

PROJECT SHOWPLACE

Storing **H**ydrogen from **O**ffshore **W**ind **P**ower
for **L**oad-balancing and **C**arbon **E**limination

- An Industry-Government-Public-
Academia Collaborative Demonstration
Project

SHOWPLACE Collaborative

Mar 11th, 2022



SHOWPLACE Collaborative (SPC)

SPC MEETING AGENDA

- ❑ Welcome from UH Energy
- ❑ Introductions of New Members and Attendees
- ❑ Funding Opportunities
- ❑ Update on Mapping Project
- ❑ Product Demonstrations
 - ❑ DCIDE System Modeling
- ❑ Administrative items
 - ❑ Association Agreement Overview
 - ❑ Non-signatory Participation
 - ❑ Public and Closed-Door segments
- ❑ Product Demonstrations
 - ❑ SINNPOWER Site Evaluation Tool
 - ❑ XODUS Mapping Tool
- ❑ Work Group Compositions and Scope - Update
- ❑ Next Workgroup Projects
- ❑ Next Meeting Date
- ❑ Lunch

SPC – Key Objectives

2022 GOALS FOR PROJECT SHOWPLACE

By YE22,

- ❑ Build a strong coalition and a credible proposal to obtain funding for concept selection, pre-FEED, and FEED level engineering design
- ❑ Complete sufficient engineering design basis work to inform concept selection
- ❑ Refine SHOWPLACE Concept to ensure reasonable chance of commercial feasibility

SPC MEMBER EXPECTATIONS

- **Minimum request to attend and fully participate in monthly SPC meetings and guide project direction and results**
 - With follow up items, estimate 4 hours per month for SPC Rep
- **Strongly encouraged to participate in working groups**
 - Max 20 hours per month for any one company's staff
 - Min 20 hours per month for all workgroup members combined
- **No financial commitments in 2022**
 - Consider budgeting funds for 2023 – primarily to satisfy 10 to 20% cost share requirements by federal funding agencies

SPC Membership Update

Confirmed Members (17)

- University of Houston
- Center for Houston's Future
- American Bureau of Shipping
- *NREL*
- Technip FMC
- Lummus
- Subsea 7
- *Elena Keen Consulting*
- Power 2 Hydrogen
- ChemePD LLC
- Bureau of Economic Geology
- WSP
- SinnPower
- AquaTerra
- GE
- Grid Advisors
- Ayatis

Awaiting Execution of Agreement (4)

- Siemens
- Talos Energy
- BOEM
- Microsoft

New members and attendees shown in black

Invited (6)

- Hecate Energy
- Project HyPSTER
- SVG
- Orsted
- GLO
- *EDF*

In Discussions (11)

- *Shell*
- ExxonMobil
- GTI / H2@Scale
- *UT CEM*
- *Linde*
- H2Ranch
- NEL
- Flowserve
- Chevron
- *Air Liquide*
- *Carbon Trust*
- *HETI*

Declined (3)

- Equinor
- BP
- *Phillips 66*

FUNDING

Near Term:

- TCEQ / UH SSI Call for Proposals expected in March; \$1-300K to cover concept refinement work
- RFI from DOE on Clean Hydrogen Production

Mid- to Long-Term

- DOE H2 Hub Funding – Call for Proposals expected mid-year; 2 – 3M\$ funding for pre-FEED / FEED
- Additional opportunities likely through Build Back Better, H2 Earthshot Initiative, LCRI, etc.

SHOWPLACE Collaborative (SPC)

SPC MEETING AGENDA

- ❑ Update on Mapping Project & Website
- ❑ Product Demonstrations
 - ❑ DCIDE System Modeling
- ❑ Administrative items
 - ❑ Association Agreement Overview
 - ❑ Non-signatory Participation
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Project Modules



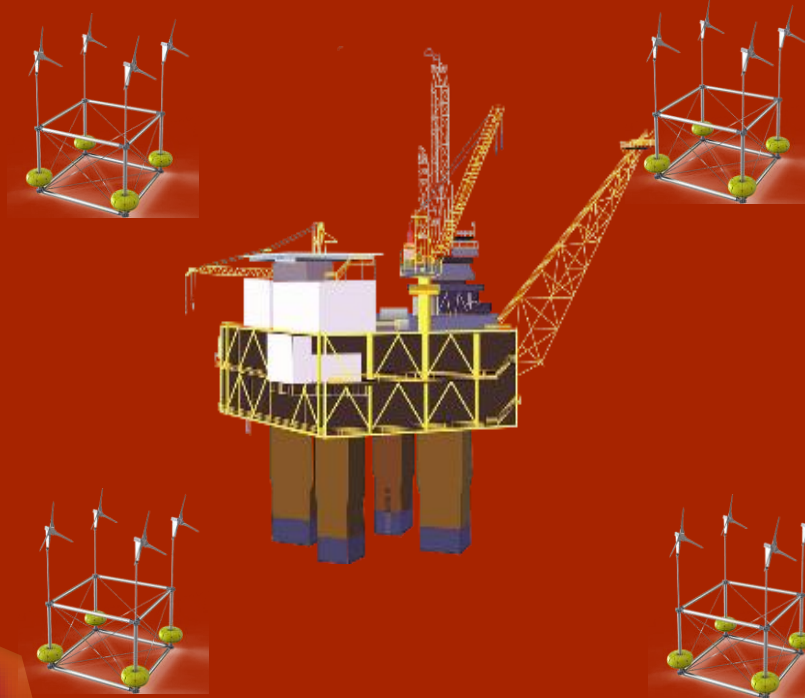
Module 1: Wind Power Generation



Module 2: Power Transmission to Shore



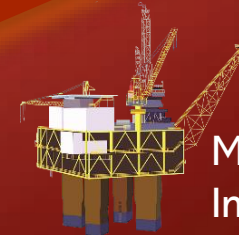
Module 3: Freshwater – Generation, Storage & Supply



Module 4: Hydrogen Generation & Utilization



Module 5: Hydrogen Storage



Module 6: Offshore Infrastructure



Module 7: Data & Digitalization

SHOWPLACE 2022 Work Scope

What critical questions do we need to answer in 2022?

