MICRO-GRID MANIA

HF710 - Prototyping and Interaction Design

- Product Demo -

Individual Project by Keyur Patel

AGENDA

1. Design Problem

2. Current Tool

3. User Stories

4. Prototype Demo

5. Next Steps

THE DESIGN PROBLEM

The principles of microgrids are complex and students lack intuitive tools to apply their knowledge and explore practical scenarios effectively.

CURRENT TOOL

Community Microgrid Simulation Game

Overwhelming with Text

Community Microgrid Simulation Game

This tool lets you try out different configurations of a community-scale microgrid system. Choose the capacities of different technologies and their dispatch order, then run the system to see how it does on fuel costs, emissions, and load served!

You have a budget of $10 million to install a microgrid. There are four technologies you can choose from and their capital costs, fuel costs and emissions are outlined in the table below.

	Capital Cost	Fuel Cost	Emissions
Diesel Generator	500 $/kW	4 $/gallon	22.45 lbs CO2/gallon
Fuel Cell	2000 $/kW	2 $/CF	121 lbs CO2/CF
Solar	1600 $/kW	0	0
Battery	800 $/kWh	0	0

Step 1: Choose the capacity of each technology in your microgrid:

Diesel Generator Capacity (kW): 1000

Fuel Cell Capacity (kW): 2000

Solar PV Capacity (kW): 2500

Battery Capacity (kWh): 1500

Total microgrid cost: $9700000

Your microgrid is within the budget.

Unengaging features

Diesel Generator Capacity (kW): 1000

Fuel Cell Capacity (kW): 2000

Solar PV Capacity (kW): 2500

Battery Capacity (kWh): 1500

Total microgrid cost: $9700000

Your microgrid is within the budget.

Step 2: Choose the order in which you will use (or dispatch) your technologies:

Choose the order: Fuel Cells × Solar PV × Batteries × Diesel Generators ×

Step 3: Run simulation for a random date or choose one?

Choose simulation mode:

- ○ Random date
- ◉ Select a date

Select a date for simulation:

Month: 12

Day: 12

Step 4: Test it!

Run simulation

Lack of User Guidance

Run simulation

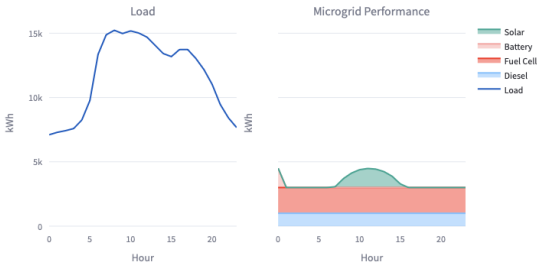
Configuration

Diesel Generator (kW)	Fuel Cell (kW)	Solar Panel (kW)	Battery (kWh)
1000	2000	2500	1500

Results for 12/12

Fuel Cost (k$)	Emissions (MTCO2)	Load Unserved (%)
7	30	70

Hourly Results



Use fullscreen mode (hover over the top right corner of the table for the button) or use the scroll bar at the bottom of the table to see all the different columns. You can also put the app in wide mode using the three dots in the top right corner, choose Settings, and check the box next to Wide Mode.

Hour	Load (kWh)	diesel dispatched (kWh)	fuel cell dispatched (kWh)	solar pv dispatched (kWh)	battery disp
0	7,105	1,000	2,000	0	
1	7,295	1,000	2,000	0	
2	7,421	1,000	2,000	0	
3	7,586	1,000	2,000	0	
4	8,241	1,000	2,000	0	
5	9,773	1,000	2,000	0	
6	13,355	1,000	2,000	0	
7	14,876	1,000	2,000	67	
8	15,227	1,000	2,000	693.1954	

USER STORY – STUDENT 1

- Goals
  - Make strategic choices to optimize microgrid simulation without second-guessing or relying on trial and error
  - Gain practical knowledge about microgrids in an interactive and straightforward manner

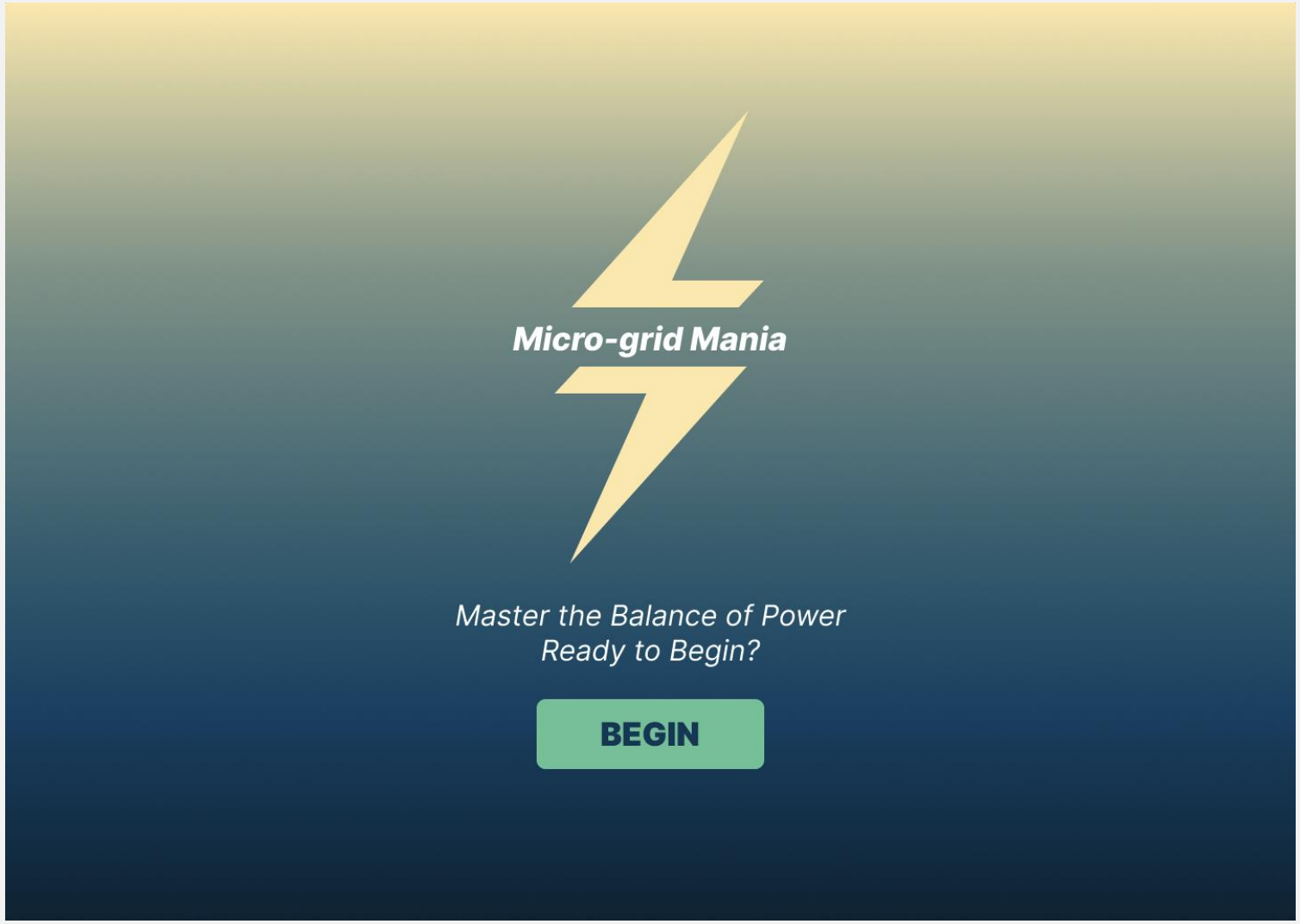
- Pain Points
  - Encountering too much text and unclear explanations
  - Struggling to understand how each technology fits and impact on simulation results

