# SGH2 Lancaster Project on Waste to Renewable H2

## Project Title and File Number:

Lancaster Waste to Renewable Hydrogen Project Conditional Use Permit (CUP) No. 21-06 2.

## Lead Agency Name and Address:

City of Lancaster Development Services Department Community Development Division 44933 Fern Avenue Lancaster, California 93534 3.

## Lead Agency Contact:

Jocelyn Swain, Senior Planner (661) 723-6100

## Project Location:

SG H2 Lancaster Holding Company LLC (SGH2), owned by SGH2 Energy Global, proposes to construct the Lancaster Waste to Renewable Hydrogen (WTRH2) facility on an approximately 15-acre site located north of Avenue M between 5th and 6th Streets East in Lancaster, California. The proposed project site is located on three parcels (Assessor’s Parcel Numbers [APNs] 3126-017-028, 3126-017-040, and 3126-017-039). The parcels include vacant, undeveloped land designated as Heavy Industrial (City of Lancaster, 2009). Adjacent and surrounding areas are also zoned as Heavy Industrial and include vacant land, industrial uses, and three single-family residences. The project site is approximately two miles east of the Antelope Valley Freeway (State Route 14) in the southern portion of the City of Lancaster, just north of the City of Palmdale (see Figure 1. Project Location).

## Applicant Name and Address:

SG H2 Lancaster Holding Company, LLC Attn: Robert T. Do, MD 1000 Potomac St, NW 5th Floor Washington, DC 20007

## General Plan Designation and Zoning:

Heavy Industrial (HI)

## Description of Project:

The proposed Lancaster Waste to renewable H2 (WTRH2) Project (project) consists of the construction and operation of a facility that would produce hydrogen (H2) from unrecyclable mixed wastepaper feedstock. Feedstock is defined as a raw material to supply or fuel a machine or industrial process. The feedstock would be gasified (i.e., converted from a solid into a gas) to produce a H2-rich gas that would be further processed to reach 99.97 percent pure renewable H2. The H2 gas would be transported off-site in pressurized tube-trailer containers for use by Shell Hydrogen and Iwatani Corporation of America (Iwatani) at H2 refueling stations (HRS) located throughout California.

Map

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Figure 1. Project Location

The HRS would dispense the H2 as a transportation fuel in motor vehicles. H2 is a “clean fuel” that does not release greenhouse gases or other air pollutants, such as carbon dioxide (CO2), particulate matter, nitrous oxide (N2O), or carbon monoxide (CO) emissions, and does not contribute to climate change.

The California Fuel Cell Partnership, in coordination with the California Air Resources Board (CARB), has set a goal to have 200 HRS by 2025 and 1,000 stations by 2030. Currently, all HRS are being supplied with grey H2, which is derived from natural gas. The State mandate requires that no less than 33.3% of the H2 produced or dispensed for motor vehicles be made from renewable sources. The H2 that would be produced under the proposed project is considered renewable because the fuel would be generated from biomass, which is renewable organic material that comes from either plants or animals. The project would help meet the demand for renewable H2 and assist the State with achieving its renewable energy goals. The California Energy Commission (CEC) awarded $3 million for the engineering and construction of the project through the “Renewable Hydrogen Transportation Fuel Production” program, which funds the construction of hydrogen production facilities that produce renewable hydrogen transportation fuel utilizing in-state renewable resources.

The WTRH2 facility would convert 42,000 metric tons per year of pre-landfilled, unrecyclable mixed wastepaper provided by the City of Lancaster. The City has submitted a Letter of Interest to supply the feedstock for the project at a quantity of 120 metric tons per day for 10 years. A long-term feedstock supply agreement has also been secured with the Allan Company. The feedstock would consist of recycled wastepaper that has been rejected from further recycling and would otherwise be disposed of in a landfill; any paper that is able to be recycled would not be used at the facility and would be sent to a recycling facility instead. The project would therefore divert the unrecyclable mixed wastepaper from landfills and convert the feedstock into 4,570 metric tons of H2 per year, with a full production capacity of 13.1 metric tons of H2 per day.

