Green Visions & Their Policy Consequences

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Green Nano-Visions (1986-99)

Dr. Eric Drexler, an MIT Ph.D., published Engines of Creation in 1986 and popularized nanotechnology as a technological fix to help humankind overcome environmental limits. For example, as a solution to global warming, he envisioned self-replicating nanobots able to sort gas molecules and extract carbon dioxide from air. Drexler’s imaginative visions influenced scientists like Richard Smalley.

Dr. Richard Smalley won the 1996 Nobel Prize in Chemistry for discovering a nano-scale form of carbon called a “buckyball.” In 1989, Smalley e-mailed the U.S. Government describing his visions about nanotechnology and the importance of a NNI. He had more realistic ideas about using nanotechnology to improve the environment with clean, renewable forms of nanotechnology and green manufacturing. Smalley worked closely with major science administrators in the U.S. Federal Government.

Dr. Mihail Roco, the current Senior Advisor for Nanotechnology at Cal Tech (January 2000 – 2003), introduced ideas about possible environmental implications (right). But in 2000, when the NNI began, Roço argued that nanotechnology would provide a plethora of environmental benefits and technological solutions to environmental challenges.

Early Policy Consequences (2000-03)

In 2000, even the EPA—the agency obligated to protect environment and human health—focused almost entirely on nanotechnology’s environmental applications in its first “Background on the NNI” (top left). In its excitement to fulfill scientists’ and policy-makers’ visions, the EPA failed to consider whether nanomaterials themselves might actually damage the environment.

In 2002, the EPA still focused on nanotechnology’s “green” applications over its potential environmental hazards. The EPA’s second background report focused on environmental applications of nanotechnology. As a final thought, the EPA introduced ideas about possible environmental implications (right). But even here the EPA sought either “the most serious or harmful effects of nanotechnology on society” rather than on the environment itself, including “Impacts from the development of nanomachines.”

Finally, in 2003, three years after the NNI began, the EPA called explicitly for research on nanotechnology’s toxicity, bioavailability, fate, transport, and transformation (left). It took the EPA three years to look explicitly at nanotechnology’s Environmental and Health (EHS) Implications, and it took even longer for the rest of the NNI and the U.S. Government to follow.

Recent Policy Consequences (2003-Today)

In January of 2000, the United States initiated a multi-billion dollar venture into nanotechnology to fund the “National Institute of Nanotechnology.” Many government departments, agencies, and laboratories benefited from this major investment.

Initially, the NNI focused on nanotechnology’s environmental applications and overlooked the environmental risks and implications of new nano-scale materials and chemicals.

With such investment in nanotechnology, the U.S. Government desired rapid return on the investment. As a result, even the EPA expanded its focus from 2000 to 2003, created expectations of steady social and economic growth. And, as the sole super-power after the Cold War, America hoped nanotechnology would maintain its hegemony over the rest of the global community. This, in addition to the green nano-visions, led to a focus on applications and commercialization during the NNI’s first years.

In 2003, the U.S. Government acknowledged nanotechnology’s EHS concerns. Between 2000 and 2003, the NNI focused on nanotechnology’s societal implications and applications and some societal implications. In September 2006, the U.S. House Committee on Science echoed the EPA’s internal concerns about environmental and health risks of nanotechnology. In 2007, the EPA released publicly its first white paper on nano-science, which addressed environmental benefits and some risks. Finally, in 2008 the NNI funded two centers focused explicitly on environmental applications: the Center for the Environmental Implications of Nanotechnology (CEINT) at Duke University and the Center for Environmental Implications of Nanomaterials (CEIN) at UCLA and UCSD.

Yet, as recently as December 2011, an internal EPA evaluation criticized its own ineffectiveness in managing nanomaterials.

Conclusions & Future Work

The green nano-visions of scientists and policy-makers from the 1980s and 2000s were encouraged by delays in research on nanotechnology’s EHS issues in the first years of the NNI.

Today, hundreds of nanotechnology products already exist on the market, yet we have only ineffective and commercial regulatory programs to protect workers, consumers, and the environment.

By looking both at nanotechnology’s applications and implications from the very start, we can help prevent both technological “surprises” and economic losses.

For future work I want to learn about the implications of current nano-products in the market.