



For a Green and Secure America™

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“Green is not simply a new form of generating electric power. It is a new form of generating national power – period. It is not just about lighting up our house; it is about lighting up our future.”

David Rothkopf, 2008
Carnegie Endowment for International Peace

Renewing America's Future

Trillions of dollars worth of domestic oil remains underground in apparently “tapped-out” wells, while Americans pay endless amounts of money to foreign nations for their oil -- nations which may be politically and economically unstable.

Pioneer Energy has developed products and processes that will allow much of this domestic oil to be recovered, while generating clean electricity and reducing emissions of CO₂ into the atmosphere.

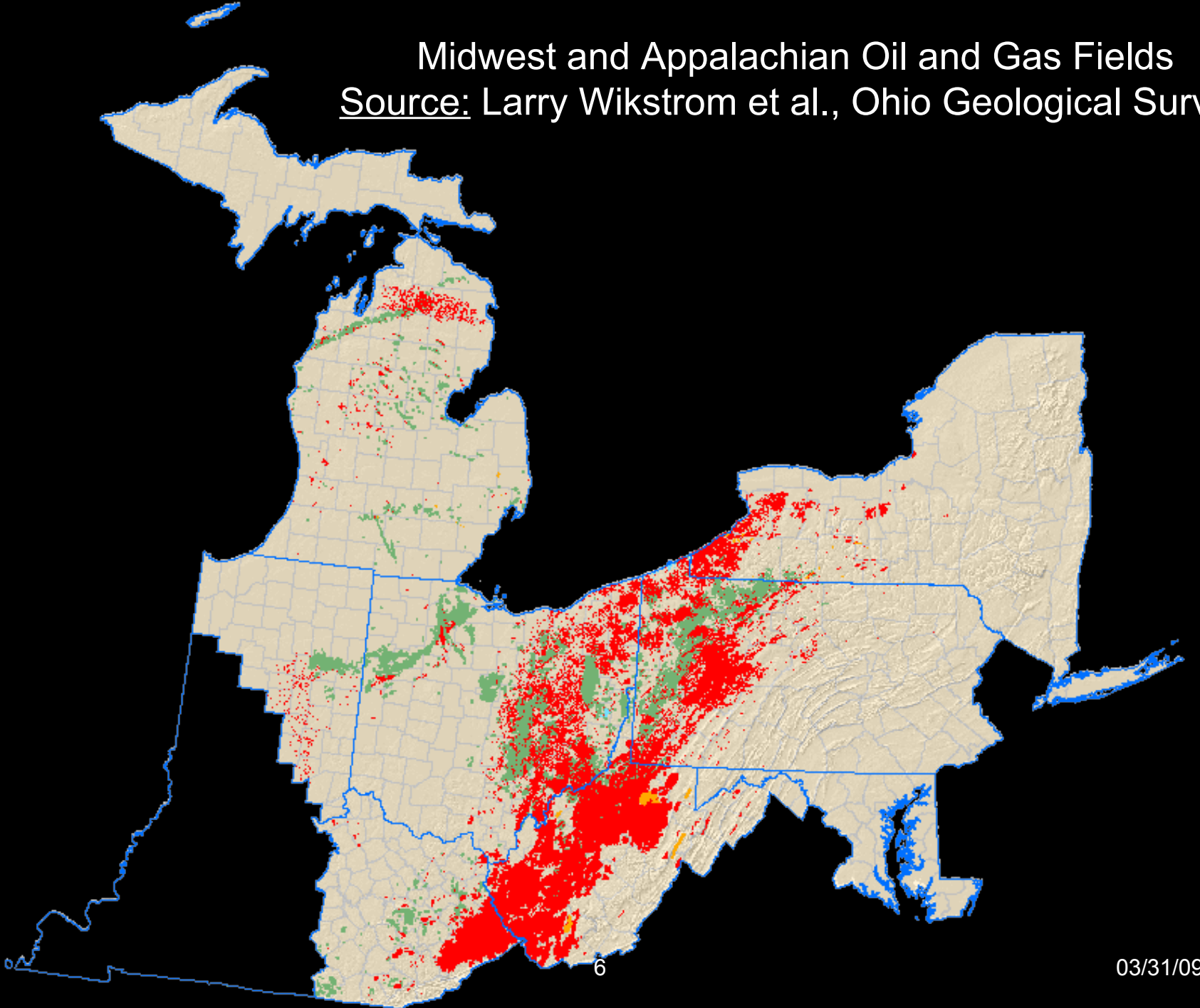
Sustainable Oil Recovery

- **Creating highly-skilled jobs in America**
- **Reducing America's dependence on imported oil by 10%**
- **Reducing America's crude oil imports from nations which may be adverse to American interests by 40%**
- **Reducing America's “dirty” coal-fired electric generation by 2% - 3.5%**
- **Reducing carbon dioxide (CO₂) emissions into the atmosphere by over 10 million metric tons a year**

The State of Domestic Oil

- U.S. produces 5.1 million barrels of oil a day, down 41% from the 1970s.
- Domestic oil fields are declining in production because the U.S. oil industry is the oldest in the world and most fields are decades old.
- The U.S. DOE conducted several studies determining CO₂-EOR to be the most promising method to increase oil recovery.
- 160 billion barrels of “stranded” oil (doubling U.S. production) can be recovered using CO₂-EOR according to studies commissioned by the U.S. government as well as commercial test cases performed by industry.

