The Economics of Fracking

What are the economic costs and benefits to Virginia of fracking? How will the new revenue generated balance with the new services required? What government actions might shift that balance? And how long will the fracking boom last?

The most often cited benefit of fracking is that it will create new jobs. It will bring profits to those who own or hold mineral rights to property with underlying deposits and to those who supply goods and services to workers. New jobs and profits will increase tax revenue that will fund government services. And the increased availability of natural gas should lower energy costs to consumers.

The immediate costs to Virginia involve infrastructure such as roads and bridges. There may be new demands on government and public services if there is an influx of workers. Depending on the fracking methods, there may be a large demand on water supplies. Nearby fracking may have a negative effect on other businesses, property values, and current land uses, thereby decreasing tax revenue. Long term costs include land remediation and potential water pollution treatment. And because natural gas is a fossil fuel, its extraction and use contribute to climate change and all the costs that will bring.

Jobs
We must look to other states’ experience to estimate how many and what kinds of new jobs will be created, and who will fill them. That’s what “U.S. Chamber’s fracking job boom: Behind the numbers” did: “Using the IMPLAN model, a widely used tool originally developed for the U.S. Department of Agriculture, the study quantifies and predicts direct, indirect and induced jobs in each state. Direct jobs in producing states include construction, oil and gas extraction, metal fabrication and truck transport. In non-producing states, directly created jobs include the manufacture of chemicals, equipment and electronics used for fracking.

“The study also counts indirect jobs, including financial and administrative services and real estate linked to oil and gas extraction. Induced jobs are created when workers spend their wages on goods and services including health care, amusement, food and beverages and general merchandise.

“Mining of frac sand was considered a major source of direct job creation in Wisconsin, Minnesota and Ohio. In Illinois, indirect jobs theoretically already created included 1,393 in fabricated metal products and 353 jobs in real estate. And induced jobs already created included more than 2,000 in health care and 601 in insurance.”

http://www.energyxxi.org/us-chamber%E2%80%99s-fracking-job-boom-behind-numbers

Energy from Shale makes the following claims: “Fracking brings good jobs and prosperity to towns across America. The industry supported 2.1 million jobs in 2012, across all 50 states, and could support 3.9 million by 2025. But the job numbers provide just a glimpse into the benefits energy safely and responsibly developed with hydraulic fracturing is having and will have on the lives of individual Americans and our broader economy. In 2012, energy from fracking and related chemical activity contributed almost $284 billion to GDP while abundant, affordable energy from shale has helped fuel a U.S. manufacturing resurgence.”

http://www.energyfromshale.org/

On the other hand, “What Happened to 160,000 Fracking Jobs? Under Wolf, the Numbers Change” presents a cautionary example of job counting in Pennsylvania. “Roughly 30,000
people work directly in six “core” oil and gas industry jobs. But starting in 2011, the labor department began publishing a monthly booklet called Marcellus Shale Fast Facts, which showed about 200,000 other jobs in 30 “ancillary” industries. This figure included every road construction worker, trucker, and steel worker in Pennsylvania– whether they had ties to the gas industry or not.” https://stateimpact.npr.org/pennsylvania/2015/06/16/what-happened-to-160000-fracking-jobs-under-wolf-the-numbers-change/

It is worth asking which new jobs Virginians will be qualified to fill. OilJobFinder is one of a number of employment listing sites that recruit nationwide. For the Marcellus shale region they list:

- Environmental hydro-geologists
- Jobber assistants
- Ecologists
- Tanker drivers
- Drill site managers
- Petroleum landsmen,
- and pipeline engineers.

"Other types of employees that are needed at the Marcellus shale include clerical and administrative workers, finance and information technology experts, sales managers, and legal and human resources personnel."
http://www.oiljobfinder.com/marcellus-jobs.php

A frequently expressed concern about the higher-paid specialist employees is that their presence will be temporary and the majority of their earnings sent back to wherever they consider home. And if the fracking has a negative impact on farms or local recreation businesses, the result could be a net loss of jobs for residents.

