

Community Hydrogen Action Plan

Building Grassroots Hydrogen Communities

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California Fuel Cell Partnership

In collaboration with the
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Draft Document

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Introduction

Communities¹ across the United States are being tasked to reduce their energy consumption with the goal of establishing energy independence and decreasing greenhouse gas (GHG) emissions. Some of these efforts are federally mandated, some are a result of state regulatory action. As a result, communities are taking the initiative in leading society towards a renewable future to meet federal and state goals, and to improve their residents' quality of life through improved air quality, lower energy costs and new “green” jobs. To achieve the targets, communities—big and small—are adopting climate action plans that set environmental goals and specify the steps needed to reach the goals.

A principal strategy for communities to meet energy and environment goals is to transition to hydrogen-fueled fuel cell vehicles for transportation, deploy stationary fuel cells for distributed generation of electricity, and integrate fuel cells into other promising capacities such as fork lifts for manufacturing and warehousing . California has deployed hundreds of demonstration hydrogen fuel cell vehicles throughout the state, and is now preparing for early commercial launches of even more vehicles. Already, more than 20 MW of stationary fuel cell product are deployed in California at hotels, industrial and food processing plants and university campuses. Hydrogen vehicles and stationary fuel cells offer the benefits of zero-emission power with reduced or zero greenhouse gas emissions and the ability to use local resources for feedstock. In addition, hydrogen and fuel cells bring green jobs into a community.

This document outlines a Community Hydrogen Action Plan (CHAP) as a guideline for communities to more effectively and efficiently reach their energy and environment goals, including:

- Reduce carbon footprint (climate action goal)
- Improve air quality
- Decrease dependency of foreign oil
- Lower fossil fuel consumption
- Increase energy independence
- Strengthen energy security
- Create “green” jobs

CHAP is a systematic six-step template for successfully jumpstarting hydrogen and fuel cell projects. CHAP focuses on local leadership and activities to streamline project acceptance and planning. Implementing the CHAP process ensures a community's position as a leader in sustainable energy, and creates a foundation for long-term economic and social benefits.

¹ Communities: Cities, municipalities, military bases, university campuses, national laboratories

What is a hydrogen community?

Hydrogen is already pervasive in many communities¹ in support of industrial processes such as manufacturing. As a result, hydrogen is being regularly generated, transported, and utilized around the clock in communities throughout the state. Hydrogen is also a major ingredient in the refining of gasoline.

A hydrogen community is an early adopter of next-generation hydrogen technology. Examples include communities that deploy stationary fuel cells, establish hydrogen fueling stations, and replace gas or battery-powered forklifts with hydrogen fuel cell powered forklifts and lift trucks. In particular, a “hydrogen community” is a community united by a common vision of using hydrogen fuel and stationary fuel cell technologies to meet their daily transportation and electric power needs and thereby improve the community environmental and public health.

A defense distribution depot in Susquehanna, PA, replaced half of their battery-powered forklifts with 40 fuel cell forklifts. According to Argonne National Labs, compared to battery or propane-powered forklifts, fuel cell forklifts use less energy, create fewer GHGs, refuel faster and have longer operating time.² According to the depot, the fuel cell forklifts also improve distribution efficiency because they have less down time.

In Chico, CA, Sierra Nevada Brewing Company captures digester gas from its brewing process to power stationary fuel cells and create electricity for the brewing operation. This can significantly reduce brewery operating costs and means Sierra Nevada is less susceptible to changes in the cost of grid electricity, plus it reduces demand on the grid and the overall environmental footprint. Gills Onions in Oxnard, CA, has just commissioned a similar strategy.

In the San Francisco Bay Area, AC Transit currently operates a fleet of three fuel cell buses. These buses produce zero local pollution, require less maintenance than diesel buses and achieve double the fuel efficiency of current buses.³ Diesel buses emit over half a ton⁴ of particulate matter into California’s urban centers each day and more than 400,000 tons of GHG every year.⁵ Replacing diesel with zero-emissions buses has an immediate impact on public health in the densely populated urban areas.

In the greater Los Angeles area, several car manufacturers have demonstration programs for passenger fuel cell vehicles (FCV). Customers lease FCVs and drive them as regular family cars. They refuel the vehicles at demonstration hydrogen stations throughout the city. Automakers have hundreds of vehicles on the road today, but expect that to increase to thousands by 2014, and tens of thousands by 2017. Building retail stations in the Los Angeles area is a priority to enable the roll out of these vehicles.

