What Could an “Asian Super-grid” Mean for Northeast Asia?

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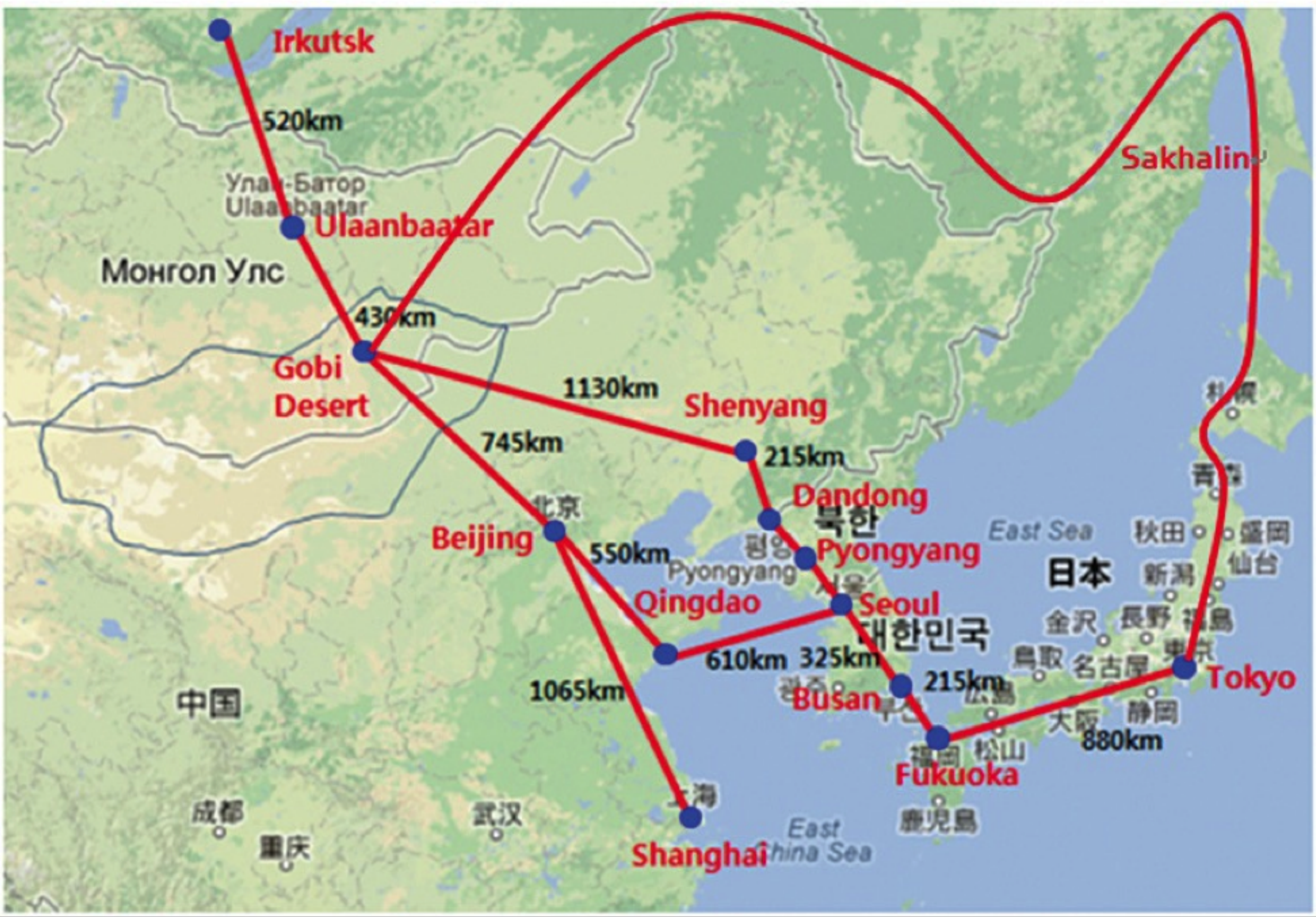

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I. INTRODUCTION

Proposals for Asian "Supergrids"—potential regional interconnections of electrical grids and related infrastructure to allow the trading of power, in particular (but not exclusively) electricity generated from renewable resources, across Northeast Asia and beyond—have been considered for many years. Such interconnections could help nations to address their energy needs and reduce greenhouse gas and other pollutant emissions (importers) and contribute to economic development (exporters). Care is required, however, in considering the ultimate impact of a supergrid on overall regional greenhouse gas emissions, and the difficulties associated with the construction, operation, and financial, institutional, and political arrangements associated with a supergrid should not be underestimated. A supergrid can be one piece of the energy puzzle in Asia, but each country must also look to measures it can implement on its own to improve its environmental performance and energy security.

