Developing the Northeast Asia Regional Energy Market

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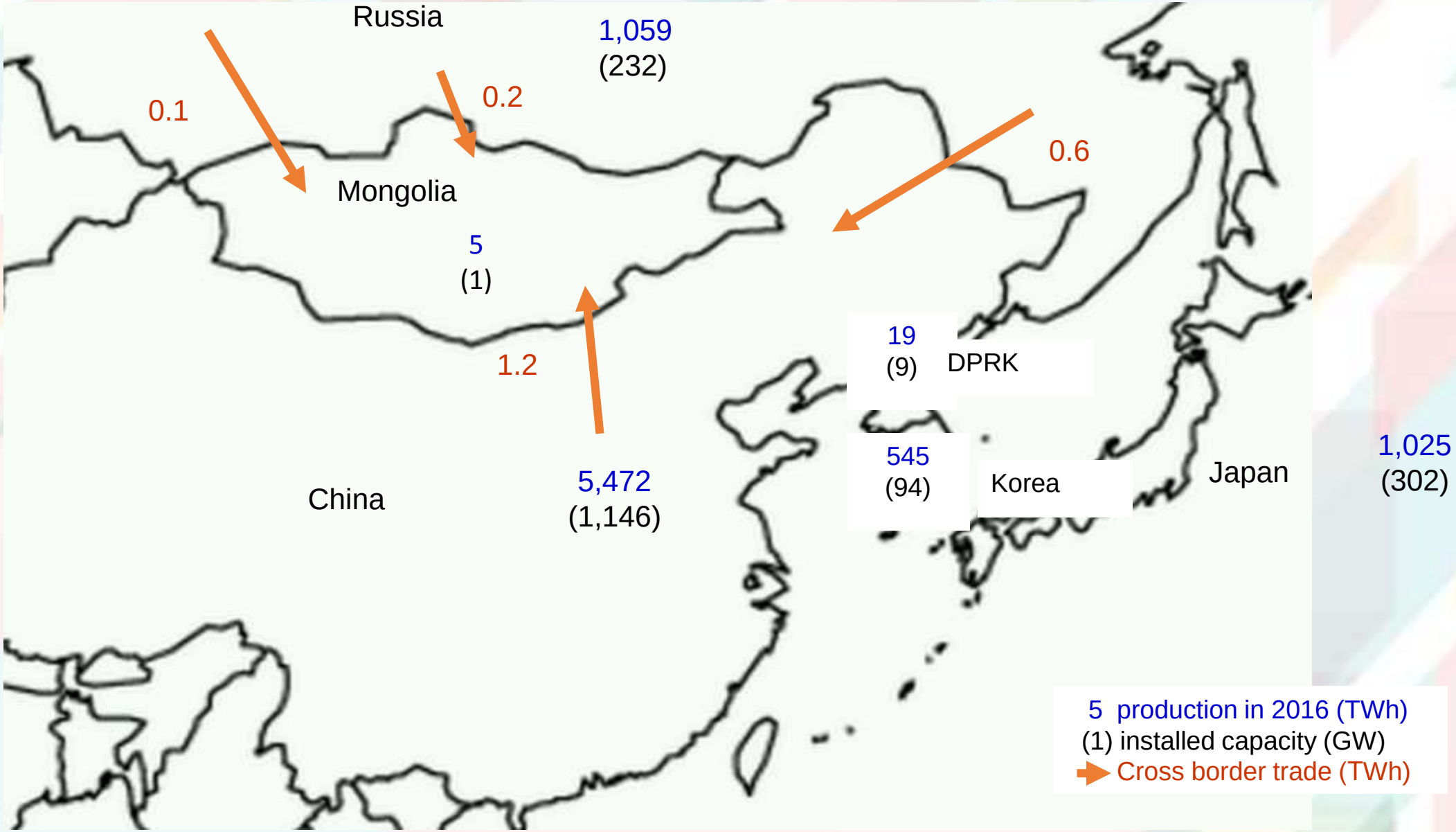
Northeast Asia – Key Information

Nearly 40% of global CO_2 emissions from the region

	GDP (in billion dollars) Figures in parentheses are GDP per capita (in thousand dollars)	Population (in million people)	Electricity generated (in TWh)	CO_2 emissions (in million tons CO_2)
China	8,909 (6.5)	1,376	5,811	9,154
Japan	5,986 (47.2)	127	1,036	1,208
South Korea	1,267 (25.0)	50	522	649
Mongolia	12 (3.9)	3	5	18
Russia	1,616 (11.0)	143	1,063	1,483
Northeast Asia	17,790 (~10.5)	1,699	8,437	12,512
World	74,889 (10.2)	7,349	24,098	33,508
Share of Northeast Asia	20-25%	20-25%	30-35%	~37%
Source	World Bank *Constant 2010	United Nations	BP; For Mongolia, figure from IEA in 2014	BP; For Mongolia, figure from IEA in 2014

