SAFIR ANNUAL CONFERENCE 2025

Theme: *"Strengthening Infrastructure Regulation in South Asia: Resilience, Innovation, and Regional Cooperation"*

South Asia Forum for Infrastructure Regulation (SAFIR)
Secretariat.: Central Electricity Regulatory Commission
Venue: Hyderabad, Telangana

Date: 24th October, 2025

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SAFIR ANNUAL CONFERENCE

"Strengthening Infrastructure Regulation in South Asia: Resilience, Innovation, and Regional Cooperation"

24th October 2025; Friday; 09:30 AM

Hyderabad, Telangana, India

INAUGURAL SESSION	
09.30 am	Group photograph
09.40- 09.45 am	Welcome Address by Dr. (Justice) Devaraju Nagarjun, Chairperson, Telangana Electricity Regulatory Commission (TGERC), India
09.45 – 09.50 am	Address by Prof. K.P.L. Chandralal, Chairman, Public Utilities Commission of Sri Lanka (PUCSL), Sri Lanka
09.50 – 09.55 am	Address by Mr. Jalal Ahmed, Chairman, Bangladesh Energy Regulatory Commission (BERC), Bangladesh
09.55 – 10.05 am	Keynote Address by Mr. Jishnu Barua, Chairperson, South Asia Forum for Infrastructure Regulation (SAFIR) / Central Electricity Regulatory Commission (CERC), India
BUSINESS SESSION	
10.15 – 11.15 am	**PANEL DISCUSSION 1: INFRASTRUCTURE REGULATION IN SOUTH ASIA: CHALLENGES & OPPORTUNITIES** Base Presentation & Moderator: Mr. Rajiv Ratna Panda, Independent Strategy and Political Adviser, South Asia Discussants: 1. Mr. Dorji Dorji, Chief (Monitoring), Electricity Regulatory Authority (ERA), Bhutan 2. Mr. Piyal Hennayake, Deputy Chairman, Public Utilities Commission of Sri Lanka (PUCSL), Sri Lanka 3. Mr. Jalal Ahmed, Chairman, Bangladesh Energy Regulatory Commission (BERC), Bangladesh 4. Mr. Jishnu Barua, Chairperson, SAFIR / Central Electricity Regulatory Commission (CERC), India

11.15 – 12.15 pm	**PANEL DISCUSSION 2: REGULATING INFRASTRUCTURE: FOCUS ON ECONOMIC EFFICIENCY AND INNOVATION** Moderator : Mr. S.K.G. Rahate, Chairman, Airport Economic Regulatory Authority (AERA), India Discussants: 1. Dr. M.V. Rao, Chairperson, West Bengal Electricity Regulatory Commission (WBERC), India 2. Dr. (Justice) Devaraju Nagarjun, Chairperson, Telangana Electricity Regulatory Commission (TGERC), India 3. Mr. Viswajeet Khanna, Chairperson, Punjab State Electricity Regulatory Commission (PSERC), India 4. Mr. Sanjay Kumar, Chairperson, Maharashtra Electricity Regulatory Commission (MERC), India 5. Mr. Ramesh Babu V., Member, Central Electricity Regulatory Commission (CERC), India
12.15 – 01.15 pm	**PANEL DISCUSSION 3: DIGITALISATION, CYBERSECURITY & EMERGING TECHNOLOGIES** Moderator: Ms. Manju Gupta, ED (Commercial & Regulatory Cell), Power Grid Corporation of India Ltd. (PGCIL), India Discussants: 1. Ms. Swetha Ravi Kumar, Executive Director, FSR Global 2. Mr. T. Srinivas, Executive Director, CERT-GO, CISO, Grid Controller of India Ltd. (GRID INDIA), India 3. Mr. Manoj Kumar Jhawar, CMD, Power Trading Corporation India Ltd. (PTC), India 4. Mr. Gyaneshwar Kumar Singh, DG & CEO, Indian Institute of Corporate Affairs (IICA), India
01.15 – 01.20 pm	Vote of thanks by Mr. Harpreet Singh Pruthi, Secretary, SAFIR / CERC
01.20 – 02.00 pm	Networking lunch
02.30 pm onwards	Site visits

EXECUTIVE SUMMARY

The **SAFIR Annual Conference 2025–26**, hosted by the Telangana Electricity Regulatory Commission (TGERC) in Hyderabad, brought together regulators, policymakers, industry leaders and experts from across South Asia to deliberate on the theme of resilient, efficient and future-ready infrastructure regulation. The Conference provided a platform for sharing regional experiences and exploring collaborative approaches to address the rapidly evolving energy landscape shaped by decarbonisation, digitalisation, emerging technologies and changing consumer expectations.

2. The inaugural session highlighted the growing need for regulatory frameworks that are agile, forward-looking and capable of supporting innovation while safeguarding consumer interests. Speakers underscored the importance of regional cooperation, harmonised regulatory approaches and cross-border collaboration in strengthening energy security, accelerating clean energy deployment and building resilient infrastructure across South Asia.

3. The first panel discussion: ***Infrastructure Regulation in South Asia: Challenges and Opportunities***, focused on the regulatory implications of rapid infrastructure expansion and the energy transition. Participants observed that South Asian countries are pursuing ambitious renewable energy, transmission and infrastructure development programmes, requiring regulators to balance reliability, affordability, resilience and sustainability. Discussions emphasised the importance of adaptive regulatory frameworks, robust stakeholder engagement, regulatory capacity building and transparent decision-making to encourage investment while effectively integrating renewable energy. Panelists also highlighted the need for stronger regional cooperation through harmonised regulations, common grid practices and enhanced cross-border electricity markets to improve system flexibility, optimise resource utilisation and strengthen regional energy security.

4. The second panel discussion: ***Regulating Infrastructure: Focus on Economic Efficiency and Innovation***, examined how regulation can simultaneously promote

investment, innovation and consumer welfare. Deliberations recognised that regulators must strike an appropriate balance between ensuring cost-reflective tariffs, maintaining affordability and creating an enabling environment for long-term infrastructure investment. Participants stressed the importance of flexible and technology-neutral regulation, regulatory certainty and meaningful stakeholder consultation to facilitate innovation while maintaining transparency and accountability. Regulatory sandboxes, hybrid regulatory models, efficient dispute resolution mechanisms and performance-based incentives were identified as useful approaches for encouraging technological advancement and operational efficiency without compromising consumer protection. The discussion also highlighted that regulations should remain dynamic and continuously evolve in response to changing technologies and market conditions.

5. The third panel discussion: ***Digitalisation, Cybersecurity and Emerging Technologies***, explored the transformative role of digital technologies in modern infrastructure regulation. Panelists discussed how Artificial Intelligence (AI), Internet of Things (IoT), Blockchain, advanced analytics and digital platforms are reshaping infrastructure planning, system operations and regulatory oversight. While these technologies offer significant opportunities to improve operational efficiency, predictive maintenance, resource optimisation and evidence-based decision-making, they also introduce new challenges relating to cybersecurity, data governance and privacy. Participants emphasised that increasing digital interconnectedness requires comprehensive cybersecurity frameworks, dedicated institutional capabilities, secure data-sharing mechanisms and robust governance structures. The discussions further underscored that successful digital transformation depends not only on technology adoption but also on interoperable data ecosystems, standardised data governance, ethical use of emerging technologies and continuous capacity building across institutions.

6. A recurring theme across all panels was the evolving role of regulators as facilitators of innovation while ensuring fairness, resilience and long-term sustainability. Participants agreed that future regulatory frameworks must be adaptive,

evidence-based and collaborative, enabling infrastructure systems to respond effectively to technological advancements, changing market dynamics and the increasing complexity of energy systems. Discussions also highlighted the growing significance of regional knowledge sharing, institutional cooperation and coordinated regulatory action in addressing common challenges faced by South Asian countries.

7. The deliberations reaffirmed SAFIR's role as an important regional platform for advancing regulatory excellence and fostering collaboration among member countries. By promoting the exchange of experiences, harmonisation of regulatory practices and collective approaches to emerging challenges, SAFIR continues to contribute towards building secure, sustainable and future-ready infrastructure systems across South Asia.



INAUGURAL SESSION

In his welcome address at the SAFIR Annual Conference 2025-26 held at Hyderabad **(Appendix I: List of Participants)**, Dr. (Justice) Devaraju Nagarjun, Chairperson, TGERC warmly received delegates from India, Sri Lanka, Bhutan, and Bangladesh, highlighting Hyderabad's legacy as a centre of innovation and trade, and emphasizing the need for regulatory frameworks that keeps pace with decentralised, digital, and AI-driven infrastructure systems. He underscored that strengthening regulation means enhancing regulatory intelligence to support innovation, resilience, ethical governance, and consumer welfare.



2. Prof. K.P.L. Lalith Chandralal, Chairperson Public Utilities Commission of Sri Lanka (PUCSL), Sri Lanka in his address stressed the transformative role of regulation in enabling affordability, sustainability, and digitalisation and emphasised the value of regional cooperation in modernising utilities, promoting advanced energy systems, and expanding access to reliable, clean energy.



3. Mr. Jalal Ahmed, Chairperson, Bangladesh Energy Regulatory Commission (BERC) outlined Bangladesh's progress in near-universal electrification, its challenges stemming from declining domestic gas reserves, import dependence, commitment to expanding renewable energy, strengthening transmission networks, and ensuring transparent tariff-setting. He reiterated that regional power markets, regulatory harmonisation, and cross-border energy trade are



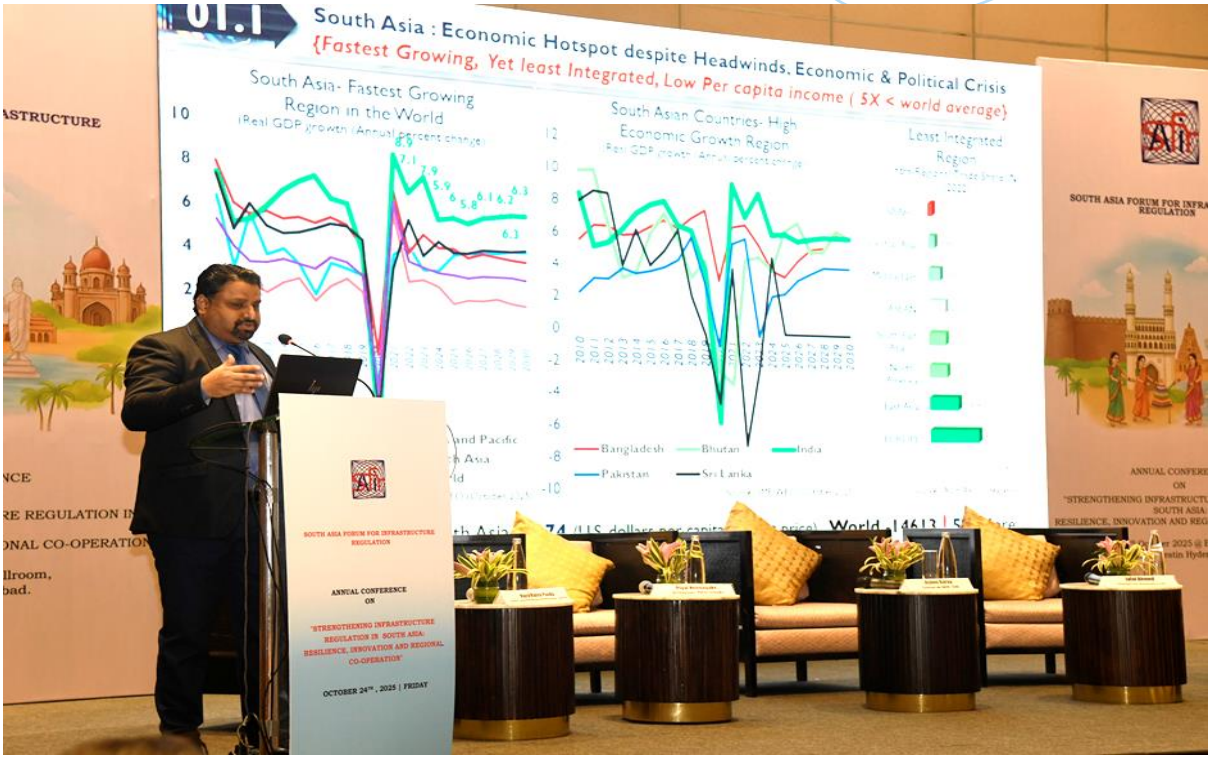
essential to South Asia's energy resilience.

4. Addressing the dignitaries, Mr. Jishnu Barua, Chairperson, SAFIR / CERC, warmly welcomed all delegates to the SAFIR Conference. He highlighted SAFIR's role as a



vital platform in South Asia for fostering resilient infrastructure supported by sound regulation and collective action. Emphasizing the importance of economic efficiency, innovation, cybersecurity, and emerging technologies, he noted that the discussions would generate valuable insights and practical strategies to guide the region in addressing emerging challenges and opportunities. He underscored that combining resilience with innovation and strengthening regional cooperation would help ensure sustainable and inclusive infrastructure development for the subcontinent's vast population. He thanked all members for their participation, expressed his hope for productive deliberations, and formally declared the conference open.

