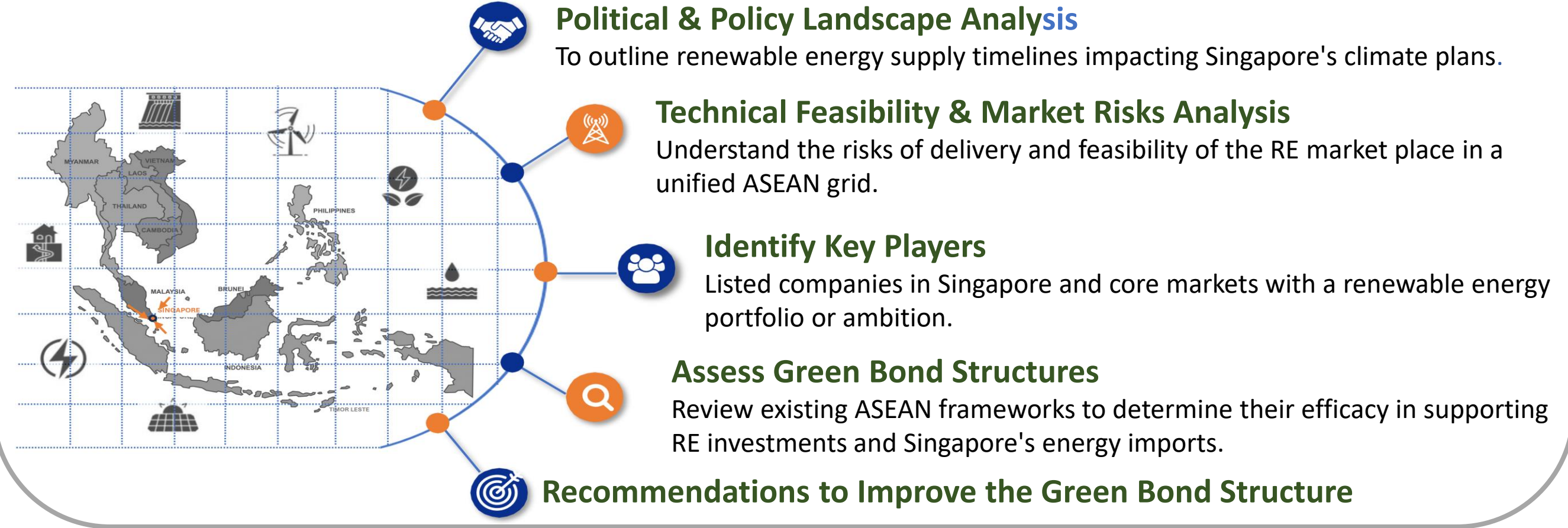


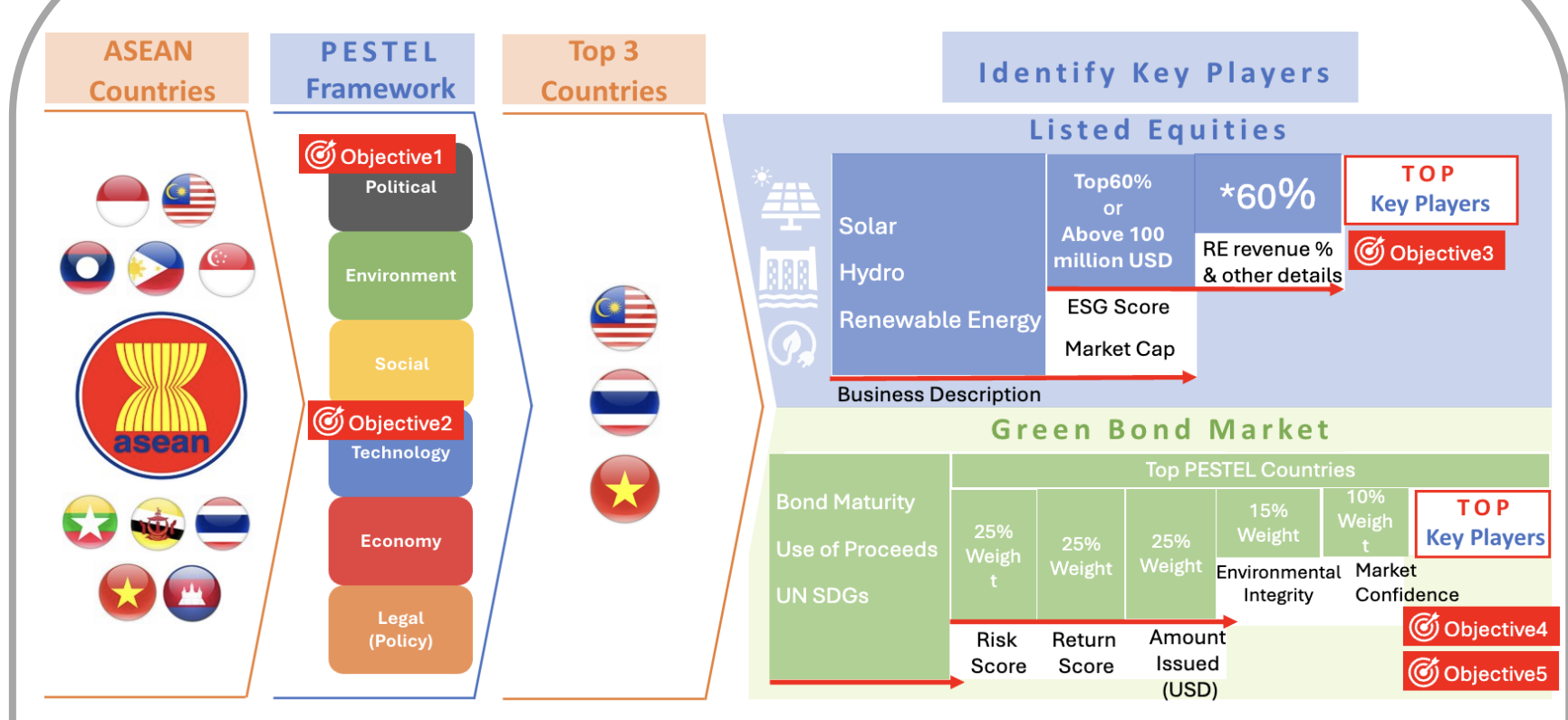
Academic Advisor: Dr. David Broadstock *Team Members:* Long Wenjing, Roopa Nair, Yizi Liang, Zhou Hui

Project Introduction

Due to its limited land and geographical constraints, Singapore's domestic renewable energy production will remain constrained. Importing green energy is thus strategically crucial for meeting its 2030 and 2050 climate targets. The project focuses on leveraging ASEAN's renewable energy market to address Singapore's pressing need for sustainable power sources and the role of capital markets to facilitate this.



Methodology



The PESTEL approach analyzed nine ASEAN countries, excluding Singapore. Based on the PESTEL Framework Analysis, rankings of ASEAN countries were obtained, and key equity players were identified through several filtering methods. To determine the key players in bonds, 399 green bonds in ASEAN were put through the filtering process.

PESTEL Analysis Objective 1 & 2

To ensure comparability among indicators, Normalization Method was employed for scoring. By collecting data from multiple sources, we normalized the raw data to a scale of 0 to 10 using Excel functions, subsequently analyzing and ranking it based on these results. Higher values corresponded to higher ranks. The Inversed Normalization Method was also used, where lower values were prioritized for higher ranks. For data that could not be directly normalized, we applied specialized scoring methods to transform it into analyzable data, known as the Flagged Method. The Individual PESTEL pillar indicator model is shown on the left.

Political Indicators

Indicators	Indicators in Details
National Commitments	NDCs rating
	Future Ambitions
Foreign Relations	Fuel Import
	Trade Balance
	Trade Complementarity Index
National Governance Index (WGI)	Voice and Accountability
	Political Stability & Absence of Violence
	Government Effectiveness
	Regulatory Quality
	Rule of Law
	Control of Corruption

Economic Indicators

Indicator
GDP per Capita at PPP (USD)
Economic Growth
Total Unemployment
Total Energy Consumption per Capita (KWh per capita)
Total renewable Energy Consumption per Capita (KWh per capita)
% of Fuel as a part of Total Export
% of Fuel as a part of Total Import
No of Green Bonds available
Green bonds as a % of Total ASEAN Green Bond Market

