
INNOVATING FOR CLIMATE

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LCS-R, Paris

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Clean energy revolution



Big questions

- Can innovation solve the climate problem?
 - Can we solve the climate problem without innovating?
 - How can we promote innovation and make it work?
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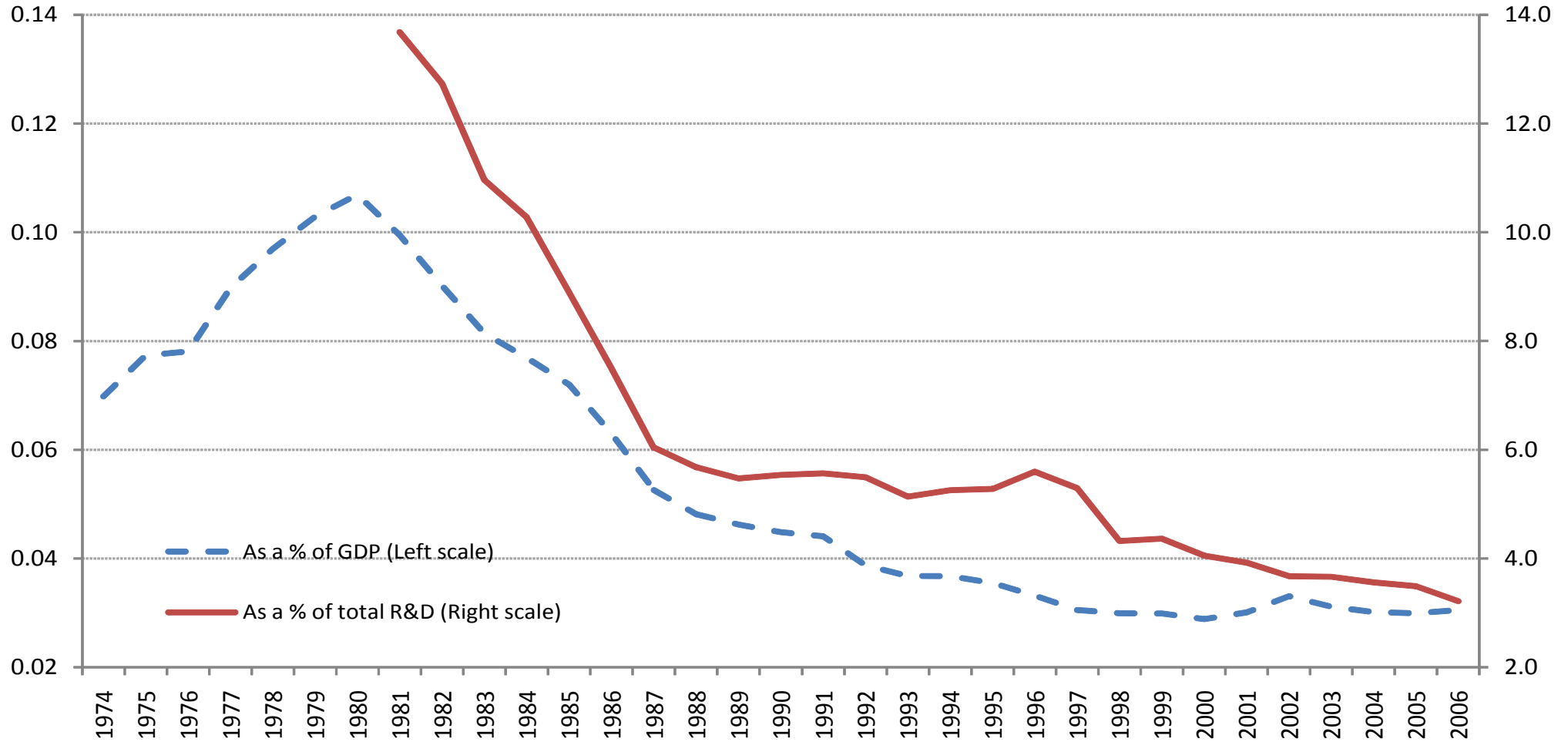
Clean energy innovation: a HOT topic

- Not much else is being done..
- Oil prices and energy security
- Innovation market failures and environmental externalities call for joint policy intervention in both areas
- Feeling that international cooperation might be bought easier on R&D and technology than on mitigation
- Innovation as an engine of growth and competitiveness

