According to the UN, by 2050, 66% of the world's population will live in cities. Therefore, architects master the air, creating so-called vertical settlements. Already today, the Vertical City organization offers to build not just skyscrapers, but entire complexes 400 stories high, when one building will have everything - housing, a school, a kindergarten, a hospital. At the expense of verticality, supporters of this idea want to protect the environment from the spread of high-rise buildings to new territories.

An alternative to the vertical one is the so-called floating city. This concept of a settlement for 10,000 people was developed by the Danish architectural bureau BIG. Their Oceanix City project takes into account the pace of climate change and rising sea levels. Therefore, BIG proposes to settle people on floating platforms, where houses will be built no higher than seven floors. They will be made of environmentally friendly materials such as bamboo, and solar panels will be mounted on the roof. Part of the buildings in such a city of the future will be used as marine farms for the cultivation of algae and shellfish. And it will be possible to move from one platform to another with the help of electric transport.

If these ideas seem fantastic to someone, then remember that not long ago, few people believed in "passive" and "smart" houses, in vertical gardens or swimming pools on the roof of high-rise buildings. And today all this is a reality! So, another, perhaps unusual, but exciting world of future architecture awaits us. I hope there will be harmony between human needs and environmental protection.

HOUSES BY A 3D-PRINTING

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These days, the real estate market is changing and evolving at a rapid pace. Every day thousands of architects think of new ways of building. They research of new materials and technologies for more sustainable and cost-effective residential projects. Therefore, for many years the method of 3D printing of houses has been practiced.

The digital visualization of every component through innovations like BIM and renders has been key in advancing the printing process. By accurately modeling construction systems, with all their dimensions and layers, it is possible to maximize the understanding of how materials fit and work – and consequently aim for a better, more creative architecture. By combining these representation methods with 3D printing, future design possibilities for housing become endless, even in changing climatic conditions. Also, environmentally friendly materials are added to innovative technologies, which make this process cheaper and more "correct" from the point of view of the environment. For example, Italy hosted the

first ever construction printed in raw earth; a circular housing prototype whose entire structure and cladding was built in 200 hours with multiple printers working simultaneously.

3D printing is also considered a real potential solution to humanitarian issues like the global housing crisis. In parts of the world where a roof over your head is far from a guarantee, the ability to quickly and inexpensively produce a livable structure has enormous potential, like entire 50-home 3D-printed community in Mexico.

Builder PERI GmbH and designer MENSE-KORTE ingenieure+architekten collaborated on the first-ever 3D printed house in Germany, a two-story building with approximately 860 square feet of livable space per floor. The project uses a special 3D printer called BOD2, pioneered by Danish manufacturer COBOD. The machine allows the addition of pipes and other internal building components, even while the printing is underway. It can print up to 10 square-feet of double-skin wall in just 5 minutes and only needs to be calibrated once before getting to work on each section. Eventually, the team of Mense-Korte managed to construct a two-storey building. The first level has an open floor plan including a living room, dining area, and a cozy fireplace in the middle. The second floor consists of three separate bedrooms (which might also be used as working space, for example). In addition, there are three bathrooms to accommodate several family members and guests. Since the whole building was made by a 3D printer, it took less than a year to complete the construction.

Another example of the use of 3D technologies in construction is a 6,900 square-foot administrative building for the Dubai Municipality. This building is currently the largest 3D printed building in the world. Apis Cor, the first company to develop specialized equipment for 3D printing in the construction industry, completed the 3D printed wall structures of this building. The innovative 3D printer used allowed the structure to be built directly in place, without any extra assembly works. The mobile machinery moved around the site by crane, to be able to cover the whole printed area, bigger than its normal reach. In fact, only 3 workers and the machine were needed to 3D print wall structures of the entire building. For this venture, the 3D Printing material used is a gypsum-based mixture produced locally and poured onto rebar, which was also made using 3D technologies.

After all, the examples listed in this article are far from the only ones in this area. People have created and continue to create buildings using innovative 3D printing technologies. I believe that this method of construction is a significant breakthrough in the field of architecture and in the future may become one of the main.

References:

1. Paving the way for future living: Germany's first 3D-printed house. [Electronic resource]. URL: https://www.gira.com/uk/en/inspirations/references/3d-house-germany#taking-a-look-inside-the-3d-printed-concrete-house

2. 6 of the World's Most Impressive 3D Printed Buildings. [Electronic resource]. URL: https://www.procore.com/jobsite/6-of-the-worlds-most-impressive-3d-printed-buildings/

3. Dubai Municipality to Become the World's Largest 3D-Printed Building. [Electronic resource]. URL: https://www.archdaily.com/930857/dubai-municipality-to-become-the-worlds-largest-3d-printed-building

4. 3D Printing, Prefabrication, and Interior Design: Construction Trends for 2022. [Electronic resource]. URL: https://www.archdaily.com/973281/3d-printing-prefabrication-and-interior-design-construction-trends-for-2022?ad_source=search&ad_medium=projects_tab&ad_source=search&ad_medium=search_result_all

PROSPECTS FOR THE PRODUCTION OF SHALE OILS FROM THE RUDOV BEDS OF THE DNIEPER-DONETSK DEPRESSION

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At present, the subject of my research "Geological criteria for the formation of shale oil accumulations in the Rudivska strata of the Visean Lower Carboniferous of the Dnipro-Donetsk Basin" has proved to be highly actual, taking into account the current paradigmatic situation in the field of geology and relevant studies.

The process of extracting hydrocarbons from shale rocks involves the use of hydraulic fracturing, which is not unambiguous from an environmental point of view. In this connection, experts divide environmental pollution into mechanical, chemical, biological, physical and radiation according to its type of origin.

Mechanical pollution includes contamination with solid particles, containers and waste items that accumulate on the earth's surface: in soil, water, and air. Chemical pollution is pollution by substances and compounds of artificial origin that enter the geographical environment and disrupt the processes of the circulation of matter and energy. Biological pollution is the spread of organisms that have emerged as a result of human activity. Examples of biological pollution include bacteriological weapons, new viruses that cause epidemics of dangerous diseases, and the rapid reproduction of certain plant or animal species that have been relocated by humans from one place of distribution to another. Physical pollution includes changes in thermal, electrical, and radiation conditions caused by human activity, as well as vibrations and noise.

Thus, the peculiarities of natural resource management in my field of work focus on such three categories of environmental pollution as mechanical, chemical, and physical contamination [1].