

NATURAL GAS

SPOTLIGHT



LOW-COST ENERGY SOURCE THAT
CURBS EMISSIONS AND LAND IMPACTS

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About the Author



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Jon Sanders studies regulatory policy, a veritable kudzu of invasive government and unintended consequences. As director of regulatory studies at the John Locke Foundation, Jon gets into the weeds in all kinds of policy areas, including electricity, occupational licensing, hydraulic fracturing, the minimum wage, poverty and opportunity, state rulemaking, film and other incentives programs, certificates of need, and cronyism.

A classical liberal, which for the uninitiated doesn't mean a socialist who happens to like Mozart, Jon takes to heart the revolutionary declaration that all are created equal and endowed with the unalienable rights of life, liberty, the pursuit of happiness, property, and the enjoyment of the fruits of their labor. He shares the belief with Milton Friedman and Gary Becker that "the greatest beneficiaries of capitalism are those at the bottom of the income ladder" and agrees with Julian Simon that "the ultimate resource is people."

Jon holds a master's degree in economics with a minor in statistics along with a bachelor of arts degree in English literature and language from North Carolina State University. This left brain/right brain confluence sometimes causes Jon to cite Jane Austen in discussing energy, Chaucer in lending regulations, C.S. Lewis in overregulation, and Shakespeare pretty much whenever he thinks he can get away with it. He's also prone to drop pop-culture references as the mood strikes.

Prior to joining the research division at JLF, Jon researched issues in higher education for the John William Pope Center for Higher Education Policy. Jon has also taught economics as an adjunct for N.C. State and the University of Mount Olive.

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Key Facts

- The top priority for electricity policy in North Carolina is keeping consumers' costs as low as possible.
- Thanks to technological advances in natural gas exploration, falling prices for natural gas have caused actual reductions in consumer electricity rates.
- Gas-fired power plants are far more efficient and far less expensive than solar and wind plants.
- Gas-fired electricity production is responsible for actual lowering of CO₂, SO₂, and NO_x emissions.

Introduction

A May 2016 push poll conducted for an advocacy group calling itself “Conservatives for Clean Energy” included a question that gave respondents the opportunity to state their “top priority.” One of the options was “Looking for low-cost energy sources regardless of environment impact.”¹

Such wording implied that a low-cost source of electricity could not have a positive environmental impact. The implication is false.

Low-Cost Energy: What It Means and Why It's Important

What is a “low-cost” energy source? It could mean raw fuel cost, which would favor renewables such as solar and wind² as they are “free” when nature makes them available. But in the context of a poll question, it clearly means “low-cost” to consumers (respondents).

Cost to consumers is the most important consideration.³ In 2015, electricity costs to the poorest North Carolina households (those earning less than \$30,000 per year) averaged 9 percent of their after-tax income.⁴ That is a significant monthly expense.

Costs to consumers in North Carolina are lower than the regional and national averages. Since the passage of the renewable energy portfolio standard (REPS) mandate, however, they have

been increasing at a much faster rate than the regional and national averages (see Chart 1).⁵

Electricity is not a luxury item, however. It is a basic human need.

