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Deployable Wind Turbines for Resilient Operations

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Resilience Week 2020

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Defense and Disaster Deployable Turbine (D3T)

- **Funded by the US Department of Energy Wind Energy Technologies Office**

- **National Laboratory R&D Partners**

- **Brian Naughton**, Sandia National Laboratories – Project lead, system modeling and design, data integration, reporting.
- **Jake Gentle, Brad Whipple, Dylan Reen**, Idaho National Laboratory – DOD engagement, technology evaluation
- **Tony Jimenez, Robert Preus**, National Renewable Energy Laboratory – Industry engagement, technology evaluation

- **Stakeholders**

- 15+ Military offices involved with planning, testing, and procuring energy systems for bases.
- 20+ Distributed wind industry members with concepts and existing systems that could be adapted to military and disaster relief applications.
- Open to others. Contact: Brian Naughton bnaught@sandia.gov

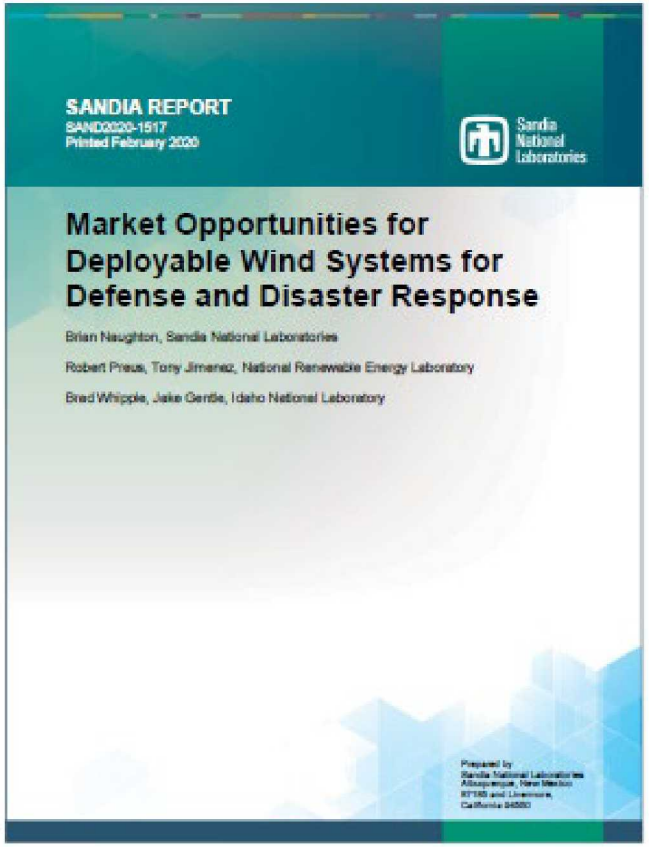
Project Objectives

- **Identify markets for deployable wind systems in defense and disaster response applications**
- **Develop design guidelines to increase value of deployed wind systems**
- **Facilitate engagement between industry and military stakeholder to test and deploy solutions**

Photo courtesy of US Army

Market Assessment for Deployable Wind

- Information gathered from recent military energy conferences, direct interviews with key military and industry stakeholders, and published documents
- Deployable wind market opportunities:
  - U.S. Army and Marine Corps dismounted warfighter systems ~1-3 kW range
  - U.S. Army systems to support contingency basing needs ~10-30 kW units also for use in domestic and international disaster response
- Strategically, the U.S. Military is shifting from the sort of longer-term base networks in the Middle East fighting insurgent adversaries to smaller, dispersed, more resilient units to defend against "near-peer" adversaries especially in the Pacific.
- Developing high-value deployable wind systems will need to consider metrics relevant to the types of military missions

