ROICE

Repurposing Offshore Infrastructure for Clean Energy

A UH ENERGY PROGRAM

ROICE Program Overview
July 1, 2024

An Industry-Government-Public-Academia Collaborative to Install and Operate a Demonstration Project in the GOM to Establish Feasibility of Repurposing for Clean Energy

Division of Energy and Innovation

UNIVERSITY OF **HOUSTON**

UH Energy ROICE Program

ROICE Objective: Develop a comprehensive framework for successful clean energy repurposing projects in the Gulf of Mexico (GOM)

ROICE-TE

Techno-Economic Analysis
of ROICE Installations
in the GOM

ROICE-PIF

Project Implementation Framework
for ROICE Installations
in the GOM

- Funded by current and future research grants from state and federal agencies and support by industrial clients
- Advised by experts from industry, academic, research and community organizations who form the ROICE Project Collaborative (RPC)
- Phase Gate approach to implementing and operating a demonstration project

ROICE Vision

*To implement a **ROICE H2 Pilot Project** by 2032 - a wind to H2 project on a repurposed oil & gas facility in the Gulf of Mexico*

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ROICE Phases

- ❑ Phase 1 – Screening Studies (complete)
  - ✓ Levelized Cost (LC) Model and LC Heat Maps developed for Wind and Hydrogen ROICE projects in the GOM
  - ✓ Chartered Regulatory and Technical workgroups to develop project implementation framework
- ❑ Phase 2 – Feasibility Studies – by 2Q24
  - ✓ Screen offshore GOM assets for ROICE implementation potential; refine ROICE designs
  - ✓ Understand path to profitability of ROICE projects – capex reduction, incentives etc.
  - ✓ Develop ROICE Project Implementation Framework –for Regulatory and Technical aspects, for base scenarios

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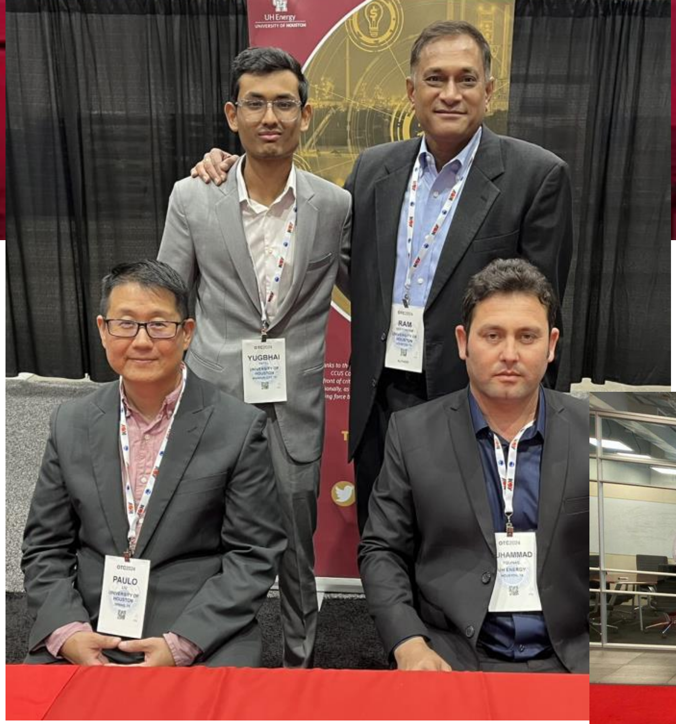
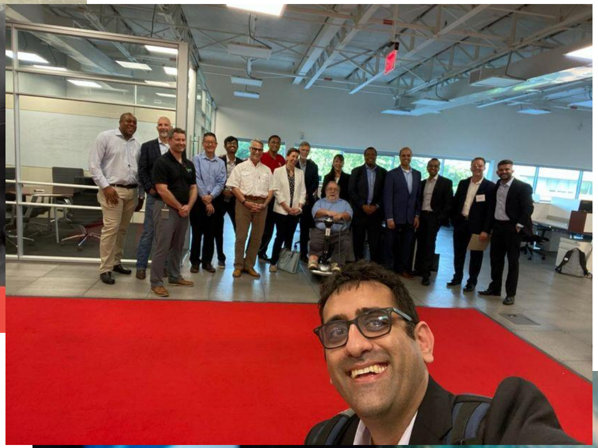
- Phase 3 – Demonstration Project Design – by YE25
  - Develop scope and refined design for short list of demo project locations
  - Expand ROICE Project Implementation Framework
  - Apply to shortlisted assets as case studies
  - Launch and complete commercial framework for all scenarios
  - Envision how it would work for 2 pilot locations as case studies
  - Solicit partners (asset owners, funding agencies, OEM and EPC companies) and develop scope and project execution plan for ROICE H2 Pilot
- Future Phases
  - ‘26 – ‘29: Detailed design and execution
  - ’30 – ’32: Start up Window

ROICE Program Admin Update

- ❑ Phase 2 work completed; documenting results in technical paper / final report
- ❑ Phase 3a kickoff meeting held on June 19th
  - ❑ DOE NETL Funded – focus on comprehensive PIF, asset selection and optimal power systems design
- ❑ Funding being sought for Phase 3b
  - ❑ Demonstration project planning; economic modeling; stakeholder engagement and decommissioning incentivization
- ❑ Publications – 7 papers
  - ❑ OTC: Published two papers on Phase 1 TE and PIF Overview
  - ❑ Two ROICE GOM Phase 1 papers submitted "Renewable and Sustainable Energy Reviews" -
  - ❑ One ROICE California paper to be submitted to journals
  - ❑ Phase 2 PIF: 2 Research Reports released through SSI





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ROICE Program Collaborative (RPC)

- The ROICE Program is advised by experts from over 40 organizations – engineering and OEM companies, operators, national labs, associations
- Three categories of members with increasing influence on project direction
  - Informed – invited to meetings
  - Active – signed agreements to provide consultation; shape program scope
  - Sponsor – joint ownership of program; outreach to stakeholders; greater influence on demonstration project
- No funding expectation currently; program funded through research grants

AECOM
American Bureau of Shipping
Apache
AquaTerra
Argonne National Lab
Ayatis / DSIDER
Baker Hughes
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BP
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TSB Offshore Inc
Wood PLC
WSP
XODUS Group
Young America Capital

Current RPC Members

ROICE Phase 3: RPC Membership

- ~20 Active RPC Members signed Association Agreement in 2022 – will request confirmation of extension
- ~20+ others on RPC mailing list to be requested to sign AA and formalize RPC Membership
- Request company logo for display in ROICE publicity materials
- Expectations and benefits of “active” and “sponsor” RPC Members outlined
- Option to simply stay as “informed” – on ROICE mailing list and receive invitations to monthly and annual meetings

ACTIVE AND SPONSOR MEMBERS EXPECTATIONS & BENEFITS
Provides expert consultation time and data; letters of support and cost share for funding proposals
Participates in Workgroups to develop white papers
Influences key segments of work through small group working meetings
Has early access to results
Has access to student and faculty time for company-funded projects
Has First Right of Refusal to participate in ROICE Demo Project

ROICE Program Sponsorship

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- ❑ More formal partnership – Sponsorship of the ROICE Program
- ❑ Sign MOU with UH or UH Energy
- ❑ Public and website announcements, shared media releases
- ❑ Greater influence on project direction and demonstration project scope
- ❑ Participation in meetings with key stakeholders and influencers

ROICE Program is grateful for our current sponsors

promethean

Endeavor

Argonne NATIONAL LABORATORY *

** Argonne National Lab has an overarching MOU with the University of Houston and is an RPC Member*

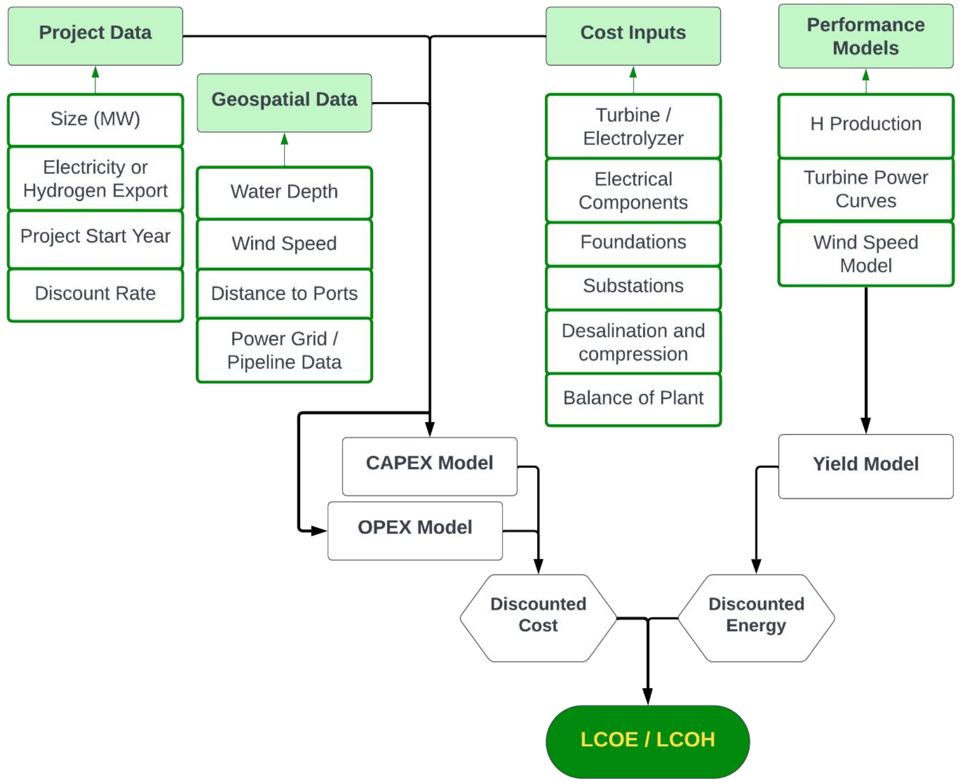
ROICE-TE Phases 1 – 2 Overview

Funding

Phases 1 and 2 of the ROICE Program was paid for with federal funding from the Department of the Treasury through the State of Texas under the Resources and Ecosystems Sustainability, Tourist Opportunities, and Revived Economies of the Gulf Coast States Act of 2012 (RESTORE Act). The statements, findings, conclusions, and recommendations are those of the author(s) and do not necessarily reflect the views of the State of Texas or the Department of the Treasury.

The ROICE Team is very grateful for the funding provided by UH Subsea Systems Institute, TCEQ and the US Department of Treasury for making these funds available to carry out the work reported here.

