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Low carbon development in Northeast Asia: Challenges and Opportunities

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Questions for discussion

1. Low carbon development as a new driver for growth and development
2. Global climate change agreements
3. Carbon emissions - global and regional pathways
4. Processes and expectations
5. Conclusions

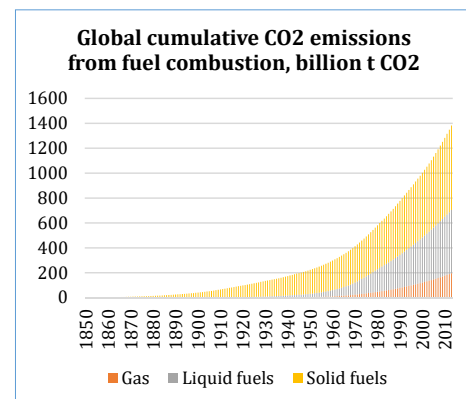
Paris Climate Agreement

- 21st UNFCCC Conference in Paris – Dec 2015
 - Adoption of the new climate treaty, aimed at prevention of global warming “well below 2°C”
 - Voluntary commitment of countries to reduce carbon emissions by 2030 and beyond
 - After 2050 global carbon emissions should become net-zero!
 - By 2018 – all Parties present low carbon development strategies
 - International mechanisms of cooperation in emission reduction, adaptation, technology transfer, compensation of damage
- 22nd COP in Marrakech – Nov 2016
 - Entry into force of Paris Agreement on **Nov 4, 2016**
 - First meetings of over 80 Parties of new treaty
 - Launch of work on the rules, procedures, mechanisms, etc.
- Russia and Japan are Signatories, but not Parties as yet



Why the Paris Agreement is important for energy and environment?

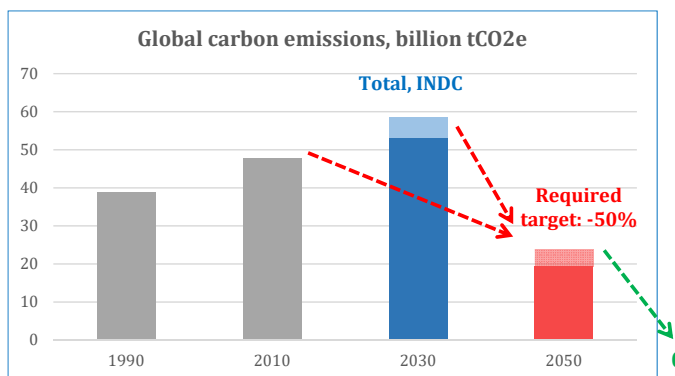
- The world energy systems and economies are based and dependent on fossil fuels, since the industrial revolution
- But to keep warming below 2°C, we can afford to emit less than 500 billion tC
- If we continue emitting under current trends, this volume will be exceeded in 2040s
- The economies and energy systems must be radically rearranged towards meeting the climate target, and we have to start now
- Otherwise the damage from climate change impacts can reach 5-20% of global GDP per year



Sir Nicolas Stern, LSE, author of the *Climate Change Economics report*

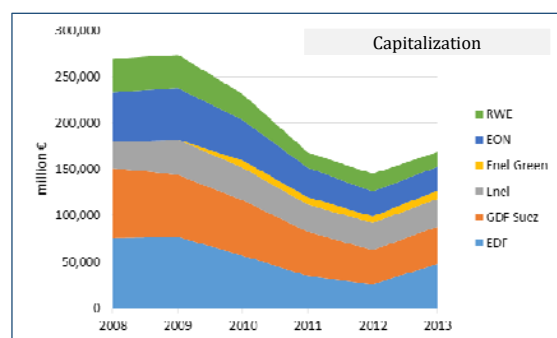
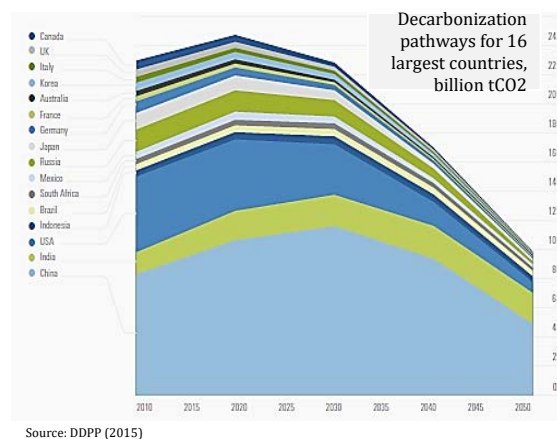
Ambitious carbon emission targets?

