



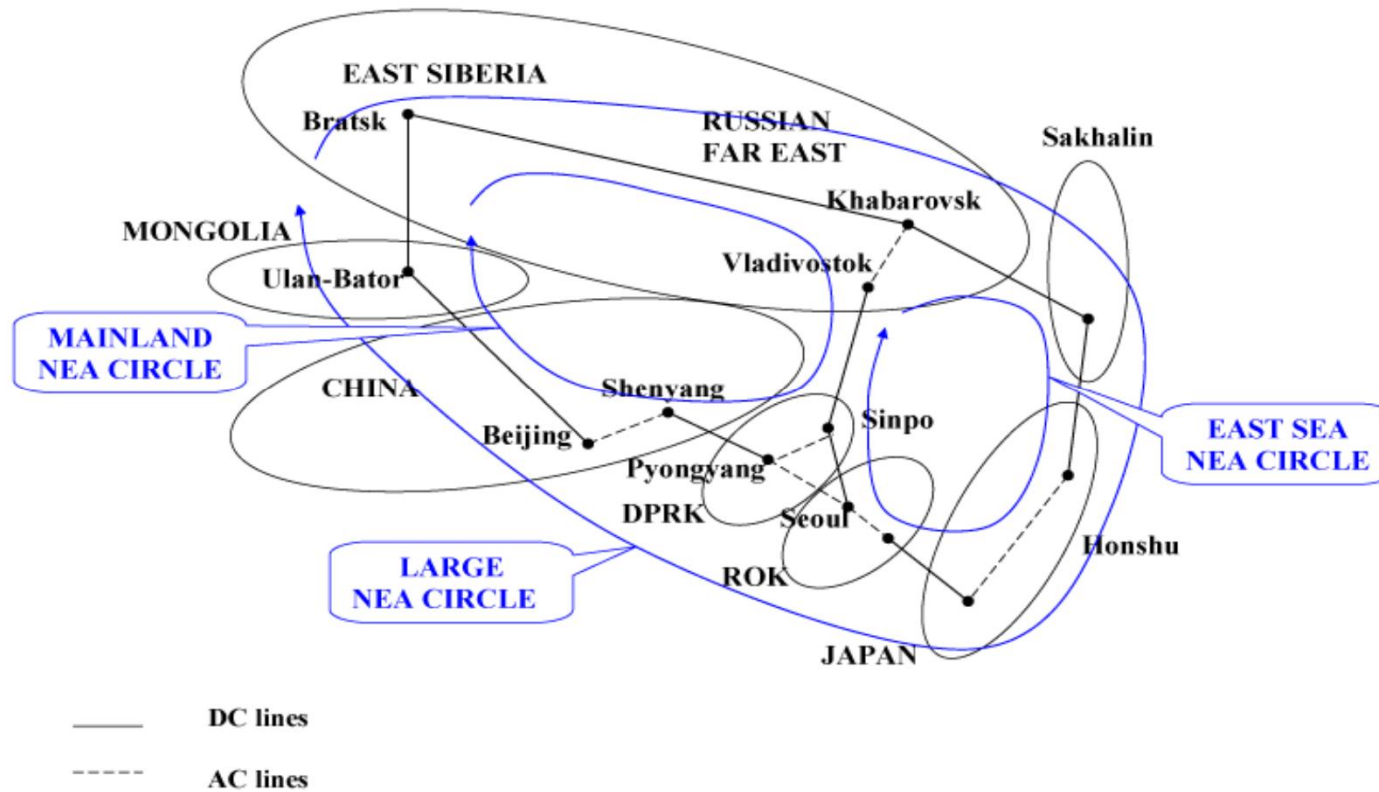
# Electricity Interconnection in the Northeast Asia - Barriers and Opportunities, Russian Perspective

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APERC Annual Conference,  
March 26-27, 2014



