

# Lessons from Technology and Policy Case Studies

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## Challenges of Science and Technology for Policy

Major public policy questions are increasingly rooted in technical and scientific issues that present significant challenges to decision makers. A prominent set of issues, ranging from climate change to internet policy to public health, require policy decisions with sweeping implications for governments, society and the planet, yet involve significant uncertainty and cost/benefit trade-offs. While there are limited established frameworks for evaluating these technical policy questions, a set of recent high-profile issues and events offers the opportunity for analysis and learning. Drawing on class assignments from a core course in MIT's Technology and Policy Program, we investigate a set of these technical policy questions as case studies in technology and policy decision-making. Based on their review, common themes are explored and best practices for future policy-making and policy education are identified.

## Methods: Common Research Questions

As part of the MIT course ESD.864/12.844 (Modeling and Assessment for Policy), students were given a topic in which scientific and technical information played an important role in an ongoing decision-making process. They were asked to address the following questions:

### Common Case Questions

**What is the goal of the technically-focused policy analysis? That is, what decision needs to be made?**

**Who is or was the decision-maker?**

**What technical information is or was available to inform this decision? Was a particular model or statistical approach used?**

**Who conducted the technical analysis and how?**

**How was the technical information viewed by the decision-makers?**

**What policy decision was made, and what were its implications?**

**What general lessons can you draw from this case about the use of technical information in policy?**

Students worked in groups of four to identify suggested background readings, prepare a 3-5 page briefing memo on the topic, and give a presentation on the case to the rest of the class.

## Methods: Case Selection

The case studies for the class were chosen to cover a broad range of student interest in technology and policy/decision-making domains. In Spring 2012, the following case studies were examined:

- 1) **NASA's model standard:** the development of a credibility standard for the use of models at NASA (1) after the Columbia shuttle disaster
- 2) **Economic Modeling:** the use of quantitative models in U.S. Federal Reserve decision-making
- 3) **Airline transportation:** assessing aviation safety during the Eyjafjallajökull volcanic eruption
- 4) **Sports Statistics:** the use of statistical information to make decisions in professional sports
- 5) **Climate Change Negotiations:** the application of modeling in the context of international climate policy, focusing on the C-ROADS simulation (2)
- 6) **Internet Policy:** the role of technical information in discussions of the Stop Online Piracy Act (SOPA) and Protect IP Act (PIPA)
- 7) **Nuclear Disaster:** technical information in crisis management during the Fukushima nuclear disaster
- 8) **Cancer Screening:** statistical modeling in the context of recommendations for population-based cancer detection
- 9) **Polar Bears:** scientific information in the context of listing polar bears on the U.S. Endangered Species Act

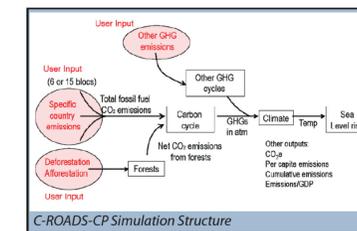
### ESD.864/12.844 (Modeling and Assessment for Policy)

*This is a graduate-level course that explores how scientific information and quantitative models can be used to inform policy decision-making. It is a core course of the Technology and Policy Master's program at MIT. Learning objectives include:*

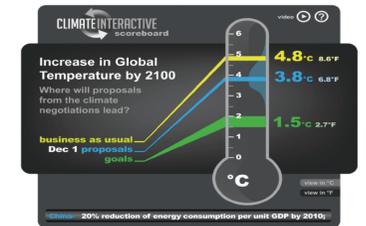
- 1) Understanding and applying tools and techniques used for technically-focused policy analysis
- 2) Identifying best practices and limitations in using quantitative models for policy
- 3) Evaluating the effectiveness of scientific and technical advice in policy-making processes
- 4) Describing and analyzing strategies to manage scientific and technical advice processes
- 5) Communicating technical results to policy audiences

## Case Example: Climate Change Negotiations

The Climate Rapid Overview and Decision Support (C-ROADS) model (2) aims to help decision-makers better understand the implications of emissions cuts for global temperature change in the context of climate negotiations. Assessment of the use of the C-ROADS model in the context of climate negotiations focused on its credibility and utility to two main audiences: climate negotiators and the general public.



C-ROADS-CP Simulation Structure  
Figures from Climateinteractive.org



Analysis of the case focused on the difficulty of adapting technical information to the changing needs of multiple stakeholders. The C-ROADS tool was well-received by climate negotiators who participated actively in its development and refinement. Its impact among the general public was more difficult to measure. Lessons from the case suggest that iterative, ongoing interaction with model users was critical to ensuring its credibility and utility.

## Lessons across Case Studies

The nine case studies offer rich material to draw lessons about best practices and limitations in conducting technically-focused policy analyses. Analysis of these cases is ongoing, but initial lessons focused on lessons for technical analysis, policy decisions, and socio-technical systems. Cross-cutting issues identified included:

*management of uncertainty  
decision consequences  
stakeholder values  
transparency  
limitations of scientific assessment and modeling  
communication*

Continuing analysis of the cases aims to connect these lessons to other cases and literature in science and technology policy.

## References

(1) Bertch, William J., Zang, Thomas A., and Martin J. Steele. Development of NASA's Models and Simulations Standard. Pasadena, CA: Jet Propulsion Laboratory, National Aeronautics and Space Administration, 2008.; (2) Sterman, J. et al. 2012, "Management Flight Simulators to Support Climate Negotiations: The C-ROADS Climate Policy Model." Environmental Modeling and Software, forthcoming.