

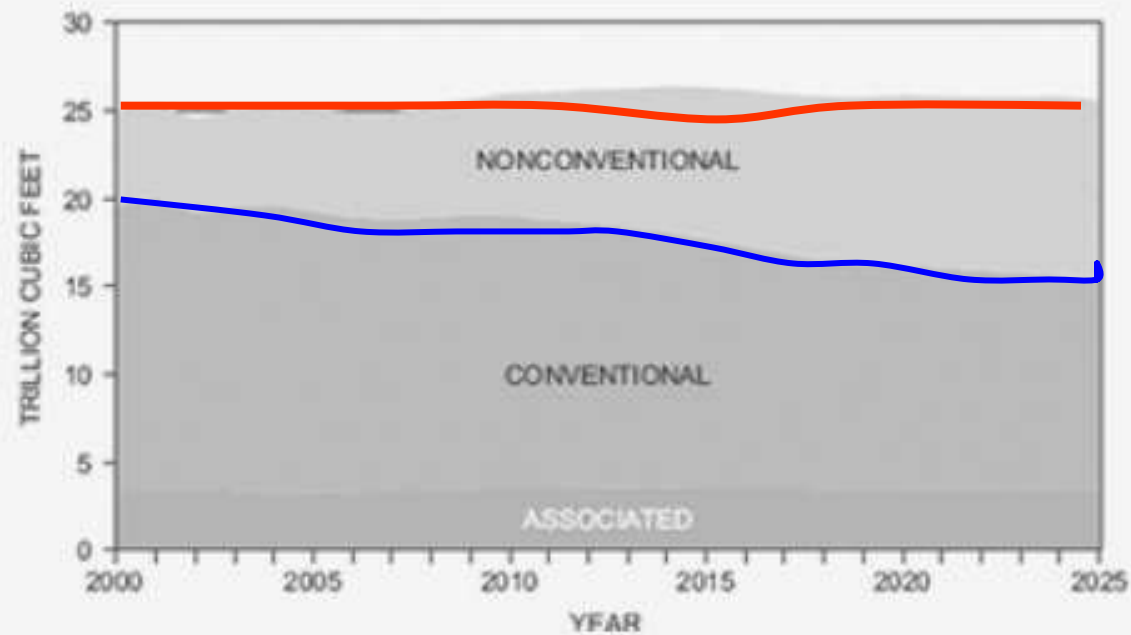
**“A CRYSTAL BALL VIEW OF THE ENERGY INDUSTRY
IN 2025:
HOW ENVIRONMENTALISTS HOLD THE KEY TO
AMERICA’S FUTURE ENERGY SECURITY”**



