Electricity Cooperation in Northeast Asia

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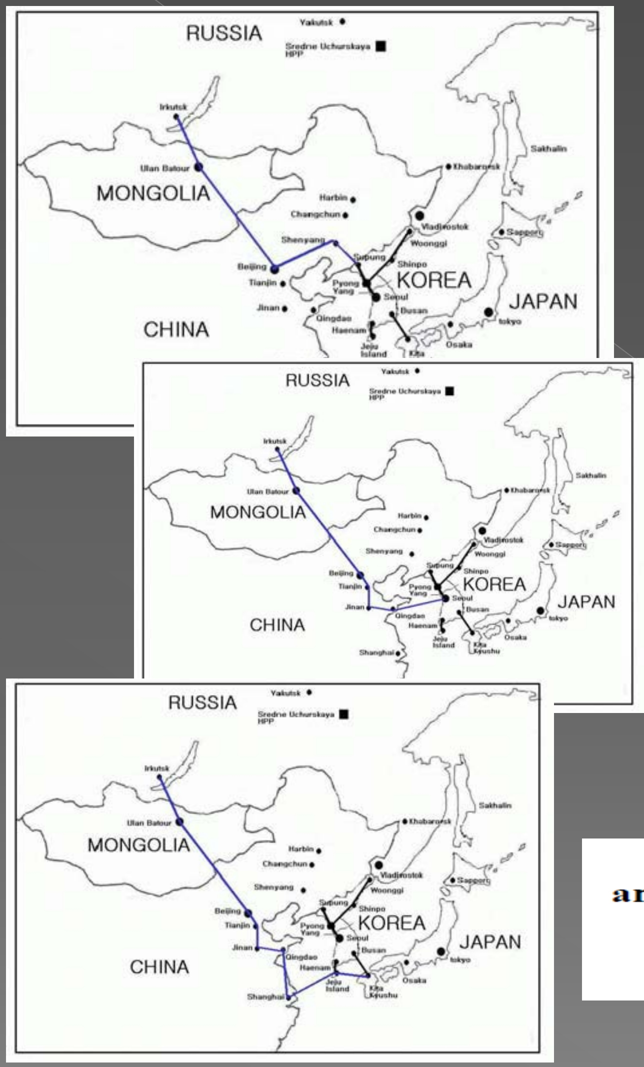
Why Energy Cooperation in NEA ?

- The most dynamic economic growth
- China will rise as the most promising economy
- The economic growth of South Korea, which will continue to surpass the world average
- Japan as a global economic leader
- Active reforms implemented to attract foreign investment in Russia and Mongolia and attractive mineral resource of Mongolia

- High economic growth will inevitably result in a surge of energy demand in the region, the energy security of Northeast Asia is vulnerable and the problem is expected to aggravate over time. With energy demand increasing rapidly and energy imports growing , the gap between the region ’s energy demands and its indigenous supply is widening
- Energy imports are largely dependent on Middle East suppliers, any regional conflicts or marine transportation route crises could seriously impact the stability of energy supplies to Northeast Asia.

- The energy industries in Northeast Asia are relatively immature and inefficient, making them less adaptable to the current heightened market volatility. Furthermore, while other regions of the world such as Western Europe and North America are seeking to improve energy market efficiency and secure cost-effective energy supply through energy market integration and system interconnection, the countries in the Northeast Asian region are deprived of such opportunities due to their isolated and, in some cases, fragmented energy systems.



- Energy cooperation among the countries in Northeast Asia takes on particular significance , as it offers an effective and mutually beneficial solution to all participating countries

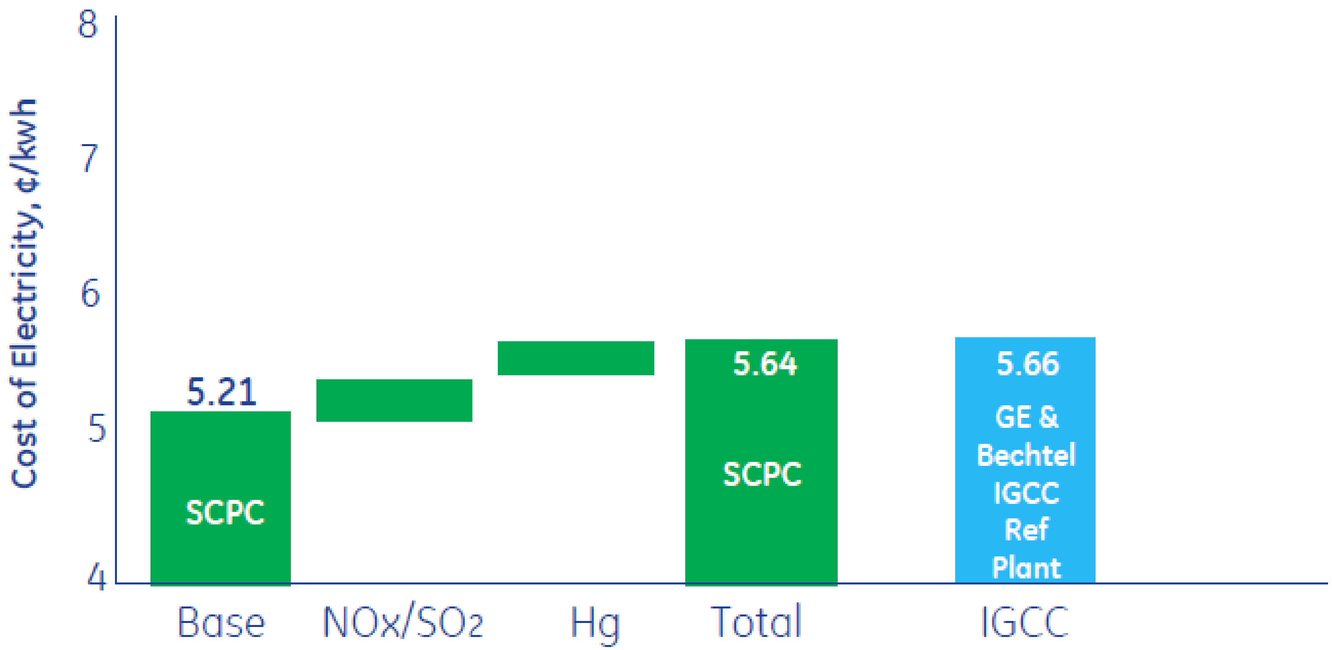
Northeast Asia Interconnection Scenario Map, and Power Flow Analysis Considering Seasonal Load Patterns for Power Reserve in South Korea

