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Evaluating the Energy Security Implications of a Carbon-Constrained US Economy

Britt Staley

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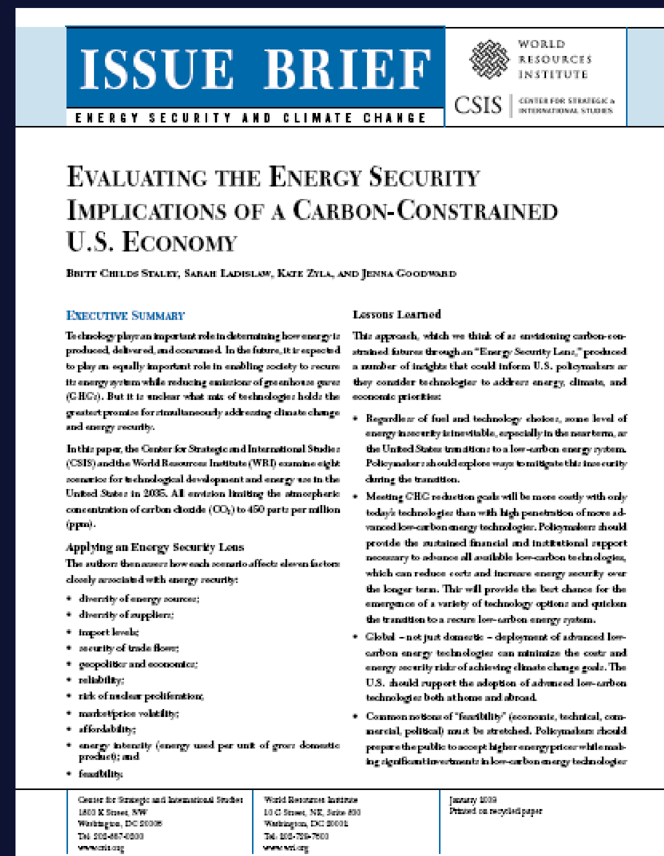
Energy Security & Climate Change

How energy secure is a carbon constrained future?



ISSUE BRIEF

ENERGY SECURITY AND CLIMATE CHANGE

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Evaluating the Energy Security Implications of a Carbon-Constrained U.S. Economy

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Executive Summary

Technology plays an important role in determining how energy is produced, delivered, and consumed. In the future, it is expected to play an equally important role in enabling society to secure its energy system while reducing emissions of greenhouse gases (GHGs). But it is unclear what mix of technologies holds the greatest promise for simultaneously addressing climate change and energy security.

In this paper, the Center for Strategic and International Studies (CSIS) and the World Resources Institute (WRI) examine eight scenarios for technological development and energy use in the United States in 2035. All envision limiting the atmospheric concentration of carbon dioxide (CO_2) to 450 parts per million (ppm).

Applying an Energy Security Lens

The authors then assess how each scenario affects eleven factors closely associated with energy security:

- diversity of energy sources;
- diversity of suppliers;
- import levels;
- security of trade flows;
- geopolitics and economics;
- reliability;
- risk of nuclear proliferation;
- market/price volatility;
- affordability;
- energy intensity (energy used per unit of gross domestic product); and
- feasibility.

Lessons Learned

This approach, which we think of as envisioning carbon-constrained futures through an "Energy Security Lens," produced a number of insights that could inform U.S. policymakers as they consider technologies to address energy, climate, and economic priorities:

- Regardless of fuel and technology choices, some level of energy insecurity is inevitable, especially in the near term, as the United States transitions to a low-carbon energy system. Policymakers should explore ways to mitigate this insecurity during the transition.
- Meeting GHG reduction goals will be more costly with only today's technologies than with high penetration of more advanced low-carbon energy technologies. Policymakers should provide the sustained financial and institutional support necessary to advance all available low-carbon technologies, which can reduce costs and increase energy security over the longer term. This will provide the best chance for the emergence of a variety of technology options and quicken the transition to a secure low-carbon energy system.
- Global – not just domestic – deployment of advanced low-carbon energy technologies can minimize the costs and energy security risks of achieving climate change goals. The U.S. should support the adoption of advanced low-carbon technologies both at home and abroad.
- Common notions of "feasibility" (economic, technical, commercial, political) must be stretched. Policymakers should prepare the public to accept higher energy prices while making significant investments in low-carbon energy technologies

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The Energy Security Lens

11 Factors:

- diversity of energy sources;
- import levels;
- security of trade flows;
- risk of nuclear proliferation;
- affordability;
- energy intensity;
- feasibility;
- *diversity of suppliers;*
- *reliability;*
- *price volatility; and*
- *geopolitics.*

The Carbon-Constrained Scenarios

- 450ppm CO_2 constraint
- Global cooperation
- 2035

Technology Scenarios	Assumptions
Constrained Reference Case	"Reference" assumptions for all technologies (i.e., normal technological progress and no carbon capture and storage [CCS])
Energy Efficiency and Renewables Case	Advanced technology assumption for efficiency, renewables, and biomass; reference nuclear power and no CCS
Energy Efficiency Case	Advanced efficiency, no CCS, all else reference case
CCS Case	Advanced CCS, reference case nuclear power, and other technologies
Nuclear Case	Advanced nuclear power, no CCS, reference case for other technologies
Biomass and CCS Case	Advanced biomass and CCS, reference case for other technologies
Advanced Supply	Reference end-use technologies; all else advanced
All Advanced	Available CCS and advanced assumptions for all technologies

