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Myanmar-India Partnership for Clean and Green Energy

Introduction

Myanmar, located to the South and South East of India's North Eastern Region (NER),[1] shares a land border totaling about 1,643 kms and a maritime boundary of 1,083 kms with India. Of its nine ports, along its coastline of 2,228 kms, *Yangon* is the major international port, handling more than 90 percent of the country's merchandise trade.[2] Strategically, it is the *Kyaukphyu* (*Ma'de* island) deep seaport (DSP) which is of geopolitical and economic significance as it is designed to supply 22 million metric tons (MMT) of crude and about 12 billion cubic meters of natural gas per annum by pipelines across 2500 kms to Kunming in Yunnan province in China, thereby circumventing the Malacca Straits.[3]

Myanmar is rich in natural resources, especially natural gas, hydropower and minerals. Myanmar's potential reserves of crude oil, natural gas, and coal are 15,220 million barrels, 93.698 trillion cubic feet (tcf), and 711 MMT, respectively. Proven oil reserves are estimated at 50 million barrels, and gas reserves at around 10 tcf.[4] Myanmar's hydroelectric potential is pegged at more than 100,000 MW, solar potential is estimated at over 7,700 GW and wind energy resources at 482 GW, makes Myanmar second only to Thailand in renewable energy (RE) capability among ASEAN countries (Table 1).[5]

Green hydrogen (GH) - produced via RE driven electrolysis - has emerged as a crucial enabler for net-zero emission strategies. Myanmar's RE endowments could theoretically yield up to 310 MMTPA of GH,[6] although realistic scenarios suggest an eminently feasible range of 3–5 MMTPA of GH after accounting for topographical, land-use, and logistical constraints, at the lowest Levelised Cost of Hydrogen(LCOH) in the region at only US$ 3.8/kg in the near term. Even such a reduced production scale holds enormous economic value and strategic leverage, given that global energy transitions are increasingly favouring hydrogen-based fuels.

However, internal disturbances and infrastructure challenges have hindered realization of Myanmar's RE and GH potential.

India's NER and Sittwe

India's NER, occupying about 7.9 percent of India's land and hosting approximately 3.75 percent of its population, contributes only 2.75 percent[8] to national GDP. Bordering

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This policy brief by Shri Sujeet Samaddar, Visiting Fellow RIS, follows up on the Policy Brief No 2 of May 2023, authored by Dr Prabir De, Professor, Centre for Maritime Economy and Connectivity (CMEC) at RIS, New Delhi and the subsequent Discussion Paper # 297 (by Shri Sujeet Samaddar, Visiting Fellow RIS). Author is grateful to Professor Sachin Chaturvedi, Director General, RIS and to Dr Prabir De for providing much valued guidance in preparing this Policy Brief. Views are personal. Usual disclaimers apply. E-mail: sujeet.samaddar@ris.org.in

[1] The North Eastern Region of India (NER) comprises the states of Assam, Arunachal Pradesh, Manipur, Meghalaya, Mizoram, Nagaland, Sikkim and Tripura.

[2] Kyaukphyu Deep Sea Port Project, Myanmar Port Authority, Source: https://www.mpa.gov.mm/ports/kyaukphyu-deep-sea-port//#ports

[3] Cooperation Agreement between the Government of the People's Republic of China and the Government of the Union of Myanmar on the Myanmar-China Oil and Gas Pipelines, dated 24 .03. 2009. See also, https://hydrocarbons-technology.com/projects/Myanmar-china pipelines/. A press release by the Ministry of Foreign Affairs, People's Republic of China following a meeting between Foreign Minister Wang Yi and Myanmar's Deputy Prime Minister and Foreign Minister U Than Swe, in Nay Pyi Taw, the communiqué stated, "The two sides should maintain high-level exchanges and enhance political mutual trust, steadily promote the development of the China-Myanmar Economic Corridor, and ensure the safe and smooth operation of the China-Myanmar oil and gas pipeline project". Source: https://www.mfa.gov.cn/eng/wjbzhd/202408/t20240815_11474220.