- Over 185 countries provided their targets for greenhouse gas emissions by 2030 (INDCs)
- In total, the trend of emission growth is projected to rise, though many countries plan emission reductions up to 2030:
 - Russia – by 30% below 1990 level
 - Japan – by 26% below 2013 level
- The global goal is to reduce emissions by 50% below current level
- Some countries/states set domestic 2050 targets:
 - UK: -80% (legally binding)
 - California: -80% (law)
 - Japan: -80% (declared)
 - EU: -80-95% (Energy strategy)
 - G7: >80% (declared)
 - Russia: agreed with G8 to reduce global emissions by 50%



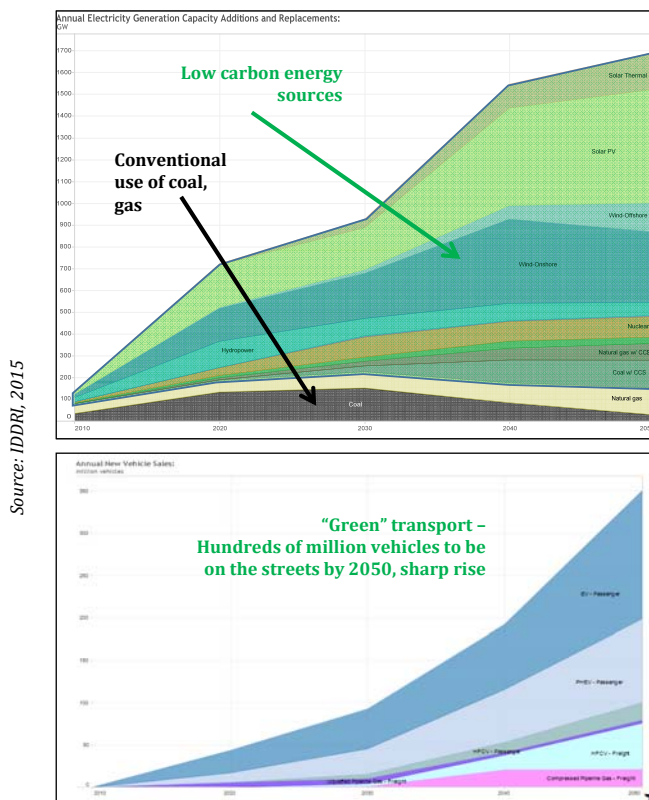
How serious is it?

- Radical transformation of the energy systems and markets worldwide
 - Energy efficiency improvement by >80%
 - Deep decarbonization of energy supplies
 - Massive electrification of end-use
 - Carbon-free fuel use (biofuel, hydrogen...)
- 3 out of 5 current energy giants will disappear in the near future
 - Example: RWE (Germany) capitalization down from 55 to 9 billion Euro since 2008
 - Reason: priority purchase of solar and wind power
 - California: coal-fired power plants to be totally phased out in the coming years
 - Renewables cost down by 80% for last 10 years



Decarbonized world: absolutely different energy markets and technologies

- The share of conventional fossil fuel use in new installed capacities will become negligible
- Domination of green energy sources, especially after 2030
- Green transport boost:
 - Electric vehicles
 - Fuel cells
 - Gasified cars
 - Biofuel
 - Massive rearranging of infrastructure in favor of carbon free transport



