LEAP-IBC

An integrated assessment tool for emission scenario and benefit estimation

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Session 5B Inventory reporting: Examples; Gaps and Challenges; Emerging Solutions

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CCAC Initiatives

Reducing BC Emissions from Heavy Duty Diesel Vehicles and Engines

Mitigating SLCPs from the Municipal Solid Waste Sector

Mitigating BC and Other Pollutants from Brick Production

Supporting National Planning for action on SLCPs (SNAP)

Addressing SLCPs from Agriculture

Reducing SLCP Emissions from Household Cooking and Domestic Heating

Regional Assessments of SLCPs

Accelerating Methane and BC Reductions From Oil and Natural Gas Production

Promoting HFC Alternative Technology and Standards

Urban Health Initiative

Financing Mitigation of SLCPs

Reducing SLCP Emissions from Household Cooking and Domestic Heating
Overview

Implementation of emission reduction measures

Estimate change in emissions

Link emissions to air pollution concentrations

Estimate benefits

Health
Climate
Agriculture

‘Long-range Energy Alternatives Planning system - Integrated Benefits Calculator’
LEAP-IBC Tool Components

**A. LEAP – Emissions and Scenarios Tool**
- User-friendly energy and emissions planning software – already widely used
- Provides the interface for entire tool

**B. LEAP emission inventory template for SLCPs**
- SEI has developed a default data structure for SLCP inventory and emissions scenario analysis in LEAP
- Covers all key sectors and contains default emission factors for all key pollutants

**C. Integrated Benefits Calculator**
- Concentrations of PM$_{2.5}$ and O$_3$ derived from in-built coefficients generated by a global atmospheric chemistry transport model (GEOS-Chem Adjoint)
- Determines impacts on health, crops, and climate
- Requires limited user inputs - default data available for most parameters

**Diagram:**
- Emissions → Concentrations → Impacts
LEAP-IBC User interface

The main menu and toolbar give access to major options.

Data are organized in a tree.

Select scenarios here.

Edit data by typing here.

Select units and scaling factors here.

Switch between views of the area here.

The status bar notes the current Area and View.

Data can be reviewed in chart or table format.
Emissions template for SLCPs
Estimating emissions

Emission = Activity rate x Emission factor

Data for level of activity (Activity rate)
Estimating emissions:
Emission factors (Environmental loading)

- **Carbon Dioxide Biogenic**: 112 kg Metric Tonne per Terajoule
- **Carbon Monoxide**: 4260 kg Kilogramme per Terajoule
- **Methane**: 300 kg Kilogramme per Terajoule
- **Non Methane Volatile Organic Comp**: 600 kg Kilogramme per Terajoule
- **Nitrogen Oxides**: 73 kg Kilogramme per Terajoule
- **Nitrous Oxide**: 4 kg Kilogramme per Terajoule
- **Sulfur Dioxide**: Kilogramme per Terajoule
- **Particulates PM10**: 10.2 kg Kilogramme per Metric Tonne
- **Particulates PM2p5**: 8.16 kg Kilogramme per Metric Tonne
- **Black Carbon**: 1.12 kg Kilogramme per Metric Tonne

Notes:
- a) IPCC 2006 Guidelines - Tier 1 default EFs
- b) Zhang et al. (2000) Average EF for household stoves in China.
- c) EMEP/EEA (2013) Tier 1 emission factor
- d) Bond et al. 2004 (Table 6)
- e) Assume PM2.5 = 80% of PM10 as reported for wood and crop waste by Reid
- f) GAINS ECLIPSE EFs from Klimont et al (2016) Table S2.3
Estimating emissions: fuel share scenario for cooking

By 2050 70% of stoves will be improved
Baseline emission scenarios

Example: BC, OC and CH₄ emission progression
Avoided BC emissions from cookstoves and diesel policy.
Avoided premature deaths from cookstoves and diesel policy

Increase in deaths due to population increase
LEAP-IBC: Progress so far

- 15 countries now participating in SNAP national planning using LEAP-IBC.
- LEAP-IBC training workshops already held for Colombia, Côte d’Ivoire, Ghana, Morocco, Nigeria, Peru and Togo (plus Estonia and Nepal). Training for Bangladesh, Mexico and Philippines to follow shortly.
- Quote from Daniel Tutu Benefoh, EPA, Ghana:

  "LEAP-IBC is a one stop shop. Rather than using multiple tools, I use LEAP-IBC which allows both energy and non-energy emissions from all sectors to be calculated with the added ability to assess impacts of mitigation scenarios. LEAP-IBC can easily be modified to capture the impact of specific activities ...... a convenience you can’t find in any other software. This means that LEAP-IBC can effectively serve the interests of local users ”
Emissions inventory development in LEAP-IBC (1)

Not just an emissions inventory of Black Carbon and Methane – must also include all relevant co-emitted substances to determine net impacts:

- **For BC mitigation** strategies, must also include emissions of:
  - All **primary particulate matter** (PM) emissions (BC, OC and other PM$_{2.5}$), and,
  - The major **precursors of secondary PM** (SO$_2$, NO$_x$, and NH$_3$)

- Similarly, emissions of all the major **ozone (O$_3$) precursors** (NOx, CO, and NMVOC as well as CH$_4$) are needed to model O$_3$ formation and impacts on health and crops.

- **For net climate impacts**, the change in **radiative forcing all co-emitted substances** (both warming and cooling) must be included.

- **Challenge**: for some key sources (e.g. cookstoves) the emission factors reported in the literature rarely include all of the above species.
Emissions inventory development in LEAP-IBC (2)

Most default emission factors (EFs) are from the EMEP/EEA 2016 Air Pollutant Emission Inventory Guidebook and IPCC 2006 Guidelines

- **Challenge**: These EFs may not be appropriate for regions outside Europe and N. America
- **Solutions**:
  a) For key sectors, include more appropriate EFs from the literature, e.g.
  b) Encourage use of locally determined EFs where possible
  c) Continue to liaise with the other CCAC initiatives to improve EFs/methods
  d) Continue to develop an EF database within LEAP-IBC so users can select alternative factors
Emissions inventory development in LEAP-IBC (3)

‘Accuracy’ versus ‘Usability’

- LEAP-IBC is intentionally designed not to be ‘data hungry’ – finding reliable and sufficiently disaggregated data is often the biggest challenge for users.
- The need to develop SLCP mitigation scenarios also constrains the level of detail of the EI approach - users will need to create a story of how each variable will change over time.
- No such thing as a ‘final’ emission inventory with the ‘right’ number. It improves iteratively with improved data and scientific knowledge.
- In general, LEAP-IBC uses the same sources of activity data and EFs as international inventory efforts.
- Inclusion of uncertainty is being looked at – but primary purpose of the tool is to allow users to compare likely impacts of alternative SLCP mitigation scenarios.
Thank You