

Decarbonizing Steel

- ## How the steel industry is cutting coal

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Presenters

Margaret Hansbrough

Climate campaigner, advisor, and consultant specializing in industrial decarbonization. She served with the the Government of the United Kingdom in the Department of Business, Energy, and Industrial Strategy (BEIS) as senior policy advisor for COP 26, helping craft and launch the Glasgow Breakthrough on Steel. She spent three years at Waxman Strategies and Mighty Earth launching heavy industrial campaigns. In 2023 she will be launching a new corporate steel climate watchdog organization focused entirely on accelerating the pace of steel industry decarbonization.

Caitlin Swalec

Chemical engineer and environmental data science professional with experience in heavy industry decarbonization, renewable energy technology, and natural resource management. Caitlin manages a team of researchers and leads the Global Steel Plant Tracker project at Global Energy Monitor.

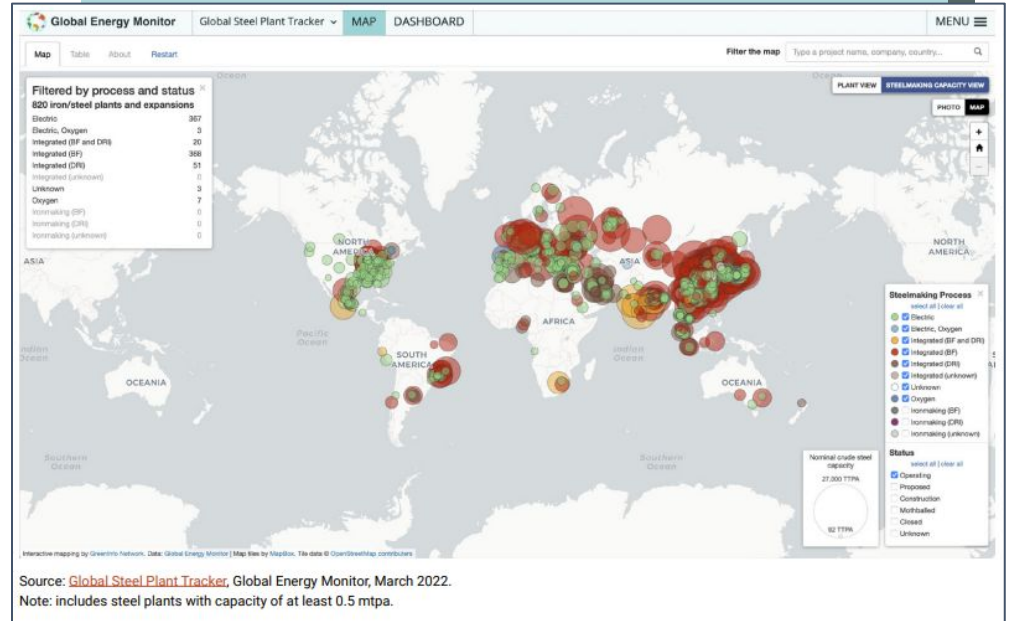
Overview

- I. Iron & steel industry and climate emissions
- II. Iron & Steelmaking process
- III. Important highlights from Global Energy Monitor (GEM)
- IV. Underreported emissions from coal mining
- V. 1.5C scenarios for steel decarbonization
- VI. Global and regional policy developments
- VII. EU Scenarios
- VIII. Standards discussion & met coal
- IX. Recent examples from the news
- X. Key Takeaways



Why do we care about iron and steel plants?