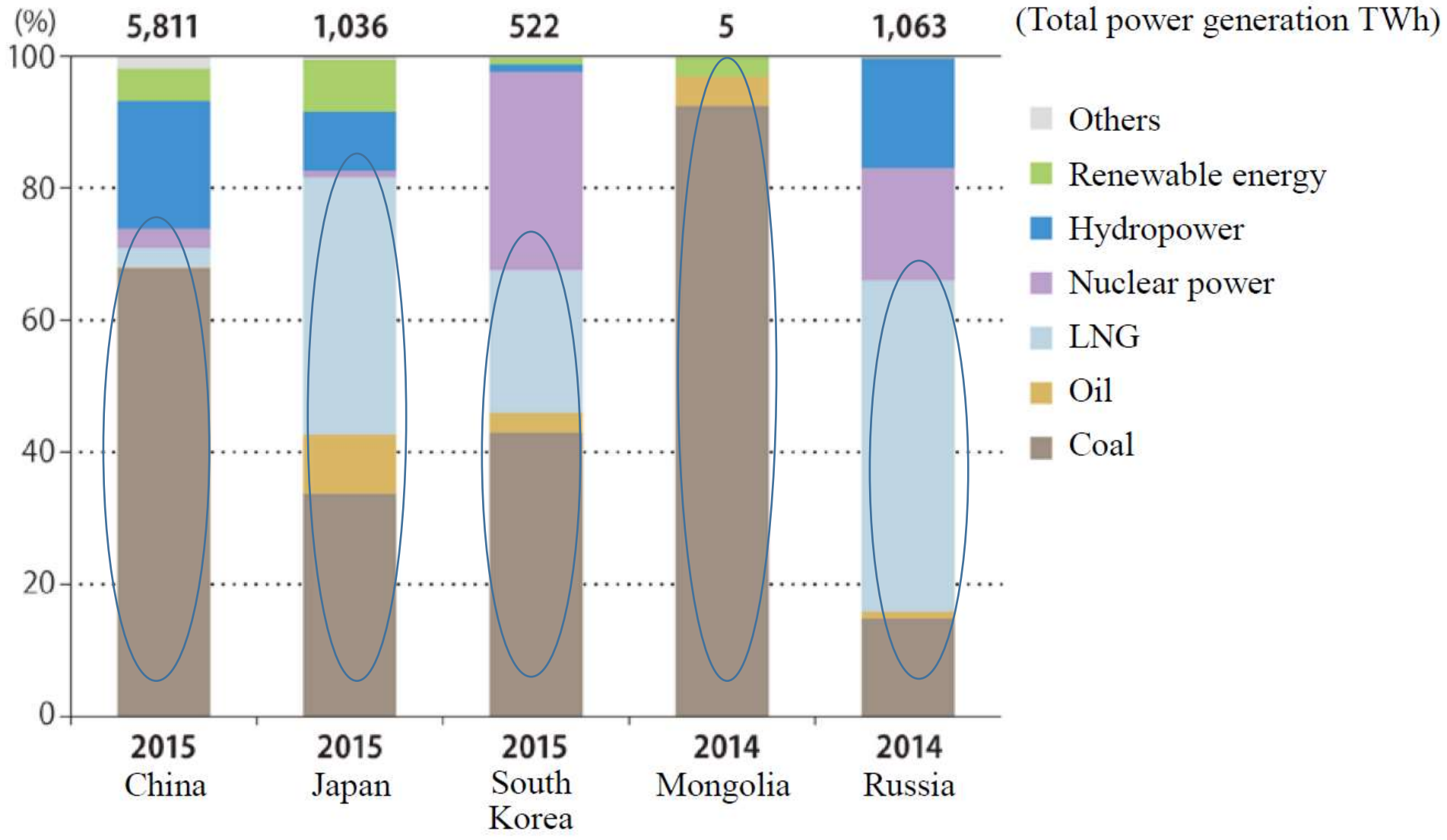
Source: Created by Renewable Energy Institute based on data released by national governments and international organizations.

Installed Capacity & Electricity Production (2016)



Source: International Energy Agency 2016

Power Generation Mix – High share of fossil fuels



Source: Created by Renewable Energy Institute based on CEC "Annual Data," IEA "Statistics by countries" "Electricity Information 2016," BP "Statistical Review of World Energy 2016.

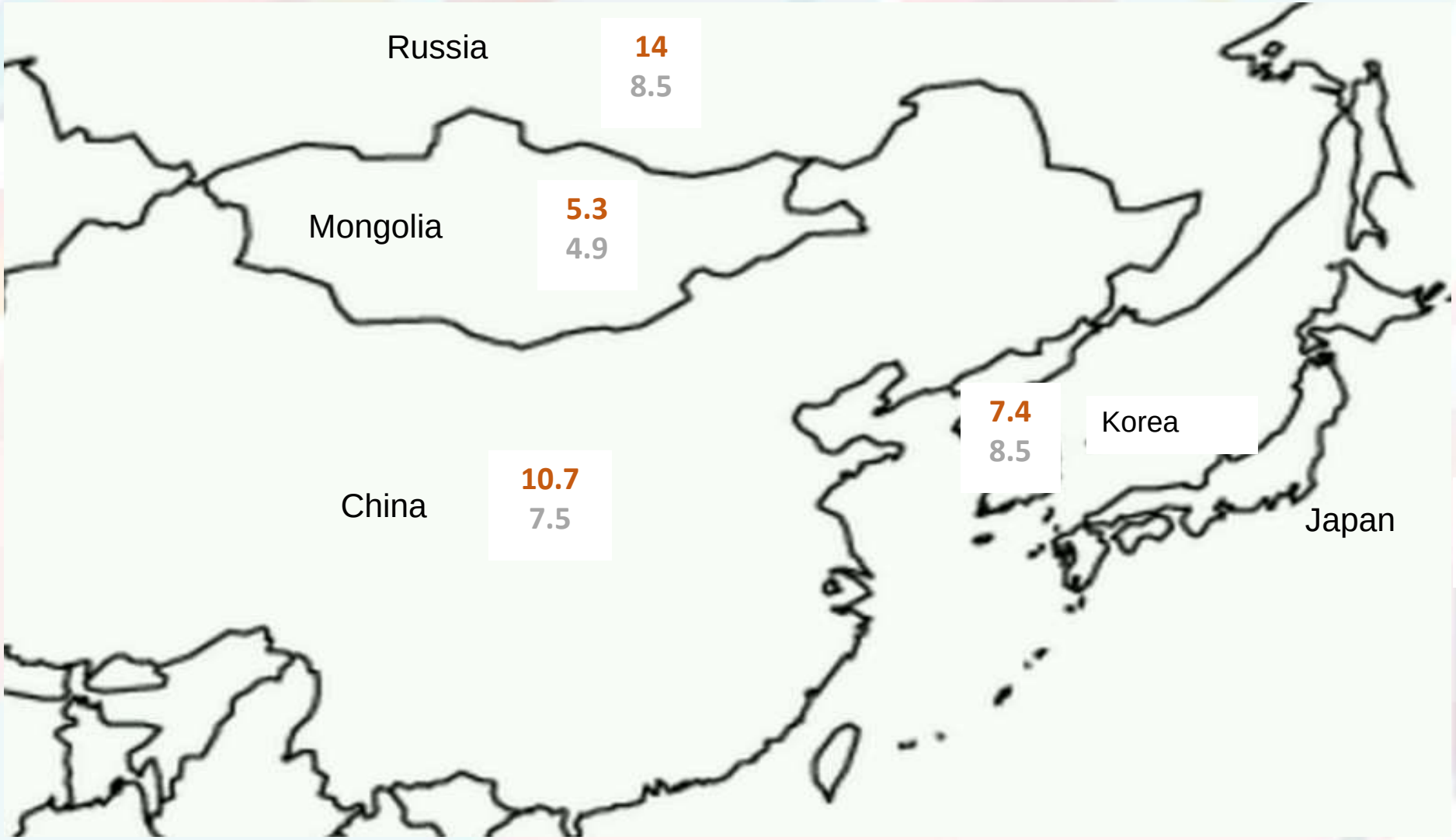
Projected Electricity Production in 2030 Compared with 2016

