Appendix S

HECA Public Outreach Program

1.0 PUBLIC INFORMATION, OUTREACH AND COMMUNICATIONS PLAN

Hydrogen Energy International LLC (HEI), (the Applicant), is undertaking a broad based public information and community outreach and communications program to inform and educate key members of the public, as well as Project-related stakeholders, on the details and merits of the Hydrogen Energy California (HECA) Project, including its impacts and benefits. Focus will be placed upon constituencies in the broader Kern County area, as well as key energy and environmental policy stakeholders and decision makers.

The public information, community outreach, and communication programs will ensure that all affected "publics" are well-informed about the Project and the issues related to the Project, including utilizing hydrogen for power generation, capturing carbon dioxide (CO_2), transporting it for enhanced oil recovery (EOR), and sequestration. HEI will work with relevant agencies to ensure coordination of communication and public information efforts required by respective agencies. However, HEI also will seek to positively position its hydrogen power plant before select stakeholders and constituencies in order to ensure required regulatory approvals.

1.1 Overview

The Applicant will initiate a three-tiered approach to its public information, outreach, and communication programs.

- **Tier 1** will be direct community outreach and communications with the local public and affected constituencies in the Kern County area, and numerous politically-interested and policy-oriented stakeholders.
- **Tier 2** will be a broad communications effort focusing on the complex and often difficult to understand policy issues surrounding the elements of the Project, specifically, integrated gasification and combined cycle (IGCC) power generation and carbon capture and sequestration (CCS).
- **Tier 3** will be focusing on managing the series of specific public official and agency relationships necessary to ensure proper and expedited pubic review, input, and ultimately approval of the Project before all relevant agencies and other jurisdictional bodies.

1.2 TIER 1 – Community Outreach and Communications

The Applicant's outreach and communication efforts will focus on the geographic and geophysical logic related to potential sites for an IGCC hydrogen power plant with carbon dioxide capture and sequestration to benefit the region's EOR operations. A Kern County facility will be positioned as a needed project consistent with the state's objective of low emission power generation and reducing greenhouse gasses, while at the same time taking advantage of ongoing EOR operations in Kern County and the availability of well-located land next to available carbon dioxide sequestration locations.

As part of this effort, HEI will:

- Develop key messages and communications materials relative to a Kern County project, and related issues.

- Identify and educate the public and stakeholder groups about the Kern County Project.
- Organize community and political education on the new Project, to be accomplished through in-person briefings, small group meetings, organizational meetings, targeted direct mail, and electronic (website and e-mail) communications.
- Mobilize participation in the political process through attendance and testimony at hearings plus communicating with decision makers, including letter writing and e-mails.
- Manage media coverage with a response-to-inquiry approach more than a promotional approach. Proactive media outreach will be undertaken when appropriate.

1.2.1 Key Messages

- Convert refinery by-product/other feedstock fuels to produce hydrogen
- Generate clean hydrogen power in Central Valley
- Capture carbon dioxide for long-term sequestration in nearby oil fields
- Design, construct, and operate to highest environmental as well as safety and health standards that meet or exceed stringent California rules
- Provide community and environmental benefits, which include:
  - Providing approximately 250 megawatts (MW) of new, baseload, low carbon generating capacity, enough to power over 150,000 homes
  - Reducing greenhouse gases (approximately 2 million tons/year) with underground sequestration
  - Boosting local economy by creating jobs (100 permanent) and new tax revenues
  - Preserving limited fresh water sources, using brackish groundwater creating a beneficial impact to local groundwater quality and agriculture
  - Using carbon dioxide injection for oil field enhanced oil recovery processes
  - Building new source of hydrogen formulation for potential uses, such as clean transportation

1.2.2 Communications Materials

While there is emerging awareness and knowledge on IGCC power plants, hydrogen energy and carbon capture and sequestration, the Applicant recognizes that there will be a need to communicate on these issues locally in the Kern County area among elected officials, opinion leaders, and community members. New communications materials will be developed for the Kern County Project such as the following:

- Key Message document that frames primary and secondary messages for presentations/discussion
- Project Fact Sheet
- Issue Fact Sheets (gasification, carbon capture, hydrogen, sequestration, safety)

- Talking points for supporter response
- Informational brochure with supporter response
- Internal questions and answers (Q&A)
- External questions and answers (Q&A)
- Newsletter
- Website
- Events and forums for speaking and exhibiting
- Letters
- Radio and TV interviews and media "spots"
- Press releases/press conferences
- Conference exhibits
- Telephonic Information Line

Related to the news media, a standard media response relative to the new site investigations in Kern County has been developed highlighting positive aspects of a Kern County site. Preliminary local press briefings have been undertaken.

1.2.3 Contact Program

HEI has put together a team of consultants which represent informed experience with energy project and environmental issues, as well as local knowledge of siting and permitting within Bakersfield. This team is charged with managing local relationships and building awareness within the local jurisdictional bodies; as well as other elected officials and broader business, community, and environmental organizations.

Prior to the filing of an Application for Certification (AFC), communications have already occurred in the nature of exploratory outreach efforts, and an assessment of position and posture. Communications activity and outreach will accelerate and intensify approaching AFC filing. After filing, the public information and communication process ramps up with iterative contacts and mobilization for public hearings.

HEI already has undertaken a limited effort to focus on communicating with state leaders. These include the Governor's office, California Energy Commission (CEC), California Public Utilities Commission (CPUC), and California Air Resources Board (CARB) leadership. HEI has begun and will continue to brief jurisdictional stakeholders including members of the Board of Supervisors and staff, members and staff of the San Joaquin Air Pollution Control District (APCD) and select other local and state elected and public officials who represent the Kern County area.

1.2.4 Pre-Application Timing

The following Key Contact Program will be implemented sequentially, following upon the heels of the top priority contacts already completed. Scheduling priority will be based on relative sensitivity of the contact.

