Considerations for future IPCC inventory work on SLCF (black carbon example)

- Does policy context matter?
- A quick look at source categories
- A quick look at methods
- Implications

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- Policy context is important
  - For GHG inventories, IPCC focus is on national totals, to facilitate international cooperation (policy relevant but not prescriptive)
  - BC inventories are part of a broader strategy on health & environment for national, regional and local governments
- Implications for potential IPCC work
  - Additional inventory information needs for BC?
    - Timing during year
    - Location (high latitude, other sensitive regions, population centers)
    - Co-emitted pollutants, including negative radiative forcers
    - Weather conditions & air quality monitoring needs
  - Policy relevance of "annual national totals" of BC?
    - Growing importance, but part of a broader strategy
    - Individual countries are likely to need more as their capacities increase

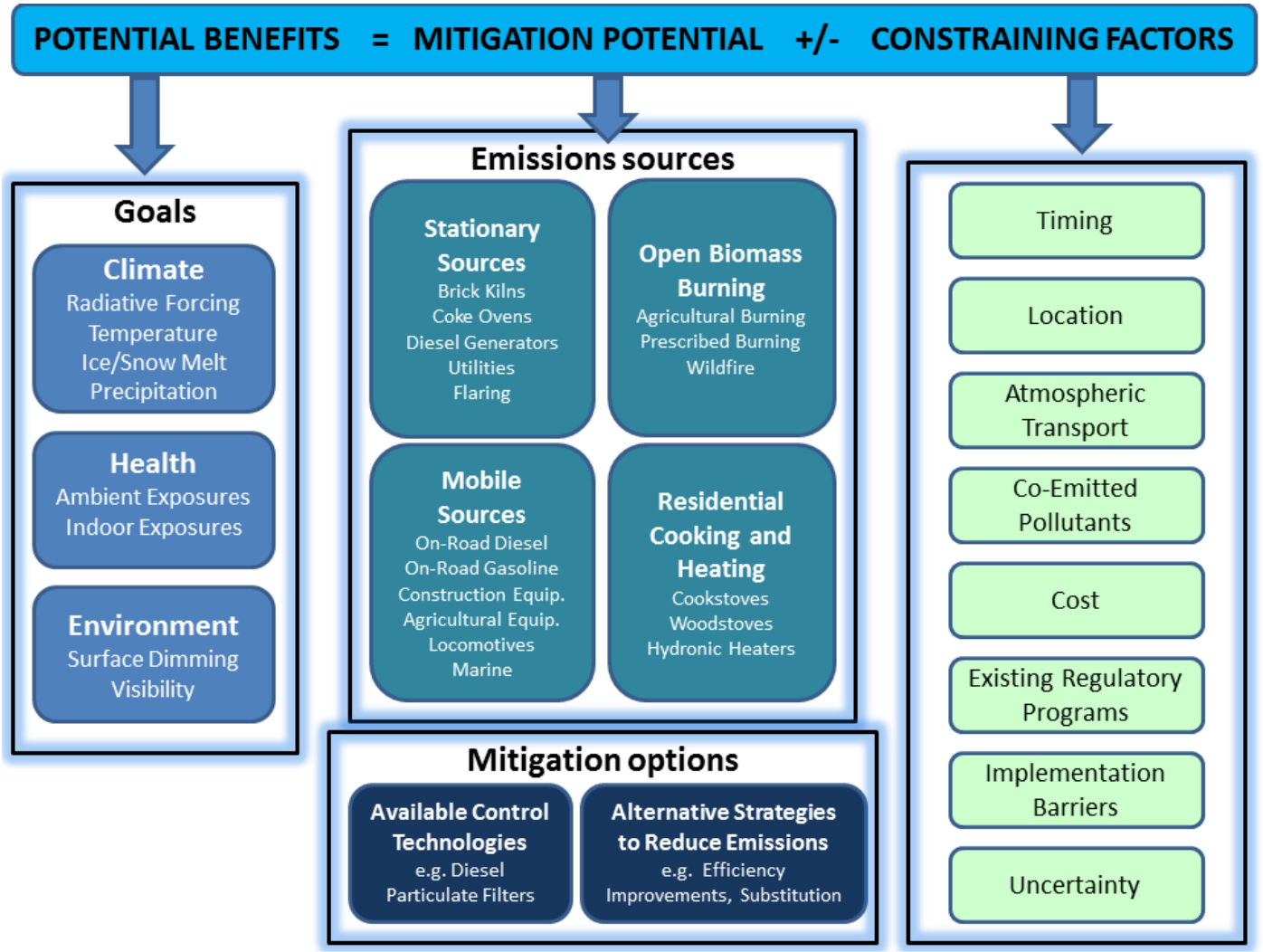


Figure D. Policy Framework for Black Carbon Mitigation Decisions. (Source: U.S. EPA.)