Dave Burnett
Texas A&M University

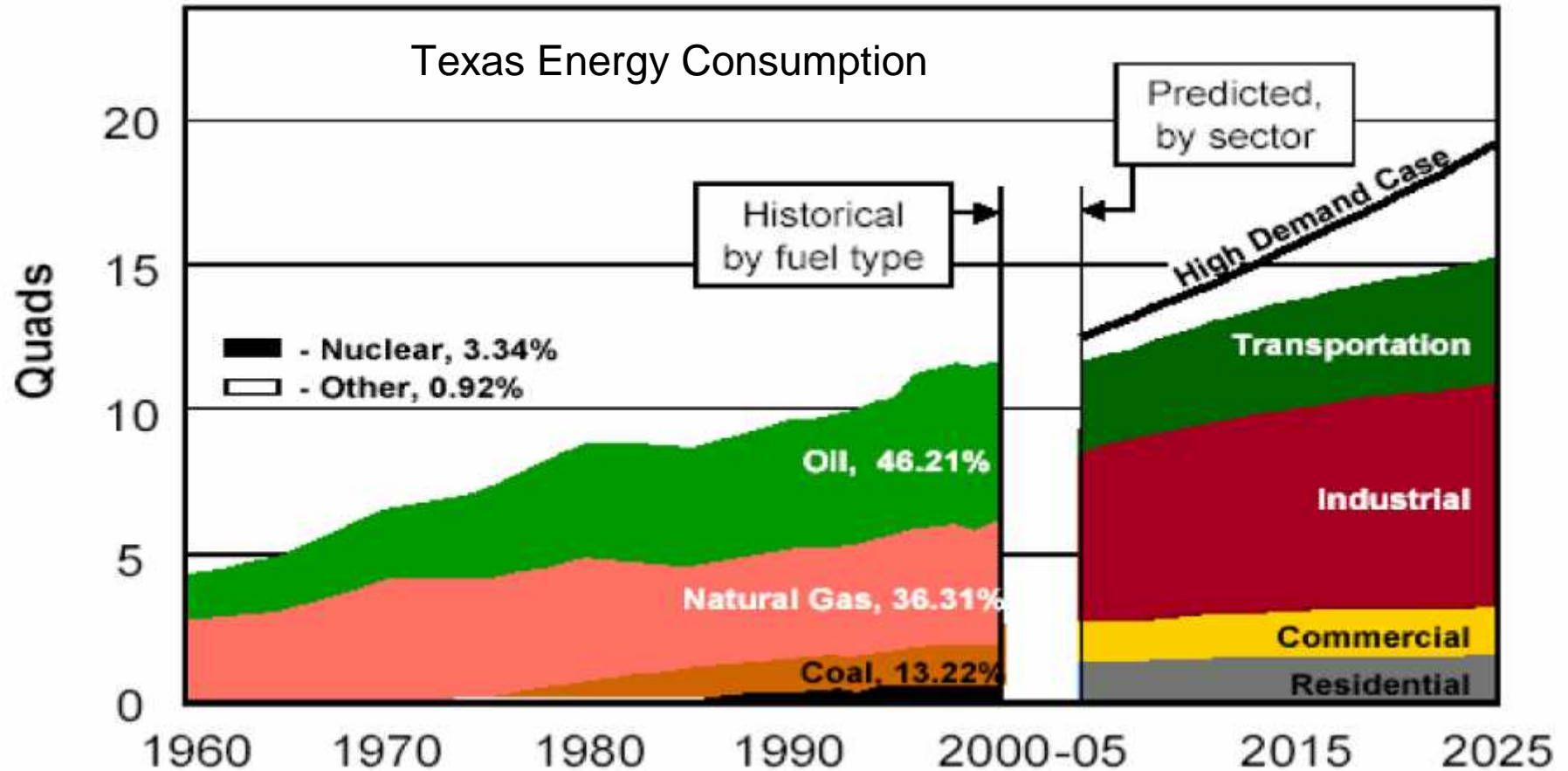
The Need

Future Energy Needs to be Met by Unconventional Resources



U.S. Lower 48 and Non-Arctic Canadian Gas Production by Type

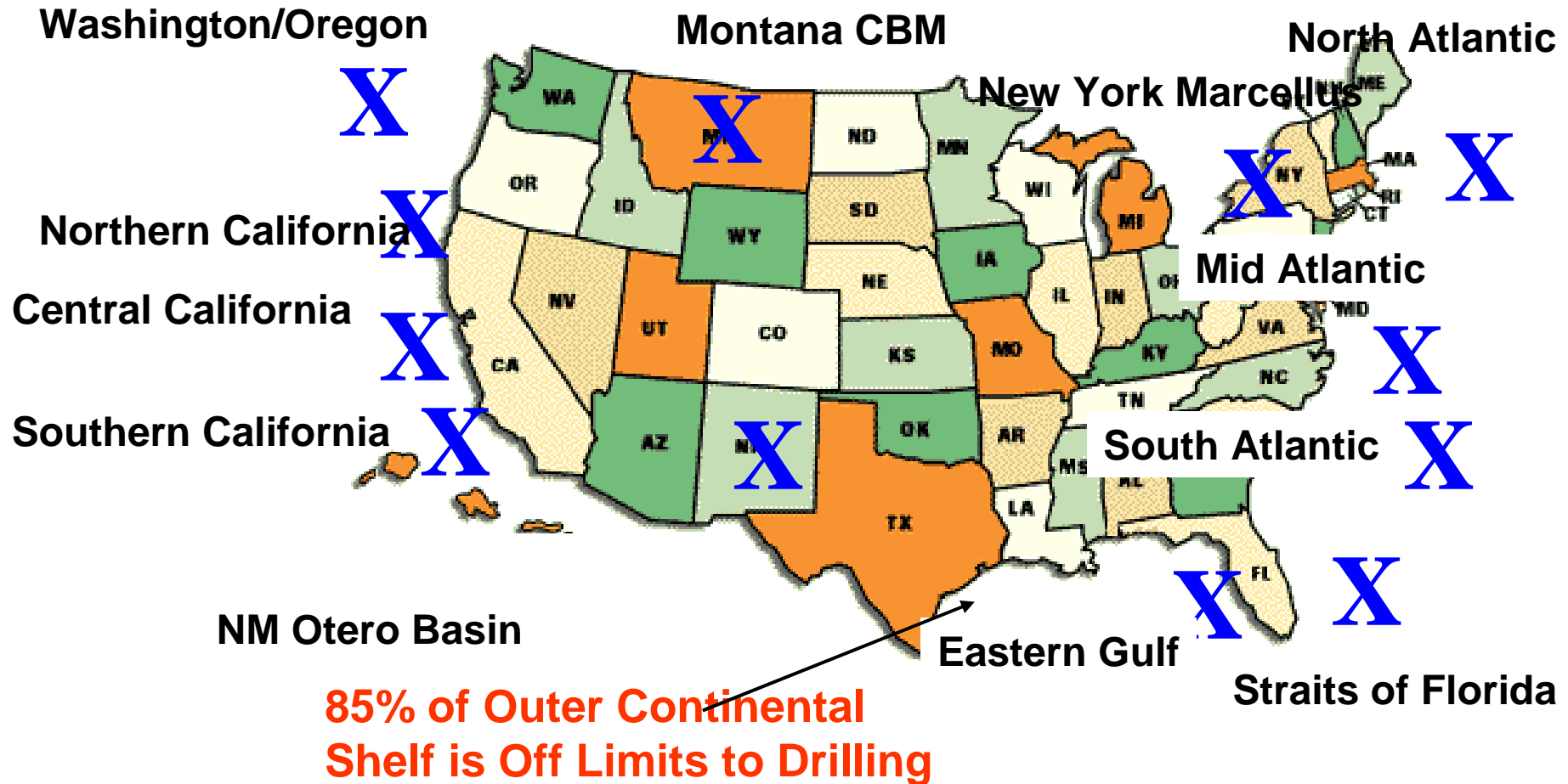
Fact: Fossil Fuels Are Our Near Term Future



For more Info see:

<http://www.rrc.state.tx.us/tepc/finalenergyplan.pdf>

Fact: Regulatory Barriers Place Natural Gas Resources off Limits



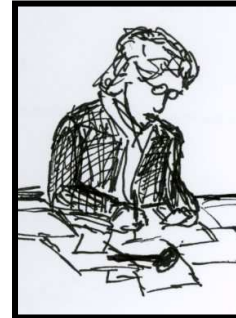
The “Outcome” Equation Defines the Opportunity for Energy Development---



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The Outcome

Environmental Issues

Economic Decisions

Stakeholder (Public) Decisioning

When the “Outcome” Equation Favors No Drilling, What is the Key Factor?--



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Environmental Issues

The Outcome

Economic Decisions

Stakeholder (Public) Decisioning

Problem When Societal Issues Dominate the Outcome Equation



Opposition to Development in the Barnett Shale

LOCAL NEWS

Developer protests Devon well site

By Joy E. Cressler/Staff Writer
Mar 30, 2006, 09:01

[Email this article](#)
[Printer friendly page](#)

BURLESON — A local developer objected to a request for a natural gas drilling site at the Burleson City Council's March 9 meeting, saying the well's proximity to his development would interfere with property values in the area.

The council voted unanimously to table a request by Devon Energy Production for a drill site, pushing the final decision until the council receives more information.