Another component of the proposed project would include the capture of CO2 gas as a byproduct of the H2 production. The facility would capture approximately 70,000 metric tons of CO2 annually using Air Liquide’s proprietary CryoCapTM system from the off-gas of the pressure swing adsorption (PSA) unit after the H2 is separated; the PSA unit absorbs impurities, such as CO2, to obtain a high purity H2. The CryoCapTM system would recover the CO2 and produce CO2 liquid that would be transferred to a site in Bakersfield for permanent sequestration (i.e., stored in a manner that prevents the CO2 from being released into the atmosphere with the goal of reducing climate change impacts).

The WTRH2 facility would operate for a period of approximately 25 years. The facility is designed to operate 24 hours a day, 7 days a week for 350 days each year, or 8,400 hours per year. The facility is expected to employ approximately 43 individuals. During business hours, a total of 25 administrative, technical, and support staff would be at the facility. The operations personnel would be organized into four shifts of 6 people with each shift working 12 hours per day (two shifts per day with the other two shifts off.) This does not include other support personnel that are anticipated to be contractually engaged through 3rd parties, such as security personnel.

## Gasification Process

The gasification process would be conducted using Solena Plasma Enhanced Gasification (SPEG) technology, which would allow the complete molecular dissociation of organic hydrocarbon compounds and conversion into a clean and high energy biosyngas composed primarily of CO and H2.

The gasifier would operate under limited oxygen and atmospheric pressure conditions. Because of these conditions, the process does not result in combustion or burning of the feedstock and does not produce any products of combustion, such as bottom or fly ashes, or carcinogenic semi-volatile organic compounds (SVOCs), such as dioxins, furans, or other SVOCs.

The overall process to produce H2 using the SPEG technology is shown in Figure 2. The SPEG system is a fixed-bed oxygen-blown gasification system optimized with a plasma heating system. Each SPEG houses three plasma torches of 600-kilowatt (kW) capacity that generate high-temperature plasma jets to heat a carbon catalytic bed. The extreme heat dissociates organic hydrocarbon materials into basic elemental gases while at the same time melting all the inorganic inert materials into a glass matrix, which is cooled into an inert and non-leachable slag (a glass-like by-product).

Diagram

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Figure 2. WTRH2 Gasification Process

Step 1: Feedstock Conversion to Hydrogen - During the first step of the gasification process, an air separation unit (ASU) would produce oxygen and nitrogen from ambient air; the oxygen would be used in the plasma gasification unit, which would convert the feedstock to syngas (CO and H2) and produce slag as a waste product.

Step 2: Hydrogen Purification - During the second step of the gasification process, the syngas would be cooled and purified. Solid particles would be removed, and a chloride scrubber would reduce chloride content in the H2 to less than one part per million volume (PPMV). The syngas would be compressed and would go through the water-gas shift process to convert CO and water into additional H2 and CO2. The syngas would be cleaned further and then sent to the PSA unit, which would absorb impurities, such as argon (Ar), nitrogen (N2), CO, and CO2, to obtain a high purity H2. The H2 would then be compressed for storage and transport. During this step, waste heat would be used to generate power for internal plant consumption. In addition, the PSA tail gas containing mostly CO2 would be sent to the CO2 removal and liquefaction unit.

Step 3: Transport to Hydrogen Refueling Stations for Motor Vehicle Use - As the final step, the H2 gas would be loaded onto H2 tube trailers for final distribution to refueling stations throughout California.

The gasification process would generate brine from the recovery of recycled process water; iron sponge from the removal of sulfur (S)/hydrogen sulfide (H2S) as waste products from the syngas cleaning process; and liquid CO2, which would be transported offsite by truck for permanent sequestration. Produced CO2 would not be vented except under emergency upset conditions. In addition, all upset vents would be sent to the ground flare for safe combustion. The facility would not discharge any process gas streams into the atmosphere. Overall, the process would convert all carbon from the waste feedstock into H2 and CO2, remove all particulates and acid gases, and produce no toxins or pollutants.

## Project Construction

Project construction would be completed within approximately 16 months and would include the following:

* Site preparation, grading, and paving;
* Installation of foundations and structural components for process equipment;
* Construction of administrative/control and warehouse building; and
* Underground trenching for utilities, including electrical, process and potable water piping, and sewer piping.

