Dialogue on long-term cooperation
Realizing the full potential of technologies
In-session workshop during SB26 UNFCCC

Targeting at Technologies: Innovative International Mechanism in the Climate Context

16 May 2007, Bonn, Germany

Zou Ji
Renmin University of China
Li Liyan
China National Development & Reform Commission

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- Why climate sound technologies (CSTs)?
- Understanding the CSTs
- Leverage points
- Measuring effectiveness of D&D&T of CSTs
- Fundamental challenge: market failure
- Needs for strategic innovation on international enabling mechanism

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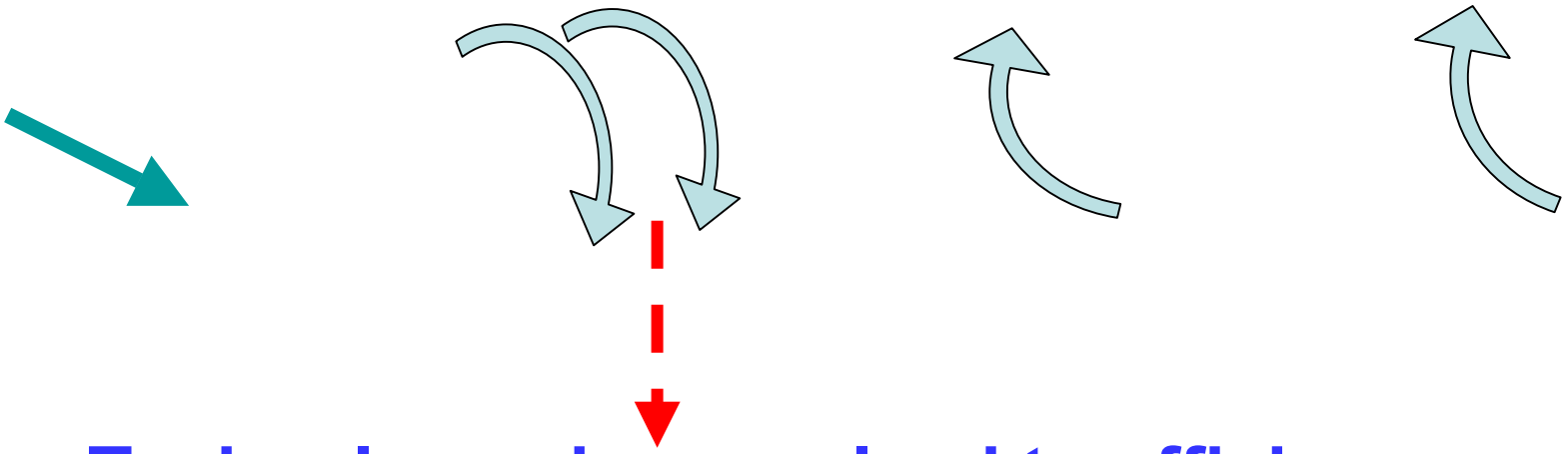
Why climate sound technologies?

- Objective: the better life quality, higher living standard, more energy use by improving energy efficiency and decreasing GHGs emission.
- As population and GDP per capita will continue to increase, the only way-out is to decrease emission intensity.
- Emission intensity depends on progresses in CSTs heavily.

