



## Delivering real world solutions to global warming

California has long led the nation and the world in the search for new ways to meet the nation's basic energy needs while producing less pollution, including those emissions that contribute to global climate change. Nowhere has this leadership been more evident than in providing the electricity that powers our economy.

Recently, laws have been passed in California to encourage a reduction in the greenhouse gases, especially carbon dioxide (CO<sub>2</sub>), that are believed to contribute to global climate change. Now, both the government and the private sector are taking the necessary steps to move toward a cleaner and more sustainable "hydrogen" energy economy.

## Hydrogen Energy California (HECA): hydrogen based power, fertilizer, and greenhouse gas reduction

SCS Energy California LLC ("**SCS Energy**") has acquired the Hydrogen Energy California LLC ("**HECA**") project from its initial owners and will move the project forward through permitting, construction and operation. SCS Energy is an independent power producer nationally recognized for its involvement in clean power project development and environmental stewardship.

SCS Energy will implement its well developed project design and commercial model and integrate it with the existing HECA project at its Kern County, California site. Commercial operation of the modified project is expected to commence in 2017.

The improved facility design for HECA includes:

- An Integrated Gasification Combined Cycle ("IGCC") polygeneration plant that produces electricity and fertilizer while capturing and storing 90% of the carbon dioxide emissions. Plant feed stock will be a blend of California produced petroleum coke (a waste product currently exported) and western coal. Natural gas is only used during the plant start-up:
- Among the many environmental benefits, the facility will utilize brackish water that is threatening clean water aquifers and will be supplied the by Buena Vista Water Storage District:
- A hydrogen-fired combined cycle power plant that will generate nominally 400 MW of power of which 120 MWs will be used by the internal industrial complex, making available 280 MWs to the grid at peak times, to be sold through long-term power purchase agreements:
- The separated hydrogen will also be used to produce approximately 1 million tons of locally manufactured, 90% carbon-free fertilizer per year, enhancing the local agricultural economy and reducing foreign imports of a critical farming supply:
- The plant will capture and deliver approximately 2.5 million tons of CO<sub>2</sub> per year that will be sold under long term contract for enhanced oil recovery (EOR) and permanent storage at a nearby oil field:
- The design allows a steady state operation of the gasifier by producing the maximum power output to match the needs of the power grid and using hydrogen in off peak periods to create fertilizer: and



- With a combined infrastructure which produces power, fertilizer, and CO<sub>2</sub> for EOR, including capturing and storing 90% of the CO<sub>2</sub>, and treating brackish water, the plant will be one of the cleanest manufacturing and energy producing plants in the country.

HECA will continue to provide the jobs and tax revenue, as well as the funding and investment of the original plant design, but will now add a new California benefit by producing a local, large source of nearly carbon footprint-free fertilizer while reducing the cost of clean power, providing valuable operational flexibility, and maintaining California's leadership in clean technology. The addition of a large fertilizer production facility will benefit the community both in job creation and also by producing an important and much needed product.

HECA is proposed to be located adjacent to the existing Elk Hills oil field. Along with a coal feedstock, HECA plans to use petroleum coke that is a by-product of oil refining, as feedstock to create hydrogen that will be used for power generation. Currently, petroleum coke is trucked from refineries to ports to be loaded onto ships for export to other nations where it is burned, releasing CO<sub>2</sub> emissions directly to the air. The use of petroleum coke and coal by HECA will ensure the captured CO<sub>2</sub> emissions associated with their use will be prevented from being released into the atmosphere.

### **A new polygeneration plant and pipeline**

Here in California, HECA will establish a model for future hydrogen-based power generation and fertilizer production. HECA will also demonstrate carbon sequestration is a viable strategy for mitigating global climate change through monitoring and verification techniques developed for underground CO<sub>2</sub> storage.

