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

August 1, 2014

Dear Governor Cuomo,

I write to urge you to lift the current moratorium on unconventional natural gas development in New York State. Producing natural gas in New York State, as elsewhere, will reduce global warming, improve human health, and increase prosperity. Good regulation can assure that natural gas incurs less risk than any other economically equivalent development, and the economic benefits of natural gas development are large.

Global warming is a major concern; however displacing other fuels by natural gas in transportation and electricity generation will reduce greenhouse warming by more than 40% of what could be achieved by immediately moving to zero carbon energy sources. Extracting and using natural gas rather than other fuels constitutes the biggest and easiest step we could take to reduce global warming:

- It has been argued that substituting natural gas will cause tipping points in global warming, but this is false. Even if so much methane leaks that substituting gas does not reduce warming, the same temperatures are reached as when gas is not substituted- they are just reached a few years sooner. Tipping point risk is thus unchanged by gas substitution. This important point is illustrated in the appendix figure.
- In fact leakage rates are low enough that substituting natural gas has immediate benefits. U.S. carbon dioxide emissions decreased by 10% over the last five years with half due to converting ~40 GW of coal electrical generation to natural gas. The increase in atmospheric natural gas concentration was negligible in the global warming context.
- In the long run, substituting natural gas greatly reduces warming because so much less carbon dioxide, the long-lived greenhouse gas, is put into the atmosphere.

Moving forward with safe natural gas development in New York State would set an important example. By the end of the 22<sup>nd</sup> century the world's oil and natural gas resources will be depleted (but not its coal resources), and the planet will have warmed an acceptable 1.5°C, about the warming that has occurred between 1700 and 2011 AD. Coal is the serious global warming threat. Combusting our resources of oil and natural gas will release ~2.2 pre-industrial atmospheric levels (PAL) worth of carbon dioxide; combusting our coal resources will release 6.6 PAL. Less developed countries already have health incentives to develop natural gas rather than coal because natural gas is a much cleaner fuel. If NYS

shows that it can develop its natural gas resources safely and to great economic and environmental benefit, others will be further encouraged to develop natural gas in preference to coal resources. If, over the period that oil and gas resources last we work to make low carbon energy sources more economic than coal, most of the world's coal resources might never need to be tapped, and global warming would be kept to acceptable levels.

Conversion of coal electrical generation facilities to natural gas will improve the health of New York residents. A study<sup>1/</sup> of 9 old Michigan coal plants showed they cost Michigan \$1.5 billion and the U.S. \$5.4 billion in extra health costs (chronic bronchitis, asthma exacerbations, 176 pre-mature deaths) each year. A 2010 NRC study<sup>2/</sup> found the life cycle health impact of natural gas is 20 times less than coal's \$62 billion health damage per year. Emissions of benzene and ethylbenzene have been found to be elevated near unconventional drilling operations, but only at about the levels that exist in urban areas of the U.S., and the elevation is temporary because the drilling is temporary. Natural gas development will reduce emission health damage, not increase it, and the reductions will be of major importance even in NYS.

The economic benefits of natural gas development are major, and natural gas development is perhaps the best way to help rural areas of New York. The benefits will go directly to poor farmers and help preserve rural lifestyles and communities. The increased income will have health benefits. The recent economic crisis led to 4,750 additional suicides in the U.S., according to a recent Journal of Psychology study<sup>3/</sup>.

Hydrofracturing will not threaten New York State's abundant water resources, and will not open leakage pathways to the surface. The overpressured gas in shales like the Marcellus has been trapped stably for 300 million years by capillary seals, and these seals will continue to trap whatever depressurized gas is left after production is finished. The injected waters will not return, except in production wells. Return of fracking fluid chemicals is of less concern than chemicals dissolved from the shale (brine, metals, radium). The risk of aquifer contamination comes from spillage of waters returned to the surface, and to a lesser extent casing failures. These risks are local. With attentive government supervision dangerous materials can be handled safely just as equally or more hazardous materials are handled routinely in cities and farms.

