WTERT 2018

WTERT-Columbia research activities

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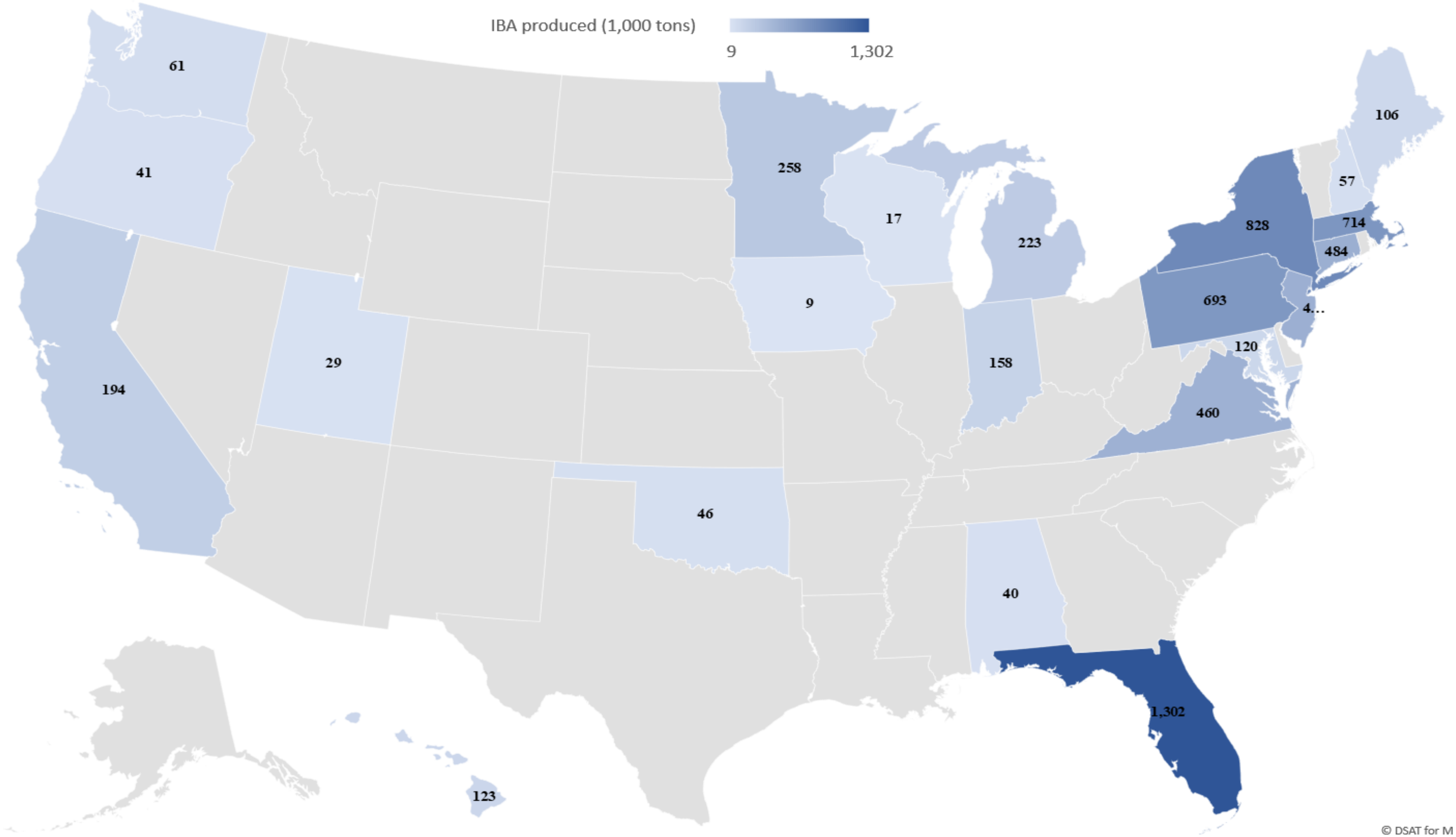
EARTH ENGINEERING CENTER

