Exposing the Oil and Gas Industry’s False Jobs Promise for Shale Gas Development

HOW METHODOLOGICAL FLAWS GROSSLY EXAGGERATE JOBS PROJECTIONS
About Food & Water Watch

Food & Water Watch works to ensure the food, water and fish we consume is safe, accessible and sustainable. So we can all enjoy and trust in what we eat and drink, we help people take charge of where their food comes from, keep clean, affordable, public tap water flowing freely to our homes, protect the environmental quality of oceans, force government to do its job protecting citizens, and educate about the importance of keeping shared resources under public control.

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Executive Summary

The oil and gas industry, industry-funded academics and ideological think tanks have promoted shale gas development — through the controversial process of hydraulic fracturing, or fracking — as a sure-fire job creator during difficult economic times. Food & Water Watch closely examined a recent report touting the job-creation potential of shale gas development and found numerous inaccuracies and methodological flaws. Even after correcting for these problems, questions remain about the validity of using economic forecasting models to predict the economic impacts of expanded shale gas development.

The purported economic benefits of shale gas development have served as a primary justification for opening up large parts of New York State to fracking. In a 2011 report, the Public Policy Institute of New York State (PPINYS) claimed that, by 2018, the development of 500 new shale gas wells each year in the five counties of Allegany, Broome, Chemung, Steuben and Tioga could sustain 62,620 new jobs in New York, relative to the case of no shale gas development. Another 500 new wells would need to be drilled and fracked every year to sustain these jobs.

Of these 62,620 jobs, PPINYS claimed that 15,500 would be “direct jobs” created from direct spending by shale gas companies. Only a small fraction of the direct jobs would actually be in the gas industry; most would be direct jobs in different industries due to shale gas company spending. The remaining 47,120 jobs would be “indirect jobs” and “induced jobs” created through the economic spillover effects from direct job creation; that is, through a multiplier effect.

However, after identifying and correcting the numerous inaccuracies and methodological flaws that led to this rosy projection, Food & Water Watch determined that the economic forecasting model PPINYS relied on only supports a claim of 6,656 New York jobs by 2018, under the PPINYS scenario of drilling and fracking 500 new shale gas wells that year. Yet this corrected estimate — a little over one-tenth of the original PPINYS claim — still does not account for any of the negative impacts that shale gas development would have on other economic sectors, such as agriculture and tourism.

The explanation for how PPINYS arrived at such a rosy projection of the economic benefits of allowing shale gas development in New York consists of two parts:

Overestimation of the direct economic impacts:

The PPINYS report misused a flawed finding in a Pennsylvania State University study to conclude that direct spending by shale gas companies in New York could lead to 15,500 direct jobs:

- The Penn State study undercounted the number of wells drilled in Pennsylvania, and thus overestimated the number of direct jobs per well;
- The Penn State study exaggerated the portion of gas company spending that stayed in Pennsylvania, and thus overstated direct job creation;
- The Penn State study included payments to landowners as spending that creates direct jobs, but these payments only create induced jobs, through landowners re-spending their income;
- PPINYS failed to mention that many of the high-paying gas industry jobs created would go to transient, out-of-state workers with shale gas industry experience, not to New Yorkers; and
- PPINYS misused the Penn State study results by not accounting for economies of scale and gains in productivity, which will lower the spending necessary to develop future shale gas wells.

Correcting for these five points reduces the PPINYS projection of direct jobs from 15,500 down to 3,469 created by 2018, assuming 500 new wells drilled and fracked each year.
Overestimation of the indirect and induced economic impacts:

PPINYS incorrectly projected the economic spill-over effects from direct job creation by selecting the wrong employment multiplier, and then misusing this multiplier.

- PPINYS stated that it used a Type II employment multiplier of 3.04, but using this multiplier correctly would have meant that 15,500 direct jobs would lead to 47,120 total jobs. Instead, PPINYS wrongly claimed that 15,500 direct jobs would lead to 47,120 indirect and induced jobs, for a total of 62,620 jobs; and

- PPINYS incorrectly assumed, when it selected 3.04 as an employment multiplier, that all direct jobs created through shale gas development spending would be in the gas industry. In fact, most of the direct jobs would be created in other industries, and the employment multipliers for these other industries are smaller than the gas industry multiplier.

Based on the findings of a report led by the lead author of the Penn State study and funded by the American Petroleum Institute, an employment multiplier of 1.92 better estimates the potential total jobs across industries created by shale gas development in New York in 2015. Multiplying this employment multiplier with the corrected direct jobs estimate results in a corrected PPINYS estimate of 6,656 total jobs (roughly 1.92 times the corrected PPINYS projection of 3,469 direct jobs).