Table 1: ASEAN Nations: Amount of RE Resources [@<$150/MWh] and GH (MMT)[7]

ASEAN Member States	Solar PV (GW)	Wind (GW)	Biomass (GW)	Geo (GW)	Hydro (GW)	GH Export by 2050 (MMT)	LCOH (2030) (US$/kg H2)
Brunei	16	0.02	0	0	NA	0	5.4
Cambodia	3198	69	0	0	10	121	4
Indonesia	1052	50	32.6	29.5	95	31	5.1
Lao PDR	1278	13	1.2	0.05	18	45	4.8
Malaysia	1965	2	0.6	0	123	53	5.3
Myanmar	7717	482	0.99	0	100	310	3.8
Philippines	1910	217	0.24	4	13	74	5.3
Singapore	2	0.02	0	0	0	-2	5.8
Thailand	10538	239	2.5	0	13.5	373	3.9
Vietnam	2847	311	0.56	0.34	26	102	5.4

Source: Aouthor compilation.

Bangladesh, Bhutan, China, Myanmar and Nepal makes the NER a strategically sensitive region. Further, the landlocked NER connectivity to the rest of India is only through the 22 kms wide and 60 kms long Siliguri corridor and underscores its logistical vulnerability. The NER has endured development challenges due to socio-economic issues, limited logistics connectivity and access to markets, rugged topography, and comparatively weak industrial infrastructure. Per capita electricity consumption in the NER hovers near 570 KWh, less than half the all-India average of about 1,255 KWh.[9] The NER relies heavily on oil products transported by rail or road - 2.5 MMTPA[10] of High Speed Diesel (HSD) alone, viz. about 2.9 percent of national consumption[11] - for meeting its mobility and industrial requirements. Therefore, there is plenty of headspace for sustainable development of the NER, which is hinged upon improving connectivity, better resource availability, higher agricultural productivity, eco-friendly industry and tourism which all require clean and green energy. Alternate access routes to unlock its economic potential and enhance social development are, therefore, crucial.

Myanmar's proximity to the NER presents a unique opportunity for collaboration. Within Myanmar, it is *Sittwe*, located near the mouth of the Kaladan River and the administrative capital of *Rakhine* State of Myanmar, that is the nearest deep seaport outlet to the Bay of Bengal for the NER via the Kaladan Multi-modal Transit Transport Project (KMTTP). This is significant as the revamped Sittwe Port has been operational since May 2023 and is administered by Indian Ports Global Limited, and thus provides a ready foundation for exploring further collaboration and commerce. However, since the alongside depths at the jetty is limited to about 5 meters the capacity to ship bulk and containerized cargoes is, therefore, restricted. Also, there is no rail head at Sittwe. Road connectivity exists between Sittwe and Nay Pyi Taw and Yangon but there is no direct road connectivity between Sittwe and the NER, yet. Once the Zorinpui-Paletwa road section of the KMTTP project is complete Sittwe can be the entrepôt for access to the NER. Sittwe airport is operational but would need to be upgraded to a ICAO Cat I facility for international connectivity.

But, very significantly, depths of 30 meters at about 8-10 km from the coast[12] make VLCC operations from Single Point Mooring (SPM) feasible. Sittwe has an estimated solar and wind energy potential of 26.96 GW and 33.83 GW respectively.[13] Assessments indicate that about 1.8 GW of solar photovoltaic power could alone be installed atop the plateau of

Myengu island located a few kilometers from the Sittwe Port, while another 11.5 GW of wind power could be generated in identified 'Class 7' locations[14] on the Chi/Arakan Range only about 150 kms from Sittwe.[15]

Sittwe is connected by a 66kV power line and the nearest 230kV electricity line is at *Ponnagyun* about 40 kms North East of Sittwe. India is presently providing about 2 to 3 MW power through a 11 kV transmission line from *Moreh* to *Tamu*".[16] But, a BIMSTEC Grid Interconnection MoU exists[17] and an agreement for a 500 MW line from Imphal to Tamu has also been reached[18] but would require extending the 230kV grid from Tamu to Kaley in Myanmar over about 120 kms.[19] By accessing 'green' power from Sittwe, Myanmar could also meet its immediate reliable base load requirements from India.[20]

Further, the sparse population and considerable undeveloped land tracts in the area suggest that land availability for large green energy and clean fuel projects would not be an insurmountable issue. There is also ample riverine and sea water supply due to the perennial nature of the Kaladan River, which is a requirement for processing industries. About 1,000 acres of land have been leased by India for industrial development as a Special Economic Zone (SEZ),[21] near *Ponnagyun*.