In “Virginia can join the energy revolution,” Michael D. Ward, Executive Director of the Virginia Petroleum Council, a division of the American Petroleum Institute, says, “Among those with bright prospects for taking part in America’s energy revolution are women and minorities. A new study from IHS, the information services company, finds that the oil, natural gas and petrochemicals industries will generate up to 1.3 million new job opportunities by 2030 — with almost 408,000 positions projected to be held by African-American and Hispanic workers, while women will fill an estimated 185,000 industry jobs.”
http://www.richmond.com/opinion/their-opinion/columnists-blogs/guest-columnists/virginia-can-join-the-energy-revolution/article_b47f5e58-f7fe-5e89-9b2c-3c1bbd3f8e6b.html

Contradicting the image of prosperity from fracking, in “The Rural Reaches of Income Inequality" Kim Soffen discovered, "Homegrown inequality occurs predominantly in areas with significant energy-related industries. Drilling for oil or using hydraulic fracturing, or fracking, to extract natural gas requires a lot of open land, so it happens in rural areas. And because of the immense value of these energy sources, the landowners who have property rights over them become tremendously wealthy, while the people who keep the oil rigs running do not. This is clear in South Texas, which is filled with oil fields. In La Salle County, where nearly a third of residents live below the poverty line, the top 1 percent of earners makes on average 126 times as much as earners in the 99 percent do."
Property and profits
Unlike the George Washington National Forest, much of the Taylorsville Basin lies under many private, rural properties in Caroline, Essex, King and Queen, King George, and Westmoreland Counties. According to City-Data.com's 2014 statistics, the five-county area is over 70% rural with a population of roughly 90 thousand. http://www.city-data.com/

"Some 84,000 acres within the basin are already leased by Texas-based Shore Exploration Corp., which has established a local headquarters office in Caroline." http://www.fredericksburg.com/opinion/editorials/editorial-king-george-board-puts-county-first-on-fracking/article_6894be1b-221c-5755-98d9-12dcb1bb530c.html

The Virginia Public Access Project notes that Shore Exploration & Production Corporation retained a lobbyist in 2014 to deal with SB48 "Eastern Virginia Groundwater Management Area; prohibition on oil and gas drilling" which passed the Senate but was tabled in the House of Delegates. http://www.vpap.org/lobbying/client/246304-shore-exploration-production-corporation/

SB48 would have provided that: "Drilling in the Eastern Virginia Groundwater Management Area. Allows the drilling for oil and gas in the Eastern Virginia Groundwater Management Area if certain Department of Environmental Quality (DEQ) standards for the protection of groundwater and surface water are met. The Department of Mining, Minerals and Energy (DMME) is not authorized to issue a permit to drill in the Eastern Virginia Groundwater Management Area until DEQ has completed its review of (i) the current surface water and groundwater quality and quantity regulations in the management area and (ii) any amendments to the regulation that are necessary to protect groundwater and surface water." https://lis.virginia.gov/cgi-bin/legp604.exe?141+sum+SB48

Natural Gas and Surface Owner Rights in Virginia from the Virginia Department of Mines, Minerals, and Energy is a two-page brochure that explains the rights of property owners of surface, coal, and minerals including gas based on the Virginia Gas and Oil Act of 1990. It explains what happens when those rights are owned by different parties that may not agree, for example on the use of the surface for a drilling pad. It points out that a well may drain an area beyond a property's boundary and provides for forced pooling of all owners into a drilling unit. https://www.dmme.virginia.gov/dgo/pdf/GasSurfRightsFlyer.pdf

There are cautions as well as profits for the owner of gas rights on a property. The natural gas will eventually run out and the value of the property, the ability to insure it, and to mortgage it, may all be negatively impacted. “A 2010 study in Texas concluded that houses valued at more than $250,000 and within 1,000 feet of a well site saw their values decrease by 3 to 14 percent.” http://www.environmentamerica.org/reports/ame/costs-fracking

“At least three institutions — Tompkins Financial (TMP) in Ithaca, N.Y., Spain's Santander Bank and State Employees' Credit Union in Raleigh, N.C. — are refusing to make mortgages on land where oil or gas rights have been sold to an energy company.” http://www.americanbanker.com/issues/178_218/fracking-boom-gives-banks-mortgage-headaches-1063561-1.html