5 production in 2016 (TWh)
12 estimates in 2030 (TWh)

Source: BP energy outlook 2030

Electricity Tariff (2016)

Highest Japan – Lowest Mongolia in the region

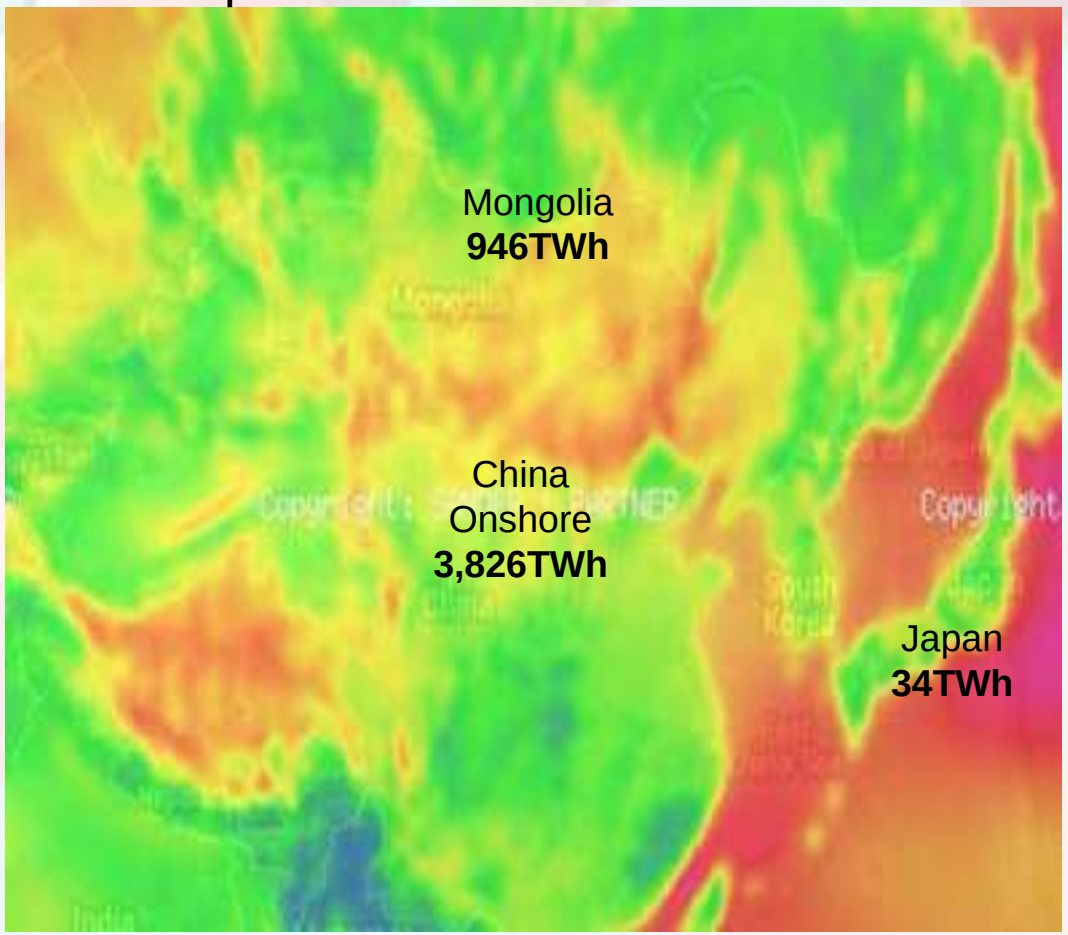


5.3 – Industrial (cent/kWh)
4.9 – Household (cent/kWh)

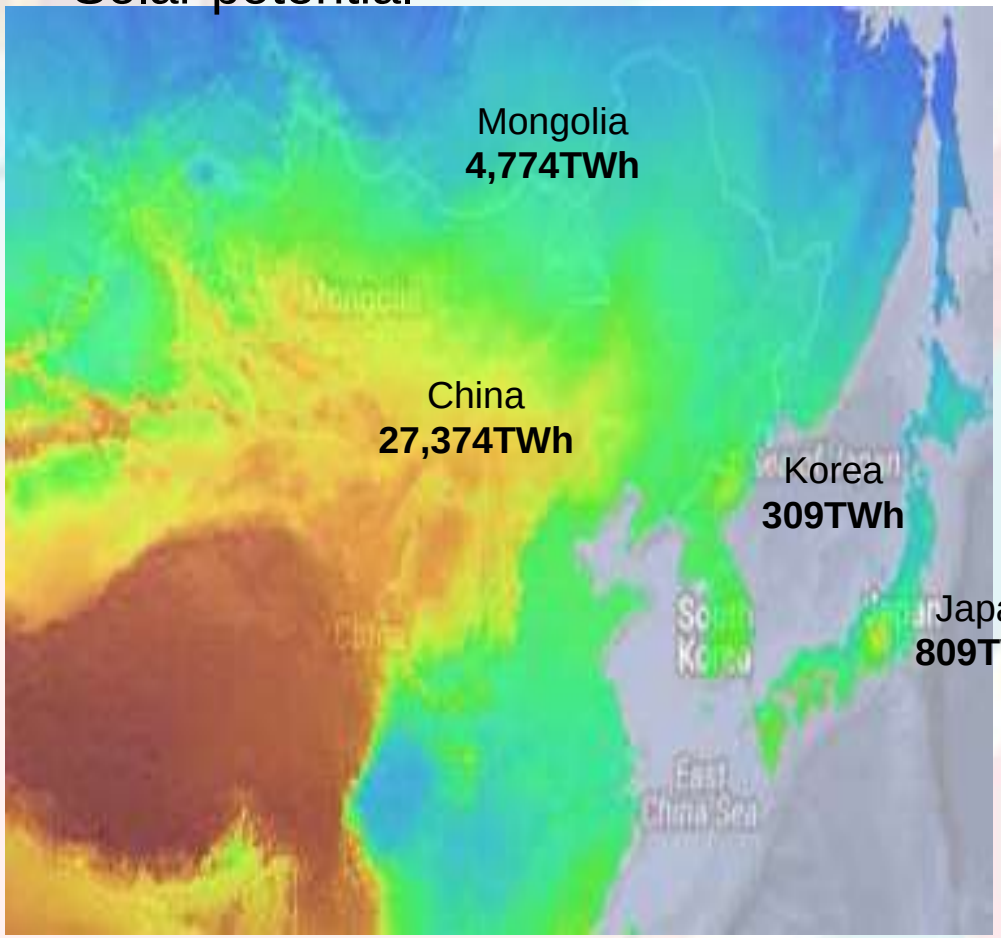
Source: Energy Regulator Commission 2016

