

Asian Energy Highway

Inclusive and sustainable development through regionally integrated power development in Asia and the Pacific

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Executive Summary

Regional energy security for inclusive and sustainable development

Energy resource imbalances along with accessibility and affordability issues are prompting a need for governments and development agencies within the Asia and Pacific region to increasingly look beyond national borders as a means to secure necessary energy supplies. The expansion of electrification, particularly through grid based delivery, has become an increasingly dominant investment option for countries in terms of energy service expansion in addressing access gaps. In light of these developments, the United Nations Advisory Group on Energy and Climate Change (AGECC) has determined that delivering access to these demands will require a combination of both decentralized and centralized energy technologies. The former operating at small and localized capacities in keeping with rural requirements and the later meeting the demands of urban and industrial centers. Such a solution could be further enhanced however by integrating existing centralized energy systems to deliver enhanced integration and cooperation between energy services within the region.

Whilst Asia-Pacific, on the whole, has considerable potential for the development of a variety of conventional, alternative, and renewable energy technologies, the availability of these energy reserves remains unevenly distributed throughout the region, in terms of both supply and demand, and the national development capacity. Asia on whole is also the largest regional emitter of CO_2 on a global scale, with necessary development projects destined to increase this share further again unless significant adjustment in development planning occurs. The challenge that faces energy planners and policy makers at the state, sub-regional and regional level therefore, is how best to distribute these supplies in an efficient manner that is not only economically sound but conscious of developing social and environmental pressures.

The general trend for energy resource supply and development imbalances within the Asia-Pacific region has led to a growing trend in reliance upon international trading. In light of these growing interdependencies and in order to promote further regional cooperation, the United Nations Economic and Social Commission for Asia and the Pacific (ESCAP) is recognizing an opportunity to build upon existing initiatives towards enhanced integration of energy services within the Asia-Pacific by promoting the Asian Energy Highway (AEH) concept.

Subregional energy cooperation and integration

In line with the increased demands of urban electrification and industrialization, technological developments have permitted the interlinking of multiple isolated systems in order to deliver necessary supplies. At the broader national and regional level, grid interconnections are also continuing to be promoted as a means to enhance the security of power supply.

Cross-border energy cooperation and trading is not a new concept within Asia as recognition has been developing for some time regarding the mutual benefits of cross-border energy trading as a means to address energy imbalances. These include the ASEAN Power Grid in South-East Asia, with further linkages to East Asia through the GMS Program; SAARC within South and South-West Asia; CASAREM between Central and Southern Asia; and CAREC which is developing cooperative energy development linkages at a broader regional level from Central Asia to both Eastern and Southern Asia, in order to open trading opportunities to address energy supply imbalances. Such existing and developing integrated infrastructure projects shed light on the feasibility of further integration at the region wide level, by establishing further linkages again to form a single integrated electricity network.

Enhanced regional cooperation presents a unique opportunity to develop a common vision and response to shared vulnerability and to improve energy security for Asia and the Pacific. By harmonizing policies and exchanging knowledge, regional energy security can be advanced through improved physical connectivity and by developing institutions to promote greater capacities for sustainable energy trading. A regional consensus on energy development could further be one of the catalysts for a new energy paradigm, paving the way for a more sustainable future energy delivery system.

Investing in a cooperative energy future - the Asian Energy Highway Concept

Asian and Pacific nations will require considerable investment in energy infrastructure in the coming years to deliver the necessary energy to support the continued economic growth. A unique opportunity exists now to identify wider opportunities for supply and collectively take advantage as a region of the latest technologies. In order to most effectively address imbalances between resource supply and demand, advanced grid and transmission technologies could be employed to connect and manage the distribution of energy in the most efficient and effective manner, whilst supporting a higher injection capacity for renewable generating technologies. A key driver of energy security is diversification of the energy mix. By focusing on regional integration within the power sector, opportunities can be created to not only encourage energy mix diversification in the short-term, but to also improve capacity to adjust to ongoing developments in power generation technology. A sustainable regional energy supply chain could then be developed to support increasing demands for power, by improving efficiency, equity of access, scalability in to relation to expanding to meet growing demand, and environmental friendliness in support of lowcarbon energy development.

A regional planning perspective for energy distribution and security is likely to garner financial benefits in terms of an overall reduced net expenditure on energy infrastructure. As nations look beyond their borders, more economically, socially and environmentally viable integrated solutions can be found to meet demand growth. The diversification of energy resource supply is now projected to play an important role in meeting demand and managing carbon emission issues. An assessment into initiatives that could catalyze positive shifts in investment outlooks is therefore a timely endeavor.