“Insurance Issues for Drilling and Fracking” summarizes a longer report: “If you live in an area
where fracking often occurs, or live in an area that may seem promising to fracking companies, it’s worth it for you to do the same thing insurers like Nationwide have – take a pre-emptive strike and check your policy for exclusions regarding earthquake damage and water contamination, as well as finding out on your own if there may be some loopholes in a policy that would deny a fracking related loss. ...And it’s not just homeowners who should be concerned. Farmers of plants and livestock could potentially be affected. ...Even if you take legal action, insurance won’t cover the legal fees involved. It could also depend on which state you live in. If your state of residence has specific requirements of fracking companies to protect surrounding property and mitigate any damage, your basis for a claim might be recognized. And then again, it may not.” http://integrityandaccountability.org/home-insurance-article.pdf

Energy prices
Energy from Shale says, “For U.S. households, the energy surge made possible by fracking has produced household savings through lower natural gas prices estimated at $1,200 per household in 2012.” http://www.energyfromshale.org/

The U.S. Energy Information Administration (EIA) explains, “Natural gas prices are a function of market supply and demand. Because of limited alternatives for natural gas consumption or production in the near term, even small changes in supply or demand over a short period can result in large price movements that bring supply and demand back into balance. Three supply side factors affect prices:

- Variations in the amount of natural gas production
- The volumes of natural gas imports and exports
- The amount of gas in storage facilities (referred to as storage levels)

“Increases in supply tend to result in lower prices, and decreases in supply tend to increase prices. Three demand side factors that may affect prices:

- The level of economic growth
- Variations in winter and summer weather
- Prices of competing fuels

“Factors Affecting Natural Gas Prices” http://www.eia.gov/energyexplained/index.cfm?page=natural_gas_factors_affecting_prices

“Hydraulically fractured wells provide two-thirds of U.S. natural gas production”
Virginia has 2,800 billion cubic feet of natural gas proved reserves. This puts us in 16th place among U.S. states and offshore fields. For comparison, West Virginia has 31,153 billion cubic feet and Pennsylvania 60,443. [http://www.eia.gov/energyexplained/index.cfm?page=natural_gas_reserves]

“How Fracking Affects Natural Gas Prices” by Jesse Emspak, asserts, “But whatever you think of fracking, it has done one thing: keep the price of natural gas from increasing more than it has. Unlike oil, natural gas is a local market. That is, the amount produced in the U.S. – or more accurately, the U.S. and Canada – has a direct effect on the price. That’s because natural gas being, well, a gas, is difficult to transport without a pipeline. It can be liquefied, but that costs money. It’s far cheaper to build a pipeline to the customer.”

“A look at the annual wellhead price of natural gas over time shows a peak at $7.97 per thousand cubic feet in 2008. For residential users the peak occurs at the same time, hitting $13.89. It was just after that, about 2008-2009, when the Bakken, Eagle Ford, Marcellus, and Permian shale gas areas started seeing a big increase in the number of wells dug. The peak price at the wellhead dropped all the way to $2.66 by the end of 2012, while the average 2013 price for residential users went to $10.33.” [http://www.investopedia.com/articles/markets/080814/how-fracking-affects-natural-gas-prices.asp]

Thus the bulk of natural gas used today is fracked. Its price is affected by the distance to the producing area and by seasonal and other factors, but is considerably lower than it would be without fracking. Virginia’s proved reserves, therefore, will affect local energy costs more by proximity than by total volume. One cautionary note: be careful to distinguish between natural gas and gasoline when exploring the topic of fracking. Both can be produced from fracking, but they are two different products.

A critical factor for long-term energy prices is how long the gas wells will be productive. In “The Popping of the Shale Gas Bubble” Bill Powers warns, “America’s shale gas resources and reserves have been grossly exaggerated and today’s level of shale gas production is unsustainable. In fact, due the distortions of zero interest rates and other factors, an enormous shale gas bubble has developed. ... While many economists like to think that higher prices will always bring about more supply, the laws of physics and geology always win and in increasingly mature areas, like much of the US, rising prices will at best only slow