Midwest and Appalachian Oil and Gas Fields
Source: Larry Wikstrom et al., Ohio Geological Survey



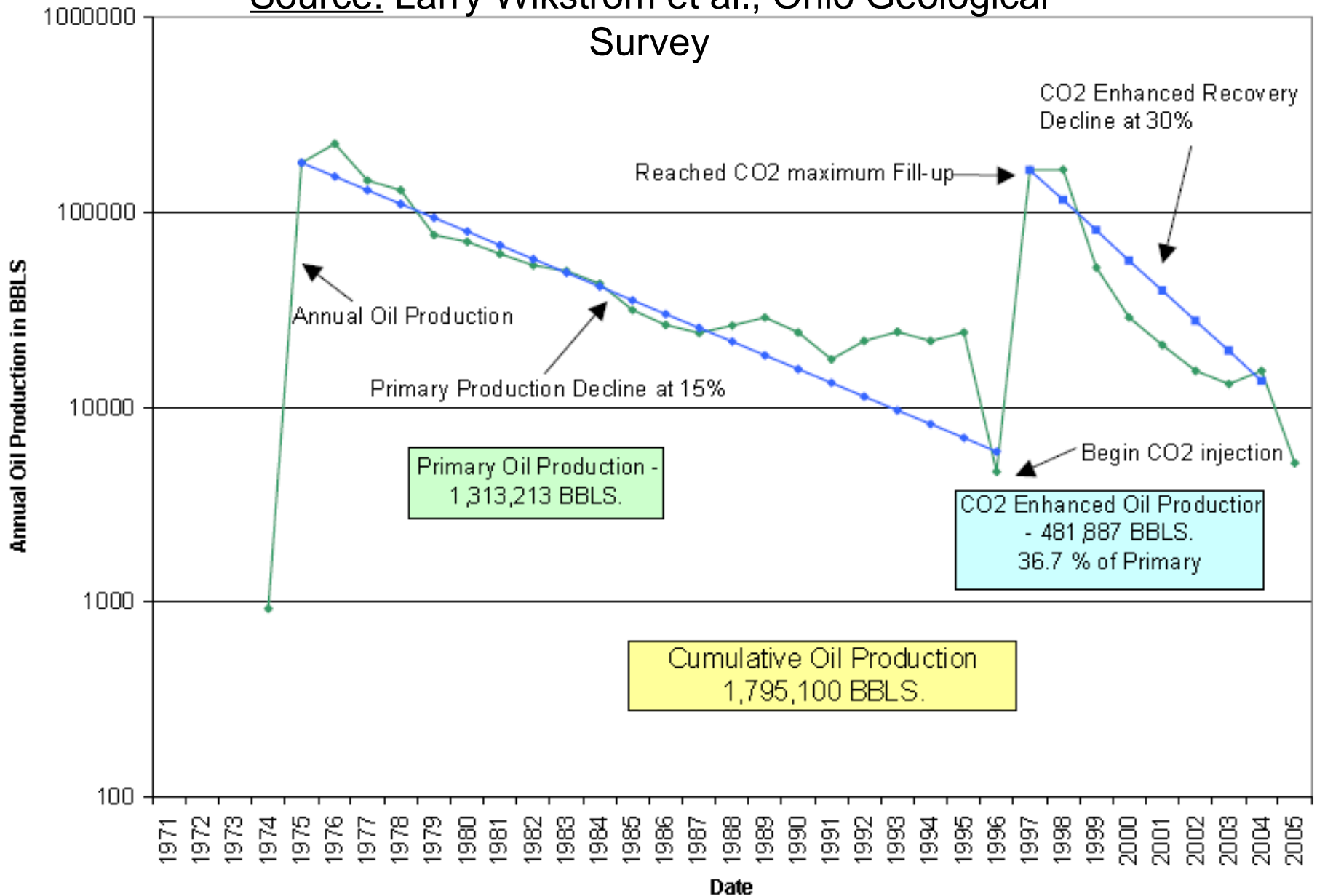
CO₂ Enhances Oil Recovery

Injection of CO₂ has been used since 1972 in the United States for significantly increasing oil production in an economic and environmentally-friendly manner.

Dover 33 Niagaran Reef Field, Otsego County, Michigan

Enhanced Recovery with CO2 (through June, 2005)

Source: Larry Wikstrom et al., Ohio Geological



Domestic oil production obstacles

- **CO₂ is not readily available at or near most oil fields in the U.S. and requires pipelines to transport – which often is not geographically feasible.**
- **Costs associated with bringing CO₂ to oil fields are extremely high and usually uneconomical, especially for small to medium sized fields.**
- **Revenues from CO₂-based EOR take long to realize and require very large, long-term investments.**

Driver Gas Generation System (“DGGS”)

An innovative, portable system for generating CO₂ and hydrogen from coal and/or biomass, directly at the oil field, allowing for cost-effective CO₂-EOR, with an immediate additional revenue stream from clean electricity generation

**~ Unique ~ Patented ~ First to Market ~
~ Solving Market Needs ~**

Benefits of the *DGGS*

- Portable CO₂ production at the oil field – overcoming any geographic and economic constraints
- CO₂ sequestration costs well below industry defined “economically viable limits”
- Converting byproduct hydrogen into clean energy as immediate income stream generator
- Reduction in emissions of CO₂

