Cooperation in the countries of North-East Asia (environmental aspect)

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Abstract. The article deals with the deep analysis of current cooperation of the countries of North-East Asia (NEA) on the formation of environmental policy in order to regulate further relationships, improve the ecological, socio-economic well-being of the population living in global instability. This consolidation includes geographically six states: China, Democratic People's Republic of Korea, Mongolia, the Republic of Korea, Russian Federation and Japan. The format of subregional geographic approach in the comprehensive activities of the UNESCAP (Economic and Social Commission for Asia and the Pacific of UN), including the environmental sphere, turned out to be successful. Thus, the Subregional Program of North-East Asia for Cooperation in the Field of Environmental Protection (NEASPEC) became the most important and effective policy instrument in the 21st century. The development of subregional cooperation in the field of low-carbon urban spaces continues as a promising platform to address the challenges of global climate change and rapid urbanization – NEA LCCP (North East Asia Low Carbon City Platform). The article presents the results of the initiated Russian research on the example of the administrative center of the subject of the Siberian Federal District – Irkutsk – a large cultural, historical and economic city of the Baikal natural territory.

1. Introduction
North-East Asia (NEA) is a large civilizational (cultural), economic and geopolitical macro-region of the world. Its population is 40% of the population of Asia (1 bln. 754 mln at the beginning of 2019), and the occupied territory is 60% of the area of Asia (29 mln km²). Some researchers include only Pacific Russia in NEA and others the Asian part of Russia or the whole country. Using the countrywise approach we included Russia, China, Japan, Mongolia and the countries of the Korean Peninsula. The study of the territorial differentiation of the ongoing global processes in the NEA countries, the emerging risks, including environmental ones since the last quarter of the 20th century, is one of the traditional issues of social geography. The existing environmental problems in this largest macroregion, with positive cooperation, firstly, can open potential opportunities, become the basis of the road map for the development of interaction and cooperation between countries. Secondly, an early exchange of experience in this area can both mutually enrich and complete the institutional and ecological-socio-economic national developments and allow solving joint tasks for the sustainable development of the macroregion as a whole.

2. Methods
Experience in the framework of the Korean-Russian project “Korean-Russian joint study of territorial production and resource structures based on the inclusion of the green economy in the achievement of...
the Sustainable Development Goals” (2016-2019), a Russian-Chinese scientific expedition to explore environmental problems in the period of intensive development of urban agglomerations (2016), targeted trips to Mongolia (2014, 2019), participation in scientific development studies of Siberian urbanized territories, including the city of Irkutsk, Angarsk, Baikalsk (1997-2019) and others firstly, created our own scientifically grounded vision of processes of deterioration of residential territories and the surrounding space in the countries of NEA. Secondly, they provided access to primary materials, initial documents on the functioning and development prospects of large territories, modern statistical observations in the context of urban municipalities, primarily Russian. We actively used the available electronic resources: of the Irkutsk Territorial Statistical Department of the Federal State Statistics Service, a database of indicators of municipalities of the Irkutsk region (Irkutsk: indicators for the assessment of the efficiency of local government bodies in urban districts and municipal districts; the official website of the city of Irkutsk, etc. Cartographic methods are being developed for visualizing the research results.

3. Results and discussion

The Northeast Asia subregion is unique (demographic volume, natural resource potential, civilizational and ethnic diversity, etc.), including from the standpoint of the ecological state. Along with the countries - world leaders in the greening of the national economy (Japan and the Republic of Korea), there are also countries with very low indicators for assessing environmental state and natural resources use (China, Mongolia), the EPI index of the latter does not exceed 40 (2020) (table 1). Moreover, 5 Chinese megalopolises – Beijing, Shenyang, Shanghai, Xian and Guangzhou are among the ten most "dirtiest" cities in the world. Until 2018, China imported about 60% of the utilized solid municipal and equivalent waste (plastic, waste paper, used household appliances, etc., the main suppliers are the EU countries and the USA). The applied methods and technologies resulted into complex environmental and social consequences (air and water pollution, difficult working conditions, low wages, high morbidity, etc.) [1-3].