USER STORY – STUDENT 2

- Goals
  - Understand how different seasons and weather influence the performance of my microgrid
  - Test and compare previous simulations to understand how to optimize microgrid performance

- Pain Points
  - Uncertainty of what specific microgrid terminology means
  - Lack of visual graphs to better analyze the data
  - No statistical feedback or guidance on overall efficiency on my microgrid simulations

PROTOTYPE DEMO



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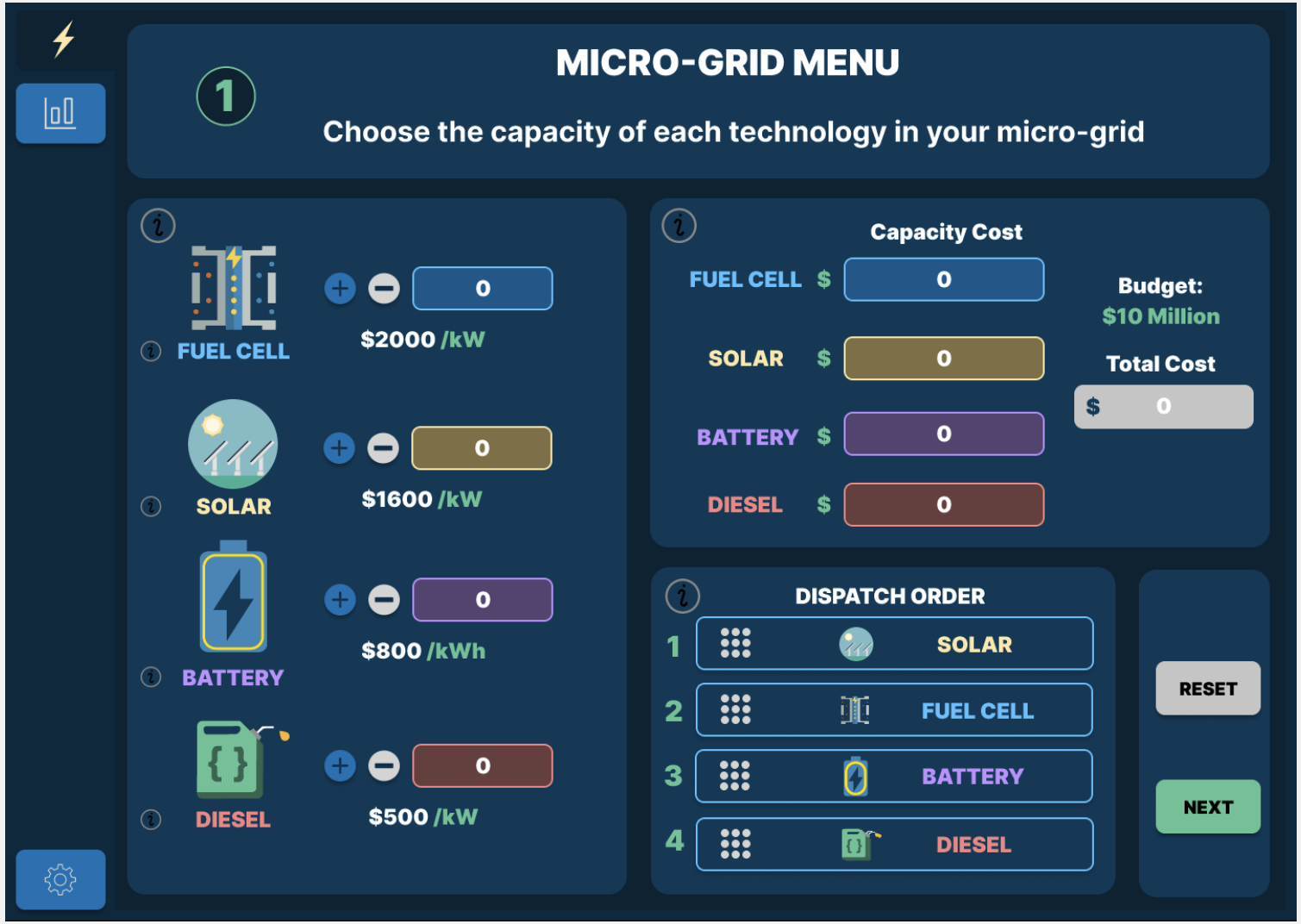

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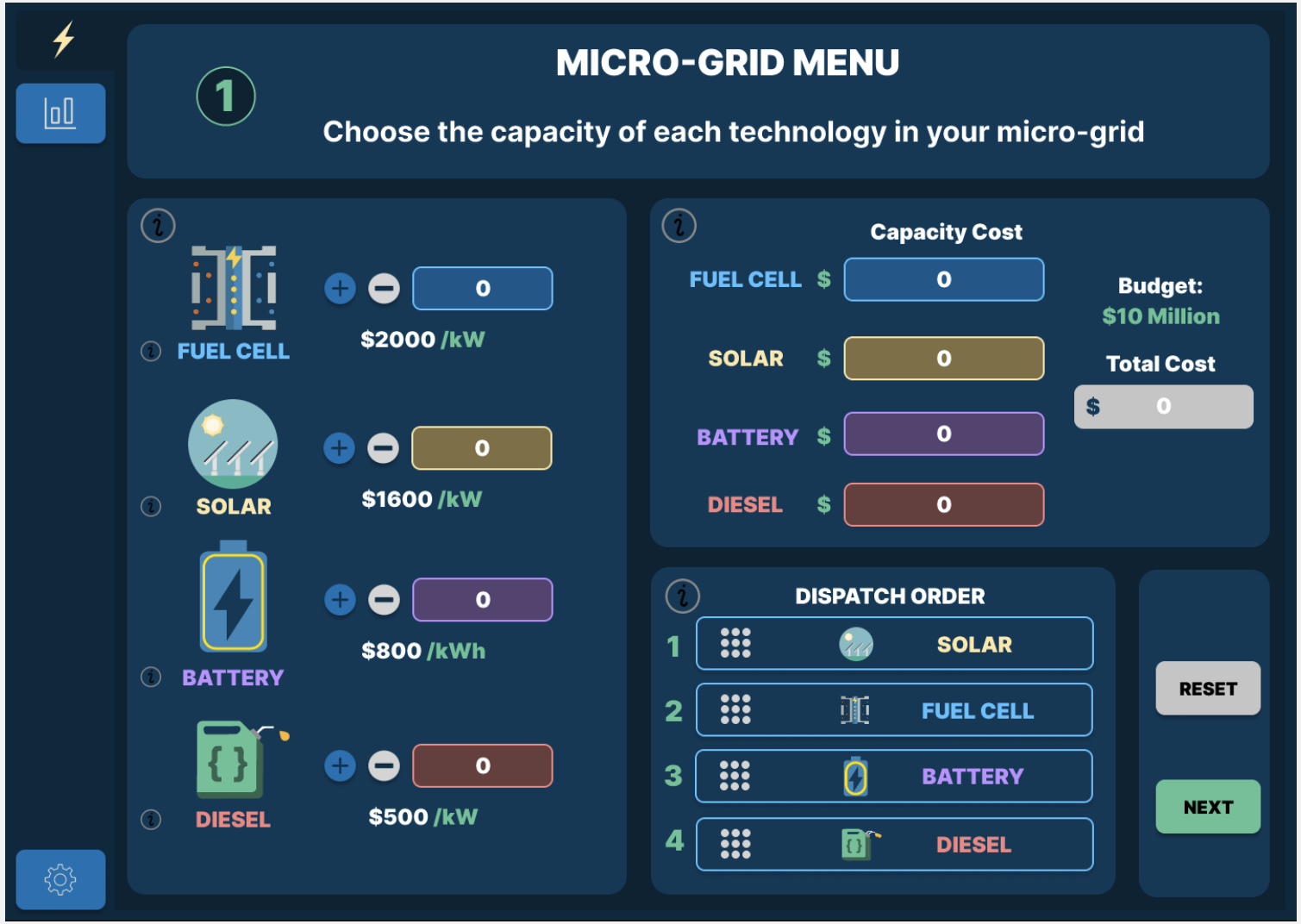
  - PAINT POINT - Encountering too much text and unclear explanations



