

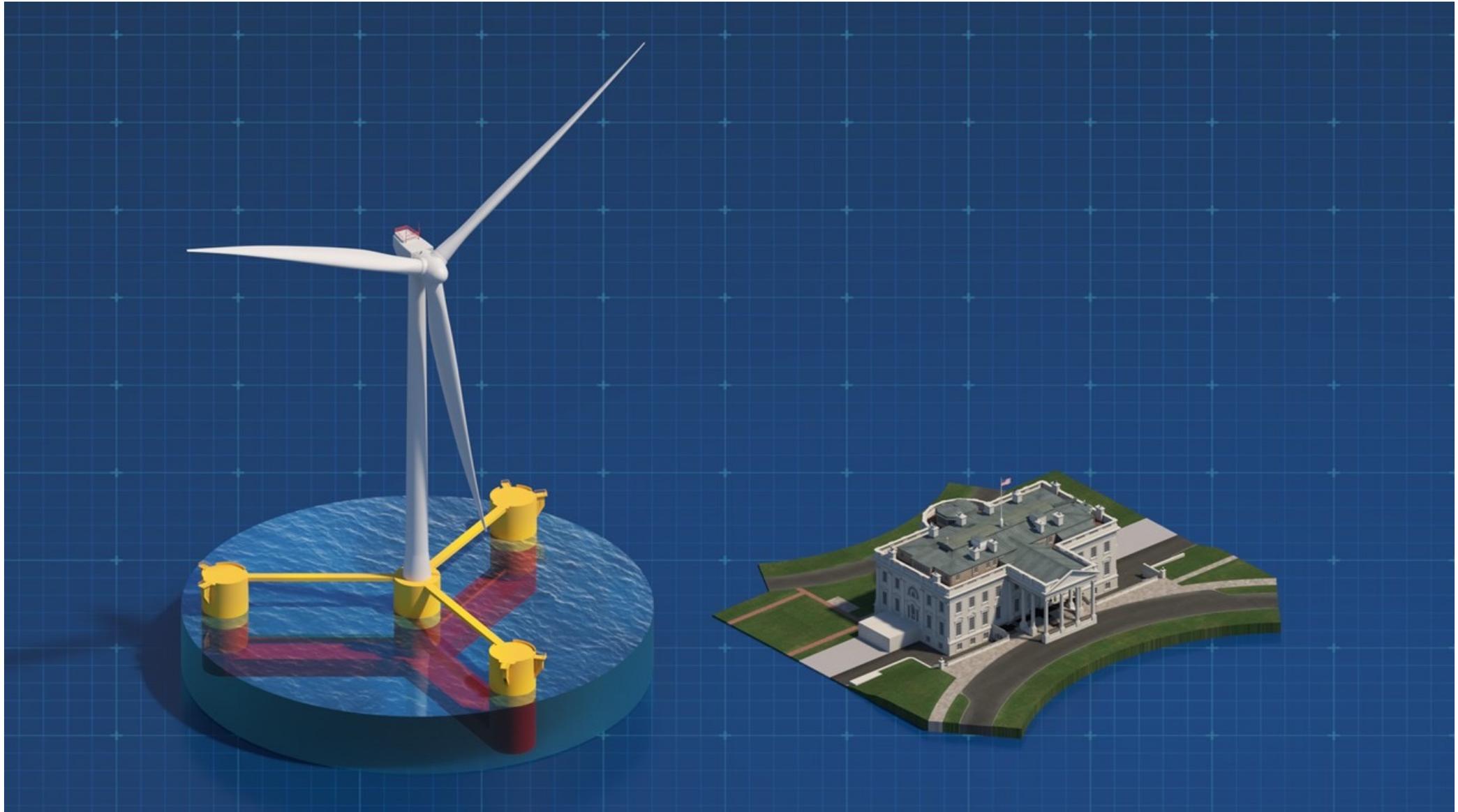
Systems Engineering for Floating Offshore Wind

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Scale of Floating Platforms



Floating Platform Challenges

- **Cost Reduction**
- **Available Infrastructure/Supply Chain**
- **Design Process, analysis capability, testing & verification to drive optimizations**
- **Anchoring & Mooring**
- **Dynamic Cables**
- **Simultaneous platform industrialization and major step changes in turbine innovation (e.g. up-sizing)**
- **Large equipment maintenance & replacement**
- **Technical Debt - Near-term Deployments vs long-term innovation**

Parallel paths to innovate and industrialize



Floating Oil and Gas Technology:
Heavy, expensive, customized, one unit production

Innovation and Optimization

- Physics-based engineering tools
- System up-scaling
- Weight reduction
- Load management and control
- Reliability and maintainability
- Site independence
- Novel platform/turbine configurations

