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# Green Windows of Opportunity for Latecomer Development?

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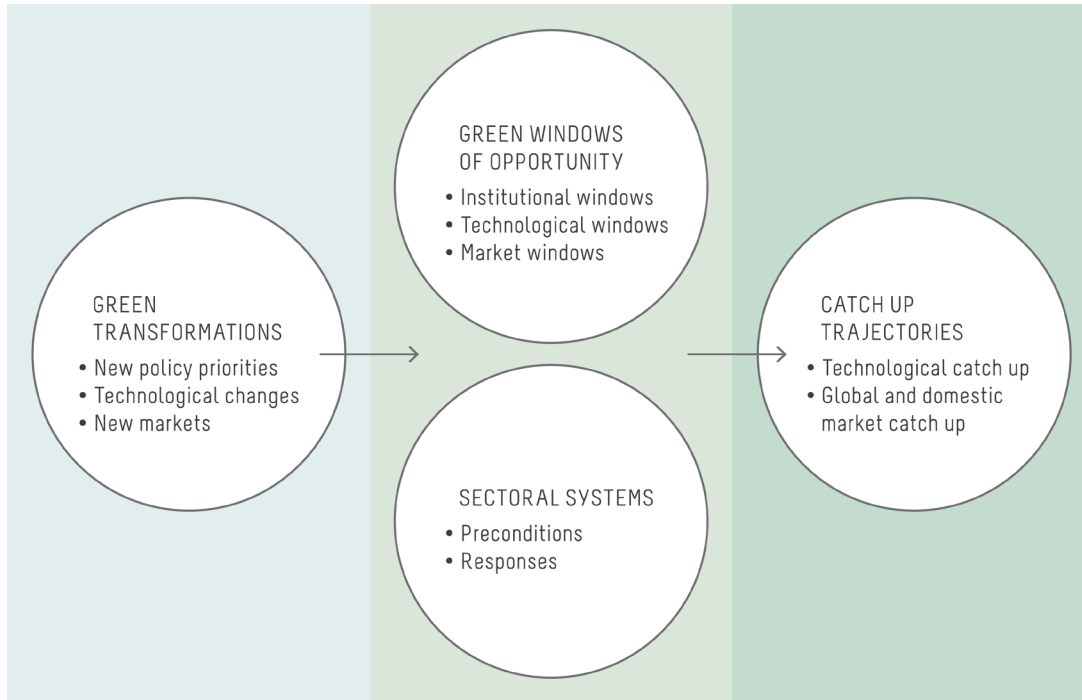
# A new framework for seizing GWOs in latecomer countries

- Other frameworks for the analysis of low-carbon technologies are mainly concerned with the development and deployment of such technologies, not with their economic co-benefits (industrial 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



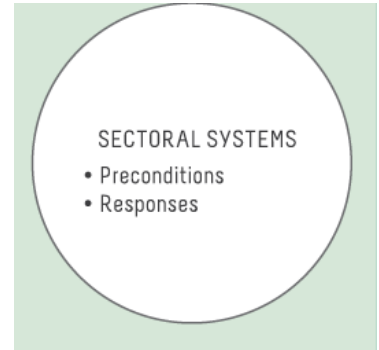
# Green windows of opportunity

- GWO are mainly *endogenous*, created by governments and influenced by *domestic and global* environmental and energy 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

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

# Scenario 1: Effective GWO seizing

## Example: Renewables in China

- **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:**
  - 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.

## Scenario 2: Missed opportunity

### Examples: Solar in India and Biogas in Bangladesh

- **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:** A portfolio of R&D investments in biogas energy projects was not complemented with the strengthening of the production system
  - No appropriate incentives to encourage biogas plant installations (subsidies).
  - Very little has been done to increase awareness among farmers about the potential of correct waste management