Devon is the owner of a gas lease on 260 acres at the southwest corner of Hidden Creek Parkway and the Union Pacific Railroad, according to information presented by Clayton Husband, the city's director of planning and community development.

Devon has applied for gas well permit on the property, which has already been reviewed by the planning and community development department, the engineering department and the fire marshal's office, Husband said.

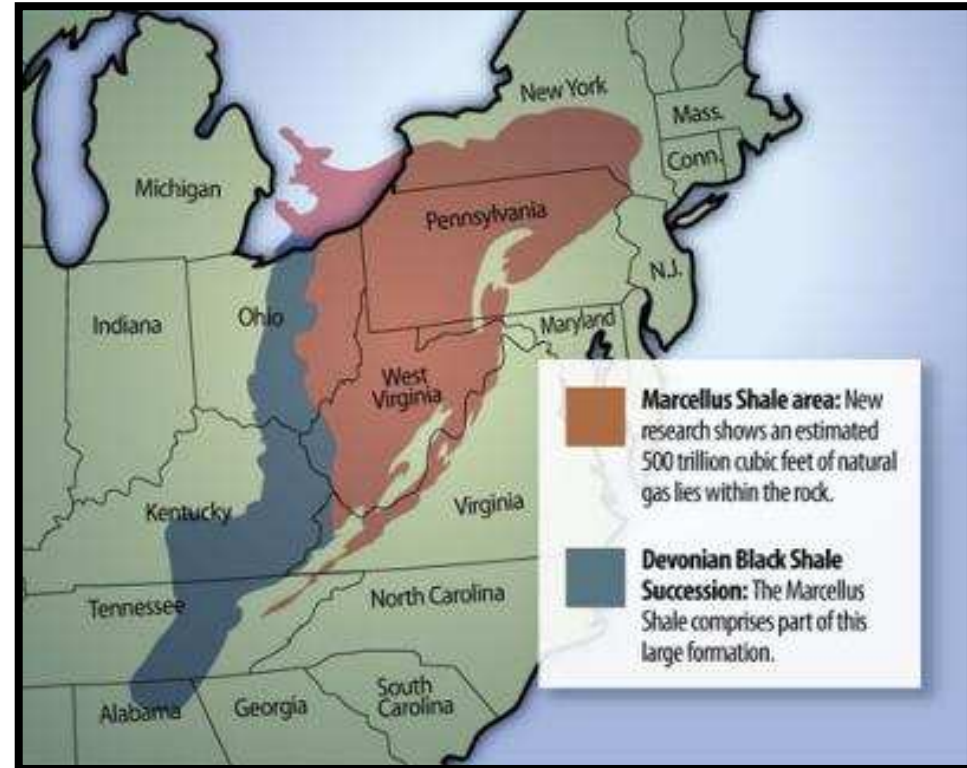
The proposed drill site is a 2-acre area adjacent to the railroad right-of-way in the southeastern portion of the property.



Problem When Environmental Advocacy Outweighs Economic Arguments

Objections to Marcellus Shale Development --50 TCF?

- Penn State and SUNY-Fredonia,-
- original gas in place at 168-516 Tcf
- Recoverable reserves of as much as 50 Tcf, recoverable reserves ~ 1 Bcf per vertical well on 40-acre spacing
- F&D costs of about \$1.00/mcf.
- Horizontal wells are estimated at about 2.5 Bcf on 80-acre spacing at costs less \$1.00/mcf.
- Shales are easily accessible, susceptible to new techniques in fracturing and completing, and cover an area several times the size of the Barnett shale.
- ~\$200 billion gas resources all within 500 miles of New York and Washington D.C.
- **But What About Water, Access, Emissions?**



The Problem When Environmental Advocacy Outvotes Economic Reality

Opposition to Offshore Oil & Gas Development- California

“The only way out of this crisis is for Californians to realize if they want to raise the revenues to pay for all these social programs, they have \$8 billion of revenues they can tap by developing their own resources right offshore.

At some point policy makers are going to have to decide in California - do they want all these social programs and will they oppose drilling to get the money to pay for them.”