The Energy Imperative

India's domestic crude oil production is projected to fall from 700 kilo barrels per day (kb/day) in 2023 to 580 kb/day by 2030 and India's energy demand projections point towards an increased appetite for crude oil imports, rising from 4.6 million barrels per day (mb/day) in 2023 to potentially 5.8 mb/day by 2030.[22] This growth, amounting to about 1.2 mb/day, would be more than one-third of the total projected global growth of 3.2 mb/d[23] which translates to an additional refining capacity requirement of 60 MMTPA.[24] India's import dependency on crude oil is already 87.4 percent which is only likely to grow.[25] Therefore, additional sources of crude oil and commensurate refining capacity are required to preserve India's energy security.

The natural complementariness between the energy and fuel requirements of India and its NER and the resources and location of Sittwe offers a significant strategic opportunity to engage with Myanmar to develop Sittwe as a clean and green petrochemical hub for mutual benefit.

Project Conceptualisation

In the above context the strategic vision is to position Sittwe as a multi-pronged clean energy zone that houses a modern mega refinery, powered with greenfield solar, wind farms and existing hydropower plants, battery energy storage system (BESS) for ensuring Round the Clock(RTC) availability of power, an integrated Green Hydrogen (GH) production plant and a desalination plant for meeting the Hydrogen and demineralized water requirements of such a mega refinery.

Assuming a monthly arrival of eight to twelve VLCC cargoes discharging crude through a SPM – moored barely 8 km South West of the *Myengu* island at the entrance to the Sittwe port – would total to about 18 MMTPA of crude for processing. This would potentially produce 19 MMTPA of refined petro products. About 11–12 MMTPA of refined products could be exported via LR1 tankers from a second SPM about 6 kms from the *Myengu* island. The remainder, roughly 6–7 MMTPA, would be available to meet Myanmar's naptha, gasoline, jet fuel etc., requirements whilst the balance could be piped to the NER along the KMTTP corridor.

To process the imported crude three scenarios are explored in the succeeding paragraphs.

html (Accessed 02 November 2024). (automation), the automobile, the computer, the Internet, medicine, and artificial intelligence

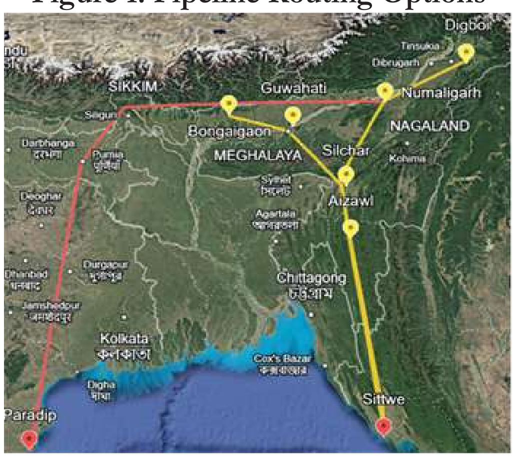
4 "Energy Poverty among Plenty", World Bank, Myanmar Energy Sector Update, June 2024. Source: https://documents1.worldbank.org/curated/n/099062324221019838/pdf/P500473148b24a01b-19ce31dee0cba378ed.pdf

5 Myanmar Energy Sector Update, June 2024, "Energy Poverty amid Plenty", Source: https://documents1.worldbank.org/curated/n/099062324221019838/pdf/P500473148b24a01b-19ce31dee0cba378ed.pdf

6 Refer Table 9. Opportunities and Barriers for Renewable Energy Development across ASEAN Member States, in "Exploring Renewable Energy Opportunities in Select Southeast Asian Countries: A Geospatial Analysis of the Levelized Cost of Energy of Utility-Scale Wind and Solar Photovoltaics", Nathan Lee, Francisco Flores-Espino, Ricardo Oliveira, Billy Roberts, Thomas Bowen, and Jessica Katz National Renewable Energy Laboratory (Revised June 2020). Source: https://www.nrel.gov/docs/fy19osti/71814.pdf See also Table 11, "Green hydrogen export potential of the Association of Southeast Asian Nations(ASEAN) based on renewable energy potential and levelized cost of hydrogen". Hyeonjun KIM, Gayoung

Leveraging Existing NER Refineries: The NER has four refineries—Digboi, Guwahati, Numaligarh, and Bongaigaon—whose key challenge is access to crude which in the case of Numaligarh is sourced from Paradip across 1,614 kms of pipeline,[26] whilst the others are mainly dependent upon captive, and perhaps, depleting oil wells. On the other hand a crude pipeline from Sittwe to these refineries would only span 700–950 kms (Figure 1). A refined product pipeline could transport petroleum products back from the refineries to Sittwe for exports and also service the NER and Northern Myanmar thus obviating the need for rail/road supplied petro products. GH, produced at Sittwe, could also be piped across, to the NER refineries and surplus exported but poses some technical and diplomatic complexities.

