

DOE/GO/10039-1

# Solar Powered Hydrogen Generating Facility And Hydrogen Powered Vehicle Fleet

Technical Progress Report For The Period August  
11, 1994--September 30, 1994

James J. Provenzano  
Managing Director

Clean Air Now  
660 Venice Blvd., #112  
Venice, CA 90291  
(310) 450-2121

November 1994

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**MASTER**

**PREPARED FOR THE UNITED STATES  
DEPARTMENT OF ENERGY**

**Under Contract No. DE-FC36-94GO10039**

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## Technical Progress Report

1. **INSTRUMENT NO.:** DE-FC36-94GO10039
  
2. **PROJECT TITLE:** Solar Powered Hydrogen Generating Facility And Hydrogen Powered Vehicle Fleet
  
3. **REPORTING PERIOD:** August 11, 1994 through September 30, 1994
  
4. **NAME AND ADDRESS:** Clean Air Now  
660 Venice Blvd., #112  
Venice, CA. 90291
  
5. **PROJECT START DATE:** August 11, 1994
  
6. **COMPLETION DATE:** September 10, 1995
  
7. **APPROACH CHANGES:**
  1. On September 27, 1994, **United Technologies Corporation (UTC)** informed us that they were **withdrawing their participation from the Project**. (Please refer to attached letters 1&2 for explanation.) This development required extensive discussions with alternative sources for the electrolysis system and related equipment. Subsequently, a RFP solicitation was prepared for distribution to Electrolyser Corporation and Teledyne Brown Engineering. These two companies were chosen for their demonstrated experience with renewable hydrogen generation systems utilizing water electrolysis. The change of a source for the electrolyzer will require that the system be re-evaluated when a new

subcontractor is selected. This is particularly important to the interconnection scheme for the PV-Electrolysis system since UTC was designing their system to operate off 480 volt, 3-phase electrical power and the PV array provided a DC voltage at up to 250 volts. In addition, the interconnection with the grid was clarified to ascertain whether expensive line interactive equipment was needed. This will be fixed when the electrolyzer subcontract is awarded. At present, the grid connection will be manual so that grid electricity can be utilized when more hydrogen than can be provided by the PV arrays is necessary. It was decided that a more effective demonstration could be achieved if the amount of solar generated hydrogen was maximized. Thus the system will produce as much hydrogen from the PVs as possible, even if it is not needed by the vehicles. In this way the system performance can be characterized providing data for an optimized control scheme. (Potential schedule/Statement of Work changes due to change in contractors is discussed in #10 below.)

2. The **vehicle retrofit** engineering team determined it was necessary to **improve low end torque and acceleration** over current design as per University of California at Riverside's hydrogen powered 2.3L Ford Ranger. This will be accomplished by replacing the turbo with a Roots type supercharger, increasing the stroke to increase displacement by 30%, and installing a higher ratio rear axle. With these modifications it was estimated they would provide a more than doubled improvement in low-end performance (power to power). These changes will vastly improve the first vehicle's driveability and the customer's (Xerox) satisfaction. It is estimated that these changes will result in a delay of delivery of the first vehicle by 14 days. This will not affect critical path items nor overall systems schedule.

## **8. PERFORMANCE VARIANCES, ACCOMPLISHMENTS, OR PROBLEMS:**

1. **Praxair broke ground for the Fueling Station and Storage Facility** at the Xerox site on November 11, 1994. This was performed several days ahead of schedule, so we anticipate a completion date of December 12, 1994, which is on schedule. We have made arrangements to **recharge the Ballard/South Coast Air Quality Management hydrogen fuel cell powered bus** that will be touring southern

California at that time. This will allow us immediate public exposure to the feasibility and practicality of hydrogen transportation technologies. It also demonstrates Clean Air Now's and Xerox's cooperation with any entity that can benefit from this Project. We are also in discussions with a **Belgium hydrogen fuel cell bus manufacturer** to work out a cooperative agreement to **showcase a public application of hydrogen fuel**. If implemented, this side project will provide El Segundo, California industry with the first zero emission vehicle for use as an employee shuttle bus servicing the local area. This will demonstrate the development and use of an hydrogen infrastructure in Southern California.