A maximum of 281 staff would be onsite during construction for a limited time, and generally a range of 81 to 277 staff would be on site during construction, depending on the work being conducted. Prefabricated, skid-mounted process equipment would be delivered to the site to reduce on-site installation of individual equipment components. Skid-mounted equipment would be installed permanently at the site.

## Project Operation

### Facility Layout and Equipment

The main areas of the facility include feed and product storage and transport areas, water systems, and a flare system (see Figure 3). Access to the proposed facility would be from Avenue M, Avenue L-12, 5th Street East, and 6th Street East. Additional roadways to access the site include State Route 14, Avenue L, and Challenger Way (10th Street East). Both 5th and 6th Streets are private roads that are currently unpaved; these roads would be paved as part of the project. The entire site would also be paved with concrete or asphalt to prevent dust (particulate matter) emissions from truck movement within the complex.

A concrete block and/or tubular steel wall would be installed around the perimeter of the site to serve as a noise barrier and enhance site security. The height and thickness of the wall would be designed so that noise from the facility equipment would not exceed the City’s noise limits (70 A-weighted decibels [dBA]) at the fence line, per Section 8.24 of the Lancaster Municipal Code. Noise-generating equipment would also be located at ground level and would be located within enclosures to reduce noise levels. The site and buildings would be gated and access controlled. Landscaping would be provided on the project site in accordance with the City zoning ordinance including within the parking areas and around the perimeter of the site.

Diagram, schematic

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Figure 3. Proposed Site Layout

As shown in Figure 4, the WTRH2 facility would include a two-story administrative/control and warehouse building, as well as process equipment, such as pumps, boilers, compressors, and power generation equipment. The facility would include an oxygen-blown fixed bed gasification island, H2 processing, and storage and transportation by H2 transport modules (tube trailers/trucks).

Additional equipment at the site would include the ground level flare, wastewater treatment system, flare stack, emergency generator, cooling tower, deaerator vent, oil-water separator, PSA unit, and ASU. The ASU, at 90 feet high, would be the tallest piece of equipment at the facility.

The H2 panels would be designed to receive H2 continuously and to automatically direct the H2 to tube trailers that are connected to it. The H2 compressor and the loading panels would be designed to fill two trailers simultaneously. On-site H2 buffer storage of 4,400 pounds would also be provided. Normally the storage would be kept half-filled, which would be used when there is no flow of H2 from the plant due to emergency shutdowns. In the event that empty trailers are not available, the H2 produced in the plant would be routed to on-site buffer storage.

A 250-kilowatt (kW) spare firewater pump and a 500-kW emergency generator for emergency use only would require diesel fuel (natural gas is also being explored as a fuel source, but diesel is assumed as a worst-case scenario for this analysis). The facility would be equipped with safety mechanisms, such as fire protection and sprinkler systems, dust suppression systems, detectors/alarms, shutdown systems, and temperature monitoring and controls, and would undergo a full Hazard and Operability Analysis (HAZOP) review as part of engineering design.

### Energy, Water, and Wastewater Requirements

The facility would produce a maximum of 2 megawatts (MW) of energy for internal plant consumption; this energy would be produced with a waste heat steam boiler/generator and fuel cell. The City (Lancaster Choice Energy) would provide 10 MW of renewable energy with grid tie-in to the Lancaster renewable power grid via Southern California Edison (SCE) underground distribution lines connecting to the 20th Street East SCE substation. Landale Mutual Water Company would supply potable water for the plant’s power and process water, as well as domestic water requirements. Additional process water would be obtained through stormwater retention via an above ground retention basin on the site. Onsite stormwater drains and catch basins would convey water to the stormwater retention basin. Overflow stormwater would be discharged to storm drains in the public right-of-way.

For wastewater treatment and ammonia (NH3), S, and H2S removal, the facility would include a brine concentrator, ammonia wash column, and iron sponge bed-based system. The facility’s Zero Liquid Discharge (ZLD) design would allow process wastewater to be treated and re-used internally with no discharges into the storm drain system. If the wastewater treatment system is down for any reason, sewer tie-in would be needed to maintain operation of the plant. The facility would tie into the sewer system either on the south side of Avenue M or other nearby sewer line.

