



Conclusions and Draft Recommendations

(Discussion Topics)

My Main Thought

- **We must not be satisfied with internal consistency among various EI products, nor even assume that the “best” EI products are accurate, but we must test EIs against what the atmospheric science community infers about source strengths from studies of the composition of the atmosphere at regional or global scale.**
- **Iterate among:**
 - **Emissions → Models → Observations → Emissions.....**

The relationship between national inventories and regional/global inventories

- **We need to take advantage of the knowledge of local experts that has gone into compiling national inventories**
- **We may need to supplement national inventories, according to an organized representation of source types**
- **But how to accommodate inconsistent assumptions across national inventories? Does it matter?**
- **Regional/global inventories have their own advantages (consistency, transparency, etc.)**
- **GAP tool has the ability to input local knowledge about emission factors**

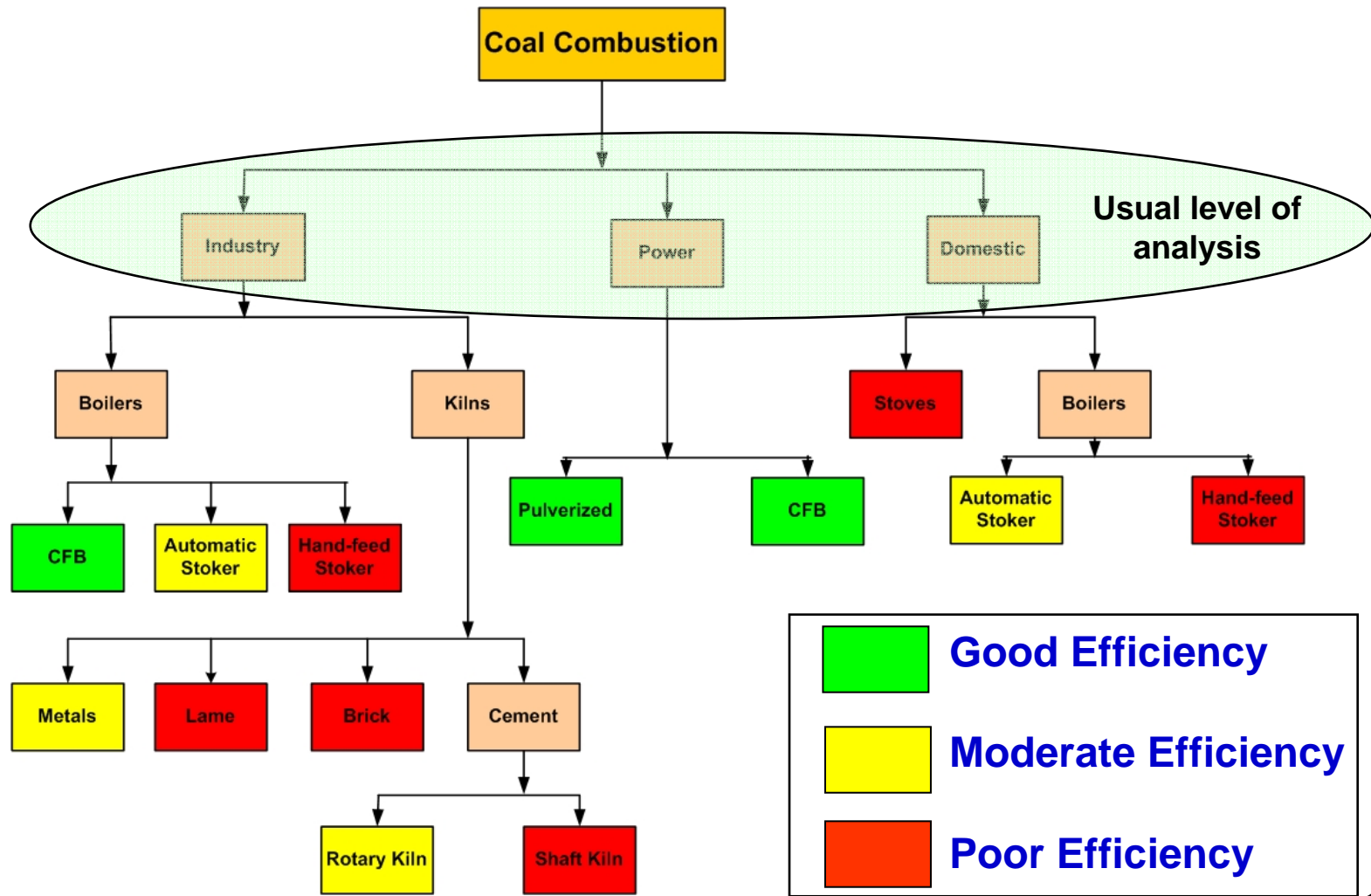
Spatial representation of emissions

- Time-varying application of regulations (EDGAR vs NEI) can lead to differences in point-source emissions
- Newly developing industrial regions (e.g., Russian Far East, Central Asia)
- How important is it for HTAP to get spatial details right? Can we do some sensitivity studies?

