System Design of Airborne Wind Energy

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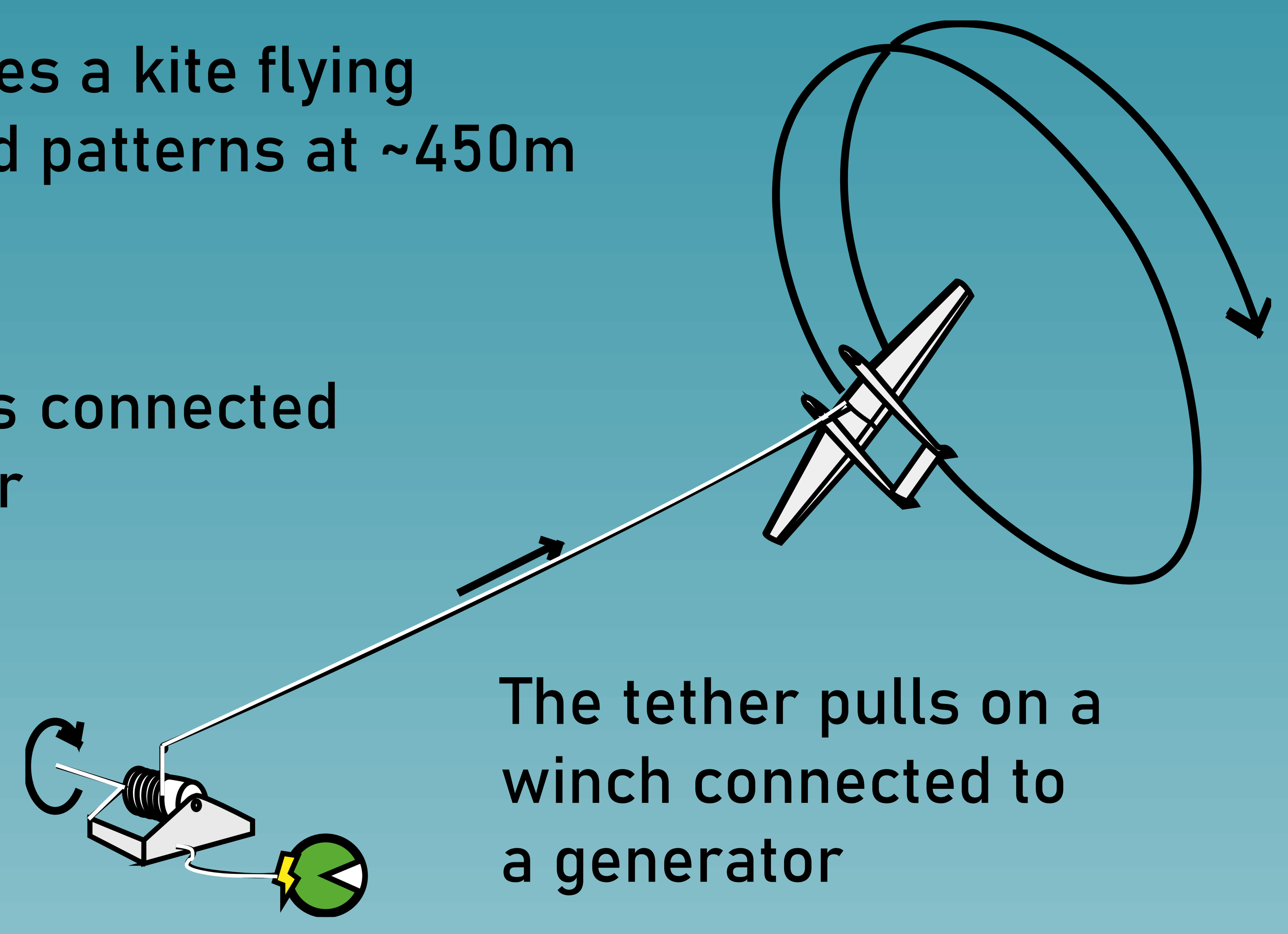
What is airborne wind energy?