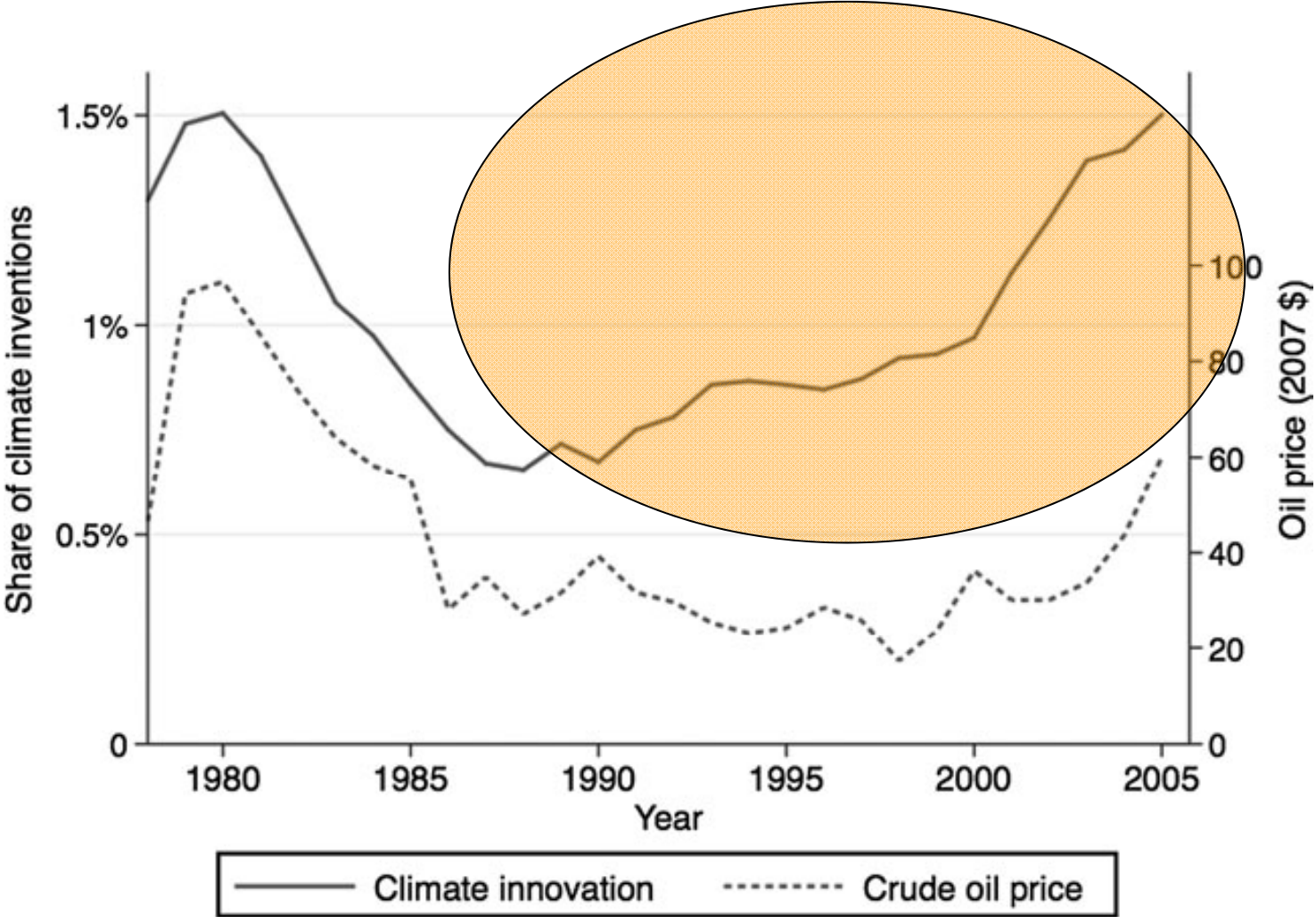
Public energy R&D expenditures in OECD countries

Energy R&D

(Percentages)