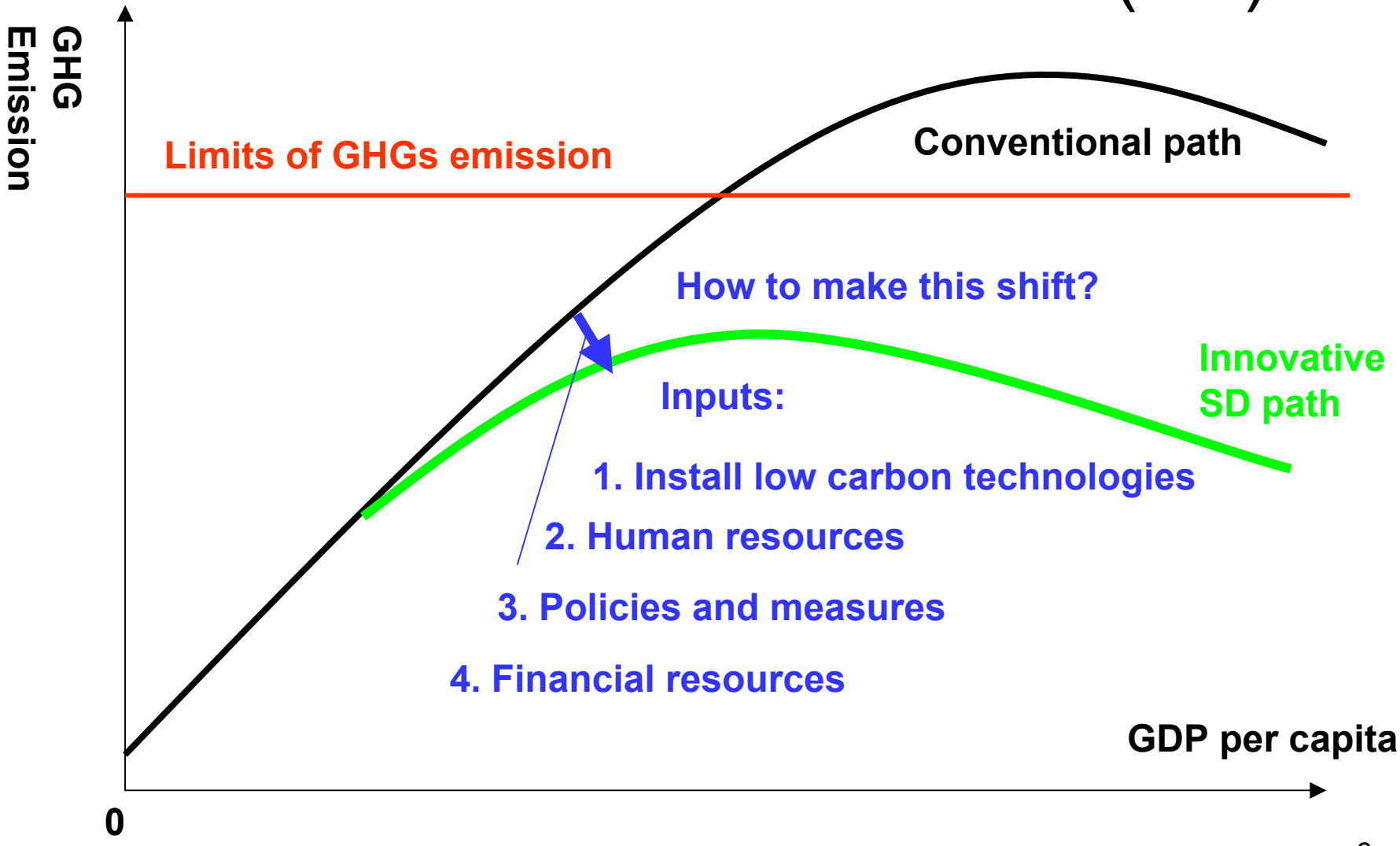
Technology change is the only way-out for developing countries

$$Emission = \frac{Emission}{GDP} * \frac{GDP}{Population} * Population$$



Technology changes lead to efficiency improvement

It's a matter of development paths: Conventional *v.s.* Innovative (SD)