Phase 1 Refresher – Levelized Cost Model



Workflow of our Model

- ROICE projects (Repurposing Offshore Infrastructure for Clean Energy) have the potential to transition significant fraction of offshore infrastructure in the GOM and other areas into clean energy projects
- ROICE Levelized Cost (LC) model built for wind or wind to hydrogen projects; LC values estimated for all locations in the GOM
- Levelized costs for ROICE projects are a complex function of various variables – wind speed, water depth, distance to shore, project size, new build vs. repurposed

Phase 1 Refresher – Levelized Cost Model

High-level Results

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Shallow Water / Near shore locations appear to have the lowest LC for all cases

- New Build or Repurposed, Power or Hydrogen

Repurposing improves the LC by 1 to 10%

In deeper waters (Further away from shore), repurposing can reduce the LC by

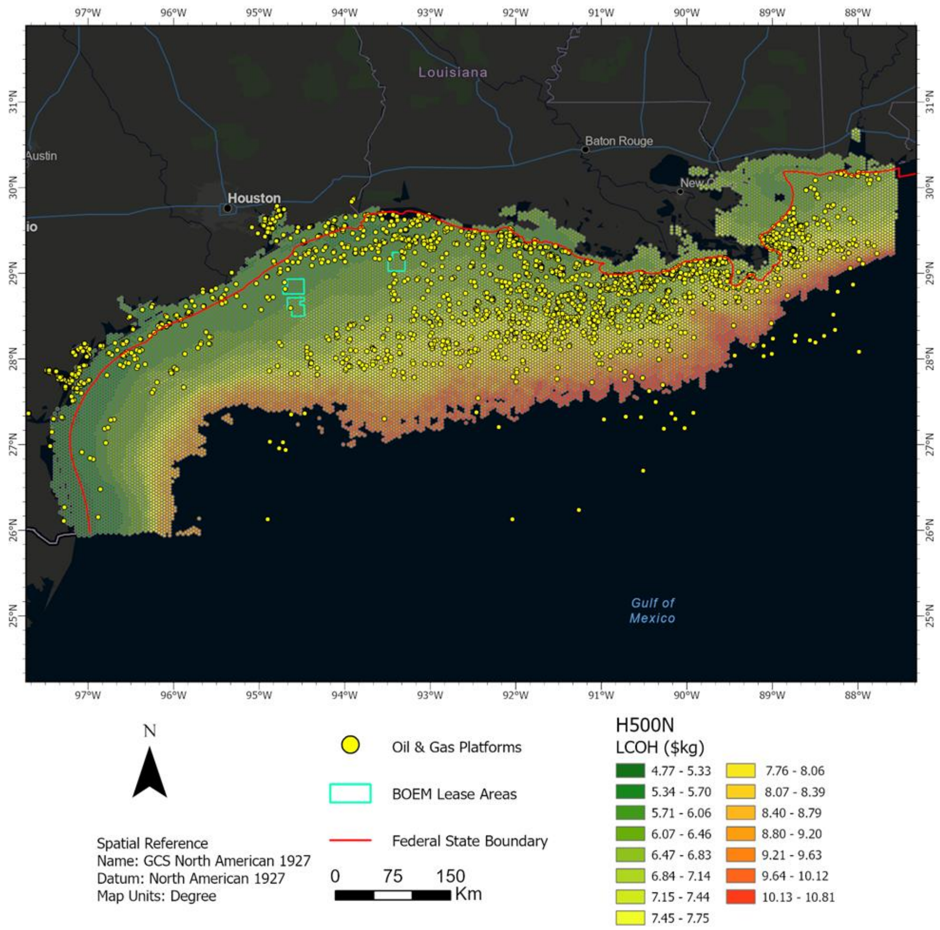
- up to 15% for larger scale projects
- up to 40% for smaller scale projects.

Incremental economics on additional CAPEX for hydrogen generation is likely to be promising, with healthier federal incentives for hydrogen production.*

Unlike power projects, hydrogen projects maintain their economic feasibility in deeper waters and over a range of project sizes.*

** Later proved to be challenging after more detailed work in Phase 2*

Phase 1 Refresher – Levelized Cost Maps



Heat Map for 435 MW New Build Hydrogen Export Project

Ratios of Repurposed CAPEX to New Build CAPEX

Power	Shallow	Deep
435 MW	99%	93%
105 MW	98%	81%

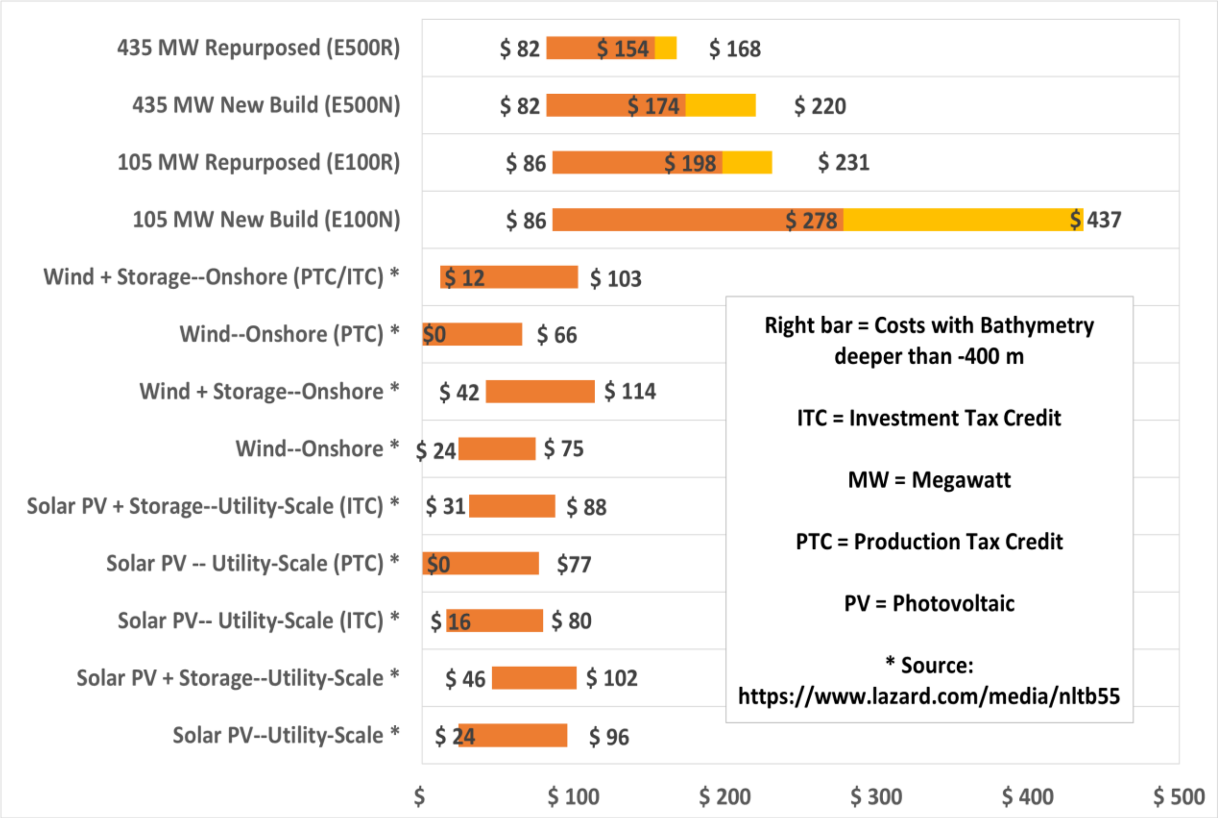
Hydrogen	Shallow	Deep
435 MW	97%	85%
105 MW	88%	61%

Capex Reduction from repurposing existing structures

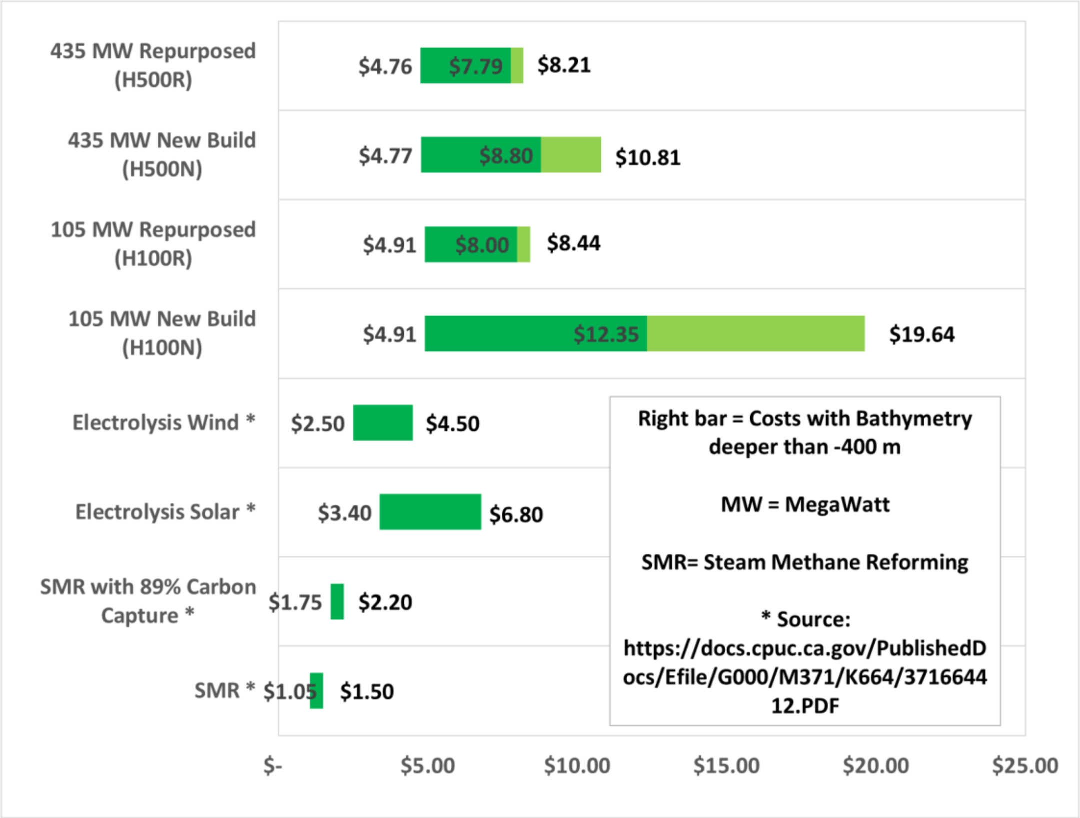
- 1 to 12% for shallow water locations
- 7 to 39% for deeper water locations

Phase 1 Refresher – Economic Challenges

NOTE:
- LC's based on 2023 CAPEX – no cost reduction trends assumed
- No incentive credits applied



LC Comparison for Power Projects



LC Comparison for Hydrogen Projects

Phase 1 Refresher – Economic Challenges

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Challenges remain:

Levelized Costs (LC) range is higher than equivalent low-carbon renewables-based onshore projects, and even more challenged versus high-carbon alternatives.