Comparison of priority ('key') sources

- In the US (and other developed countries?) the largest sources of BC are typically transportation and burning of biomass (forests fires & agricultural residue burning).
- Developing countries may have higher BC emissions from residential cooking and industrial sectors, with growing mobile source sectors.

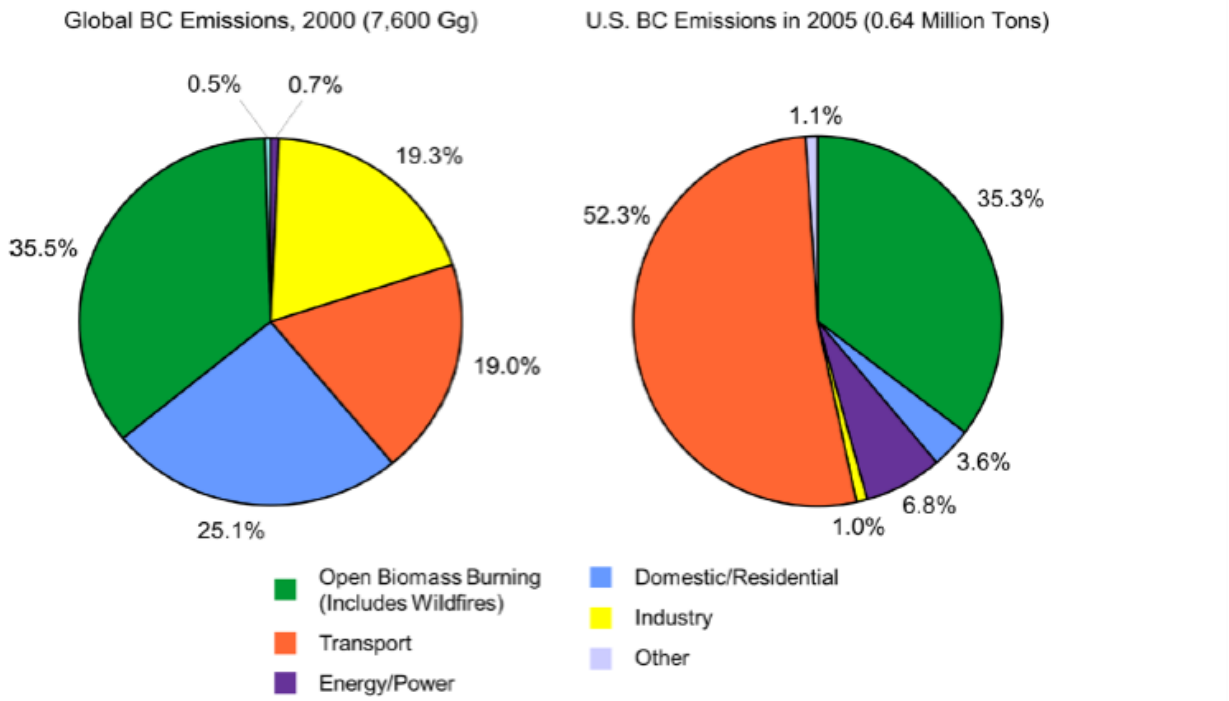
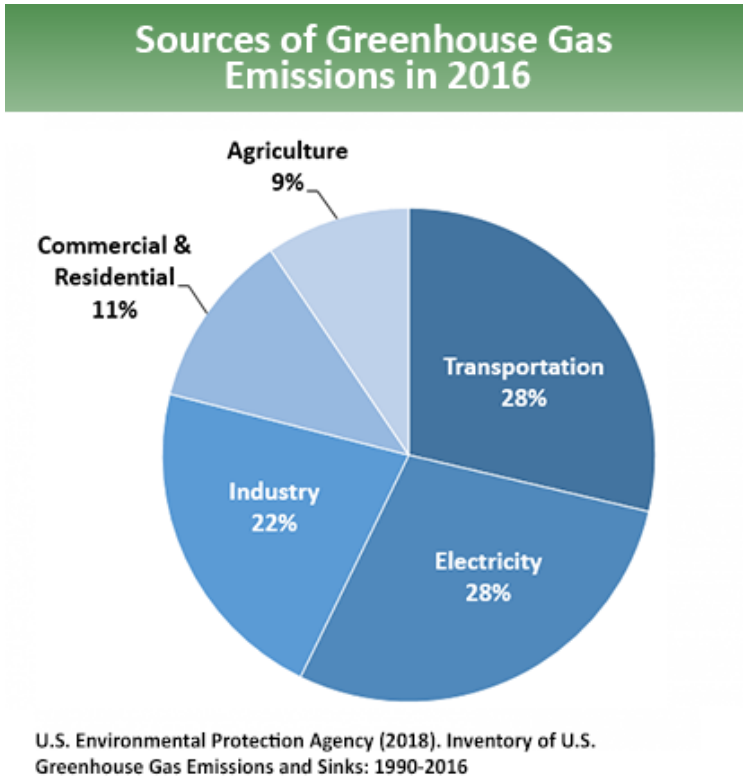


