SUMMARY REPORT

Natural Gas Infrastructure Build-Out in New York

Overview:

The rapid build-out of natural gas infrastructure creates a number of possible scenarios which put New York State and its taxpayers at risk. This infrastructure comes in the form of pipelines, compressor stations, storage facilities, and distribution networks that supply a growing number of power plants, homes, and businesses in New York with gas from fracking operations in Pennsylvania, Ohio and West Virginia. Increased volumes of gas are also being transported through the state to New England and Canada. The Office of the State Comptroller has the responsibility of seeing that taxpayer money is used effectively and efficiently to promote the common good.

To the extent that State Agencies are not sufficiently staffed or do not possess the expertise to properly oversee massive and complex industrial projects (such as large-diameter, high pressure gas pipelines) or that the entities engaged in construction of gas infrastructure networks are not sufficiently bonded or insured, the public and the State are at risk. Similarly, the State may have some degree of risk if chemically toxic or radioactive waste from fracking operations in other states is imported into New York where residents could be exposed and suffer health problems.

Finally, much of the cost of dealing with the impacts of climate change – higher temperatures, severe storms, flooding, spread of disease and infestation, population displacement, food and water shortages – will fall on the State and its taxpayers.

For these reasons, we believe it is incumbent on the Office the State Comptroller to be fully cognizant of the risks related to natural gas: its transportation, storage, waste, potential for leakage or explosion, and ultimately its impact on our climate.

The Impact of Methane on Climate Change

Methane, the main ingredient of natural gas, is 86 times more powerful as a greenhouse gas than carbon dioxide over a 20 year timeframe.[1] This means that if more than about 2% of methane escapes into the atmosphere during its "lifecycle" of extraction, processing, transport, or distribution, any climate benefit over coal for electricity generation is negated. (For other uses, there is no climate benefit in any scenario.)

And the methane does escape, with rates as high as 12% during the process of fracking and

[1] In a 2011 assessment of data by Howarth, Ingraffea, and Santoro of Cornell estimates leakage rates of 3.6% to 7.9% for natural gas obtained using high-volume fracking; document accessed at http://www.eeb.cornell.edu/howarth/web/Marcellus.html ; more recent satellite data cited by Howarth has suggested rates as high as 12%.

transporting gas hundreds of miles. As a driver of climate change, natural gas is actually the "dirtiest" of fossil fuels. New York is now the fourth largest consumer of gas in the country, and its growing use of fracked gas puts both the climate and people at risk.

The Impact of Gas Pipelines on Real Estate

New York has an aging gas pipeline infrastructure system that was laid in sparsely populated areas in the middle of the last century. In the interim, these regions have become more densely populated with homes, schools, hospitals and other community buildings located in close proximity to those pipelines and others which have been constructed more recently. Transmission pipelines built today are also bigger than in the past, some as large as 42 inches in diameter, and they operate at higher pressure.

Pipeline easement agreements govern the rights and obligations of the company laying the pipe. Notably, these easement agreements contain sparse insurance provisions, and the provisions are limited to the actual pipeline contractor, not the pipeline owner.[2] This puts most of the risk on the homeowner, although ironically homeowner's insurance does not cover pipeline explosions. In other areas of the country the existence of a pipeline has dramatically lowered property values. As climate change and pipeline explosions become more a part of the public consciousness, we are seeing a reluctance to live near large, high-pressure pipelines.

The emergency response to the rupture of a high-pressure 42-inch pipeline is necessarily different from that of a lower-pressure gas line less than half that size. Pipeline experts estimate the blast area of a pipeline rupture can be up to 4,000 feet.[3] Nevertheless, emergency response plans are not being adequately updated and personnel are not being properly trained to handle the possibility of a pipeline rupture of this magnitude or scale.

Pipelines and Related Infrastructure Concerns

Independent pipeline contractors working for gas companies have an incentive to build pipelines and related infrastructure as quickly and cheaply as possible. This puts them in conflict with safety regulations and inspection routines. Reports of cracks and faults on pipelines have increased as the massive build-out of pipelines continues across the northeast. Seven years ago, after a massive pipeline explosion in San Bruno, California, the Pipeline and Hazardous Materials Safety Administration (PHMSA) which has responsibility for ensuring the safety of pipelines, proposed new safety rules, but they have not yet been approved.

Gas transmission pipelines usually require compressor stations every 40-50 miles. The more gas that can be pushed through the pipeline, the more profitable the pipeline becomes. As a result,

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[2] We note that the NYS Comptroller has supported legislation requiring pipeline construction companies to be properly insured.