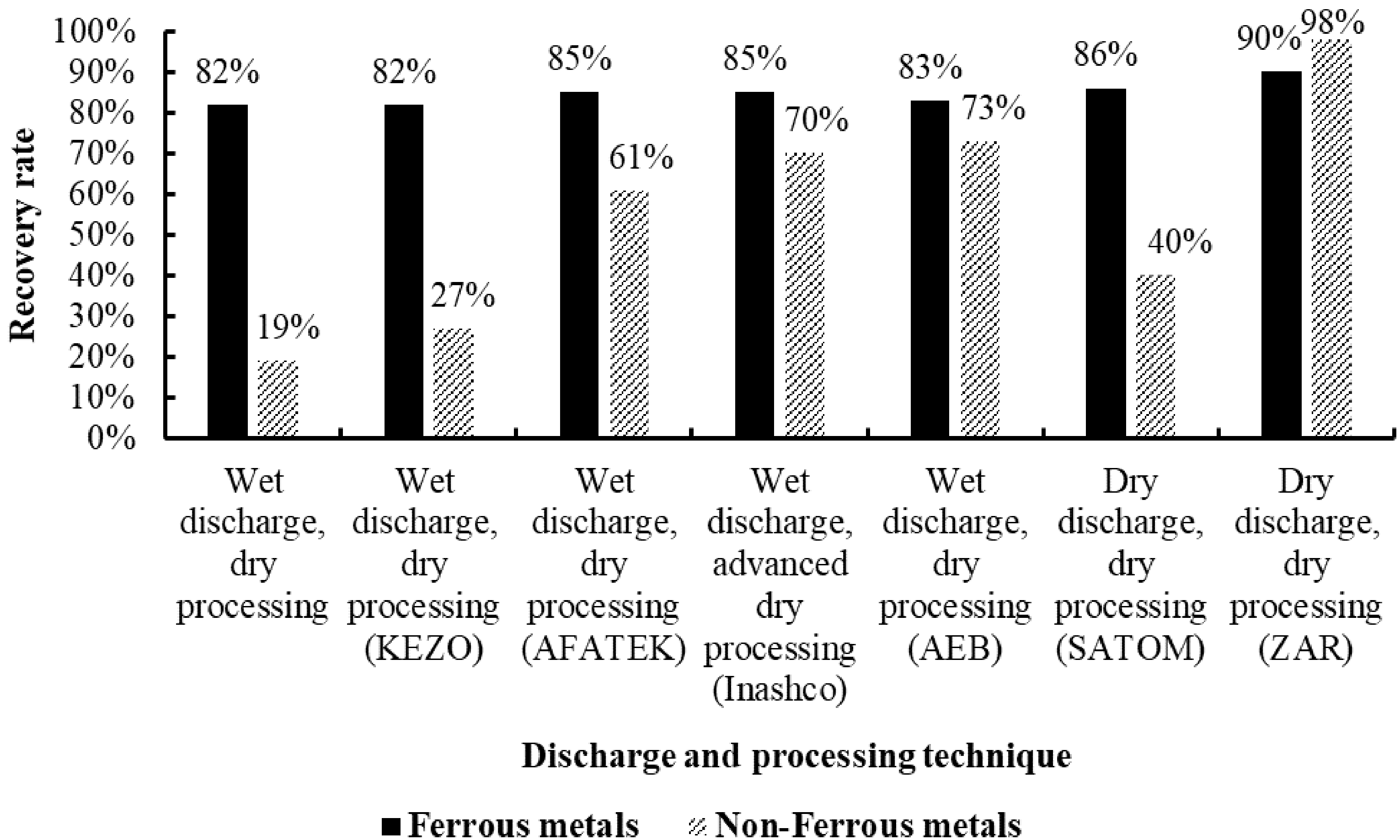
IBA availability in the US.

Data are reported in 1,000 tons of IBA

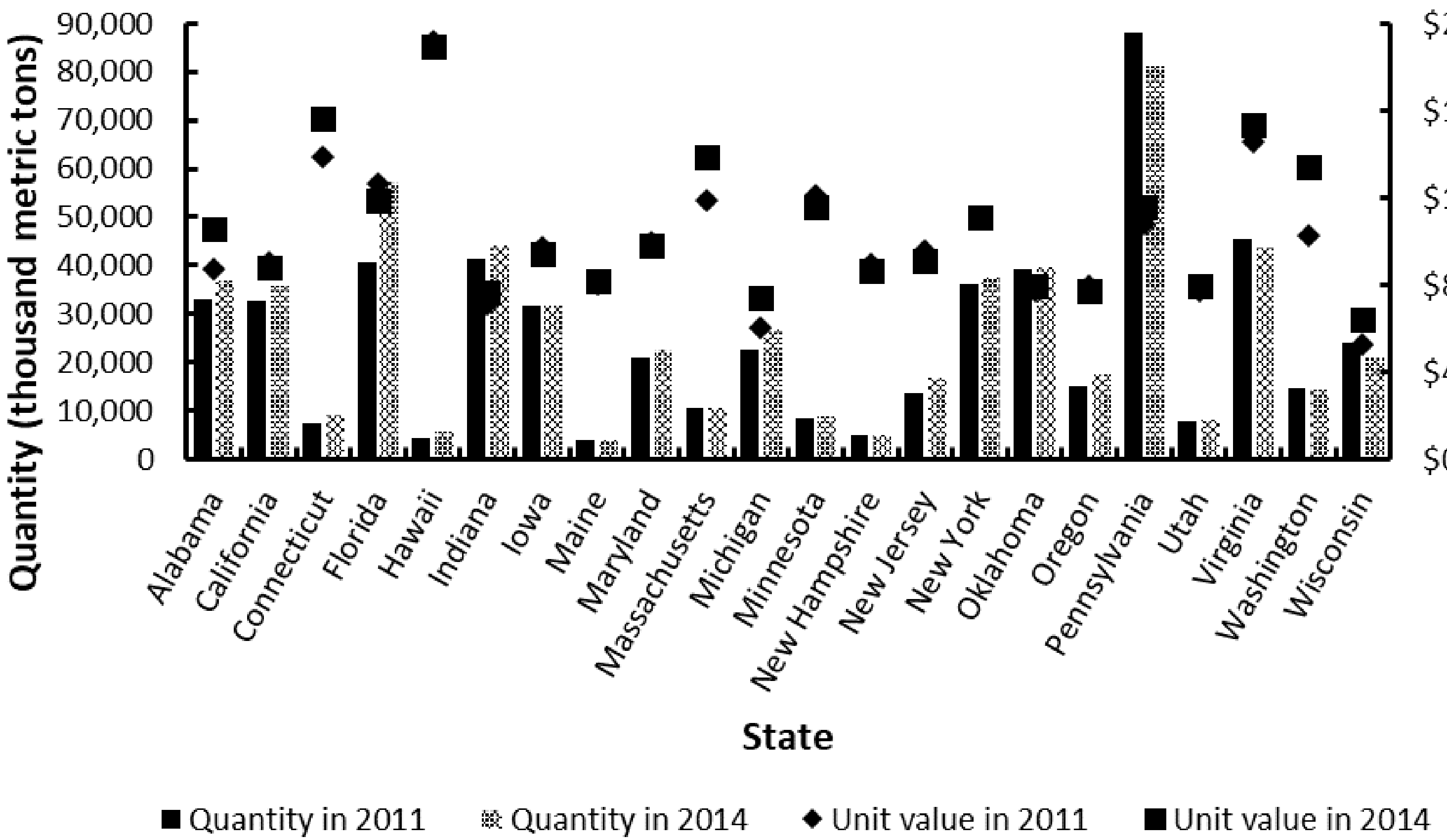


Ronglong Shen, EEC/Columbia 2018

Metal recovery from processing Waste-to-Energy Bottom Ash in Europe



Aggregates Sold or Used in States with WTE facility in 2011 and 2014



Key findings:

