



# Green Windows of Opportunity: Catching Up in Latecomer Countries

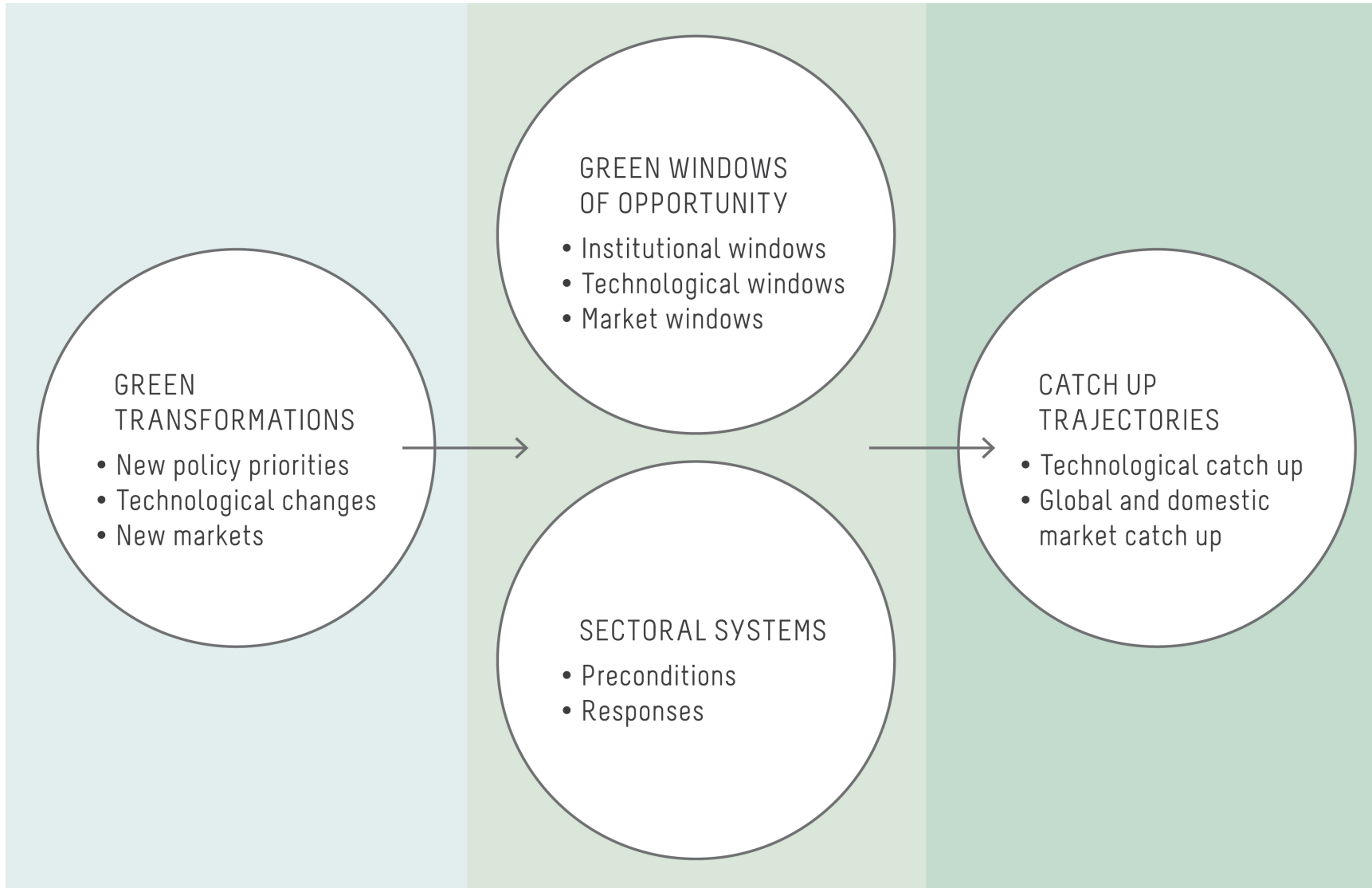
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# A new framework for seizing GWOs in latecomer countries