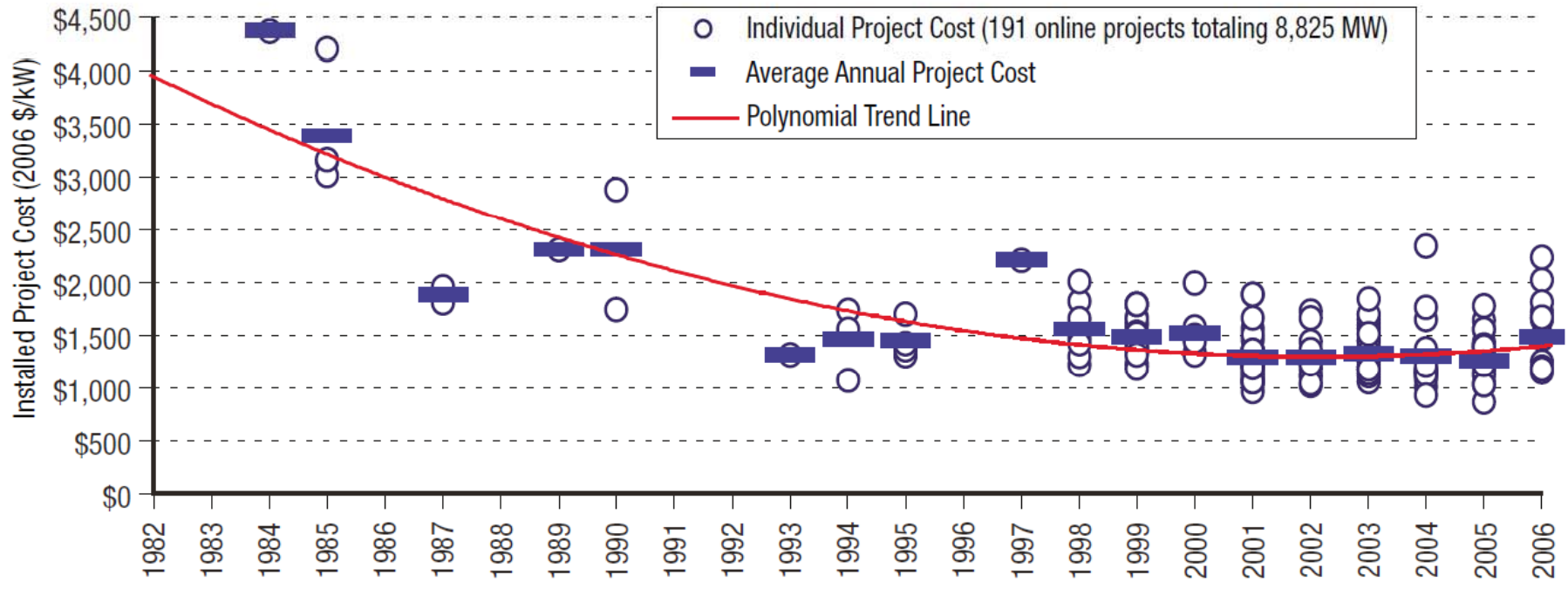


Climate innovation via patents



Dechezlepretre et. al, 2011

Wind plants costs in the US



NREL, 2007

Rationale for public support to innovation

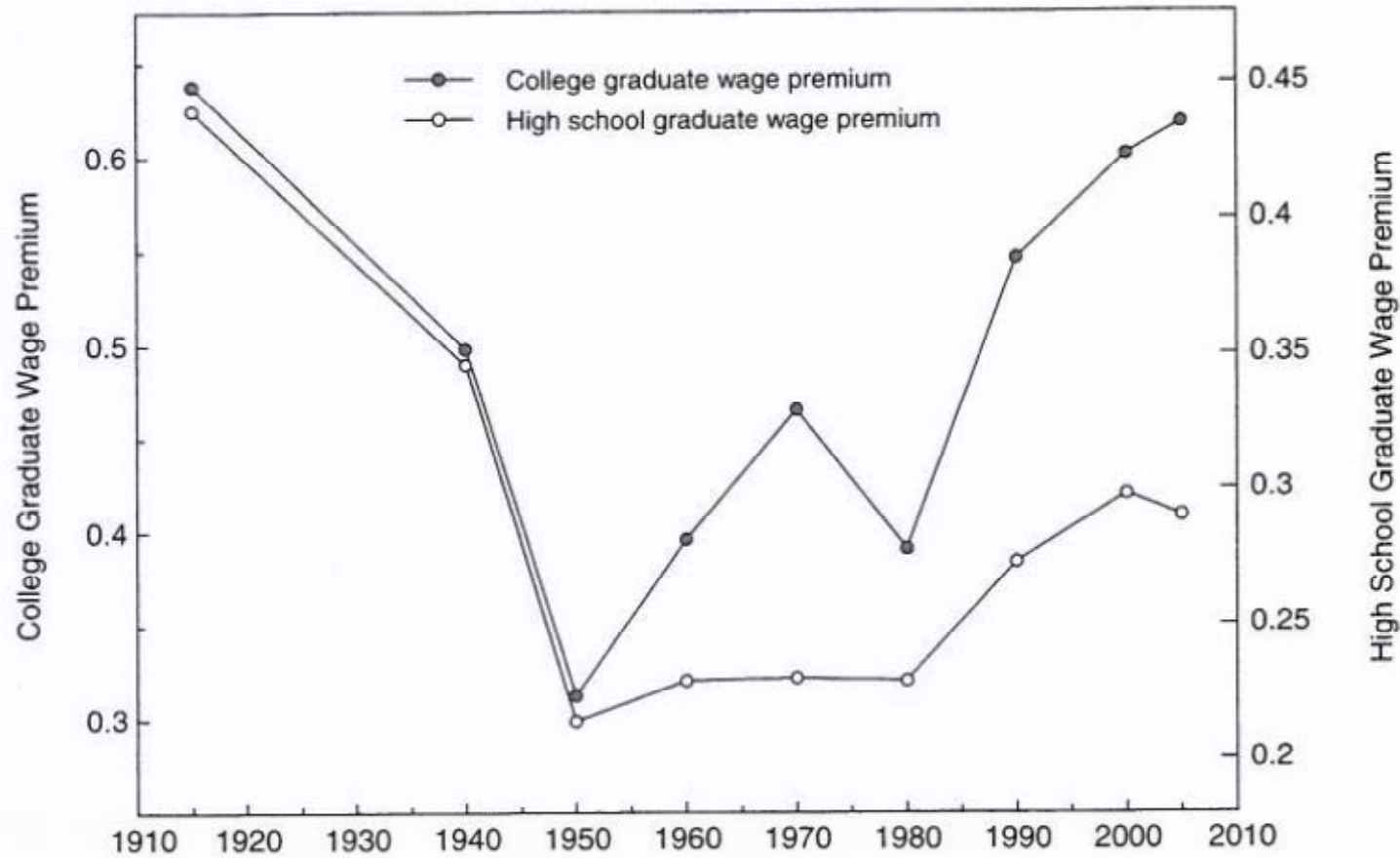


- Difficult to appropriate full benefits
- Social and international spillovers
- Problem increases along the innovation chain (Newell, 2008)

Markets are nonetheless important because:

- firms have substantial R&D capacity
- reward inventive activity
- failures of large scale government R&D programmes (Coehn and Noll)

The role of Education



Education premiums (Goldin and Katz, 2009)

Policy instrument choice and innovation

The
Economist

Regulation provides less incentives for firms to exceed the standard imposed by the legislation.