Costs

The cost reductions are expected in all low carbon technologies for energy and transport

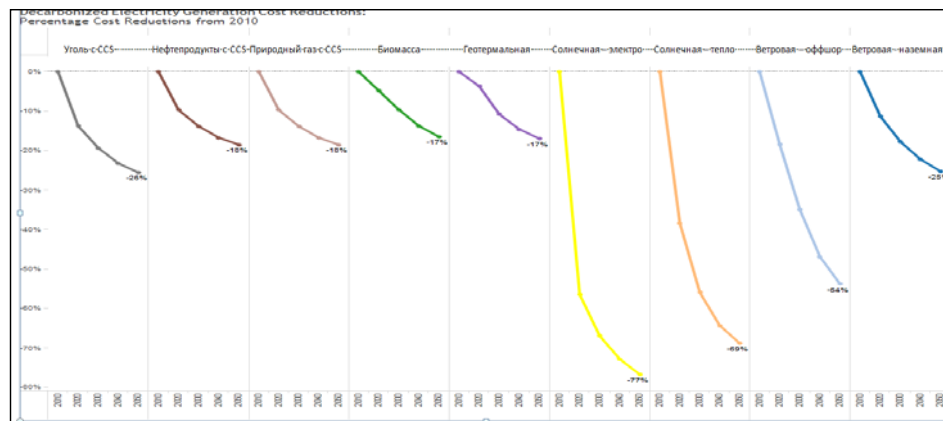
E.g. solar PV may go down by 77% below 2010 price by 2050

Hydrogen vehicles can get cheaper by 79% by 2050

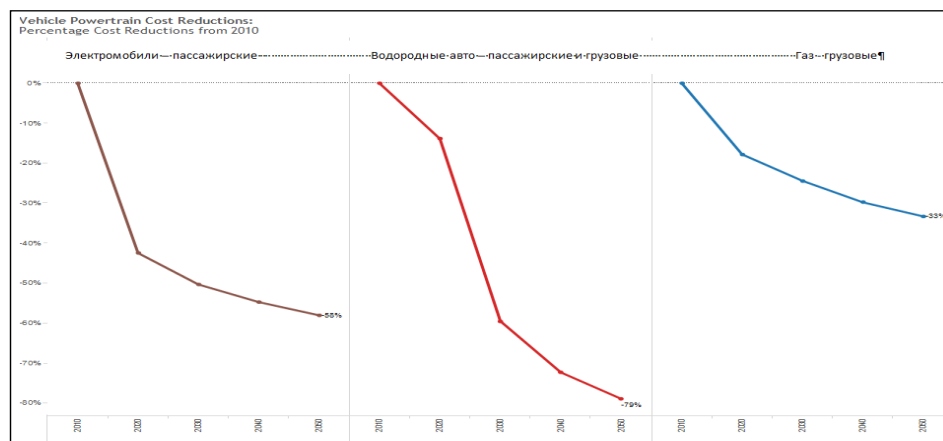
Electric vehicles price: sharp drop by 40% already by 2020

Overall cost of decarbonization of world economy is estimated at 0.8-1.2% of GDP per year

