US POLICY & OUTREACH

Summarizing the C2ES Innovation Policy Matrix

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The Center for Climate and Energy Solutions' (C2ES) Innovation Policy Matrix—informed by the insights generated from over two years of work with 140 companies across the innovation ecosystem through the C2ES Technology Working Group program—is a user-friendly, technology-neutral tool designed to help policymakers craft effective innovation policy. Primarily, it offers a framework for understanding the dynamics that impact a given technology on its path toward wide-spread adoption and use. The tool is designed to help policymakers quickly diagnose barriers to deploying innovative technologies and identify policy solutions that can speed commercialization.

Component 1: Key Risks

The federal government has an important role to play as a risk-tolerant supporter of innovation, particularly when technological feasibility and market applications are unclear. The goal is not for the government to fully shoulder all innovation risk, but rather to encourage private capital investments by providing sufficient policy certainty and reducing risks. There are four key risks that must be managed within an innovation ecosystem:[1]

- **Science risk** refers to the possibility that a technology may prove to be scientifically or physically infeasible.
- **Engineering risk** is the risk that a technology that works under ideal conditions (i.e., in the lab) cannot be reproduced cost-effectively at scale or under real-world conditions.
- **Financing risk** is the challenge a company faces in accessing capital or managing debt effectively.
- **Commercial and management risk** involves the possibility that the innovation will not generate sufficient market demand, fail to be competitive with alternatives, confront supply chain limitations, or otherwise fall short of profitability for a critical mass of market participants.

Component 2: Innovation Process

The innovation process is often non-linear, with lessons from later stages feeding back into earlier steps. Each stage of the innovation process carries a distinct risk profile. Well-designed innovation policies can help mitigate these risks.

Component 3: Ecosystem Functions

The innovation process does not occur in a vacuum. It is shaped by market, regulatory, and technological dynamics across the innovation ecosystem. The matrix leverages the International Energy Agency's "Four Pillars of Effective Energy Innovation System" to help capture the nature of a given risk from different perspectives in the ecosystem:[2]

1 Adapted from Bipartisan Policy Center, Navigating the Stage of Commercialization to Deploy Direct Air Capture at Scale (Washington, DC: BPC, 2023), https://bipartisanpolicy.org/report/navigating-commercialization-risk-dac.

2 International Energy Agency, Clean energy technology innovation and the vital role of governments (Paris, France: IEA, 2020), https://www.iea.org/reports/clean-energy-innovation/clean-energy-technology-innovation-and-the-vital-role-of-governments.

- **Resource push**: Provide sustained resources to research, prototyping, demonstrations, and early-stage product development as well as education and skills
- **Knowledge management**: Ensure appropriate knowledge flows to other users and into new products. Includes networks for knowledge exchange, patent, and publication systems
- **User pull**: Stimulate users, whether in markets or outside of them, to understand the costs, benefits, use cases, and risks of adoption
- **Socio-political support**: Increase the chances of new technologies being adopted by minimizing the tension between innovation and existing social preferences

Component 4: Key Principles of Innovation Policy

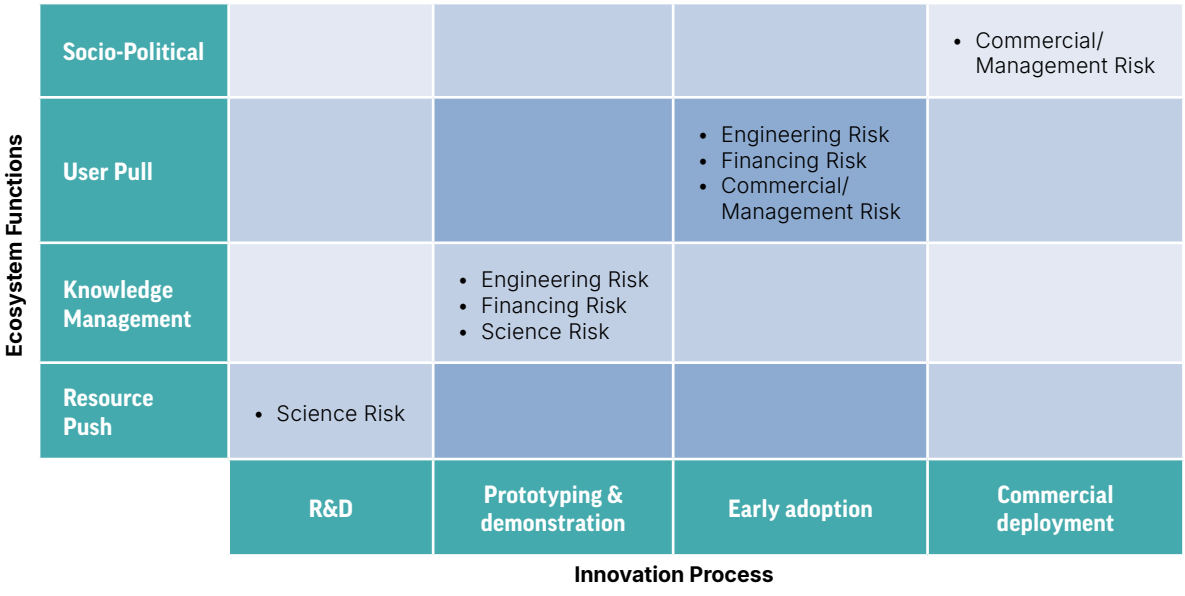
Drawing on insights from C2ES's technology working groups, these policies are intended to guide federal innovation policy for any emerging solution facing similar commercialization barriers. These do not map onto specific functions or stages; rather, they serve as key best practices.

- **Focus on Building Ecosystems, Not Picking Winners.** The role of federal policymakers is not to pick a specific winning company or technology, but rather to foster a robust, and ultimately self-sustaining, innovation ecosystem.
- **Shoulder Risks Where Private Markets Cannot.** The federal government should shoulder appropriate risks—including by removing barriers to innovation—that the private sector cannot manage on its own.
- **Enact Durable Policies to Crowd in Private Capital.** Effective innovation policy should have a multiplier effect on private capital, and over time, private sector funding into technologies must meaningfully exceed the amount invested by the federal government.
- **Align Policy Duration with Technology Commercialization.** Innovation policies should be aligned with real-world commercialization and maturation timelines in order to be maximally effective.

Putting it all together: The Innovation Policy Matrix

These different components—risk, function, process—can be combined into a single matrix, which is intended to produce a heatmap of where policy need will likely be the greatest (see **Figure 1**). The universe of potential innovation policies is vast and varied, and our full paper includes sample policies to support brainstorming efforts. In many cases, the same policy can address multiple stages of the innovation process and ecosystem functions. **The key is to think about the policy through the lens of the specific stage, function, and risk that needs to be addressed.**

FIGURE 1: THE C2ES INNOVATION MATRIX



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