

Modeling Technology Oriented RD&D Strategic Cooperation for
Climate Change Mitigation: Methodological Issues and Alternative Policy
Scenarios

Fondazione Giorgio Cini – Venice, Italy, 17~18 March 2008

Technological Changes: Policy Scenarios

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Outlines

- Motivation/purpose: int'l regime and domestic policies
- Major concerns to consider technology policies
- Technological strategies: options, path, and leverage points
- Policy options and scenarios

Motivation 1

Copenhagen Agreement in 2009

Improving Kyoto Approach: not only target-oriented, but also more direct agreement to drive innovation in key technology areas to contribute to implementation of Bali Roadmap with technology as a key element

Motivation 2

Domestic strategies and policies for energy conservation and emission reduction

- High political will and increasing public awareness, but lack of support of convincing design and effective enforcement of policies to support achievement of the domestic targets: 20% of reduction in energy intensity and 10% of reduction in emission of SO₂ and COD
- How to guarantee cost-effectiveness of the policies?

Major Concerns on technology policies: decision-making criteria

- Availability of technologies and their functioning: reliability and significance to policy objectives: e.g., energy security, less emission, competitiveness
- Costs for R&D/invention, innovation, and diffusion
- Financial and human resources resource
- Institutional support
- Adequacy of infrastructure support: complementary conditions

Technology strategies

- Objectives
- Technological options and programs/schemes
- Path towards a system of lower carbon technologies
- Leverage points

Technology strategies: objectives

to enhance competitiveness redefined in the context of low carbon economy and increase welfare including global and local environmental implications

- Reducing emission intensity in both GDP and energy use terms sharply
- Being rivalrous in cost for high penetration
- Being reliable for energy supply to contribute to energy security

Technology strategies: technological options and programs/schemes

- Identify major energy/emission intensive sectors and products
 - Power (*lock-in*)
 - Transport (*lock-in*)
 - Building (*lock-in*)
 - Iron & Steel
 - Non-ferrous metallurgy
 - Cement and other non-metal materials
 - Petroleum processing
 - Raw chemical materials
- Identify meaningful technologies in each of the above sectors
- Develop programs/schemes of R&D for innovation, deployment for diffusion.

Energy intensive sectors

In 2005, such seven sectors in China as iron & steel, raw chemical materials, cement and other construction materials, power, mining, petroleum processing, non-ferrous metallurgy accounted for 37% of industrial value-added and 15.6% of GDP, with share of 64.4% of industrial energy use and 45.6% of total energy use.

Technology needs assessments

Sectors (most energy/emission intensive)	Technology options	Main points of leverage	Degree of mature or reliability	Expected emission reduction	Costs acceptance	
					Short-term	M&L-term
Power	Remove outdated and high emission intensive capacity of equipment and devices with SC (600 MW)	transformation	+++	+	+++	
	USC	deployment	+++	++	+	+++
	USC + CCS	R&D for innovation	-	+++	-	++
	CFB + CCS	R&D for innovation	-	+++	-	++
	IGCC + CCS	R&D for innovation	-	+++	-	++
	IGCC combined with coal – chemical production + CCS	R&D for innovation	-	+++	-	+++
	Hydro power	Deployment and diffusion	+++	+	+++	
	Wind power – large size	Deployment and diffusion	++	++	+	+++
	Solar power	Deployment	+	+	+	++
	Nuclear power	Deployment and diffusion	+++	++	++	+++

Technology needs assessments

Sectors (most energy/emission intensive)	Technology options	Main points of leverage	Degree of mature or reliability	Expected emission reduction	Costs acceptance	
					Short-term	M&L-term
Transport						
Fuel economy of vehicle	More efficient engine	Deployment and diffusion	+++	++	+++	
	gearing	Deployment and diffusion	+++	++	+++	
	Lighter weight of vehicles (new materials and smart design)	Deployment and diffusion	+++	++	++	+++
Vehicle with clean energy	Electric vehicle	R&D for innovation	++	+	+	+++
	Hybrid	Deployment and diffusion	++	+	+	+++
	Hydrogen powered	R&D for innovation	+	+++	-	++
Smart/optimized transport system	Systematic design of transport infrastructure (optimal integration of air, road, railway, and shipping)	Deployment and diffusion	+++	+	+++	
	Rational urban planning	Deployment and diffusion	+++	+	+++	