- Existing frameworks for the analysis of low-carbon technologies in latecomer countries predominantly emphasize the adoption and deployment of green technologies, overlooking their significant potential to catalyze industrial and technological development.
- To fully harness the potential of the green transition, access to technologies and know-how alone is insufficient.
- Latecomer countries must adopt a distinct approach from the outset, rather than simply attempting to catch up by following 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

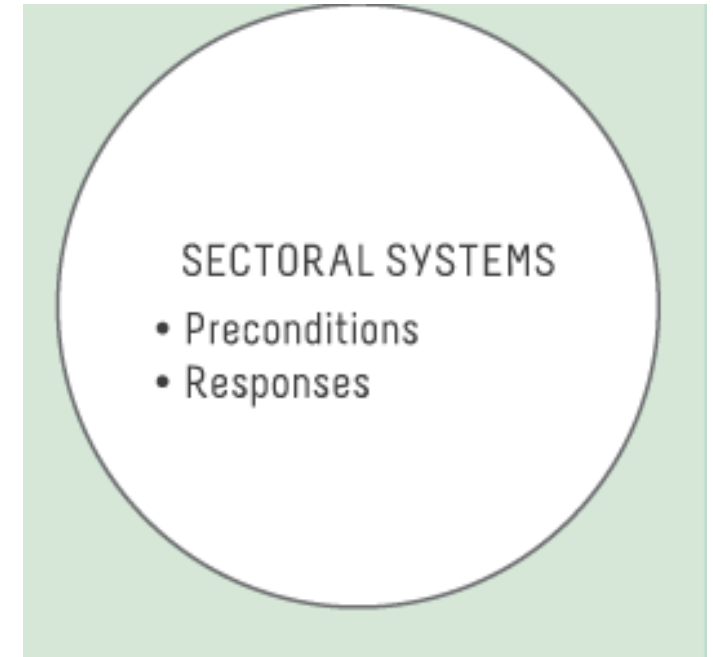
# Green windows of opportunity

- In green sectors, there are remarkable local, national, and international endeavors to foster the development and widespread adoption of innovative technologies, driven by mounting environmental concerns and negative externalities.
- GWO are mainly endogenous, created by governments and influenced by *national 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 & responses

- The ability to take advantage of GWOs in developing countries differs across green technologies and countries.
- To investigate and understand how they differ, we focus on the two components of the sectoral system:
  - the preconditions to take advantage of the opportunity
  - the strategic responses of public and private actors for seizing the GWOs
- Responses to GWOs differ depending on technological maturity and tradability.



# Seizing GWOs: four scenarios

Combining different levels of existing preconditions and responses we propose four different possible scenarios

Four green window scenarios

Responses \ Preconditions	Strong	Weak
<b>Strong</b>	<b>Scenario 1: Windows open</b> Solar PV, Biomass, CSP – China Bioethanol – Brazil Hydrogen – Chile (potentially)	<b>Scenario 2: Windows to be open</b> Solar PV – India Biogas – Bangladesh CSP – Morocco Wind – China
<b>Weak</b>	<b>Scenario 3: Windows within reach</b> Biomass – Thailand and Viet Nam Hydrogen – Namibia	<b>Scenario 4: Windows in the distance</b> Wind – Kenya Bioenergy – Mexico and Pakistan

# The wind sector

Responses Preconditions	Strong	Weak
Strong	<b>Windows open</b> China (2010)	<b>Windows to be open</b> China (2020) India
Weak	<b>Windows within reach</b> Ethiopia	<b>Windows in the distance</b> Kenya

## China

### Windows to be open

- Active industrial policy
- Active approach by firm: licensing, co-design, firms 'acquisitions;
- Catching up close to frontier in 2010;
- Now falling behind in post-turbine, hybrid technology due to insufficient IS response.

