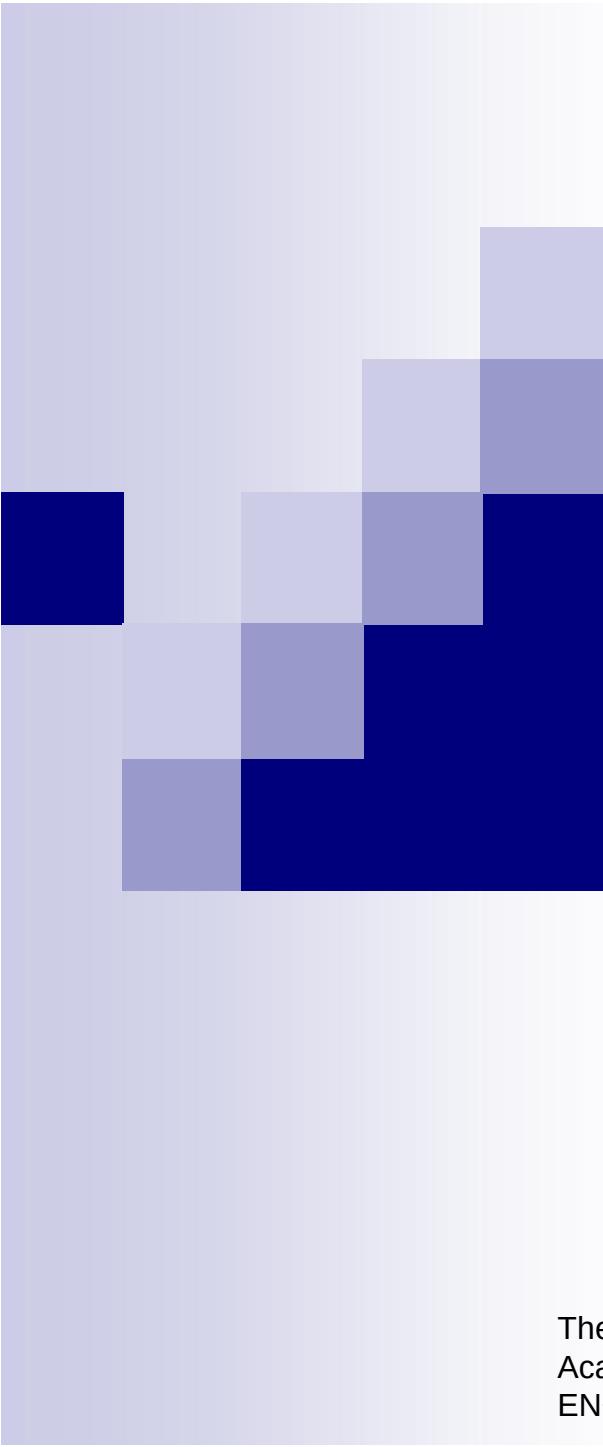




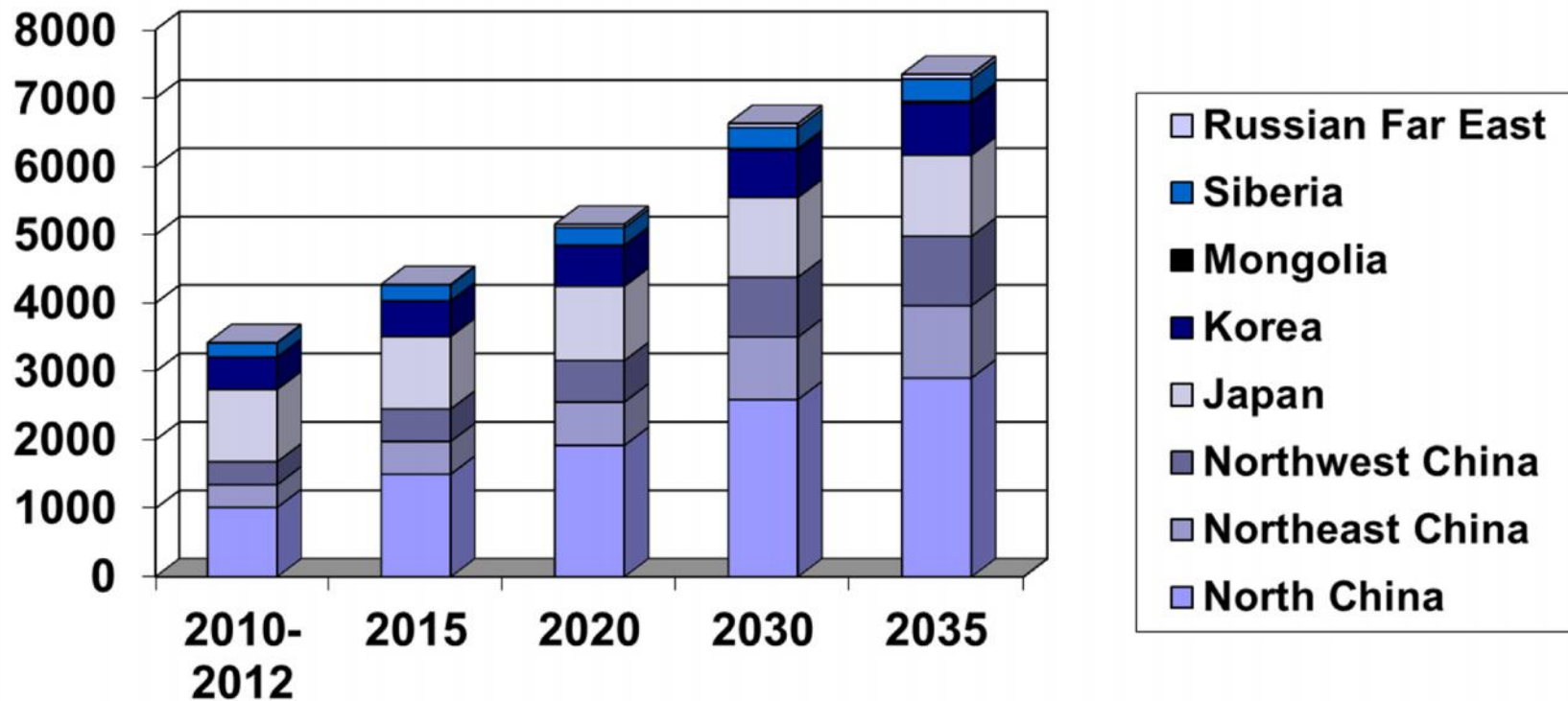
Energy Systems Institute, Irkutsk, Russia

