BAT DETERRENT SYSTEMS

A TURNKEY SOLUTION FOR THE WIND INDUSTRY

NRG Systems

Better Energy by Every Measure®

THE VALUE OF SAVING BATS

NRG Systems developed its pioneering bat deterrent technology to significantly reduce bat take while minimizing the need to curtail. By keeping turbines in operation more of the time, we help preserve annual energy production (AEP), protect the financial viability of wind projects, and maximize ROI.

NRG Systems®

REDUCE CURTAILMENT, MAXIMIZE OUTPUT

Some of the most effective bat mitigation methods involve curtailing or stopping wind turbines – a practice that reduces energy output. NRG Systems understands that this is not an ideal option for wind plant operators or for winning the fight against climate change. NRG's Bat Deterrent Systems have been shown to significantly reduce bat take while minimizing the need to curtail, meaning operators can produce more renewable energy more of the time while keeping bats out of harm's way.

DATA-EMPOWERED OPERABILITY

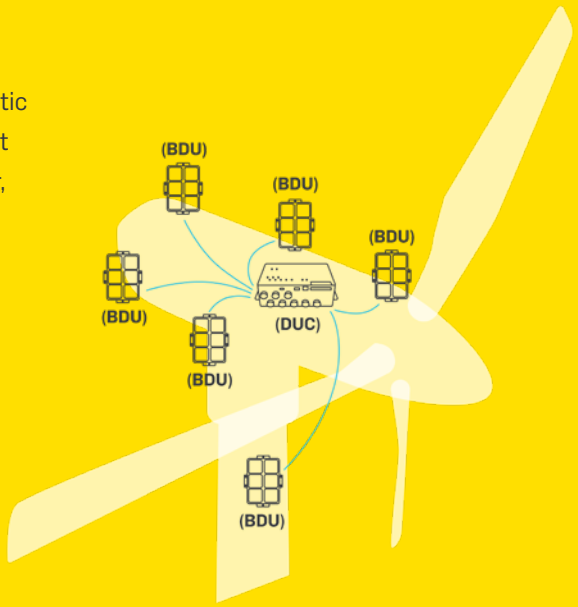
To ensure that deployed Bat Deterrent Systems are operating as expected, NRG Systems remotely monitors the system health of all fielded units. Our systems come with out of-the-box global communication capabilities that leverage satellite connectivity to provide reliable, uninterrupted data access. This advanced feature enables operability peace of mind without the complexities of integrating with a wind plant's SCADA network.

A TURNKEY EXPERIENCE, BACKED BY UNPARALLELED SUPPORT

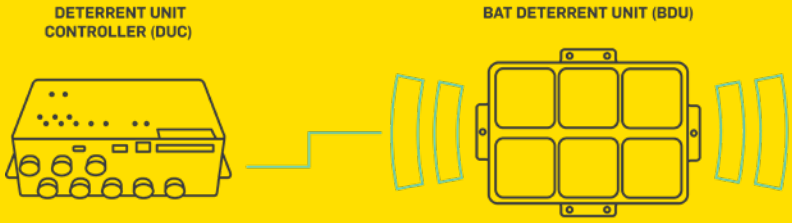
NRG Bat Deterrent Systems are designed to be turnkey, with unparalleled support from procurement through operation. Our team will work with all necessary stakeholders to determine the most effective system configuration for a project and support installation and commissioning, no matter where your project is located. Once units are deployed, our in-house data analysis and system reporting ensure worry-free operation, minimizing downtime and maintaining optimal energy production.

THE BAT DETERRENT SYSTEM

The NRG Bat Deterrent System includes multiple Bat Deterrent Units, each equipped with six solid-state ultrasonic speakers that emit a continuous acoustic signal spanning 20 kHz to 50kHz – the same frequency range used by many bat species for echolocation. The system also features a Deterrent Unit Controller, which enables real-time system control and monitoring.

