Net-Zero Grid with Offshore Wind & Hydrogen Site

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Overview

Design both a net-zero 10-GW grid and an energy production site in North Carolina using different renewable energy sources. Regulatory restrictions, capital and operating expenses, construction timelines, and maintenance schedules were the primary factors for design consideration.

Goals

- Compare energies to meet net-zero cost-effectively
- Optimize energy generation to meet seasonal demands
- Create P&IDs aligning with site design vision
- Forecast costs for energy production site

Proposed Solution

Technologies for Site & Grid Design

Offshore Wind Energy

- Cost-Effective
- Prone to variability

Green Hydrogen Energy

- Produced from excess wind (and solar) energy
- Excess energy will be converted to stored hydrogen

Technologies Used Only in Grid Design

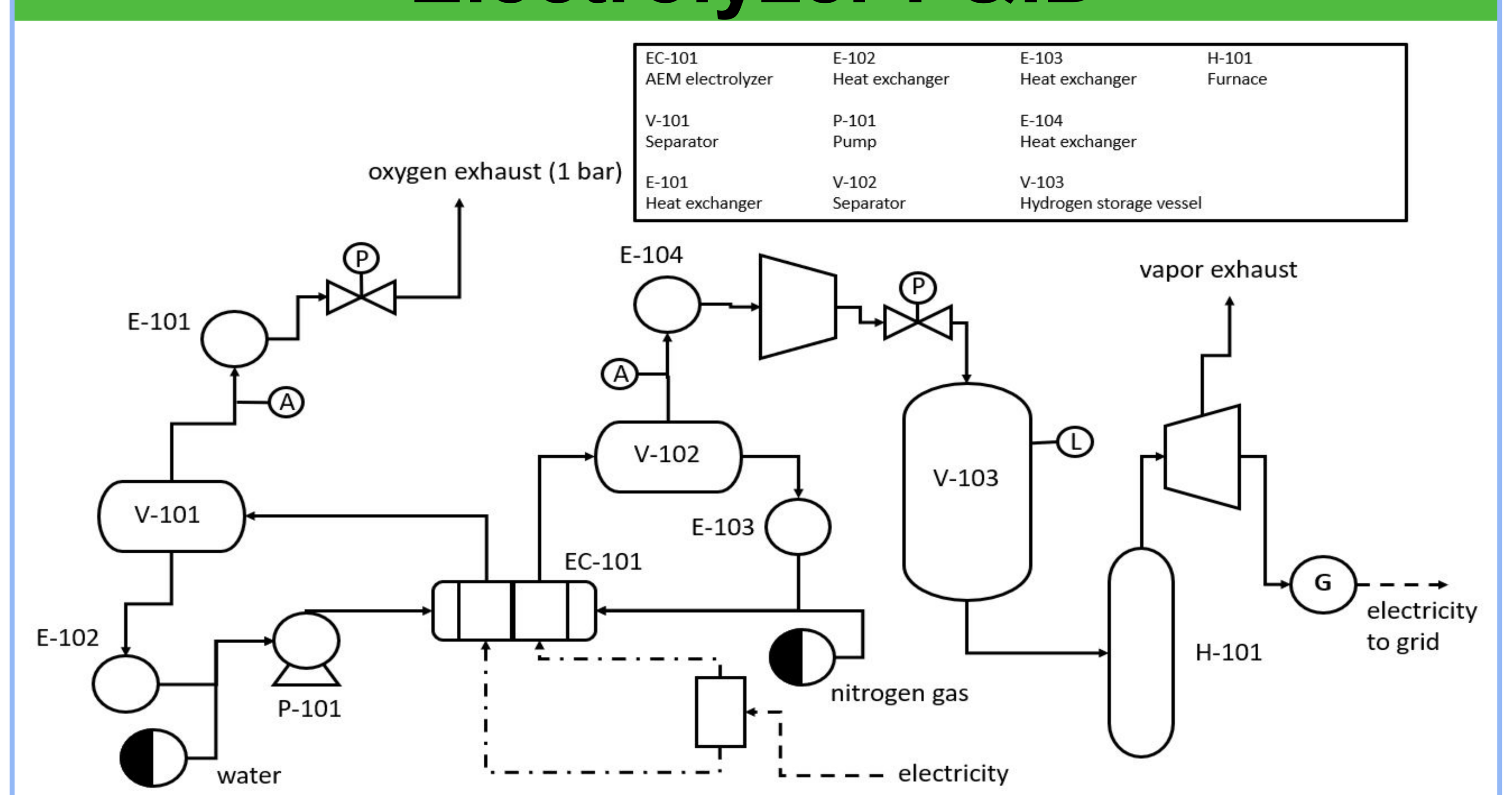
Solar Energy

- Cost-Effective
- Highly effective during summer months
- Variable based on weather conditions

Nuclear Small Modular Reactor (SMR) Energy

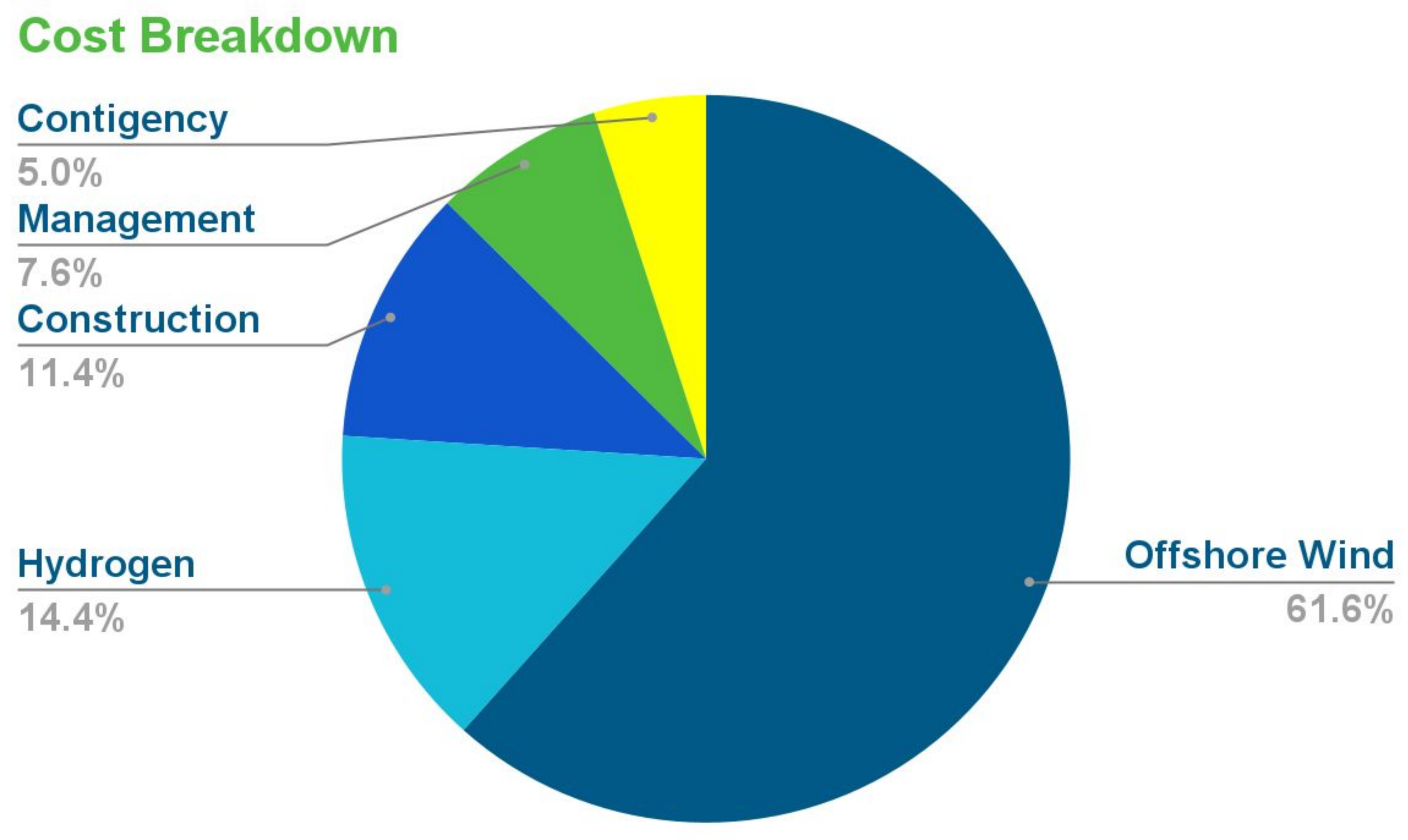
- To provide base-load of energy
- No variability