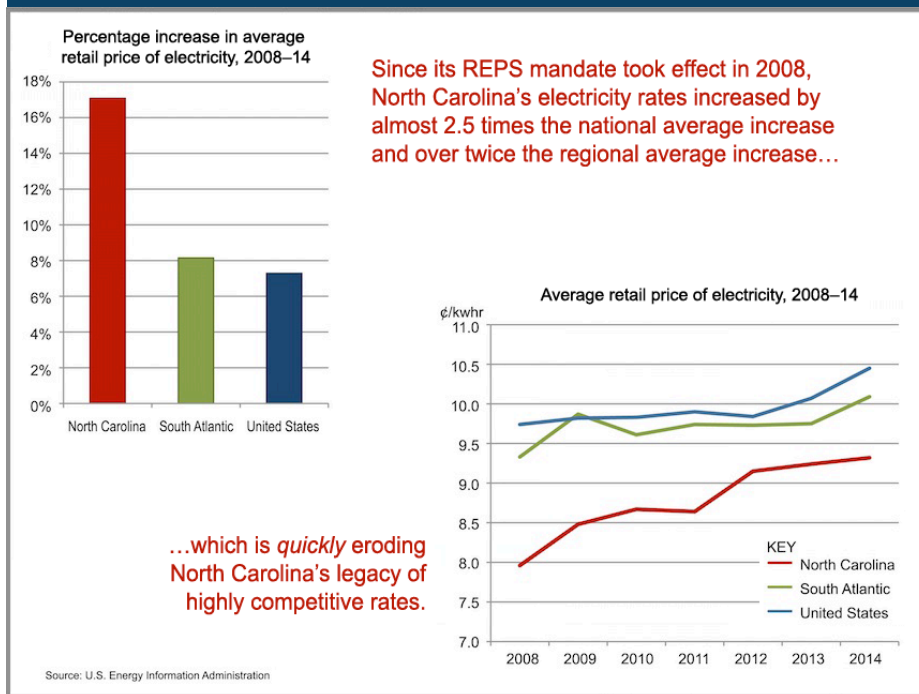
Electricity provision in North Carolina is from a monopoly provider. There is no choice in provider. A household is dictated its electricity provider. There is no choice in rates or source of electricity.

Those things — (1) basic human need, (2) no consumer choice allowed, (3) serious budget impact on poor households — show how important consumer costs are. It is critical to keep consumer costs as low as possible. State officials from the Utilities Commission to the General Assembly to the Governor must always bear that responsibility in mind.⁶

Low-Cost Natural Gas is Behind a Recent Drop in Rates

Since 2015 Duke Energy Progress's electricity rate has fallen, on net. That is according to testimony by Kendall Bowman, Duke Energy vice president of regulatory affairs and policy, and Sam Watson, general counsel of the Utilities Commission, before a January 5, 2016, meeting of the

Chart 1. Bigger Rate Increases Are Erasing North Carolina's Low-Rate Advantage



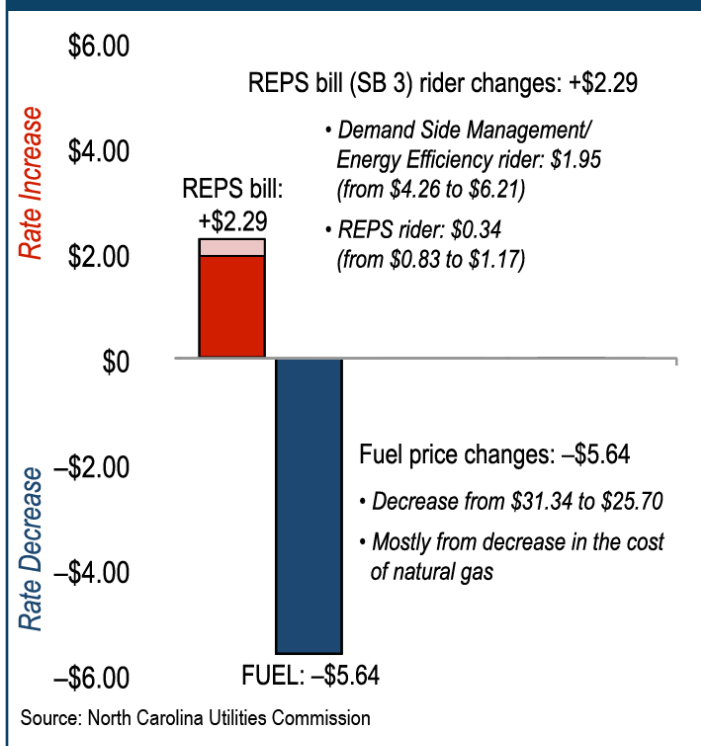
Bowman said the typical Duke Energy Progress customer using 1,000 kilowatt hours of power per month would pay \$1.59 less when all the increases and decreases of fuel costs, taxes, and various riders are tabulated. Watson said the decrease was \$1.52, going from \$36.43 to \$34.91 per month.