Renewable Energy (Solar + Wind) Potential – Rich resources in China and Mongolia

Wind potential



Solar potential



Source: http://globalatlas.irena.org/

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Proposed Solution:

Interconnection (HVDC) + Renewables + Intelligence = Smart Northeast Regional Grid

Source: Electric power grid interconnections in Northeast Asia: A quantitative analysis of opportunities and challenges.

What ADB is doing ?

TA 9001-MON: Strategy for Northeast Asia Power System Interconnection

- **Study cost**: $1.75 million
- **Implementation period**: 2 years (from May 2017 to May 2019)
- **Executing Agency**: Ministry of Energy, Mongolia
- **Study team**: Électricité de France + China Electric Power Reach Institute + Nova Terra (Mongolia)

Advisory Committee Members (as of draft final workshop in 8 March, Tokyo, Japan)

- **Mongolia:** Ministry of Energy, Central Region Transmission Company, Energy Regulatory Commission,
- **China:** State Grid of China and/or GEIDCO
- **Korea:** KEPCO, Korea Energy Economic Institute
- **Japan:** Renewable Energy Institute (Observers: TEPCO, Japan Electric Power Exchange, Organization for Cross-regional Coordination of Transmission Operators, Softbank Energy, Sumitomo Electric Industries, ABB, Institute of Energy Economics, Tokyo University, Waseda University)
- **Russia:** ROSSETI
- **International organizations:** Energy Charter, IRENA

Key Activities of Study

Module 1: Stock Taking	▪ Existing power studies in North Asia (Literature Review, etc.) ▪ Initial Consultations ▪ Remarks of the workshop and the Steering Committee
Module 2: Market & Power Trade Assessment	For each area/country : ▪ Electricity demand (i.e., annual load curve, forecasts, etc.) ▪ Electricity generation fleet detailed information
Module 3: Planning & Evaluation Criteria	▪ General economic data to validate the internal demand ▪ Industry economic data in Mongolia ▪ Macroeconomics data of the different countries
Module 4: Energy Sector Profile & Projections	▪ Geospatial data for suitable land areas assessment ▪ Resource data and technology characteristics ▪ Data on densely populated areas for social acceptability assessment.
Module 5: Power System interconnection Expansion Plan	▪ Present and future bulk power system ▪ Operation of the bulk power system ▪ Existing system performance ▪ Environmental data
Module 6: Institutional and tariff Settlements & Modelling	For each area/country: ▪ Current regulation and planning procedures

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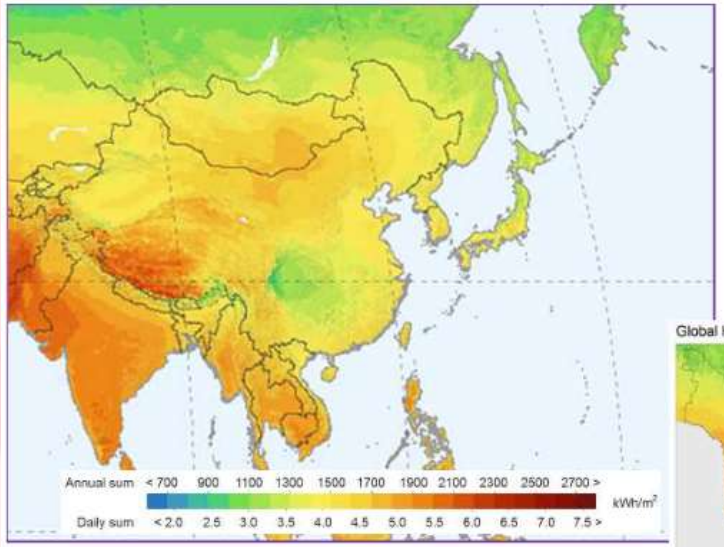
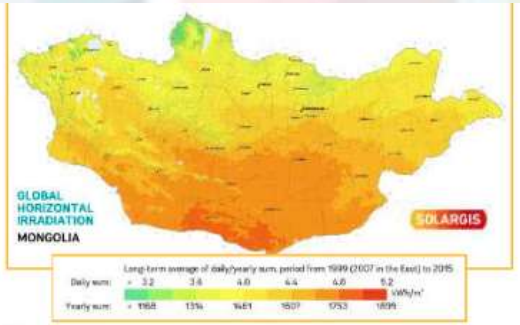
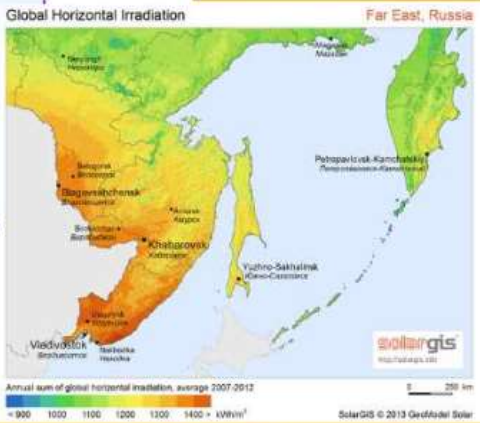
TA activities completed

