

Hg Emissions Modeling and Inventory and Hg Stack Sampling

Presented at the EPA and USGS Hg Roundtable
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Overview of Presentation

- Argonne Hg emissions model
- Zhejiang University Hg emissions sampling
- **NETL, USGS, EPA collaboration**
 - NETL modeling and emissions sampling
 - USGS World Coal Quality Inventory
 - EPA ambient monitoring

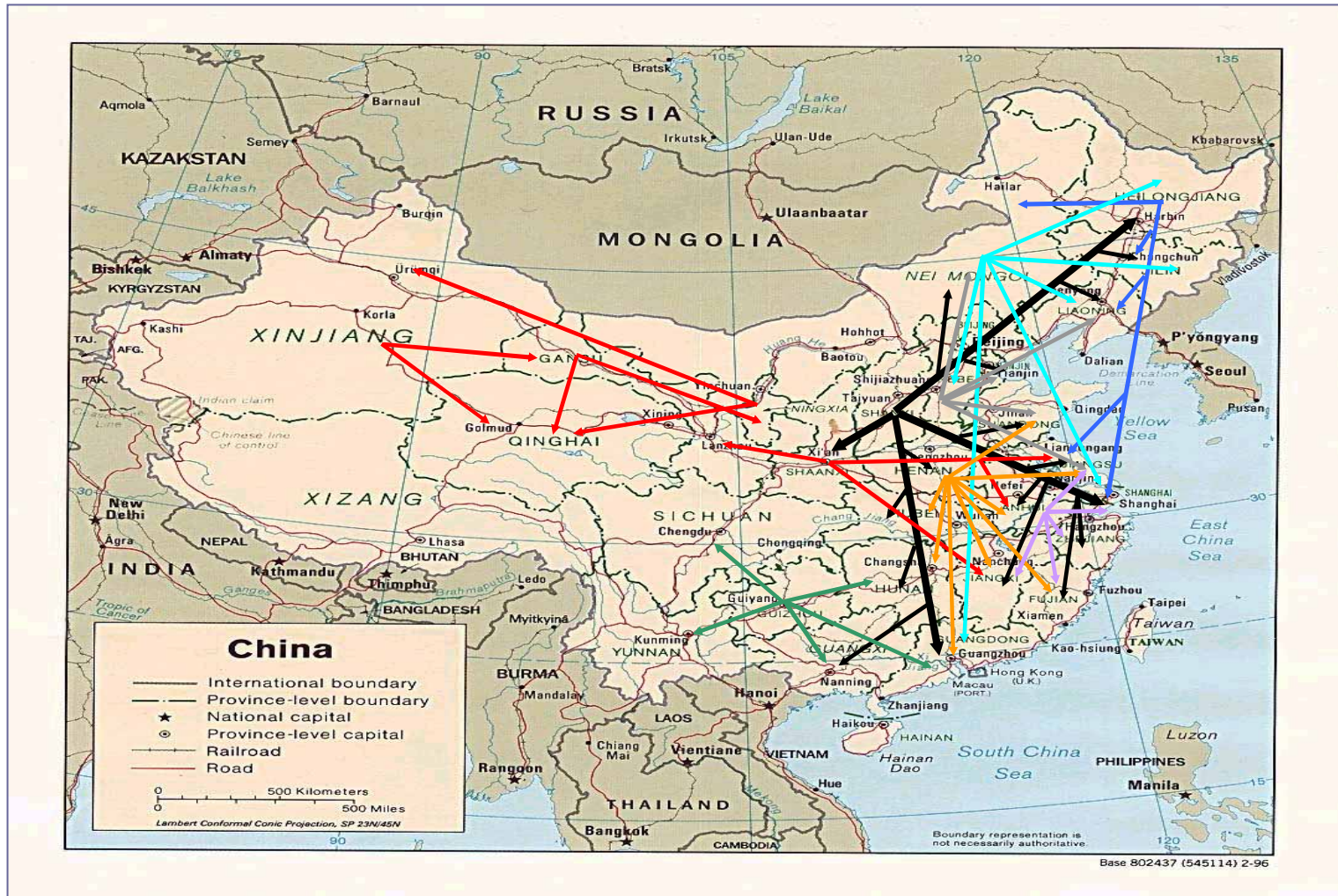


Argonne Hg Model Summary

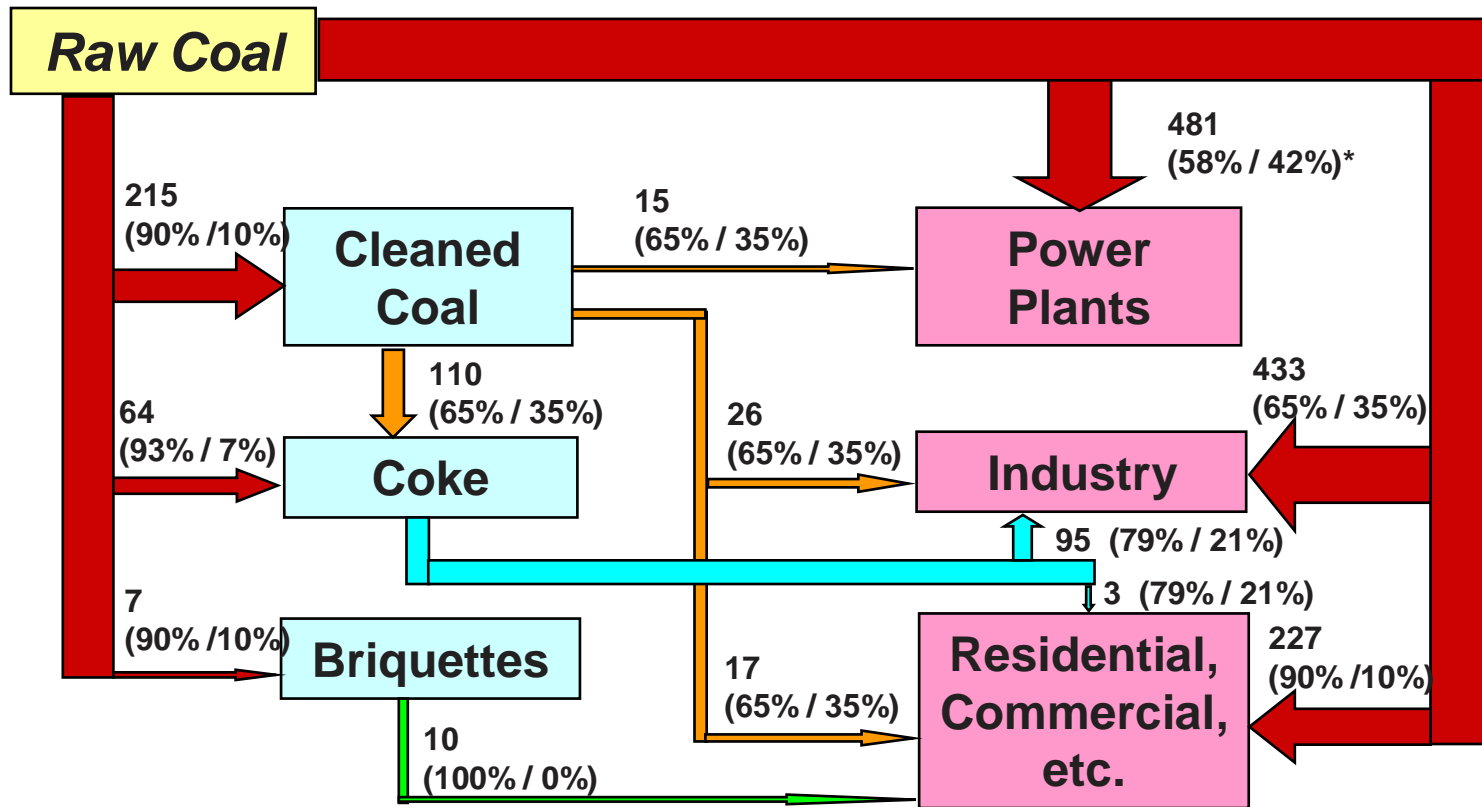
- **Inventory of provincial level Hg emissions in China**
 - 1996+1, 1999+1
 - Hg(p), Hg(2+), and Hg(0)
- **Increase understanding of**
 - Hg content of fuels
 - Coal cleaning and transportation
 - Emissions factors for combustion technology
 - Efficiency of particulate removal devices
- **Recommendations to reduce Hg release in China**
- **Supplement atmospheric transport model**
 - Spatially allocate the emissions to a 1 deg x 1 deg grid
 - Input to U.S. EPA's CMAQ model



Inter-province model of coal transportation flows



Coal transportation flows by usage, 1999



* 481 (58% / 42%): million tons of coal used (percent in-province supply / percent out-of-province supply)



