

GREEN HYDROGEN INTERNATIONAL MARKET: BARRIERS AND PROSPECTS FOR SOUTH AND SOUTHEAST ASIA

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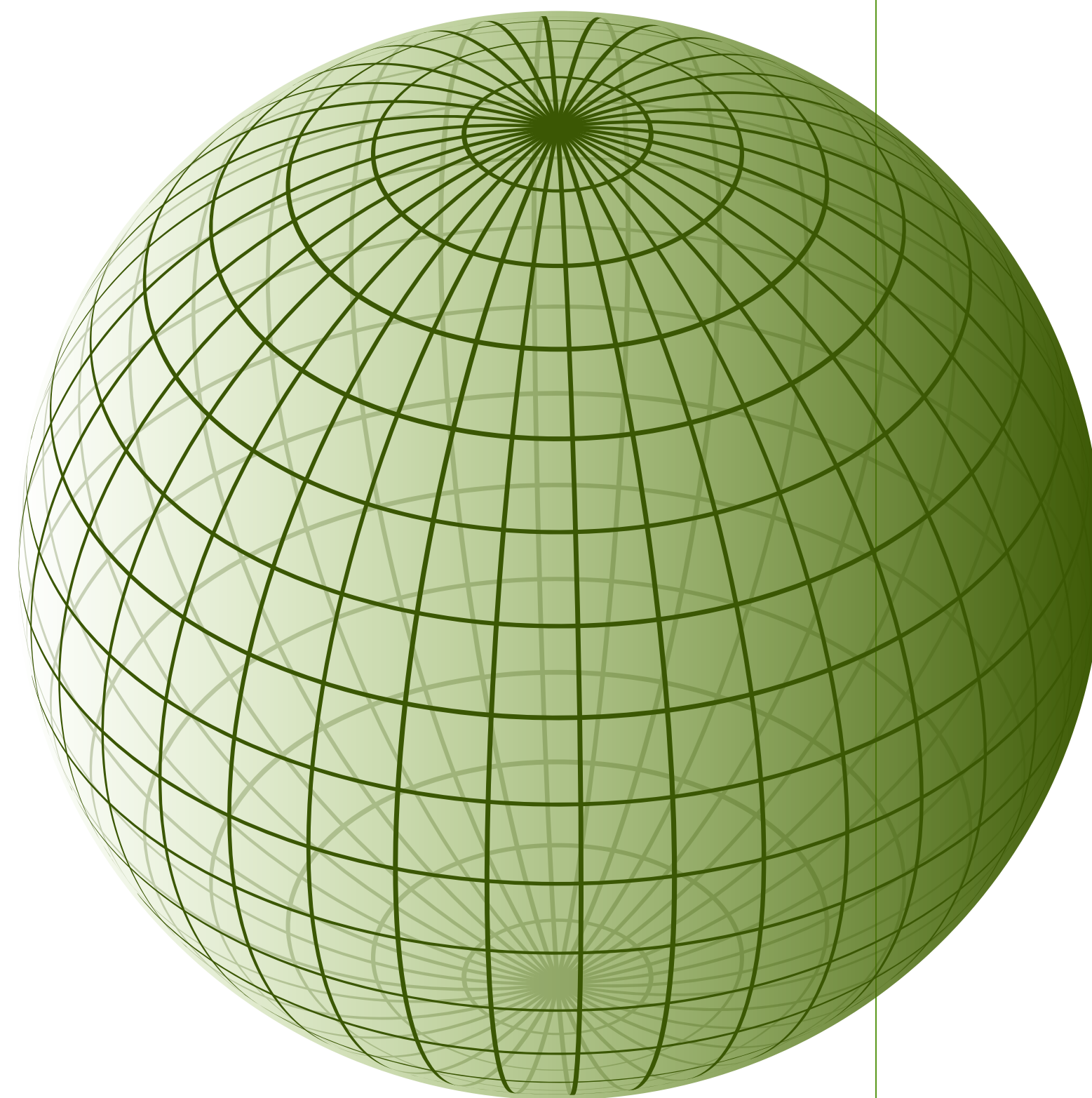
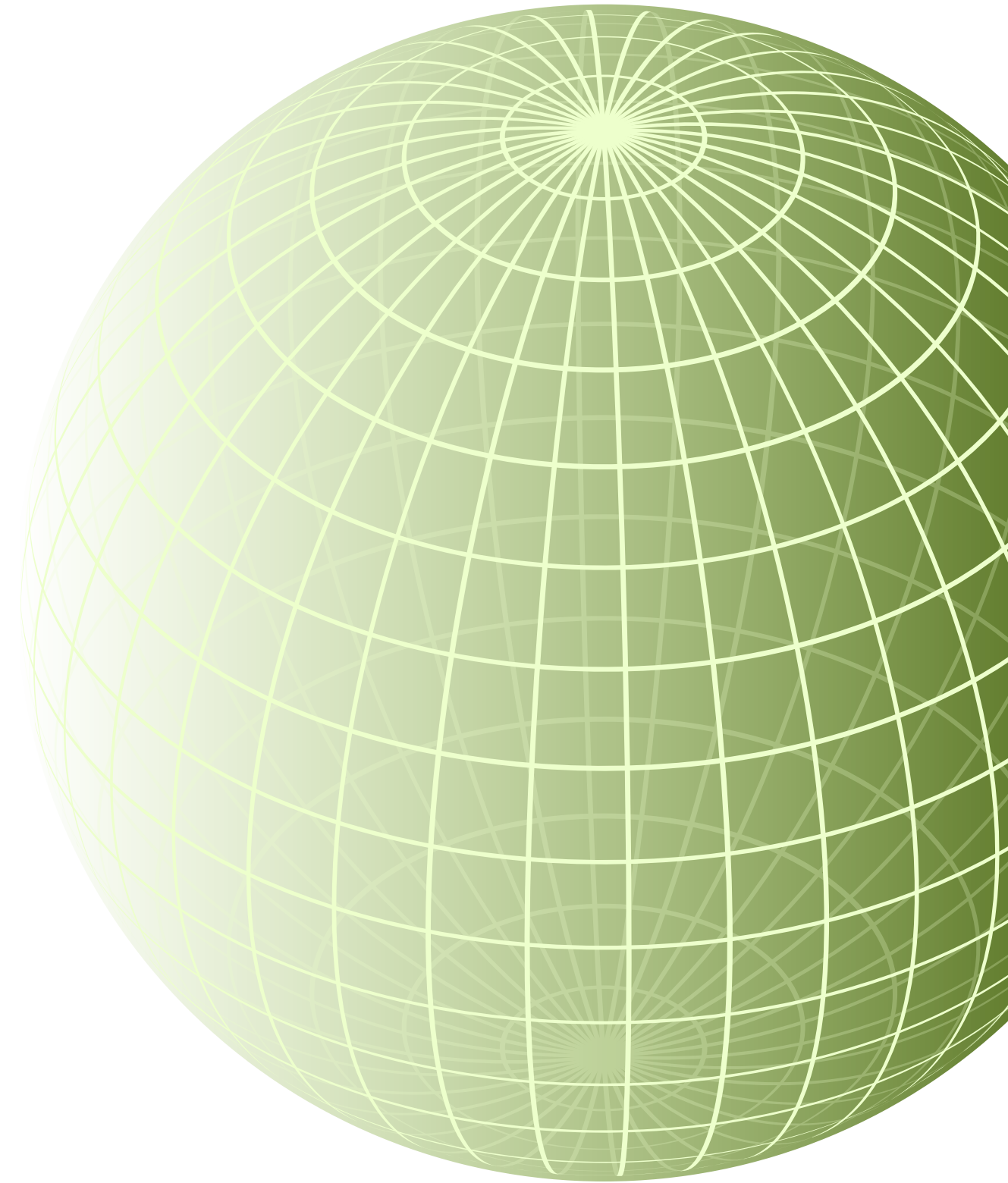




