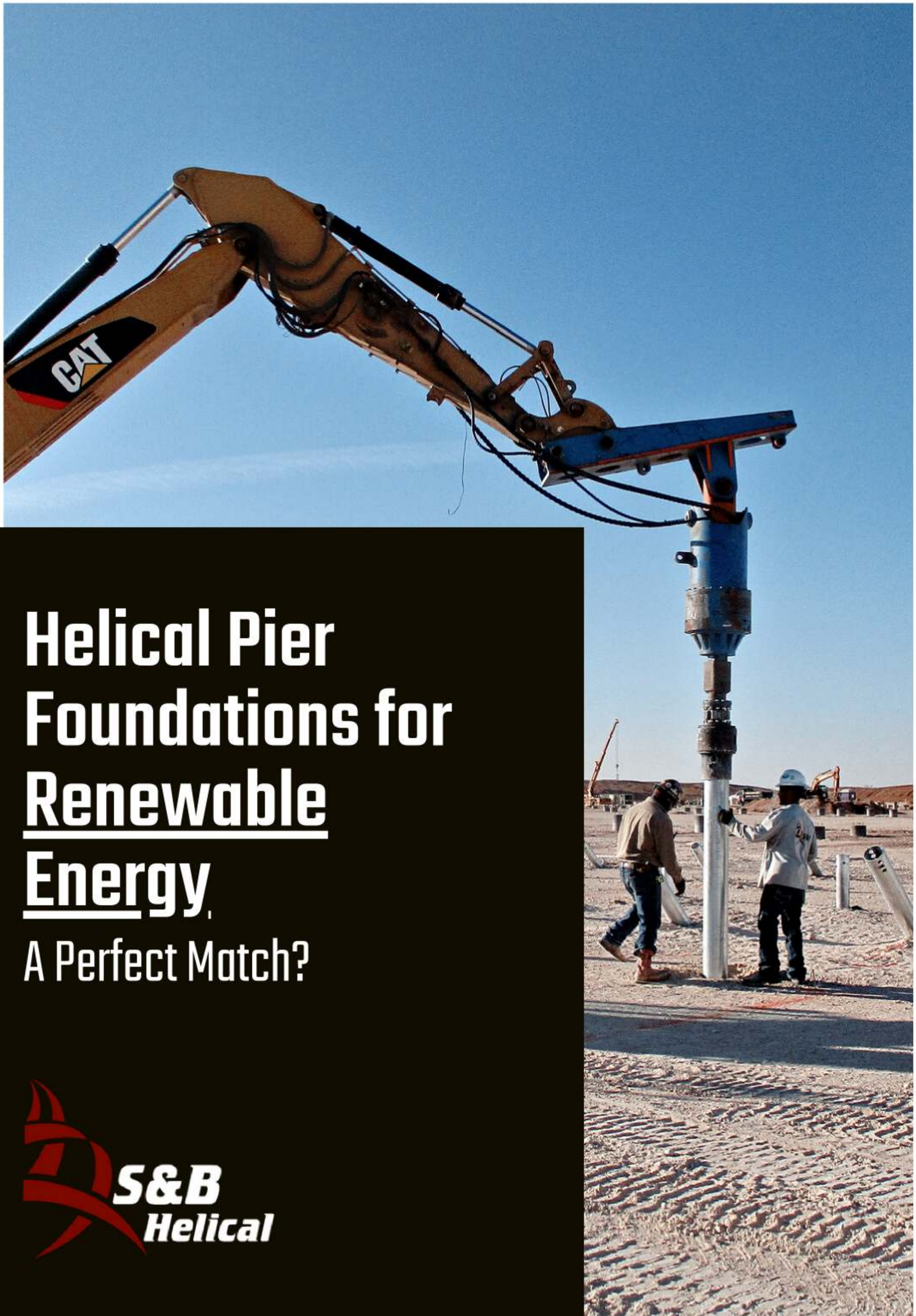


Helical Pier Foundations for Renewable Energy,

A Perfect Match?

S&B
Helical

Introduction

The demand for renewable energy in the United States has steadily increased for the past decade. In 2020, renewable energy like wind and solar accounted for 12% of total U.S. energy consumption.

It's clear that renewable energy is here to stay, and demand will only increase through the 2020's and beyond.

Despite the growing demand, renewable energy has its caveats.