Figure 1: Pipeline Routing Options



Greenfield Refinery at Aizawl/Silchar: A new refinery in Aizawl/Silchar would integrate directly into the NER economy and enable easier distribution of refined products in the region. Crude could be transported from Sittwe's SPM via a pipeline of about 350-450 kms and processed in this greenfield refinery. The refined petroproducts would be available for meeting domestic consumption and exports to other customers from Sittwe through a second 'product' pipeline terminating at another SPM at Sittwe. However, developing a major industrial facility in a hilly terrain with sensitive environmental issues and socio-cultural concerns may pose formidable challenges. Community acceptance, land acquisition, and environmental clearances might be deal breakers.

Greenfield Refinery at *Ponnagyun*: Locating an 18 MMTPA refinery adjacent to *Ponnagyun* capitalises on Sittwe's core advantages. Offshore SPMs would handle crude intake and product dispatch. Renewable power harnessed from local solar and wind farms, augmented by Myanmar's hydropower and the BESS, would power the refinery, desalination plants and the electrolyser. The requirement of hydrogen for hydrosulphurisation is about 1 percent of the refinery capacity. Currently, refineries produce hydrogen using steam methane reformation, which emits substantial carbon dioxide. A 200,000 TPA GH plant, would meet the purpose and surplus could also be exported or converted into green derivatives like ammonia or methanol at near zero carbon dioxide emissions. Further, demineralised water for the GH and Refinery complex could come from a RE powered desalination facility by tapping into the perennial Kaladan River. Given Sittwe's unique locational advantages the operational requirements of such a refinery project can be entirely met by RE, GH, perennial water and ample unutilized land availability.

A cost-benefit assessment of these models can clarify the optimum approach, but *Ponnagyun* appears promising due to existing land availability, easier maritime access, and readiness of basic port infrastructure as Table 2 suggests.

Rough Order of Magnitude Costs

Developing an integrated green energy hub anchored by an 18 MMTPA refinery in Sittwe/*Ponnagyun* entails the capital expenditure summarized in Table 3.

SONG, Yoonhee HA, Graduate School of Energy and Environment (KU-KIST Green School), Korea, University (#519, R&D Center Bldg., 145 Anam-ro, Seongbuk-gu, Seoul 02841,South Korea) Source: https://papers.ssrn.com/sol3/papers.cfm?abstract_id=4795212

7 Compiled from various reports of the Government of ASEAN states and authors calculations.

8 Compiled from the North East Council Dashboard. Source: https://necouncil.gov.in/

9 Calculated from Central Electricity Authority database, Source :https://cea.nic.in/dashboard/?lang=en

10 "Snapshot-of-India-Oil-and-Gas-data-Nov-2024", Policy Planning and Analysis Cell, Ministry of Petroleum and Natural Gas, Government of India. Source: https://ppac.gov.in/

11 Calculated from Table V.16 "State wise consumption of High Speed Diesel Oil", IPNG Statistics 2022-23. Ministry of Petroleum and Natural Gas, Source: IPNG-Annual-Report-2022-23-web.pdf

12 National Hydrographic Office, Chart 3511, "Approaches to Sittwe harbour" and Electronic Charts of the coastal regions of Rakhine coast.

13`Calculated from the

Table 2: Summary of Refinery Location Options[27]

Parameter	Expand the four Refineries in NER	Greenfield Refinery at Aizawl Silchar	Greenfield Refinery at Ponnagyun
Land availability	2	3	1
Refinery Cost	3	2	1
Pipeline Cost	3	2	1
Energy Cost	2	3	1
Water access	3	2	1
Social impact	2	3	1
Environmental impact	2	3	1
Project Complexity	1	3	2
Market Access	3	2	1
Feedstock Access	3	2	1`
Risk	1	2	3

Source: Author's compilation.

Note: Ranking Code 1 = Best; 2 = Good; 3 = Fair.

