

January 10, 2012

The Honorable Andrew M. Cuomo
Governor of New York State
NYS State Capitol Building
Albany, NY 12224

Dear Gov. Cuomo:

Daily, as the public becomes truly informed about hydro-fracking for gas, they are decidedly not trusting words calling it safe. In New York, there are over 70 non-profit groups fighting fracking, undertaking Herculean efforts on their own initiatives, spending precious personal time to convince you and other legislators at the pending harm that will come. There are over 40 towns that have taken measures to protect themselves by prohibiting heavy industrial use. Your public is clearly sending you an urgent message.

This letter is to express my deep concern, based on evidence and science. The problems of this technology and fuel procurement cover many perspectives and in over-lapping categories. The following is not a comprehensive list, yet it highlights most important issues, and shows how much is not addressed and remains unknown. Many of these problems should be - in themselves - sufficiently insurmountable cause to stop hydrofracking for gas. Based on this combined block of information, there is no other course than a statewide ban.

Climate change issues: [rdSGEIS 6.6 Greenhouse Gas Emissions](#)

- Shale gas (aka natural gas) is **not clean** energy. It emits less greenhouse gases than oil and coal when burned, yet the peer-reviewed study by Cornell University's Ingraffea and Howarth demonstrates that, over the entire process of procuring shale gas to the burning of it, **shale gas has a higher greenhouse gas contribution than coal!** "NASA climate scientist Drew Shindell's work, published in the prestigious journal, Science, shows that methane – natural gas – is 105 times more powerful than carbon dioxide as a global warming contributor over a 20-year time horizon, and 33 times more powerful over a century". ^{i ii iii iv v vi}
- Scientists say that we have only 5 (five) years to mitigate climate change which is predominantly caused by fossil fuel use. If we fail to act, climate change will be irreversible. We must start now with renewable energy. This is the 800,000,000 ton gorilla in the room and humans should be smart enough to not ignore it. **"Anything built from now on that produces carbon will do so for decades, and this "lock-in" effect will be the single factor most likely to produce irreversible climate change, the world's foremost authority on energy economics has found. If this is not rapidly changed within the next five years, the results are likely to be disastrous."** ^{vii}

- The development and use of shale gas (along with other fossil fuels) condemns us to push the climate to irreversible and incomprehensible tragic change. ^{viii}
- **An excerpt regarding the SEQR mission from the DEC web site: III. Purpose and Background:** Global climate change is one of the most important environmental challenges of our time. There is scientific consensus that human activity is increasing the concentration of GHGs in the atmosphere and that this, in turn, is leading to serious climate change. These climate changes will continue to affect the environment and natural resources of the State of New York.”
- In Chapter 6.6, the rdSGEIS shows data based on a 2009 study, which recognizes many steps in the extraction process that emit GHG, yet these more current Ingraffea and Howarth studies must replace the older data.
- **It is not possible to follow the requirements and mission of SEQRA and simultaneously permit hydrofracking for gas in New York State, this “human activity” – acknowledged above - glaring us in the face with its undeniable shale-gas dangerously-high carbon-contribution level.**
- Even though this is a national and global issue, New York State government should take this opportunity to lead with courageous change by developing and encouraging renewable energy. In this way we New Yorkers can be proud to take a step toward a better and sustainable future for our citizens, environment and State.

Financial issues:

- The business of natural gas is a powerful engagement between the stock markets and gas companies selling and buying assets and product. In the endnote here, a chart shows some of that activity: ^{ix} While this can be thrilling for the markets and stock holders, it mirrors the bundled mortgage market which collapsed the housing market a few years ago, there is substantial evidence that this industry’s markets carve the same paths of over-exhuberance. ^{x xi xii}
- *“But it may be hard for the SEC, the companies themselves, and investors in general to determine just how much gas these firms hold in the ground - a key metric in determining the stock price for any energy company. “The history of these wells is so limited,” said Neal Dingmann, a Houston-based analyst at investment bank SunTrust Robinson Humphrey. “It’s going to be a very touchy call to determine what you can book on these reserves.”^{xiii} “Yet it is possible for firms such as K.K.R. to have extraordinary success in investing in so-called shale plays. Starting in 2009, the firm has placed three consecutive bets on the business of extracting natural gas from shale rock formations through hydraulic fracturing technology, or fracking. It had previously sold two of those investments, flipping them to large energy companies and making billions of dollars for the firm and its investors. It further pressed its shale bet earlier this week with its \$7.2 billion purchase of the Samson Investment Company, the largest corporate leveraged buyout of 2011.”^{xiv}*
- The quantity of Marcellus shale gas that is extractable is substantially less than the industry estimates. In August, 2011, the USGS said it is about 80% less (84 trillion cubic feet) of extractable gas than industry estimates (410 trillion cubic feet). ^{xv} This is not cost effective for lessees or NY State; the income the gas industry would earn will not be from the well production.^{xvi} An update/ correction of information is

needed on the DEC web site: <http://www.dec.ny.gov/energy/46288.html> which still states older information: "Geologists estimate that the entire Marcellus Shale formation may contain up to 489 trillion cubic feet of natural gas throughout its entire extent. It is not yet known how much gas will be commercially recoverable from the Marcellus in New York." National average as of 12/29/11 is only 11 years of gas.^{xvii} One wonders - what's the fuss all about if we don't have sufficient gas to extract!

- Since the gas supply in New York State is not significant, the benefits of increased gas procurement do not make sense. "A review of more than 9,000 wells, (*in Texas where there is more extractable gas than in NY*) using data from 2003 to 2009, shows that — based on widely used industry assumptions about the market price of gas and the cost of drilling and operating a well — less than 10 percent of the wells had recouped their estimated costs by the time they were seven years old."^{xviii} Examples of industry exaggerating estimates in Texas.^{xix} (repeating: National average as of 12/29/11 is only 11 years of gas.^{xx})

