Precious Metals Refining: A Pathway To A Sustainable Future

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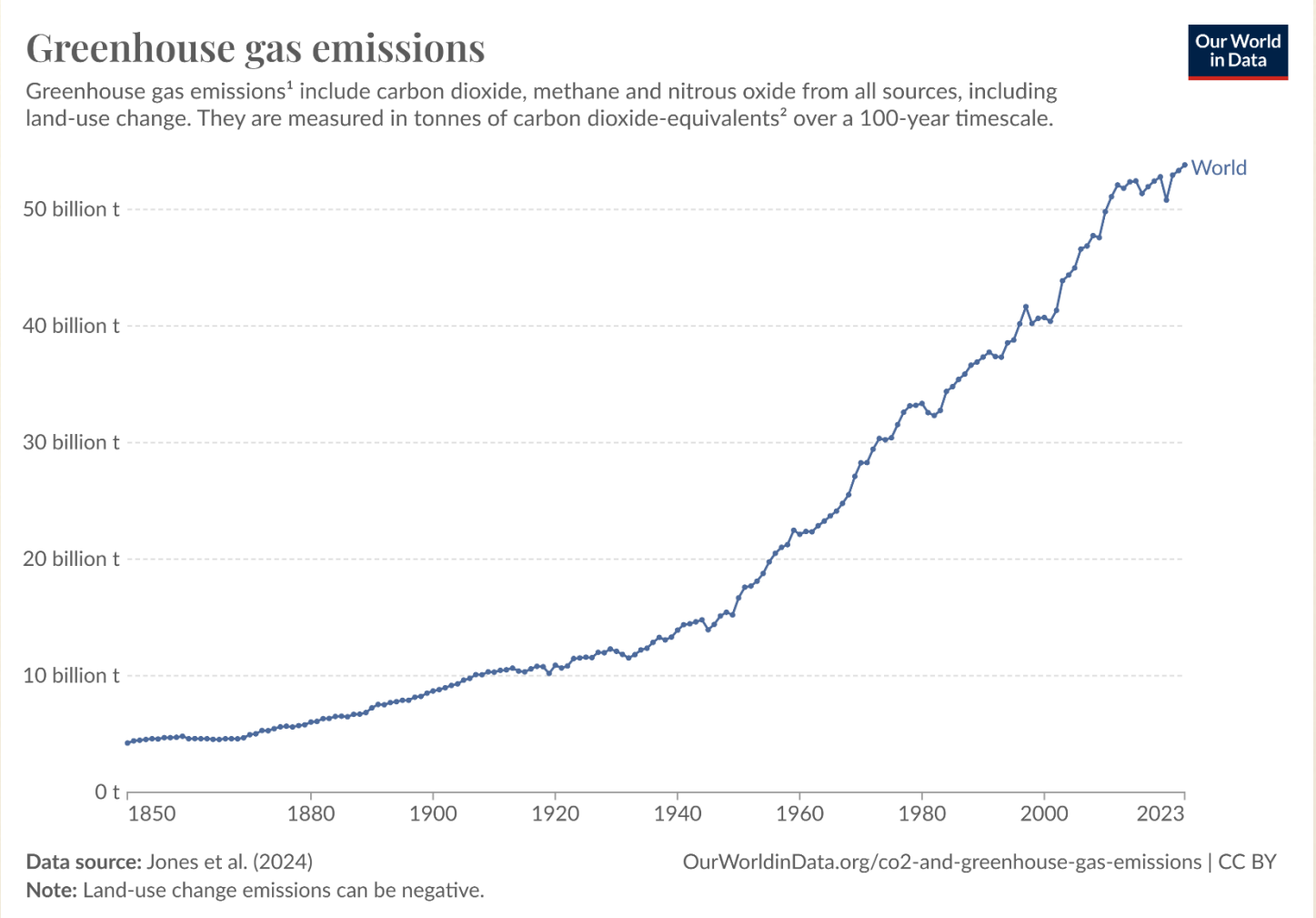
WHAT IS SUSTAINABILITY?

CARBON FOOTPRINT

- Total greenhouse gas emissions caused directly or indirectly by a company
- Measured in tonnes of carbon dioxide equivalents (CO_2e)
- Gold industry emissions estimated to be 126 million tonnes CO_2e in 2017
- 53.8 billion tonnes of CO_2e were emitted globally in 2023
- Australia's net zero emissions target by 2050



HOW DO WE QUANTIFY?

SCOPE ONE

Direct Emissions

Emissions from sources owned or controlled by the company

SCOPE TWO

Indirect Emissions

Emissions generated by purchasing electricity consumed by the company

SCOPE THREE

>99%

Indirect Emissions

All other emissions generated from sources not owned or controlled by the company

METHODS FOR REDUCING CARBON FOOTPRINT

- Review and optimise existing processes
- Reduce consumable and chemical usage
- Utilising renewable energy sources
- Improving energy efficiency
- Reducing waste
- Support green technologies and sustainable practices

STORY AS REFINERS

- Refining methods are similar for most refiners globally
- Refining precious metals relies heavily on chemicals
- Aqua Regia, Miller Process (Chlorination), Electrolytic Gold Refining
- Chemical usage contributes to the carbon footprint and waste generation

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PROCESS OVERVIEW - TRADITIONAL

Miller Process (Chlorination):

- **Flexible** – Can deal with a wide range of impurities
- **Scalability** – Easily expandable with equipment changes
- **Efficient** – More chlorine means more reaction
- Forms chloride byproducts
  - Requiring further chemical treatment
  - Generates additional waste during recovery
- Safety considerations – Chlorine is hazardous

PROCESS OVERVIEW - RECENT

AcidLess Separation (ALS):

- Works by vacuum distillation and condensation
- Dependant on vapour pressures between metals
- Using electricity (can be sustainably sourced)
- Without the use of chemicals
- High Ag metallic condensate
  - Reduces chemical treatment processes

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SUSTAINABLE REFINING - BENEFITS

- Reducing operational costs
- Reducing chemical footprint
- Reducing waste generation
- Reducing carbon footprint
- Safer working environments with less hazardous materials

CONSIDERATIONS OF ALS REFINING

- Refining capacity is confined by ALS condenser size
- Potential of extracting more Au than intended into the Ag condensate
- Challenges in fully separate certain base metals (Fe, Cu, etc.)
- Reliance on downstream processes to remove impurities
- Highlights challenges of eliminating Miller Process (Chlorination)
- The combination of both technologies provides flexibility and reduces carbon footprint

THE PATHWAY TO A SUSTAINABLE FUTURE

Questions?

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