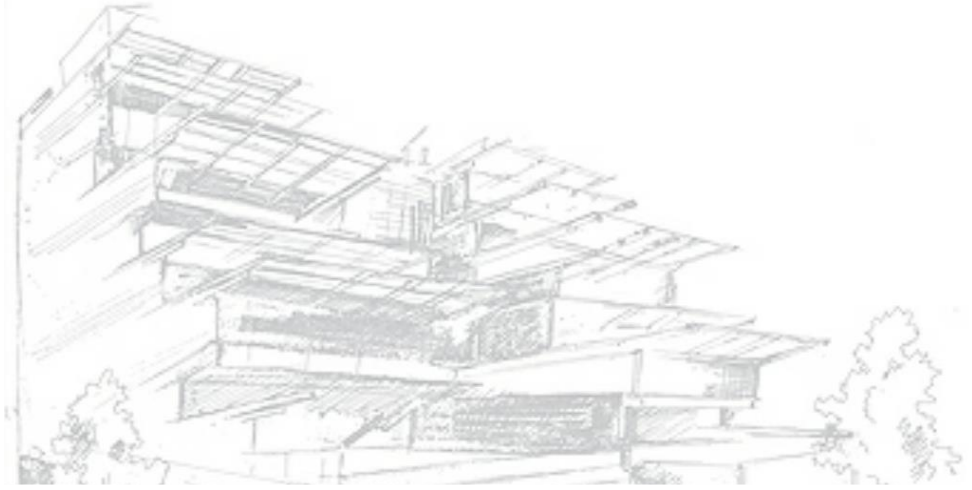

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# Projection of Atmospheric Mercury Emission in China

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**Tsinghua University**
**Nov 5, 2020**