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MOTIVATION

BACKGROUND

- Green hydrogen is key to achieve decarbonisation goals given its high energy intensity and capacity of being stored, which render it suitable for the transport and heavy industry sector.
- Countries which currently have green hydrogen roadmaps recognize their incapacity to meet domestic demand through national hydrogen production, giving rise to the discussion of green hydrogen trade and international market
- IRENA estimates that in 2050 over 30% of hydrogen will be traded across borders, a figure higher than the current trading of natural gas (IRENA, 2022).
- Countries in south and southeast Asia are largely excluded from the discussion of green hydrogen international market given the lack of policy

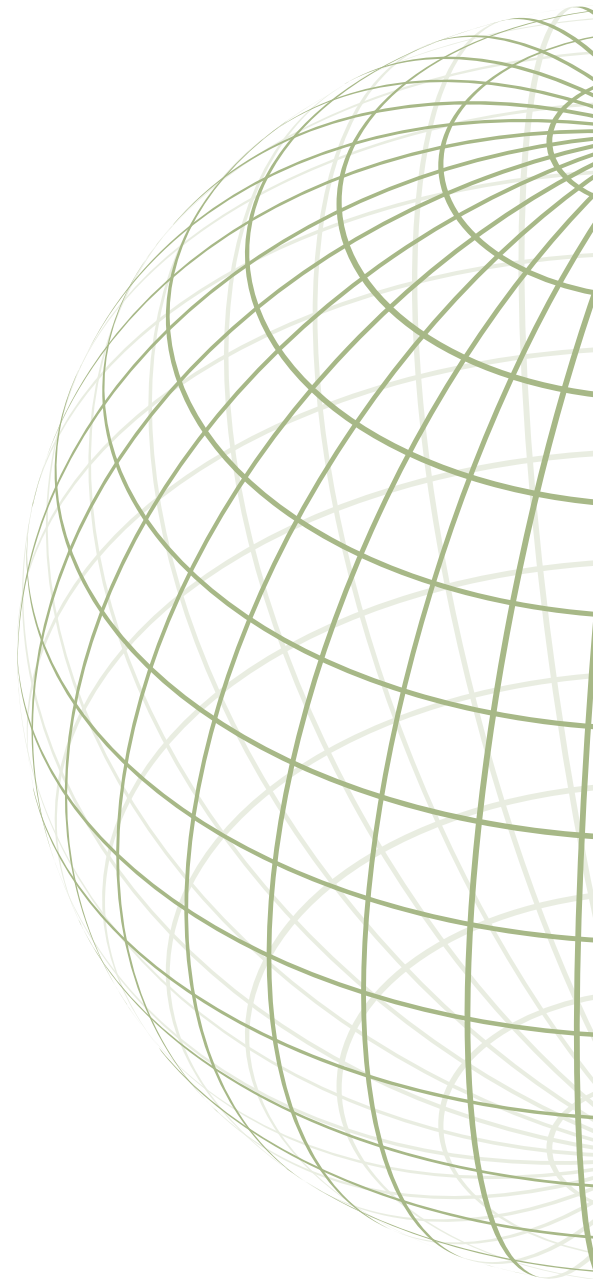
CONTRIBUTION

This chapter argues that countries in south and southeast Asia have prospects to profit from the international green hydrogen market given their renewable energy capacity, their export of materials and components, and the possibility to produce innovation still needed to reduce the costs of green hydrogen production. Because of these reasons, the chapter discusses barriers countries in the region must overcome in order to enter the market, contributing to the discussion of green hydrogen market at large by providing a set of key policy pre-requisites necessary for countries to enter the market.

WHAT ARE THE PROSPECTS FOR COUNTRIES IN SOUTH AND SOUTHEAST ASIA IN ENTERING THE GREEN HYDROGEN MARKET?