Gas companies are interested in selling abroad instead of domestically because the price is \$4 here in the US and it is \$9-15 per million Btu abroad. An example of that is the Spectra's application to run a pipeline through the West Village of Manhattan, would also supply a compressor plant for production of liquid natural gas to ship it abroad. "Gas that sells for \$4 per million Btu in Alberta or Wyoming can be piped to the Oregon Coast, liquefied, and delivered to Japan via tanker for about \$9, they say. That beats what a Gulf Coast terminal can deliver due to shorter shipping distances. The spot price for natural gas in Japan, which has no gas or pipeline access of its own, is currently in the range of \$11 or \$12. The price under multiyear contracts is even higher, as those contracts are indexed to crude oil prices. Bottom line, U.S. producers can double or triple their net by exporting to Asia versus selling domestically".^{xxi} ^{xxii} As of 12/31/11, gas futures price have dropped and are reported at \$3 Btu. "*American natural gas production growth is essentially useless at this particular point in time since you can't make any profit on North American natural gas,*" *EOG Resources Inc. Chief Executive Mark Papa told an energy conference in late November. EOG plans to direct 90% of spending to oil production in 2012, drilling for gas only where it is necessary to hold on to acreage, he said.*^{xxiii} ^{xxiv}

- The US shale gas boom has the hallmarks of a technology bubble: firms need continual re-capitalization but their gas output is not demonstrably profitable. Value is instead based on reserves and technology. Reserves are not independently verified and are industry inflated.^{xxv} The switch from gas to oil suggests shale gas can survive only through cross-subsidization.^{xxvi} *Over the past five years Chesapeake has entered into 600,000 leases covering 9 million acres, paying out \$9 billion in lease bonuses to landowners in the process—so much land that it would take Chesapeake 30 years to drill it all. And the more new shale plays uncovered, the more land McClendon continues to acquire. Chesapeake has piled on \$10 billion in long-term debt and raised billions more through financial finagling to gobble up its acres. McClendon argues it's money well spent because there's only a small window to get good acreage for low prices. As Jeff Mobley, his investor relations spokesman, explains: "If we lived within cash flow we'd miss the opportunity. But think about it: what value is it to*

shareholders for Chesapeake to be sitting on gas fields it won't get around to drilling for a decade or more? Especially when every year it has to pay interest on the debt it took on to acquire the acreage. It's like if General Electric built a factory to make LED lightbulbs then just kept it in mothballs."^{xxvii}

- Lawmakers asked the SEC to investigate gas industry officials about the reliability of their estimated resources.^{xxviii} *"The recovery is very low, apparently 10% or less. Well life is short, due to rapid decline of production. Barnette wells are abandoned, on the average, at seven and a half years. Marcellus wells decline more rapidly. Secondary recovery, restimulation of played-out wells has not been demonstrated."*^{xxix}
- Per Financial Analyst, Deborah Rogers: If shale gas usage in the US increases, and if Congress adopts a T. Boone Pickens plan which is to implement a mass conversion of our heating, electric and transportation systems to shale gas it will be a project requiring decades of work and substantial funds, and it will position natural gas as our prominent energy source. Although it is more profitable to export gas now, domestic prices will rise inevitably because of exportation. This will be great for gas companies who will make tremendous money. But what about the citizens who have been told that gas is cheap and abundant? Now we are all dependent on natural gas, and trapped as we watch natural gas prices escalate through the roof from \$4 to \$15 or even higher as the shale gas is depleted. We will be caught in a classic consumer squeeze.^{xxx}
This could lead the US to another financial collapse - if not also a global one.
- **We are at a point where environmental and health degradation costs are higher than the income/economic benefit.**^{xxxi xxxii xxxiii xxxiv}

Environmental and health issues: Chapter 3 and Chapter 4 & sub-heads

- The overarching reason the DEC states as a cause of water contamination is casing failure but that is not the major issue. Migration is a huge, under-appreciated problem, that is dismissed in the rdSGEIS. To disregard methane migration as only a naturally occurring circumstance is to overlook the obvious fact that methane did not appear in people's wells until after fracking occurred. Because the reSGEIS ignores the impacts of migration caused by fracking, a most important component in the full picture is not valued for its cumulative impact. Gas companies like to drill where more fissures and fractures exist since it helps draw the gas. Because they are exempt from important provisions of the Safe Drinking Water Act and Clean Water Act they are able to escape cause and pass burden of proof on to those damaged. These chapters of the reSGEIS must be re-examined.
- HVHF contaminates drinking water wells with frack fluids and methane.^{xxxv} There are numerous examples of this occurring across the USA, even though many are not reported (or recorded) by state DEC's or DEP's.^{xxxvi xxxvii} Further, maps the DEC used of fractures and fissures, which provide ready pathways for migration, are not current and do not show the complexity that exists.^{xxxviii xxxix}
- Chapter: 3.2.5 New York City's fate is inextricably bound to a clean, frack-free Upstate NY.

- Fracking will contaminate the NYC Watershed over time, because the underground is alive and migration is not predictable.^{xi} New York City will be affected if fracking occurs around the Delaware/Catskill Watershed, which supplies about 90% of NYC drinking water. Regulations to fracture rock only 1000 ft from NYC subsurface water supply infrastructure (tunnels) could cause vibration substantial enough to collapse tunnels. New York City could lose its water in 24 hours.^{xli} Our City could be put out of business.
- Under the current rdSGEIS, gas companies can drill 4000 ft from watershed boundaries. rdSGEIS ignores underground migration of frack fluids and methane - with no supporting data. The Hazen and Sawyer report, written in 2009 regarding fracking's impact on New York City, describes migration as a most substantial issue.^{xlii} That is reinforced by current maps showing Upstate NY and the Delaware/Catskill watershed's abundant naturally occurring faults, joints and fractures in the layers of shale. Please note these dense layers of fractures seen in Jacobi map attached.^{xliii} Explosions used to fracture shale stimulate unpredictable migration pathways for methane and frack fluid through these fissures.
- That the 80% of processed water left underground will stay down there is simply a myth. Industry geologists may say that the pressure of the rock above the shale will hold the processed water down. Again, please refer to Hazen and Sawyer, and the following statement which discusses the Delaware River Basin – part of the region proposed for fracking in New York State: *Paul A. Rubin says, "In my professional opinion, vertical exploratory gas wells, as well as horizontal hydraulically fractured wells, create a high risk of contamination of the water resources of the Delaware River Basin. This risk exists not only at the time of drilling but also increases over time, because of a) the likelihood of failure of the well over time, b) the likelihood of eventual migration of toxic natural and drilling-related substances through extensive natural fractures that exist throughout the region, and c) the exacerbation of a) and b) above by natural or drilling-induced seismic activity."*^{xliv} The cumulative impact of toxic frack fluids creeping up to aquifers, wells, springs, streams and rivers is more than 'quite likely'. The attached study by Paul A. Rubin needs to be examined in its entirety.^{xlvi}

"As the production pressure declines with time, the fissure will tend to open more because the casing is less pressurized. Also, fracture growth in the vertical direction is undoubtedly aided by pressure and thermal cycles."^{xlvi}

- The Catskill Mountains and the Appalachian Basin, among the oldest mountains in the world, are laced with joints, fractures and fissures. It's no surprise that gas is migrating in the Susquehanna River region, uncontrollably, caused by drilling. This migration currently covers 60 sq. miles.^{xlvi} This situation is not confined only to our region - there is documented evidence of frack fluid migrated for 28 miles in Wyoming in 2009^{xlvi}.