Even if this corrected PPINYS total jobs projection — 6,656 total jobs, down from 62,620 total jobs — were to become reality, it would be insignificant next to overall employment in New York State. To put the number in perspective, it is less than 0.1 percent of projected employment in 2018 in the state of New York, which is projected to be 9,726,760.

Yet it is still overly optimistic to predict that 6,656 new jobs would be sustained in New York by 2018 from the drilling of 500 new wells each year, relative to a baseline of no drilling. The corrected PPINYS projection remains based on industry-supplied spending data and the dubious use of economic forecasting models, not on actual employment data from regions with shale gas development. Unlike forecasting models, actual employment data account for the negative impact that shale gas development has had on employment in other economic sectors, such as agriculture and tourism. Indeed, Food & Water Watch analysis of actual employment data from five Pennsylvania counties adjacent to the five New York counties used in the PPINYS scenario suggested that shale gas development could have far less of an impact than even the corrected PPINYS projection.

Local, state and federal policymakers should look to actual employment data, not dubious economic forecasts, when evaluating whether the supposed benefits of allowing shale gas development are sufficient to justify short-term and long-term costs to public health and the environment.
Introduction

Over the past decade, oil and gas companies have combined horizontal drilling techniques with hydraulic fracturing, or fracking, to extract natural gas from shale, a previously unprofitable source.¹ The oil and gas industry,² industry-funded academics³ and ideological think tanks⁴ have promoted unfettered expansion of shale gas development as a sure-fire job creator in difficult economic times.

However, toxic above-ground spills of fracking fluid and wastewater,⁵ water well contamination from methane⁶ and fracking fluid migration underground,⁷ local and regional air pollution,⁸ explosions⁹ and the likelihood of accelerated climate change¹⁰ highlight the environmental and public health risks of the practice.

Increased awareness and understanding of these problems with shale gas development have led to growing public resistance to fracking.

Invested in the need to stop this anti-fracking movement,¹¹ the oil and gas industry has benefited from media¹² and U.S. government¹³ reports in which the supposed economic benefits of shale gas development have been taken for granted. This analysis fills the void by raising questions about the methodology behind many of the rosy, industry-backed shale gas jobs projections that have been made, and by revealing numerous problems with one such projection.

Food & Water Watch closely examined a shale gas jobs projection made in a 2011 report by the Public Policy Institute of New York State (PPINYS) and found that numerous inaccuracies and methodological flaws led to a gross exaggeration of the jobs that might be expected in New York if the state chooses to allow shale gas development. PPINYS claimed that, by 2018, the development of 500 new shale gas wells each year could sustain 62,620 new jobs, relative to the case of no shale gas development in New York.¹⁴ Another 500 new wells would need to be drilled every year to sustain these jobs.¹⁵

Of these purported 62,620 jobs, 15,500 would be “direct jobs” created in different industries from direct spending by shale gas companies.¹⁶ The remaining 47,120 would be indirect and induced jobs potentially created as this direct spending reverberated through the New York economy.¹⁷

The following analysis details the inaccuracies and methodological flaws that led PPINYS to this exaggerated claim. Correcting these problems reduces the number of jobs projected by economic forecasting models by nearly a factor of 10. But even this corrected PPINYS jobs projection likely remains generous to the shale gas industry, at the expense of public health and the environment. This is because the corrected projection is still based on industry-supplied spending data and on the dubious use of economic forecasting models. The projection is not based on the reality of actual employment data in Pennsylvania, for example, so the negative impacts that shale gas development has had in other economic sectors in Pennsylvania are not taken into account.
Many of the problems that mar the PPINYS claim stem from a series of studies carried out by Pennsylvania State University researchers. In light of these flaws, it is concerning that the Shale Gas Subcommittee of the U.S. Secretary of Energy Advisory Board cited a study by the Penn State researchers when it stated that shale gas development would bring enormous economic benefits.

Before detailing and correcting the inaccuracies and methodological flaws of the PPINYS report, a brief explanation is provided of the economic forecasting model used by PPINYS and the Penn State researchers.

Forecasts of Shale Gas Jobs Rely on the Dubious Use of Input-Output Analysis

The Penn State researchers surveyed natural gas producers to estimate how much the industry had spent on Pennsylvania Marcellus Shale gas development in 2009. Based on these survey responses, the Penn State study used an “input-output model” to predict that shale gas development had led to the creation of 21,778 direct jobs during 2009 in Pennsylvania, again relative to the baseline of no shale gas development.

This predicted impact on employment in Pennsylvania accounted for how direct spending by the gas industry could have created direct jobs in different economic sectors, not just in the gas industry. For example, when a fracking company spends money to house out-of-state, transient workers at a hotel, the model credits the gas industry with creating some fraction of a direct job at the hotel. Mining, construction, retail, health care and financial and insurance services are other examples of economic sectors in which direct jobs could be created from the shale gas industry’s spending on goods and services.