Sang-Seung Lee, Jong-Keun Park, Seung-Il Moon, and Yong-Tae Yoon

Current condition of participation of Mongolia to energy integration NEA

- Now Mongolia has very restricted power cooperation with the region countries. Unfortunately, even traditionally wide and long-term power cooperation with Russia in a last 20 years is minimized. However, the government of Mongolia beginning of last years starts to pay special attention to expansion of power cooperation with the region countries. So, since 2005 Mongolia and China are negotiating for construction TPP on brown coal deposits in the Shivee Ovoo of Mongolia. This power station will work almost for export of electricity (more than 80 % of an installed capacity) to Northern China.
- The Chinese party suggests to build this TPP very sweepingly and low-costly in comparison with cost of similar power station in the developed countries. So, if the capital cost of SCPC in the developed countries is not less than 1000$ / kW, China suggests no more 500$ / kW including SOx removing system, low nitrogen combustion technology and air cooling turbine unit. A stumbling block to the negotiations conducted is electricity export price and ecological problem concerning ash handling system.

Cost of Electricity: IGCC vs. SCPC



Basis

Plant output: 600MW

SCPC price: $1450/kW (Greenfield)

IGCC 10% capex premium

Fuel: IL #6, price $1.75/MMBTU (both)

First year cost of electricity in 2005

Availability: SCPC 90%, IGCC 85%

Emissions: $3500/ton NOx
$750/ton SO2

* Hg Removal Costs: $2.79/MWhr (SCPC)
$0.25/MWhr (IGCC)

* - DOE/Parsons: Gasification & Mercury Removal from Coal-Based Power Generation: the Least Cost Alternative, October 2001

Approximate roles of Stakeholders

- Just Group-General Coordinator
- Erdenes Mongolia-Political issues
- Prophecy Resource-Coal+PowerStation+Lines+Export
- En-Plus Group-Power Station+Lines+Export
- Investors Financial Model

The NDA signed between JG and PR corporation

between JG and En+ Group

Table 3. Total Energy Consumption Projection

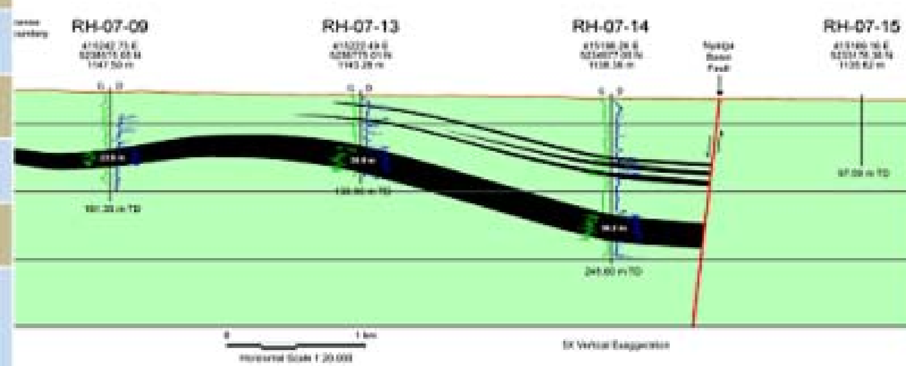
(Unit: Quadrillion Btu)

	2001	2005	2010	2015	2020	2025	Annual Growth (2001-2025)
S. Korea	8.1	9.0	10.6	12.0	13.0	13.9	2.3
Japan	21.9	22.4	23.8	25.2	26.0	27.1	0.9
China	39.7	43.2	54.4	65.5	77.6	90.8	3.5
World	403.9	433.0	481.0	532.0	583.0	640.0	1.9

Source: Energy Information Administration (EIA), U.S. Department of Energy, *International Energy Outlook 2003* (May 2003).

