

## Appendix

### Data Inputs

**Table A1: Current Power Generation Capacity (MW)**

	North China	Japan (East)	Japan (West)	East Russia	Mongolia	South Korea
Coal	233,369	11,620	20,780	16,150	1,050	26,273.6
Diesel/HFO	0	16,166	11,374	0	0	2,950
Natural gas	2,109	31,353	37,797	16,150	18.4	27,296
Hydro	13,595	8,383	12,140	28,600	0	1,644
Small hydro	11	156	141	0	15.05	122.8
Geothermal	4.2	264	219	3.6	0	0
Wind	34,509	1,424	1,434	0	50	641.5
Solar PV	194	8,143	14,916	15.2	0.88	1,894.2
Biomass	0	1196	1361	0	0	500
Nuclear	0	19,056	25,208	48	0	20,716

HFO = heavy fuel oil, MW = megawatts, PV = photovoltaic.

Source: Authors.

**Table A2: Load Factor**

	North China (%)	Japan (East) (%)	Japan (West) (%)	East Russia (%)	Mongolia (%)	South Korea (%)
Coal	85	80	80	70	70	80
Diesel/HFO	85	50	50	85	85	50
Natural gas	85	74	74	85	85	74
Hydro	52	60	60	52	52	60
Small hydro	30	45	45	30	30	45
Geothermal	85	83	83	85	85	83
Wind	30	25	25	30	30	25
Solar PV	11	13	13	11	11	13
Biomass	85	87	87	85	85	87
Nuclear	85	80	80	85	85	80

HFO = heavy fuel oil, PV = photovoltaic.

Source: Authors.

**Table A3: Current Capital Cost of Generation Capacity (million US\$/MW)**

	North China	Japan (East)	Japan (West)	East Russia	Mongolia	South Korea
Coal	2.079	2.526	2.526	2.4948	2.4948	2.2734
Diesel/HFO	1.139	1.995	1.995	1.3668	1.3668	1.7955
Natural gas	1.054	1.202	1.202	1.2648	1.2648	1.0818
Hydro	4.933	6.385	6.385	5.9196	5.9196	5.7465
Small hydro	2.3	8.979	8.979	2.76	2.76	8.0811
Geothermal	6.18	7.882	7.882	7.416	7.416	7.0938
Wind	2.187	3.919	3.919	2.6244	1.5309	3.52665
Solar PV	1.5	3.283	3.283	1.8	1.05	2.95425
Biomass	4.027	3.971	3.971	4.8324	4.8324	3.5739
Nuclear	5.0	4.083	4.083	6.0	6.0	3.6747

HFO = heavy fuel oil, MW = megawatts, PV = photovoltaic.

Source: Authors.

**Table A4: Current Operational Cost including Fuel Costs (US\$/MWh)**

	North China	Japan (East)	Japan (West)	East Russia	Mongolia	South Korea
Coal	31.86	87.7	87.7	38.2	38.2	78.9
Diesel/HFO	229.75	58	58	275.7	275.7	52.2
Natural gas	43	62	62	51.6	51.6	55.8
Hydro	4.32	80	80	5.2	5.2	72
Small hydro	4.68	602	602	5.6	5.6	541.8
Geothermal	14.23	314	314	17.1	17.1	282.6
Wind	20.58	135.5	135.5	24.7	14.4	121.95
Solar PV	19.52	34.5	34.5	23.4	13.7	31.05
Biomass	28.87	257	257	34.6	34.6	231.3
Nuclear	30	173	173	36.0	36.0	155.7

HFO = heavy fuel oil, MWh = megawatt-hour, PV = photovoltaic.

Source: Authors.

**Table A5: Growth Rate of Capital Cost of Generation Capacity**

	<b>North China (%)</b>	<b>Japan (East) (%)</b>	<b>Japan (West) (%)</b>	<b>East Russia (%)</b>	<b>Mongolia (%)</b>	<b>South Korea (%)</b>
Coal	3.0	3.0	3.0	3.0	3.0	3.0
Diesel/HFO	3.5	3.5	3.5	3.5	3.5	3.5
Natural gas	2.5	2.5	2.5	2.5	2.5	2.5
Hydro	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1
Small hydro	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1
Geothermal	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1
Wind	-3.0	-3.0	-3.0	-3.0	-3.0	-3.0
Solar PV	-3.0	-3.0	-3.0	-3.0	-3.0	-3.0
Biomass	0.8	0.8	0.8	0.8	0.8	0.8
Nuclear	-0.5	-0.5	-0.5	-0.5	-0.5	-0.5

HFO = heavy fuel oil, PV = photovoltaic.

Source: Authors.

**Table A6: Growth Rate of Operational Cost of Generation Capacity**

	<b>North China (%)</b>	<b>Japan (East) (%)</b>	<b>Japan (West) (%)</b>	<b>East Russia (%)</b>	<b>Mongolia (%)</b>	<b>South Korea (%)</b>
Coal	3.0	3.0	3.0	3.0	3.0	3.0
Diesel/HFO	3.5	3.5	3.5	3.5	3.5	3.5
Natural gas	2.5	2.5	2.5	2.5	2.5	2.5
Hydro	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1
Small hydro	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1
Geothermal	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1
Wind	-3.0	-3.0	-3.0	-3.0	-3.0	-3.0
Solar PV	-3.0	-3.0	-3.0	-3.0	-3.0	-3.0
Biomass	0.8	0.8	0.8	0.8	0.8	0.8
Nuclear	-0.5	-0.5	-0.5	-0.5	-0.5	-0.5

HFO = heavy fuel oil, PV = photovoltaic.