# Calculating mercury emissions in China

## A technology-based emission factor method

$$E = c \times R \times \Pi(1-\eta) \times \theta \times A$$

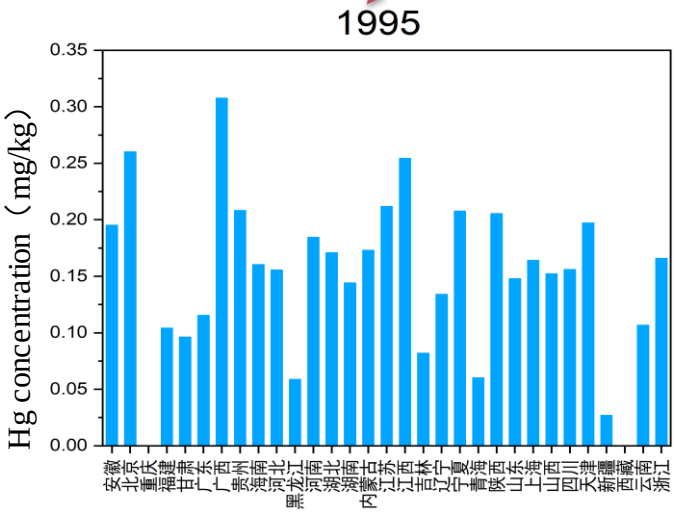
$A$: Activity levels

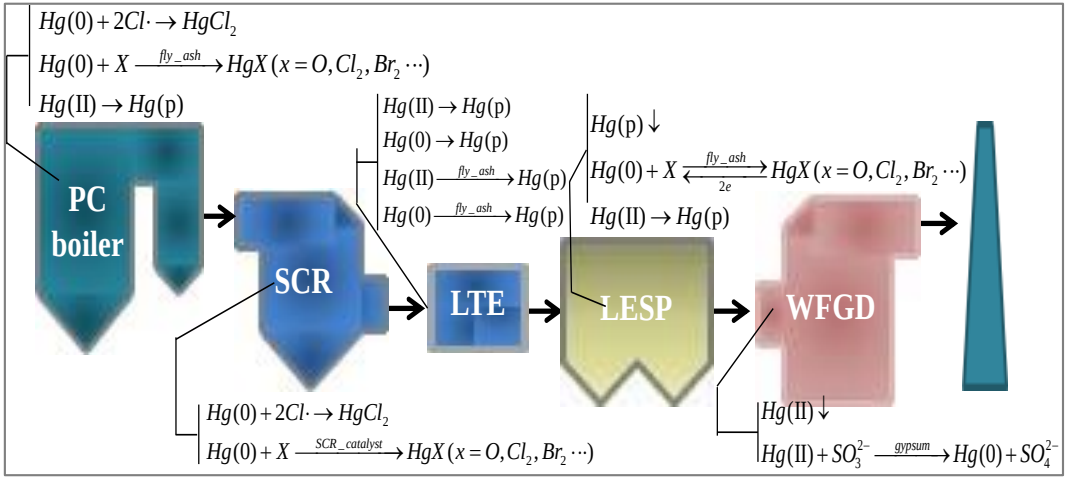
$c$: Hg concentration in fuel/raw materials

$R$: release

$\eta$: removal

$\theta$: speciation




Wu et al., Environmental Science & Technology, 2016, 50: 13428-13435; Zhang et al., ACP, 2016, 16(4): 2417~2433

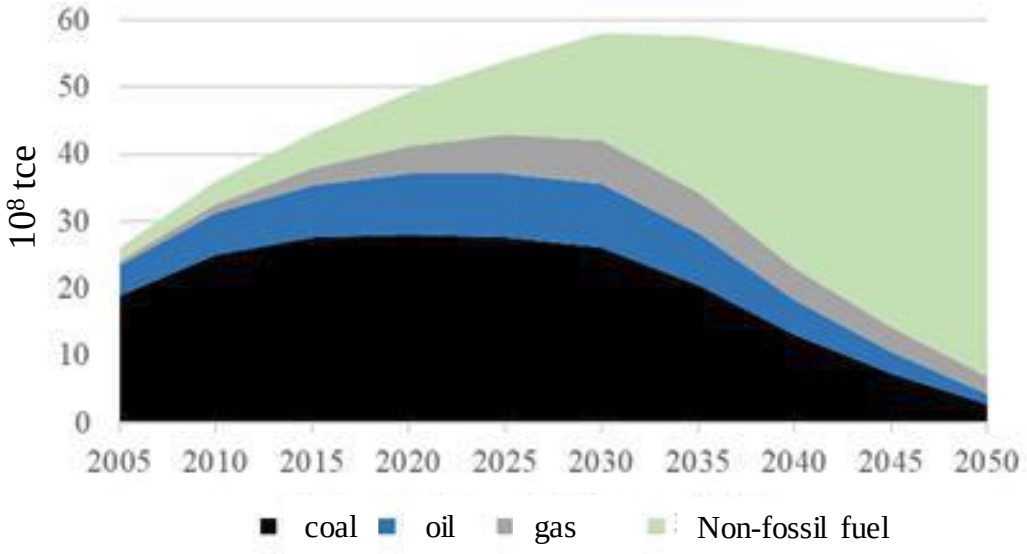
# Future activity levels: impact of climate policy

**China's climate goal: to have the $CO_2$ emissions peak before 2030 and achieve carbon neutrality before 2060.**

To achieve carbon neutrality by 2060, China will strive to achieve a long-term deep decarbonization oriented towards the 1.5℃ target.

- **By 2050, the total energy demand is 5 billion tce.**
- **The proportion of non-fossil energy is more than 85%.**
- **The proportion of non-fossil power in the electricity generation is over 90%.**
- **The proportion of coal in total energy is below 5%.**