One may hear that 7 miles is a sufficient boundary for the watershed^{xlix}, but who can prove that migration will not travel 50 or 100 miles - now or in 10 or 20

years? Migration travels great distance vertically and horizontally in the Devonian Layers.^l (Read Paul Rubin, referenced above.) Nobody really knows how water will migrate and how new fissures will form.^{li} That the SGEIS ignores this vital issue is reason to discard it. This issue presents a risk not worth taking.

- Leaking from well casings is inevitable – regardless of being “faulty”. Cement casing failure rate is about 12% immediately, 60% within 30 years, and 100% within 100 years, according to Professor Anthony Ingraffea, fracturing mechanics expert at Cornell University. ^{lii liii} (The industry agrees.)
- Chapters 3.2. and 6.1 Destroys ecosystems: trees, wildlife (endangered species as well), wetlands^{liv lv} The SGEIS treats this is an acceptable consequence of this “necessary” technology. The proposed ‘screens’ to keep fish from being captured during water withdrawals is a simplistic solution and will not protect habitats and their variety of species from losing their food sources and being killed. Groups dedicated to protect wildlife and environments are greatly troubled or oppose this devastation of nature by fracking: Riverkeeper, *“My name is Paul Gally and I’m the Hudson Riverkeeper. I’ve been an environmental advocate for twenty-five years and I don’t think I’ve ever seen a bigger danger to human health, air and water, or community character than the one we now face from fracking.”*^{lvi}, Audubon Society^{lvii}, Catskill Mountainkeeper, Sierra Club^{lviii}. The nuances of species needs for existence is not appreciated in the rdSGEIS, as it should be in this example: *“51) Gas drilling activities may pose a health risk to cave-dwelling species and cavers, including the federally endangered Indiana bat (Myotis sodalis). The build up of methane and other toxic chemicals in caves and mines may pose both an explosive and health risk to cavers, cave scientists, and cave-dwelling fauna. People and bats in caves may potentially be overwhelmed by the build up of methane and other toxic chemicals. This could lead to their deaths via inhalation or via explosions similar to those that have occurred at wellheads above gas plays. If methane or LNAPLs were to seep or flow into caves (from below or from leaking surface holding pits) situated above gas-rich shales, caves might in effect become “confined spaces” - toxic to breathe in with great and, possibly, rapid exposure risk. Importantly, cave dwelling animals, such as bats (Figures 8 and 9), might have their already stressed populations (i.e., via White-Nose Syndrome; USGS, 2010) further decimated by gas field related contaminant excursions.”*^{lix} This is another conflict with SEQRA, as fracking destroys biodiversity.
- Health impacts on farm animals are not assessed in the rdSGEIS. ^{lx} This also has cost implications on farming, as vet bills rise, animals die or can not produce milk. These costs must be coupled with the loss of businesses selling organic milk or produce which cannot be classified as ‘organic’ when surrounded by air and land contaminated by fracking.

Chapter 6.5

- Air Quality: Fracking degrades air quality. *The Uintah Basin of northeastern Utah and the Green River Valley of southwestern Wyoming are sparsely populated areas... But*

when thousands of new natural gas wells were drilled over the past decade, the result was some of the thickest smog in the United States.

In Sublette County, WY, where 10,000 people live across an area the size of Connecticut, the pristine air of years past has proved stubbornly hard to restore. When officials looked at air quality monitors several years ago, they discovered that emissions from drilling wells had made the air so dirty that it rivaled the worst summer days in Southern California.”^{lxi lxii lxiii lxiv lxv}

- Upstate are the lungs for NY State and NY City: Pollution turning the air into smog from mists sprayed into holding ponds, methane releases and truck tail pipe emissions (from thousands of trucks daily) moves into air and can travel 200 miles. These pollutants are known to cause cancer, asthma, heart attacks among other illnesses. ^{lxvi} Wyoming drilled first and now tries to understand the severe consequences. Naysayers may well - in hindsight - understand these graver impacts including cancer, neurological disorders and death for humans. That irresponsibility cannot be the plan for New York State.^{lxvii}
- New York doctors want a health study included in the rdSGEIS. More than 250 doctors and other health care professionals have signed a letter to Gov. Andrew Cuomo seeking a comprehensive human health study of the state's proposal to permit new deep drilling for natural gas across the Marcellus Shale region of upstate New York. ^{lxviii} The rdSGEIS should fully address this and extend the comment period. If the analysis is not prepared by non-industry affiliates, fracking cannot happen in NY.

Chapter 6.13.14

- Fracking and its related activities (i.e:injection wells) causes earthquakes, which will be even more likely in seismic New York State (over 700 earthquakes have occurred in NYS since 1860’s). There are documented earthquakes caused by fracking in Arkansas, Oklahoma, West Virginia (which we felt in NY in late summer 2011, and whose epicenter was surrounded by numerous fracking wells within very close proximity), and England. ^{lxix lxx lxxi lxxii lxxiii} Ohio had another on Jan 1, 2011 magnitude of 4.0, Ohio is not seismic. ^{lxxiv}Further, it is quite possible that New York’s seismic tendencies will be amplified and earthquakes will occur much more frequently due to fracking, setting a platform for future earthquakes to be of much higher than historically. “... earthquakes may instantly destroy the integrity of hundreds of gas wells, thereby forever and irreparably compromising the hydrologic integrity of geologic formations that formerly protected freshwater aquifers.” (Paul Rubin xxxix) The rdSGEIS says that earthquakes won’t have an impact, but this 2011 version was written before some of the earthquakes in England and Oklahoma occurred, hence, these studies must now be incorporated into the SGEIS. Since now ‘frack-quakes’ impacts include a likely scenario that earthquake velocity will rise causing buildings to fall, roads to crumble, NYC aqueducts to collapse, and people and animals to die, if this is permitted by the rdSGEIS, it will have to be seen as a preventable event the DEC ignored.
- Chapter 6 & 7: Radioactive shale gas travels through pipelines, and will have unacceptable levels of radon to be safe for use in New York City. Radioactivity also

degrades the pipelines themselves.^{lxxv} Marcellus Shale gas has high radium levels and therefore high radon levels, reaching 140 to 150 picocuries per liter.

