

# LESSONS LEARNED ABOUT SOCIETAL RESPONSES TO EMERGING TECHNOLOGIES PERCEIVED AS RISKY\*

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**OAK RIDGE NATIONAL LABORATORY**  
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# BY WAY OF INTRODUCTION:

- **I Am Reporting on a Project That Seeks:**
  - to consider the historical experience in the U.S. with developing new technologies associated with public concerns about risks
  - to consider how lessons learned might be relevant to societal implications of emerging technologies such as bioengineering for alternative energy production
  - all of this in the context of major commitments by DOE to advance science and technologies for bioenergy production, including potentials for genetic engineering
- **Principal Investigators For The Project Are:**
  - Susan Cozzens, Georgia Institute of Technology; Brian Davison, Oak Ridge National Laboratory; Eugene Rosa, Washington State University; Paul Stern, National Research Council, and Tom Wilbanks, Oak Ridge National Laboratory

# Generally, We See Around Us:

- **Breakthroughs in science and technology (S&T) that are driving societal change, seemingly at an accelerating rate**
- **Institutions that are better at producing such breakthroughs than anticipating and coping with their effects**
- **A significant challenge of establishing adaptive management practices that avoid undesirable effects, unnecessary social controversy, and a waste of R&D investments in new S&T that run into obstacles due to societal concerns**
- **One contribution to such adaptive management is to improve our foresight about possible societal concerns, so that:**
  - **R&D programs can take such concerns into account in agenda-setting**
  - **programs can incorporate public involvement in technology development discussions as soon as possible**
  - **institutions that would implement the results can begin developing socially acceptable risk management strategies in time to earn public credibility and trust**

# **There are At Least Two Possible Sources of Insight About Societal Concerns and Responses:**

- **Induction from past experience with societal reactions to risks associated with emerging technologies**
- **Deduction from knowledge bases about relevant behavioral and social processes affecting societal decision-making in such cases**

# Induction from Past Experience (I):

- **Experience with technology utilization**
  - **Nuclear energy use**
    - While scientists tend to focus on probabilities, the public tends to focus on consequences
    - Consequences associated with unknown risks are viewed differently than consequences associated with evidence-based knowledge
  - **Radioactive waste management**
    - Dread is associated with consequences that are potentially unbounded in their effects
    - Public participation is often an effective way to promote public confidence in both institutions and technologies
  - **DNA manipulation**
    - It is easier to discuss risk issues before they become chronic and positions become hardened
  - **Risk assessment and management more generally**
    - Risk amplification is shaped by risk communication

# Induction from Past Experience (II):

- **Experience with emerging technologies**
  - **Nanotechnology**
  - **Biotechnology**
  - **Information science and technology**

# Deduction From Knowledge of Basic Social Processes:

- **Perception, assessment, and management of societal risks**
  - It is at least as important to get the right science as to get the science right
- **Common-pool resource management**
  - Adaptive risk management is more likely to be successful if it employs a mixture of institutional types and decision rules
- **International institutions and networks**
  - The effectiveness of policy networks depends heavily on a shared sense of need for collective thinking
- **Science communication and utilization**
  - Effective use of information often depends on efforts of intermediaries or “boundary organizations”

# **General Insights From These Two Sources Include:**

- **Technology acceptance is fundamentally a social process, not a scientific process**
- **Societal concerns tend to focus on non-zero vs. zero risks of large-scale catastrophic unintended consequences, while S&T programs tend to focus on most likely outcomes under best practices – these very different perspectives need to be bridged**
- **Social impediments are less likely to arise if risk communication occurs earlier rather than later, building trust in institutions by promoting public participation**



# **We Are Now Looking At The Case of Bioengineering for Alternative Energy Technologies, Generally Grounded in Societal Concerns about Genetic Engineering (I):**

- **Most of the relevant existing literature is concerned with (a) agricultural applications of genetic science, (b) threats to human security, or (c) risks associated with the interconnectedness of all life**
- **Applications of bioengineering to alternative energy production include two alternatives:**
  - **Accelerating demonstrated technologies: e.g., uses of genetically modified organisms in biorefining**
  - **Radically transforming organisms: e.g., increasing the hydrocarbon of plants through genetic engineering**

## **We Are Now Looking At The Case of Bioengineering for Alternative Energy Technologies, Generally Grounded in Societal Concerns about Genetic Engineering (II):**

- **Concerns about unintended consequences may include:**
  - **Possible auto-replication that could spin out of control**
  - **Possible mutation of new organisms into unintended forms**
  - **Possible unintended transfer of genes to a third species (e.g., from growing genetically-engineered crops)**
  - **Possible releases from biorefineries as their numbers increase**

## **If These and Other Concerns Can Be Addressed Early in the Bioengineering R&D Process:**

- **It is more likely that the resulting technologies will have features sensitive to societal concerns, increasing their likelihood of acceptability**
- **It is more likely that impact-sensitive constituencies will be supportive of technology deployment and use**