2. The first **Xerox Ford Ranger** pickup was **delivered to the retrofit engineer** on August 30, 1994. Work is progressing on schedule with changes made as previously discussed in #7 above.
3. Activities during this period were focused on project **organizational and start up activities**. We held several planning meetings. The purpose of these meetings was to determine the course of action and determine any areas that needed further definition before the project could get rolling. We clarified areas of responsibility and identified potential problems. We held a **kick-off meeting with the DOE** (Lucito B. Cataquiz - DOE/OTT Headquarters, G. William Ives - Golden Field Office, and Ruth E. Adams - Golden Field Office) and the Project participants. This meeting provided an overview of Project scope and status, the participants, technical discussions, and administration clarification.
4. Several **configurations for the photovoltaic arrays** were considered and discussed with the project team and Xerox management (Please see #11 and associated drawing). Considerations of the site plan included the minimum reduction on parking spaces in the employee parking lot, maintaining access through the lot for other vehicles, and the accessibility of the dispensing station to Praxair tank trucks. More general issues of **safety, operability, and aesthetics** were also considered. A main issue was the required distances between the various component systems such as the electrolysis unit and the PV array.

5. **Overall systems and vehicle safety reviews** were commenced and action items determined. These included proper hydrogen venting, sensing, pressures, and flow rates. Vehicle safety features were discussed. The Clean Air Now engineering team along with Xerox Corporation and Praxair are undertaking a **failure mode analysis** of all the systems. Findings from this work will be discussed in future reports.

## 9. OPEN ITEMS:

1. All **contracts** with subs have been signed with the exceptions of Energy Technology Engineering Center (ETEC), and the as-of-yet unknown hydrogen generator supplier. These contracts have been written and are pending review by legal teams. We will have these two contracts signed by year's end.
2. **Cofunding documentation** reflecting contractual figures will be sent to Ruth Adams, Contract Administrator, DOE Golden Field Office by November 11, 1994.
3. After the **electrolyzer** suppliers' proposals are evaluated by the review team of ETEC, Dr. Paul Scott, Project Engineer, and James J. Provenzano, Managing Director, the Clean Air Now board of directors will make its **selection** and pass it on to the **DOE** for **review and approval**. We anticipate that the DOE will be notified of CAN's decision by the end of November 1994.
4. Subsequent to the DOE's approval of the new electrolyzer supplier for the Project, Clean Air Now anticipates the submission for a **revision to the Project's Statement of Work and Schedule**. (This is further discussed in #10 below.)

## 10. STATUS ASSESSMENT AND FORECAST:

1. Due to the change in electrolyzer supplier we are anticipating a **request to the DOE for a schedule/statement of work revision**. This cannot be determined until the electrolyzer contract is signed, which we anticipate will be by December 1, 1994. At this same time we will

perform an **overall systems integration review** to develop a revised scope/Statement of Work for the Project.

2. Clean Air Now is facilitating discussions between ETEC and Brunswick Composites to begin a course, under an ETEC CRADA, to perform **tank testing and acquire DOT approval** of hydrogen storage for vehicular use.
3. Even though the project is to be a deployment project, it is **desirable to acquire as much data as possible** to support future development projects, utilizing advanced technologies, currently under development by other DOE programs.
4. Work during the next month will be on an **ongoing review of the overall system safety and energy efficiency**.

#### 11. DESCRIPTION OF ATTACHMENTS:

1. Letter dated October 6, 1994, to Mr. Kevin Grohs of United Technologies Corporation, from Paul Staples, Executive Director Clean Air Now re: UTC's withdrawal from the Project.
2. Letter dated October 6, 1994, to Mr. John Meeker of DOE, Golden Area Office, from Paul Staples, Executive Director Clean Air Now re: UTC's withdrawal from the Project and competitive bid RFP from Electrolyser Corp. And Teledyne Brown Engineering.
3. Schematic of PV array and equipment layout on Xerox, El Segundo E lot.
4. Process flow diagram of integrated systems overview.