- The Spectra Energy Pipeline would serve as a conduit for the transmission of Marcellus Shale gas and its radioactivity into NYC apartments and homes, schools, hospitals, commercial properties and Con Ed utility substations.
- The pipeline travel time from the shale gas areas of New York and northeastern Pennsylvania will be about 12 to 15 hours. Decay of the radon over this transit time will be 10 to 15%. This will result in radon levels in NYC apartments in the range of 120 to 130 picocuries per liter, over two orders of magnitude greater than the EPA action level. Radon is heavier than air and will settle in the lowest part of a dwelling, i.e. near the floor. This will mean small children will inhale more of the radon than adults. (It also means that workers on sites will not be safe from inhalation of it.)
- The health impact of the radon occurs in a person's lungs when it decays by radioactive emissions and the energized particles strike the tissue inside the lung. DNA is broken and cancer cells are produced. EPA has found that exposure to radon is the second leading cause of lung cancer, just behind cigarette smoking.
- EPA's estimate of excess cancer deaths from radon is 21,000 per year on a nationwide basis. The estimated excess radon induced cancer deaths from shale gas is over 13,000 per year – more than a 50% increase over the EPA national estimate, and these additional cancer deaths will be concentrated in the New York Metro area and the New England states where the Marcellus gas will be distributed.
- Chapter 2, 2.5.9 Hundred-year floods - and even 500 year floods - are happening every few years now. Holding ponds, equipment failure and leaks make it impossible to frack safely in regions of many streams, springs and rivers which encompasses regions with shale gas. The Sept 2011 horrific floods should be fair warning of the forthcoming climate change impacts of more severe weather. All regions with rivers and streams now must be classified as flood plains and prohibited from fracking,
- 3.2.2.1 Definition of High – Volume ... mentioned 300,000 + gallons of water used. This is not a cumulative impact amount. *"In the Barnett Shale, estimated frack water usage ranges between 2.5 to 9 million gallons per frack. The Marcellus Shale average, according to **Dr. Anthony Ingraffea** is 5.5 million gallons per frack. The Eagle Ford Shale average, according to the Texas Water Development Board, is 7.5 million gallons per frack. We don't know exactly how much water they use because most of the estimates come from industry. We do have **the little dab of information from the Upper Trinity Groundwater Conservation District** that revealed industry used **1,146,598,272.73** gallons of groundwater in 2009. But that only considers the metered sources. There were many cases where industry took water from unmetered sources with no enforcement action or fines".^{lxxvi}*
- There is no way to dispose of all of frack waste's toxins safely. "In Dec. 2011, at a hearing, DEC Deputy Commissioner Eugene Leff testified that, besides "recycling,"

the disposal methods anticipated are disposal wells or processing at water treatment plants ... yet Leff acknowledged that no plants are authorized to accept waste water from fracing operations in New York State.”^{lxxvii} Frack waste must be reclassified as hazardous waste, and treated appropriately under that definition. “To be treated, that wastewater would have to be reduced to a slurry, by some yet-to-be- built facility, not by municipal wastewater plants. And that slurry would have to be injected into a seismically inert formation. In theory, all of this is doable, if problematic. But the practical challenges of disposal have yet to be addressed by local governments or the NY DEC. Without appropriate disposal systems in place, radioactive waste is likely to be dumped at municipal water treatment plants, which will be left with radioactive sludge that they cannot get rid of safely. Since some of these radioactive wastes may be shipped across state lines for disposal, they present an interstate problem, which would necessitate the scrutiny of the EPA, which has regulatory authority over radioactive wastes. Radium decays into radon, a highly carcinogenic gas and the second leading cause of lung cancer. Unfortunately, radon is found at elevated levels in the Marcellus shale. Parts of the Marcellus are particularly “wet” with propane, which has physical properties similar to radon. So radon gas may separate out of Marcellus gas with propane, presenting a health risk to workers who handle Marcellus source propane, and potential hazards to users of such propane, if radon contaminants are not removed prior to sale. Radon contamination may pose a risk to persons that use Marcellus gas in the field, in compressors, truck engines and other equipment.”^{lxxviii}

- Chapter 5.13 – Waste disposal
In light of the information provided regarding migration, injection wells will never be safe for long term use. Please refer to “Environment” comments above.
- Chapter 7.17.2 Road spreading should never be permitted. The toxic hazards are too dangerous for domestic and wild animals, plants and crops.

Economic issues:

- Jobs – the industry estimates hundreds of thousands of jobs, but non-gas company studies show only a few hundred, or less than ten thousand over a decade. A report issued in Nov. 2011, shows that Pennsylvania jobs have strongly declined – and these were the years of their shale boom. *“Between September 2009 and September 2010, Pennsylvania ranked fourth among the states in the number of jobs created and seventh by job growth percentage.... Over the last year, Pennsylvania has lost 21,000 public-sector jobs, including some 13,000 education jobs. Among the 50 states, Pennsylvania saw the sixth-largest decline in state and local jobs in the last year.”* ^{lxxix}
“One of the most compelling pro-gas drilling arguments was negated yesterday by the Keystone Research Center’s report on the gas industry lackluster job generation in Pennsylvania. A press release issued by the Center, a research and policy development institute, noted that the “48,000 new jobs” statistic, which is often tossed around by friends of the gas industry and repeated in news reports, does not accurately reveal the whole truth of the matter. Instead, they posit that “between late 2007 and 2010, the Marcellus Shale boom created fewer than 10,000 new jobs in Pennsylvania.”^{lxxx}
- Reduces real estate values in regions where fracking occurs up to 70-90, if not

100%.^{lxxxii} This depression will destabilize towns. When real estate values drop, the impact ricochets throughout a region affecting restaurants, contractors, architects, housing wares and goods, furniture, all sorts of businesses and property tax revenues. Banks have a conflict giving residential mortgages to properties that have industrial uses, and in some cases will cancel a loan because of the change in use. To complicate that, gas companies are getting mortgages on their leases (without owner consent), which then reflects on the owner's loan to value.^{lxxxiii} "Homeowners who sign gas leases to permit hydraulic fracturing for shale gas in Maryland, New York, West Virginia, Pennsylvania and other states may be defaulting on their mortgages, risking loss of title insurance and homeowners' insurance coverage, and preventing future buyers from obtaining title insurance or mortgage loans on affected property."^{lxxxiii}