N.I.Voropai, S.V.Podkovalnikov, D.A.Sokolov

Interconnections of Russia with countries of Northeast Asia in the framework of possible electricity unification

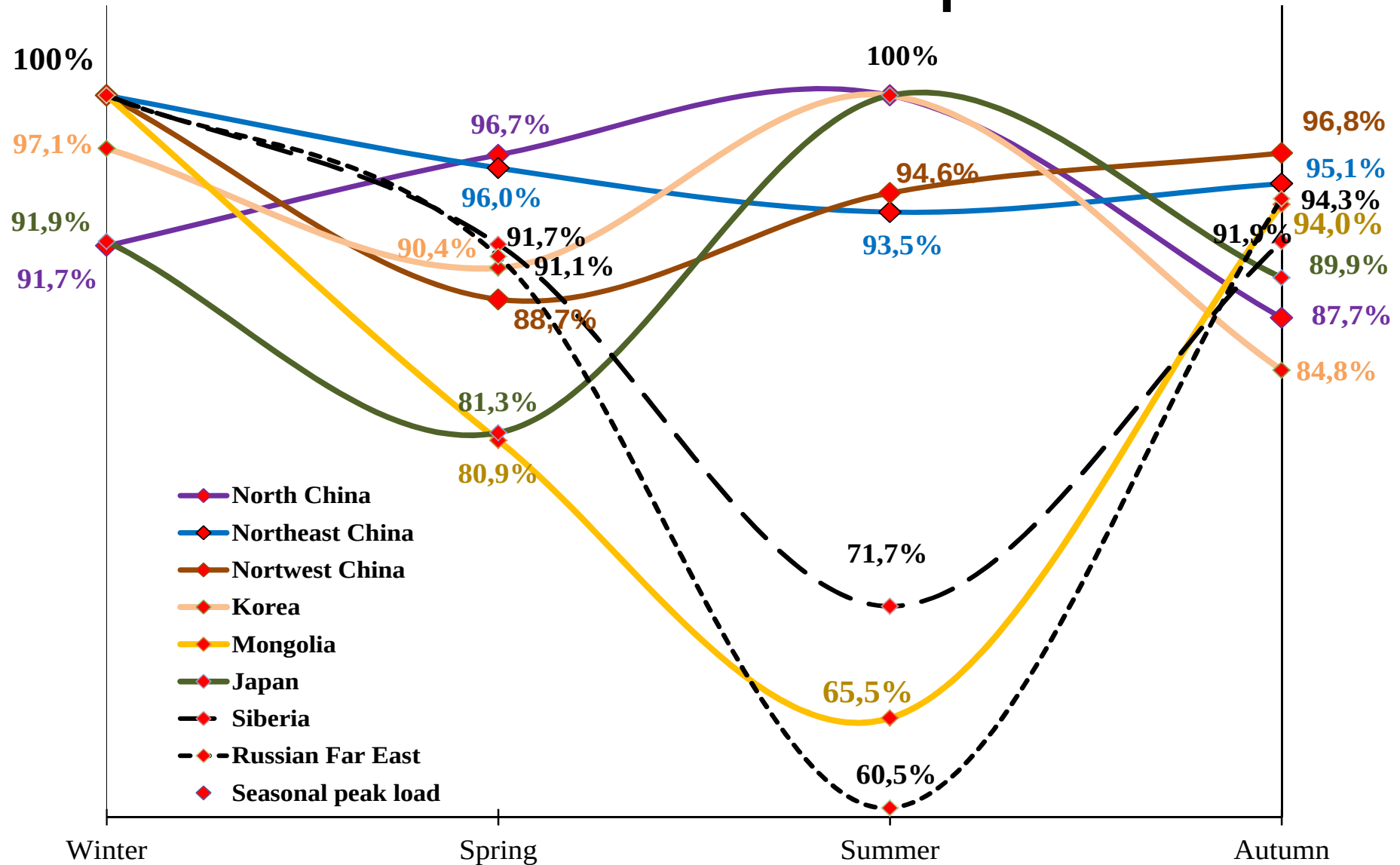
The study is being conducted by Energy Systems Institute of Siberian Branch of the Russian Academy of Sciences in collaboration with Skolkovo Institute of Science and Technology and EN+ Group.

Projection of prospective electricity demand for Northeast Asia (NEA) countries and regions, TWh/year



