

Solar vs. Coal: a Tale of Two Trains

How many trainloads of coal does it take to make as much electricity as a trainload of solar panels?

Here are the facts:

The solar train



120 boxcars¹

Each carrying 80 pallets of 29 solar panels²



SolarWorld SW320 XL
320-watt peak output

Pallet dimensions:

78.46" wide
39.4" deep
38" tall
1,381 pounds



That's 278,000 solar panels, weighing 6,600 tons



It takes 13,300 gallons of diesel fuel for an average trip⁴



The solar panels on this train are capable of making 104 GWh of electricity per year

The coal train



120 hopper cars

Each carrying 120 tons of coal



Bituminous coal
1-kilowatt-hour per pound³

Coal dimensions:

4,800 cubic feet per car
120 tons per car



That's 576,000 cubic feet of coal, weighing 14,400 tons



It takes 28,800 gallons of diesel fuel for an average trip



The load of coal on this train is capable of making 29 GWh of electricity

Wait...

That means you need

3.6 coal trains

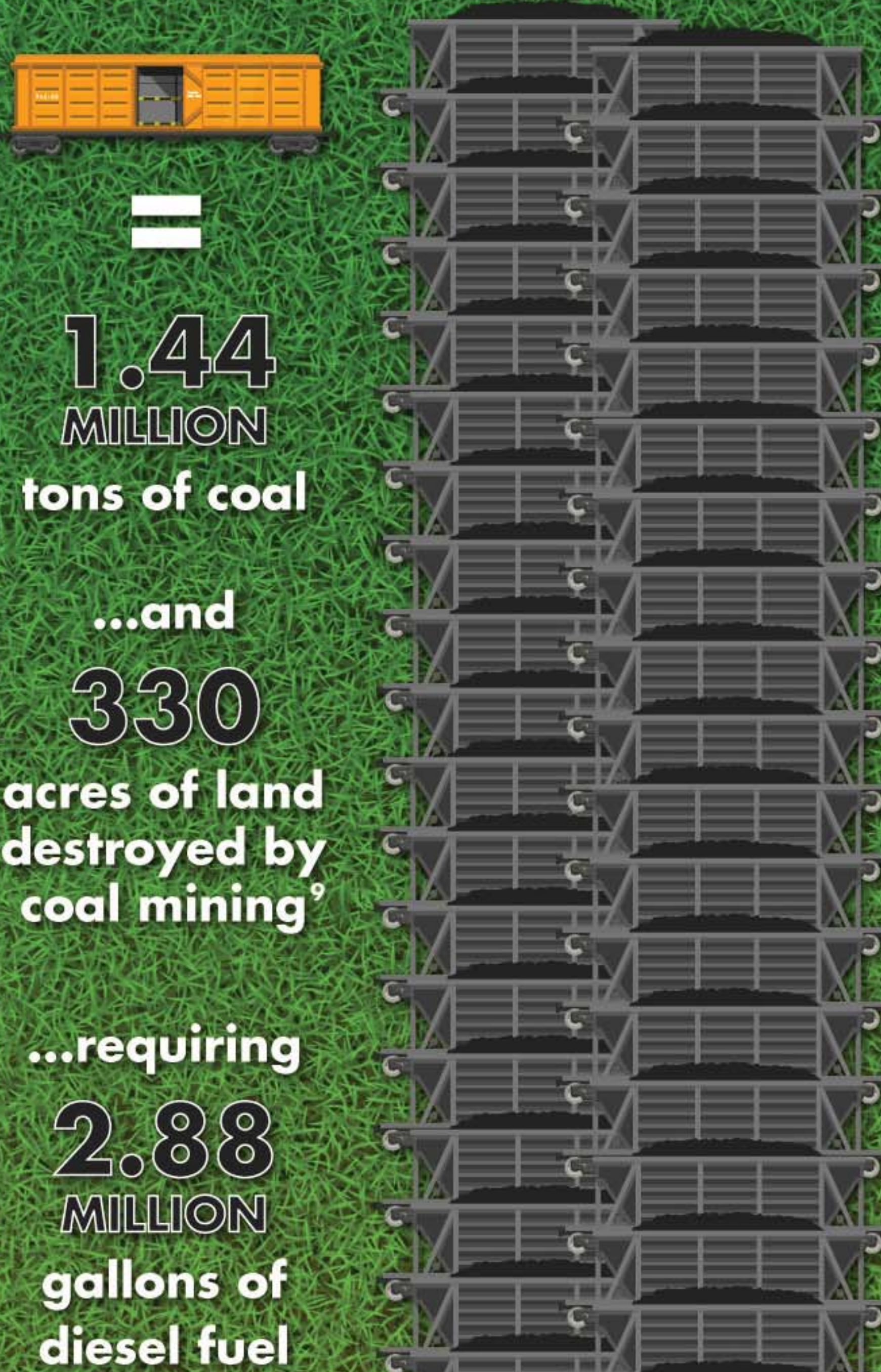
to make the same electricity in a year as the panels on the solar train.



