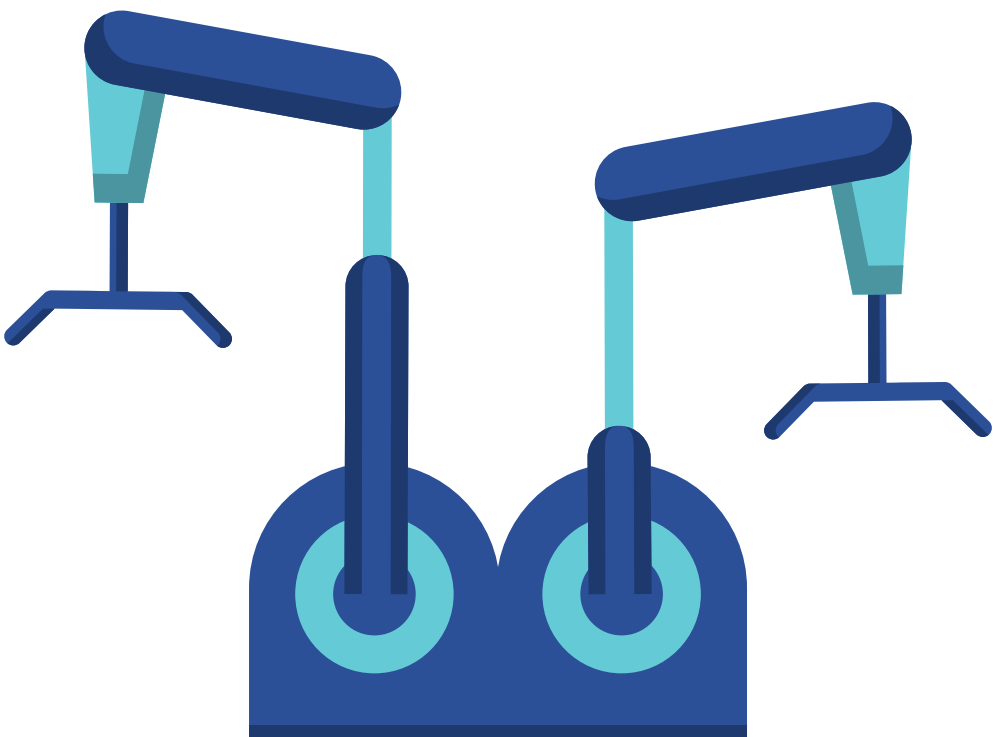
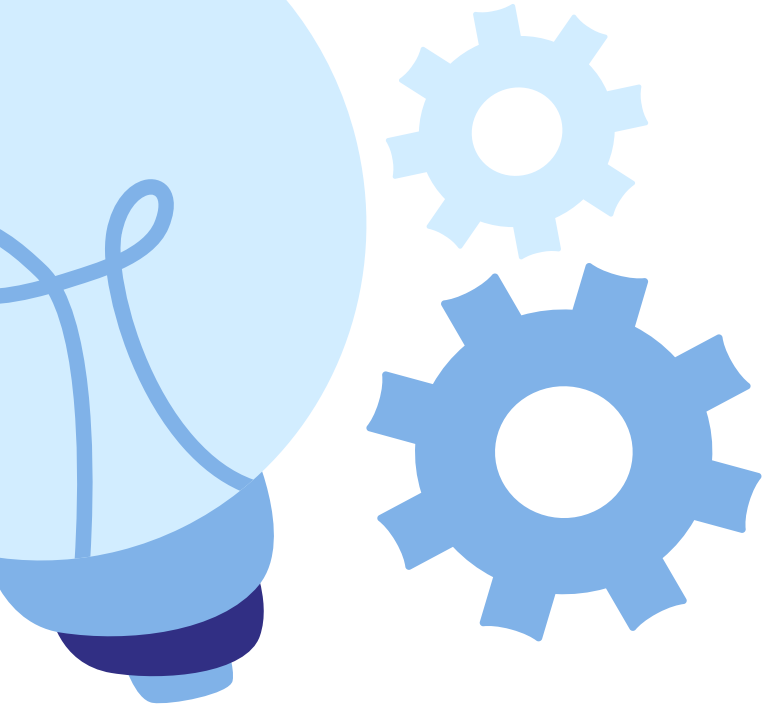


# *Renewable Energy Storage*





# ABSTRACT

**Flywheel Energy Storage(FESS) stores excess electrical energy that is generated during low demand time periods and releases it during times of high demand**