The next step in an input-output analysis is to predict how direct impacts, such as on employment, lead to indirect and induced economic impacts through a multiplier effect. Continuing the above example, when the hotel worker who is considered employed because of local shale gas development re-spends his or her salary on goods and services, this re-spending is said to be induced spending that creates induced jobs. Similarly, direct spending on drilling equipment would lead to indirect spending by the manufacturers of the equipment, and this indirect spending in turn creates indirect jobs along the manufacturing supply chain (and induced jobs from workers along the supply chain re-spending their income).

The total number of direct, indirect and induced jobs created for each direct job created is the type II employment multiplier. That is, if spending on a project is estimated to create 10 direct jobs, and if the employment multiplier associated with that project is 1.5, then the input-output model would predict that 15 total jobs would be created by the project. As detailed below, the PPINYS report misused type II employment multipliers when it claimed that 15,500 direct jobs would result in 47,120 indirect and induced jobs, for a total of 62,620 jobs.

However, regional input/output models are only well suited for analyzing the economic impact of clearly defined projects for which the interdependencies between relevant economic sectors, over the course of the project, are well understood and quantifiable. For example, when a bridge is to be built, there is a solid understanding of how direct spending on the project leads to indirect and induced spending between industries within the regional economy, in part because such projects are not typically new to a region. In contrast, because shale gas development is a new industry in Pennsylvania, such understanding is lacking. As a consequence, the parameters in the input/output model used in the Penn State study could not have been tested and verified as accurate for predicting the economic impacts of shale gas development in Pennsylvania.

For this reason, the below corrections to the PPINYS report’s claim of 62,620 jobs still do not yield a reliable prediction of the actual impact that shale gas development would have in New York if shale gas development moves forward. The corrected projection is still not based on actual employment data. Also, the negative impacts on agriculture and tourism that result from shale gas development are not accounted for in the input-output analysis, although job creation in health and human services, presumably due to shale gas industry accidents, is included.

Nonetheless, the below corrections do reveal that industry-backed jobs projections demand close scrutiny.
The Penn State study exaggerated direct job creation per well in Pennsylvania in 2009 by undercounting the number of wells drilled.

Fixing this error lowered the corrected PPINYS direct jobs projection by about 9 percent, from 15,500 to 14,178 direct jobs potentially created.

To make its direct jobs projection, PPINYS took the estimate of 31 direct jobs per well from a 2011 Manhattan Institute report by the lead author of the Penn State study. This estimate was derived by taking the 21,778 direct jobs the Penn State study claimed had been created in 2009 in Pennsylvania, and dividing this number of direct jobs by 710, which is what the Penn State study said was the number of new shale gas wells in 2009 (21,778 direct jobs divided by 710 new wells yields about 30.7 direct jobs for each new well). However, in January 2010 the Pennsylvania Department of Environmental Protection reported that 768 Marcellus Shale wells were drilled in 2009.

PPINYS Correction: Using the official number of new wells in Pennsylvania in 2009 lowers the number of direct jobs per new well to 28.4. Under the PPINYS scenario of 500 new wells in 2018 in the five New York counties, this first correction lowers the PPINYS estimate to 14,178 direct jobs by 2018.

The Penn State study overstated the in-state portion of drilling and production spending by shale gas companies in Pennsylvania in 2009.

Fixing this error further reduced the PPINYS direct jobs projection by 19 percent, from 14,178 to 11,479 direct jobs potentially created.

The Penn State study conducted an industry survey of total spending on Marcellus Shale gas development in 2009 and used an input-output model based on this spending to project direct job creation that year. An initial step in the Penn State study was to estimate the in-state portion of this total spending in 2009, since direct jobs in Pennsylvania could only have come from spending that stayed in Pennsylvania. The Penn State study took an estimate of the in-state portion of 2008 total spending and applied it to total spending in 2009. This estimate that in-state spending was 95 percent of total spending in 2009 led directly to the model’s prediction that 21,778 direct jobs had been created in the state across multiple economic sectors in 2009.

However, Food & Water Watch’s close examination of data on shale gas development spending reveals two ways in which the Penn State researchers had overstated the in-state fraction of spending in 2008, and thus also overstated direct job creation in Pennsylvania in 2009:

- First, the Penn State study included payments to landowners and taxes when calculating the fraction of spending that stayed in Pennsylvania. Although these payments are technically in-state spending, they are not in-state spending that creates direct jobs, so they should not have been included to estimate the fraction of total spending that goes toward direct job creation. Landowner payments do create induced jobs because landowners re-spend their income, but direct jobs are not created when royalty and lease payments are made; and

- Second, shale gas companies subcontract many aspects of exploration, drilling, pipeline construction and processing, and such subcontracting disguises out-of-state payments as in-state payments. For example, when a natural gas company subcontracts with a subsidiary or independent company that maintains a presence in Pennsylvania, then payments to the subcontractor are counted as in-state spending, regardless of whether the subcontractor primarily used these payments to pay for out-of-state goods and services.

