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Boosting solar investment with limited subsidies: Rent management and policy learning in India

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HIGHLIGHTS

- India's National Solar Mission effectively triggered solar investments.
- Reverse bidding substantially decreased policy costs.
- Sequenced implementation allowed for policy learning.
- India's solar policy is a good example of green rent management.

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ABSTRACT

In order to avoid irreversible damage to global ecosystems, new 'green' technologies are needed, some of which are nowhere near commercial maturity. In these cases, governments may create temporary rents to make investments 'artificially' attractive, but the creation of such rents involves risks of faulty allocation and political capture. This article first highlights the importance of managing rents effectively in promoting 'green' technologies; it then shows how India's National Solar Mission has been remarkably effective in triggering solar investments and managing the necessary subsidies, e.g. through a process of competitive reverse bidding for tariffs. Policy design and implementation also reflect considerable experimentation and learning. Some risks remain, especially regarding the enforceability of renewable energy quotas at the level of Indian states.

1. Introduction

Sir Nicholas Stern has called climate change "a result of the greatest market failure that the world has seen",[1] because it has potentially huge global effects for the whole world's inhabitants. In order to keep global warming within tolerable limits, new mitigation technologies must be developed. The areas in which it is necessary to accelerate major technological breakthroughs are well known: renewable energy, energy storage, carbon capture and storage, mobility, resource-saving materials, and eco-efficient agriculture—to name just a few. In most cases, it could take years, or even decades, until carbon-efficient technologies become competitive in the market place. To accelerate their development, reliable long-term policy frameworks are required with attractive subsidies and/or guarantees that reduce the risk and bridge early development and commercial success. *Policy rents* need to be created, that is, investors need to be able to earn above-average returns in the new green industries for as long as needed to make these industries competitive.

Creating rents for supporting specific industries can, however, have two undesirable effects (Chang, 1996): Policymakers act on incomplete information that can lead them to support technologies which never become commercially viable; and the possibility of earning above-average returns in regulated markets creates a strong incentive for rent-seeking, that is, lobbyists will try to influence regulations in order to increase their rents or stretch them over longer periods of time than are necessary for developing the new industries ('political capture'). Thus the challenge for policymakers is to *manage rents* so that they reach the targets with a minimum of political capture and waste of taxpayer and consumer money.

Rent management is especially demanding when pressing environmental problems require that established technological trajectories be disrupted and fundamentally new technologies developed. In such cases, policymakers must often design support schemes without knowing which among a range of promising technological options will become the commercially successful

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[1] http://www.guardian.co.uk/environment/2007/nov/29/climatechange.carbonemissions.

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'dominant design' (Anderson and Tushman, 1990); also, they will not have full information on the specific capital requirements or how long it will take until economies of scale reduce unit production costs to cost parity with incumbent technologies. This makes it very difficult to determine the necessary amount and duration of subsidies or protection. Industry lobbies are likely to take advantage of these uncertainties, overstating the need for subsidies and protection. Governments must take the trial-and-error approach to testing various policy options and continuously adjust their support in view of the market's changing realities.

This article explores how the Government of India allocates rents in its attempt to promote solar energy generation, how it tries to minimise political capture and how it tests and fine-tunes its policies. Energy from the sun is a socially desirable source of energy that deserves and requires long-term policy support: it is practically emissions-free, is more abundant than other renewable energies in many countries. At the same time, solar energy remains considerably more expensive than energy from other sources and therefore requires steadfast support until it achieves grid parity. The Government of India has recently adopted a 'National Solar Mission' that includes a range of new incentives, and some Indian state governments are also experimenting with support measures. India thus provides a unique 'laboratory' for learning about solar policy.

This article has four sections. Section 1 explains why governments need to create rents in order to channel resources into environmentally more sustainable new technologies. It also addresses the risks of government failure and political capture. Section 2 explores the rationale for using solar energy in India and provides an overview of the country's solar energy policies. Section 3 analyses two key aspects of these policies from the perspective of rent management: (a) how governments determine the right level of preferential tariffs for solar energy, and (b) how state-level renewable energy targets are politically negotiated and linked to a certificate trading scheme. Both aspects have far-reaching implications for the creation and transfer of rents. Section 4 concludes.