- Once land is fracked, it cannot be re-used in a healthy way.
- **Social and economic studies are in progress and the public needs a 2 month extended comment period respond to that.** Independent studies - not gas company affiliates or other conflicts of interest - must conduct these studies.
- Evaluate the cumulative impact of these costs:
 - adverse health impacts on animals
 - loss of organic farm product and jobs
 - loss of an ecosystem since fracking impact and accidents could permanently modify the landscape – the trees, wildlife, wetlands - which will not be returned to any usable status
 - ruined domestic wells and financial burden on owners
 - destroyed recreational regions: skiing, fishing, hiking, camps for people of all ages, air pollution
 - road construction/repair should be an expense is gas companies.^{lxxxiv}
- Even the NY State Comptroller's office wants to have a gas company escrow for "hazardous" damage.^{lxxxv} Many million dollars is not going to meet these expenses.
- Between 1947 and 1977, General Electric (GE) dumped an estimated 1.3 million pounds of carcinogenic polychlorinated biphenyls (PCBs) into the Hudson River. After over 30 years filled with law suits, they now are scheduled to start a clean up in May 2012. The Newtown Creek site, a 3.5 mile region of Queens, a superfund site damaged by Exxon Mobil, BP and others, will take now 18 to 22 years combining a study and the remediation to clean up. The spill was discovered in 1978, and in 2010 a settlement of \$25 million made by the oil companies, \$19.5 million is allotted to environmental restoration. Anticipated cost for clean up is \$400 million.^{lxxxvi}
- Complex legal networks are being employed to get what gas companies want. Farm land in Louisiana, leased to Texaco (a subsidiary of Chevron) was contaminated. After 14 years of the farm owner's claims remaining unsatisfied, Sabine Pipeline stepped in and (another subsidiary of Chevron) gave the family a choice to either sell the land or be forced to sell - a variation on eminent domain. Soon after, Sabine sued the farmer to take the over the land, "saying the 14-year legal fight with Texaco was threatening the continued operation of one of the most important **natural gas** pipeline hubs in the country." "The Broussards, (the farm owners) say the timing of the letter and the scope of the demand are more than a little curious. They contend

iii <http://www.cbc.ca/news/canada/new-brunswick/story/2011/11/28/nb-f-shale-gas-anthony-ingraffea-122.html>

iv <http://www.tcgasmap.org/media/Ingraffea%20Slides%207-25-11.pdf>

v <http://tcgasmap.org/media/Ingraffea%20Transcript%207-25-11.pdf>

vi <http://www.youtube.com/watch?v=EHg6Ueb2t-E&feature=related>

vii <http://www.guardian.co.uk/environment/2011/nov/09/fossil-fuel-infrastructure-climate-change>

viii <http://www.nytimes.com/2011/12/17/science/earth/warming-arctic-permafrost-fuels-climate-change-worries.html?scp=4&sq=climate%20change&st=cse> To deliberately allow any more carbon into the air now – in this case, encouraging use of natural gas – is truly a death wish to the planet.

ix https://docs.google.com/spreadsheets/ccc?authkey=CMP4r_QI&key=0AttP1cRHZ8J_dGc1SFp4OHIEQ3UtVVl2UDILYkxxM3c&hl=en_US&authkey=CMP4r_QI#gid=0

x <http://www.nytimes.com/2011/06/27/us/27gas.html>

xi <http://www.nytimes.com/interactive/us/natural-gas-drilling-down-documents-5.html#document/p9/a21602>

xii http://www.nytimes.com/2011/06/26/us/26gas.html?_r=1&nl=todaysheadlines&emc=tha2

xiii <http://money.cnn.com/2011/08/03/news/companies/shale-gas-sec/index.htm>

xiv <http://dealbook.nytimes.com/2011/11/25/k-k-r-s-energy-billionaires-club/>

xv The DEC web site still says 489 trillion cubic feet even though the USGS says 84 trillion cubic feet. <http://www.dec.ny.gov/energy/46288.html>

xvi <http://www.nytimes.com/2011/08/25/us/25gas.html>

xvii http://www.slate.com/articles/health_and_science/future_tense/2011/12/is_there_really_100_years_worth_of_natural_gas_beneath_the_united_states_.single.html

xviii <http://www.nytimes.com/2011/06/26/us/26gas.html?pagewanted=all>

A former stockbroker with Merrill Lynch, Ms. Rogers said she started studying well data from shale companies in October 2009 after attending a speech by the chief executive of Chesapeake, Aubrey K. McClendon. The math was not adding up, Ms. Rogers said. Her research showed that wells were petering out faster than expected.

“These wells are depleting so quickly that the operators are in an expensive game of ‘catch-up,’ ” Ms. Rogers wrote in an e-mail on Nov. 17, 2009, to a petroleum geologist in Houston, who wrote back that he agreed.

xix <http://www.nytimes.com/imagepages/2011/06/26/us/26gasgraphic1.htm>

xx http://www.slate.com/articles/health_and_science/future_tense/2011/12/is_there_really_100_years_worth_of_natural_gas_beneath_the_united_states_single.html

xxi By [Ted Sickinger, The Oregonian](#)

http://www.oregonlive.com/business/index.ssf/2011/07/oregon_lng_terminal_plans_reve.html

xxii <http://energy.aol.com/2011/11/10/what-will-lng-exports-cost-us-consumers/>

xxiii

http://online.wsj.com/article/SB10001424052970204720204577130482684060876.htm?mod=WSJ_hp_LEFTWhatsNewsCollection

xxiv <http://monongahelagas.wordpress.com/2011/12/31/shale-drilling-facts-you-might-not-know/>

xxv <http://www.nytimes.com/2011/06/26/us/26gas.html?scp=1&sq=drilling+down+deborah+rogers&st=nyt>

xxvi <http://russia.platts.com/newsfeature/2010/chesapeake/index>

xxvii <http://www.forbes.com/sites/christopherhelman/2011/10/05/aubrey-mcclendon-chesapeake-billionaire-wildcatter-shale/2/>