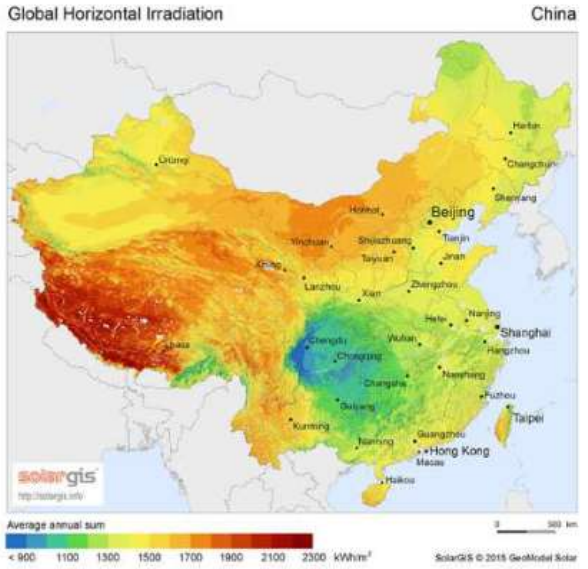
- Study kicked-off in Ulaanbaatar, Mongolia in June 2017 (Module 1 – stock taking)
- Midterm international workshop in Guwanjyu, South Korea in November 2017 in conjunction with KEPCO hosted BIXPO 2017 (Module 2 – market and power trade assessment)
- Draft final international workshop in Tokyo, Japan in March 2018 in conjunction with Japan Renewable Energy Institute hosted REVision (Module 3 and 4)

Solar Resource in Northeast Asian Counties









Good solar ressource in Mongolia : very large areas with GHI ranging 1800-1900 kWh/m².

GHI similar to China (in particular Inner Mongolia); GHI is higher only in western China but in unsuitable mountainous areas...

South Korea (max GHI 1600 kWh/m²), Japan (max GHI 1700 kWh/m² but few available areas), Russia (max GHI 1500 kWh/m² along eastern Mongolia border).

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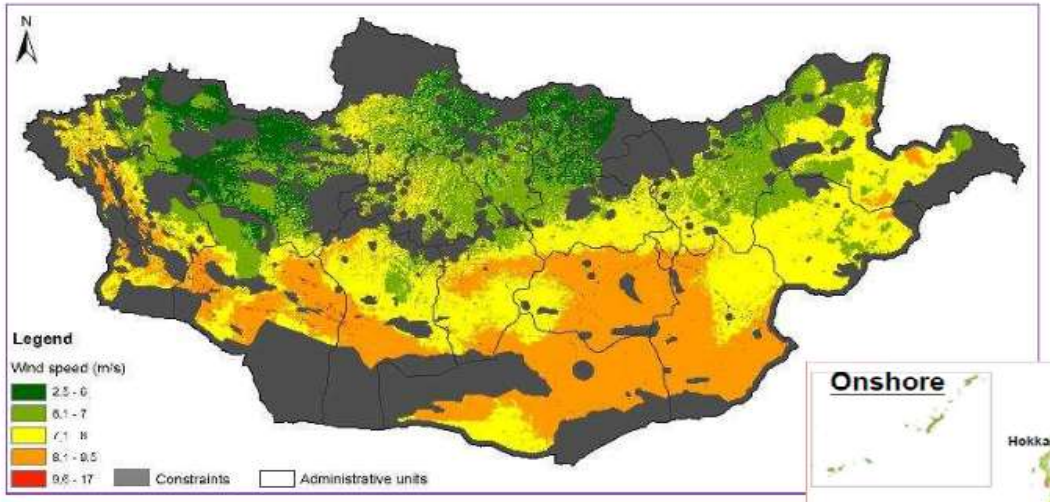
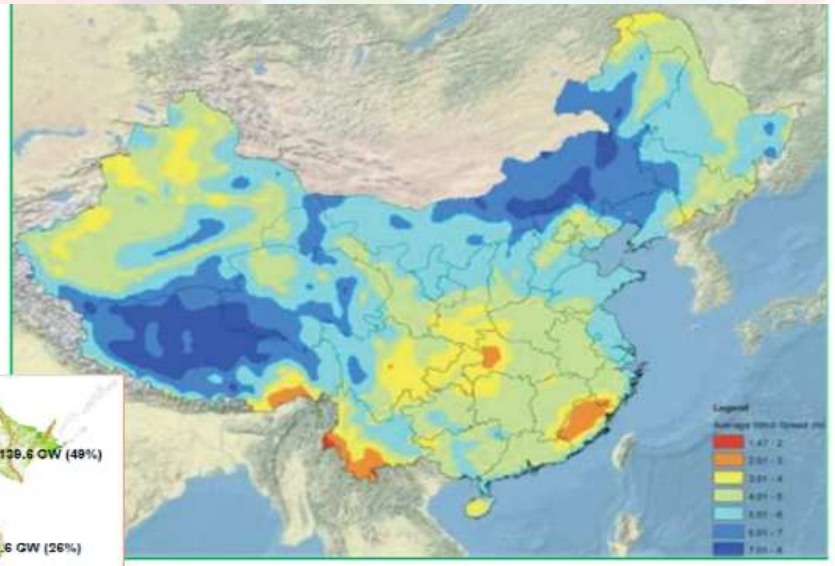
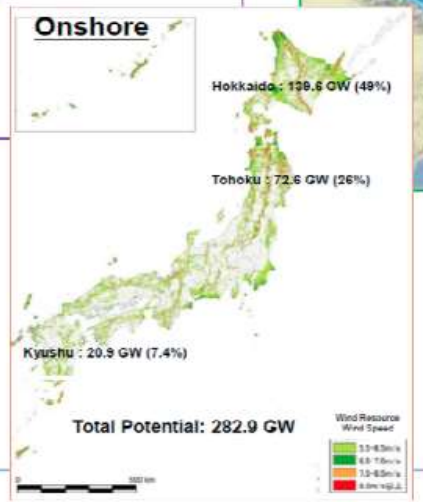
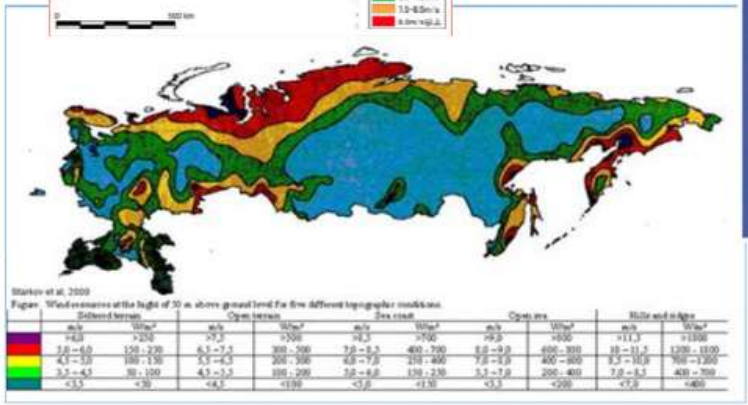
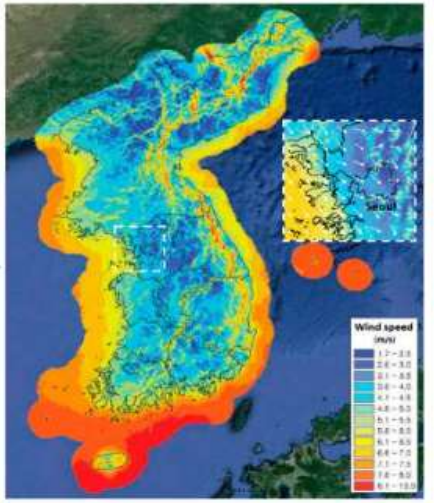
Wind Resource in Northeast Asian Counties