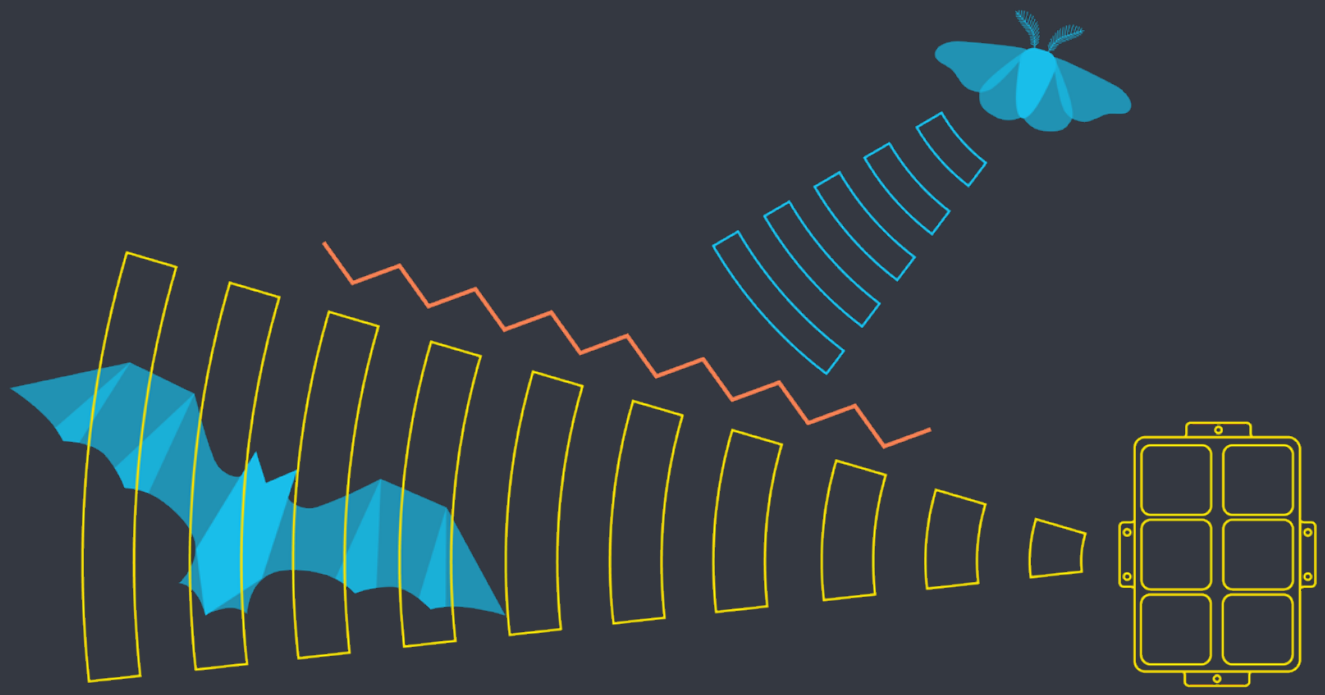


Locations of units for illustration purposes only. Multiple configurations are available.



HOW IT WORKS

The Bat Deterrent Systems emit an ultrasonic acoustic field in the same range as bats' natural calling frequencies.



When a bat enters the airspace where the deterrent units are operating, the ultrasound from the deterrent units (blue) will be louder than the echo return the bat is listening for (yellow). This effectively "jams" the bat's ability to hear its own return. If the bat cannot hear the echoes, it is unable to successfully forage and orient itself, so it chooses airspace without the ultrasonic noise and away from the turbine's rotor swept zone.

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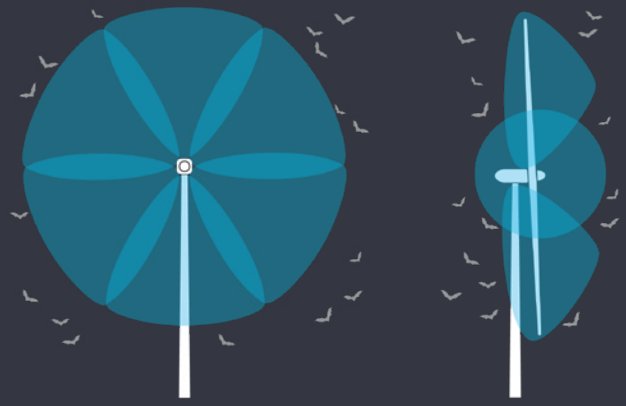
**For illustration purposes only.*

NACELLE PLUS TOWER-MOUNTED UNITS



NACELLE-MOUNTED UNITS

Inquire about system mounting options.