xxviii http://hinchey.house.gov/index.php?option=com_content&view=article&id=1670:hinchey-calls-on-sec-to-investigate-charges-of-overbooking-questions-eias-handling-of-shale-gas-reserve-estimates&catid=71:2011-press-releases

xxix <http://monongahelagas.wordpress.com/2011/12/31/shale-drilling-facts-you-might-not-know/>

xxx http://www.youtube.com/watch?v=bYzU4bEfj5U&feature=channel_video_title

xxxi http://www.youtube.com/watch?v=bYzU4bEfj5U&feature=channel_video_title
<http://www.nytimes.com/2011/06/26/us/26gas.html?scp=1&sq=drilling+down+deborah+rogers&st=nyt>

xxxii <http://www.sustainablefuture.cornell.edu/news/attachments/Howarth-EtAl-2011.pdf>

xxxiii <http://www.cbc.ca/news/canada/new-brunswick/story/2011/11/28/nb-f-shale-gas-anthony-ingraffea-122.html>

xxxiv <http://www.guardian.co.uk/environment/2011/nov/09/fossil-fuel-infrastructure-climate-change>

xxxv <http://www.tcgasmap.org/media/Ingraffea%20Slides%207-25-11.pdf>

xxxvi http://switchboard.nrdc.org/blogs/amall/incidents_where_hydraulic_frac.html

xxxvii <http://www.nytimes.com/2011/11/20/magazine/fracking-amwell-township.html?pagewanted=all>

xxxviii <http://www.damascuscitizens.org/gas-migration-into-Susquehanna-river.html>

xxxix <http://damascuscitizens.org/Stray%20gas%20plagues%20NEPA%20Marcellus%20wells%20%207%3A10%3A2011.pdf>

xl http://www.damascuscitizens.org/Does_Old_EPA_Fracking_Study_Provide_Proof_of_Contamination.html Please review all articles on this web page re migration.

xli Al Appleton, former Commissioner of NYC DEP, stated this at a hearing conducted by Jim Gennaro in NYC this fall.

xlii http://www.nyc.gov/html/dep/pdf/natural_gas_drilling/nycdep_comments_final_12-22-09.pdf The 2009 comments from NYC re: migration continue to be dismissed in the 2011 SGEIS. "Section 4.5 of the dSGEIS should have addressed the possibility of un-mapped faults and other brittle-type structures such as these linear features with respect to induced seismicity and seismic hazards. Additionally, the dSGEIS does not present an adequate assessment of the possibility of faults and other features serving as conduits that could allow transmission of formation water or fracturing chemicals into the local freshwater aquifers or towards tunnels and aqueducts. This discussion should include an analysis of the likelihood of linear features as well as joint sets and un-mapped features contributing to the migration of formation water or fracturing chemicals in the subsurface and possibly to the surface."

xliii <http://hydroquest.com/Riverkeeper/Figure%203%20-%20Lineaments%20&%20Faults%20of%20NYS.pdf>

xliv http://www.damascuscitizens.org/Rubin-Report_R1.pdf

xlv http://www.damascuscitizens.org/Rubin-Report_R1.pdf

xlvi <http://www.scribd.com/doc/65704543/Casing-Leaks>, see pg 4 and rest of document.

xlvii <http://damascuscitizens.org/gas-migration-into-Susquehanna-river.html>

xlviii <http://www.propublica.org/article/natural-gas-drilling-what-we-dont-know-1231>

^{xliv}http://www.nyc.gov/html/dep/pdf/natural_gas_drilling/12_23_2009_final_assessment_report.pdf This entire report is relevant.

^l <http://www.gswweb.org/aapg/abstracts/Ryder.pdf>

^{li} <http://hydroquest.com/Riverkeeper/HydroQuest%20Geologic%20Report%20on%20Exploration%20Wells%2011-15-10.pdf>

Jacobi (2002) documented numerous joints and faults (collectively termed fractures) present throughout the headwaters of the Delaware River Basin, as well as elsewhere throughout portions of New York State overlying the Marcellus and Utica shales (Figure 3).

^{lii} <http://tcgasmag.org/media/Ingraffea%20Transcript%207-25-11.pdf>

^{liii} <http://www.scribd.com/doc/65577477/How-Gas-Wells-Leak>

^{liv} water withdrawals, impact on river http://www.damascuscitizens.org/DRBC-DCS_D_2009-20-1.pdf

^{lv} <http://hydroquest.com/Riverkeeper/HydroQuest%20Geologic%20Report%20on%20Exploration%20Wells%2011-15-10.pdf> Note page 15 and 16.

^{lvi} <http://www.riverkeeper.org/news-events/news/safeguard-drinking-water/riverkeeper-fracking-remarks-1130/>

^{lvii} <http://www.audubon.org/newsroom/press-releases/2011/statement-audubon-president-david-yarnold-bp-panel-report>

^{lviii} http://search.atomz.com/search/?sp-a=sp1001da90&sp-x-1=collection&sp-q-1=National&sp-p=all&sp-t=site_wide&sp-q=fracking

^{lix} http://www.damascuscitizens.org/Rubin-Report_R1.pdf

^{lx} <http://protectingourwaters.wordpress.com/2011/11/04/gas-drilling-impacts-pa-farmer-terry-greenwoods-cows-gave-birth-to-zero-calves-this-year-after-ten-dead-calves-in-2008/>

<http://www.grist.org/natural-gas/2011-05-19-fracking-with-our-food-how-gas-drilling-affects-farming>

^{lxi} <http://protectingourwaters.wordpress.com/2011/06/03/new-york-times-could-smog-shroud-the-marcellus-shale's-natural-gas-boom/>

