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The Realities of Nuclear Expansion

Good morning. Thank you Chairman Markey and Ranking Member Sensenbrenner for inviting me to provide comments on the topic of nuclear energy expansion and its contribution to mitigating global climate change. Chairman Markey, I would like to request permission to submit longer testimony for the record and will summarize my remarks here. In addition, I would like to present a few graphics on nuclear expansion, which I understand is unorthodox, but in this case, a picture may be worth a thousand words.

Recent nuclear enthusiasm stems from several expectations: that it can help beat global climate change, meet rapidly increasing demand for electricity, combat rising costs of oil and gas, and provide energy security. The gap between expectations and reality, however, is significant.

This morning I will focus on what it would really take for nuclear energy to make a difference in terms of global climate change and why this is unlikely to happen.

Global nuclear reactor capacity now stands at 373 GWe – or about 439 reactors [SLIDE 1]. By 2030, under a "realistic growth" scenario, based on U.S. Energy Information Administration figures, capacity could grow 20% [SLIDE 1a].

Yet, since electricity demand is expected to almost double in that time, nuclear energy is unlikely to keep its market share, which could drop from the current 16% to 10% of worldwide electricity generation. In the United States alone, according to nuclear industry estimates, a stable market share for nuclear energy would require the United States to build 50 nuclear reactors by 2025. At the same time, the United States would also be building 261 coal-fired plants, 279 natural-gas-fired plants and 73 renewables projects.

States' plans for nuclear energy, however, may be anything but realistic. In my second scenario – what I call "wildly optimistic" – the total reactor capacity would reach about 700 GWe by 2030 [SLIDE 1b]. This is not a projection, but rather takes at face-value what states have announced they will do. More than 20 nations have announced intentions to install nuclear capacity that do not now have nuclear power plants. And more than half of these are in the Middle East.

The final scenario depicts what an expansion to 1500 GWe might look like [SLIDE 1c], based roughly based on the high-end projections for 2050 done by MIT in its 2003 study entitled "The Future of Nuclear Power."

This “climate change” scenario is more than a Pacala-Socolow wedge (defined as the level of growth needed to reduce carbon emissions by one billion tons per year by 2050 (i.e., 1070 GWe) but less than the Stern Report on Climate Change estimates that nuclear energy could reduce carbon emissions between 2 billion and 6 billion tons/year (1800 GWe to 4500 GWe). The Stern numbers were literally off the map, so I have not included them here.

For 1500 GW capacity, MIT estimated that 54 countries (an additional 23) would have commercial nuclear power programs. This essentially means a five-fold increase in the number of reactors worldwide and an annual build rate of 35 per year. [SLIDES 2 and 3].

These expansion scenarios have implications for both the front and back ends of the fuel cycle. As this graph shows [SLIDE 4], building one “nuclear wedge” could require tripling uranium enrichment capacity. And, new states could find it economically feasible to develop their own enrichment. [SLIDE 5]

It is unlikely that these expansion rates will be achieved, however. The United States has just a fraction of the nuclear infrastructure it had two decades ago and other countries have not fared much better. In the last twenty years, there have been fewer than 10 new construction starts in any given year. Industrial bottlenecks are significant now, particularly in forging reactor pressure vessels and steam generators. The sole company with ultra-large forging capacity – Japan Steel Works – has a two-year waiting list and when it completes its expansion in 2010, will only produce enough forging sets for 8 reactors per year. The capabilities of alternative suppliers such as China are unknown. Other constraints include labor shortages (engineers, craft labor, construction labor) and long lead times for components and materials. Financing is another huge topic, worthy of a separate hearing. And the cost of inputs has risen significantly in recent years.

Finally, the proliferation risks of nuclear expansion are not limited just to a three- four-, or five-fold increase in the number of reactors. Some states may move forward anyway, propelled by unrealistic expectations and could acquire uranium enrichment and plutonium separation capabilities. Such national fuel production capabilities could introduce even greater uncertainty about proliferation intentions in regions like the Middle East, because of the latent nuclear weapons capability in such plants. Efforts to address both supply and demand for such sensitive capabilities need to be redoubled.

The current policy debate paints nuclear energy “clean and green,” advocates nuclear energy for all -- even though some states with nuclear reactors could pose significant safety and proliferation concerns -- and suggests that nuclear energy is a path to energy security. At the same time, U.S. officials insist that some states forego developing indigenous nuclear capabilities. This confused message obscures important policy considerations. If nuclear energy can’t really make a difference in terms of global climate change, are the huge costs and risks worth it?

Thank-you.