We have developed splits between Hg released and Hg remaining in bottom ash

Sectors	Boiler types	Ratio, %
Residential Use	Traditional cookstove	17.0
	Improved cookstove	17.0
	Stoker	17.0
Industrial Use	FBF/PC	8.0
	Stoker	17.0
Power Plant	PC	1.0
	Stoker	2.0
Farming, Construction, and etc.	Stoker	17.0

The ratios shown here are Hg remaining in bottom ash

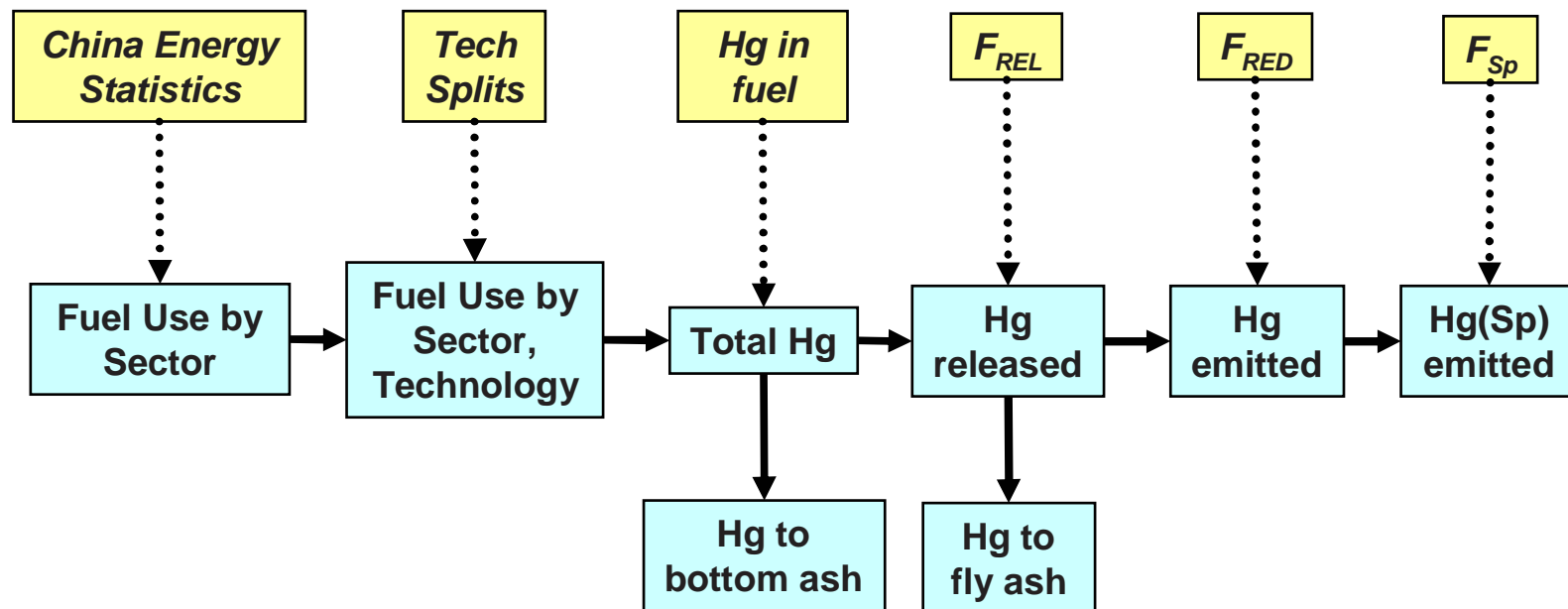


Hg removal efficiencies have been estimated, but no province or combustor variation yet

Case	Fuel/Combustor Type	PM Control	Removal Efficiency (%)				
			Provinces of China				
			Anhui	Beijing	Fujian	Gansu	Guangdong
31	Hard coal/PC	filter or ESP	30.6	30.6	30.6	30.6	30.6
33	Hard coal/PC	scrubber	6.5	6.5	6.5	6.5	6.5
34	Hard coal/PC	cyclone	0.1	0.1	0.1	0.1	0.1
32	Hard coal/stoker	filter or ESP	30.6	30.6	30.6	30.6	30.6
35	Hard coal/stoker	scrubber	6.5	6.5	6.5	6.5	6.5
36	Hard coal/stoker	cyclone	0.1	0.1	0.1	0.1	0.1
85	Hard coal/cyclone	scrubber	6.5	6.5	6.5	6.5	6.5
86	Hard coal/cyclone	cyclone	0.1	0.1	0.1	0.1	0.1
37	Cleaned coal/PC	filter or ESP	30.6	30.6	30.6	30.6	30.6
39	Cleaned coal/PC	scrubber	6.5	6.5	6.5	6.5	6.5
40	Cleaned coal/PC	cyclone	0.1	0.1	0.1	0.1	0.1
38	Cleaned coal/stoker	filter or ESP	30.6	30.6	30.6	30.6	30.6
41	Cleaned coal/stoker	scrubber	6.5	6.5	6.5	6.5	6.5
42	Cleaned coal/stoker	cyclone	0.1	0.1	0.1	0.1	0.1



