Motu

Promoting Innovation in the Private Sector

Adam B. Jaffe

Director, Motu Economic and Public Policy Research

Economic and Social Systems Research Theme Leader, Te Punaha Matitini

Adjunct Professor, Queensland University of Technology

Harvard/Tsinghua Workshop: Energy Technology Innovation Policy in the Backdrop of the US/China Emissions Deal

18 June 2015

Innovation in Kiwi-land

Motu

Overview

- The Challenge
- Invention, innovation and diffusion
- Policy levers
- Concluding thoughts

The Challenge

- There's controversy around the exact timetable, but general agreement that over approximately the next 4 decades, GHG emissions have to be drastically reduced
- We hope that world GDP will continue to grow over this period, so the GHG/GDP ratio needs to fall by even more than the needed absolute reduction in GHG emissions
- Back of the envelope: something like a 75-90% reduction in global GHG/GDP is needed by 2050

How hard will this be?

- From 1970-2010, the global petroleum/GDP ratio fell by about 40%.
- Over this time period, we saw an approximately 6-fold increase in the price of petroleum (prior to the most recent decline)
- Since petroleum is a subset of fossil fuels, it is inherently much more difficult to reduce overall fossil fuel use than to reduce petroleum use

We need a transformation in the energy/economy system that is qualitatively broader and deeper than anything that we've ever seen in this sector.

Motu

Is there any historical analogue?

- The global IT/communication system has seen a transformation in performance over the last 4 decades that is qualitatively comparable to what we need in energy.
- Most of the key features of today's IT/communications system (the internet; smart mobile phones; gigabytes of memory on a keychain, etc.) were not even visualized as potential future products or markets as of 1970.
- We need a qualitatively comparable transformation of the energy/economy system.

Implications

- If we succeed, it is very likely that major components of the 2050 system will be technologies that we have not yet even conceived, let alone begun to develop
- The companies that will play large roles in the 2050 system probably do not exist today, and many of today's giants are likely to disappear, shrink, or be radically transformed.
- Major new technologies are likely to emerge and then fall by the wayside (think minicomputer, fax machine, CD ROM)
- Major contributions will be needed from both the public and private sectors

Motu

What drives private sector R&D

- No one really knows.
- On some level, perceived commercial opportunity has to be part of it.
- Demand for more powerful computation and communication is intrinsic; demand for GHG reduction has to be created by policy.
- Demand must be perceived as long-term and sustained
- Scientific/technological opportunity is also necessary
- “Demand pull” and “technology push” are both needed

Motu

Invention, Innovation and Diffusion

- The “linear model” is dead.
- Spillovers and information asymmetries, long understood to characterize invention and innovation, are just as relevant for diffusion
- Learning-by-doing and other forms of user-driven innovation make diffusion/deployment as much of a policy concern as invention/innovation
- Incentive for fossil-based technological change will remain large for a long time.

Policy levers: “price” on emissions

- Long-term commitment to significant and rising “price” on GHG
- Could be carbon tax, cap and trade or other mechanisms, but private sector must perceive that there will be eager customers
- Could start low, but somehow people have to believe that demand will be there in 10, 20 and 30 years.

Motu

Policy levers: fundamental research

- Significantly increased fundamental science funding
  - Large private science efforts such as Bell Labs, IBM, Xerox were major drivers of early digital technology
  - These are mostly gone and do not seem likely to come back
- Capability building must be addressed along with research funding per se (think of NIH training grants)
- Entire energy science/technology system must be scaled up
- Again, need long-term commitment—ideally 5% real increase for decades, not a crash programme that creates large adjustment costs and then goes away

Policy levers: government procurement

- The analytical and empirical argument for public funding of research is widely accepted,; the argument for public support of the development and deployment phases is more controversial.
- But there is both conceptual and empirical support at these stages
  - The technology adoption process is characterized by positive externalities through demonstration effects
  - The IT/communications revolution has been prodded by government acquisition at virtually every stage

Motu

Government procurement

- Large-scale specific goals, such as the atomic bomb (Manhattan project) or landing on the moon (Apollo project).
  - Scientific/technological advances emerge as by-product of the need to solve the particular challenges of the project.
    - Not clear if this is a cost-effective way of improving technology
    - May be valuable as political/popular focusing mechanism
- Design competitions for ongoing purchases (think military aircraft)
- Mandates on quasi-public or regulated entities, such as renewable energy portfolio rules

Policy Levers: Intellectual Property Rules

- IP protection theoretically supports investment in innovation by providing protection for development expenditures.
- Empirical evidence in support of their efficacy is limited.
- “Strong” IP protection also inhibits the diffusion of new technologies. This is problematic for two reasons:
  - GHG-reducing benefit is less than it could be
  - Feedback from deployment to innovation is also inhibited, so new technologies may not improve as fast as they might.
- LDCs are not fooled by the claim that enforcing strong IP is in their own economic interest.

Motu

Systematic Evaluation

- It's embarrassing how little we know about the effectiveness of different policy instruments
- Agencies are allowed to get away with success stories rather than true evaluation
- Need to measure the "treatment effect" of a policy intervention just as we do for drugs
  - Randomized control trials
  - Natural experiments
- Over the next decade, we could learn a lot about what works best, which could then be implemented as we continue to ramp up

Motu

Conclusion: Innovation policy in the context of climate agreements

- “Carbon” policy and “innovation” policy are not substitutes—they are complements and we need both
- Investment in GHG-reducing technology is a double public good—particularly hard to recognize/credit in an international agreement
- Time scale is decades, which allows time to build capabilities efficiently, but also requires credible long-term commitments
- Should be embarking on systematic programme evaluation
- Look for opportunities for global “win-win”: e.g. pair strong global IP enforcement with significant financial assistance for poor countries to implement new GHG-reducing technologies