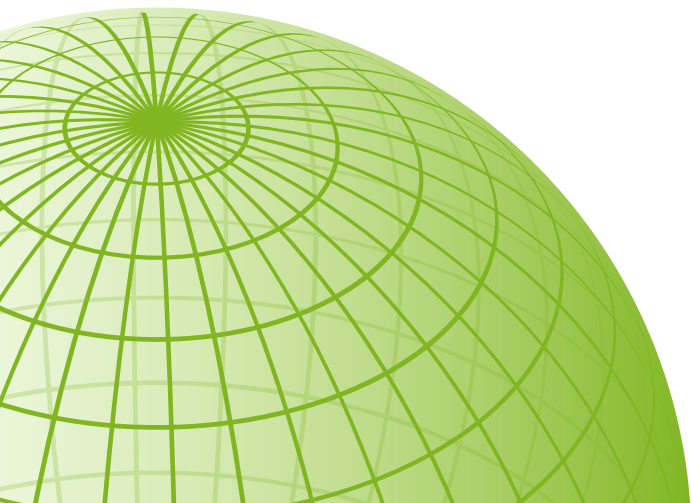
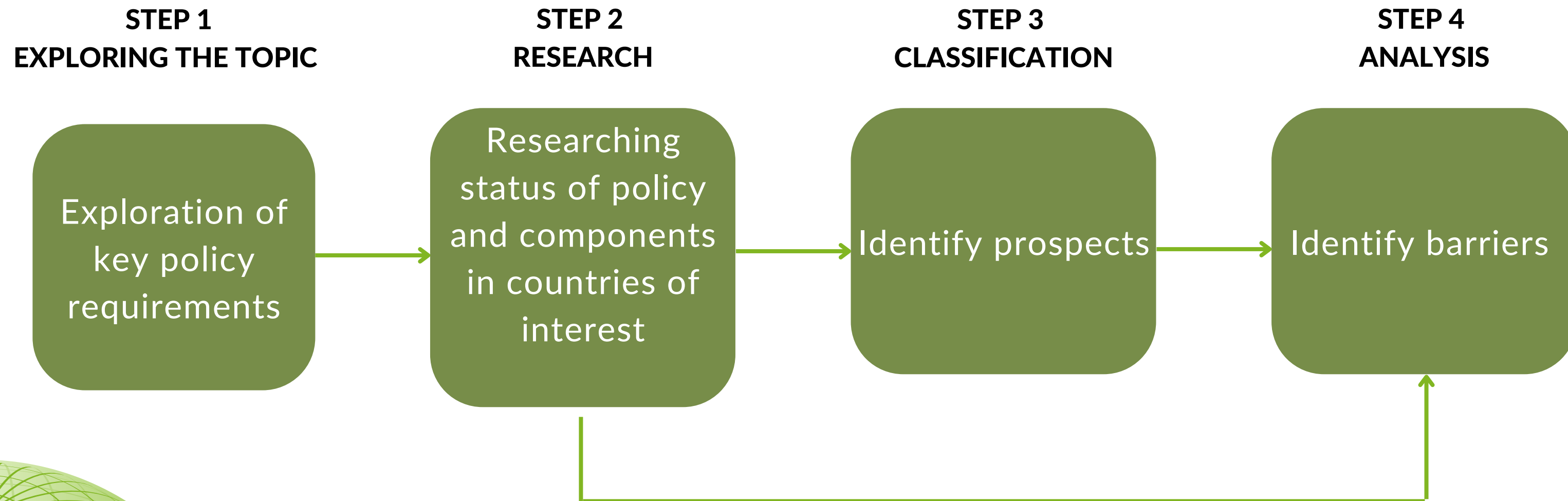


WHAT BARRIERS MUST COUNTRIES IN SOUTH AND SOUTHEAST ASIA OVERCOME IN ORDER TO PROFIT FROM THE INTERNATIONAL GREEN HYDROGEN MARKET?



CONCEPTUAL FRAMEWORK

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STEP 1: KEY POLICY REQUIREMENT

004

OF PRODUCTION

- Framework of reference: Rep. of Korea, Japan, People's Republic of China
- Key policy features observed:
 - Demand projections
 - Production
 - Infrastructure
 - Utilization

OF EXPORT

- Framework of reference: cellphone global supply chain and IRENA geopolitics shift
- 3 groups of activities identified :
 - Research and patent development
 - Materials
 - Manufacturing of components
- Transportation strategy

STEP 2: STATUS OF POLICY

005

GREEN HYDROGEN

- India is the only country in the analyzed ones having a green hydrogen, but the policy is incomplete (lacking demand forecasting and end sector utilization discussion)
- Malaysia invested in hydrogen research at the beginning of the millennium
- Brunei Darussalam

RENEWABLE ENERGY

- India and the Philippines have complete hydrogen policies. India in particular has sufficient energy supply forecasted for 2050 to sustain hydrogen production.
- Other countries in the region have incomplete plans or are underachieving as their plans predict less than 40% of RE energy in the energy mix in 2050