Demand driven, profit based incentive to invest in innovation

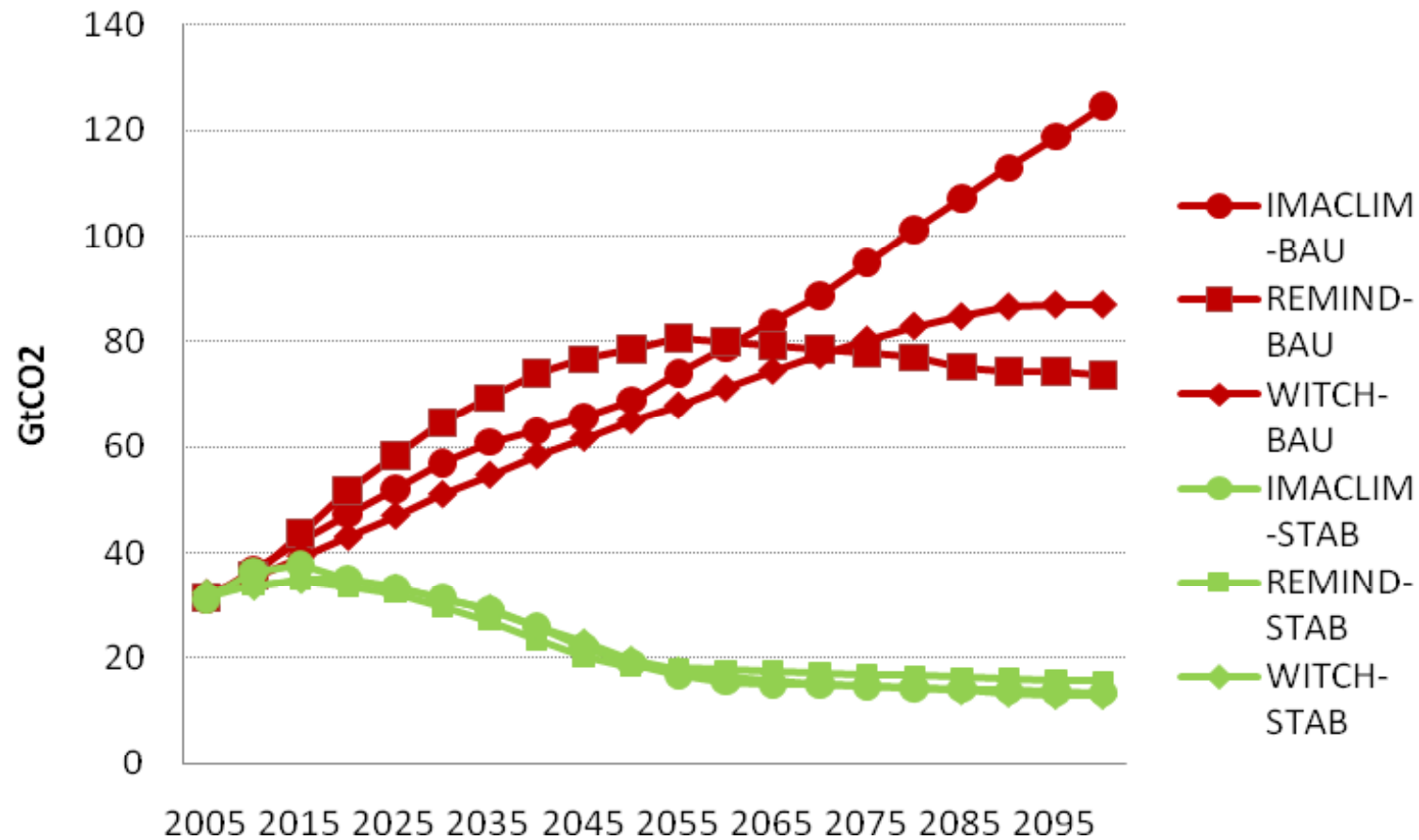
Q: what about countries that don't have institutional requirements for the efficient functioning of markets?



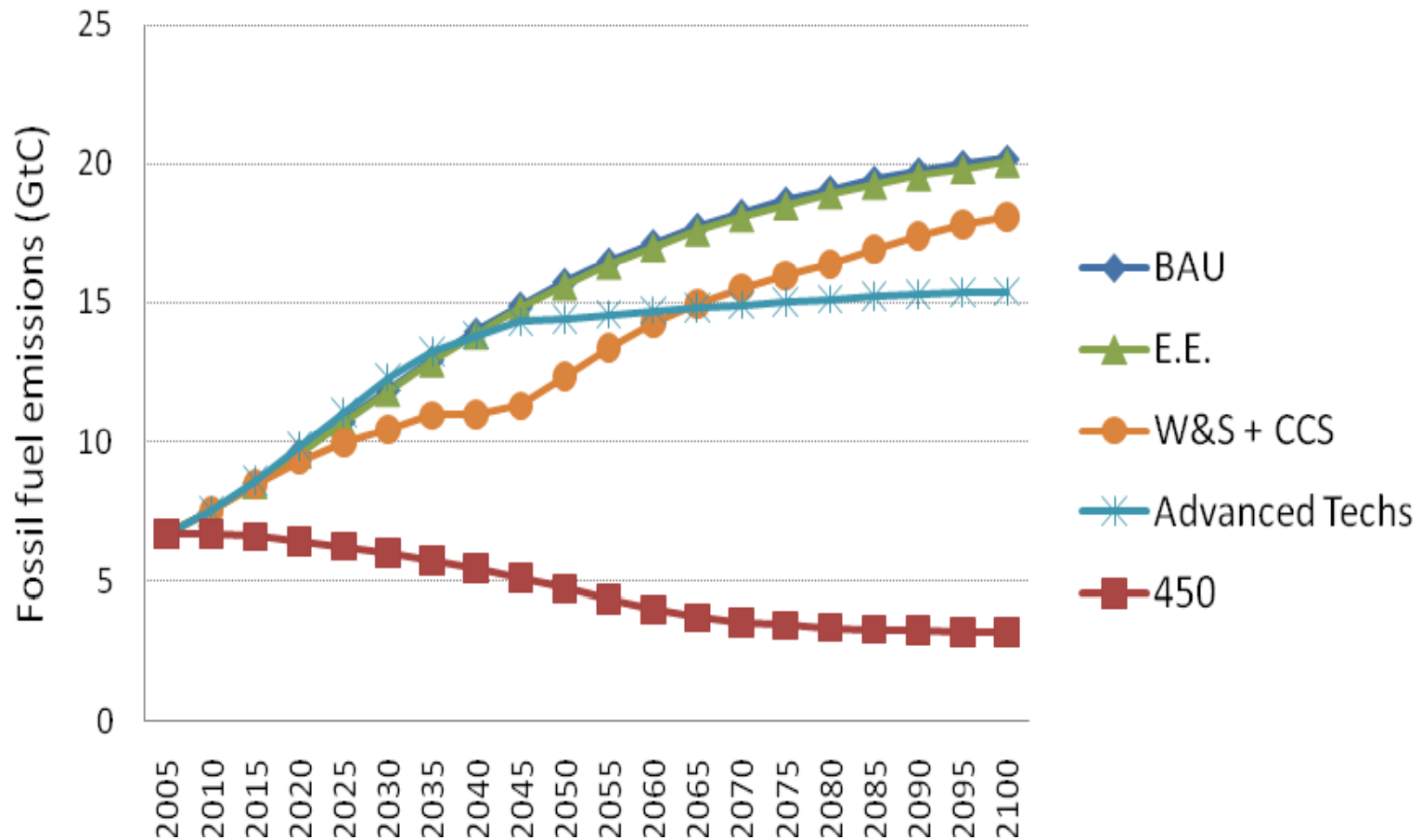
Regulation provide more certainty

Q: risk of choosing winners and losers, especially if institutions are weak to special interests