[3] Public statement of Richard Kuprewicz, former pipeline safety expert for ARCO petroleum, in response to the Federal Energy Regulatory Commission regarding the placement of a natural gas pipeline with 105 feet of critical structures at the Indian Point Energy Facility in Buchannan, New York.

newly installed pipelines are typically rated for pressures in excess of 1400 psi compared to previous pipelines with pressures of 400-900 psi. This requires more powerful and polluting compressor station equipment, and significantly increases the impact of any rupture and/or explosion.

Compressor stations within a transmission pipeline are large, noisy industrial facilities capable of continuous operation, and significant sources of air pollution, each producing many thousands of tons of greenhouse gas emissions annually, along with pollutants hazardous to human health.[4] Toxic emissions from compressor stations include benzene and other volatile organic compounds (VOCs), carbon monoxide, nitrogen oxides, and formaldehyde.
In addition, as part of regular maintenance or in an emergency, compressor stations conduct "blowdowns" that release large volumes of unburned methane and toxic chemicals directly into the atmosphere.

Other types of gas infrastructure associated with pipelines include valve stations, metering equipment, coolers, glycol dehydrators and heaters, separators, pigging stations, onsite electricity generation, and odorant injection. These are additional sources of emissions that contribute to climate change, expose surrounding communities to pollution, and introduce risks of chemical spills, fumes, fire, and explosion.

To maximize profit, the industry tends to build compressor stations and related infrastructure as quickly, and with as little regulatory oversight, as possible. Although local officials have the authority to enforce local codes, they are typically told that their jurisdiction is preempted by the Federal Energy Regulatory Commission (FERC) or by state permitting processes. Similarly, the Department of Environmental Conservation (DEC) often acts as if it is unable to deny a project or require additional mitigation for impacts if FERC has already granted approval. This is not true. In many cases, measures exist to reduce risk to public health, but those measures are not implemented because the state chooses not to require them.

Monitoring and enforcement occur almost entirely by the "honor" system, whereby the state simply requires facility operators to perform their own tests and submit results. There is little or no verification of emission limits or inspection to determine that permit conditions are being satisfied. Nor does the state verify compliance with safety protocols and emergency preparedness. Because compressor stations and other types of gas infrastructure are exempt from most citing requirements, they are frequently located within or close to communities. Nevertheless, they are clearly industrial operations with industrial-related risks. This represents a significant public concern and potential liability for the State if agencies fail to properly enforce codes, standards or otherwise protect the public health.

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[4] In New York, many compressor stations also employ outdated technology (such as wet-seals) and lack basic emission controls (such as oxidation catalysts)[4] which could more effectively mitigate pollution. An oxidation catalyst is comparable to a catalytic converter, which has been required standard equipment for automobiles built since the 1970's. Compressor stations produces emissions comparable to hundreds or thousands of automobiles, however many are not equipped with oxidation catalysts. Some stations also use very large reciprocating engines for compression which are inefficient, notoriously leaky, and extremely loud.

Mobile transport of natural gas

New York's dependence on gas has not only resulted in more pipelines, but also a proliferation of natural gas transported overland by truck. These vehicles, which carry explosive compressed natural gas (CNG) or liquefied natural gas (LNG), are a growing danger on roads and in communities throughout New York, posing a new liability to the public and state.

CNG

The gas industry is presently developing a network of CNG distribution hubs throughout New York, consisting of large fueling stations, each attached to a main transmission pipeline or storage facility, from which gas is transferred to fleets of large trailer trucks and then delivered to various locations within a service region. Each trailer truck can carry up to 12 tons of CNG in tanks under very high pressure, up to 3600 psi — nearly three times the pressure of a modern high-pressure pipeline. Because customers are located in remote areas without municipal gas, the roads traversed by these vehicles are often narrow and winding. The potential for accidents and resulting catastrophe is significant.

An emerging new threat is that CNG fleets are also being used as a "virtual pipeline" for transferring large volumes of gas to main transmission pipelines.[5] Instead of just serving end-use customers, facilities like the Manheim CNG fueling station in Herkimer County are being used—without any federal or state oversight— to inject gas into upstate pipelines that has been trucked over a hundred miles from Pennsylvania. According to observers, many of these massive CNG trucks drive on winding roads in excess of posted speed limits in a rush to make their daily delivery. This is a serious regulatory problem.

LNG

Liquefied Natural Gas (LNG) can also be transported by truck, but operates very differently. Instead of achieving density by pressurization, LNG is contained by maintaining methane within insulated tanks at an extremely low cryogenic temperature of -162 degrees Celsius (-260 degrees Fahrenheit). This is the temperature at which methane is a "boiling" liquid. LNG tanks are transported by truck to locations where the gas is used or to a fueling station for trucks or large vehicles which burn LNG for fuel.