# Potential electricity interconnections in Northeast Asia: the concept



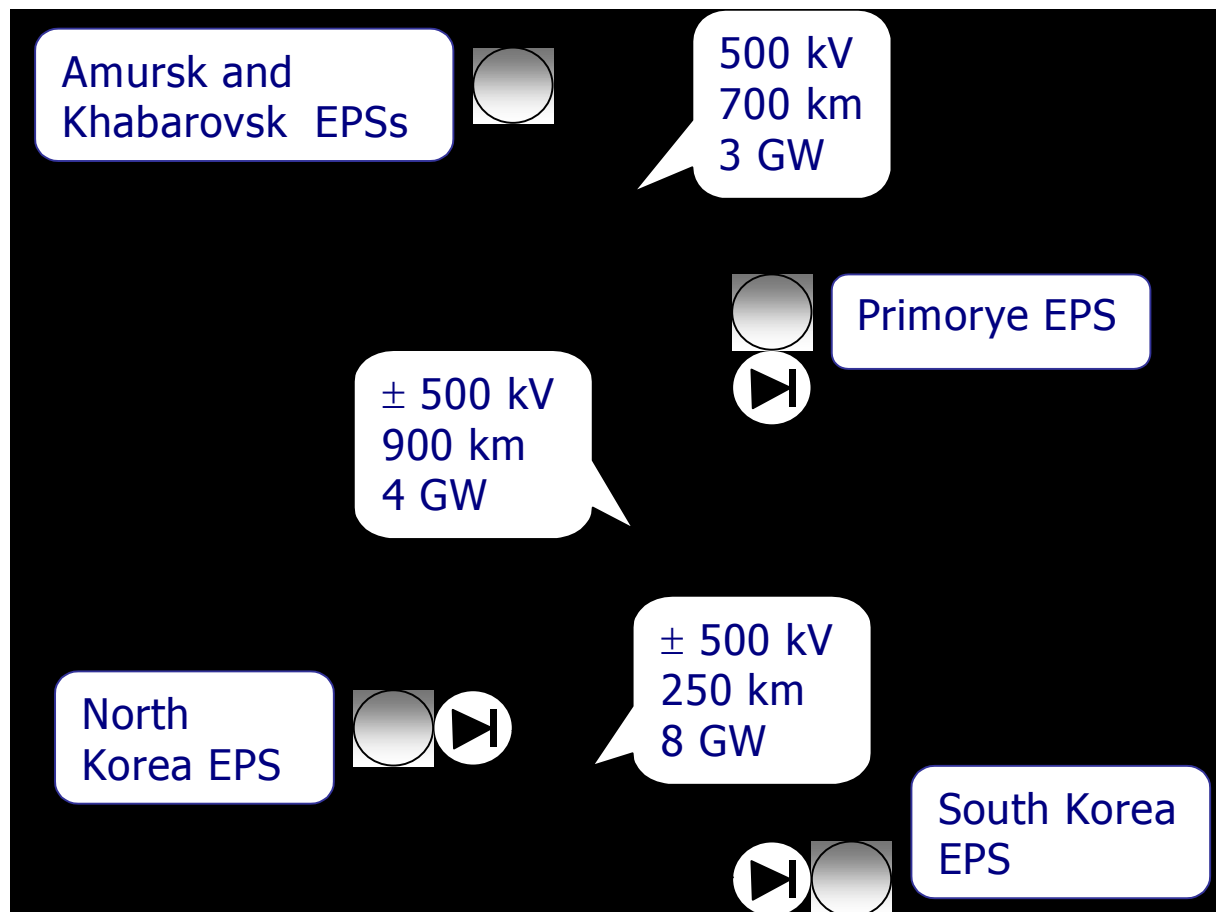


# Russia-NEA countries electricity interconnections

Proposals

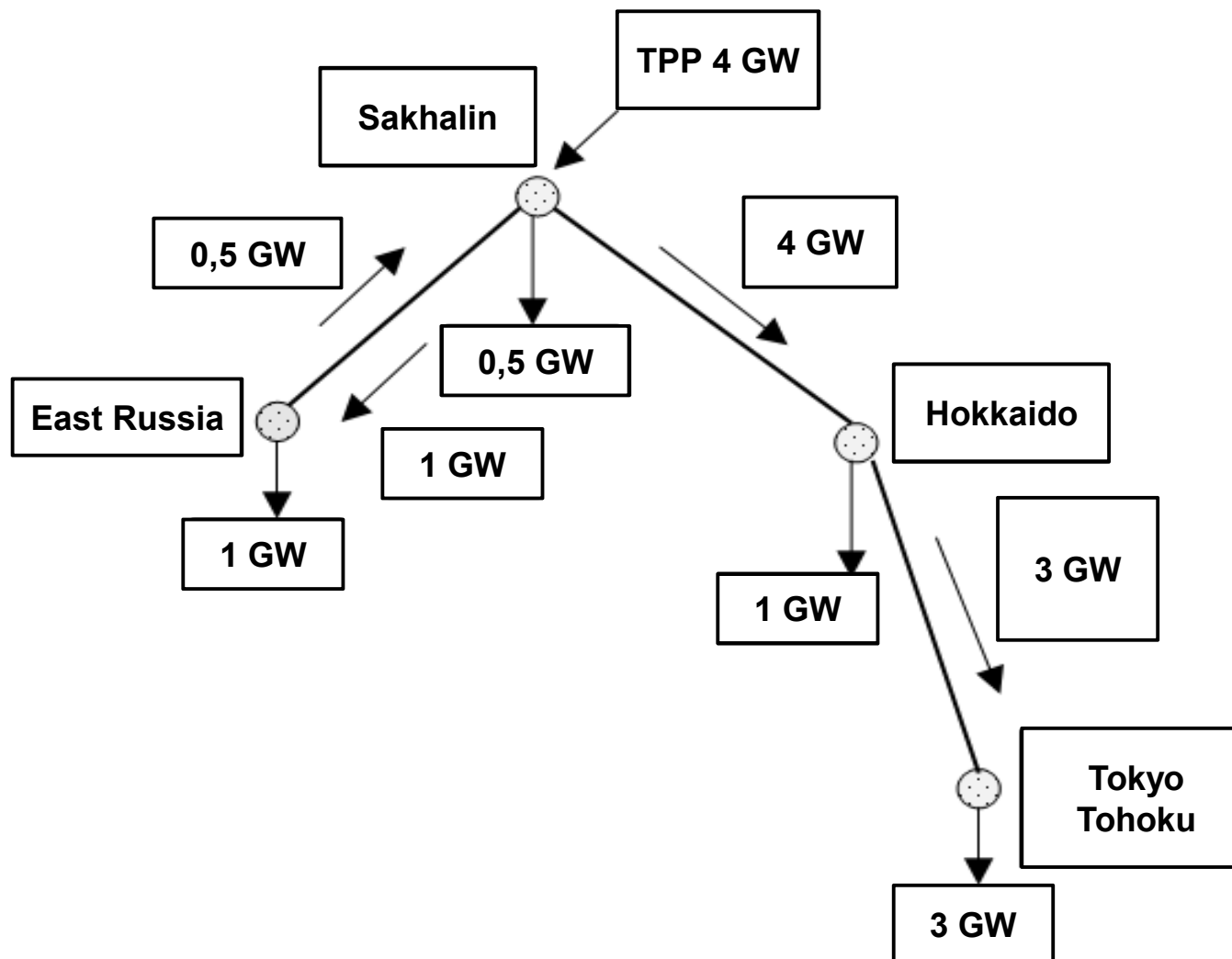