^{lxii} <http://www.essentialpublicradio.org/story/2011-11-23/health-effects-hydraulic-fracturing-9570>

lxiii <http://www.mariettatimes.com/page/content.detail/id/537827/Impact-of-sand-still-unknown.html?nav=5002>

lxiv <http://shaleshockmedia.org/2011/09/29/4-sandra-steingraber-hammondsport-9-15-11/>

lxv <http://www.gasp-pgh.org/wp-content/uploads/2010/10/marcellus-air-information-for-air-adv-board.pdf>

lxvi <http://steingraber.com/wordpress/wp-content/uploads/CancerFrackingDec12.pdf>

lxvii <http://www.stanford.edu/group/ruralwest/cgi-bin/drupal/content/despite-ozone-spikes-more-drilling-proposed-wyoming-community>

lxviii <http://online.wsj.com/article/APa25632b3cf7f42b89d718f4573d213b0.html>

lxix http://www.damascuscitizens.org/Rubin-Report_R1.pdf

lxx <http://news.gather.com/viewArticle.action?articleId=281474980725341&mid=5208>

lxxi Several pads withing 900 ft of the epicenter
<http://www.youtube.com/watch?v=qhDqugorwsM&feature=uploademail>

lxxii <http://www.truth-out.org/fracking-operations-cause-thousands-earthquakes-arkansas/1311877041>

lxxiii <http://www.nytimes.com/2011/10/22/science/earth/22fracking.html?scp=1&sq=england%20earthquake&st=cse> and
<http://www.nytimes.com/2011/06/02/business/global/02fracking.html?scp=2&sq=england%20earthquake&st=cse>

lxxiv http://www.washingtonpost.com/business/40-magnitude-quake-strikes-in-northeast-ohio-the-latest-near-a-gas-drilling-injection-well/2011/12/31/gIQAhiRoSP_story.html

lxxv <http://vimeo.com/32302635>

RADIOACTIVITY

Dr Resnikoff stated during his Nov 16th, 2011 presentation at Binghamton University <http://vimeo.com/32302635> that the brine from the Marcellus is extremely high in radioactivity. The radioactive radium can be solidified and filtered out but that has not been recommended in the rdSGEIS. It should be.

Also, pipes used during drilling and removed and which have a radioactivity measuring more than 50 microR/hr would require a DOH license; under that number, that is not required. According to Dr Resnikoff, pipes measuring less than 50 microR/hr have a measureable radium 226 level of 1300pC/g, and radium 228 level greater than 300 pC/g--both excessively high readings and which should trigger surface contamination warnings.

Dr Resnikoff also stated that radon, which comes up with the natural gas, will enter homes through kitchen stoves because the Marcellus has a high radioactive content, including radium and radon. He stated that the

estimated NY State excess lung cancer deaths over the lifetime of NY State residents is 13,200. Among his recommendations were that workers should wear radiation badges and masks.

Dr. James W. Ring, Winslow Professor of Physics Emeritus, Hamilton College, testified to the following on Oct. 6, 2011

Nuclear Physics

1. **Both Radium 226 and Radon 222 are radioactive and decay by emitting alpha particles.**
2. Radium 226 becomes Radon 222 by means of its alpha emission. Radium is chemically active and is similar to Calcium while Radon is a noble gas and is scarcely active at all.
3. Radon 222 emits an alpha and becomes another radioactive isotope, which in turn decays to another until after several decays, stable Lead 206 is reached. Lead is chemically active like Radium but in a different way. It is similar to Tin.
4. **Radium, Radon and Lead are all health hazards, with Lead a heavy metal that is toxic when ingested or its dust is breathed in, while Radium and Radon cause tissue damage particularly to the lungs when breathed in or when ingested. Next to smoking Radon is the most potent cause of lung cancer.**

The Connection with gas drilling

1. **The Marcellus Shale contains Radium 226 as has been shown by DEC tests of wastewater in 12 wells drilled in NYS. (See Appendix 13 of the DEC's rdSGEIS.)**
2. **In 11 wells the Ra226 exceeded the EPA's limit for safe discharge—in one case by 267 times that concentration.**
3. **Radium, unlike Radon, is chemically active and, much like Calcium, dissolves in water.**
4. **The inference then is that the Marcellus contains Ra226 in solid form and that Radon 222 will also be present there as a gas.**

The Conclusion (per Dr Ring)

Both natural gas and Radon will generally be released by the fracturing process and will move together as a mixed gas out of the well. Also as the Radon decays, lead is formed in the pipes or in the homes to which natural gas is piped.

Dr Ring concludes: Until we have mitigation measures for these health hazards worked out and regulations based on these measures ready to be enforced we should not allow hydrofracking in New York State.

Mr. Chip Northrup, a former oil and gas engineer, writes: **The radon piggybacks on propane when it is separated from the raw gas stream (methane, propane, butane, ethane, etc) at a processing plant.**

Radon can kill gas field workers if it is not separated from propane/ butane during the separation process.

If it is not removed from the propane - it could in theory end up in people's homes - where it would settle.

And when vented in the field, it can pollute surroundings because it settles - could "run" down a creek bed - gassing livestock, etc.

And attorney Jeff Zimmerman wrote that he was particularly interested in a 1980 article by Gogolak I sent, from the U.S. Department of Energy, about the radon levels in natural gas. "From a public health standpoint, it seems to me that radon levels in the gas that is piped into homes and apartments may be the largest public health risk in the whole shale gas risk picture because of the very large number of people who will be exposed to the radon.... One mitigating factor it cites is the decay of radon levels during the transit time from the gas fields in the southwestern U.S. where the major pipelines started in 1980 when this article was written. Of course, the travel time from the Marcellus shale producing area of northeastern PA and the southern tier of New York to distribution of this gas in the New York City area is going to be much shorter. This would seem to me to mean

that people will be exposed to higher radon levels, unless the gas is sequestered somewhere, until much of the radon has decayed."

lxxvi <http://www.dailykos.com/story/2011/07/12/993820/-Water:-Fracking-sucks-more-than-you-think!?via=siderecent>

lxxvii **Subject:** NY DEC Still Does Not Have a Plan for Fracing -- Wastewater issue alone is huge

As New York State and Democrat Governor Andrew Cuomo edge closer to opening the door to high-volume hydraulic fracturing, the state senate Standing Committee on Environmental Conservation held a public hearing on what to do with the wastewater produced from this activity.

Testimony was by invitation only and speakers included the DEC, waste management companies, gas industry, academia and environmental NGOs.

Sandra Steingraber, Ph.D. (biology), author, and Distinguished Scholar in Residence at Ithaca College pointed out that the wastewater from an estimated 62,000 fracing wells envisioned for New York State, would amount to a Niagara Falls of wastewater running for 35 hours.

Does New York State -- which promises it can do this "safely" have a plan? No but it has "options."

Steingraber testified: **"The where-to-put-it question is not adequately addressed in the [DEC's] draft generic Environmental Impact Statement, which does not put forth a comprehensive plan for waste disposal nor explicitly prohibit fracking waste from entering sewage treatment plants."**

In fact, water treatment plants are one of DEC's 3 "options."