## Ethiopia

### Windows within reach

- Wind part of energy policy and planning;
- Active role in designing wind projects to guarantee maximum local learning;
- Still limited industrial outcome but local learning secured.



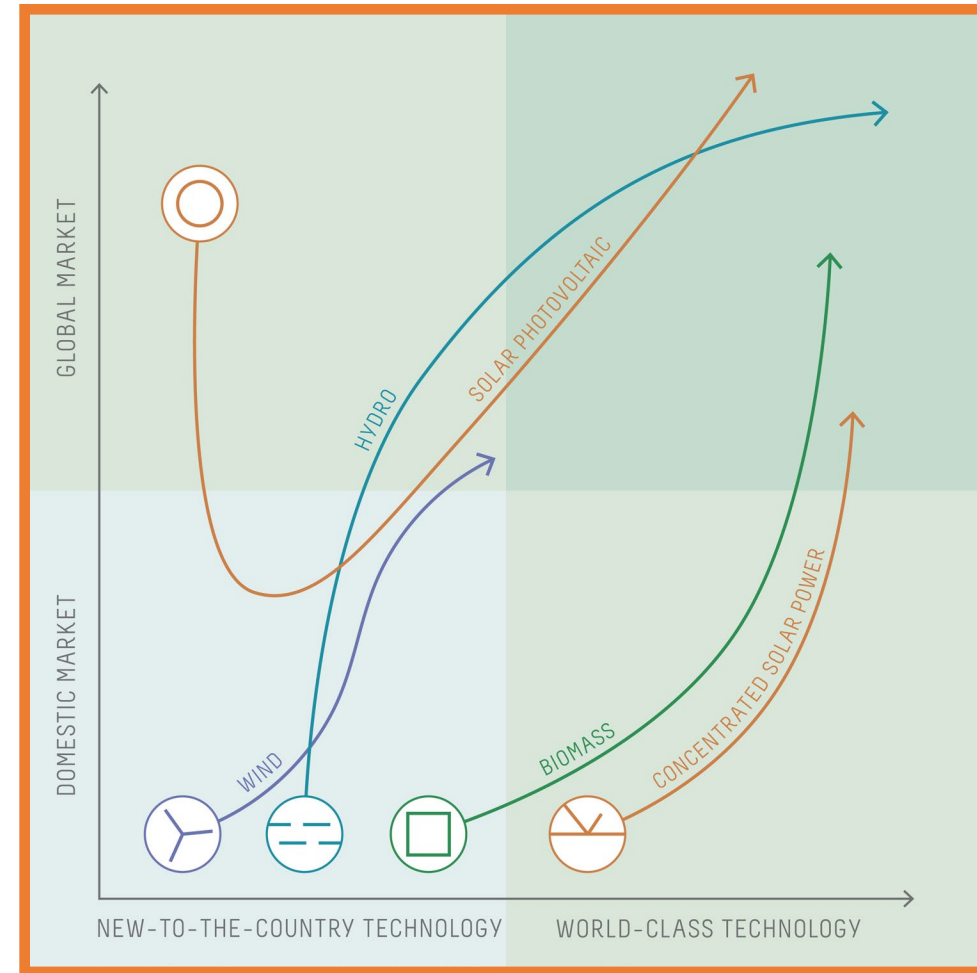
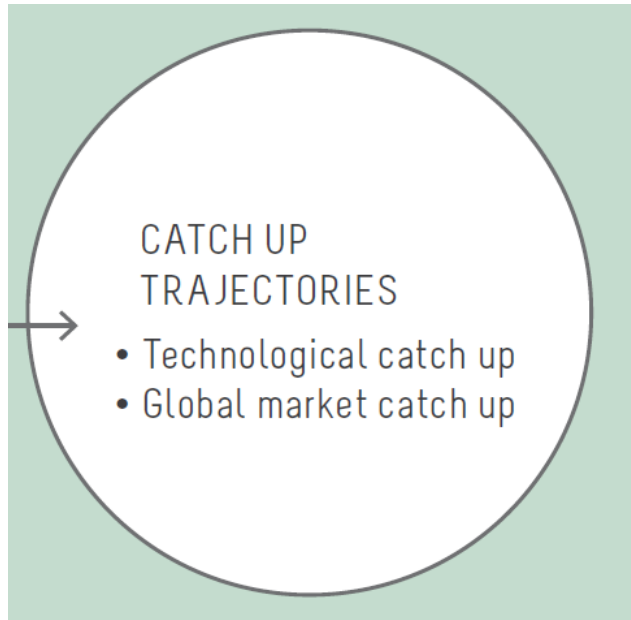
## Kenya