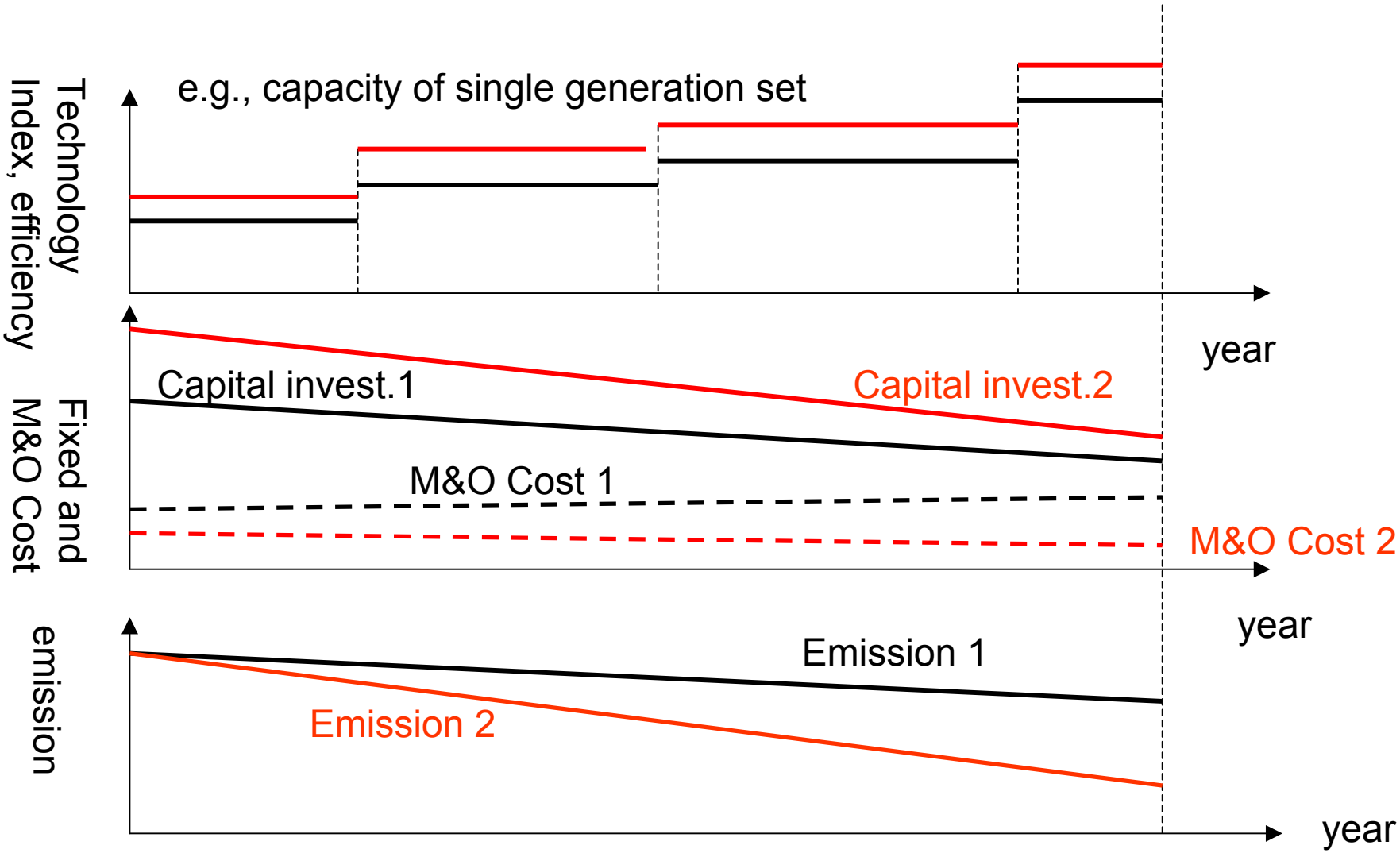
Urgency: lock-in effects

However, we are faced with risks of lock-in effects on high carbon economy in developing countries, which may lead us to lose a historic opportunity to stabilize GHG concentration in the coming decades.

Lock-in effects

- Energy intensive sectors are easy to be locked-in: power, heating, air-conditioning, transportation system, ……;
- Long lifetime for infrastructure operation: over several decades;
- Not easy to change the emission feature of existing infrastructure with very high replace costs
- Developing countries, e.g., China, are deploying massive construction of infrastructure with available but low-efficient technologies

Example of lock-in effects in Power Sector



1. High carbon tech scenario; 2. Low carbon tech scenario.

Estimation on reduction of CO2 and SO2 emission with more advanced coal-fired generators in 2020 and 2030

size of single generation set	<100～200 MW	>300 MW ultra supercritical	Difference
Capacity in 2020, GW	0	300	300
coal use per unit, g/kwh	400	270	130
CO2 reduction, 2006-20, Mt	**3328**		
CO2 reduction, 2006-30, Mt	**9014**		
SO2 reduction, 2006-20, Mt	**17.6**		
SO2 reduction, 2006-30, Mt	**46.3**		

Notes:

1. The emission of generators with small size (less than 100~200 MW) is regarded as baseline given the assumption that all large size generators (>300 MW ultra supercritical) will be used to substitute the small ones.
2. The increase of ultra supercritical generators is assumed to be linear with a rate of 20 GW/yr starting from 0 GW in 2005.

Technology potential

- The gap of general energy efficiency between China (35%) and the OECD average (45%) is up to 10%.
- This shows a current potential for China to control its GHG emission by improving its energy efficiency with more efficient technologies available from developed countries.
- With large share of energy use and GHG emission, only several percentage points of improvement in energy efficiency may lead to significant GHG reduction.

Energy efficiency for major products in China, 1990 - 2004

energy consumption	China			Int'l standard	Gaps in 2004	
	1990	2000	2004		absolute	%
Thermal power generation Coal consumption（gce／kwh）	392	363	349	299.4	49.6	16.57
Power plant electric supply Coal consumption（gce／kwh）	427	392	376	312	64	20.51
alternating current consumption for Electrolytic Aluminum （kwh／t）	16233	15480	15080	14100	980	7.00
Steel （large firm） （kgce／ton）	997	784	705	610	95	15.57
cement（kgce／ton）	201.1	181	157	127.3	29.7	23.33
Crude oil process（kgce／ton）	102.5	118.4	112	73	39	53.42
Ethene （kgce／ton）	1580	1125	1004	629	375	59.62
synthetic ammonia （kgce／ton）（large scale）	1343	1327	1314	970	344	35.46
Paper and cardboard（ kgce／ton）	1550	1540	1500	640	860	134.38