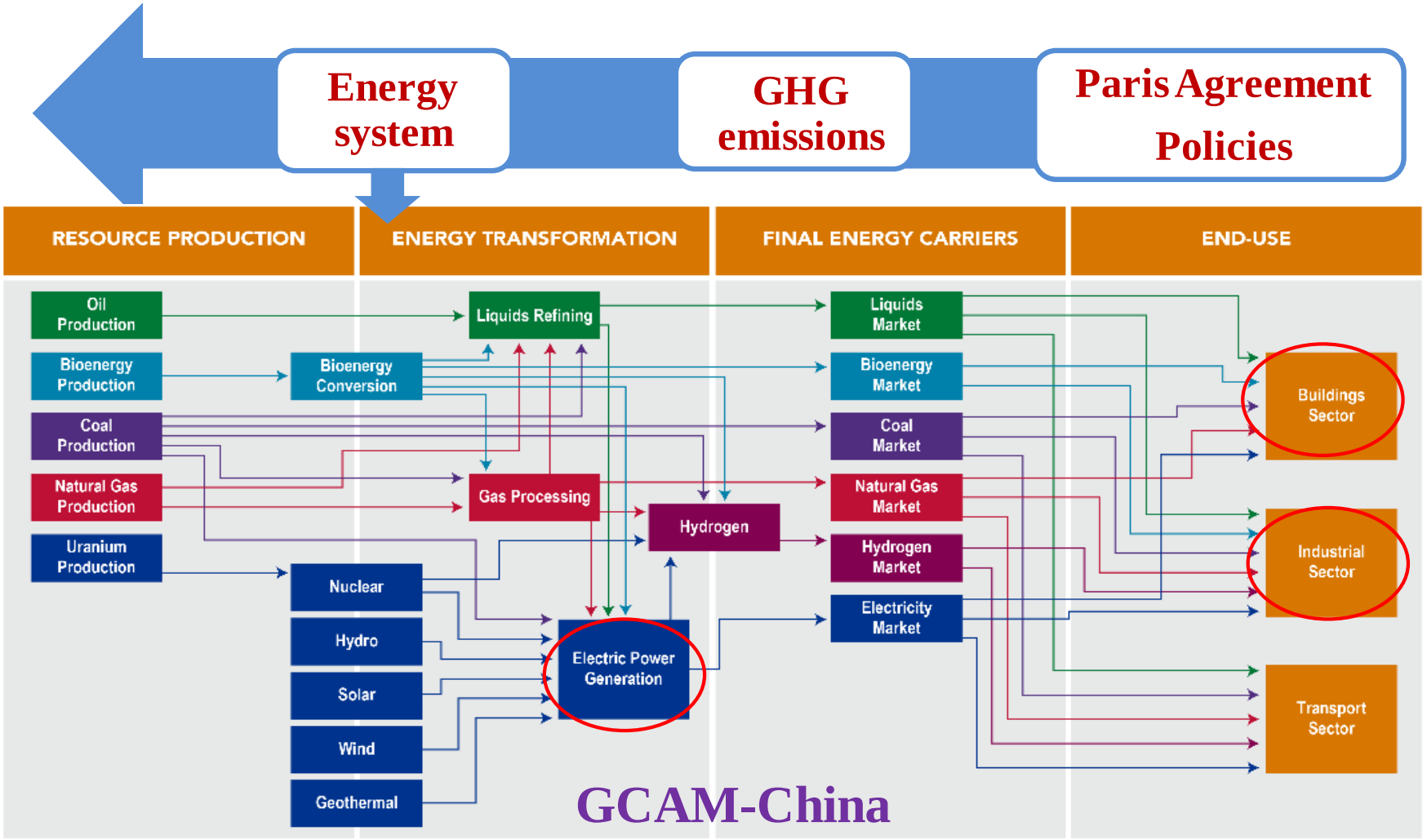
Primary energy consumption and composition of carbon dioxide net emission scenarios under the target of 1.5℃.