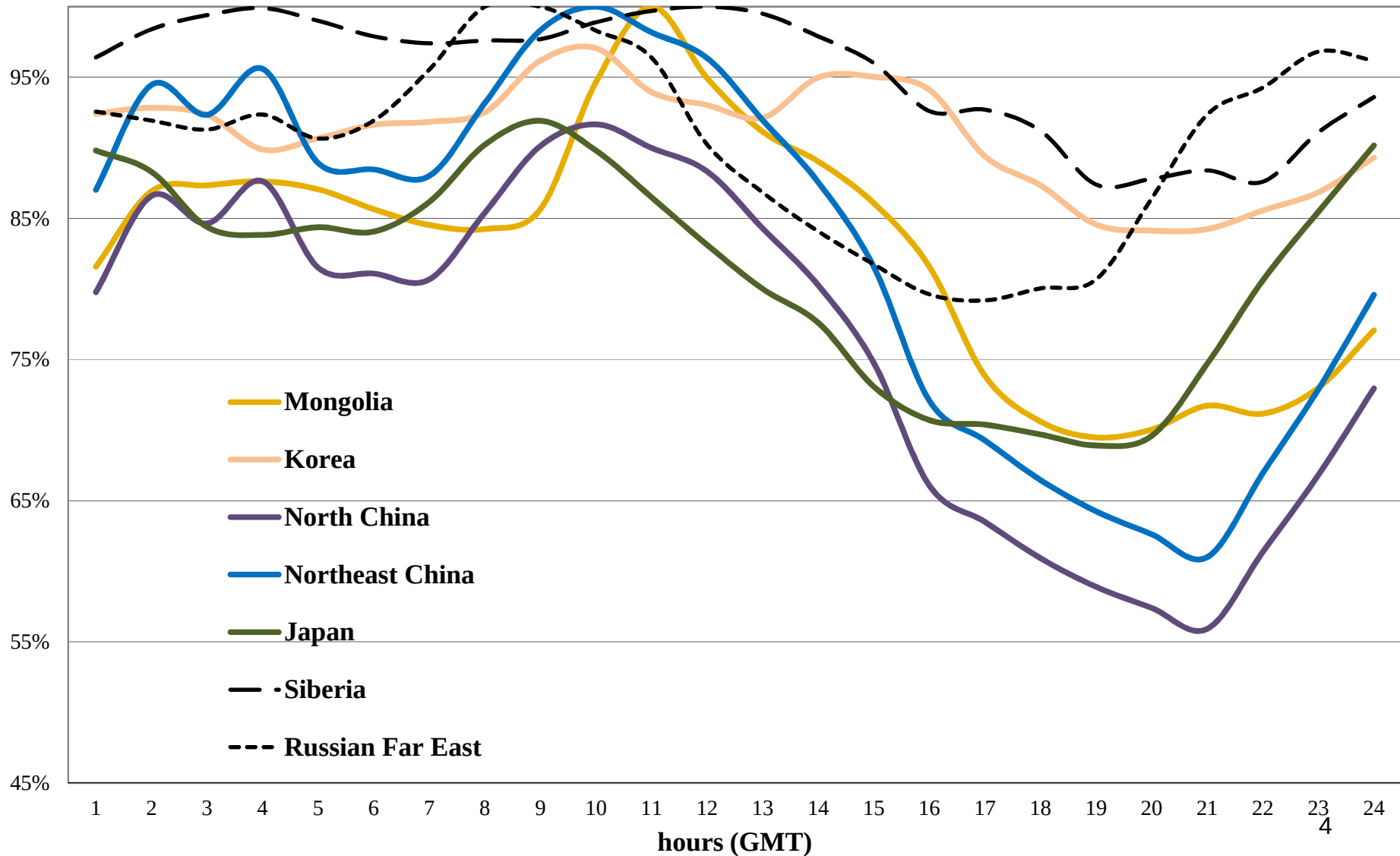
Electricity demand in the region is expected to grow more than twofold for the considered period.

Seasonal electric load profiles

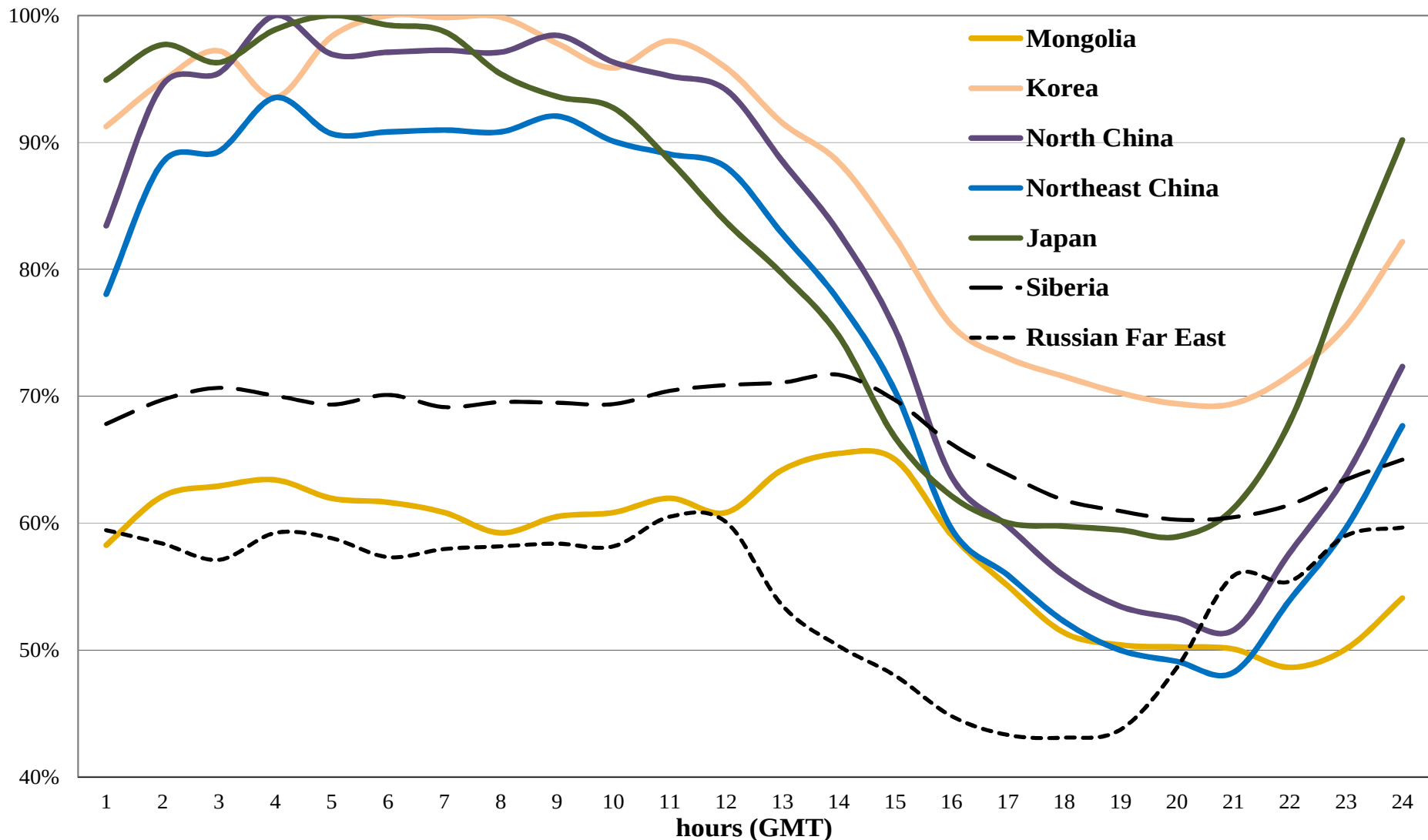


Seasonal load profiles are very divers. In some countries they come in summer in other – in winter.

