Public support for low-carbon demonstrations

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In between Tech Push and Demand Pull: the “Valley of death”

**Weak incentives between R&D and deployment phase**
- High spillovers: Teece 1986; Hall, Mairesse et al 2009
- Large capital requirements:
- High technology risk
- Uncertain demand: Kalkuhl et al., 2016; Nemet et al., in review; Koch et al., 2015
In between Tech Push and Demand Pull: the “Technology Pork Barrel”

“political institutions introduce predictable systematic biases to R&D programs so that on balance, government projects will be susceptible to performance underruns and cost overruns.”


Government failures when selecting financed projects:

- Information asymmetry
- Risk averse bureaucracy
- Lobbying groups
- Representative democracy

One interpretation: **Governments should not pick winners**

...but what if scale, spillovers, and market uncertainty force a choice?
Bridging the Valley of Death while avoiding the Technology Pork Barrel

Motivating question:
• How can public support for technology demonstration projects be structured to be most effective?

Approach:
• Coding characteristics of 511 cases of large-scale demonstration projects
• Technology areas included:
  • Solar thermal electricity
  • Nuclear
  • Wind power
  • CCS power
  • CCS industry
  • Steel
  • Cement
  • Synthetic fuels
  • Cellulosic biofuels

Timing of projects
Public sector financial contribution

![Box plot showing public share of investment across different sectors.](image-url)
Private sector share decreases over time and over projects

Relationships are not significantly different from zero
Up-scaling takes time and is not trivial
Market conditions can result in cancellation of projects

Hotelling Path subject to much variation

Other literature: Krautkraemer (1998); Zaklan et al (2011)
EU ETS price as market condition for CCS projects facing large uncertainty
Conclusion

Summary results from 511 demos:

• Public share varies, even within technologies

• Up-scaling is central
  • Need many demos, increasing in size
  • Sequential to enable iterative learning

• Need payoffs that are robust to market conditions
  • Risky to depend on hotelling price increases
  • Niche markets, hedging across markets,
Follow up study

“The results indicate that larger plant sizes increase the risk of CCUS projects being terminated or put on hold; increasing capacity by 1 Mt CO2/y increases the risk of failure by nearly 50%.”

Fig. 6. Risk comparison of infrastructure projects (PPP), electricity infrastructure projects (PPP), oil coal & gas infrastructure projects, drug development projects (phase II) in the United States, and CCUS projects.
Implications for policy decisions on support for demonstrations:

Policy makers should consider:
1) prioritizing learning,
2) iterative upscaling,
3) private sector engagement,
4) broad knowledge dissemination, and
5) making demand pull robust.
Implementation issues:
1) Rent seeking
2) Selection, picking winners
3) Information access
4) Crowding out
5) Risk aversion
APPENDIX
Types of demos

• Large scale
• System integration within projects
• Upscaling unit size
• Development of supporting infrastructure
Motivation for projects

- Production
- Proving technology
- Scale up
- Creating knowledge

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<th>Total</th>
<th>Solar Thermal Electricity</th>
<th>Wind power</th>
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<td><strong>Proving technology</strong></td>
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<td><strong>Scale up</strong></td>
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<td><strong>Creating knowledge</strong></td>
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