- Higher metal recoveries can be achieved by dry discharge systems. However, an add-on cost of $500,000 to 1.2 million per unit is needed, which does not easily overcome the calculated revenues gained from the investment.
- Wet discharge systems followed by the Advanced Dry Treatment (ADR) can give a high metal recovery rate at relatively low cost.
- The market analysis showed that Florida, Pennsylvania, Virginia, New York, Connecticut, and Massachusetts, are good markets for the beneficial use of IBA minerals.

Waste-to-Energy bottom ash recycling plant

Non-Ferrous Metals (0.5-2%)

Bottom Ash (85-95%)

Weathering/ Size Separation

Ferrous Metals (5-15%)

Fine Fraction (11 - 45 %) < 2 mm

Challenging fraction

Medium Fraction (40 - 70 %) 2 – 9.525 mm

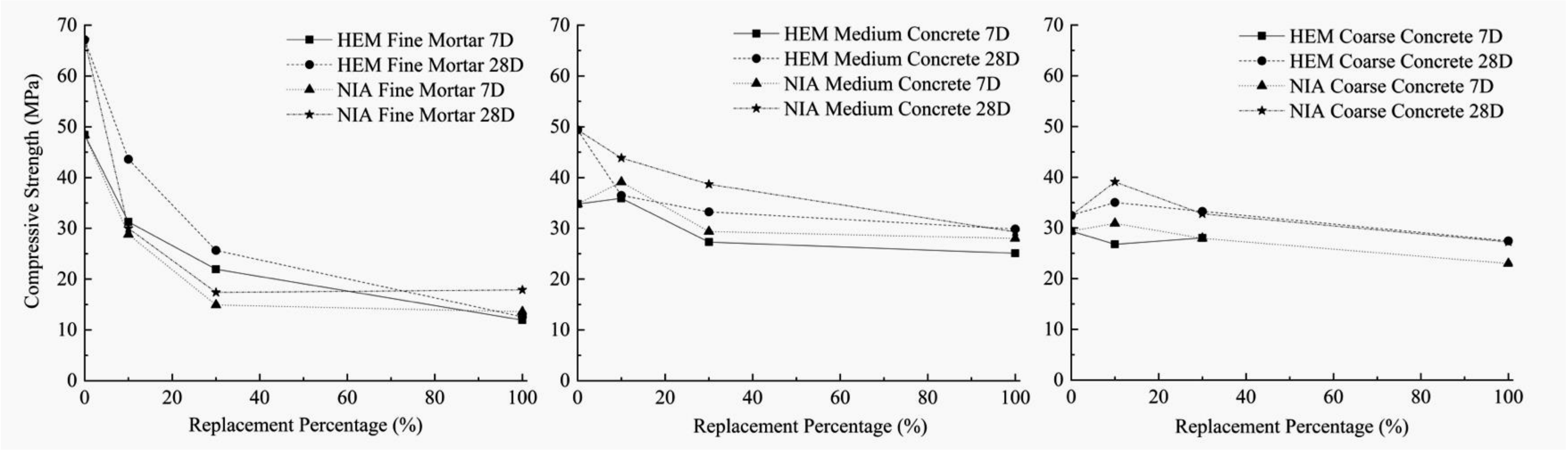
Coarse Fraction (10-15 %) 9.525 – 25.4 mm