While wind turbines and solar panels can capture energy from the environment it's useless without extensive supporting infrastructure to store and distribute that power.

We cannot simply build a wind turbine on a hill or put solar panels in a field and call it done.

A comprehensive list would be far too lengthy, but some of the infrastructure that renewable energy requires includes:

- Wind power plants
- Solar farms
- Battery energy storage systems *(for storing power)*
- Step-up substations
- Transmission substations
- Distribution substations
- High-voltage transmission lines
- Local power lines
- Microgrids
- And more

Traditionally, the most common foundation solutions for renewable energy projects and supporting infrastructure has been concrete or driven steel H-piles.

However, both concrete and driven piers come with limitations that can make them undesirable for certain projects or locations.

Helical piers are an alternative deep foundation technology that, while being nearly 200 years old, is relatively new to the renewable energy industry.

Compared to concrete or driven piers, helical piers have a range of unique benefits that make them ideal as deep foundations for renewable energy projects.

However, because of the rapid adoption of helical pier foundations in the industry, there's still much confusion and misinformation regarding the technology.

In this brief report you'll learn how helical piers work, where they can be used, and how they compare to other foundation solutions.

Short History of Helical Piers

Even though helical pier foundations may be unfamiliar in the U.S. renewable energy market, they're far from a new or unproven technology.

They were originally invented in the 1830's by a remarkable Irish engineer named Alexander Mitchell. Despite going blind in his early 20's, Mitchell would become a successful engineer and move to England to begin a thriving construction business.

Mitchell had a passion for the sea, and legend goes that he was hugely bothered when hearing stories of shipwrecks and loss of life. At the time, navigating coastlines and waterways was a dangerous prospect.

Lighthouses were critical safety infrastructure that could guide ships through dangerous waters and passages. Unfortunately, the locations where lighthouses could be built were limited by the soil conditions.

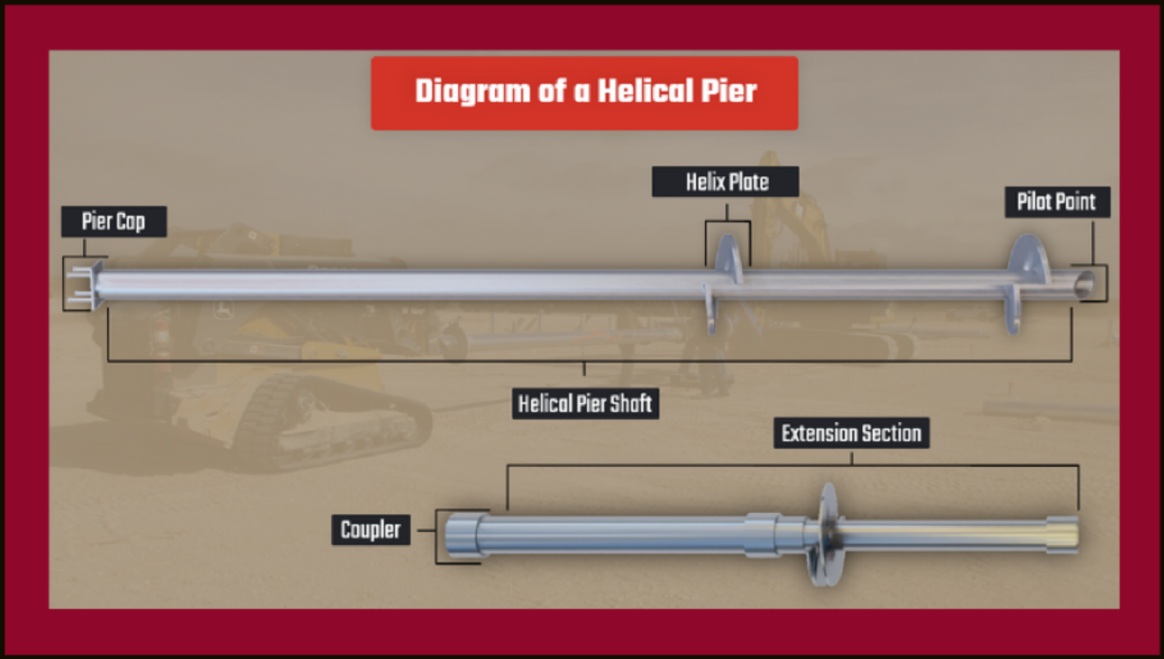
Deep foundation technology was primarily limited to timber piles. While sturdy and long-lasting in the right conditions, they weren't appropriate for the brutal conditions a coastal lighthouse would face.