Other Details of Inventories

- **Release heights (importance for long-range transport)**
- **Temporal allocation of emissions**
- **Speciation of VOC**
- **Some aspects of biomass burning (forest fires) may not be covered by either IPCC or national inventories; standardizing the development of biomass burning emissions from satellite observations of burning; extending individual observations of fires to “annual” or year-to-year emission trends**
- **Need for source testing to get reliable emission factors for unconventional source types**
- **Performance and application rates of emission controls**

How to get the necessary level of technology detail to get emissions of CO, PM, HC correct?



We desperately need more emissions testing of small residential, industrial, and vehicular sources in the developing world

Representativeness of entire population of sources

Typical operating practices

Typical fuels and fuel characteristics

Relationship to similar sources in the developed world

Daily and seasonal operating cycles



Emissions from intermittent sources like open biomass burning are difficult to estimate and can interfere with inferences of regional emissions from observations and modeling



✓ Emission factors have rarely been measured in the field

✓ Burning activity is not well known for historical periods and for all regions of the world

✓ Extent of burning (and therefore emission) depends on forest type (boreal, tropical, woodland, peat...)

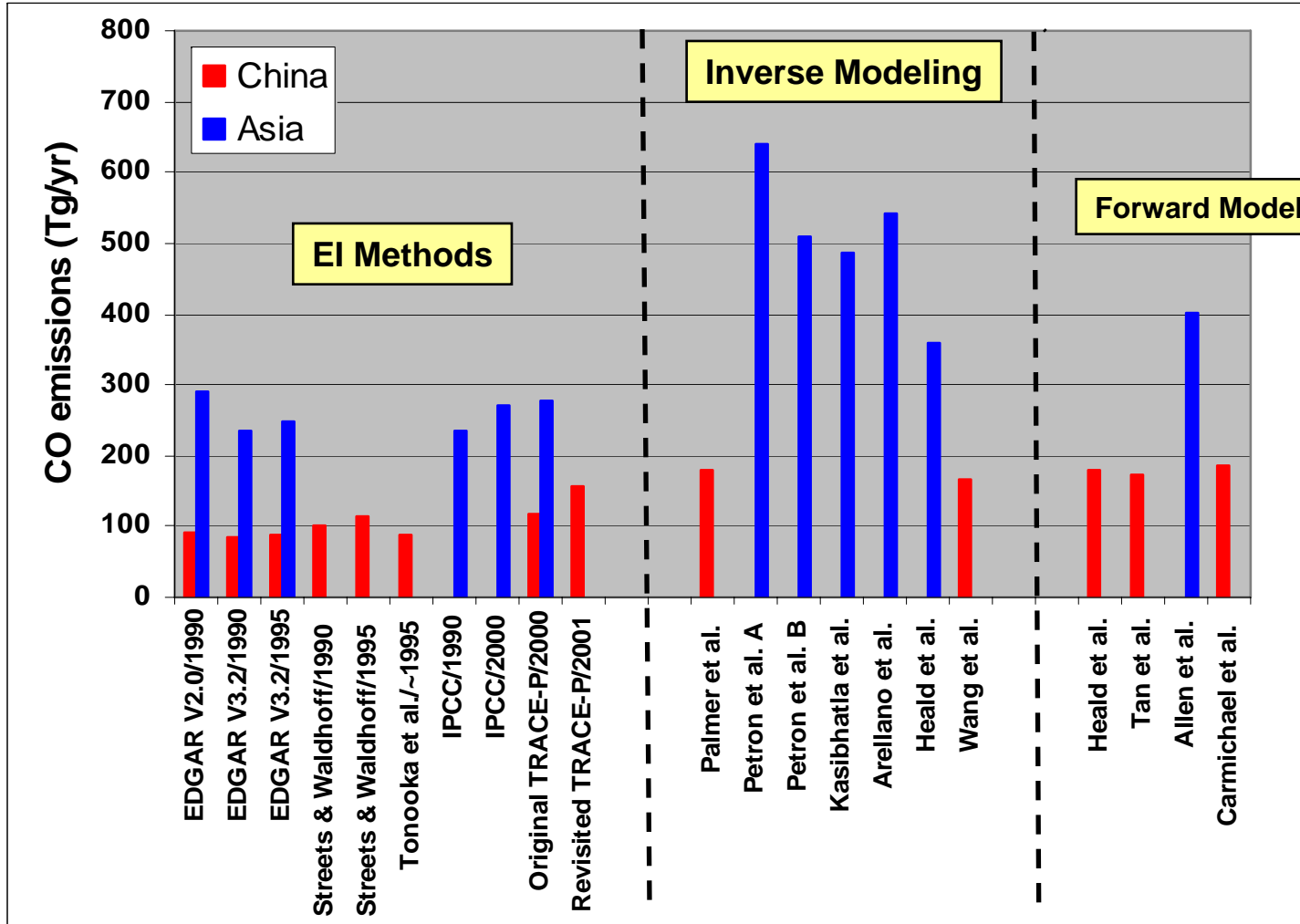
✓ Seasonal crop burning is particularly hard to estimate

