

Hawaii Hydrogen Power Park

**2004 DOE Hydrogen, Fuel Cells & Infrastructure
Technologies Program Review Presentation
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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.**

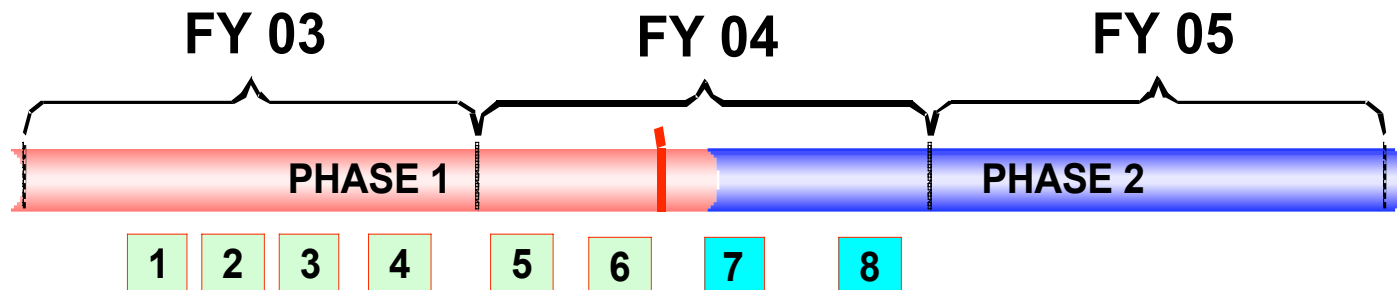


Project Safety

- ❑ 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.



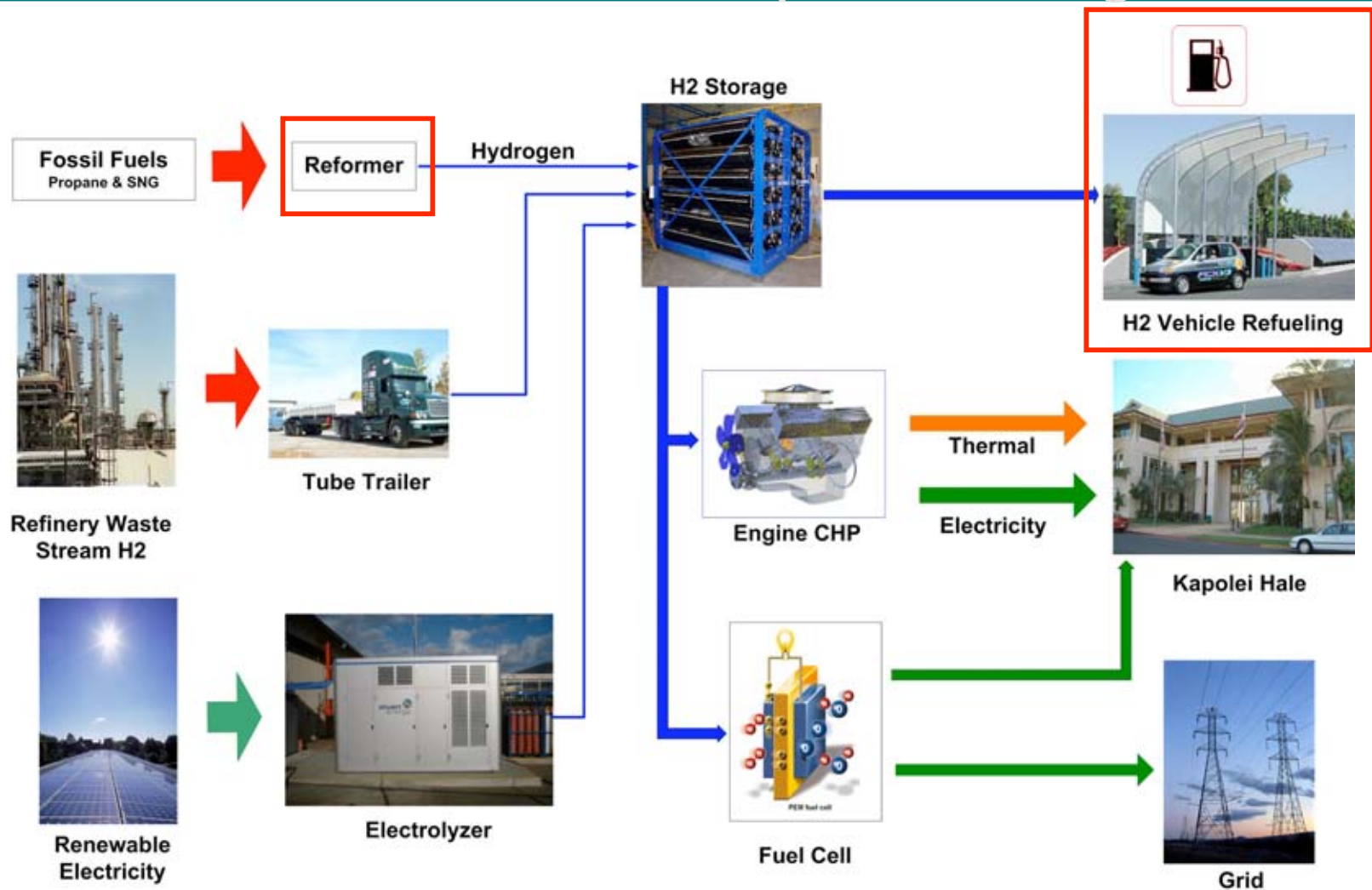
Timelines & Milestones



<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.



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



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