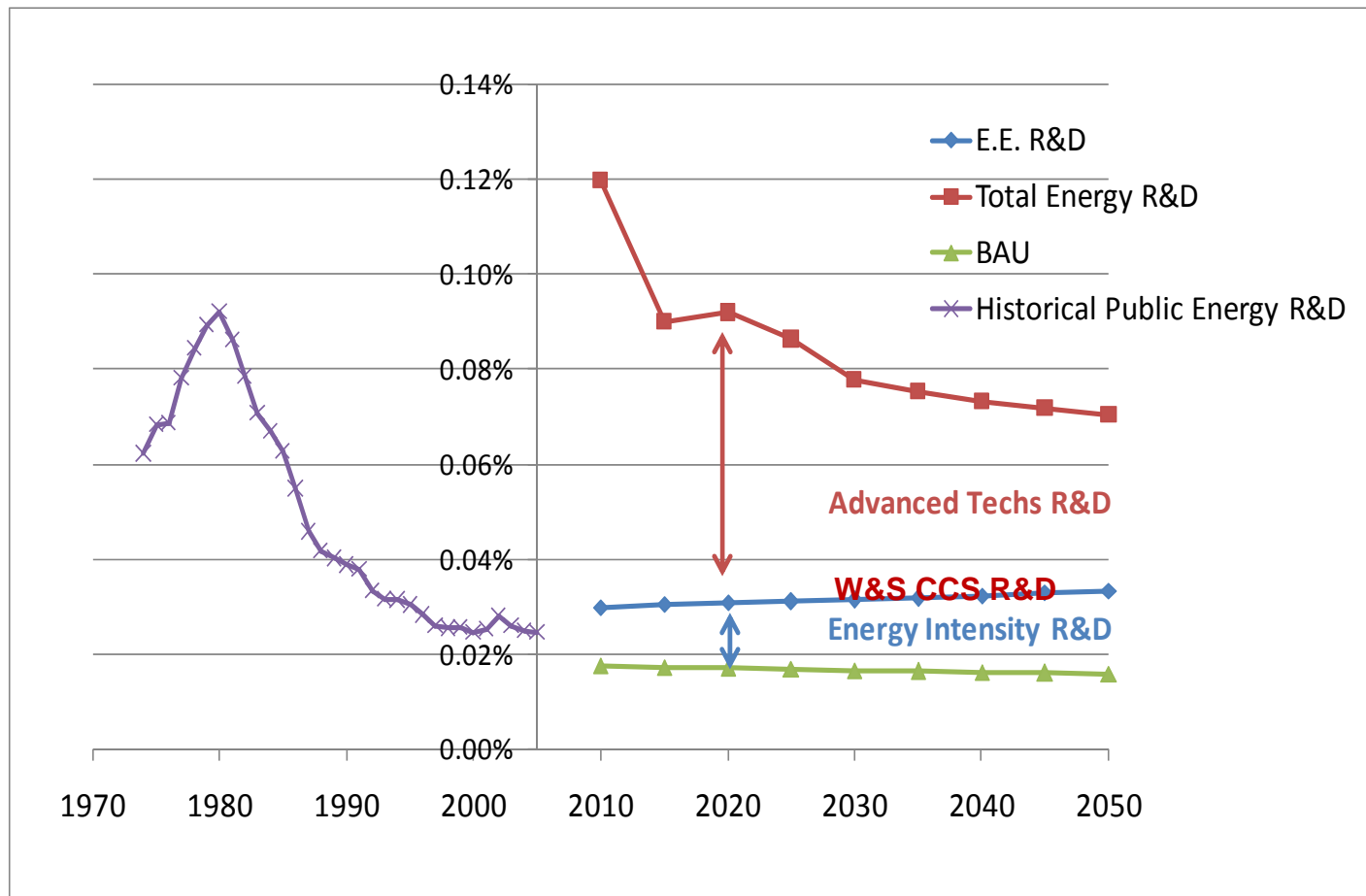
The climate stabilization challenge



Emissions under a variety of clean energy R&D funds

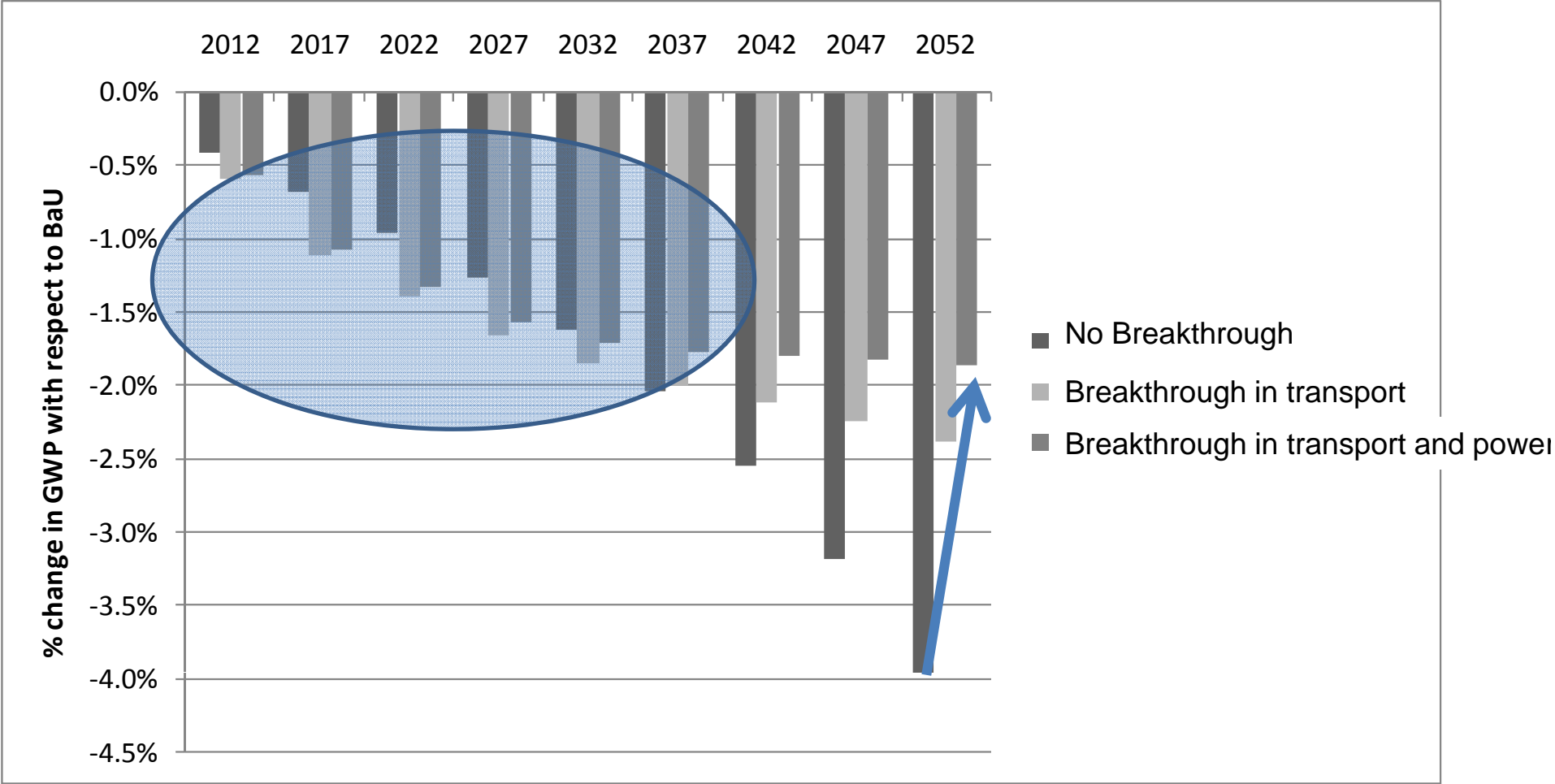


