



North-East Asia Regional Power Interconnection and Cooperation Forum 2018

Ulaanbaatar, 31 October – 1 November 2018

REPORT OF THE FORUM

1. United Nations ESCAP, China Electricity Council (CEC), Ministry of Energy of Mongolia, Ministry of Foreign Affairs of the Republic of Korea, and Asian Development Bank (ADB) jointly organized the North-East Asia Regional Power Interconnection and Cooperation Forum 2018 from 31 October to 1 November 2018 in Ulaanbaatar, Mongolia. The Forum was organized in partnership with Melentiev Energy System Institute (ESI) of the Russian Federation, Renewable Energy Institute (REI) of Japan, Greater Tumen Initiative (GTI), and Global Energy Interconnection Development and Cooperation Organization (GEIDCO).
2. The Conference brought together about 160 representatives from about 75 organizations consisting of government agencies, utility companies and research institutions from North-East Asia to (a) discuss national and joint feasibility studies by research institutions, power corporations, international organizations as well as new bi-/multilateral initiatives, (b) review the current status and progress at the national and subregional level made for power cooperation and interconnection in North-East Asia, (c) share recent progress in dialogue and cooperation for power interconnection and seek possible options of intergovernmental/multilateral arrangement, and (d) finalize the terms of reference of the NEARPIC Forum.
3. Among the speakers were representatives from the Ministry of Energy of Mongolia, UNESCAP, CEC, ESI, ADB-Northeast Asia Power System Interconnection (NAPSI) project, GEIDCO, REI, Mongolian Energy Economic Institute (MEEI), National Energy Administration (NEA) of China, Electric Power Planning and Engineering Institute (EPPEI) of China, Inner Mongolia Power (Group) Co. Ltd. (IMPC) of China, EuroSibEnergo JSC of the Russian Federation, and Asian Infrastructure Investment Bank (AIIB).

[Opening session]

4. The Forum was formally opened by H.E. Mr. Gantulga Tudevkhoo, Vice Minister of Energy of Mongolia who highlighted the importance of regional cooperation harnessing complementarities for the achievement of sustainable development goal 7, *ensure access to affordable, reliable, sustainable and modern energy for all*. In the opening session, Mr. Sangmin Nam, Interim Head of East and North-East Asia Office of UNESCAP, Mr. Zhixuan Wang, Vice President of CEC, and Mr. Teruhisa Oi, Principal Energy Specialist of East Asia Department of ADB echoed and called for joint action and partnership for power interconnection and cooperation in the subregion. It also highlighted power interconnection decarbonizing economic growth of the subregion by promoting renewable energy.

[Session 1-1] National and bi-/multilateral feasibility studies and planning

5. In the first session, representatives of GEIDCO, REI, ADB-NAPSI, EPPEI delivered presentations introducing ongoing and recently-released feasibility studies for power interconnection in North-East Asia. All studies found that interconnection in selected study areas between countries in North-East Asia are physically/technically feasible and cost-effective.
6. GEIDCO presented its new study on North-East Asia Energy Interconnection and Regional Development, including opportunities for cooperation, outlook of energy and electricity in the subregion, and development strategy of Northeast Asia Energy Interconnection (NEAEI) as a part of the concept of Global Energy Interconnection. The study of GEIDCO estimated technical potential of 54.5 GW in hydropower from the Lena and the Heilongjiang-Amur Rivers, 430 GW in wind power in 19 bases in the North-East Asian countries, and 510 GW in solar energy mainly in Southern Mongolia. Based on this potential, it estimated the capacity of clean energy would exceed that of fossil fuel in North-East Asia in around 2030, where wind, solar and hydropower capacity would account for around 75 percent of the total capacity in 2050. It concluded by calling for enhanced coordination for policy-making, improving bilateral and multilateral mechanisms, building regional electricity market, promoting innovations in financing, and implementing pilot projects of clean energy utilization.
7. This was followed by a recorded presentation of REI on its recent feasibility study on power interconnection of Japan-Russian Federation and Japan-Republic of Korea, discussing multiple routes for interconnection. The construction costs of 2 GW capacity interconnector estimated JPY 430.5 to 573 billion for Japan-Russian Federation interconnections, and JPY 202.4 to 246.5 billion for Japan-Republic of Korea. Based on four business models for interconnector investment recovery (which are generators/suppliers dedicated line model, regulated grid tariff model, transmission rights sales model, and congestion charge model), this cost can be recovered assuming 1 or 2 GW of supplied power with prices between 5 and 9 yen/kWh. In addition to the economic benefits, it reported social benefits of power interconnection.

