

Hawaii Hydrogen Power Park

**2004 DOE Hydrogen, Fuel Cells & Infrastructure
Technologies Program Review Presentation
24 – 27 May 2004**

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This presentation does not contain any proprietary or confidential information



Objectives

- ❑ **Demonstrate an integrated Hydrogen Power Park comprising the following:**
 - **Electrolyzer powered by a renewable energy source.**
 - **Hydrogen storage & distribution system.**
 - **Grid connected PEM fuel cell.**
- ❑ **ID codes & standards required to site a Power Park.**
- ❑ **ID barriers to a hydrogen infrastructure.**
- ❑ **Educate local authorities on hydrogen technologies.**
- ❑ **Economic analysis of hydrogen infrastructure.**



Budget

□ FY 03 - \$900k

- Funded through DOE SEP program
- DOE - \$450k
- In-Kind Cost Share - \$450k

□ FY 04 - \$625k

- DOE - \$500k
- \$125k cost share from City & County of Honolulu
- Additional cost share expected



DOE Technical Barriers

DOE Technical Barriers addressed by Power Park Project:

- ❑ **Hydrogen Production**
 - T. Renewable Integration
- ❑ **Off-Board Hydrogen Storage**
 - U. Codes & Standards
 - V. Life Cycle & Efficiency Analysis
- ❑ **Technology Validation**
 - B. Hydrogen Storage
 - C. Hydrogen Refueling Infrastructure
 - E. Codes & Standards
 - H. Hydrogen from Renewable Sources
 - I. Hydrogen & Electricity Co-production
- ❑ **Education**
 - A. Lack of Awareness
 - B. Lack of Demonstrations or Examples of Real World Use
 - C. Institutional Barriers and Access to Audiences



Approach

- ❑ **Leverage DoD funding in the Hawaii Fuel Cell Test Facility:**
 - **Install and operate Stuart electrolyzer.**
 - **Install high pressure hydrogen storage system.**
 - **Install and operate PEM fuel cell system.**
- ❑ **Develop strategic partnerships with industry technology leaders to transfer technology & “lessons learned”.**
- ❑ **Work with Hawaii electric & gas utility companies.**
- ❑ **Leverage Bishop Museum science education programs.**
- ❑ **Work with the City & County of Honolulu to educate public officials & overcome barriers.**

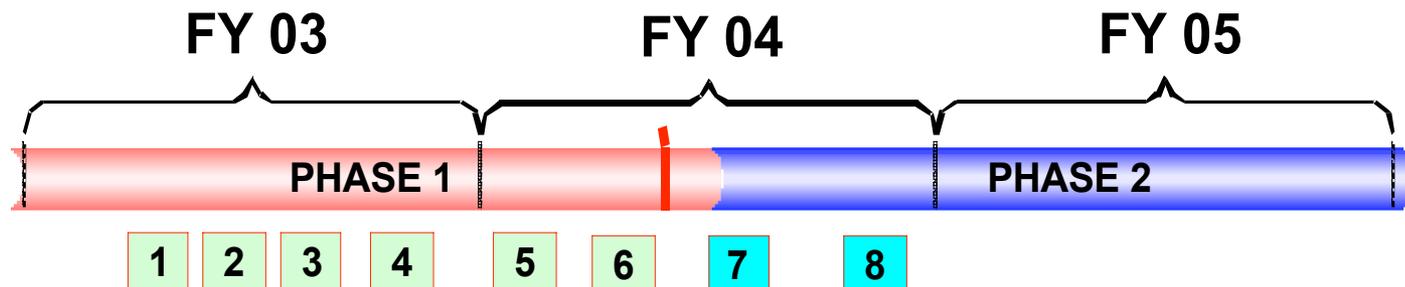


Project Safety

- ❑ For the “Hawaii Fuel Cell Test Facility,” HNEI has developed extensive hydrogen safety plans. Elements include:
 - Complete database of relevant codes & standards.
 - Failure modes and effects analysis (FMEA).
 - Review by industrial partner of FMEA and safety compliance.
 - Generation of in-house safety manuals.
- ❑ Project-specific elements additional to core HNEI safety plans:
 - Design based on relevant codes & standards.
 - Design review & safety inspection by industrial gas supplier.
 - Conduct “first responders” training.
 - Maintain Configuration Management and management of change procedures.



