Induced Innovation, Inventors, and the Energy Transition

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Motivation

- Clean energy innovation is critical to reducing the costs of climate mitigation
- Firms respond to incentives (e.g., high energy prices, environmental policies)

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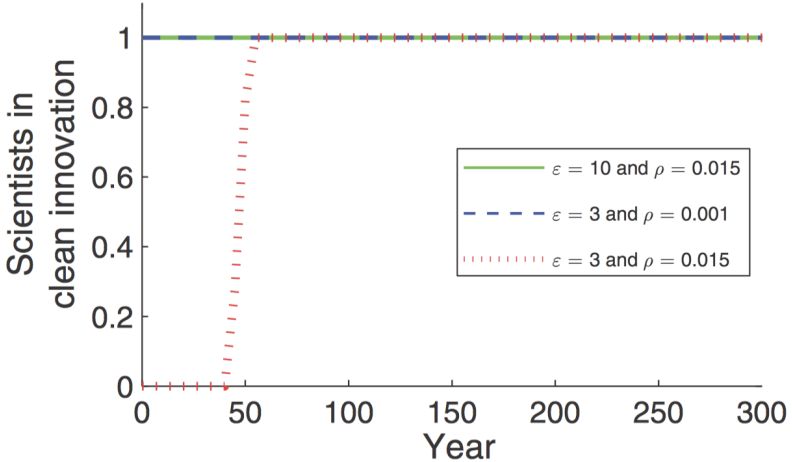
- Firms respond to incentives (e.g., high energy prices, environmental policies)
- Carbon pricing and R&D subsidies can generate a switch from dirty to clean. For example, Acemoglu et al. (2012):



Human Capital

Human Capital

To what extent can inventors be induced to work on different fields?
What is the role of new entrants vs incumbents?

This Paper

- We document the types of inventors behind clean innovation and the extent to which they respond to economic incentives
- Measure innovation using global data on patent applications (PATSTAT)
  - Electricity generation-related patents (classified based on patent technological codes)
  - Inventors with at least one OECD patent post 1990
- Document stylized facts about energy inventors
- Estimate how individual inventors respond to changes in natural gas prices

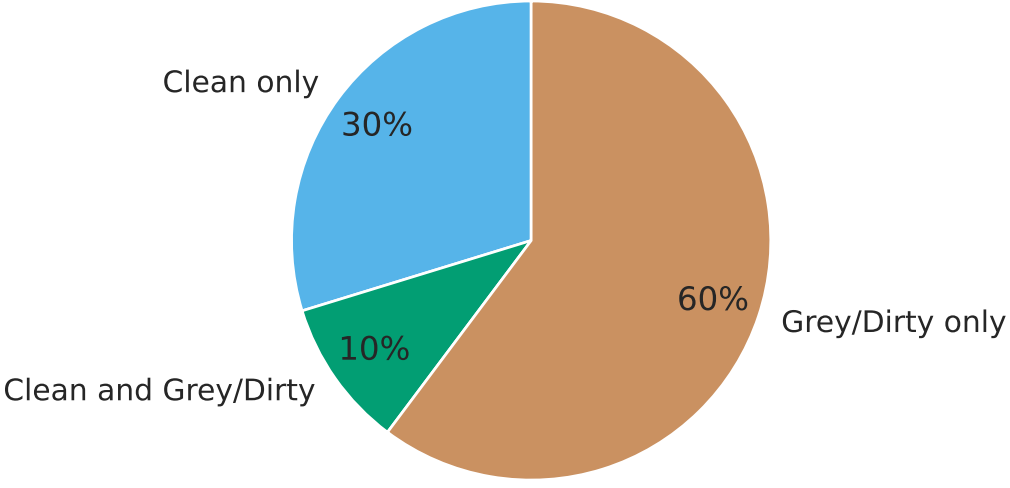
  Both intensive and extensive margin responses

  Natural gas prices $\uparrow \Rightarrow$ expected demand for substitutes in the future $\uparrow$

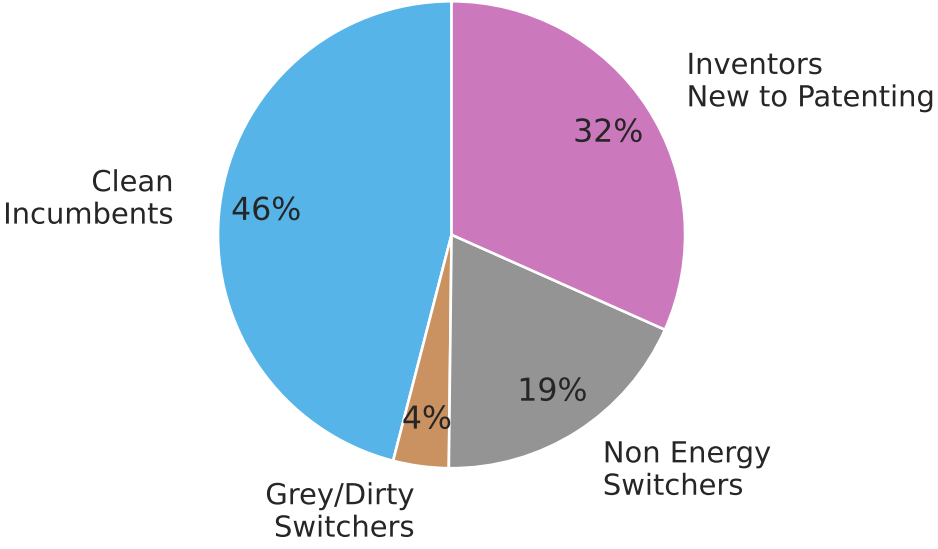
  Simulate how inventors would respond to carbon pricing

    Using a SCC of 51 \$/tCO2

Fact 1: Energy Inventors Specialize in Clean or in Dirty
$\Rightarrow$ Clean Patents Come Primarily from Inventors Who Specialize in Clean



Fact 2: About Half of Clean Patents Come from "New Entrants"



Decomposing the Induced Innovation Effect by Inventor Type

Source	Induced Innovation Effect	Total Number of Clean Families
Intensive margin response		
Incumbent inventors	**81%**	46%
Extensive margin response		
Entry to patenting	**14%**	32%
Entry from grey/dirty	**4%**	4%
Entry from non-energy	**1%**	19%

- Entrants are less responsive on the margin compared to their contribution to overall patenting.
- Over-reliance on incumbents. Sub-optimal if time is of the essence.
- Motivate future work to study the formation of human capital in clean energy.

Thank you!

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