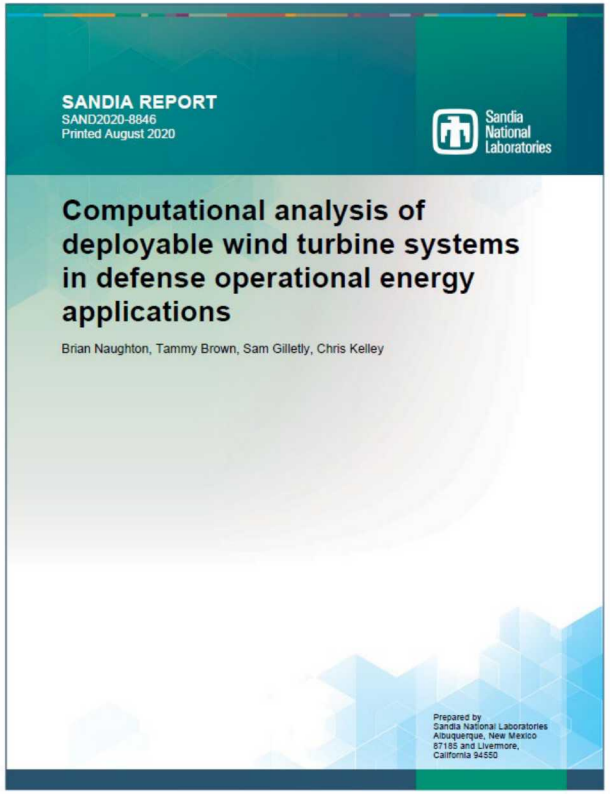


https://energy.sandia.gov/download/45834/

Measuring Value of Deployable Wind

Modeling and Simulation Tools can help estimate the potential value of an optimized deployable wind turbine

- Wind turbines were shown to reduce diesel fuel use between 22% and 83% and reduce the number of required convoy trucks between 5% and 26% over a 30-day mission.
- Lower benefits generally represent systems with commercial turbine designs, no battery storage and low wind resource, while increased benefits result from systems with optimized turbine designs in higher wind speed resources with battery storage.
- Optimization studies suggest that from a total transportation burden metric, wind turbines start to break-even on missions lasting longer than about 3 months in this particular mission profile.



Industry Stakeholder Engagement

- Over 20 interviews have been conducted with wind energy industry members regarding current products and concepts and interest in deployable wind systems
- A handful of companies have active discussions and a couple of funded efforts with the military to develop deployable wind systems, all in early stages
- We are also working to identify pathways to funded industry research, development and testing opportunities within the Defense Department
- We will continue to engage interested industry members in the development of the deployable wind design guidelines that we hope to release later this year

Military and Disaster Response Stakeholder Engagement

Most common feedback regarding wind energy includes:

- Signature concerns (radar, noise, visual)
- Variability & predictability of wind resource
- Simplicity of setup and operation
- Use comparative logistics metrics vs alternatives in the context of the mission
- Military is looking for energy system solutions, not independent technologies
- Military is moving towards open-protocol, interoperable microgrids (but still isn't there)

Good and bad experiences with wind energy were provided (more bad than good). It's important to learn from these experiences to understand what worked and what didn't so we don't repeat them.

Air Force Research Lab
Energy Assurance at Remote Radar Sites

Design Guideline Development

- **Commercial Systems**
- LCOE as primary objective
- Single deployment for 20+ years

Military & Disaster Response Applications

Deployable systems with logistics requirements

Compatible with base energy systems (microgrid)

Mission focused (resiliency, operational reach)

Richard Rice / Wind Turbine / CC BY-SA 2.0

Forward Operating Base Hammer, Iraq. Credit: USAF

Technology Development Opportunities

- Defense TechConnect Innovation Summit & Expo (November 17-19 2020)
  - Concept pitch opportunities to relevant DOD staff
  - Presentations from DOD offices regarding current interests and opportunities and resources for small businesses
  - Exposition floor and networking time with military and other industry member
  - Pre-conference workshop for technology innovators on navigating DOD

- Defense Department Small Business Programs
  - Small Business Innovative Research (SBIR) program
  - Rapid Innovation Fund (RIF) program
  - Air Force AFWERX program https://www.afwerx.af.mil/
  - Army small business resources https://osbp.army.mil/

- Partnering with system integrators for military and disaster response applications

- DOE Distributed Wind Competitiveness Improvement Project
  - https://www.nrel.gov/wind/competitiveness-improvement-project.html

Vision of Success

Near-term:

Public reports quantifying the market opportunity for and value of deployable wind systems in defense and disaster response applications

Identify the design space and technology gaps for optimized deployable wind systems.

Longer term:

Facilitate opportunities between DOD & industry to effectively develop technology solutions

Ultimate Vision:

US distributed wind energy industry is providing technology solutions for our deployed forces to meet their missions, safely and effectively