



Why Invest in Decentralized Infrastructure?

Decentralized projects bring direct benefits to the communities where they are located by providing system **resilience** and local **revenues**, and they do it in a way that is **adaptable**, **ecological**, and **quick to roll out**. When compared to traditional centralized infrastructure, these common features make decentralized infrastructure particularly attractive as a long-term investment in a time of uncertainty.

Benefits:

Resilience - Decentralized infrastructure is particularly well adapted to crisis situations:

- Each project makes up only a small percentage of the entire system, limiting the disruption caused by shutdowns or failures.
- Projects that have been damaged by a natural disaster or technical fault can be identified, isolated, and repaired while the rest of the system continues to operate.
- Their smaller size makes decentralized infrastructure projects less attractive as targets for malicious attacks.

Revenues - While the economic benefits are similar for infrastructure projects regardless of scale, for the same cost decentralized projects can benefit a greater number of local communities than centralized projects. The benefits include:

- Taxes for the municipality
- Rent to local landowners
- Contracts for local businesses
 - All projects require construction, operations, and maintenance support, including electrical, civil, and road works. For centralized projects, their large scope often requires specialized crews that operate nationally, whereas decentralized projects can rely on local service providers.

Attributes:

Adaptable - Decentralized infrastructure solutions are often modular, and can be optimized to address the specific needs of the community and the site:

- Located close to the users, projects can be sized for local demand, minimizing the cost and disruption of upgrades to supporting infrastructure such as transmission lines and sewers.
- Decentralized renewable energy projects can sometimes be connected to the distribution grid, reducing their expense and complexity.
- Modular solutions can be scaled up or down as needed to respond to changes in demand, and upgraded as new technologies become available and affordable.

Ecological - All infrastructure projects bring some environmental costs as well as benefits. Being physically smaller than their centralized counterparts mitigates the ecological impact of decentralized projects in two key ways:

1. They take up less space, so the location of a decentralized project can be more easily shifted to avoid ecologically- or culturally-sensitive sites and minimize impact on wildlife.
2. They require less construction, resulting in:
 - A smaller total volume of materials used in the project itself, and proportionally less embodied energy; and,
 - Less expansion of supporting infrastructure, like roads, electrical transmission, or sewers, with the accompanying habitat loss.

Embodied Energy: the amount of energy required to extract, process and transport a material to the point of use or application.

Source: <https://www.sciencedirect.com/topics/engineering/embodied-energy>



Why Invest in Decentralized Infrastructure?

Quick to roll out - Their smaller size and modular nature make decentralized infrastructure solutions faster to implement than centralized solutions because:

- Permits are simpler to obtain
- Less equipment needs to be procured
- Less infrastructure needs to be modified

This results in:

- Reduced equipment rental and staff costs during construction and installation
- Reduced risk that changes in market dynamics or public perception affect project returns, as has happened with nuclear power and large-scale hydroelectric projects
- Ability to take advantage of new regulatory incentives

References and Further Reading

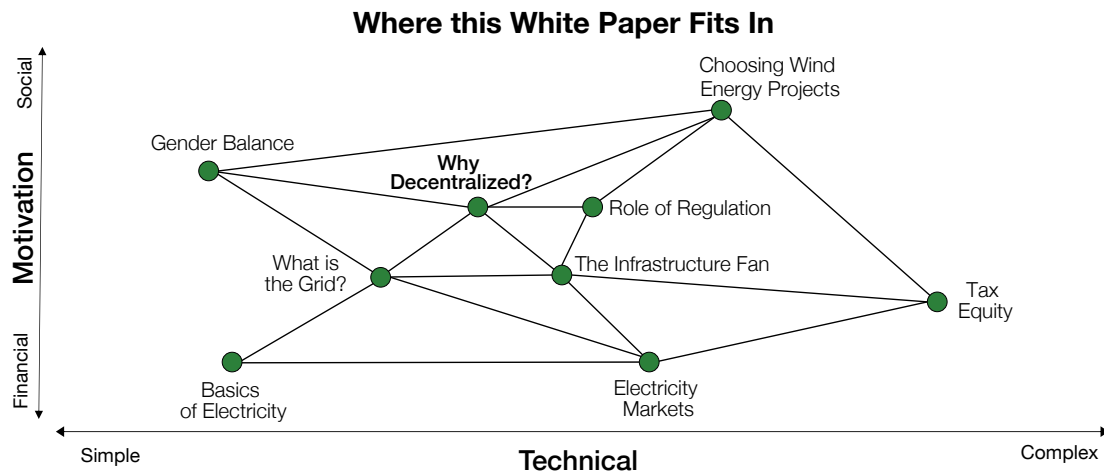
US Office of Energy Efficiency & Renewable Energy WIND Exchange, "Wind Energy's Economic Impacts to Communities" (2021): <https://windexchange.energy.gov/projects/economic-impacts>.

Charting New Waters, "Optimizing the Structure and Scale of Urban Water Infrastructure: Integrating Distributed Systems" *The Johnson Foundation at Wingspread*, (2014): https://www.johnsonfdn.org/sites/default/files/reports_publications/CNW-DistributedSystems.pdf

"Experts Make the Cyber Security Case for Distributed Renewable Energy" *Memoori*, (2018): <https://memoori.com/experts-make-cyber-security-case-distributed-renewable-energy/>.

Schneider, K. "Massive Infrastructure Projects Are Failing at Unprecedented Rates" *National Geographic*, (2017): <https://www.nationalgeographic.com/news/2017/11/mega-projects-fail-infrastructure-energy-dams-nuclear/>.

US DoE Office of Energy Efficiency and Renewable Energy, "Advantages and Challenges of Wind Energy." <https://www.energy.gov/eere/wind/advantages-and-challenges-wind-energy>.



About Treehouse Investments: Treehouse Investments is a minority-owned firm dedicated to addressing climate change. We are a family business, founded by a family from Puerto Rico. We target direct investments in both publicly traded and private entities. Our focus areas fall under the broad description of decentralized infrastructure: companies and projects that contribute to building sustainable and resilient energy, water, and waste systems.