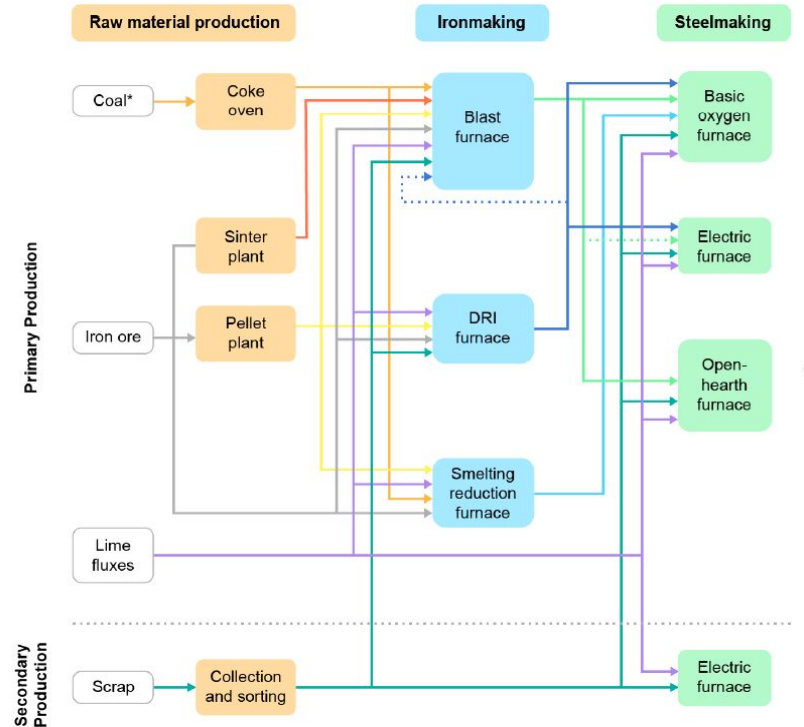
- 11% of global carbon dioxide emissions and 7-9% of global greenhouse gas emissions
- Steel is essential and demand will continue to grow
- Steel is “difficult” to decarbonize





Coal can be used in two ways in iron/steelmaking:

- As a power source
- As a raw material





Three main routes of steel production:

- BF-BOF
- DRI-EAF
- Scrap-EAF

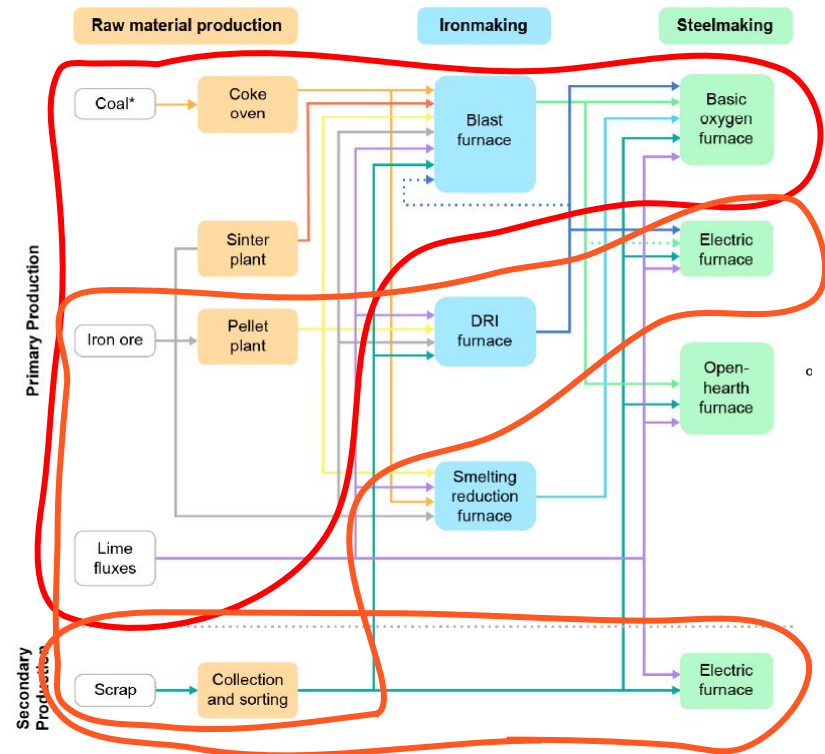
Steel Terms

Blast furnace (BF)

Direct reduced iron (DRI)

Basic oxygen furnace (BOF)

Electric arc furnace (EAF)





How does GEM track iron and steel plants?