#### 12. SIGNATURE OF RECIPIENT AND DATE:

*James P. Brennan 11/8/94*  
*Managing Director*  
*Clean Air Now*

#### 13. SIGNATURE OF DOE REVIEWING REPRESENTATIVE AND DATE:



October 6, 1994

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**YU-YUE WIDRIG**

Mr. Kevin Grohs  
United Technologies Corp./Hamilton Standard Division  
One Hamilton Road  
Windsor Locks, CT 06096-6000

Re: CAN/Xerox Project for Soar Power Hydrogen Generating  
Facility and Hydrogen Powered Vehicle Fleet

Dear Mr. Grohs:

Clean Air Now (CAN) is in receipt of your letter of September 27, 1994 advising us that Hamilton Standard Division of United Technologies Corporation (UTC) is withdrawing its participation from the project because it cannot accept the provisions of the cooperative agreement related to rights to intellectual property. You further stated that the imposition of the cooperative agreement on UTC is contrary to its program proposal and in conflict with prior representations by CAN.

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**WILLIAM WYBOURN**

**ANDREW ZALAY**

We do not agree with your statement that UTC was not made aware of the terms of the cooperative agreement and its applicability to UTC. Upon receipt of the draft agreement from DOE, CAN forwarded a copy of the agreement to UTC for its review and comment. After having the agreement for over two weeks without any comment from UTC, you faxed me a letter, on the day that the final contract came back from the D.O.E. ready to sign, expressing your concern about the intellectual property rights provision. CAN requested that DOE amend the agreement to accommodate UTC's concerns. The DOE agreed to limit the scope of the intellectual property provisions to only encompass solar powered hydrogen generating applications. We understood that UTC was satisfied with this modification. There was never any indication from you that UTC intended to withdraw from the project if the intellectual property provisions were made applicable to it. Also, further analysis of these provisions showed that UTC's concerns were unwarranted due to a provision that stated that UTC would not be required to grant DOE a license for its background patents if there were "alternatives" available, which we concluded there were.

CAN has now relied on UTC's co-funding commitment and its participation in the project on the terms and conditions proposed in its statement of work. Therefore, CAN cannot accept UTC's withdrawal from the project until a suitable replacement has been found. CAN will attempt to replace UTC with another company willing to participate in the project at the same co-funding level and on the same terms and conditions. However, until CAN secures a suitable replacement, we expect UTC to remain prepared to participate in the project.

If you have any questions regarding the foregoing, you may contact the undersigned,

**SPONSORS:**

**XEROX CORP.**

**PRAXAIR INC.**

Sincerely,

Paul Staples  
Executive Director:  
**CLEAN AIR NOW!**

cc: Lucito Cataquiz, DOE/D.C.  
Bill Ives, DOE/Golden  
John Meeker, DOE/Golden  
Ruth Adams, DOE/Golden



October 6, 1994

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**ANDREW ZALAY**

**SPONSORS:**

**XEROX CORP.**

**PRAXAIR INC.**

John Meeker  
U.S. Department of Energy  
Golden Office  
1617 Cole Blvd.  
Golden Colorado, 80401  
Re: Cooperative Agreement #DE-FC36-94GO10039-A000

Dear Mr. Meeker:

Clean Air Now (CAN), pursuant to paragraph 14, of the general terms and conditions for research financial assistance awards, is hereby requesting that the Department of Energy (DOE) pre-approve a replacement of one of its subcontractors who has withdrawn from the project with a subcontractor of equal or greater ability. In its statement of work provided to the DOE, CAN indicated that it intended to use equipment supplied by Hamilton Standard Division of United Technologies Corp. (UTC) and have UTC install and interconnect its equipment to the photovoltaics, utilities, and the hydrogen storage receiver. However, on September 26th, 1994, CAN received notice from UTC that it was withdrawing its participation from the project, due to the fact that it could not accept our condition that it grant DOE a non-exclusive license to its background patents utilized in the project, as required by the DOE's cooperative agreement.