STATE Priority (Completed)

- Governor's Office
- Utilities Commission
- Energy Commission
- CARB
- San Joaquin APCD
- Natural Resources Defense Council (NRDC), Environmental Defense, state-wide

LOCAL Priority

- Senator 16th Senate District (completed)
- Senator 18th Senate District (completed)
- Assembly member 30th Assembly District (completed)
- Assembly member 32nd Assembly District (completed)
- Kern County Supervisor 4th District (site district) (completed)
- Director Resource Management Agency (RMA)
- Director Planning Department (completed)
- San Joaquin Valley APCD Board Chair
- San Joaquin Valley APCD Board member Supervisor - Kern County (completed)
- San Joaquin Valley APCD Board member———South Central Valley (vacant)
- Kern County Supervisor 1st District (completed)

Additional LOCAL Priority

- Kern County Supervisor 2nd District
- Kern County Supervisor 3rd District
- Kern County Supervisor 5th District (completed)
- Kern County Fire Department
- Kern County Counsel
- Kern County Chief Administrative Officer (CAO)
- Greater Bakersfield Chamber of Commerce
  - (Government Review Council and Energy Committee)

- Kern Economic Development Corporation (completed)
- Kern Taxpayers Association
- Central Valley Air Quality Coalition
- Smart Growth Coalition
- Independent Oil Producers Agency
- Local Sierra Club representative

1.2.5 Application Timing

- Mayor, Bakersfield
- Vice Mayor, Bakersfield
- Mayor, Shafter
- Mayor, Taft
- Select San Joaquin Valley APCD Board members
- Hispanic Chamber of Commerce in Bakersfield
- Black Chamber of Commerce in Bakersfield
- President, California State University, Bakersfield/Geology Department
- Local Chambers of Commerce
  - Buttonwillow
  - Taft
  - Shafter
  - Wasco
- Shafter Economic Development – City of Shafter
- Kern County Farm Bureau
- Vision 2020
- Bakersfield Association of Realtors
- Home Builders Association
- Local Rotary Clubs (service clubs for community leaders, active in key communities in county)
- Labor (Kern County Building and Trades Council)
- Environmental Groups, including
  - Earth Justice
  - Association of Irritated Residents

- Center on Race, Poverty & the Environment
- Latino Communities Energy Project (UFW)
- Local Audubon Society

1.2.6 Post Application Timing

Following upon the heels of filing an AFC, HEI will continue to maintain contact with all key individuals and organizations included in its initial outreach efforts, bolstered by the inclusion of additional interested parties that become engaged and involved in the Project as it proceeds through the public approval process.

Activities will include identifying engagement/event opportunities, various targeted communications plans, identifying supplemental, direct communications methods (including direct mail, etc.), developing necessary communications materials appropriate for various constituencies, implementing targeted contact management plans for identified constituencies, and developing strategies to support an appropriate regulatory framework. Specifically, HEI will need to:

- Re-contact all key stakeholders, with focus on Project application filing and future hearings.
- Develop and implement local information program, including direct mail response program, to be launched with filing of application.
- Contact select local media and request/conduct editorial briefings.
- Consider media event, invite VIPs, stakeholders, media, speakers (to be determined), use displays, site maps, etc.
- Develop news advisory and news release (brief key energy and environmental reporters in advance).
- Develop periodic newsletter and e-mail newsletter updates.
- Update contact matrix and contact database.

1.2.7 Project Approval/Public Review Timing

Activities will include:

- Conduct group meetings and presentations using PowerPoint, prepared handout materials.
- Continue contact generation program and manage contact database.
- Roll out newsletter and e-mail newsletter updates.
- Convene community/neighborhood, meetings, as appropriate, timed towards hearings.
- Issue hearing alerts and contact/mobilize all stakeholders to participate (speak/write letters) in hearing process.
- Draft testimony and letters as needed.
- Develop opinion pieces for local media, timed for prior to hearings.
- Request Editorial board session, timed prior to hearings.

- Develop other opportunistic media plans to positively profile Project
- Prepare news media strategy and approach anticipating Project approval.
- Manage and update website.

Hydrogen Energy California

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, new laws have been passed in California to encourage a reduction in the greenhouse gases, especially carbon dioxide (CO_2), 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 power and greenhouse gas reduction

Hydrogen Energy International (HEI), a joint venture between BP and Rio Tinto, has proposed a new hydrogen-powered electricity generating facility for the Kern County area that would capture and sequester (store) most of its carbon-related emissions.

This facility will be similar to, but with lower emissions than, the cleanest of natural gas power plants Instead of using natural gas to run its turbine electrical generators, this plant will use hydrogen. The result will be local power generation in a local area with growing power demands – enough power for over 150,000 homes – along with 90% reduction in the emission of carbon dioxide, the most common greenhouse gas. CO_2 emissions will be captured and stored deep underground, preventing release into the atmosphere.

HECA is proposed to be located adjacent to the existing Elk Hills oil field. It plans to use both petroleum coke that is a by-product of oil refining, as well as coal, as the 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_2 emissions directly to the air. The use of petroleum coke and coal by HECA will ensure the captured CO_2 emissions associated with their use will be prevented from being released into the atmosphere.

At Hydrogen Energy California, the carbon-rich coke and coal will be converted into hydrogen gas and carbon dioxide through widely-proven gasification and capture industrial processes. The hydrogen gas will then be used to fuel a combined cycle power plant to generate low-carbon electricity. Ninety-percent (90%) of the CO_2 will be captured and sent via pipeline and injected into depleted and deep-seated oil reservoirs for long-term storage.

a new power plant and pipeline

Here in California, HECA will establish a model for future hydrogen-based power generation. HECA will also demonstrate carbon sequestration is a viable strategy for mitigating global warming through specialized monitoring and verification techniques developed for underground CO_2 storage.

The HECA site will include a storage facility for receiving petroleum coke (and coal, as needed) from several sources. It will include a closed-loop process gasification facility that will convert the coke 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.

Importantly, the captured CO_2 will NOT be released into the air and contribute to global climate change, but instead it will be stored deep underground in depleted oil and gas reservoirs. HECA will include a very short pipeline -- to transport the CO_2 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_2

In California, policymakers agree that one of the first steps in the fight against global warming is to curb CO_2 emissions. Geologists agree that the most immediate and effective way to do this is to capture the CO_2 before it gets into the air, and then store, or "sequester" it, underground in depleted oil and gas reservoirs.

CO_2 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_2 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, but it will also enable the removal of its carbon, which will be captured and stored thousands of feet underground in sealed oil reservoirs. The injection of carbon dioxide deep underground has been in 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_2 emissions for thousands of years. Here in Kern County, the CO_2 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 over 150,000 homes in the local community with new, clean electric power (250 megawatts), 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_2 into oil reservoirs, where the CO_2 would also be permanently stored.*
- *HECA will boost the local economy by creating up to 1,500 construction jobs and up to 100 permanent operational positions. HECA's construction will generate $5 million in new tax revenues, and its operation will generate $1 million in annual tax revenues.*
- *HECA will reduce dependence on US natural gas supplies, by using a refinery by-product as fuel.*
- *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_2 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_2 storage, and for economic use in enhanced oil recover 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 of recycled and produced wastewater.

