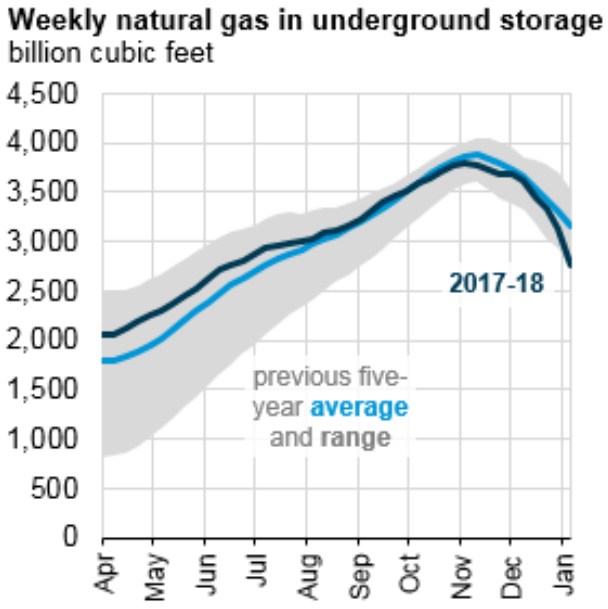
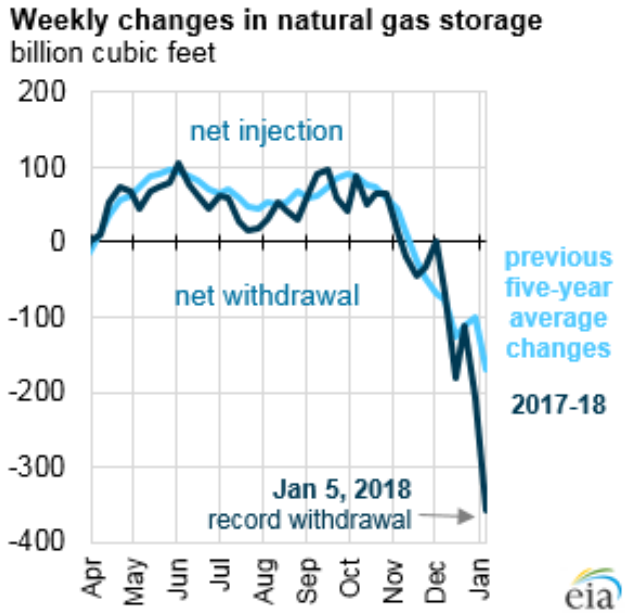
Consider the Coal Equivalency for a Record Large Quantity of Natural Gas

This past January (the 12th), eia[1] reported a record week for withdrawal of 359 Bcf (billion cubic feet) of natural gas from storage facilities[2] during the previous week ending on January 5. This withdrawal was about 80% greater than the previous record of 288 Bcf set in the week ending January 9, 2014. With an increase of this size it should not be a surprise that a withdrawal of this magnitude caught eia's attention and mine(!), see the graphs below.





Driven by my curiosity, I wondered what the energy of such a large quantity, 359 Bcf, of natural gas would be in coal equivalents. In order to get an appreciation of the magnitude of this quantity of energy, I made some back of the envelope calculations to see a hypothetical coal equivalent. The calculations presented here are, mostly, in SI units; the values were taken from the US eia or the GREET 1.8 tables. Further, only the LHVs (lower heating value) for each fuel were used and values were rounded to whole numbers.

The Natural Gas:

Three hundred fifty-nine Bcf of natural gas is a large quantity of energy:

Moving to SI units: 359 Bcf x 0.0283 m3/ft3 = 10.16 x 10E9 m3 of gas

10.16 x 10E9 m3 x 34.64 MJ/m3 = 352 x 10E9 MJ for the energy content of the natural gas

[1] US Energy Information Administration (https://www.eia.gov/about/)
[2] During recent cold snap, the U.S. withdrew a record amount of natural gas from storage

The Coal:

For coal, the GREET 1.8 value for bituminous coal of 22,460,600 BTU/ton (22.460 MMBtu/ton) was used. (This GREET 1.8 value was also stated in SI units as 26.12 MJ/kg.) However, the readily available data for coal transport employs English units; I'm going to do something terrible, I'm going to mix units… (Oh, the horror!)

Coal energy requirement: 22.46 MMBtu x 1,055 MJ/MMBtu = 23.7 x 10E3 MJ/ton
Using this value for the energy content of the coal and our calculated energy content for the natural gas at 352 x 10E9 MJ, we get a coal equivalent of:

352 x 10E9 MJ x ton/23.7 x 10E3 MJ = 14.8 x 10E6 tons of coal

The coal, used here in Colorado, comes out of Wyoming in unit trains of 100 or more cars. Wyoming coal is one of the most common coals used for electricity generation; even Excel Energy uses Wyoming coal for its coal burning power plants along the Front Range, even though coal is mined in Colorado. The coal is transported via these unit trains that can range from 115 coal cars on up. Each car can contain about 120 tons of coal. A unit car train of 120 cars with 120 tons of coal per car is moving about 14,500 tons of coal.

Q: How many such trains will we need to move our 14.8 x 10E6 tons of coal?

A: 14.8 x 10E6 tons x one unit train/14.5 10E3 tons = about **1,000 unit trains**

A CXS publication noted that it takes about 5 hours to load a single 15,000-ton unit train. That time value indicates that it should take **5,000 hours to load the required number of unit trains**. Since a week has 168 hours, the time window to move the coal energy equivalent of the 359 Bcf of natural gas says that we will need about 30 independent coal train loading stations to meet this record tally of energy transport. (No consideration was given here to transport times since sources and destinations are quite variable and distributed.)

Bottom line:

When you crunch the energy numbers, it becomes apparent that we, in this country, use a very large amount of energy in all of its manifestations. If you are interested in lowering your energy footprint, let me suggest that energy conversation is the most cost effective and quickest route to implement any goal for energy use reduction.

Norvell Nelson
Lakewood Colorado
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