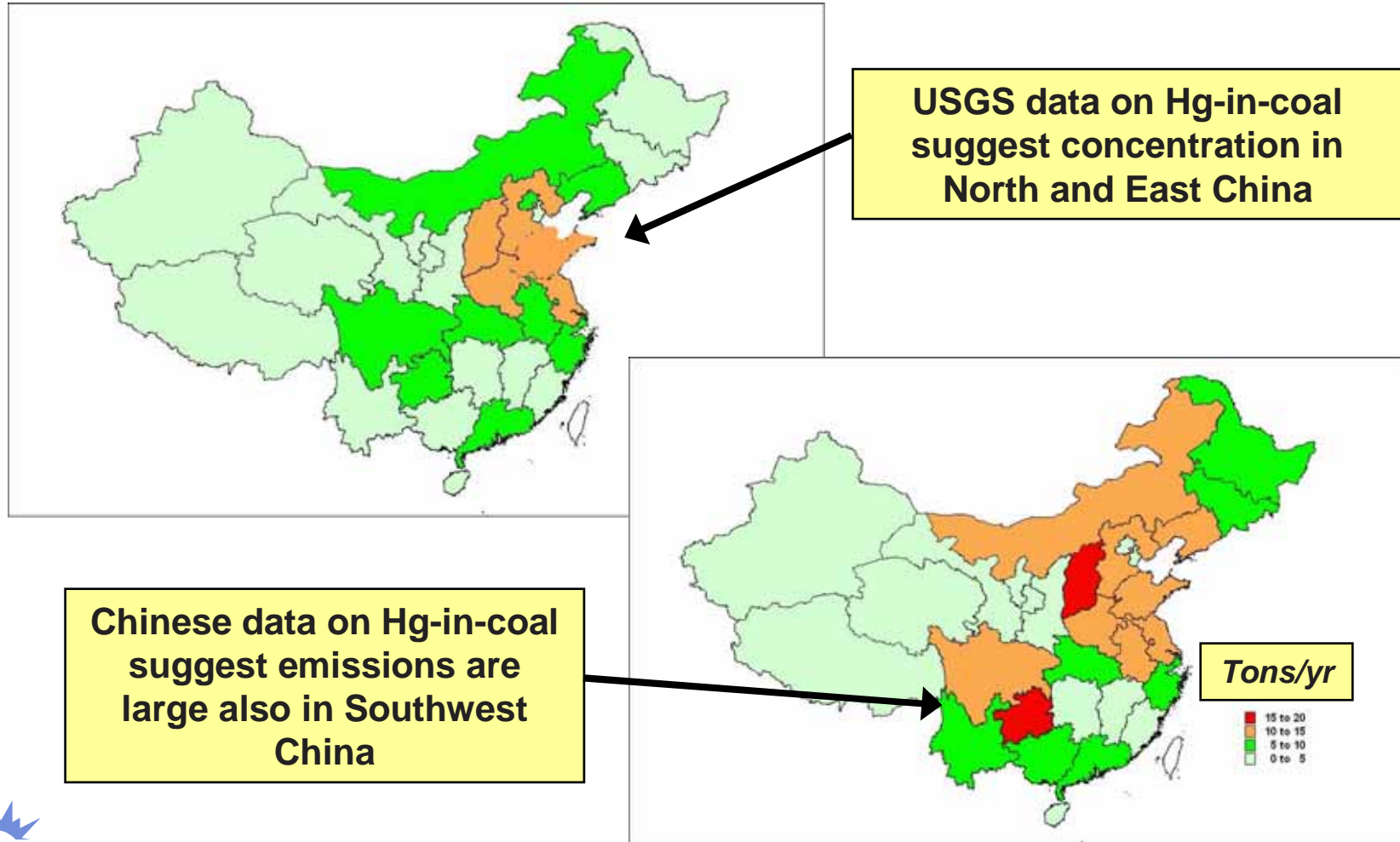
Schematic of Hg emissions calculation procedure



