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BEATING THE HEAT

PROTECTING WIND-ENERGY WORKERS FROM CLIMATE CHANGE

It is critical for wind-energy companies to act now to confront the growing threat of heat-stress injuries to protect workers and stay competitive. (Courtesy: Shutterstock)



By combining acclimatization protocols, wearable technology, weather-based work modifications, and heat safety training, employers can minimize the risks to workers' health and productivity.

By KYLE HUBREGTSE and NICK HERNANDEZ

As the world transitions toward renewable energy to combat climate change, the wind-energy sector has seen remarkable growth in recent years. Wind farms, both onshore and offshore, are rapidly expanding to harness the power of wind and generate clean electricity. However, this surge in development is exposing a growing number of workers to the hazards of rising temperatures and heat-stress injuries exacerbated by a warming climate.

Heat-related illnesses (HRIs) pose an increasing threat to the health, safety and productivity of workers in the wind-energy industry. Outdoor workers, including those involved in the construction, operation, and maintenance of wind turbines, are at the highest risk. As global temperatures climb, the number of excessively hot days workers must endure is also on the rise. In the United States alone, outdoor workers are expected to experience a three- to four-fold increase in the number of days with a heat index above 100°F (38°C) by mid-century. This means more frequent exposure to dangerous heat conditions that can lead to a range of HRIs if not properly managed.

HEAT-STRESS SYMPTOMS

Heat stress occurs when the body is unable to adequately cool itself, resulting in rising core temperature. Early symptoms include heavy sweating, headache, dizziness, fatigue, and muscle cramps. If untreated, heat exhaustion can rapidly progress to potentially fatal heat stroke, marked by confusion, loss of consciousness, and dangerously high body temperature above 104°F (40°C). Even when not life-threatening, the physical and cognitive effects of heat stress can be debilitating for workers.

Physically, workers suffering from HRIs experience reduced strength, coordination, and work capacity. The strain of thermal stress on the cardiovascular system leads to decreased blood flow to muscles and the brain. This impairs physical performance and increases the risk of accidents and



The latest smart PPE innovations include devices worn by workers to monitor physiological indicators such as core body temperature, heart rate, and activity level. (Courtesy: Kenzen)

injuries from fatigue, dizziness, and impaired balance. Repetitive physical tasks common in wind-farm construction and maintenance become more difficult and dangerous in the heat.

Prolonged or repeated heat stress also takes a considerable toll on workers' cognitive abilities, raising the risk of errors, accidents, and injuries. Studies show heat impairs attention, memory, information retention, and complex problem-solving — all critical skills in the technical work of the wind industry. Mental fatigue and difficulty concentrating can cause workers to make mistakes, overlook safety procedures, or misjudge risks. For workers operating at heights, near high voltage, or with heavy machinery, momentary lapses from heat-dulled thinking can prove disastrous.

AFFECTING THE WORKFORCE AS A WHOLE

Left unchecked, the impacts of heat stress go beyond individual worker health and safety to affect overall workforce productivity and companies' bottom lines. Physical and mental efficiency significantly decline as temperatures rise, slowing work output. One study estimates that by 2030, the U.S. may lose nearly \$40 billion in labor productivity annually from extreme heat exposure for outdoor workers. The wind industry is not immune to such losses.

Additionally, as climate change makes heat waves more frequent and intense, companies must prepare for higher rates of absenteeism when conditions become too extreme for safe work. Replacing sidelined workers and training new hires is costly. There are also financial impacts from reduced output, project delays, and higher insurance premiums to cover heat-related workers comp claims. Cumulatively, these effects can hamper companies' ability to complete projects on time and on budget to meet the growing demand for wind energy.

Fortunately, with proper awareness, planning and interventions, HRIs are largely preventable. A key strategy is acclimatizing workers to hot conditions. Acclimatization is a physiological adaptation that occurs over days to weeks of controlled heat exposure, resulting in increased tolerance and a lower risk of heat illness. The body adapts by starting to sweat sooner and more profusely, increasing skin blood flow, and decreasing cardiovascular strain and core temperature at a given workload.

IMPLEMENTING PREVENTATIVE MEASURES

Employers should implement acclimatization protocols for new and returning workers at the start of the warm season or upon transferring from cooler climates. OSHA rec-



Wearable technology allows objective, individualized monitoring of workers' heat stress even when environmental heat measurements are within acceptable limits. (Courtesy: Kenzen)

ommends starting at 20 percent of the usual duration and intensity of work in the heat on Day 1 and gradually building up to 100 percent over one to two weeks. Regular breaks in the shade and ample hydration are also crucial. Acclimatized workers demonstrate marked improvements in work capabilities in the heat. Studies estimate that acclimatization increases productivity by 20 to 90 percent compared to an unacclimatized state.