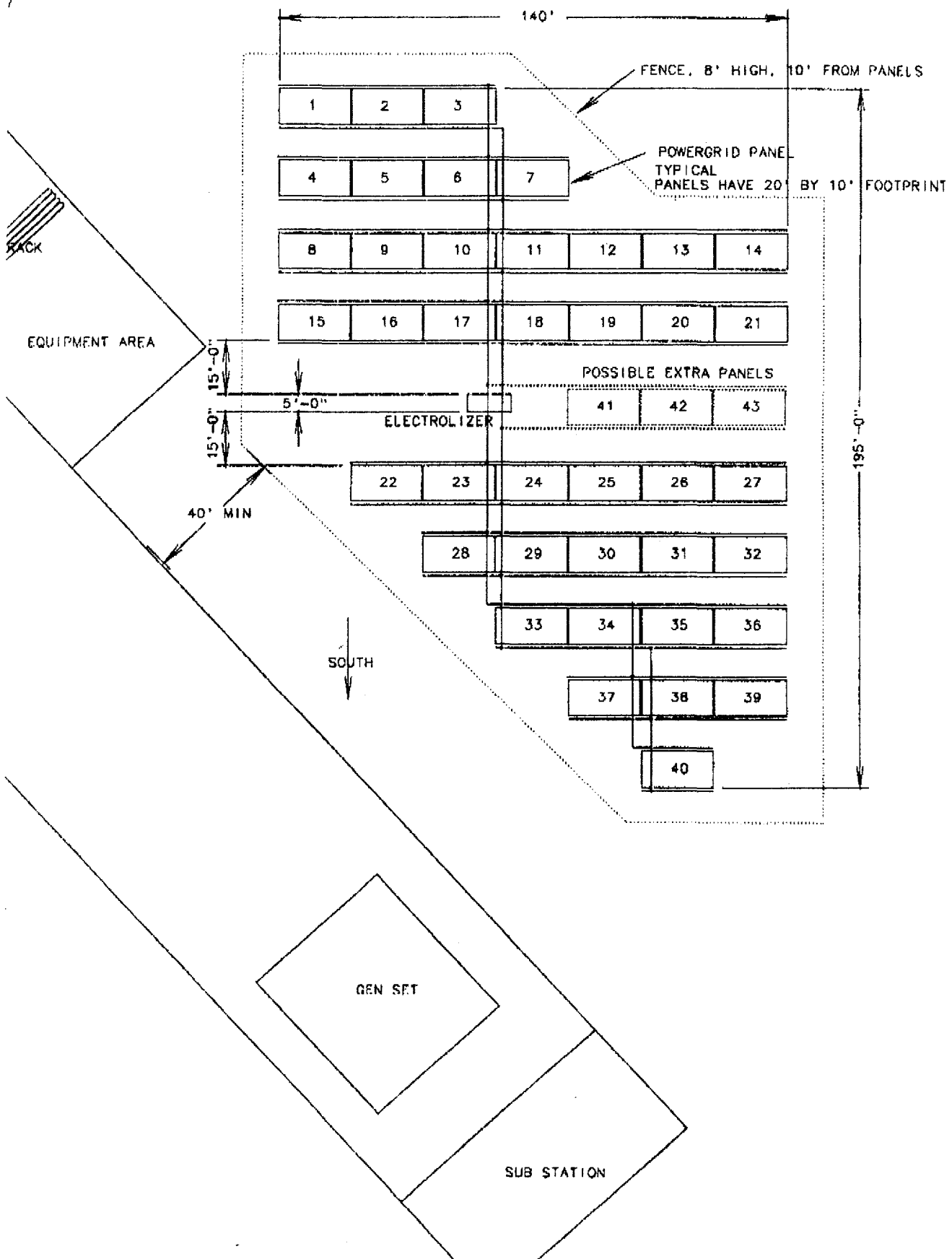
CAN has since contacted Electrolyser Corp. and Teledyne Brown about stepping in and replacing UTC and providing the equipment on the same basis and at the same co-funding levels. CAN will receive proposals from Electrolyser Corp. and Teledyne Brown. After a detailed evaluation, CAN will make its selection.