Altogether, the project's baseline capital requirement could approach INR 70,000–72,000 Crores (~ US$ 9 billion). Additional costs for insurance, transportation, local labour and contingencies, and risk mitigation might increase the final investment outlay marginally.

Economic, Strategic and Political Considerations

An 18 MMTPA refinery, operating at scale, can generate robust revenues. With an annual processing capacity of 131 million barrels,[29] the crude feedstock would cost about US$ 10 billion annually (assuming US$ 75 per barrel). Processed product margins presently hover around 15 percent[30] which would raise about US$ 150 million annually from sales of pertroproducts. The integrated RE capacity - assuming a 20 percent average capacity utilisation factor - would produce around 1.8 billion kWh of clean electricity per year, locally valued at approximately US$ 450 million. A

Table 3: RoM Costing[28]

Sl No	Facility	Capacity	Costing (Rs Crores)
1	Refinery at *Ponnagyun*	18 MMTPA	54,000
2	SPM Buoys and pipelines at *Sittwe/Ponnagyun*	1 for crude import. 1 for HSD export.	2,300
3	Tank Farms for crude and products storage together with Pipelines from SPM to *Ponnagyun*	15 days Storage for crude and HSD each. Pipelines about 50 kms.	1,200
4	Desalination and Cogeneration Plant at *Ponnagyun*	400 MLD and 60 MW plant.	1,000
5	Renewable Energy Generation at *Myengu* Island and *Arakan* Hills	Solar (700 MW). Wind (250MW). BESS (200MWh).	2,800 1,750 500
6	GH Plant at *Sittwe*	200,000 TPA	8,000
7	Port *Sittwe* Augmentation	Utilities, Transport, Tugs, Boats, Supply Vessels and Interceptor Craft.	500
8	*Sittwe* Airport Upgrade	ICAO CAT 1	150
9	Product Pipeline	~350 kms *Sittwe* to Aizawl.	1,000

Source: Aouthor's compilation.

Global Wind Atlas and the Global Solar Atlas.

14 Table 1-1, "Classes of Wind Power Density", Wind Energy Resource Atlas of the United States, Elliott, D. L.Barchet, W. R.Foote, H. P.Sandusky, W. F

15 Source: As per authors calculations using data sheets from Global Solar Atlas and Global Wind Atlas.

16 Source: NATIONAL ELECTRICITY PLAN VOLUME II – TRANSMISSION, October 2024, Central Electricity Authority, Ministry of Power, Government of India.

17 See: "Memorandum of Understanding for Establishment of BIMSTEC Intergrid Connection", Source: https://powermin.gov.in/sites/default/files/uploads/BIMSTEC_MoU.pdf

18 Page 109, NEP Volume-II (Transmission). Ministry of Power, Government of India. Source: https://powermin.gov.in/sites/default/files/uploads/National_Electricity_Plan_Volume_II_Transmission.pdf

19 Authors estimation, 'National Energy Grid of Myanmar', Published by: Open Development Myanmar, Source: https://data.opendevelopmentmekong.net/en/dataset/national-energy-grid-of-myanmar

200,000 TPA GH plant, with hydrogen priced around US$ 6–7/kg, could add an additional US$ 1.2–1.4 billion in revenue.

Strategically, routing petroproducts/crude imports from Sittwe diminishes dependence on the Siliguri corridor, eases NER connectivity bottlenecks, diversifies supply options, opens new markets for petro products and paves the way for deeper bilateral relations with Myanmar and the ASEAN states. Locating advanced technology energy facilities at Sittwe could stimulate local job creation, spur socio-economic development, alleviate political tensions and promote political stability.

India's NER states would benefit through cheaper, more reliable deliveries of refined fuels and green energy and connectivity to the Bay of Bengal. Hence, this integrated approach has visible potential returns to make the project sustainable, scalable and saleable.

However, challenges exist, chiefly revolving around Myanmar's political volatility and the uncertain security situation in the area. The turbulent political climate in Myanmar must be taken note of in any discussion on Sittwe matters. South Korea's ambitious plan for a "new city" at Sittwe as a comprehensive complex development area has not succeeded. Similarly, Japan's East-West Economic Corridor Highway Project and development of the Dawei deep sea port[31] have not materialised. On the other hand, both China and India have enjoyed success in the *Ma'de* island DSP and the modernization of the Sittwe Port project respectively. These examples indicate that the core problem impeding investment and development of the Sittwe Port is clearly political in nature. Indian policymakers have signaled commitment to remain engaged, reflecting the high stakes involved[32]. Hence, diplomatic dexterity combined with socio-economic incentives may be essential to realize the project.

