentally sustainable energy solutions for poverty reduction and economic growth”
  - Completed or ongoing low carbon development work in 18 countries

- Countries need LCD analytical tools:
  - LCD work is often complex involving many variables over time
  - Focus on low carbon in development is not a well-trodden path
  - Many countries lack capacity to perform the detailed analysis
**Tools are Informing Policy and WB Lending**

**IMPLEMENTED (OR ONGOING) IN 18 COUNTRIES SO FAR**

<table>
<thead>
<tr>
<th>Country</th>
<th>Tool Used</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bosnia and Herzegovina</td>
<td>TRACE</td>
</tr>
<tr>
<td>Brazil</td>
<td>TRACE, MACTool, EFFECT</td>
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<tr>
<td>China</td>
<td>EFFECT</td>
</tr>
<tr>
<td>Ethiopia</td>
<td>TRACE</td>
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<td>TRACE, EFFECT</td>
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<td>Ghana</td>
<td>TRACE</td>
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<tr>
<td>India</td>
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<tr>
<td>Indonesia</td>
<td>TRACE</td>
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<tr>
<td>Kenya</td>
<td>TRACE</td>
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<td>TRACE</td>
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<tr>
<td>Poland</td>
<td>EFFECT</td>
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<td>Serbia</td>
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<tr>
<td>Thailand</td>
<td>EFFECT</td>
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<tr>
<td>Turkey</td>
<td>TRACE</td>
</tr>
<tr>
<td>Vietnam</td>
<td>TRACE, EFFECT, MACTool</td>
</tr>
</tbody>
</table>

**EXAMPLES OF IMPACT**

**EFFECT, India** | Brought together disparate government departments. Highlighted the importance of two things: (1) regional transmission - Bank has loaned US$2B towards those projects (2) hydropower - Bank is currently preparing studies for mobilizing US$20B for hydropower projects.

**MACTool, Brazil** | Government designing a domestic cap and trade program using MACTool for supply and demand analysis at different CO₂ price levels (with Partnership for Market Readiness).

**TRACE, Turkey** | Informed the creation of the Sustainable Cities pillar in the US$4.45billion, 2012-2015 Country Partnership Strategy.
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A convenient way to assess electricity supply technology options
Why META?

Strong demand from countries:
- To screen electricity supply options
- To assess electricity supply environmental externalities

Key advantages of META
- Focuses on particular projects, unlike other tools which look more at system-wide options for meeting a given level of demand
- Helps client countries evaluate various technology options at early stages of planning
- Factors in environmental externalities while calculating levelized costs
META | How it works

META takes user input and default inputs to calculate delivered energy cost. The Default Inputs can be customized for a specific country.

Different Levels of Use
META provides:
• Energy cost
• Transmission cost
• Substation cost
• Environment cost

Assumed CO2 price = US$23/tCO2e
Results | Screening Curves

Screening Curves allows the user to analyze the variation in cost as the capacity factor changes.

![Screening Curves for Technology Options](chart)

- **Coal Supercritical**
- **Diesel generator (large)**
- **Large hydro (ROR)**
- **Wind onshore (large)**
- **No generation**
META is Customizable by Country

Default values are derived from the following countries:

- US - default values for developed countries
- Romania - default values for middle-income countries
- India - default values for developing countries

Default values can be changed easily to match local conditions: E.G.

- Unit capital and O&M cost
- Interest during construction
- Fuel heating value
- Emission factors
- Projected fuel prices
- Transmission losses
- Transmission peak load
- Distribution losses
- Operation and maintenance
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An Open Tool for Building Low Carbon Development Scenarios and Forecasting GHG Emissions
Why EFFECT?

Strong Demand from Countries:
- Building LCD scenarios consistent across sectors
- Forecasting GHG emissions
- Improving access to climate change finance
- Developing industrial advantage

Key Advantages of EFFECT:
- Transparent - Enables consensus building among a wide range of stakeholders
- Flexible - Enables customization to suit local conditions
- Adept - Compiles a large amount of local data from multiple sources
EFFECT yields economy-wide GHG emission forecasts from data about energy producing/consuming assets in development scenarios.
Objective

- Reduce fossil fuel use in order to improve balance of trade and energy security

Symptoms

- Chronic current account deficit (above 10%)
- 10-fold increase in petroleum imports between 1998 and 2008
- 27% increase between Jan and May 2011 (year study started)
Option 1 | Baseline Fuel Consumption

Significant increase in total fuel imports if the government takes no action
Option 2 | Greening Private Cars Scenario