Food & Water Watch’s correction shows that only 76.5 percent of total spending went toward in-state direct job creation in 2008, while the Penn State study had claimed 95 percent was in-state that year.

To obtain this correction, Food & Water Watch estimated the total amount of out-of-state spending in 2009 in two steps: one to correct for how including

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a 21,778 direct jobs divided by 768 new wells equals 28.4 direct jobs per well.
b Precisely, 500*(21,778/768) = 14,178.385...
landowner payments and taxes skewed the fraction of spending that stayed in-state to create direct jobs, and another to account for how out-of-state payments were disguised by subcontracting. Food & Water Watch then determined in-state spending by subtracting this estimate of out-of-state spending from the amount of total spending.

Spending data for 2008 led to the Penn State study’s assumption that, in 2009, the in-state portion of spending was 95 percent of total spending. The 2008 data suggested $3.09 billion in total spending in 2008, $2.95 billion of which was in-state spending while $140.0 million was out-of-state spending. However, according to these data $2.02 billion of the $2.95 billion in in-state spending consisted of landowner payments and taxes. This leaves $930 million in in-state spending toward direct job creation. Adding to this the $140 million in out-of-state spending suggests that about $1.07 billion in total spending went toward direct job creation in 2008, of which 13.1 percent went toward out-of-state direct job creation.

Now turning to 2009 data, according to the Penn State study total spending toward direct job creation was about $2.75 billion in 2009, again after having factored out leasing and royalty payments and signing bonuses to landowners. Assuming that 13.1 percent of the total spending toward direct job creation was out-of-state in 2009, just as in 2008, then about $360 million was spent out-of-state, before accounting for additional out-of-state spending disguised as in-state subcontracting payments.

Few data are available on how much shale gas development spending is awarded to subcontractors. According to the Marcellus Shale Education and Training Center (MSETC), national or international companies have conducted most of the shale gas development in Pennsylvania, relying heavily on contractors who bring previous shale gas experience from outside of Pennsylvania. MSETC has found that, on average, between 20 and 30 different subcontractors are involved in the drilling of a single shale gas well.

To estimate the amount of out-of-state spending likely disguised by in-state subcontracting, Food & Water Watch first conservatively assumed that subcontracting accounted for 20 percent of total spending in 2009. This means $550 million out of the $2.75 billion in total spending in 2009 likely went to subcontractors, again having factored out leasing and royalty payments and signing bonuses to landowners. Further assuming that the subcontractors spent half of this $550 million on out-of-state supplies, then over $275 million in out-of-state spending would have been disguised as in-state spending.

Combining this $275 million in out-of-state spending through subcontractors with the $360 million in direct out-of-state spending estimated above yields $635 million in total out-of-state spending. Again, according to the Penn State study, total spending, excluding landowner payments, in 2009 in Pennsylvania was just over $2.75 billion, so subtracting the combined total of $635 million in out-of-state spending means that just over $2.1 billion was in-state spending toward direct job creation. This amounts to 76.9 percent of the total spending — in-state and out-of-state — that impacts direct job creation.

The estimate of 21,778 direct jobs in Pennsylvania was derived from the Penn State study’s assumption that 95 percent of total spending stayed in state, but Food & Water Watch’s above analysis shows that likely only 76.9 of spending toward direct job creation stayed in state. This leads to a correction as follows. First, had in-state spending been 100 percent, the estimate would have been 22,924 direct jobs. Since in-state spending

\[ \frac{521.9 \text{ million}}{143.9 \text{ million}} = 3.658 \text{ billion} \]

\[ \frac{140 \text{ million}}{1.07 \text{ billion}} = 13.1 \% \]

\[ \frac{2,751,854,000 \text{ dollars}}{1.07 \%} = 2,650,370,800 \]

\[ \frac{550,370,800 \text{ dollars}}{20 \%} = 275,185,400 \]

\[ \frac{635,241,064 \text{ dollars}}{76.9 \%} = 2,116,612,936 \]

\[ \frac{2,116,612,936 \text{ dollars}}{76.9 \%} = 2,751,854,000 \]
was more accurately 76.9 percent, the corrected direct job estimate is 17,632 in Pennsylvania in 2009.\textsuperscript{m}

**PPINYS Correction:** Using the official count of 768 wells drilled in 2009, and using 17,632 direct jobs in Pennsylvania in 2009, not the 21,778 claimed in the Penn Study study, lowers the estimate to about 23.0 direct jobs created for each new well started, down from the 31 direct jobs per well claimed.\textsuperscript{n} In turn this provides a corrected PPINYS estimate of 11,479 direct jobs by 2018 under the PPINYS scenario of 500 new wells each year.\textsuperscript{o}

The Penn State study overstated direct job creation by wrongly including landowner payments as creating direct jobs

Fixing this error further lowered the PPINYS direct jobs projection by 39 percent, from 11,479 to 6,965 direct jobs potentially created.