Watson said a decrease in fuel costs, mostly in natural gas, resulted in a \$5.64 decrease in that average customer's bill.

But the cost of the Renewable Energy Portfolio Standards that requires utilities to purchase increasing amounts of renewable energy went up 34 cents, from 83 cents to \$1.17 per month. A Demand Side Management/Energy Efficiency Rider went up \$1.95, from \$4.26 to \$6.21.⁸

So clearly natural gas is a low-cost energy source. But what sort of environmental impacts does it have?

Chart 2. Rider Changes to Duke Energy Progress Rates, 2015-16
For Residential Customer Using 1,000 kWh/month.



Natural Gas and The Environment

Environmental impacts include many things. Among them are carbon dioxide (CO₂) and other emissions, impacts on water, and impacts on land and wildlife.

CO₂ and Other Emissions

According to the U.S. Energy Information Administration (EIA), a federal agency, energy-related CO₂ emissions in the U.S. are down 12 percent since 2005.⁹ They are not up; they are down. (see Chart 3 on next page)

Why CO₂ emissions are down, according to the EIA, is “mostly because of changes in the electric power sector.” The main reason is the changeover to natural gas for electricity production:

Many of the changes in energy-related CO₂ emissions in recent history have occurred in the electric power sector because of the decreased use of coal and the increased use of natural gas for electricity generation. ... Overall, the fuel-use changes in the power sector have accounted for 68% of the total energy-related CO₂ reductions from 2005 to 2015.¹⁰

This changeover is helping reduce sulfur dioxide (SO₂) and nitrogen oxides (NO_x) emissions as well, according to researchers at the National Oceanic and Atmospheric Administration (NOAA). They found that the increased use of natural gas for electricity generation was responsible for the following reductions per unit of power produced from 1997 to 2012:

- 23% lower CO₂ emissions
- 40% lower SO₂ emissions
- 44% lower NO_x emissions¹¹

The European Union in 2012 classified natural gas as a green, low-carbon energy source.¹²

What about other sources? A recent Brookings Institute study evaluated different energy sources according to their effect on reducing CO₂ emissions and their efficiency.

Chart 3. U.S. Energy Related Carbon Dioxide (CO₂) Emissions (2005 - 2015)

U.S. energy-related carbon dioxide (CO₂) emissions (2005-15)

million metric tons

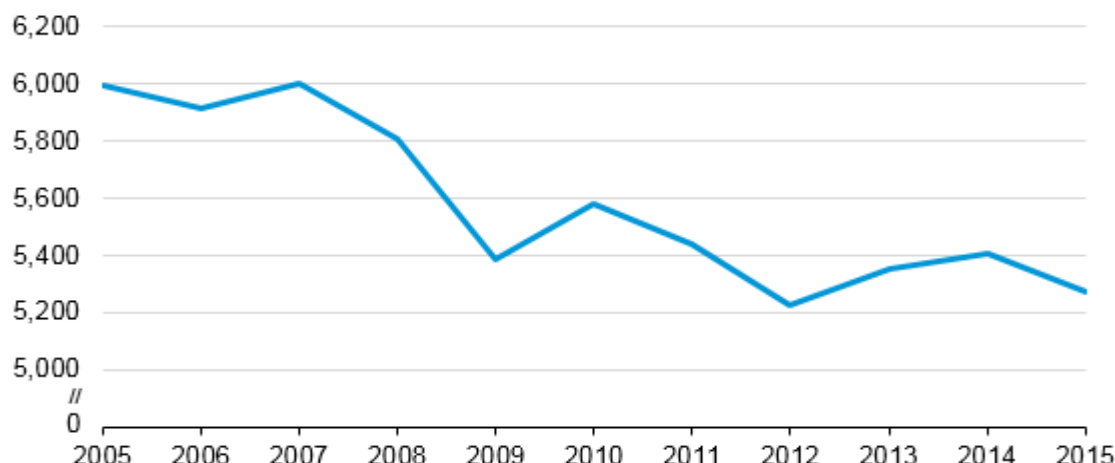


Chart 4. How Many Power Plants Would It Take?