Hydrogen Energy California

carbon capture and sequestration

Many scientists agree that the earth's temperature is rising, and there is strong evidence to suggest that this is due at least in part to increased emissions of carbon dioxide, or "CO_2" from fossil fuels. As data on the progression of global warming is gathered, it is appearing more and more imperative that carbon dioxide emissions need to be curbed. This is why California and other states have passed legislation to reduce emissions of carbon dioxide into the air.

This is also why environmental organizations, community leaders and energy businesses are supporting and developing ways to capture carbon, and to store it permanently so it does not go into the atmosphere. Over the past decade, energy companies in different places around the world have been employing a safe, efficient, and cost-effective method for managing carbon dioxide emissions: They are capturing it and safely storing, or "sequestering" it, underground.

At Hydrogen Energy California (HECA), carbon dioxide captured during the 'gasification' process to produce hydrogen for power generation will be contained and kept out of the atmosphere by this method of 'carbon sequestration'.

Today, much of the world's economy runs on fossil fuels. And, in developing countries like China and India, fossil fuel usage is expanding significantly. While policymakers, scientists and consumers begin our transition to new, renewable sources of energy, as well as adopt conservation and efficiency measures to reduce the use of traditional energy sources, we also must take action to reduce the CO_2 from these traditional sources of energy. So, how do we get a handle on CO_2 emissions? Carbon capture and sequestration is one way. Many people agree that to not pursue this viable, safe and proven means of addressing global warming would be environmentally and socially irresponsible.

carbon dioxide -- a natural part of our environment.

Carbon dioxide is the gas we exhale when we breathe, the source of the bubbles in our carbonated beverage of choice, and the gas that trees synthesize into oxygen. It is a natural part of our atmosphere. It is the *overabundance* of atmospheric CO_2 that is believed to be contributing to global climate change.

It is believed that this extra density of CO_2 in the atmosphere is trapping heat from the sun and causing the Earth's temperature to rise. *Carbon Sequestration* is the practice of sending CO_2 emissions into depleted oil reservoirs or other geologic formations deep beneath the Earth's surface where it cannot affect the climate. When properly stored underground, it poses no threat to people or the environment. Moreover, it is estimated that there is enough space in these underground cavities to store all of the world's potential carbon emissions for thousands of years to come.

Oil and gas exist in networks of billions of pores within layers of sandstone rock sediments. Oil excavation involves drilling though layers of solid, non-porous 'cap rock' to reach the porous, oil-rich sandstone layers underneath. Once the oil and gas have been extracted, there are huge volumes of empty space within these porous layers of sandstone. In carbon sequestration, this surplus of space beneath the earth is used to permanently store CO_2.

Since the CO_2 will be sent into existing oil fields through existing oil wells, no significant amount of new exploration, drilling, or digging will be required. This is why carbon sequestration is such an efficient and cost effective means of managing CO_2: much of the infrastructure is already in place and the oil reservoirs are well understood.

At HECA, the carbon dioxide captured from the 'gasification' process will be permanently stored in nearby, available, geologically sound adjacent oil reservoirs.

CO_2 pipeline and pipeline safety

In addition to building the hydrogen powered electric generating plant, HECA also will build a pipeline to carry the CO_2 to the nearby storage reservoirs within the adjacent Elk Hills oil field. This pipeline will travel a short distance through or along an existing or new pipeline route.

Pipelines are the safest means of transporting liquids and gas. While trucks and trains pollute and are prone to accidents, pipelines transport their contents cleanly and silently. The US Department of Transportation and the Centers for Disease Control estimate that one is 420 times more likely to die in a motor vehicle accident than as the result of any pipeline related incident.

Since pipelines are designed to withstand powerful earthquakes and other seismic activity, almost all pipeline related accidents are due to “third party interference”. Usually, this involves accidental rupture of the pipeline by construction equipment. This, of course, can be prevented with proper caution on the part of both pipeline operators and any construction company who may be contracted to dig in the area.

HECA’s CO_2 pipeline will adopt the latest pipeline safety technologies, including electronic monitoring and automatic isolation and shut off valves that will run the entire length of the line. This will enable safe operation and maintenance of the pipeline and immediate notification of any potential leak.

sequestration safety

Throughout recorded history, no earthquake has ever been powerful enough to cause an instantaneous release of oil or gas from a sandstone sediment layer. And since the CO_2 would be held in place by the very same “cap rock” that has held oil and gas under the earth through millions of years and countless earthquakes, history had demonstrated that sequestered CO_2 would not be in danger of release due to seismic activity.

Based on industry experience, the biggest potential escape route for the sequestered CO_2 to the earth’s surface is from the oil well through which it was injected into the earth in the first place. As is the case with pipelines, oil wells are designed to withstand seismic activity, and are equipped with all of the latest leak detection technologies. Any leak of CO_2 from the well, or “injection point”, would be detected, fixed and addressed so as to minimize any release of CO_2 to the atmosphere.

sequestration -- a method available right now.

As soon as the Hydrogen Energy California plant comes on line, the infrastructure necessary to keep its carbon emissions out of the atmosphere will be in place. The available reservoirs for sequestration have been in operation for almost a century and are well understood.

The apparatus for oil and gas excavation can now serve a new purpose. Instead of just extracting oil and gas from the ground, oil wells can be used to inject carbon dioxide deep into the earth to be stored safely and permanently. Carbon sequestration is a method that makes use of existing infrastructure, and can be employed just as easily in still functioning oil fields as well as in depleted fields.

Just as HECA will be extracting clean hydrogen fuel from a petroleum refinery by-product, HECA also will be using existing oil fields and wells as a means of managing its carbon “footprint”. In other words, with hydrogen energy technology and carbon sequestration, carbon emissions can be curbed right away.

Hydrogen Energy California

gasification – taking the pollution out of the fuel before you use it.

The gasification process is over a century old. Before electricity, lamps using coal gas lighted city streets. The scientists of the day learned that when they fed coal into a hot, hydrogen-starved environment, they could produce a gas that gave off far less smoke than coal.

What they were doing, through gasification, was removing excess carbon from the coal. Gasification (also known as "decarbonization") breaks fossil fuels down at a chemical level. In these early gasification practices, the coal would be fed into a large, kiln-like oven. As the heat rose, the fuel-valuable gas would rise to the top, and the excess carbon would fall to the bottom as, essentially, soot. This soot, which would have wound up in the air as carbon monoxide and CO_2, could now be captured and contained, leaving a cleaner burning gas for the street lamps.

