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Future mercury emission reduction in China

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Representing China's clean air policies in GAINS

China is estimated to have emitted >25% of global anthropogenic mercury (Hg) emissions to the air in 2015[1], but its biggest Hg emission sources are undergoing rapid transformations as stringent policies to control emissions of PM, SO_2 and NOx and climate targets are implemented. The GAINS model[2] is ideally suited to compute and visualise scenarios of co-benefits from air pollution and greenhouse gas policies, thanks to an update to the Hg emission computation which considers existing pollutant control strategies, as well as mercury-specific controls for all emission sources. Here, we show two current legislation (CLE) and one maximum feasible reduction (MFR) scenarios for the IEA World Energy Outlook 2021 stated policies and net-zero emission projections[3].

GAINS simulates **current** and **future policies** to control individual air pollutants

→ PM, SO_2, NO_x, CO_2, CH_4, Hg…
→ 182 regions (35 for China)
→ 100+ Hg emission sources

https://gains.iiasa.ac.at/

Current Legislation

Co-benefits from PM and SO_2 control

Fabric filters, electrostatic precipitators (ESP), flue gas desulfurization (dry/wet FGD) or acid plants remove significant amounts of mercury from flue gas and are considered Best Available Technologies (BAT) for most industrial flue gases. The PM and SO_2 control strategies are implemented on the province level.

Max. Feasible Reduction

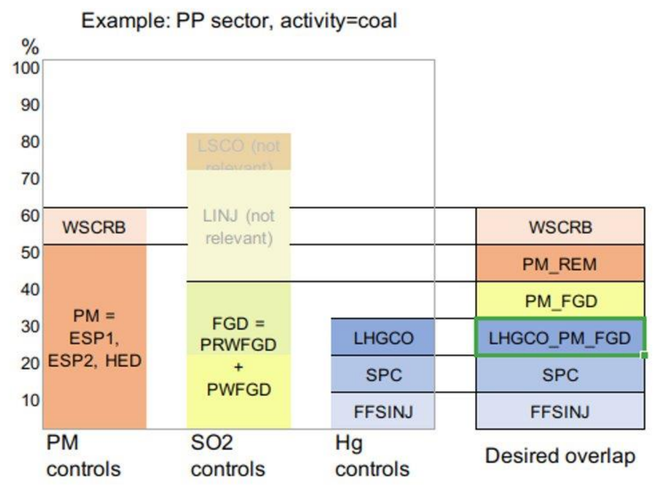
Dedicated Hg controls

- Power sector, industrial production: 100% application of sorbent injection with added fabric filters by 2050
- Artisanal & small-scale gold mining, caustic soda production: phasing out / banning activity.

Technology	Removal efficiencies* [%]→	Power plants	Industrial processes	Others (incl. ASGM, caustic soda)
ESP, High-efficiency dedusting (incl. FF)		38.2 – 51.4	41.4	
ESP/HED + Flue gas desulphurization		79.2 – 85.9	61.6	
Sorbent injection + fabric filter		86.8 – 95.2	90.7	
Ban				100

* Dependent on sector / fuel used (e.g. hard coal, brown coal, waste)

Fig. 1: Combining PM, SO2 and Hg control strategies



Activity Projections

Baseline:
IEA World Energy Outlook 2021: "Stated Policies Scenario"(STEPS)

Climate Policy:
IEA World Energy Outlook 2021: "Net Zero Emissions by 2050" (NZE)
Strong focus on greenhouse gas reduction, projections for non-ferrous metal production, waste and ASGM as in baseline scenario

Both scenarios:
Addition of **Hg-specific activities:** share of ASGM of total gold mining, cremation, VCM production, Hg mining

