

DOE Initiatives Spur Private Industry Investment

“The Carson Hydrogen Power Project”



An EDISON INTERNATIONAL® Company

*Presented by Gardiner Hill
Manager, Group Technology, BP*

*5th Annual Conference on Carbon Capture
and Sequestration
May 9, 2006*

Carson Hydrogen Power Project Sponsors and Participants



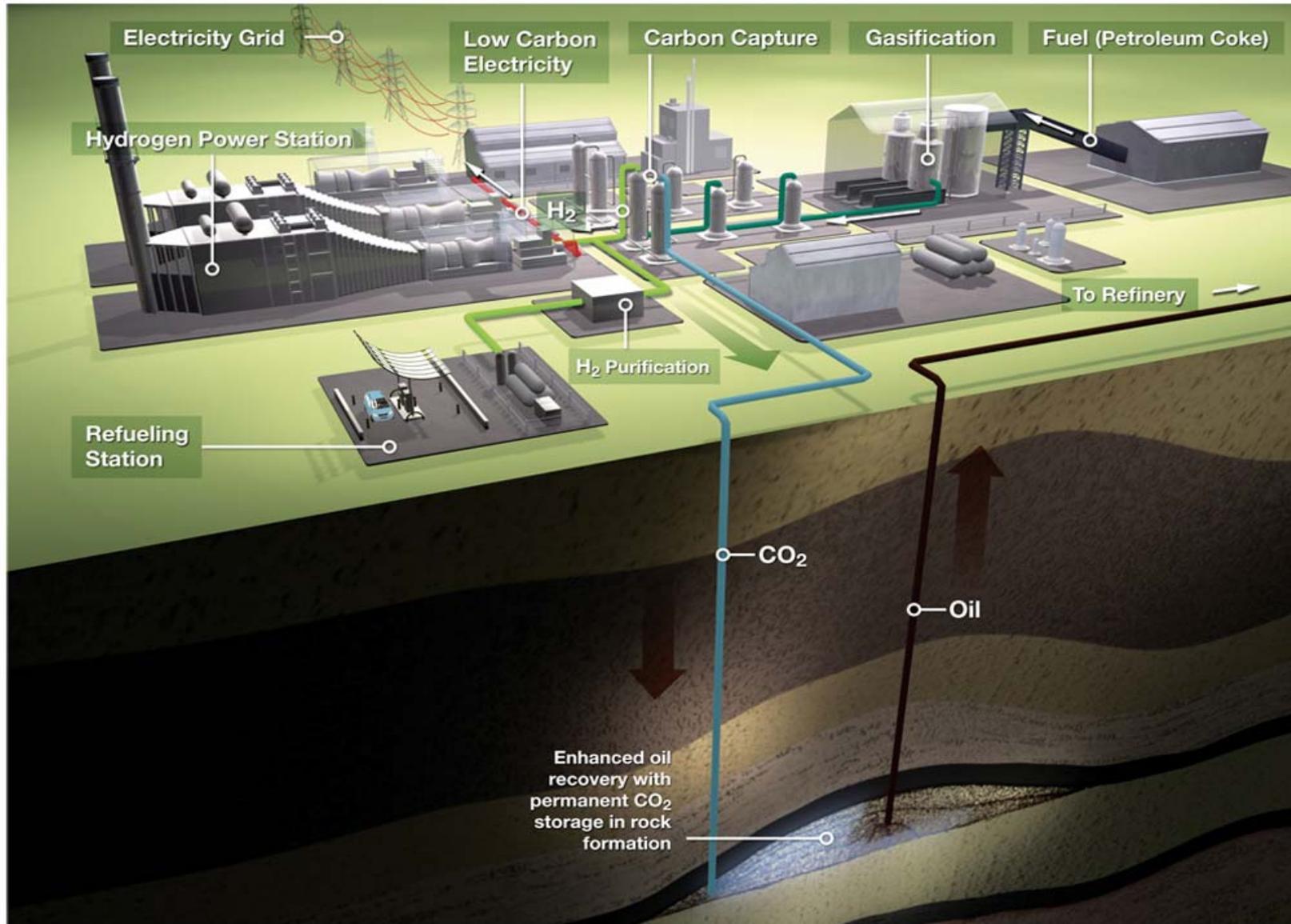
- **BP** – *Global leader in decarbonized fuels projects, including gasification projects and GHG sequestration*
 - ❑ *CO₂ Capture Project, In Salah, Peterhead and others*
- **Edison International/Edison Mission Energy** - *Pioneer in IGCC:*
 - ❑ *120 MW Cool Water IGCC facility, 1st commercial scale clean coal power project*
 - ❑ *528 MW ISAB IGCC in Italy, 1st large scale deployment of IGCC technology*
- **Fluor** - *one of the world's largest publicly-held EPC contractors*
 - ❑ *leader in the design of clean coal, clean fuels, & carbon capture processing plants & power generation facilities*
- **Occidental** - *World's largest CO₂ EOR operator*
 - ❑ *injecting >1 Bcf per day in TX/NM Permian Basin oil production*
 - ❑ *operator of the Elk Hills field in California's San Joaquin Valley and the THUMS operation in Long Beach*
- **West Basin Water District** – *Nationally recognized water recycler*
 - ❑ *CHPP will reuse treated wastewater provided by West Basin*



