INL/MIS-24-76861-Revision-1

Distributed Wind for Commercial Loads

June 2024

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Changing the World's Energy Future

Idaho National Laboratory

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Prepared for the
U.S. Department of Energy
Under DOE Idaho Operations Office
Contract DE-AC07-05ID14517

Distributed Wind for Commercial Loads

Distributed wind can help meet on site energy and resilience needs for a wide variety of commercial loads.

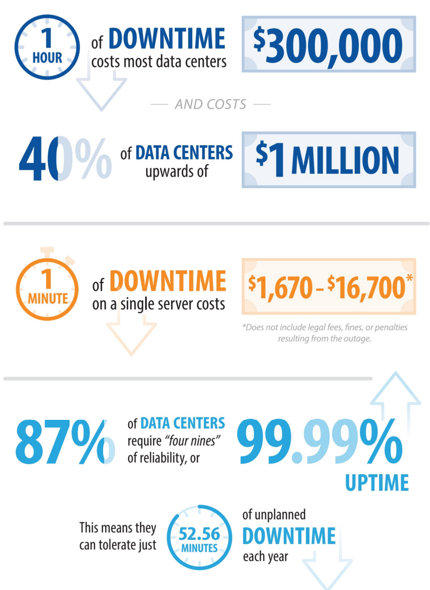
Wind technologies are often overlooked as distributed generation sources. Distributed wind projects can use a wide range of turbine sizes, from the small kilowatt scale up to multi-megawatt units interconnected on the distribution side of the electric grid. Distributed wind can serve a variety of functions both in front-of-the-meter and behind-the-meter applications that can contribute to local energy and resilience needs. Learn how this resource can support commercial loads below.

A Google data center in Eemshaven, the Netherlands, powered in part by distrubuted wind [1].

Commercial Load Energy Use

The commercial sector includes service-providing facilities and equipment. It includes federal, state, and local governments and other private and public organizations. In 2018, the United States had about 5.9 million commercial buildings. Of these, warehouse and storage buildings had the largest share of commercial buildings, followed by office buildings. Space heating is the largest driver of energy consumption in commercial buildings, followed by ventilation and lighting [2].

Commercial loads typically have clear daily and weekly trends, peaking during standard working hours and dropping over weekends, although this can vary depending on the specific facility [3]. Seasonal changes in load are driven by heating and cooling needs, but the types of functions performed by the commercial facilities will largely stay constant throughout the year.



By the numbers: A 2020 survey by the Information Technology Intelligence Consulting Corp (ITICC) found that costs of outages for data centers rise quickly due to high demands for reliability [4].

Commercial Resilience Needs

Many commercial loads, such as data centers, medical facilities, financial corporations, and military facilities, have specialized energy and resilience requirements. Interruptions in power to these types of facilities can cause significant losses for the organizations and those that depend on their services. Uninterrupted power, or at least smooth degradation, gives commercial loads time to respond to disruptions and ensure they can continue to operate critical processes.

For example, financial facilities may have irrecoverable transactions during an outage. Schools and universities may experience loss of education tools, missed instructions, student safety, damage to equipment or machinery, or interruptions of experiments. Data centers may experience lost data, corrupted files, or broken equipment. Depending on the service agreements, this could result in breaches of contract for the data availability promised to customers.

Critical impacts are felt in healthcare facilities too. They are impacted by the loss of heating and cooling, the loss of the ability to sterilize, failure of devices or machines, blackouts in rooms without emergency power, loss of water pressure, and even loss of signaling nursing staff for assistance. These consequences can quickly degrade the level of care a facility can provide.

Why Distributed Wind?

Distributed wind can help meet many of the energy and resilience needs of commercial loads. While it is a variable resource, it has predictable daily and annual production trends. The presence of on-site renewable generation can enhance resilience, supplying power for long periods of time without worrying about conserving fuel supply. The addition of properly sized storage or complementary solar resources can further reduce the challenges of intermittency and reduce the need for fuel-limited backup power during outage situations [5].

For commercial loads that have high sensitivity to power quality and momentary interruptions, the use of universal power supply (UPS) devices can be used to guarantee uninterrupted power during transitions. Facilities that can be designed to separate critical and noncritical loads may leverage smart building technologies to achieve resilience using distributed wind as a primary energy source, if grid-forming capabilities are designed, maintaining service to critical loads even if noncritical loads are interrupted during an energy provider outage.

Offsetting Carbon Footprints

Many commercial companies that are concerned with monitoring and reducing their carbon footprint may enter into power purchase agreements (PPAs), which allow them to buy the clean energy from an off-site renewable energy plant while still relying on the utility provider to maintain reliability. While managing on-site energy production is an extra step for commercial facilities to take, the on-site distributed wind promotes energy consumption that is directly supplied by clean energy and provides an alternative to diesel backups, which also require fuel maintenance. Even if on-site distributed wind is insufficient for large commercial applications on its own, it can supplement off-site PPA resources and provide a visible clean energy resource, enhancing public and community relations.

Wind can provide backup power in case of emergency, assuming the appropriate controls exist to manage an islanded microgrid. Additionally, distributed wind can help offset peak energy consumption, reducing energy bills for the commercial operation, and potentially providing benefits such as transmission congestion reduction to the local grid, depending on the network and limitations.

When Is Distributed Wind the Right Choice for a Commercial Load?

There are a few key things to evaluate to decide if distributed wind is a good candidate to support commercial loads:

Is there sufficient wind resource?

Before investing in distributed wind, a study should be conducted to determine if the wind resource is sufficient to generate the expected energy over the course of a year. The Wind Integration National Dataset (WIND) Toolkit is a good place to start. For smaller projects, modeled data may be enough to assess feasibility. Larger turbines may justify meteorological tower measurements, though these can be costly and time consuming to use.

Can the turbine(s) be sited locally to commercial loads?

Land use, building obstructions, terrain and siting permits must be considered to decide whether it is feasible to place a turbine in a location where it can connect to the local distribution system and serve the intended loads. Both behind-the-meter and front-of-the-meter installations may be used to support commercial loads. Land leasing is often an option to support siting in rural areas. Tools Assessing Performance (TAP) for Distributed Wind provides computational resources to assess siting constraints with local obstacles.

Is there feeder capacity for renewable generation?

Feeder capacity may be limited by power line sizing, transformer sizing, local regulation, or other constraints. The local utility can help determine if wind capacity can be added to a particular feeder.

Are there sufficient value streams?

Depending on the market, it may also be possible to bid into ancillary service markets using inverter functionalities to support grid stability. Consideration of all the potential uses of distributed wind, both in normal operating conditions and resilience scenarios, can help maximize the value of the project and help justify the investment.

References

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This work was supported by the Wind Energy Technologies Office (WETO).

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