Over the past century, gasification has become an integral part of modern power production. It is used to extract clean burning gas (also known as "syngas") from coal, and to remove impurities from natural gas before it is burned to generate electricity. And over this time, gasification techniques and technologies have advanced considerably. Today, we can isolate hydrogen – the simplest chemical element on earth – through gasification.

Hydrogen Energy California (HECA) proposes to generate hydrogen using gasification of petroleum coke - a common, plentiful refinery by-product, and from locally delivered coal. The hydrogen would be used to fuel a state-of-the-art combined cycle electric power plant.

feedstock fuels and their components

Petroleum coke, a carbon heavy "hydrocarbon" (another term for fossil fuel), is made up of 95% carbon and hydrogen, 4% sulfur, and 1% chemically inert, other materials. Bituminous coal has a composition comprised of roughly 72 % carbon, 5% hydrogen, 22% oxygen and ash, with less than 1% sulfur. At HECA, these components of the feedstock fuels will be isolated and contained through gasification, and will *not* be released to the environment.

While technologies and techniques have advanced considerably since people began extracting lamp oil from coal centuries ago, the fundamental principles of gasification are the same. The process still occurs in a "gasifier", a large, kiln-like oven, and the overall chemical process has not changed. However, with state of the art temperature controls, monitoring devices, and extraction procedures, the various components of the substance being broken down can be isolated and contained with much greater accuracy.

This advanced form of gasification will enable HECA to not only extract hydrogen gas for use as a clean burning fuel, but to capture and contain the carbon and sulfur – elements that could otherwise wind up in the environment if the coke or coal were burned as a conventional fuel. The carbon will be captured as carbon dioxide (CO_2) and kept out of the atmosphere through a technique called "carbon sequestration". And the sulfur will be captured in its elemental form – a benign yellow powder with many industrial uses – and will not be released to the air as harmful sulfur dioxide.

inside HECA's gasifier.

At high temperatures inside the gasifier, a combination of gasses, known as "syngas", is created, comprised primarily of carbon monoxide, hydrogen, carbon dioxide and water. This combination of gasses, or syngas, is then directed into a "scrubber", which will wash out any solid, particulate impurities that may have traveled with it. The remainder of the feedstock's mass – a mixture of various inert substances – will be left at the bottom of the gasifier's chamber as gasification solids. This solid, glass-like matter is removed and managed safely.

The combination of hydrogen, carbon monoxide and carbon dioxide gasses will then be piped into a "shift reactor" which will use water to convert the carbon monoxide into carbon dioxide. An "acid gas removal unit" will be used to clean up the gas further by removing minor components such as hydrogen sulfide, which will be directed to a "sulfur recovery unit" to produce sulfur. This leaves a hydrogen-rich stream, which is used to fuel the power plant, and carbon dioxide, which will be captured and directed for enhanced oil recovery and sequestration.

While petroleum coke may sometimes contain only trace amounts of mercury, special mercury recovery systems also have been built into HECA's gasification process. Once the "syngas" mixture has passed through the gasifier and scrubber, it passes through "mercury guard beds" – filters that capture the heavier mercury from the lighter syngas combination. So, while there can be some mercury in petroleum coke, the amounts are very small, and will be captured and contained.

Since gasifiers have been common equipment in natural gas plants for such a long time, safety measures for gasification are well established, and at HECA, all of these practices will be employed. Additional state of the art electronic measuring devices will be used to monitor conditions inside the gasifier.

a promising overall emissions profile

Even in its earliest incarnations, gasification was a method of "de-carbonizing" coal by removing a large portion of its carbon before it was burned -- carbon that would have wound up as smoke, or pollution. Now, gasification technology has advanced to a point where we can break fossil fuels down to their fundamental chemical elements. We can now capture these elements, both useful hydrogen and carbon dioxide, and manage them safely.

HECA will employ an "integrated gasification/combined cycle" system virtually identical to the generator systems used in the cleanest natural gas power plants today. In this process, the fuel extracted through gasification is fed directly into the plant's electrical generators. However, while standard power plants use natural gas to power their generators, HECA will use hydrogen.

Hydrogen Energy California will be using tried and true methods and technologies – gasification and combined cycle turbine generators – to create clean hydrogen power from petroleum coke, a common and plentiful refinery by-product. The result will be a whole new standard for the potential of clean energy.

Hydrogen Energy California

hydrogen safety

Hydrogen is a basic element with tremendous potential. When oxidized, or combined chemically with oxygen, its only byproducts are heat and pure water. This is why hydrogen bears so much promise as a source of clean energy.

At normal temperatures, hydrogen exists in a gaseous form. It is handled in a similar fashion to natural gas. And, since hydrogen has long been a component of the petroleum refining process and is being used more and more frequently as a fuel, techniques for the safe handling and storage of hydrogen are well established.

Like other common gaseous fuels, such as natural gas, hydrogen is only combustible in the presence of oxygen. It cannot burn when contained by itself in a tank or a pipeline. Hydrogen also has certain properties that make it advantageous with respect to safety. Hydrogen is non-toxic and also is the lightest element on earth, twice as light as helium. Thus, when released into the air, it disperses very quickly, reducing the potential for unwanted or accidental combustion.

sources of hydrogen

Hydrogen is the simplest and most common chemical element on earth. It can be extracted from many sources, including water or fossil fuels such as natural gas or coal. Hydrogen Energy California (HECA) will be extracting hydrogen from petroleum coke, a refinery by-product, as well as locally-delivered coal.

At HECA, the petroleum coke (and coal) will not be burned. Through a chemical process called “gasification”, the fuels will be broken into their component parts, including hydrogen and carbon. If the petroleum coke were “burned” in a traditional way, its carbon would be released into the atmosphere as carbon dioxide, the “greenhouse gas” of most concern in efforts to address global climate change. With gasification, this environmentally harmful component is captured and contained before being released into the air.

By using petroleum coke as a source for hydrogen, HECA will take advantage of a common by-product that has little value as a standard hydrocarbon fuel. And, by processing it through gasification, 90% of its carbon -- which would normally end up in the air as pollution and CO_2 -- will be kept out of the atmosphere.

gasification

The gasification process is over a century old. Before electricity, it was used as a method of extracting clean-burning gas from coal for use in street lamps. Today, it is a standard part of the natural gas power generation process.

When introduced into a hot, oxygen starved environment, hydrocarbons like petroleum coke or coal break into their component parts. At HECA, this will take place in a “gasifier”, which is basically a large, kiln-like oven.