Technology needs assessments

Sectors (most energy/emission intensive)	Technology options	Main points of leverage	Degree of mature or reliability	Expected emission reduction	Costs acceptance	
					Short-term	M&L-term
Building	Heating system	Deployment and diffusion	+++	++	+++	
	Air-conditioning system	Deployment and diffusion	+++	++	+++	
	Lighting system	Deployment and diffusion	+++	+	+++	
	Adoption of energy-saving materials (insulated, heat preservation, etc)	Deployment and diffusion	++	++	+++	
	Environmentally sound design (windows, doors, areas, etc)	R&D for innovation	++	++	+++	
	Energy measurement/meters	Deployment and diffusion	+++	+	+++	

Technology needs assessments

Sectors (most energy/emission intensive)	Technology options	Main points of leverage	Degree of mature or reliability	Expected emission reduction	Costs acceptance	
					Short-term	M&L-term
Iron & Steel						
Non-ferrous metal materials						
Coking						
Ammonia						
Ethene						

Path towards a system of lower carbon technologies

- First step: to deploy technologies rivalrous in terms of maturity and costs with encouraging policies and institutional arrangement (for easier and favored financing and removing barriers)
- Second step: to invest in R&D for innovation for a near and medium term deployment
- Third step: to invest in R&D for innovation and invention in a long-term perspective

Leverage points

	<i>Invention</i>	<i>Innovation</i>	<i>Diffusion</i>
<i>Key stakeholders</i>	<ul style="list-style-type: none"> •Universities •Nat'l lab •Individuals •Gov'ts and int'l GOs 	<ul style="list-style-type: none"> •Companies •Univ. and research institutes •Gov'ts and int'l GOs 	<ul style="list-style-type: none"> •Companies •Brokers •Consulting firms •Gov'ts, NGOs, and GOs
<i>Activities</i>	<ul style="list-style-type: none"> •Researches •public investment in R&D 	<ul style="list-style-type: none"> •Medium-scale experiments •Develop. of norms and standards •Design •demonstration 	<ul style="list-style-type: none"> •Marketing •Invest. proposals •Commercial negotiation •financing •Training H. R. •deployment
<i>Applicable policy instruments</i>	<ul style="list-style-type: none"> •Subsidies •Public expenditure in R&D 	<ul style="list-style-type: none"> •Norms, standards •Joint R&D investment (in various forms incl. venture capital) •IPR arrangement 	<ul style="list-style-type: none"> •C&C: Norms and standards, bans and permits favored approval process, market access •Taxation on energy use and emission; tax exemption for EST •Subsidies and credit guarantee •Cap & Trade System •Labeling, awareness, performance transparency

Checklist for technology-oriented policy scenarios design

- Technology and technology needs assessment
- Target of emission reduction/efficiency improvement (related to norms and standards)
- Constraints of cost (affordability) and cost-sharing scheme
- Technology penetration: share of installed capacity of production
- Applicable stakeholders (companies, univ., research institutions, etc): sensibility of policies

In the context of Bali Action Plan

Understanding:

Measurable, reportable, and verifiable for both *mitigation actions* and *supporting and enabling measures in technology, financing, and capacity-building*

To measure technology become more important

Some current key topics on technology issue in UNFCCC negotiation

- Monitoring performance of technology development and transfer: indicator development
- Innovative financing mechanism
- Enabling environment: encouraging policies
- Technology information
- Capacity building

A potential deal in Copenhagen in 2009 on technology:

Technology-oriented and Program-based Package

Framework programs/schemes for international technological cooperation

- Prioritized areas, sectors, locations/parties
- Serious of key technologies based on TNAs: including innovation and diffusion/transfer
- Penetration and deployment of selected technologies
- Emission reduction targets and SD objectives of the programs
- Need for financing based on cost estimation
- Cost sharing mechanism based on and assessment of affordability
- Supporting and enabling policies and measures (T&DD, capacity building, financing, policies, infrastructure)
- Impact assessment: economic, environmental and social impacts

Linking process with target

- 5~10 programs for R&D and Deployment/Diffusion/Transfer
- A package of fund supporting the programs
- Financial mechanism: linking public fund with capital market
- Performance and impact assessment system: criteria, process, steps and organization

- Is this rough proposal for further negotiation feasible?
- What are its advantages and disadvantages?
- What are further recommendation for setting issues?

Thank you for your attention!

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