Wind drives a kite flying crosswind patterns at ~450m

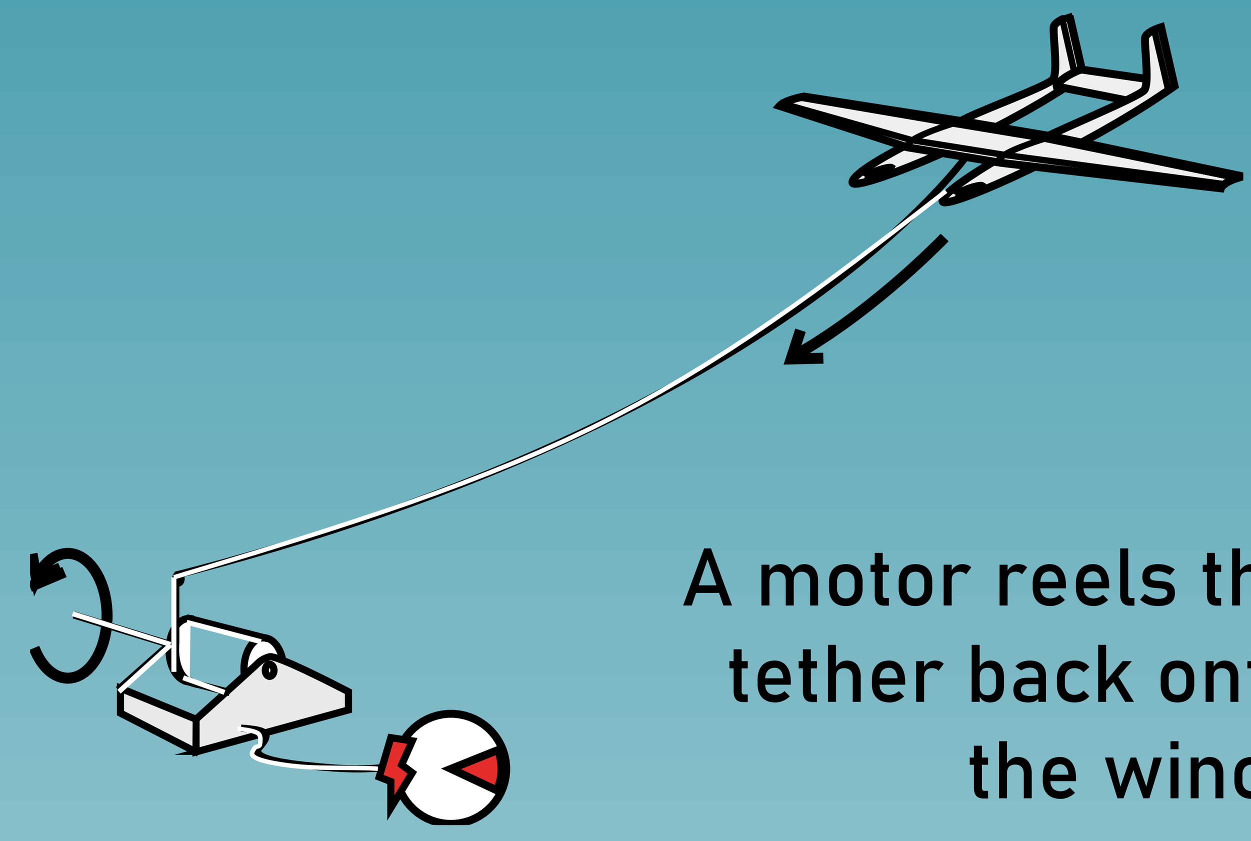
The kite is connected to a tether



The tether pulls on a winch connected to a generator

Reel-out phase: Power generation

Wind is stronger and more stable at higher altitudes



A motor reels the tether back onto the winch

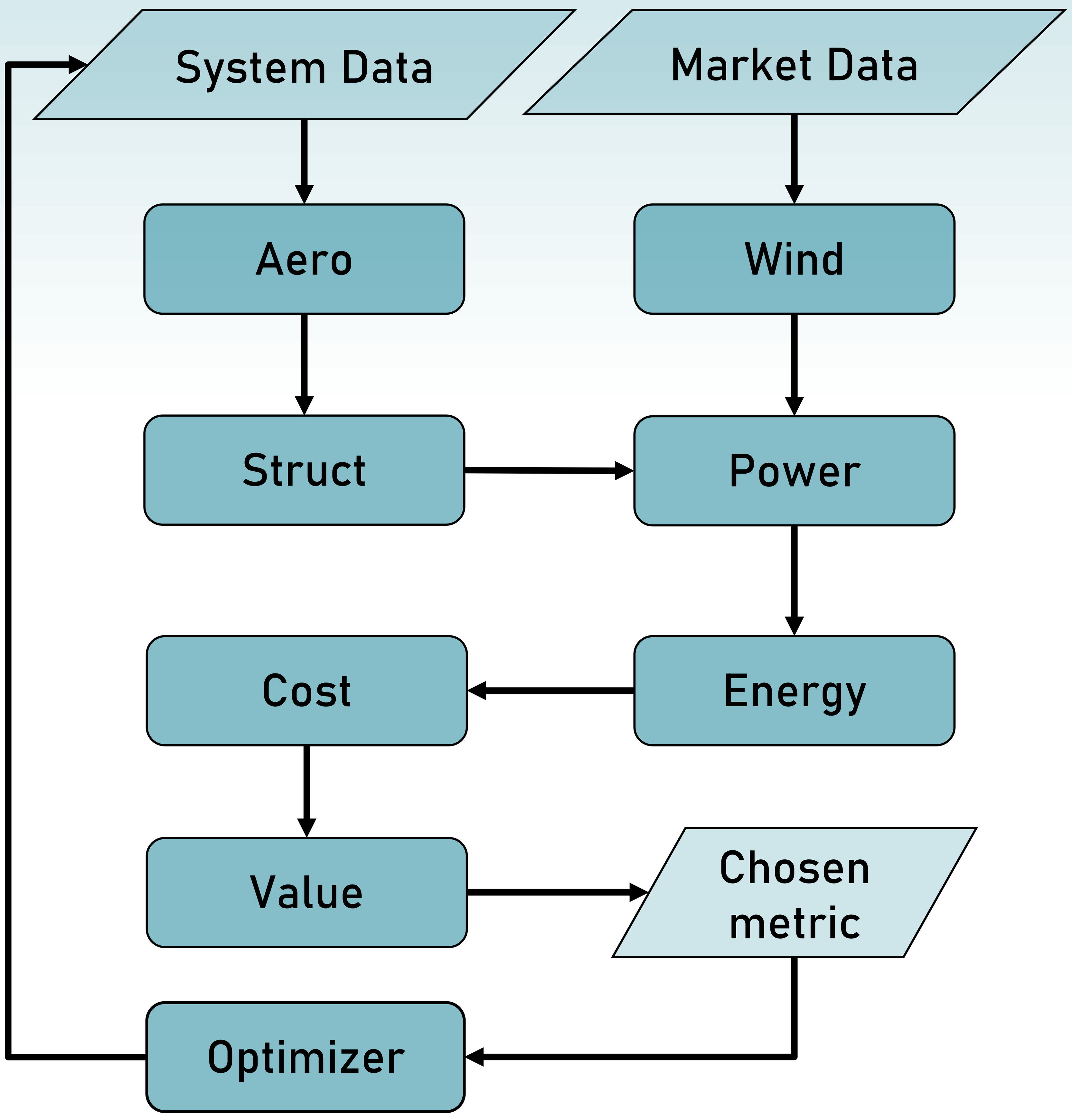
Reel-in phase: Power consumption

Image: Ampyx Power B.V.

Research outline

This PhD aims to provide a systems engineering perspective on the integration of airborne wind in the energy system. The overarching objective is to identify promising entry markets and narrow down the system design space addressing these markets. This will be achieved by developing a Multi-disciplinary Design Analysis and Optimization (MDAO) framework by integrating required models. No model is 100% accurate, the key is to choose the simplest models capturing the critical dependencies, allowing us to make the required trade-offs.