PANEL DISCUSSION I – INFRASTRUCTURE REGULATION IN SOUTH ASIA: CHALLENGES AND OPPORTUNITIES



5. Presentation, titled "Infrastructure Regulation in South Asia: Challenges & Opportunities," **(Annexure – I)** was delivered by Mr. Rajiv Ratna Panda, Independent Strategy & Political Adviser, South Asia. The core message of the presentation was South Asia's rapidly growing economic region that faces both significant opportunities and complex challenges in infrastructure development, particularly in the energy sector. It was emphasised that, addressing these challenges will require a Dynamic Regulatory Approach (DRA) that can effectively balance the priorities of reliability, affordability, and resilience. This becomes especially critical in the context of large-scale technological transformations, increasing penetration of artificial intelligence, accelerated integration of renewable energy, and the massive expansion of energy infrastructure required to support the transition towards net-zero emissions. Mr. Panda highlighted how South Asia is the fastest-growing region in the world, and yet it remains the least economically integrated and continues to have a per capita income nearly five times lower than the global average; and how the region requires

massive expansion of infrastructure, both at the national and regional levels. To address these challenges, South Asian countries have begun undergoing massive non-energy and energy infrastructure expansion. For India, it includes goals such as doubling of present number of airports; make significant investment to meet infrastructure needs in cities and 6G Telecom Rollout by 2030. India would need approx. 7,753 GW of power capacity by 2070 for meeting its Net Zero target. Similarly, Bangladesh has a 'Delta' plan – Bangladesh Delta Plan 2100 – to achieve a safer, more prosperous delta, reducing vulnerability to natural disasters (floods, cyclones, droughts), and ensuring long-term sustainability. Bhutan is building Gelephu Mindfulness City, a first of its kind in the world, encompassing conscious and sustainable businesses, to create a vibrant economic hub by providing a conducive business environment and compelling incentives. By 2050, the development of intercontinental and inter-regional power corridors connecting the South Asian power grid with ASEAN, the GCC, Africa, and Europe could reach a capacity of nearly 49 GW. Mr. Panda emphasised, that the share of RE in South Asia's electricity capacity is projected to increase significantly as RE demand rises sharply. Few examples demonstrating this rise includes Nepal, where 67% car sold are electric; and Sri Lanka, where PV roof top accounts for 30% of total installed power capacity. India aims to have 100 GW of Nuclear energy by 2047. RE demand from Green Hydrogen and Data centres will further add to RE requirements, especially Data Centres, which will have a massive impact on the local grid reliability and will require both generation and network expansion. He concluded, that the use of RE is only going to rise from here. South Asia faces a daunting regulatory challenge of incentivizing massive RE investment, while managing the intermittent RE, and ensuring a safe, secure, economical grid operation.

6. Following the presentation, a high-level panel discussion was held which had participation of Mr. Dorji Dorji, Chief (Monitoring), ERA, Bhutan; Mr. Piyal Hennayake, Deputy Chairperson, PUCSL, Sri Lanka; Mr. Jalal Ahmed, Chairperson, BERC, Bangladesh; and Mr. Jishnu Barua, Chairperson, SAFIR / CERC, India. The

panel discussion was moderated by Mr. Rajiv Ratna Panda. The summary proceedings of the panel discussion are as follows: -



a) Mr. Dorji Dorji, Chief (Monitoring), ERA, Bhutan, spoke on the regulatory opportunities and challenges and stressed that in a globalized world, change happens in an extremely fast manner and regulators need to keep pace with this change. There is a need to include a wide range of stakeholders, which is especially important in regulation making, as we need to come up with a very responsive regulatory framework. He emphasized the need to proactively consider the rapid introduction of artificial intelligence, digitalization, and smart grid technologies, driven by evolving national policies and broader economic strategy plans that outline a roadmap for development in the 21st century. Emphasis was on the need to reflect deeply on the evolving nature of power systems and the importance of developing a robust and vibrant regulatory framework capable of enhancing system resilience. He highlighted the importance of building regulatory capacity and stressed on the importance of SAFIR and similar other forums. He emphasized that regulators must remain dynamic and adaptive so that they can effectively support the private sector and other licensees in an ever-changing environment. Emphasis should be placed on ensuring exceptionally smooth regulatory processes and clear well-defined guidelines that help

stakeholders understand the steps they need to follow, when approaching the regulator.

b) Mr. Dorji mentioned about Bhutan's current installed capacity of 3,500 MW+ and



how they plan to reach 25,000 MW by 2040. This includes harnessing 15,000 MW from hydropower resources while simultaneously adding 5,000 MW from solar energy. Achieving effective integration of a solar–hydro energy mix also presents a significant challenge. He mentioned the need to have a very formalized, harmonized, across the board regulatory framework. This is especially important because it provides confidence and trust in the stakeholders, to have a noticeably clear vision of what to be done in the coming years and how to establish it. He emphasized the need to develop a robust and dynamic mechanism or tool that engages stakeholders in a timely and meaningful manner. Such an approach would ensure that stakeholders are well informed in advance, thereby preventing any unexpected shocks in the future. Regulators must become more responsive and act as facilitators and enablers of strategic initiatives that support country's development.

c) Mr. Piyal Hennayake, Deputy Chairperson, PUCSL, provided a background on Sri Lanka and explained about the power sector reform, that is underway. Sri Lanka had only the Ceylon Electricity Board (CEB) in the power sector, and they were the generator, transmitter, and distributor until 1994. Subsequently, Sri Lanka introduced the development of small hydropower projects, allowing generators other than the CEB to connect to the national grid. Only in 2008, the current day regulator – Public Utilities Commission of Sri Lanka (PUCSL) – came into effect. PUCSL primarily regulated the CEB and generators, mainly small hydropower companies. A new Electricity Act was enacted in 2024 and has since been revised this year. Following these reforms, the CEB is expected to be unbundled into three main segments — generation, transmission, and distribution. It may be noted that earlier, in 2009, a

subsidiary structure under the CEB had already been introduced. In the context of ongoing reforms, it is important to adopt a forward-looking perspective and learn from the experiences of others. As electricity regulation is still relatively new in Sri Lanka, PUCSL must seek knowledge and insights from neighboring regulators in the region, and possibly from regulators across the world, to better understand how to effectively regulate a reformed electricity industry.

d) Mr. Piyal emphasized that attracting the right kind of investment for infrastructure will require fostering competition. It will help reduce prices, while appropriate mechanisms such as market-based approaches and competitive open tenders can help lower risks and uncertainties. He also noted that Sri Lanka has made significant progress in promoting rooftop solar; however, a more holistic approach is needed that considers grid integration and system operation challenges, along with the corresponding solutions. He highlighted the importance of maintaining fair and balanced electricity pricing to attract investment in the sector. At the same time, electricity must remain reasonably priced for key economic sectors such as industry, exports, and tourism to support income generation. There is a need to strike a careful balance, so that both investors and consumers are adequately served.

e) Mr. Jalal Ahmed, Chairperson, BERC, shared Bangladesh's perspective and stressed the importance of organizations like SAFIR, which help open up ideas and experience of different countries in the region and also provide global perspective to member countries. He said, regional forums like these help us regulators immensely and also allow us to share our own experiences.

f) Bangladesh after undertaking reform, have significantly improved its power generation capacity. Currently, the installed capacity is more than 28 GW and if captive power generation in the industries is added, total is around 34 GW. At the same time, demand is around 16 GW; making the country power surplus. But, on the other hand, Bangladesh is becoming increasingly dependent on imported LNG, which has its limitations and is associated with very high costs. Consequently, the country is seeking to transition toward greater use of renewable energy. At present, renewable energy production stands at around 1,300 MW, but the country aims to add

approximately 6,700 MW of solar capacity by 2030. To support this transition, Bangladesh has promulgated the Renewable Energy Policy 2025 and introduced the Merchant Power Plant Policy (MPPP). In addition, the government has issued the National Rooftop Solar Guidelines 2025 and the Net Metering Instructions 2025 to further promote the adoption of solar energy. Bangladesh is expecting that by 2040, 30% of the total generation capacity is from renewables. This will help Bangladesh in getting rid of high-cost electricity, which has become a significant challenge for Bangladesh. The country follows a single-buyer model, under which the BPDB procures electricity at relatively high prices and sells it to consumers at subsidized rates. This places considerable pressure on the government to provide subsidies. In this context, expanding the deployment of renewable energy could help lower generation costs over time and reduce the subsidy burden on the government. In his closing remarks, Mr. Ahmed said, despite progress, regional collaboration is lagging behind, and we must collectively work together to change this scenario.

g) Mr. Jishnu Barua, Chairperson, SAFIR / CERC, spoke in detail on the Indian perspective and acknowledged the need to continuously evolve the process of regulation, given the rapid changes underway in the sector. In this context, he emphasized that dynamism will be key to ensuring that regulatory frameworks remain relevant and effective. He hoped that utilities, generators, and stakeholders will understand the regulator's predicament because of the dynamically evolving environment in energy and power sectors. He highlighted that, while India's installed capacity has gone up to 495 GW, growing exponentially as we speak, the per capita consumption of power is still 1395-kilowatt hour, which is exceptionally low. India has the aspirations to be a developed country; therefore per capita electricity consumption must be at least double the current levels. There is a long journey, still to be undertaken to reach that level.

h) He highlighted that India has a unified grid (which got unified by 2013-14) and today Indian national grid is the most unique grid in the world – there is no country in the world, which is a single / unified grid. Therefore, with a grid of this size and complexity there would obviously be some problems and some complex challenges.

India is going through these complex challenges especially with regard to energy transition. The problem is how to manage this transition and how to manage the peak hour; what to do with the intermittent nature of renewable energy – which India aims to take to 500 GW by 2030. Grid efficiency should be taken with enormous seriousness from a regulatory standpoint. There should be adequate and trained staff in the State Load Dispatch Centres (SLDCs), and the states should also have resource adequacy; learning lessons from the recent grid collapse in Spain. Grid Operation and Grid Management in the era of high penetration of RE needs careful planning, regulation, and implementation.

i) He emphasized the importance of having a diversified energy mix at the regional level and ensuring seamless power transfers to meet the energy requirements of different countries. He noted that Bhutan and Nepal possess enormous hydropower potential and already generate most of their electricity from hydro sources. He noted that, if grid stability is to be maintained and the energy transition effectively managed, it must be approached from a regional perspective, with greater cooperation and integration across countries.

j) To enable this regional approach, there is a need to harmonize regulatory and operational systems across countries. In this regard, an important step has already been taken in the form of a Uniform Grid Practice – Draft Model Regulation, formed by the SAFIR Working Group and already shared with the members of SAFIR. He expressed the view, that these initiatives should be quickly implemented because today's internal problems and geopolitical problems are not going to be there forever.

k) He emphasized the requirement or necessity to have consensus on regional market design. For instance, there could be a regional Day-ahead Market (DAM) in South Asia. He also highlighted the need for political consensus, and this consensus can only come up when we as regulators try to sensitize our stakeholders, especially the government and people who make decisions, regarding the requirement of a more harmonized regional approach. While regulators may not have all the tools to address all the problems, they must be proactive and highlight the constraints through proper analysis and research before the stakeholders.


