



**ARRC/H2 Alliance**

Prototype

Advanced Refueling Retail Center

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## Introduction



### What is:

The service station is one of the most widespread and frequented commercial buildings. Its visual impact on our towns and cities is substantial – often devastating, yet there has been virtually no change in layout in more than 75 years. Today's service station – typically a convenience store, canopy, and pumps placed on islands set in a field of asphalt is virtually the same as those that were built in the 1930's. Only the technology and the graphics have improved.

### What can be:

We have evaluated the performance of today's service stations by focusing on the insights from consumer groups, planning and design review boards, members of the oil industry and our own observations.

It is our view, and one shared by others, that hydrogen will not only reinvent the automobile – it will reinvent the gas station as well.

Hydrogen provides a new source of energy and hydrogen cars use new technologies, so it is appropriate that a hydrogen station be innovative as well. An innovative design will heighten the public's awareness of hydrogen as a clean, safe, renewable energy.

The new design recognizes the civic and commercial importance of the service station by responding to customer demands and the public's growing concerns for its communities and the environment.

**ARRC/H2 Photographs**



ARRC/H2 panorama view

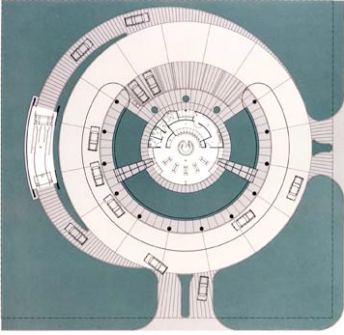


ARRC/H2 street level view



ARRC/H2 aerial view

## ARRC/H2 Features



### Station-in-the-Park Environment

The park-like-setting, approximately 25% of the site is landscaped, responds to the public's concern for the environment and its communities. Plants are selected for maximum durability and minimum maintenance according to "plant zones."

### Speed and Ease of Entry and Exit

The circular one-way traffic pattern enables drivers to gain quick, easy and safe access to **all** fueling positions, optimizing the pumping capacity of the station. A system of red and green signal lights directs the customer to open dispensers or ones about to be vacated.

Greater security control and protection against "drive-offs" is achieved by using a single exit for mid-block sites and dual exits for corner sites.

### Greater Flexibility

The canopies repetitive design, modular construction, and site utility layout allows for fueling positions to be added in multiples of one as future business requirements warrant with minor cost and disruption. In addition to hydrogen, dispensers can be designated to dispense ethanol, biodiesel or other alternative fuels.

### On-Site Hydrogen Fuel Generation

The hydrogen generation system is based on emission-free electrolysis technology. The system generates and stores fuel cell grade hydrogen gas reliably, safely and on-site. During low hydrogen vehicle use it may be possible to use excess power for other purposes. This would depend on the amount of regenerative energy produced and the frequency by which the power would be produced from the stored H<sub>2</sub>.

**ARRC/H2 Features** (continued)

**Environmental Design**

Environmentally sustainable construction using recycled materials, water and energy efficiencies, reduced site disturbance and other sustainable features.

**Solar Energy**

The solar energy system generates electricity that covers all or a portion of the station's total lighting requirements depending on geographical location.

**Cost Effectiveness**

Cost savings in engineering and construction can be achieved from a standard layout that serves both mid-block and corner sites of varying size and alternative profit centers.

**Reduced Visual Clutter Greater Security Control and Increased Customer Safety**

The ARRC/H2 design appears less cluttered because the site lighting does not use light poles and the fuel dispensers along with other mechanical and electrical systems are fully integrated into the architecture

The site lighting directs light into the landscape areas to inhibit vandalism and enhance the customer's visibility and comfort.

The fully concealed lighting system asserts the station's presence while providing glare free, highly efficient illumination.

The dispensers are integrated into the columns and an internal steel bumper system concealed in the lower part of the column cover protects the dispenser and the column.

The CCTV security and fire suppression system are fully concealed in the column.

**ARRC/H2 Features** (continued)

**Information Center**

The Information Center and its exhibits are designed to provide the visitor with a memorable hydrogen experience. Interactive displays explain how the hydrogen fuel car works in a light and engaging manner. A 20 capacity open theatre accommodates school and community groups for presentations. The center piece of the exhibit is a fully operational Hydrogen Fuel Cell Car.