Past and Future Clean Energy R&D investments

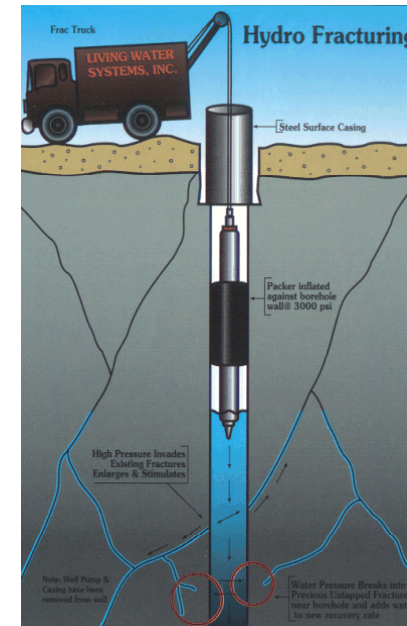
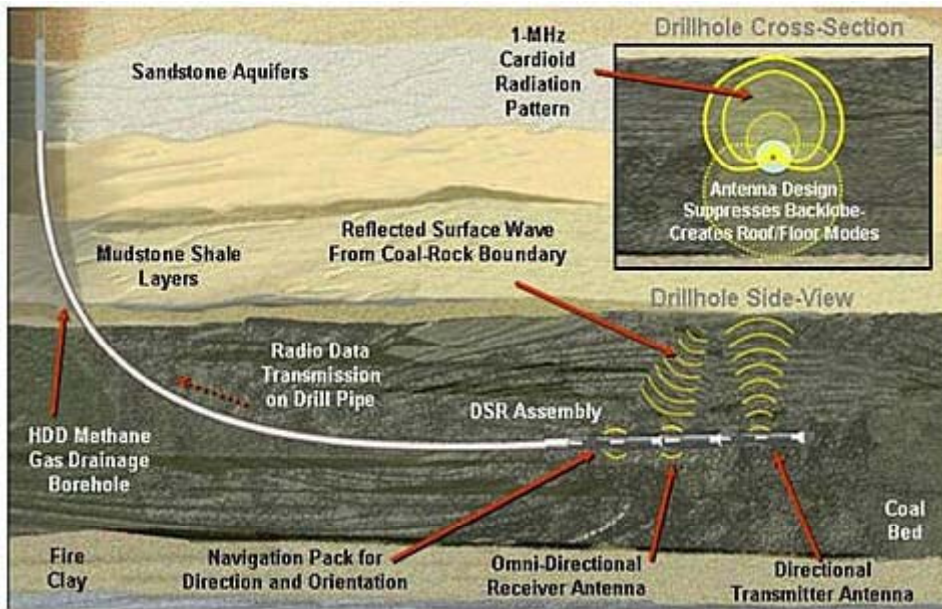


Carbon pricing would induce a 4 fold expansion of energy R&D expenditures.