Daily electric load profiles (winter)

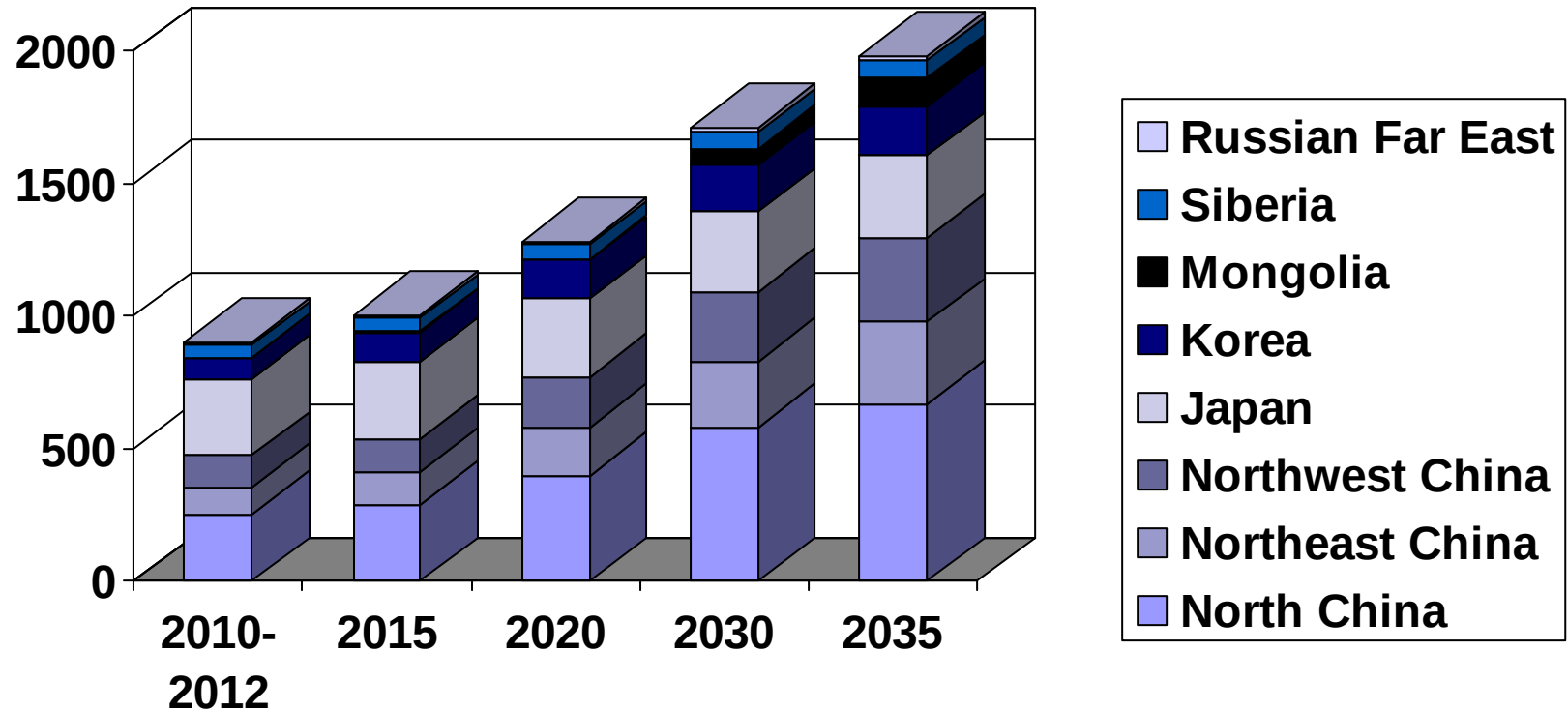


Daily electric load profiles (summer)



Divers load profiles, both yearly and daily, result in large capacity saving and economic benefits in NEA region. This can be seen further.

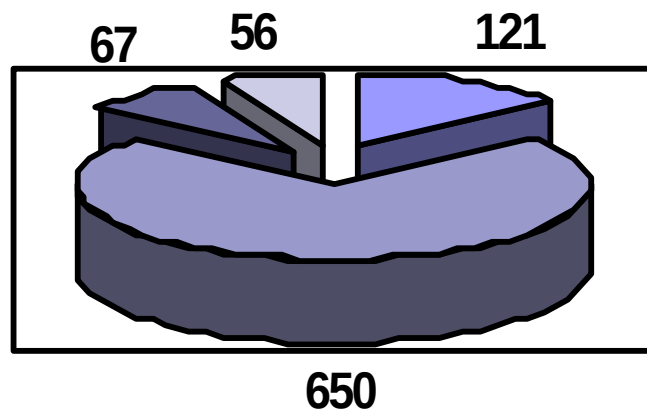
Forecast of generating capacity expansion, GW



Generating capacity in the region is expected to grow more than twofold for the considered period.

NEA generating capacity mix by type of power plants, 2010-2012

GW

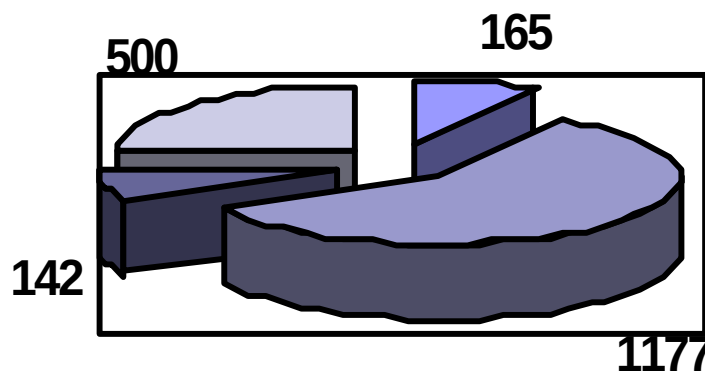


Fossil fuel generating capacity is dominating in the capacity mix currently. Conventional hydro is ranked second. Renewables follow the nuclear.