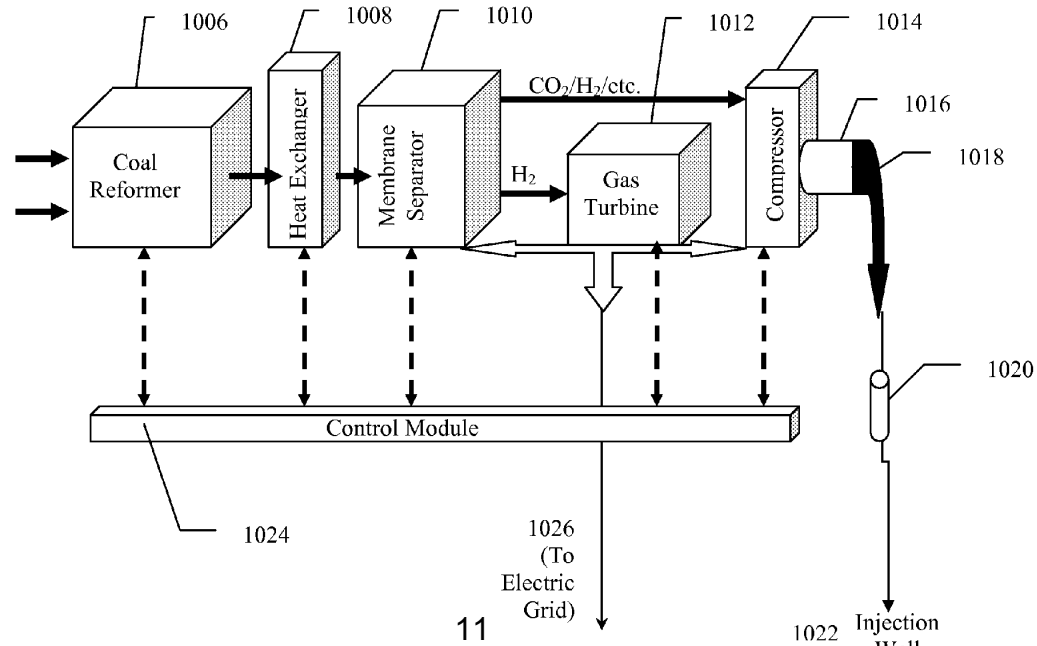
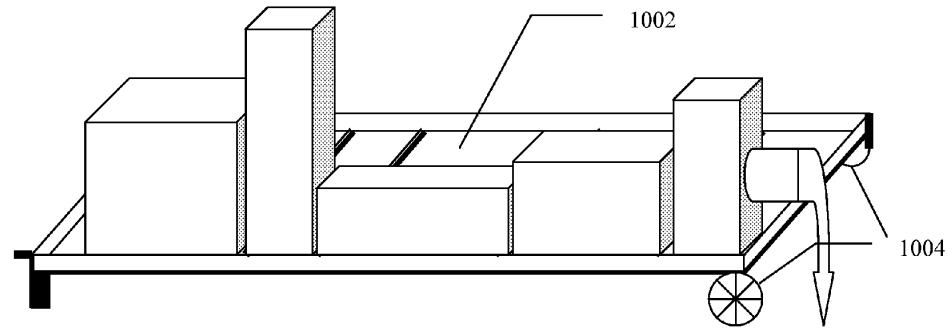
The DGGS Explained

- A mobile, miniaturized, portable, and modular coal/ biomass processing system
- Reforms coal and/or biomass into carbon dioxide and hydrogen at the oil field:



- Carbon dioxide (CO₂) is used to extract the otherwise inaccessible oil
- Hydrogen (H₂) is consumed on-site to produce clean electricity

“EOR on the back of a truck”



Environmental Benefits

- Reduction of CO₂ emissions into the atmosphere
- Reductions of other harmful emissions from “dirty” coal-fired electricity generation
- Coal and biomass are available nearly everywhere in the United States at low cost
- No CO₂ transportation infrastructures that are detrimental to the environment are necessary

America's Green Oil™

- **America's Green Oil™: The amount of carbon sequestered in the Pioneer process is equal to or greater than the amount of carbon in the oil recovered.** Thus, the oil produced is truly “green,” since it has been fully “paid for” by the carbon sequestered to get it.
- **America's Green Electricity™:** Using the hydrogen produced from the coal and/or biomass, the Pioneer Energy process produces electricity without emitting CO₂ into the environment.

America's Green Electricity™

- A typical small oil producer can use the Pioneer Energy system to generate one million cubic feet of CO₂ a day and 1.4 million cubic feet of hydrogen (equivalent to 2 MW of electricity). Larger systems are also available.
- CO₂ is sequestered underground in the field, generating about 100 extra barrels of America's Green Oil™ per day, while the hydrogen is consumed on site to generate approximately 2 MW of emissions-free, America's Green Electricity™.
- A typical small producer can make an extra \$1.8m/year from oil at an oil price of \$50/bbl.

