CCS and Enhanced Oil Recovery: Technology, Business, & Policy Considerations for California

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Corporate Review

BACKGROUND ON SUMMIT

Background on Summit Power Group

- **Founded: 1989 by Don Hodel & Earl Gjelde**
  - Don Hodel (Chair): Secretary of Energy & Secretary of Interior for President Reagan; Administrator (CEO) of Bonneville Power Administration prior
  - Earl Gjelde (CEO): Assistant Secretary to Mr. Hodel at Energy & Interior; Deputy Administrator at Bonneville Power Administration prior

Today: More than 40 professionals, all working on climate-friendly power project development

- **Primary business: developing clean energy projects primarily for utilities & IPPs**

- **Types of projects:**
  - Wind
  - Solar
  - Gas-fired
  - Carbon capture from solid feedstocks and natural gas, and from direct air capture of CO2
- **Projects developed to date: Totaling $9B (current dollars) and over 9,500 MW**

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Diverse Business Lines

Four primary business lines:

1. **Gas-fired power plants**
   - Greatest volume of projects in total – 7,800MW+.
   - Base load combined cycle as well as peaking simple cycle projects.
2. **Wind**
   - Summit pioneered the “White Creek” prepaid equity flip financing structure that cuts delivered cost of wind power for publicly owned utilities
   - Development role in projects operating or under construction 925MW+.
3. **Solar**
   - JV for utility scale projects with REC (NorthLight Power).
   - 60 MW ac NorthStar project for PG&E, approved by CPUC.
   - Development portfolio of over 300+ additional MW.
4. **Carbon capture**
   - Large industrial capture projects from solid feedstocks, natural gas or the atmosphere.
   - 400 MW Texas Clean Energy Project (TCEP) in late stage financing.
   - Technology portfolio and additional projects under development in US and abroad, including TCEP replicas & carbon capture from natural gas (plus direct air capture).

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A new business for dramatically reducing CO2 emissions from power

SUMMIT CARBON CAPTURE, LLC

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Summit Carbon Capture, LLC

- A wholly-owned LLC subsidiary of the Summit Power Group
- Mission: Develop clean power with CO_2 capture & sequestration
- Initial focus: primarily CO_2 for Enhanced Oil Recovery (EOR), to aid economics
- Geographic focus: where low-carbon power & CO_2 for EOR is desired
- Types of projects:
  - CO_2 capture from natural gas-fired power projects (new and retrofit)
  - CO_2 capture from coal feedstock projects, including
    - Integrated Gasification Combined Cycle (TCEP and replicas in U.S. and abroad)
    - Coal plant retrofits
    - Surface facilities for underground (*in situ*) coal gasification
  - Other solid fuel gasification facilities (e.g. pet coke)
  - Projects/facilities for direct air capture of CO_2
- Focus on implementing best capture & sequestration technologies and monitoring systems to demonstrate the climate integrity of CO_2 storage

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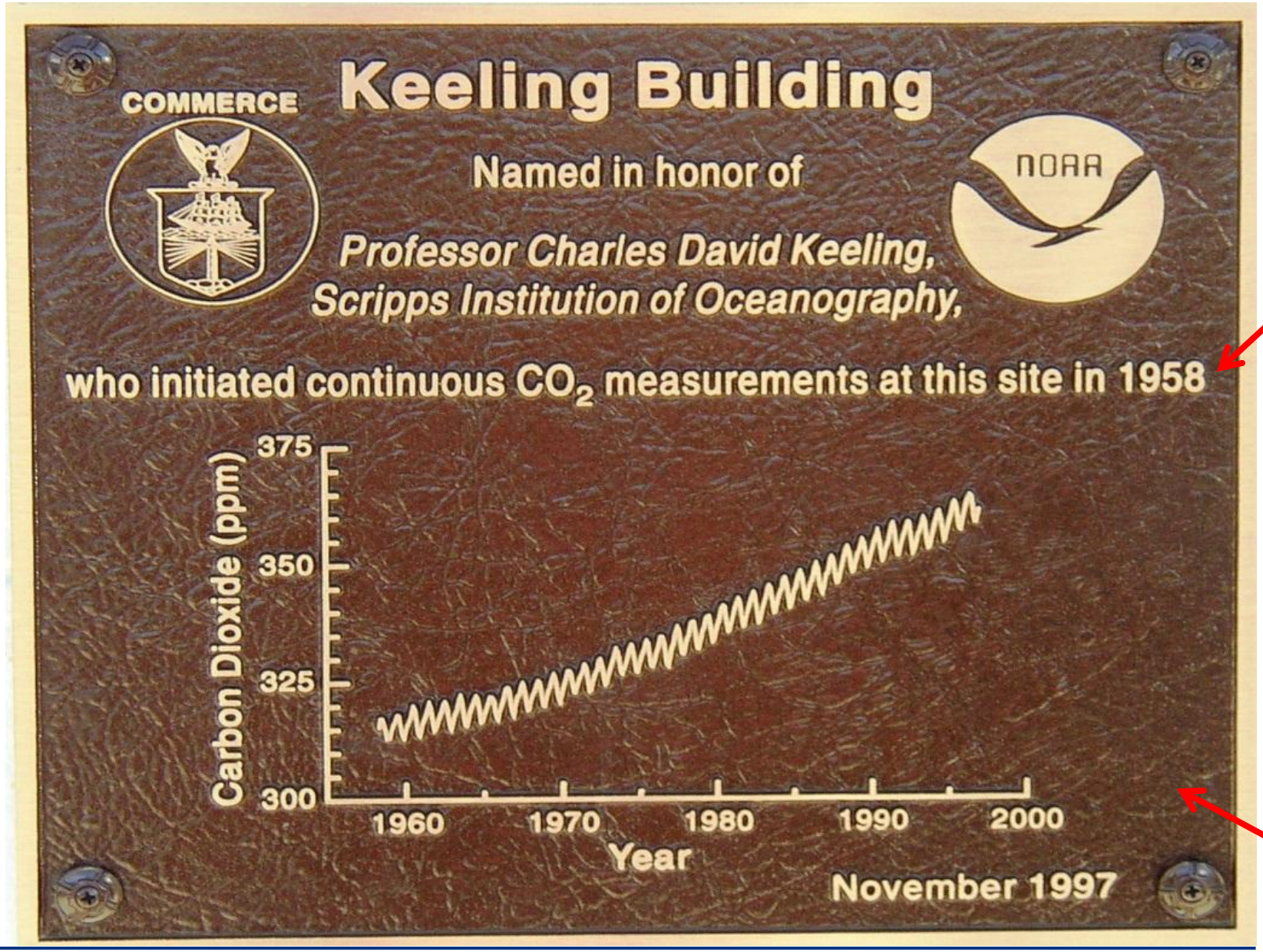