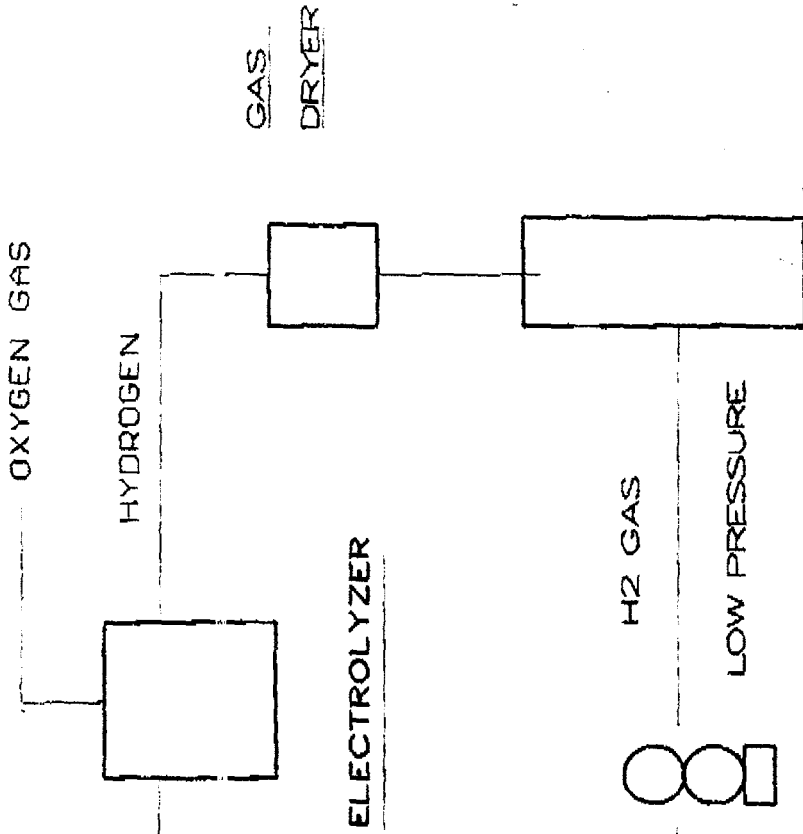
Based on the foregoing, CAN respectfully requests that the MSRC pre-approve Electrolyser Corp. and Teledyne Brown for participation in the project on the same basis and co-funding levels as UTC. We have requested a proposed statement of work from both of these parties and will forward that to you as soon as that is available. Because we would like to avoid any delay to the project schedule, we would appreciate you expediting your approval process. If you have any questions or concerns, you may contact the undersigned at 310-450-2121.

Sincerely,

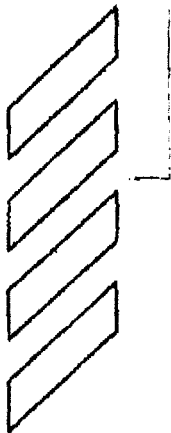
Paul Staples  
Executive Director  
Clean Air Now

cc: Lucito Cataquiz, DOE/D.C.  
Bill Ives, DOE/Golden  
Ruth Adams

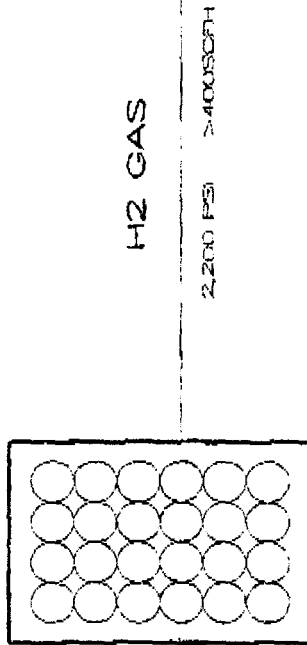




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VOLTAGE: TBD



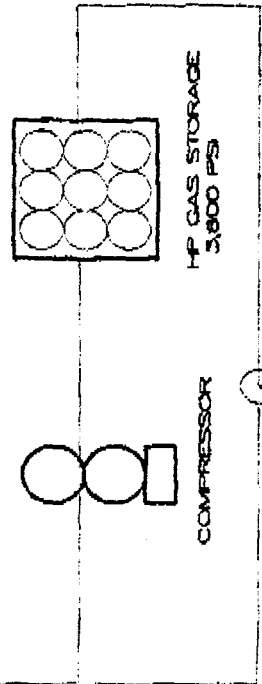
PHOTOVOLTAIC



GAS STORAGE  
72,000 SCF

COMPRESSOR

GAS HOLDER



PROCESS FLOW DIAGRAM

DRAWN BY: W. HOAGLAND  
XEROX EL SEGUNDO FACILITY  
SOLAR HYDROGEN GENERATING SYSTEM

DATE: 10/8/94

DWG NO.

WH-1