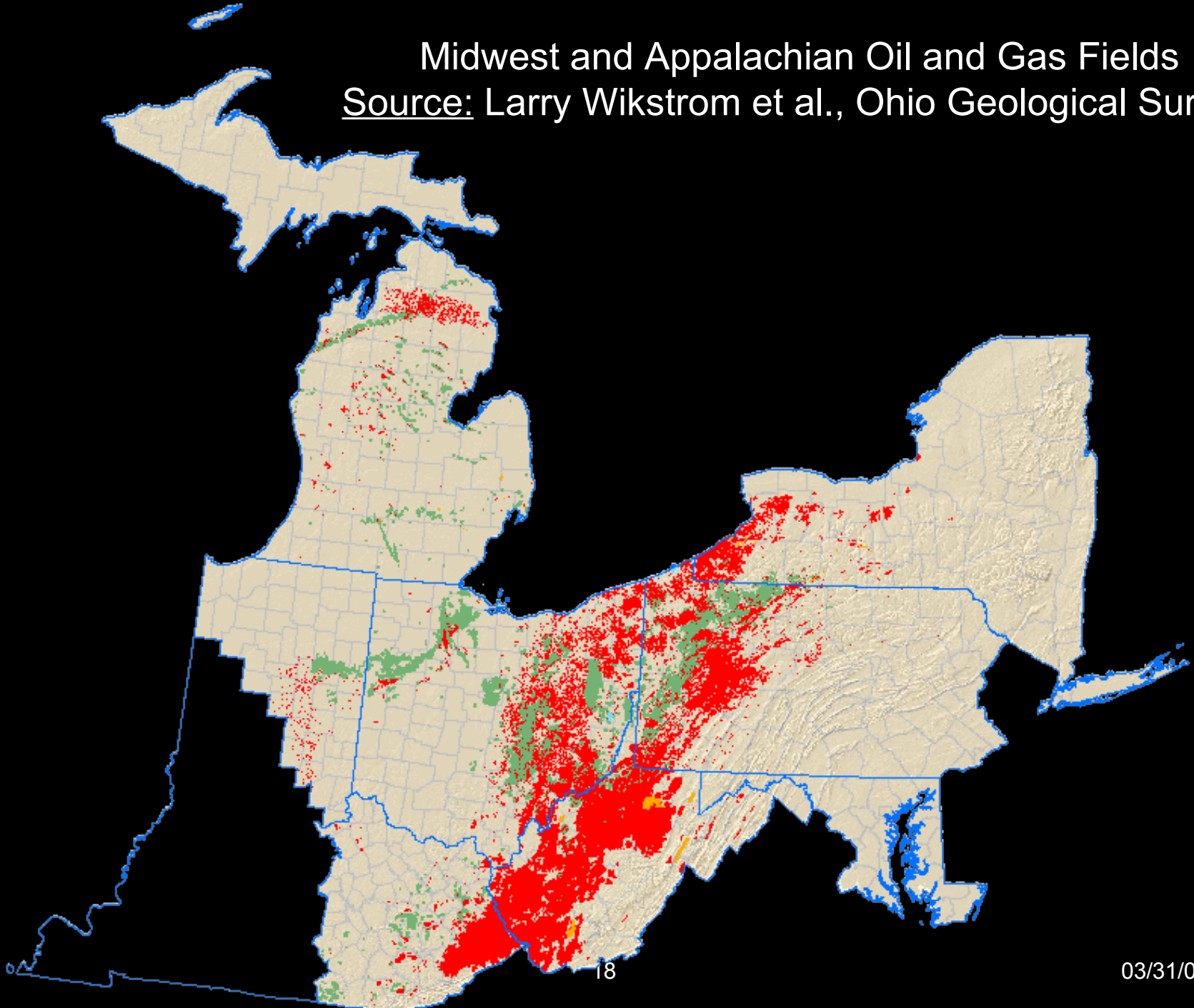
“Drawbacks to Conventional EOR in Midwest/Appalachia”

Source: Larry Wikstrom et al, Ohio Geological Survey

- Many operators/leaseholders per field
- Relatively small operating companies
- Large numbers of old wells in some fields
- Inexperienced work force – need to import/gain secondary/enhanced recovery experience
- Variety of reservoirs and range of heterogeneity and permeability

Midwest and Appalachian Oil and Gas Fields

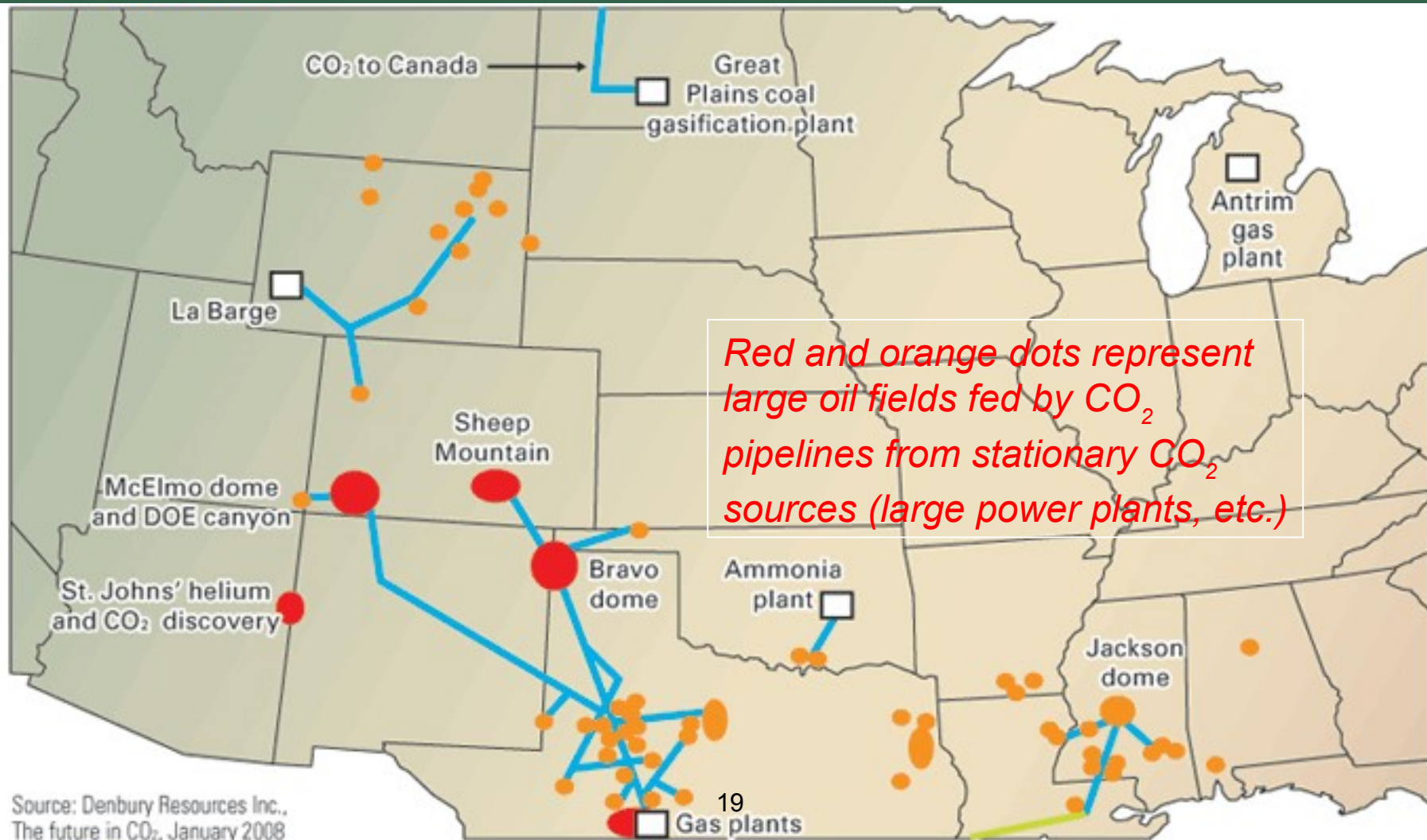
Source: Larry Wikstrom et al., Ohio Geological Survey