Wastewater injection can cause moderate earthquakes if continued for years at high injection rates and pressures. Hydrofracking itself poses no earthquake risk because injection is of very short duration. The recent earthquakes in Oklahoma were produced by injecting brine from conventional oil fields in efforts to increase production. The injection had nothing to do with hydrofracturing, and the volume of hydrofracturing fluid that would need to be disposed is small by comparison. The volume is reduced by the fact that usually less than 20% of the injected hydrofracking waters return to the surface, the rest is soaked up by the shale which acts like a "dry sponge". The volume can be further reduced if the returned fracking fluids are recycled to the next fracture job, as is now occurring.

Natural gas development will increase traffic about 4%. Heavy loads bend roads, and trucks will cause road damage. Ways can and should be found to assure natural gas operations pay for proper maintenance of roads.

A major recent study of over 600,000 unconventional and conventional oil and gas wells found well integrity failures occurred in 0.03 to 0.005% of all wells. Single barrier failures occur in several percent of all wells, but wells are constructed with multiple barriers and single barrier breaches can be fixed. Methane leakage from wells is not the problem some have feared.<sup>4/</sup>

Support for the above statements made is available at <http://blogs.cornell.edu/naturalgaswarming/>, and the Appendix figure summarizes graphically some of the important points made above.

Having looked at these issues carefully over the last 5 years, my conclusion is that the benefits from natural gas development far outweigh any risks or negatives involved. Natural gas represents a major economic, health, and global warming reduction opportunity, not a threat. I urge you to lift the moratorium on natural gas development and allow communities that wish to proceed to do so. I am not a spokesperson for the gas industry, am not funded by them, and will not benefit any more than anyone else from this decision, but as an academic who has studied the issue carefully I believe that we would be ill advised to walk away from the benefits offered by natural gas.

Sincerely yours,



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1/ Public health impacts of old coal-fired power plants in Michigan, prepared for the Michigan Environmental Council by Environmental Health and Engineering Inc., 2011.

[http://www.michigan.gov/documents/energy/PublicHealthImpactsofOldCoal-FiredPowerPlantsinMichigan\\_420109\\_7.pdf](http://www.michigan.gov/documents/energy/PublicHealthImpactsofOldCoal-FiredPowerPlantsinMichigan_420109_7.pdf)

2/ National Research Council. Hidden Costs of Energy: Unpriced Consequences of Energy Production and Use. Washington, DC: The National Academies Press, 2010.

[http://www.nap.edu/catalog.php?record\\_id=12794](http://www.nap.edu/catalog.php?record_id=12794)

3/ <http://www.bbc.com/news/health-27796628>

4/ King GE and King DE (2013) Environmental Risk Arising From Well Construction Failure: Difference Between Barrier and Well Failure, and Estimates of Failure Frequency Across Common Well Types, Locations and Well Age, Society of Petroleum Engineers, 166142, 28p.

## Appendix

The figure below plots calculated global warming from 1600 to 2211 AD, expressed as the change in global average temperature relative to 2011. Temperatures measured by NASA from 1880 to 2011 are overlain. Past predictions are calculated from a reasonable continuation of pre-industrial era natural forcing and greenhouse forcing from past atmospheric methane and carbon dioxide concentrations compiled by the IPCC(2013). Future predictions are based on greenhouse gas emissions from the three fuel use scenarios shown in the insert and a reasonable extension of natural forcings. A natural gas leakage of 2% of consumption and IPCC(2013) parameter values are used.