- Hydro (conventional + pumped storage)
- Thermal (steam turbine + combined cycle + cogeneration)
- Nuclear
- Renewables (wind + solar + geothermal)

NEA generating capacity mix by type of power plants, 2035

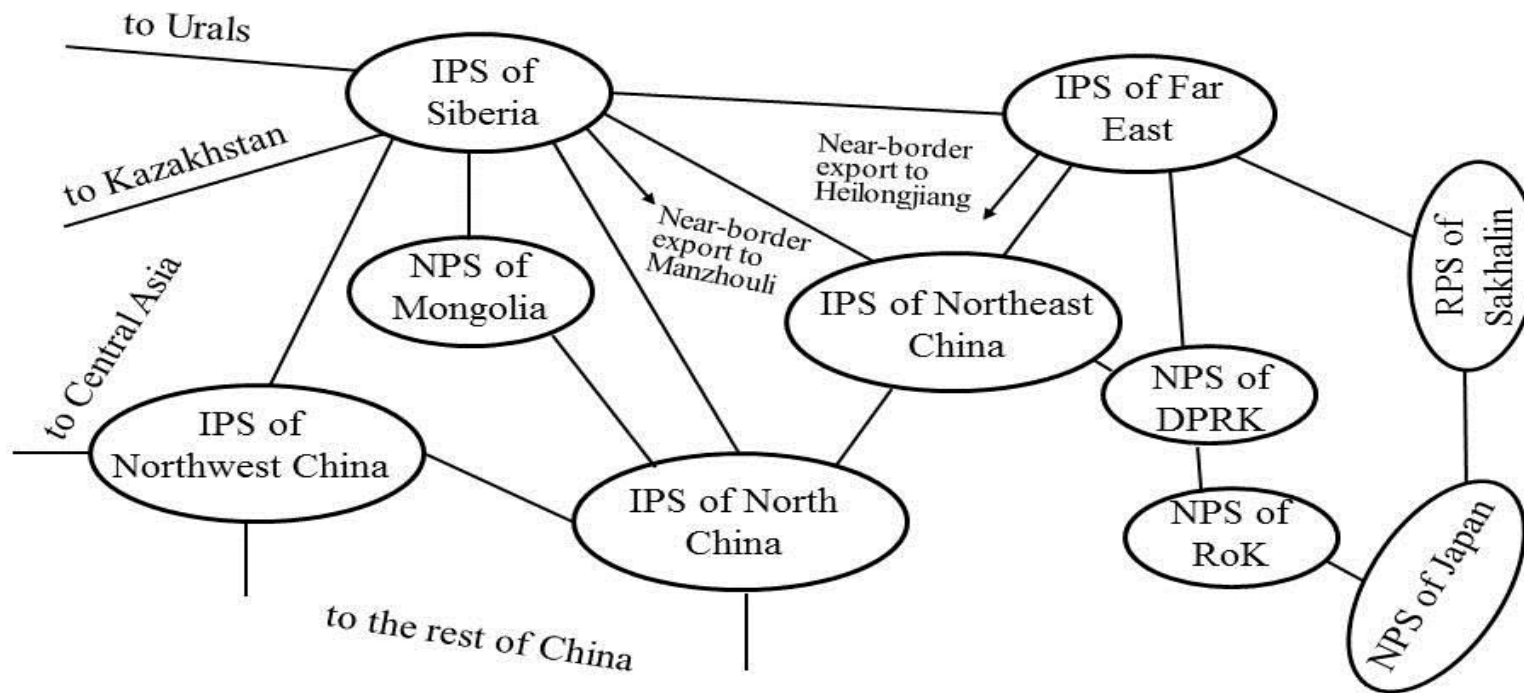
GW



Fossil fuel generating capacity is still dominating but its share in the capacity mix is decreasing for the considered period. Renewables are ranked second. Their capacity is supposed to grow swiftly.

- Hydro (conventional + pumped storage)
- Thermal (steam turbine + combined cycle + cogeneration)
- Nuclear
- Renewables (wind + solar + geothermal)

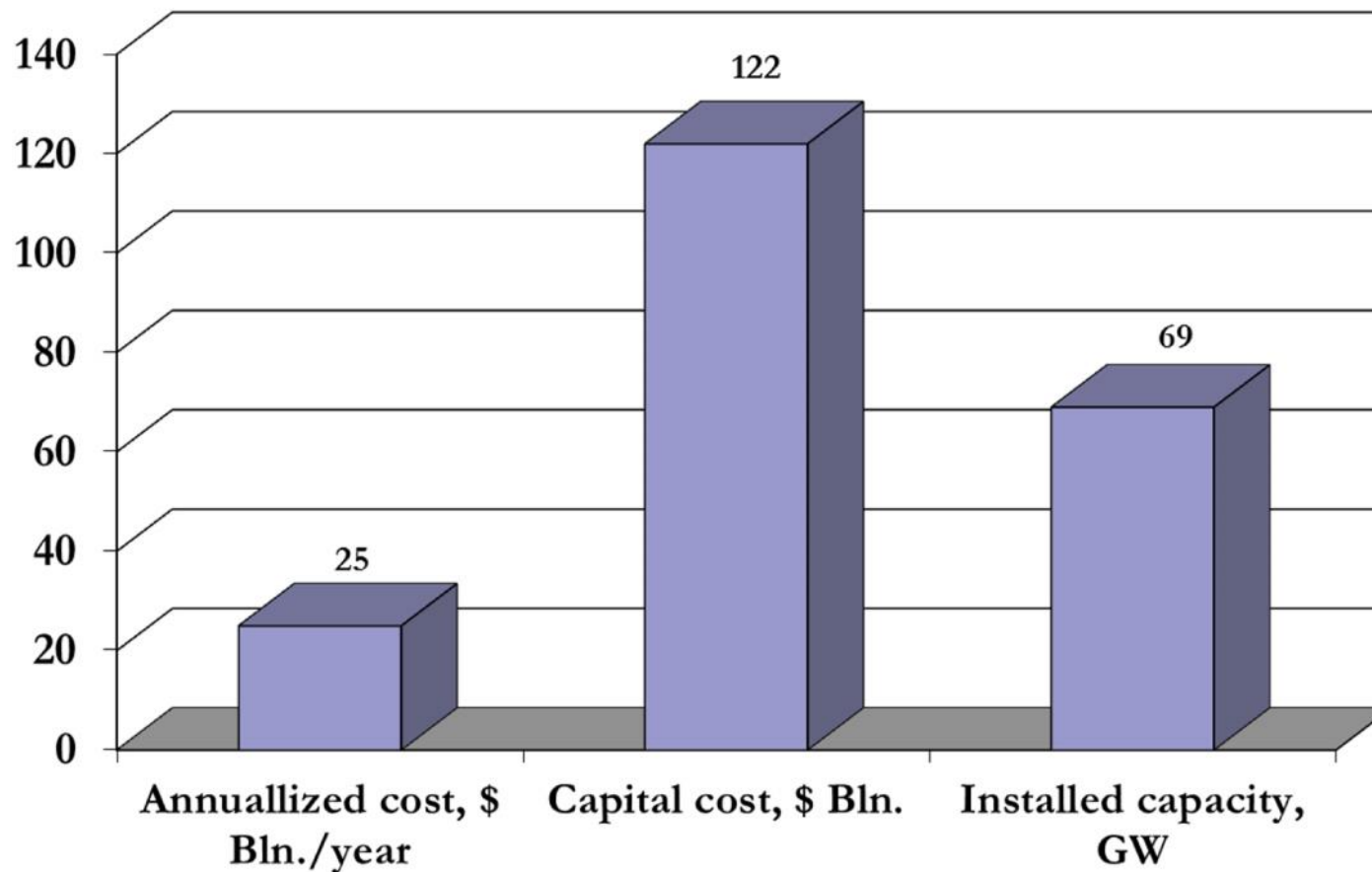
Scheme for potential power system interconnections in Northeast Asia