Modern environmental policy in NEA is developing at three levels: international – within the United Nations (UN); regional – multilateral agreements and organizations; bilateral agreements on ecology [4]. Briefly about the first two. Especially important among the mechanisms for assessing environmental degradation and environmental policy developed by the UN is the Environmental Performance Index (EPI) as a result of a global study and the accompanying rating of the countries of the world concerning the environmental impact and rational use of natural resources (calculated according to the methodology of Yale Center for Environmental Law and Policy – together with a group of independent international experts who use in their work statistical observations of national institutions and international organizations, along with various analytical works).

| Country                  | 2016 rank | 2016 rating | 2018 rank | 2018 rating | 2020 rank | 2020 rating |
|--------------------------|-----------|-------------|-----------|-------------|-----------|-------------|
| China                    | 109       | 65.1        | 120       | 51.0        | 120       | 37.3        |
| Mongolia                 | 114       | 64.4        | 83        | 58.0        | 147       | 32.2        |
| Republic of Korea        | 80        | 70.6        | 60        | 62.3        | 28        | 66.5        |
| Russian Federation       | 32        | 83.5        | 52        | 64.0        | 58        | 50.5        |
| Japan                    | 39        | 80.6        | 20        | 74.7        | 12        | 75.1        |

\[a\] Compiled by author based on Index of environmental performance. Humanitarian encyclopedia: Research Center for Humanitarian Technologies, 2006-2020 Income accessed online on 29th August 2020 via https://gtmarket.ru/ratings/environmental-performance-index and Environmental Performance Index 2016 (EPI) doi: 10.13140/RG.2.2.19868.90249.

\[b\] No data available for Democratic People's Republic of Korea.
The subregional geographic approach to the thematic work of United Nations Economic and Social Commission for Asia and the Pacific (UNESCAP) provides more opportunities for neighboring countries to establish close subregional and intraregional cooperation. Furthermore, in 2010, the UNESCAP office was opened in the region (Incheon, the Republic of Korea) and the secretariat of the Subregional Program for Environmental Cooperation for North-East Asia (NEASPEC) is also located here – this is a comprehensive intergovernmental framework for cooperation in solving environmental problems in Northeast Asia. Approved in 1993 (as part of the follow-up to the UN Conference on Environment and Development: Rio de Janeiro, 1992, as part of the already indicated six participating States). Key areas of work under the UNESCAP “Improving Environmental Sustainability” direction are: Transboundary Air Pollution; Nature Conservation; Marine Protected Areas; Low Carbon Cities; Desertification and Land Degradation. In the current context of increasing attention of the world community to the Arctic, as well as the intensive development of technologies for its study and development, cooperation, including environmental cooperation, is becoming increasingly important in this region [3-5].

We started our research in the framework of Low Carbon Cities. Here, perhaps, an explanation is needed. In many highly developed countries of the European Union and North America, and in NEA – in Japan, from the end of the 20th century, comprehensive measures were introduced aimed at the formation of environmentally friendly urban areas, which can be called a milestone transition to energy efficient, low-carbon, highly sustainable and climate-neutral cities as locomotives of the movement towards green economy and low-carbon development model in general [6, 7]. In Northeast Asia, China and Korea, following Japan, implemented policies and practices for the development of low carbon cities (LCC) at different territorial levels (national and regional), using different approaches. Thus, the National Development and Reform Commission of China, already in 2010, officially launched a state pilot program on low-carbon technologies in several provinces and cities (currently six pilot provinces and 81 pilot cities) with low carbon emissions (according to the official NEASPEC portal). In the framework of NEASPEC, since 2015, the ideology of a low-carbon city has been officially promoted in the NEA LCCP format – North East Asia Low Carbon City Platform as a Platform for low-carbon cities in Northeast Asia. At the 23rd Senior Officials Meeting (SOM) NEASPEC (October 10, 2019 Ulan-Bator, Mongolia) supported the proposal of Mongolia and the Russian Federation to expand geography and officially include the Mongolian cities of Chingis and Tsetserleg and the Russian cities of Ulan-Ude and Irkutsk in the NEA LCCP regional research program.

Irkutsk is the largest transport hub in the Asian part of Russia, located at the strategically important intersection of the country’s main international transport corridors in its central and southeast Asia. Three large Russian transport departments are concentrated in the city: the East Siberian branch of the corporation Russian Railways, the East Siberian Interregional Territorial Administration of the Federal Air Transport Agency and the corporation East Siberian River Shipping Company. The favorable geographical location in the center of the Asian part of Russia allowed Irkutsk to become an important point of intermediate landing on the airlines connecting the airports of Southeast Asia and the Far East with the European part of Russia and the CIS countries. The population is 623,562 (as of January 1, 2020). The territory of Irkutsk within the boundaries of the urban district is 277.4 km².