At the correct temperature and pressure, the primary chemical elements of the petroleum coke (and coal) will rise to the top of the gasifier's chamber as hydrogen, carbon monoxide and carbon dioxide gas. This combination of gases, or "syngas", will then be directed into a "scrubber", which will wash out any solid, particulate impurities that may have traveled with it. The syngas then passes through a "shift reactor" that uses water to convert the carbon monoxide into carbon dioxide. A "sulfur recovery unit" then captures any remaining sulfur. This leaves hydrogen (H2) which will be used to power the plant, and carbon dioxide (CO_2) which will be captured and kept out of the atmosphere.

Scrubbers and sulfur recovery units are common equipment in natural gas plants (they are used to remove impurities from the gas), and safety measures are well established. At HECA, all of these practices will be employed. State of the art electronic measuring devices will be used to monitor conditions inside the gasifier.

hydrogen as a fuel

HECA's electrical generators will be "combined cycle turbines", the very same systems used in clean natural gas power production. These are essentially jet engines, similar in operation to those in commercial aircraft. They turn a turbine that produces electricity. The also produce hot air which is used to power a steam generator, producing more electricity, thus maximizing efficiency. HECA's generators will be the same in almost all respects to those in natural gas plants, but they will operate on hydrogen fuel.

HECA's hydrogen will be produced at the plant site, and most of it will be consumed by the power generation process. However, HECA represents a new and significant source of hydrogen production, with potential to contribute to the future growth of California's emerging hydrogen energy economy.

When used as a fuel, hydrogen is similar to natural gas, except that it does not have elemental carbon as natural gas does. HECA will already have captured the carbon from its feedstock fuel through its gasification process, and thus HECA will have prevented that carbon from being oxidized into the atmosphere as CO_2. However, since hydrogen combustion occurs within the existing ambient air, which already has limited amounts of nitrogen, particulates and other pollutants, there will be some emissions associated with hydrogen fuel usage, including NOx and particulate matter. These emissions will meet or exceed all of California's stringent air quality standards, including the Air Pollution Control District's BACT (Best Available Control Technology) standards.

a new hydrogen energy economy

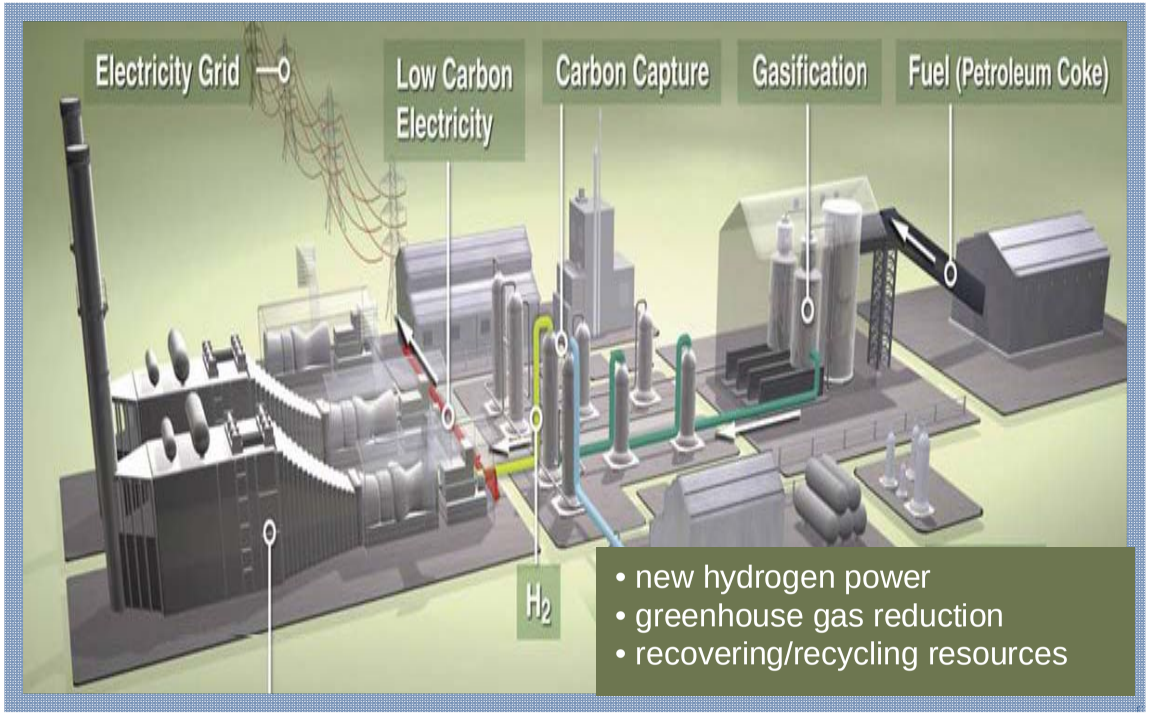
In the face of global climate change, a growing consensus including environmental organizations, the Department of Energy, major automobile companies, public utilities and power companies are looking towards hydrogen as the viable alternative to standard fossil fuel energy. Already, there are hundreds of miles of hydrogen pipeline in the United States. Hydrogen fuel cell powered cars have been tested successfully under accepted consumer conditions, and in Iceland and Norway, fleets of city busses run on hydrogen.

This all suggests that the emergence of a new, hydrogen based energy economy is real step. It is a viable approach to solving today's energy and air quality problems. Taking advantage of hydrogen's clean-burning properties is a way of addressing the global climate change challenge. In addition to providing clean power to over 150,000 homes in the Bakersfield area, as hydrogen powered cars become available to consumers, and new hydrogen powered busses, trucks and trains come on line, HECA will be standing at the cutting edge of the new energy economy.

hydrogen energy

delivering real world solutions on global warming:

Hydrogen Energy California



model of
Hydrogen Energy California

bp RioTinto A joint venture between BP Alternative Energy and Rio Tinto

project goals and strategy

hydrogen energy

key goals for Hydrogen Energy California

generate low carbon “hydrogen power” to meet California's increasing power demand