Figure A. BC Emissions by Major Source Category. (Source: Lamarque et al., 2010 and U.S. EPA)



U.S. Environmental Protection Agency (2018). Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990-2016

US Example

- Transportation (diesel engines) is a leading sources of both GHGs and BC
- Wildfires less important for CO_2 than for BC

“On-road” Transportation – methodological comparison

- US CO2 estimates (key category)
  - IPCC Tier 2: aggregate fuel use by mode x country-specific carbon content
  - Approximately 30% of total national emissions
- US Non-CO2 estimates (N2O key category, CH4 non-key category)
  - IPCC Tier 2: Vehicle Miles Traveled by Vehicle Type, Fuel Type, Model Year, and Control Technology x CH4/N2O
  - Less than 1% of total national emissions
- EMEP/EEA air pollutant emission inventory guidebook 2016 (Tier 2)
  - PM emissions = Number of vehicles by category/technology x distance traveled x technology-specific emission factor
  - BC = percentage of PM
- US black carbon estimates for transportation (Report to Congress)
  - “MOVES” model calculates total PM2.5 emissions and BC emissions at the county level.
  - Accounts for high emitters, deterioration of PM emissions (i.e., increase in PM mass) with higher mileage, and increased PM emissions at lower temperatures.
  - Directly calculates BC emissions (as well as other exhaust PM components such as sulfates and OC), and accounts for the significantly reduced BC fraction emitted from on-road diesels due to application of diesel particulate filters (DPFs).
  - Gasoline OC and BC emissions increase dramatically at lower ambient temperatures. To calculate this increase for gasoline vehicles, an hourly grid-cell temperature adjustment was done as part of emissions processing at the county level for each of over 3,200 counties.
  - MOVES can also be used to calculate tire and brake wear PM2.5, with speciation factors applied to calculate BC.

Similar

Increasing complexity

Forest fires/wildfires – methodological comparison

- US CO2 estimates (Forest Land remaining Forest Land - key category, IPCC Tier 3)
  - Total C stocks are estimated for each C storage pool, next the net changes in C stocks for each pool are estimated, and then the changes in stocks are summed for all pools to estimate total net flux.
  - Changes in C stocks from disturbances, such as forest fires or harvesting, are included in the net changes.

Method not comparable

- US Non-CO2 from forest fire estimates (non-key category)
  - IPCC Equation 2.27: Area burned x Fuel available x combustion factor x EF
  - Data inputs from forest land survey data (FIA) and burn severity data (MTBS)
- AP-42 (PM2.5 emissions) – similar to EMEP/EEA air pollutant emission inventory guidebook 2016
  - Emissions = Pollutant yield/fuel consumed x fuel/area x area
  - BC is % of PM

Similar

- US black carbon estimates for fires (Report to Congress)
  - Process modeling and remote sensing data to estimate fire activity patterns and emissions from fires (Blue Sky Framework, 2010). Blue Sky can enable
    - the lookup of fuels information from fuel maps
    - the calculation of total and hourly fire consumption based on fuel loadings and weather information
    - the calculation of speciated emissions (such as CO2 or PM2.5) from a fire

Increasing complexity

Summary

- Policy context can have implications for inventory requirements and future work
  - More to consider than just adding another column to IPCC tables
- Similarities and differences in priority sources & methods for GHGs and BC
  - Alignment for some sources, and some methodological approaches, but not for others
- Historical IPCC core strengths and limitations for methodological development
  - IPCC focus on complete and comparable national totals and Tier 1/Tier 2 methods
  - Limitations on utility for atmospheric modeling and setting/assessing domestic standards because of spatial/temporal resolution, and tracking of mitigation efforts.
- IPCC Approach: incremental approach or one-stop shop?
  - IPCC could focus on products that facilitate countries preparing GHG and SLCF inventories
    - Cross-walk IPCC categories with major sources to identify focus areas (e.g., for BC - forest fires, residue burning, transportation, some industrial sources
    - Detailed survey of available guidance to identify gaps
    - Identify where methods and activity data converge (e.g., Tier 2 for non-CO2 and BC)
    - Identify where methods and AD do not converge (e.g., C stock changes, fluorinated gases)
  - Formats?
    - Series of IPCC technical bulletins focused on particular sectors? (E.g., agricultural burning)
    - Emission Factor Database (EFDB) to include SLCF?
    - IPCC methodological supplement?
  - Longer-term planning?
    - Process for getting feedback from inventory compilers and considering additional work? (no UNFCCC inventory reports or reviews to