Source: Qinyi Wang, *International Petroleum Economics*, 2006, NO.2

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CSTs are a matter of protecting global public goods

- Climate benefits are core returns of CSTs;
- More rapid and effective development, transfer, diffusion, and deployment of CSTs in developing countries are of great importance to protect global climate as global public goods;
- These global public goods are shared and enjoyed by all the countries; and
- It may be regarded as an efficient global allocation of technology resources to curb global warming.
- We need to find out an innovative mechanism to realize the above global allocation of technologies efficiently and effectively.

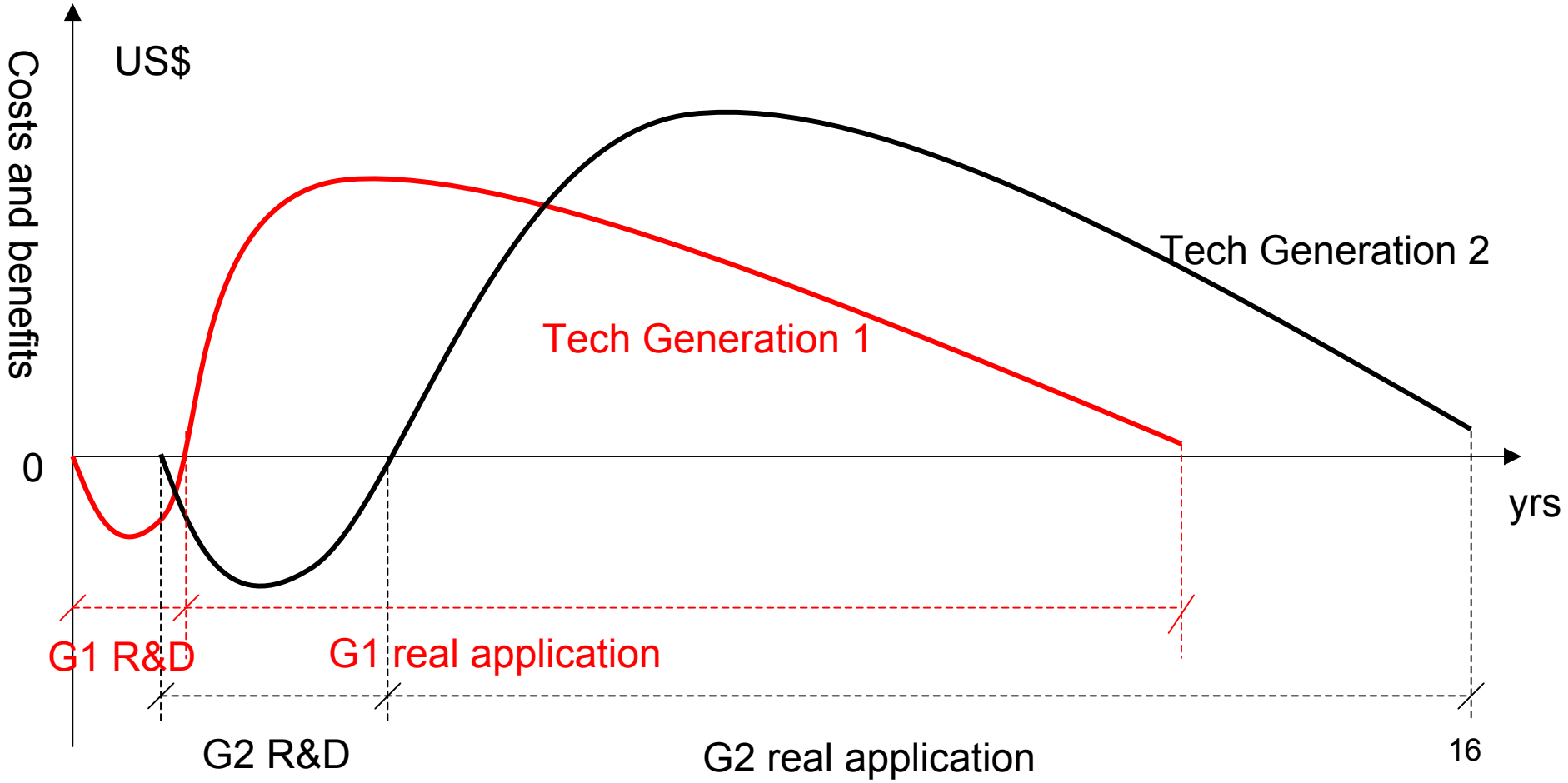
CSTs are a whole package

CST may include:

- Hardware: devices, equipment, process, etc.;
- Software: IPRs, designs, know-how, mechanism, policies, appropriate institutional arrangement;
- Human resources: well trained and qualified; and
- Financial resources to make D&T&T happen.