Expected cost reduction in energy technologies

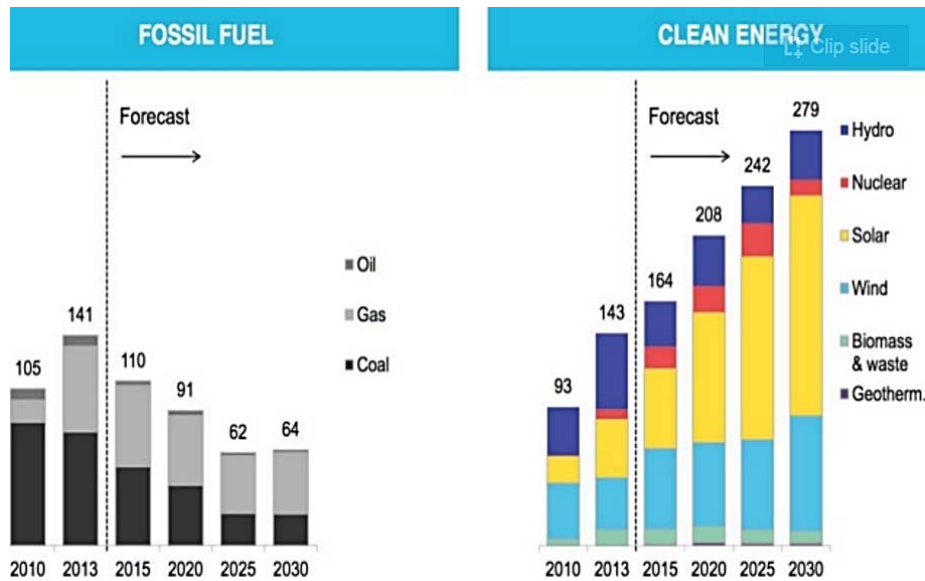


Expected cost reduction in transport



Reality of myth?

- The process has already started
- Investments in clean energy exceeded investments in fossil fuels in 2013
- Projections are self-explaining



Green innovations

- Amount of start-ups in carbon free energy, transport, new materials is growing hyperbolically (*Telsa, Nissan, Bill Gates...*)



Spillovers much higher in clean

Citations to 1000 dirty... ..and 1000 clean innovations

- Amount of patents in clean innovations is much exceeding the “dirty” ones



Divestment process from “carbon assets”

- In just one year 2014-2015 total value of investment assets committed for decarbonization increased 50-fold and reached 2.4 trillion USD
- About 2500 investors refuse to invest in fossil fuels now
- Ban on new coal projects by international financial organizations
- UNEP Initiative of decarbonization of investments
- Rearrangement of the portfolios of large scale investors:
 - Norway Pension Fund,
 - California Public Employees’ Retirement System,
 - Sweden’s AP2 Pension,
 - pension funds in the US, Australia, Denmark,
 - health care institutions,
 - private investors,
 - faith based organizations



Map of divestments from fossil fuels, Sept 2015



Source: Arabella Advisors (2015)

Recent news

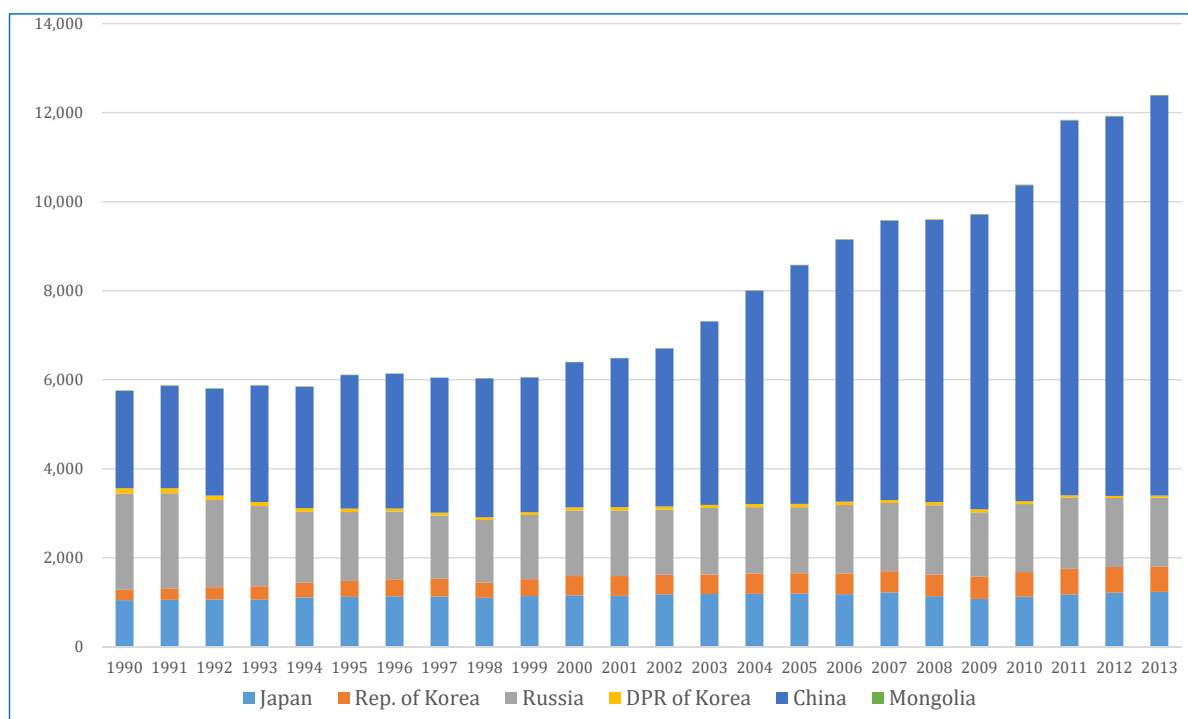
- ICAO decision on carbon emissions from international aviation (Oct 2016)
 - Requirement to estimate and compensate all emissions
 - Use of certified emission reduction units (primarily from forest carbon sequestration projects)