**The flywheel quickly absorbs and delivers energy, making it effective for reimbursing short term variations in renewable energy output with the change in enviromental factors such as : Wind speed flucutaions, cloud cover and tempature shifts**


**Overall the flywheel system provides an essential solution to improving energy stability and supporting the implimention of renewable energy sources, at the same not damaging our earth**





# INTRODUCTION

**Energy Storage Systems (ESS) are essential for integrating renewable sources of energy like solar and wind into the power grid. These systems store excess energy and release it when the demand is higher. Energy Storage Systems' limitations are mainly their cycle life because of repeated recharging and discharging, which reduces the capacity over time. Flywheels store energy mechanically by spinning a composite rotor at tens of thousands of revolutions per minute and recovering it as the rotor decelerates. By utilizing carbon fiber rotors, magnetic bearings, and vacuum enclosures, they achieve close to zero friction loss while providing an optimal lifetime.**



# PROBLEM STATEMENT



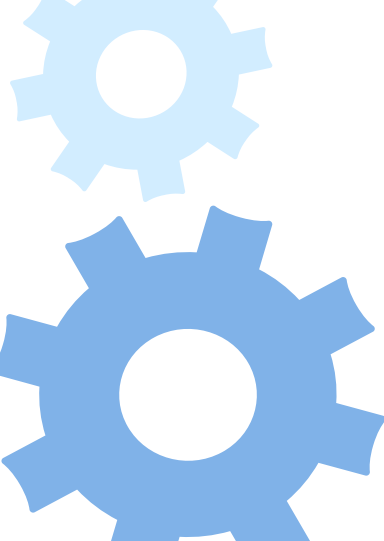
Renewable energy sources like solar and wind are sustainable but inherently inconsistent, creating challenges in balancing energy storage solutions, fluctuations in power generation can lead to frequency instability, equipment damage, and financial losses, limiting the large scale adoption of renewable systems.

# PROPOSAL

- A high-capacity flywheel energy storage system provides the necessary inertia to smooth out grid frequency fluctuations, while also having a lower environmental impact compared to traditional battery systems.
- Flywheels have a higher energy density compared to batteries and a much higher lifespan, lasting on average several decades as compared to the several years that batteries last.
- Modern systems utilize technologies such as magnetic bearings and vacuum enclosures to minimize friction as well as energy loss, allowing the rotor to spin with high efficiency at high speeds.
- Can rapidly charge and discharge energy, making it suitable for applications requiring quick response times.



# Timeline



Our team started by researching information on renewable energy and how we can reduce the use of fossil fuels

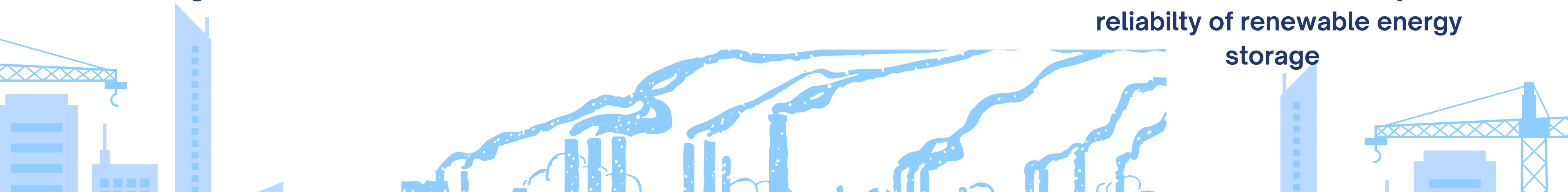
Our team started testing materials determined to maximize energy storage, and usage

Within a year of development, our new Flywheel energy storage system is expected to reduce reliance on fossil fuel-based power by improving renewable energy integration and grid stability

We started looking into the flywheel energy storage system, seeing how we could improve its operations. Our team went with High speeds within the flywheel being more efficient.