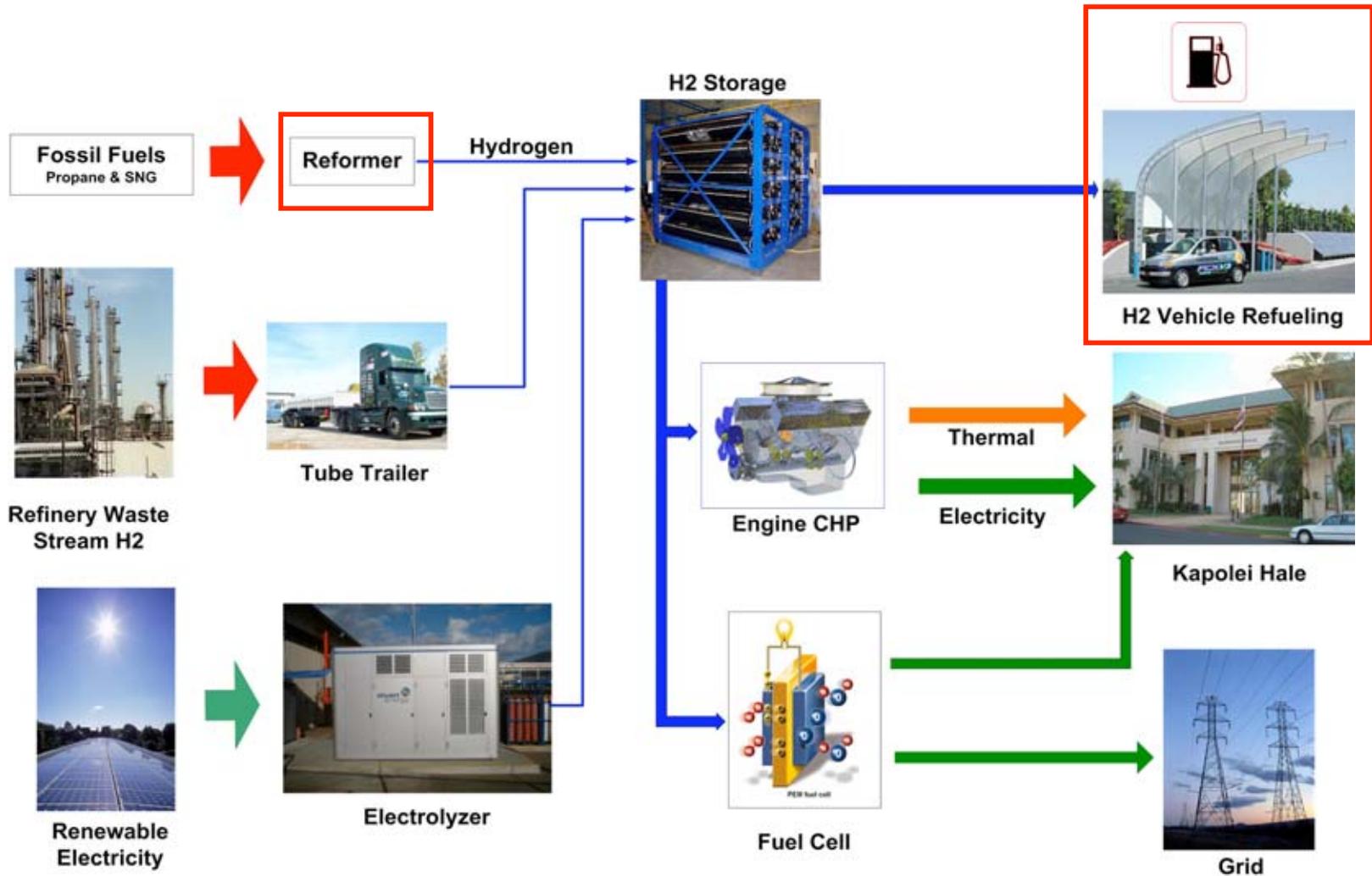
Timelines & Milestones



<i>FY 03 – Phase 1 Milestones</i>	Status
MS#1 – Complete Conceptual Design	Completed
MS#2 – Complete FMEA	Completed
MS#3 – Install Electrolyzer, H2 & Data Acquisition System	Completed
MS#4 – Complete Outreach Plan	Completed
MS#5 – Complete System Model	Completed
MS#6 – Install 5kW fuel cell	On order
<i>FY 04 – Phase 2 Milestones (Proposed)</i>	
MS#7 – Install Kapolei infrastructure	Negotiating Agreements with C&C
MS#8 – Kapolei site operational. Start test program	September 04



Power Park Conceptual Design



Components that are not currently funded



Accomplishments/Progress

- ❑ **Performed FMEA analysis of initial test system.**
 - Leveraged extensive expertise of UTC Fuel Cells.