Opportunities in different stages of CST lifecycle

This provides different leverage points for international cooperation.



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Leverage points of int'l technology cooperation

They may be in all the stages of technology lifecycle:

- Basic scientific researches;
- Joint R&D;
- Dissemination: market tapping, increasing penetration by transfer, diffusion, and deployment of CSTs; and
- Full application (or even commercialization).

Some leverage points in China 1

- R&D to provide for strategic technology backup for medium and long-term development
- Enlarge penetration of current low-carbon technologies in markets by
  - Curbing market obstacles related to int'l transfer and cooperation of CSTs
  - Innovative international regime as enabling environment, including incentives

Some leverage points in China 2

- Infrastructure sectors, such as power, transport, and construction/building should be paid an urgent attention.
- Streamlined designs at strategic, policy, and technological levels are crucial
- Integrating:
  - water strategies, policies and investment with adaptation
  - CO2 mitigation with air quality and energy security

Some important fields in China

- Integrated assessment and design:
  - global VS local concerns;
  - technologies VS economy;
  - transportation VS urban planning
- Advanced coal technologies: linking with desulphurization and NOx reduction and CCS (IGCC, CFB, breeze)
- High efficient vehicle
- Implementation of building/construction energy conservation
- Energy intensive manufacture sectors (metals, cements, chemical products, etc.)

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How to measure the effectiveness of D&D&T?

- Speed of technology flow
  - Considering to avoid lock-in effects in developing countries
  - Needed time after becoming mature
- Scale of technology flow
  - Share of market or installed capacity
- Range of technology flow
  - Covering most of the meaningful sectors

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Fundamental Obstacles: market failure

- If the commercial returns of CSTs are not high enough to attract private investors who normally own most technologies and/or financial resources, what should we do?
- How to address the trade-off between IPR protection and climate protection?
- The existing market mechanism is not adequate enough to speed up, widen, and enlarge technology flow from developed to developing countries for taking earlier and more effective actions

Managing externality: general approaches

- Internalizing externality
  - Impose taxes or levy charges on public bads (GHG emissions)
  - Impose taxes or levy charges on beneficiaries of public goods
- Subsidies by transfer payment: based on earmarking environmental and income (from the rich) tax/levy
- Define environmental property right: cap & trade of emission quota

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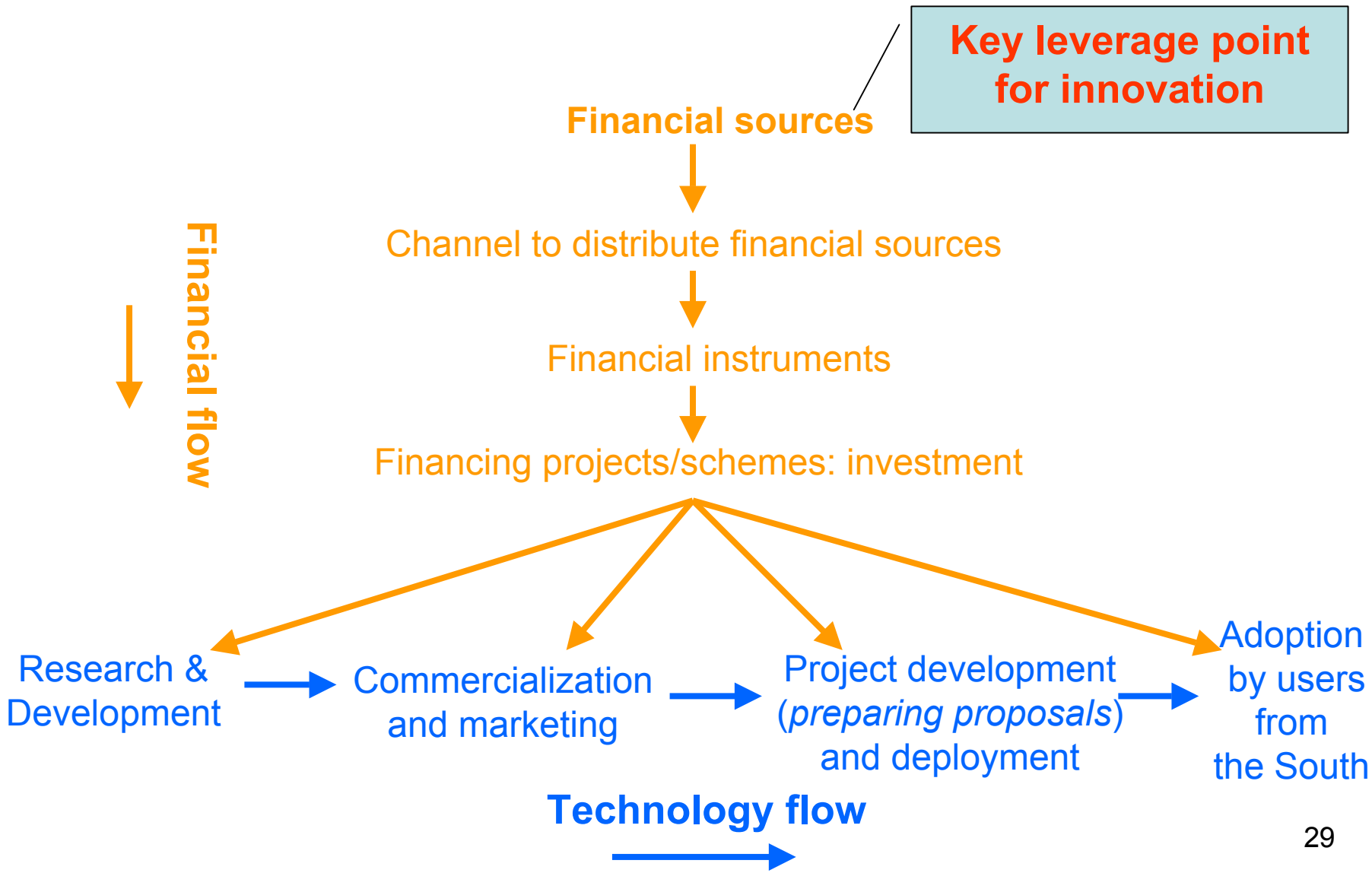
Needs for strategic innovation on international enabling mechanism