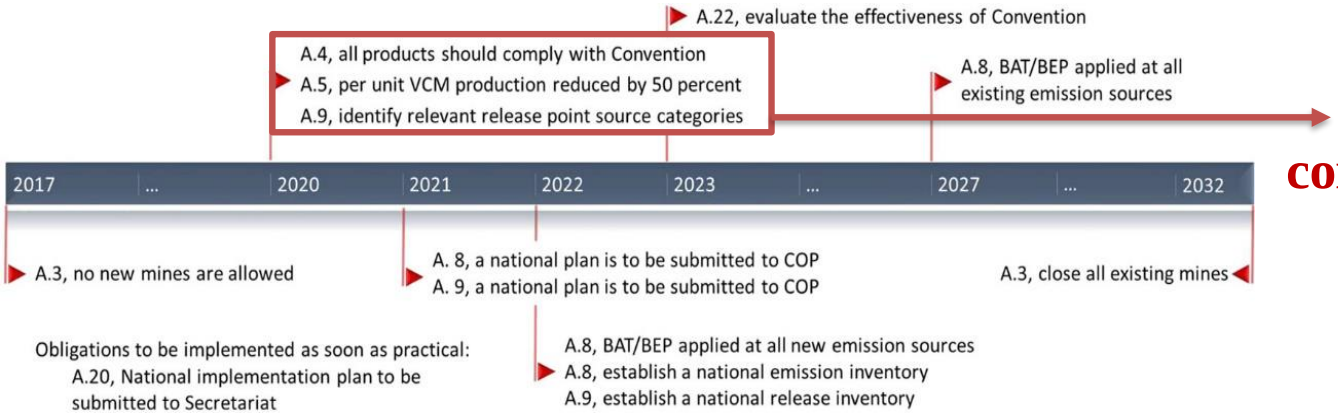

ICCSD, Tsinghua University, 2020

# Future activity levels: impact of climate policy

**The goal of carbon neutrality before 2060 will synergistically reduce the Hg emissions from energy sector (not limited to MC regulated sources).**



# Future activity levels: impact of Minamata Convention




**Reduction of Hg content in solid wastes**

| | | | |
|---|---|---|---|
| Fuel consumption | Coal-fired power plants | Incineration and interment | Waste incineration |
| | Coal-fired industrial boilers | | |
| | Residential coal combustion | | Biomass combustion |
| | Other coal combustion | | Interment |
| | Natural gas combustion | Production activities using Hg | Mercuric chloride catalyst production |
| | Oil refining | | Vinyl chloride monomer (VCM) production |
| | Oil combustion | | |
| Building materials production | Iron and steel smelting | | Thermometer production |
| | Cement production | | Sphygmomanometer production |
| | | | Fluorescent lamp production |
| Nonferrous metal smelting | Copper smelting | | Battery production |
| | Lead smelting | | Dental amalgam production |
| | Zinc smelting | Use of Hg-added products | Use of thermometer |
| | | | Use of sphygmomanometer |
| | Industrial gold smelting | | Use of fluorescent lamp |
| | Aluminum smelting | | Use of battery |
| Hg recovery | Hg production from recyclable resources | Primary Hg ore mining | Primary Hg ore mining |

Lin et al., National Science Review, 2017, 4: 677–679

# Future activity levels: impact of other policies

***Notice on the comprehensive implementation of domestic waste classification in cities at prefecture-level and above across the country.***

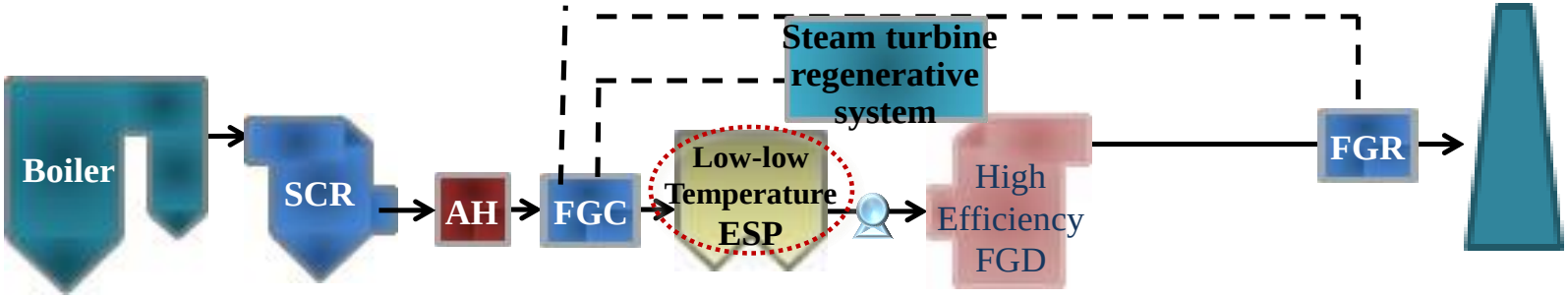
Before the end of 2019, all cities should prepare and complete the implementation plan for domestic waste classification. Clarify the standards for domestic waste classification, and promote the target tasks, key projects, supporting policies, and specific measures for promoting domestic waste classification.