8. Preliminary findings of the NAPSI project of ADB were also presented including its three master plans for over 20 years, namely renewable generation, interconnection grid, and market and power trade. It reiterated Mongolia's huge potential in solar and wind power generation as well as its potential contribution to the reduction of CO₂ emissions in North-East Asia. Specifically, it estimated technical potential of up to 200 GW in wind power and 1,200 GW in solar power in Mongolia, much higher than previous potential assessment studies due to new technologies available for wind and solar power generation. Through market assessment, the study also found that investment in renewable energy in Mongolia could have large economic gains and environmental benefits. To support realization of the potential, including its ambitious large interconnection scenario to connect 100 GW renewables by 2036 and afterwards, it recommended harmonized rules for grid connection to be set out.
9. A presentation was delivered by EPPEI, overviewing current status of power interconnection and analyzing potentials in North-East Asia. Highlighting energy complementary among the North-East Asian countries, it identified various challenges in power interconnection, including the need for political decisions and large investments, and standardization of grid code and electricity market design, among others. It further suggested to expand interconnection from less difficult projects at the bilateral level, noting the existing China-Russian Federation and China-Mongolia power interconnections, while wider power interconnection in the subregion (such as interconnection of China-Republic of Korea-Japan) could be pursued afterwards. The speaker echoed in calling for strengthening cooperation mechanism for power interconnection in North-East Asia, jointly carrying out research and planning work, and promoting regional power market, among others.

[Session 1-2] Panel discussion

10. This was followed by a panel discussion where speakers in the previous session were invited as panelists. During the discussion, panelists agreed that technologies required for power interconnection in North-East Asia are available and investment costs can be recovered. It was further noted that real projects can be implemented in multiple phases starting from less difficult interconnection projects, and it is important to involve private sectors, financial institutions and governments in the process. In addition, to support political decisions of countries in North-East Asia with more accurate information, panelists called for further research.
11. Noting the differences in estimated renewable energy potentials from feasibility studies, more coordination was encouraged among researchers on the methodologies used and assumptions made. Nevertheless, despite the differences in the estimates, it was clear that all studies indicate significant potential for renewable energy in North-East Asia. Different estimation on the volume of power trade through interconnection was also

discussed. While 100 GW trade of power after 2036 was the most ambitious estimate, it was pointed out that this is still less than 5 percent of total current power consumption in North-East Asia.

12. On the question of better engaging the North-East Asian countries, panelists stressed that subregional power interconnection is benefiting for all countries replacing fossil fuel energy with clean energy. In addition, it was informed that the remaining part of NAPSII project plans to focus on measuring benefits of each country from power interconnection. In comparison to power interconnection of EU and ASEAN, it was suggested that power interconnection in the subregion should take bottom-up approach in the absence of high-level intergovernmental mechanism that can provide overall direction and guidance. In this regard, the importance of NEARPIC Forum was also noted in facilitating dialogue among many key stakeholders in the North-East Asian countries.
13. To move forwards, it was suggested to 1) strengthen cooperation mechanisms including NEARPIC and Energy Connectivity Expert Working Group of UNESCAP; 2) carry out joint research and planning; 3) focus on short- and medium-term planning to find priority projects; 4) promote the exchange of grid construction and operation standards; and 5) explore the construction of regional power market. It was also encouraged to engage government representatives as well as project implementers/investors such as bankers, power companies and cable companies in future sessions.

[Session 2] Review of progress on subregional cooperation for power interconnection

14. MEEI introduced the State Policy on Energy approved by the Parliament in 2015, the Government Action Plan 2016-2020, legal environment of Mongolia for energy cooperation and current state of Mongolia. It noted that Mongolia's energy sector is still dominantly fossil-fuel based, coal being accounted for over two-thirds of energy supply. However, it also stressed the huge potential for renewable energy in Mongolia.
15. This was followed by a presentation of the NEA of China on power development in China. The 13th five-year plan of electric power development 2016-2020 aims to increase non-fossil fuel power generation from 26 to 31 percent during this period, and to develop grid from energy-rich to energy-poor areas. The presentation also overviewed power cooperation between China and other North-East Asian countries, noting the contributions of power cooperation with the Russian Federation and Mongolia to safe and stable power supply and optimal allocation of resources. It noted the need for further technical progress in long-distance large capacity transmission of new energy and submarine transmission to support power interconnection.
16. EuroSibEnergO also shared its experiences and current projects in power interconnection. The presentation stressed the opportunities from abundant hydropower resources in the

Russian Federation, especially those from Siberia which provides opportunities for cooperation with China and Mongolia.