SYSTEM SPECIFICATIONS

Frequency Range	20kHz - 50kHz
Power	For 5 BDU System: 24 V DC, 10 A (240 W) Typical
System Control	• Discrete input • Modbus TCP • Modbus RTU • Configurable automated schedule
Temperature Range	Operating: 0˚ C to 50˚ C, Non-operating: -30˚ C to 70˚ C
Warranty	2 years or 3,000 operating hours
Design Life	10 years
Certifications	CE marked for EMC, RoHS, Safety
System Monitoring	Modbus TCP, Modbus RTU and/or optional web-based monitoring service
System Diagnostics	Automated Built-In Testing (BIT) with resolution down to an individual subarray

ONE SOLUTION. EVERY STEP COVERED.

Our end-to-end Bat Deterrent System includes:

- Expert system configuration tailored to site-specific bat activity and project requirements
- Comprehensive support spanning planning, training, installation, and long-term operation
- Out-of-the-box global communication using satellite connectivity for reliable, uninterrupted data – eliminating the need for SCADA network integration
- In-house data analysis and continuous monitoring, with regular system performance reporting that integrates securely into broader operational and environmental workflows for both internal and external stakeholders

91%

NRG Systems' Bat Deterrent Technology, Paired with Curtailment, Reduces Bat Fatalities at Wind Projects in Canada by Up to 91%

Natural Resource Solutions Inc., Canada, 2025

A PROVEN SOLUTION

NRG's Bat Deterrent System is backed by nearly a decade of field research and successful deployments worldwide. Trusted by many of the world's largest renewable energy developers, the system has been deployed at wind plants across North America, Europe, Asia, Africa, and Australia. By reducing bat fatalities while maintaining energy production, NRG's solution delivers measurable results and supports conservation without compromising performance.

A trial of NRG Systems' Bat Deterrent System at the Pilot Hill Wind Project in Illinois (EDF Renewables) resulted in a 67% overall reduction in bat fatalities. Even greater reductions were observed among species commonly impacted by wind energy, including a 72% reduction in Silver-haired Bats, 71% in Hoary Bats, and 94% in Big Brown Bats.

BACKED BY SCIENCE

The effectiveness of the NRG Bat Deterrent System has been validated through multiple independent studies in collaboration with leading organizations. These studies demonstrate the system's ability to reduce bat fatalities at wind energy facilities without compromising energy production.

WHITE PAPERS

- *Developing an Ultrasonic Acoustic Bat Deterrent System for the Wind Industry*
- *Efficacy of Acoustic Deterrence for Bat Occupancy of Highway Structures*
- *Exploring How Attenuation Affects NRG Systems' Bat Deterrent System*
- *First European Trial of NRG's Bat Deterrent System Shows Promising Results*
- *Validation Methodologies for NRG Systems' Bat Deterrent System*