2022 WORK SCOPE ELEMENTS AND STRAWMAN WORKGROUPS

** Awaiting confirmation*

Module 0: Strategy, Funding and Concept Refinement

- *UH, Lummus, GE, CHF**
- Project Siting and Scope for Scale-Up - identifying sweet spots
- Define “Minimum Viable Concept” and “Justifiable Adds” - what has to stay offshore, what do we have option to bring onshore
- Overall project cost estimates and schedule
- Legal and Regulatory requirements
- Coordination with Broader Vision and Roadmap for Houston Area (HETI, UH Energy, H2Hub etc.)
- Develop proposals in advance of funding proposal announcements

SHOWPLACE 2022 Work Scope

What critical questions do we need to answer in 2022?

2022 WORK SCOPE ELEMENTS AND STRAWMAN WORKGROUPS

*All workgroups to
generate cost estimates*

Module 1 & 2: Power Generation and Transmission

- *GE, Grid Advisors, AquaTerra, SinnPower, Siemens,*
- Turbine design and specs for the Texas Gulf Coast
- Fixed to platform or floating?
- Extreme weather challenges
- Transmission to shore and grid integration challenges
- HVAC or HVDC technology?
- Battery storage systems needed?
- Offshore use opportunities – oil & gas operations, CO2 sequestration
- Transmit power to shore or fully utilize to generate H2?
- Zero curtailment goal – feasible?

Module 3 & 4: H2 Generation – Desalination and Electrolysis

- *AquaTerra, Power 2 Hydrogen, ChemePD LLC, Siemens*
- PEM vs Alkaline?
- What is the typical power load?
- Offshore vs Onshore?
- Space and support is available on offshore platforms?
- Onshore freshwater?
- Saline electrolysis?
- Ability to handle marine conditions
- Maximizing capacity factor of electrolyzers

SHOWPLACE 2022 Work Scope

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2022 WORK SCOPE ELEMENTS AND STRAWMAN WORKGROUPS

*All workgroups to
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Module 5: H2 Storage and Transportation

- *BEG, WSP*
- What elements stay offshore vs bringing them onshore
- Well design – injectors, producers; pressure requirements
- Storage in salt caverns vs depleted hydrocarbon reservoirs
- Pipeline challenges for hydrogen – re-use or new?

Module 6: Offshore infrastructure

- *Lummus, Talos, Technip FMC, ABS, Subsea 7, Elena Keen Consulting*
- Offshore infrastructure inventory and mechanical integrity assessment
- Module removal and new module placement (size, weight, space etc.)

Module 7: System Controls and Modeling

- *GE, Ayatis, Siemens, Microsoft*
- Developing a digital twin and other models for rapid evaluation of options
- Controls, sensing, data collection and transmission
- Revenue optimization algorithms

BACKUP

SHOWPLACE Concept

OBJECTIVE:
ESTABLISH COMMERCIAL
FEASIBILITY OF SYNERGIES
BETWEEN OFFSHORE WIND
POWER & HYDROGEN
GENERATION & STORAGE

KEY CONCEPT ELEMENTS

- ❑ Re-purpose existing offshore Gulf of Mexico oil and gas platforms and pipelines
- ❑ Install floating or fixed (to platform) wind turbines
- ❑ Transport power to onshore electric grid within capacity constraints
- ❑ Utilize excess wind power to generate freshwater via desalination
- ❑ Generate hydrogen from freshwater via electrolysis
- ❑ Store hydrogen in subsurface geological reservoirs
- ❑ Transport freshwater to shore or reuse later for subsequent hydrogen production
- ❑ Transport hydrogen to shore for use as industrial feedstock or for power generation
- ❑ Comprehensive roadmap that also addresses
 - ❑ Ocean observing systems
 - ❑ Hydrogen safety
 - ❑ STEM curriculum and workforce retraining programs
 - ❑ Community engagement, economic growth, and job creation opportunities
 - ❑ Regulatory requirements

Project SHOWPLACE Concept Potential

THE POTENTIAL OF PROJECT SHOWPLACE

- ❑ Capital outlay reduction through reuse of installed infrastructure
- ❑ Long term energy storage via hydrogen and freshwater enables utilization of all available windpower (zero curtailment goal)
- ❑ Active hydrogen economy in Texas Gulf Coast
- ❑ Multiple revenue streams with potential for revenue optimization
- ❑ Individually technologies generally proven; key challenge is cost-effective combination of these proven technologies offshore
- ❑ Scaleable with accompanying cost reductions
- ❑ Skilled energy industry workforce in Texas Gulf Coast
- ❑ Leverage learnings from multiple similar projects globally