ANNUAL CONFERENCE
ON
"STRENGTHENING INFRASTRUCTURE REGULATION IN SOUTH ASIA:
RESILIENCE, INNOVATION AND REGIONAL CO-OPERATION"

PANEL DISCUSSION II – REGULATING INFRASTRUCTURE: FOCUS ON ECONOMIC EFFICIENCY AND INNOVATION

7. The session was moderated by Mr. S. K. G. Rahate, Chairperson , Airport Economic Regulatory Authority (AERA), India, and included distinguished panellists Mr. V. Ramesh Babu, Member (Technical), CERC; Mr. Viswajeet Khanna, Chairperson, Punjab State Electricity Regulatory Commission (PSERC); Mr. Sanjay Kumar, Chairperson, Maharashtra Electricity Regulatory Commission (MERC); Dr. M.V. Rao, Chairperson, West Bengal Electricity Regulatory Commission (WBERC) and Dr. (Justice) Devaraju Nagarjun, Chairperson, Telangana Electricity Regulatory Commission (TGERC). The summary proceedings of the panel discussion are as follows: -

a) Setting the context and background for discussion, Mr. Rahate highlighted the critical importance of securing energy supplies and developing robust infrastructure to support South Asia's rapid economic growth, urbanization, and rising energy demand. He emphasized the need for a regulatory framework that effectively balances energy security, reliability, affordability, sustainability, economic efficiency, and innovation. He noted that since the enactment of the Electricity Act, 2003, electricity regulation in India has strengthened competition, transparency, and consumer protection, while also encouraging innovation through open access, renewable integration, and smart grid initiatives. However, with ambitious targets such as achieving 500 GW of non-fossil fuel capacity by 2030, regulators now face emerging challenges related to grid flexibility, resilience, and financial sustainability of distribution utilities; along with the growing importance of regulatory approaches supporting smart transmission networks, storage integration, smart metering, energy markets, and distribution reforms, alongside ongoing policy developments such as the draft Electricity Amendment Bill, 2025.

b) Mr. V. Ramesh Babu, Member (Technical), CERC, highlighted the need for tariffs in the power sector to remain cost-reflective, affordable, and capable of providing reasonable returns, particularly in the context of the ongoing energy transition. He

noted that while renewable energy tariffs have declined significantly, the associated system-level and hidden costs such as grid balancing, part-load compensation for thermal plants, and network usage must be duly accounted for in tariff determination. Emphasizing innovation, he distinguished between operational improvements within existing systems and the adoption of emerging technologies, advocating the introduction of regulatory sandboxes with a cost-plus approach to enable safe experimentation with new technologies. He further stressed the importance of incentivizing efficiency gains by allowing utilities to share savings achieved through improved performance. Mr. Babu also underlined the critical role of consumer sensitization and capacity building, observing that acceptance of 'tariff increases' improves when service quality and reliability are demonstrably enhanced. Finally, he emphasized the need for flexibility, timely dispute resolution, and innovative statutory mechanisms such as alternative dispute resolution to enhance investor confidence and support sustained infrastructure development in the power sector.



c) Dr. M. V. Rao, Chairperson, West Bengal Electricity Regulatory Commission (WBERC) emphasized that effective regulation must keep pace with rapid technological advancements in the power sector, noting that regulators who do not adequately understand emerging technologies may struggle to deliver fair and effective outcomes. He highlighted the importance of meaningful public consultation

as a statutory mandate, observing that while regulators adopt various approaches, such as public hearings, stakeholder consultations, and invitation of objections, the quality and inclusiveness of these processes are crucial. Citing a recent case from Kerala related to amendments in rooftop solar regulations, Dr. Rao pointed out that extensive public objections and subsequent judicial intervention underscored the need for transparent, well-structured, and accessible public hearings. He emphasized, that regulators must continually assess how effectively they engage with stakeholders and ensure that regulatory processes genuinely reflect public participation and evolving sector realities.

d) He also discussed the regulatory trade-offs between price cap and rate-of-return models, noting that each approach carries inherent risks. While price cap regulation promotes cost efficiency, it may discourage investment in new technologies and innovation, whereas rate-of-return regulation provides comfort and certainty to utilities but can lead to overinvestment and inefficiencies due to assured high returns. He emphasized that regulation need not be an "either-or" choice and advocated for a hybrid regulatory approach that balances long-term investment incentives with consumer protection. Such a framework, he noted, can encourage investments in technology, research, and development while safeguarding consumer interests through well-defined benchmarks and standards, particularly for operation and maintenance costs. In his closing remarks, he cautioned against over-regulation, stressing the need for flexibility in regulatory frameworks to foster innovation and allow new technologies and business models to flourish.

e) Mr. Viswajeet Khanna, Chairperson, PSERC, highlighted the inherent challenge in infrastructure development within a growing economy, where investors seek high returns while consumers expect affordable and often subsidized services. He emphasized that subsidies ultimately impose a financial burden on the public and are not cost-free, underscoring the need for greater awareness of their economic implications. He noted that while attracting investment is essential, it is equally important to ensure that service delivery remains fair, reasonable, and non-exploitative. He concluded by emphasizing the crucial role of legislators and

regulators in balancing investor expectations with consumer affordability, which remains a central challenge in regulatory decision-making.



f) Mr. Sanjay Kumar, Chairperson, Maharashtra Electricity Regulatory Commission, highlighted Maharashtra's unique challenges as a large energy-producing state and emphasized the role of innovation and consultation in effective regulation. He cited the adoption of online and hybrid public hearings during the COVID period as a successful innovation that continues to enhance accessibility and efficiency. Reflecting on regulatory independence, he noted that innovation often emerges through strategic partnerships among governments, regulators, and stakeholders rather than in isolation, citing initiatives such as distributed generation, green energy mechanisms, and multi-year tariff frameworks in Maharashtra. He stressed that innovation must be purposeful, consultative, and aligned with the sector's capacity to absorb change, as its costs are ultimately borne by society. Mr. Kumar emphasized the need for a clear, long-term infrastructure investment roadmap, coupled with flexibility in regulatory frameworks to accommodate evolving technologies and business models, ensuring that innovation remains effective, inclusive, and economically justified.

g) Dr. (Justice) Devaraju Nagarjun, Chairperson, Telangana Electricity Regulatory Commission (TGERC), underscored that rapid technological advancements in the

power sector have outpaced regulatory responses, and failure to regulate in alignment with these developments could disadvantage all stakeholders, particularly consumers. He stressed the need for a more robust and inclusive consultation process prior to framing regulations, extending beyond public consultations to actively engaging academicians, technologists, and innovators to better understand emerging technologies. Emphasizing that regulations are "living documents," he noted that they must be continuously reviewed, monitored, and amended to remain relevant in a dynamic technological environment. Drawing on his judicial experience, Dr. Nagarjun cautioned against regulatory overreach, highlighting the importance of respecting constitutional and statutory boundaries while striking a careful balance among stakeholder interests. He concluded that effective regulation requires adopting new technologies, leveraging expert inputs, and maintaining flexibility to regulate in step with innovation, thereby ensuring fairness and justice across sectors.



PANEL DISCUSSION III – DIGITALISATION, CYBERSECURITY & EMERGING TECHNOLOGIES



8. The session was moderated by Ms. Manju Gupta, ED (Commercial & Regulatory Cell), Power Grid Corporation of India Ltd. (PGCIL) and included distinguished panellists Ms. Swetha Ravi Kumar, Executive Director, FSR Global; Mr. T. Srinivas, Executive Director, CERT – GO, CISO, Grid Controller of India Ltd. (GRID INDIA); Mr. Manoj Kumar Jhawar, CMD, Power Trading Corporation India Ltd. (PTC); and Dr. Naveen Sirohi, Director, Indian Institute of Corporate Affairs (IICA). The summary proceedings of the panel discussion are as follows: -

a) Setting the context for the session, Ms. Manju Gupta informed the audience, that discussion will now shift from the regulatory and economic dimensions of infrastructure to a set of forces fundamentally reshaping how infrastructure is built, managed, and governed at present, namely — digitalization, cybersecurity, and emerging technologies. It was highlighted that these three pillars are no longer peripheral, but central to the way industries operate, infrastructure is maintained, and services are delivered. Digitalization has moved well beyond being a future aspiration

and has become a present-day reality. From smart grids and automated trading platforms to digital governance and compliance systems, traditional sectors are rapidly transforming into highly interconnected, data-driven ecosystems, enabling greater efficiency, transparency, and responsiveness. At the same time, it was pointed out that this increased interconnectedness brings a new set of vulnerabilities. Cybersecurity was identified as a critical concern, particularly for sectors handling sensitive data and critical infrastructure. Ensuring resilience against cyber threats is now a strategic priority for both govt. and organizations. The moderator further underlined that emerging technologies such as Artificial Intelligence, the Internet of Things, and Blockchain are driving the next wave of innovation. These technologies were described as not only enhancing service delivery but also redefining how services are conceptualized, accessed, and governed. However, it was also acknowledged that they raise important questions around privacy, fairness, and accountability, which require careful consideration by regulators and industry stakeholders. Session will revolve around how these forces are shaping our industry – what risk and opportunity they present, and how we can collectively navigate this evolving landscape to build a secure, inclusive and innovative future.

b) Ms. Swetha Ravi Kumar, Executive Director, FSR Global, in her address underscored, how digitalization is at the heart of her work, for the foreseeable next months; as she works on India Energy Stack, which is envisioned to act as the digital backbone of India. She emphasised how digitalization is asking us to rethink the way we look at the system in general. First and foremost, it is going to allow us to break through the silos, wherein earlier, each stakeholder or systems were interacting within their mini networks, but now, be able to be more interoperable. As a consequence, she highlighted, data flow will be more seamless and we will also be able to do more evidence-based decision making, as there will be accessibility of data across systems. Overall, the benefit will be at the system level, and it will definitely be a win-win situation for all the stakeholders. Concluding her address, she emphasised on how this is not a zero-sum game and it is more of a win-win situation for all; how this win or takeaway feels for the stakeholders, will be the journey for the upcoming months.

c) Mr. T. Srinivas, Executive Director, CERT – GO, CISO, Grid Controller of India Ltd., highlighted how Grid Operation is getting complex day by day, driven by rapid digitalization and the growing integration of renewable energy. It was noted that the traditional one-way flow of electricity — from supplier to consumer — is evolving into a more dynamic, two-way system, with the proliferation of rooftop solar, battery storage, electric vehicle charging, and demand-side management solutions. This transformation is making systems significantly more advanced. It was further emphasized that the integration between Information Technology (IT) with Operational Technology (OT), is increasing rapidly, resulting in a thinning of the boundary between the two. At the same time, the sector is becoming more open and interconnected, with widespread adoption of IoT devices, smart grids, and smart energy meters. He indicated that in the next 3–5 years, and over the coming decade, these systems will expand to connect with multi-crore users, making it imperative to ensure robust cybersecurity frameworks. It was cautioned that without adequate cybersecurity measures, managing such complex and interconnected systems would become extremely challenging. He emphasised on how technological advancements can have both positive and negative implications, underscoring the importance of embedding ethical considerations within cybersecurity practices. Drawing parallels with the financial sector, where instances of fraud, hacking, and ransomware attacks have increased, he warned that similar risks could emerge in the power sector, particularly with the rollout of smart metering. In this context, cybersecurity is a critical parameter that must be addressed proactively to safeguard the integrity and reliability of the system.

d) He shared his confidence on India's ability to deal with these threats. He noted how sectoral CERTs are already fully operational. CERC is also coming with cybersecurity regulations framework in the near future. Capacity building of the SLDCs, DISCOMs is also taking place, in this regard. Awareness is already there and we are very well on our way.

e) Dr. Naveen Sirohi, Director, Indian Institute of Corporate Affairs (IICA), added that technology is emerging as a major disruptor, with digitalization now emerging as

an infrastructure for infrastructure. Newer technologies bring both significant opportunities and considerable risks. On the opportunity side, he noted that digitalization can play a meaningful role in areas such as arbitration, dispute resolution, and grievance redressal. It was emphasized that technology can enhance resolution processes through mechanisms such as Online Dispute Resolution (ODR) platforms. He pointed out that several government departments, MSMEs, and the Ministry of Finance have already adopted such digital platforms, demonstrating their potential. It was observed that technology can support regulatory oversight, particularly in situations where operators face financial distress or insolvency, which has the potential to disrupt operations. Reference was made to institutions like the Insolvency and Bankruptcy Board of India (IBBI), which leverages technology to maintain financial information on operators, through information utilities. It was suggested that there is scope for greater real-time data sharing and cross-collaboration to strengthen monitoring and response mechanisms. The increasing frequency of cyberattacks, both globally and within India, was cited as a key concern. Illustrative examples were mentioned, including a cyber intrusion into a water treatment facility in Florida in 2021, cyber-induced blackouts in Ukraine, power grid disturbances in Mumbai, and cybersecurity incidents at AIIMS in 2020. These examples were used to emphasize the urgent need for a strong, proactive framework to enhance resilience.



f) Dr. Sirohi stressed that building such resilience would require institutional capacity and coordinated efforts, such as strengthening Computer Emergency Response Teams (CERTs), including sector-specific CERTs for critical infrastructure. He concluded that these considerations should be embedded within policy and regulatory frameworks, supported by strategic foresight. International examples, such as efforts in the European Union and the United Kingdom underline the importance of forward-looking approaches. Additionally, ensuring capacity building will also be detrimental, particularly given the current reliance on outsourced expertise and the limited in-house capabilities within institutions.

g) Ms. Manju Gupta, emphasised on the importance and need for Cybersecurity experts and Chief Security Officers. She highlighted how Ministry of Power (MoP) has made renewed focus on this, and it was decided that there should be dedicated officers for cybersecurity in every state and every company.

h) Mr. Manoj Kumar Jhawar, CMD, Power Trading Corporation India Ltd. (PTC), talked about the two key focus areas, they are currently working on. The first relates to energy portfolio management services. As a trader, he explained, there is a need to continuously engage with and develop platforms that can facilitate efficient energy portfolio management. It was observed that grid management was earlier relatively straightforward, however, with the increasing integration of renewable energy — characterized by intermittency — the complexity of grid operations has grown significantly. This complexity has been further compounded by the rise of distributed generation, particularly solar, and is expected to increase even more with the integration of battery storage systems. He emphasized that managing such a system would increasingly resemble a multivariate equilibrium problem, which may not be optimizable through human intervention alone. As a result, advanced algorithms, extensive computations, and robust digital platforms would become essential. The second area highlighted was the need to better understand pricing dynamics in spot markets. Mr. Jhawar pointed out that prices currently exhibit significant volatility — dropping to near zero during daytime hours and rising to as high as ₹10 during peak or

nighttime periods. He suggested that there is a need to analyze these trends more deeply to identify patterns and potentially develop some degree of predictability.