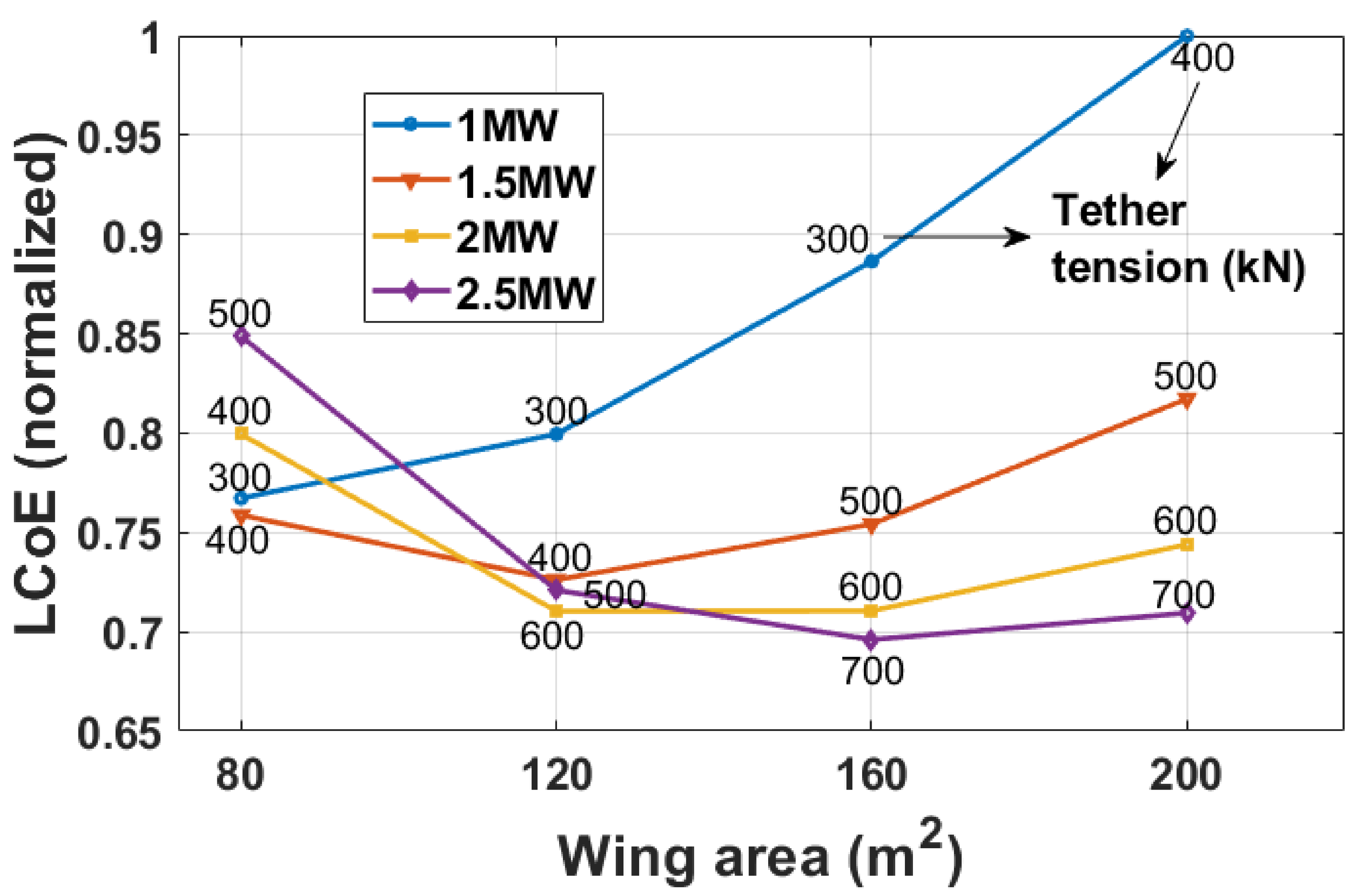
Framework



Sample Results

The framework can be used for techno-economic analyses, system sizing, and design optimization studies.

The figure shows a comparison between different system designs based on a metric known as the levelized cost of electricity (LCoE).



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