- Introduce vehicle emission standards
- Increase vehicles taxes on older imported cars
Option 3 | Greening Public Transportation Scenario

- Correct mini-bus market failures
- Support development of sustainable urban transport
- Support commercial intercity public transportation services
With all else being equal, public transportation interventions result in a greater reduction in fuel consumption.
Analysis can Cover 6 Sectors

- Transport (road + rail)
- Power
- Industry
- Households
- Agriculture
- Nonresidential
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An Easy and Transparent Way to Build a Marginal Abatement Costs Curve
Countries conducting low carbon studies/implementing Cap-and-Trade systems to achieve voluntary emission reductions. There is need to:

- Achieve the targets efficiently
- Choose among many mitigation options
- Know the potential results
- Know the potential costs

**Key Advantages of MACTool:**

- Considers the break-even carbon price
- Discount rate customizable by technology
- Visual display of the results easy to share with stakeholders
How it Works

**Input Data**

**Calculate Marginal Abatement Costs**

**Rank Marginal Abatement Costs**

**MAC Curve & Great Graphics**

**Marginal Abatement Cost (MAC):**
Net Present Value of Costs and Benefits (unique IRR for each option) associated with a Mitigation Option, divided by the number of Tons of CO₂ abated during the period considered.
Marginal Abatement Cost Curve

Marginal Abatement Cost (\$/tCO_2e)

Net Cost Costs > Benefits

Net Benefit Costs < Benefits

Abatement Potential = 916 MtCO_2e during the period considered (2010-2030)

Reforestation

Cost > Benefits

Cumulative Mitigation Potential of Low Carbon Options (MtCO_2e)

$42/tCO_2
The MACTool explores the order of magnitude of the Supply Side of a Domestic Carbon Market, testing different price configurations.

Domestic Market Supply

Domestic Supply
1878 MtCO₂

Domestic Supply
760 MtCO₂
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A Decision Support Tool for Evaluating Energy Efficiency Opportunities in Cities
**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 helps cities identify under-performing sectors, evaluate improvement and cost-saving potentials, and prioritize sectors and EE interventions.
Visual depiction of how a city compares with peer cities
Prioritization | Sector Results

Comprehensive sector prioritization with quantified potential benefits

### City Authority Sector Ranking

<table>
<thead>
<tr>
<th>Rank</th>
<th>Sector</th>
<th>REI%</th>
<th>Spending CA (US $) Control</th>
<th>Score</th>
<th>Check to Select</th>
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<tbody>
<tr>
<td>1</td>
<td>Potable Water</td>
<td>86.1</td>
<td>20,046,760</td>
<td>13,319,468</td>
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<tr>
<td>2</td>
<td>Municipal Buildings</td>
<td>54.8</td>
<td>13,836,029</td>
<td>7,566,851</td>
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<tr>
<td>3</td>
<td>Solid Waste</td>
<td>48.2</td>
<td>500,000</td>
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<td>4</td>
<td>Wastewater</td>
<td>5.0</td>
<td>1,194,840</td>
<td>53,767</td>
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</table>

### City Wide Sector Ranking

<table>
<thead>
<tr>
<th>Rank</th>
<th>Sector</th>
<th>REI%</th>
<th>Spending CA (US $) Control</th>
<th>Score</th>
<th>Check to Select</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Public Transportation</td>
<td>40.6</td>
<td>53,775,872</td>
<td>12,015,656</td>
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<tr>
<td>2</td>
<td>Private Vehicles</td>
<td>36.5</td>
<td>199,442,747</td>
<td>10,930,996</td>
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<tr>
<td>3</td>
<td>Street Lighting</td>
<td>51.2</td>
<td>12,999,355</td>
<td>5,998,875</td>
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<tr>
<td>4</td>
<td>Power</td>
<td>31.5</td>
<td>538,517,487</td>
<td>1,701,657</td>
<td></td>
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</tbody>
</table>
A matrix of recommendations based on savings potential, first cost, and speed of implementation.
An Open Platform for Low Carbon Development Planning Instruments

Platform will enable:
- Open-access
- Crowd-sourcing
- Collaboration
- Data sharing

Client Benefits:
- One-stop platform
- Community of users
- Technical support

FY12
- Initiate the platform development

FY13
- Controlled launch of the platform and development of partnerships to expand

FY14
- Full-fledged platform
- Develop and strengthen a ‘community of practice’
Thank You.

FOR ADDITIONAL SUPPORT, CONTACT:
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