Greg Stella's Dream

- **A global inventory that will be subject to “scientific appraisal”**
 - **Complete**
 - **Accurate**
 - **Timely**
 - **Transparent**
 - **Affordable**
 - **Documented uncertainty**

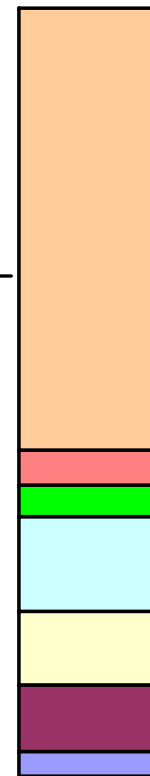
Any hope to make progress towards this goal in the lifetime of HTAP?

Survey of CO emission estimates for China and Asia: [“We should not mistake consistency for accuracy” (Tami Bond)]



Miscellaneous small sources are highly significant emitters of CO in China (Problem: we have tended to ignore or downplay sources we know little about)

- **Brick kilns**
- **Lime kilns**
- **Synthetic ammonia production**
- **Coke making**
- **Residential coal boilers**
- **Residential coal stoves**
- **Residential biofuel stoves**
- **Tractors**
- **Rural vehicles**
- **Power plants**
- **Coal-mine fires**
- **Oil and gas burning**
- **Open biomass burning**



We use a dynamic methodology to represent the rapid technology change in the last decade

Emission source

Trends of NOx EF

Driving forces

Power plants

Decreased

LNB technology

Vehicles

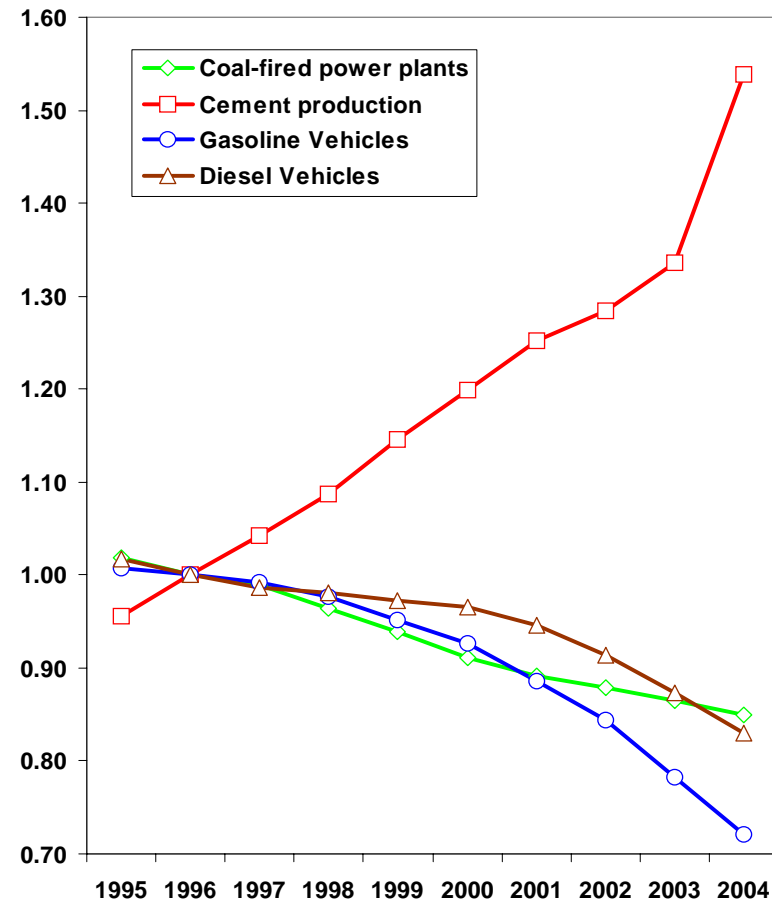
Decreased

Vehicle emission standards

Cement Kilns

Increased

new dry-process kilns



Trends of NOx emission factors, 1996 = 1.0