Source: Authors.

**Table A7: Life of Generation Capacities (Years)**

	<b>North China</b>	<b>Japan (East)</b>	<b>Japan (West)</b>	<b>East Russia</b>	<b>Mongolia</b>	<b>South Korea</b>
Coal	40	40	40	40	40	40
Diesel/HFO	30	30	30	30	30	30
Natural gas	30	30	30	30	30	30
Hydro	80	80	80	80	80	80
Small hydro	50	50	50	50	50	50
Geothermal	30	30	30	30	30	30
Wind	25	25	25	25	25	25
Solar PV	25	25	25	25	25	25
Biomass	25	25	25	25	25	25
Nuclear	40	40	40	40	40	40

HFO = heavy fuel oil, PV = photovoltaic.

Source: Authors.

**Table A8: Maximum Additional Generation Capacity Allowed (MW)**

	<b>North China</b>	<b>Japan (East)</b>	<b>Japan (West)</b>	<b>East Russia</b>	<b>Mongolia</b>	<b>South Korea</b>
Coal	No limit	No limit	No limit	No limit	No limit	No limit
Diesel/HFO	No limit	No limit	No limit	No limit	No limit	No limit
Natural gas	No limit	No limit	No limit	No limit	No limit	No limit
Hydro	28,000	0	0	0	6,300	0
Small hydro	3.6	539	1,000	0	314.8	0
Geothermal	1,000	394	4,929	0	0	0
Wind	98,000	1,715	10,000	0	300,000	25,000
Solar PV	100,000	17,800	50,000	0	2,180,000	450,000
Biomass	30,000	163	200	0	0	0
Nuclear	18,000	0	0	0	0	44,000

HFO = heavy fuel oil, MW = megawatts, PV = photovoltaic.

Source: Authors.

**Table A9: Existing Transmission Capacity (MW)**

	<b>North China</b>	<b>Japan (East)</b>	<b>Japan (West)</b>	<b>East Russia</b>	<b>Mongolia</b>	<b>South Korea</b>
North China	No limit	0	0	800	120	0
Japan (East)	0	No limit	1,200	0	0	0
Japan (West)	0	1,200	No limit	0	0	0
East Russia	800	0	0	No limit	230	0
Mongolia	120	0	0	230	No limit	0
South Korea	0	0	0	0	0	No limit

MW = megawatts.

Source: Authors.

**Table A10: Capital Cost of Cross-Border Transmission Capacity (US\$ per MW\*km)**

	<b>North China</b>	<b>Japan (East)</b>	<b>Japan (West)</b>	<b>East Russia</b>	<b>Mongolia</b>	<b>South Korea</b>
North China	0	1,086	1,086	1,086	1,086	1,086
Japan (East)	1,086	0	1,086	1,086	1,086	1,086
Japan (West)	1,086	1,086	0	1,086	1,086	1,086
East Russia	1,086	1,086	1,086	0	1,086	1,086
Mongolia	1,086	1,086	1,086	1,086	0	1,086
South Korea	1,086	1,086	1,086	1,086	1,086	0

km = kilometre, MW = megawatts.

Source: Authors.

**Table A11: Operational Cost of Cross-Border Transmission Capacity (US\$ per MW\*km per annum)**

	<b>North China</b>	<b>Japan (East)</b>	<b>Japan (West)</b>	<b>East Russia</b>	<b>Mongolia</b>	<b>South Korea</b>
North China	0	2	2	2	2	2
Japan (East)	2	0	2	2	2	2
Japan (West)	2	2	0	2	2	2
East Russia	2	2	2	0	2	2
Mongolia	2	2	2	2	0	2
South Korea	2	2	2	2	2	0

km = kilometre, MW = megawatts.

Source: Authors.

**Table A12: Length of Required Cross-Border Transmission Line (km)**

	<b>North China</b>	<b>Japan (East)</b>	<b>Japan (West)</b>	<b>East Russia</b>	<b>Mongolia</b>	<b>South Korea</b>
North China	0	1,500	900	300	300	600
Japan (East)	1,500	0	50	600	3,000	550
Japan (West)	900	50	0	1,500	2,400	300
East Russia	300	600	1,500	0	300	300
Mongolia	300	3,000	2,400	300	0	1,600
South Korea	600	550	300	300	1,600	0

km = kilometre.

Source: Authors.

**Table A13: Expected Rate of Power Losses along the Cross-Border Transmission Line**

	<b>North China (%)</b>	<b>Japan (East) (%)</b>	<b>Japan (West) (%)</b>	<b>East Russia (%)</b>	<b>Mongolia (%)</b>	<b>South Korea (%)</b>
North China	0	8	5	8	5	5
Japan (East)	8	0	3	5	8	5
Japan (West)	5	3	0	8	8	3
East Russia	8	5	8	0	3	5
Mongolia	5	8	8	3	0	8
South Korea	5	5	3	5	8	0

Source: Authors.