Even where the impact of repurposing is high, The overall cost remains a challenge

However:

Stronger government incentives and major cost reductions will be needed to make these competitive.

Federal and state incentives (up to $3 / kg of hydrogen) could make projects at the lower end of LC range competitive

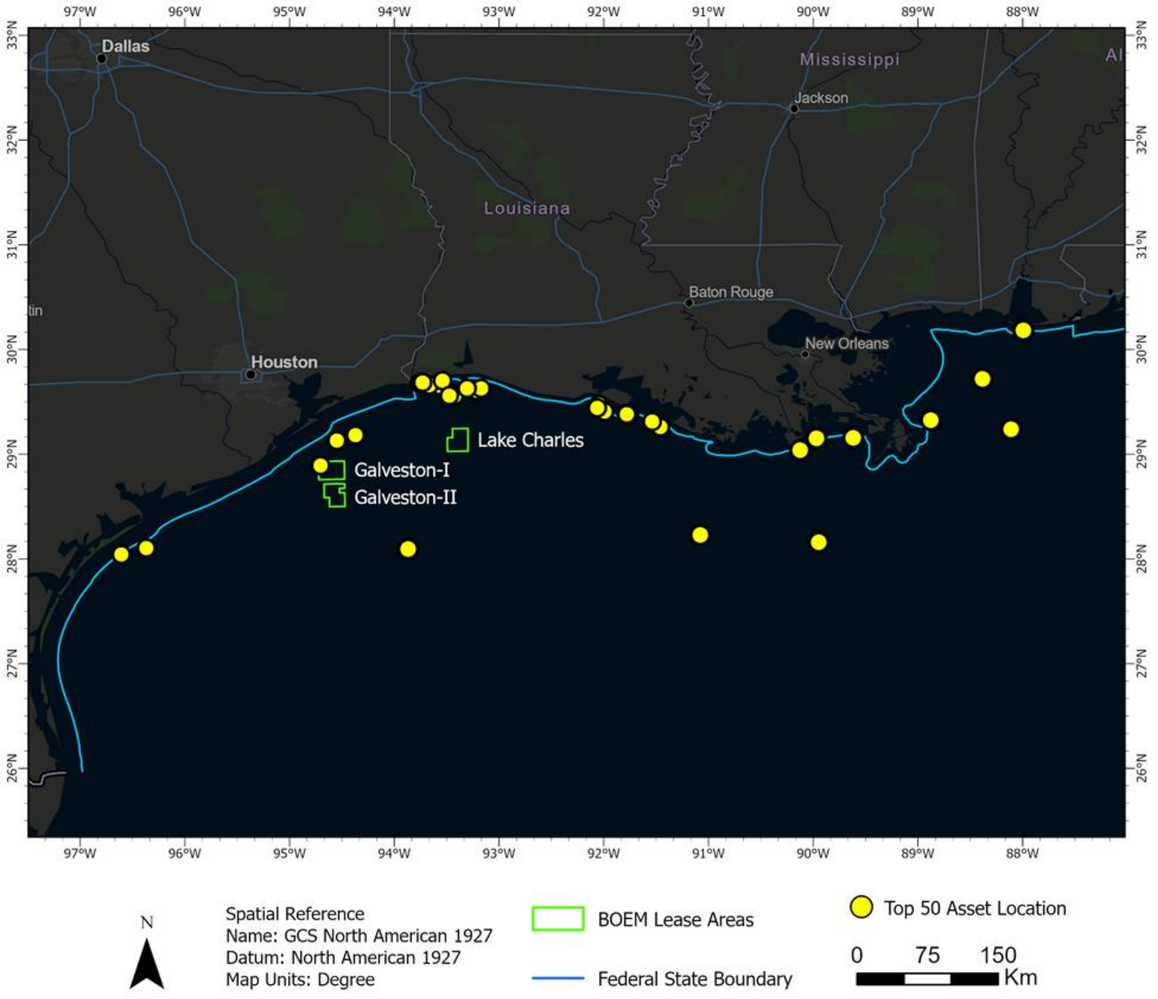
LC Ranges:

Repurposed wind projects in the GOM: $82 to $231 per MWh. Equivalent new build projects: $82 to $437.

Repurposed hydrogen projects in the GOM: $4.76 to $8.44 per kg of hydrogen. Equivalent new build projects: $4.77 to $19.64.

Phase 1 Refresher – Asset Selection

- LC's estimated for all ~1500 assets in the federal waters of the GOM
- 40 assets selected with favorable LC's (mostly near shore assets); 10 other assets added based on other criteria
- *Optimized ROICE designs for these 50 locations were to be developed in Phase 2; however, access to asset information proved difficult*
- *Switched to design work on typical platforms based on data received from RPC members on recently decommissioned assets*
- *Can revisit asset list in Phase 3*



Spatial Locations of Top 40 Assets

Wind Power to Hydrogen Projects

Project Sizes for Typical Structures from a West Delta Complex

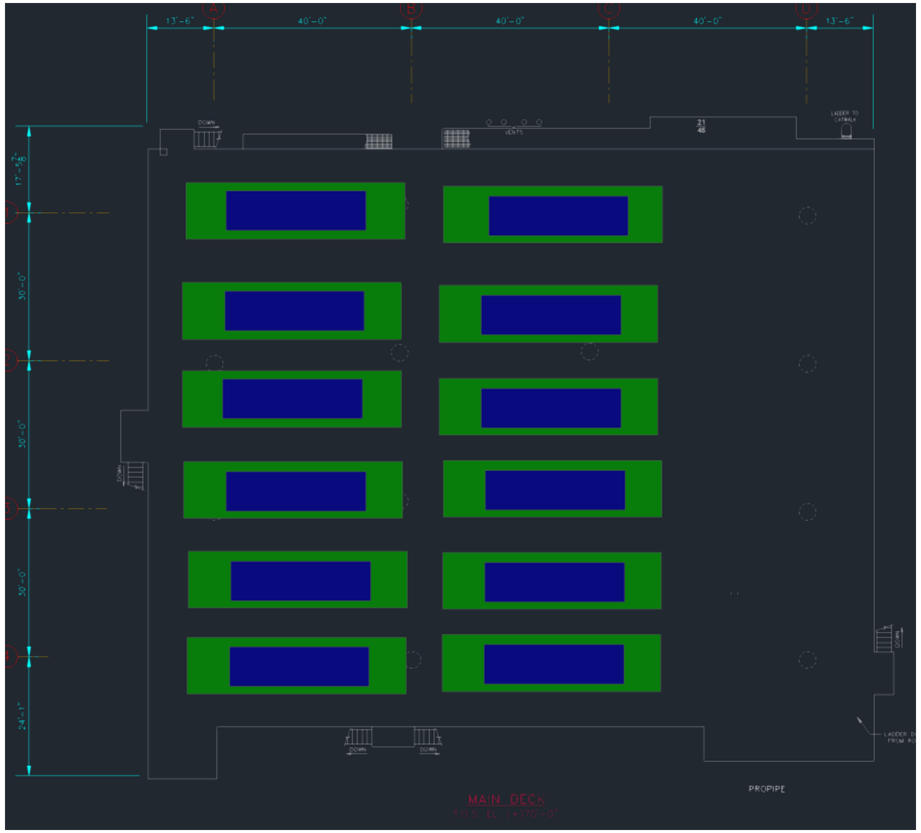
- *5MW IMI Design and 10 MW NEL Design used to estimate footprint*

16 Leg Platform	3300 tons; 90 ft water depth; Main Deck ~ 150 x 130 ft	60 MW (5MW units) – 100 MW (10 MW Units)
12 Leg Platform	3600 tons; 102 ft water depth; Main Deck ~ 135 x 120 ft	60 MW (5MW units) – 100 MW (10 MW Units)
8 Leg Platform A	3000 tons; 143 ft water depth; Main Deck ~ 155 x 65 ft	30 MW (5MW units) – 70 MW (10 MW Units)
8 Leg Platform B	2650 tons; 143 ft water depth; Main Deck ~ 170 x 70 ft	30 MW (5) – 50 MW (10)
8 Leg Platform C	2500 tons; 154 ft water depth; Main Deck ~ 170 x 70 ft	30 MW (5) – 50 MW (10)

Pathways to larger H2 Projects
- Subsea hydrogen gen
- Onshore hydrogen gen
- Efficient footprint designs
- Stick build design

- *Hydrogen projects likely limited to max 100 MW per platform; multiple platforms needed for larger projects*