The above correction addressed how the Penn State study, by including payments to landowners and taxes, overstated the fraction of spending that stayed in the state. The Penn State study went on to include payments to landowners, such as signing bonuses and leasing and royalty payments, as in-state spending that actually created direct jobs.\textsuperscript{50} These payments did not create direct jobs, however; they could have created only induced jobs through landowners re-spending their income.

According to the Penn State study,\textsuperscript{51} payments to landowners in Pennsylvania in 2009 accounted for 39.3 percent of total spending by natural gas companies.\textsuperscript{p} It follows that only 60.7 percent of the estimated spending that the Penn State study used to calculate economic impacts could have actually led to direct job creation in Pennsylvania. Accounting for this fact, the number of direct jobs created in Pennsylvania by 2009, owing to shale gas development, is reduced by 39.3 percent, down to 10,699 from the previous correction of 17,632.\textsuperscript{q}

**PPINYS Correction:** Using the official count of 768 wells started in 2009 in Pennsylvania, the corrected estimate of 10,699 direct jobs created in Pennsylvania in 2009 translates to about 13.9 direct jobs per well.\textsuperscript{r} In turn, this leads to a corrected PPINYS estimate of 6,965 direct jobs by 2018, under the PPINYS scenario of 500 new wells developed each year.\textsuperscript{s}

PPINYS failed to mention that many of the high-paying gas industry jobs would go to transient, out-of-state workers, not to New Yorkers

Accounting for transient, out-of-state gas industry workers lowers the direct jobs projection by about 18 percent, from 6,965 to 5,707 direct jobs for New Yorkers.

While New York residents would be employed in direct jobs created in some sectors, such as hotel and food services or emergency response, the high-paying direct jobs in the gas industry would often not go to local workers.\textsuperscript{52} This is because New Yorkers are not likely to have the gas industry experience necessary to compete for shale gas drilling jobs. This has been the case in Sublette County, Wyoming, where transient workers primarily have taken the drilling, hydraulic fracturing and pipeline construction jobs.\textsuperscript{53} Yet when PPINYS claimed that shale gas development would bring 15,500 direct jobs to New York, it failed to mention that many of these jobs would go to transient, out-of-state workers in the gas industry.

Few data have been collected on the size and composition of the transient workforce engaged in gas

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\textsuperscript{1} Consistent with the input-output model used in the Penn State study, 21,778 divided by 0.95 gives the total number of in-state and out-of-state direct jobs, about 22,924 direct jobs.

\textsuperscript{m} Multiplying the total number of direct jobs by 2,116,612,936, divided by 2,751,854,000, (i.e., taking about 76.9 percent), means that about 17,632.36 direct jobs are actually created in-state. \[ (21778/0.95)*(2116612936/2751854000) = 17,632.36... \]

\textsuperscript{n} Precisely, \[ (((21778/.95)* 2116612936)/2751854000)/768 \] = 22.958...

\textsuperscript{o} Precisely, \[ 500*(((21778/.95)* 2116612936)/2751854000)/768 \] = 11,479.40...

\textsuperscript{p} $1,728,765,000 in lease and bonus payments plus $54,683,000 in royalty payments accounts for about 39.3 percent of the $4,535,304,000 in total spending.

\[ ((1728765000 + 54683000)/4535304000)/768 \] = 11,479.40...

\textsuperscript{q} Precisely, \[ (21778/0.95)*(2116612936/2751854000)*(1-(1728765000 + 54683000)/4535304000))/768 \] = 10,698.6689...

\textsuperscript{r} Precisely, \[ ((21778/0.95)*(2116612936/2751854000)*(1-(1728765000 + 54683000)/4535304000))/768 \] = 13.93...

\textsuperscript{s} Precisely, \[ 500*(21778/0.95)*(2116612936/2751854000)*(1-(1728765000 + 54683000)/4535304000))/768 \] = 6,965.279...
drilling.\textsuperscript{54} One estimate indicates that 70 percent of
gas rig jobs in Pennsylvania have gone to workers from
out-of-state.\textsuperscript{55} According to one \textit{Wall Street Journal}
article, Nomac LLC, a subsidiary of Oklahoma-based
Chesapeake Energy Corporation, employed no local
residents at its 23 Pennsylvanian drill rigs in 2009,
but by 2011 half of its employees were local residents.\textsuperscript{56}

Based on this limited evidence, Food & Water Watch
conservatively assumed that at least half of the gas
industry jobs would be filled by out-of-state workers if
New York is opened up to shale gas development.