Civil engineering- Concrete blocks

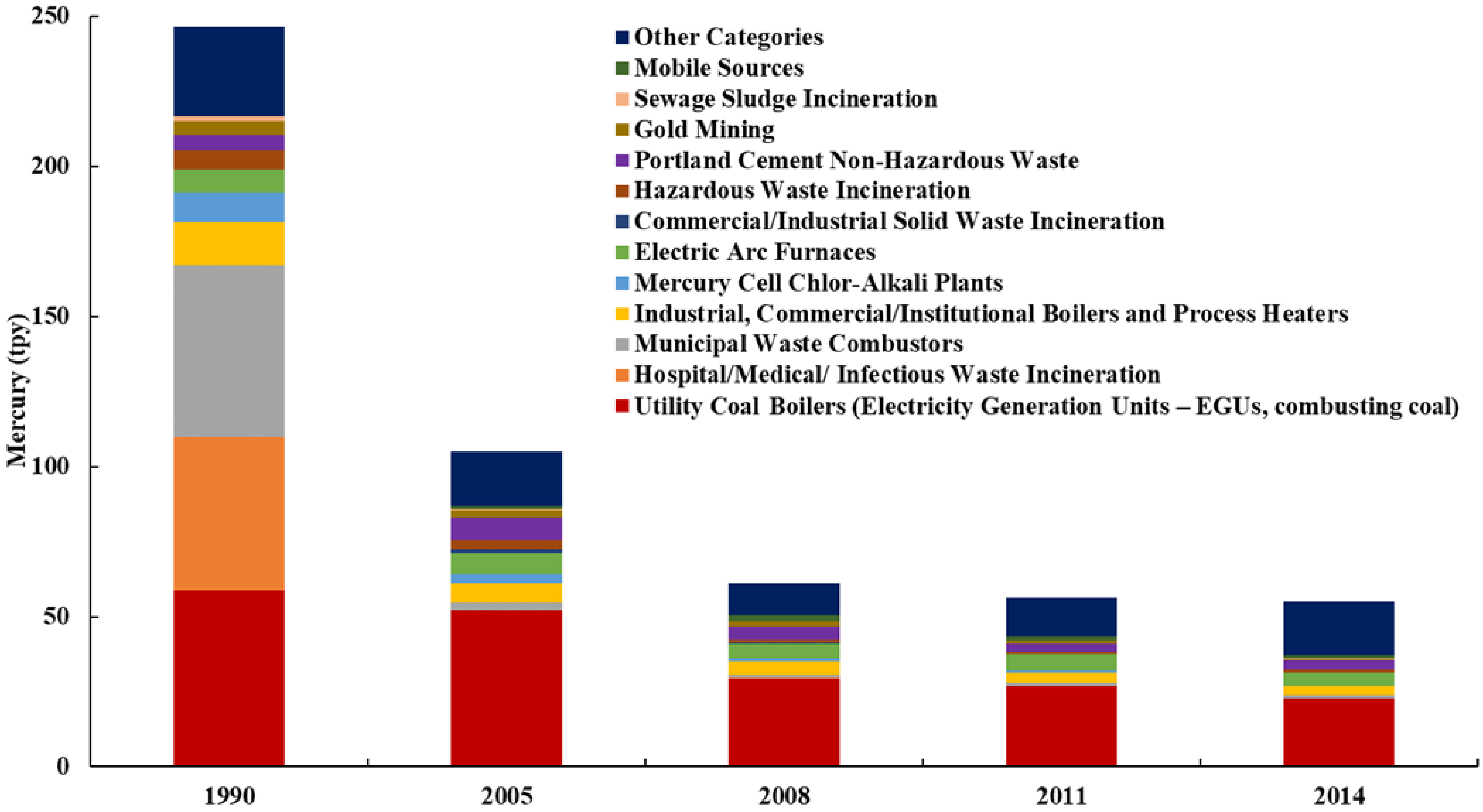
Concrete blocks produced: medium and coarse fraction