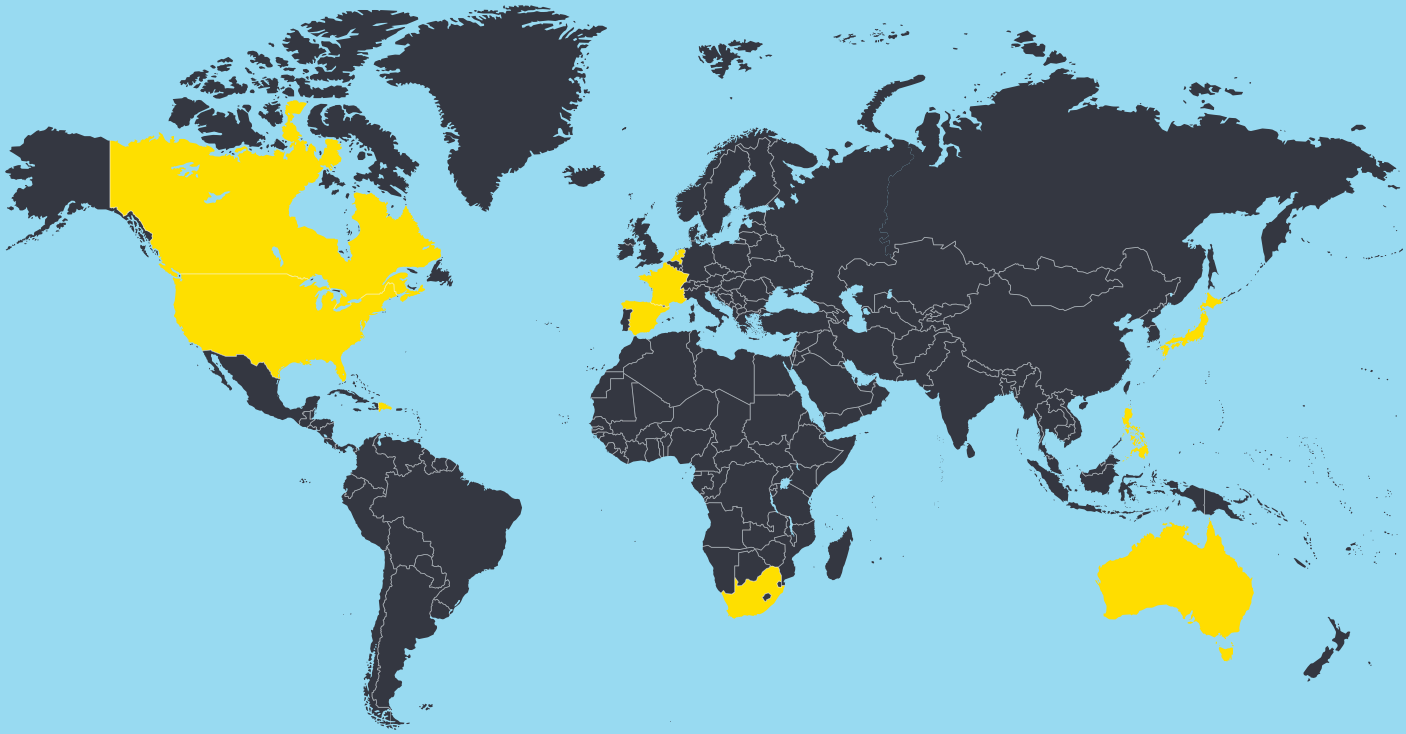
PRESS RELEASES

- *Bat Deterrent + Curtailment Reduces Bat Fatalities in Canada by Up to 91%*
- *67% Reduction in Bat Fatalities at Illinois Wind Plant*
- *54% Reduction in Bat Fatalities at Texas Wind Facility*

