

# Mitigating Environmental and Health Risks Associated with Renewable Energy in Azerbaijan

*Parvana Babayeva*

Renewable energy is becoming an increasingly critical component of Azerbaijan's energy mix. The country has a moderately small but growing renewable energy sector, with wind and solar power projects underway. Azerbaijan's renewable energy sector is anticipated to play a main role in fulfilling the country's energy demands and decreasing its dependence on fossil fuels.

Azerbaijan has considerable potential in green energy, with proved offshore wind potential of 157 gigawatts, onshore wind and solar potential of 27 gigawatts, and up to 10 gigawatts of wind and solar potential in the liberated territories. The Nakhchivan Autonomous Republic also has considerable potential, with negotiations underway to build a 500-megawatt solar power station. Azerbaijan is currently executing two investment projects in solar and wind power generation with Masdar and ACWA power, totaling 470 megawatts, and another project with BP for 240 megawatts in the Jabrayil district. Besides, Azerbaijan has signed MoUs and agreements with three major energy companies to construct up to 25 gigawatts of renewable energy offshore and onshore, solar, and wind, with an additional 2.5 gigawatts to be signed and implemented. This presents a huge opportunity for Azerbaijan to develop consequential renewable energy capacity.

However, the production and disposal of solar panels and wind turbines can also have harmful environmental and health influences. For instance, the production of solar

*Parvana Babayeva is a Senior Engineer in the Science and Technology Division of Ekol Engineering Services CJSC. She formerly worked as a Senior Engineer in the Science and Technology Division of SOCAR's Ecology Department. She holds a master's degree in energy science and policy from Ajou University in South Korea, a master's degree in environmental chemistry from Baku State University, and a bachelor's degree in chemistry from Baku State University. She is on the roster of experts for the United Nations Framework Convention on Climate Change (UNFCCC). The views and opinions expressed herein are solely those of the author.*

panels involves the application of toxic chemicals such as cadmium and lead, which can have harmful effects on human health and the environment if not handled appropriately. Likewise, the disposal of wind turbines can generate hazardous waste and contribute to environmental degradation.

To mitigate these risks, relevant policies and regulations need to be executed. This IDD analytical policy brief will outline recommendations for addressing the environmental and health risks associated with renewable energy production and use in Azerbaijan, on the basis of foreign best practices and the like.

## *Environmental Risks of Renewable Energy*

Solar panels' production involves the application of toxic chemicals such as hydrochloric acid, sulfuric acid, nitric acid, hydrogen fluoride, trichloroethane, and acetone. The disposal of these panels also forms an environmental risk. Besides, wind turbines' production involves the application of rare earth elements and fiberglass, which also have adverse environmental impacts.

The following potential risks should be considered during the implementation of green energy projects:

- Large-scale wind and solar projects can disrupt natural habitats, fragment ecosystems, and have significant influence on wildlife populations. This is particularly true in Azerbaijan, where many unique and endangered species are found.
- Wind and solar projects require large amounts of land, which can lead to the conversion of natural habitats and agricultural land into industrial sites. This can impact local ecosystems and communities, as well as disrupt food production and other land-based activities.
- Both wind and solar projects require significant amounts of water, particularly during the construction and maintenance phases. This can put pressure on local water resources, which are already strained in many parts of Azerbaijan. Additionally, the production of solar panels and wind turbines can result in water pollution if toxic chemicals are not properly managed.
- Renewable energy technologies generate waste and require careful management to avoid environmental impacts. For example, solar panels contain toxic materials that require special handling and disposal procedures. Similarly, wind turbines generate waste in the form of broken or worn-out blades, which can be difficult to recycle or dispose safely.
- Wind and solar projects can have significant visual impacts on landscapes, which can be particularly concerning in areas that rely on tourism or have cultural significance. Additionally, some communities may view renewable energy infrastructure as an intrusion on their way of life or cultural values.

- Wind turbines have been known to cause bird and bat fatalities, particularly in areas where migratory species are present. Additionally, solar panels can produce heat islands that impact local insect and bird populations.

While renewable energy technologies offer many advantages, they also come with environmental risks that must be carefully managed. In Azerbaijan, it will be essential to balance the potential advantages of renewable energy against these risks, considering the unique ecological and social context of the country.

