

SURFACE AREA REQUIRED to equal the energy of MARCELLUS SHALE GAS (BTU COMPARISON) WITH SOLAR POWER:

100 Quad (quadrillion BTU)
Amount of energy that the United States uses every year. This number is combined from all energy sources.

Research shows that using natural gas from shale creates 20% more emissions of carbon dioxide and other greenhouse gases (most significantly methane) than coal. -<http://www.bbc.co.uk/news/science-environment-13053040>

51.450 Quad = 49 trillion cubic feet
Amount of energy contained in the extractable gas from the Marcellus shale formation. If all of our energy were derived from Marcellus shale gas, then we would run out in six months.

- Sources:
- www.eia.doe.gov/
 - www.dep.state.pa.us/
 - geology.com/
 - www.marcellus-shale.us/
 - en.wikipedia.org/wiki/Marcellus_Shale

solar vs. shale

- 1,088 Km² (267,782 acres)**
Area of solar power to equal entire extractable Marcellus energy in BTUs over 35 years. Area to only replace current levels of production in red.
- 812 Km² (200,000 acres)**
Area of disturbed and cleared land required to place 20,000 gas wells, create fluid impoundment areas, and run gas pipelines in order to extract all Marcellus gas within 35 years.

Each hydraulic fracturing treatment requires 4-6 million gallons of water and 15-22 thousand gallons of chemical additives. These chemicals along with flammable gases, heavy metals, radioactive solids, arsenic, barium, and brine can infiltrate aquifers and contaminate drinking water.

Solar power estimate assumes a conversion efficiency of 20% and 2000 hours per year. Technology could be CSP, PV, HCPV, or other.

For an equal per-year comparison, it was estimated that each Marcellus well will be in operation for 35 years. The entire extractable amount of gas was then divided by 35 to arrive at a BTU per year amount which was converted to KWh (= 435,400,000,000 KWh). Since 400 kilowatt-hours can be generated by each square meter per year, this number was divided by 400 to arrive at the area required to produce the same amount of energy each year with solar.

Total output of all Pennsylvania wells combined stands at about 200 billion cubic feet per year. This graphic assumes that this number could go up by over seven times over the next decade.

1000 cubic feet (1 MCF) of natural gas is equal to 300 KWh of electricity when equated in BTUs.

The Marcellus shale formation spans New York, Pennsylvania, Ohio, Maryland, and West Virginia. The formation contains natural gas which can be extracted using horizontal drilling and a method of expanding cracks in the rock called hydraulic fracturing (fracking). Extraction efforts have increased dramatically since 2007, leading to concerns about the environmental effects of the drilling and extraction processes which have been shown to pollute drinking water.

23.67 Quad = 23 trillion cubic feet (TCF)

Amount of natural gas that the United States consumes in one year. If all of our gas came from Marcellus shale, then we would run out in two years and two months. Estimates of how much gas exist in Marcellus shale go as high as 490 trillion cubic feet, but these same researchers conclude that only 10% of it can be extracted with existing hydraulic fracturing technology.

1.48 Quad = 435,400,000,000 kilowatt-hours

Amount of energy from Marcellus shale gas that can possibly be extracted each year (1.4 TCF). It is this energy amount that was compared when generating the solar area equivalent. It will take 35 years at the 1.4 TCF rate to extract all 49 TCF of Marcellus gas. The solar installations would have the potential to continue generating energy for a long time after that.