- Asset-level tracking of iron and steel plants as well as individual blast furnace units (to be released in 2023)
- Capacity of at least 0.5 mtpa crude iron or steel
- Covers over 90% global crude steel production and 89% global crude iron production

82 countries included

957 steel plants tracked

500+ plant owners

2.9B tonnes annual crude steel capacity



Annual assessment of the global steel industry

Pedal to the Metal

2022
**IT'S NOT TOO LATE TO ABATE EMISSIONS FROM
THE GLOBAL IRON AND STEEL SECTOR**

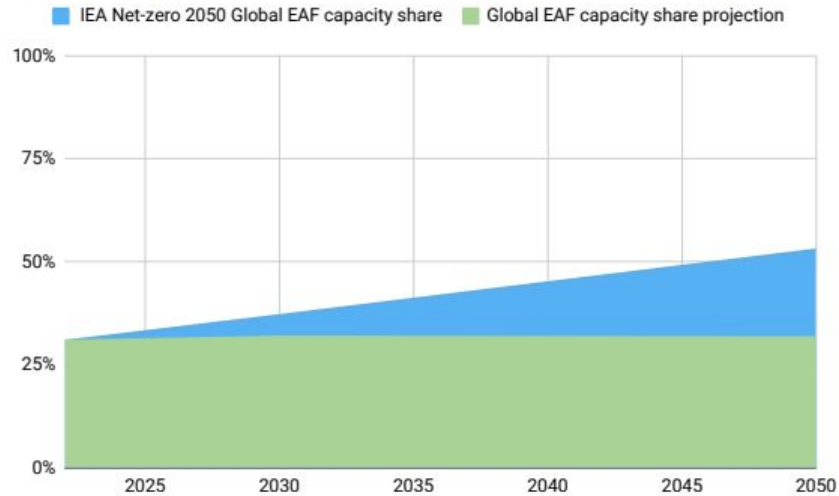
Caitlin Swalec





Shift away from BF-BOF capacity is too slow

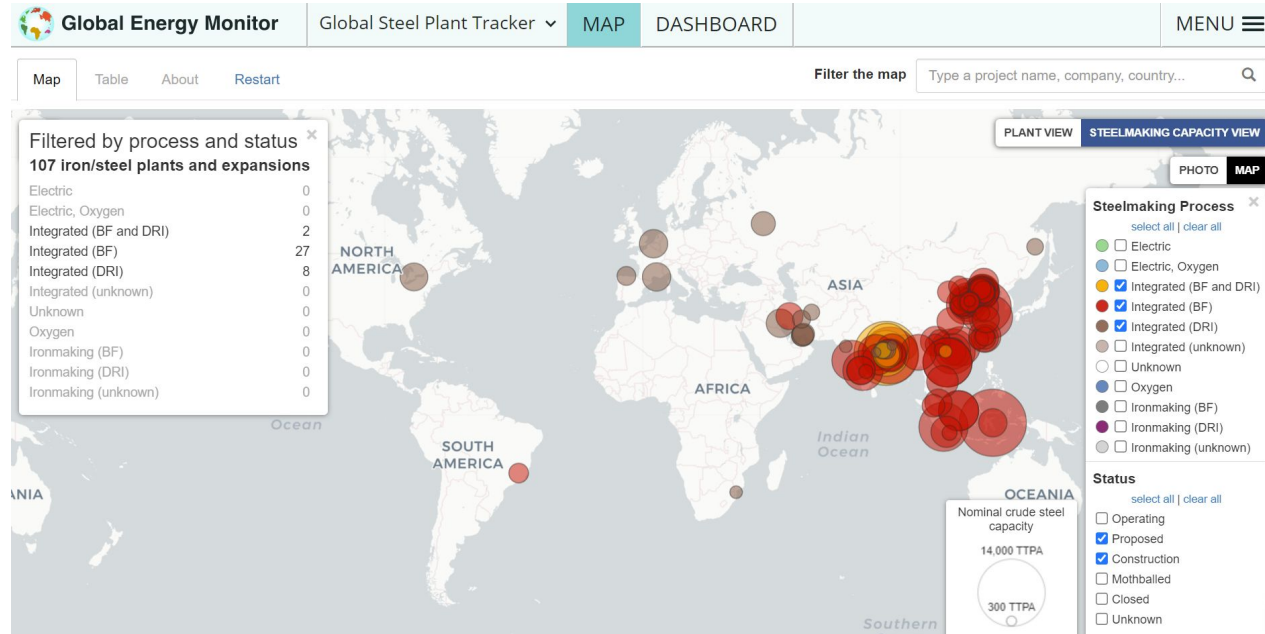
Figure 5: Current plans for steelmaking capacity development put shift towards EAF production behind decarbonization targets



Source: EAF capacity projection data from [Global Steel Plant Tracker](#), Global Energy Monitor, March 2022.
EAF capacity net-zero projection from 1.5C pathway in [IEA Net-zero by 2050](#).

