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Good Morning, Mr. Chairman, Committee Member

I am honored to appear before this Subcommittee to testify on this issue. At one level, the issue the Committee is addressing appears simple, what is the appropriate level of environmental regulation. But to address the potential of shale gas and, indeed, the other unconventional fuels the Subcommittee will be reviewing requires a rigorous approach to the underlying economics of this issue. I hope this testimony will assist the subcommittee in doing so.

Should shale gas drilling be subject to the normal requirements of good environmental housekeeping? The industry argues that this would be "overregulation" and that it would economically undermine the future of shale gas extraction. Yet at the same time, when touting shale gas, the industry promises annual revenues of many billions of dollars to state governments and local landowners, and describes shale gas as an asset ultimately worth trillions. With projected cash flows of these levels, the claim that the natural gas industry cannot afford the costs of meeting basic environmental housekeeping standards, costs every other American industry, most of whom are far less profitable than shale based natural gas, routinely pay, is not a claim that survives even the most rudimentary due diligence.

The industry also argues that shale gas extraction is environmentally safe. This is also a claim that challenges basic common sense. Shale gas extraction is dependent on hydraulic fracturing; also known as fracking, a process of using high pressure injection of sand in water to fracture the shale formations and release the natural gas trapped in the shale. But sand added to water merely sinks to the bottom. What must also be added is some liquid with the same specific gravity as sand to hold the sand in solution so that it can exert its fracturing force. As has been widely documented, these fracking fluids use a witches brew of toxic chemicals, nearly all of which are intrinsically hazardous to the environment.

Why are they so intrinsically hazardous to the environment? The answer is simple: these compounds do not biodegrade. Once in the environment, they stay in the environment. Most of them bioaccumulate. The remainder volatilize, removing them from water and land, but adding them to the atmosphere where they become contributors to global warming. The only way to protect the environment, and particularly water resources, is to prevent their introduction into the environment. Streams have no capacity to absorb these compounds; dilution is the only solution for their pollution. And because these compounds are toxic in such minute amounts, streams very quickly reached their capacity to safely dilute such compounds.

So how does fracking introduce these compounds into the environment? There are three ways.

First, fracking leaves a significant portion of the fracking fluid underground, where it is free to migrate into groundwater. The industry argues that fracking, particularly in the East, takes place at depths so far below aquifer layers that fracking presents no threat to underground water resources. Unfortunately, there are three qualifications to that reassuring conclusion. The first is that currently there is no standard based assessment of the underground hydrology required before a site is chosen for fracking. So what one has, in effect, is underground injection of wastes without any the safeguards of permitted underground injection.

The second qualification is that the industry position assumes that, as the concrete casing is drilled through the water bearing strata, it is properly drilled and maintained so its integrity is not breached, allowing fracking materials to pollute the water. To insure this, far more oversight of the drilling process is needed than takes place now.

And the third qualification is time. Fracking material may not invade aquifers immediately; it is a process that could take decades. But because those materials do not biodegrade, if they can move towards water sooner or later they will get there. And then what? The issue of delayed damages is one that has drawn almost no attention, but it is one that thirty years from now those dependent on aquifer water could passionately and bitterly care about. Time is also the enemy of concrete, yet the requirements for maintaining concrete drilling casings, particularly once a well has ceased to produce, have yet to adequately address the question of long term casing integrity. .

The second way fracking materials can enter the environment, particularly the water environment, is through surface spills. There are three sources of such spills, unplanned irruption of underground liquids, including fracking materials, to the surface; poor housekeeping; and surface floods. Fracking liquids, and the materials for them, are typically stored in open lagoons, a practice that should end in favor of off the ground, corrosion proof tanks. It should be remembered that so far shale gas extraction has operated largely on the flat, arid, sparsely populated, often publicly owned lands in the West. As shale gas extraction moves into the hilly, rainfall abundant, densely populated and privately owned East, only proper regulation and a far different standard of care can avoid an inevitable disaster.

One of the key elements of those regulations must be stormwater management, an issue that in many jurisdictions is avoided by keeping the size of the actual drilling pad to less than five acres and is exacerbated by the Clean Water Act exemptions from stormwater permitting for oil and gas production.