Policy Recommendations

In view of the foregoing the following policy recommendations are proposed:

1. **Bilateral Engagement with Myanmar:**
   - Obtain local public support for the proposed refinery project and associated infrastructure at *Ponnagyun* and Sittwe through a well structured information, education and awareness campaign.
   - Engage with all stakeholders to secure a sustainable operational environment at Sittwe.
   - Negotiate an irrevocable all – party agreement that ensures stable legal and political frameworks that could be underwritten by Multisectoral Investment Guarantee Agency (MIGA), under the aegis of the World Bank.
2. **Project Structuring and Financing:**
   - Constitute an inter-ministerial study group supported by suitably qualified Subject Matter Experts to finalise site selection, project design, cost estimates, and financing modalities.
   - Explore funding from Development Financial Institutions, including sovereign conditional lines of credit, private capital, employing innovative instruments such as fractional ownership of real world assets through blockchain based tokenization and smart contracts.
   - Consider a Public-Private-People-Partnership model for the project.
   - The project could be partitioned into (a) Refinery (b) RE (c) GH and (d) Port operations and could be tendered accordingly as Special Purpose Vehicles.

[20] See also, "Power Supply to Myanmar: An Approach for Development of Transmission Infrastructure and Modality of Power Supply", June 2021, South Asia Group on Energy, RIS, New Delhi.

[21] "India planning to set up SEZ in Myanmar's Sittwe" Source: https://economictimes.indiatimes.com/news/politics-and-nation/india-planning-to-set-up-sez-in-myanmars-sittwe/articleshow/53496839.cms

[22] "Indian Oil Market Outlook to 2030", International Energy Agency, Source: https://www.iea.org/reports/indian-oil-market/executive-summary

[23] Ibid.

[24] 1 mb/day is 49 MMTPA. Hence 1.2mb/day is about 60 MMTPA. Source: Table 27. Conversion factors and volume conversion. "SNAPSHOT OF INDIA'S OIL & GAS DATA MONTHLY READY RECKONER DECEMBER-24", PPAC December 2024. file:///C:/Users/RISC-241/Downloads/1737011904_

3. **Refinery and GH Integration:**
   - Design an ultra modern state of the art refinery that integrates advanced emission control, digitalization technologies and AI enabled operations.
   - Incorporate GH production and carbon capture and utilisation to further minimise the refinery's environmental footprint, with potential scaling up for green ammonia or e-methanol production.
4. **Renewable Energy Development:**
   - Conduct in-depth site surveys for locating solar arrays, windmills, battery energy storage system (BESS) and Green Hydrogen Plant.
   - Modernise power grids to facilitate reliable and RTC power to the project.
   - Extend the 230kV grid from *Tamu* to *Kaley* to connect with the NER grid.
5. **Port Logistics and Connectivity:**
   - Lay two SPMs and associated pipelines for Very Large Crude Carrier (VLCCs) and LR1 tankers for crude intake and product exports.
   - Lay pipelines connecting the refinery with key destinations in the NER and North Western Myanmar.
   - Upgrade Sittwe airfield to International Civil Aviation Organization (ICAO) Cat 1 standards to improve cargo and passenger movement.
   - Complete the road link between Paletwa and Zoinpui as part of the Kaladan Multi-modal Transit Transport Project (KMTTP).
6. **Security and Stability Measures:**
   - Build social acceptance among local communities across the region.
   - Develop a targeted approach to risk management, possibly including dedicated security arrangements in coordination with local authorities, ensuring uninterrupted port and refinery operations.
   - Provide a line of credit for procurement of security systems and platforms for the SPM.
   - Explore deployment of Central Industrial Security Force (CISF) and Indian Coast Guard (ICG) for security of the refinery and SPMs/offshore pipeline respectively.
   - Set up skill development and training centers to maximize local jobs.
7. **Blue Economy and Environmental Stewardship:**
   - Classify the entire venture as a "Blue Economy" initiative that optimises ocean-land interfaces with minimal ecological burden.
   - Embed robust environmental impact assessments, stakeholder engagement, and local livelihood protection measures to preserve marine and terrestrial ecosystems.