### *Health Risks of Renewable Energy*

In addition to the risks associated with the production of renewable energy technologies, there are also health risks associated with the operation and maintenance of renewable energy installations in Azerbaijan. The application of toxic chemicals in solar panel production poses a health risk to workers. Silicon dust, which is generated during the production process, is a hazard to workers and can induce respiratory problems. Besides, rare earth elements used in wind turbines also pose a health risk to workers. For instance:

- Wind turbines induce noise pollution, which can cause sleep disturbance, annoyance, and hearing impairment. Investigations have shown that protracted exposure to high levels of noise can increase the risk of cardiovascular disease, stroke, and other health problems.
- Solar panels and wind turbines induce an electromagnetic radiation, which can cause interference with medical devices, such as pacemakers, and may also have unfavorable health effects on workers and nearby residents.
- Hydroelectric power plants can cause water pollution if they are not adequately maintained. Leaks and spills from the dam and the power plant can contaminate water sources and harm aquatic life, posing a risk to human health if the water is consumed or used for irrigation.
- Workers who install and maintain solar panels are at risk of heat stress, particularly in hot weather conditions. Protracted exposure to high temperatures can lead to heat exhaustion, heat stroke, and other heat-related illnesses.
- The production of biofuels and biomass energy can involve exposure to hazardous chemicals, such as pesticides and herbicides, which can pose health risks to workers and nearby residents.

While renewable energy technologies have the potential to offer many advantages to Azerbaijan, it is necessary to carefully consider and address the potential health risks associated with their production, operation, and maintenance to ensure that they are sustainable and profitable in the long term.

## *Investment in Research and Development*

Promoting investment in research and development is crucial to decreasing the amount of toxic chemicals utilized in the production of solar panels. Incentivizing research on to develop less hazardous alternatives to the chemicals presently utilized in the production process would be useful. Through regulatory intervention, relevant government bodies could not only positively impact upon decreasing the adverse environmental influence of solar panel production but also improve the health and safety of workers involved in the manufacturing process. There are some potential strategies that relevant state organs could adopt to encourage investment in research and development and incentivize the development of less hazardous alternatives:

- The provision of grants, loans, or tax breaks to companies and research institutions that are working on designing less toxic chemicals and materials for solar panel production. This funding could also support study into more efficient manufacturing processes and supply chain optimization.
- The promotion of cooperation between research institutions and industry stakeholders to foster innovation and expedite the improvement of safer and more sustainable manufacturing practices.
- The setting of industry standards that require companies to decrease the amount of toxic chemicals utilized in solar panel production. These standards could also incentivize companies to adopt safer and more sustainable manufacturing practices.
- Partnering with private companies to fund and improve more environmentally friendly materials and processes for solar panel production. This could include joint research and development projects, as well as the sharing of knowledge and resources.
- The raising of consumer awareness about the environmental influence of solar panel production and the advantages of utilizing less toxic materials. This could support the establishment of a market demand for safer and more sustainable solar panels, which could incentivize companies to invest in research and development.
- The provision of tax incentives to companies that produce and utilize less toxic materials in solar panel production. This could support to lower the costs associated with the development of safer and more sustainable manufacturing processes.
- Investments in education and training programs to support companies and workers transition to more sustainable manufacturing practices. This could include training programs for workers to learn how to utilize less toxic materials and manufacturing processes, as well as educational programs for business owners and managers on the advantages of sustainable manufacturing.

By executing these strategies, Azerbaijan could encourage investment in research and development and incentivize the development of less hazardous alternatives for solar panel production. This could support to decrease the environmental influence of solar panel production and promote more sustainable manufacturing practices in the renewable energy industry.

## *More fully Develop a Waste Management Plan*

Key elements of the infrastructure for renewable energy sources are solar panels and wind turbines. But if not properly managed, these might eventually become a source of waste that themselves threaten the environment. Therefore, it is crucial for a country like Azerbaijan to more fully develop a waste management strategy that tackles how to dispose of these items in a way that has the least possible negative effects on the environment. The following should be taken into account by those tasked with revising the country's waste management plan:

- Before drafting an updated waste management plan, it is critical to comprehend the environmental impact that solar and wind energy systems have over the course of their whole lives cycles. Raw material extraction, production, shipping, installation, maintenance, and end-of-life disposal should all be considered in this evaluation. The most important areas for improvement can be determined by deepened understanding of the environmental impact of each stage.
- The recyclability of the materials used should be taken into account by manufacturers when developing solar panels and wind turbines. For instance, they must refrain from employing materials that are challenging to recycle, including specific plastics or composites. Additionally, they ought to make the parts easy to disassemble and recycle.
- Manufacturers should institute a take-back program so that solar panels and wind turbines are appropriately disposed and repurposed once their useful lives have expired. Incentives for customers to recycle their old solar panels or wind turbines might be part of this initiative, along with collaborations with recycling facilities to ensure that the materials are recycled sustainably.
- State participation in the development of the infrastructure to handle these materials is required to promote the recycling of wind turbines and solar panels. Among these might be facilities for specialist recycling that are set up to handle the particular materials utilized in these technologies. Public funds should also be spent on research to develop new recycling methods that can manage the intricate materials used in wind turbines and solar panels.
- Finally, it is critical to inform customers about the value of properly disposing of wind turbines and solar panels. Many people are not fully informed about how these technologies affect the environment and might not know how to properly dispose of them. State regulatory bodies can ensure that these items are appropriately managed and recycled by teaching citizens about the value of recycling and by outlining precise disposal procedures.