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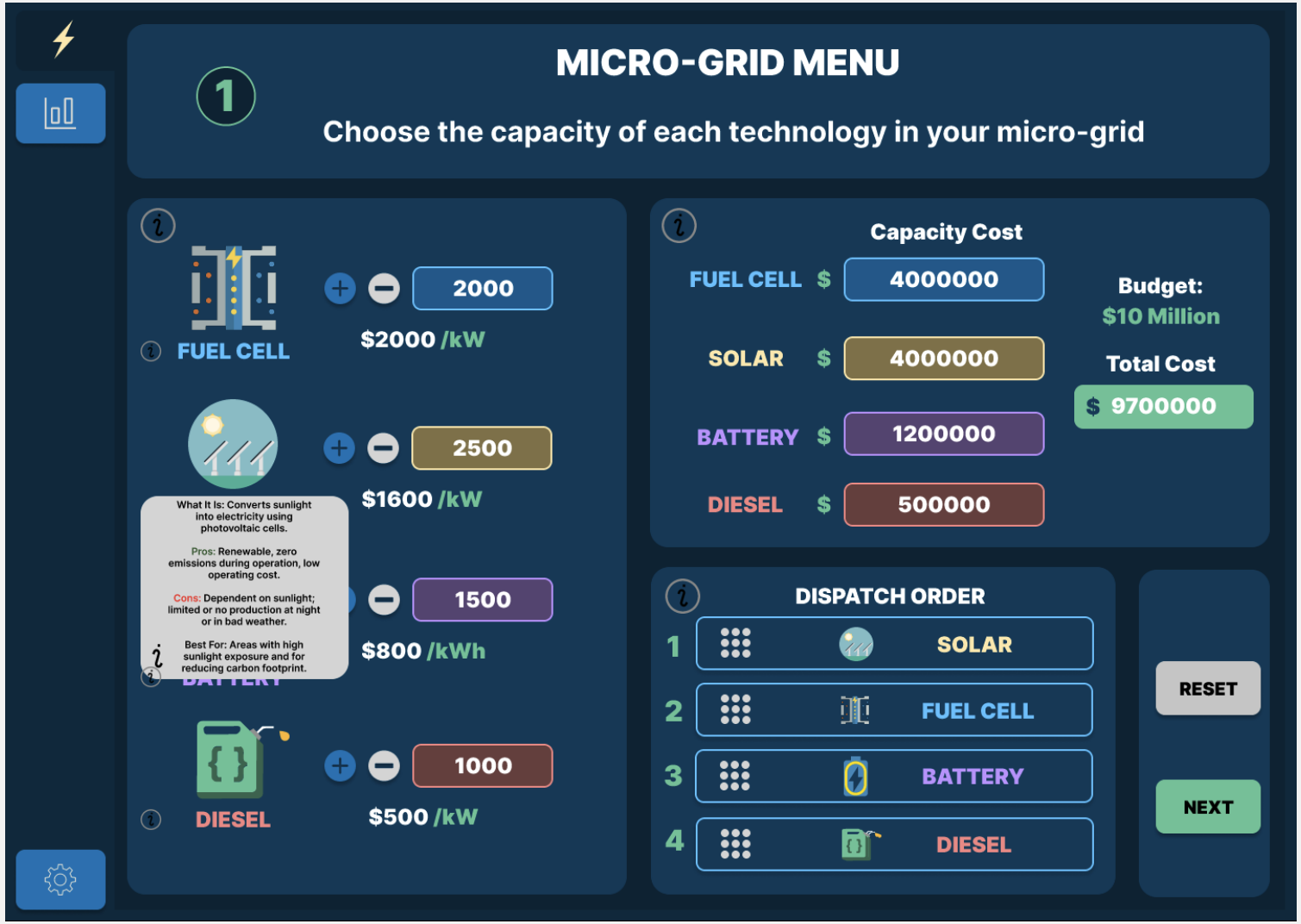

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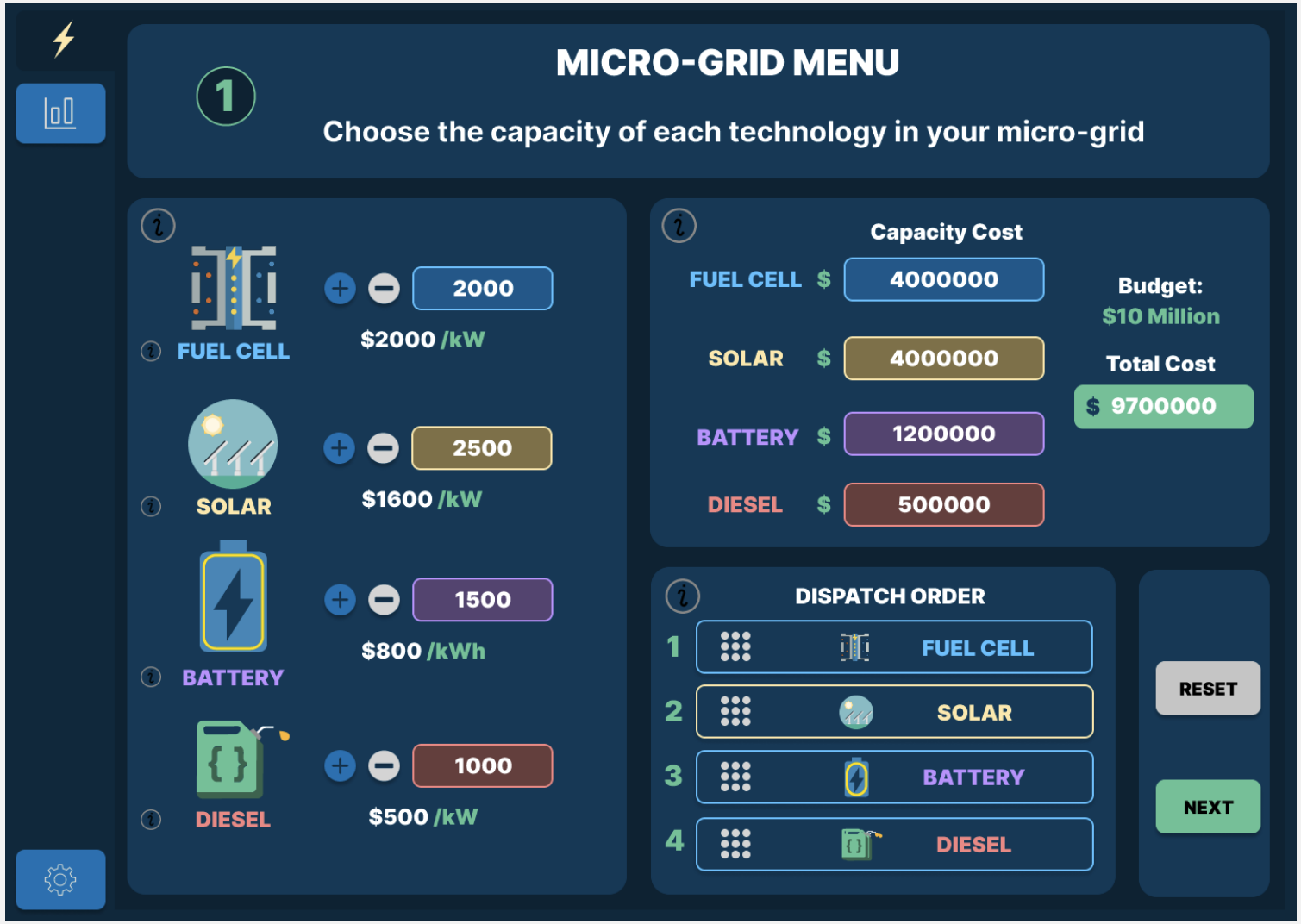