Irkutsk is a leader in the socio-economic activities of Irkutsk oblast. Over the past decades, the share of industrial production in the city has been a quarter in the oblast volumes of the manufacturing sector, almost half of the retail trade and public catering turnover is carried out in the regional center, and almost 30% of the economy is concentrated in the city. Irkutsk tops the list of territories of the oblast for the commissioning of residential buildings. Half of its enterprises and organizations are located here (for example, more than 200 report on emissions into the atmosphere of the city).

The volume of urban products shipped by actual activities of large and medium-sized enterprises is 125 billion rubles (2016), which amounts to (3.3 thousand dollars/pers. at the average dollar exchange rate for the indicated years). The main share of output is the production of vehicles, metallurgical and mining equipment, and the production of electronic and electrical equipment. The basic industries are
mechanical engineering and food, which account for more than 85% of production of large and medium-sized enterprises of the city. More than half of the products are exported to various countries of the world.

The industrial economic basis of the city is the largest machine-building plants IAP (Irkutsk Aviation Plant), corporation Irkutsk Heavy Machine-Building Plant, food industry enterprises (Yanta group of companies, own meat and bakeries, water processing), a unique pharmaceutical company (Farmasintez corporation), etc. The IAP operates an engineering cluster of the Irkutsk region with the infrastructure created (certification, standardization and testing center; engineering center, etc.). It should be noted that the atmospheric emissions of IAP make up more than 10% of the annual flow of pollutants from stationary sources of Irkutsk. The export destination points of the Irkutsk Aircraft Plant are mainly the countries of southern and southeast Asia. The pharmaceutical enterprises of the city are members of the pharmaceutical regional cluster.

Irkutsk is one of the largest energy centers in the country, it manages the largest energy holding in Russia – corporation Irkutsenergo, which ranks second in the country in the production of thermal energy and third in the production of electricity. Within the city limits, its two largest facilities are located - the Irkutsk Hydroelectric Power Station and the Novo-Irkutsk Thermal Power Plant (NI TPP), the total annual output of which exceeds 6 billion kWh. Emissions from NI TPP make up more than 70% of the annual flow of pollutants from stationary sources of the city.

Natural and climatic conditions determine the duration of the heating season, atmospheric pollution form, including hydrocarbon emissions. The location of Irkutsk in the center of the Eurasian continent (south of the Central Siberian Plateau, in the southeastern part of the Irkutsk-Cheremkhovo foothill plain, surrounded from the south, southwest and southeast by the stepped uplifts of the East Sayan and Pribaikalskii Ranges) predetermined its natural and climatic conditions. Atmospheric circulation in Irkutsk is characterized by the following features:

- neither Atlantic nor Pacific air masses enter the territory;
- atmosphere replenishment is carried out mainly due to the Arctic air, which is transformed over the continent into the air of the temperate zone;
- the presence of three large water bodies in Irkutsk oblast, the Irkutsk reservoir, the Angara and Irkut rivers, as well as small tributaries – Ushakovka, Kaya, which valleys dissected the relief (flat or rounded peaks of interfluves have a height of 480-520 m, relative to the bottom of the valleys – even of 60-100 m), causes special microclimatic conditions within the city and affects the general circulation of the atmosphere.

The main conclusions of the first stage of the author's research based on the analysis of the basic program and strategic documents for the development of Irkutsk (table 2) are as follows.

The analysis of the development program and strategic documents of Irkutsk make a key conclusion that for the implementation of the strategy of social and economic development of the city of Irkutsk, the basic components have been laid, corresponding to the ideology of the LCC platform. Thus, the main tactical and strategic goals for the medium-to-long-term development will contribute to: ensuring the sustainable development of the territory of Irkutsk based on a balanced consideration of environmental, economic, social and other factors through territorial planning, town planning zoning and territory planning; improving the position of Irkutsk in the environmental rating of Russian cities; an increase in the sector of electric power modes of transport (trams, trolleybuses) in passenger traffic; creating conditions for providing the population of Irkutsk with affordable and comfortable housing, etc. The information on the urban complex and environmental state is detailed in the context of 8 thematic sections, including power consumption, land use, water, waste, etc. Thus the waste management in Irkutsk (rate of generation of wastes, operational enhanced waste reuse and recycling, etc.) and the infrastructure for deposition and recycling are made in a cartographic format, included in the section “Municipalities” prepared for the publication of the Atlas “Baikal Region: Society and Nature”. A number of other specific indicators of the urban economic complex, including energy intensity, energy consumption structure, CO₂ emissions per unit of energy and others, will change and
be adjusted in connection with the unfavorable socio-economic situation caused by the COVID-19 pandemic.