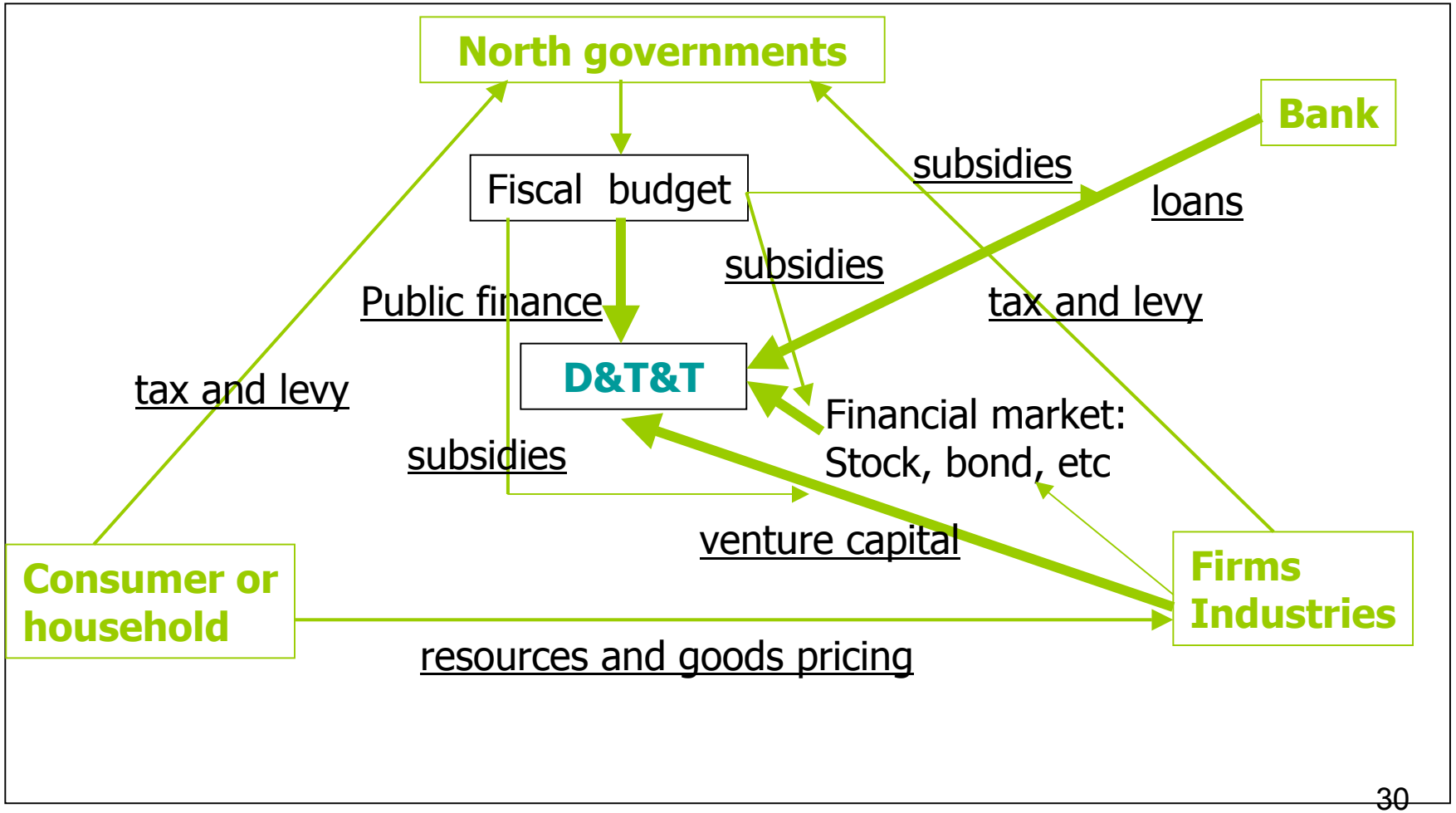
Objectives: *Win-win*

to speed up, widen, and enlarge international technology cooperation to catch the historic opportunities, meanwhile ensure companies to make profits and boom economies.

Technology flows v.s. financial flows



The roles of different stakeholders in financing D&T&T



Needs for strategic innovation on international enabling mechanism

- Intergovernmental cooperation remains a major driving force;
- Guiding and providing for incentives to private sectors are core task of intergovernmental cooperation
- PPP: Innovative financing to curb market failure
- A roadmap to innovative int'l mechanism

Intergovernmental cooperation 1