[5] An example of this is the Manheim CNG facility in Herkimer County. In 2014, the Public Service Commission (PSC) and town of Manheim authorized development of a CNG distribution facility for the specific purpose of filling 8 to 45 trailer trucks daily with gas *from* the Iroquois Pipeline. However today the facility is being used to inject 50,000 DTh/day of gas *into* the Iroquois Pipeline from trucks that drive 133 miles from Forest Lake, Pennsylvania. According to Iroquois documentation, an average of 143 trucks, each carrying 350 DTh of gas, enter and leave the site every day. This daily convoy forms a "virtual pipeline" through Broome, Otsego, and Herkimer counties.

After an LNG storage facility exploded on Staten Island killing 40 people, new LNG facilities were banned within New York State. In 2015, the State loosened its ban on LNG to allow storage of LNG in tanks that are 70,000 gallons or less.[6]

LNG is an inherently leaky storage method since evaporating methane is typically allowed to vent from tanks to keep the remaining LNG at a constant -162 degrees. If a rupture occurs, LNG expands very rapidly and becomes explosive. It also destroys flesh on contact, so it must be handled with extreme care. These vehicles and facilities create additional risk and liability.

Underground Natural Gas Storage

The formation of Stagecoach Gas Services in 2016 by Con Edison represents a major commitment to expanded storage in the state. New York State has nearly one thousand underground storage facilities, the third most of any state. This is a significant concern.[7]

Last year, the Obama administration produced a set of recommendations for improving safety and preventing leakage at storage facilities.[8] New York has not performed a comprehensive evaluation of greenhouse gas emissions from the state's storage facilities, nor have the risks and liabilities associated with these facilities been evaluated. It would be wise for New York to investigate this latent threat and take appropriate measures before an accident occurs.

Gas-Fired Power Plants

Although accounting for less than half of New York's total consumption of natural gas, power plants are by far the biggest individual users of natural gas and emitters of hazardous pollutants. Even when equipped with the latest emission control technology, pollutants from these plants are at least an order of magnitude higher than compressor stations because of their sheer size.[9]

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[6] This roughly corresponds to the maximum size of a metallic LNG tank which can be transported by vehicle. (Larger LNG tanks are typically reinforced concrete structures manufactured on site.)

[7] California's recent gas storage leak at Aliso Canyon was the worst documented methane disaster in U.S. history, lasting nearly four months, spewing over 100,000 metric tons of methane into the atmosphere, causing extensive public health impacts, and resulting in the evacuation of thousands. Until then, few people were aware of this risk which extends across a vast network of underground storage wells across the country. Most of those storage facilities are actually located in the northeast.

[8] Ensuring Safe and Reliable Underground Natural Gas Storage—Final Report of the Interagency Task Force on Natural Gas Storage Safety. October 2016; accessed at https://www.energy.gov/sites/prod/files/2016/10/f33/Ensuring%20Safe%20and%20Reliable%20Underground%20Natural%20Gas%20Storage%20-%20Final%20Report.pdf

[9] For example, the 650MW CPV power plant presently under construction in Wawayanda, NY is projected to have pollutant concentrations up to ten times that of the Minisink compressor station, both of which would receive gas from the Millennium Pipeline. Another large gas-fired power plant slated for development is the 1100MW Cricket Valley facility in Dover, which would receive gas from the Iroquois Pipeline.

In addition to building large gas-fired power plants, the State is also currently promoting the development of Distributed Energy Resources (DER), which consist of smaller electricity generators intended for local micro-grid applications. Distributed generation in the form of renewables— such as wind and solar—is beneficial, but distributed fossil fuel generation is not.[10]

Ignoring the lifecycle impacts of methane, NYSERDA incorrectly credits New York for having reduced greenhouse gas emissions by replacing coal with natural gas for electricity generation. Furthermore, since coal has now basically no longer a factor in New York, any new gas-fired power plant will clearly result in *additional* greenhouse gas emissions and set the state backwards in the fight against climate change.

Fracking Waste

The term "fracking waste" covers a wide array of materials, including drill cuttings, sludge, flowback fluid, produced water (fracking brine) and construction materials required for building and dismantling the fracking site itself. For its part, the DEC denies that toxic fracking waste is being imported into the State, although waste from Pennsylvania fracking sites *is* being dumped in landfills in New York (the DEC has issued permits for such dumping). However, neither the DEC nor any other state agency conducts any testing to determine the origin or content of those materials.

Dumping is not the only problem. Billions of gallons of wastewater from fracking operations are being imported into New York State to be used for de-icing and dust control on roads in counties where the DEC has issued a Beneficial Use Determination ("BUD"). This "brine" contains chemicals used in the fracking process as well as radioactive material pulled from underground.