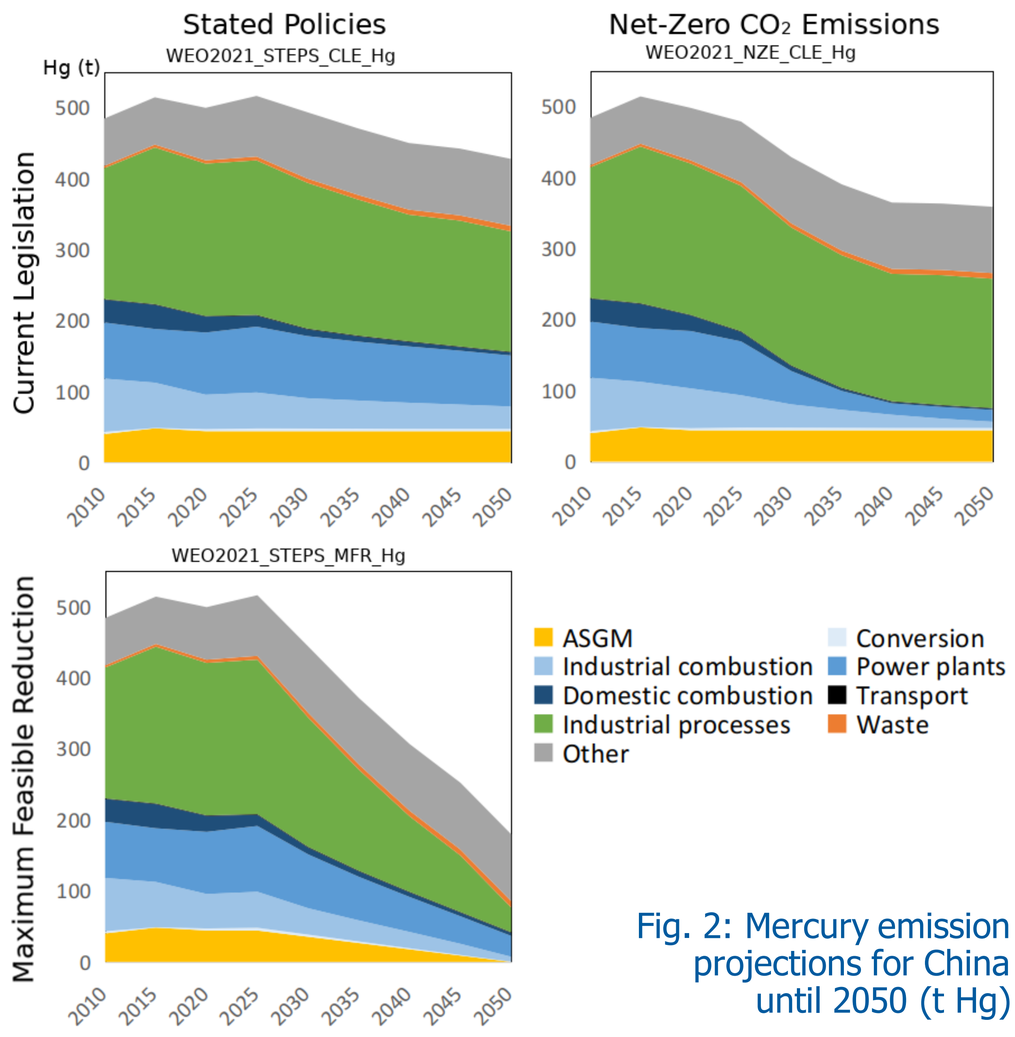


Fig. 2: Mercury emission projections for China until 2050 (t Hg)

Conclusion & Outlook

- GAINS now generates a mercury control strategy based on PM and SO_2 pollution control technologies
  --> Quantification of co-benefits.
  --> Mercury emissions can be quantified for every policy scenario in GAINS
- All analysed scenarios achieve mercury emission reduction below 2015 values
- To achieve substantial emission reduction below 300 t/year, abatement options for mercury release from industrial processes need to be applied and activity projections for these sectors need to be refined.
- A recording of the Hg-GAINS workshop on 19.7.2022 is available on the ICMGP'22 platform for anyone wishing to understand and possibly use Hg-GAINS!

I'd love to get in touch - contact me at brocza@iiasa.ac.at!

1. AMAP / UNEP, 2019. Technical background report to the global mercury assessment 2018. Arctic Monitoring and Assessment Programme, Oslo, Norway / UN Environment Programme, Che and Health Branch.
2.Rafaj, P.; Bertok, I.; Cofala, J. & Schöpp, W., 2013. Scenarios of global mercury emissions from anthropogenic sources Atmospheric Environment, *Elsevier BV, 79*, 472-479
3. IEA, 2021. World Energy Model Documentation, October 2021, IEA Publications.

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