**Table 2.** The main concepts and programs (elements of the institutional environment), contributing to the development in the direction of LCC for Irkutsk.

| Main program and strategic documents | Validity period |
|--------------------------------------|-----------------|
| The strategy of social and economic development of the city of Irkutsk for the period up to 2030 | until 2030, approved by the decision of the Irkutsk Duma as of 22.02. 2018 |
| General plan of the city of Irkutsk until 2030 | until 2030 (approved by the decision of the Irkutsk Duma as of June 28, 2007 with the latest changes on December 03, 2018) |
| The program of complex socio-economic development of Irkutsk for 2008-2020 (section “Environmental state and the main strategic directions for improving the urban environment”) | 2008-2020 |
| Municipal program “Energy conservation and energy efficiency in the city of Irkutsk for 2016 – 2021” | 2016-2021 (with amendments from 2018) |
| Municipal programs: “Economic development”, “Development of engineering infrastructure. Increasing energy efficiency”, “Development of the transport system”, “Improving the quality of management of municipal property in the city of Irkutsk and land plots in the city of Irkutsk”, etc. | 2020-2025 |

The peculiarities of Irkutsk location in Siberia determine the long heating season: 240 days (starts on September 15, ends in May) and, accordingly, significant emissions from fuel combustion products. Irkutsk is included in the Priority list of Russian cities with the highest level of air pollution (since 2001). Thus, in 2019, according to data from 677 stations in 250 cities of the state observation network, the atmospheric pollution index of Irkutsk was assessed as “very high”. Substances that determine very high atmospheric air pollution in Irkutsk: benzo(a)pyrene and formaldehyde, suspended solids, nitrogen dioxide, ozone, sulfur dioxide, etc. Improving the atmospheric condition is one of the priority tasks of the municipal administration and large enterprises of the city [8-10]. It should be noted that the General Plan of the city of Irkutsk considers the scenario of replacement of solid and liquid fuels with gas (with specific calculations, table 3).

It is very important that the city program on energy saving and energy efficiency in Irkutsk contains control indicators of the main positions for the next 5 years, including: stimulating energy saving and increasing the energy efficiency of the Irkutsk economy; ensuring accounting of consumed energy resources, formation of organizational foundations and information field for the dissemination of the ideology of energy conservation and energy efficiency increase; implementation of measures aimed at reducing the consumption of energy resources. Qualitative, quantitative and organizational result: we plan to regularly monitor the involvement of the entire infrastructure of the city in the
process of energy saving, using the accumulated experience of the NEA LCCP platform in the cities of NEA.

Table 3. Comparison of the amount of emissions of harmful substances when replacing solid and liquid fuels with natural gas in Irkutsk.

| Components           | Quantity, t/year | Reduction, t/year |
|----------------------|------------------|-------------------|
|                      | Current situation| After conversion to natural gas |                |
| Carbon monoxide      | 6792             | 340               | -6452          |
| Nitrogen dioxide     | 11640            | 5180              | -6460          |
| Nitric oxide         | 1892             | 846               | -1046          |
| Sulfur dioxide       | 45599            | 0.68              | -45598.32      |
| Solid matter         | 12011            | -                 | -12011         |
| Total                | 77934            | 6366.68           | -71567.32      |

*General plan of the city of Irkutsk (approved by the Irkutsk Duma on June 28, 2007 with the latest amendments on December 3, 2018). Income accessed online on 20th August 2020 via https://admirk.ru/; Program for the integrated development of municipal infrastructure systems of Irkutsk for the period 2016-2021 and with a perspective up to 2025. Income accessed online on 20th August 2020 via https://admirk.ru/Pages/root.aspx.*

4. Conclusion

We will jointly conduct research and practice-oriented work with the scientific community, the city government for the further favorable urban environment for the life of Irkutsk people. Namely, the harmonious embedding of the ideology of sustainable development on the LCC platform into the evolutionary development process of a diversified, balanced economy and formation of a comfortable living environment, which will ensure a steady increase in the life quality of population, contribute to leveling the trend of climate change in Cisbaikalia. The institutional structures of the city administration, the adopted package of strategic documents correspond to the key positions of the LCC platform. The step-by-step subsequent systematic activity is aimed at improving the state of the city's air basin first of all. Existing mechanisms (as programs, events and monitoring) are used in the planned activities in the energy system, industry, housing and communal services (housing and public buildings), in the transport sector, in the field of land use and landscaping). The practical experience gained from other cities in North-East Asia will be studied and correctly applied, in line with the natural-historical and socio-economic characteristics of Irkutsk.

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