² <http://www.transportation.anl.gov/pdfs/TA/537.pdf>

³ *Fuel Cell School Buses, Report to Congress*, U.S. Department of Energy, 2008

⁴ <http://www.arb.ca.gov/app/emsinv/fcemssumcat2009.php#heading>

⁵ http://www.arb.ca.gov/cc/inventory/data/tables/ghg_inventory_scopingplan_2009-03-13.pdf

In Orange County, a wastewater treatment plant uses digester gas to power a stationary fuel cell that tri-generates electricity for the plant, high-quality heat for the digester, and hydrogen for vehicle fueling. The technology demonstrates the ability to generate renewable power and fuel to support the electricity and transportation needs of the community 24 hours a day.

Becoming an early adopter of these types of hydrogen programs demonstrates regional environmental leadership to neighboring communities while positioning your community for job growth as hydrogen technologies and markets mature. Adopting hydrogen vehicle and stationary fuel cell technologies can also allow a community to take advantage of untapped local resources (e.g. biogas) to make clean, efficient, carbon neutral electricity.

The role of fuel cells and hydrogen in a climate action plan

California’s Global Warming Solutions Act of 2006 (AB 32) requires that the state cut greenhouse gas emissions to 1990 levels by 2020. The AB32 Scoping Plan created a blueprint for achieving these goals. The measures include expanded energy efficiency programs and higher efficiency standards, a revised Renewable Portfolio Standard that requires 33 percent of electricity to be generated from renewable sources by 2020, and several measures to decrease emissions from transportation.

Many communities have already started local climate action plans; others are investigating how to get started. Most plans incorporate changes in behavior, reducing consumption, increasing building energy efficiency, revised land use planning, incorporating more renewable energy and incorporating zero-emission vehicles.

Benefits of Fuel Cell Technology:

- Energy efficient
- Flexible and scalable for a broad range of applications
- Can use local resources for fuel
- Zero criteria pollutant emissions
- Low or zero GHG emissions
- Near-silent operation

Hydrogen fueled fuel cell vehicles (FCVs) and stationary fuel cells have emerged as a major strategy to meet community climate action goals. Stationary fuel cells are already being commercially deployed as a statement of the value added attributes of this technology to reduce GHG emissions in the electricity generation sector, and studies show that electric drive vehicles—fuel cell and battery—will be required to reduce GHG emissions and energy use in the transportation sector (which accounts for 1/3 of all US CO2 emissions).⁶

For many communities, the first step into a new technology is the hardest. They need a process to quickly integrate new types of projects using existing resources and showing results. CHAP provides communities with a process to help implement hydrogen projects

⁶ NAS Report *America’s Energy Future*. 2009. Pg 39

in a cost-effective, reliable manner and avoid mistakes learned from early hydrogen transportation demonstration programs.

CHAP — A plan to help bring hydrogen into the community

The California Fuel Cell Partnership (CaFCP)⁷ and National Fuel Cell Research Center (NFCRC)⁸ have been instrumental in implementing hydrogen demonstration programs within California. Based on years of experience in helping place hydrogen stations, small fleets of fuel cell vehicles and buses, and stationary power fuel cells, the two organizations in collaboration have developed a process model to help stakeholders become a hydrogen community: the Community Hydrogen Action Plan, or CHAP.

Using the Clean Cities program as a guide, CHAP is a systematic six-step template for successfully jumpstarting hydrogen and fuel cell projects. CHAP focuses on local leadership and activities to streamline project acceptance and planning. Implementing the CHAP process ensures a community's position as a leader in sustainable energy, and creates a foundation for long-term economic and social benefits.

Stakeholders can use this template to assess their community's readiness and resources, and then implement specific steps to reach defined goals.

CHAP Steps

CHAP's goal is to make it easier for municipalities and military bases to get started with hydrogen. As mentioned earlier, CHAP's strength comes from its focus on local leadership and activities to streamline the acceptance and planning for hydrogen projects. The process and associated template are provided at the CaFCP website, and both the CaFCP and the NFCRC are available as resources upon which to depend to facilitate the process.

The template of activities and steps guides a municipality through assessing community readiness and resources, and then implement specific steps to reach defined goals. The six formal CHAP steps include:

1. **Organize** a group of stakeholders (led by a local champion from the community leadership⁹) that commits to the success of the hydrogen community. The organizers delegate tasks and create goals and work plans to implement the CHAP model.
2. **Assess** local resources to determine a community's hydrogen potential, or "hydrogen inventory," and evaluate the positive impact hydrogen and fuel cells (motive and stationary) can make in a community.