Cost Reduction Pathways

Design for Implementation at Scale

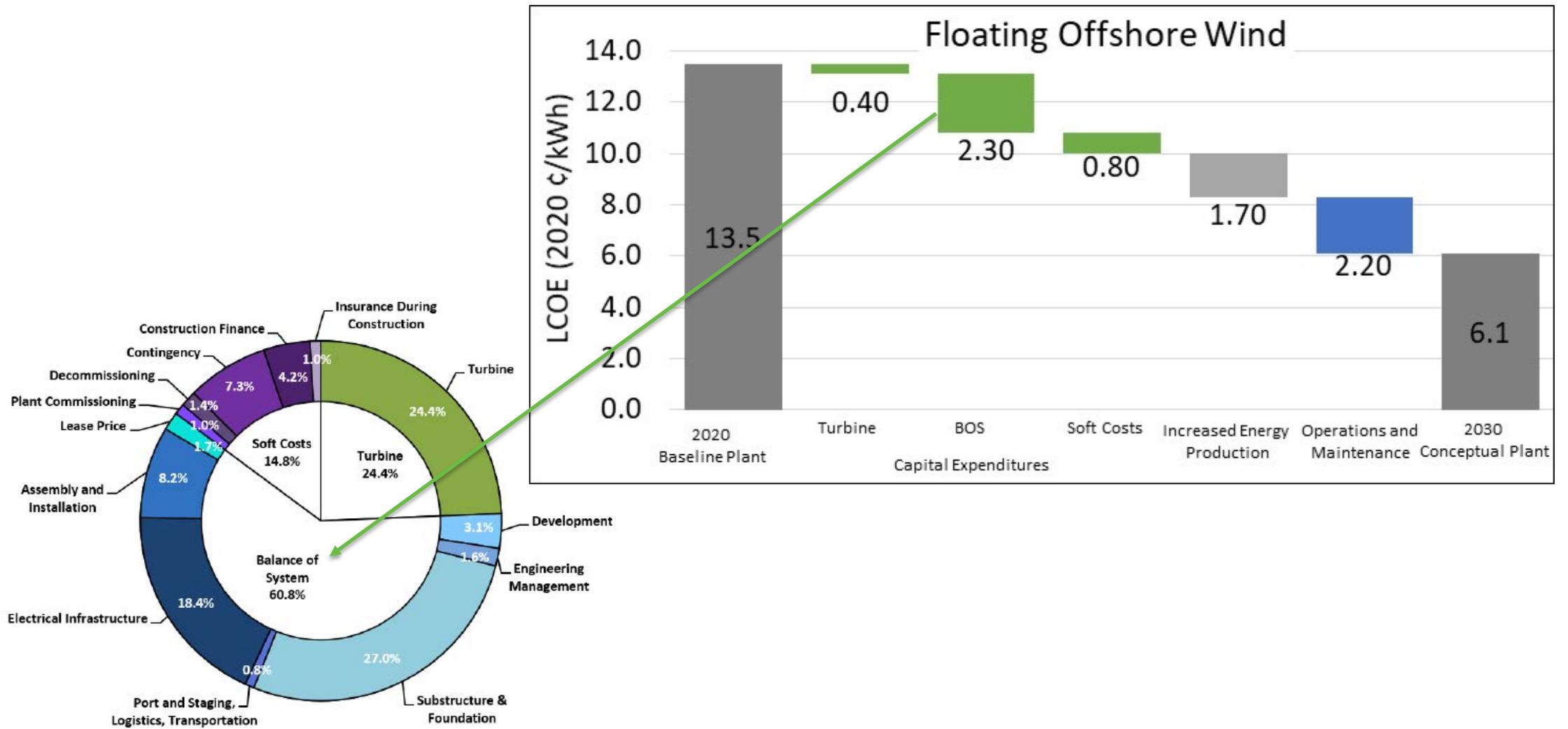
- Design for manufacturing
- Port adaptation
- Speed of assembly
- Mass produced components
- Local supply chains
- Standards Development

Competitive OSW Costs and Market Maturity

- GW scale utility markets
- Grid services
- Minimal environmental impacts
- Co-existence with ocean users
- Safe work environment

“What would you do different if you were doing 100-200 instead of just a couple”

RD&D Plans Guided by Detailed Cost-Analyses



CapEx reduction through wind plant economies of scale, turbine scaling and export/array cables with less material use, and optimized foundation design.

Increase in AEP through turbine scaling, enhanced control strategies, reduced wind plant losses, and higher availability due to improved vessel access.

OpEx reduction from advanced operations & maintenance strategies, improved vessel accessibility.

Survey of Floating Concept Developers

Conducted by NREL (Winter 2021-22)

Topic	Significance	Impact	Total
Improved Station-Keeping Technology	8	9	17
Manufacturability and Industrialization	9	4	13
Improved Design Process and Tools	5	7	12
Array System Designs	4	7	11
Design for Reliability and Maintainability	6	5	11
Local Content	7	4	11
Minimizing Weight Above the Waterline	5	5	10
Decommissioning and Repowering	5	5	10
Designing for Scalability	6	4	10
Regulatory Compliance	6	4	10
Floating-Specific Turbine Designs	3	6	9
Deployability	4	5	9
Adaptability of Designs	3	4	7
Improved Resolution on Design Conditions	3	4	7
Minimizing Loading and Motion	3	3	6