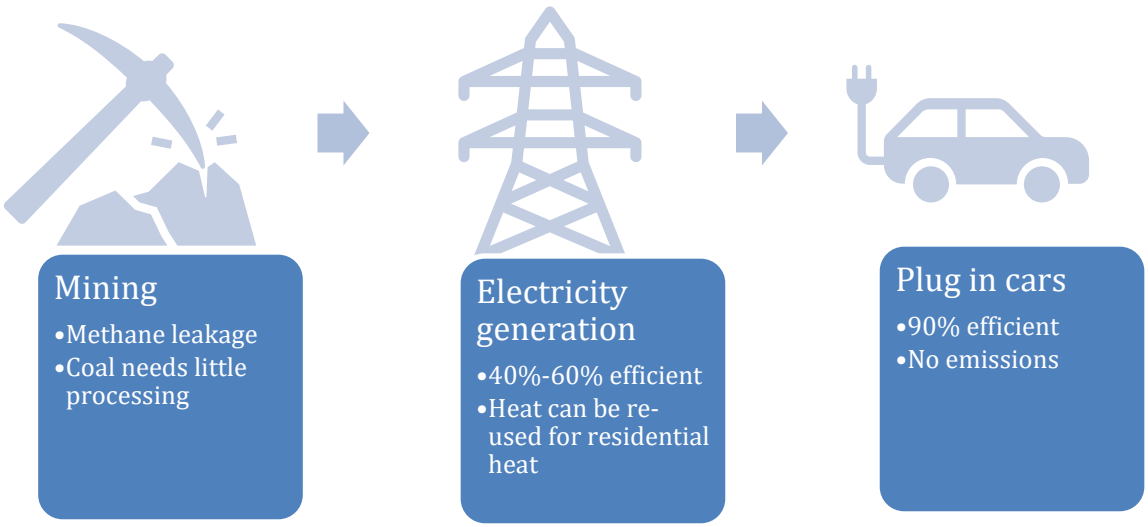
Coal is Greener than Crude Oil: The Case of Electric Vehicles

Perhaps it is preposterous to suggest coal is green. The very thought of coal evokes images of soot and smoke; simply touching a piece of coal can stain clothes. How can coal possibly be greener than anything?

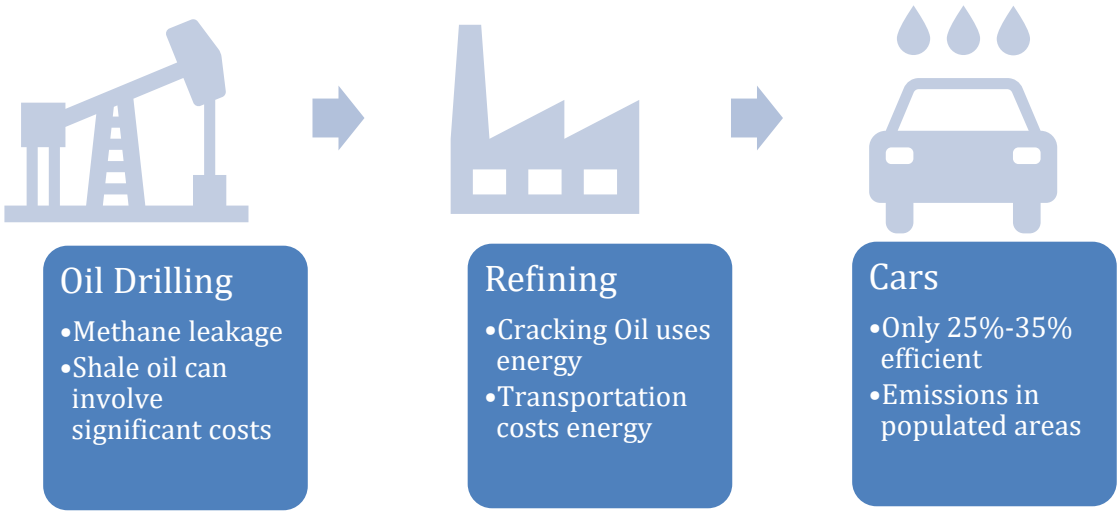
One of the largest and most long-lasting effects of coal use is the release of carbon dioxide, a greenhouse gas that causes climate change. Carbon dioxide traps solar energy from sun and causes the Earth's temperature to rise. In recent decades, a global effort has emerged to combat climate change. The Paris Agreement aims to strengthen the global response to the threat of climate change by reducing global emissions of carbon dioxide and other greenhouse gases. In the context of carbon dioxide emissions, how does coal stack up against gasoline?

Energy is commonly measured in British thermal unit (BTU), the amount of heat required to raise the temperature of one pound of water by one degree Fahrenheit. More commonly, energy generation is measured in terms of a million BTUs, or MMBTU. According to the Environmental Investigation Agency (EIA), generating one million BTUs from coal produces 205 to 228 pounds of carbon dioxide. In comparison, generating the same amount of energy from gasoline creates roughly 158 pounds. Comparing these values, it appears gasoline is indeed a greener source of energy compared to coal.

By directly comparing the amount of carbon dioxide released per MMBTU, we have made an implicit assumption that energy production is perfectly efficient – there is no energy loss in the production process. If we account for differential efficiencies in the energy production of coal or gasoline, a different picture emerges. Let's compare the energy usage of automobiles.



Coal power plants are large and mature operations typically running at 40-60% efficiency – for every MMBTU of coal, 400,000 BTUs of electricity are produced and the rest of the energy is released as heat. In the United States, the upper end of the range can be achieved in combined heat and power plants that recycle the lost heat for heating purposes in the winter. The engine of an electric vehicle is 90% efficient in converting electricity into motion. Therefore, the overall efficiency from coal to powering electric vehicle is 36-54%.



To put this figure into perspective, a typical internal combustion engine in a conventional gasoline-powered vehicle is 25-35% efficient, depending on the car model and type of usage.

If we combine the carbon dioxide production of coal and gasoline with their efficiency in energy generation, we see that gasoline is no longer the greener energy source. To generate one MMBTU of useful work for a conventional vehicle, an internal combustion engine produces between 451 and 632 pounds of carbon dioxide. To generate the same amount of useful work for an electric vehicle, coal-powered electricity produces between 379 and 633 pounds of carbon dioxide. Even if electric vehicles were entirely powered by electricity generated from coal power plants, the resulting carbon dioxide emission per unit of energy would still be equal or lower compared to conventional vehicles. In the case of electric vehicles, coal is greener than gasoline!

Of course, the power source of electric vehicles does not exclusively rely on coal. The United States only produces 20% of its electricity from coal. The remaining 80% are split amongst more environmentally-friendly sources with less emission including natural gas (40%), nuclear (20%), and other renewable sources (20%). Natural gas emits approximately one-half as much carbon dioxide as gasoline per unit of energy, where as

nuclear and other renewable sources produce negligible carbon emissions. Considering these greener energy sources clearly tilts the environmental scale in favor of electric vehicles.