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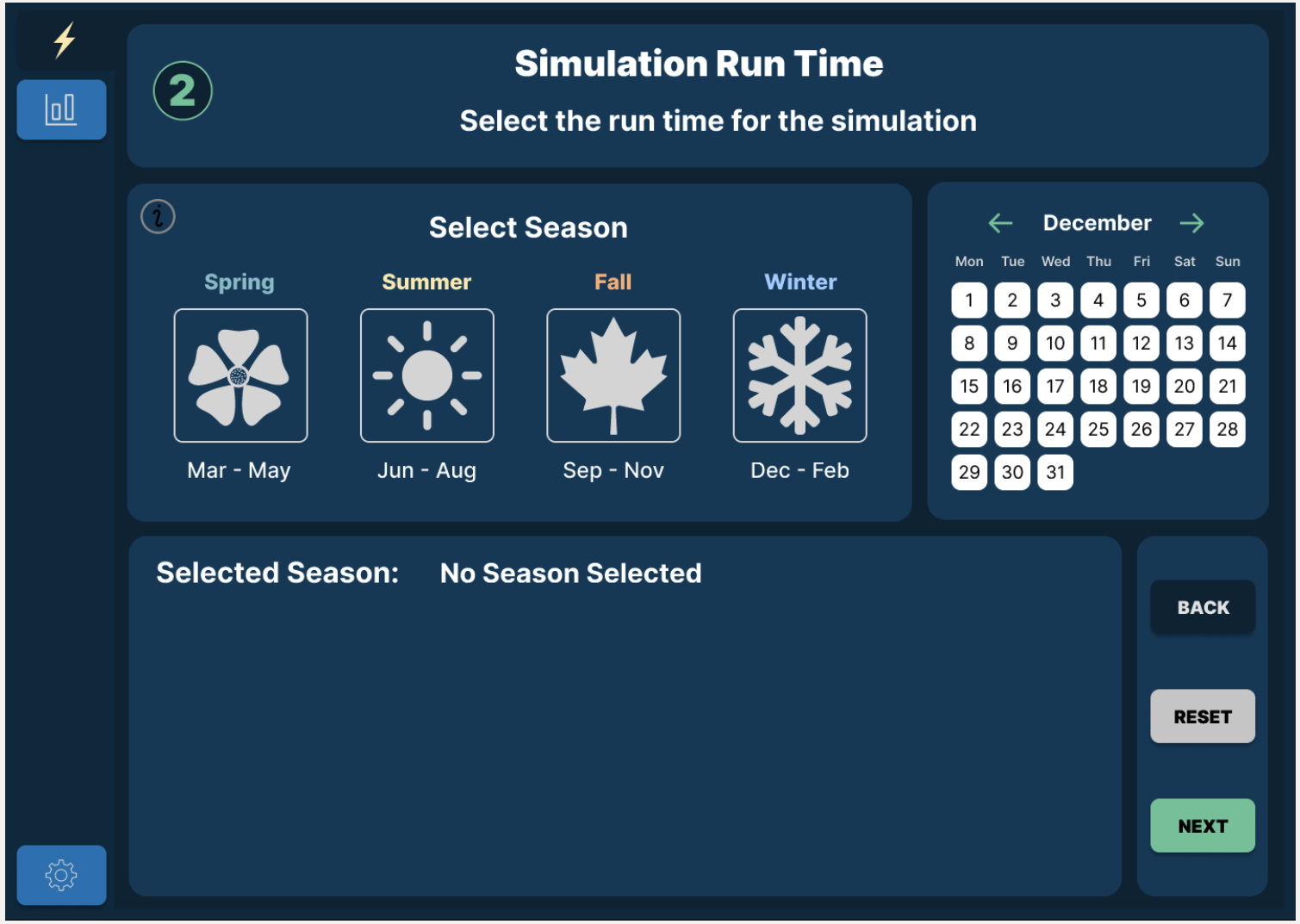

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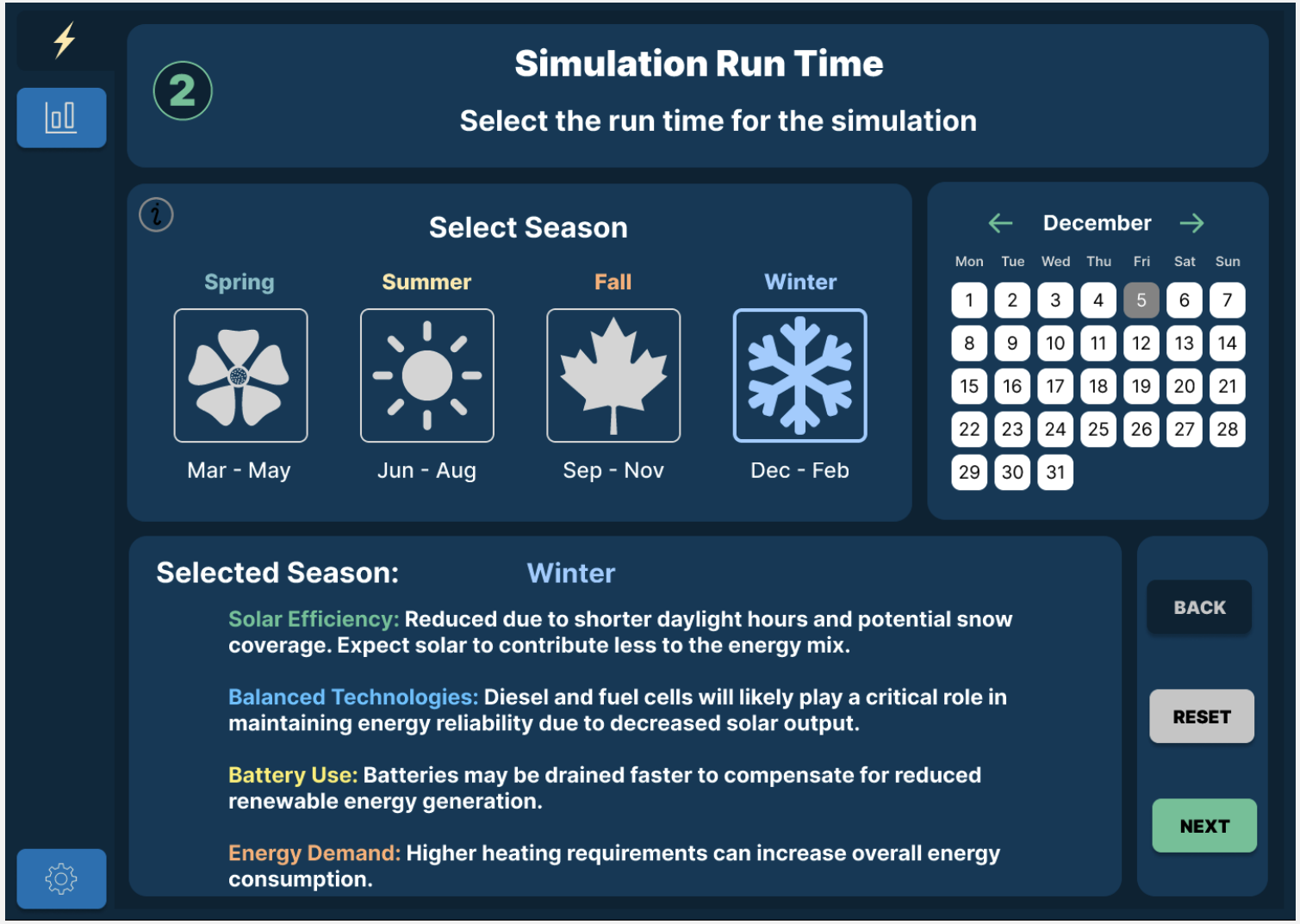