- Enhance mechanism within UNFCCC: need a more effective and implementation-oriented body to:
  - Provide for advices, guidance, and recommendation;
  - Coordinate actions by different international stakeholders;
  - Promote communication and info/knowledge sharing; and
  - Monitor and assess the performance and progresses.
- Cooperation on other bilateral and multilateral bases

Intergovernmental cooperation 2

With priorities on:

- Policy dialogues and coordination for better incentives to private sectors and markets;
- Financing basic research and R&D; and
- Direct transfer and diffusion of publicly owned technologies.

Back to Needs for Strategic Innovation

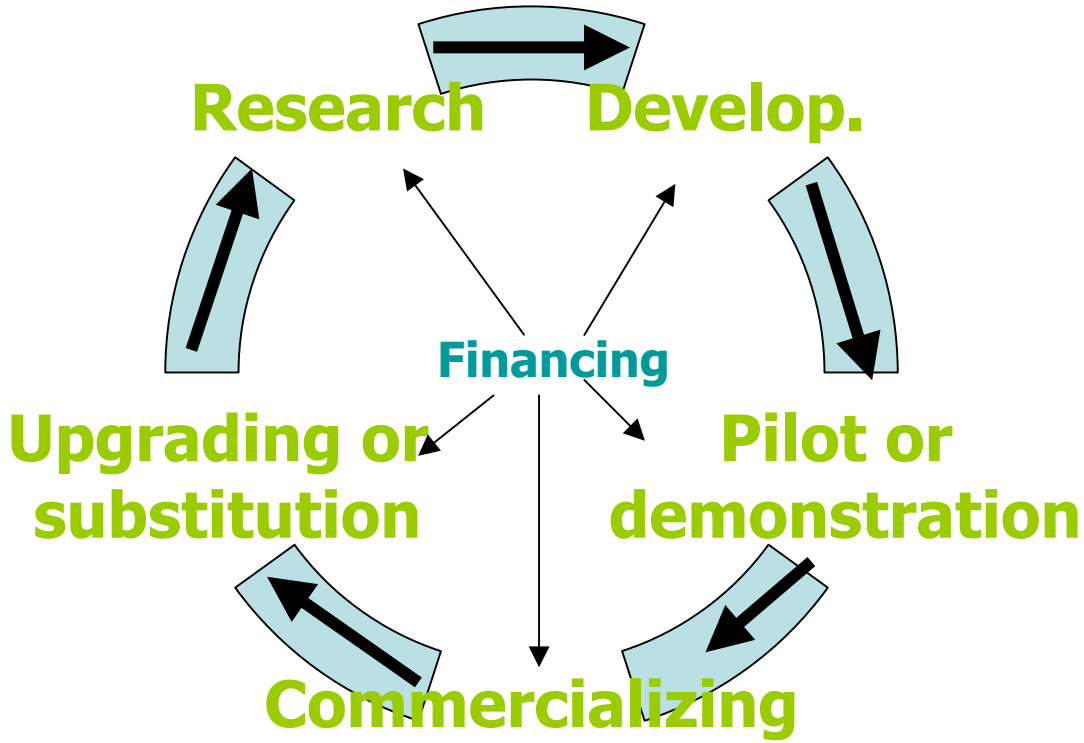
Guiding and providing for incentives to private sectors