385 ppm

2010

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CO2 Capture and Enhanced Oil Recovery

- Yields ultra low carbon baseload (or load-following) power
- Selling CO2 for EOR produces revenue to help offset costs of CO2 capture but does not generally cover all these costs
    - Need to close the cost gap through carbon credits, power price premiums, etc.
- CO2 for EOR revitalizes and extends the life of existing oil fields, produces jobs, and results in increased public revenues from added oil production
- CO2 captured and injected via an EOR operation is sequestered permanently in an excellent storage reservoir, i.e. the depleted oil field. Texas statutory standard: 99% should stay sequestered for 1000 years.
- The only oil recovery method that sequesters CO2; involves no “fracking;” doesn’t increase oil demand or reduce the price; just makes lower-carbon oil available – and CO2 produced with the oil is re-captured & re-injected
- Summit is developing one of the world’s leading carbon capture projects in Texas, has proposed a second for the U.K., and would like to develop natural gas plants with carbon capture in California (and elsewhere)

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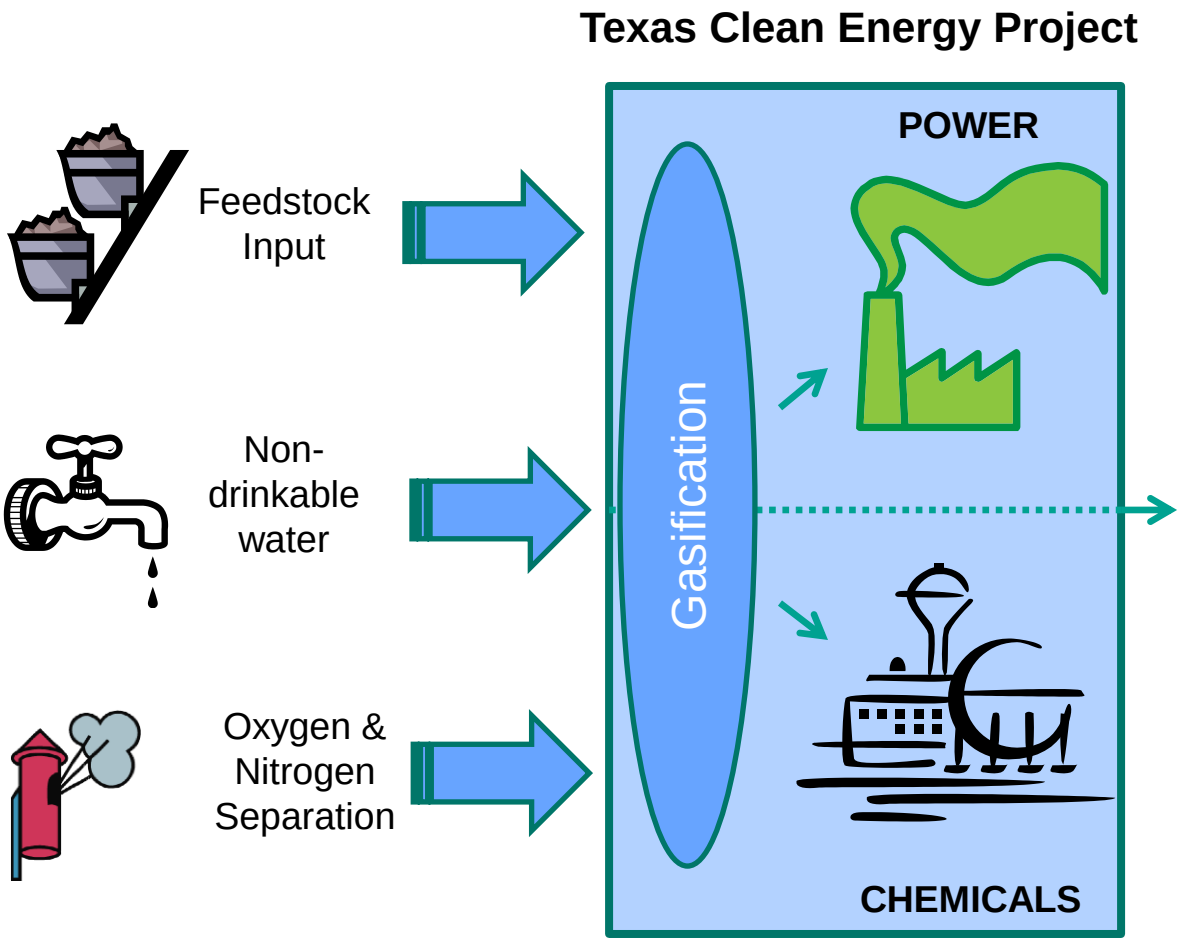
Texas Clean Energy Project (TCEP)