HEM medium 100% fractured surface

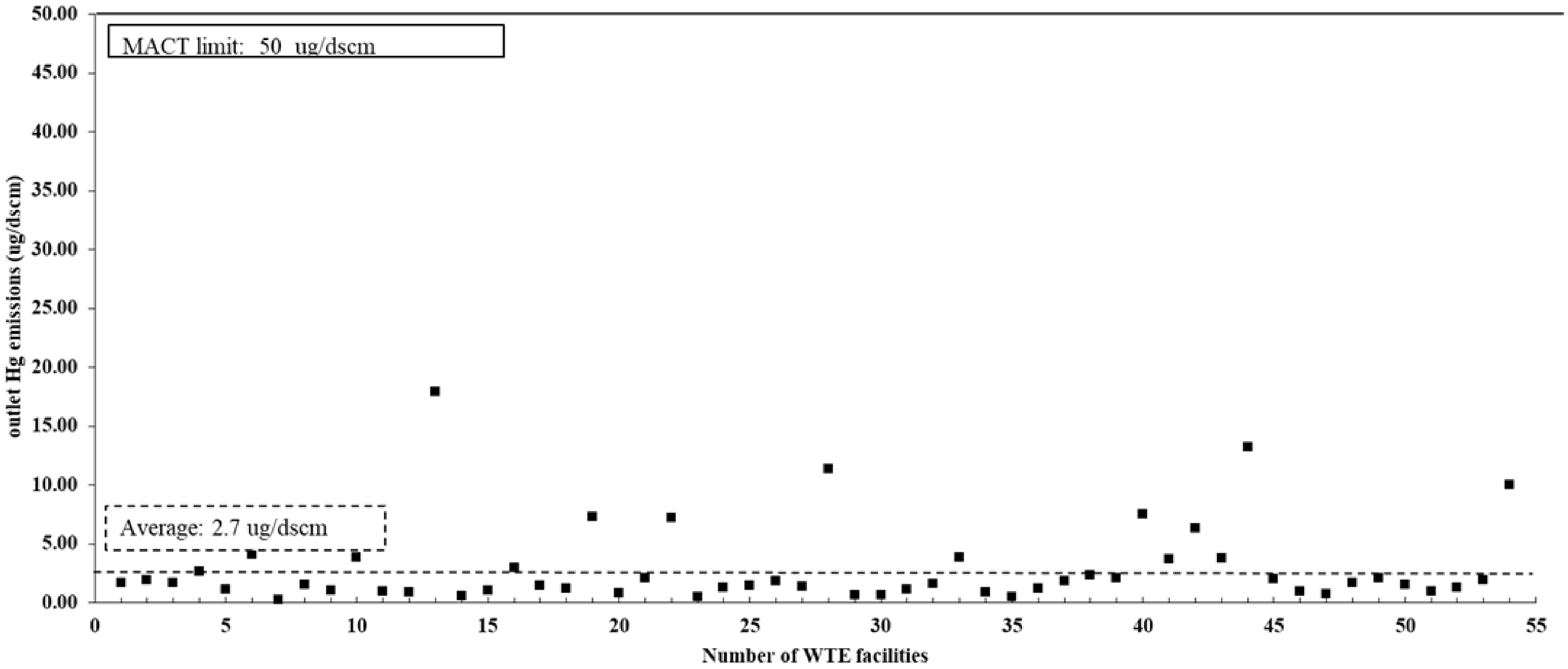
Mechanical Performance



Inventory of US mercury emissions to the atmosphere



Outlet concentration as reported by the WTE facilities

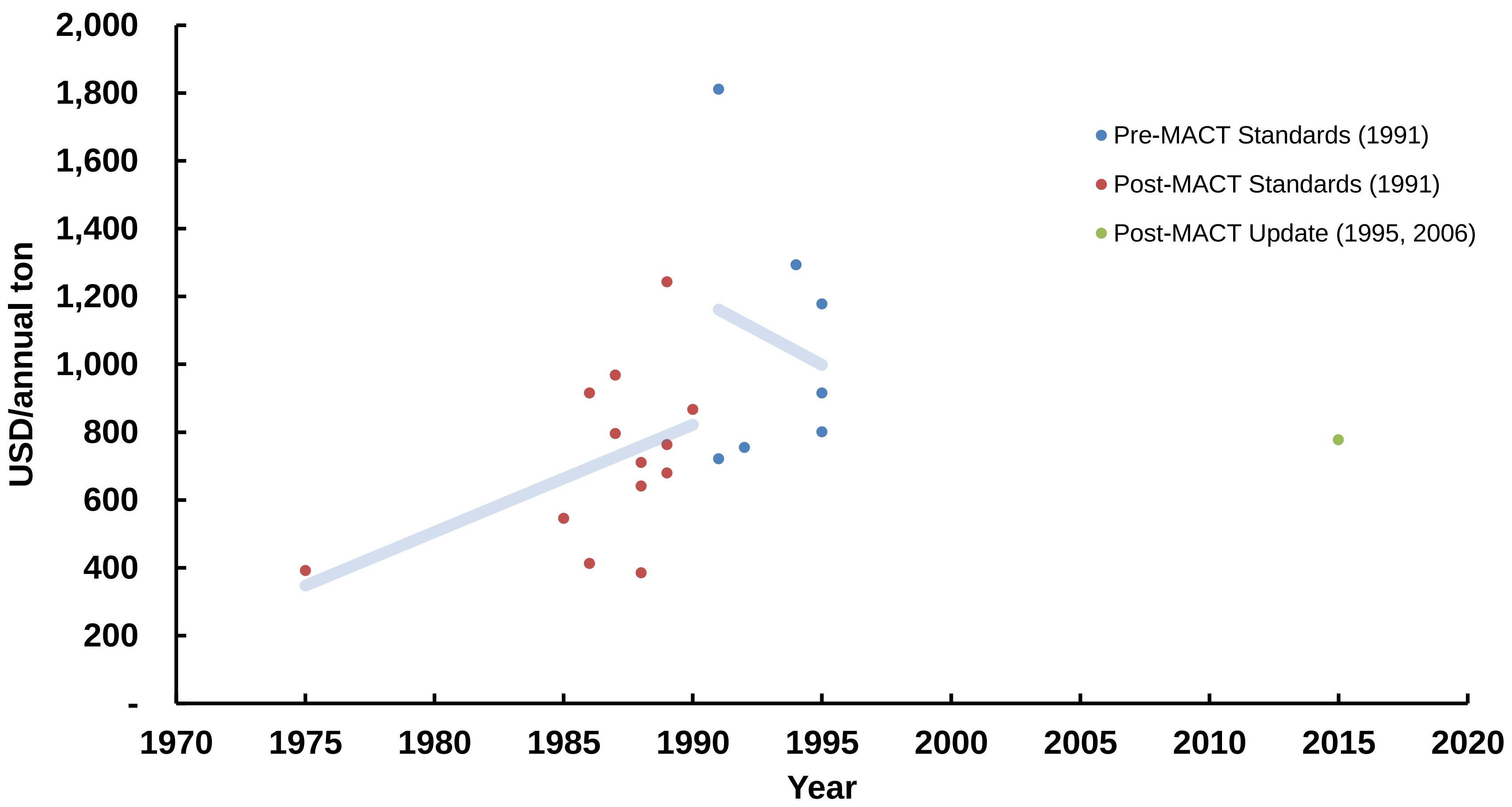


Inventory of US mercury emissions to the atmosphere

- The 2014 total anthropogenic emissions of mercury in the U.S. were 51.4 tons;
- The largest source of mercury were coal-fired pilot plants, 44.4% of total;
- Ferrous metals recycling emitted 5.5 tons and the cement industry 4.1 tons;
- The 2014 mercury emissions from WTE industry was 0.73% of total;
- The APC systems of the WTE plants had an average efficiency of 96.4%,
- Between 2001 and 2015 the U.S. WTE industry mercury emissions were reduced by a factor of six;
- Mercury in MSW has decreased by a factor of five, i.e. from 1.5 ppm in 2002 to 0.3 ppm in 2015.