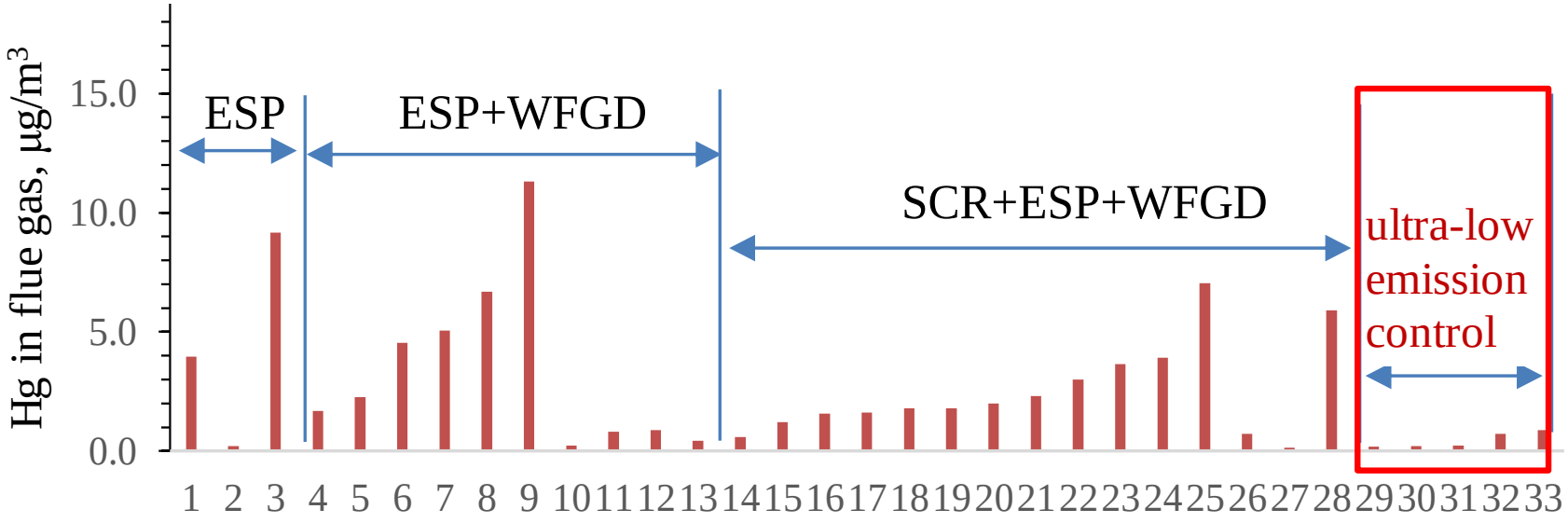

Figure source: https://news.cgtn.com/news/3d3d774d3459444d35457a6333566d54/index.html