PEER-REVIEWED STUDIES

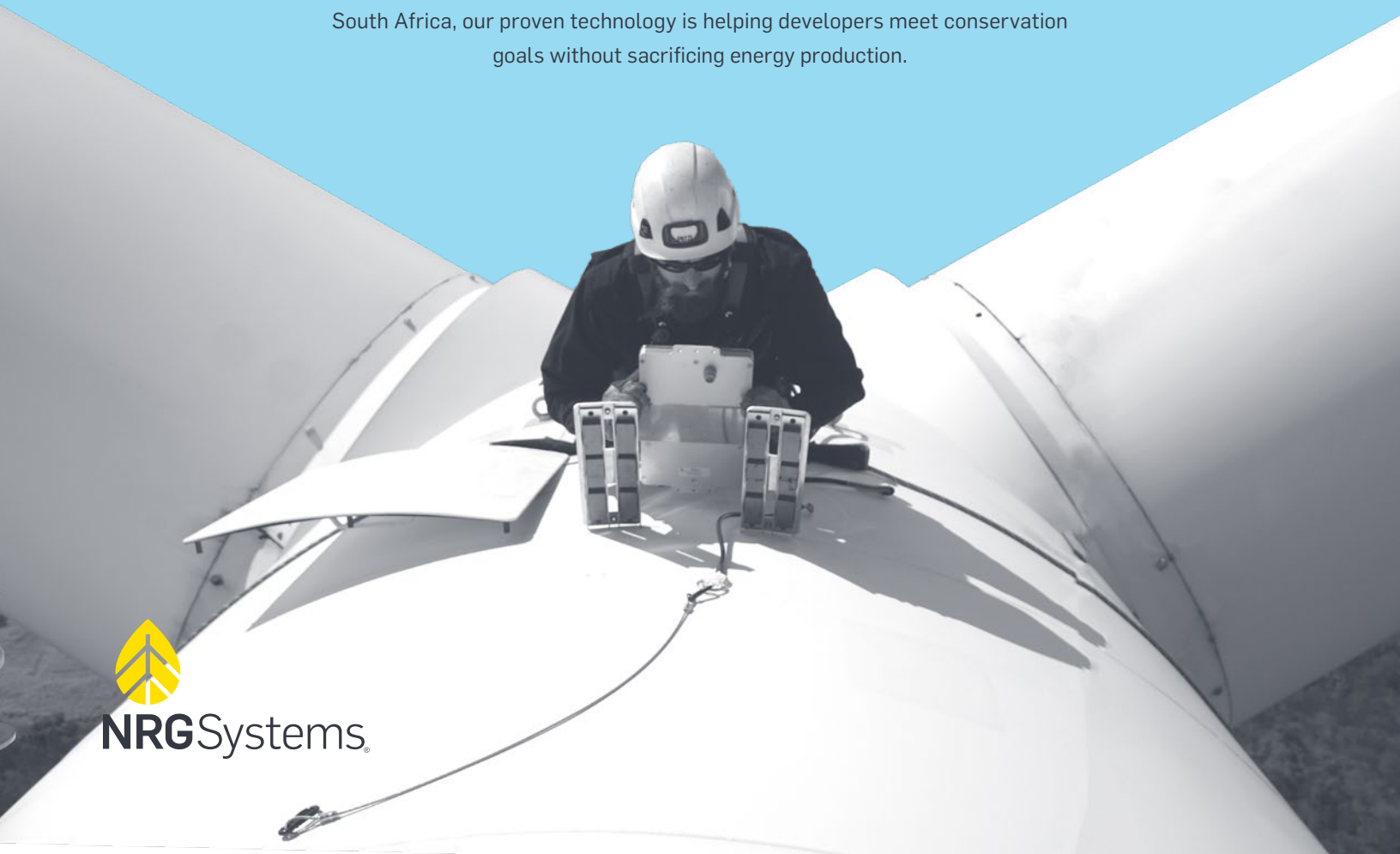
- *Bat Deterrent Field Trials (ScienceDirect)*
- *Efficacy of Acoustic Deterrents (Wiley)*
- *Bat Conservation International Report (Tethys)*
- *Engie European Study (Laborelec)*

NRG Systems has collaborated with leading organizations, including Duke Energy Renewables, EDF Renewables, Engie, Bat Conservation International, Texas State University, and Natural Resource Solutions Inc., to study and advance the effectiveness of acoustic deterrent technology.



OUR SYSTEMS ARE REDUCING BAT TAKE ACROSS THE GLOBE

NRG's Bat Deterrent Systems are making a significant impact at wind energy facilities worldwide. With installations in the United States, Canada, the Dominican Republic, Japan, the Philippines, Australia, Spain, France, the Netherlands, and South Africa, our proven technology is helping developers meet conservation goals without sacrificing energy production.



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SAVING WHILE SAVING

Protecting bats at wind energy sites supports both biodiversity and long-term project success. NRG's Bat Deterrent System aligns with global best practices for bat protection, complements regulatory requirements, and enhances environmental stewardship. While wind energy brings vital benefits to the planet, it can pose risks to bat populations. Our solution helps wind farms minimize those impacts, supporting wildlife conservation efforts while maintaining compliance and optimizing financial performance.