An all-encompassing strategy that considers the full lifecycle of these technologies is necessary when developing a waste management strategy for solar panels and wind turbines. The state can reduce the environmental impact of these technologies and make sure they support a sustainable future by designing for recyclability, instituting a take-back program, establishing recycling infrastructure, and educating the public.

## *The Use of Non-Toxic Materials in Wind Turbine Production*

The environmental impact of producing wind energy can be minimized through the use of non-toxic materials. In order to promote the use of non-toxic materials in wind turbine production and encourage the production of less dangerous alternatives, the state should adopt the following actions:

- Conduct a thorough analysis of the existing materials used in wind turbine production and any potential negative effects on human health and the environment. The hazards and effects connected to the production, consumption, and disposal of these materials should be evaluated as part of this review. Specific materials and procedures that should be targeted for improvement or replacement can be identified using this information.
- Establish a legal framework that supports the use of non-toxic materials in the manufacture of wind turbines. This framework should establish requirements for using particular products and procedures and encourage the application of less harmful substitutes. For instance, it could contain financial rewards for businesses that utilize non-toxic materials or sanctions for those that keep using hazardous materials.
- Establish a public-private cooperation mechanism to aid in the study and adoption of less dangerous production methods for wind turbines. State bodies, companies that make wind turbines, and educational institutions could be part of such a cooperation mechanism. Funding from various sources could be harnessed for the development of less harmful new materials and technologies as well as for their testing and certification.
- Provide producers of wind turbines instruction and training on the use of non-toxic materials and procedures. This might involve instruction on safe handling and disposal procedures for dangerous substances as well as the advantages of utilizing non-toxic substitutes. Additionally, resources and tools might be made available to manufacturers to aid in the shift to non-toxic products and procedures.
- Engage stakeholders in a dialogue meant to emphasize the value of producing wind turbines with non-toxic materials. This could involve educating the general people, advocacy organizations, and other stakeholders on the advantages of choosing non-toxic substitutes and the potential negative effects of using hazardous materials on their health and the environment.
- Share best practices and information on the use of non-toxic materials and procedures, encourage cooperation between wind turbine producers. The development of industry-wide standards for the use of non-toxic products and procedures as well as protocols for the handling and disposal of hazardous materials could fall under this category.

These steps may encourage the use of non-toxic materials in the manufacture of wind turbines and promote the establishment of less risky substitutes. State and public

institutions may assist the development of the renewable energy sector in their respective countries while promoting a safer and healthier environment for both workers and communities by decreasing the usage of hazardous products.

## *Occupational Health and Safety Regulations*

The risk of worker exposure to hazardous chemicals and substances increases along with the production and installation of solar panels and wind turbines. Injurious health effects from exposure to these compounds include cancer, neurological impairment, and respiratory issues. To safeguard employees in this sector, it is essential to design and enforce comprehensive occupational health and safety standards.

The following steps should be taken into consideration in this regard:

- At the onset, identify the various dangers and hazards that employees may encounter on the job in order to safeguard them properly. This entails carrying out a thorough analysis of the manufacturing and installation procedures for solar panels and wind turbines, identifying the dangerous chemicals and materials used, and evaluating the hazards related to exposure to these materials.
- Establish strict guidelines for the maximum allowed exposure limits for workers based on the hazard assessment. This should consider both the potential long-term consequences of chronic exposure as well as any potential short-term consequences of exposure.
- Take measures to ensure employees have the appropriate protective gear and training to reduce their risk of exposure after the dangers have been recognized and standards have been established. This entails outfitting employees with the proper respirators, gloves, and other safety gear and instructing them on how to use it safely and effectively.
- Implement constant monitoring and evaluation of workplace conditions and employees' health in order to guarantee the efficacy of occupational health and safety legislation. This entails routine air quality inspections and monitoring, worker health monitoring, and routine medical examinations to look for any early warning indications of potential health issues.
- Establish, implement, and enforce penalties for employers that violate occupational health and safety regulations.

To safeguard workers in the renewable energy sector from exposure to dangerous substances, it is crucial to design and enforce strict occupational health and safety laws. The hazards can be reduced and workers in this profession can work safely and without fear of damage by taking the necessary precautions.

