Discussion

"Green Innovation by US Public Firms: Trends, Determinants, and Economic Impacts"

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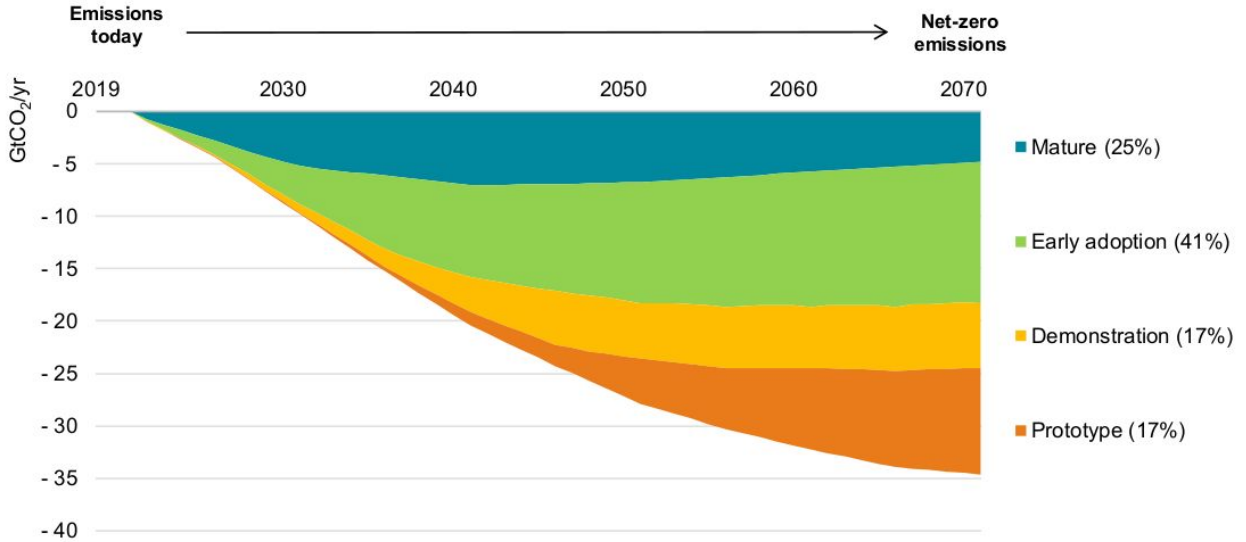
Innovation is important - We still need innovation

The key technologies the energy sector needs to reach net-zero emissions are known today, but not all of them are ready.

Only 25 % of emission reduction rely on mature technologies such as wind and solar electricity.

Source: IEA - Special Report on Clean Energy Innovation (2020)

Figure 3.1 Global energy sector CO_2 emissions reductions by current technology readiness category in the Sustainable Development Scenario relative to the Stated Policies Scenario



Notes: Percentages refer to cumulative emissions reductions by 2070 between the Sustainable Development Scenario and the Stated Policies Scenario enabled by technologies at a given level of maturity.

Innovation is not exogenous!

Empirical evidence from price or policy shocks:

- Popp (2002): higher energy prices associated with a significant increase in energy-saving innovations
- Aghion et al. (2016): significant impact of carbon taxes on the direction of innovation in the automobile industry.
- Calel and Dechezleprêtre (2016): effect of the EU ETS
- Dugoua (2023): Montreal Protocol and innovations on CFC substitutes

This paper focuses specifically on the US, one of the lead patenting countries.

This Paper

Question: **Have state-level renewable policies induced green innovation?**

Approach:

- LHS: Green patent count of firm f in year t+h (in state s, sector i)
- Key RHS: Annual change in the nbr of renewable policies in state s in year t
- FEs: firm, industry-year
- Controls: Patent count at time t, t-1, t-2; N employees, capital stock, unemployment rate; + lags of the policy variable

Main Comment 1

Should we expect state policies to impact state-level innovation?

What drives firms' green patenting? Expected (future) demand: could be in demand in their own state, but also in other states, and globally.

> Popp, D. 2020. "Promoting Clean Energy Innovation at the State and Local Level." Agricultural and Resource Economics Review.
>
> "While state-level policies can promote clean energy innovation, it is overall market size that matters most. Thus, innovation need not occur in those states most actively promoting clean energy"

California vs Maine

Results robust to excluding California?

Main Comment 1bis

Implication: SUTVA violation?

→ Demand shock in state s can/will impact firms in other states.

This will complicate the causal interpretation

Also, how do we think of subsidiaries/branches here in this context as well?

More descriptives on the spatial distribution of firms and green patenting

Main Comment 2

The policy changes are not quasi-random here and so we need to think about potential confounders.

Alternative story: a green tech cluster developing in a state at the same time as environmental policies are ramped up.

Lags won't solve the problem here. It may still be that some states get more environmental policies at the same time as they get more industrial policies or energy R&D support.

Can you exploit maybe some more quasi-random changes? E.g., state elections, California effect?

Minor Comment 1

5-year delay is in fact a really long delay given prior evidence from the literature and a survey:

Nagaoka, Sadao, and John P. Walsh. 2009. The R&D Process in the US and Japan: Major Findings from the RIETI-Georgia Tech Inventor Survey. RIETI Discussion Paper Series 09-E-010. Research Institute of Economy, Trade and Industry.

→ the average amount of time spent on research leading up to a patent application is less than two years, and that **between 80% and 90% of patents involve three or fewer years of research leading up to an application**.

Side question: year when the firm applies or the year when the patent is granted?

Other Minor Comments

- How do you input zeros? How do you deal with entry/exit of firms in the patenting data?
- The results on “Pure Green” not being significant: the point estimate though remains fairly similar, it’s just much more noisy.
- Transparent list of the CPC code used somewhere in the appendix…