



PIONEER
ENERGY

Portable Enhanced Oil Recovery Technology
A Solution to Pilot Scale CO₂ Needs

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Recovering America's Strength

- **America has the oldest oil industry in the world. We invented it.**
- **As late as World War II, we produced twice as much oil as the rest of the world put together.**
- ***That's why we won.***
- **Now we only produce 8%. It's our greatest weakness.**
- **But most of the oil that was ever here, is still here, and can be retrieved using Enhanced Oil Recovery (EOR).**



USAAF B-24 Liberators hit the Nazi oil refineries at Ploesti, August 1, 1943.

The Problem: CO₂ is Not Available

- Pipeline CO₂ is simply unavailable in most of the country.
- Even in regions where pipelines exist, they are unavailable to small producers.
- Projects by large producers are also held back by high capital costs, remote locations, limited pipeline access, long construction lead-times, and the prohibitive costs of pilots.



Top Ten Stripper Oil Well States
(Number of Wells)



Source: IOGCC, 2009

- Project Short Term Incremental CO₂ Needs

Approach to Enhanced Oil Recovery

- **Mobile equipment and processes enabling portable CO₂ injection**
- **CO₂ produced in situ, eliminating the cost of transporting the gas, large capital outlay, and time required for pipeline construction**
- **Pioneer “Portable Enhanced Recovery Technology” (PERT) steam reforms natural gas to EOR-grade CO₂ and H₂ at the oil field location**
- **CO₂ is injected into an injection well, H₂ is burned in a generator**
- **Produces near-zero-emission electricity for local use or sale to the grid**
- **Revenue stream from the electric output covers the cost of unit operation**





The Portable Enhanced Recovery Technology (PERT)



Economics

- **At current oil and electricity prices one PERT unit:**
 - **Can generate more than \$1.5 million in annual revenues, without CO₂ recycle. Over \$3 million per year with CO₂ recycle**
- **Electric production pays for the ongoing cost of PERT operation**
- **Cost of the CO₂ produced with PERT comes down to output divided by depreciation of the capital expenditure.**
- **Typical cost about \$3/MCF, using purchased natural gas. More expensive than pipeline CO₂ (\$2/MCF), much cheaper than truck CO₂ (\$12/MCF).**
- **Costs are much less if flare gas can be employed.**





Expanding EOR Market Opportunities

- Streamlines EOR projects by deploying mobile CO₂ generation wherever needed
- Validate the field's probable EOR results before risking the CapEx on a stationary pipeline
- *Expand EOR industry by making pilots more affordable*
- Operate a cost-effective EOR project using the PERT
- Or build a permanent pipeline and move the mobile CO₂ infrastructure to the next field
- Start a full EOR project in a year, practically anywhere
- Opens huge markets for fields out of reach of pipeline CO₂





Generate CO₂ for Fracing

- **CO₂ is routinely added to the fracing fluids in some formation to reduce the swelling caused by water.**
- **This CO₂ is trucked to the fracing site at an average cost of \$12/MCF.**
- **Producing the CO₂ on location from wellhead associated gas can reduce the total cost of fracing or alternatively can increase the amount of CO₂ used which will further reduce swelling and increase recovery.**
- **Ultimately, CO₂ could be used instead of water for waterless fracing. The PERT can both provide the power for operations and produce the fracking fluids at the wellhead site.**

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The PERT1



- 500 MCF CO₂ per day
- 1.2 MWe hydrogen power
- Now being assembled.
- Will be ready for field testing by end of 2014.



For More Information

See the Video at

http://www.youtube.com/watch?feature=player_embedded&v=vkhTkoGfb54