Current CO₂ Sources and Pipelines for EOR: 100 U.S. CO₂ EOR projects underway

Note most of the U.S. not reachable by pipelines

Source: Larry Wikstrom et al., Ohio Geological Survey



Oil & Gas Journal's 2008 Survey shows CO₂-EOR is 250,000 bbls/day of U.S. oil production and rising

Source: Larry Wikstrom et al., Ohio Geological Survey

US EOR PRODUCTION

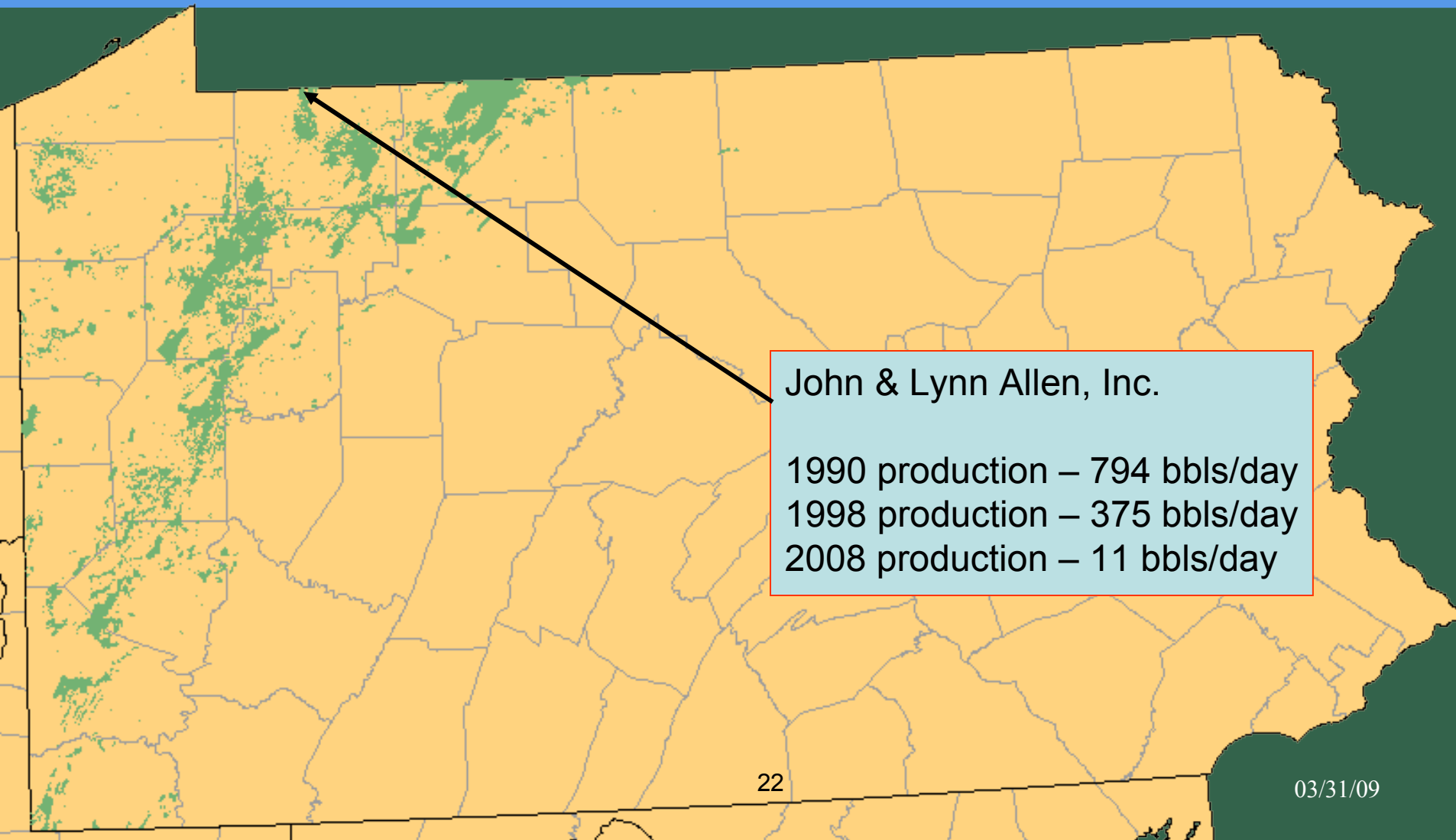
Table 1

	1986	1988	1990	1992	1994	1996	1998	2000	2002	2004	2006	2008
Thermal												
Steam	468,692	455,484	444,137	454,009	415,801	419,349	439,010	417,675	365,717	340,253	286,668	273,947
Cumbustion in situ	10,272	6,525	6,090	4,702	2,520	4,485	4,760	2,781	2,384	1,901	13,260	17,025
Hot water	705	2,896	3,985	1,980	250	250	2,200	306	3,360	3,360	4,370	1,776
Total thermal	479,669	464,905	454,212	460,691	418,571	424,084	445,970	417,675	371,461	345,514	304,298	292,748
Chemical												
Micellar-polymer	1,403	1,509	617	254	64	0	0	0				
Polymer	15,313	20,992	11,219	1,940	1,828	139	139	1,598				
Caustic/alkaline	185											
Surfactant			20					60	60	60		
Total chemical	16,901	22,501	11,856	2,194	1,892	139	139	1,658	60	60	0	0
Gas												
Hydrocarbon miscible/ immiscible	33,767	25,935	55,386	113,072	99,693	96,263	102,053	124,500	95,300	97,300	95,800	81,000
CO ₂ miscible	28,440	64,192	95,591	144,973	161,486	170,715	179,024	189,493	187,410	205,775	235,344	240,313
CO ₂ immiscible	1,349	420	95	95				66	66	102	2,698	9,350
Nitrogen	18,510	19,050	22,260	22,580	23,050	28,017	28,117	14,700	14,700	14,700	14,700	19,700
Flue gas (mis- cible and immiscible)	26,150	21,400	17,300	11,000	—	—	—	—	—	—	—	—
Other				6,300	4,400	4,350	4,350	—				
Total gas	108,216	130,997	190,632	298,020	288,629	299,345	313,544	328,759	297,476	317,877	348,542	350,363
Other												
Carbonated waterflood												
Microbial				2	2							
Total other			2	2								
Grand total	604,786	618,403	656,700	760,907	709,094	723,568	759,653	748,092	668,997	663,451	652,840	643,111

Typical Appalachian Small Producer

- **John & Lynn Allen, Inc.**
- **Location: Warren County (Sugar Grove, PA)**
- **John Allen (President) in the business since 1982**
- **Production down from a peak of 794 bbls/day in 1990 to only 11 bbls/day in 2008**

