

How Many Fires Burn for You?

(Take 2ish, a work forever in progress)

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We'd like feedback from teachers and students on this draft activity. A fundamental strategy for our educator professional development programming is to engage participants - and their students - as colleagues and collaborators. This activity is a work in progress, and a complement to both [Where Does Gasoline Go?](#) And [Fire! The Root of Modern Climate Change](#).

Background:

We humans are the only species that control fire. Research indicates that our ancestors gained and lost that control a few times in the evolutionary history of hominids. The control of fire is fundamental to making us human. Fire makes us human, makes our modern way of life possible, and simultaneously endangers our modern way of life.

And, for most of Earth history, there was essentially no fire.¹ Fire requires dry fuel, and fuel is almost always the result of biological processes, and the root process for making fuel is photosynthesis. Plant matter and its fossil remnants make up the overwhelming majority of the fuel in the world. Up until the Silurian Period, roughly 460 million years ago, almost all life was underwater. There was essentially no dry fuel for 90% - the first four billion years - of Earth's history.

The atmosphere also lacked sufficient oxygen to sustain fire.²

*Now, billions of fires are burning all of the time.*³

The core idea of the activity is reflected in the simple question in the title. How would you use that question to shape an activity or guide a discussion? A start at this follows.

- **Counting Our Fires** - how many fires have burned for you today? How many burned before today to make the day what it is?

¹ See a nice video on the history of fire and why Earth is the only planet that we know of that has fire [here](#).

² HHMI's [EarthViewer](#) is an interactive website that allows you to display global oxygen and carbon dioxide levels as well as average temperature over the last 540 million years.

³ Just in the US, we need to replace a billion machines in our homes that are powered by fire by those powered by electricity from renewable sources. This number includes motor vehicles, and machines for space heating, water heating, cooking, and gas clothes dryers. See: <https://www.rewiringamerica.org/policy/one-billion-machines>. It does not include fire machines outside of the home (in power plants and factories, for example).

- **Today:** Furnace, power plant (depending on where your power comes from), internal combustion engine in (almost) every vehicle you've ever been in, water heater, stove, and probably more. *Can you list the fires that have burned for you today?*
- **Before today:** Virtually everything you own was produced by processes that depend upon burning and transported by fuel burning vehicles. Produce wasn't made by fire, but was almost certainly harvested by a fire-powered machine, packaged in paper or plastic made by fire, processed by fire, and shipped via fire-driven transport. *How did fire shape or make the things you've used or come into contact with today?*
- **Beyond today:** *What fires are burning for you today to make things that you will use tomorrow, next month, or next year?*
- **Scale it up:** How many controlled fires are burning around the world right now? Surely, it's at least a billion. Don's guess is that there are at least two billion fires burning at any given time, and it is likely much more. *What do we need to figure out to make a good estimate?*
- **Scale it down:** This is the way the world works right now. *What are we going to do to shrink the size and number of fires burning today and that will burn tomorrow, next month, and next year?*
 - Working on your own fires is an obvious place to start, but isn't enough.
 - How can we help shrink the size and number of fires across the school district, state, country and globe?
 - What hot processes can you replace with a cooler processes?

Shaping this learning activity

This activity isn't fully polished. Read on for some ideas about what to do to figure out how many fires burn for you and consider both why that matters and what should be done to better polish and finalize this activity.

Counting Fires

1. List and briefly describe the fires that have burned for you in the last 24 hours, to power your activities directly. Include, for example, if you've ridden in a motorized vehicle, taken a hot shower, or cooked a meal, identify the fires likely behind each of those activities.

Don's attempt at a tally (last updated 1/5/24):

1. **Furnace:** my house is heated with natural gas. In the course of the day (from about October to March), this kicks on and off several times, depending on the weather.
 - a. There's also a boiler burning at PRI to keep my colleagues warm. And one at the Cayuga Nature Center. Changes are planned for eventually heating the Museum

of the Earth with geothermal heat, and a new electric system for Palmer Hall, our office building. It's very unclear when that change will happen.