## *Personal Protective Equipment*

It is crucial to offer personal protective equipment (PPE) that successfully lowers workers' exposure to harmful chemicals and silicon dust in order to secure their safety while producing solar panels and wind turbines. Respirators, gloves, goggles, and protective clothes are some examples, although they are not the only ones. Employers need to be required to supply PPE that satisfies or exceeds industry requirements and to make sure that employees have received training on how to use and maintain them. To ensure that workers are sufficiently protected, regular evaluations of the PPE program's performance should be done. The following steps should be taken into consideration in this context:

- A crucial first step in lowering workers' exposure to harmful chemicals and silicon dust is to provide PPE for them. Respirators, gloves, goggles, and protective clothes are a few examples of PPE. These products aid in preventing hazardous substance exposure by inhalation, skin contact, and eye contact, which can result in major health issues like lung disease, cancer, and other respiratory ailments.
- Prior to supplying PPE to employees, it is critical to evaluate the individual workplace risks and choose the right PPE for each job task. Hazard assessments, work hazard analyses, and exposure monitoring can all be used to achieve this. Employers can determine the right PPE type, the necessary level of protection, and the frequency of use by conducting these assessments, on the basis of suitable guidelines.
- It is crucial to outfit employees with PPE suitable for their job duties and any potential hazards at work. For instance, a respirator that works well to guard against dust might not be the best choice to protect against vapors or gases. Workers should have PPE that is effective against the specific risks they are exposed to from their employers.
- It is insufficient to only provide PPE to employees. The proper use of PPE, including how to put it on, take it off, and maintain it, must be taught to employees. Workers should be given PPE that fits them well and is comfortable to wear since PPE that is uncomfortable or poorly fitted may not be used as intended.
- Having PPE available is only one component of establishing a safe workplace. Employers should also promote safe workplace practices, offer training on recognizing and avoiding hazards, and routinely evaluate and update their safety rules and procedures in order to foster a culture of safety.
- To ensure that workers are receiving enough protection, PPE efficacy must be regularly assessed. Exposure monitoring and assessing the potency of PPE against certain threats can accomplish this. Employers should take steps to find the source of the issue and implement fixes if PPE is shown to be ineffective.

Properly encouraged, employers ought to be able to ensure their workplaces are safer and healthier for their staff by taking the foregoing actions.



## *Develop and Implement a Comprehensive Training Program*

All employees involved in the handling and disposal of harmful materials should receive thorough training from an appropriate organ of the state, which should establish and implement the program. The safe handling and disposal of these products should be included in this program, along with the appropriate use of personal protective equipment, storage practices, spill response procedures, and disposal techniques. All workers who handle toxic chemicals, including new hires, should receive training, which should be constantly updated to take best practices and new legislation into account. The safety of employees and reduction of the likelihood of environmental harm from improper handling of toxic materials can be ensured by putting such a training program into place. The following steps should be taken into consideration in this regard:

- Determine the potential hazards of the specific hazardous substances that are present at work. A hazard assessment or material safety data sheets (MSDS) can provide this information.
- Produce educational materials that cover the particular risks related to each dangerous substance. Written materials, films, and interactive training sessions are examples of such resources.
- Make a training program that guarantees all employees receive the required instruction prior to being exposed to dangerous materials.
- Periodically repeating the training is advised to solidify the acquired knowledge and abilities.
- Make certain that every employee receives practical instruction in the safe handling and disposal of harmful materials. Before using the actual dangerous materials, this can involve giving presentations and practicing with non-toxic items.
- Establish a mechanism to monitor and record the training that each employee has completed. Sign-in sheets, training records, and computerized records are examples of this.
- Evaluate the training program on a regular basis to find areas that need improvement. This can include comments made by staff members, instructors, and managers.

By putting these procedures in place, the instituted training program would adequately instruct employees on the safe handling and disposal of harmful chemicals, lowering the chance of workplace accidents and injuries.

## *A Necessary Step*

Investments in research and development can help to reduce potential environmental and health dangers linked to renewable energy technologies, which are advancing quickly. Azerbaijan can make sure that it is using the most effective and eco-friendly technologies for its renewable energy production by investing in R&D.

There are numerous instances abroad of effective research and development projects in renewable energy that have aided in reducing threats to the environment and human health. For instance, a study by the International Energy Agency (IEA) revealed that the health of people is not significantly impacted by wind power. Similar to this, studies done by the U.S. National Renewable Energy Laboratory (NREL) have helped to lessen the negative effects of solar energy production on the environment.

There are already several projects to invest in the R&D of renewable energy in Azerbaijan. For instance, the Azerbaijan National Academy of Sciences is now studying how the country uses renewable energy sources like solar and wind energy. Additionally, the Azerbaijan Renewable Energy Agency is promoting the growth of renewable energy in the nation through initiatives in research and development.

Azerbaijan can further mitigate any potential environmental and health dangers linked with the technology by investing in R&D for renewable energy. This will make it more likely that the country can achieve its targets for renewable energy in a sustainable and responsible manner.