i) Elaborating further, Mr. Manoj observed that with each passing day, new technologies are emerging, leading to an increasing convergence of interconnected data. In the context of IoT, with the large-scale deployment of smart meters — targeting nearly 20 crore installations — was cited as a prominent example. Initially, the focus was on installation and data collection; however, the he noted that the critical question soon became how to meaningfully utilize this data. This led to the need for developing a strong commercial case, with early use cases centered around understanding consumption patterns. He explained that data analytics has enabled the identification of anomalies, such as consumers misclassifying themselves or under-declaring loads. It has also supported technical improvements, such as phase balancing and reduction of losses. Mr. Jhawar highlighted a shift from random inspections to "precision vigilance," where algorithm-driven insights allow for more targeted and professional interventions. Reference regarding an interaction with an Australian firm was shared, that demonstrated how detailed household-level heat maps could be created by combining device-level consumption signatures with meter data. This enables highly granular insights into appliance usage patterns within households. He remarked that such convergence of data and analytics can produce powerful outcomes. While concluding, Mr. Jhawar emphasised that the convergence of data and technology holds immense potential, but it also introduces new risks and responsibilities, particularly around privacy and ethical use, which must be carefully managed.

j) Ms. Manju Gupta opened the floor to all the panelists on the question, "What role do emerging technologies like AI, IoT, Blockchain play in enhancing service delivery and innovation."

k) The panel converged on the view that emerging technologies such as AI, IoT, and blockchain are fundamentally transforming service delivery across infrastructure sectors, but their effectiveness hinges on both opportunity realization and risk management. Panelists highlighted a wide range of practical applications already

underway. AI and IoT are enabling predictive maintenance, smart resource management, and operational optimization across transport, water, irrigation, and power systems. In the energy sector specifically, AI-driven forecasting, contingency analysis, and real-time grid monitoring are becoming critical as renewable energy integration increases system complexity. Similarly, digital twins, smart sensors, and data-driven decision-making are improving resilience and efficiency in utilities.

l) At the same time, there was strong emphasis on the foundational role of high-quality data. Effective deployment of these technologies requires robust data collection, standardization, and governance frameworks. Ensuring data integrity, consistency, security, and accessibility, without compromising critical infrastructure, is essential. The need for common data models, secure data exchange mechanisms, and periodic data audits was underscored to maintain reliability of insights. Panelists also cautioned that while technological convergence (AI, computing, communication, and even biotechnology) opens up significant innovation potential, it introduces new and complex risks. These include cybersecurity threats, misuse of highly confidential data, and unintended consequences of advanced capabilities. Overall, the consensus was that emerging technologies offer immense potential to enhance efficiency, resilience, and innovation, but their success will depend on strong data ecosystems, prudent governance, and a cautious, well-regulated approach to adoption.

m) Concluding the panel discussion, Ms. Manju Gupta emphasised on how digitalization and new and emerging technologies are here to stay and we will have to learn to live with these advancements. There will be need to have strong policy and regulatory interventions to face the challenges associated with these emerging technologies.


South Asia Forum For Infrastructure Regulation
ANNUAL CONFERENCE
ON
"STRENGTHENING INFRASTRUCTURE REGULATION IN SOUTH
RESILIENCE, INNOVATION AND REGIONAL CO-OPERATION

VOTE OF THANKS BY SECRETARY, SAFIR / CERC



9. Secretary, SAFIR / CERC, expressed the privilege of delivering the vote of thanks and conveyed sincere gratitude to Shri Jishnu Barua, Chairperson of SAFIR / CERC, for his guidance on the conference theme, which helped shape the deliberations and provided direction for regional regulatory collaboration. He mentioned about the extensive internal discussions and brainstorming, that had been undertaken to design an agenda that would be meaningful and beneficial for all members. Appreciation was extended to the leadership and representatives from Sri Lanka, Bangladesh, Bhutan, and Regulatory Commissions in India, including those from the electricity and airport sectors, for their active participation and thoughtful contributions. Summarizing the panel discussions, he highlighted that the first panel brought in global perspectives and underscored the diverse infrastructure and energy challenges faced across South Asia, ranging from renewable energy integration and transmission costs in India, rooftop solar integration in Sri Lanka, to energy diversification in Bangladesh, and renewable expansion in Bhutan. The discussions reflected shared challenges and the need for technological innovation and decentralized system management. The second panel, comprising Indian regulators, focused on balancing efficiency and innovation in consumer-facing sectors such as electricity and aviation. Key themes included optimal resource allocation, subsidy design, and the potential role of regulatory sandboxes to foster innovation. The third panel, consisting of academicians, system operators, industry participants, and NGOs, provided valuable stakeholder perspectives on digitalization and cybersecurity, enriching the regulatory discourse. He also acknowledged the Chairperson, TGERC and team from Telangana for their meticulous arrangements and warm hospitality, which ensured the smooth conduct of the conference, and appreciated the efforts of the SAFIR Secretariat for smooth coordination. In conclusion, gratitude was extended

to all participants for their engagement and commitment to strengthening regional regulatory frameworks. Secretary, SAFIR / CERC, emphasized that continued cooperation, knowledge sharing, and regional energy trade would play a crucial role in addressing common challenges and improving affordability and quality of life across South Asia.





APPENDIX-I

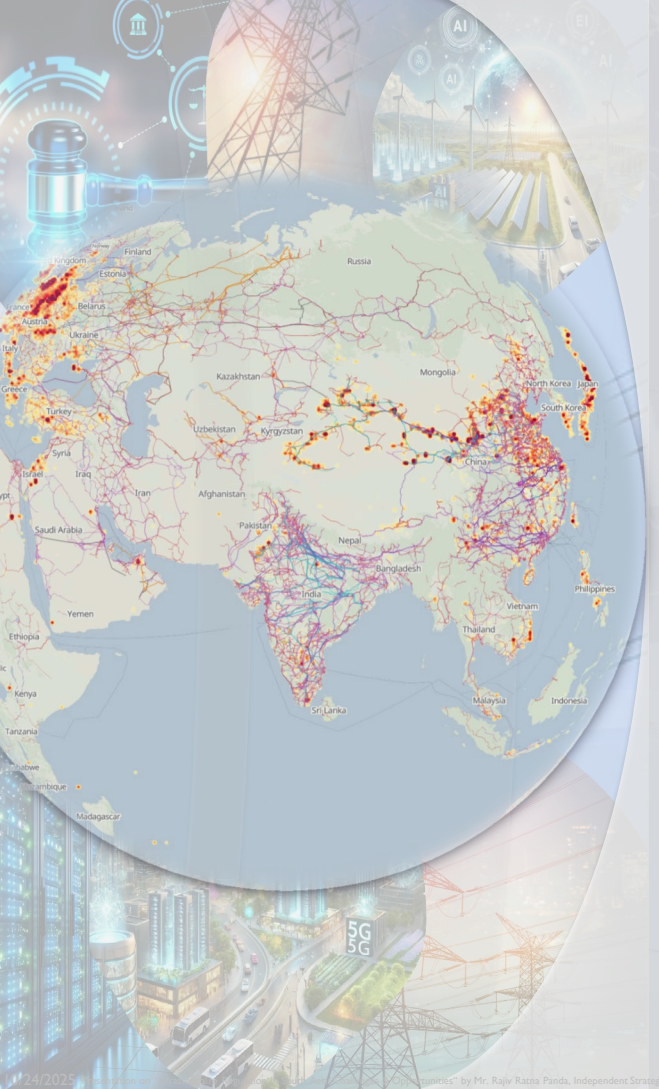
LIST OF PARTICIPANTS

S.NO.	NAME	ORGANIZATION
01.	Mr. Jishnu Barua, Chairperson, CERC & SAFIR	Central Electricity Regulatory Commission (India)
02.	Mr. Jalal Ahmed, Chairman, BERC	Bangladesh Energy Regulatory Commission (Bangladesh)
03.	Prof. K.P. Lalith Chandralal, Chairperson, PUCSL	Public Utilities Commission of Sri Lanka (Sri Lanka)
04.	Mr. Piyal Hemayake, Deputy Chairperson, PUCSL	Public Utilities Commission of Sri Lanka (Sri Lanka)
05.	Mr. Dorji Dorji, Chief (Monitoring), ERA	Electricity Regulatory Authority, Bhutan
06.	Mr. Sanjay Kumar, Chairperson	Maharashtra ERC (India)
07.	Mr. Viswajeet Khanna, Chairperson	Punjab SERC (India)
08.	Mr. P. Ravi Kumar, Chairperson	Karnataka ERC (India)
09.	Dr. M.V. Rao, Chairperson	West Bengal ERC (India)
10.	Mr. Alok Tandon, Chairperson	JERC for State of Goa & UTs (India)
11.	Mr. Arvind Kumar, Chairperson	Uttar Pradesh ERC (India)
12.	Mr. S.K.G. Rahate, Chairperson	Airports Economic Regulatory Authority (India)
13.	Mr. Chandan Kumar Mondol, Chairperson	Meghalaya SERC (India)
14.	Dr. (Justice) Devaraju Nagarjun, Chairperson	Telangana SERC (India)
15.	Mr. R. Manivannan, Chairperson	Tamil Nadu ERC (India)
16.	Mr. Hemant Verma, Chairperson	Tripura ERC (India)
17.	Mr. Gopal Srivastava, Chairperson I/c.	Madhya Pradesh ERC (India)
18.	Mr. A.J. Wilson, Member	Kerala SERC (India)
19.	Mr. Mehul M. Gandhi, Member	Gujarat ERC (India)

20.	Mr. Mahendra Prasad, Member	Jharkhand SERC (India)
21.	Mr. Shashi Kant Joshi, Member	Himachal Pradesh ERC (India)
22.	Mr. Arun Kumar Sinha, Member	Bihar ERC (India)
23.	Mr. Surender Babbar, Member	Delhi ERC (India)
24.	Mr. Vivek Ganodwale, Member	Chhattisgarh SERC (India)
25.	Mr. Prabhat Kishor Dimri, Member	Uttarakhand ERC (India)
26.	Dr. Manoj Kumar Jhawar, CMD	PTC Ltd. (India)
27.	Mr. Praveen Saxena, Managing Director	ONGC TPC (India)
28.	Mr. T. Srinivas, Executive Director CERT-GO-CISO	Grid Control of India Ltd. (India)
29.	Ms. Manju Gupta, Executive Director (Com. & Reg. Cell)	Power Grid Corporation of India Ltd., India
30.	Mr. Ripun Joy Bhuyal, I/c. Executive Director (Com.)	NEEPCO Ltd. (India)
31.	Mr. Puneet Chitkara, Sr. Vice-President (Strategy)	IEX (India)
32.	Mr. Ranjeet Thakur, General Manager (Com.)	NHPC Ltd. (India)
33.	Mr. Naveen Sirohi, Director	Indian Institute of Corporate Affairs (India)
34.	Mr. Harpreet Singh Pruthi, Secretary, CERC	Central Electricity Regulatory Commission (India)
35.	Dr. Sushanta K. Chatterjee, Chief (Regulatory Affairs), CERC	Central Electricity Regulatory Commission (India)
36.	Ms. Swetha Ravi Kumar, Executive Director	FSR Global Council (India)
SPECIAL INVITEES		
37.	Mr. Ramesh Babu Veeravalli, Member	Central Electricity Regulatory Commission (India)
38.	Mr. Harish Dudani, Member	Central Electricity Regulatory Commission (India)
39.	Mr. Raghu Kancharla, Member	Telangana SERC (India)

40.	Mr. C. Srinivasa Rao, Member	Telangana SERC (India)
41.	Mr. Rajiv Ratna Panda, Independent Strategy & Political Adviser, South Asia	South Asia (India)
SAFIR SECRETARIAT		
42.	Ms. Rashmi Somasekharan Nair, Jt. Chief (Regulatory Affairs)	Central Electricity Regulatory Commission (India)

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SAFIR ANNUAL CONFERENCE

"Strengthening Infrastructure Regulation in South Asia: Resilience, Innovation, and Regional Cooperation"

Presentation

on

INFRASTRUCTURE REGULATION IN SOUTH ASIA: CHALLENGES & OPPORTUNITIES

PANEL DISCUSSION I : INFRASTRUCTURE REGULATION IN SOUTH ASIA: CHALLENGES & OPPORTUNITIES

Presented by
Mr. Rajiv Ratna Panda
Independent Strategy and Political Adviser, South Asia