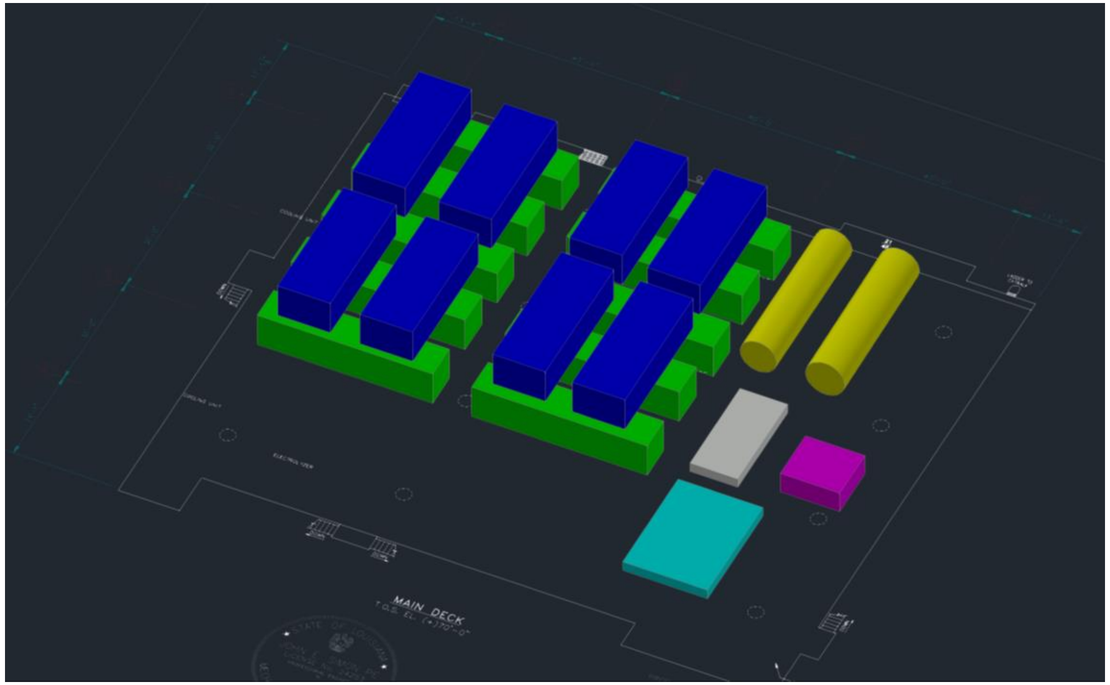
Wind Power to Hydrogen Projects



16 Pile Platform

5 MW Electrolyzer Units from IMI

on Main Deck



16 Pile Platform

10 MW Electrolyzer Units from NEL

on Main Deck

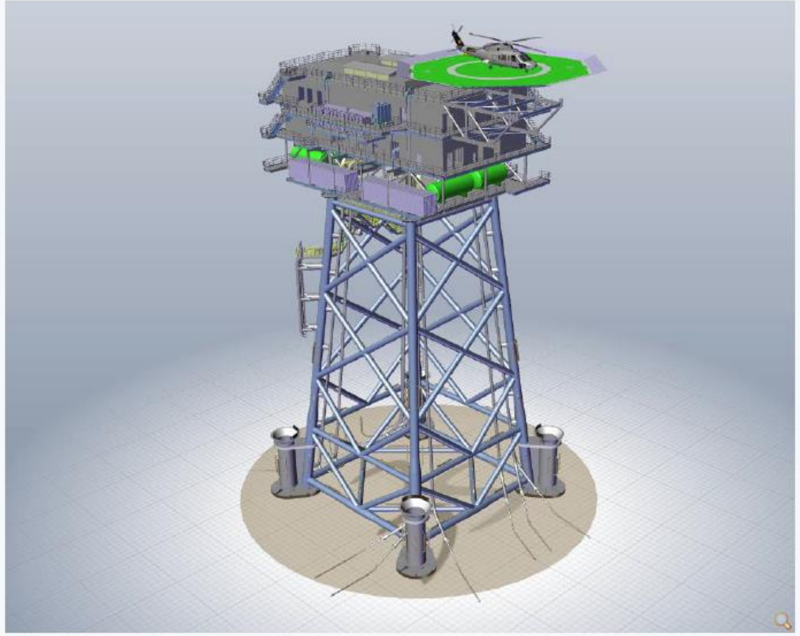
ROICE Phase 2 – Project Sizing

Wind Power Projects

- ❑ Power Export projects will require significantly lower footprint than equivalent MW hydrogen export projects
- ➢ Repurposed decks can house larger power projects than hydrogen projects
- ❑ Offshore Power Export Project examples from literature:
  - ❑ 332 MW uses three decks 32 x 16 m (~15 K Sq Ft)*
  - ❑ 400 MW uses three decks 20 x 20 m (~13 K Sq Ft)**
- ➢ Based on size of current power export projects, a 500MW power export project could potentially fit on a West Delta 16 Leg Platform
- ❑ Caveat: Offshore support components may need to be divided into smaller modules for placement on ROICE repurposed platforms

Dimensions:

Topside (L x W x H):	32 x 16 x 18 Meter
Jacket (H):	51 Meter
Water Depths:	28 Meter
Topside Weight:	2,293 tons full operational
Jacket Weight:	1,683 tons excl. piles
Topside Decks:	4 incl. Roof Deck with helicopter landing deck



Courtesy: Nordsee One GmbH

*https://www.nordseeone.com/engineering-construction/offshore-substation.html

**https://www.windpowerengineering.com/making-modern-offshore-substation/

ROICE Cost Estimator

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- CAPEX estimates refinements built into ROICE Cost Estimator; also models power and hydrogen generation
- Major CAPEX components for key project cases shown below
- Existing pipelines assumed to be repurposed for low pressure (<30 bar) hydrogen transport to shore; onshore compression costs included
  - Pre-ROICE Decommissioning costs ~10% of ROICE project capex for small projects and 1 to 3% for larger projects

CAPEX PARAMETERS $K	10 MW H	60 MW H	10 MW E	60 MW E	500 MW E
Fixed Project Development Cost	$ 8,640	$ 51,840	$ 8,640	$ 51,840	$ 432,000
WTG Costs	$ 31,401	$ 160,624	$ 31,401	$ 160,624	$ 1,125,900
Foundations & Installation	$ 9,146	$ 15,097	$ 10,721	$ 15,860	$ 67,457
Cable Cost	$ 220	$ 786	$ 28,670	$ 29,243	$ 35,382
Onshore Substation	$ -	$ -	$ 1,430	$ 6,073	$ 46,929
Offshore Substation Topside	$ -	$ -	$ 2,861	$ 12,146	$ 93,857
Hydrogen Production	$ 16,079	$ 80,872	$ -	$ -	$ -
Repousrposing Pipelines for H2	$ 26,194	$ 26,194	$ -	$ -	$ -
Pre-ROICE Decommissioning	$ 7,625	$ 11,150	$ 7,625	$ 11,150	$ 11,150
Total	$ 99,306	$ 346,563	$ 91,349	$ 286,937	$ 1,812,676
OPEX PARAMETERS					
Power OPEX ($/year)	$ 1,164	$ 6,981	$ 1,164	$ 6,981	$ 58,175
H2 OPEX ($/year)	$ 1,152	$ 6,864	$ -	$ -	$ -

Nomenclature: [Project Capacity] MW [Primary Export]
*Only array cable cost included for Hydrogen projects

ROICE Economic Model Cases

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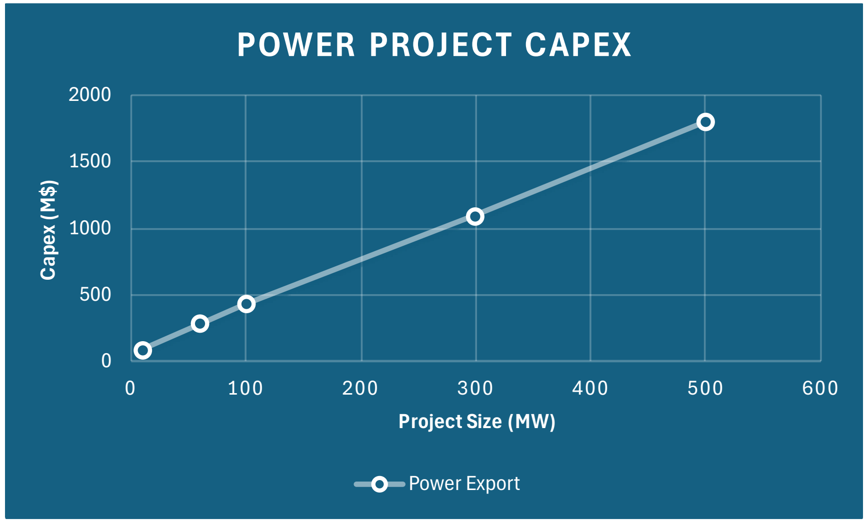
Project economics estimated for five projects (3 Power, 2 Hydrogen); limited by topsides footprint

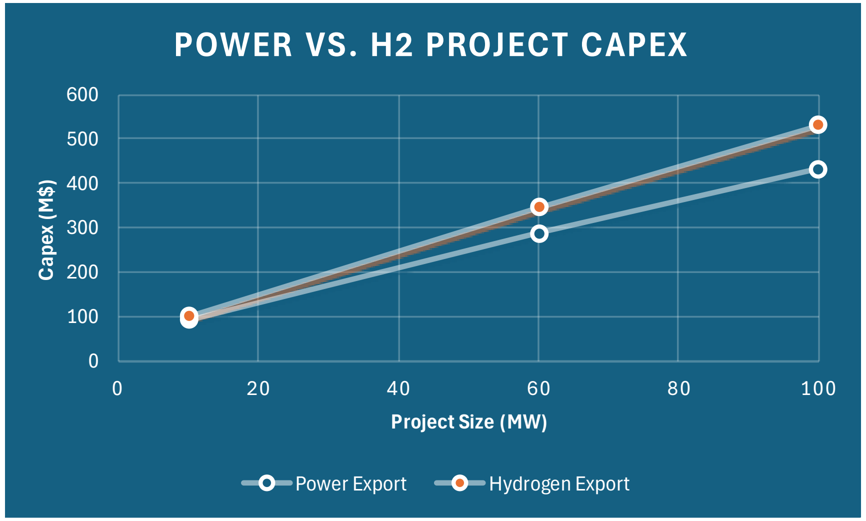
- Demonstration Size Project: 10 MW Wind Power Export; Wind Power to Hydrogen; on a single deck of 8-pile platform
- Commercial Size Hydrogen Project: 60 MW Wind Power Export; Wind Power to Hydrogen; on a 16-pile platform
- Commercial Size Power Project: 500 MW Wind Power on a 16-pile platform

Favorable conditions for profitability applied to all cases

- Most favorable wind conditions
- Shallow water projects (<150 ft water depth)

ROICE Economic Model Cases





Hydrogen projects only require 10 to 20% additional CAPEX over equivalent power export projects

- Projects further from shore may even see capex reductions

AVP from ROICE projects more than sufficient to cover pre- and post-ROICE decommissioning

- Example: For a 60 MW Project with Incentive Offtake Pricing, AVP is 2 to 30 times decommissioning costs

Results Summary – 10 MW Projects

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10 MW Power Project

Offtake (cents/kwh)	CpxRed	CAPEX (M$)	0% Borrowing Costs AVP (M$)	0% Borrowing Costs IRR (%)	5% Borrowing Costs AVP (M$)	5% Borrowing Costs IRR (%)
8	0%	91				
8	30%	66				
8	50%	50	3	1.9%		
10	0%					
10	30%		5	1.6%		
10	50%		22	4.7%		
15	0%		27	2.9%		
15	30%		52	6.3%		
15	50%		69	10.0%	6	1.5%

10 MW H2 Project

Offtake ($/kg)	CpxRed	CAPEX (M$)	0% Borrowing Costs AVP (M$)	0% Borrowing Costs IRR (%)	5% Borrowing Costs AVP (M$)	5% Borrowing Costs IRR (%)
2	0%	101				
2	30%	85				
2	50%	67				
5	0%					
5	30%					
5	50%		-7	0.1%		
10	0%		45	3.9%		
10	30%		60	5.6%		
10	50%		79	8.5%	-6	0.1%

Borrowing costs have a major impact on profitability – low- cost loans critical

10 MW Demonstration size project unlikely to generate a return on investment

Path to Profitability – defined as minimum required to achieve a 5% return:

- Zero Cost Loans
- 50% Capex Reduction + 10 c/kwh for a power project
- 30% Capex Reduction + 10$/kg for a hydrogen project

Results Summary – 60 MW Cases

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Path to Profitability – defined as minimum required to achieve a 5% return:

- Assuming 5% borrowing rate
- 30% Capex Reduction + 15 c/kwh for a power project
- 30% Capex Reduction + 10 $/kg for a hydrogen project

60 MW Power Project

Offtake (cents/kwh)	CpxRed	CAPEX (M$)	0% Borrowing Costs AVP (M$)	0% Borrowing Costs IRR (%)	5% Borrowing Costs AVP (M$)	5% Borrowing Costs IRR (%)
8	0%	287	27	1.1%		
8	30%	204	110	4.2%		
8	50%	149	165	7.6%		
10	0%		140	3.8%		
10	30%		223	7.3%		
10	50%		278	11.1%	88	3.3%
15	0%		424	8.9%	58	1.2%
15	30%		506	13.2%	246	5.9%
15	50%		561	17.9%	371	10.9%

60 MW H2 Project

Offtake ($/kg)	CpxRed	CAPEX (M$)	0% Borrowing Costs AVP (M$)	0% Borrowing Costs IRR (%)	5% Borrowing Costs AVP (M$)	5% Borrowing Costs IRR (%)
2	0%	345				
2	30%	276				
2	50%	210				
5	0%		26	0.9%		
5	30%		95	2.9%		
5	50%		162	5.6%		
10	0%		540	9.3%	101	1.7%
10	30%		609	12.0%	257	4.6%
10	50%		676	15.8%	409	8.7%

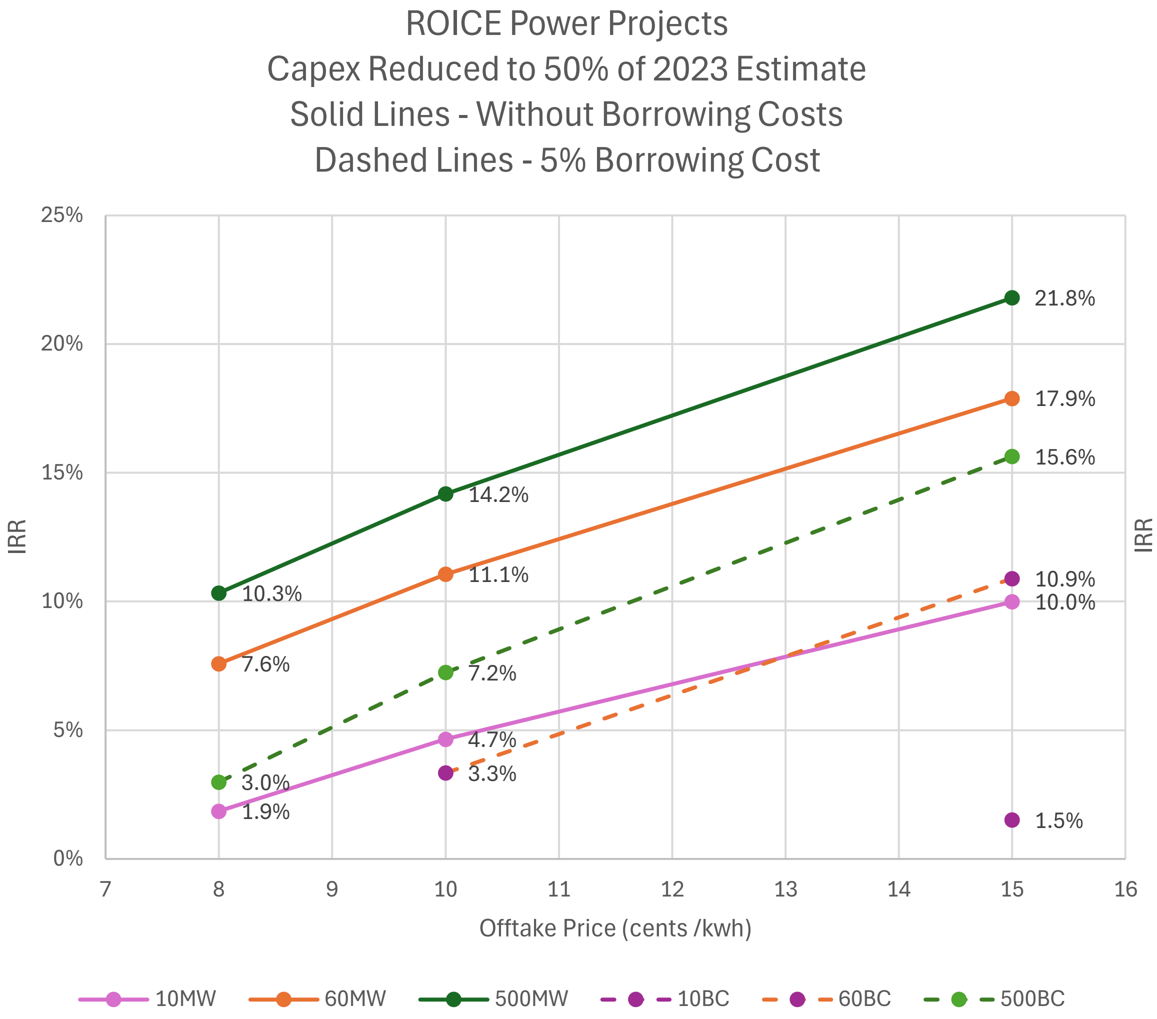
Results Summary – 500 MW Power Project

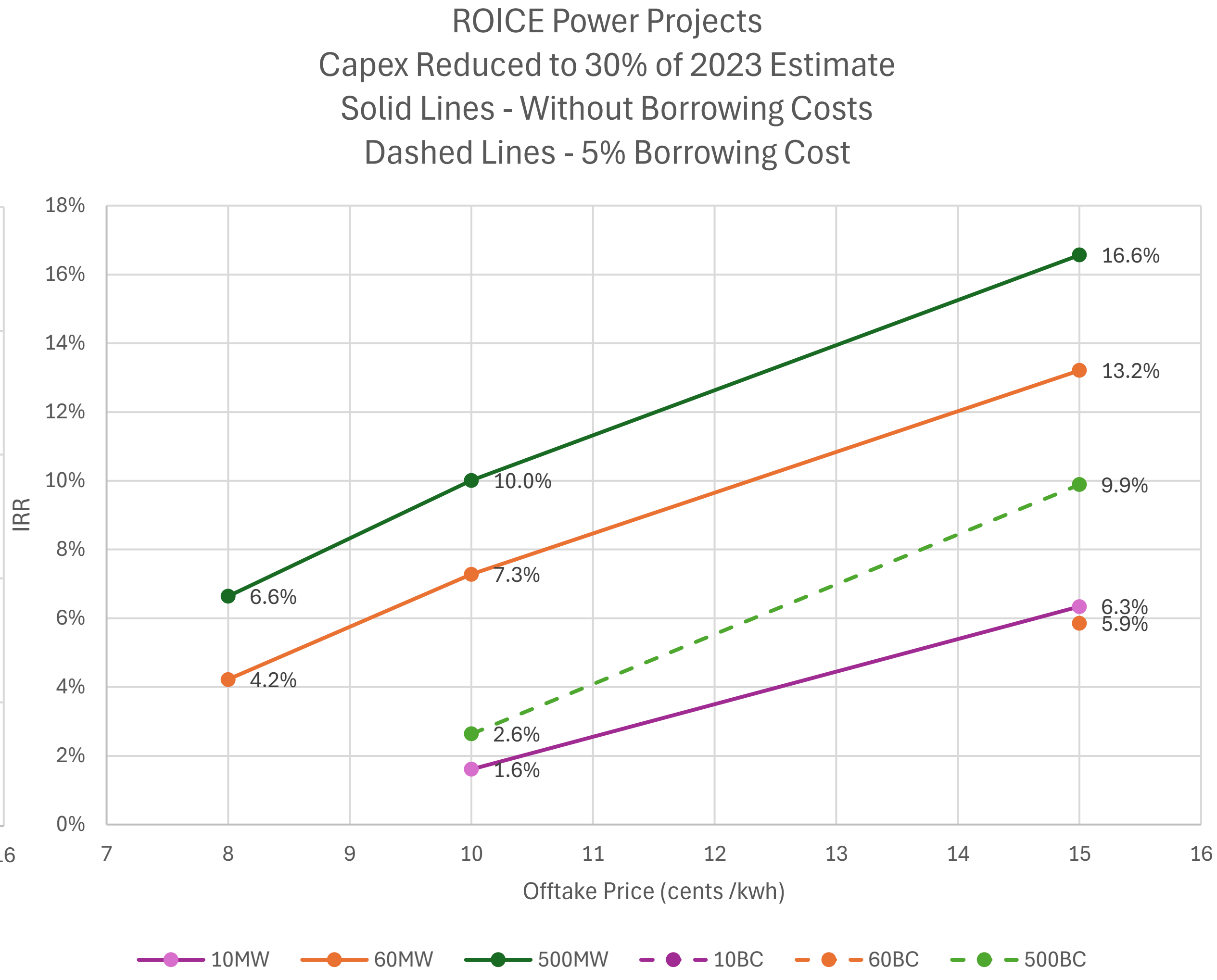
Path to Profitability (min req for 5% return): → 50% Capex Reduction + 10 c/kwh → 0% Capex Reduction + 15 c/kwh