The Penn State study reported that mining and
construction jobs accounted for 36 percent of all direct
jobs (7,867 mining and construction jobs out of the
estimated 21,778 direct jobs created during 2009).\textsuperscript{57}
Assuming that half of these gas industry workers are
from out-of-state, 18 percent of all direct jobs would
have gone to transient workers,\textsuperscript{5} possibly gas workers
from Texas, Oklahoma and Louisiana where shale gas
development was more established.

Accounting for 18 percent of direct jobs going to
transient workers means that, out of the corrected Penn
State study estimate of 10,699 direct jobs in Penn-
sylvania in 2009, only 8,766\textsuperscript{u} were likely to have been
filled by in-state workers.

\textbf{PPINYS Correction:} Using the official count of 768
new wells drilled in Pennsylvania in 2009 suggests that
only 11.4 direct jobs for Pennsylvanians were created
for each new well.\textsuperscript{v} Under the PPINYS scenario of 500
new wells in the five New York counties in 2018, this
would mean 5,707 direct New York jobs by 2018.\textsuperscript{w}

\textbf{PPINYS exaggerated future direct job
creation by ignoring economies of scale
and productivity growth}

\textit{Fixing this error further lowered the corrected
PPINYS direct jobs projection by about 39
percent, from 5,707 down to 3,469 direct jobs
potentially created.}

When PPINYS applied the Penn State estimate of direct
jobs created per well in 2009 in Pennsylvania to its 2018
scenario for potential shale gas development in New
York, PPINYS did not account for economies of scale and
gains in productivity,\textsuperscript{58} both of which reduce the amount
of shale gas development spending that can be expected
for each new well. Reduced spending on each new well
developed, in turn, leads to a reduction in the direct job
creation that can be expected when using an economic
impact analysis. Food & Water Watch found that econo-
mies of scale and gains in productivity would together
lower spending per well, and thus also direct job creation
per well, by about 39 percent.

As the number of shale gas wells developed in a given
region increases over several years, the amount of gas
industry spending needed to develop each new well
falls because supporting infrastructure, such as access
roads and pipelines, is already in place. Also, many
horizontal wells are drilled from a single well pad, so
the spending to establish the well pad is an upfront
cost. In Pennsylvania, data on actual and planned
spending indicate that in 2008, an estimated 364 wells
were drilled\textsuperscript{60} and $3.2 billion was spent,\textsuperscript{60} while in
2012, gas companies plan to spend $14.6 billion\textsuperscript{61} and
develop 2,415 wells.\textsuperscript{62} In terms of spending per well,
this suggests that economies of scale in Pennsylvania
have led to a 31.5 percent reduction in the amount of
spending per well,\textsuperscript{x} and thus an equivalent reduction in
potential direct job creation per well.

If the State of New York chooses to open up the state
to shale gas development, drilling and fracking would be
ramped up gradually over five years from 2013 to 2018.
Food & Water Watch estimates this would create econo-
mies of scale in New York for shale gas development
that, just as in Pennsylvania, reduce spending per well
by about 31.5 percent between now and 2018.

Across all economic sectors, the use of equipment and
technologies would lead to gains in productivity that
would, like economies of scale, reduce over time the

\begin{align}
\text{t} & \quad 0.5 \times (7867/21778) = 0.180618055… \\
\text{u} & \quad \text{Precisely, [ (21166112936/2751854000)\times(1\text{-}(1728765000 + 54683000)/4535304000)\times(1\text{-}(0.5\times7867/21778))] } = 8,766.296… \\
\text{v} & \quad \text{Precisely, [ (211778/0.95)\times(21166112936/2751854000)\times(1\text{-}(1728765000 + 54683000)/4535304000)\times(1\text{-}(0.5\times7867/21778))/768 ] } = 11.414… \\
\text{w} & \quad \text{Precisely, [ 500\times(211778/0.95)\times(21166112936/2751854000)\times(1\text{-}(1728765000 + 54683000)/4535304000)\times(1\text{-}(0.5\times7867/21778))/768 ] } = 5,707.224… \\
\text{x} & \quad \text{The total of $14.6478 billion divided by 2,415 wells is about $6.065 million per well. This is 31.53 percent less than 2008 spending per well, which was $3.2246 billion divided by 364 wells, or $8.8588 million per well.}
\end{align}
amount of spending necessary to develop each new well. The Congressional Budget Office (CBO) projects that labor productivity will increase by an average of 1.5 percent a year from 2010 to 2016, and by slightly more thereafter. This expected growth in productivity means, for example, that in 2011 the same output would be gained from 1/1.015, or 98.5 percent, of the cost of labor in 2010.