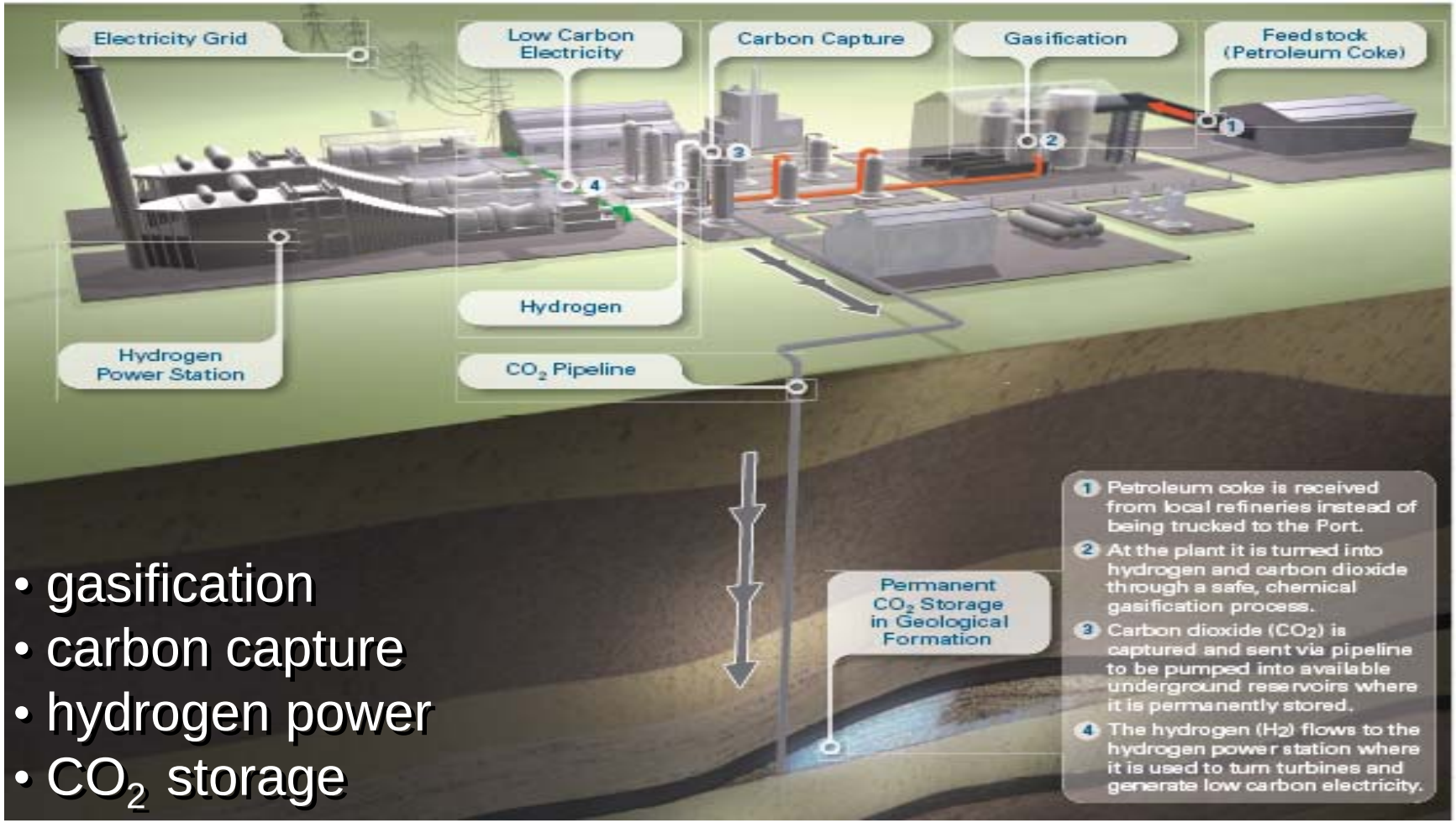
- capture carbon dioxide (CO_2) for long-term storage or “sequestration” in nearby oil fields to address global warming concerns
- utilize CO_2 for enhanced oil recovery and generate new revenues

part of a broader strategy

- accelerate development of the hydrogen energy economy in California
- commercialize hydrogen power technology for use as alternative to conventional power generation globally
  - gasification technology
  - hydrogen fueled turbines
  - carbon capture and sequestration methodologies

- hydrogen power
- greenhouse gas reduction of 90%

hydrogen energy



- gasification
- carbon capture
- hydrogen power
- CO_2 storage

environmental benefits

hydrogen energy

eliminating 2.5 million tons/year of greenhouse gases

- by sequestering them underground in depleted oil reservoirs

building a hydrogen source for electrical power generation and possible future uses, including clean transportation

reducing carbon emissions related to petroleum coke transportation and use as a combustion fuel

utilizing a by-product from the oil refining process

- reducing stress on natural gas demand for power generation
- reducing dependence on foreign oil imports

preserving limited fresh water sources

- by using brackish ground water supplied by a local agricultural water district that currently negatively impacts local agricultural activity.

community benefits

hydrogen energy

providing over 150,000+ homes with new, clean electric generation (250 MW)

- when state agencies are predicting possible power shortages in coming years…

boosting the local economy

- create up to 1,500+ construction jobs and 100 permanent operational positions in the Bakersfield area
- generate new tax revenues for local communities and the state

reducing emissions

- use of hydrogen for power generation will dramatically reduce emissions associated with electrical power generation

who are we?

hydrogen energy

a company jointly owned by BP and Rio Tinto

- established to focus on industrial scale, base-load, hydrogen-fuelled, low carbon power generation using fossil fuels and carbon capture and sequestration
- complementary skills
  - BP's leading position and expertise in chemical processing, low-carbon power generation and carbon capture & sequestration
  - Rio Tinto's expertise and world-class assets in coal extraction and supply

Hydrogen Energy California

key participants (as of may '08)

hydrogen energy

BP Alternative Energy -- global leader in clean fuels projects, including gasification projects and CO_2 sequestration

Rio Tinto -- internationally recognized global resources company

GE Energy -- leading provider of IGCC technology and equipment and supporting services

Fluor -- among world's largest publicly-held engineering and construction contractors, and leader in the design of CCS and power facilities

URS -- renowned leader in the permitting of power plants; respected technical expertise and work relationships with CEC, EPA and SCAQMD

Occidental Petroleum -- world leader in oil and gas production.

capturing and sequestering CO_2

hydrogen energy

- over 1 billion tons of CO_2 storage capacity available in local Californian oilfields (over 200 years)
- initial studies are complete designating the most attractive depleted oil fields for CO_2 sequestration
- studies include:
  - pipeline routing studies to transport CO_2
  - site characterization for effective sequestration and enhanced oil recovery
  - evaluating appropriate long term monitoring techniques
- initial study suggests the Elk Hills reservoirs meet all of the screening criteria.

•CO_2 to remain permanently stored underground.
•additional oil recovery generates new revenues for the state.

safety

hydrogen energy

each component of hydrogen power technology is proven and in use:

- Gasification technologies have been in use for over a century. Integrated gasification combined cycle (IGCC) technology is currently state of the art in natural gas power generation.
- CO_2 pipelines and underground storage have been in widespread use throughout the world for decades.
- CO_2 injection has been in use in the U.S. oil industry since the 1930's.

hydrogen power generation employs methods similar to those employed in natural gas power generation.