The U.S. Energy Information Administration offers a different assessment based on the assumption that there is five times as much gas that is as yet undiscovered.  “In addition to the proved natural gas reserves, there are large volumes of natural gas classified as undiscovered technically recoverable resources. Undiscovered technically recoverable resources are expected to exist because the geologic settings are favorable despite the uncertainty of their specific location. Undiscovered technically recoverable resources are also assumed to be producible over a time period using existing recovery technology. The U.S. Energy Information Administration estimated that as of January 1, 2013, the United States had 1,968 Tcf of undiscovered technically recoverable resources of dry natural gas.”  http://www.eia.gov/energyexplained/index.cfm?page=natural_gas_reserves

Tom Zeller Jr. comments, “Whether the upside or downside projections will prevail, of course, remains to be seen. If gas outputs are still flowing and growing 10 or 20 years from now, the skeptics will have been proven wrong — though if they’re right, we’ll know sooner than might be comfortable for a lot of stakeholders.”  “Does Anyone Really Know How Long the Shale Gas Boom Will Last?”  http://www.forbes.com/sites/tomzeller/2015/01/05/does-anyone-really-know-how-long-the-shale-gas-boom-will-last/#16fdfbf525ef

Demands on communities and local government

“How Is Fracking Shaping Your Community and Economy?” by Headwaters Economics recommends five categories that local governments should monitor: population growth & worker residency patterns; employment, personal income, and local business effects; cost of living and housing; service, infrastructure, capacity, and revenue; quality of life and other local concerns. “Monitoring can help local governments better understand the socioeconomic impacts caused by energy development, and support requests to industry and state government for assistance to implement appropriate mitigation. Effective monitoring also is an essential part of adaptively managing drilling activity to minimize negative impacts while maximizing benefits.”  http://headwaterseconomics.org/energy/oil-gas/energy-monitoring-practices/

One of the first concerns to arise about fracking was the volume of water used. In “Is Fracking Safe? The 10 Most Controversial Claims About Natural Gas Drilling”, Seamus McGraw writes, “It can take up to 7 million gallons to frack a single well, and at least 30 percent of that water is lost forever, after being trapped deep in the shale. And while there is some evidence that fracking has contributed to the depletion of water supplies in drought-stricken Texas, a study by Carnegie Mellon University indicates the Marcellus region has plenty of water and, in most cases, an adequate system to regulate its usage. The amount of water required to drill all 2916 of the Marcellus wells permitted in Pennsylvania in the first 11 months of 2010 would equal the amount of drinking water used by just one city, Pittsburgh, during the same period, says environmental engineering professor Jeanne VanBriesen, the study’s lead author.”  http://www.popularmechanics.com/science/energy/g161/top-10-myths-about-natural-gas-drilling-6386593/
Demands on the local water supply will vary according to the fracking method used. Compared to hydraulic fracking, nitrogen foam, for example, can considerably reduce water use. The former CEO of Shore Exploration and Production, Ed DeJarnette, expressed a preference for nitrogen fracking in a meeting with King George County residents at the University of Mary Washington in 2014. “But DeJarnette, under heavy questioning, admitted Shore may sell the leases and he couldn’t guarantee whoever buys those leases will not use water-based fracking.”  


The industrial equipment necessary to drill a well must travel on local roads. “The Impact of Natural Gas Extraction and Fracking on State and Local Roadways” summarizes a Pennsylvania study. “The estimated road-reconstruction costs associated with a single horizontal well range from $13,000 to $23,000. However, Pennsylvania often negotiates with drilling companies to rebuild smaller roads that are visibly damaged, so the researchers’ conservative estimate of uncompensated roadway damage is $5,000 and $10,000 per well.”  


Local governments may need to fund increases in police, emergency and medical personnel, and other government workers. “Fracking brings with it increased demands for public services. A 2011 survey of eight Pennsylvania counties found that 911 calls had increased in seven of them, with the number of calls increasing in one county by 49 percent over three years.”  

http://www.environmentamerica.org/reports/ame/costs-fracking

“The Social Costs of Fracking: a Pennsylvania Case Study” states “This study is the first detailed, long-term analysis of the social costs of fracking borne by rural Pennsylvania communities. Key findings include:

- Fracking is associated with more heavy-truck crashes: Heavy-truck crashes rose 7.2 percent in heavily fracked rural Pennsylvania counties (with at least one well for every 15 square miles) but fell 12.4 in unfracked rural counties after fracking began in 2005.
- Fracking is associated with more social disorder arrests: Disorderly conduct arrests increased by 17.1 percent in heavily fracked rural counties, compared to 12.7 percent in unfracked rural counties.
- Fracking is associated with more cases of sexually transmitted infections: After fracking, the average increase in chlamydia and gonorrhea cases was 62 percent greater in heavily fracked rural counties than in unfracked rural counties.”  

https://www.foodandwaterwatch.org/sites/default/files/Social%20Costs%20Fracking%20Report%20Sept%202013_0.pdf

A continuing study, “Local Government Fiscal Impacts of Oil and Gas Development,” has an interactive map by state of local government revenues and costs from fracking. The three Marcellus shale states – Ohio, Pennsylvania, and West Virginia – show interesting differences in revenue streams and demands on local government. The authors found that revenue from property taxes on the land being drilled and from sales tax grew quickly. However, they cautioned that local governments should not become reliant on the increased revenue. “Major costs for local governments have tended to center on three issues: increased demand for road repair associated with industry-related truck traffic; increased demand for sewer and water services associated with industry-driven population growth; and a variety of staff costs,
such as expanding police or emergency services and raising compensation to compete with high-paying jobs in the oil and gas sector. https://energy.duke.edu/shalepublicfinance

Environmental costs
In the past, the ability to defer or avoid environmental costs helped make extractive industries more profitable. An increasing awareness that these costs were being passed on to the public has led to regulations requiring coal and oil companies to set aside funds for remediation. The recent bankruptcy of Alpha Natural Resources illustrates some of the problems. “The U.S. government agreed to a mine clean-up deal that allows coal producer Alpha Natural Resources to exit bankruptcy, despite concerns that Alpha will be unable to fund $400 million in commitments, a government lawyer told a court on Thursday. The agreement stems from an industry subsidy that allows coal companies to self-insure the environmental costs of mining, called self-bonding, rather than set aside cash or other collateral.” http://www.insurancejournal.com/news/national/2016/07/08/419511.htm

“Infographic: Who Pays to Plug Inactive Oil and Gas Wells?” shows the variation among states. Oklahoma and Texas set the bond requirement higher than the average cost, but Michigan's was woefully inadequate. “Comparing the average costs of decommissioning orphaned wells in 12 states with the average required bond amount in each state, we found that average costs exceed average bond amounts in 10 of the 12 states” http://www.rff.org/research/publications/infographic-who-pays-plug-inactive-oil-and-gas-wells

The EPA regulates air pollution and wastewater treatment resulting from fracking, but there is a gap in the EPA’s ability to regulate fracking with regard to the Safe Drinking Water Act. Nicknamed the Halliburton loophole, “The Energy Policy Act of 2005 excluded hydraulic fracturing, except when diesel fuels are used, for oil, gas or geothermal production from regulation under the UIC program.” UIC is Underground Injection Control, in other words, fracking fluid. https://www.epa.gov/hydraulicfracturing

In Virginia, “The Virginia Gas and Oil Act of 1990 provides a comprehensive program to protect public safety and the environment from risks associated with exploration and development of natural gas and oil resources. The law and regulations govern activities including planning, well site construction and drilling, and the final plugging and reclamation of the well site after the well stops producing. The installation and operation of gathering pipelines are also governed by the Act.” https://www.dmme.virginia.gov/dgo/pdf/GasSurfRightsFlyer.pdf

The Fredericksburg Free Lance-Star editorialized, “Fracking has been credited with increasing U.S. energy independence as well as reducing petroleum prices. But at what cost? Residents of some areas where it’s prevalent say it brings with it noise, heavy truck traffic, destruction of the countryside and the threat of groundwater and runoff contamination. These are fracking byproducts that, with the well-being of their county and constituents in mind, King George officials are looking to limit...After an Aug. 16 public hearing at which both pro- and anti-fracking views were aired, the supervisors voted unanimously to bar fracking within 750 feet of protected resources such as waterways, roads, buildings and school grounds.” http://www.fredericksburg.com/opinion/editorials/editorial-king-george-board-puts-county-first-on-fracking/article_6894be1b-221c-5755-98d9-12dcb1bb530c.html
Other environmental complaints have included nighttime lighting, gas flaring, and especially the pipelines to carry the gas from the well to the consumer. The environmental group, Grace Communications Foundation points out that, "Most proposed gas drilling projects are located in rural areas where a ready supply of fresh water is essential to agriculture, tourism, sport fishing, hunting and manufacturing. Drilling accidents, which can and do happen, can have a profound impact on these industries, and the boom-bust cycle of energy extraction can irreparably change the way of life in rural communities.”  