**Lower Maintenance**

The buildings are protected from vehicular damage by wide planting areas and sidewalks.

**Advanced Technology**

ARRC/H2 employs the latest technology for leak-containment and monitoring, security surveillance, fire suppression, integrated business systems monitoring, electronic signage, and pay-at-the-pump options.

The modular fully integrated monitoring system monitors business management, regulatory compliance and environmental protection.

The product distribution system utilizes fiberglass double wall tanks, centralized remote fill, spill containment and fiberglass piping and secondary containment.

The remote electronic control system simultaneously changes prices at the street and the fuel dispenser. Changeable exterior merchandising signs can similarly be controlled from within the building or off-site.

**ARRC/H2 Features** (continued)

**Increased Income**

ARRC/H2's innovative design has greater customer appeal than traditional stations and offers the potential for a greater return on capital investment.

The standard layout can accommodate a variety of alternative profit centers each prominently located and easily accessible. This arrangement not only provides additional revenue, but optimizes fuel sales as well as attracting more customers particularly at non-peak hours.

**Station Branding**

ARRC/H2's clean simple geometric forms provide for a wide choice of architectural treatments and accommodates all current identity programs.

**Car Wash Option**

The Car Wash operation is showcased through a glass wall, automatically cleaned by a water removal wiper system. The fully automated, soft-cloth rollover vehicle system uses an environmental water reclaim and treatment system.

**Hydrogen Vehicles**

Hydrogen cars have a storage capacity of approximately 2-5 kg. and can travel 30-50 miles per kg. Refueling time varies between 4-15 minutes depending on the type of car. The hydrogen storage capacity of a bus is 30-50 kg.

## ARRC/H2 Facts + Figures

Location: Urban or Suburban Site, corner or mid-block

Size: 6 Fueling Positions and a 1,996 square foot Information Center.

Size of stations vary from 6 to 16 fueling positions with Convenience Store and Car Wash options.

<b>Site Dimensions</b>	Including assumed setbacks	152'w x 160'd 0.56 acres
	Front setback	25'
	Rearsetback	55'
	Side setbacks	20'
<b>Site Coverage</b>	Driveways	50%
	Sidewalks	7%
	Landscaping	22%
	Structures	21%
<b>Circular Interior Roadway</b>	3 lane circular driveway	27'-0" wide
<b>Information Center</b>	Area	1,966 square feet
	Size	50'-0" diameter
<b>Canopy</b>	Width	22'-0"
	Clearance under canopy	14'-0"
	Distance between dispensers	22'-0"
<b>Fuel Dispensers</b>	Total Number of Fueling Positions	6
	Hydrogen fueling dispensers	2
	Ethanol fueling dispensers	2
	Fueling Dispenser expansion	2
<b>Hydrogen Generation</b>	Hydrogen generation on-site on demand using electrolysis technology.	
	Storage Capacity 40 kg Dispensing Capacity Min 30 kg/day, 7 days a week Dispensing Capacity 5,000 psi at dispenser with ability to upgrade to 10,000 psi with additional equipment Hydrogen Purity up to 99.999% fuel cell grade Electric Consumption 70 kWh/kg for H2 Generation	
<b>Ethanol Fuel</b>	In addition to hydrogen, ethanol or other alternative fuels can be dispensed.	

**ARRC/H2 Facts + Figures** (continued)

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<b>Solar Energy</b>	AC Rating in Fairfield County, CT	2,660 watts
	AC Rating in Long Beach, CA 1	11,8700 watts

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<b>Lighting</b>	Site	1,750 watts
	Canopy	7,300 watts
	Information Center	1,636 watts
	Total	10,686 watts

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**Hydrogen Cars**

Although not part of this conceptual proposal the availability of hydrogen vehicles and their compatibility with the fueling station is vitally important. Lease/purchase agreements for a diverse fleet of hydrogen-powered vehicles, their maintenance, and the types of hydrogen fuels required, needs to be explored.

The AARC/H2 Alliance maintains relationships with most of the major car manufacturers and can provide assistance in this area.