2. The promotion of green technologies and the creation of rents

2.1. The enhanced role of public policy in promoting 'green' technologies

New resource-saving technologies are needed in order to avoid irreversible damage to global ecosystems. The development of these 'green' technologies must be policy-driven—much more than in other fields of technology development, where market-driven search processes prevail (World Bank, 2012, 65 ff.). This is because the current rate of global-ecosystems degradation threatens to reach environmental tipping points that will create ecosystem disequilibria with unparalleled negative consequences for mankind (Stern, 2007). Developing and deploying technologies for the sustainable use of resources must be achieved quickly, especially with regard to climate change mitigation. If global greenhouse gas emissions continue to increase for another decade, many consequences may become irreversible, while the cost of abatement will grow exponentially (McKinsey, 2009).

Innovation processes should be as market-driven as possible in order to ensure that demand is met effectively. Incentives should preferably aim at general policy targets, such as energy saving or emissions reduction, without prescribing specific technological solutions. Governments can achieve a lot by enhancing market transparency, educating the general public, training technicians, setting standards and certifying market players, or taxing the use of scarce resources. With regards to innovations for sustainable development, however, market-based allocation alone is not likely to suffice:

1. Many environmental innovations require more than a decade or two to develop a new technology, run pilot tests and establish full-scale commercial operations (Kramer and Haigh, 2009, p. 568). Given the risk of environmental tipping points, unsustainable technologies need to be replaced quickly.
2. Cumulative market failures are holding back investments in innovations for environmental sustainability (Stern, 2007), as their social value for current and future generations is not reflected in their cost. Moreover, investing in new technologies that are far from the commercial frontier requires early investors to risk the full costs of failure, while in successful cases, much of the potential gain is likely to be reaped by other market actors. Finally, information and coordination failures are particularly severe when systemic changes are needed—such as changing from high- to low-carbon energy or transport systems (Altenburg and Pegels, 2012, p. 12).
3. Lock-in effects such as path-dependent consumer behaviour and incentives to continue exploiting aged, depreciated industrial infrastructure hinder efforts to replace outdated technologies (Unruh, 2000).
4. Investments in renewable-energy technologies such as solar, hydro and wind are often not 'bankable' because although the running costs are minimal, considerable capital investment must be made upfront. Banks are often reluctant to finance such projects as these do not yet have an established track record.

Public policy is needed to correct these market failures and make green technologies more profitable than less sustainable ones. In economic terms, policies must create ***rents*** to lure capital into socially desirable green investments. Rents are "payment[s] to a resource owner above the amount his resources would command in their next best alternative use" (Tollison, 1982, p. 577), or more simply, returns that are higher than opportunity returns.

Already temporary rents have accelerated mass production and deployment in a range of green technologies, spurred technological learning and permitted producers to reap economies of scale. In the case of photovoltaic (PV) solar technology, subsidised feed-in tariffs increased global demand and allowed for economies of scale, with the effect that the cost of electricity generation has decreased by 22% each time the globally installed cumulative generation capacity doubled (IRENA, 2012, III). The German Advisory Council on Global Change estimates similar learning curve effects for electricity generation from wind, biomass and solar thermal-power plants (WBGU, 2011, 167 f.). As a result, the cost gap in relation to competing incumbent technologies has decreased substantially, meaning that subsidies may soon be discontinued.

2.2. The risks of government failure

Creating rents through policy decisions can be risky:

For starters, policymakers may take the wrong decisions and support technologies that never become commercially viable. Critics of technology selection have long argued that governments do not know who will win any better than markets do (Pack and Saggi, 2006). This argument overlooks two aspects: First, governments bring a public welfare perspective. Certain technologies may be socially more desirable than others, perhaps because of environmental externalities, or due to dynamic spillover effects that are not adequately reflected in the decisions made by individual investors. Second, governments may facilitate technology-specific collective