The calculations predict that the rate of warming over the next century will be about the same as over the last. Between 2011 and 2111 the world will consume its oil and gas (but not its coal) resources. If fossil fuel use terminates in 2111, as assumed in the figure, the rate of warming will slow. Substituting natural gas reduces warming by more than 40% of what could be achieved by moving immediately to low carbon energy sources (compare red and green curves), and this is true even if natural gas leakage in the substitute gas fuel use scenario is an unrealistically high 14% of consumption (dashed red curve). At this high leakage, from 2011 to 2111 the warming is attained slightly earlier than if gas were not substituted. After 2111, the warming benefits return because less CO<sub>2</sub> has been put into the atmosphere by burning natural gas rather than coal (divergence of blue and dashed red curves).

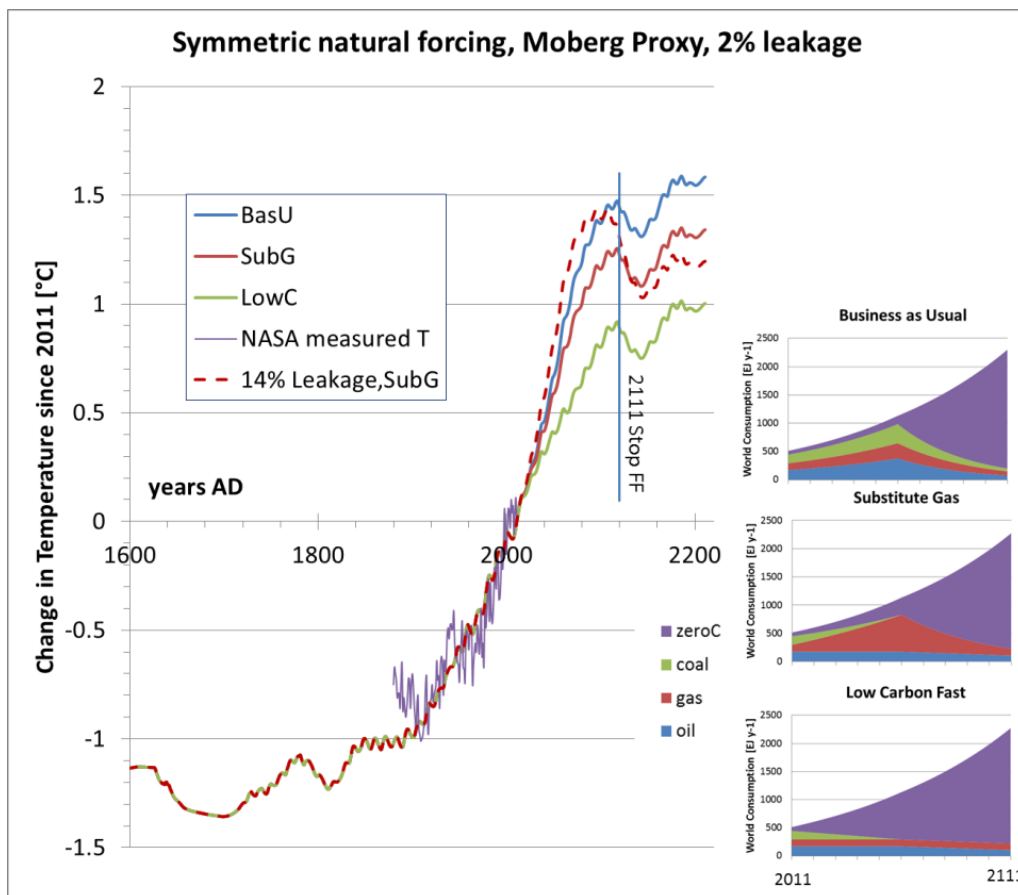


Figure 1. Predicted average global temperature changes relative to 2011. The purple curve shows the historic temperatures compiled by NASA. The blue vertical line marks the termination of the fossil fuel use in 2111 AD. The red dashed line shows warming for a substitute gas scenario with 14% (rather than 2%) natural gas leakage. The variations post-2011 reflect the assumed natural forcing. The insert shows three fuel use scenarios that by 2111 provide every human in a population of 10.5 billion with the 7 KW enjoyed today by the average Frenchman.