Estimated number of energy plant by source, required to produce the same amount of power with the same reliability as a coal-fires plant.

Solar 7.3

Wind 4.3

Nuclear 1

Natural Gas 1

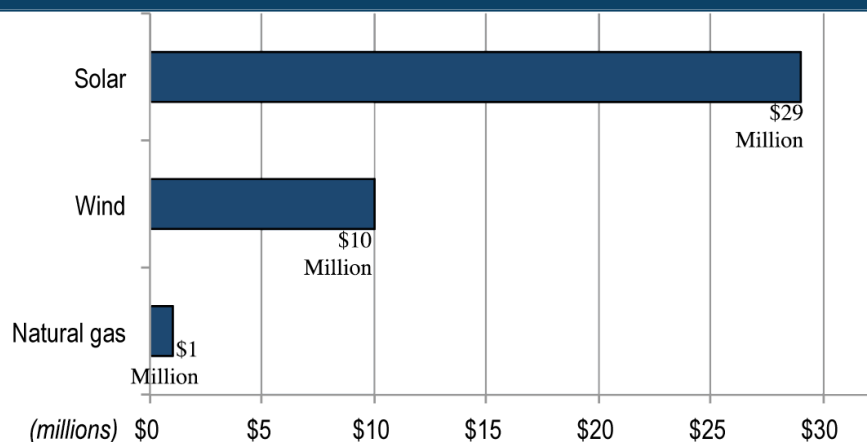
Source: Brookings

The study by economist Charles Frank found that natural gas offered the least expensive way to reduce carbon dioxide emissions in generating electricity. Not solar or wind. Frank found solar and wind to be the most expensive ways to reduce carbon dioxide emissions in generating electricity.¹³

Here's why: solar and wind can produce electricity at peak capacity for only a fraction of the time. That means their benefit of reducing CO₂ emissions only occurs a fraction of the time. The rest of the time they are imposing huge costs.

Because of their variability and inefficiency, Frank estimated "at least 7.3 solar plants and 4.3 wind plants are

Chart 5. Different Sources, Different Investment Levels Needed To Achieve The Same Amount of Electricity With The Same Amount of Reliability.



Source: Brookings

required to produce the same amount of power with the same reliability as a coal-fired plant." On the other hand, new gas-fired and nuclear plants "can replace a coal-fired plant on a one-to-one basis."¹⁴ (see Chart 4)

Frank found:

"In dollar terms, it takes a \$29 million investment in solar capacity, and \$10 million in wind capacity, to produce the same amount of electricity with the same reliability as a \$1 million investment in gas combined cycle capacity." (see Chart 5)

Impacts on Water

The main concern about an impact of natural gas on water is through exploration for natural gas. It centers on the misunderstood process of hydraulic fracturing (“fracking”), which is *not* used for drilling wells.¹⁶

The recent combination of hydraulic fracturing with horizontal drilling was a revolutionary technological innovation that changed the energy industry.¹⁷ It essentially opened up America’s vast resources of oil and natural gas, where they had been locked in shale rock formations.

Such a transformation has been the subject of fear, fascination, and study. Several recent major university and government studies tested suspicions of fracking causing methane and other contamination of drinking water.¹⁸ All those studies found fracking did not cause contamination of drinking water. They reiterated that the process of hydraulic fracturing is intrinsically safe. Well construction is the key to safe wells.

Impacts on Land and Wildlife

Because of horizontal drilling, the surface profile of a well using hydraulic fracturing is quite small. Gas-fired electricity plants are not very large and can be located close to the populated areas whose electricity they help provide.

Wind and solar plants, by contrast, require enormous amounts of land.¹⁹ (see Chart 6) Conversion of land for wind and solar energy production involves large disruptions of natural ecosystems, loss of arable cropland, clear-cutting, erosion, and other potential impacts.²⁰ Wind and solar plants must also be located where the resource can be collected, which requires building transmission lines out to them.