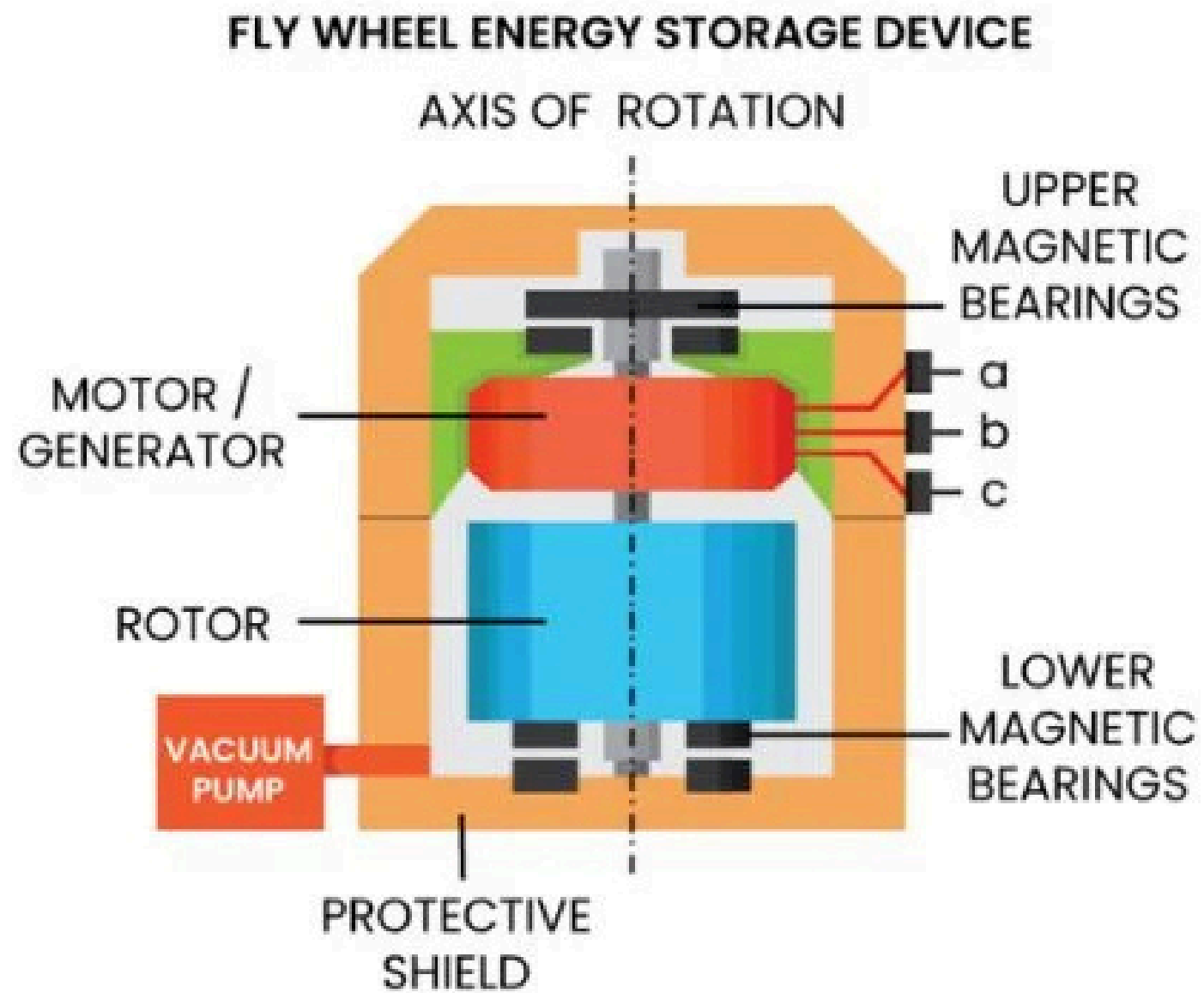
Following successful design evaluation and sponsors approval to fund the project, it will proceed to prototype optimization and scalability testing, transitioning to full-scale production

Future energy projections suggest a continued decline in fossil fuel dependency as renewable energy adoption increases. Our Flywheel energy storage system is expected to enhance the efficiency and reliability of renewable energy storage



# TECHNICAL DESIGN

## Flywheel Energy Storage system



- Rotor & shaft: ceramic fiber composite
- Magnetic bearings: YBCO
- Housing: carbon steel
- Bidirectional power converter (not shown): BTB converter using IGBT switches
- Control electronics: frequency monitors, temperature monitors, etc.
- Cooling system (not shown): closed-loop, liquid argon coolant



# TECHNICAL DESIGN (cont.)



- **Grid topology**
  - **solar farm as energy source**
  - **Flywheel connected in parallel**
    - **only necessary to use during demand/supply fluctuations**
    - **charges from farm and discharges into grid as necessary**