DEC Deputy Commissioner Eugene Leff testified that, besides "recycling," the disposal methods anticipated are disposal wells or processing at water treatment plants.

Without even blushing, Leff acknowledged that no plants are authorized to accept waste water from fracing operations in New York State.

Meanwhile, Steingraber worked to educate attendees about Newton's laws:

"The volume of the wastewater may decrease, but the total mass of toxic, radioactive chemicals stays the same and, indeed, is even more concentrated within the smaller volume of fluid that remains. And this even-more-poisonous material still requires transfer and injection in underground wells or disposal somewhere."

Among other steps, she urged that a "human health impact assessment must precede and inform the decision whether or not to move forward with fracking. To skip this step and risk exposing New Yorkers to inherently toxic chemicals without their consent is a violation of basic human rights."

See **NY Wastewater Hearings** at this link: <http://www.spectraenergywatch.com/blog/?p=1501>

lxxviii http://63.134.196.109/documents/10sep21_RadioactiveWastefromHorizontalHydrofracking.pdf

lxxix <http://keystoneresearch.org/media-center/press-releases/public-sector-job-losses-put-brakes-pennsylvania's-recovery>

lxxx <http://keystoneresearch.org/media-center/media-coverage/numbers-game-marcellus-shale-industry-created-less-10000-jobs-pa>

lxxxi Ruth Hardinger is an artist and real estate broker in New York City who has spoken to second home buyers who will not purchase in zones where fracking occurs, or even near them. In conversations with Upstate brokers, these brokers predict prices falling 70-100% based on the region, the loss of domestic water, environmental damage and accessibility. It will have a huge impact on 2nd home buyers who will not want to travel through roads filled with thousands diesel trucks for weekend relaxation. Thousands of diesel trucks could cover the interstates 17, 87 and 84 as well as highways 28 and 30, among many others.

lxxxii <http://www.athensnews.com/ohio/article-34365-join-the-effort-to-mobilize-against-fracking.html>

lxxxiii <http://pubcit.typepad.com/clpblog/2011/11/fracking-mortgages-and-insurance.html>

lxxxiv (In PA that they are spending more money on road repairs than they are getting from gas revenues. – supporting information to follow)

lxxxv <http://www.dansvilleonline.com/newsnow/x1819701667/NY-Comptroller-says-state-needs-more-protection-from-drilling-accidents?mid=5672587>

lxxxvi <http://www.thirteen.org/metrofocus/news/2011/11/four-toxic-rivers-a-super-sad-true-superfund-story/>

lxxxvii http://www.nytimes.com/2011/12/30/us/in-louisiana-twist-in-legal-fight-over-texaco-drilling-lease.html?_r=1&scp=1&sq=chevron%20and%20sabine%20pipeline&st=cse

lxxxviii <http://queenslyfe.com/2011/07/11/obama-administration-forces-cleanup-of-newtown-creek-by-exxon-and-others/>

lxxxix http://www.youtube.com/watch?v=bYzU4bEfj5U&feature=channel_video_title
<http://www.nytimes.com/2011/06/26/us/26gas.html?scp=1&sq=drilling+down+deborah+rogers&st=nyt>

xc <http://www.sustainablefuture.cornell.edu/news/attachments/Howarth-EtAl-2011.pdf>

xc1 <http://www.cbc.ca/news/canada/new-brunswick/story/2011/11/28/nb-f-shale-gas-anthony-ingraffea-122.html>

xcii <http://www.guardian.co.uk/environment/2011/nov/09/fossil-fuel-infrastructure-climate-change>

xciii http://www.damascuscitizens.org/timesunion_hydrofracking_boom-bust_endeavor.html

YOUNGSTOWN, Ohio -- A research report conducted by a professor at Ohio State University is drawing headlines across Ohio, Pennsylvania and West Virginia for its conclusion that the shale drilling industry will result in 20,000 new jobs in the next few years -- not the 200,000 new jobs forecast by studies underwritten by the industry.

^{xciv} http://www.damascuscitizens.org/timesunion_hydrofracking_boom-bust_endeavor.html

^{xcv} <http://www.foodandwaterwatch.org/reports/exposing-the-oil-and-gas-industrys-false-jobs-promise/>

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.

^{xcvi} Unanswered Questions About The Economic Impact of Gas Drilling in the Marcellus Shale: Don't Jump to Conclusions http://www.damascuscitizens.org/Economic_Paper.pdf

^{xcvii} http://www.damascuscitizens.org/timesunion_hydrofracking_boom-bust_endeavor.html

Evidence from already developed shale plays indicates that shale gas drilling relies mostly on out-of-state workers. Local employment is concentrated in trucking, construction and retail jobs -- many of which are part-time, short-term, or low-pay.

While there have been exaggerated claims about job creation in Pennsylvania, more accurate data from the [Keystone Research Center](#) and the [Pennsylvania Department of Labor and Industry](#) show that Marcellus core industries have created about 9,300 jobs since the shale boom began in 2007 -- far below projections. All job creation is important during a recession, but shale gas jobs are making only a modest contribution to Pennsylvania's economy. We can expect similar results in New York.

Many of the costs of shale gas extraction fall on county and local government, including localities where drilling makes no appreciable contribution to the economy through job creation or tax revenues. Take, for example, the proposed Seneca Lake gas storage facility just north of Watkins Glen. With underground storage for 1.45 billion cubic feet of natural gas, the complex would play a key role in moving gas from the Marcellus Shale to market. Although its environmental footprint is enormous, the facility is expected to produce only 10 permanent jobs after its construction

^{xcviii} <http://www.foodandwaterwatch.org/reports/how-new-york-state-exaggerated-potential-job-creation/>

Based on the New York analysis, Food & Water Watch estimates that in the first year of the “average” shale gas development scenario, current New York residents can expect only 195 new oil and gas industry job opportunities. This would grow steadily to over 600 new jobs for current New York residents in the tenth year of development, but after this tenth year, there would be next-to-no new jobs for established New York residents.

^{xcix} <http://business-journal.com/ohio-state-study-finds-no-jobs-boombread-executive-summary-of-research-p20628-1.htm>

^c http://www.ucsusa.org/assets/documents/clean_energy/cashing-in-national.pdf

^{ci} http://www.ucsusa.org/clean_energy/technology_and_impacts/impacts/public-benefits-of-renewable.html (This study was published prior to the 5 yr horizon for climate change report was released. This information would make it more urgent to switch only to renewables.)