The third way fracking materials can enter into the environment is through the disposal of used fracking liquids. Though a significant portion of fracking material will remain underground, an even larger portion returns to the surface presenting critical problems of waste disposal. The industry has done everything from spreading these liquids on the road as deicers, to depositing them in streams, to putting them through normal sewage treatment plants. None of these are acceptable practices. The enormous loophole for oil and gas waste in the Resource Conservation and Recovery Act (RCRA) needs to be replaced by a positive program that insures fracking materials will receive proper disposal.

The path that needs to be taken is to put waste fracking materials through an industrial strength hazardous materials treatment facility and then to properly dispose of them through a properly and strictly enforced program of planned and hydrologically safe underground injection. Though many advocate allowing discharge of hazardous material treated effluent into streams under carefully controlled limits, any disposal of treated fracking liquids in streams needs the most careful study. It must be banned in any areas that are used for water supply purposes because of the threat of bioaccumulation. Even in other areas, conclusions that treated fracking fluid can be disposed of in surface waters run the peril of misleading the industry as to how much dilution capacity a surface stream has and inducing it to depend on a resource whose limits they will soon exceed.

Though the pollution problems of fracking materials have attracted the bulk of attention with respect to shale gas extraction, they are by no means the only environmental issues that fracking raises. There is air pollution, from a combination of using diesel powered equipment, an enormous volume of drilling related truck traffic and the venting to the atmosphere of a number of gases, including methane.

Then there is the question of where will the shale gas industry get the water for the fracking process? Even if one uses the industry numbers for the amount of wells that will be drilled, in absolute terms the amount of water fracking will need is not outlandish. But that conclusion scants some critical complexities in terms of local impacts. First, the volume of water needed for a single fracking event, two to ten million gallons, can have a huge impact on local tributary streams. Second, the timing of such withdrawals can be critical in terms of issues such as fish spawning and maintaining the natural annual pulsing of stream flows to which the stream ecology is adapted. Third, water withdrawals that could be acceptable in wet years may not be acceptable in dry ones. Fourth, if the industry shifts to groundwater use, those withdrawals could have significant effects on groundwater aquifers that are providing base flows for surface streams. And finally, water withdrawals from any stream that is receiving discharges of treated fracking fluids must be coordinated with discharge planning so that the reduction in the dilution capacity of the stream is reflected in the amount of discharge allowed.

If water withdrawal for fracking purposes by natural gas drillers is to proceed in an orderly and ecologically responsible manner, a proper regulatory and planning framework needs to be created.

Here a pause to take note of industry claims that state regulation will be sufficient is particularly appropriate. Both the issues of discharge of treated fracking fluid waste, and the issue of water withdrawals are not just local ones. Many streams traverse more than one state making common rules for interstate situations essential if development is to proceed in an orderly manner and if a race to the bottom to avoid the requirements of good environmental housekeeping is not to be created.

Two other issues of environmental impact and cost externalization will complete the immediate inventory of concerns for this subcommittee should be most aware of. The first is the impact of fracking on the rural landscape, particularly in areas that support water resources. These impacts

are both ecological and social. Ecologically, five acre drilling pads, surrounded by a larger leased area degraded by drilling support and combined with new pipeline corridors and new or expanded roads mean a landscape transformed from rural to industrial.

Then there are the social impacts of such drilling. These include 24 hour drilling operations, problems of noise, odor, light pollution, greatly increased volumes of truck traffic and road congestion, potential health impacts from the toxic chemicals that fracking operations put into the environment, and the disruption of well based rural water supplies. The landscape transformations from the new shale gas economy undermine rural businesses in tourism, depress the property values of those adjacent to well sites whose property was not leased for oil and gas drilling, and are often incompatible with traditional agricultural business activity.

Many will argue about the level of these problems, dismissing them as few isolated instances, but consider the numbers. Even if only 2% of proposed drilling sites generate some significant adverse impact, on the basis of industry projections of 120,000 drill sites for Pennsylvania and New York alone that would create 2,400 instances of significant impacts. Given shortages of an experienced labor force and a historical culture that has emphasized production over environmental housekeeping, if the industry expands at the rate the industry projects, one could reasonably expect to see a glitch percentage closer to 5%, or 6,000 adverse impacts in New York and Pennsylvania alone.