24th October 2025, 10.15-11.15 AM, Hotel Westin Mindspace, Hyderabad, Telangana, India

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{Unprecedented Scale, Pace of RE growth in South Asia and Rapid Technological Progress in the World}

03 Regulating Amidst Massive Infra Transformation: *The Great Challenge of Balance*

{Nature of Infra Investments, Setting the Expectations, High RE Integration Challenges, The Dynamic Regulatory Approach}

04 Regulating Amidst Massive Infra Transformation: Opportunities

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{Infrastructure Regulation in South Asia: Challenges & Opportunities}



01 South Asia Economy, National and Regional Cooperation Infrastructure Need

{Fastest Growing, Yet least Integrated, Low Per capita income, Massive Infrastructure Expansion (National, X border & Regional)

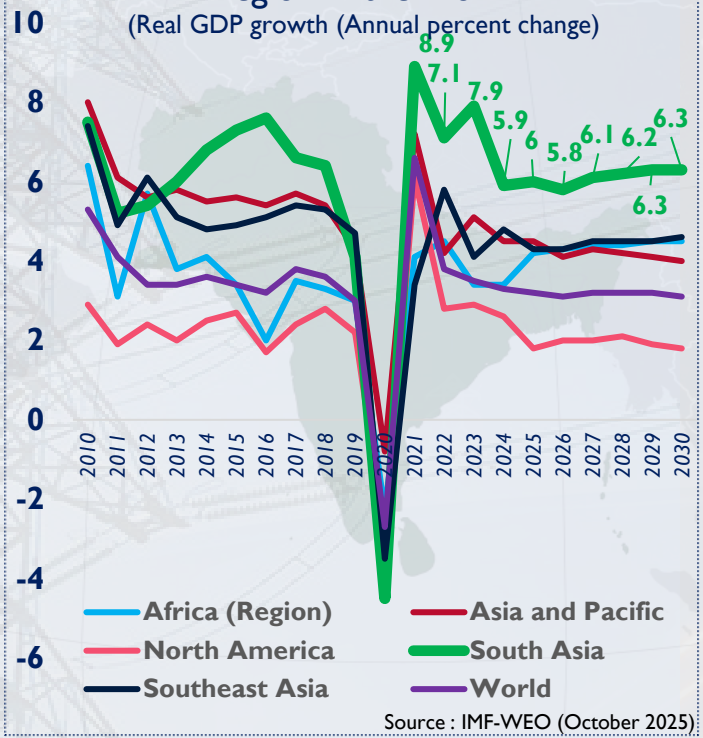


01.1 South Asia : Economic Hotspot despite Headwinds, Economic & Political Crisis

{Fastest Growing, Yet least Integrated, Low Per capita income (5X < world average}

South Asia- Fastest Growing Region in the World

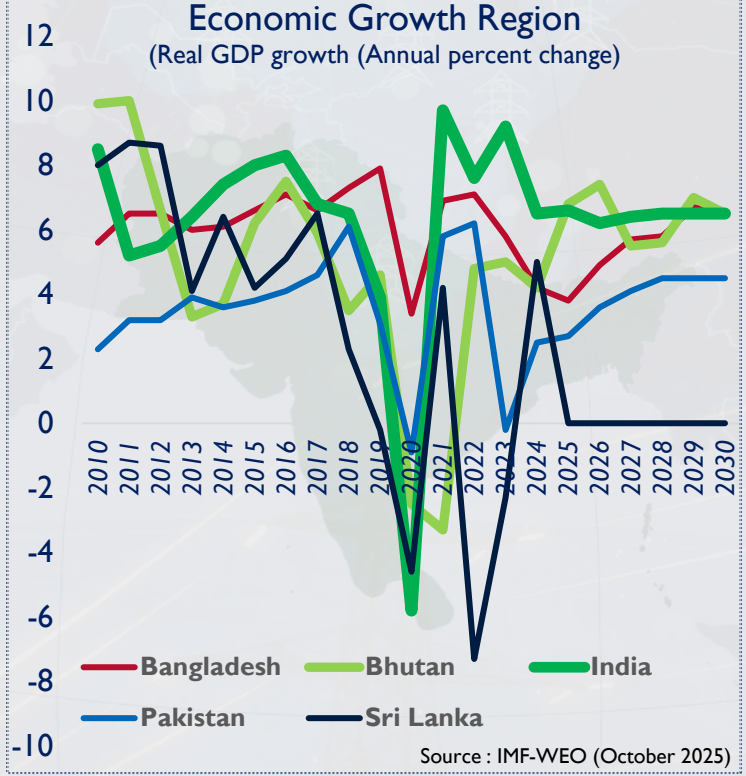
(Real GDP growth (Annual percent change)



Source : IMF-WEO (October 2025)

South Asian Countries- High Economic Growth Region

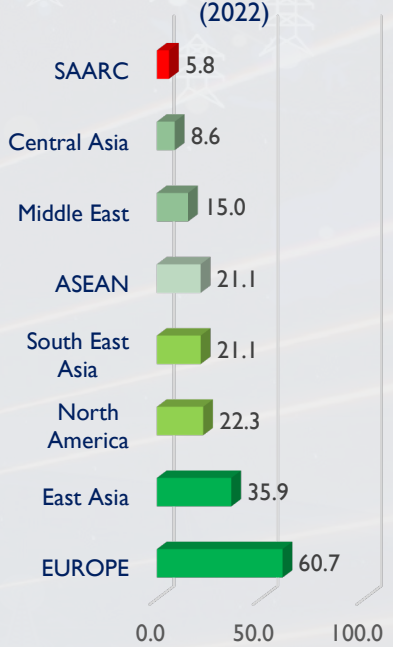
(Real GDP growth (Annual percent change)



Source : IMF-WEO (October 2025)

Least Integrated Region

Intra-Regional Trade Share (%) (2022)



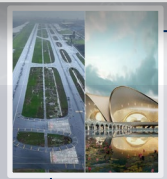
Source : ADB-ARIC Integration

Per Capita Income: South Asia- **2674** (U.S. dollars per capita current price) , **World -14613 | 5 x** More

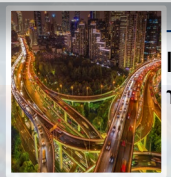
01.2 South Asia : Massive Non-Energy Infrastructure Expansion

{ Building Resilience, Long term & Sustained Economic Prosperity}





India- **double** the number of airports to **350** by **2047**



India-**$2.4 trillion** by 2050 to meet the need for new, resilient, low-carbon infrastructure, services in **cities**



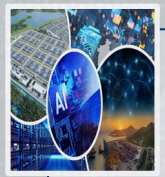
India-**150+** initiative across various maritime sectors like ports, shipping, water ways



75-90% India's passenger vehicle **electric** by 2050. **90%**-new private 4 wheelers **electric** by 2030 in **Nepal**

SAGARMALA
PORT-LED PROSPERITY

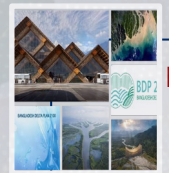
India-Ports Expansion and modernisation, Sagarmala 1.0. US$ **67.12** billion, Sagarmala 2.0 -US$ **139.11** billion



GIGA Scale AI HUB and Data Center. **India's first 15 Billion US $** - AI hub in Visakhapatnam



India-**6G Telecom** Rollout by 2030



Bangladesh Delta 2100 Plan (38 Billion USD) , Bhutan- Gelephu Mindfulness City

Viksit Bharat

India-Vikashit Bharat USD 30 trillion GDP by **2047, 7 X increase**



India-Steel (Million ton)- 530 BY 2047, **3.67 X Increase**



India-Cement (Million ton)- 910 BY 2047, **2 X Increase**



India-Aluminum (Million ton)- 30 BY 2047, **5.45 X Increase**

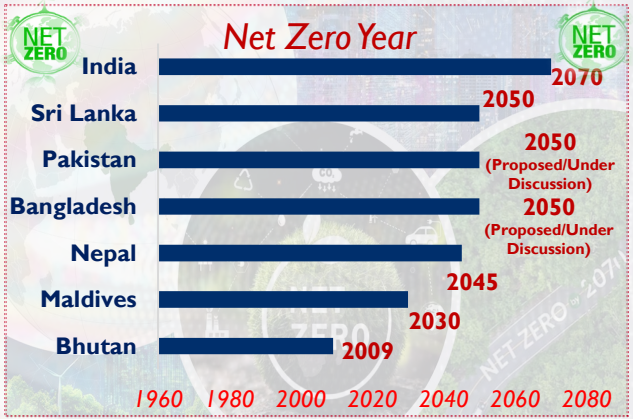


India-5 MT of Green Hydrogen Need 135 GW of RE, 74 GW of electrolyser

01.3 South Asia : Massive Energy Infrastructure Expansion for Net Zero Transition

{India's Scale of Green Transition – 7753 GW Capacity for Net Zero by 2070 | 13.1Trillion USD Investment}

Net Zero & RE Goals/Ambitions



Renewable Energy

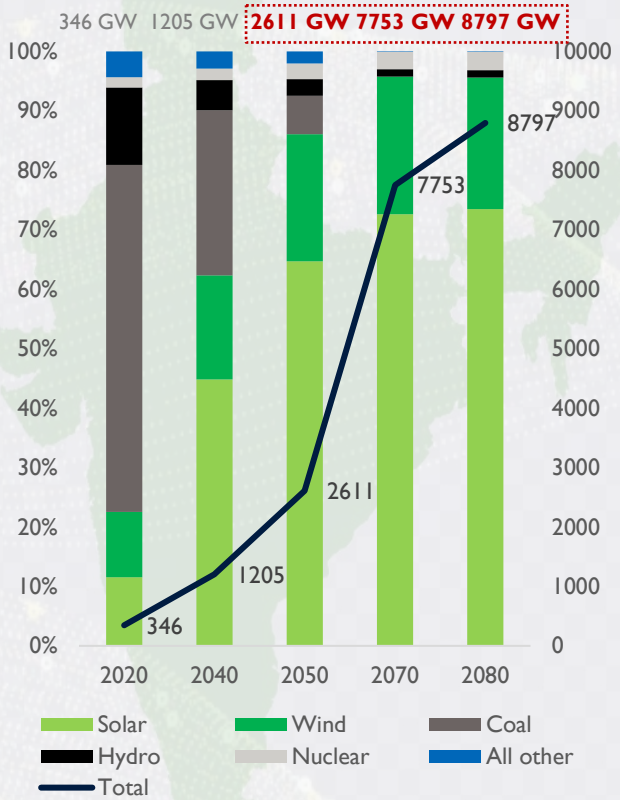
- 2205 GW (2047)
- 38 GW (2050)
- 52 GW (2050)
- 35 GW (2035)
- 25 GW (2040)
- 14 GW (2044)

2371 GW RE | 100 GW Nuclear by 2047 (India)

Note: RE- Renewable+ Hydro/Clean Energy/Non-Fossil /Hydro as the case in a Country Context, BD –IEMP-2023-Table 5.3-1 Renewable energy generation deployment plan-, Pakistan-IEGEP Plan , Sri Lanka-CEB LGTEP , Nepal –WAM Scenario- Page-27 of Nepal's LTS for Net-zero, Bhutan- Energy Policy

Power Generating capacity

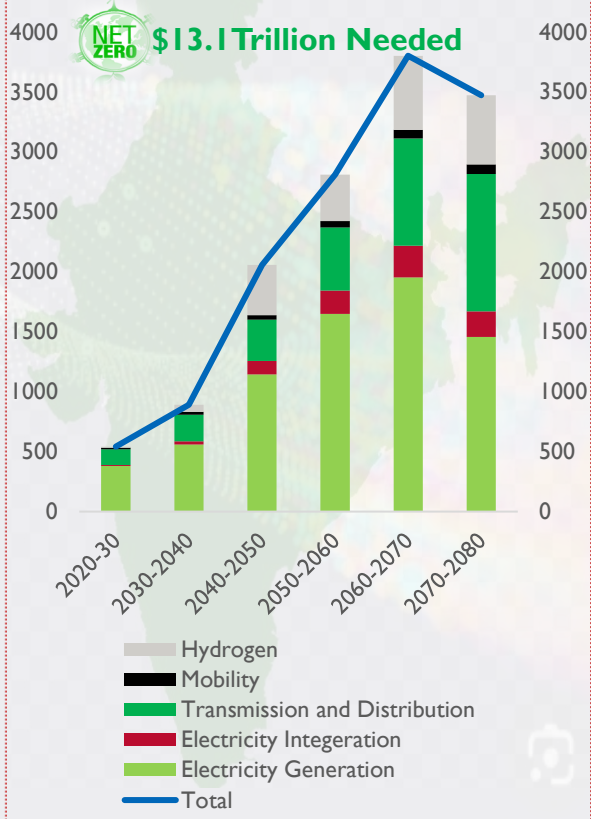
(Peaking @2040 & Net-zero @2070)



