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Green Windows of Opportunity for Latecomer Development

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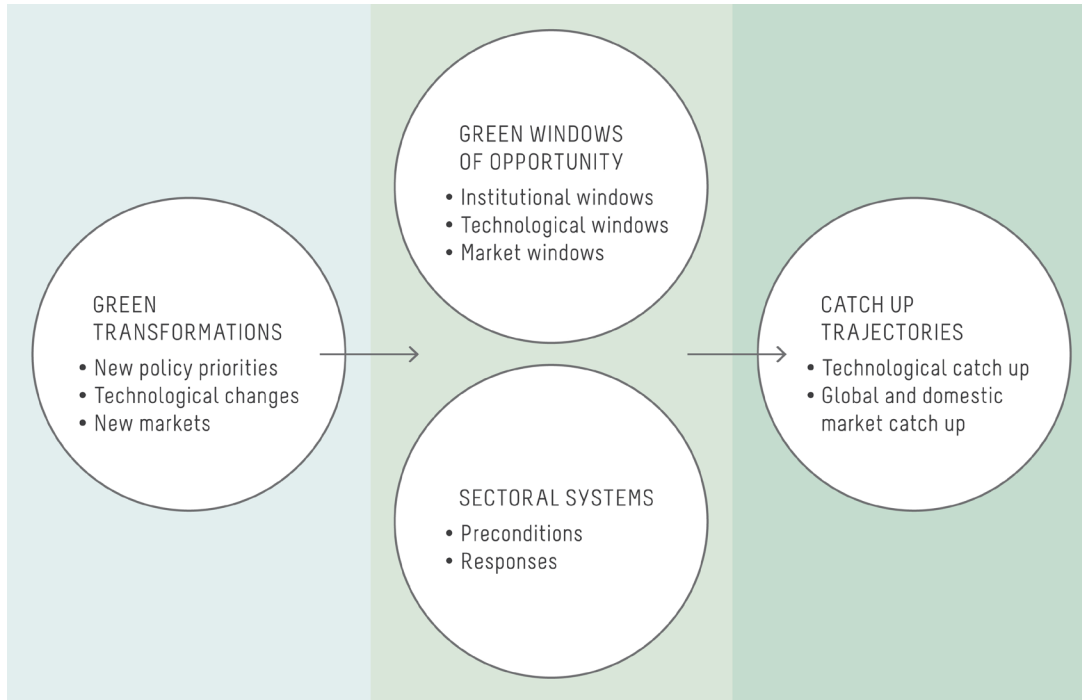
A new framework for seizing GWOs in latecomer countries

- Other frameworks for the analysis of low-carbon technologies are mainly concerned with the development and deployment of such technologies, rarely situating the discussion in the context of latecomer development
- Existing frameworks on latecomer development do not focus on the green economy.
- Latecomers should from the outset develop differently rather than catch up along established pathways

Grow first and clean up later models are not viable!



GWO framework



1. Green Windows of opportunities
2. Sectoral system of production and innovation: preconditions and responses of public and private actors
3. Catch-up trajectories resulting from the interactions of GWO with stakeholders' actions



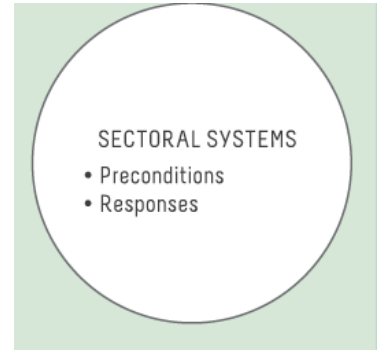
Green windows of opportunity

- GWO are mainly *endogenous*, created by governments and influenced by *domestic and global* environmental and industrial policies
- Examples are:
 - **China**: 2006 Renewable Energy Promotion Law; Golden Sun Demonstration Program; Ride the Wind Program.
 - **Brazil**: Sugarcane-based ethanol fuel program.
 - **India**: 2020 National Electric Mobility Mission Plan.
 - **Brazil, Chile, Uruguay, Viet Nam, Turkey, Morocco, Namibia** and **South Africa**: existing or forthcoming green hydrogen national strategies.



Sectoral systems: preconditions and responses

- The exploitation of GWO depends on the existing preconditions and on the responses of firms and other public and private actors
- Technological maturity and tradability of green technologies significantly affect sectoral trajectories.