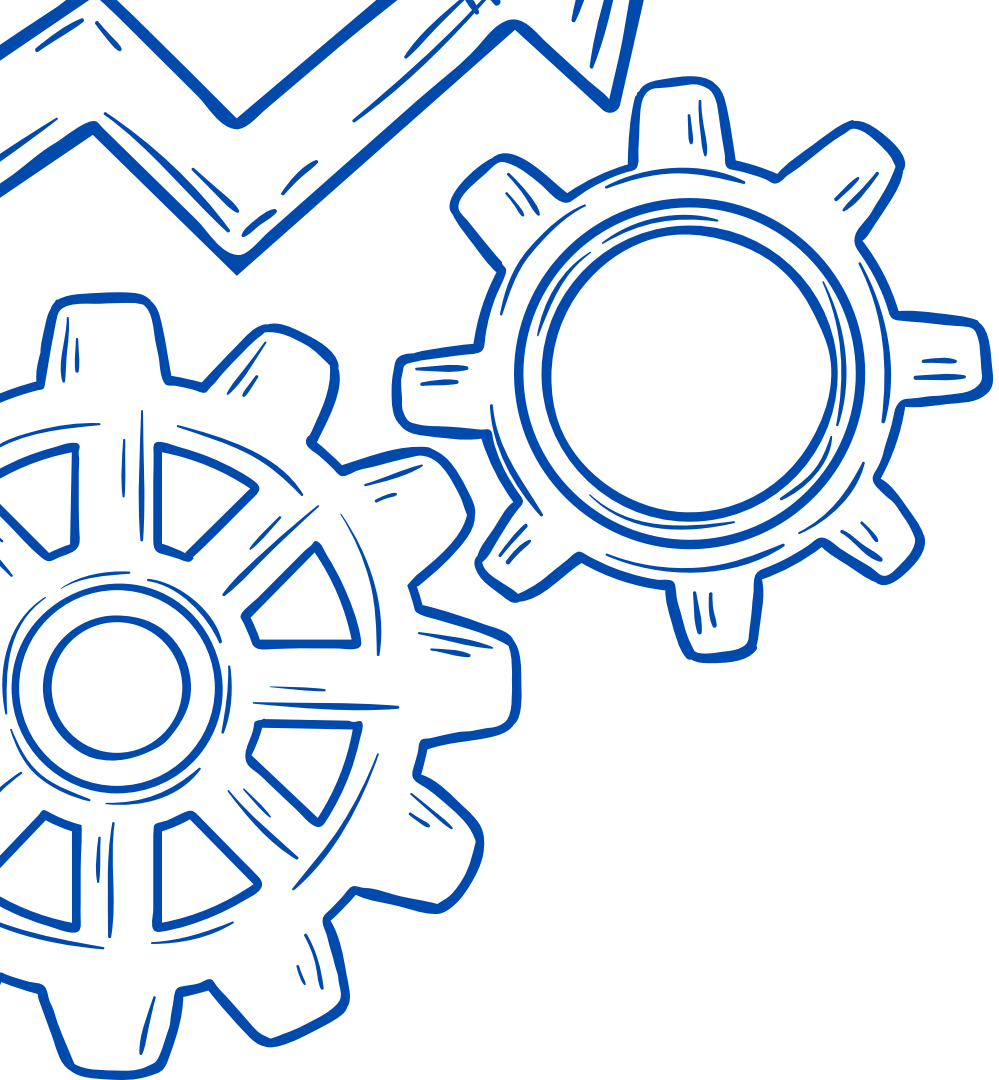




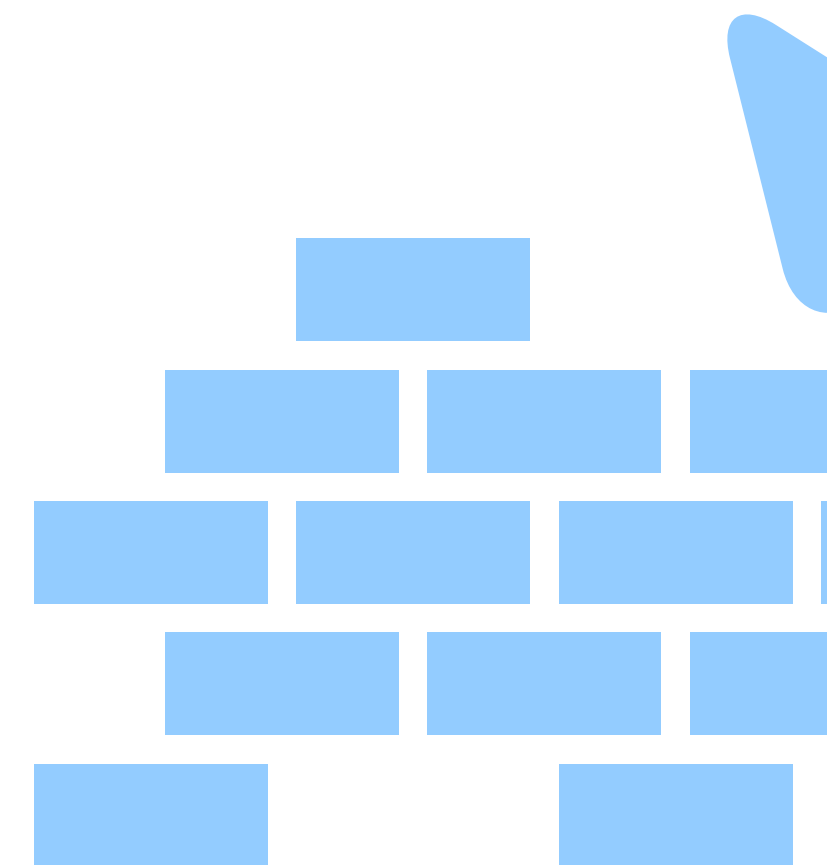
# Sponsors



- United States Department of Energy- \$3.6M renewable energy innovation grant supporting fly wheel system design, prototype development, and performance testing
  - New York Energy Research and Development Authority- \$3.0M funding dedicated to renewable energy integration, grid modernization, performance testing and long-term sustainability evaluation.