Chandgana Project

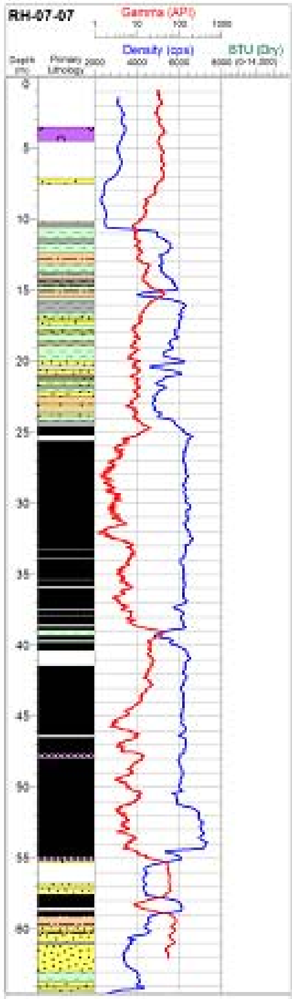
Chandgana (Coal- Fired Power Plant)	
Location:	Mongolia
Primary Product:	Thermal Coal (no washing required and no imparting seams)
Strip Ratio:	1.9:1 (Khavtgai) 0.53:1 (Tal)
Resource: (M&I)	1,211 million tonnes 4,354 kcal/kg
Stage:	NI 43-101
Single seam	1.2 billion tonnes
Coal thickness	37.7-45.4 meters
Low Ash	12.49%
Low Sulfur	0.68%
Power Plant	4200 MW *submitting Power Plant license application

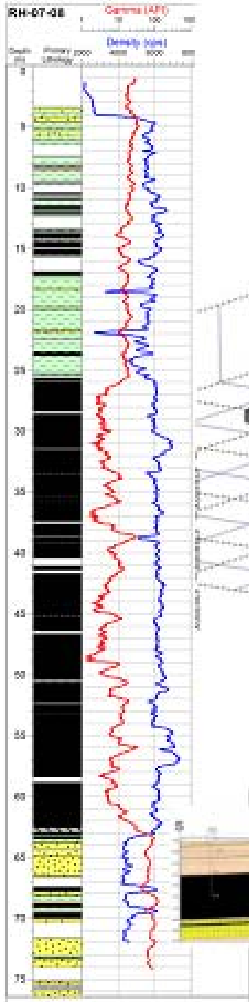


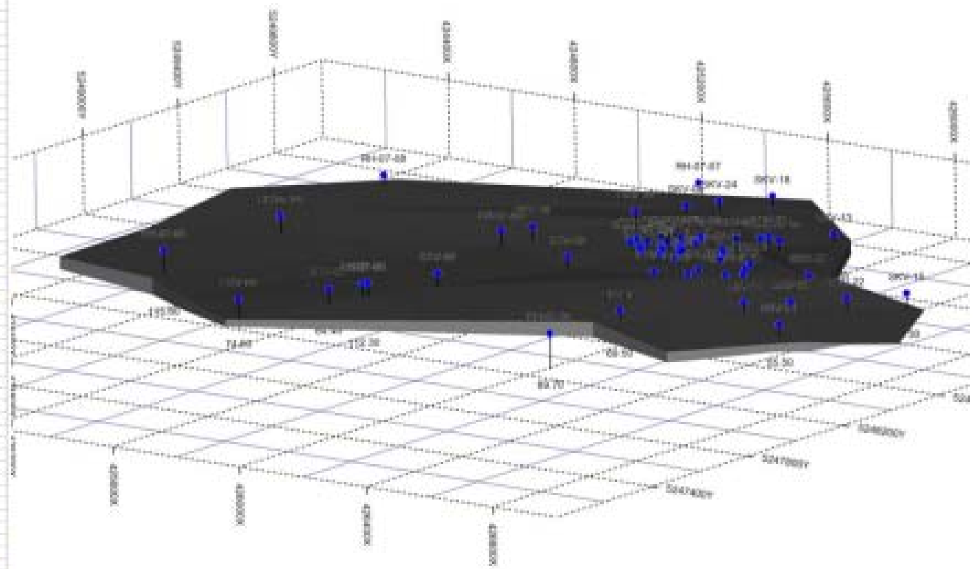
• 150 km from existing power infrastructure

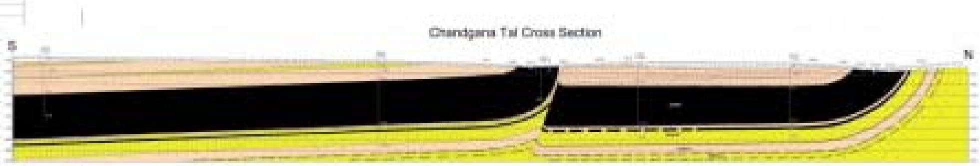

Chandgana Tal Cross Section

Chandgana Tal Seam









Dr.Batkhuyag and Dr.Yondongombo

Prophecy Resource Corp.