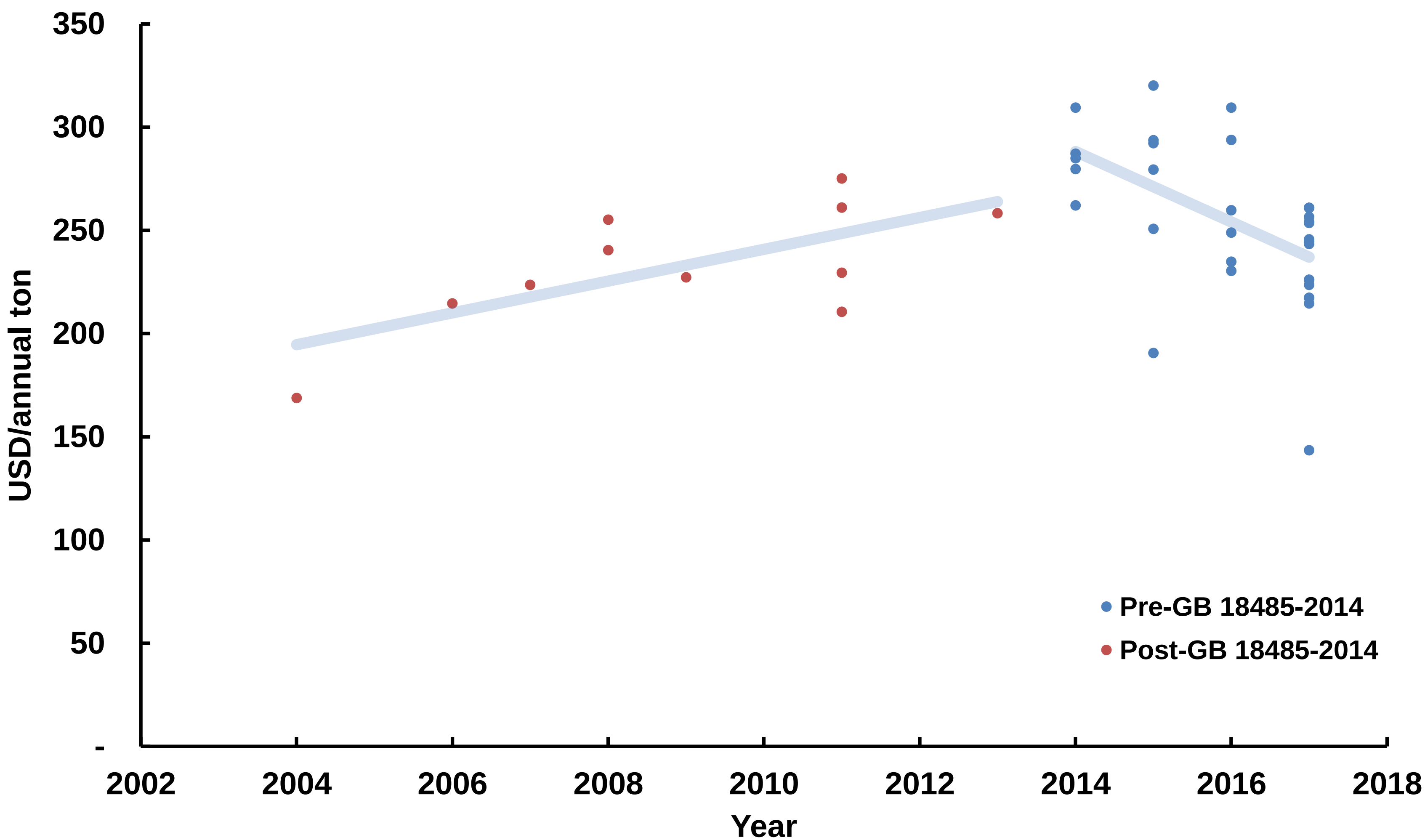
Cost of WTE in the US

Adjusted for Exchange Rates and Inflation



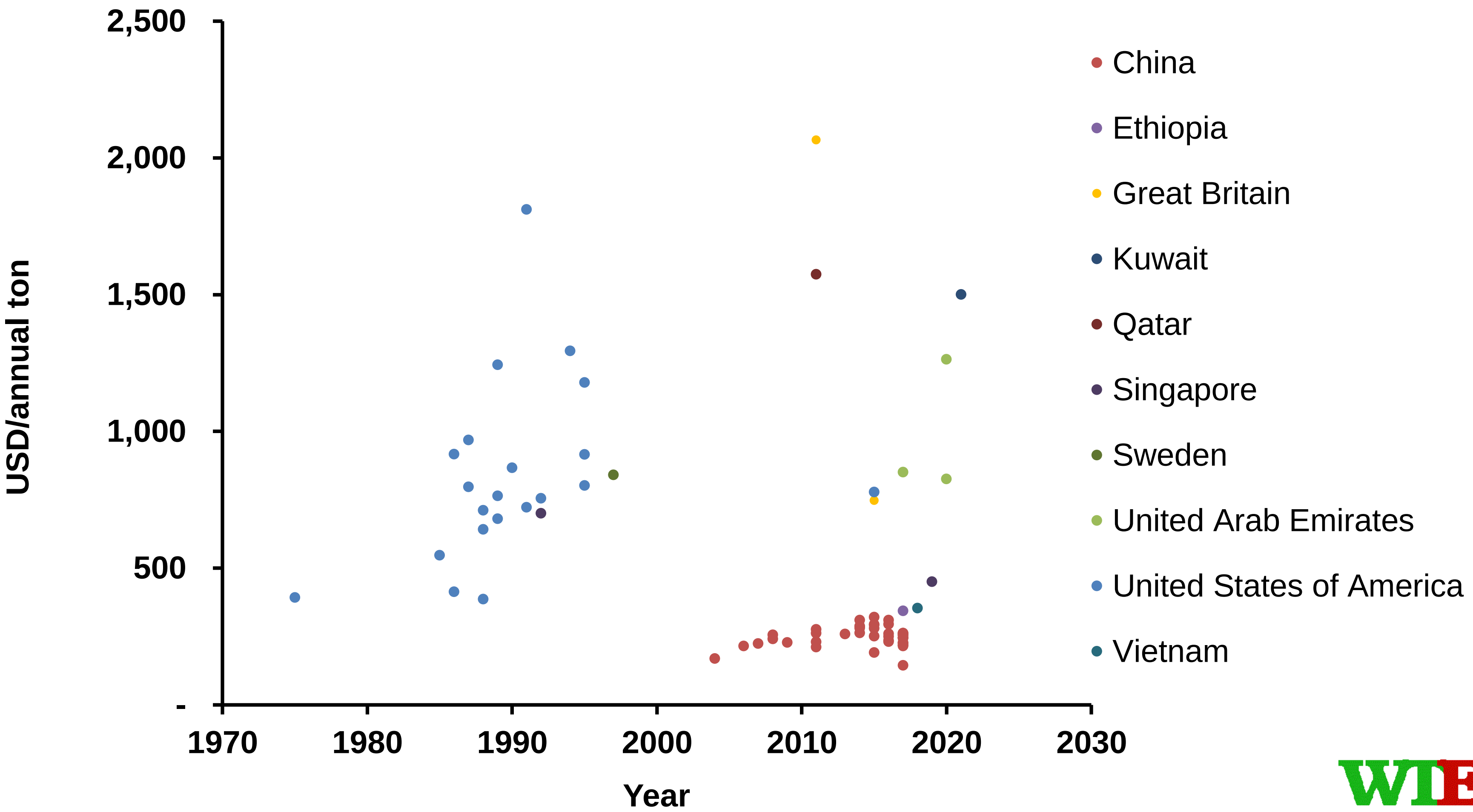
Cost of WTE in the China

Adjusted for Exchange Rates and Inflation



Cost of WTE by country

Adjusted for Exchange Rates and Inflation

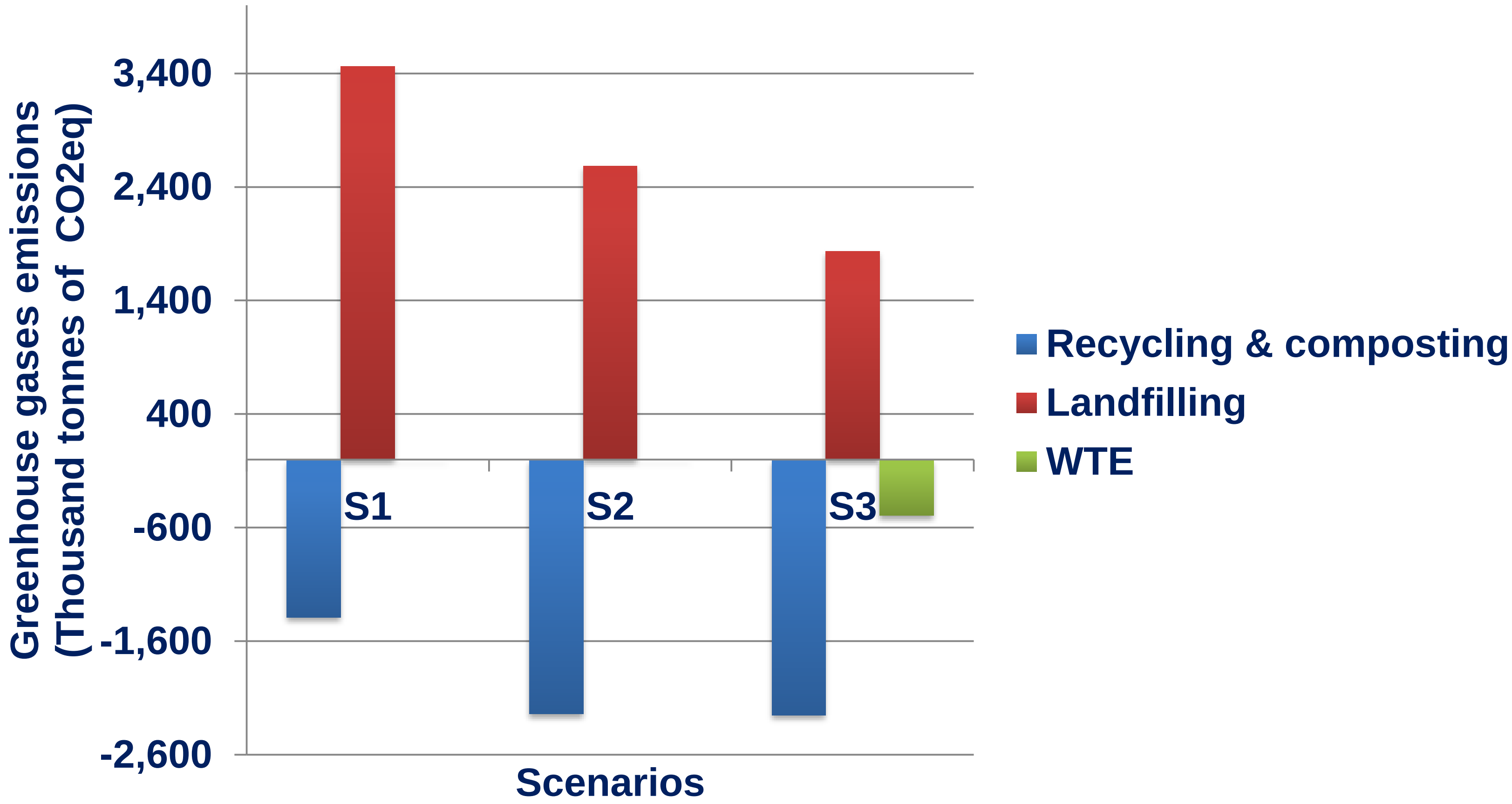


Jane Wu, 2018

Pre-feasibility study of a waste-to-energy plant in Santiago, Chile

- Capacity: 1 million tons per year
- Capital cost :$320MM
- IRR of 8.5%, carbon credits, metals recovery, and lower transportation costs have been ignored.
- Profitable up to a capital cost of $420 per ton of annual capacity.
- Analysis of NPV was conducted for different electricity prices and gate fees, break-even points of:
    - $42/MWh for electricity, and
    - $13.5 per ton for gate fees.