Figure source: m.hxnews.com/news/gn/shxw/201907/10/1775402.shtml

# End-of-pipe control: coal-fired power plant

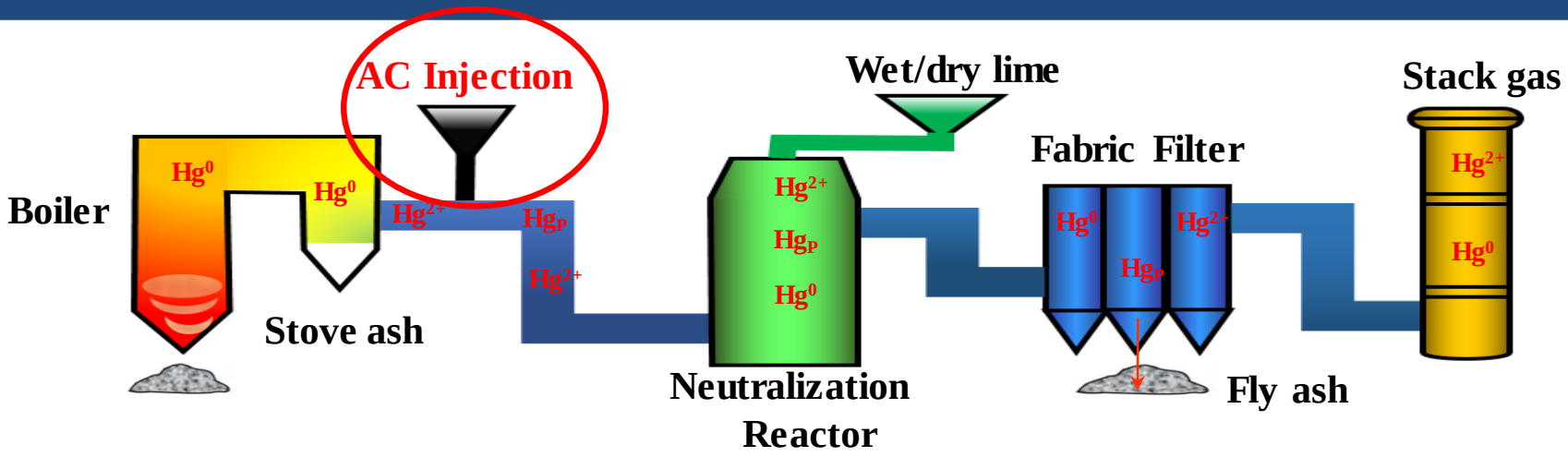
***Work plan to implement the ultra-low emission and energy-saving transformation for coal-fired power plants:*** By 2020, all coal-fired power plants complete the ultra-low emission transformation.