⁷ www.cafcp.org

⁸ www.nfcrc.uci.edu

⁹ For example, mayor, university chancellor or president, base general, laboratory director

3. **Set** specific goals, such as “reduce the community GHG footprint by 5%,” or “reduce local gasoline consumption by 10%. Identify the potential job creation that could result from the hydrogen implementation activities.
4. **Create** a strategic plan to achieve the community’s goals and objectives. Use a planning tool to develop the needed perspective, facilitate discussion and identify measures to reach the goals. Such measures could include initiatives such as “install two hydrogen stations, and deploy five fuel cell buses,” or “build one energy station” or “retrofit one fork lift fleet.” A detailed timeline for completing tasks and a method for measuring success should be included.
5. **Implement** the steps of the plan with clearly assigned responsibilities, and the CHAP coordinator monitoring the activities. Make corrections to the plan as needed.
6. **Track/Measure** to determine if the hydrogen program is on target and on time. Once the hydrogen program is implemented, measure the results according to goals, including GHG reduction and jobs created. Set new goals and targets for ongoing and additional hydrogen activities.

The first key steps: Organize and Assess

For the CHAP program to work, the stakeholders must develop and support the project, and the project must specifically meet the community’s resource capabilities and environmental requirements.

The CHAP model is built upon a grassroots, locally supported effort. Identifying the players is an important first step. In some communities, the organizers have been city council members, in others it has been a university, still others have been community residents. Wherever the early leaders come from, experience has shown that strong, active champions are critical to the program’s success. (See the appendix for an example.)

The organizer needs to identify all the people who will ultimately be involved, including the fire marshal, permitting officials, the utility company, neighborhood groups and local activists. CHAP helps you determine who needs to be onboard and provides suggestions for approaches.

CHAP recommends designating a person as the CHAP coordinator—either a new hire or a person who has job duties reassigned. In demonstration communities, this person is usually an employee of the local government or a committed industry stakeholder.

For some communities, putting the team together may take hours, for others it may take months. By being involved from the beginning community residents and local officials are vested in the process. They understand the goals, agree with the steps and see the tangible benefits of their actions, which encourages more local activity and thereby creates a positive feedback loop.

Once the team is in place, the next important step is assessing willingness, readiness and capabilities. No one knows better what works in a community than its own residents, business leaders, and elected officials. By having a local community evaluate its own resources and create strategies tailored to its specific needs, they avoid the risk of trying to apply a one-size-fits-all model to the individual community.

CHAP outlines the assessment steps, which include, but not limited to:

- Existing regulations that allow or prohibit the technology
- Zoning ordinances that allow or prohibit the technology
- Assessing GHG and air quality
- Assessing hydrogen resources (biogas, nearby H₂ production, etc.)
- Assessing current energy and fuel use
- Understanding public opinion
- Researching financial support, including grants, incentives and tax rebates

A key component is establishing current and projecting future year GHG emissions and air quality at the local level. This provides a baseline for planning and measuring impact. The Spatially and Temporally Resolved Energy and Environment Tool (STREET), provided by the NFCRC, facilitates this step.¹⁰ STREET characterizes and optimizes strategies for the deployment of hydrogen infrastructure suited to the community needs.

Some communities will have accomplished some of these assessments as part of an overall climate or energy plan. Other communities will start from scratch. Not every assessment will apply to every community.

The goal is to emerge from the assessment with a plan: how can the community implement hydrogen to meet locally based goals with the least impact on existing resources. The community may find that the best way to start is to encourage hydrogen stations and passenger vehicles, or it may wish to help local businesses convert forklifts to hydrogen fuel cell power, or to deploy stationary fuel cells.

Getting Started with CHAP

The CHAP template is free and available on the California Fuel Cell Partnership website. Getting started is as easy as downloading and reading through the document. When your confident that your community is ready consider a hydrogen project, start organizing.

¹⁰ Stephens-Romero, Shane D., Carreras-Sospedra, Marc, Brouwer, Jacob, Dabdub, Donald, Samuelsen, G. Scott (2009) Determining Air Quality and Greenhouse Gas Impacts of Hydrogen Infrastructure and Fuel Cell Vehicles, Environmental Science & Technology, in press.