Implementation Pathway

Successful project implementation would require a multi-phase approach:

- **Phase I: Pre-Feasibility reconnaissance and Diplomatic Engagement (0–9 months)** A joint study group should be formed to refine technical, financial, diplomatic and security details. Diplomatic channels with Myanmar must be engaged to iron out concerns regarding sovereignty, local governance, and project ownership. Environmental and social impact assessments would commence in parallel. Site selection and land acquisition or lease agreements should be finalized with the complete buy-in of the local population, political leadership and the administration.

Snapshot-of-Indias-Oil-and-Gas-Data_WebUpload_December-2024_compressed.pdf

[25] Ibid. Table 2 refers

[26] "Current Initiatives", Source: https://www.nrl.co.in/NRL-Current_Initiatives

[27] Source: Authors assessment

[28] Source: Authors assessment in consultation with industry experts.

[29] 18 MMTPA amounts to 131 mb/day. Source: "Table 27. Conversion factors and volume conversion", SNAPSHOT OF INDIA'S OIL & GAS DATA MONTHLY READY RECKONER DECEMBER-24", PPAC December 2024. file:///C:/Users/RISC-241/Downloads/1737011904_Snapshot-of-Indias-Oil-and-Gas-Data_WebUpload_December-2024_compressed.pdf

[30] Table 10 : "Gross Refining Margins (GRM) of refineries ($/bbl)", Source: "SNAPSHOT OF INDIA'S OIL & GAS DATA MONTHLY READY RECKONER DECEMBER-24", PPAC December 2024. file:///C:/Users/RISC-241/Downloads/1737011904_Snapshot-of-Indias-Oil-and-Gas-Data_We-

bUpload_December-2024_compressed.pdf

[31] Japan had commenced surveys for the Dawei Deep Sea Port in 2020. https://www.myanmarwaterportal.com/news/2360-japan-to-conduct-survey-on-dawei-deep-sea-port-project.html

[32] "India Strengthens Maritime Ties with Myanmar and Bangladesh", Source: https://www.thehindubusinessline.com/economy/logistics/india-strengthens-maritime-ties-with-myanmar-and-bangladesh-sarbananda-sonowal/article68705415.ece

- **Phase II: Detailed Engineering and Financial Closure (9–21 months)** Upon concluding feasibility studies, final project designs and tenders for refinery construction, pipeline routing, and RE and GH installations can be floated. Negotiating financial closure with domestic and international investors, development institutions, and private equity will be crucial.
- **Phase III: Construction and Initial Operations (21–48 months)** Augmentation of Sittwe Port and Airport. Construction of SPMs, tank farms, transmission lines, desalination units, GH electrolysers, and the refinery can proceed in a staged manner. If political stability is sustained, pilot cargo operations may begin even before full project completion. Midway, partial green energy and GH production could supply local industries and earn early revenues.
- **Phase IV: Scale-up and Integration (60 months and beyond)** Once the core project is functional and profitable, thereafter developing GH derivative fuels, pipeline linkages to the existing NER refineries or constructing new lines to supply sub-regional markets could follow.

Conclusion

Sittwe's transformation into a green energy hub offers a rare confluence of strategic, economic, and environmental gains for both Myanmar and India's NER. First, it provides a gateway for the landlocked NER to access global maritime routes, drastically improving logistical efficiency and diversifying India's energy import pathways. Second, harnessing substantial renewable resources in the Sittwe area supports development that is both profitable and consistent with global climate goals. Third, integrated GH production enables low-carbon refining processes and opens prospects for exporting hydrogen and its derivatives.

A structured approach involving infrastructure funding, robust diplomacy, local engagement, and environmental stewardship can convert obstacles into workable solutions. The corollary benefits—job creation, improved social welfare, and strategic leverage—can, in turn, stabilise the region and reduce humanitarian crises tied to conflict-induced human migration.

India's timely push for a clean fuel and green energy partnership with Myanmar seeks to strengthen energy security, reduce GHG emissions, stimulate cooperation and bolster confidence with the ASEAN and BIMSTEC community whilst strengthening connectivity and commerce with the NER. By backing a feasibility study, securing agreements, devising partnerships and mobilising finance, policy makers can transform Sittwe and in turn the NER into a thriving energy hub fostering cross-border collaboration, sustainable resource use, and shared prosperity and growth for all in the region.

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