500 MW Power Project

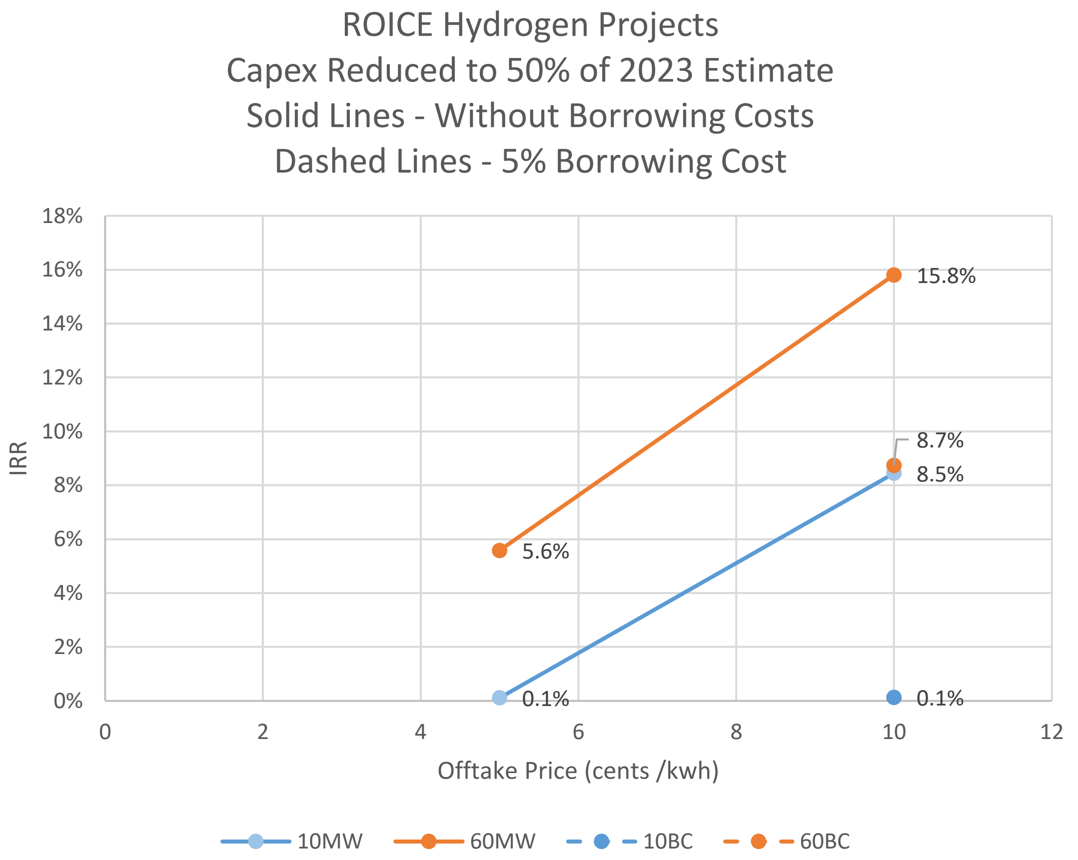
Offtake (cents/kwh)	CpxRed	CAPEX (M$)	0% Borrowing Costs AVP (M$)	0% Borrowing Costs IRR (%)	5% Borrowing Costs AVP (M$)	5% Borrowing Costs IRR (%)
8	0%	1806				
8	30%	1268	1347	6.6%		
8	50%	909	1706	10.3%	547	3.0%
10	0%		1753	6.2%		
10	30%		2292	10.0%	675	2.6%
10	50%		2651	14.2%	1492	7.2%
15	0%		4114	11.8%	1811	4.7%
15	30%		4653	16.6%	3037	9.9%
15	50%		5012	21.8%	3853	15.6%

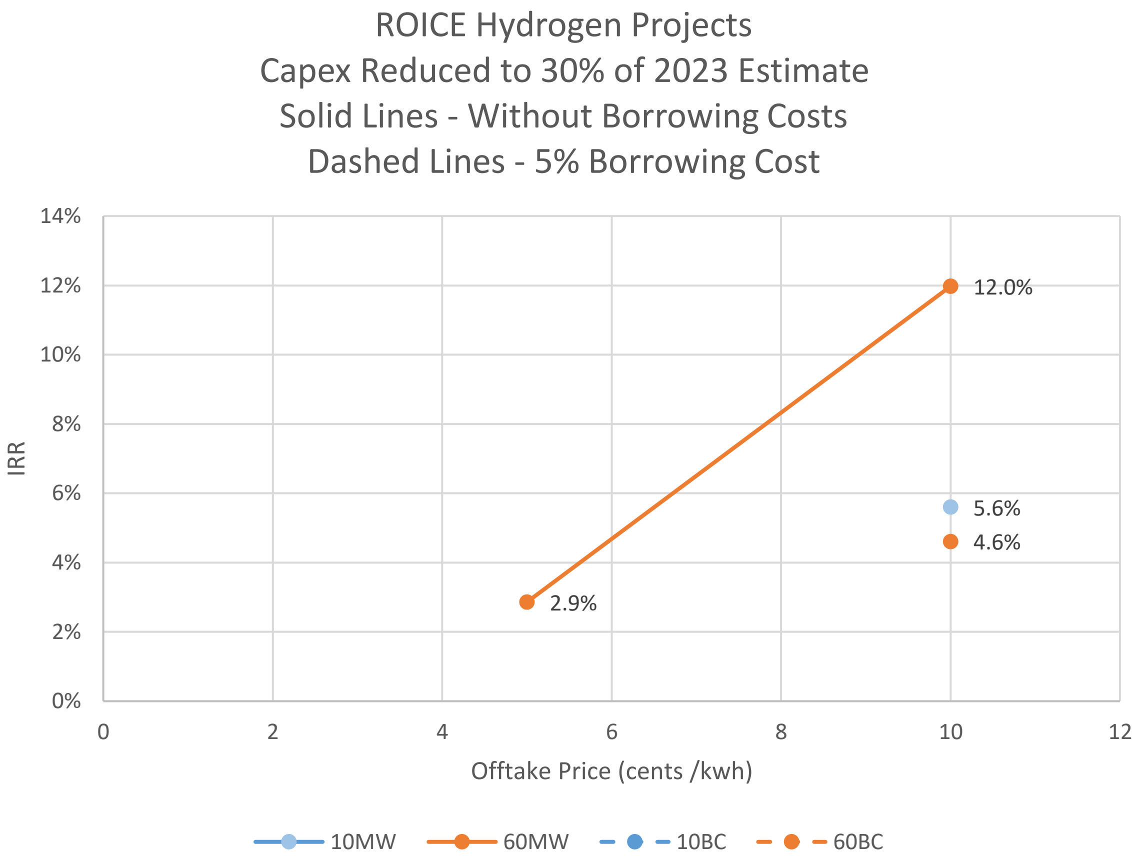
Economic Model Results: Wind Power Projects





Economic Model Results: Hydrogen Projects





Conclusions and Next Steps

- ROICE Cost Estimator model refined; ROICE Economic Model built
- Hydrogen and power module placement exercise carried out for several typical offshore deck layouts
- Project economics estimated for a range of project sizes, offtake prices, capex reduction, loan rates
- ROICE projects can cover the cost of decommissioning
  - Pre-ROICE Decommissioning costs ~10% of ROICE project capex for small projects and 1 to 3% for larger projects
  - AVP from ROICE projects more than sufficient to cover pre- and post-ROICE decommissioning
- Challenge is in generating an acceptable rate of return on ROICE capex
- All projects – power, H2, varying sizes challenged at today's capex
- Borrowing costs have a major impact on project profitability – low-cost loans needed

Conclusions and Next Steps

- Keys to profitability of ROICE projects
  - Scale: hydrogen topsides footprint limits max project size to ~ 100 MW; power projects less limited – can be as large as 500 MW
  - Green Premiums / Offtake Incentives: 2 to 5 cents of additional PTC incentives needed for power; 2 to 5 $/kg additional 45V incentives needed for hydrogen
  - Capex Reductions / Additional Investment Incentives: 50% reduction needed from 2023 capex; through design and technology improvements, supply chain resolution, tax incentives etc.
  - Low-Cost Loans
- Hydrogen projects more challenged than power export project
  - Incremental CAPEX minimal, but high offtake prices / green premiums needed to generate sufficient IRR
- Demonstration size project (10 MW) not likely to generate an acceptable return – can break even with enhanced incentives
- Next Steps
  - Document Phase 2 results in report and technical paper
  - Plan and carry out Phase 3 work scope

ROICE-PIF Phases 1 – 2 Overview

ROICE-PIF Overview

Phase 1:
6 ROICE-PIF Workgroups Formed

Regulatory Considerations (RC) Workgroups
- RC-1: Regulatory Requirements & Pathways
- RC-2: Financial Assurance & Decommissioning

Commercial Considerations (CC) Workgroups
- CC-1: Project Business Models, Financing & Uncertainties

Technical Considerations (TC) Workgroups
- TC-1: Decommissioning & Reuse
- TC-2: Re-certification
- TC-3: Transportation & Storage

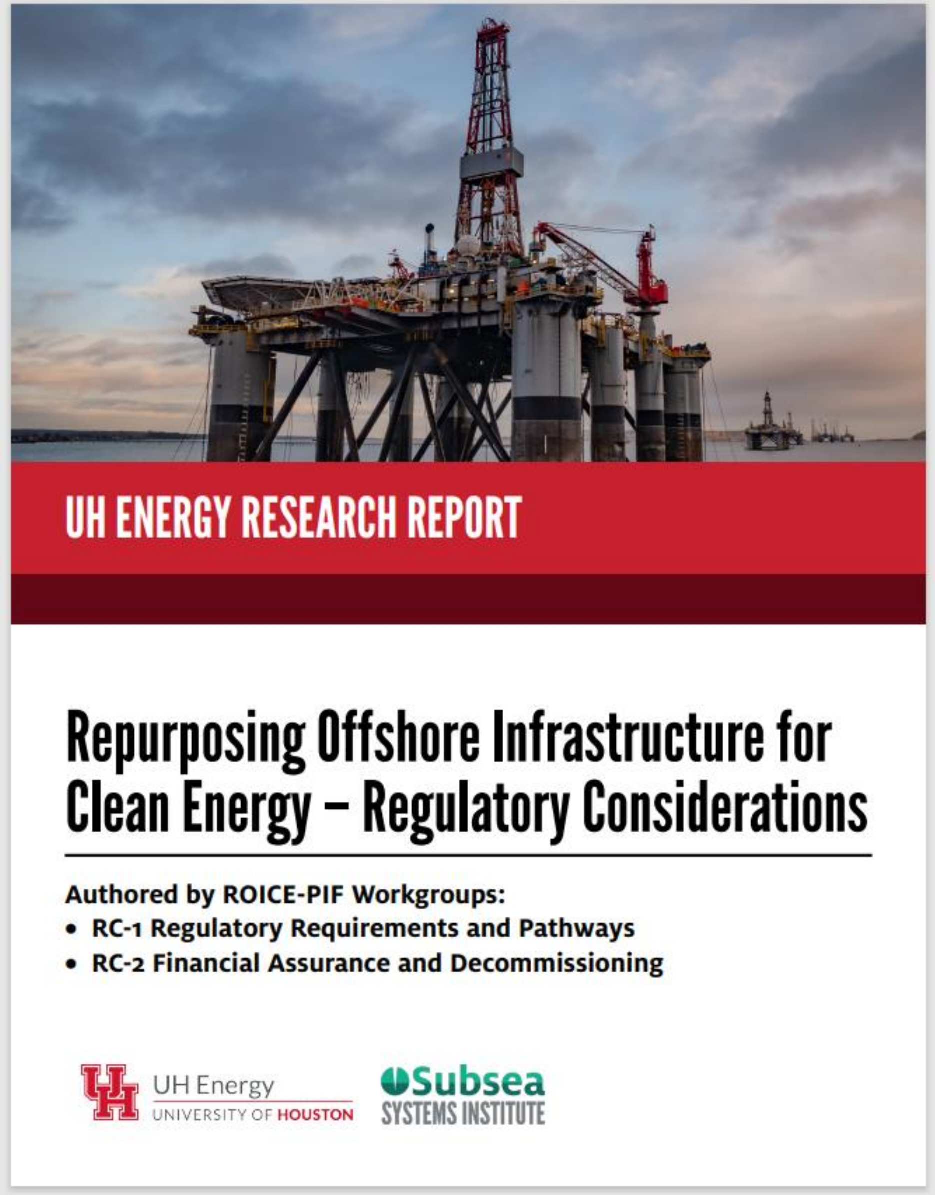
Phase 2:
- RC-1, RC-2, TC-1 and TC-2 convened and began to address Phase 2 scope
- Two research reports issued

ROICE-PIF Phase 2 Scope - Develop research reports that:

- Answer the question: *"What do ROICE Project Stakeholders need to know about ________ for a ROICE project and energy transition – repurposing fixed offshore structures for wind power generation, hydrogen generation and CO_2 sequestration?"*
- For the following areas
  - RC-1: Regulatory Oversight
  - RC-2: Financial Assurance
  - TC-1: Decommissioning
  - TC-2: Recertifying & Reuse of Assets
- For the following scenarios:
  a. Current owner ceasing O&G operations and switching to a ROICE project
  b. Current owner leasing assets to a ROICE developer
  c. Current owner selling assets to a ROICE developer
  d. NOTE: Case studies, bankrupt asset scenarios, hybrid scenarios* and floating assets to be handled in Phase 3
- Assume that ROICE project will only re-use the jacket, topsides structures and potentially some pipelines. All the rest of the O&G infrastructure will need to be decommissioned as per normal process.

