Researchers of Russia and Finland to create a unique wind turbine for the Arctic

Peter the Great St.Petersburg Polytechnic University (SPbPU), in consortium with LUT University and Central Research Institute of Structural Materials "PROMETEY" develop energy-efficient installations based on the use of wind power to supply consumers in the Arctic. The research project EFREA was awarded in the framework of South-East Finland - Russia Cross-Border Cooperation Program 2014-2020.

The project aim is to achieve advances on the following topics: welding processes and methods, materials for arctic conditions, light-weight structures, standards and patents, coatings, and 3D manufacturing and corrosion protection.

"Our program area is an emerging cluster for Arctic technology development, which utilizes extensive Russian and Finnish experience and have high scientific competence and technical knowledge. To remain competitive in the field of Arctic engineering, strong cross-border cooperation is needed and institutional frameworks should be established. The project will assess the usability of new high-strength materials and advanced joining methods for application in various Arctic

structures," - said Associate professor Paul Kah, the EFREA project manager.

"*The problems of energy supply is very acute in the Northern regions. The delivery of the organic energy resources to these areas is very expensive. In addition, the emissions of fuel combustion products, as well as storage of the spent fuel barrels cause significant environmental damage to the Arctic nature,*" said professor Viktor Elistratov, director of the Scientific and Educational Center "Renewable Energy Sources and Installations based on them" SPbPU. The scientist also added that using the wind energy resources in the Arctic region is difficult due to the harsh climatic conditions: icing of wind turbine blades and the metal becomes brittle due to low temperatures. Due to off-road and a short summer period, there are serious problems with the manufacturing of the foundation of the installation and its assembling.

At the first stage of the project, the scientific group should determine the type and design parameters of the modular type wind turbine, which is to be developed based on the principles of digital design. Researchers will assess the natural and climatic characteristics and wind potential of the Arctic region and identify the most effective zones and extreme climatic factors for designing and manufacturing of the wind turbine. It should be noted that scientists consider the possibility of calculating both grounds and floating (underwater) installation. Taking into account the features of the Northern Sea Route operation, the large water surfaces of the northern seas and lakes in Russia and Finland, the manufacturing of such installations opens up tremendous prospects for the ecological energy supply to remote Arctic regions.

The Finnish participant of the consortium is the LUT University, which has extensive experience in the development and implementation of Arctic materials. "*We have a long-term experience in collaboration with LUT University,*" said Professor Sergei Parshin, the Head of the department "Theory and Technology of Welding Materials" of SPbPU.

He added that supervisor of the project from the Finland Paul Kah has been a visiting professor at St. Petersburg Polytechnic University for the three years in now and successfully combines work in the joint research project with teaching students.

The third participant in the consortium, the Central Research Institute of Structural Materials "PROMETEY" is engaged in analyzing the types of materials, which can be used in the manufacturing of structural elements and the construction of the installation in Arctic conditions. The result of the project should be a prototype (digital twin) of a wind turbine adapted to northern conditions, as well as a geographic information system with wind potential, natural and climatic characteristics (including extreme ones).

As an educational aspect of the project implemented in the framework of the European program "Cross-Border Cooperation", the obtained results will be used in programs curriculum for students of SPbPU and LUT University relevant departments. The students will be able to work on their undergraduate and

masters diplomas in the framework of real-life an international project.

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