Asia is the steel capacity development hotspot

- 80% of BF-BOF steelmaking capacity under development is planned in China (158 mtpa) and India (123 mtpa)
- Additional 14% planned in Indonesia (24 mtpa), Vietnam (16 mtpa), and Malaysia (12 mtpa)



<https://globalenergymonitor.org/projects/global-steel-plant-tracker/tracker-map/>



Stranded asset risk is much higher than previously thought

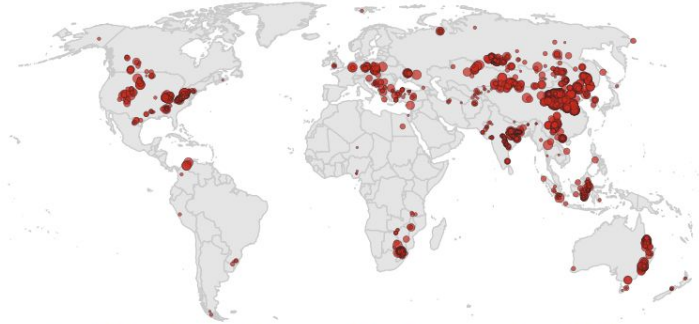
- Previously estimated \$47-70 billion USD stranded asset risk
- New pledges to lower national emissions and improved tracking of steel plant projects
- Now estimating \$345-518 billion USD stranded asset risk
- This is from capacity under development only; operating steel capacity faces additional risk

\$518 billion USD



Underreported emissions from coal mining

Figure 3: Global methane emissions at operating coal mines



The red dots represent operating coal mine methane emissions, scaled to emissions in million cubic meters per year. Source: Global Coal Mine Tracker and GEM analysis.

- Steel industry currently emits approximately 2.6 Gt direct CO₂ emissions and 1.1 Gt indirect CO₂ emissions from the power sector and combustion of steel off-gases
- Methane emissions from metallurgical coal mining could add an additional 1 Gt CO₂-e₂₀ to this footprint (27% increase)
- All of these “extra” emissions are attributable to BF-BOF steelmaking; one more reason to move away from coal-based steel production



Annual assessment of the global steel industry

- Shift away from BF-BOF capacity is too slow
- Asia is the steel capacity development hotspot
- Stranded asset risk is much higher than previously thought
- Clear standards, definitions, and policies needed
- Underreported emissions from coal mining

Pedal to the Metal

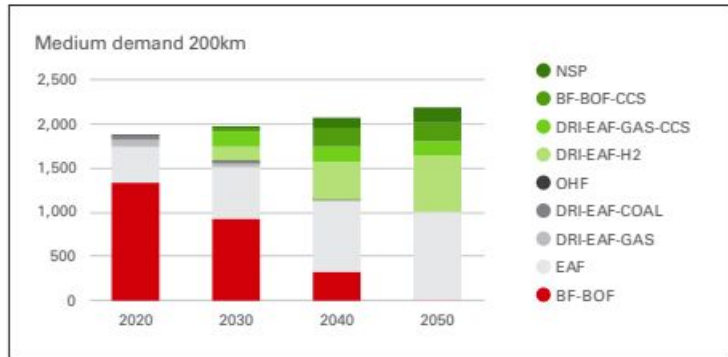
2022

**IT'S NOT TOO LATE TO ABATE EMISSIONS FROM
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Caitlin Swalec



Steel Decarbonization Basic Facts



- Primary steel production from blast and basic oxygen furnaces using coal accounts for about 70% of all global steel production, secondary steel production from electric arc furnaces accounting for 30%
- By 2030, 1.5C degree warming alignment will require direct emissions net reduction by 29-31% for the steel sector and an emissions intensity per ton reduction of 27-29%.