Social Indicators

Indicators	Indicators in Details
Potential for Positive Effects Brought by Renewable Energy	Mortality rate attributed to household and ambient air pollution age-standardized (per 100,000 population)
	PM2.5 air pollution, mean annual exposure (micrograms per cubic meter)
Education & Human Capital	Population living in areas where elevation is below 5 meters (% of total population)
	Jobs in RE as share of total industrial workforce (%)
	Quality of education
	Availability of skilled workforce (mid and high level skills)

Overall Ranking

Country	Overall Rank
Malaysia	1
Thailand	2
Viet Nam	3
Indonesia	4
Philippines	5
Lao PDR	6
Cambodia	7
Brunei Darussalam	8
Myanmar	9

Technology Indicators

Indicator	Indicators in detail
Existing Technologies	Renewable Energy Patents
	Comparative advantage in low carbon technologies
Security of Technological Systems	Flexibility in electricity system
	System Average Interruption Duration Index
	System Average Interruption Frequency Index
Infrastructure Readiness of Technological Systems	Electric power T&D losses (% of power generation)
	Renewable capacity buildout score
	Quality of transportation infrastructure
	Digital infrastructure readiness
Innovation and Development	Innovative business environment
	Development of environmental technologies (% of all technologies)
	Public investment in research and development, (% of GDP)
	Public investment in energy related technologies

Environmental Indicators

Indicators	Indicators in Details
Air	Average PM2.5 Concentration (µg/m ³)
	Water Quality
Water	Water Sustainability
	Water Capacity
Land	Arable Land (% of land area)
	Arable Land (hectares per person)
	Population Density (people per sq. km of land area)
Natural Disasters	Frequency (the number of natural disasters)
	Intensity
	Respond Capacity

Legal Indicators

Indicators	Indicators in Details
International Cooperation: FDI in Renewable energy Projects	Investment Incentives
	Feed-IN Tariff (FIT)
Existing Contracts	PPP/PPA
	Land Acquisition
Fiscal Incentives	Interconnection Existing Projects
	Interconnection Future Projects
Carbon Pricing Status	Tax Incentives
	Public investment/loans/grants/subsidies/rebates
Policy Environment	Investment or Production Tax Credits
	Law of Act in Carbon Pricing
	Carbon Tax
	Emission Trading System
	Carbon Credit
	Stability of Policy

By summing up the ranks across all pillars, the lowest total number indicates the highest overall rank in each country. The top 3 countries in our PESTEL Analysis are Malaysia, Thailand and Vietnam, which became our focus when further analyzed key RE market players.

Key Players Identification Objective 3

Equity

Malaysia

- Mega First Corporation Bhd
- YTL Power International Berhad
- Taliworks Corporation Bhd
- Tenaga Nasional Bhd

Thailand

- CK Power PCL
- Gunkul Engineering PCL
- BCPG PCL

Vietnam

- Power Generation JSC
- Vinh Son Song Hinh Hydropower
- Ha Do Group JSC
- PC1 Group JSC