  - We'd work alongside Amber Kinetics who focus on making flywheels for California and foreign countries such as Japan, to expand and further innovate.
- 



# ***BUDGET***



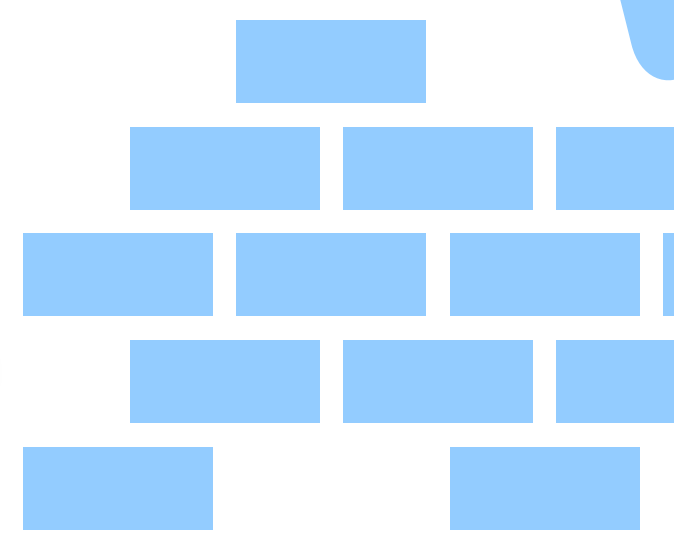
**Cost of 1 High-speed Flywheel Unit**

<b>Composite Rotor:</b>	<b>\$36,820</b>
<b>Magnetic Bearings:</b>	<b>\$18,451</b>
<b>Power Converter:</b>	<b>\$49,618</b>
<b>Motor Generator:</b>	<b>\$8,100</b>
<b>Enclosure:</b>	<b>\$5,312</b>
<b>Shaft:</b>	<b>\$1,089</b>
<b>Vacuum Pump:</b>	<b>\$2,400</b>
<b>Total Cost:</b>	<b>\$121,880</b>