RPS – regional power system
IPS – interregional power system
NPS – national power system

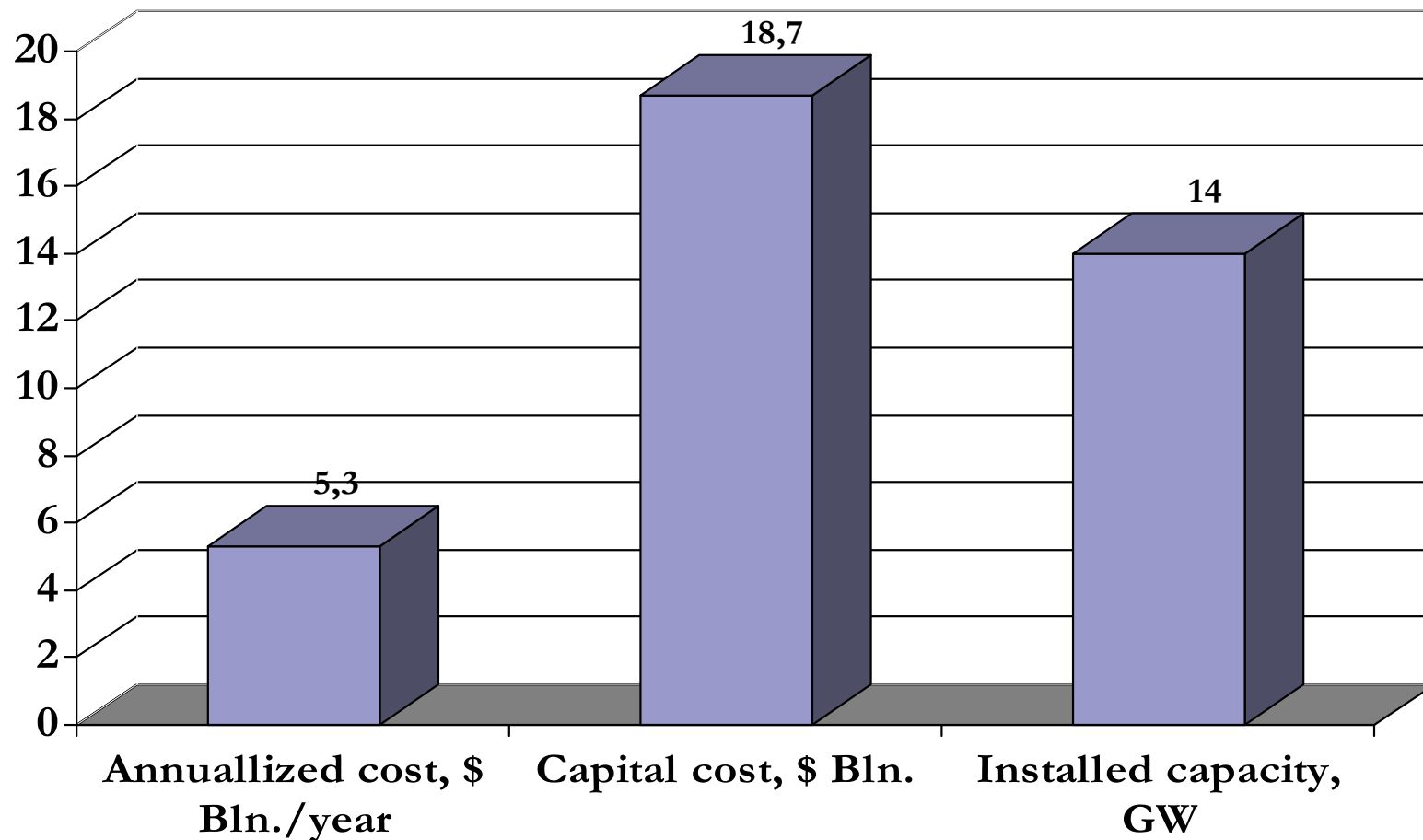
This scheme is modeled and studied. Considered were base case with no power system interconnections (as now) and case of full integration when no constraints are imposed on power flows among countries. Optimization expansion planning model ORIRES was applied for the study.