Electrolyzer P&ID

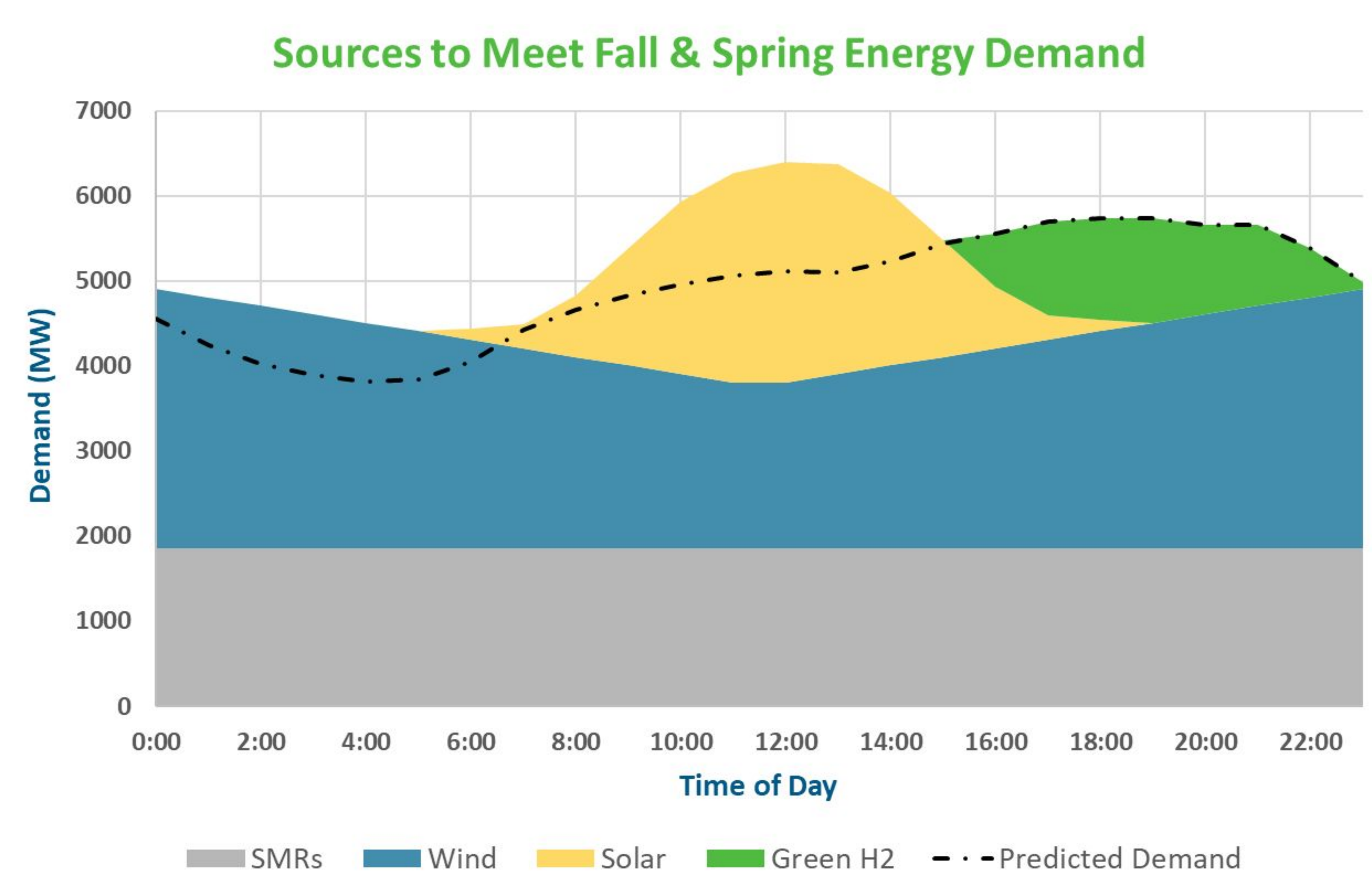


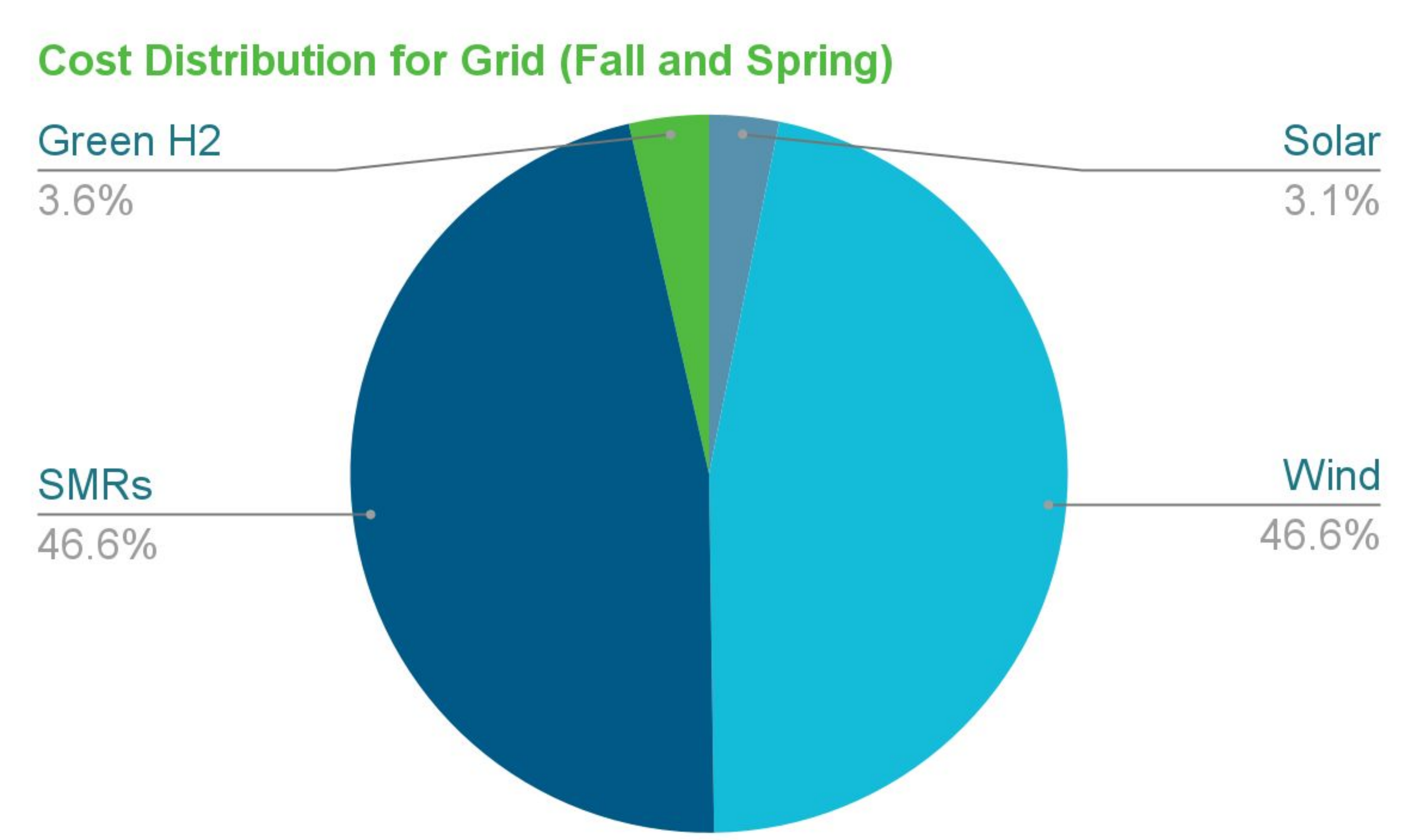
Site Design Economic Analysis

Offshore Wind for Green Hydrogen Site