Typical Appalachian Small Producer



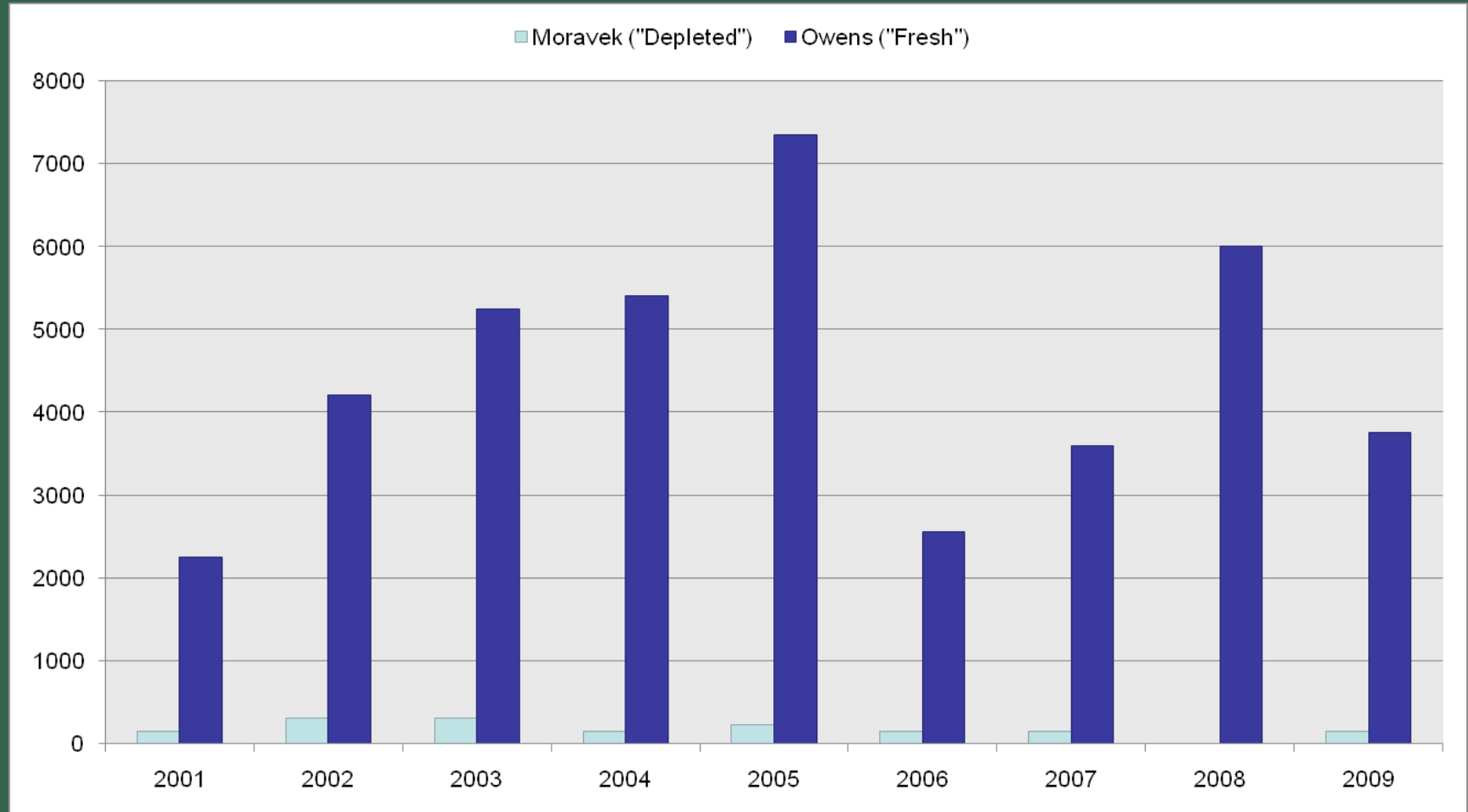
John Allen Inc. Field Characteristics

- **Location of field: Warren County, Pennsylvania**
- **Reservoir Depth: varies – 863' in valley; 1033' in hill**
- **Number of producing wells: 49**
- **Number of low producing wells: 25**
- **Number of non-producing wells: 28**