Excellent wind ressource in Mongolia : very large areas with average wind speed ranging 8-9.5 m/s.

Average wind speed similar to China (in particular Inner Mongolia); best wind resource in western China but in unsuitable mountainous areas...

In South Korea (max 8m/s but in mountains and small areas), Japan (max 8.5m/s but very few available areas), Russia (max 6m/s).

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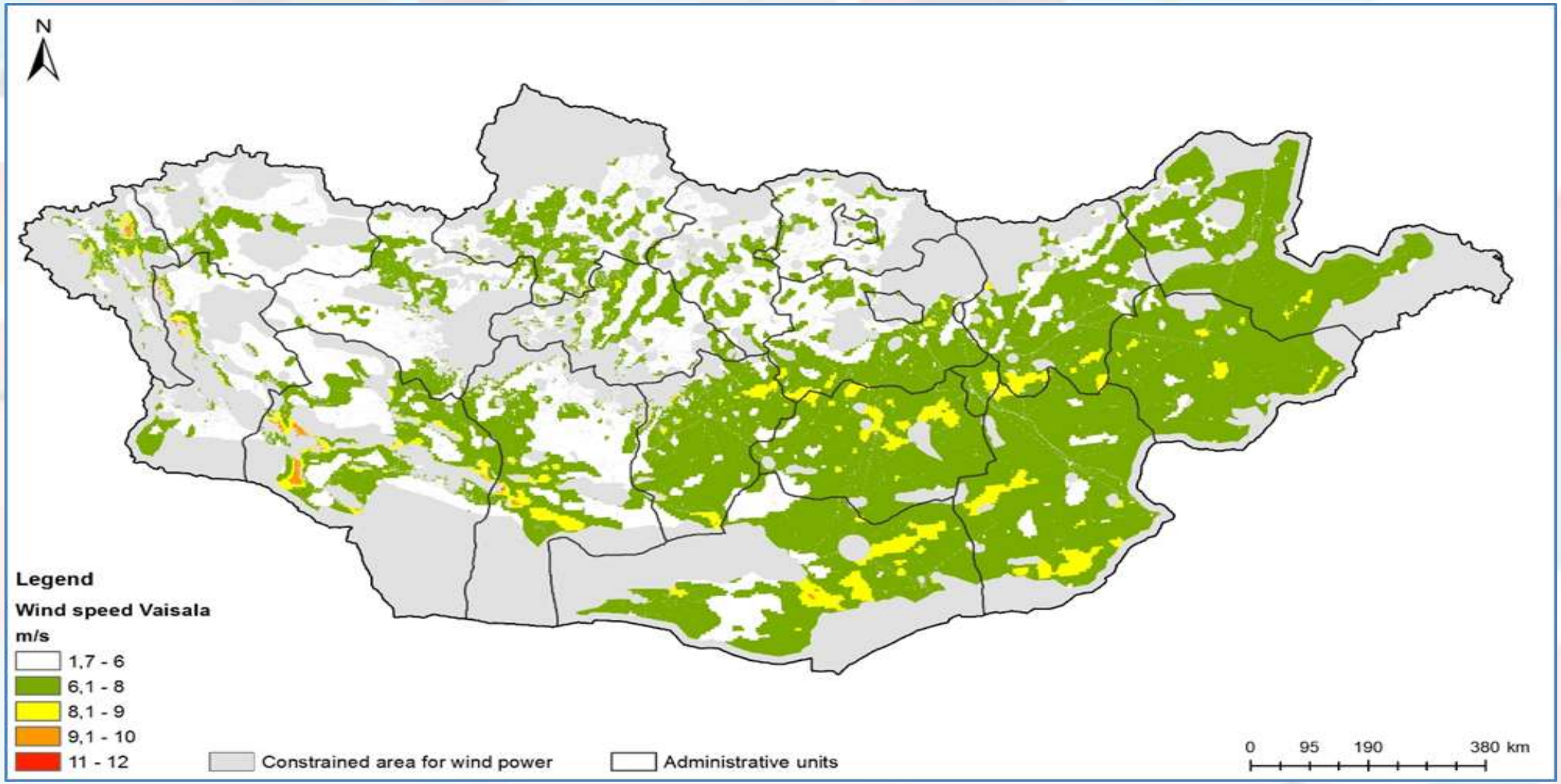
Identified Suitable Area for Wind Power Development in Mongolia

(excluding environmental and regulatory constrains)