It's important to note that acclimatization has its limits and does not provide total protection in extreme heat waves when temperatures spike suddenly. During heat waves, even stringent precautions may be inadequate to continue work safely, and it may be most prudent to halt work until conditions improve. Employers should develop heat safety plans that include monitoring weather conditions, adjusting work schedules, and setting clear weather-related work/rest thresholds.

Another promising tool for protecting workers and enhancing productivity is wearable technology. The latest smart PPE innovations include devices worn by workers to monitor physiological indicators such as core body temperature, heart rate, and activity level. This real-time data can alert workers and supervisors when heat strain approaches dangerous levels, so timely interventions can be taken. By

analyzing this data and employing predictive algorithms, wearable technology offers personalized recommendations on when to rest, hydrate, or seek shade, thus preventing HRIs before they occur.

WEARABLE MONITORING TECH

Kenzen has developed an innovative solution that provides real-time warnings to workers as they near hazardous levels of heat exposure, ultimately boosting comprehensive heat-stress management among the workforce. This continuous physiological monitoring system, worn inconspicuously on the upper arm, uses a personalized algorithm that considers diverse individual factors to accurately predict core body temperature. In addition to alerting workers through haptic vibrations emitted by the device, the system enables safety managers to monitor workers in the field via a user-friendly team dashboard. Furthermore, from a managerial standpoint, Kenzen supplies invaluable data-driven insights that can inform and shape future decision-making strategies.

Wearable technology allows objective, individualized monitoring of workers' heat stress even when environmental heat measurements are within acceptable limits. This is important because there is no one-size-fits-all heat stress threshold. Workers' susceptibility to heat varies based on fac-



If data consistently shows workers reaching heat-strain thresholds by mid-morning, supervisors can adjust schedules to shift more work to cooler early morning hours. (Courtesy: Kenzen)

tors such as age, underlying health conditions, medications, and acclimatization status. A huge advantage of wearables is the ability to track each worker's personal physiological tolerance to set individualized work/rest schedules and maximize safe productivity.

Wearables also drive productivity by enabling workers to safely work closer to their limits while still avoiding heat illness. In the past, generic guidelines based on environmental conditions alone required workers to follow overly conservative work/rest schedules, sacrificing output. Now, with continuous physiological feedback, workers can minimize breaks when not under heat strain and take necessary breaks when their personal tolerance dictates, optimizing output while working safely.

Additionally, data from wearables can reveal opportunities to improve productivity through targeted interventions. For example, if data consistently shows workers reaching heat-strain thresholds by mid-morning, supervisors can adjust schedules to shift more work to cooler early morning hours. If data indicates certain teams or work sites experience more heat stress, focused training can be delivered. By leveraging the data, companies can implement practical changes to simultaneously boost productivity and reduce heat illness risks across entire sites and organizations.

SMART BUSINESS STRATEGY

It is critical for wind-energy companies to act now to confront the growing threat of heat-stress injuries to protect workers and stay competitive. Employers who fail to take the risks seriously will find it increasingly difficult to recruit and retain skilled workers. Reports of workers falling

ill on the job erode morale, increase turnover, and deter new talent from entering the field. In contrast, employers who demonstrate leadership in heat-illness prevention can position themselves as employers of choice better able to attract and retain a thriving workforce.

Investing in heat-stress prevention is also a smart business strategy for fueling company growth. An employer's reputation for safety directly affects its ability to win contracts and investment dollars to expand.

On the global stage, renewable-energy projects are increasingly being evaluated on environmental, social, and governance (ESG) criteria that include worker welfare. Companies that score high on worker protection are more likely to secure lucrative contracts and financing to grow their operations.

The time to normalize heat-stress prevention across the wind industry is now. By combining acclimatization protocols, wearable technology, weather-based work modifications, and heat safety training, employers can minimize the risks to workers' health and productivity. Proactively implementing best practices for heat safety will help companies gain a competitive edge to continue to meet the world's growing demand for clean wind energy, even in a warming climate. When it comes to protecting workers from heat, an ounce of prevention truly yields a pound of clean-energy production. ✌

ABOUT THE AUTHORS

Kyle Hubregtse is Chief Executive Officer with Kenzen. Nick Hernandez is Global Accounts Manager with Kenzen. For more information, go to kenzen.com