- **Average distance between wells: 350 ft.**
- **Type of oil in reservoir: Light Crude**
- **Peak production 20 years ago: 794 bbls/day in 1990**
- **Peak production 10 years ago: 375 bbls/day in 1998**
- **Current production: 11 bbls/day (2008)**

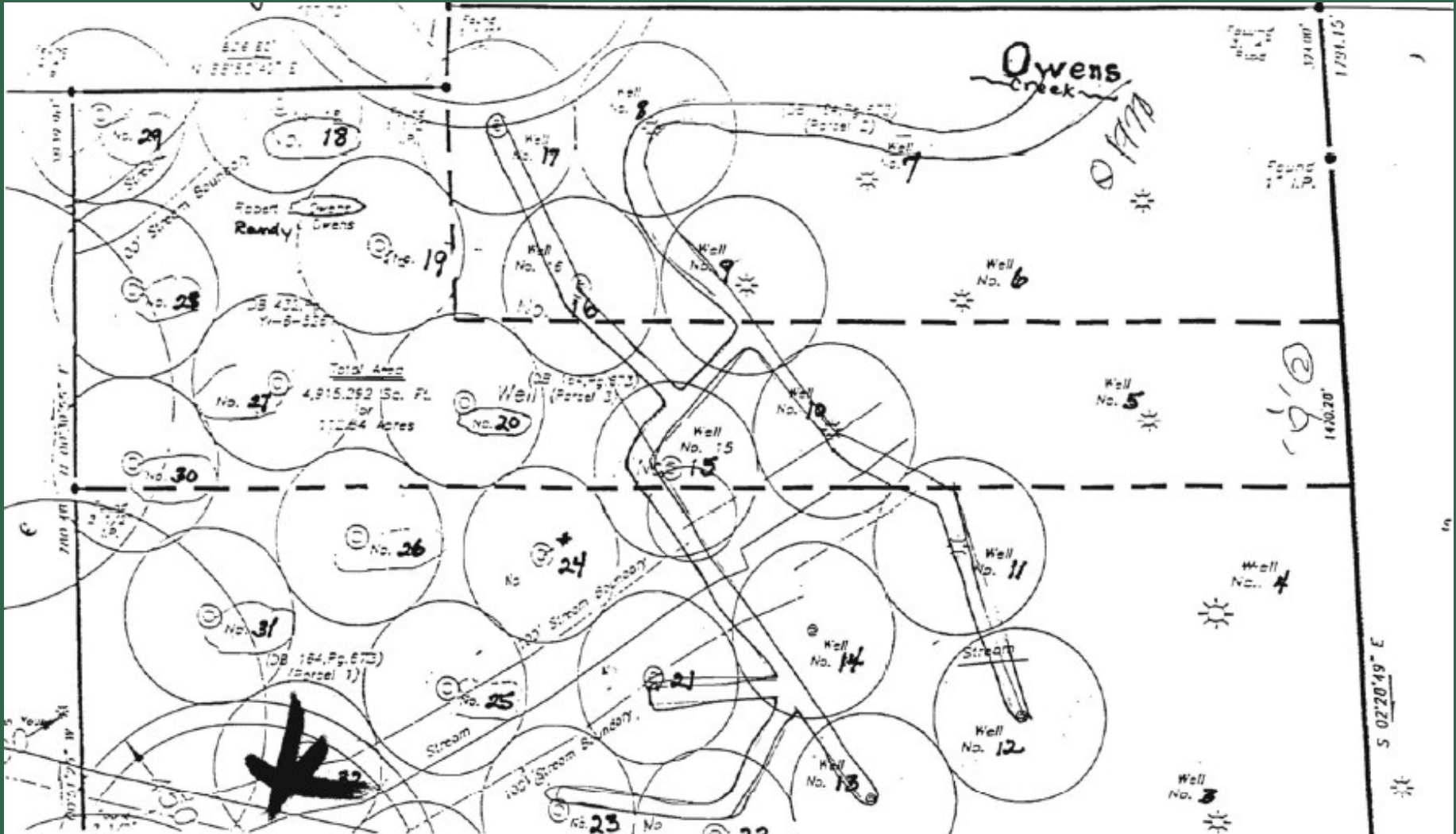
Source: John & Lynn Allen, Inc.