## **ARRC/H2 Alliance Members**

### **AG/ENA 1977 –**

*Eliot Noyes & Associates 1947-1977*

Long recognized as one of America's most respected design firms, AG/ENA has completed more than 500 projects in 18 states and 14 countries since its founding in 1947. The firm served as design consultants to The Mobil Oil Corporation on a continuous basis from 1966 to 1991 and was responsible for the design of numerous prototypes that affected more than 25,000 stations worldwide.

The American Institute of Architects honored AG/ENA for its "consistent maintenance of the highest standards of design and professionalism as evident throughout the wide range of excellent projects. The worldwide influence that AG/ENA has exerted through its commitment to corporate design standards has made a lasting impression on cities in America and around the world."

### **Forum Inc.**

Since its founding in 1963, Forum has earned a reputation for designing, manufacturing and pioneering creative and innovative lighting solutions. The company has the ability to take a custom design from concept to prototype to production in a cost effective manner without sacrificing their high standards for quality and integrity of design. Forum is the lighting fixture supplier to a number of large energy companies.

### **Frey-Moss**

Frey-Moss is one of the nations leading pre-engineered modular building companies with nearly 15 years experience. The company is a major manufacturer of service station canopies, convenience stores and car wash buildings for the energy industry. Frey-Moss recently received "The Supplier of the Year" award from a major energy company.

### **Hydrogenics Corporation**

Hydrogenics is a world leader in hydrogen infrastructure technology and products supported by over 55 years of world leadership in the development, manufacturing and installation of onsite hydrogen generation systems for industrial and energy markets.

### **Shell Hydrogen**

Shell Hydrogen is a global business of the Royal Dutch/Shell Group of companies with the headquarters in Amsterdam, the Netherlands, and regional bases in Houston and Tokyo. Shell Hydrogen was set up in 1999 to pursue and develop business opportunities related to hydrogen and fuel cells.

The aims of Shell Hydrogen are to produce hydrogen in the most cost-effective way to help meet the world's future demand for hydrogen, and to promote and support the development of the fuel processing devices and technical solutions the world needs to hydrogen.

### **Signstrut Milwaukee**

Signstrut is a full-service sign supplier whose superior products, service, and engineering have resulted in their becoming the sign company of choice for many of the large energy companies and others as well. Signstrut is a leader in the field of LED signs and a manufacturer of architectural specialty items such as dispenser valances, canopy column shrouds, etc.

**ARRC/H2 Alliance Construction Manager**

**Turner Construction Company**

*Provides Pre Construction Consulting and Project Manager Services to the ARRC/H2 Alliance.*

Turner ranks first or second in major segments of the construction industry and maintains a nationwide network of offices and a staff of more than 5,000 employees, performing work on over 1,500 projects each year.

Turner is committed to the success and increased adoption of sustainable construction practices, known as “Green building” practices. Turner’s extensive experience across a wide variety of sustainable construction projects enables them to create a detailed databank of cost-effective Green materials, processes and suppliers.

As part of Turner’s commitment to have a positive impact on the communities they serve, they have launched a broad-based program of initiatives to promote sustainable development practices and to aggressively expand their capabilities and leadership in this growing field.

**Alan Goldberg, FAIA: ARRC/H2 architect**



After graduating from Washington University's School of Architecture, Goldberg began his career in New York where he worked for 10-years prior to joining Eliot Noyes and Associates in 1966. He was named head of the firm's architectural department in 1972, a partner in 1974, and in 1977 the sole principal under the firm's new name AG/ENA.

Goldberg's work involves design in the broadest sense, including architecture, interior design, lighting, graphics, industrial design and corporate design consulting. His leadership in design and design management is evident in a remarkably wide range of projects for some of the nations leading corporations and public agencies -- everything from the development of a master plan for a large technical center to gasoline dispensers.

In 1988, Goldberg was made a Fellow of the American Institute of Architects with this citation: "The worldwide influence he exerted through his commitment to design standards has made a lasting impression on cities in America and around the world." In 2004, Goldberg received a Distinguished Alumni Award, from Washington University, "in recognition of his extraordinary accomplishments as a designer and unique contributions to the field of architecture."





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