# Russia-DPRK-RoK electricity interconnection



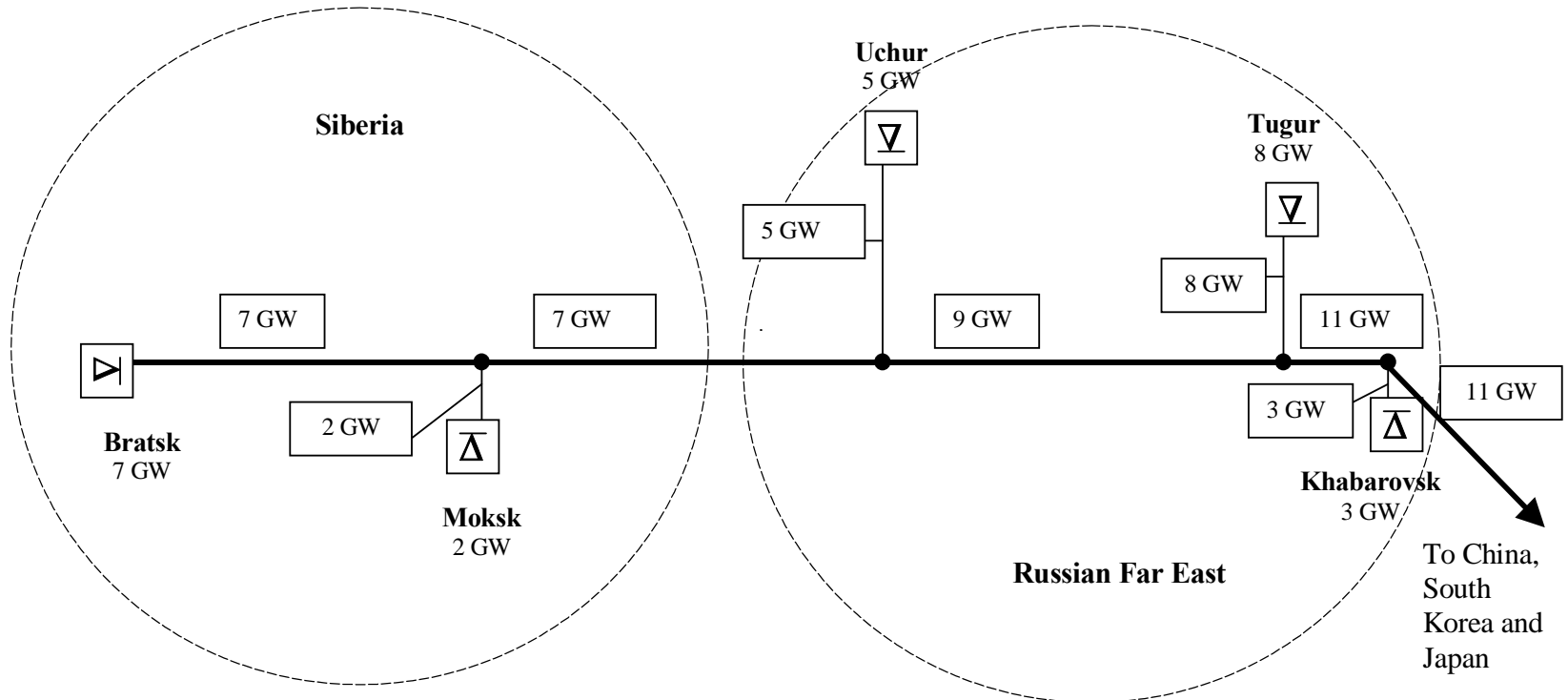


# Russia-Japan electricity interconnection





# Siberia-Russian Far East-NEA countries electricity interconnection (high voltage direct