Conclusions


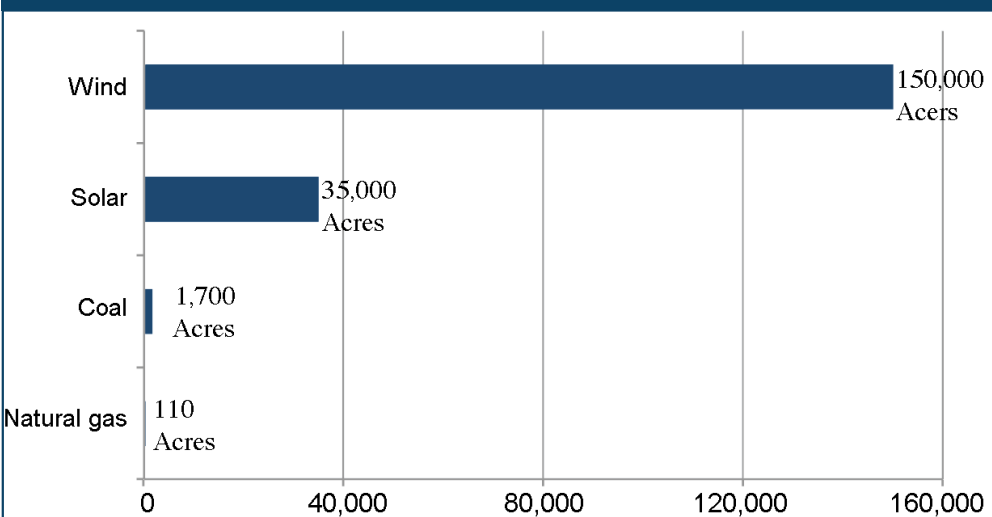
- Keeping consumers costs as low as possible is the number one issue in electricity policy in North Carolina.
- Natural gas is not only a low-cost source of electricity, it has positive environmental impacts. Gas-fired electricity production is responsible for lowering CO₂, SO₂, and NO_x emissions.
- Compared with solar and wind plants, natural gas is many times over more efficient and reliable. It also uses considerably less land and with much less disruption of natural ecosystems than solar and wind plants. 

Chart 6. Land Use (in acres) For Comparable 1,000 MW-Equivalent Power Plants, by source



Source: U.S. Nuclear Regulatory Commission

Endnotes

1 “North Carolina Statewide Poll for Conservatives for Clean Energy,” Strategic Partners Solutions, April 18–19, 2016, <http://www.cleanenergyconservatives.com/wp-content/uploads/2016/05/cce-poll-2016-results.pdf>; see discussion at Jon Sanders, “Poll Pushes Renewable Energy Cronyism,” *Carolina Journal*, May 5, 2016, <https://www.carolinajournal.com/opinion-article/poll-pushes-renewable-energy-cronyism>.

2 For expediency, when discussing solar and wind energy production, this report refers to photovoltaic solar and onshore wind.

3 See discussion at Jon Sanders, “The Four P’s of Electricity Competition,” John Locke Foundation, Rights & Regulation Update, February 28, 2014, <http://johnlocke.org/newsletters/research/2014-02-28-1dn0d2675mhv1nv-j0r6b21i4i6-regulation-update.html>.

4 Eugene M. Trisko, “Energy Cost Impacts on NC Families, 2015,” American Coalition for Clean Coal Electricity, January 2016, <http://www.americaspower.org/wp-content/uploads/2016/02/NC-Energy-Cost-Analysis-116R.pdf>, author’s calculation from isolating electricity costs from energy costs.

5 Jon Sanders, “Why it’s not enough to say ‘but our electricity rates are some of the lowest around’,” The Locker Room, John Locke Foundation, November 3, 2015, <http://lockerroom.johnlocke.org/2015/11/03/why-its-not-enough-to-say-but-our-electricity-rates-are-some-of-the-lowest-around>.