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II. POLICY FORUM BY DAVID VON HIPPEL

What Could an "Asian Super-grid" Mean for Northeast Asia?

Given Mongolia's status as an upcoming energy supplier to the Northeast Asia (NEA) region, it is fitting that its capital city of Ulaanbaatar hosted the Energy Charter Forum "Developing Renewable Energy through Gobitec and the Asian Supergrid in Northeast Asia" in June of 2014.[1] The Forum, with presenters from Korea, Russia, China, Japan, Mongolia, and Europe, explored the prospects for and issues associated with potential regional interconnections of electrical grids and related infrastructure to allow the trading of large quantities of energy, and in particular electricity generated from renewable resources, across Northeast Asia and beyond. Variants of the Asian Supergrid concept have been discussed for many years. A central focus of "Gobitec" and other initiatives has been to explore networks of high-voltage direct current (DC) and alternating current (AC) powerlines connecting at least the countries of NEA, with power mostly flowing from coal, gas, hydro, and possibly nuclear generating stations in the Russian Far East and from coal-fired, wind, and solar generation in Mongolia to the major cities of Japan, the Republic of Korea (ROK), and China,[2] but with some power flow between nations to take advantage of different seasons and times during the day when power is available and needed in different countries. Some of these concepts include the participation of the Democratic People's Republic of Korea (DPRK); some of the issues surrounding the DPRK's participation were explored in an earlier *Global Energy Monitor* article by the author.[3] Other concepts of the Asian Supergrid go beyond Northeast Asia to include the growing economies of Southeast Asia (Vietnam, Thailand, Malaysia, the Philippines, and Indonesia, for example), and the energy resource areas of South Asia (such as those in Indonesia). Some concepts go even further, and include linkages between the countries of South Asia (and from there to NEA) with Australia, with Australia providing renewable generation (solar and wind) to the Supergrid,[4] and/or serving the regional Supergrid with a nuclear energy complex that integrates uranium production, enrichment, fuel fabrication, generation, and waste disposal in an "isolated, secure, safeguarded" area of the country.[5]

Potential benefits of Asian Supergrid include local and regional (such as the nitrogen and sulfur oxides that contribute to acid precipitation) air pollutant emissions reduction, overall electricity costs reduction, more extensive deployment of renewable energy sources and technologies, reduction in greenhouse gas emissions, and promotion of cooperation between the nations of the region.

Importing electricity by wire means that local power production from fossil fuels (particularly coal) can be reduced, resulting in cleaner air in electricity consuming areas such as big cities. If coal-fired power is used to produce electricity for the Supergrid in remote locations (such as is planned in the next few years for Mongolia, with power sold to China), then pollution is simply displaced to those sites. There may even be an overall net increase in emissions of local and regional pollutants if emission controls and/or efficiency requirements at remote power plants are not as stringent as would be the case for power plants near cities (or in power importing countries).

Costs of generation can be reduced if power plants are located where production costs for fossil fuel resources are low, hydro plants can be developed inexpensively, and/or where solar or wind resources are particularly abundant. Balancing any decrease in resource and other generation costs, of course, are the considerable additional costs for construction and operation of large powerlines spanning great distances.

Building powerlines from areas where renewable resources are abundant to areas where power is needed will spur the development of renewable resources, as it connects potential power projects to markets, providing an incentive for state- and non-state investors to finance renewable energy. Additional renewable energy production, in turn, reduces greenhouse gas emissions to the extent that fossil-fueled generation is displaced by renewable generation. This is of international benefit, as well as helping to fulfill the commitments of individual nations under the United Nations Framework Convention on Climate Change (UNFCCC).   Not entirely clear in all instances, however, is the mechanism by which the transfer of renewable energy from one country can count for climate agreement purposes as a reduction in greenhouse gas emissions in the importing nation (while not being double-counted by the exporting nation).

Development, maintenance and operations of the international powerlines constituting an Asian Supergrid would require very close cooperation between governments, state-owned enterprises, non-state businesses and actors, and, probably international agencies and companies. Cooperation will be needed not just to set technical standards and assure reliable operation, but in the setting and enforcement of environmental and labor standards, in setting of electricity prices and transit fees, and a host of other areas. As a result, the energy supply security benefits associated with a nation (such as the ROK) diversifying its energy suppliers to include (for example) renewable energy from the Russian Far East or Mongolia would come at the price of the need to cooperate with producing and powerline transit nations, and needing to trust those nations to keep power flowing. Cooperation in Asian Supergrid issues may help overall relations between nations in the long run, but will likely require the nurturing of new and, initially, unfamiliar cooperation mechanisms between nations that will require great patience to develop.