TCEP will be the world's lowest emitting fossil fuel plant when completed



Products	% of Revenue
Near Zero Carbon Baseload Power (200 MW)	21%
Urea for Agriculture	53%
CO2 for EOR	18%
Carbon Credits (2.5 MM tpy)	??

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Industry experience and insights

CCS AND EOR

EOR is not new

- Forty year history of safe, successful CO_2 injections (geologic CO_2)
- No serious environmental issues (e.g., no “fracking,” no over-pressuring)
- Widespread acceptance by producers, environmentalists, and public
- Very large volumes injected: ≈ 40M new tons/year (100M tpy total) in the Permian Basin of West Texas alone
- Geology is well-understood; monitoring techniques are well-developed
- Good data available on permanence of sequestration: it is permanent
- Large existing CO_2 pipeline infrastructure (thousands of miles)
- More CO_2 pipelines are safe and can be built quite readily
- Favorable federal tax treatment of (1) EOR, and (2) CO_2 pipelines
- Very large remaining CO_2/EOR production possible, including in CA

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CO2 Capture is One Key to Reducing the Risks of Climate Change

- Fossil fuels are by far the largest driver of the global energy economy and of mankind's emissions of greenhouse gases.
- While the growth of renewable and alternative energy sources is promising, the time scales for their ability to replace fossil fuels are too long to rely on this pathway alone in reducing CO2 emissions.
- Scientists and environmentalists agree that managing the carbon from our existing fossil energy sector - by capturing and disposing of its CO2 emissions underground - is an essential component of any serious plan to limit GHGs & reduce climate risks.
- Significant research and industrial experience in recent decades provide great confidence that underground storage of CO2 is feasible & safe – especially with EOR.
- However, the world has been slow to implement policies that enable CCS in the energy marketplace. Fortunately, there are emerging opportunities to commercially develop these systems today. This is what SCC is setting out to do.
- The integration of CCS with power and oil production can lead to very low carbon (or even negative carbon) fuels and electricity.

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Summit's Activities

- Working with others, Summit is actively developing a "project pipeline" for next generation follow-on plants in California
  - Focusing on either new or retrofit natural gas fired power projects with carbon capture (pre- or post-combustion, oxy-fired, etc.)
- We believe the benefits to CA from the development of such projects would be large, including:
  - Ultra low carbon firm (baseload) power to supplement renewables
  - Pathway to meeting CA's climate targets: 80% reduction by 2050
  - Offsets, volumetric additions, and price easing for Cap & Trade program
  - Increased economic development and jobs from more large oil and power projects

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CCS in California

- Texas leads the world in CO2 for EOR volumes, but Texas doesn't link this to climate goals. California can lead the world in CO2/EOR for climate:
  - Cutting edge environmental programs valuing low carbon power and fuels
  - Use of ultra low carbon firm (and non-intermittent) power to balance California's growing portfolio of intermittent renewable electric power generation
  - Excellent geology and capacity for CO2/EOR projects
- But California does need to encourage and facilitate projects
  - Quickly work out rules for certifying credits in cap and trade, drawing on vast amount of highly credible existing work from US EPA and others
  - Consider granting CCS projects grid dispatch preference, include them in a second-tier RPS, or providing PPA's
  - Develop offset rules for projects outside California, recognizing express purpose of California's efforts is to reduce **global** GHG emissions for **global** benefit

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