All of which points to three conclusions. First, shale gas drilling is completely inappropriate in any area that is a major drinking water source, such as the New York City watershed, the Delaware River Basin, and recharge areas for sole source aquifers.

Second, the above panoply of landscape and social problems can only be addressed by one tool, zoning, which most rural areas currently lack. Such zoning, designed as all zoning is, to minimize the impacts of incompatible uses being placed adjacent to each other, is essential not only to minimize harm to existing countryside residents from fracking, but to maintaining over the long term, public support for the use of fracking technology. .

Finally, it seems clear that a system of impact payments to local rural governments will be needed, to deal with issues like congested road systems, facilities for workforces, adverse impacts on traditional outdoor recreational resources, improvements in utility systems and schools and so forth.

In closing this section of my presentation, a word must be said about enforcement, which must be the companion of any restoration of the environmental standards of the Clean Water Act, Safe Drinking Water Act, and of the other new environmental regulations needed to address the above issues.

The Department of Energy's report on Comparative Gas regulation identifies eight separate tasks involved with shale gas regulation. Moreover, because prevention is the only viable strategy for many of these issues, and because of the intrinsic difficulty in monitoring underground activity, it is clear that frequent site visits, a number of which should be unannounced, will be required, not to mention that there are a number of tasks such as supervising concrete work on drilling

casings that should be independently supervised and reviewed by regulators at the time they are carried out.

Taking New York as an example, the industry currently projects 40,000 wells will be drilled in the State. If half that number, 20,000 wells are active at any one time, then New York State regulators need a staff adequate to oversee 20,000 wells. Though to offer any precise number of additional regulators that New York will need would depend on too many assumptions to be done casually, it is clear that an adequate regulatory oversight staff for fracking will number in the many hundreds if not larger. When the New York City watershed program was created, it required 400 new staff to cover an area a tenth of the size of area of the Marcellus and to manage what was ultimately a less complicated environmental oversight task.

Addressing these issues must be the foundation of any successful long term policy towards extraction of shale natural gas. Yet ideally, this would only be the beginning. The current debate over shale gas extraction is based on an industry approach that assumes the environment is, in economic terms, a cost center, and that the policy issue is to find a balance point where economic activity can be maximized and the costs of environmental compliance minimized. But this is essentially what should be called, for lack of a better term, the old accounting, in which industry tries, by minimizing its environmental obligations, to externalize as many costs as possible and, by externalizing them, to maximize its profits.

But as a society, what we have increasingly come to recognize is that we want is a new accounting, the accounting of sustainability, where the environment is not seen as a cost center to be avoided to the greatest extent possible, but as a profit center, where environmental stewardship becomes the key to a smooth functioning, profitable industry that maximizes overall public wealth.

The problem with the old accounting is that, while it makes money for some, it costs money for many more. Externalizing costs is, in any free market economy, intrinsically inefficient. It is a form of corporate welfare performed at the expense of all those who must pay the externalized costs, costs that in any full cost accounting system generally wind up being far greater than the sum of the benefits that come from doing so. For example, the natural gas industry projects New York State will receive a billion dollars in additional annual revenue from shale gas development. However, if such development were to undermine water quality in the New York City watershed, as it undoubtedly would, the cost of building and operating filtration works would be at least 1.2 billion dollars a year. Extend these impacts throughout the state and we have an industry whose profits would depend on an inaction subsidy from New York State's government and the costs paid by state residents would be far in excess of what it would produce for them.

There is an even more fundamental flaw, one that applies nationally, with allowing the shale gas industry to externalize its costs through a lack of environmental regulation or effective enforcement of applicable environmental regulations. The country has made a historical commitment to a green energy economy at all levels of government. Again using New York as an example, electrical power customers in New York State are paying enormous sums as surcharges on their electrical bills to support green energy.