Applying the Lens

BAU is NOT a desirable outcome

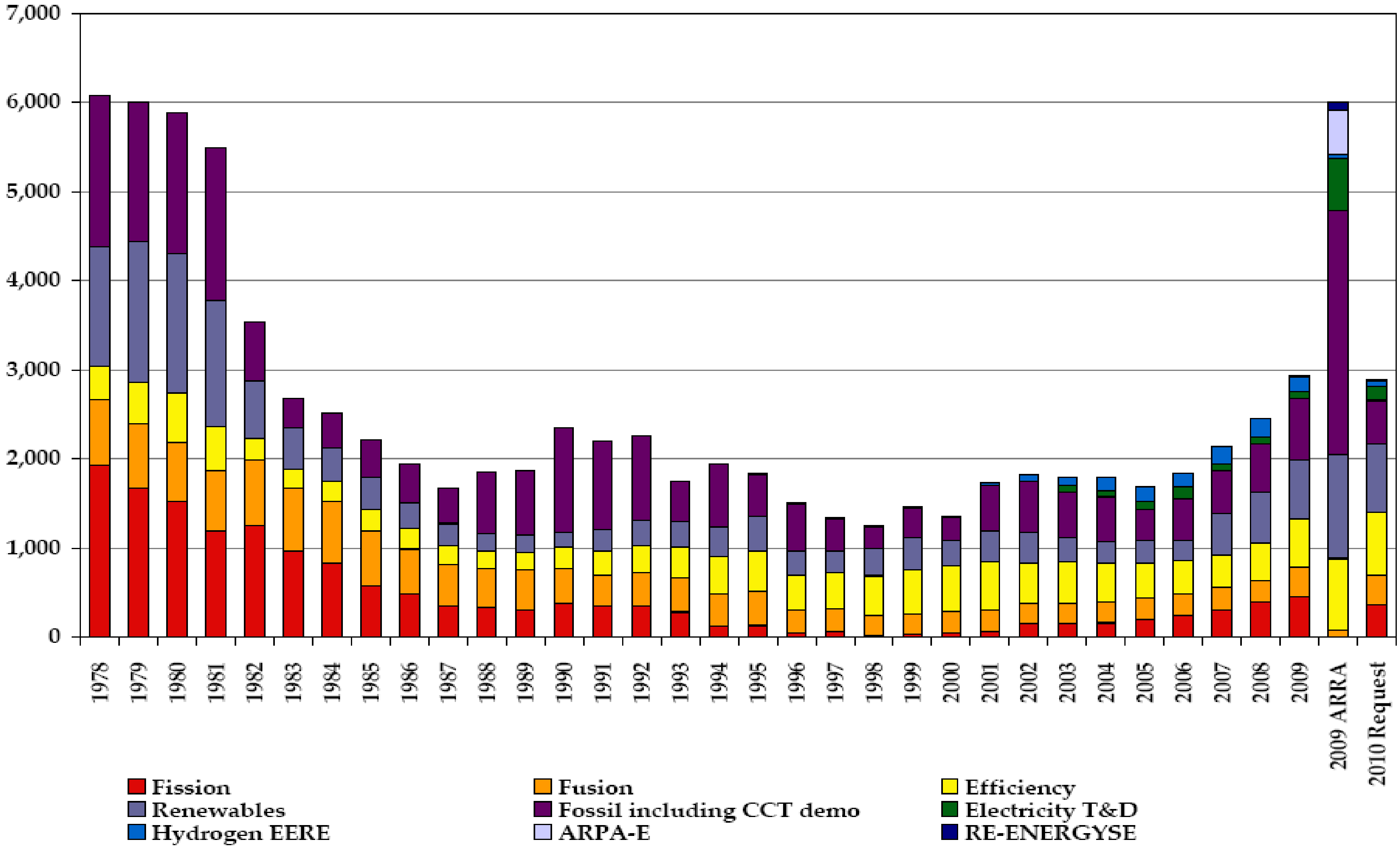

Summary of Lessons from Applying Energy Security Lens: 2035
Technology Scenarios
Diversity of Fuels (power gen)
Diversity of Fuels (transport)
Feasibility
Proliferation
Affordability
Total Energy Demand
Total Oil Consumption
Total NG Consumption
Constrained Reference Case
Energy Efficiency and Renewables Case
Energy Efficiency Case
CCS Case
Nuclear Case
Biomass and CCS Case
Advanced Supply Case
All Advanced Case

Lessons

- Advancing technology, particularly efficiency technologies and renewables.
- Lingering insecurities
- Cooperating internationally
- Redefining feasibility

Figure 1: Energy RD&D funding by DOE between 1978 and the FY 2010 request, including ARRA funds*

(in millions 2000$)



* Figure 1 does not include funds for the EFRCs, Basic Energy Sciences, or the NSF. The nuclear fission figures do not include funding for nuclear facilities (e.g. Idaho facilities management, or radiological facilities management), because because historically, a substantial fraction of this funding has gone to activities that were not directly related to RD&D on new nuclear energy technologies. As this funding is becoming more important to nuclear energy RD&D, we will incorporate nuclear facilities funding in future editions of the budget database (Gallagher, Anadon 2009)