current bus)



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# Russia-China electricity interconnection

New findings



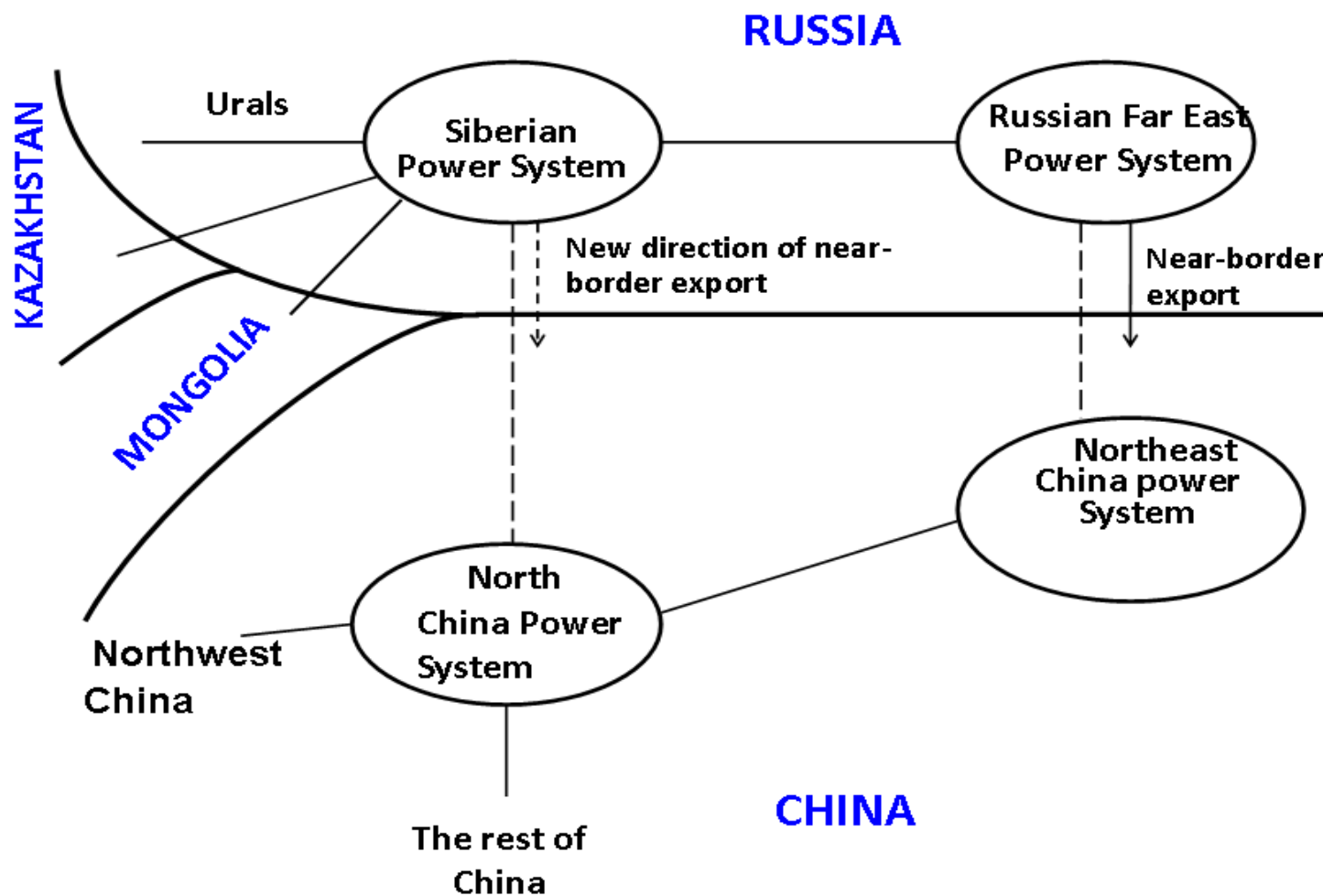
## Peculiarities of Russia-China electricity interconnection