- b. For the furnaces and boilers cycling on and off for me today, we'll count that as 25 fires.*
2. **Hot water heater.** I have a natural gas fired hot-water heater. The dishwasher ran, drawing hot water, as did my shower. I washed some dishes by hand with hot water as well. I wash my clothes with cold water, but haven't done laundry in the last 24 hours.
 - a. We'll take a guess of 5 fires.*
3. **Power plants.**
 - a. The last coal-fired power plant in New York State closed in February of 2020, so if you are a New Yorker, none of your electricity is coming from coal. A small portion of New York electricity comes from outside of the state. The majority of that comes from Ontario, Canada which also no longer uses coal to generate electricity.
 - b. I live in Western New York, and the biggest power plant in the area - by far - is the Robert Moses Hydropower Plant at Niagara Falls.
 - c. There are much smaller generators of electricity including natural gas, wind, landfill gas, trash-to-energy, and solar. I took an educated guess to put these in rough order. Hydropower is certainly the biggest piece of my electricity (at home) and solar is probably the smallest, especially on a cloudy day. I do subscribe to a solar farm for some of my electricity. Once electricity is on the grid, it's not simple (in a way I know, at least) to figure out where it came from, but looking at the types of power plants near you and the amount of electricity they generate can give you a rough idea. Natural gas, landfill gas, and the direct burning of trash all likely provide some small portion of the electricity that comes to my house on a typical day.
 - d. The Energy Information Administration website, <https://www.eia.gov/>, has [an interactive map](#) of the US energy system where you can click on individual power plants to see data on how much power each has generated over time. See also EIA's [Renewable Electricity Infrastructure and Resources Dashboard](#) that allows you to view renewable electricity generation by state, and to easily compare states.
 - e. The Environmental Protection Agency's [Power Profiler](#) shows the US's regional electric power grids. New York is an unusual state with three regional grids within the state - [NYC-Westchester](#); [NYLI-Long Island](#); and; [NYUP-Upstate NY](#). The Upstate grid is - by far - the subregion emitting the least carbon pollution of all US grids.
 - f. The electricity used in my employers' buildings differs somewhat in source than at home. While I telecommute, I'm interacting with folks at PRI in Ithaca nearly every day, so that energy counts as part of my consumption as well. Probably the biggest segment of the electric power consumed in Central New York is also hydropower from Niagara Falls. And, it's closer to more in-state nuclear power than I am in Western New York. I added the in-state modifier as some electricity

crosses the border from Canada, and the largest currently operating nuclear power plant in the world - the Bruce Nuclear Generating Station - is in Ontario. We all probably get some electricity from there some of the time. Central New York also has a trash-to-energy plant, so some probably comes directly from burning garbage. Up until a couple of years ago, PRI's electricity was mostly from coal.

- g. In my typical day, I'm also on the Internet a lot, and sometimes relying on distant data centers and servers that likely bring some coal burning into my day.
 - i. *As an Upstate New Yorker, I'm lucky on this front. We'll call it another five fires, but you can see how uncertain these guesses are.*
 - ii. AI - Artificial Intelligence, in its current form is very energy intensive and may change electric power demands substantially .
4. **Driving.** As a longtime telecommuter, I was pleased that I'd sometimes go a few days without getting into my car, but on the average pre-pandemic day I drove at least a few miles. In the thick of the pandemic, I could go more than a week without moving the car. I have a fully electric Kia Niro. Up until May of 2021, I had a Kia Forte and its average fuel consumption was 35 miles per gallon.⁴ Figuring out how to count each little explosion generated by the spark plugs inside my engine is tricky. We'll just call each trip in a car with an internal combustion engine a fire. I drove to Ithaca Tuesday morning.
 - a. *Again, I'm lucky to be an Upstate New Yorker and especially one with an EV.*
5. **Then there are all the fires to make what I'm using on a daily basis.** Those burned more than 24 hours ago. We'll let them be for now.
6. **And all the fires burning to make, package, ship, and dispose of all the stuff I'm going to use in the coming days, months, and years.** No doubt many of those fires are burning today.

Some guesses at how many fires are burning today (from an earlier workshop):

- 154 billion
- 7 to 100 billion
- 10s of billions
- 100 billion
- 70 billion
- 70 to 80 billion

⁴ I used to track that with the Fuely app. See: <https://www.fuely.com/>. Other apps are available for tracking fuel use, and I've not done a systematic evaluation of them, but I like Fuely. I don't use it anymore as I now lease an electric vehicle.