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King coal? Clean coal? Tradeoffs and opportunities for emissions reductions within the Southeast.

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Introduction

Currently, coal-based electricity accounts for roughly **39%** of all generation within the Southeastern U.S., producing more than **65 million tons of CO₂ annually**.¹ With recent renewed interest in **clean coal** and **coal jobs**, it is worth taking a closer look at the full picture of coal emissions.

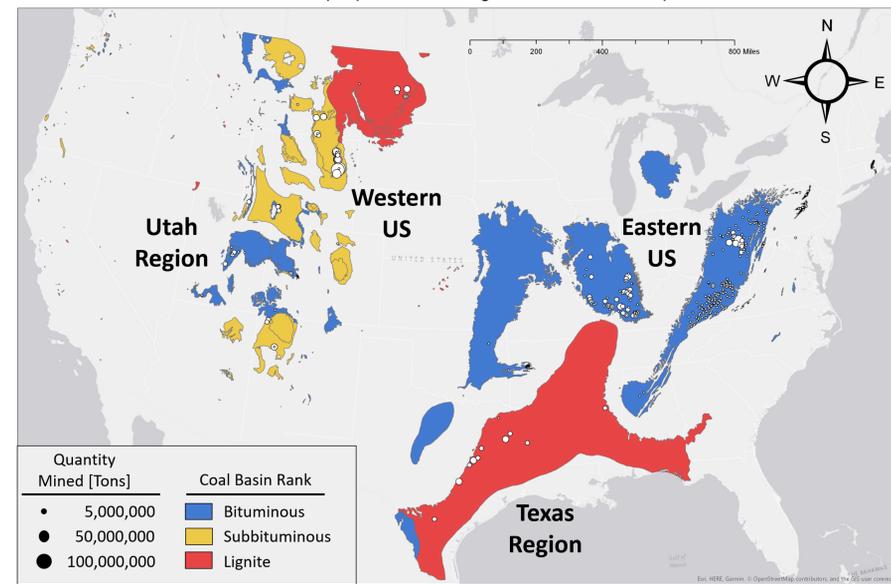
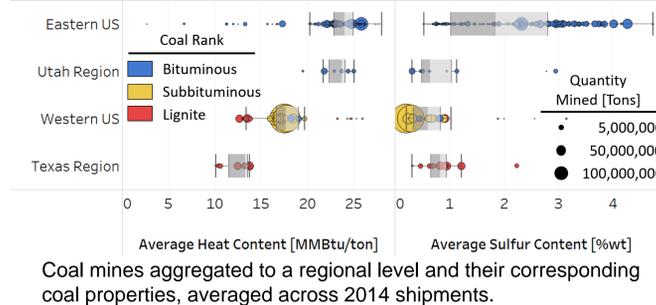
The goal of this study is to:

- 1) Analyze coal properties from each coal mine within the U.S.
- 2) Determine rail transportation routes and distances for every power-plant related coal transaction from 2008-2016.
- 3) Analyze every coal plant's transportation emissions, and their relation to operational emissions.
- 4) Discuss emissions tradeoffs and reduction opportunities through policy proposals for the Southeastern U.S.

Geography & Geology

The U.S. contains several coal basins of varying coal quality.³ **Bituminous** coal has the highest heat content and highest sulfur content, and is mined in the east. **Subbituminous** coal is mined in Wyoming, and has moderate heat content and low sulfur content. **Lignite** coal is mined near Texas, and has the lowest heat content.

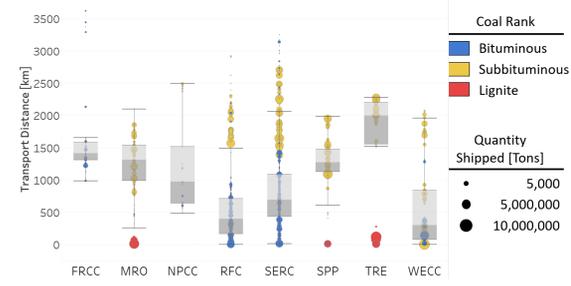
To avoid sulfur, which causes **acid rain**, power plants purchase significant quantities of coal from the western, **subbituminous** mines.



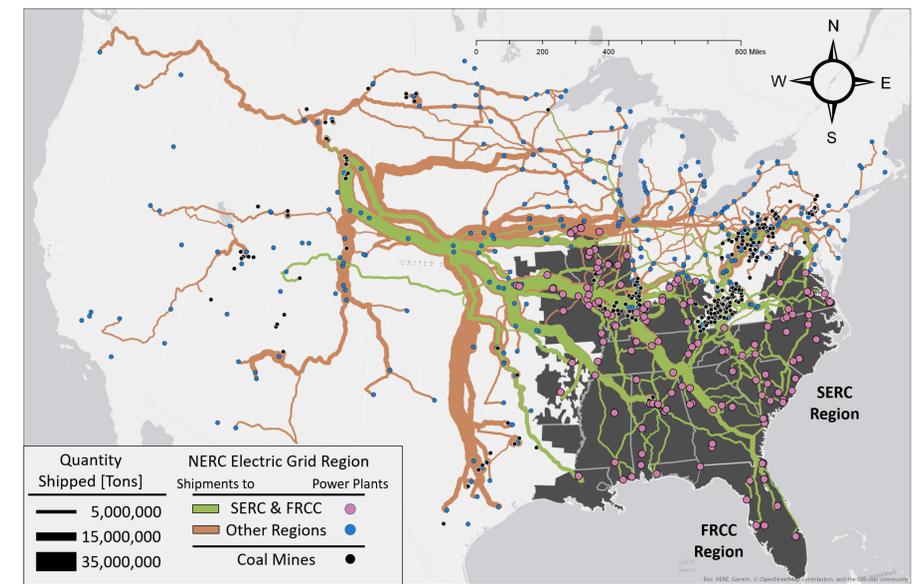
Map of U.S. Coal basins, with associated mines sized by quantity mined in 2014.

