

УДК 621.311

**ENVIRONMENTAL ADVANTAGES OF SOLAR ENERGY
FOR PREVENTING ENERGY WASTE AND STRENGTHENING
YEMEN'S THE ENVIRONMENT**

Talal M. Obaid^{1,2,3}, Kamal F. S. AL-Kamali¹, Esam F. S. AL-Kamali¹

Science supervisor Marwan F. S. AL-Kamali^{1,4}

¹*Scientific Association for Research and Innovations, Taiz, Republic of Yemen*

²*Taiz University, Republic of Yemen*

³*Mansoura University, Egypt*

⁴*Sukhoi State Technical University of Gomel, the Republic of Belarus*

In this study, we shed light on the extent of the difficulties faced by Yemenis as a result of the lack of government power and the search for alternatives due to the high cost of fuel, and how they eventually transitioned to solar.

Keywords: solar energy, Yemen, environment.

**ЭКОЛОГИЧЕСКИЕ ПРЕИМУЩЕСТВА СОЛНЕЧНОЙ ЭНЕРГИИ
ДЛЯ ПРЕДОТВРАЩЕНИЯ ПОТЕРЬ ЭНЕРГИИ И УКРЕПЛЕНИЯ
ОКРУЖАЮЩЕЙ СРЕДЫ ЙЕМЕНА**

Талал М. Обейд^{1,2,3}, Камаль Ф. С. Аль-Камали¹, Эсам Ф. С. Аль-Камали¹

Научный руководитель Марван Ф. С. Аль-Камали^{1,4}

¹*Научная ассоциация исследований и инноваций организации, г. Таиз,
Йеменская Республика*

²*Таизский университет, Йеменская Республика*

³*Университет Аль-Мансура, Египет*

⁴*Учреждение образования «Гомельский государственный технический
университет имени П. О. Сухого», Республика Беларусь*

Определены масштабы трудностей, с которыми сталкиваются йеменцы в результате отсутствия государственной власти и поиска альтернатив из-за высокой стоимости топлива, и рассмотрено то, как они в конечном итоге перешли к солнечной энергии.

Ключевые слова: солнечная энергия, Йемен, окружающая среда.

Today, because of the conditions that the Yemeni people are enduring as a result of the instability created by the events of 2011, the government's electric current has been totally cut off since that time, forcing Yemenis to seek alternate energy options in order to continue their everyday lives. Appropriate alternatives, but they have several downsides, including the fact that there is currently no equipment that fully utilizes solar energy.

On the fig. 1 we can see images of the Republic of Yemen's map that show potential installation sites for solar panels.

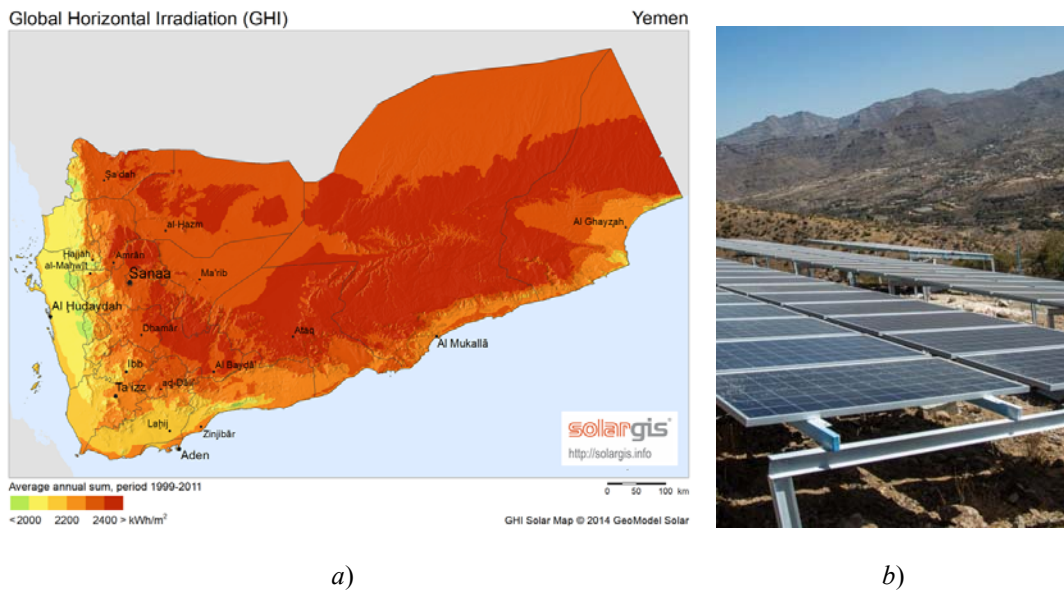


Fig. 1. Images of the Republic of Yemen's map that show potential installation sites for solar panels

With the start of Yemen's civil war, solar panels swiftly expanded throughout the country. Sana'a had a permanent power outage on March 23, 2015. The Marib power station, which supplied energy to Yemeni cities, has been decommissioned. As a result, the generator industry flourished for a long period. However, due to Yemen's volatile conditions, it cannot be assured that the generators will always be operational due to high fuel costs, fuel shortages, and unavailability of fuel at other times. As a result, Yemenis were forced to rely on solar energy.