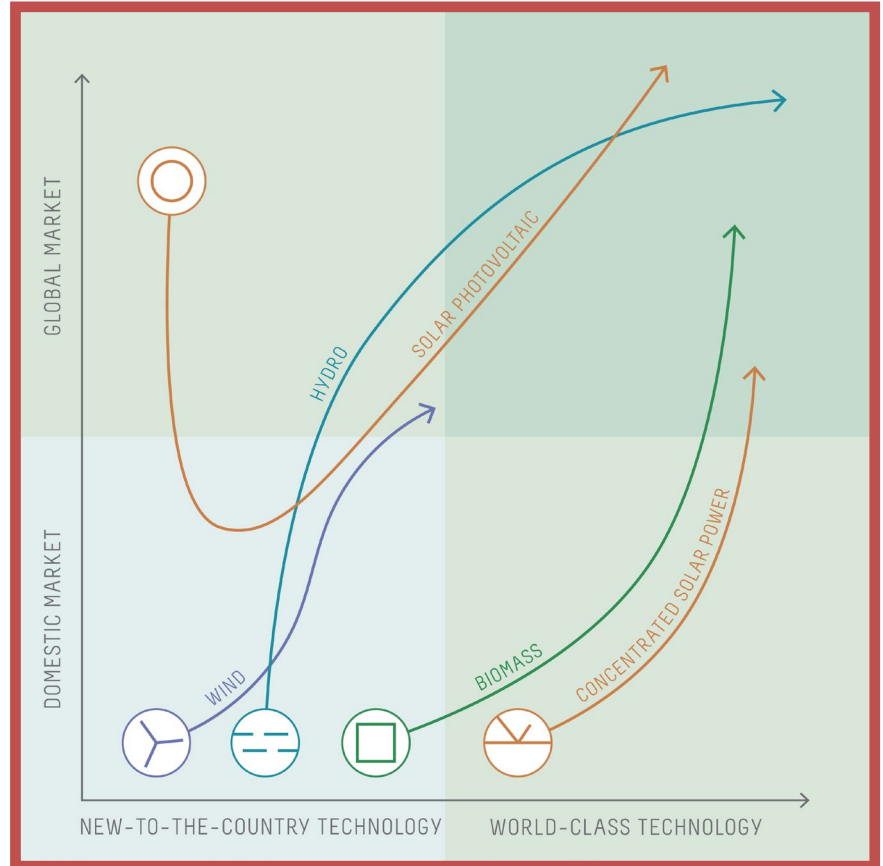
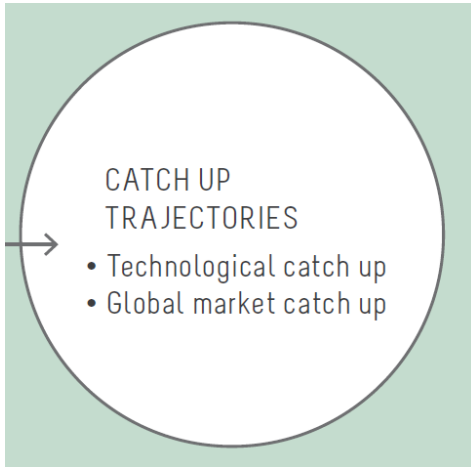


## Scenario 3: Active approach

### Example: Biogas in Thailand

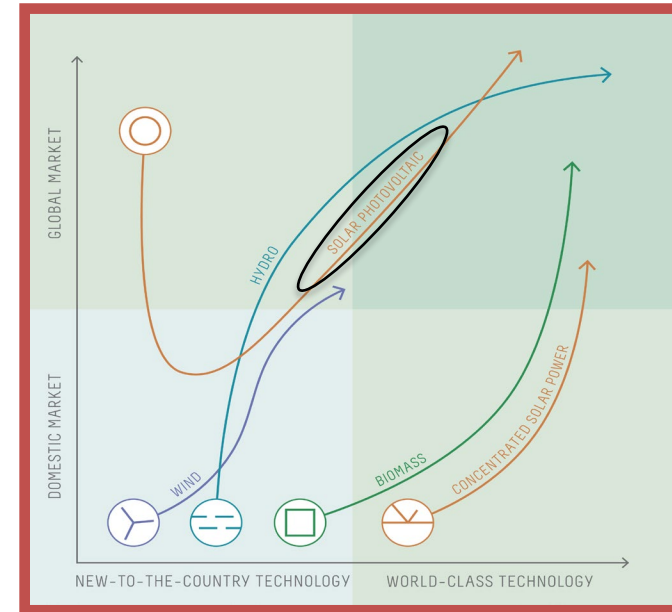
- **Preconditions:** Limited initial experience, absence of domestic firms and fragmentation of actors
  - Factories (e.g of casava starch) were not interested to invest in biogas production due to high investment costs
  - Pilot projects supplied by foreign firms (no domestic suppliers in the 1990s/2000s)
- **Responses:** 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.

# Sectoral trajectories – catching up / industrial development



# 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 typically opened by institutional (policy) changes
- The seizing of GWOs depends on the country's preconditions and the response patterns of public and private actors – green sectors are specific
- 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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 SHUKURIA MERASTAWHY SANCO MAAKE ATTO ANBIA WABEEJA MAITEKA  
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