Benefits for the power system interconnection in NEA region



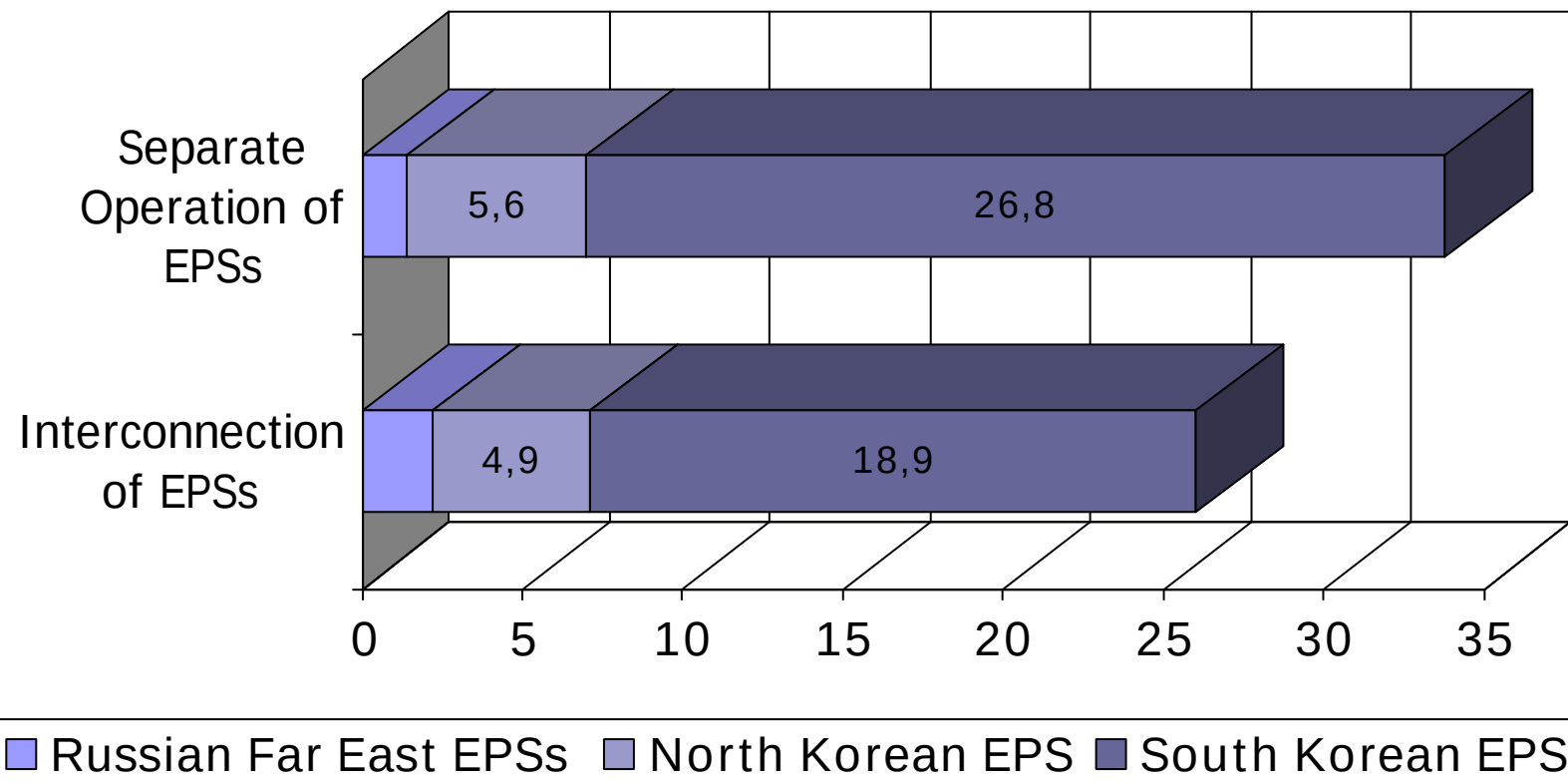
The main benefits for the entire NEA power system interconnection were calculated as difference between the indexes for the base case and integration case. They are quite sufficient. For example, capacity saving benefit is equal to three quarter of the current generating capacity of Republic of Korea.