- UN decision to phase down emissions of HFCs – a very powerful greenhouse gas (Oct 2016)
 - Will gradually reduce consumption of HFCs in refrigeration systems

- Germany:
 - Ban on purchase of new fossil fuel driven automobiles since 2030



CO₂ Emissions by Northeast Asia Countries, MtCO₂



Source: IEA database

Reserves of Conventional and Non-conventional Fuels in the North East Asian Countries

	Coal	Oil	Natural gas	Shale oil	Shale gas	Gas-hydrates
Reserves of fuels, bln toe						
China	79.8	2.6	2.9	90.2	94.9	100.0
Russia (Siberia+Far East)	121.8	14.4	27.1	174.0	0.3	913.0
Mongolia	70	<i>na</i>	<i>na</i>	11.9	0.05	<i>na</i>
South Korea	0.1	<i>na</i>	<i>na</i>	<i>na</i>	<i>na</i>	1.2
North Korea	3.2	0.1	<i>na</i>	<i>na</i>	<i>na</i>	<i>na</i>
Japan	0.2	<i>na</i>	<i>na</i>	<i>na</i>	<i>na</i>	16.6
Total reserves, billion toe	275.1	17.1	30.0	276.1	95.2	1030.8
Carbon emissions, Billion tCO₂	1,089.6	52.5	76.3	847.7	223.9	2,421.1

