

**Fostering green technological
innovations:
The role of environmental policy**

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Outline

- Green technologies and their benefits
- Environmental policy instruments for green technology innovations
- Main environmental policy requirements
- Conclusions

What is Green Technology?

- Green technology: any technology that has the potential to significantly improve environmental performance relative to other technologies
- Related terms
 - Environmentally-sound technologies
 - Low-carbon technologies
 - Climate-smart technologies

Areas of green technology

- Air and water pollution abatement
- Waste management and recycling
- Water purification and recycling
- Renewable energy
- Energy efficiency
- Sustainable building materials
- Etc.

Benefits of innovative green technologies

- Improvements in environmental quality
- Improved cost effectiveness of environmental policy
 - Lower costs for achieving a given objective
 - Achieve more improvements for the same costs
- Exploit “win-win” opportunities
 - Improved environmental outcomes at lower cost

Types of (green) innovations

- Product innovation (product characteristics)
- Process innovation (production method)
- Marketing innovation (Product design, Packaging)
- Organizational innovation (business practices, etc.)
- **Extent of innovation**
 - Incremental innovation (small changes to products; processes, etc.)
 - Radical innovation (new products, processes, etc.)

Environmental policy and innovation activities

- Environmental policy can create incentives for the development and diffusion of green technologies by increasing the demand (of firms, consumers, government) for low-cost cleaner production methods and more environmentally-friendly products
- Environmental policy as a “demand-pull” factor for green technologies

Environmental policy instruments

- Two main categories of instruments:
 - Economic instruments
 - Incentive-based or market-based instruments, such as taxes on pollution; tradable permits; subsidies etc.
 - Regulations
- Other types of instruments:
 - Green procurement
 - Eco-labeling

Economic instruments: Tax on emissions of air pollutants

- Tax per unit (ton) of emissions of a pollutant
- A continuous incentive for pollution reduction
- Polluter decides about ways and means of pollution abatement
- But: Tax rate has to be strong enough to create incentives for pollution abatement!
- Otherwise: Tax only serves to generate revenues for the government.

Sweden : Tax on NOx emissions

- Introduced stringent tax in 1992
- Created incentives for adoption of the latest abatement technologies, which had to be mainly imported
- First year: only 7% of firms had this technology.
- Second year: proportion rose to 62 per cent!

Direct regulations

- Traditional command and control policy:
 - Mandatory uniform technology standards,
 - Issue: cost effectiveness
 - No incentives to improve environmental performance once the standard has been achieved. .
- Modern types of regulations based on best available technologies (BAT):
 - Define performance standards (e.g. energy efficiency)
 - Give industry freedom to choose technology – creates incentives for innovation!

Japan's Top Runner Programme

- Energy efficiency standards for 21 products (e.g. refrigerators; TVs)
- Best performing model of a product group: standard for all other products;
- Companies to meet the new baseline standard
- Failure to meet standard is made public!
- Continuous incentives for improvements in energy efficiency!

Subsidies and tax incentives

Examples:

- Support purchases of less polluting passenger cars - based on different categories of emission levels (g CO₂/km)
 - Used in France since 2007 (Bonus/Penalty system);
- Differential taxation of motor fuels
 - Leaded vs. unleaded petrol
 - Accelerated phasing out of leaded fuels!

Feed-in tariffs for renewable energy

- Encourage investments in renewable energy sources (wind, solar, small hydro etc.)
- Renewable energy producers receive a long-term price guarantee for all electricity they produce
- Often combined with minimum quotas for renewable energy in total electricity supply of utilities.

Public procurement

- Public sector: large consumer of goods and services
- Green procurement policies : aim at selection of goods and services that minimize environmental impacts
- Define environmental criteria to be used
 - Recycled paper; energy efficiency standards, clean fuel vehicles, etc.
- Limited information on extent of public green procurement

Key requirements for innovation-friendly environmental policy

- Stringency
- Flexibility
- Predictability and credibility

Stringency

- Policy objectives should be both ambitious and realistic
- Low emission tax rates / weak regulatory standards : Weak incentives for innovation activity!
- Performance standards : progressive tightening in line with developments of economically feasible BAT.

Flexibility

- Flexible policy regime:
 - Focus on environmental outcomes
 - Allow firms to identify the best way to meet the environmental objective
 - Technology-neutrality: avoid prescriptions of certain pollution abatement methods
- The more flexible the policy regime the greater the scope for innovation!

Predictability and credibility

- Set realistic targets (short-, medium and long-term) for expected environmental performance
- Avoid unanticipated large changes in policy parameters to reduce adjustment costs associated with increased policy stringency
- Unpredictable policy regime: creates investor uncertainty and leads to postponement of investments in innovative activities

Interaction of demand and supply forces for innovation

- Environmental policy is only a necessary condition for creating incentives for green technological innovations!
- Wide range of supply-side factors that determine innovation in general, including eco-innovation:
 - Overall capabilities of the national R&D sector;
 - public R&D support;
 - Inward FDI and knowledge flows
 - Extensive international collaboration
 - Access to finance, etc.

Technology transfer

- Many countries, notably smaller ones, meet their demand for environmental technologies mainly from foreign sources.
- Firms have to build absorptive capacities to adapt technologies to local conditions
- Remove trade barriers to trade in environmental technologies
- Effective patent protection

Conclusions

- A mix of economic instruments and regulations can spur the development of innovative environmental technologies and accelerate the diffusion of existing ones.
- Innovation policy in general should focus on creating favourable supply-side conditions for innovative activities, including in the area of environmental technologies.

Conclusions (II)

- Green technology innovations should become integral part of sectoral development strategies
- Closer integration of innovation policy and environmental policy requires effective policy coordination between government departments in charge of innovation; industrial sector development; and those in charge of environmental protection.

THANK YOU!