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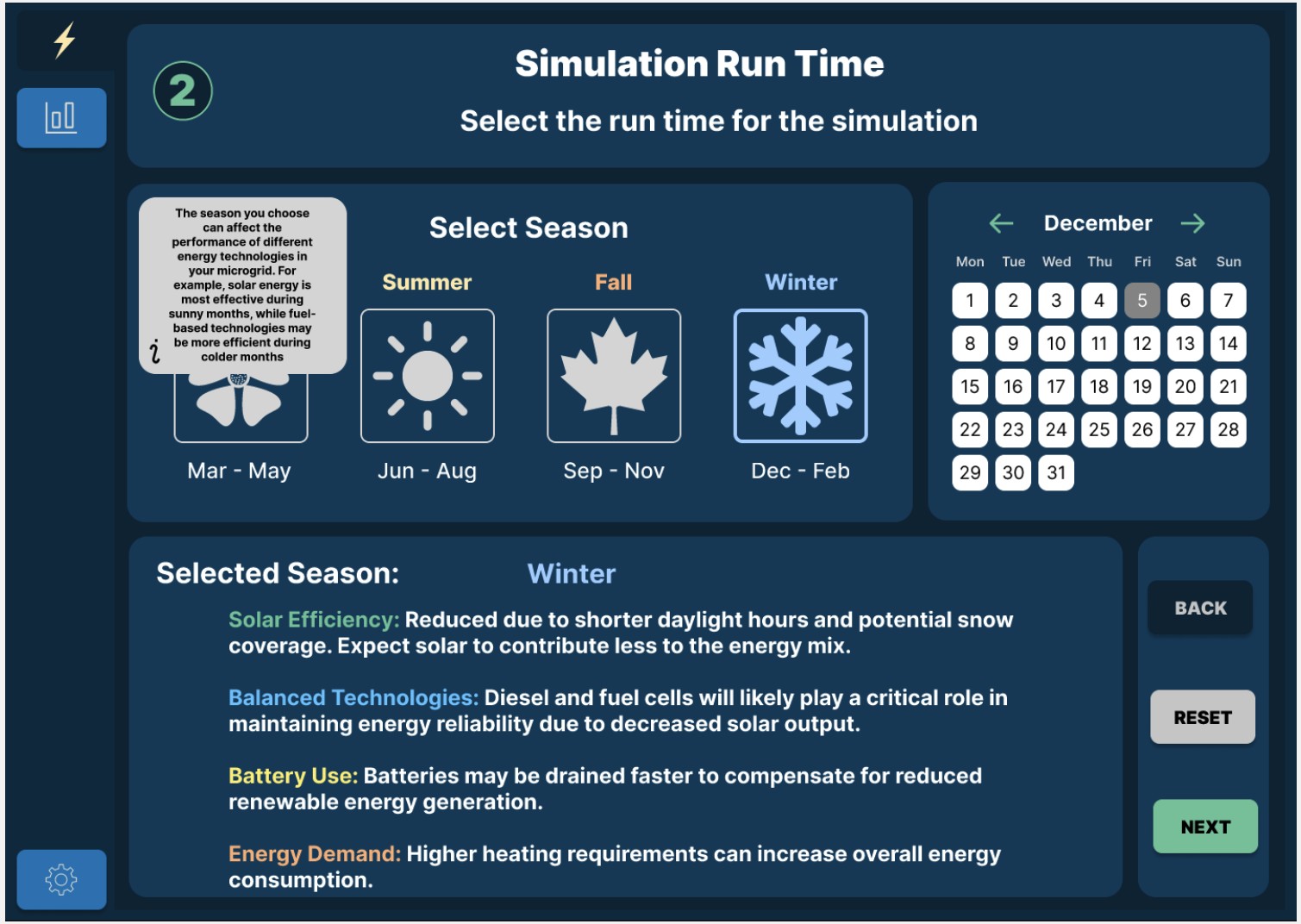

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PROTOTYPE DEMO

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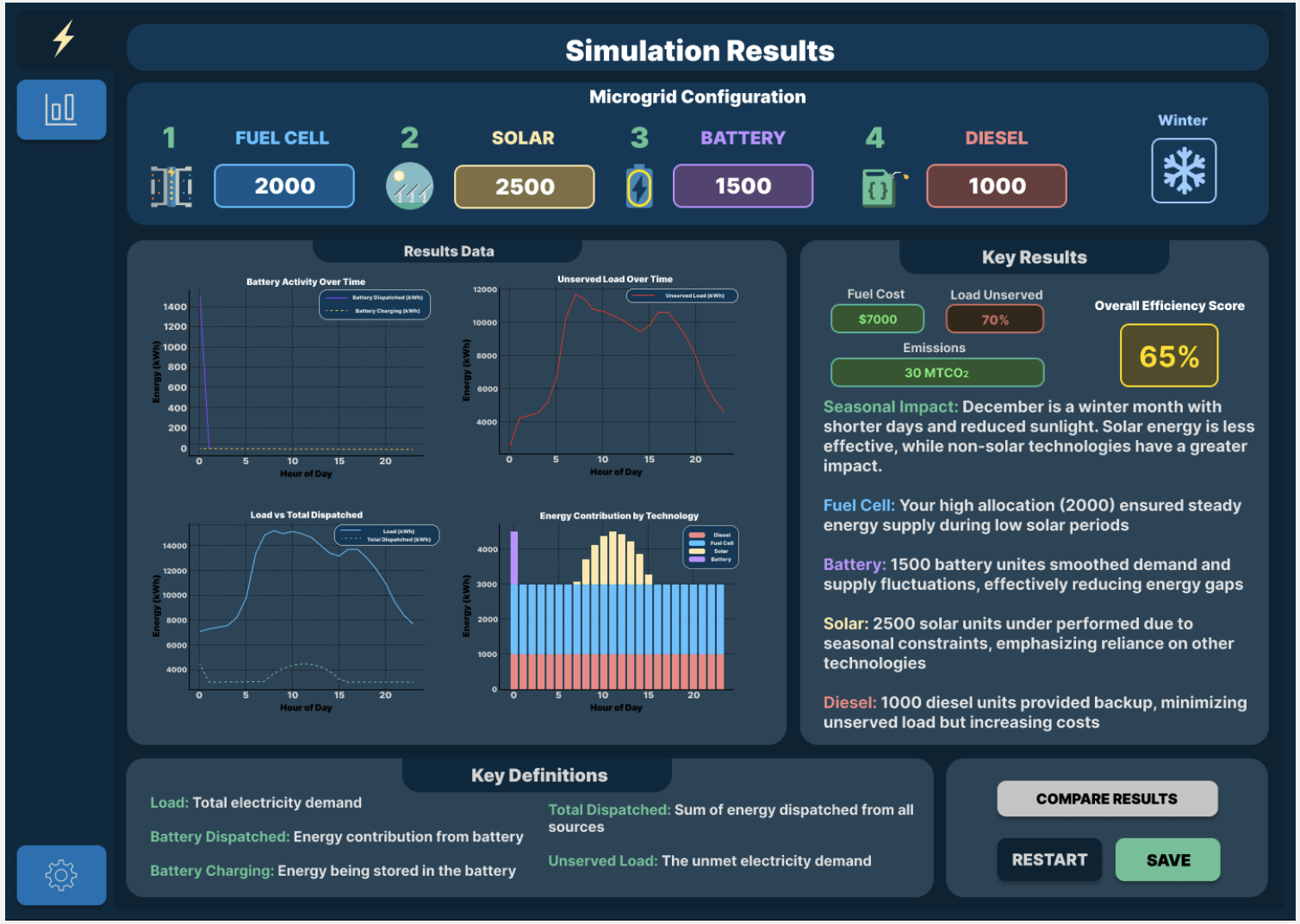