Four key levers for a 1.5C aligned steel sector

- Recycled electric arc furnace (EAF) steel with renewable electricity needs to account for around 49% of market by 2050
 - Material efficiency across entire value chain is the most immediate near term tool and at least a 25% material intensity decline will be required by 2050
- Primary steel from hydrogen direct reduced iron (HDRI) followed by an EAF
 - Milestones productions ranges for this still pilot stage technology will need be 6-16.1% by 2030 and 23.1-42.2% by 2050
- Synthetic gas fired furnaces with 90% carbon capture and storage (CCS)
 - CCS may be used on a range of 3.7%-12.9% of global steel by 2030 and 2050 it will be 6.2%-21.6%.
- Blast furnace basic oxygen furnaces (BF-BOF) with -90% CCS
 - No BF-BOFs without 90% CCS can be built past 2025 or risk stranded assets

Challenges to Address

- Adequately prioritizing material efficiency on supply and demand side
- Going from pilot stage to cost competitive commercialization of hydrogen, CCS, and other emerging technology by 2030 in key markets around the world
- Dramatically scaling up steel industry access to large sources of renewable electricity (4 to 7 times the electricity demand growth as compared with 2020)
- Potential decoupling of ironmaking and steelmaking where competitive advantages may exist and ensuring competitive benefits of reconfigured supply chain
- Enabling policy and investments, geopolitical and trade alliances needed in next few years to shift momentum all in the face of growing global disruptions
- All existing coal based production plants will have a relining or refurbishment date that will ultimately need be the key point of intervention for shifting toward cleaner technology

Steel Breakthrough Agenda

- At COP 26, 40 world leaders representing 70% of the world's economy signed the five pillar cross sector Breakthrough Agenda, which included Power, Road, Steel, Hydrogen, & Agriculture
- The Steel Breakthrough sets to make near-zero emission steel the preferred choice in global markets, with efficient use and near-zero emission steel production established and growing in every region by 2030
- The IEA monitors and reports progress on this agenda annually and it provides an ongoing global framework for cooperation across the following: standards and definitions demand creation and management; research and innovation; trade conditions; finance and investment; landscape coordination

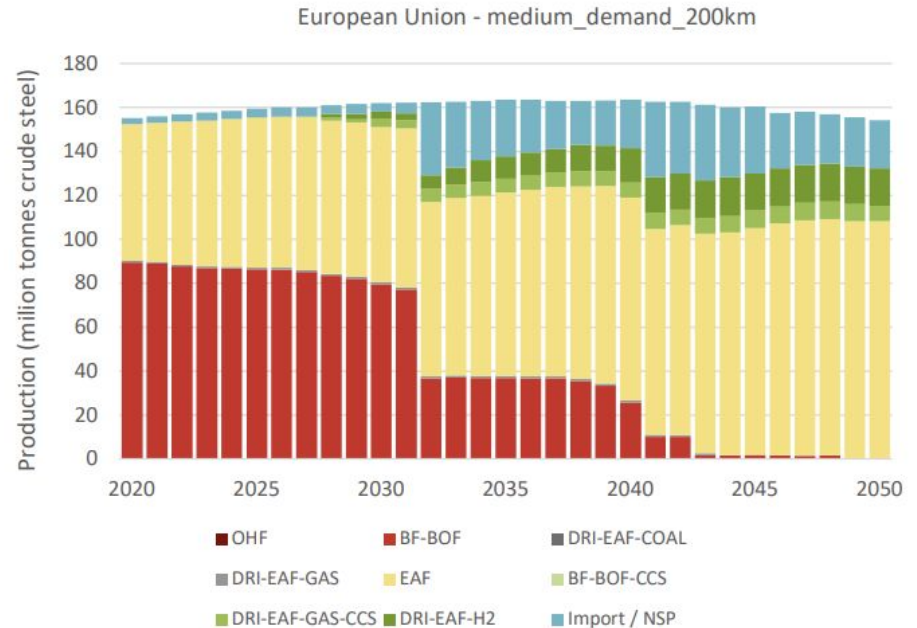
Recent Key Policy Developments

- The Inflation Reduction Act (IRA) passed in the US set aside billions for making cost competitive clean technologies like green hydrogen combined with direct reduced iron making and “Buy Clean” government purchasing of zero and low emissions steel and concrete
- EU is positioning further policy incentives to accelerate the pace and scale of industrial decarbonization in the EU to keep pace with what is fast becoming a competitive race to zero for industrial manufacturing
- A Carbon Border Adjustment Mechanism (CBAM) passed at the end of 2022 in the EU to ensure the EU can prevent emissions leakage in industries like the steel sector and also position its own industries to compete on both cost and emissions
- India’s recent passage of a \$2.4 billion subsidy program for green hydrogen is one of the loudest signals yet that governments are betting big on coal free industrial pathways