Mitchell noticed that in the harbours, ships were anchored to the seafloor by way of helix anchors turned several feet into the sand. These anchors provided secure moorings even in violent storms.

Showing an incredible understanding of soil mechanics for the time, Mitchell reasoned that a helix anchor installed deep enough into the ground could support a structure in loose sandy soils.

Receiving a patent for the "screw pile" *(today also called helical piers or helical piles)* in 1833, Mitchell's foundation technology would ultimately go on to support hundreds of lighthouses around the world - many of which still stand today.

How a Helical Pier Foundation Works



Helical pier foundations operate on a simple but effective concept. They are, in essence, an **end-bearing deep foundation**. However, Their load capacity actually comes primarily from the unique **helix plates** found attached to the pier shaft.

These helix plates *(pl. helices)* are designed to allow the pier to smoothly turn into the ground using a hydraulic drive.

As the helical pier turns into the ground, the soil exerts **force** on the helices. This force can be read as the **torque** required to advance the pier.

It's the force of the soil on the helices that prevents a helical pier from shifting, sinking, or heaving.

It's because of this unique relationship between the large surface area of the helices and the smaller surface area of the pier shaft that makes the technology so effective.

The large surface area of the helices allows the helical pier to support enormous loads. In fact, some helical piers have load-tested to over **1-million pounds** of compressive capacity.

Combining the wide helices with a comparably narrow pier shaft makes the helical easier to install, more efficient in raw material usage, and highly resistant to movement.

Because the pier turns into the ground with hydraulic power, installation is quiet and disturbance-free.

Why Use Helical Piers (Benefits)

Because of its' unique design, a helical pier can be installed faster and easier while offering equal *(if not better)* support than driven h-piles or poured concrete.

While there's a time and place for different foundation solutions, helical piers offer a range of relevant benefits to renewable energy construction.

That said, any construction technology has limitations and nothing is perfect.

If you want to know what the specific benefits and downsides of a foundation solution might be for your project, you should get in touch with a foundation expert.

Helical Pier Foundation Benefits for Renewable Energy
Requires minimal, or no, excavation or soil disturbance to install
Does not require curing time, can be loaded immediately after installation
Efficient equipment and procedures makes installation fast
Uses less raw material than other foundation solutions, reduces CO_2 emissions
Steel construction and optional coatings make them suitable for sensitive sites
Highly resistant to corrosion and long service life
Ideal for saturated or difficult soils, especially wetlands and coastal areas
Can be value-engineered to match exact structure and site conditions

What Renewable Energy Projects Use Helical Piers?

Battery Energy Storage Systems

Solar Farms

Microgrids

Power Distribution

Transmission Lines

Carbon Capture Plants

Helical Piers & Other Foundations Compared

	Helical Piers	H-Piles	Concrete
Installation	No disturbance to the soil or surrounding structures during install - zero vibration	Hammering piers causes site disturbance and risks nearby structure damage via soil vibration	Requires extensive excavation and/or drilling to install, serious site disturbance
Removal	Quickly and easily uninstalled using same equipment as installation, leaves zero trace behind	Removal can be more challenging and costly than helical piers, requiring specialized equipment	Extensive excavation to remove, costly and challenging site remediation
Equipment	Uses common equipment like excavators and skidsteers to install, reducing mobilization costs	Bulky equipment like pile drivers/cranes can increase mobilization costs and overall price	Extensive heavy & bulky equipment like concrete trucks, pumps, cranes, and so on
Carbon Emissions	Produces dramatically fewer emissions as it requires much less raw material and equipment	Additional equipment could increase emissions cost to install foundation	Huge amounts of raw material can dramatically increase CO_2 emissions
Versatility	Can install at an angle, suitable for wide range of site conditions, minimal lay-down space	Cannot install at an angle, may not be suitable for saturated soils, cutting/splicing adds time and cost	Cannot install at angle, long cure times, not the best for saturated soils, susceptible to weather and climate delays

Questions or comments about this report?

Let our team of foundation experts answer your questions about **faster**, **easier**, more **efficient**, and more **environmentally-friendly** foundations.

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