CO_2 pipelines are regulated by the government and have been commonly operated in the U.S. for decades.

HECA will meet or exceed California health and safety requirements, including its strict air emission standards.

why Kern County?

hydrogen energy

an optimal location:

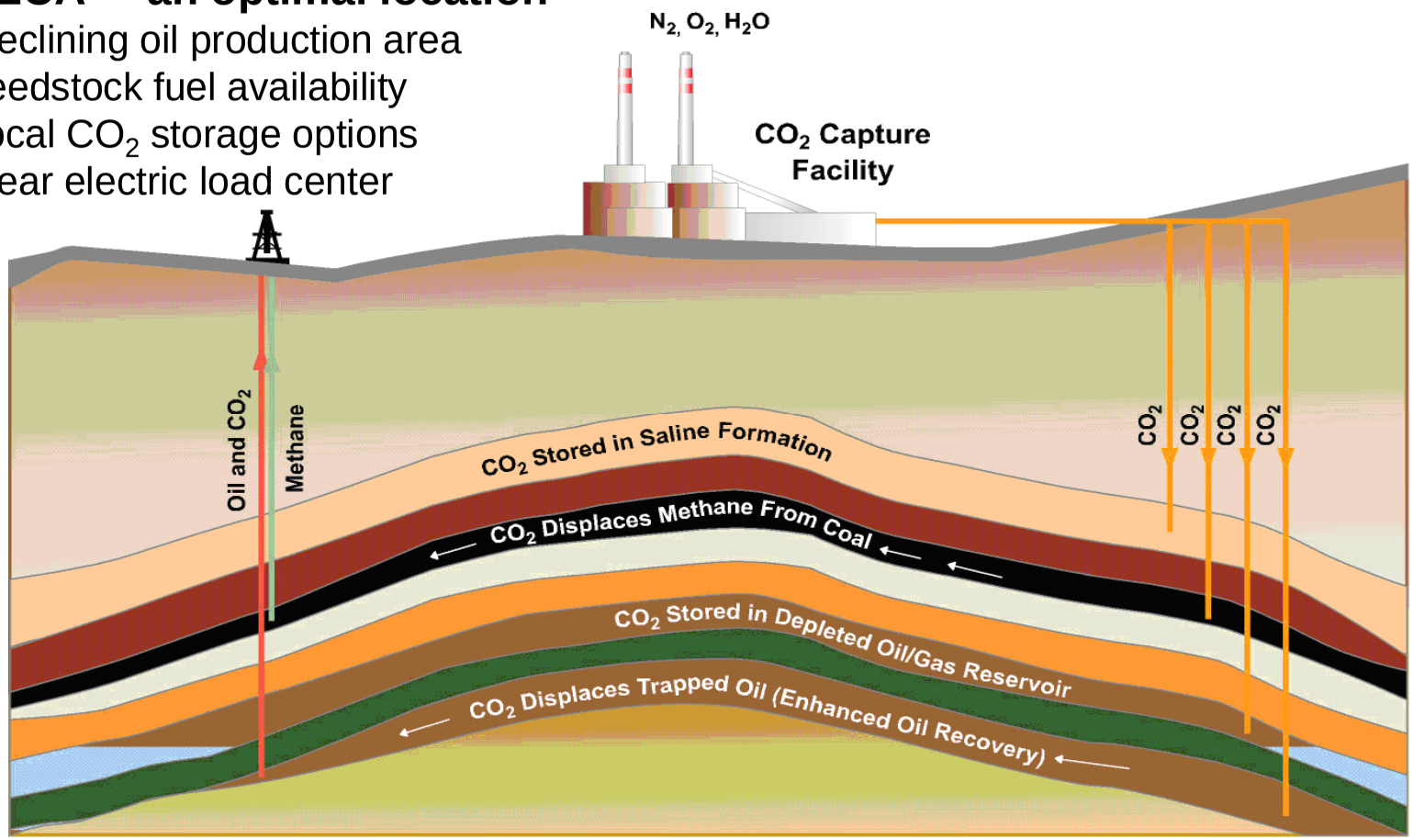
- located in an area adjacent to oil production facilities and needed infrastructure, including electrical transmission lines
- near existing depleted oil reservoirs to store carbon dioxide
- local supply of recycled or non-potable water
- growing demand for electrical power
- need for hydrogen for other future uses

proximity to CO_2 storage options

hydrogen energy

HECA – an optimal location

- declining oil production area
- feedstock fuel availability
- local CO_2 storage options
- near electric load center



key CO_2 EOR considerations

hydrogen energy

CO_2 capture and sequestration *can* take place during enhanced oil recovery

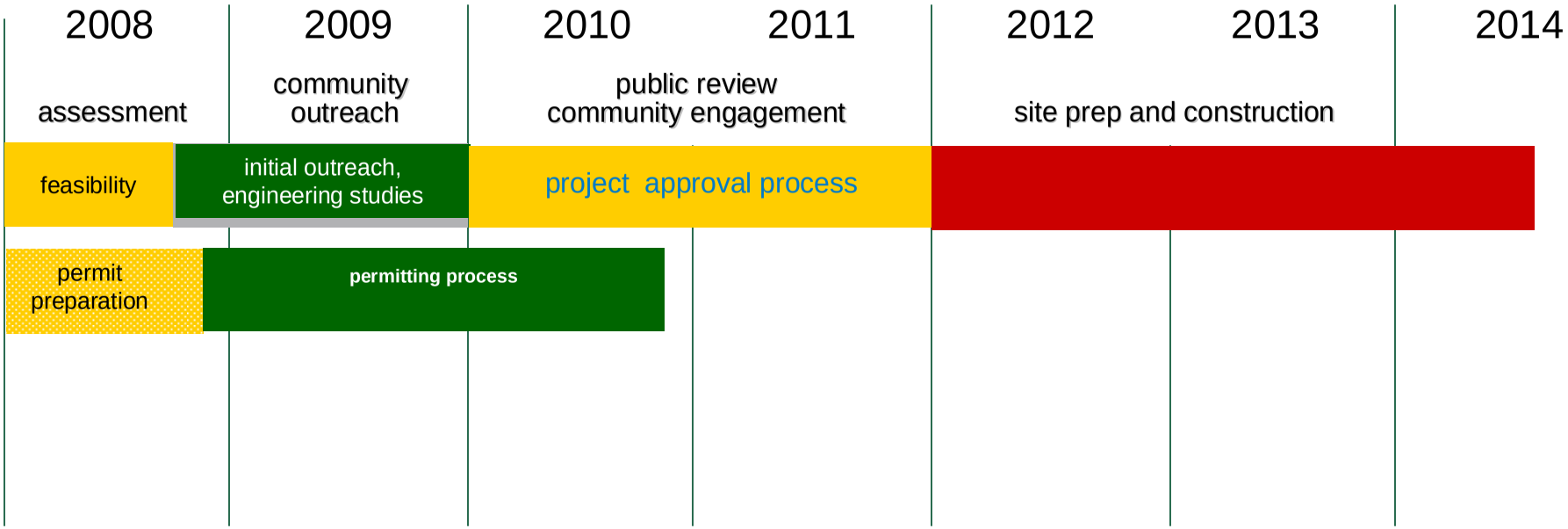
- CO_2 purchase contract must ensure:
  - economic viability and sustainability for all parties
  - the CO_2 demand matches continuous plant output
  - the CO_2 captured will be appropriately stored
- both parties need assurance on:
  - validated geologic models and reservoir characterization (e.g., compartmentalization, storage capacity)
  - field development plan and operating strategy to underpin CO_2 injection profiles
  - demonstration of CO_2 sequestration (e.g., well integrity, seal capacity, leakage risks analysis, monitoring plan)