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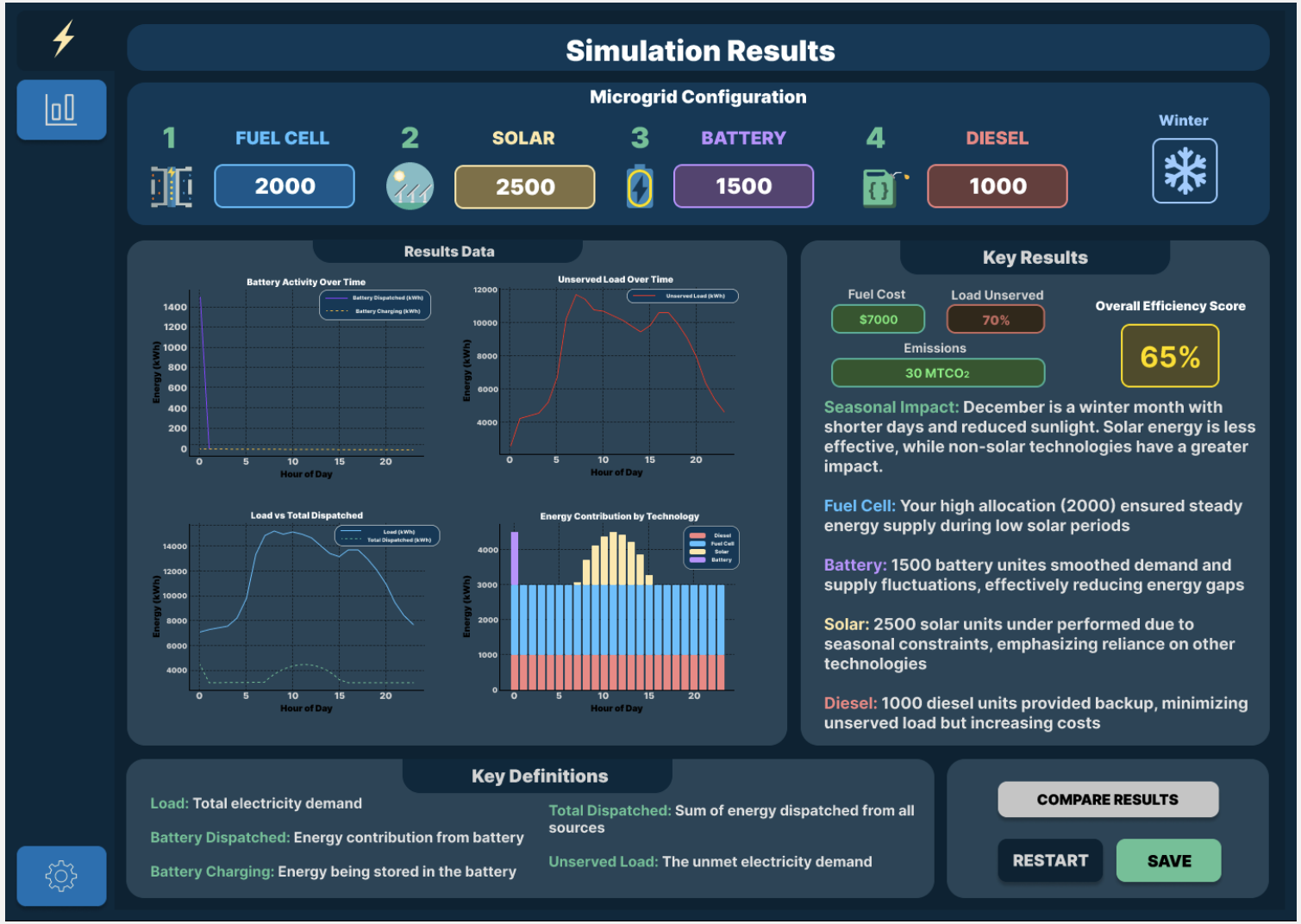

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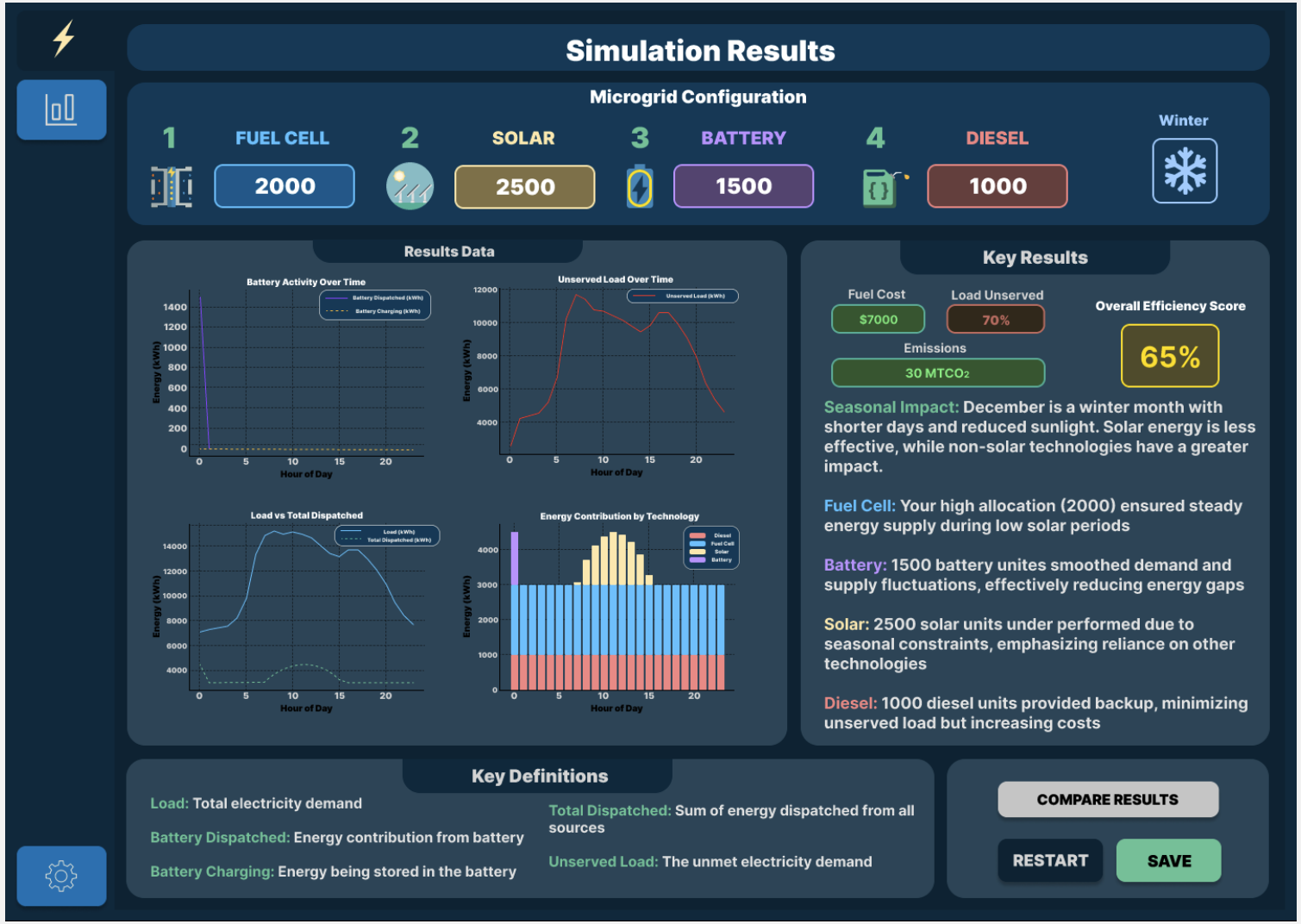