- Tax exemption for CSTs exports of companies in developed countries;
- Subsidies to encourage R&D and transfer of CSTs;
- Favored conditions for CST-related export credits: guarantee for technology export credits, subsidies, etc.;
- Removal of technology export constraints; and
- Other policies and measures.

Innovative financing to curb market failure

- Public finance may play a crucial role in guiding and attracting private financial resources into D&D&T of technologies
- A PPP frame for financing D&D&T of technologies may be feasible to link public and private finance; and
- A range of financial instruments may be applied for financing D&D&T.

Financing leverage points based on technology cycle



A Framework for Financing D&D&T of CSTs

financial sources	policy instruments	challenges to address	specific targets	typical technologies	stage of technologies	barriers for D&D&T	adequacy and performance assessment	solutions
Public	fiscal budget: ODA & additional for CC; subsidies for T&T,GEF, Tax exemption; R&D, Gov't guarantee for Export Credit, venture investment etc	CB, LDC, small islands, adaptation, R&D, market tapping, infrastructure, etc	1.CB,2. R&D in strategic areas, 3. catalyzer of T&D, kick-off market; 4. prototype/pilot/ demonstration, 5. adaptation, 6. policy development	pre-commercial or pre-competitive techs in power, transport, building (infrastructure), adaptation tech, etc.	basic researches; pre-competitive and in process of commercializa-tion	political will	Effectiveness: scale, speed, and range	to improve awareness of politicians and the public , increase scale via current tunnels and potential new pipelines.
Private	FDI incl. CDM, trade of IPR, service and product, and C-credits; fund and loans from commercial banks, venture invstment	massive investment	substantial GHG reduction with a win-win manner	manufacture sector: end user technologies	pre-competitive and in process of commercializati on; commercialized	1.market force, 2. technical capacity, 3.export permits, 4. others	1. Guidance and incentives; 2. Effectiveness: Scale, speed, and range	1. Guidance from gov'ts policies; 2. enforcement of laws; 3. incentives; 4. breaking negative market forces (limit monopoly)
PPP	combination of public and private financial resources: joint venture, subsidies, managing C-market, funds, …	attract private investment in climate public goods	guiding financial flow into the targeted areas	Infrastructure: power, transport, building, and relevant energy intensive technologies	R&D, Market tapping; Massive investment; etc.	market force	Effectiveness: scale, speed, and range.	Initiatives by governments: cooperation between the North and the South.

Roadmap to develop innovative international mechanism for D&D&T of CSTs

- Establish and operate a Special Intergovernmental Body for D&D&T of CSTs under COP of UNFCCC;
- Develop an involvement mechanism for owners, developers, and potential receivers of CSTs and policy makers;
- Identify prioritized strategic areas of CSTs by TNAs;

Roadmap to develop innovative international mechanism for D&D&T of CSTs (Cont'ed, 1)

- Develop a special PPP financial system to combine and bridge:
  - public finance (mainly from developed parties)
  - carbon market, CST markets, and
  - capital markets

Roadmap to develop innovative international mechanism for D&D&T of CSTs (Cont'ed, 2)

- Select appropriate financial instruments and pipelines
  - Share-holding in climate sound projects
  - Venture investment in R&D of CSTs
  - Funds
  - Bonds
  - Insurance for adaptation
  - Long-term soft loans
  - Others
- Initiate a series of programs/schemes targeting at specific technological areas in developing countries

Conclusion

- D&D&T of CSTs are necessary and should be enhanced rapidly;
- The current international mechanism is not effective and quick enough to make meaningful change of technologies in developing countries to avoid *Lock-in Effects* or repeating the conventional path of development.
- To address this global externality or protect climate as global public goods, we need to make efforts to overcome market failure in international technology cooperation;

Conclusion (cont'ed)

- Intergovernmental mechanism should be developed to contribute to establishing an international PPP; and
- Public finance can play crucial roles to combine carbon, CSTs, and financial markets as an innovative financing for D&D&T of CSTs.

Thank you for your attentions

Contact information:

Prof. Zou Ji: zouji@ruc.edu.cn

Ms. Li Liyan: lily@ndrc.gov.cn