MapQuest for Trains

We generated shipment routes for every coal sale in 2014, using an Energy Information Administration (EIA) coal transaction dataset.¹ To do this, we geolocated every coal mine across the U.S., primarily by using satellite imagery within the known county of a coal mine. This data shows a significant amount of Western coal traveling to the Southeast. The Southeast electric grid interconnect (**SERC**) and the Florida grid interconnect (**FRCC**) have **large variability** in the average shipment distance.

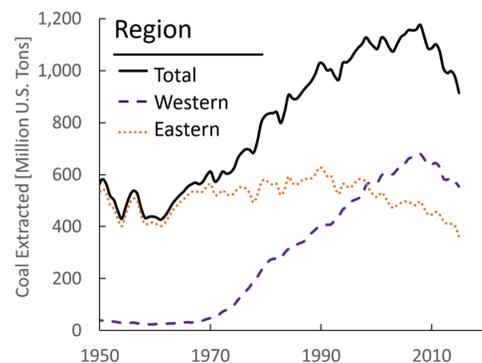


Transport distances across the dataset, aggregated to the North American Electric Regulatory Committee (NERC) region level. Each dot represents a specific mine-plant route.

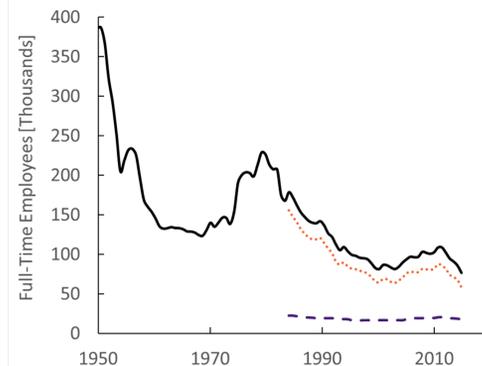


Map of coal flowing across U.S. railroads in 2014. the **SERC** and **FRCC** regions are dark grey. Mines and power plants are shown.

Employable Coal



The U.S. Coal industry can largely be divided into two groups: East and West. Many **underground** coal mines in West Virginia and Pennsylvania have been active for over a century. Conversely, Western coal mines are mainly **open-pit**, and were brought online in the 1970s.



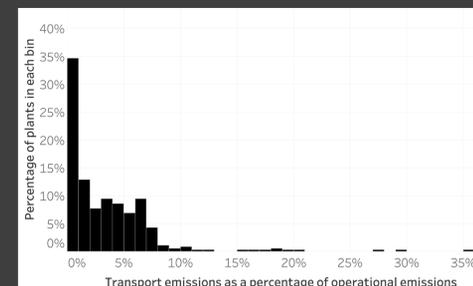
Despite mining over 60% of all coal today, the West has significantly fewer jobs because of the type of mine.²

The Federal government has stated support for both **clean coal** and **jobs**. **Are these goals aligned?**

Historical coal production & employment across regions

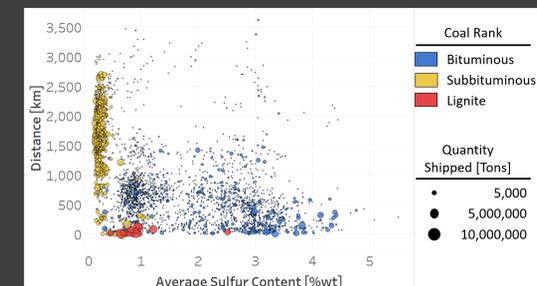
CO₂ Emissions

By utilizing a life-cycle assessment database, we transformed the route distances (and quantity shipped) into transportation CO₂ emissions data. Then, we compared this data to each power plant's operational emissions. For some plants, the transportation emissions are as high as 35% of the operational emissions!



Comparison of direct plus indirect transportation emissions to a power plant's operational emissions for each rail-supplied coal power plant in the U.S.

Conclusion



Comparison of transportation distance to average sulfur content of the transported coal. Each point is a specific mine-plant path within the dataset.

Finally, we can compare distance travelled to coal's sulfur content. There is a distinct trade-off between emitting CO₂ (transport) and sulfur! To reduce CO₂, it may be worth buying high sulfur coal.