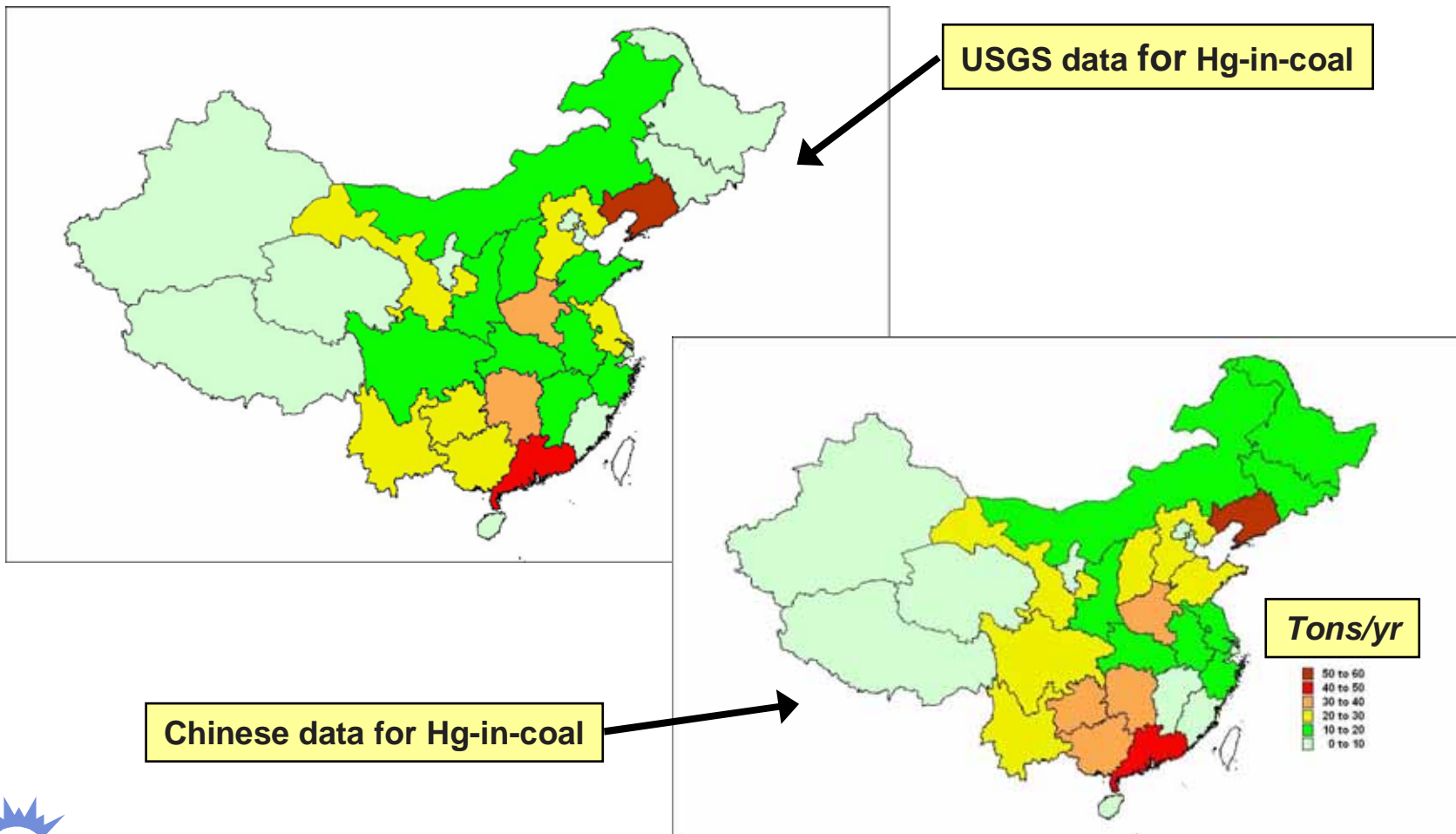
Spreadsheet is 107 x 32 (Fuel/Tech combinations x provinces)