Representative Depleted vs. Fresh Fields Operated by John Allen, Inc.

Barrels of Oil Produced Per Year



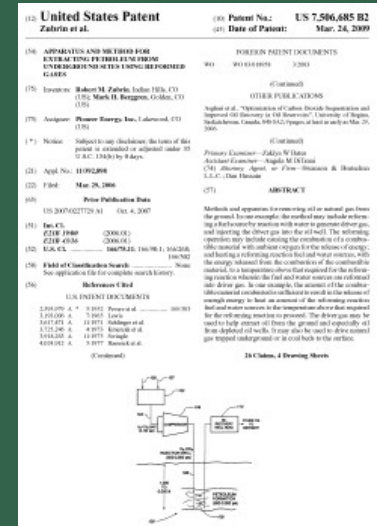
Maps of John & Lynn Allen, Inc.



Intellectual Property

➤ Pioneer Energy has one issued U.S. Patent, eight pending U.S. patents, one international patent application, and one pending Canadian patent, encompassing over 200 claims.

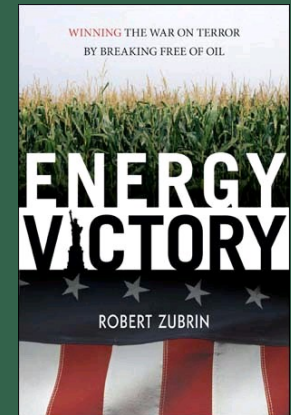
➤ U.S. Patent No. 7,506,685 issued on March 24, 2009 (filed on March 29, 2006), “Apparatus and method for extracting petroleum from underground sites using reformed gases.” Claims are primarily directed to reformation of methanol and ethanol. 26 claims issued.



Dr. Robert Zubrin



- **Best-selling author of *Energy Victory***
- **An aerospace, nuclear and chemical engineer for decades**
- **45 R&D projects for NASA, the DOD, the DOE, and other government agencies, with high success track record**
- **Leads Pioneer Energy with an agile development team, working with him for over 12 years**
- ***Taking space-age technology into the commercial sector with a vision for a safer America and a greener world***





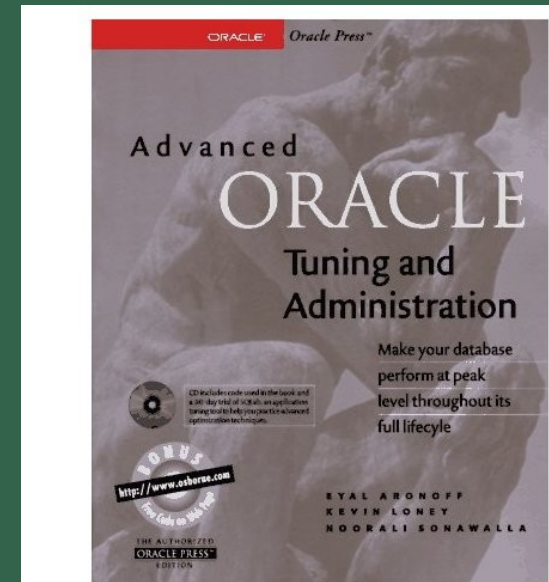
Dan Hussain

- **Serial entrepreneur; Co-Founder and former President of KD Secure, an intelligent safety and security company**
- **Leads Pioneer Energy's intellectual property strategy and business development operations**
- **Inventor on three issued U.S. and International patents**
- **Graduate of MIT and the NASA Academy**
- **Studied intellectual property law at Harvard Law School, and pursuing a Ph.D. in Civil & Environmental Engineering at Carnegie Mellon University**
- **Siemens Westinghouse National Science Award**



Eyal Aronoff

- Founding investor of Pioneer Energy since 2008
- Founding CTO of Quest Software
- Public speaker on database management principles
- Has invested \$2M into Pioneer Energy



References

- Department of Energy (DOE): *“Undeveloped domestic oil resources: The foundation for increasing oil production and a viable domestic oil industry,”* (2006).
- Larry Wickstrom et al.: *“Enhanced Oil Recovery Potential and CO₂ Sequestration in the Michigan and Northern Appalachian Basins Region,”* American Association of Petroleum Geologists meeting, (2008).
- DOE: *“Evaluating the potential for ‘Game Changer’ improvements in oil recovery efficiency,”* (2006).
- DOE: *“New CO₂ Enhanced Oil Recovery technology could greatly boost U.S. oil supplies,”* (2006).
- DOE: *“Project injects CO₂ to boost oil recovery; also captures emissions. DOE-funded watershed project in Kansas demonstrates new technology,”* (2006).
- Bob Moen, The Associated Press: *“CO₂ is squeezing more oil out of Wyoming field.”* Deseret News, Aug. 5, 2005.

“New drilling and exploration might be more romantic than secondary work but often not as profitable.”

E. V. O'Rourke, 1940, AAPG Bulletin,
Recent Secondary Recovery of Oil in Ohio