Technological breakthrough fundamental for cost containment



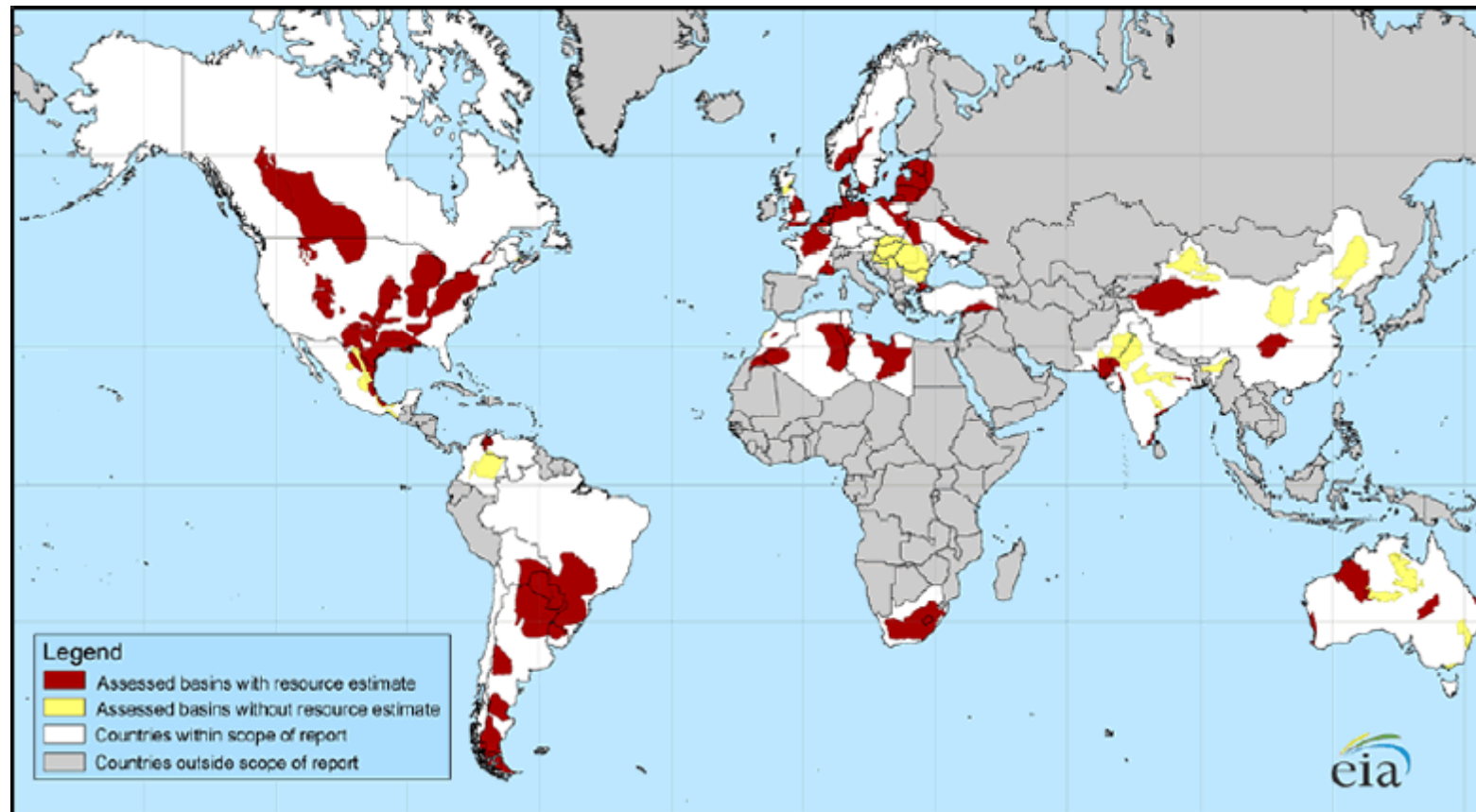
Technical change to where?



Directional drilling:
commercial viability
during the 1980's

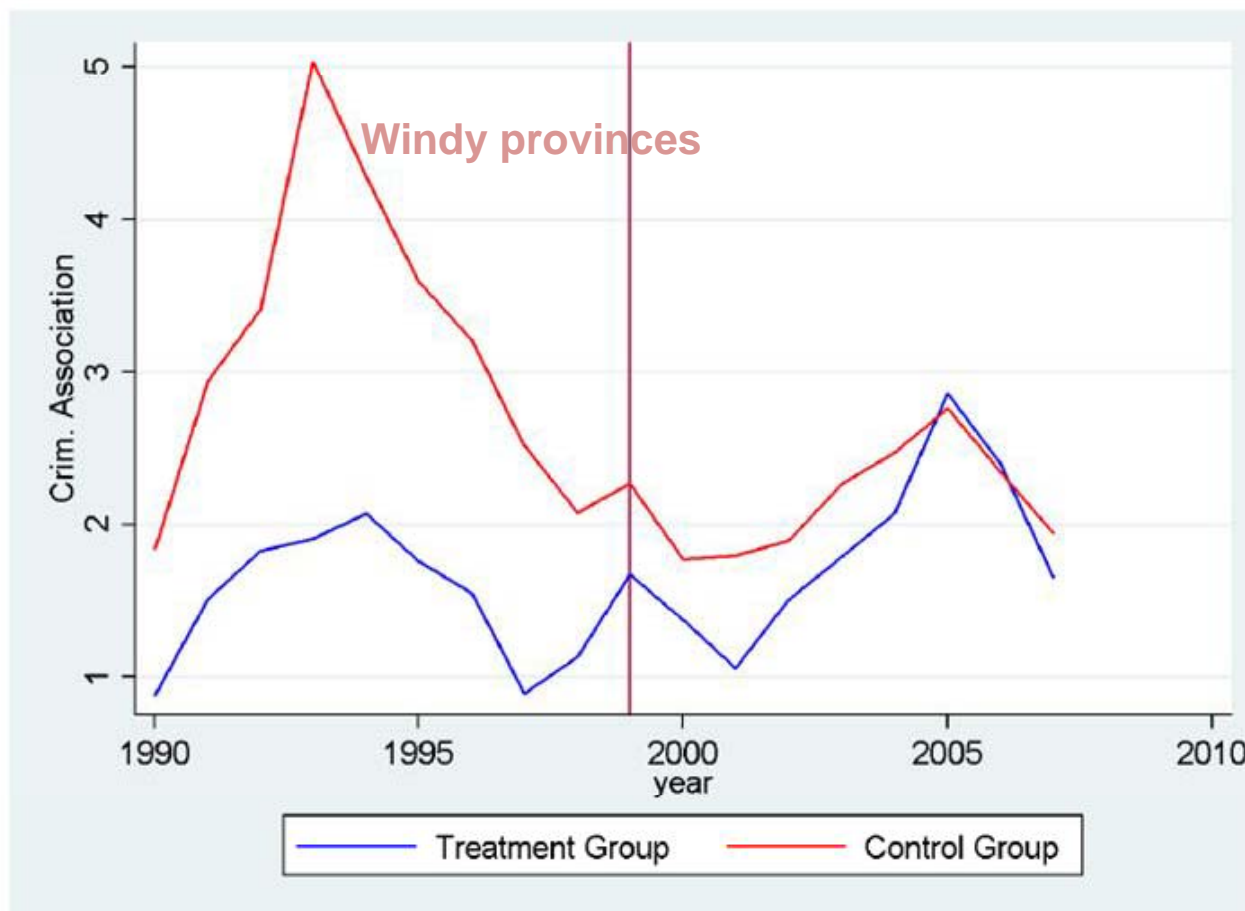
Hydraulic fracturing:
first used commercially
in 1947