Coal Supply shortfall				
Operating Mines	Commissioned	Design Capacity	Actual Output	Shortfall
		mtpa	mtpa	mtpa
Sharyn Gol	1965	2.5	0.7	1.8
Baganuur	1978	3	1.1	1.9
Shivee Ovoo	1990	2	0.73	1.27
Sub-Total		7.5	2.533	4.967
ThermalPower Plants	Commisioned	Design Capacity	Actual Output	Incremental Demand
		MW	MW	mtpa
Darkhan	1965	48	39	0.50
Erdenet	1987-1989	29	22	0.23
TPP #2	1961-1969	22	18	
TPP# 3	1973-1979	136	107	
TPP #4	1983-1991	540	460	0.50
TPP# 5	Planned	600	600	2.40
Sub-Total		1,374	1,247	3.63
South Gobi	Commisioned	Design Capacity	Actual Output	Future Demand
		MW	MW	mtpa
Oyu Tolgoi	Planned	300	300	1.2
Tavan Tolgoi	Planned	300	300	1.2
Sub-Total		600	600	2.4
Total Coal Supply Shortfall				10.997
Total MW Supply Shortfall		1200		14

To be retired(2013)

To be retired(2016)

To be retired (2013)

Planned for 2013/2014

Planned 2012/2016

Planned 2016/2018

Domestic Power Station

Darkhan:
Incremental Demand 500 ktpa

Erdenet:
Incremental Demand 230 ktpa

Ulaanbaatar:
Incremental Demand 500ktpa.

Tpp #5 (in tender)
Incremental/New Demand: 2,400 ktpa.

Total Incremental Mongolian(demand (excl. South Gobi): 3.63 million tons per annum.

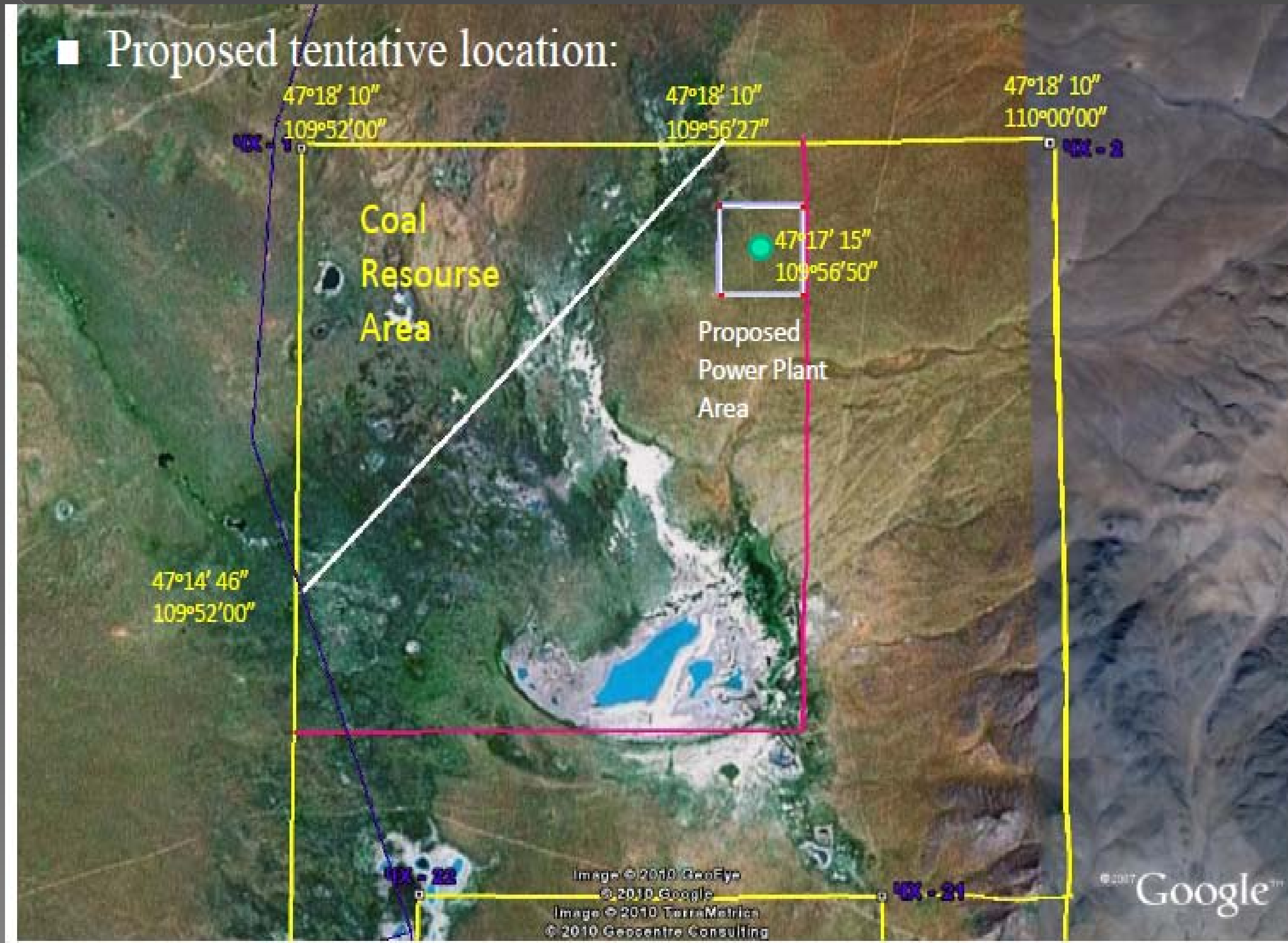
Total Incremental Mongolian:

10.997 million tons per annum.