Benefits of Russia-China power system interconnection



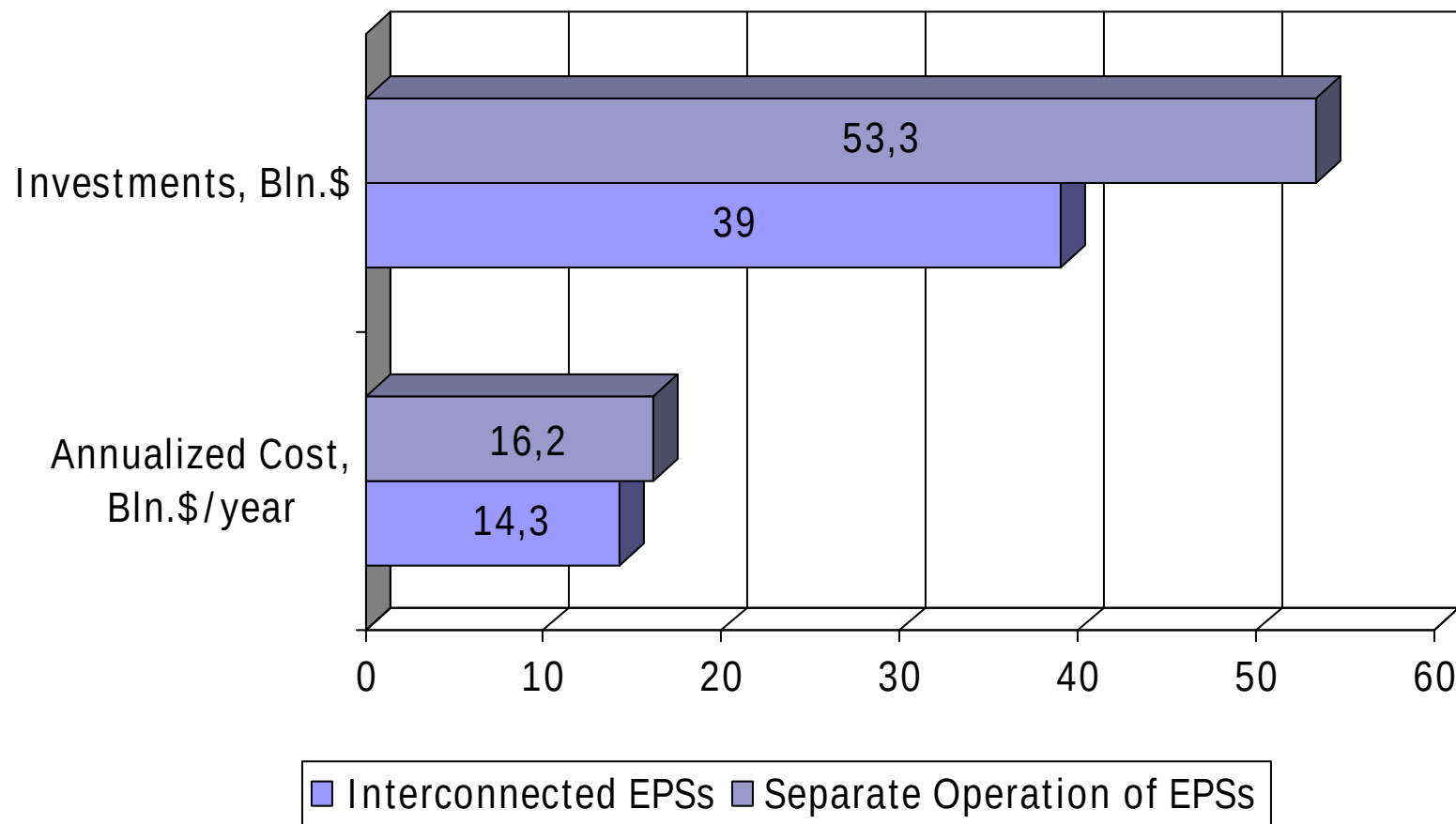
Previously conducted studies for Russia-China, Russia-Korea and Russia-Japan power system interconnections confirm the obtained benefits for the entire NEA region.

Capacity benefit of Russia-Korea power system interconnection, GW



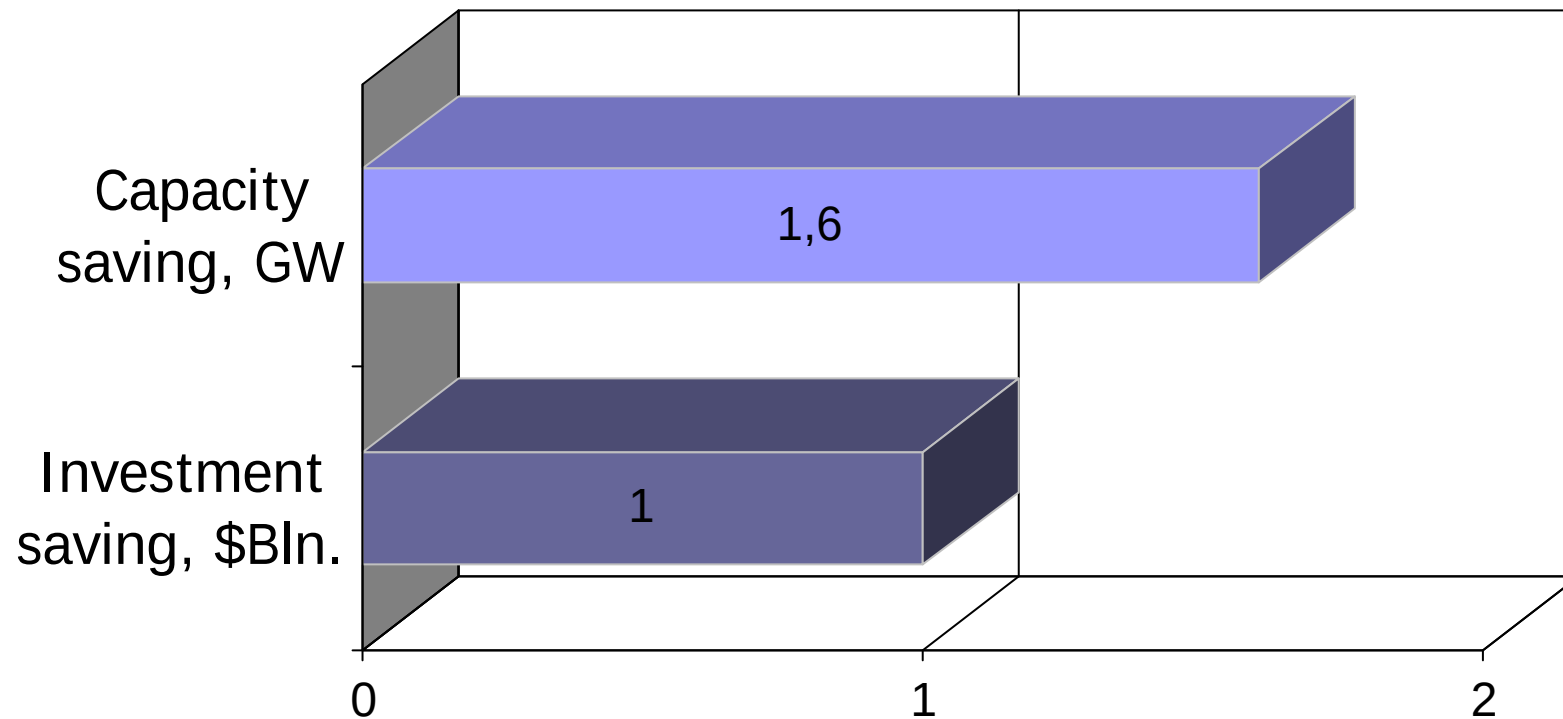
Capacity benefit for Russia-Korea power system interconnection is about 8 GW.

Economic benefit of Russia-Korea power system interconnection, GW



Investment saving benefit for the Russia-Korea power system interconnection is estimated to be about \$14 Bln.

Russia-Japan power bridge benefits





Conclusions

- Electricity interconnections in NEA region are supposed to bring about substantial benefits for countries—participants
- Further more deep studies by international teams are needed