Although most of the chemicals found in fracking waste clearly meet the criteria for hazardous waste, they are specifically exempted from regulation under current NY DEC rules. A current proposal to overhaul sections of the DEC's regulations on solid waste leaves this exemption (Section 6NYCRR Part 370) in place. As a result, fracking waste will continue to enjoy this regulatory "loophole" and be treated as regular construction debris or given BUD's by the DEC until or unless legislation is adopted.

Exposure to chemicals typically used in the fracking process include known carcinogens,[11]

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[10] The emissions associated with these smaller gas-fired generators are essentially identical to compressor stations. In fact they typically use the very same turbines. Since they are often not combined-cycle, these smaller facilities also tend to be less efficient. There is a significant danger that New York's much-touted emerging network of "distributed generation" will take the form of numerous local gas-fired power plants delivering greenhouse gas emissions and pollutants into the atmosphere within communities across the state.

[11] "Toxic Stew: What's In Fracking Wastewater" from Environmental Working Group. Accessed at http://www.ewg.org/research/toxic-stew

neurotoxins, endocrine disruptors[12] and other chemically toxic or radioactive materials known to negatively impact human health and development.[13] Industry "trade secrets" and gag orders on physicians who treat workers suffering exposure prevent the public from knowing exactly what chemicals are being used at any particular fracking site.

This failure to properly classify toxic chemicals as "hazardous" puts the State at risk from litigation in the event residents of areas near dumping sites or downstream from polluted water suffer health impacts from the chemicals in fracking waste and bring legal charges against the State.

Social Cost of Carbon

A useful tool to quantify the financial liabilities of climate change is the Social Cost of Carbon (SCC). As described by an interagency working group created under the Obama administration, the social cost of carbon represents *"the monetized damages associated with an incremental increase in carbon emissions in a given year. It is intended to include (but is not limited to) changes in net agricultural productivity, human health, property damages from increased flood risk, and the value of ecosystem services due to climate change."* [14]

The social cost of carbon can vary widely depending on the various models used, consideration of risk, and discount rate. It also increases over time as emissions cause climate change to put greater stress on physical and economic systems. A commonly cited value for the social cost of carbon today is $36 per metric ton of CO2. However, many climate researchers have determined it to be much higher, citing rates that are upwards of $200 per metric ton.[15]

By quantifying the externalized costs to society of fracked gas, it is possible to make appropriate decisions about investments in renewable energy, efficiency, and other actions to avoid the worst impacts of climate change.

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[12] Duke University Study accessed at http://www.sciencedirect.com/science/article/pii/S0048969716305356

[13] In an analysis of more than 1,000 chemicals in fluids used in and created by hydraulic fracturing (fracking), Yale School of Public Health researchers found that many of the substances have been linked to reproductive and developmental health problems, and the majority had undetermined toxicity due to insufficient information.

[14] Technical Support Document: Technical Update of the Social Cost of Carbon for Regulatory Impact Analysis Under Executive Order 12866, Interagency Working Group on Social Cost of Greenhouse Gases, August 2016; accessed at https://www.epa.gov/sites/production/files/2016-12/documents/sc_co2_tsd_august_2016.pdf

[15] New York consumed approximately 1360 billion cubic feet of natural gas in 2015, which produced approximately 74.4 million metric tons of CO2. Assuming a mean leakage rate of 5.8% results in a total greenhouse gas impact of about 210 million metric tons of CO2e (carbon dioxide equivalents). If a conservative value of $36 for the social cost of carbon is applied, this means that New York's use of fracked gas in 2015 cost society over $7.5 billion in negative impacts—a number that will rise each year as the incremental social cost of carbon grows and if the New York continues on its current trend of increased dependency on gas. For higher discount rates and higher levels of methane leakage, the total cost over 20 years could approach a trillion dollars.

Conclusion: The Need for a Swift Transition from Fossil Fuels to Renewables

New York's greenhouse gas reduction goal is to reduce emissions 80% from 1990 levels by 2050, and 40% by 2030. The state also has a goal of obtaining at least 50% of its electricity from renewable sources by 2030.

These goals stand in stark contrast to current trends. New York is now the fourth largest consumer of natural gas in the nation, and each year consumes even more gas than before. This is compounded by the fact that in order to make deep cuts in greenhouse gas emissions from other energy sectors like transportation and heating, New York will have to convert to end-use systems that do not burn fossil fuels, such as electric vehicles, electric heat pumps and electric motors for industry. This will increase New York's demand for *additional* electricity, *and* this additional electricity must also be emissions-free in order to have a climate benefit.

In order to truly meet New York's ambitious greenhouse gas reduction goals, far greater investments in renewables, along with energy efficiency, will be required than is presently anticipated or being planned. The costs associated with those investments are significant, but necessary, in order to avoid the adverse impacts and related costs of climate change and air pollution which will otherwise result from our continued dependence on fossil fuels.