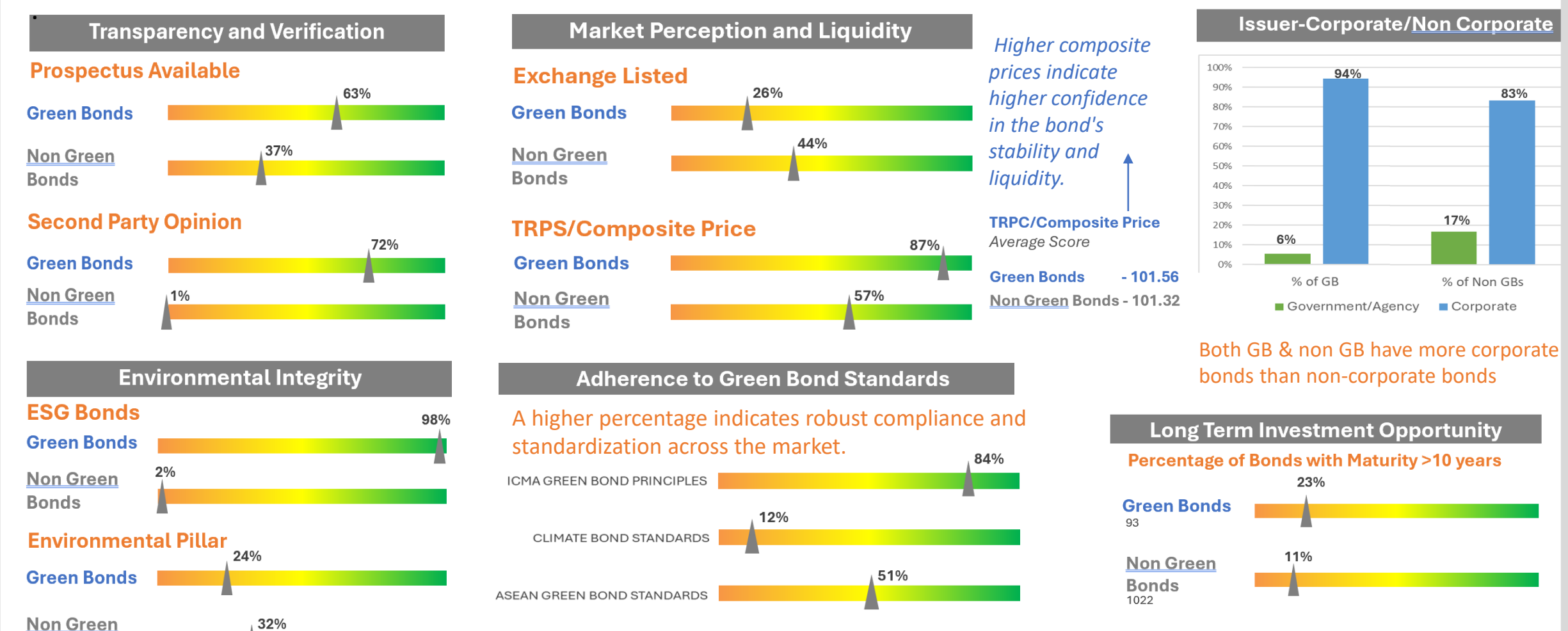
ASEAN Green Bond Market Objective 4

An analysis of the ASEAN bond market reveals that **Green Bonds (GB) constitute only 3.4% of total issuances**, highlighting a significant opportunity for expansion in sustainable investment within the region.

Bonds	Issued By	No of Bonds	Amount Invested (Billion USD)
Total Bond Market in ASEAN	Corporate	9794	\$443.29
	Non corporate	2064	\$1,810.50
Green Bonds	Corporate	377	\$9.26
	Non corporate	22	\$15.40

Adequacy of Green Bond Structures

Proportion of bonds that meet specific assessment criterion (given below) relative to the total number of bonds in each category; 399 for green and 9,715 for non-green were analyzed.



Green Bonds (399 nos)

- 1 **Bond Maturity**
Select Green bonds with maturity > 5 years (Green Bonds >01.08.2029)
- 2 **Use of Proceeds**
Select Green bonds that are related to Renewable energy sector
- 3 **Alignment with UN Sustainable Development Goals**
Select GBs aligned with UN SDG Goal 7 (Affordable and Clean Energy) and Goal 11 (Sustainable Cities and Communities)
- 4 **Top Countries from PESTEL Analysis - Singapore, Malaysia, Thailand**
Focus on countries with advanced green finance infrastructure
- 5 **Issuance Volume**
Select Green bonds with issuance volume more than 10 million USD.
- 6 **Scoring system**
Risk, Return, Issuance Volume - 25% weightage
Environmental Integrity (15% weightage), Market confidence (10% weightage)

A total no of 71 green bond projects investment opportunities were identified in ASEAN with 13 in Singapore, 36 in Malaysia and 20 in Thailand.

Recommendations Objective 5

To enhance the ASEAN green bond sector, it is crucial to focus on countries with advanced green finance infrastructure, such as Singapore, Malaysia, and Thailand, while also supporting emerging markets with strong sustainability plans. Aligning green bonds with international standards from ICMA and CBI will boost credibility and global competitiveness. Strengthening the ASEAN Green Bond Standards with stricter ESG criteria, integrating ESG performance targets into bond yields, and requiring detailed environmental impact reports with independent third-party verification will prevent greenwashing and ensure genuine sustainability. Implementing supportive policies like tax benefits, grants for certification, and reduced regulatory barriers will encourage issuance, and introducing credit enhancements will attract conservative investors. Listing green bonds on exchanges will improve liquidity and global accessibility. These strategic interventions will position ASEAN as a leader in global green finance and sustainable development.