Chandgana Power Plant

Proposed Installed capacity:

- Phase I: 2x300 MW (connect to CES, EES of Mongolia)
- Phase II: 6x600 MW (connect to North East Power Grid of China)


Proposed tentative location:
47°18′ 10″
109°52′00″
47°18′ 10″
109°56′27″
47°18′ 10″
110°00′00″
Coal
Resourse
Area
47°17′ 15″
109°56′50″
Proposed
Power Plant
Area
47°14′ 46″
109°52′00″
Image © 2010 GeoEye
© 2010 Google
Image © 2010 TerraMetrics
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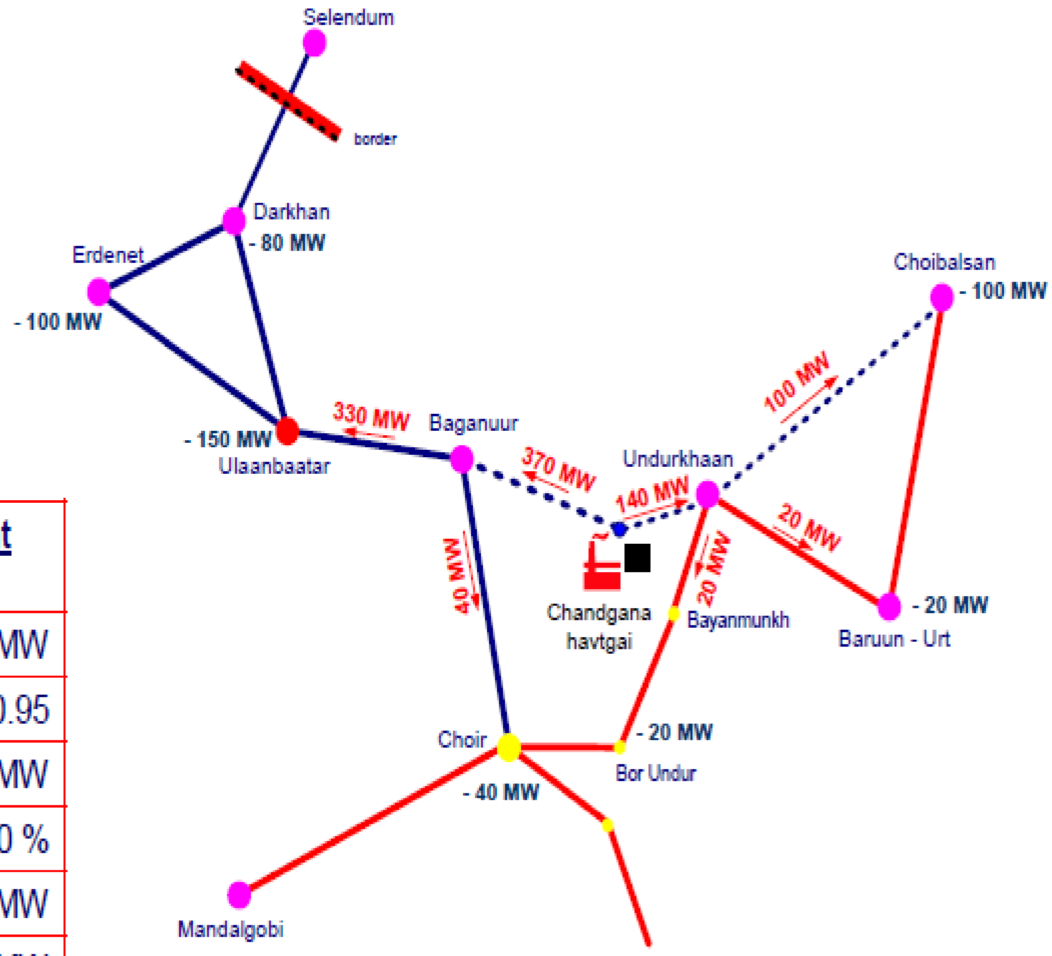
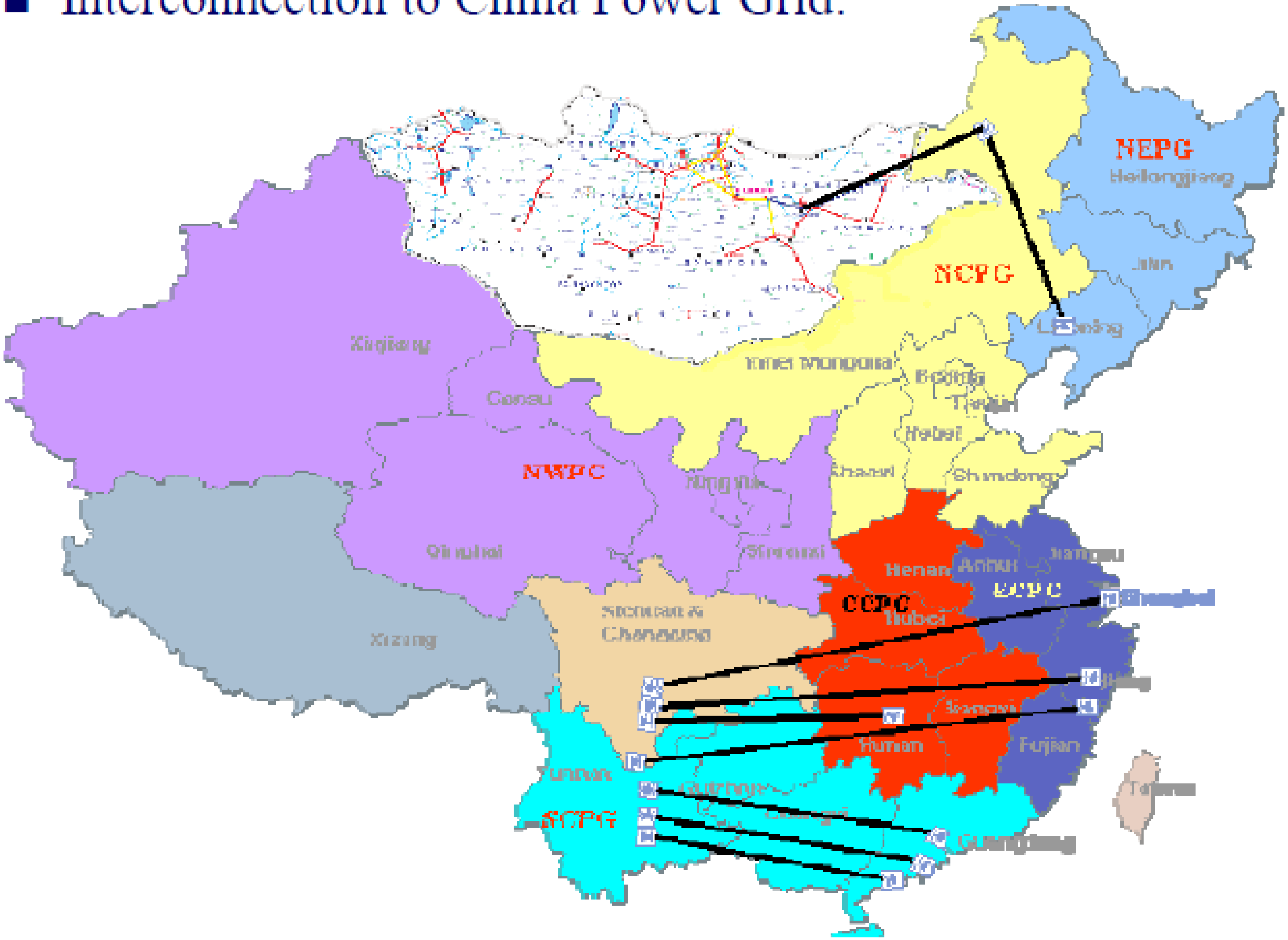
Google