Wen et al., Journal of Hazardous Materials, 2020, 396: 122729

# End-of-pipe control: waste incineration

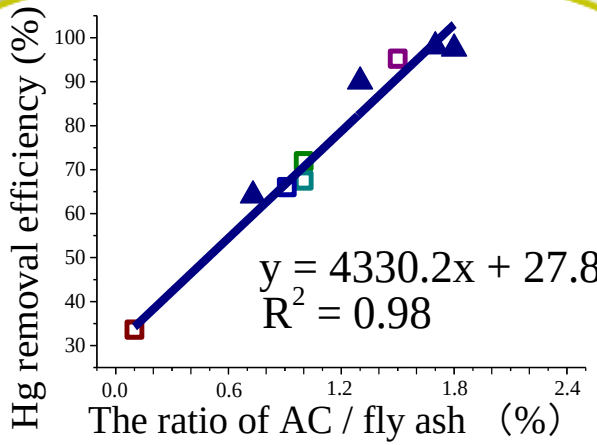



## Optimization of Carbon Injection Rate

170 mg·Nm$^{-3}$

100 mg·Nm$^{-3}$

**AC injection rate**




90%-95%

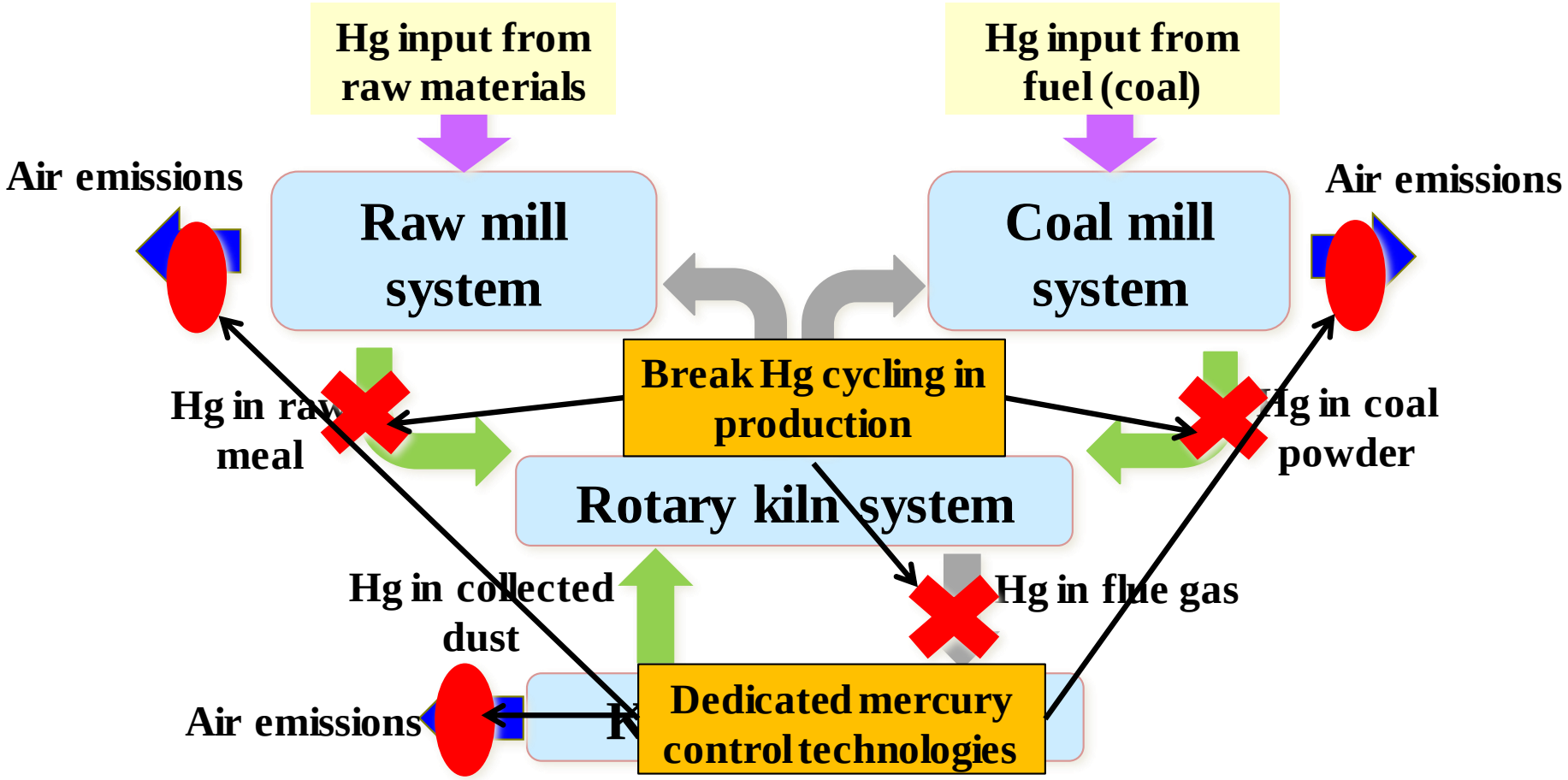
66%-78%

**Hg removal**

Li et al., Environmental Science & Technology, 2018, 52(4): 1940~1945

# End-of-pipe control: cement clinker production

- The mercury cycling significantly increases the Hg emissions.
- BAT/BEP technologies shall be applied to control Hg emission from cement.




Wang et al., Journal of Hazardous Materials, 2016, 302: 27~35

# Thanks for your attention!

**Contact me:**

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