The future energy prospects of Mongolia, and its place in a future Asian Supergrid, provide a fascinating example of the types of issues that may arise among the energy producers and consumers in future international electricity interties. Mongolia's just under 3 million people live in a nation with over 60 times the land area of the ROK, making it, on average, the most sparsely settled nation on earth, with the exception of a handful of small island nations. Mongolia's population, however, is about 60 percent urban, with the proportion living in cities, particularly the capital, increasing annually. Mongolia's own power needs are relatively low, with current capacity at less than 1 gigawatt (GW, equal to one billion watts or one million kilowatts), but many of its Soviet-era coal-fired combined heat and power plants are old, polluting, inefficient and located in urban areas. Mongolia, however, is endowed with great mineral wealth, including huge coal reserves, and also with some of the best wind and solar resources on the planet. As such, recent years have seen a boom in Mongolia's mining economy, with projects in operation or proposed to export coal, mostly to China, and to export coal-derived electricity. Also under development are wind power resources, with the opening of the Salkhit 50 MW wind farm in mid-2013 the first big step toward commercial wind power production. Mongolia has an impressive and ambitious green development plan.[6] Bringing the plan to fruition may require some difficult choices about which of its resources to develop with which international partners, and how to secure the benefits of energy and mineral resource development for the Mongolian people for the long term in a way that preserves Mongolia's national environmental and cultural heritage. Mongolia may, within two decades, be exporting tens of gigawatts of coal-fired power, or tens of gigawatts of wind and solar power, or, possibly, both, to consumers in China and/or Korea and Japan—but which energy development path it takes, and the cooperative arrangements required to follow those paths, will have significant ramifications for the shape of the Mongolian economy and society in years to come.

The decisions faced by other nations that may be involved in an Asian Supergrid project are not as striking as those faced by Mongolia—no other nation is in the position to have its future energy exports dwarf its domestic energy use. Nonetheless, there are considerations that should be taken into account by all of the nations that might participate in such projects. First, even if flows of 100 or more GW can be accommodated by the Supergrid infrastructure—power flows certainly unprecedented in Asia—they will only account for a small portion of the power needs of the East Asia region. China alone now has well over 1000 GW of generation, Korea and Japan have more than 300 GW combined, and the large and growing nations of Southeast Asia will account for hundreds of additional GW of demand within the next two decades.   As such, though the Supergrid may help the nations of the region to achieve energy supply security and environmental goals, most of the progress towards those goals must come through domestic programs, including aggressive domestic (though possibly in cooperation with other nations) energy efficiency programs and the development of renewable energy resources, including for electricity generation. It should be remembered that local renewable energy (for example, solar photovoltaic—PV—systems) developed as distributed generation can reduce requirements for electricity transmission and distribution (T&D), and can reduce T&D losses. A key to the cost-efficiency of renewable resources is the annual capacity factor—the annual hours of strong winds or sunshine that can be captured, for example. The average solar resource in Mongolia's Gobi desert is about twice that, per unit land area, available in cloudier Korea, and thus a kilowatt of solar PV capacity in Mongolia will produce twice the annual energy as the same kilowatt in Korea. This advantage is eroded to some degree, however, by the need to build long, large, expensive powerlines to bring the power to Korea, as well as by the power losses (perhaps 5 to 10 percent) incurred in moving power between the nations. This and other technical, economic, political, environmental and other considerations mean that although there are certainly potential national and international advantages associated with developing an Asian Supergrid, each participating nation should at the same time be pursuing domestic energy efficiency, renewable energy, electricity infrastructure modernization (for example, "smart grid") and other initiatives that will help prepare for the advent of Supergrid interconnections, while at the same time reducing electricity energy and power needs so as to reduce the required costs and impacts of Supergrid infrastructure.

III. References

[1] See Energy Charter (2014), “Ulaanbaatar Energy Charter Forum: Developing Renewable Energy

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[3] See David von Hippel and Peter Hayes, “The DPRK as a Participant in Northeast Asia Regional Energy Cooperation: Benefits and Challenges”, *Global Energy Monitor*, Vol. 2, No. 10 (December 2014), available at javascript:downGo('GEM%5F2014%2D12%2Epdf','257').

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