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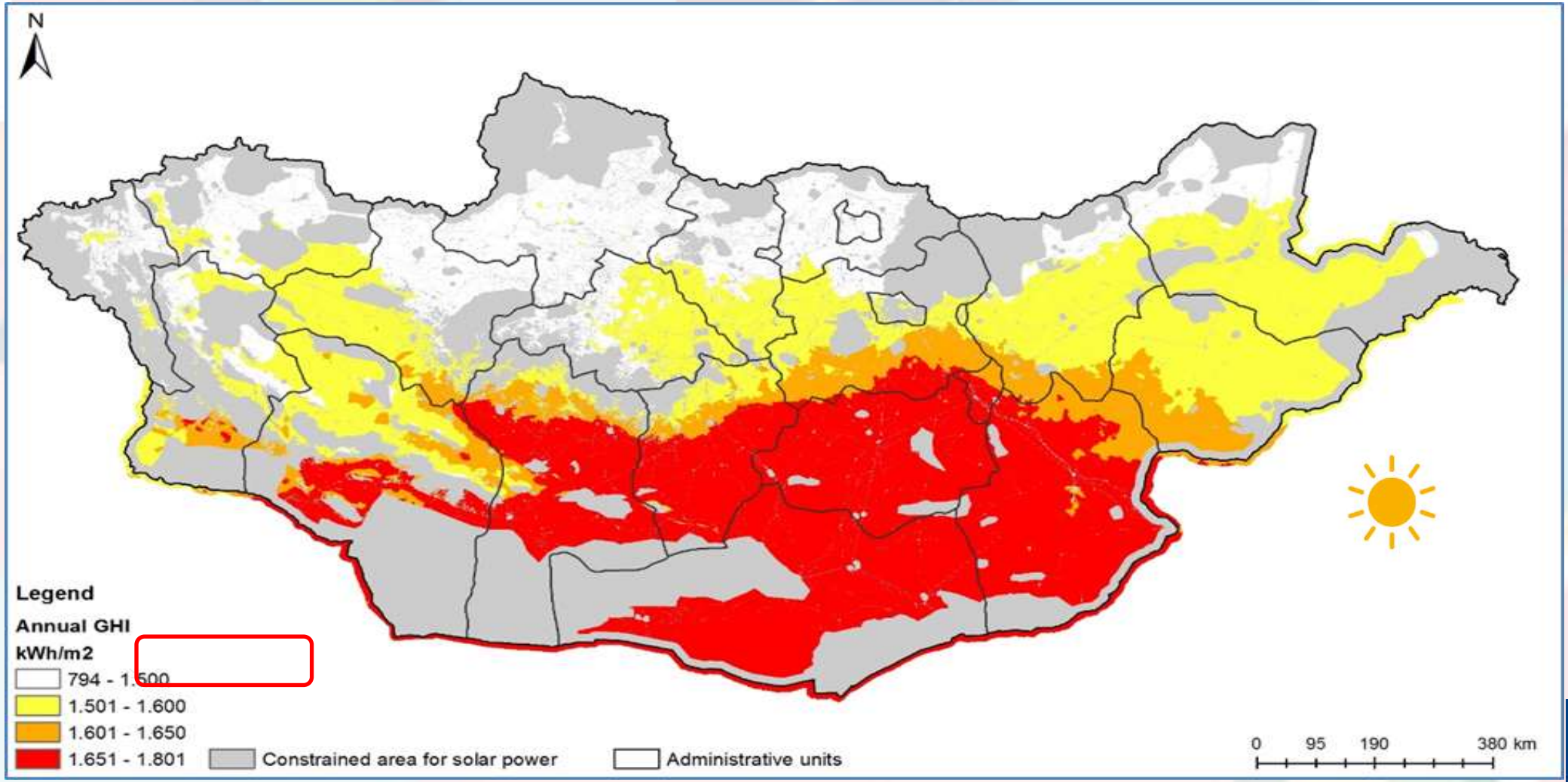
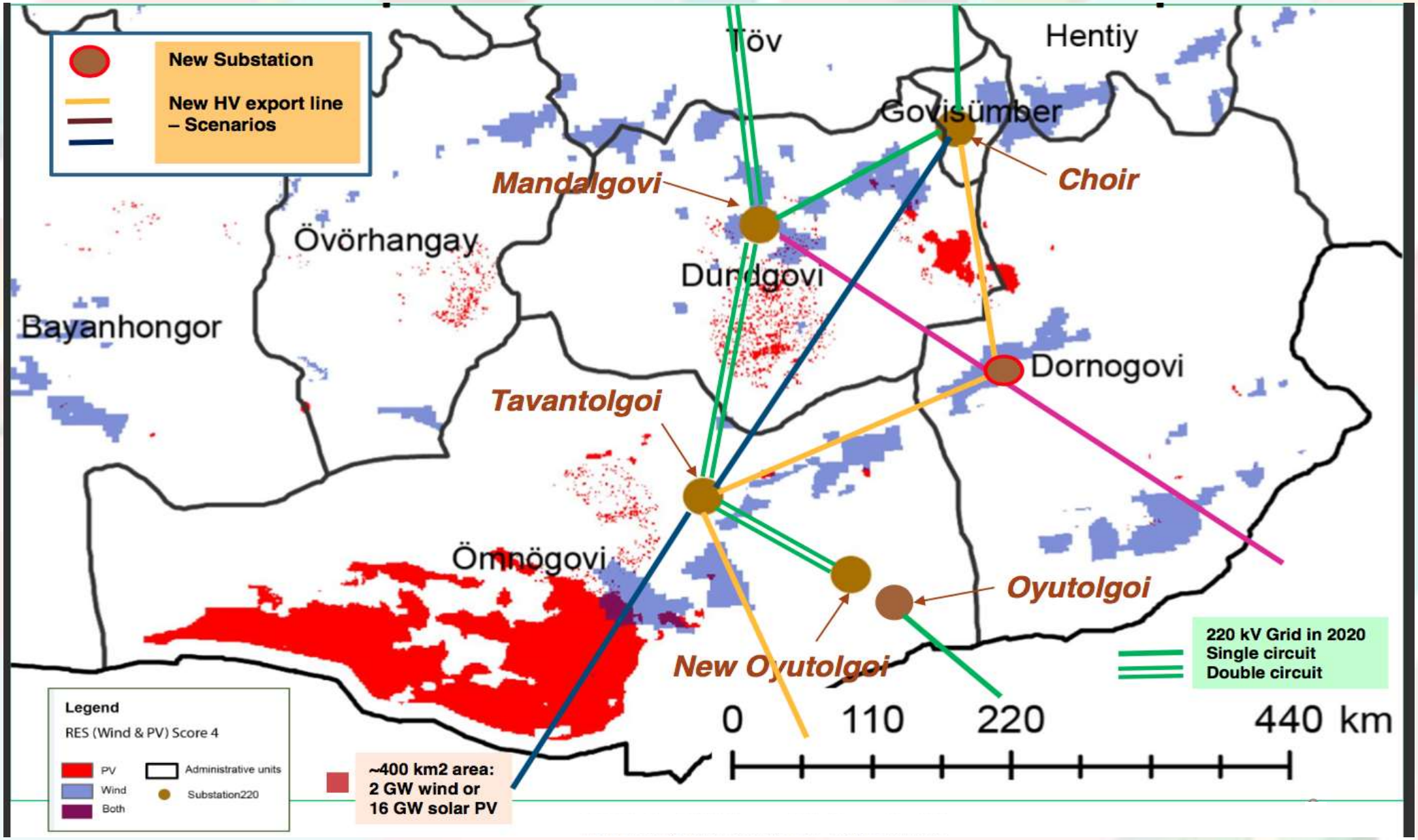
Identified Suitable Area for Solar Power Development in Mongolia