Seizing green windows of opportunity: four scenarios

<div style="text-align: right;">Preconditions</div> <div style="text-align: left;">Responses</div>	<u>Strong</u>	<u>Weak</u>
<u>Strong</u>	Scenario 1: Effective GWO seizing <ul style="list-style-type: none"> • Solar PV, Biomass, CSP: China • Bioethanol Brazil • Hydrogen Chile Potentially 	Scenario 2: Missed opportunity <ul style="list-style-type: none"> • Solar PV: India • Biogas: Bangladesh • CSP: Morocco • Wind: China
<u>Weak</u>	Scenario 3: Active Approach <ul style="list-style-type: none"> • Biomass: Thailand and Vietnam • Hydrogen: Namibia 	Scenario 4: Distant opportunity <ul style="list-style-type: none"> • Wind: Kenya • Bioenergy: Mexico and Pakistan

Scenario 1: Effective GWO seizing

- **Preconditions:** China have sufficient preconditions including a large internal market, a diversified industrial structure and well-developed related capabilities such as, for example, design and engineering capabilities for biomass plant construction
- **Responses:**
- **China:**
 - Co-design of environmental and industrial policies.
 - Diffusion of knowledge among firms and knowledge institutions, such as government stimulation of knowledge spillovers with loose enforcement of property rights and diffusion through state-owned design institutes in biomass.
 - Acquisition of foreign technology through licensing activity and cross-border acquisitions of foreign firms in solar PV and biomass.
 - Public R&D experimentation in CSP.
- **Brazil:**
 - Technological learning arising from innovation policies, development of sugar and ethanol processing plants, and interaction with technology suppliers and research institutions.

Scenario 2: Missed opportunity

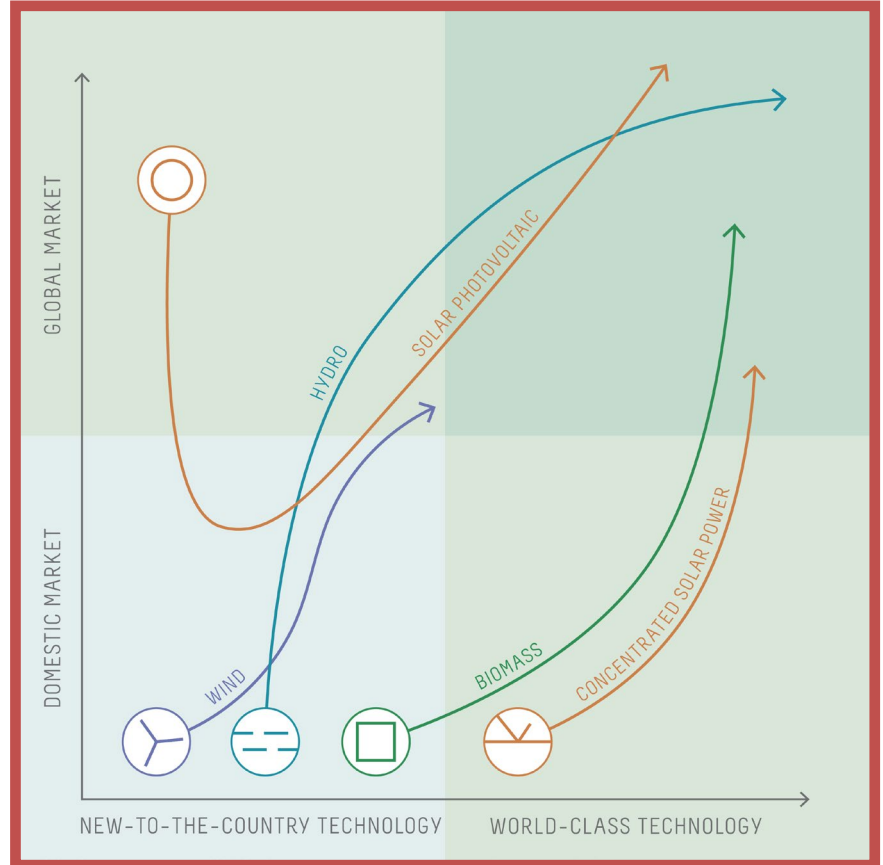
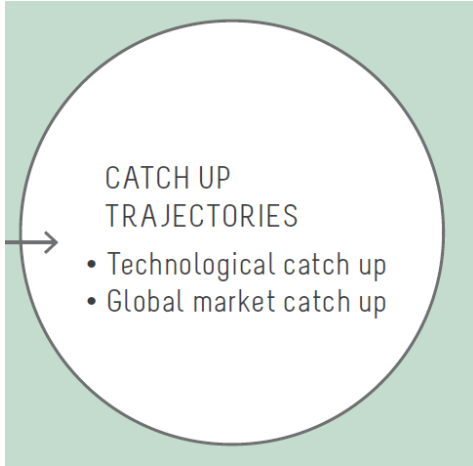
- **India:** National Solar Mission prioritised deployment at low costs above domestic manufacturing, and this resulted in a high dependency on imports.
 - Insufficient attention was paid to training, and promotion of linkages to relevant stages of the value chain and R&D to boost domestic competitiveness.
 - When local content requirements were introduced, there were not enough domestic capabilities to effectively mitigate import dependence due to the lack of domestic business creation in the early stages.
- **Bangladesh:** an existing system of R&D organizations in biomass energy projects has not been complemented with appropriate incentives to encourage biogas plant installations.
 - Very little has been done to increase awareness among farmers about the potential of correct waste management.