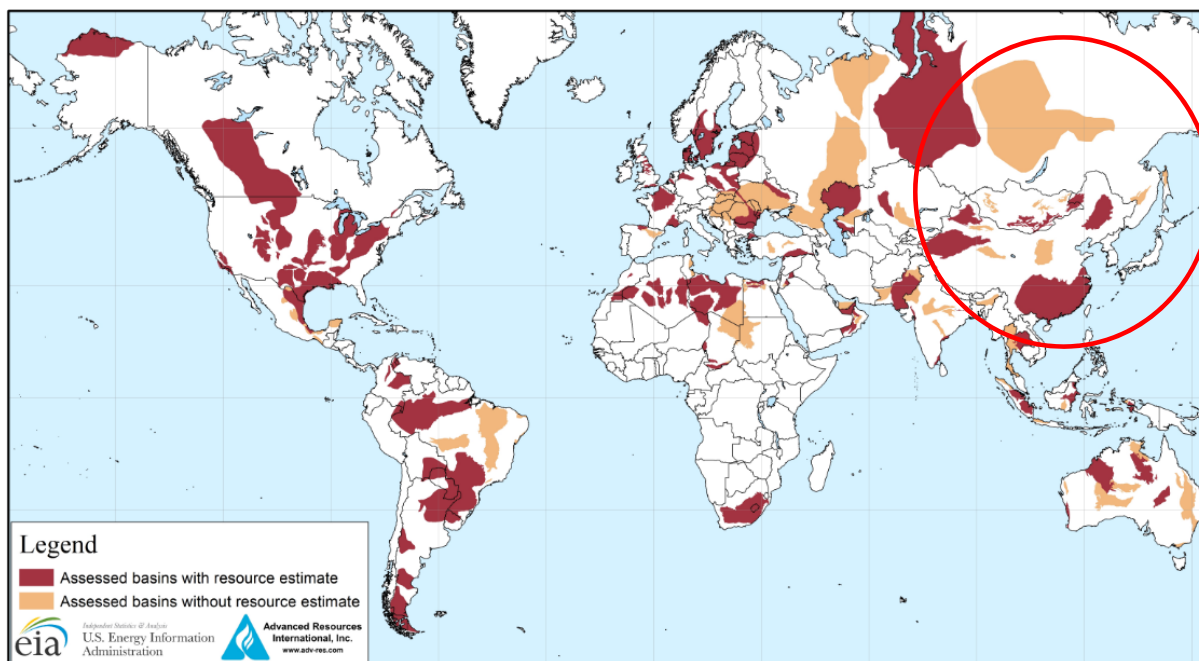
Carbon emissions from combustion of all these fuels would lead to emission of **4.7 trillion t CO₂**.
The NEA alone is able to warm the Earth by 2 degrees Celsius 3 times over!

Carbon Future: *World Coal Deposits*



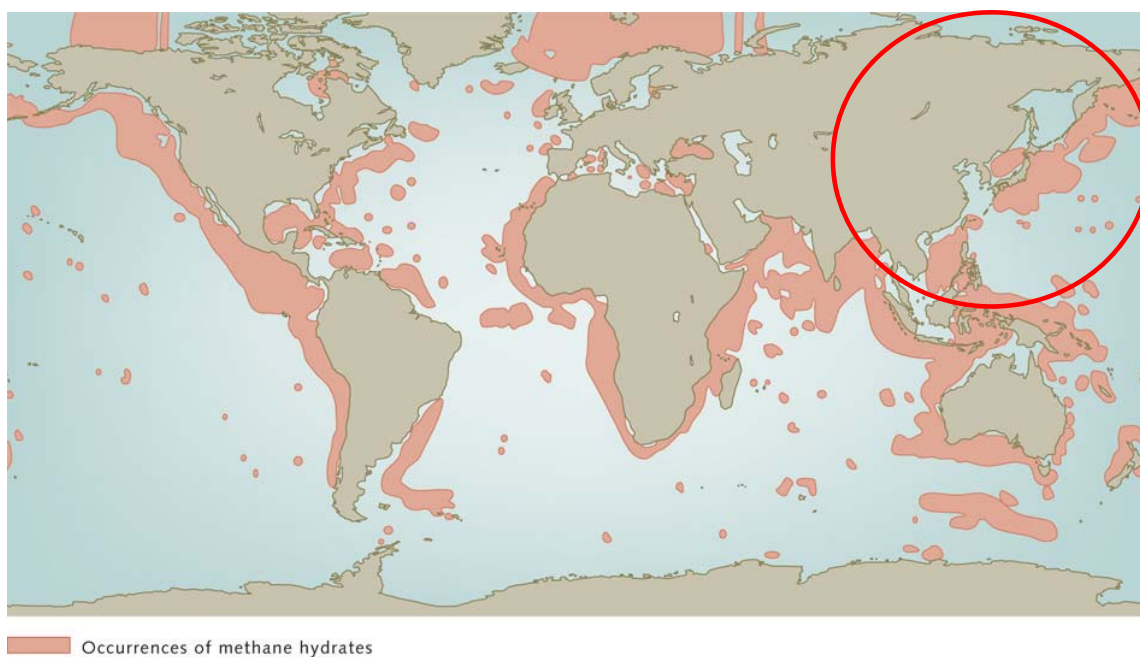
Source: Maps of world <http://www.mapsofworld.com/business/industries/coal-energy/world-coal-deposits.html>