- ❑ **Installed hydrogen systems.**
 - All permits obtained in 6 months.
 - Electrolyzer operating for over 100 hours.
 - Electrolyzer supplying hydrogen to PEM fuel cells and hydrogen storage system.

- ❑ **Simulation model developed.**
 - Collaboration with Sandia National Laboratory.

- ❑ **Outreach plan completed.**
 - Leverages Bishop Museum programs to reach teachers & school children throughout state.



Accomplishments/Progress

- ❑ **Fuel cell.**
 - Evaluated fuel cell market.
 - Quotations for 5-10kW fuel cell under evaluation.
 - June 04 installation planned.
- ❑ **Site identified for Phase 2 activities.**
 - City & County of Honolulu has offered site and in-kind cost share consisting of land, site improvements and office space. Therefore, decision was made to locate the project at Kapolei, Oahu.
- ❑ **Conducted high level education and outreach activities.**
 - All City & County of Honolulu department heads briefed on project.
 - Project highlighted on Mayor's weekly television show & Mayor's "State of the City" address.



Interactions & Collaborations

❑ **Stuart Energy**

- Provided electrolyzer & technology transfer.
- Significant cost share support.

❑ **California Energy Commission**

- Cost share partner supporting SunLine technology and “Lessons Learned” transfer.

❑ **Hawaiian Electric Company**

- Provided in-kind engineering support for grid interconnection.
- Will provide in-kind support for CHP system during Phase 2.

❑ **The Gas Company**

- Provided in-kind engineering support for low pressure hydrogen storage.
- Will provide tank for low pressure hydrogen storage in Phase 2.



Interactions & Collaborations

- ❑ **SunLine Services Group**
 - Technology transfer through design reviews and “Lessons Learned”.
- ❑ **Sentech, Inc.**
 - Engineering analysis & business case development.
 - Public outreach program support.
- ❑ **Sandia National Laboratory**
 - Engineering and economic models & analysis.
- ❑ **City & County of Honolulu**
 - Provide site and supporting infrastructure in Phase 2.
 - Provide access to PV array and 150kW CHP system in Phase 2.
 - Will provide in-kind cost share for Phase 2.
- ❑ **Bishop Museum**
 - Collaborate on public outreach and educational science program support.



Responses to Previous Year Reviewers' Comments

Comment:

- ❑ **“UTC FC is at 5kW. They need to plan to increase it to 75kW.”**

Response:

- ❑ No stationary 75kW PEM fuel cells available on the market.
- ❑ Fuel cell costs remain high. Current funding cannot support this high cost.
- ❑ Additional 5kW modules may be purchased to increase overall power output subject to adequate funding.

Comment:

- ❑ **“The plan for future activities beyond original program are not fully developed yet.”**

Response:

- ❑ Plan has been developed that is building a platform for future hydrogen demonstration projects.



Future Work

- ❑ **Balance of FY 03 Funds**
 - Complete testing of integrated 5kW fuel cell system.

- ❑ **FY 04**
 - Design & install delivery and storage infrastructure to allow for delivery of up to 10 kg/hr hydrogen to Phase 2 Power Park site.
 - Continue operation and analysis of the H₂/fuel cell system installed under Phase 1.
 - Provide delivery of hydrogen from refinery waste stream for use in 150 kW ICE CHP system.
 - Characterize effect of H₂ on ICE CHP performance.
 - Model performance of ICE CHP to assess economic, technical and environmental benefits of H₂ use.
 - Continue outreach activities.
 - Work with DOE and industry to identify other partners/technologies for incorporation into Power Park facility.

- ❑ **FY 05**
 - Incorporate renewable hydrogen production technologies into Power Park.



Power Park Proposed Future Site



Kapolei Hale, project host, will receive power from Power Park.



Asia Pacific Urban Technology Institute to house project office and support public outreach.



Large concrete pad to be installed by C&C behind existing cooling tower structure.

