

Topic and Research Question

The World Energy Council defines an energy trilemma by the core dimensions 'energy security, energy equity, and environmental sustainability'. Energy equity also includes energy accessibility and affordability. The resulting trilemma contains "(...) complex interwoven links between public and private actors, governments and regulators, economic and social factors, national resources, environmental concerns, and individual consumer behaviors" (World Energy Council 2018: 9). Countries have varying approaches concerning energy security due to individual economic preconditions, political systems and environmental situations. The trilemma concept implies that a change in one dimension impacts the remaining two, leading to a need of a balanced triangle.

China, Japan and South Korea dramatically struggle to balance the trilemma aspects in line with economic development and soaring energy demand. The energy-intensive economic development of the region led to accelerating energy demand. This was further fostered by industrialization and on-going urbanization. The three countries account for one third of the global energy consumption. As a result, the three countries suffer from depleting energy resources and ecological degradation.

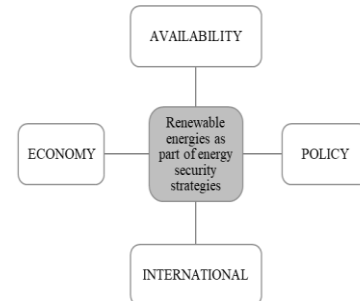
These factors make a decarbonization of the energy supply mix attractive. To ensure decarbonized energy supply, enhancing the share of renewable energies (RE) is the most suitable low-risk option. REs gain importance in the debate of energy security. Certainly, the ability of renewables in order to produce clean energy makes them an essential part of low carbon development and climate change strategies. Merging energy security and renewables as subjects of utmost concern to East Asian countries, the research question was: *What are the similarities and differences of renewable energies as part of energy security strategies in China, Japan and South Korea?*

State of the Art

In the literature, there exists no framework comparing REs as part of energy security strategies. The thesis closes this gap.

Energy security is discussed frequently throughout reports and analysis of governments, international organizations and academic publications. Nevertheless, current literature refrains from a consensus on a commonly accepted definition. Derived from a large

number of definition, the author selected four dimensions being essential to address the specific research question. The approaches of Hippel et. al. (2011) and Sovacool (2011) were influential.



Methodology and Approach

Based on the literature review, the author developed an analytical framework covering the four identified dimensions:

Dimension	Indicators	Metric	Interpretation (Preferred)
Availability	Total renewable energy capacity by source	GW	High
	Total renewable energy capacity	GW	High
	Share of renewable energies in total energy generation	%	High
	Diversification	Solar irradiation; Wind density; Geographical distribution	High
Policy	Strategic planning ▪ General Planning ▪ Capacity/production targets (by sector)	Policy Analysis	Existent
	Policy instruments ▪ Regulatory policies ▪ Fiscal incentives and public financing	Policy Analysis	High
International	International Renewable Energy Multilaterals	Membership	High
	Regional Renewable Energy Cooperation Institutions	Membership	High
Economy	Affordability ▪ Levelized costs of electricity of renewable energy ▪ Levelized costs of non-renewable energy	LCOE	Low
	Employment ▪ Renewable energy employment by technology ▪ Total renewable energy employment		High

Source: Author's own compilation

The availability-dimension forms the basis of the scope countries can utilize RE sources in the first place. Key to country strategies are policies to implement and foster a certain strategy. Hence, the policy dimension forms the core part within the framework. The international dimension firstly identifies international institutions dealing specifically with RE cooperation and secondly compares the involvement of the compared countries within the institutions in terms of membership. The economy dimension adds the costs of RE generation and employment opportunities in the renewable energy sector.

Main Facts

China has by far largest renewable energy capacity, followed by Japan and then South Korea. In China, hydro energy capacity makes the largest share. In Japan, hydro energy has the largest share, followed by solar energy and wind energy at great distance. Hydro energy is also leading in South Korea, closely followed by solar energy and bio energy on position three. In terms of the share of renewable energies at the total energy generation, South Korea is leading, closely followed by China, Japan is having the lowest share.

While all three countries have renewable energy policy frameworks, they differ in coverage and shape. Regulatory policies turned out to be central parts of their policy frameworks. Feed-in-Tariffs (FITs) and Renewable Portfolio Standards (RPS) are the most widely used regulatory policies and due to their cost competitiveness, most countries predominantly support RE development via these regulatory mechanisms. While Japan and South Korea implemented one major policy, China decided on a dual-track approach combining the policy choices of Japan and South Korea. China's approach is the most comprehensive one and the level of installed capacity implies relative success in this regard. Nevertheless, RE resources are not located along high energy consuming areas in China. Japan is challenged by high RE generation costs. The installed capacity in Japan also increased but to a less extent than in China. Even though South Korea is under pressure to ease its energy import dependency, the installed capacity growth rates are the lowest. Despite increasing emphasis on renewables, all three nations still highly depend on fossil fuels, as renewables represent a relatively small share of their energy supply.

China is the country holding most memberships in RE cooperation institutions. This is also a reflection of the specific geographical areas, regional institutions focus on. Generally, the institutions-building process covering China, Japan and South Korea is rather in an embryo stadium.

LCOE levels are the lowest in China in five out of six cases. Japan is facing the highest levels. However, RE are not yet cost-competitive with conventional energy electricity generation. In China, the most people are employed in the solar PV industry, followed by Japan and South Korea on the third position. The second largest renewable employment sector is the wind energy sector.

Results

		China	Japan	South Korea	
Availability	Total installed RE capacity in 2017 (GW)	618.803	82.696	10.861	
	RE share of total energy generation (2016)	26.4%	14.7%	27.1%	
Policy	Focus technology in target-setting	Solar	Bio	Solar	
	Key Objective	Raising the share of non-fossil energy of the primary energy consumption matrix to 15% by 2020 (respectively 20% by 2030)	22-24% of Japan's energy need met by renewable sources	Renewable energy deployment rate of 11% by 2035	
	Energy Master Plan	Feed-in Tariff and Renewable Portfolio Standard	Feed-in Tariff	Renewable Portfolio Standard	
	Key Renewable Energy Policy				
International	IEA	+	+	+	
	IEF	+	+	+	
	IPEEC	+	+	+	
	IRENA	+	+	+	
	ACE	+	+	+	
	ECNEA	/	/	+	
	EWG	+	+	+	
	EWP	+	+	+	
	GMS	+	+	+	
	GTT Energy Board	/	/	/	
	Energy Cooperation Task Force	+	+	+	
	SCO Energy Club	+	+	+	
	Economy	Onshore wind		•	○
		Offshore wind	na		•
Solar PV			•	○	
Large hydro			•	○	
Small hydro			•	○	
Biomass			•	•	
Total Renewable Energy Employment		3,955	330	na	

Legend
 + → membership
 / → Observer status or indirect participation
 na → information not available
 • → Lowest average LCOE level
 ○ → Medium average LCOE level
 • → Highest average LCOE level

References

All references can be found in the full version of the MA thesis available at <http://othes.univie.ac.at>

About the Author

Ann-Kathrin Lipponer holds a BA in Governance and Public Policy from the University of Passau, Germany. In the course of her master studies, she spend one semester at Fudan University in Shanghai, China. She gained further work and study experience in Cambodia, Hungary and Switzerland.

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