Continuing to 2012, the same output would be gained in 2012 from 1/1.015 of the cost of labor in 2011, which is (1/1.015)^2, or about 97.1 percent, of the cost of labor in 2010. Given the PPINYS report’s scenario of 500 wells being drilled in the five New York counties in 2018, gains in productivity would compound over eight years from 2010 to 2018. These productivity gains would reduce the amount of direct spending per well, and thus direct job creation per well, by about 11.23 percent.\text{\textsuperscript{y}}

Taken together, economies of scale and productivity growth would further lower spending per new well, and thus direct job creation per new well, by about 39.2 percent.\text{\textsuperscript{z}}

**PPINYS Correction**: The corrected PPINYS projection of direct jobs potentially created per new well in 2018 in New York becomes 6.9, down from the above correction of 11.4 direct jobs per well, after accounting for economies of scale and expected gains in productivity.\text{\textsuperscript{aa}} Under the PPINYS scenario of 500 new wells drilled, this would mean about 3,469 direct New York jobs could be created by 2018,\text{\textsuperscript{bb}} down from the original PPINYS projection of 15,500 direct jobs.

**PPINYS exaggerated total job creation by misusing an incorrect employment multiplier**

**Correct use of a more accurate employment multiplier, albeit taken from an American Institute of Petroleum study, leads to a projection of 6,656 total jobs, about one-tenth of the 62,620 jobs that PPINYS claimed.**

All of the above corrections address the PPINYS report’s prediction for direct job creation. PPINYS went on to incorrectly project how such direct job creation would lead to indirect and induced job creation, through a multiplier effect. The PPINYS report made two basic errors in its use of employment multipliers that, taken together, led to a twofold exaggeration of the economic spillover effects that shale gas development would have if allowed in New York.

First, PPINYS claimed to have used a multiplier of 3.04,\text{\textsuperscript{dd}} but if they had used it correctly, it would have meant that each direct job created would lead to an employment impact of 2.04 indirect and induced jobs, for a total of 3.04 direct, indirect and induced jobs.\text{\textsuperscript{65}} Instead, PPINYS claimed that each direct job created would lead to 3.04 indirect and induced jobs, and thus a total of 4.04 direct, indirect and induced jobs.\text{\textsuperscript{cc}} This is a misuse of the fundamental concept of employment multipliers.

Second, when 3.04 was selected\text{\textsuperscript{dd}} as the employment multiplier to use (or rather misuse), PPINYS assumed that all direct jobs created through shale gas development spending would be in the gas industry. PPINYS made this incorrect assumption despite the explicit breakdown in the Penn State study — the origin of the 31 direct jobs per well claim — of how direct jobs from gas industry spending were likely distributed across different economic sectors in Pennsylvania in 2009.

Assuming that all direct jobs are in the gas industry exaggerated the economic spillover effect of direct job creation because the oil and gas extraction industry has one of the largest employment multipliers of any industry.

\text{\textsuperscript{y}} The quantity ((1/1.015)^8) accounts for eight years of the expected 1.5 percent annual gain in productivity. This quantity is equivalent to 88.77 percent, meaning that an 11.23 percent reduction in spending is expected, across the economy, due to productivity growth.

\text{\textsuperscript{z}} Precisely, \[ \frac{(14647800000/2415)/(3224600000/364)*((1/1.01500)^8)}{(21778/0.95)*(2116612936/2751854000)*1-(1728765000 + 54683000)/45353040000)}*1-((0.5*7867)/21778)/768 = 0.60778477. \]

\text{\textsuperscript{aa}} Precisely, \[ \frac{(14647800000/2415)/(3224600000/364)*((1/1.01500)^8)}{(21778/0.95)*(2116612936/2751854000)*1-(1728765000 + 54683000)/45353040000)}*1-((0.5*7867)/21778)/768 = 6.93757... \]

\text{\textsuperscript{bb}} Precisely, \[ \frac{(500*(14647800000/2415)/(3224600000/364)*((1/1.01500)^8))*(21778/0.95)*(2116612936/2751854000)*1-(1728765000 + 54683000)/45353040000)}*1-((0.5*7867)/21778)/768 = 3,468.785... \]

\text{\textsuperscript{cc}} Taking the PPINYS claim of 62,620 total jobs, and dividing it by the PPINYS claim of 15,500 direct jobs, reveals that 4.04 was the employment multiplier that PPINYS actually used.

\text{\textsuperscript{dd}} PPINYS did not use an employment multiplier estimated by the Bureau of Economic Analysis. Since PPINYS did not reference its source, and did not respond to emails, how PPINYS selected 3.04 as the employment multiplier to (mis)use is unclear.
The lead author of the Penn State study, in a report for the American Petroleum Institute, projected that 15,727 total jobs across sectors would be created in New York in 2015 from an estimated 8,196 direct jobs created across sectors. This suggests that an employment multiplier of approximately 1.92 (or 15,727 divided by 8,196) accounts for differences in industry-specific employment multipliers, and for the fact that not all direct jobs would be in the gas industry.