(excluding environmental and regulatory constrains)



Identified RE Export Corridor in Mongolia



Remaining TA Activities

Module 5: Power System interconnection Expansion Plan

- Present and future bulk power system
- Operation of the bulk power system
- Existing system performance
- Environmental data

Module 6: Institutional and tariff Settlements & Modelling

For each area/country:

- Current regulation and planning procedures

Upcoming Events

- August 2018 – conference in Beijing, China
- September 2018 – investment forum in Ulaanbaatar, Mongolia

ADB welcomes those interested in this study to participate in conferences and / or as an advisory committee member!

Beyond Northeast Asia…..

- Similar exercise/initiative can be done in CAREC region
- Inclusion of this Northeast Asia power interconnection initiative in the CAREC program?

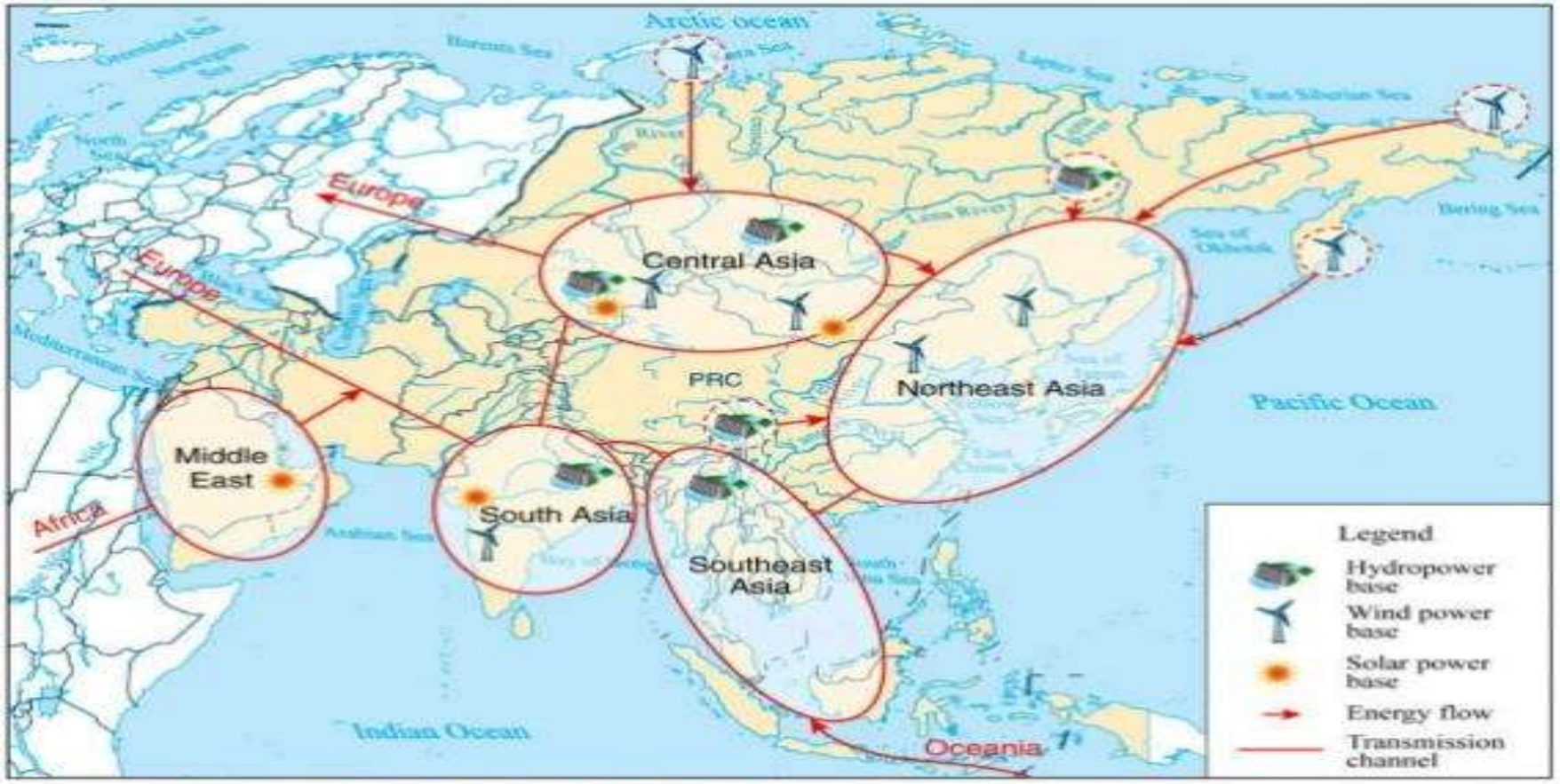


Illustration of Asia's Transnational Grid Interconnections

Source: Global Energy Interconnection Development and Cooperation Organization

Thank you

for further information

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