Project Total Cost: $10.3 billion

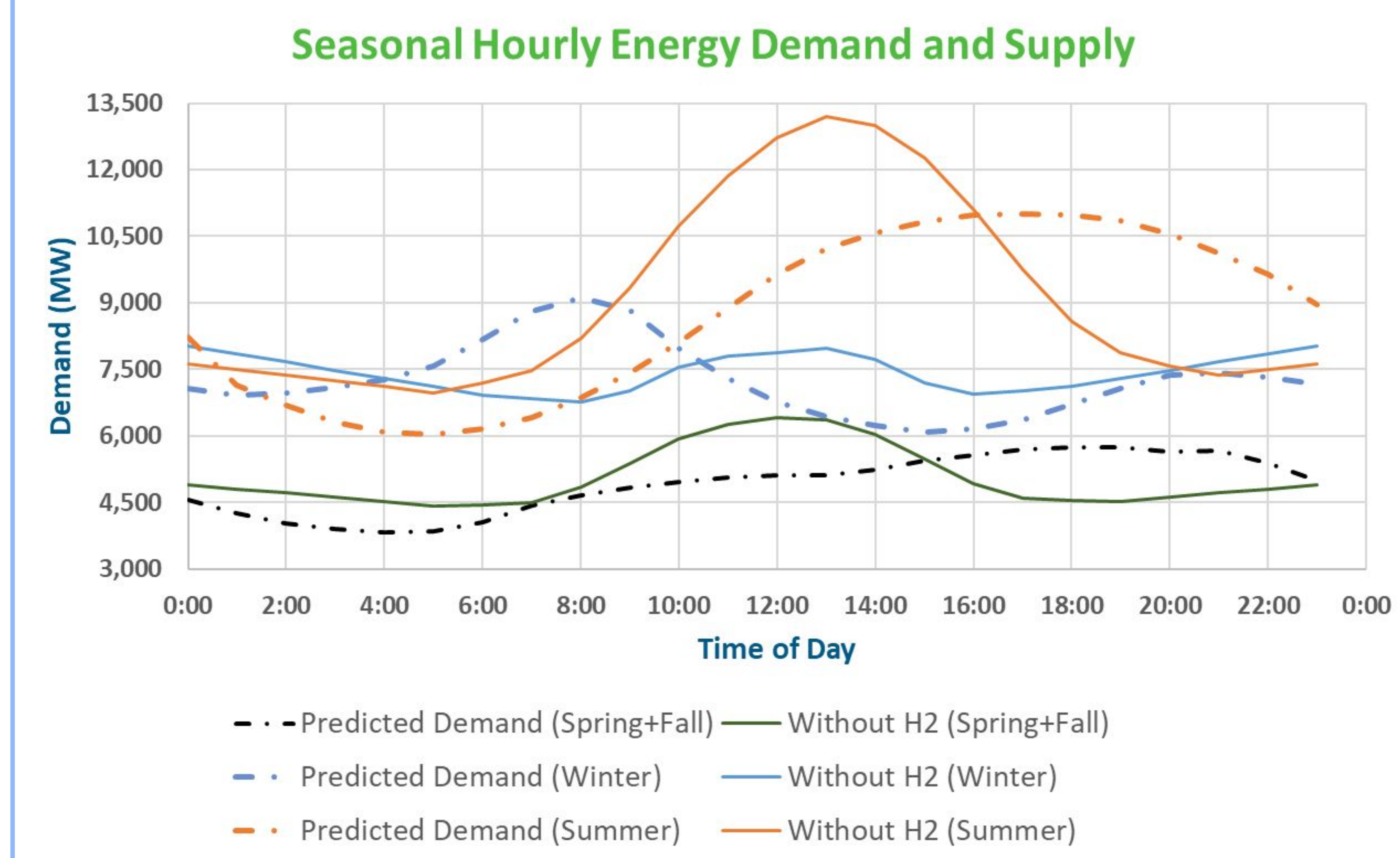


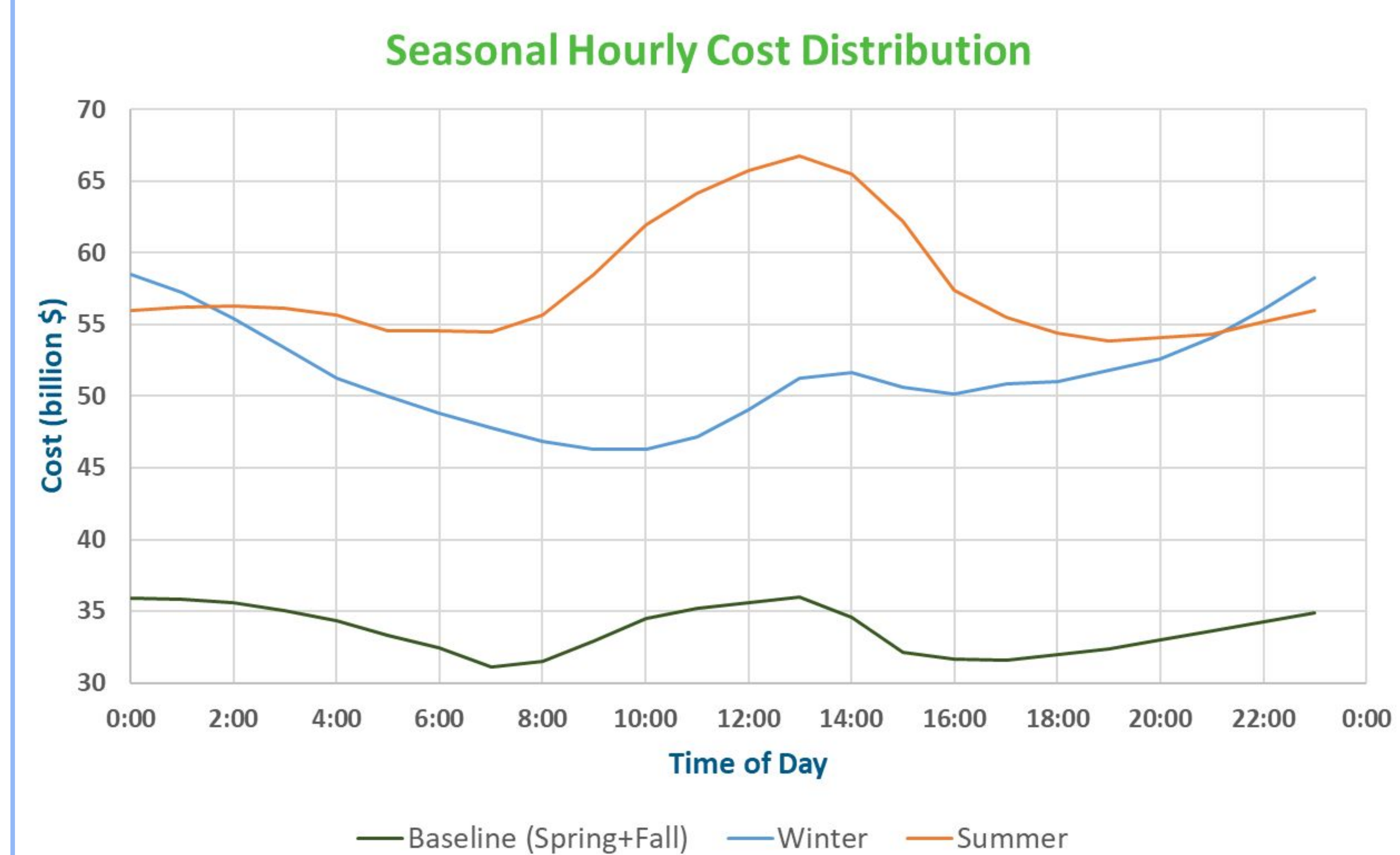
Grid Cost Distribution By Source





Seasonal Demand Curves





Applied Design Considerations

- Green hydrogen does not degrade during storage
- Offshore wind avoids NIMBY concern
- Offshore wind is more consistent than inland wind or solar
- Solar generation takes up excessive land area
- Solar energy alone does not provide consistent enough energy supply for green hydrogen generation

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