- Non-coincidence/diversity of peak power loads in Russia and China (by hours and seasons)
- Vigorous expansion of wind facilities in North and Northeast China (NC and NEC)
- Coal-fired power plants\$ domination in NC and NEC
- Expansion of nuclear power in NC and NEC
- Lack of peaking capacities in NC and NEC
- Excess of hydropower peaking capacities in Siberia
- Low cost in electric power facilities China





# Scheme for the model





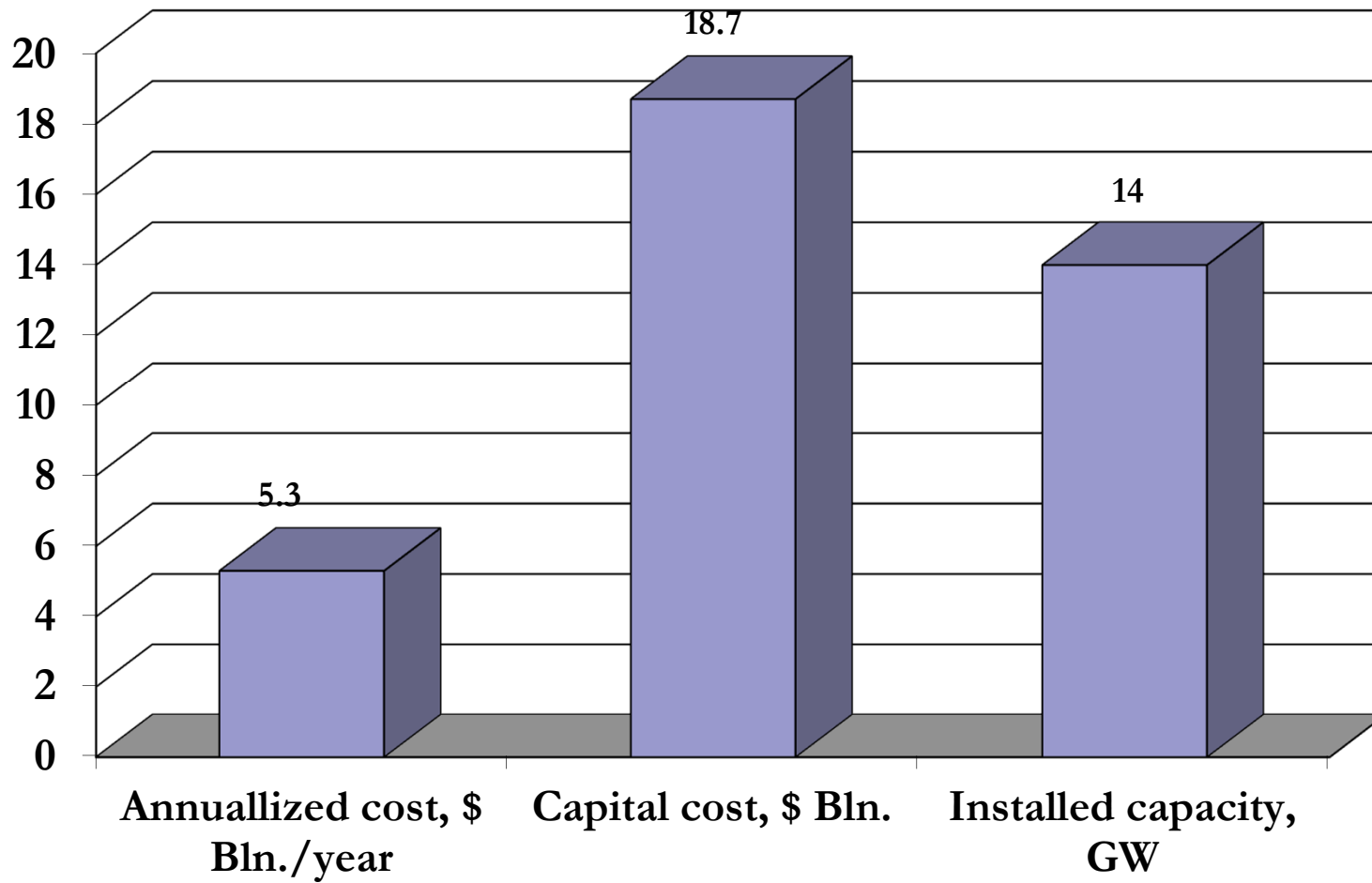
## Power exchange between Russia and China, %integration+scenario, 2030, TWh/year

Export from Russia	20,0
including from	
Siberia	15,3
RFE*	4,7
Import to Russia	22,7
including to	
Siberia	16,5
RFE	6,2

\*Including near-border trading with NEC

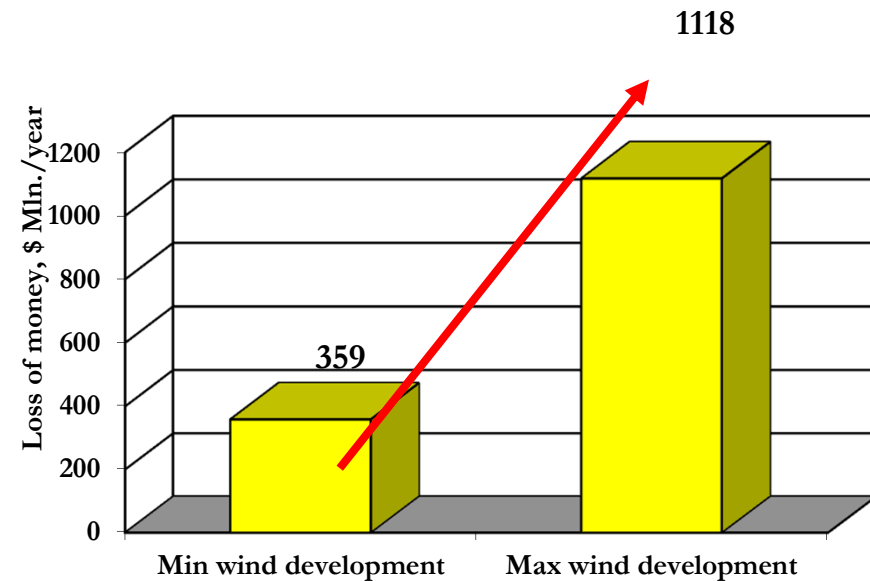
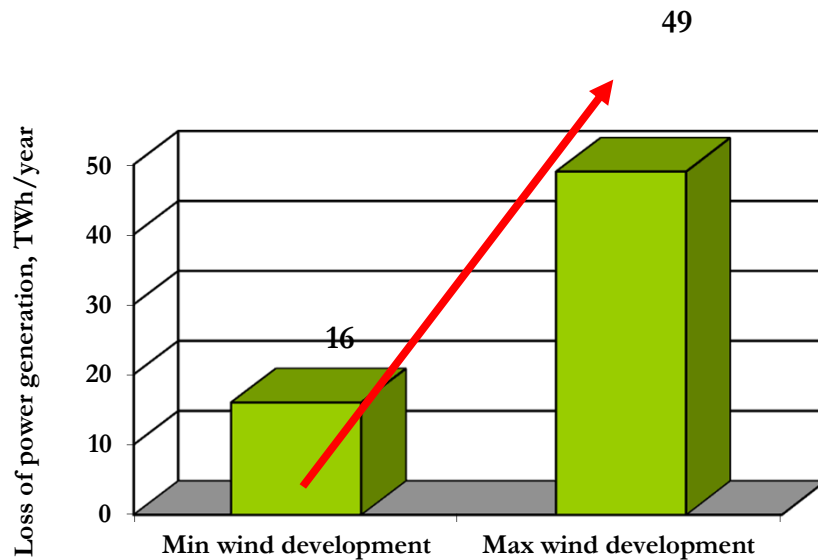