environmental permitting

hydrogen energy

- California Energy Commission has over-riding jurisdiction for permitting HECA for power generation – “one stop shop”
- permit also will include San Joaquin Valley (SJV) air pollution control district (APCD)
- HECA will meet strict operating standards
  - responsible feedstock handling & storage
  - gasification process will capture sulfur and other compounds
  - state of the art emission controls to achieve/exceed IGCC BACT emissions
  - recycling of emissions to increase efficiency and reduce venting
  - utilization of brackish groundwater unfit for agricultural production
- HECA will create options for acquiring emission offsets, such as those offered by
  - avoided emissions from petroleum coke export shipping to Asia
  - ultra-low greenhouse gas emissions

Hydrogen Energy California
project phases



permit application 3rd q 2008

community outreach and public review 2008-2009

anticipated project start-up 2014

state and local outreach

hydrogen energy

- Governor's Office
- EPA Region IX
- Cal EPA & CARB
- California Energy Commission
- CA Public Utilities Commission
- CA Dept Of Conservation/DOGGR
- State Legislative Representatives
- CA Congressional Delegation
- Nat'l Environmental Organizations
- Kern County Board Of Supervisors
- SJV APCD
- RWQCB
- Local Labor, Trade Organizations
- Area Homeowners' Associations
- Area Business Associations
- Local Community Leaders
- Ongoing Community Programs
- Local Environmental Organizations

extended community and environmental outreach to ramp up in 2008-9

delivering real world solutions to global warming

hydrogen energy

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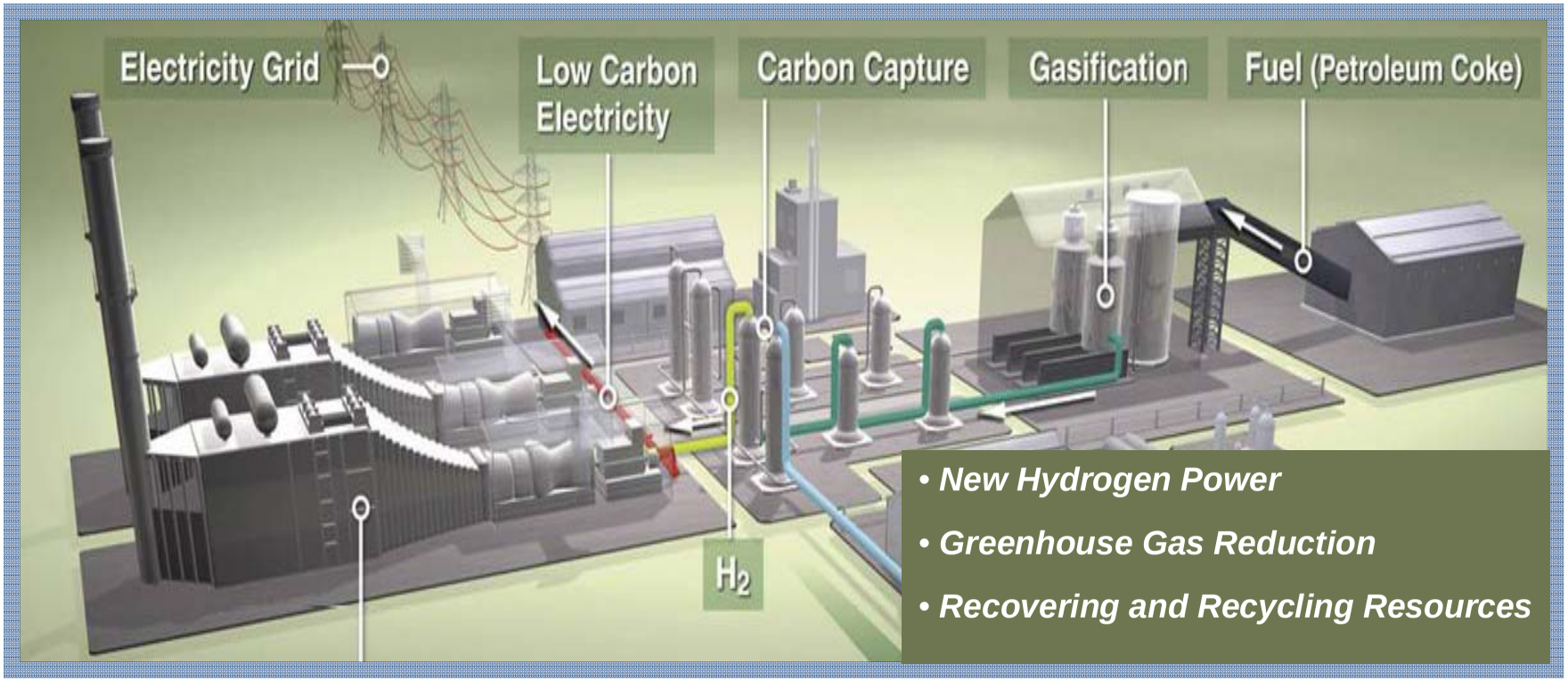

hydrogen power plant

bp RioTinto A joint venture between BP Alternative Energy and Rio Tinto