Carbon Future: *Shale Oil and Gas*



Source: Energy Information Administration,
<http://www.eia.gov/analysis/studies/worldshalegas/>

Carbon Future: *Methane-hydrates*



Source: World Ocean Review <http://worldoceanreview.com/en/wor-1/energy/methane-hydrates/>

Renewable Energy Potentials in NEA



	Wind	Solar PV	Hydro	Biomass	Geothermal	Tidal
China	1500 - 2800 GW	2700 GW	400 - 700 GW	273 - 648 Mtce/y	na	20 - 100 GW
Japan	1800 GW	350 GW	44 GW	na	14 GW	>87 TWh/y
Russia (Siberia+Far East)	3910 TWh/y	2300 mtce/y	1441 TWh/y	>500 TWh/y	>20 TWh/y	>100 GW
Mongolia	900 - 1100 GW	>1000GW	6.4 GW	na	na	na
South Korea	186.5 TWh/y	10.4 TWh/y	na	na	na	>4 GW
Total Estimates	>6,300 GW	>10,000 GW	>850 GW	>850 GW	>34 GW	>322 GW

Renewable energy resources are sufficient to cover all the energy needs of NEA. Cooperation among the NEA countries may reduce costs, improve reliability of energy supply, facilitate economic growth and technological modernization.

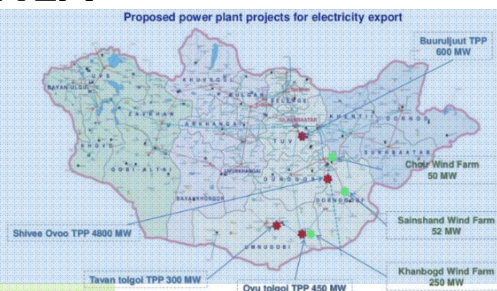
Energy-related CO₂ emissions in 2010 and “decarbonization” projections for 2050, MtCO₂

Country	2010	2050-decarb.	2050 / 2010, %
Japan	1123	180	16%
China	8152	5201	64%
Russia	1529	200	13%
The ROK	560	82	15%
The DPRK*	66	80	121%
Mongolia*	14	30	214%
TOTAL	11444	5773	50%

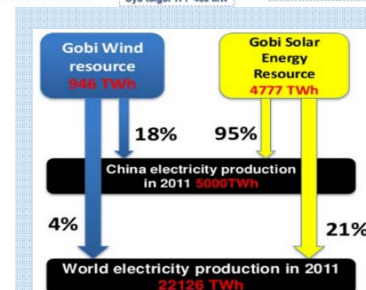
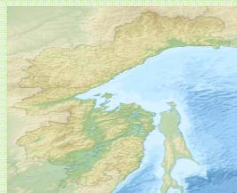
Sources: IEA; SDSN/IDDRI/DDPP; *authors' estimates

Decarbonization projects for NEA

- Wind and solar PV (Mongolia):
 - Gobitech: ~5800 TWh/y
 - Power supergrid to Eastern Asia



- Tidal power generation (Russia):
 - Penzhinskaya station and Tugursky bay: ~100-120 GW



- Nano-tubes application for basic materials (Rosnano/Russia+S.Korea...):
 - Globally - 331 bln tCO₂ reduction by 2100

.... and many others



Conclusions

- The “carbon” factor is playing an increasingly important role in the world economy
- Most of fossil fuel energy sources should be replaced with zero-emission alternatives by 2050 and beyond.
- Russia, Japan, and other countries have to realize their enormous potential in this decarbonized future and reduce financial and technological risks
- The green energy sources in Northeast Asia can fully satisfy energy needs of the region, while the technological and investment cooperation can enhance and facilitate this process
- We can jointly start now for the benefit of current and future generations of people and environment

Thank you for attention!

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