The wastewater treatment process would produce a concentrated brine that would be sent offsite by truck to a disposal facility. A septic tank would be installed for the basic sewage treatment of wastewater flows from the administrative/control and warehouse building. Catch basins with filters and depressions would be onsite in spill containment areas, which would be required for all process unit areas. Drains would collect stormwater and spills, which would be directed to the stormwater retention basin after being processed in the oil-water separator.

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Figure 4. Site Model

### Operational Truck Trips

Operational truck trips would be required to deliver feed items to the facility and to export products and waste from the facility.

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Table 1 lists these truck trips during operation of the facility. Truck trips would be required to deliver feed items to the facility, including biomass, biochar, lime, chemical, and catalyst, as follows:

### Biomass Trucks

The unrecyclable mixed wastepaper would be transported by truck to the facility from various locations within Los Angeles County, such as Lancaster, Palmdale, and Burbank, daily, including weekends. Approximately six trucks per day would be required. It is assumed that each truck would carry approximately 20 metric tons of biomass with 120 metric tons per day required for facility operation. The entry point for the biomass trucks is along 5th Street East (south end of complex), and the exit point is also along 5th Street East (north end of complex). Each truck would need 1 to 2 hours to unload. The facility would accommodate 3 days of backup feed storage onsite.

### Biochar and Lime Trucks

In addition to biomass trucks, the facility would also require truck deliveries of biochar and lime, which are supplied by a third party for use in the gasification unit. The daily requirements for biochar and lime are 6 metric tons and 1.2 metric tons, respectively. On-site enclosed biochar and lime storage would be designed for 5 days. One truck would deliver 10 metric tons of biochar to the site every other day; and one truck would deliver 6 metric tons of lime every five days. Both trucks would enter and exit along 5th Street East, as described for the biomass trucks.

### Chemical and Catalyst Trucks

Chemical and catalyst trucks would also be required on an as-needed basis. All trucks would enter and exit along 5th Street East, as described for the biomass trucks.

Truck trips would be required to export products or waste from the facility, including H2, liquid CO2, and solid waste, as follows:

### H2 Trucks

The H2 would be continuously transported offsite as it is produced, and no more than 4,400 pounds of H2 would be stored onsite in permanent/stationary storage tanks as a buffer in the event that the plant is down. Trucks would arrive at regular intervals, 24 hours a day and 7 days a week, for the transportation of compressed H2 to the filling stations. Approximately 40 truck trips per day to the plant are estimated for transferring H2 product. Each truck would need approximately two hours for staging and loading at the facility. The facility is designed to accommodate up to 14 H2 trucks at any given time (2 actively loading, 2 waiting to load, and 10 parking spots).

H2 trucks are not allowed to make unprotected left turns (i.e., only at a traffic signal with a protected left turn arrow). As shown in Figure 5, trucks would access the facility by exiting State Route 14 at Avenue L, going east on Avenue L to Challenger Way (10th Street East), heading south on Challenger Way to Avenue M, and heading west on Avenue M. Trucks would make a right turn onto 5th Street East, which would allow them to enter the facility on 5th Street East or make a right-turn onto Avenue L-12 and enter the facility through the driveway at the northeast corner of the site. This area of the facility would be utilized for the loading of the H2 trucks. To exit the facility, the H2 trucks would exit out of the facility from a driveway on the eastern boundary of the loading area, make a right turn onto 6th Street East, and then another right turn to go west on Avenue M towards State Route 14. The entry and exit points would be kept separate to avoid truck traffic within the plant, as well as to ensure that truck drivers only make right turns on the roads when leaving the plant.

Diagram

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Figure 5. H2 Truck Route

### Liquid CO2 Trucks

The facility would produce 200 metric tons per day of CO2 with onsite storage designed for 1 day. Twenty trucks per day would be required to export CO2 from the site. Each truck would need 1 hour to load. The CO2 trucks would enter and exit along 5th Street East, as described for the biomass trucks.

### Solid Waste Trucks

Each day, solid waste generated at the facility would include 3.1 metric tons of slag and approximately 17 metric tons of brine. One truck per day would be required to remove slag, and three trucks per day would be required to remove brine. All trucks would enter and exit along 5th Street East, as described for the biomass trucks.