Developing countries within the region therefore face even greater challenges in doubling their rate of energy efficiency. Incorporating modern and efficient technologies in both the supply and the demand sectors, early in the process of development, has become one of the fundamental challenges for both energy efficiency and ensuring sustainable access. The

likelihood of doubling the energy efficiency improvement rate is likely to improve considerably in these countries through regional knowledge sharing and the associated improved technical capacities that would be promoted and facilitated through a regional energy initiative. The AEH concept presents a unique opportunity to assist developing countries to "leapfrog" traditional energy-intensive development processes. In this regard, a regionally coordinated energy system provides significant potential and enhanced scope for technology-sharing and the engagement of expertise from the private sector to leverage and drive utility improvements.

Asia-Pacific energy markets

The potential for cross-border electricity trading has increasingly become an economically viable option for energy planners due to developments in power transmission technology (particularly HVDC) in recent decades. Such trading is also opening up potential for technology transfer, insofar as developing countries can access more advanced energy systems from neighbouring countries where appropriate. Indeed, studies into electricity transmission capacities are also demonstrating the competitive position that electricity trading is developing in comparison to more traditional forms of energy transport and trade technologies. For this purpose, the AEH could either develop as a progressive evolution of linkages, be developed principally as a 'supergrid' network, or a suitable combination of both. Although such decisions would require considerable planning and assessment regarding existing transmission systems and resource allocations, significant gains become possible in what would be the resultant creation of an Asian energy market.

Where market players have access to real time information on all aspects of operations, including changing market prices for electricity, it is now feasible to operate a disaggregated industry structure with high levels of economic efficiency. This has facilitating the opportunity for interconnected grids to move into a deeper level of energy trading wherein available electricity supplies can be 'pooled' from a generation and competitive pricing perspective. Integrating these concepts would not only lead to better physical connectivity between countries, but also promote greater institutional cooperation, including the development of capacities for regional energy markets. Under an integrated regional power trading arrangement, low-carbon paths that place more emphasis on efficiency and take greater advantage of renewable resources could be explored. Importantly, the AEH would help to address the power-deficit as part of working towards the goal of universal access to modern energy services.

Growing together

Although moving beyond national borders is not a new concept in terms of securing energy supplies within the Asia-Pacific, significant challenges will still need to be overcome in order progress to a regional scale of energy planning. The AEH is by nature a transnational project involving a wide diversity of players, significant cooperation at all levels, and transparency within partnerships and management processes. A desire by states to maintain energy independence from a broader regional energy system is a natural and potentially limiting obstacle to full integration of energy trading.

Regional energy cooperation has the potential to help economies within Asia and the Pacific to develop an effective response to common challenges, where enhanced levels of

cooperation can facilitate sizeable potential for encouraging efficiency, improved access to finance and technical expertise, and the application of innovative multilateral approaches to sustainable development. To maximize the potential benefit from these important but often mismatched resources, there is an urgent need for new and better regional cooperation on energy development. In reviewing subregional energy integration developments within Asia and the Pacific, ESCAP believes that a consolidated regional perspective on energy development would provide the catalyst for delivering a more sustainable energy paradigm for the region, and ensure the mutual benefits of inclusive development.

From a strategic development perspective, the achievement of ambitious development proposals such as the AEH is also likely to benefit from the establishment of collaborative and ongoing forums that can encourage the development of robust and credible common policies and strategies. In this regard, previous initiatives in the field of trans-boundary connectivity - such as the Asian Highway and Trans-Asian Railway Network - demonstrate the capacity by which ESCAP can facilitate such processes in order to achieve ambitious regional development projects. From this perspective, ESCAP can provide the platform for the development of a consolidated energy development vision, facilitated through intergovernmental agreements in order to deliver the means to enhance services within the Asia-Pacific from a planning and investment perspective.

The priority for Asia and the Pacific should be to ensure long-term energy security and supply, and to create an advanced energy delivery system that is scalable and adaptable to new and ongoing developments in energy technology. The Asian Energy Highway will require strong economic and political cooperation and support from all ESCAP member States, and therefore presents both institutional and technical challenges for developing a sustainable solution to energy security and demand development in Asia. By building upon the skills and experiences of previous ESCAP regional infrastructural initiatives, clear opportunities and benefits exist in encouraging a more significant and concerted regional effort towards energy integration.

Abbreviations

AC	Alternating Current
AEH	Asian Energy Highway
CCGT	Gas turbine combined-cycle plant
CSP	Concentrated Solar Power
CO ₂	Carbon dioxide
DC	Direct Current
DNI	Direct Normal Irradiance
GDP	Gross Domestic Product
GWh	Giga-Watt hour
Hz	Hertz
HVDC	High-Voltage Direct Current
km	Kilometer
kV	Kilovolt (1000 volts)
MTOE	Million Tonnes of Oil Equivalents
MW	Mega-Watt (1,000,000 watts)
OHTL	Overhead Transmission Line
TPES	Total Primary Energy Supply (coal, oil and gas)
TSO	Transmission System Operator
TWh	Terra-Watt hour
UHV	Ultra-High Voltage

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