6 It is easy to lose sight of this responsibility. Public Choice economics explains why a small, organized group with a vested interest tends to capture the attention of policymakers more than the majority of people with diverse (and diffuse) interests; for an introduction, see William F. Shughart II, “Public Choice,” *The Concise Encyclopedia of Economics*, Library of Economics and Liberty, <http://www.econlib.org/library/Enc/PublicChoice.html>. Note that the very language used by officials tends to obscure their responsibility; see, e.g., Jon Sanders, “Citizens, Not Cronies, Are Top Stakeholders in Energy Debate,” *Carolina Journal*, September 24, 2015, <https://www.carolinajournal.com/opinion-article/citizens-not-cronies-are-top-stakeholders-in-energy-debate>. Also, the utter lack of choice combined with unquestioned consumer need is a highly fertile ground for cronyism and special interests. An energy source that would not succeed in a freer market (winning consum-

ers on its merits) can still prosper in a closed system. All it needs to do is win over powerful politicians, who can see to it the state’s monopoly providers will sell its goods to trapped consumers.

7 Dan Way, “Lawmakers Not Concerned About ‘Green’ Energy Claims,” *Carolina Journal*, January 6, 2016, <https://www.carolinajournal.com/news-article/lawmakers-not-concerned-about-green-energy-claims>.

8 Way, “Lawmakers Not Concerned.”

9 Perry Lindstrom, “U.S. energy-related carbon dioxide emissions in 2015 are 12% below their 2005 levels,” Today In Energy, United States Energy Information Administration (EIA), May 9, 2016, <http://www.eia.gov/todayinenergy/detail.cfm?id=26152>.

10 Lindstrom, “U.S. energy-related carbon dioxide emissions.”

11 J.A. de Gouw, D.D. Parrish, G.J. Frost, M. Trainor, “Reduced emissions of CO₂, NO_x, and SO₂ from U.S. power plants owing to switch from coal to natural gas with combined cycle technology,” *Earth’s Future*, Vol. 2, Issue 2, February 2014, pp. 75–82, <http://onlinelibrary.wiley.com/doi/10.1002/2013EF000196/full>.

12 Fiona Harvey, “Gas rebranded as green energy by EU,” *The Guardian* (U.K.), May 29, 2012, <http://www.theguardian.com/environment/2012/may/29/gas-rebranded-green-energy-eu>.

13 Charles Frank, “The Net Benefits of Low and No-Carbon Electricity Technologies,” *Working Paper 73*, Global Economic Development, Brookings, May 2014, <http://www.brookings.edu/research/papers/2014/05/low-carbon-electricity-technologies-frank>.

14 Charles Frank, “Why the Best Path to a Low-Carbon Future is Not Wind or Solar Power,” Planet Policy, Brookings, May 20, 2014, <http://www.brookings.edu/blogs/planetpolicy/posts/2014/05/20-low-carbon-wind-solar-power-frank>.

15 Frank, “Why the Best Path to a Low-Carbon Future is Not Wind or Solar Power.”

16 See explanation at “Hydraulic Fracturing: The Process,” FracFocus (a web site managed by the Ground Water Protection Council and Interstate Oil and Gas Com-

pact Commission, which gives factual information to the public about groundwater protection and the chemicals used in hydraulic fracturing operations in general), <https://fracfocus.org/hydraulic-fracturing-how-it-works/hydraulic-fracturing-process>: “Contrary to many media reports, hydraulic fracturing is not a ‘drilling process.’ Hydraulic fracturing is used after the drilled hole is completed. Put simply, hydraulic fracturing is the use of fluid and material to create or restore small fractures in a formation in order to stimulate production from new and existing oil and gas wells.” Cf. the poll for Conservatives for Clean Energy, which describes hydraulic fracturing (termed “hydro-fracking”) as a drilling process (Question 9 includes the phrase “the drilling of natural gas through a process known as hydro-fracking”).

