Brief information about the project

Name of the project	AP19574454 «Efficiency study of silicon solar cells under concentrated solar radiation with a new adaptive cooling system»
Relevance	Increasing the efficiency of solar panels is today's urgent task due to the constant and inevitable increase in electricity consumption by mankind. Silicon solar cells have a very limited efficiency, which is approximately 10-15%, the use of concentrating optical systems requires the creation of solar cells with multi-junction semiconductor structures that can withstand high concentrations of up to several thousand Suns and high temperatures up to hundreds of degrees Celsius. However, such multi-junction structures are difficult to manufacture compared to polycrystalline silicon solar cells and they are not produced on an industrial scale. High concentration ratio and temperature as well as non-uniform temperature distribution of solar cells in the battery have a detrimental effect on the semiconductor structure of a silicon solar cell. For this reason, the study of silicon solar cells in conditions of low and medium concentration using a new adaptive cooling system in order to uniformly distribute the temperature of solar cells in the battery is an urgent task. The main idea of the project is to study the efficiency of concentrating silicon solar cells in conditions of concentrated solar radiation and to develop a new adaptive cooling system. During the development of the Project, computer modeling by the finite element method and finite volume method, traditional methods of studying the efficiency of solar cells using I–V curve and power output studies during experimental measurements in laboratory conditions in various weather conditions will be used.
Purpose	The aim of the project is to develop and study the efficiency of silicon solar cells with low and medium concentration, in which the output power of the solar cell increases due to the lens system, using a new adaptive cooling system in various weather conditions.
Objectives	Task 1. Theoretical study of the optical system of lenses and its modeling to create a silicon solar cell with low (2-10 Suns) and medium (10-100 Suns) concentration ratio; Task 2. Investigation of non–uniform heating and cooling of solar cells at low and medium concentrations; Task 3. Development of a new adaptive cooling system in order to achieve uniform cooling of solar cells in the battery;

	Task 4. Investigation of the optical system of lenses and the cooling system of a concentrating photovoltaic system by measuring the output power of solar cells in a laboratory, as well as under various weather conditions to study temperature modes of operation, in conditions of low and medium concentration using the developed cooling system to investigate the possibility of using concentrating silicon solar cells on a large scale.
Expected and achieved results	The main expected result of the Project will be a concentrating silicon photovoltaic system with a new adaptive cooling system. Also, the result of this work will be new knowledge about the influence of the concentration ratio, weather conditions, non-uniform heating and cooling of silicon polycrystalline solar cells in batteries on the output electrical power of solar cells. This knowledge is of great interest to both scientists and specialists in the field of solar energy. The obtained scientific results will be published in 2 (two) articles and (or) reviews in peer-reviewed scientific publications indexed in the Science Citation Index Expanded of the Web of Science database and (or) having a CiteScore percentile in the Scopus database of at least 35 (thirty-five). In addition, 1 (one) article will be published or a review in a peer-reviewed foreign or domestic publication recommended by the Committee for Quality Assurance in the Field of Science and Higher Education. Or 1 (one) article or review in a peer-reviewed scientific publication indexed in the Science Citation Index Expanded and included in the 1st (first) quartile by impact factor in the Web of Science database. The results obtained will influence fundamental and applied knowledge in the field of improving the efficiency of silicon photovoltaic systems and cooling systems, which are of great interest in the world scientific community.
Research team members with their identifiers (Scopus Author ID, Researcher ID, ORCID, if available) and links to relevant profiles	1. Nurglaliyev M. – supervisor, SSR. ORCID: 0000-0002-6795-5384; Scopus Author ID: 57202335235 2. Saymbetov A. – LSR. ORCID: 0000-0003-3442-8550; Scopus Author ID: 57230318400 3. Kuttybay N. – SSR. ORCID: 0000-0002-5723-6642; Scopus Author ID: 57196375521 4. Dosymbetova G. – SSR. ORCID: 0000-0002-3935-7213; Scopus Author ID: 57202334195 5. Zholamanov B. – JSR. Scopus Author ID: 57258537000 6. Koshkarbay N. – JSR. Scopus Author ID: 57257861100 7. Kapparova A. – Engineer Scopus Author ID: 58028607300 8. Orynbassar S. – Engineer. Scopus Author ID: 58028274600

List of publications with links to them	-
Patents	-