Source: CEEW_Investment Sizing India's 2070 Net-Zero Target

NetZero Investments

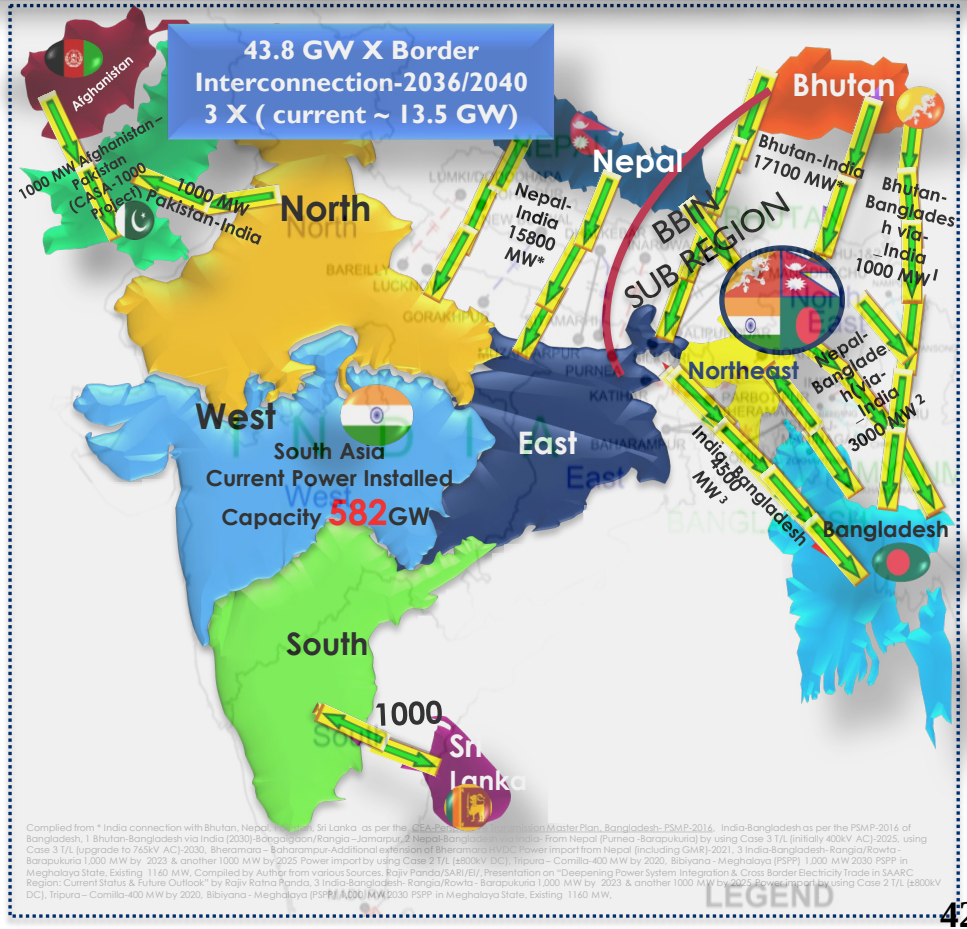
(Billion USD) (Peaking @2040 & Net-zero @2070)

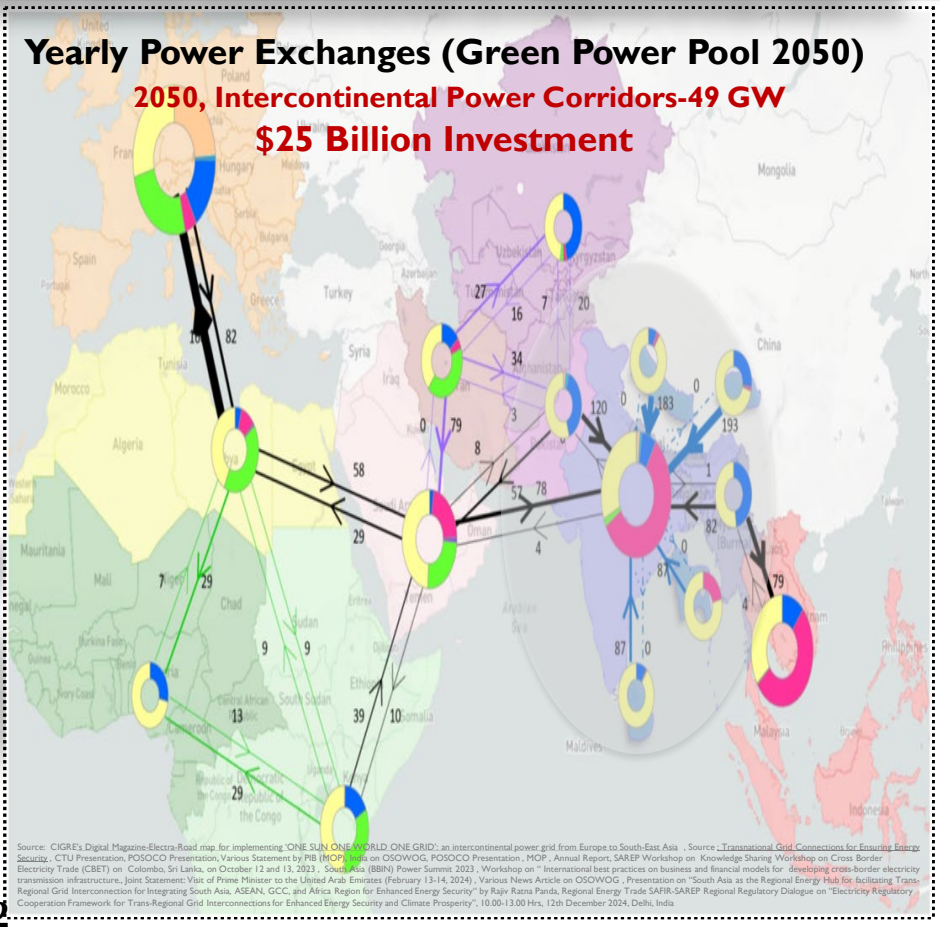


Source: CEEW_Investment Sizing India's 2070 Net-Zero Target

01.4 South Asia : Massive Regional Cooperation Energy Infrastructure Expansion

{44 GW of X Border Interconnection in Sout Asia I South Asis the Fulcrum to Emerge as a Regional Energy Hub}





Source: CIGRE's Digital Magazine-Electra-Road map for implementing 'ONE SUN ONE WORLD ONE GRID': an intercontinental power grid from Europe to South-East Asia , Source : Transnational Grid Connections for Ensuring Energy Security , CTU Presentation, POSOCO Presentation, Various Statement by PIB (MOP), India on OSOWOG, POSOCO Presentation , MOP , Annual Report, SAREP Workshop on Knowledge Sharing Workshop on Cross Border Electricity Trade (CBET) on Colombo, Sri Lanka, on October 12 and 13, 2023 , South Asia (BBIN) Power Summit 2023 , Workshop on " International best practices on business and financial models for developing cross-border electricity transmission infrastructure, Joint Statement: Visit of Prime Minister to the United Arab Emirates (February 13-14, 2024) , Various News Article on OSOWOG , Presentation on "South Asia as the Regional Energy Hub for facilitating Trans-Regional Grid Interconnection for Integrating South Asia, ASEAN, GCC, and Africa Region for Enhanced Energy Security" by Rajiv Ratna Panda, Regional Energy Trade SAFIR-SAREP Regional Regulatory Dialogue on "Electricity Regulatory Cooperation Framework for Trans-Regional Grid Interconnections for Enhanced Energy Security and Climate Prosperity", 10.00-13.00 Hrs, 12th December 2024, Delhi, India

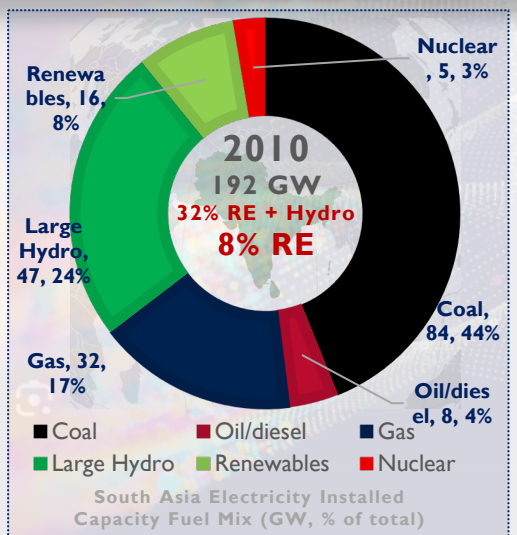
02

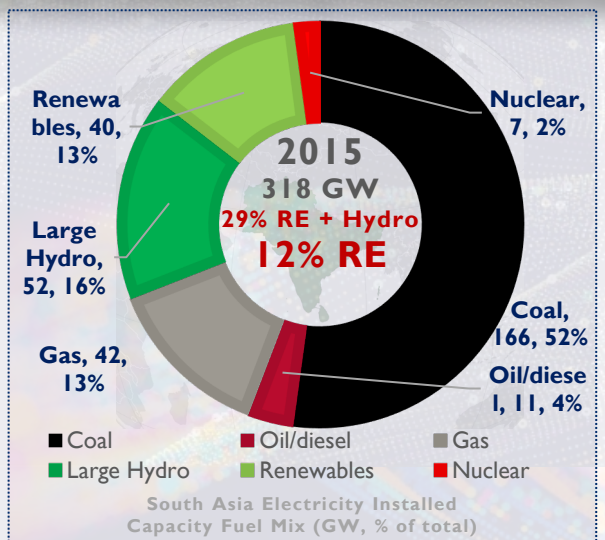
South Asia's Clean Energy Transitions : The Great, Good Creative Destruction

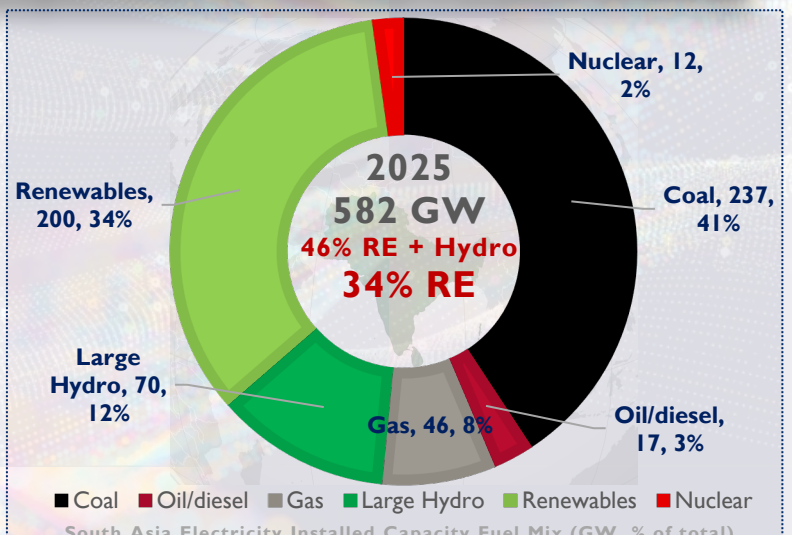
{Unprecedented Scale, Pace of RE growth in South Asia, Rapid Technological Progress in the World}

02.1 South Asia's Clean Energy Transitions: The Great, Good Creative Destruction

{3 X Increase in RE Share, Unprecedented Expansion in RE, the Perfect Storm}







The New York Times
https://www.nytimes.com › nepal-electric-vehicles-china
The Country Where 76% of Cars Sold Are Electric

PIB
https://www.pib.gov.in › PressNoteDetails
India ranks 4th globally in RE Capacity, 4th in Wind , 3rd in Solar
The Solar Surge: India's Bold Leap Toward a Net Zero Future

The Morning
https://www.themorning.lk › articles
Sri Lanka hits 70% renewable energy generation in June ...

lankanewsweb.net
https://lankanewsweb.net › archives › sri-lanka-reaches-...
30% total Capacity
Sri Lanka reaches 1700 MW rooftop solar milestone signalling ...
16 May 2025 — The 1,700 MW figure represents the total installed capacity from rooftop solar

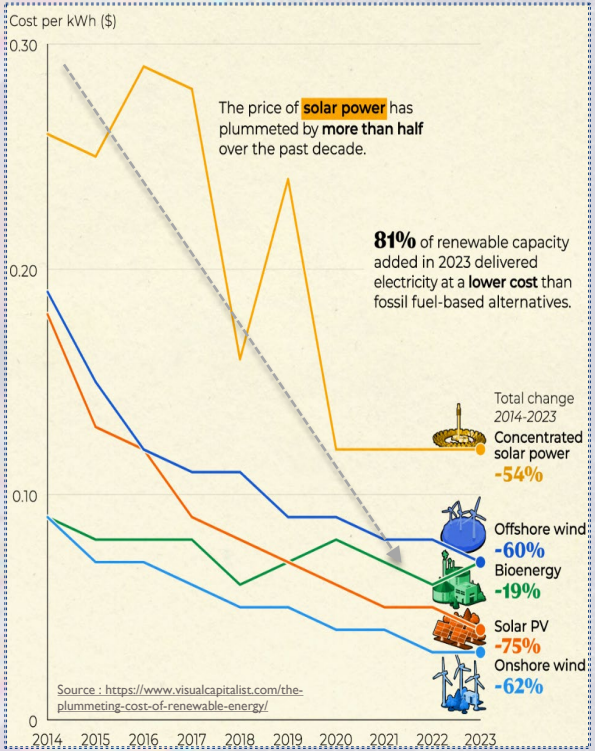
The New Indian Express
https://www.newindianexpress.com › States › Karnataka
80% demand met renewable sources
Karnataka hits 80 per cent renewable power mark on ...
20 Aug 2025 — **Karnataka** hits **80 per cent** renewable power mark on August 18, sets record. **Karnataka** also supplied 6.616 MU to Punjab as an advance power ...