* clean energy installation while hydrocarbons being produced

ROICE-PIF Phase 2 Paper – Regulatory Considerations


UH ENERGY RESEARCH REPORT

Repurposing Offshore Infrastructure for Clean Energy – Regulatory Considerations

Authored by ROICE-PIF Workgroups:
- RC-1 Regulatory Requirements and Pathways
- RC-2 Financial Assurance and Decommissioning

UH Energy
UNIVERSITY OF HOUSTON
Subsea SYSTEMS INSTITUTE

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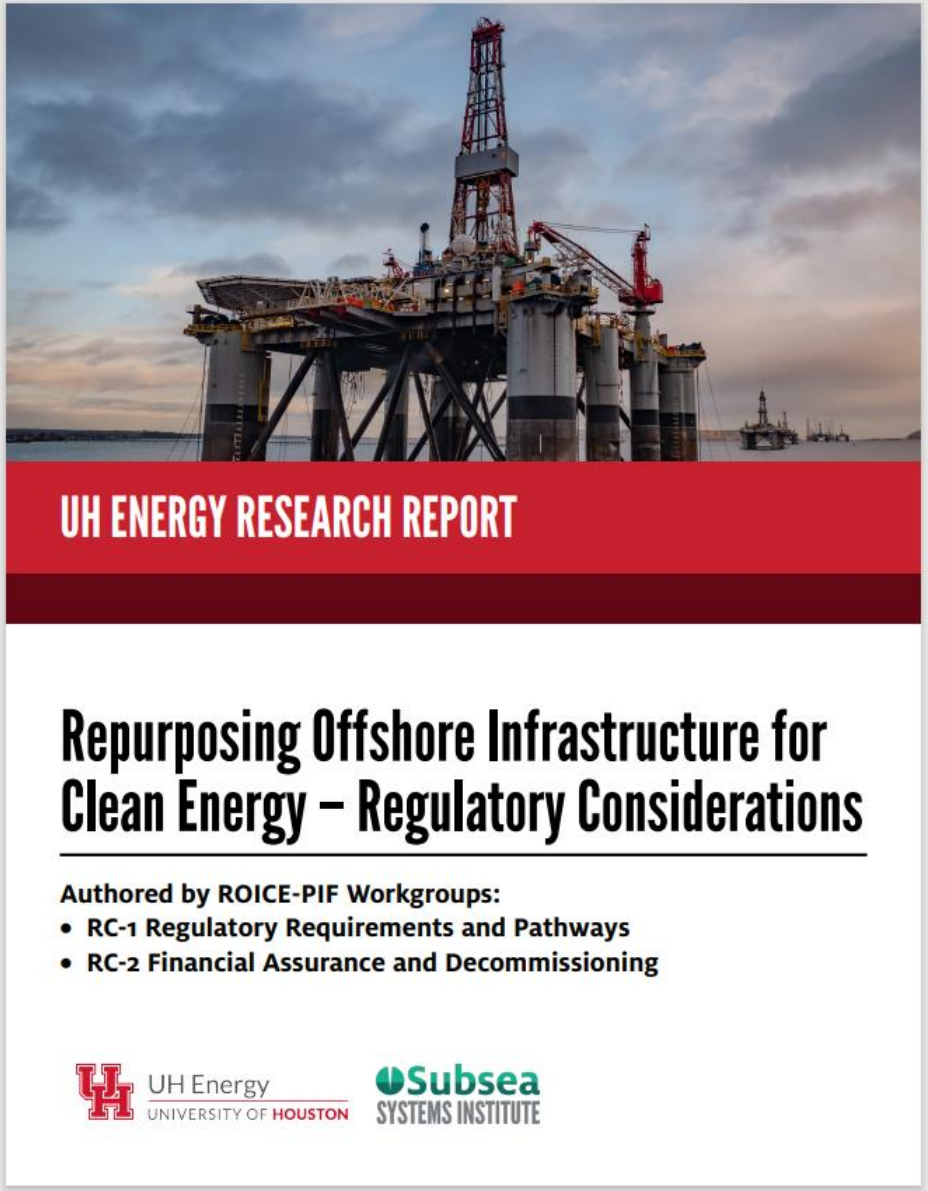
ROICE-PIF Phase 2 Paper – Regulatory Considerations



ROICE-PIF develops detailed guidance for all stakeholders of such projects:

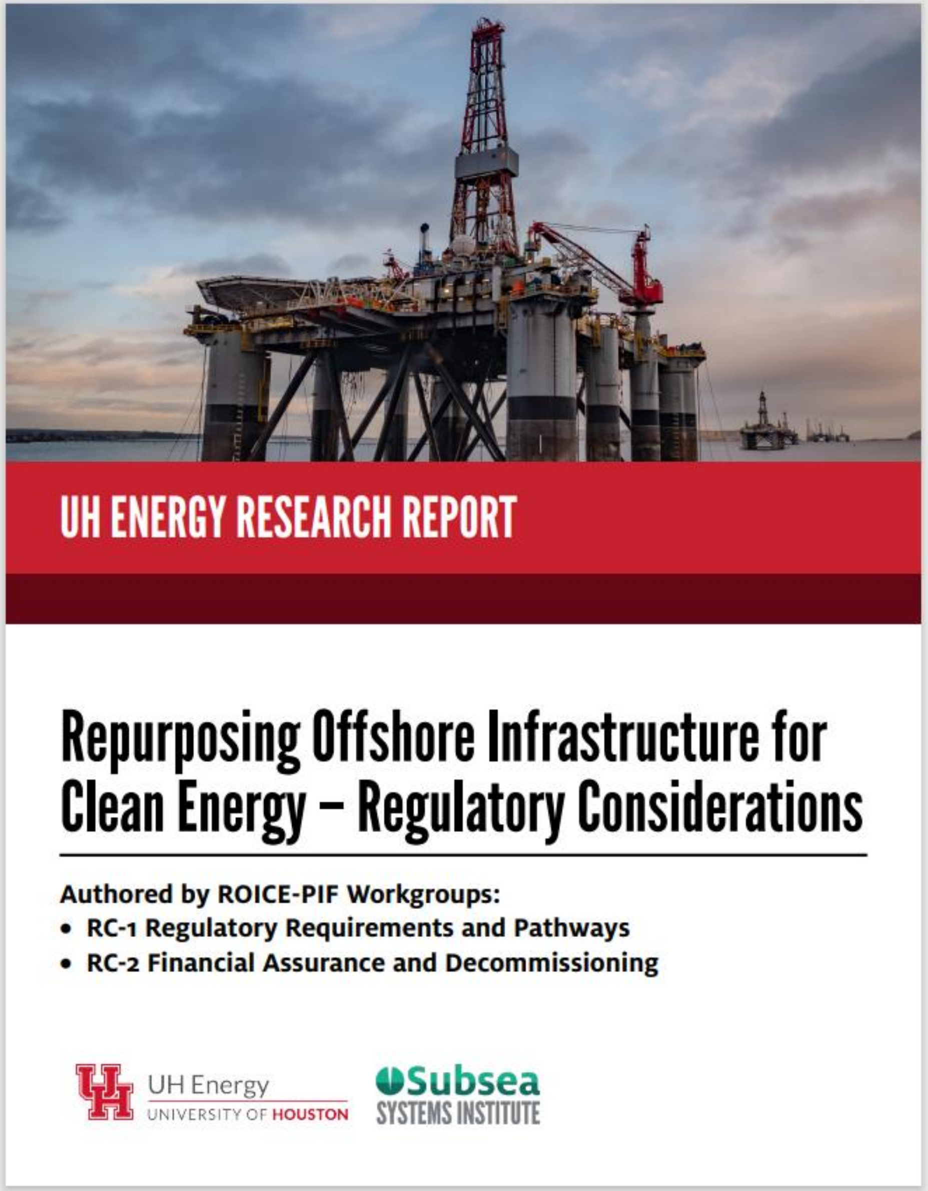
- Regulatory compliance requirements
- Liability transfer pathways
- Financial assurance mechanisms
- Commercial and operational frameworks
- Technical certification of structures
- Pre- and post-ROICE decommissioning requirements

The most likely regulatory pathway for a ROICE project:

1. The existing oil and gas operator or owner to submit an alternate use permit application under Code of Federal Regulations (CFR) Title 30 Part 285 and assign it to the new ROICE operator, of which the current operator or owner will be a stakeholder.

2. The ROICE operator could also apply directly for an alternate use permit after demonstrating its legal, financial, and technical qualifications to do so.

ROICE-PIF Phase 2 Paper – Regulatory Considerations



ROICE operators will likely use commercial agreements to address the respective rights and obligations of stakeholders:

- division and distribution of green energy profits and tax credits
- the allocation of costs for modifying the existing infrastructure for use as a ROICE project and for post-ROICE decommissioning.

The RPC recommends that stakeholders in a ROICE project focus on the following pillars of success:

1. **Communication:** Being transparent and holding proactive discussions with all regulators, agencies, communities and investors
2. **Regulatory Compliance:** Consider using 30 CFR Part 285 to obtain permits; stay up to date with regulatory changes from BOEM and BSEE
3. **Financial Assurance:** Straightforward and comprehensive transition of decommissioning and regulatory liability and responsibilities from current oil and gas operator to ROICE operator

ROICE-PIF Phase 2 Paper – Technical Considerations

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Repurposing Offshore Infrastructure for Clean Energy – Technical Considerations

Authored by ROICE-PIF Workgroups:
- TC-1 Decommissioning and Reuse
- TC-2 Recertification

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ROICE-PIF Phase 2 Paper – Technical Considerations

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ROICE-TE is building detailed design and economic models for clean energy repurposing projects and charting a path to their profitability.