- Transmission Diagram:



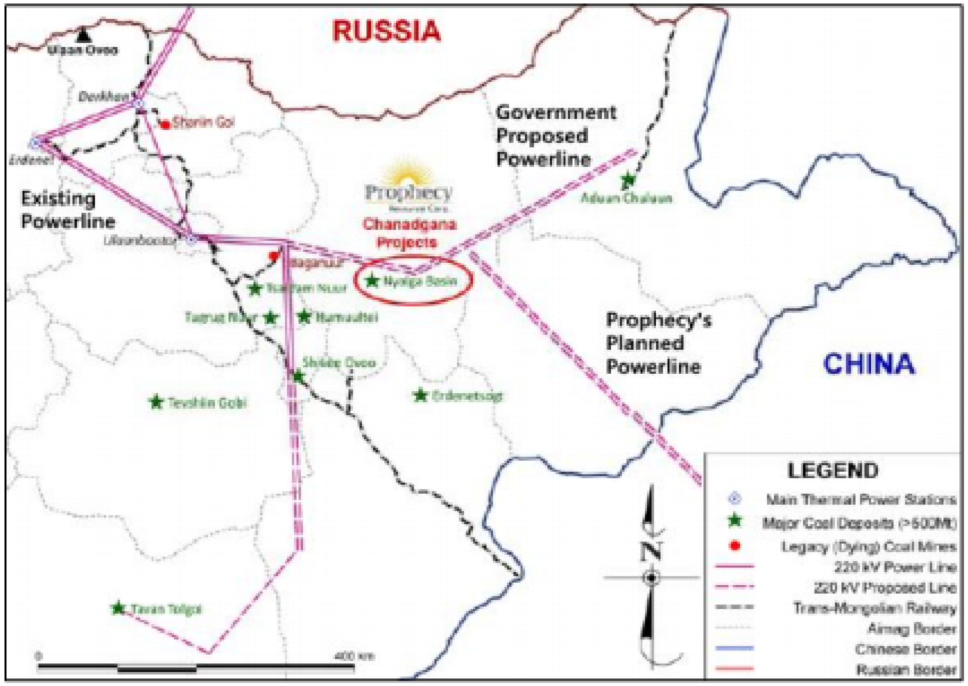
Chandgana Power Plant 2x300MW	
Installed capacity	600 MW
Power factor	0.95
Generation	570 MW
In house use	10 %
	57 MW
Transmission	513 MW

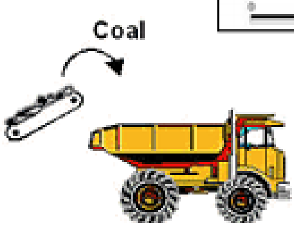
■ Interconnection to China Power Grid:



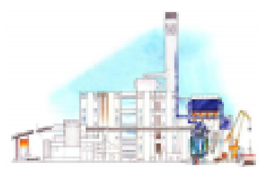
Mongolia Energy Grid and proposed lines

Prophecy Resource Corp.