Environmental justice is also a concern. “Poor Communities Bear Greatest Burden from Fracking” finds that, “Fracking wells in Pennsylvania’s Marcellus Shale region are disproportionately located in poor rural communities, which bear the brunt of associated pollution, according to a new study.” http://www.scientificamerican.com/article/poor-communities-bear-greatest-burden-from-fracking/

Natural gas contributes to climate change both directly and indirectly. With Virginia’s long coastline, the potential costs of fossil fuel-driven rising sea level must be a consideration in assessing costs and benefits. The EPA says that, “Methane (CH\textsubscript{4}) is the second most prevalent greenhouse gas emitted in the United States from human activities. In 2014, CH\textsubscript{4} accounted for about 11 percent of all U.S. greenhouse gas emissions from human activities.” Methane is estimated to have a global warming potential (GWP) of 28-36 times that of carbon dioxide. https://www.epa.gov/ghgemissions/overview-greenhouse-gases

The EIA adds, “Natural gas is made up mostly of methane, which is a potent greenhouse gas. Some natural gas leaks into the atmosphere from oil and natural gas wells, storage tanks, pipelines, and processing plants. These leaks were the source of about 29% of total U.S. methane emissions, but only about 2% of total U.S. greenhouse gas emissions in 2013.” The page also reminds us that natural gas can explode, which is why a strong-smelling chemical is added to odorless natural gas before it is used commercially. http://www.eia.gov/energyexplained/?page=natural_gas_environment

The indirect effect of cheap natural gas is to delay a shift to renewable energy sources. “Researchers at the Massachusetts Institute of Technology have found that, in the United States, gas threatens to edge out renewables as well. ‘Shale gas is a great advantage to the U.S. in the short term, for the next few decades,’ said MIT economist Henry Jacoby, lead author of the study. ‘But it is so attractive that it threatens other energy sources we ultimately will need.’” http://environment.nationalgeographic.com/environment/energy/great-energy-challenge/big-energy-question/can-natural-gas-be-a-bridge-to-clean-energy/

In a heartening development, “Court Backs Obama’s Climate Change Accounting.” “In a unanimous decision late Monday [8/8/16], the Chicago-based 7th Circuit U.S. Court of Appeals rejected an industry-backed request to overturn a 2014 rule that set energy efficiency standards for commercial refrigerators. In doing so, the court specifically backed the so-called social cost of carbon, President Obama’s administration-wide estimate of the costs per metric ton of carbon dioxide emitted into the atmosphere — currently $36. The DOE used the carbon cost in its cost-benefit analysis, justifying the rule in part because of the amount of climate change regulators believe it would avoid.”
“To determine whether an energy conservation measure is appropriate under a cost-benefit analysis, the expected reduction in environmental costs needs to be taken into account,” the judges wrote. “We have no doubt that Congress intended that DOE have the authority under the [Energy Policy and Conservation Act] to consider the reduction in SCC.”


Sources (links here rather than in the text?)

More Resources

“Natural Gas Explained” by the U.S. Energy Information Administration outlines the issues
http://www.eia.gov/energyexplained/index.cfm?page=natural_gas_home

“Fracking Outpaces Science on Its Impact” by Mark Schrope, Yale School of Forestry & Environmental Studies, is a basic introduction
http://environment.yale.edu/envy/stories/fracking-outpaces-science-on-its-impact#gsc.tab=0

“How Has Fracking Changed Our Future” by Christina Nunez, National Geographic, November 11, 2013, provides a balanced overview of the pros and cons of fracking.

How Communities Can Manage Fracking Risks (2015) Union of Concerned Scientists

http://www.virginiaplaces.org/boundaries/splitestate.html

Fracking 101 A Taylorsville Basin Primer is a set of presentation slides.
http://nnswcd.org/pdf/Fracking%20101.pdf