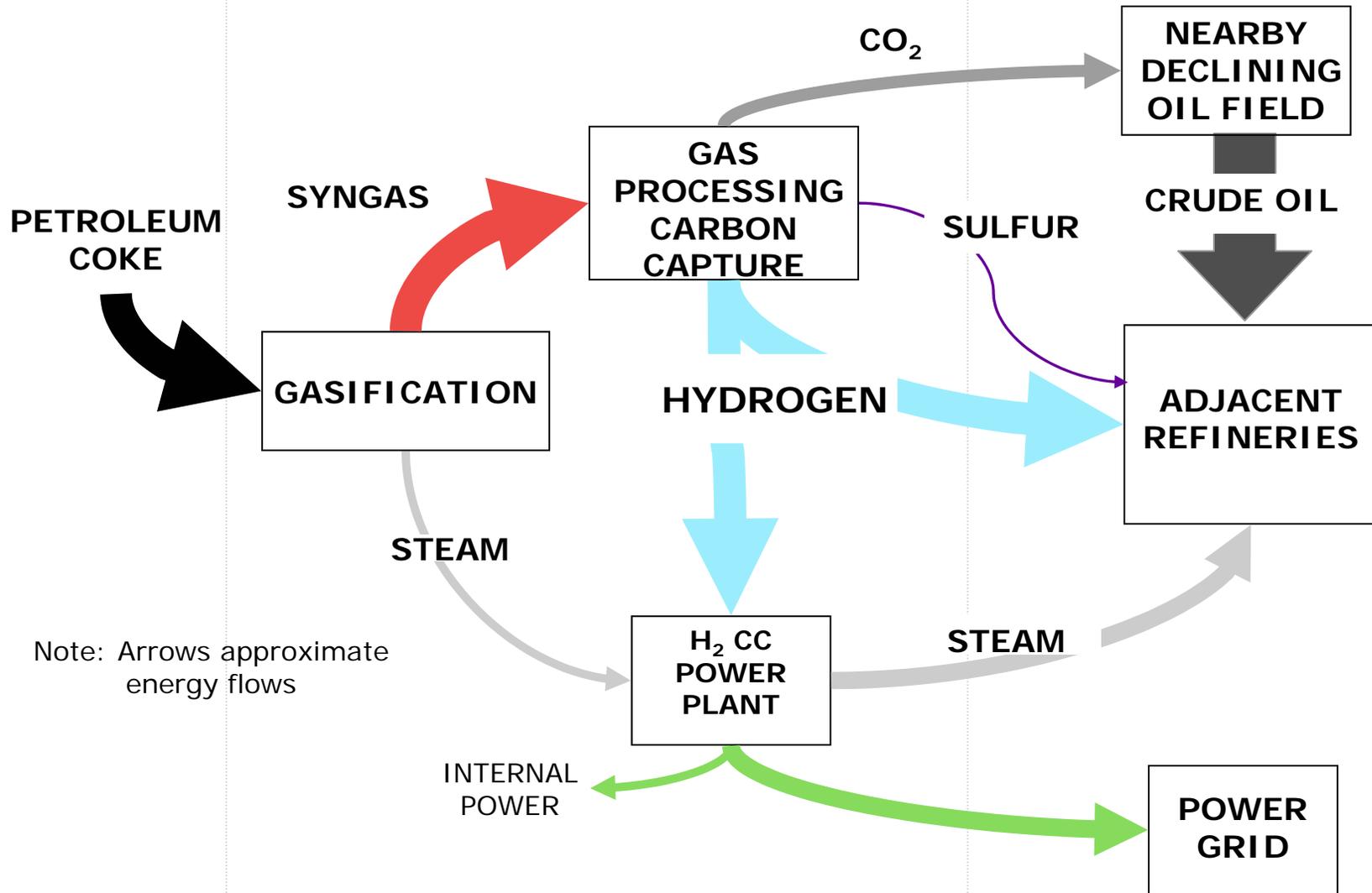
FLUOR



Carson Hydrogen Power Project



CHPP polygeneration produces useful energy far in excess of the energy value of the feedstock