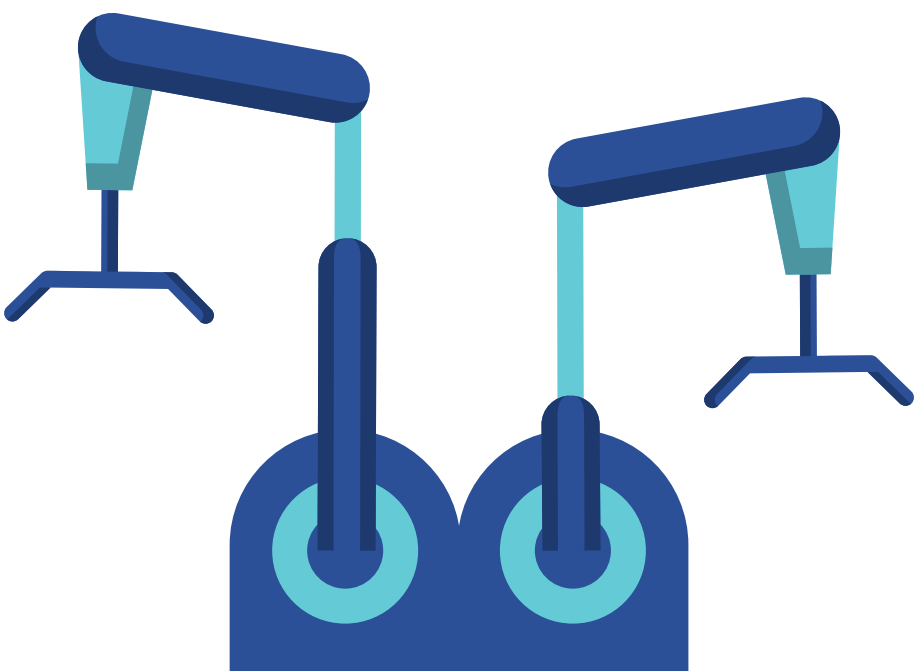




# QUALIFICATIONS

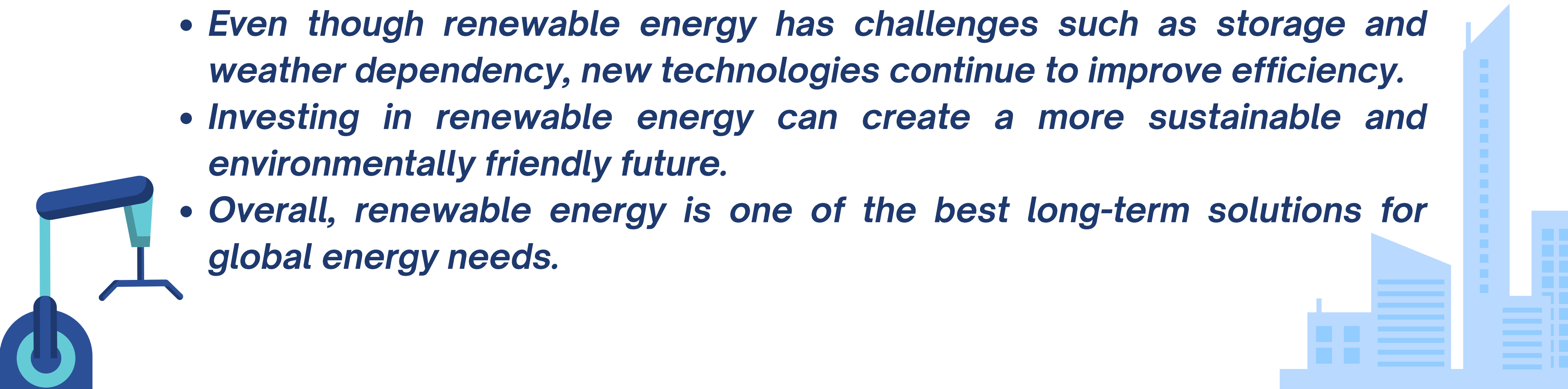


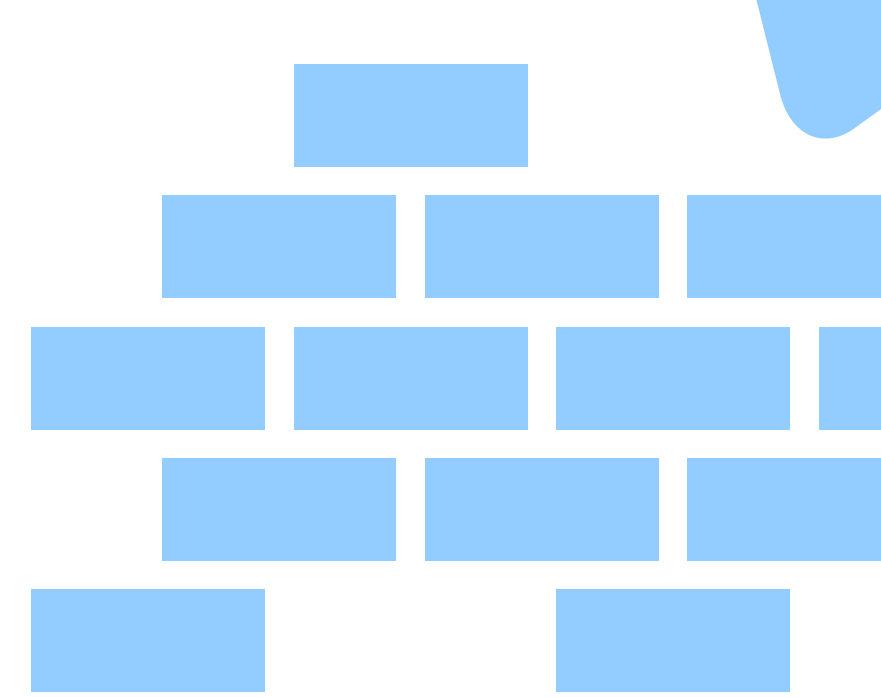
*All Engineers!* In training



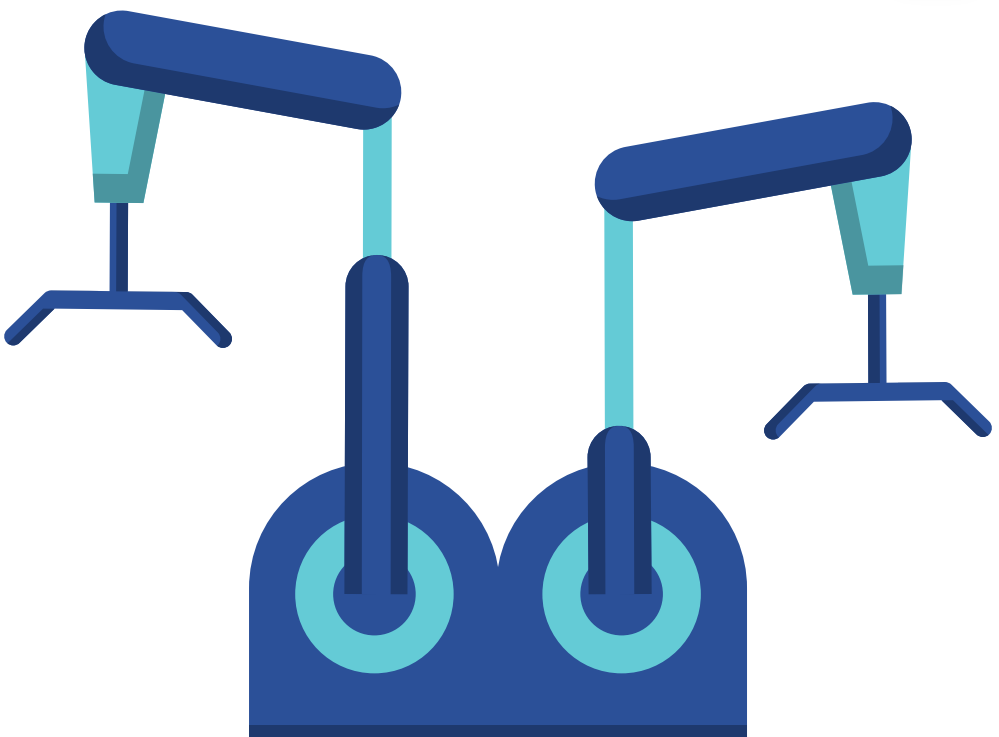


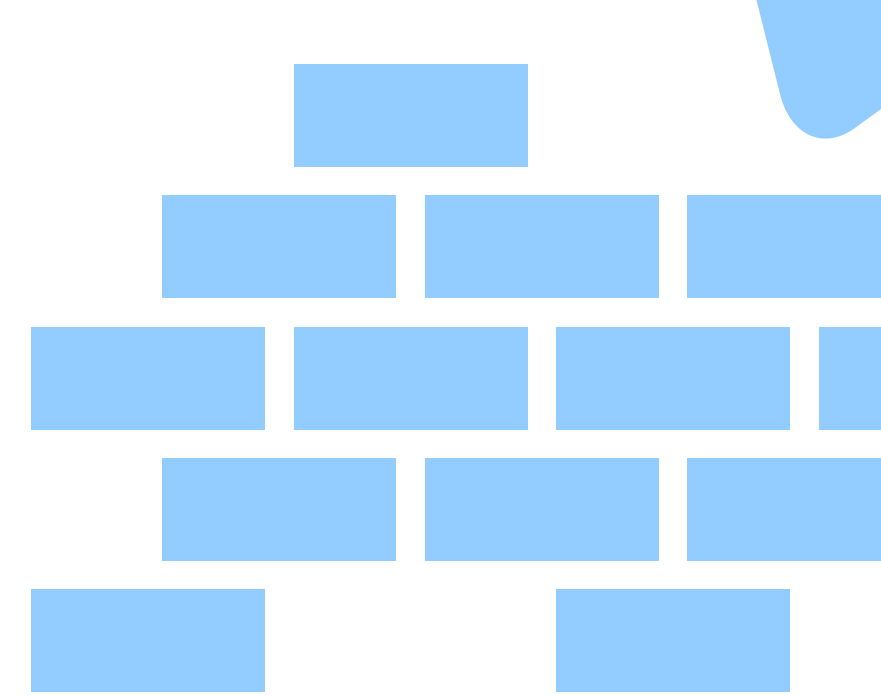
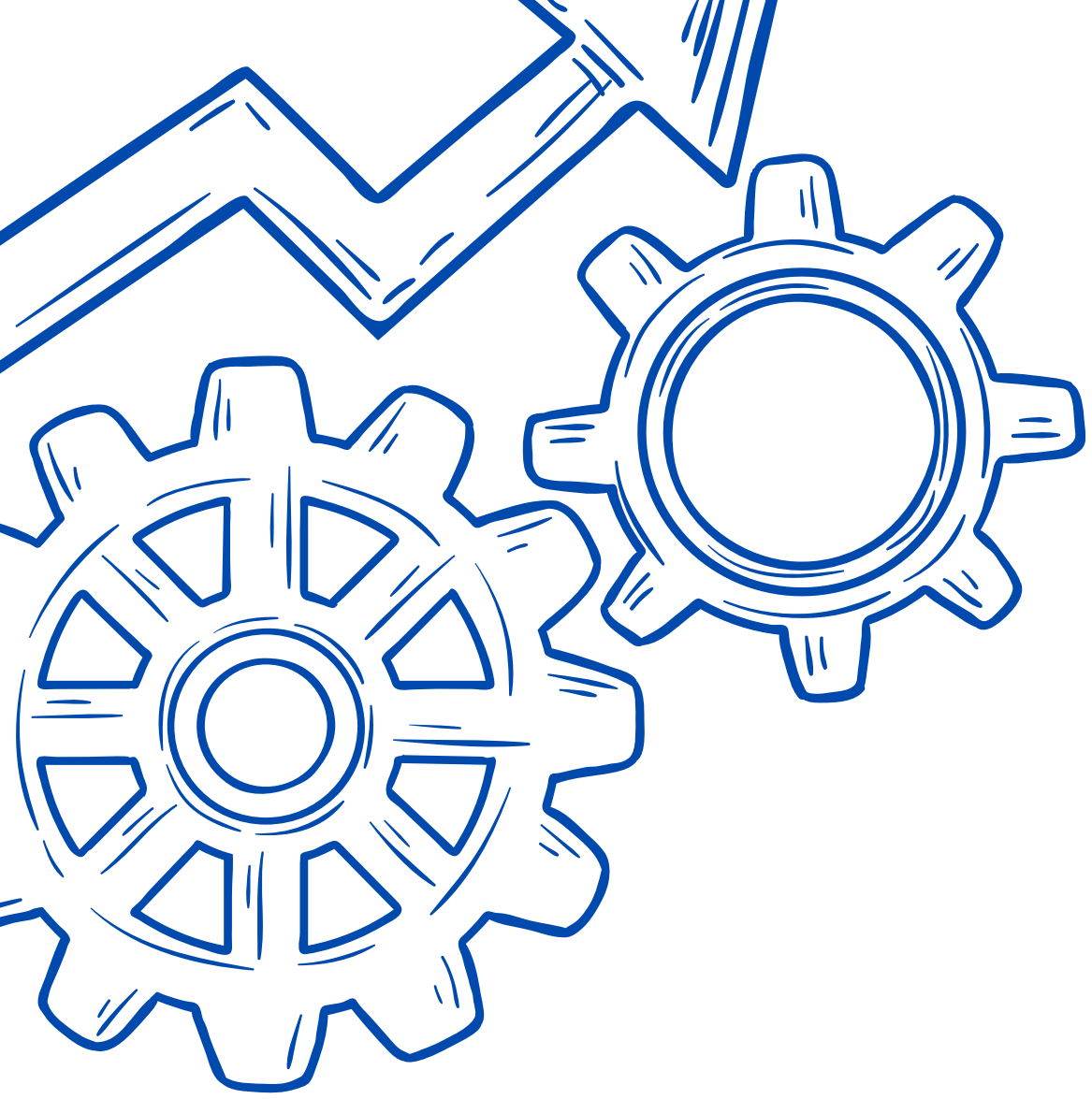
# CONCLUSION

- *Renewable energy is becoming more important as the demand for cleaner energy increases.*
  - *Sources like solar and wind power can reduce pollution and dependence on fossil fuels.*
  - *Even though renewable energy has challenges such as storage and weather dependency, new technologies continue to improve efficiency.*
  - *Investing in renewable energy can create a more sustainable and environmentally friendly future.*
  - *Overall, renewable energy is one of the best long-term solutions for global energy needs.*
- 



# *Questions?*





***Thank  
You!!!***