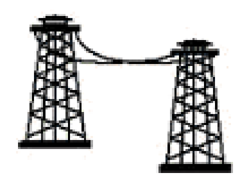




Chandgana Coal Mine



4,200 MW Thermal Power Plant on site



Power Transmission to Mongolia, China, & Russia

Regional power consumption map in China

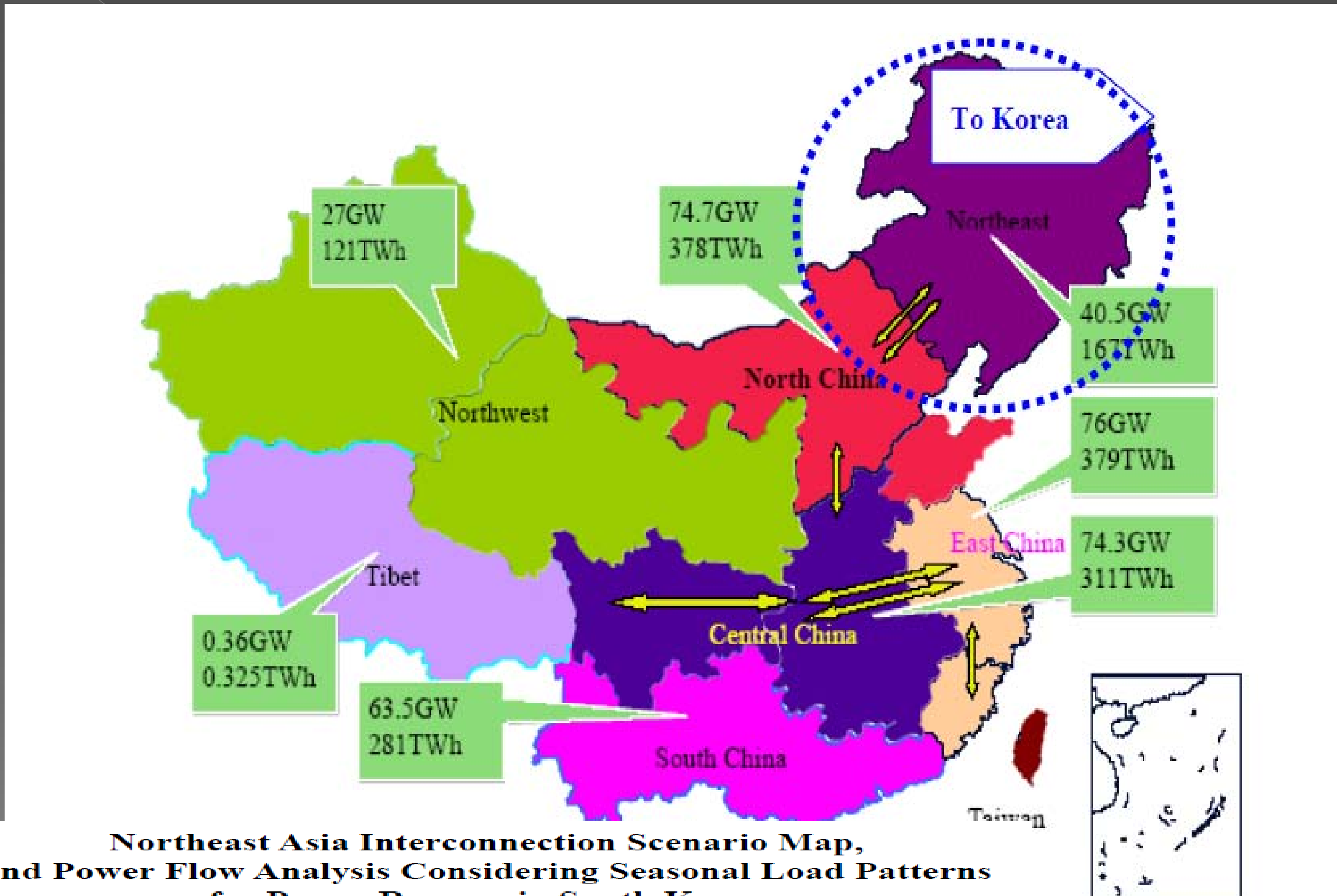


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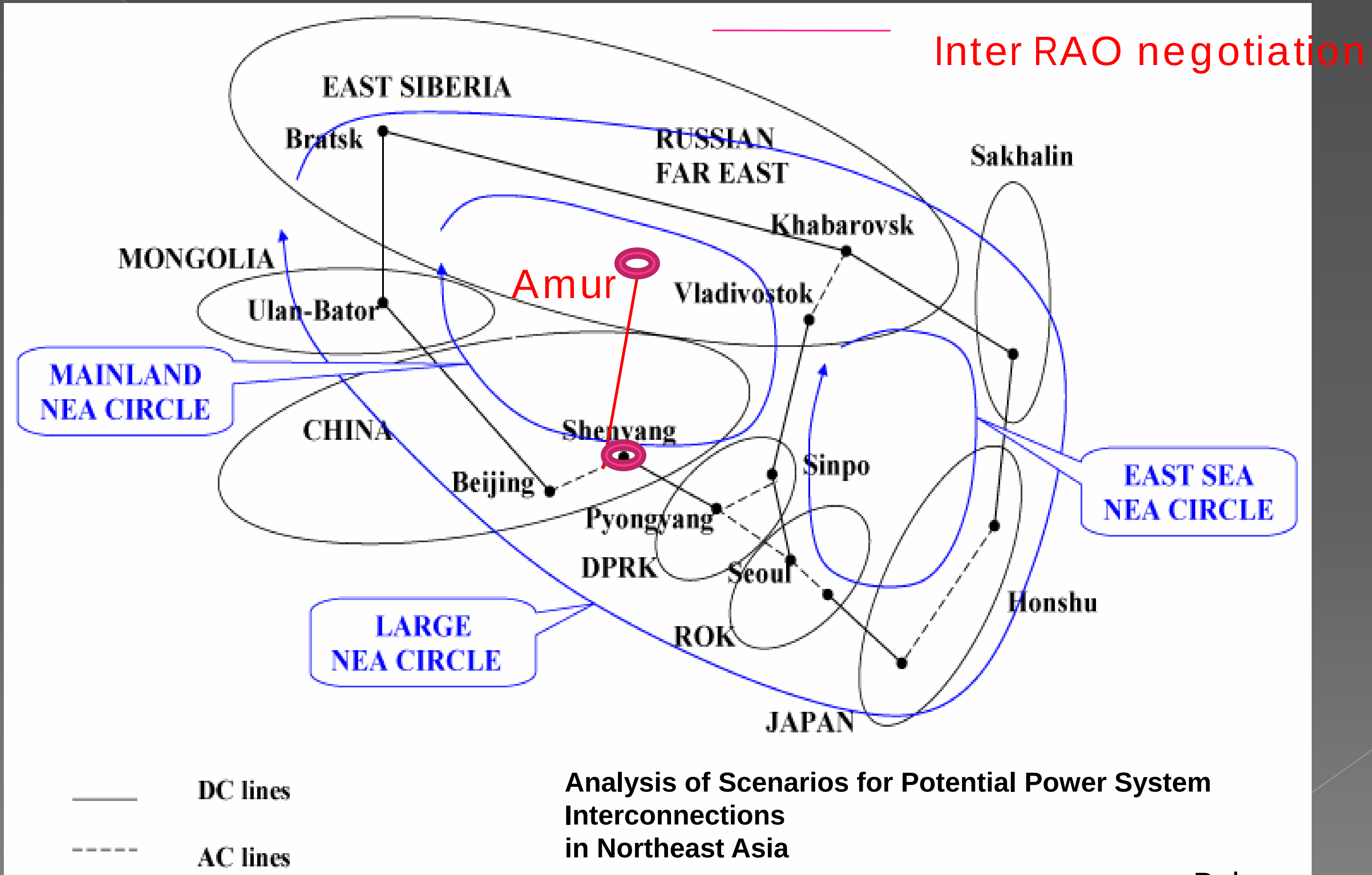
Diagram representing the NEA-wide PSI scenario.

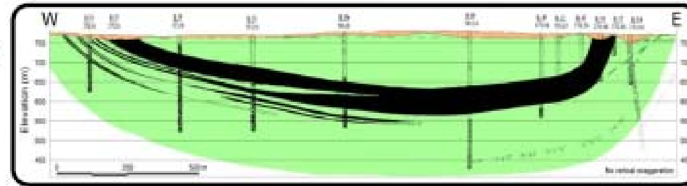


Analysis of Scenarios for Potential Power System Interconnections in Northeast Asia

D.-W. Park, H.-Y. Kim, J.-Y. Yoon, N.I. Voropai, L.S. Belyaev, S.V Podkovalnikov

Bituminous coal on a deposit of Ulaan Ovoo and possibility of export to the Russian power station “Gusinoozersky power station” (an initial size of 1 million tons per year)

Coal Production: Ulaan Ovoo



Single massive coal seam
- Outcrop is 50 m wide and max 200m deep
- 200 Mt M&I resource
- 20+ years mine life
- 5204kcal/kg (9367 btu/lb)
- Low ash 12.46% & sulfur 0.40%

Strip ratio of 2:1

First 20 million tonnes requires no washing

Total 2010 CapEx ~$5 million
($1.5m road repair, $3.5m Leighton)
Leighton Contract Operator
- 2010 Production cost = $12/t
($7 for equipment leasing, $5 mining)

Wardrop Reserve Study due in August

Conclision

- First of all, the abundant energy reserves of Mongolia could become the key source of alternative energy supply source for the countries in the Northeast Asian region, and would lessen the region’s heavy dependence on the Middle East. Moreover , the abundant environment -friendly natural gas and hydropower reserves can be effectively utilized to deal with environmental issues.

- Second, it would also be a cost-effective alternative because of its proximity to consuming markets. The regional energy cooperation schemes such as joint development of energy resources and construction of electricity grid, oil and gas pipelines will permit land routes for energy supply to countries that have depended almost entirely on marine transport for imports. The interconnection of energy supply systems will further promote efficient energy trade and improve facility utilization.

- Third , efforts pertaining to implementation of energy cooperation projects tend to promote market efficiency and accelerate liberalization process in the region. Often multilateral energy projects entail coordination of energy policies and induce various changes such as streamlining unnecessary procedures and removing of ad hoc subsidies . In the course of implementing cooperative projects, each country’s energy system and policies are likely to converge with international standards and improve energy market transparency. This will in turn lower the risks associated with multilateral energy projects and attract more investments to the region.

Thank you for attention