Shale gas prospective basins (EIA)



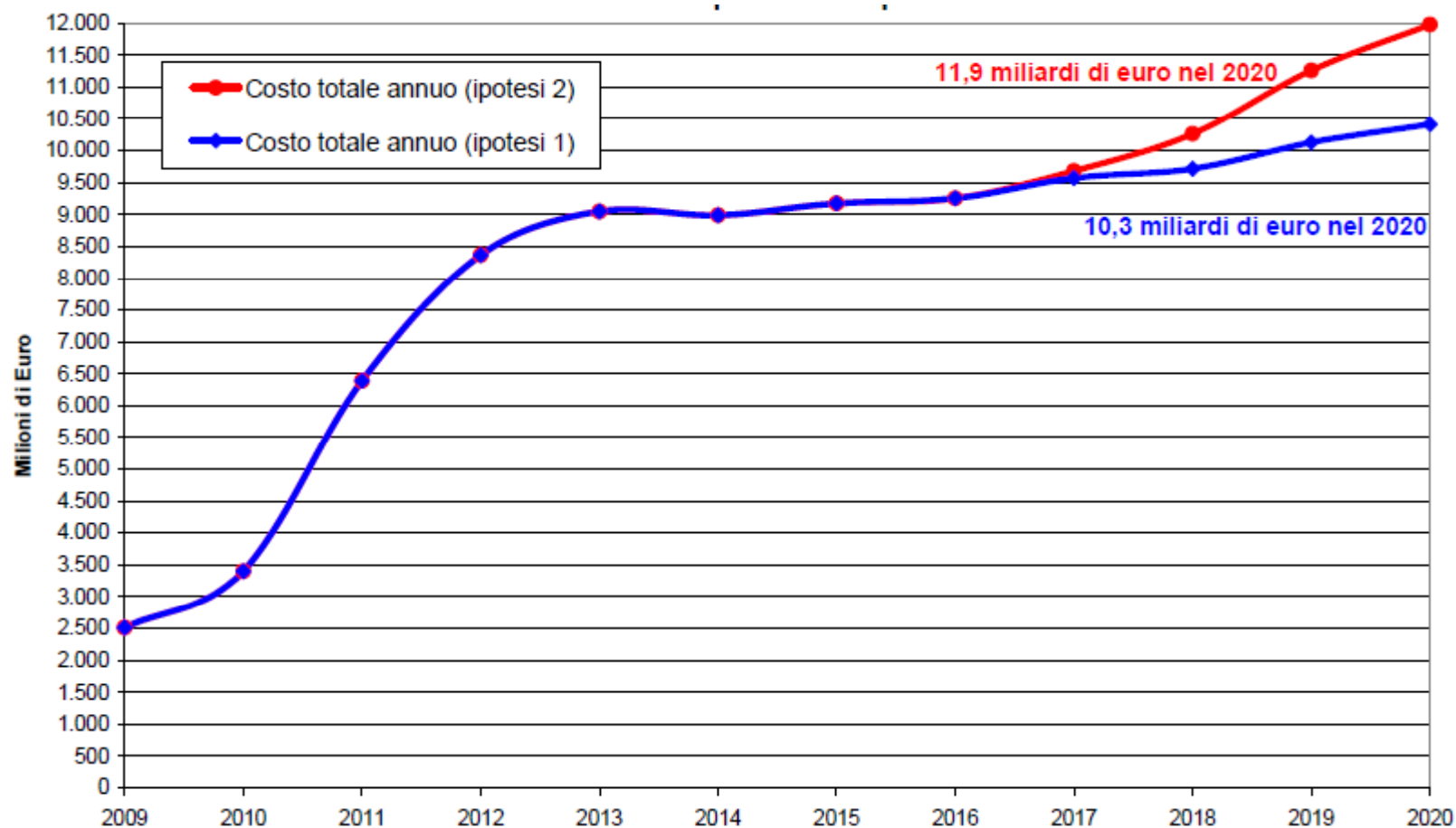
Rent seeking with weak institutions

Criminal Association Activity (number of offences over 100,000 inhabitants)¹



Gennaioli and Tavoni, 2011

Sustainability of incentives



Projection of incentives to renewable energy in Italy
AEEG, 2011

Concluding comments (the goods)

1. **Innovation policies *alone* are unlikely to effectively control climate change.**
2. **Innovation is instrumental** in achieving a **low carbon scenario**. A four-fold like increase of clean energy R&D expenditures needed for climate stabilization (only 40-50 Billions), and has **hedging value**.
3. **Carbon pricing** would set incentives and generate resources that induce clean innovation (especially useful at times of stretched public budgets). Complementary innovation policies can be beneficial.
4. There are **co-linkages** (air pollution, energy security), but trade-offs can also result (shale gas?)

Concluding comments (the bads)

1. Achieving a **low carbon world** is a tremendous **challenge**, and we should not fool ourselves that innovation will do the trick
2. **Innovation and diffusion is slow.** Carbon intensive, long lasting capital is built meanwhile.
3. Innovation is needed in many sectors of the economy, not just energy. Account for **crowd out** and **human capital**.
4. Albeit at a moderate cost, **not free a lunch**.
5. **Sustainability** of incentives to clean energy techs