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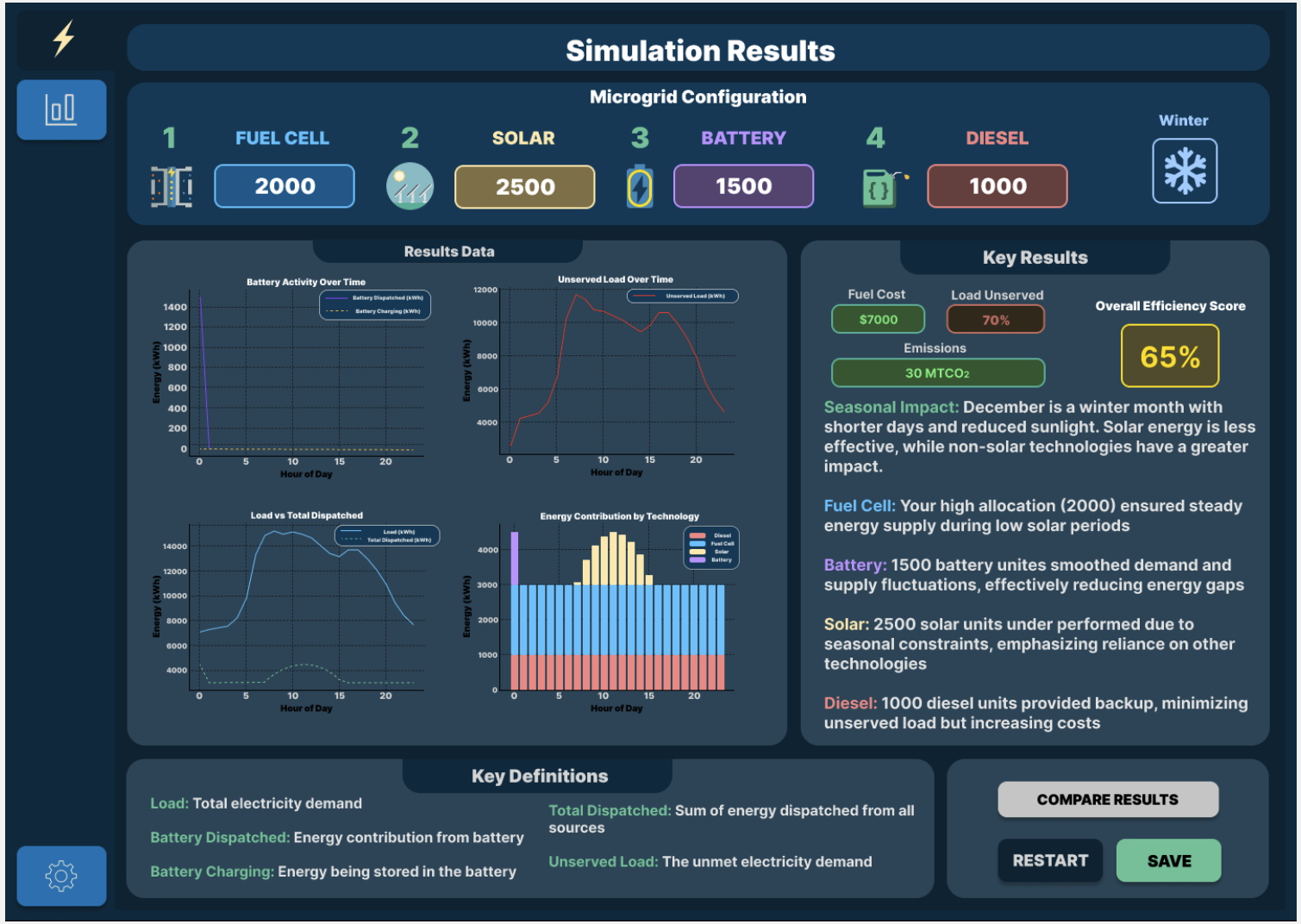

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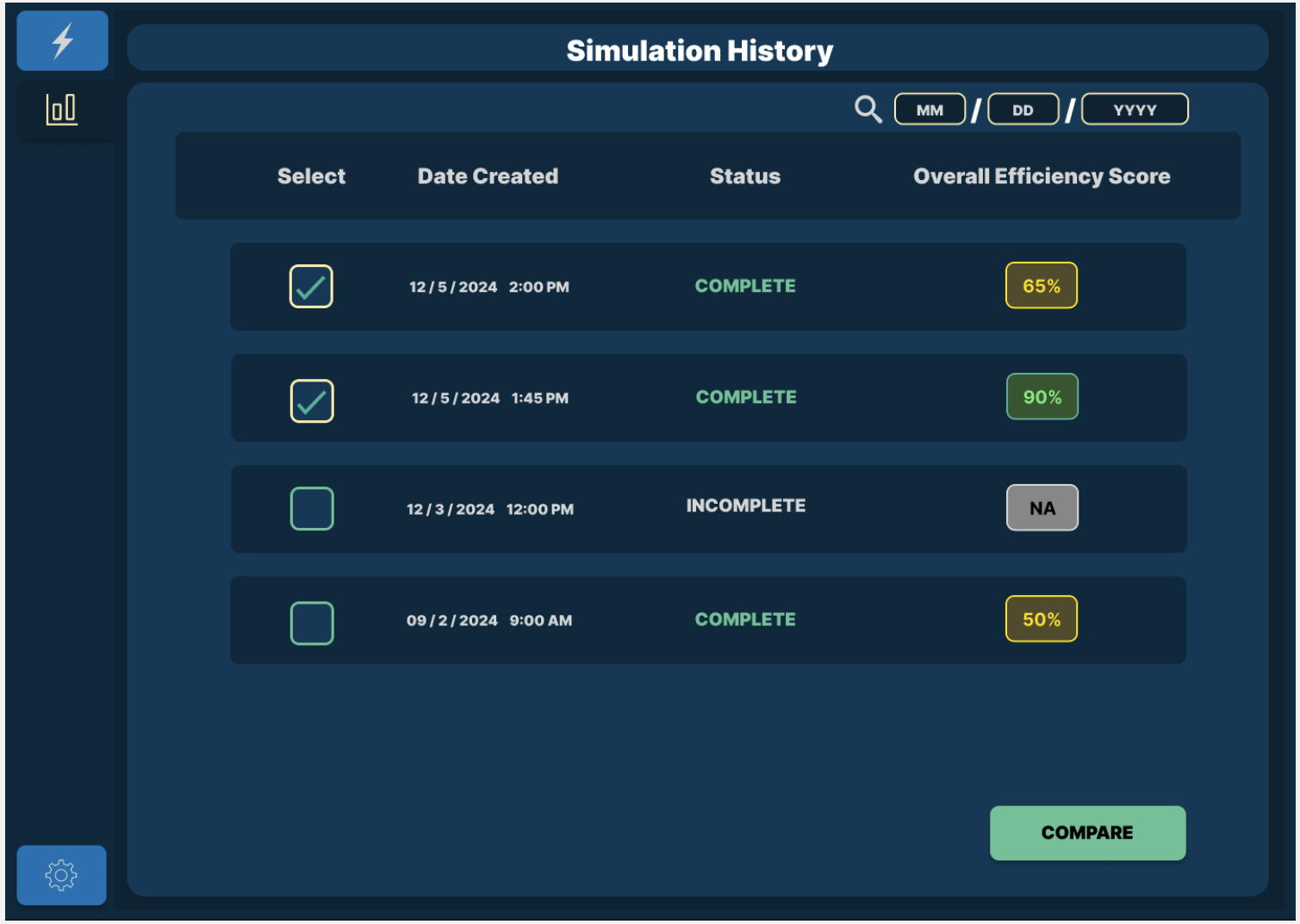