# Benefits of %integration+scenario, 2030



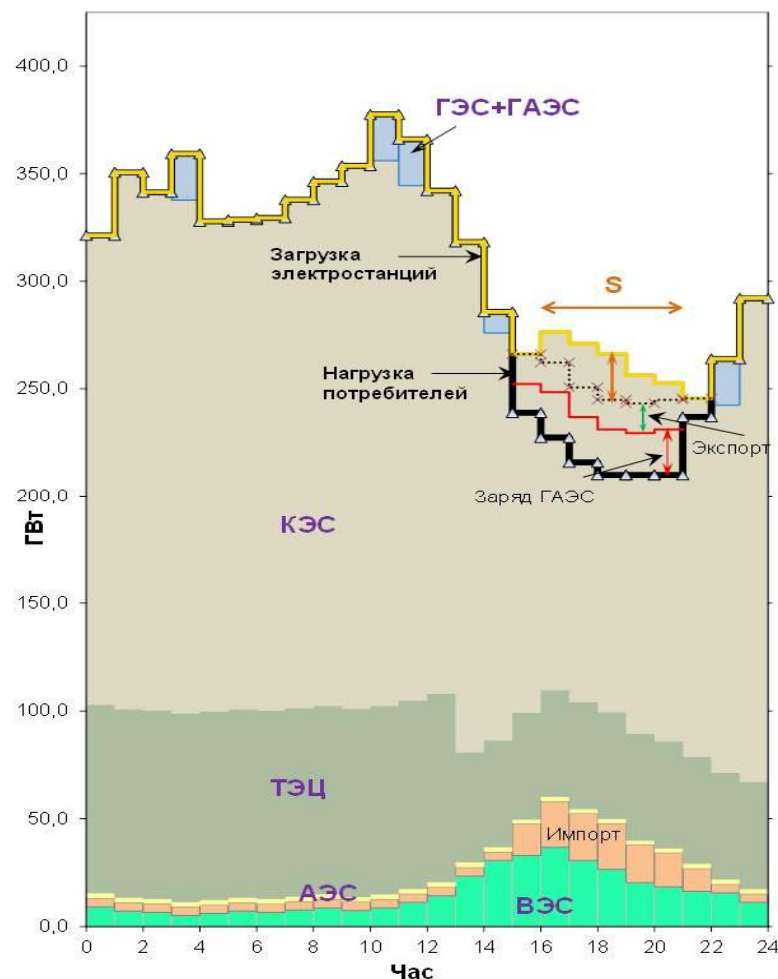
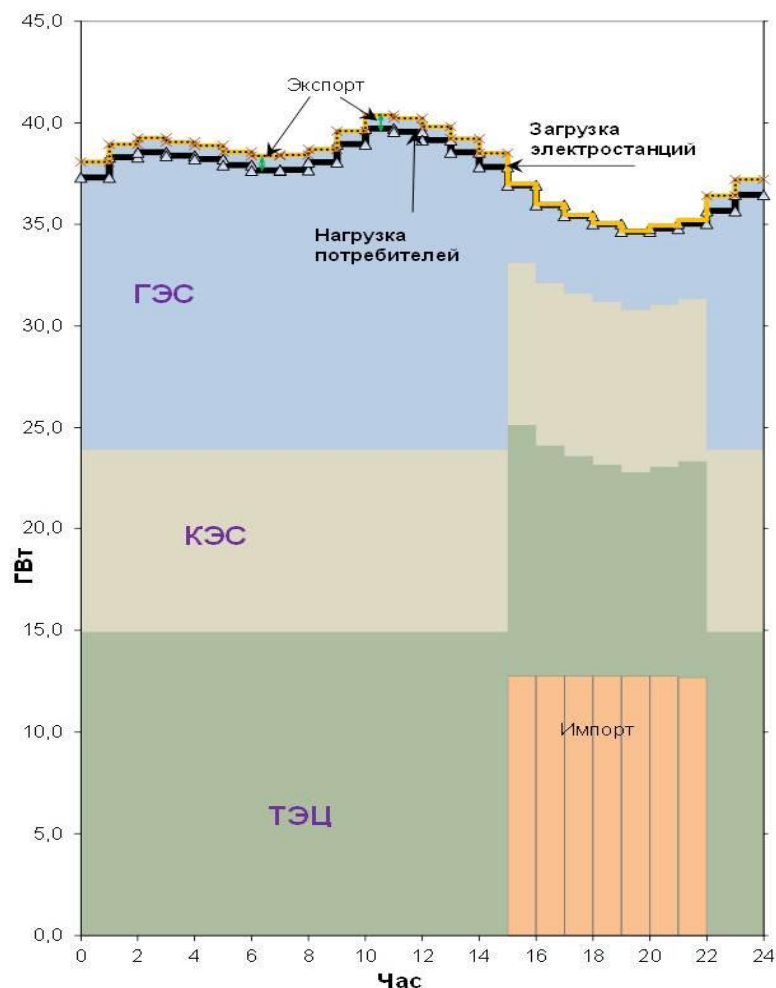