**PPINYS Correction:** Taking the corrected PPINYS estimate of 3,469 direct jobs from the above section, and using correctly the more accurate employment multiplier of 1.92, leads, under the PPINYS scenario of 500 new wells in 2018, to a predicted total jobs impact of 6,656 by year 2018, compared to the case of no drilling. This is down by nearly a factor of 10 from the PPINYS claim that opening up New York to shale gas development would create 62,620 total jobs by 2018.

**Conclusion**

Even if this corrected jobs projection — 6,656 total jobs, down from 62,620 total jobs — were to become reality, it would be insignificant next to overall employment in New York State. To put the number in perspective, it is less than 0.1 percent of projected employment in 2018 in the state of New York, which is projected to be 9,726,760.71

Yet it is still overly optimistic to predict that by 2018, about 6,656 new jobs would be sustained in New York from the drilling and fracking of 500 new wells each year, relative to a baseline of no drilling. The corrected PPINYS projection remains based on industry-supplied spending data and the dubious use of economic forecasting models, not on actual employment data from regions with shale gas development. Unlike forecasting models, actual employment data account for the negative impact that shale gas development has had on employment in other economic sectors, such as agriculture and tourism. Indeed, Food & Water Watch analysis of actual employment data from five Pennsylvania counties adjacent to the five New York counties used in the PPINYS scenario suggested that shale gas development could have far less of an impact than even the corrected PPINYS projection.72

Precisely, \[(15727/8196)*500*(14647800000/2415)/(3224600000/364)*(1/1.01500)^8)*(21778/0.95)*(2116612936/2751854000)*(1-(1728765000 + 54683000)/4535304000)*(1-(0.5*7867)/21778))/768 \] = 6,656.12...

Projected jobs in New York from shale gas development in 2018 amount to less than 0.1 percent of the state’s projected employment in 2018.

It is therefore concerning that, in August of 2011, the Shale Gas Subcommittee of the U.S. Secretary of Energy Advisory Board repeated as fact the rosy jobs projections made by the lead author of the Penn State study in his more recent industry-funded report to promote shale gas development.73 Rather than use rosy jobs projections as a counterweight to environmental and public health concerns, local, state and federal policymakers need to acknowledge that shale gas jobs projections do not stand up to scrutiny. Empirical analyses of the actual economic impacts of shale gas development, not industry-backed projections from economic forecasting models, should be the basis of policy decision making.
Exposing the Oil and Gas Industry’s False Jobs Promise for Shale Gas Development • How Methodological Flaws Grossly Exaggerate Jobs Projections

ENDNOTES


16 PPINYS. July 2011 at 3.

17 Ibid. at 3.


20 Considine, Timothy J. et al. May 24, 2010 at 3.

21 Ibid. at 9, 11, 12.

22 Ibid. at 12.

23 Ibid. at 12.


28 Ibid.

29 PPINYS. July 2011 at 16.


31 Considine, Timothy J. et al. May 24, 2010 at 12.

32 Ibid. at 5.


35 Considine, Timothy J. et al. May 24, 2010 at 6, 9 and 10.

36 Ibid. at 6 and 9.

37 Ibid. at 11 and 12.


41 Considine, Timothy J. et al. May 24, 2010 at 6 and 9.


43 Ibid.

44 Considine, Timothy J. et al. May 24, 2010 at 5.

45 MSETC. June 2011 at 19.


47 Considine, Timothy J. et al. May 24, 2010 at 5.

48 Ibid.
Ibid. at 6 and 9.

Ibid. at 1, 2 and Table 1 at 5.

Ibid. at 5, Table 1.

MESTC. June 2011 at 19.

Ibid. at 1, 2 and Table 1 at 5.

Ibid. at 5, Table 1.

Ibid. at 29 to 32.


Considine, Timothy J. et al. May 24, 2010 at 12, Table 4.


Considine, Timothy J. et al. July 20, 2011 at 11, Table 2.

Ibid. at 26, Table 9.

Ibid. at iv, Table ES1.


PPINYS. July 2011 at 3 and 16.


Ibid.

PPINYS. July 2011 at 16.

Considine, Timothy J. et al. May 24, 2010 at 3, 12.

Bureau of Economic Analysis, Regional Input-Output Modeling System (RIMS) II Multipliers (2008/2008), Table 2.5. “Total multipliers for output, earnings, employment, and value added by industry aggregation New York State (type II).” [https://www.bea.gov/regional/rims/rimsii/, subscription required]