Comparison of three scenarios for 2020

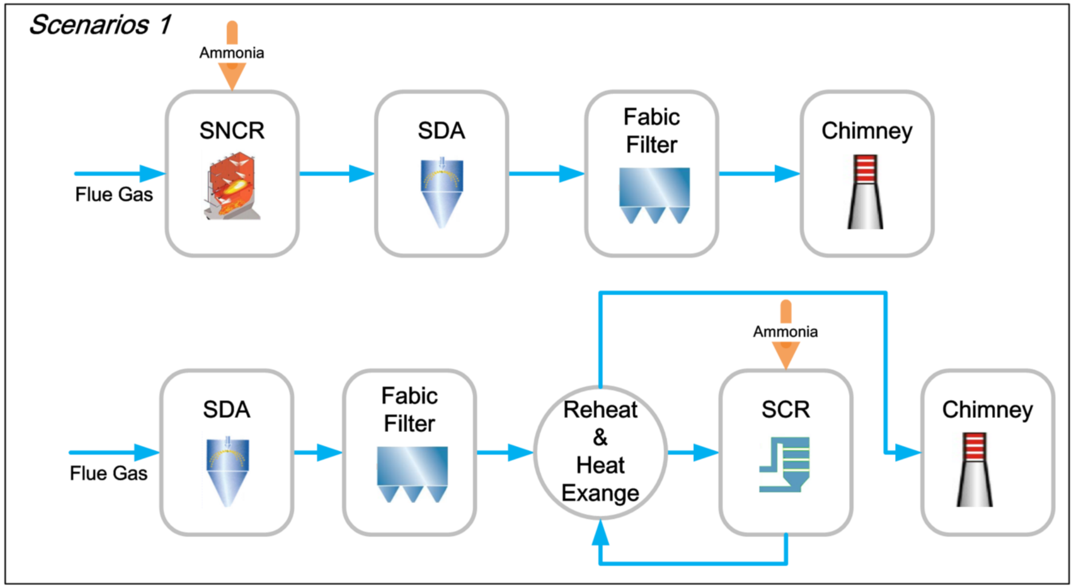


Landfills and WTE impact on individual cancer public health (based on one million tons of MSW per year)

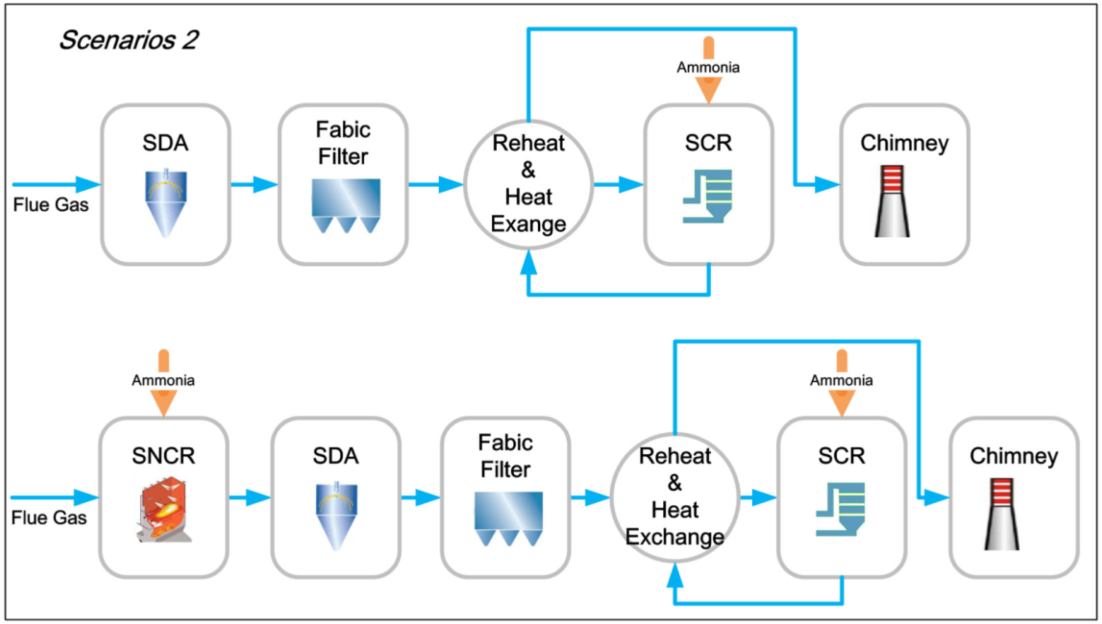
Methods	Individual cancer risks	Individual non-cancer risks
Landfill	4*10^-5	12
WTE	7.9*10^-6	2.3
Ratio between landfill to WTE	5.0	5.2

Environmental and cost effects of NOx reduction techniques in WTE facilities

(a) 200 mg/Nm^3
and the use of SNCR
or tail end SCR;



(b) 100 mg/Nm^3
and the use of tail end
SCR or a combined
SNCR and tail end



Weifen Chen, EEC/Columbia 2018

Environmental and cost effects of NOx reduction techniques in WTE facilities: Conclusions

- SNCR was the best-case scenario throughout the life cycle for GWP;
- SCR was the best-case scenario throughout the life cycle for the acidification, eutrophication, photochemical ozone and human toxicity potential;
- Higher resource consumption occurs for the scenarios with SCR technique;
- Higher energy requirements for the SCR scenarios due to reheat of the flue gas;
- High dust catalysts may be a good choice, however, higher energy consumption, i.e. operational costs, and higher cost of installation;
- If the permit for NOx requires limit to a level that cannot be achieved by SNCR, then a tail end SCR is recommended.

THANK YOU FOR YOUR ATTENTION!

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