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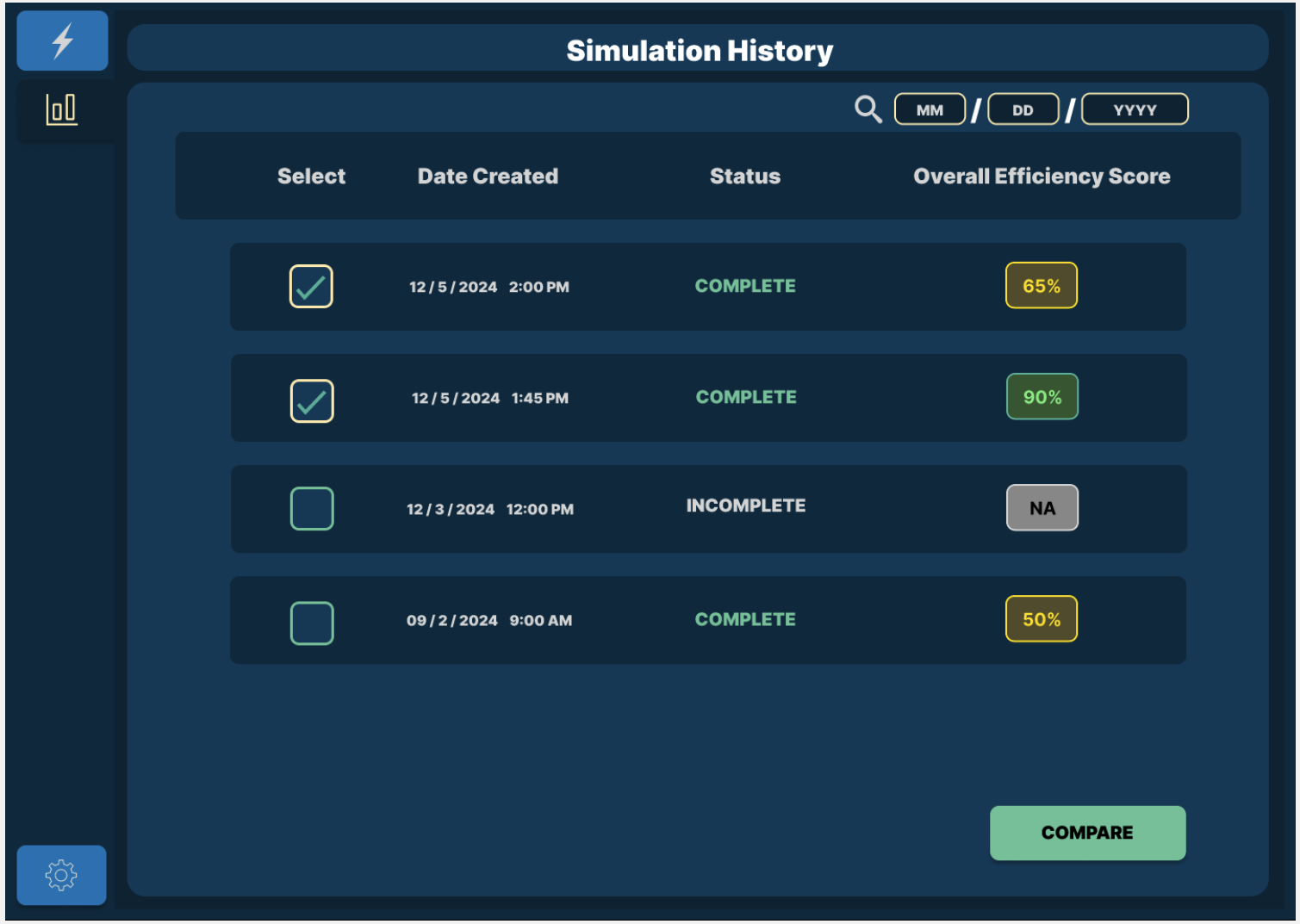

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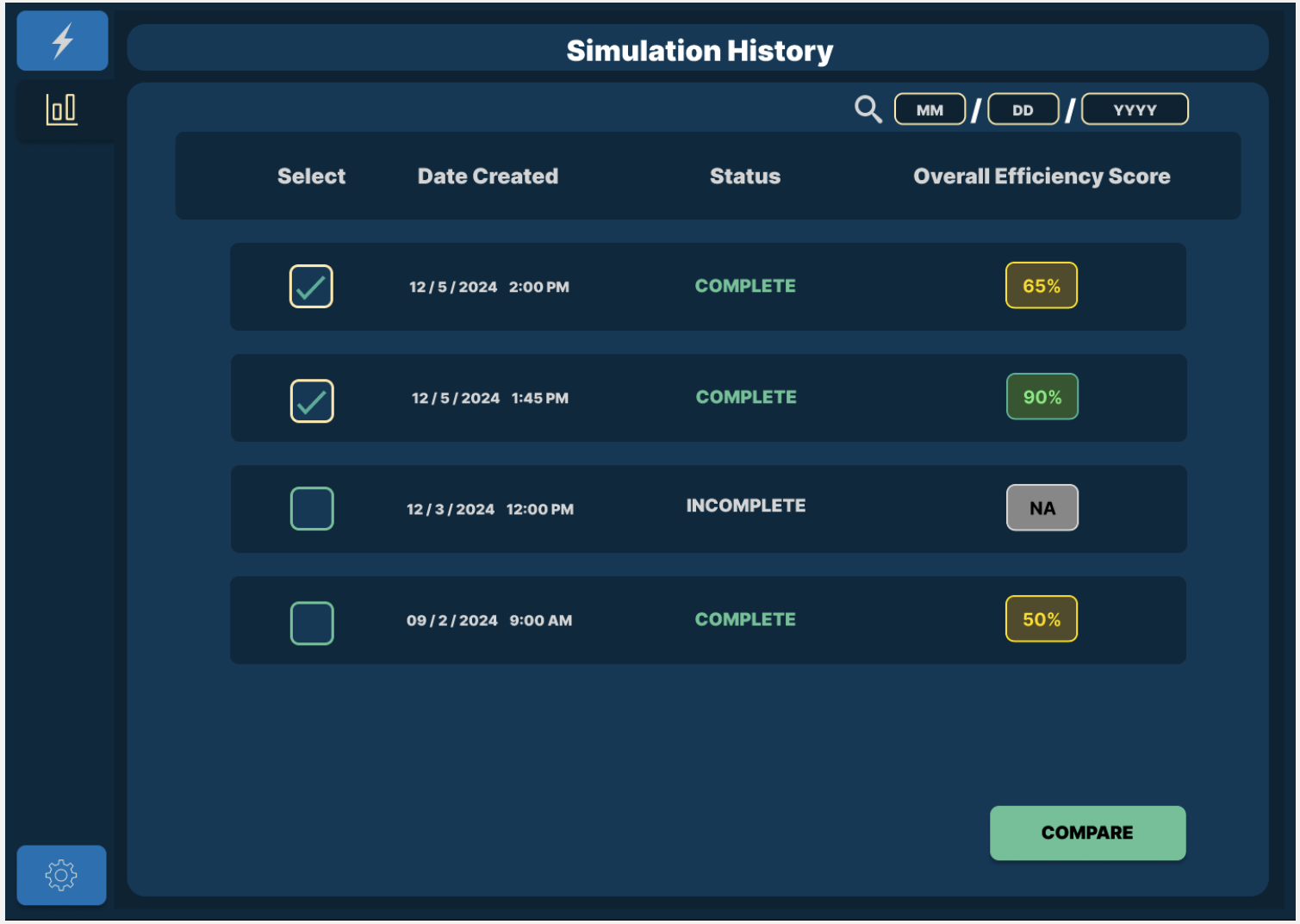

- STUDENT 2
  - PAIN POINT - No statistical feedback or guidance on overall efficiency on my microgrid simulations

NEXT STEPS

User Testing and Feedback

Conduct usability tests to identify pain points and areas for improvement.

Refine Design and Features

Enhance UI elements like information guidance and scoring mechanisms to better meet user needs.

Expand Functionality

Introduce additional scenarios and improve simulation realism.

Launch and Evaluate

Deploy the game and measure its impact on learning outcomes and engagement.

THANK YOU!