But whom does green energy compete with as a source of electricity? It competes with natural gas powered electrical generation. If the price of natural gas is kept artificially low by government's failure to prevent the externalization of the costs of fracking produced natural gas, then government is undercutting its own green energy policy. The great economist Milton Friedman once did a famed interview where he stood on the D.C. Mall and pointed first to the Department of Agriculture saying, over there well meaning people spend billions of dollars encouraging the growth of tobacco. Then, pointing to the Department of Health and Human Services, he said, and over there equally well meaning people spend billions to fight the health consequences of using tobacco. One of these sets of people, he concluded, is wrong.

If Dr. Friedman were alive today, he would undoubtedly look at our policy of sponsoring green energy while allowing the subsidization of lower prices for its natural gas competitor by externalizing its environmental costs of production, and conclude the same thing. Until we make coal, natural gas and oil production sustainable, we will continue to face that dilemma.

Sustainable is the key word. The basic premise of sustainability is that the environment is a profit center, not a cost center, and that the integration of economic development with environmental stewardship is the way to maximize individual and social profit. This is the challenge that the natural gas industry, with its resistance to the ordinary standards of environmental housekeeping that every other major American industry complies with, is notably failing to address. In clinging to the old accounting of the past, instead of the new sustainable accounting of the future, it is the shale gas industry that is generating the opposition to its use of fracking and is feeding rapidly escalating political controversy. In orienting the shale gas energy industry towards the past, instead of the future, the Cheney Energy Amendments of 2005 did the industry no favor. The industry should be seeking to make shale gas extraction as sustainable and as green that its advertising and public pronouncements, and as its slogan of clean burning natural gas, implies.

What, briefly, would that sustainable policy look like? It would end the externalization of environmental costs by raising the standards of industry practice. It would develop non-toxic and biodegradable fracking additives. It would recognize that there are critical areas, watersheds, special scenic resources, critical resources for the local economy and densely populated areas that need to be off limits for any drilling. And it would work closely with local stakeholders to develop local zoning and regional planning schemes to avoid disastrous social impacts.

So, in the context of this hearing, how important is shale gas extraction going to be for America's energy future. Unless the industry embraces sustainability, the answer is going to be not very. For the last chapter is the drama of green energy versus traditional energy is going to belong to global warming.

We are at an interesting point in political and economic time. The country and much of the world has embraced the idea of a green energy future. But we have not yet faced the full implications of what that means for the existing energy industry.

The basic reality is that over whatever time period we choose to target, total carbon combustion is going to have to drop dramatically, if we are going to avoid the multi-trillion dollars costs of global warming that we are already beginning to experience. Transitions produce these kinds of gaps in understanding. Few things can produce more of a sense of economic unreality than to read in a business publication like the Economist a rigorous assessment of the prospects for global warming and then find five pages later an article on the new oil play in the Arctic Ocean or in deepwater off Brazil that totally ignores the impact of global warming policy on hydrocarbon demand and the on the stunted economic return likely on the tens of billions that will have to be invested to recover these resources.

With respect to global warming, once the emissions implications of current economic growth in just the four CRIB countries are factored in, the numbers are inexorable. A vast reduction in carbon combustion and a massive increase in green energy production is the only future that has any choice of being sustainable.

Over the next ten years, it will become ever more apparent that the existing hydrocarbon based energy industry will be playing a game of last man standing in which the prize will go to the industry or the components of particular industries that are more efficient and more sustainable. The billions and billions of dollars involved in extracting and using the unconventional resources this committee is reviewing, these additional billions in externalized environmental costs that have so far accompanied such developments, will not be paid by a public that is struggling with both the costs of transitioning to a green economy and with the steadily accelerating costs of unprecedented climate change.

So far, the only industry that seems to recognize this fact, even if the recognition has been somewhat begrudging and incomplete, has been the coal industry. Perhaps because it has not been sheltered, as shale gas extraction has been, from the upsurge of public opposition to unsustainable energy generation, the industry is now developing a serious commitment to clean coal and trying to make deep subsurface CO<sub>2</sub> injection work. It is far too early to assess whether they will be successful in these efforts, but the fact they are starting to face their future in this manner is a welcome development. The shale gas industry needs a similar epiphany if it is not to experience a brief burst of publicly subsidized splendor followed by a decline that leaves much of the American countryside an industrialized sacrifice zone.

Hopefully, the work of this Committee will represent a starting point in that effort.

Thank You.