Gulf News
https://gulfnews.com › Opinion › Op-Eds
40 GW of Solar Panel Import in last 4 years (~90% of Pakistan's Current Electricity Installed Capacity
Pakistan's great solar escape: A revolution from below

02.2 South Asia's Clean Energy Transitions: The Great, Good Creative Destruction

{Rapid Technological Progress, World AI Progress further contribute to the Dynamism of SA, 8 GW (5X) Data Center, 2030 in India}

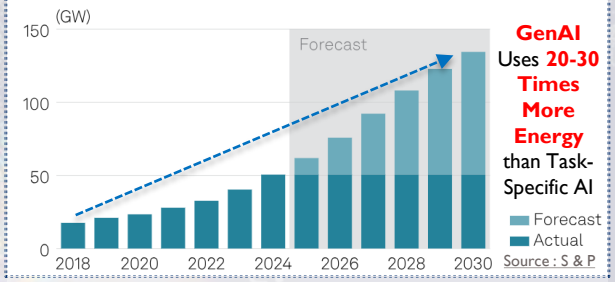
Plummeting Cost of Renewable Energy

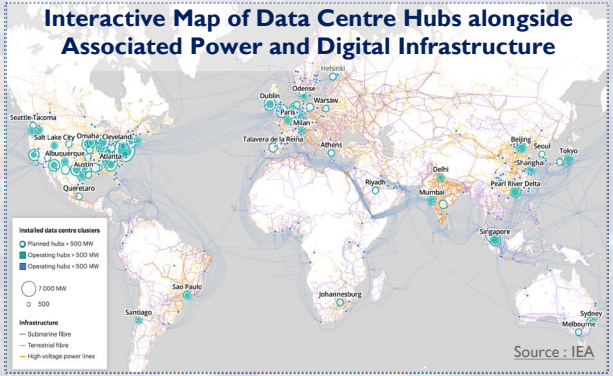


Training Compute of Frontier AI Models Grows by 4-5x per year



USA : AI-Data Center | Unprecedented Power Demand | 50 GW (2025) | 134 GW (2030)



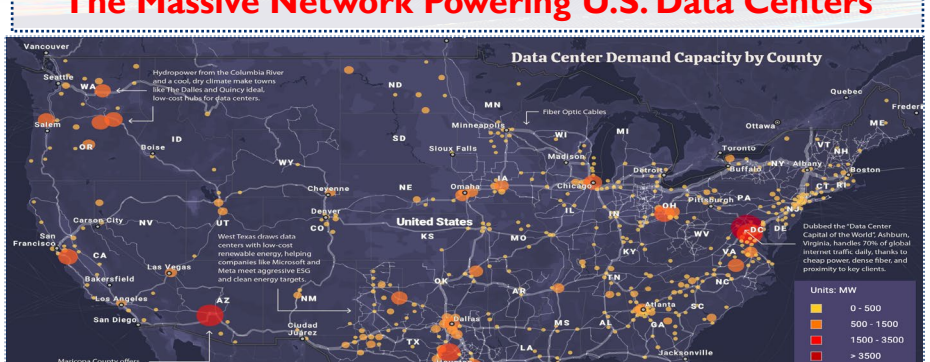


India's data centre - quintuple to **8 GW by 2030**, driven by surging data traffic, lower latency requirements, data localization, rising use of AI.

02.3 South Asia's Clean Energy Transitions: The Great, Good Creative Destruction

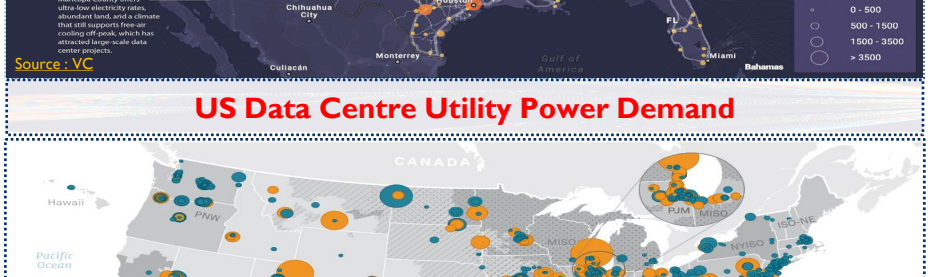
{AI Data Center Proliferation would add to the already challenging grid operation due to integration of intermittent renewable energy in large scale I USA Experience and Learnings}

The Massive Network Powering U.S. Data Centers



Source : VC

US Data Centre Utility Power Demand



Source : S & P

USA : AI-Data Center I What is the Impact on the Grid and Society ? I What are Policy and Regulatory Response ?

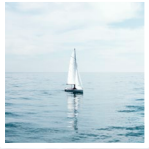
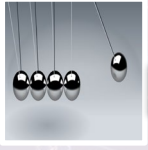
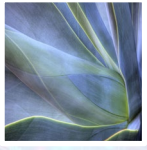
- **Massive Impact on the Local Grid Reliability & Needed both Generation and Network Expansion.**
- **Electricity now costs as much as 267% more for a single month than it did five years ago in areas located near significant data center activity.**
- **California Senate Approves Legislation to Protect California Ratepayers from Paying for Data Centers' Energy Costs**
- 14th of this Month Independent Market Monitor for PJM Interconnection, filed a brief with the FERC to reject a recently signed transmission agreement between Pennsylvania utility PECO Energy and Amazon's (AMZN) Data Services division.

03 Regulating Amidst Massive Transformation: The Great Challenge of Balance

{Nature of Infra Investments, Setting the Expectations, The Dynamic Regulatory Approach}

03.I Regulating Amidst Massive Transformation-The Great Challenge of Balance

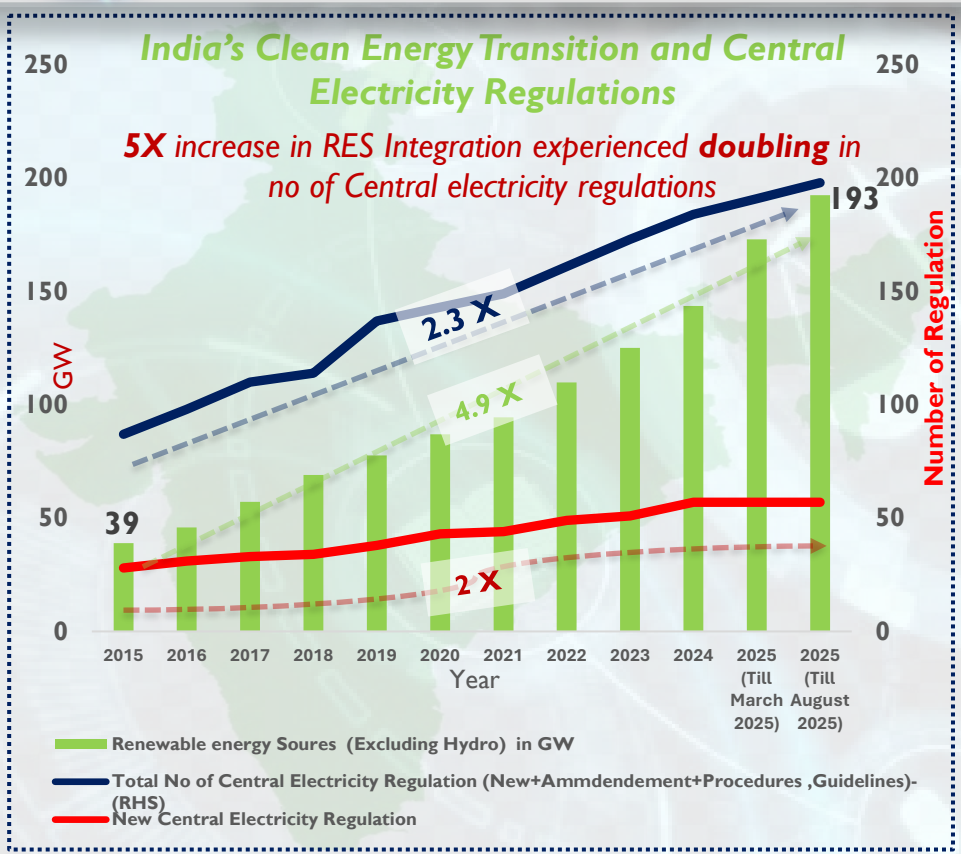
{Uniqueness, Risks I Expectation of Investors from Regulators I Setting the expectation}

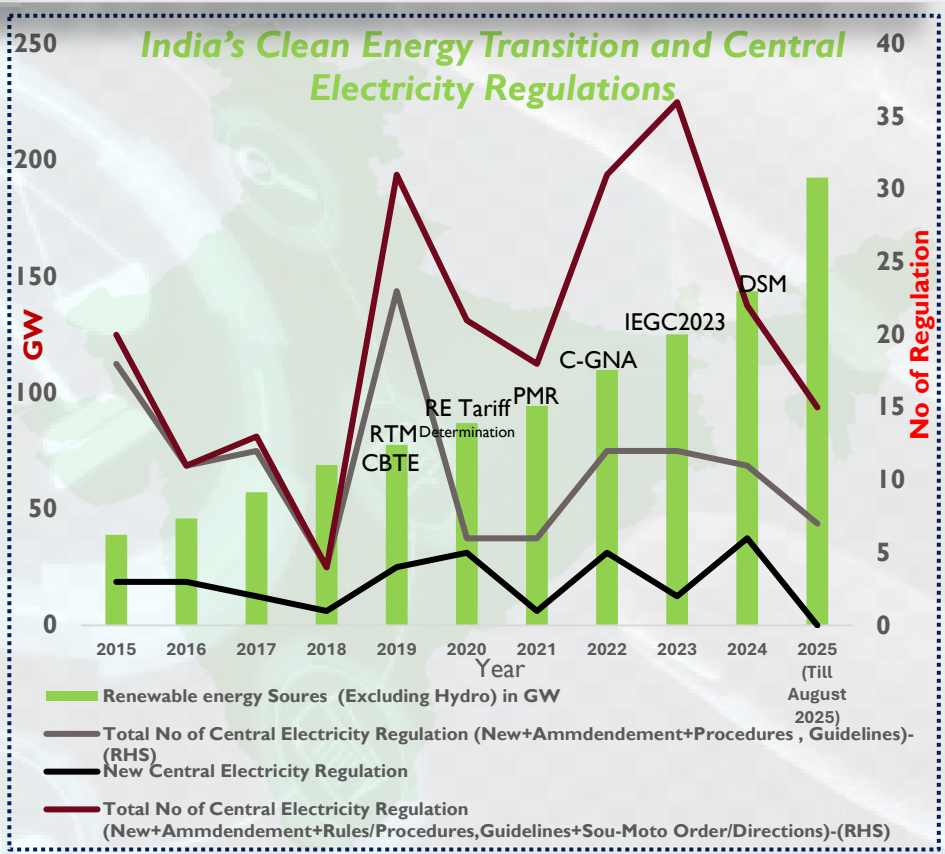
Nature of Infrastructure (National & Regional) Investment	Expectation of Investors and Stakeholders from Regulator	The Great Challenge of Balance amidst Large RE Redefining and Setting the Expectation Navigating Reliability, Affordability, and Resilience
 Long Term	 Stable	Stable but Not fixated & Rigid Setting "Stability of Intentions"
Irreversible 	Predictable 	Long Term "Visibility" Set Regulatory "Trajectory" with updating in every 3 year
 Multiple Jurisdiction	 Transparency & Minium Regulatory Risk	Consultative, Well-Communicated, Sharing of "Benefits" and "Burden"
Impact on Environment 	Adequate Return on Investment 	Systemic View I Regulatory Incentive Design must assess Potential Future Distortion

Myth of Certainty and Stability : Embracing Uncertainty and Internalizing the Dynamism will be the key

03.2 Regulating Amidst Massive Transformation-The Dynamic Regulatory Approach is Key

{5X increase in RES experienced doubling in no of Central electricity regulations}





India- Navigating Dynamism through Dynamic Regulation to Manage Intermittency of RE vis-à-vis Grid Operation, Reliability, Market Design Improvement