R&D

- R&D investment is inversely correlated to a country's GDP
- In the case of India, it is estimated the country should invest 7% of GDP into hydrogen R&D
- Low manufacturing costs in the countries can attract joint R&D development - e.g. PRC and EU firms
 - Possibilities for local cooperation amongst South Asian Association for Regional Cooperation (SAARC) countries

STEP 3-4: CLASSIFICATION & ANALYSIS

EXPORT OF GREEN HYDROGEN

- The region lacks sufficient plans for production of green hydrogen
- The region lacks transport capacity

EXPORT OF COMPONENTS

- Exports of iridium (for PEM electrolyzer) and nickel (for alkaline electrolyzer)
- Electronics manufacturing (for balance of plants components)

EXPORT OF INTELLECTUAL PROPERTY (PATENTS)

- Lack of strong IP protection laws might discourage investors to undergo joint R&D research in these countries
- High cost of obtaining patent protection abroad and negative impacts of legislation strengthening on economic growth might render this an unviable avenue

RESULTS

PROSPECTS	BARRIERS	COUNTRIES
Production of hydrogen	Lack of green hydrogen policy/ complete hydrogen policy	All countries in the region
Production of hydrogen	Lack of renewable energy capacity expected by 2050 necessary to produce hydrogen at a competitive price	Malaysia, Thailand, Viet Nam, Brunei Darussalam
Export of hydrogen (market expected to to generate US\$300 billion by 2050)	Lack of transportation infrastructure: <ul style="list-style-type: none"> • Only 16% of the world's pipelines cross the Asia-Pacific region (Hussein, 2021). • Pilot projects required to establish feasibility of ship transportation (NH3 cheapest option) 	All countries in the region
Export of electrolyzers' stack	Lack of established expected global demand might discourage countries to invest in production of electroayzers -> countries likely to continue export of minerals rather than production	Malaysia, Indonesia, Philippines
Export of electrolyzers' balance of plant		Viet Nam, Malaysia, Thailand, Philippines
Export of Intellectual property	<ul style="list-style-type: none"> • Lack of R&D research • Lack of strong patent protection 	All countries in the region

LIMITATIONS

CONSIDERATION OF QUANTITATIVE VARIABLES

- The chapter draws conclusions and results on the basis of current GDP and investment or predicted investment but does not account for expected GDP in 2050. Changes in GDP would impact R&D investment and patent law, therefore impact export of intellectual property capacity.
- The study does not account for WACC (weigheted average cost of capital), as it is not expected to impact export capacity of the countries analyzed, but it has been identified as a factor impacting export capacity for other countries so it warrants mention.

CONSIDERATION OF PROJECTED TECHNOLOGY TRANSFER

- If hydrogen production and transportation is optimized in the short term by hydrogen leading countries, it would reduce capacity for export of intellectual property, but can increase export opportunity if technology transfer is efficient between leading hydrogen countries and analyzed countries
- This would require a different set of policies for the countries analyzed facilitating technology transfer. However, the discussion regarding lack of RE policy making the cost of production of hydrogen higher and lack of a complete policy for green hydrogen remain applicable.
- The lack of a certain outlook on the green hydrogen international market also makes it difficult to ascertain timelines and reccommend specific roadmaps

FURTHER RESEARCH QUESTIONS

WHAT POLICY-PREREQUISITES ARE REQUIRED AT THE NATIONAL LEVEL TO ENACT SHORT-TERM ACTIONS TO OVERCOME BARRIERS?

WHAT IS THE TIMELINE OF THE GREEN HYDROGEN INTERNATIONAL MARKET DEVELOPMENT? --> AT WHAT TIME WILL IT BECOME MORE PROFITABLE FOR COUNTRIES IN THE REGION TO EXPORT BOP AND ELECTROLYZERS THAN MATERIALS FOR IT?

WHAT POLICIES CAN LEADING GREEN HYDROGEN COUNTRIES ENACT TO INCLUDE SOUTH AND SOUTHEAST ASIAN COUNTRIES IN THE GLOBAL SUPPLY CHAIN?



THANK YOU!