EU Scenarios

- EAF growth in EU expected to drive emissions reduction between now and 2030 with a steady decline in coal based steelmaking and dramatic drop off after 2030 if not before
- HDRI+EAF wasn't expected to take off until after 2030, recent announcements show companies staging for transition to hydrogen ready DRI already and full transition to green hydrogen once it is ready at scale and cost with early movers in Sweden and Spain expected to be fully online by 2025

Technology Transition





Clear standards, definitions, policies in development

- Emissions-based definitions are in development and coming online rapidly
 - Met coal mining emissions are addressed
- Differences between demand and supplier side definitions
- Standards currently under development include the Science Based Targets initiative



**MISSION
POSSIBLE
PARTNERSHIP**



SCIENCE
BASED
TARGETS

DRIVING AMBITIOUS CORPORATE CLIMATE ACTION



West Cumbria Mining Ltd decision

- First new UK coal mine approved in 30 years
- Decision delayed from fall 2021 to 2022 (after COP27)
- Metallurgical coal mine intended for steelmaking
- Little to no domestic demand, likely to be exported
- UK government states that scope 3 emissions (upstream and downstream including coal mine methane) are “immaterial” to environmental impact assessment
- UK government also insists that project is compatible with Net Zero 2050 goals as mine will close by 2049
- Leaves questions about boundary setting in emissions calculations (scope, time frame, etc)



HSBC Met Coal

- On December 14, 2022: HSBC announced their updated Thermal Coal Phase-Out Policy:
 - “The updated thermal coal phase-out policy also prohibits finance for new metallurgical coal mines.”
- First major financial institution to explicitly include and target metallurgical coal in coal phase-out/climate plans



HBSC Met Coal

- HBSC pledges to not provide new finance to any client for new metallurgical coal mines
- HBSC definitions and exclusions:
 - metallurgical coal mines = coal mines where 30% or less of production or coal reserve is thermal coal
 - new metallurgical coal mines = new met coal mines or major capital equipment for met coal mines, or expansion of existing met coal mines that involve geographically separate locations
 - metallurgical coal activities = exempted activities under the pledge (includes iron and steel)
 - HBSC explicitly excludes met coal mine emissions from thermal coal financed emissions target and includes this under iron and steel financed emissions

Key Takeaways

- If met coal mine emissions are accounted for in steel sector emissions, the footprint of the industry could rise as much as 27%
- The steel industry is investing in technologies that reduce emissions by not using coal, metallurgical or thermal
- CCS/CCUS may play a needed role for emissions mitigation in steel, but there is not yet a scaled 90% capture project for post combustion on a BF-BOF
 - And this is based on modeling that does not account for coal mine methane emissions
- Standards setters and financial institutions are raising the bar on targeting met coal
 - There's a clear trend that the transition away from met coal has begun

Thank You

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Appendix: Resources

Much of the information for this presentation is derived from the IDDRI report Netzerosteel.org and its authors Chris Bataille, Seton Siebert, and Francis Li. Their modeling and reports use the Global Energy Monitor Steel Plant Tracker which is also used as a resource for this presentation.

www.netzerosteel.org &
<https://globalenergymonitor.org/projects/global-steel-plant-tracker/>

Additional factbase is derived from International Energy Agency's (IEA) steel and heavy industry reports and findings and recent news articles.

Appendix: Climate Bonds Initiative Coal Mine Methane response

- CBI is an international organization that verifies and certifies capital for climate action
- Sets sectoral approaches for finance certification
 - Addressed steel in Summer 2022
 - During [public comment](#) on steel criteria, they received multiple comments citing GEM's 2022 Pedal to the Metal findings on coal mine methane (CMM) and steel production with inquiries about how CBI would address CMM from steel perspective
 - In response to these comments, CBI added [Section 6.3](#) which creates MRV (monitoring, reporting, and verification) in line with United Nations best practices for methane emissions
 - Not as ambitious or aggressive as we'd hope, but the public comments did shift CBI's approach to CMM from being non-existent in the steel criteria to documented
 - We manage what we can measure so this is a baby step in the right direction

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