The solar energy project in Yemen, which works to solve issues related to development and alternative energy, works to improve resilience in the Yemeni countryside because it is one of the most practical, measurable, and least harmful to the environment projects. Mini solar systems provide an alternative and renewable source of green energy, providing rural people with a low-cost and continuous electrical supply for extended periods of time. It also gives a solution and hope to communities that may have few other options.

Even prior to the 2015 crisis, just 23 % of Yemenis had access to energy. Because of the high prices of fossil fuels and the embargo that makes access to energy supplies more difficult, the crisis has exacerbated the country's energy challenges. Previously, 20 liters of diesel cost \$7; however, due to the country's acute fuel crisis, the equal quantity of diesel can now cost up to \$40, making energy unaffordable or accessible to the majority of Yemenis. Energy scarcity also has an impact on commercial initiatives, such as medium, small, and micro firms, as well as private sector projects, all of which suffer the most from a lack of access to alternative energy.

In fact, the massive increase in fuel prices and the permanent disruption of Yemen's public electricity network forced citizens to choose between installing home solar systems or subscribing to commercial electricity networks for diesel power generation; both options are expensive, and the renewable energy option is out of reach for many Yemenis. Whatever choice is chosen, the expense adds huge financial obligations to houses who are already experiencing suffocating financial difficulties.

Small solar grids generate alternative energy alternatives that might be a better source than diesel since it is green energy that is inexpensive in cost and can be easily deployed in rural regions, improving the lives of a huge number of Yemenis.

The struggles endured by Yemenis due to a lack of public energy and the search for alternatives due to high gasoline prices, and how they eventually switched to solar energy and benefited from solar energy transfers that can benefit countries from these experiences that have improved the use of sunlight, which Belarus can also benefit from in order to improve the environment from other energies.

УДК 536.2

ОБ ОДНОМ СПОСОБЕ АККУМУЛИРОВАНИЯ СОЛНЕЧНОЙ ЭНЕРГИИ И ОПТИМАЛЬНОГО МОДЕЛИРОВАНИЯ ПРОЦЕССА ТЕПЛОПЕРЕДАЧИ

М. Якубов

*Туркменский государственный университет имени Махтумкулы,
г. Ашхабад*

Научный руководитель М. Рахимов

Государственный энергетический институт Туркменистана, г. Мары

Аккумуляция солнечной энергии (АСЭ) в отличие от других способов производства энергии имеет свои преимущества. В условиях Туркменистана использование большого количества солнечной радиации в течение 5–6 месяцев и превращение ее в электрическую энергию говорит об актуальности проблемы АСЭ. Нами проведены опыты АСЭ с использованием солнечного соленого бассейна и рассолов с различными химическими составами без каких-либо дополнительных элементов. Исследован термический потенциал аккумуляции растворов солей из комбината «Гувлыдуз», расположенного на берегу Каспийского моря, и из солей (бишофит) озера Гарабогаз, а также соленой воды пруда Ханховуз.

С целью превращения АСЭ в электроэнергию была построена математическая модель оптимального режима насоса, определены скорости течения жидкости по трубе и расхода солевого раствора. Использовалось уравнение Навье–Стокса, решена задача оптимального моделирования турбулентного течения жидкости.

Ключевые слова: аккумуляция солнечной энергии, солнечный бассейн, соли, рассол, уравнение Навье–Стокса, уравнение Беллмана, оптимальное моделирование.

ABOUT ONE METHOD OF SOLAR ENERGY ACCUMULATION AND OPTIMAL MODELING OF THE HEAT TRANSFER PROCESS

M. Yakubov

Magtymguly Turkmen State University, Ashgabat

Science supervisor M. Rakhimov

State Energy Institute of Turkmenistan, Mary

Solar energy storage (SES) differs from other energy production methods in its advantages. In the conditions of Turkmenistan, the use of large amounts of solar radiation for 5-6 months, the possibility of accumulating and converting it into electrical energy proves the relevance of the ASE problem. We have conducted ACE experiments using a solar salt pool and brines with various chemical compositions without any additional elements. We have conducted ACE experiments us-