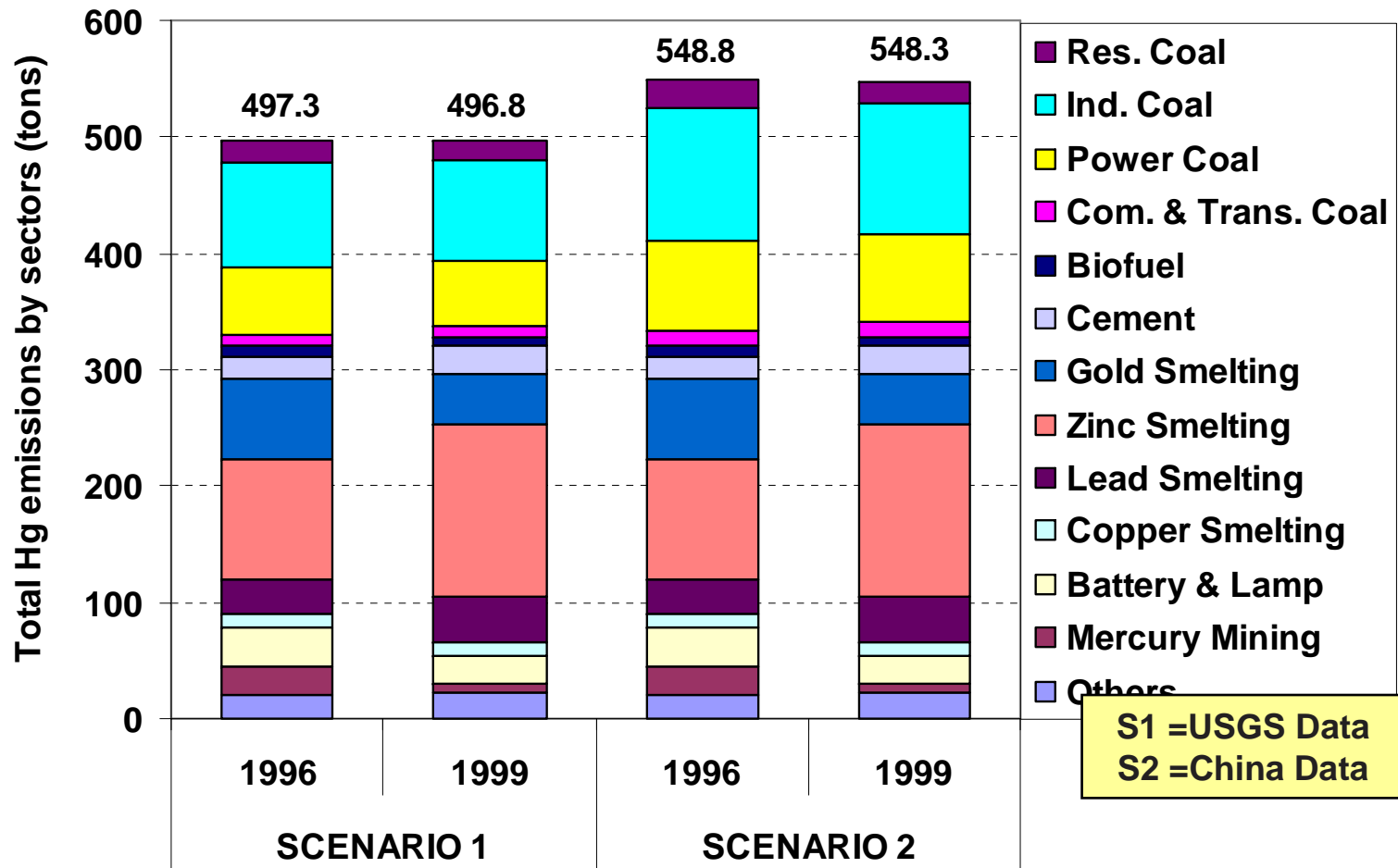
Hg emissions by province from coal combustion in 1999



Total Hg emissions by province in 1999 from all source types



Results of sector partitioning of total Hg emissions



Hg Stack Sampling

- **NETL and Zhejiang University collaboration**
 - Under direction of MOU with Ministry of Science and Technology (MOST)
- **Plan to collect samples from 6 coal-fired power plants**
 - Plants being designated
 - Awaiting approval from MOST



China Hg Working Group

- **Goal: Develop better understanding of Chinese Hg emissions**
- **USGS World Coal Quality Inventory (WOCQUI)**
- **Argonne Hg emissions inventory**
 - All sources of Hg, in addition to electricity generation
- **Power plant emissions and ambient Hg levels**
 - Zhejiang University stack sampling
 - EPA ambient monitoring
 - Beijing University
- **Most recent meeting, September 3, 2004**



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