...but that's just in the first year.

Solar panels will keep producing energy for 30 years⁸ with no additional parts and minimal maintenance, meaning you need a few more coal trains.

About **100** to be exact.



1.44 MILLION tons of coal

...and **330** acres of land destroyed by coal mining⁹

...requiring **2.88** MILLION gallons of diesel fuel

...and releasing

3.05 MILLION

tons of CO₂ after mining, transport, and burning.¹⁰

That doesn't even include all the toxic lead, cadmium, carbon monoxide, VOCs, arsenic, and mercury that comes from burning coal.¹¹

To be fair, the production of solar panels creates carbon pollution as well. For the panels in our example, it's about 140,000 tons over their lifespan.¹²

So next time you're wondering if solar really helps the environment, remember that the amount of coal we used in this example is only enough to make electricity for 8,000 people.¹³



1. Average size and weight of coal trains - Trainorders.com: https://www.trainorders.com/discussion/read.php?1_128359
 2. Pallet of SolarWorld SW320XL panels - Wholesalesolar.com: <https://www.wholesalesolar.com/1891997/solar-world/solar-panels/solar-world-sw320-xl-silver-mono-pallet-29-of-solar-panels/>
 3. EIA Energy Review for 2016, tables 7.2b and 7.3b: <https://www.eia.gov/totalenergy/data/monthly/index.php?electricity>
 4. 1 to of freight 470 miles on 1 gallon of fuel - CSX: <https://www.csx.com/index.cfm/about-us/the-csx-advantage/fuel-efficiency>
 5. Approximately 940 miles per train trip - Association of American Railroads: 2013: https://www.aar.org/StatisticsAndPublications/Documents/AAR_Stats_2013-02-07.pdf
 6. Assuming 320W STC per panel, 4 hours peak sun per day, 20% loss from wiring/inversion, 365 days per year
 7. Assuming 14,400 tons of coal per train, 1 kWh per pound (see reference #3)
 8. LCA of Photovoltaics - National Renewable Energy Laboratory: <https://www.nrel.gov/docs/fy13ost/56487.pdf>
 9. 4,350 tons per acre, when the coal is 30 inches thick - Kentucky Coal Education: <http://www.coaleducation.org/g6a/many-tons-of-coal.htm>
 10. 980 g CO₂-eq/kWh - Journal of Industrial Ecology, 2012: <http://onlinelibrary.wiley.com/doi/10.1111/j.1530-9290.2012.00465.x/full>
 11. Environmental impacts of coal power - Union of Concerned Scientists: <http://www.ucsusa.org/clean-energy/coal-and-other-fossil-fuels/coal-air-pollution/WdUN-mH5xPY>
 12. 13,000 kWh/person/year World Bank dataset: <https://data.worldbank.org/indicator/EG.USE.ELEC.KH.PC?locations=US>