17. IMPC of China delivered a presentation on its international energy cooperation with overview of Inner Mongolia grid. IMPC has provided power to mines in Southern Mongolia where grid is weak and remote from the central grid of Mongolia. Introducing its proposals on interconnection with Mongolia with two options (power delivery channels using multiple 220 kV lines and single 500 kV line) for near-, mid- and long-term, it highlighted benefits of further expansion of power interconnection between China and Mongolia, including the promotion of the Belt and Road Initiative, realization of comparative advantages, and improvement of reliability of Mongolian grid.
18. The session was concluded with a panel discussion on challenges for power interconnection and promotion of renewables, such as regulatory issues and different market systems among the North-East Asian countries. Political issues were also identified as one of obstacles in promoting the regional power interconnection, while project-specific economic analysis and technical advances also remain to be further conducted. In addition, it was noted that methodological differences in feasibility studies made communication and coordination difficult. While power generation with renewables are known to be more expensive than conventional sources of energy, panelists stressed that cost of wind and solar power generation is decreasing and can be competitive. In this regard, panelists encouraged governments of North-East Asia to engage private corporations, develop multilateral intergovernmental dialogue, and make further joint efforts for power interconnection utilizing renewable energy potentials.

[Session 3] Intergovernmental/multilateral arrangement for power interconnection

19. During the session, ESCAP presented on the role of intergovernmental/multilateral agreements, and political, regulatory, technical and economic/financial challenges for power grid. It suggested to increase interconnection in the subregion by moving towards multilateral and possible integrated regional power market. This process would require intergovernmental agreements in planning and coordination; cost and benefit sharing; regional market regulations on power trade, operation, safety and security; and synergizing of standards, prices and subsidies, among others. In this regard, it suggested that a regional roadmap for energy connectivity to be published in the end of 2019 by ESCAP could help to develop energy connectivity and institutional mechanism as well as build trust among countries.
20. A representative from ESI shared recent developments for power interconnection, reviewing bilateral arrangements of the Russian Federation with other countries in North-East Asia as well as recent multilateral arrangements in North-East Asia. Noting the strong bilateral structure of power agreements, the speaker suggested to foster transition towards multilateral arrangements. While bottom-up approach would be necessary for

power interconnection in North-East Asia, this was called to be complemented eventually by top-down approach by strengthening and creating multilateral intergovernmental body.

21. CEC also shared long history of cooperation between China and the Democratic People's Republic of Korea (DPRK) on hydropower in the border river basins, and presented preliminary concept of power interconnection from China to the Korean Peninsula. It suggested that 1) more attention should be paid to DPRK's participation in the regional power interconnection as tensions in the Korean Peninsula may start to ease along with the recent presidential talks and high-level meetings; and noted that 2) DPRK's participation may make power interconnection in the subregion technically and economically more feasible because of its strategic location. Specifically, it proposed a 3-terminal HVDC power transmission project from power plants concentrated area, Jilin province, China to the two load centers, Pyongyang, DPRK and Seoul, Republic of Korea.
22. Ministry of Energy of Mongolia delivered a presentation on role and expectation of Mongolia in promoting energy cooperation in North-East Asia. It introduced Mongolia's main drivers for power interconnection and recent aspiration towards regional energy cooperation, identifying suitable areas for wind and solar power development in Mongolia. Noting the call from the President of Mongolia on *the urgent and prompt commencement of the North-East Asian Super Grid project* at the 4th Eastern Economic Forum 2018, it suggested to work on preparing a MoU to develop power interconnection in North-East Asia to be signed by the Heads of States during the next Eastern Economic Forum. The presentation also introduced current cooperation with China and reiterated huge wind and solar potential of Mongolia.
23. This was followed by a presentation from AIIB on its energy strategy, which aims to support energy access and security, energy efficiency, reduction of carbon intensity in energy production, management of local and regional pollution, catalyzing private capital and promoting regional cooperation and connectivity. It also introduced AIIB's energy investment and operations, and its commitment for investing in cross-border power interconnection.
24. In the discussion followed, it was suggested to utilize China's experiences of joint management of four hydropower plants with DPRK to engage DPRK in power interconnection and cooperation with its neighbouring countries.
25. Panelists noted that there is political will for power interconnection at the high-level in the North-East Asian countries, but this was not yet realized on the ground due to various reasons. Quoting the proposal of President of Mongolia at the 4th Eastern Economic Forum 2018, it was encouraged for the Ministry of Mongolia to lead the work on preparing a MoU for advancing these proposals.

[Session 4] NEARPIC Terms of Reference

26. During the last session of the Forum, participants reviewed, revised and finalized the terms of reference of the Forum (Annex III), except specific members of the steering committee, which are to be followed up by the secretariat.

Annex I. Programme of NEARPIC 2018

Annex II. List of participants

Annex III. NEARPIC Terms of Reference