Scenario 3: Active approach

- **Thailand:** proactive strategy to attract private investors to the biogas industry:
 - Financial subsidies for the construction and design of biogas production plants, tax incentives for firms involved in waste transformation;
 - Small Power Purchase Tariff program for increasing the proportion of electricity generation from biogas;
 - Enforcement of an environmental law taxing companies producing pollution.
- **Ethiopia:** active role in designing wind projects to guarantee maximum local learning, by ensuring the involvement of professional users in the execution of projects.

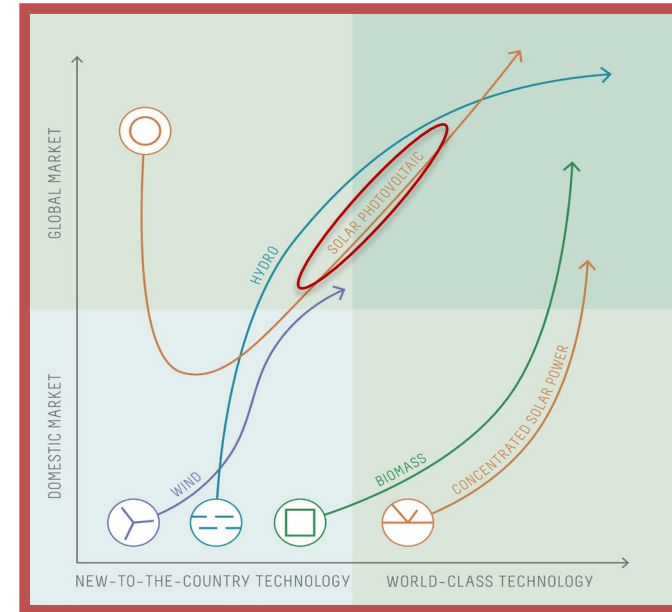


Sectoral trajectories



The Chinese solar PV trajectory: From learning from exporting over domestic strengthening to market and technological global leadership

- China Solar PV industry started exporting solar panels made with imported technology, so learning from export.
- After a fall in global demand, Chinese companies substituted the international demand with domestic demand thanks to the incentives created by public policy.
- Huge investments in building domestic technological capacity in the whole solar value chain.
- Chinese companies went back to international markets as technological and market leaders.



Key takeaways

- New green windows of opportunities are opened by institutional (policy) changes;
- The seizing of GWOs depends on the country's preconditions and the response patterns of public and private actors;
- There is significant variability in catch up trajectories at the sector and country level;
- Tradability and technological maturity are key in explaining the variability of the catch-up trajectories;
- In mature sectors such as biomass or solar PV, readily available technologies can provide a relatively fast track to the boosting of economic activities.
- Less mature technologies such as green hydrogen, CSP, or EVs are more demanding in terms of new technological capabilities and require significant investments in R&D and innovation system development.

Policy implications

Benefitting from GWOs is a sequential and dynamic process comprising two steps:

- 1. Open and augment GWO**
- 2. Assess, address and sustain the relevant sectoral systems to seize GWOs**



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Open and augment GWOs

- Combine relevant policy instruments and calibrate the policy design for the different objectives and features of the local context (i.e., feed-in-tariffs vs auction and tendering systems).
- Support policy interventions with external contributions.
- Invest in demonstration programs.



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Assess, address and sustain sectoral systems

- Align environmental and energy, STI and industrial policies.
- Access external knowledge.
- Invest in domestic R&D.
- Build domestic capabilities along the value chain.
- Invest in human capital.
- Get involved in international collaboration projects.



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Final message

International organizations, like the UN, have a key role to sustain institutional change-led, mission-oriented GWOs, facilitating the entry into the global market of new champions in the green economy and expanding the diversity of green pathways.



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