# Scenario of separate operation of Russian and Chinese power systems: losses of wind generation, 2030





# Integration+Scenario: joint operation of NC and Siberia power systems, 2030





# Barriers.I

- Dependence of countries-importers on external electricity supply
  - power interconnection lowers national energy security of countries-importers
- Different technical standards in national electric power
  - the frequency of alternating current is different in national power systems of NEA region
  - even though frequency is the same there are different approaches to maintain power quality and control in various power systems of NEA countries



# Barriers.II

- Different energy/power legislation in NEA countries
  - energy/power legislation of NEA countries have to be mutually accorded
  - international legislation is thought to be put in force in NEA region
- Long distances, difficult routes and high cost for power transmissions
  - the necessity to cross large rivers (like the Amur, in the Russian Far East) and sea straits (for example, to connect Russia with Japan) makes routes for ISETs in NEA region very difficult
- Financing
  - conditions stimulating long-term investment have to be formed in the region



# Barriers.III

- The necessity to accord national energy and power strategies and plans with other countries
  - it is national security issue and it should be taken into account at international legislation regulating relationships among NEA countries being involved into electricity interconnection
- Political tension among certain countries
  - electricity interconnection itself can be one of the policy tools improving political climate in the region
- No intergovernmental body in the region
  - to support and promote the projects of interstate electricity interconnections





# Opportunities.I

- Saving installed capacity of power plants
  - as a result of non-coincidence of yearly load maxima in power systems being interconnected
- Saving investment
  - due to saving installed capacity
- Electricity production cost and tariff decrease
  - it is caused by lowering required investments and joint optimization of operating conditions in interconnected power systems



# Opportunities.II

- Reliability improvement of power systems being interconnected
  - due to receiving backup power flows from other power systems through interstate electricity interconnections
- Environmental benefits
  - due to effective harnessing large environmentally friendly energy resources and reducing fossil fuel burning by thermal power plants
- Financial and social benefits
  - accelerated economic development of remote electricity exporting regions, additional taxes to budgets of these regions, etc.



## Conclusions

- Technical, economic, financial, legislative and political barriers obstruct development of electricity interconnections in NEA region
- Overcoming of the barriers open multiple opportunities for the electric power cooperation between Russia and Northeast Asian countries
- As conducted studies found out electricity interconnections in NEA region can bring about substantial benefits for countries. participants



**Thank you for your attention**