04 Regulating Amidst Massive Infra Transformation: Opportunities

{Navigating Reliability, Affordability, Resilience and Regional Energy Cooperation}

Regulating Amidst Massive Transformation-Opportunities

{Navigating Reliability, Affordability, Resilience and Regional Energy Cooperation}

Daunting Regulatory Challenge of Incentivizing Massive RE Investment while managing the Intermittent RE at Vis-à-vis safe, secure, economical Grid Operation



Reliability

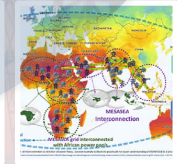
Affordability





Resilience

Regional Energy Cooperation



Structuring Political Economy

Regulators as Strategic Partners

Deepening Electricity Market & New Market Instruments

Incentivising Flexibility and Energy Storage

Restructuring Market Design

{Addressing Missing Money Problem}

SUPPLY DEMAND

More Fair Sharing of Burden and Cost of RE Integration

Early Adoption of AI in Decision Making in Increasingly Complex Grid Operation

(Cyber and AI Security needs to be addressed)

Regional Electricity Market Development

(E-MOSA,R-DAM)

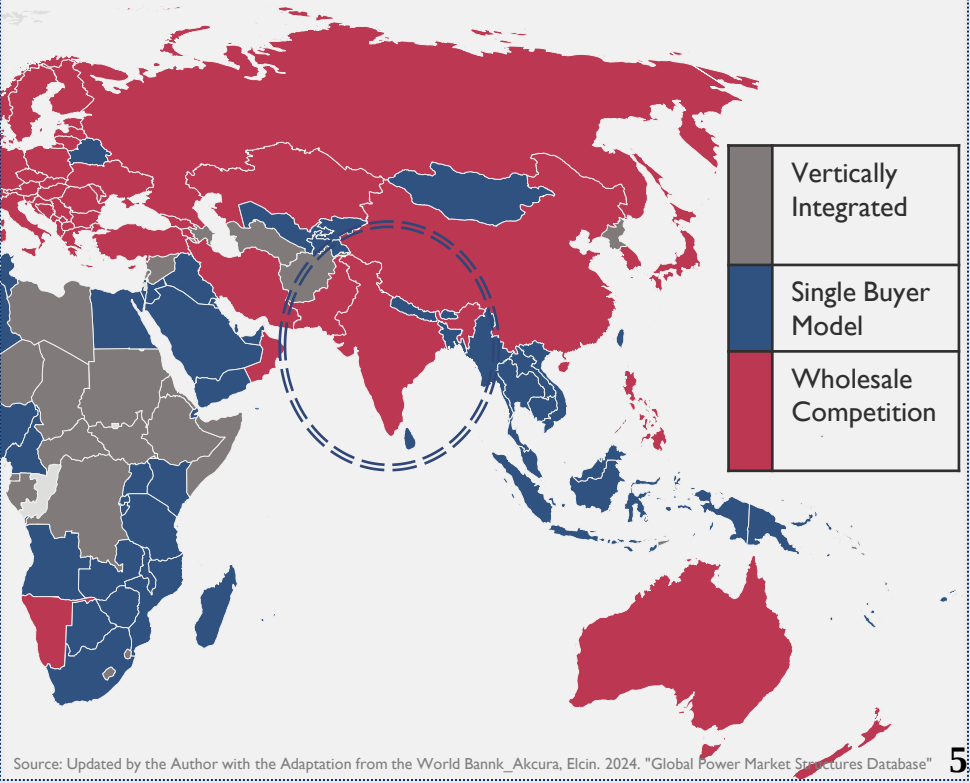
Innovative Instruments and schemes for Demand Flexibility *

* 24 GW demand shift in10 states from peak net load hours to non-peak net load hours can help avoid requirement of 30 GW of BESS capacity and thus lower system costs by INR 14,000 crore (USD 1.6 billion).

04.2 Regulating Amidst Massive Transformation-Opportunities

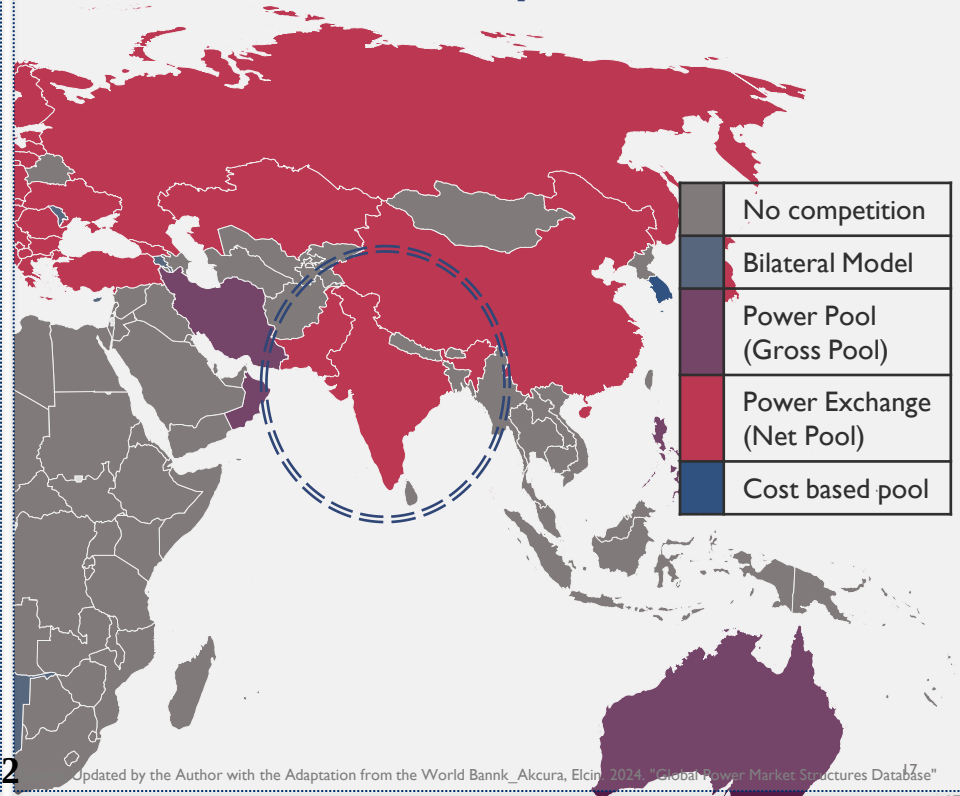
{Need to Advance National Market Development and Associated Regulations I Power Market Design Could Vary in South Asian Countries I Integrating of National Power Markets}

Power Market Model



Source: Updated by the Author with the Adaptation from the World Bannk_Akcura, Elcin. 2024. "Global Power Market Structures Database"

Wholesale Competition Models



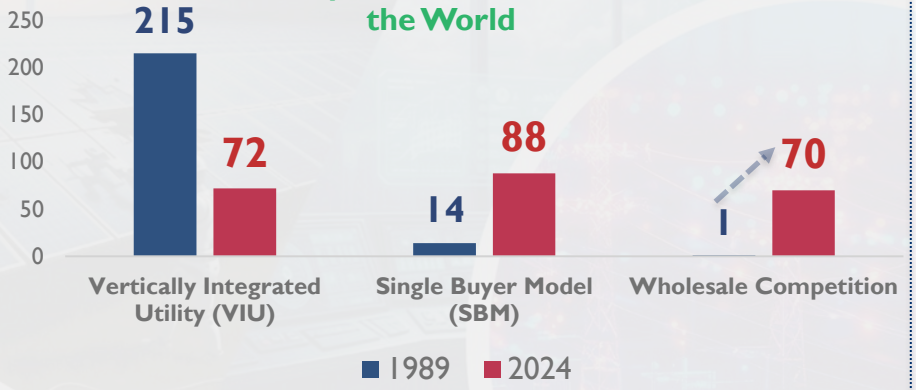
Updated by the Author with the Adaptation from the World Bannk_Akcura, Elcin. 2024. "Global Power Market Structures Database"

04.3 Regulating Amidst Massive Transformation-Opportunities

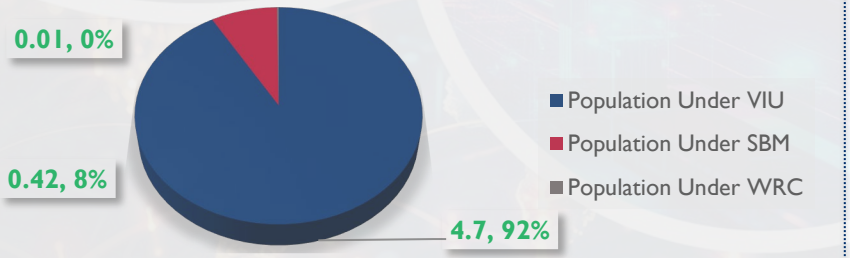
{National Market Development and Economic Prosperity}

{Wholesale market brought 17 times Increase in prosperity and well being}

Number of Countries by Market Structure
Massive Development of Wholesale Market in the World



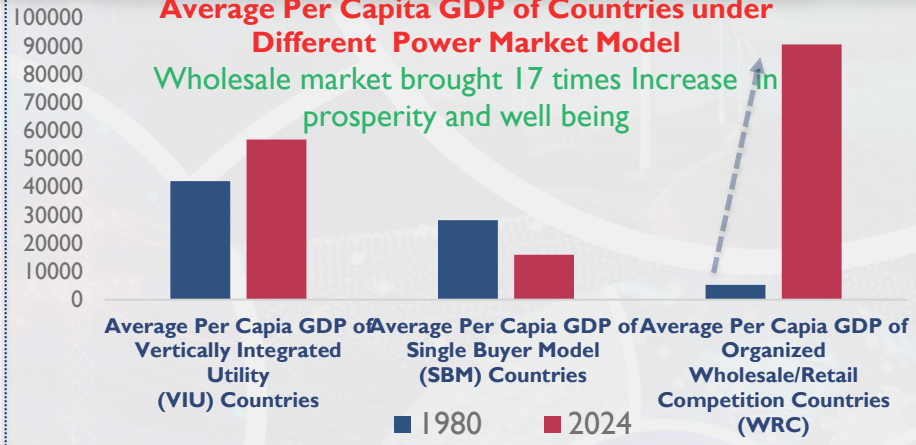
1980- 92% of World's Population under SBM



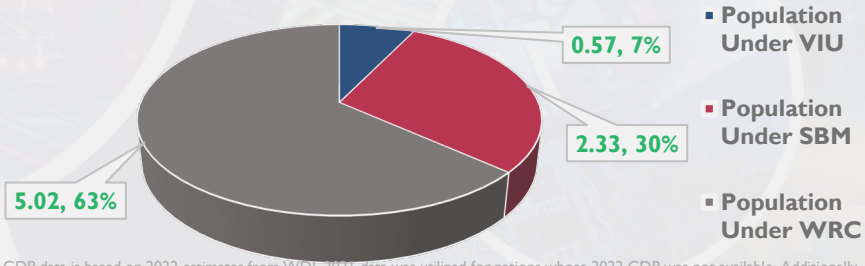
Source: Updated by the Author with the Adaptation from the World Bannk_Akcura, Elcin. 2024. "Global Power Market Structures Database"

Average Per Capita GDP of Countries under Different Power Market Model

Wholesale market brought 17 times Increase in prosperity and well being



2024- 63% of World's Population under WRC



Note: GDP data is based on 2022 estimates from WDI. 2021 data was utilized for nations whose 2022 GDP was not available. Additionally, the earliest available data was utilized for nations without GDP data for 1989.

0.5 PANEL DISCUSSION 1: INFRASTRUCTURE REGULATION IN SOUTH ASIA: CHALLENGES & OPPORTUNITIES

{Key Questions for Discussion}

1. What are the key regulatory challenges currently hindering Infrastructure Development across South Asia?
2. How can regulatory frameworks be made more transparent, efficient, and investment-friendly in the region?
3. What role can regulation play in attracting private and foreign investment in South Asian Infrastructure?
4. How can regional regulatory harmonization improve Cross-Border Infrastructure Projects (e.g. energy, transport)?
5. What policies are needed to support the integration of emerging technologies in Traditional Infrastructure Systems?
6. How can regulation support sustainable infrastructure development while ensuring affordability and equity?
7. What are the institutional capacity gaps in Infrastructure Regulation across South Asia, and how can they be addressed?
8. How can regulatory bodies in the region be strengthened to adapt to the evolving Infrastructure Landscape?



Imagined control room of the future with AI-based assistant Figure from Benjamin Kroposki and Seong Lok Choi, NREL, and DALL-E

NREL

eGridGPT:

Trustworthy AI in the Control Room

Thank You


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rajivratnapanda@gmail.com
+91-9650598697


“
Change is inevitable, but transformation is a choice.
HEATHER ASH AMARA
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“It always seems impossible until it’s done.”
- Nelson Mandela