Developing a hydrogen community will require funding and other resource support. Initially, funding needs should be minimal. CaFCP will help you identify funding sources for:

- Meeting costs
- Executing a community GHG/air quality simulation (NFCRC STREET model)
- Local hydrogen assessments
- Advocacy and outreach materials and events

Once your organizing team is in place and you have agreement to start the project, CaFCP can provide support¹¹ that can include:

- Speaking at meetings
- Recommending third parties that perform hydrogen assessments and GHG/air quality scenario models
- Convening stakeholder meetings and assist developing a strategic plan
- Assisting with advocacy and outreach efforts both within the local community and to neighboring communities
- Helping to address permitting requirements
- Firefighter training
- Assessing community needs for hydrogen stations and fuel cell vehicles

Conclusion

Hydrogen and fuel cells are an important component for many communities to meet their needs for improving air quality, reducing greenhouse gases, ending dependence on foreign oil and creating new jobs for residents. CHAP provides a process to help communities implement a hydrogen fuel cell project that meets the community's goals and maximizes local resources. One successful hydrogen project leads to another, putting the early adopter communities in a leadership position while helping meet state and national environment and energy goals.

¹¹ CaFCP partners with other organizations to provide support outside of California. CaFCP and other organizations cannot lobby or advocate for your specific project.

Appendix: City of Irvine

The City of Irvine has been involved with (1) stationary fuel cell technology with the installation of a 200kW phosphoric acid fuel cell at the Irvine Hilton (now Irvine Hyatt) in 1988 which, for many years, was the longest sustained operating fuel cell in the world, and (2) the hydrogen future when the National Fuel Cell Research Center (NFCRC) at the University of California Irvine deployed, in collaboration with Toyota Motor Corporation, the first hydrogen fuel cell vehicle (FCV) for public use in 2002. At the same time, the NFCRC established a hydrogen fueling station on the campus. The station was upgraded in November of 2003 to provide more fuel and a second generation user interface, and a second FCV was deployed in Irvine for public use.

In August of 2005, the NFCRC deployed the third FCV to the city of Irvine through a major media event hosted by city officials. Following brief remarks made by Irvine Mayor Beth Krom, Toyota's Chief Environmental Officer Dian Ogilvie, UCI Chancellor Michael Drake and NFCRC Director Scott Samuelsen, city council members accepted keys to the vehicle, making Irvine the first city in the nation to pilot a FCV.

The establishment of a hydrogen fueling station in the city and the deployment of a FCV to the city council served to inform city officials to the possibilities and potential of FCVs and the concomitant hydrogen infrastructure. The NFCRC continues to supply the city with fuel cell vehicles to this day including both the General Motors Equinox and the Toyota Fuel Cell Hybrid Vehicle.

In February 2007, the existing NFCRC hydrogen station was upgraded with additional capacity and dual pressures (350 and 700 bar). The station was introduced to the region through a major media event that included remarks by the Mayor of Irvine. At that time, the United States Postal Service initiated mail delivery service with a General Motors Equinox and continues to this day to serve the citizens of Irvine with FVC home mail delivery.

Because of the upgraded hydrogen station, the political and academic advocacy of the technology, and Irvine's demographics, General Motors and Honda both began leasing fuel cell vehicles in Irvine and nearby Newport Beach in 2008, through the Project Driveway and Clarity lease programs, respectively. The California Fuel Cell Partnership (CaFCP) designated Irvine and Newport Beach as two of the four initial Hydrogen Communities in California.

The UCI Hydrogen Station now experiences heavy use and multiple car back-ups as users wait for fuel. This is illustrative of the early demand to expand the hydrogen fueling infrastructure for FCVs. The demand is increasing exponentially as manufacturers move to deploying hundreds of FCVs in California and then transition to commercialization in 2015.

In anticipation of the expansion, the NFCRC and the CaFCP have instituted meetings with (1) the city of Irvine mayor, staff, and planning and permitting departments; (2) automakers in regards to their desired hydrogen station locations and vehicle deployment plans; and (3) fuel providers. The NFCRC has also applied STREET to identify the number and optimal locations of hydrogen fueling stations to meet the access convenience currently provided to the citizens of Irvine by the existing network of gasoline fueling stations. In addition, the NFCRC and the CaFCP have met with The Irvine Company, the major landholder in Irvine, to explain the background and expectations associated with the evolution of the city as a Hydrogen Community. These steps have served to inform the development of CHAP as well as serve as an example of a community experiencing the emerging hydrogen future.