### Windows in the distance

- Driven largely by external funds and support;
- Ad-hoc project approval with no industrial conditionalities attached;
- Virtually zero local content and learning;
- Small number of local jobs in O&M.



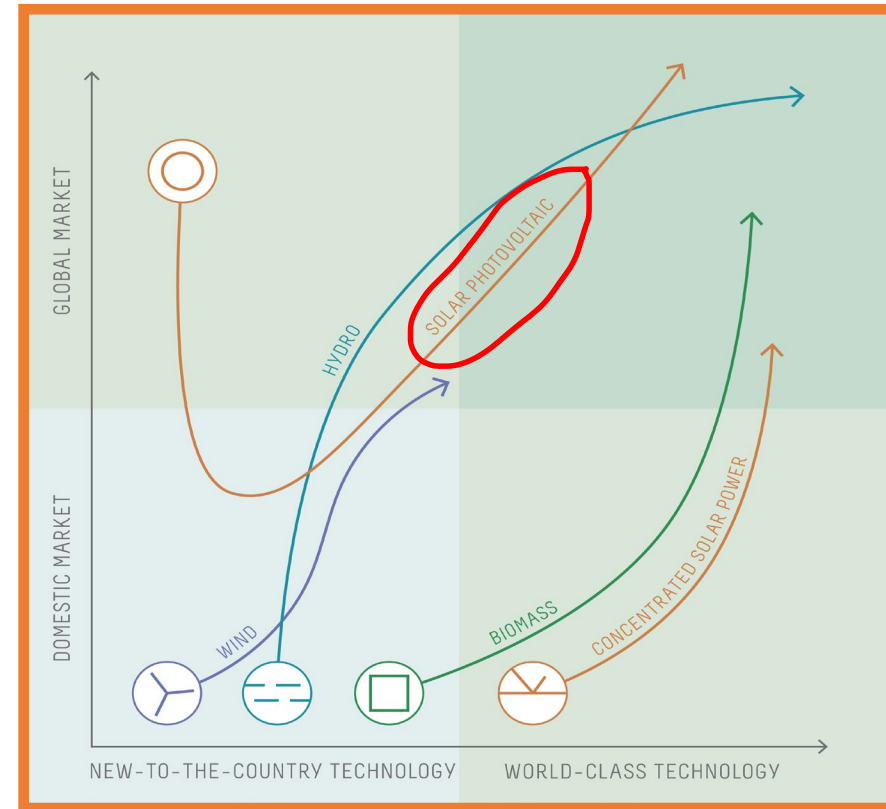
# Catch-up trajectories



# An example: The Chinese Solar PV Industry

From learning from exporting to domestic strengthening and then to global leadership

- ❖ Learning from export started in the global market exporting solar panels made with imported technology
- ❖ Substitution of international demand with domestic demand, after a fall in the global market, thanks to the incentives created by public policy
- ❖ Huge investments in building domestic technological capacity and the whole solar value chain
- ❖ 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, which are sector-specific
- 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, boosting 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.

Africa has the highest technical potential for renewable energy.

What is required to seize GWOs is strong political will to enact timely innovation, and industrial and energy policies to catch the green technological revolution early.