CoP

Valero

PRAXAIR

Shell

Kinder

CoP Carson

BP Carson Refinery

CHPP

APCI

West Basin

Captured CO₂ will enable enhanced oil recovery from California's mature oil fields



Figure 2. Major California Oil Basins



- Over 1 billion tonnes of CO₂ storage capacity available in local Californian oilfields
- DoE study (2005) estimated onshore California oilfields held approximately 57 billion barrels of 'stranded resource'
- A significant proportion of these barrels (5-10% for a typical oilfield) are technically recoverable via CO₂ enhanced oil recovery
- Technical studies are underway to determine which of Occidental's California oil fields are most attractive for CO₂ flooding technology

Energy Policy Act of 2005

Set Key Goals for US Policy - Fossil Fuels

- Use domestic coal resources to secure reliable and clean energy
 - ❑ Develop dramatically cleaner, more efficient power generation
 - ❑ Reduce carbon intensity of coal-based power
- Establishes hydrogen as America's clean energy choice
 - ❑ Supports use of domestic fuels for producing hydrogen
- Expand domestic production of oil and natural gas
- Encourage use of CO₂ for enhancing oil and gas production
- Accelerate construction of infrastructure for LNG
- Improve electricity grid for reliability

CHPP and DOE Program Linkage

Common Goals, Complimentary Technologies



DOE Policy & Programs	Carson Hydrogen Power Project
Clear Skies	<ul style="list-style-type: none"> ● Meets or exceeds EPA & local standards for air emissions
Clean Coal Power	<ul style="list-style-type: none"> ● Commercial deployment of low emission / low GHG technology ● Polygeneration
DOE R&D	<ul style="list-style-type: none"> ● Employs DOE-supported technology developments: <ul style="list-style-type: none"> ➤ Gasification ➤ Hydrogen flex fuels gas turbine ➤ CO₂ enhanced oil recovery ● Commercial platform for transition to hydrogen economy

CHPP and DOE Program Linkage

Common Goals, Complimentary Technologies



DOE Policy & Programs	Carson Hydrogen Power Project
Climate Change	<ul style="list-style-type: none"> ● Largest CO₂ capture EOR program
Homeland Security	<ul style="list-style-type: none"> ● Uses growing supply of domestic petcoke ● Increases domestic oil supply through EOR ● Increases domestic refining capacity by providing steam & hydrogen
FutureGen	<ul style="list-style-type: none"> ● Different application, complimentary efforts: <ul style="list-style-type: none"> ➤ Petcoke vs coal ➤ EOR vs geologic sequestration ➤ Non-utility vs utility operation ➤ Current vs advanced technology

CHPP could apply advanced FutureGen technologies when available



Traditional Examples

Cryogenic separation

Amine scrubbers

Amine scrubbers

Syngas turbines

Enhanced oil recovery

Current generation gasifiers

System Integration

Plant controls



Leading Edge Examples

O₂ membranes

H₂ membranes

Clathrate-based separations

H₂ turbines

Sequestration technology

Advanced gasifier designs

“first of kind” integration

“Smart” plant controls

Long Term Benefits of CHPP



CHPP demonstrates a business model that could lead to the following long term benefits:

- Adds to Energy Security by demonstrating use of under-utilized petcoke from domestic heavy crude to generate clean power and fuels.
 - Would enable 70,000 t/d of now-exported low cost pet coke to generate 7 GW of power and mitigate offshore GHG emissions.
- Polygeneration of CO₂ could support recovery of up to 5 Billion bbls of domestic oil now classified as uneconomic “stranded reserves”
- CHPP’s success of a multi-train IGCC at a 500 MW scale will stimulate investment in comparable facilities, domestically and globally, utilizing coal and petcoke
- Industrial competitiveness of US companies to export low carbon energy technology to developing countries

Benefits to the Environment and Economy



Providing 500 MW of new, clean generating capacity

- When state agencies are predicting possible shortages in coming years

Eliminating 4 million tons/yr of greenhouse gases from the atmosphere

- By sequestering them underground

Producing additional energy from existing California oil fields

- By injecting CO₂ to force 5% to 10% more oil to the surface

Boosting the Southern California economy

- 1,000 construction jobs and 150 permanent operational positions

Reducing stress on US natural gas supplies

- By using the residue left over from the oil refining process

Preserving limited fresh water sources

- By using recycled and treated city waste water for plant needs

Producing hydrogen & other byproducts for current & future use

Reduced emissions from petcoke hauling & export

- Eliminates 3000 truck miles/day to port & corresponding ship transport

Q&A