52%

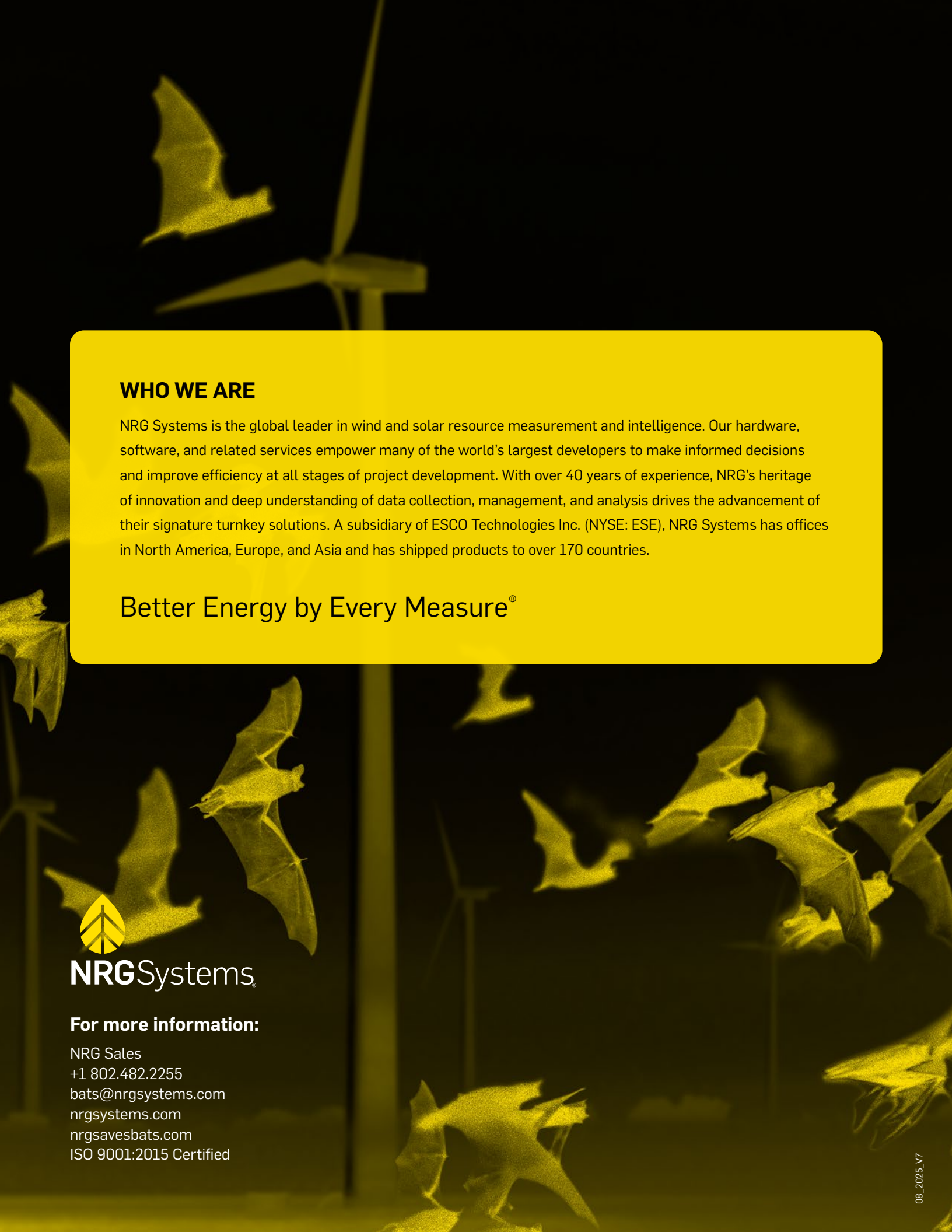
52% of bat species across the continent are at risk of severe population decline due to habitat impacts.

Bat Conservation International, State of the Bats Report, 2024

85%

Activating the NRG Bat Deterrent System reduced bat activity around the nacelle by 85% on nights when the deterrent system was active.

ENGIE, Belgium, 2019



WHO WE ARE

NRG Systems is the global leader in wind and solar resource measurement and intelligence. Our hardware, software, and related services empower many of the world's largest developers to make informed decisions and improve efficiency at all stages of project development. With over 40 years of experience, NRG's heritage of innovation and deep understanding of data collection, management, and analysis drives the advancement of their signature turnkey solutions. A subsidiary of ESCO Technologies Inc. (NYSE: ESE), NRG Systems has offices in North America, Europe, and Asia and has shipped products to over 170 countries.

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