The HECA site will include a storage facility for receiving coal. It will include a closed-loop process gasification facility that will convert the coal to hydrogen fuel and carbon dioxide. The power generation component will utilize today's most advanced and energy efficient combined cycle turbine technology that will meet or exceed applicable requirements for air emissions. The fertilizer facility will be one of the first low carbon urea manufacturing plants in the country - a manufacturing industry with a large carbon footprint.

Importantly, the captured CO<sub>2</sub> will NOT be released into the air and contribute to global climate change, but instead it will be stored deep underground. HECA will transport the CO<sub>2</sub> via pipeline to an injection facility located within the Elk Hills oil field for permanent storage.



## **Capture and store: an effective method for the management of CO<sub>2</sub>**

In California, policymakers agree that one of the first steps in the fight against global warming is to curb CO<sub>2</sub> emissions. Geologists agree that the most immediate and effective way to do this is to capture the CO<sub>2</sub> before it gets into the air, and then store, or “sequester” it, underground in depleted oil and gas reservoirs.

CO<sub>2</sub> itself is a natural component of our air and in every breath we exhale, but too much from traditional industrial and power generation sources has contributed to global climate change. Today, the best method to limit future CO<sub>2</sub> emissions from those sources is through carbon capture and sequestration. When properly stored underground, sequestration poses no threat to people or the environment.

HECA's gasification process will enable the extraction of hydrogen for power generation from petroleum coke and coal, but it will also enable the removal of its carbon, which will be captured and stored thousands of feet underground. The injection of carbon dioxide deep underground has been common practice for several decades and geologists have documented that there is enough space in existing oil reservoirs and other subterranean formations to store CO<sub>2</sub> emissions for hundreds of years. Here in Kern County, the CO<sub>2</sub> will also be used for enhanced oil recovery, resulting in increased oil production, along with related positive job and economic impacts.

## **Hydrogen Energy California -- community and environmental benefits**

HECA will provide new, clean electric power at a time when state agencies are predicting possible power shortages in coming years.

HECA will eliminate more than 2.5 million tons/yr of greenhouse gases from the atmosphere by sequestering, or storing, them underground.

HECA will enable additional production from existing California oilfields, producing previously unrecoverable oil reserves by injecting the CO<sub>2</sub> into oil reservoirs, where the CO<sub>2</sub> would also be permanently stored.

HECA will boost the local economy by creating an estimated 2000 jobs at peak and up to 140 permanent operational positions. HECA's construction and annual operations will generate millions of dollars in new tax revenues.

HECA also will create clean hydrogen, making it available for power generation as well as other potential uses, including clean transportation, contributing to the realization of the hydrogen highway.

HECA will preserve limited fresh water resources by using brackish ground water supplied by a local agricultural water district. Currently the water's poor quality and shallow location negatively impacts local agricultural activity. Process wastewater will be treated on site and recycled within the gasification and power plant systems.

## **Safety and the community**

HECA will be designed, constructed and operated to the highest environmental, safety and health standards, including California and the San Joaquin Valley APCD emission standards.

Each component of hydrogen power technology is proven and in use today. Hydrogen itself is in common usage in a variety of applications, including in oil refining for the formulation of clean fuels. Gasification



technologies have been in use for many years, and integrated combined cycle turbines are currently used in natural gas power generation throughout southern California and the world. Gas pipelines and underground storage are in widespread use. CO<sub>2</sub> already is transported by pipelines that are similar to other gas and liquid pipelines located throughout southern California.

### **Why Kern County, California?**

HECA is proposed for the Kern County area because of the existing, adjacent available oil reservoirs for CO<sub>2</sub> storage, and for economic use in enhanced oil recovery operations. Existing electric transmission lines and substations are nearby, providing the opportunity to interconnect to the local electricity grid. Refineries producing the petroleum coke by-product are nearby, as are local delivery points for western coal. Pipeline corridors already exist and are within proximity to existing reservoirs to store carbon dioxide. There also is a local supply brackish groundwater unsuitable for agriculture.

For more information please visit our website at [www.hydrogenenergycalifornia.com](http://www.hydrogenenergycalifornia.com)