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PATENT ACTIVITY IN GREEN ECONOMY OF UKRAINE*

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Patent activity in Green economy sphere was analyzed based on data of the ESPACENET. The main aim of the paper is to test the hypothesis that RE development in Ukraine positively correlates with inventor's activity.

Keywords: *green economy, patents, Ukraine.*

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According to the expert opinion, Ukraine has a potential for developing green economy (GE). The most promising areas are renewable energy, energy efficiency and organic farming [1].

An important part of GE is renewable energy (RE). Notably, the growth of RE during last 4-5 years caused unbalances in electricity market of Ukraine in 2020. as it was sharp increase of installed RE capacities, in particular solar power plants. At the end of 2019, the generation capacities of RE installed over 6600 mW, of which over 80% came from solar energy (both corporate and households), 15% came from wind energy. It was almost 3 times higher compared to 2018. Nevertheless, the share of RE in electricity generation is rather small (about 4%, that is times more than in 2018).

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The core of the GE is based on the social and technological innovations, in particular in RE [2]. Innovation may come from different channels, e.g. from domestic inventors or import from abroad. Thus, in the paper we tried to test the hypothesis that RE development in Ukraine positively correlates with inventor's activity. If not, there are two alternatives. First is that tacit knowledge prevails in RE, second is that RE development in Ukraine is not based on domestically produced innovations.

For our study, we used the ESPACENET and we admit that some patents might not to be included in our dataset due to inaccurate transfer of patent data from Ukrainian patent office to the ESPACENET. The number of such patents can be neglected as it doesn't affect the general patterns in green economy knowledge transfer. Another issue to be tackle is validity of patents: most Ukrainian patents in ESPACENET are not valid.

Green patents are based on OECD classification of selected climate change adaptation technologies (according to Cooperative Patent Classification they are represented by Y02E subclass) [3].

Total number of green patents meeting the criteria was 720, of which 647 (or 90%) were issued by Ukrainian patent office. The shares of patents issued to applicants from Ukraine by WIPO and EPO were 5% and 1% respectively (37 and 5 patents). The share of Russia was 3% and USA only 1%. Patenting in other national jurisdictions is not very popular and is based rather on personal contacts.

The green patenting activity shows negative dynamic that contradicts to pace of economic development of green energy and organic production in Ukraine. Since 2010, the highest number of green patents was granted in 2010 (182), then it is gradually declining: 159 in 2011, 119 in 2012, 109 in 2013 etc.

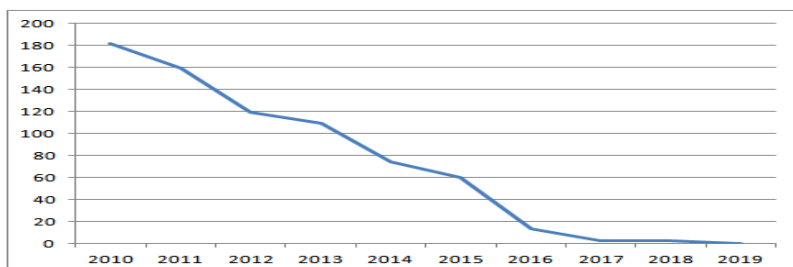


Fig. 1. Number of green patents, by earliest priority
 Source: compiled by authors using ESPACENET data

In 2017–2019 the patenting was close to zero. It might be caused by two main reasons:

- Increase of patenting fees in 2019 [4];
- Economic crisis caused by the conflict and war at the Eastern Ukraine and Crimea.

The largest green sectors are represented by wind energy (270 patents), solar thermal energy (153) and hydroenergy (112). The PV energy, fuel from waste and agriculture accounts for 40-50 patents. Zero patents were identified in superconducting electric elements and geothermal energy. Surprisingly, only 5 patents were found in hydrogen which is promising fuel of future.

Table 1. Number of patents in green economy subsectors

Subsectors	CPC	# patents since 2010 (by earliest priority date)
Wind energy	Y02E10/70-766	270
Solar thermal energy	Y02E10/40-47	153
Hydroenergy	Y02E10/20-28	112
PV energy	Y02E10/50-58	52
Fuel from waste	Y02E50/30-346	50
Agriculture	Y02P60	42
Nuclear energy	Y02E30	32
Marine energy	Y02E10/30-38	30

Bio-organic fraction processing	Y02W30/40-47	13
Biofuels	Y02E50/10-18	12
Hydrogen	Y02E70 Y02E60/30+	5
Solar thermal-PV hybrids	Y02E10/60	5
Superconducting electric elements	Y02E40/60-69	0
Geothermal energy	Y02E10/10-18	0

Source: authors compilation based on ESPACENET

Unlike patent activity, publication activity of Ukrainian scholars has positive dynamic. According to the SJR 2019 in Renewable Energy, Sustainability and the environmental areas Ukraine ranked 46th among 203 countries of the world and ranked 5th among 23 Eastern Europe counties (compared to 69th and 12th in 2015) [5]. It means that results of scientific activity are not transformed into explicit knowledge that might limit their utilization in economy.

Despite rapid economic development of GE sectors, the patent activity of Ukrainian actors remains low and decreasing. Even in subsectors which are leaders in Ukraine, namely wind energy, solar energy, hydroenergy, the number of new patents of Ukrainian applicants is not growing.

The share of green patents was higher among individual applicants than legal entities. The most active were universities and research institutions of National Academy of Sciences of Ukraine.

Detailed analysis of patent actors (inventors and applicants) showed that network structure in GE was defragmented and dominated by radial centralized groups, established around the research institutions/universities. Commercial firms in Ukraine are not interesting in patenting. Probably, they prefer other ways of intellectual property protection and knowledge transfer. The interinstitutional partnerships in patenting are rather exceptional. International

cooperation is low and involves foreign partners as co-applicants.

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