- Technical aspects that would need to be addressed when an existing oil and gas platform in the US GoM is being considered as a candidate for repurposing for a ROICE project.

This paper demonstrates that it is technically feasible to decommission, reuse, and recertify existing and ageing oil and gas platforms for clean energy uses. This paper is organized in steps:

1. Introduction

Goes over what a ROICE operator needs to know and the scope of the project

2. Selecting the Right Platform

There are guidelines for deck space, structure and height. Platforms must be larger, with 4 or more leg platforms and have an airgap

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3. Risk Assessments
Assessments should be performed to help determine an existing asset's suitability. Consequence scenarios(life safety, environment, business disruption) are identified

4. Decommissioning Challenges for US GoM Operators
Required decommissioning must be completed; existing wells must be plugged and abandoned; oil and gas processing equipment and risers and conductors removed prior to commencing a ROICE project

5. Platform Recertification Challenges
Structural inspections, a life extension study, and a structural integrity management plan to validate the existing condition

6. Conclusions
Develop a roadmap for reusing, recertifying, and finally decommissioning a ROICE project while addressing BOEM and BSEE mandates

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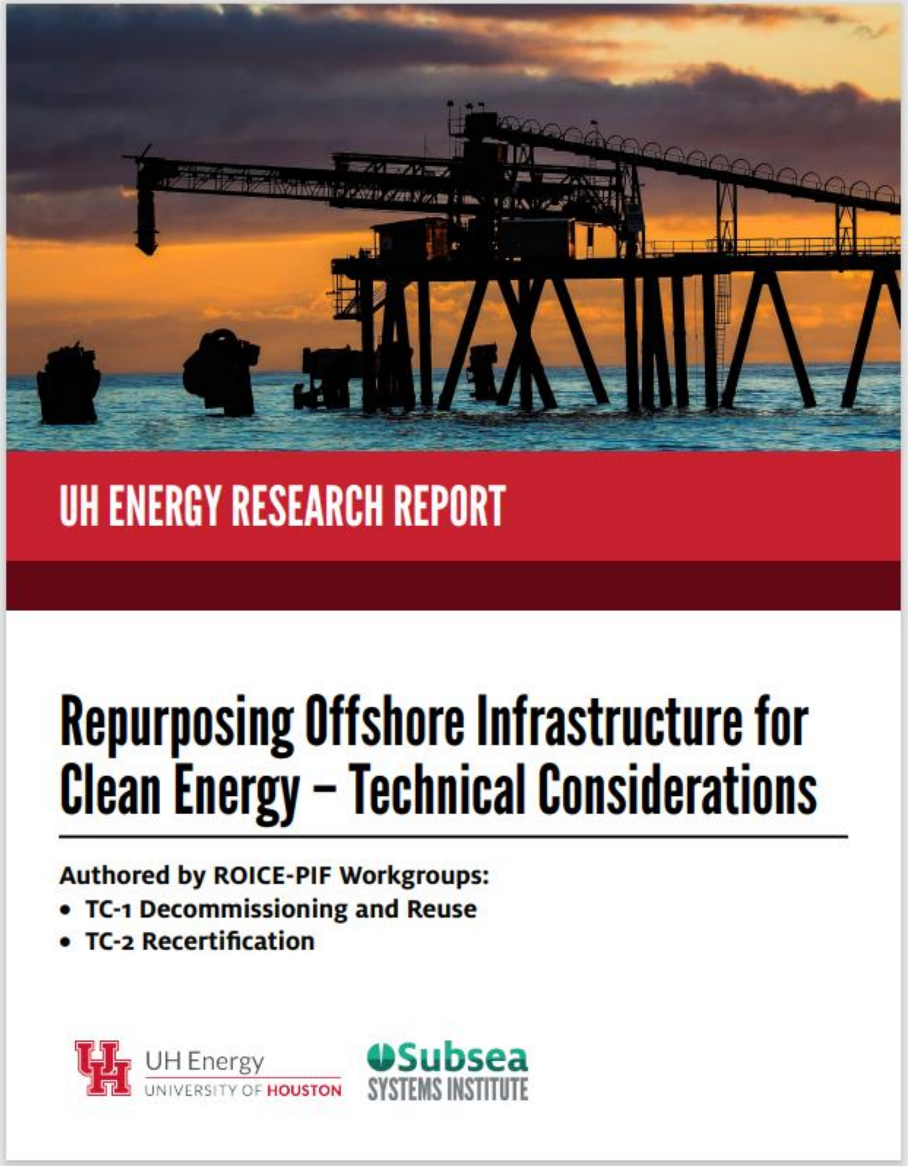

Key Conclusions and Recommendations:

- Develop case studies to quantify feasibility, extent, and options for repurposing offshore installations. This includes asset, risk, and cost assessments.
- Ensure BOEM and BSEE mandates are addressed, including a thorough structural reassessment and recertification process.
- Determine the need for, or otherwise of having to engage a CVA. If a CVA is needed, they should be engaged as early as possible in the ROICE project.
- A ROICE platform must meet certain requirements, including meeting the airgap as defined in API-RP-2A-WSD and API-RP-2MET.
- Develop a structural integrity management(SIM) plan that considers structural changes and life extension of a platform and perform risk analysis

ROICE Phase 3 Plans

ROICE Phase 3

- Objective: Develop a comprehensive roadmap for ROICE (Repurposing Offshore Infrastructure for Clean Energy) Projects in the Gulf of Mexico
- Timeline: Kickoff – 3Q 2024; Target Completion Date – 4Q 2025
- Deliverables:
  - Project Implementation Framework for ROICE projects
  - Asset Selection Criteria for ROICE projects
  - Asset Selection (2) and Pre-FEED level design for a ROICE demonstration project
  - ROICE-based decommissioning incentivization program
- Scope:
  - Phase 3a: Expand Project Implementation Framework
  - Phase 3b: Expand Techno-Economic Toolkit
  - Phase 3c: Design Demonstration Project & Incentivization Program

ROICE Phase 3 Scope Details

- Phase 3a: Expand Project Implementation Framework
  - Develop a flow chart to cover ROICE project scenarios – asset type, ownership, installation, clean energy options, asset condition etc.
  - Develop asset selection criteria & available ROICE options
  - Charter workgroups and deliver white papers on Commercial Considerations & Community Impact Considerations
  - Expand on Phase 2 papers - regulations and technical re-certification
- Phase 3b: Expand Techno-Economic Toolkit - Design Refinements and Economic Models for
  - Power equipment design optimization for ROICE projects

Funding obtained via DOE/NETL grant

  - Energy storage and additional clean energy options
  - CO_2 sequestration

Funding likely from existing sources

- Phase 3c: Design Demonstration Project & Incentivization Program
  - Project Planning: Site selection (2), process design, execution planning
  - Stakeholder Engagement: operators, investors, funding agencies, EPC, OEM
  - Incentivization: framework for incentivizing decommissioning via ROICE projects

Proposal written and seeking funding

ROICE Phase 3a – DOE Funded Scope

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- In January 2024, DOE announced selection of our proposal "A Comprehensive Roadmap for ROICE (Repurposing Offshore Infrastructure for Clean Energy) Projects in the Gulf of Mexico" for funding ($750K, 24 months); Funding approved May 29, 2024
- The ROICE PIF will be a set of white papers providing transparent and comprehensive information to stakeholders to collaborate and advance ROICE projects.
- These papers will provide asset selection criteria, feasible repurposing options, project cost estimates, available state and federal incentives, details of relevant regulations and requirements, potential pitfalls and mitigations, equipment and design resources, workforce initiatives, community resources, community benefit assessments, and more.

U.S. DEPARTMENT OF ENERGY

NATIONAL ENERGY TECHNOLOGY LABORATORY
Albany, OR • Morgantown, WV • Pittsburgh, PA

NETL NATIONAL ENERGY TECHNOLOGY LABORATORY

01/10/2024

SENT VIA ELECTRONIC MAIL

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SUBJECT: Selection of Application for Negotiation Under Funding Opportunity Announcement Number DE-FOA-0003002, University Training and Research for Fossil Energy and Carbon Management

ROICE Phase 3a – DOE Project Deliverables

ROICE
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Task / Subtask Number	Task Title	Key Participants
1.0	Project Management and Planning	Lead: Harish Krishnamoorthy and Ram Seetharam Supported by: All Team Members
2.0	Asset Selection	Lead: Ram Seetharam Supported by: Brian Gibbs, Elena Keen, Gail Buttorff
3.0	Roadmap Preparation	Lead: Brian Gibbs Supported by: Ram Seetharam, Elena Keen, Gail Buttorff
4.0	Resource Mapping	Lead: Gail Buttorff Supported by: Ram Seetharam
5.0	Community Resource & Needs	Lead: Gail Buttorff Supported by: Harish Krishnamoorthy and
6.1	Technical Pathways to Repurposing	Lead: Harish Krishnamoorthy Supported by Kaushik Rajasekara, Ram Seetharam
6.2	Community Capability	Lead: Gail Buttorff Supported by: Elena Keen
7.0	Transition Proposal	Lead: Ram Seetharam Supported by: All Team Members

Task / Subtask Number	Deliverable Title (Reports)	Due Date
1.0	Project Management Plan	Update due 30 days after award. Revisions to the PMP shall be submitted as requested by the NETL Project
2.0	Asset List	Initial Asset List in Month 3 after award. Quarterly revisits. Final Asset List submitted in month 21
3.0	Individual Roadmaps	Final version in month 21; draft versions issues periodically in months 9 and 15.
4.0	Interactive GIS Tool	Final version in month 24 interim version in month 18
5.0	White paper detailing community resources and needs; white paper on survey results; data integrated with interactive GIS tool	End of year one; end of year two; 90 days before end of project
6.1	Recommendations on technical pathways to profitability	Month 18 (18 days before end of the project)
6.2	White paper detailing results of social impact analysis	Month 18 (18 days before end of the project)
7.0	ROICE PIF	At the end of the project (Month 24)

ROICE Phase 3 – 3Q24 Work Scope

- Deep Dive: Map out Scenario Space for PIF
- Charter Commercial, Community Workgroups
- Deep Dive: Asset Selection
- Expand Toolkit / Analysis – Battery, large H2 Project, subsea H2; offtake pricing analysis
- Deep Dive: Vision for demonstration project
- Deep Dive: Incentivization Program