

Technology Push vs. Demand Pull: The Evolution of Solar Policy in the US, Germany and China

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Outline

- Theory: the push-pull debate
- Context: adoption of renewable energy
- Research method and data
- Preliminary findings & discussion

Theoretical Background

Push vs. Pull Debate

- **Technology Push**
 - Advances in science, technology and R&D drive rate and direction of innovation
- **Demand Pull**
 - Assumes that market needs drive the timing and nature of innovation
- Cf. Mowery & Rosenberg, 1979; Chidamber & Kon, 1994; Nemet 2009

Context:
Adoption of renewable energy

Motivation: MNM

“Previous public R&D programs provide limited guidance to accommodate the global scope of the problem [of AGW]...”

- Mowery, Nelson & Martin
Research Policy Oct. 2010

Policy Principles of MNM

MNM recommend principles for climate change innovation policies:

- We identified 15 specific principles
- We categorized them in 3 groups
 - Technology push
 - Demand pull
 - Conditions for both push/pull

MNM Principles (1): Push

#	Policy design principle (MNM, 2010)
T1a	Publicly funded private R&D
T1b	Private investment in R&D
T1c	No public funding of marginal improvement
T2	Broad knowledge dissemination
T3	Prize competition

MNM Principles (2): Pull

#	Policy design principle (MNM, 2010)
D1	Regulatory performance targets
D2	Targeted financial incentives
D3	Pricing externalities
D4	Government procurement

MNM Principles (3): Conditions for Push and Pull

#	Policy design principle (MNM, 2010)
C1	Long-term support
C2a	Decentralized authority
C2b	Centralized leadership
C3	Technological diversity
C4	Global cooperation

Example: Demonstration Projects

Id	Name	Description	MNM source
T4	Demonstration projects and learning in use	§Enable the set up of demonstration projects to provide key information for improvement and future research; §experiences of early adopters should be widely disseminated and fed back into R&D processes.	<i>"We believe that effective public programs to support the development of alternative-energy technologies should also include mechanisms for the support and encouragement of early trial use of new technologies so that their promise can be evaluated and the necessary improvements identified." (p. 1021)</i>

Research Design

Empirical Focus

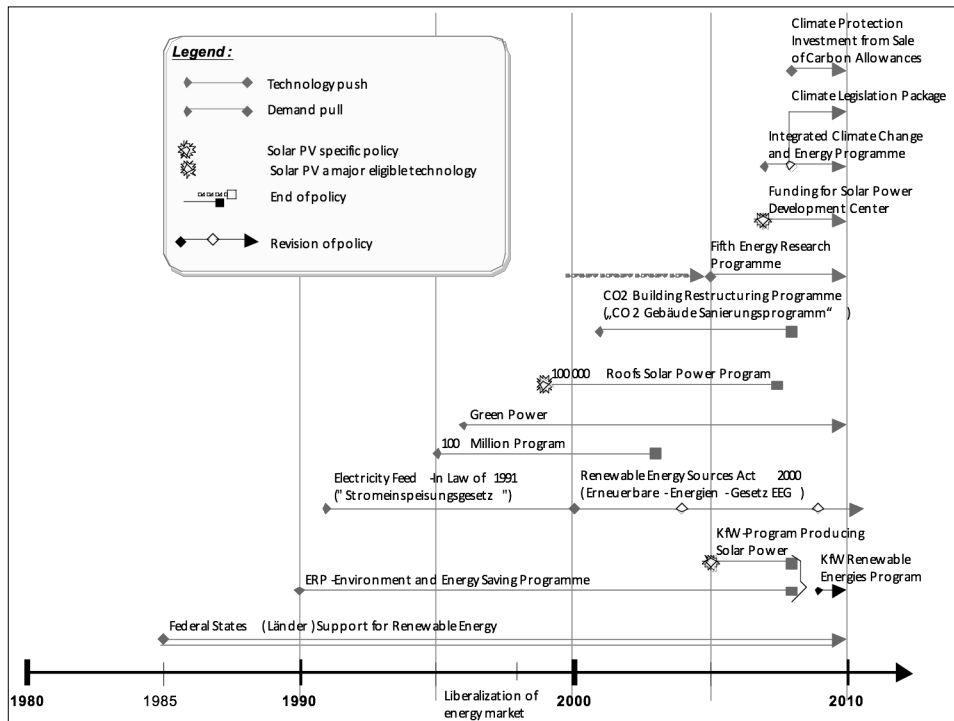
- Renewable energy: Solar
- Regions
 - **US**: Created, pioneered technology; Leading world market, 1950s-1999
 - **Germany**: policy innovator, adoption leader
 - **China**: manufacturing leader since 2009

Method

Triangulation of multiple data sources:

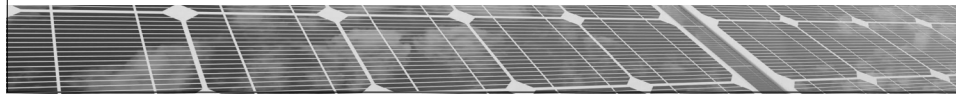
- International Energy Agency (IEA) data
 - #policies: US: 57; DE: 27; China: 13
- Secondary sources
- Interviews

Preliminary Findings



Comparative Analysis (prelimin.)

Code	Policy	US	Germany	China
T1a	Publicly funded private R&D	?	+	+
T1b	Private investment in R&D	n.m.	n.m.	n.m.
T1c	No public funding of marginal improvement		+	
T1d	Public R&D	++	+	+
T2	Broad knowledge dissemination	+	?	?
T3	Prize competition	?		
T4	Demonstration projects	+	+	+
D1	Regulatory performance targets	++	+	++
D2	<i>Targeted financial incentives</i>			
	Subsidized loans	+	+	++
	Purchase rebates and tax incentives	++	+	+
	Feed-in Tariff		++	
D3	Pricing externalities			
D4	Government procurement	+		
C1	Long-term support	+	++	+
C2a	Decentralized authority	+	+	+
C2b	Centralized leadership	+	+	+
C3	Technological diversity	+	+	+
C4	Global cooperation	(+)	(+)	(+)



Principles Empirically Underrepresented

- ✳
- ✳ Prizes (T3)
- ✳ Government procurement (D4)
- ✳ Pricing externalities (D3)
- ✳ Global cooperation (C4)

Role of Commercialization?

Missing from the MNM framework:

- Where is role of generic commercialization assets (Teece 1986)
- Today's challenges are not just product R&D but also manufacturing scale
- We found evidence of non-technology supply push policies

Extending Push/Pull Debate

- * Non-technological "push" policies
 - * complementary/generic commercialization assets
- * Analytical but not empirically distinct
 - * separate actions part of overall strategy
 - * single regulatory act addressing both

Limitations

- Clear gaps in the IEA data
- Normal coding ambiguities
- Missing information
 - private R&D funding
 - relative importance
- So far: focus on solar policies

Thank You!