17 See, e.g., James Pethokoukis, “Creative destruction wins again: How innovation killed ‘peak oil’,” AEIdeas, American Enterprise Institute, July 16, 2013, <http://www.aei.org/publication/creative-destruction-wins-again-how-innovation-killed-peak-oil>; Rob Wile, “Peak Oil Is Dead,” *Business Insider*, March 29, 2013, <http://www.businessinsider.com/death-of-peak-oil-2013-3>; Kevin D. Williamson, “The Truth About Fracking,” *National Review*, February 20, 2012, viewable at <http://www.nationalreview.com/article/293086/truth-about-fracking-kevin-d-williamson>; and discussion at Jon Sanders, “Fracking’s promise of jobs, growth too compelling to ignore,” John Locke Foundation, Rights & Regulation Update, March 9, 2012, <http://johnlocke.org/newsletters/research/2012-03-09-qf2eggkek-ci641s8qsoalpbc1-regulation-update.html>.

18 See especially Thomas H. Darrah, Avner Vengosh, Robert B. Jackson, Nathaniel R. Warner, and Robert J. Poreda, “Noble gases identify the mechanisms of fugitive gas contamination in drinking-water wells overlying the Marcellus and Barnett Shales,” *Proceedings of the National Academy of Sciences*, vol. 111 no. 39, September 30, 2014, pp. 14076–14081, <http://www.pnas.org/content/111/39/14076>; Richard W. Hammack, William Harbert, Shikha Sharma, Brian W. Stewart, Rosemary C. Capo, Andy J. Wall, Arthur Wells, Rodney Diehl, David Blaushild, James Sams, and Garret Veloski, “An Evaluation of Fracture Growth and Gas/Fluid Migration as Horizontal Marcellus Shale Gas Wells are Hydraulically Fractured in Greene County, Pennsylvania,” National Energy Technology Laboratory, Office of Fossil Energy, U.S. Department of Energy, September 15, 2014, http://www.netl.doe.gov/File%20Library/Research/onsite%20research/publications/NETL-TRS-3-2014_Greene-County-Site_20140915_1_1.pdf; Lisa J. Molofsky, John A. Connor, Albert S. Wylie,

Tom Wagner, Shahla K. Farhat, “Evaluation of Methane Sources in Groundwater in Northeastern Pennsylvania,” *Groundwater*, National Ground Water Association, Volume 51, Issue 3, May/June 2013, pp. 333–349, <http://onlinelibrary.wiley.com/doi/10.1111/gwat.12056/full>. There is also the curious case of a three-year study by University of Cincinnati geologists that the university has chosen to withhold from publication. According to public comments by lead researcher Amy Townsend-Small, “We haven’t seen anything to show that wells have been contaminated by fracking.” Townsend-Small told *The Free Press Standard* that “I am really sad to say this, but some of our funders, the groups that had given us funding in the past, were a little disappointed in our results. They feel that fracking is scary and so they were hoping this data could to a reason to ban it.” See Carol McIntyre, “University of Cincinnati study finds fracking’s bad rap is not supported,” *The Free Press Standard*, March 2, 2016, <http://freepressstandard.com/university-of-cincinnati-study-finds-frackings-bad-rap-is-not-supported>, and discussion at Jeff Stier, “Why Are They Hiding the Good News About Fracking?” *Newsweek*, April 23, 2016, <http://www.newsweek.com/hiding-good-news-about-fracking-451400>.

19 U.S. Nuclear Regulatory Commission (NRC), Generic Environmental Impact Statement for License Renewal of Nuclear Plants: Main Report (NUREG-1437, Vol. 1), “Table 8.1 Environmental impacts of constructing 1000-MW(e)-equivalent electric power plants for non-nuclear alternative generating technologies,” May 1996, table reviewed/updated March 29, 2012, <http://www.nrc.gov/reading-rm/doc-collections/nuregs/staff/sr1437/v1/TBL8-1.html>.

20 NRC Table 8.1; also see, e.g., Dan Way, “Lawmakers Warn of Solar Farm Cleanup Costs,” *Carolina Journal*, August 10, 2015, <https://www.carolinajournal.com/news-article/lawmakers-warn-of-solar-farm-cleanup-costs>.



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