For more Info see:

<http://newsbusters.org/blogs/jeff-poor/2009/07/22/nbc-news-california-offshore-drilling>

<http://www.environmentcalifornia.org/oceans2/stop-offshore-drilling>

The Problem When Societal Decisions Outweigh Environmental and Economic Factors

Sacramento Municipal Utility customer *Raging Wire* operates a 216,000-square-foot data center in Sacramento center has about 6,000 tons of chiller capacity. The data center provides service to that Northern California area.

6,000 tons of HVAC chiller = ~ 72 MM BTU = >25,000 Hp = 6 diesel engines



For more Info see:

<http://www.reuters.com/article/pressRelease/idUS111466+24-Mar-2009+MW20090324>

Problem When Societal Decisions Outweigh Environmental and Economic Factors



Otero Mesa Landscape

Otero Mesa encompasses 1.2 million acres of Chihuahuan Desert grassland between the Hueco and Guadalupe Mountains.

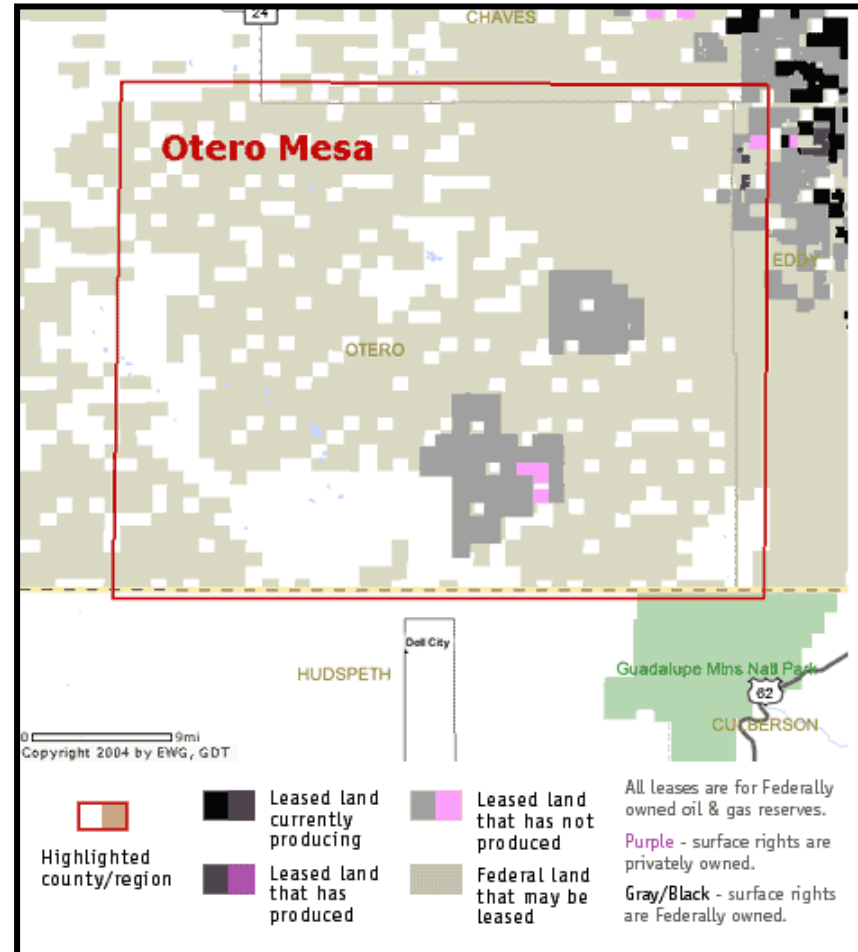
Conservative estimates show that there is enough fresh potable water underlying Otero Mesa to serve a community of over 500,000 people for over fifty years. (25% of the population)

Natural gas benefits estimated to be more than \$800 million over 20 year span (>20% of total NM revenue from federal lands)

For more Info see:

<http://wilderness.org/files/TWTD-NM-Otero.pdf>

http://www.nmstatelands.org/uploads/News/2004/2004_0205Otero.pdf



Problem When Economic Decisions Outweigh Environmental

Opposition to Development of Powder River Basin

CBM



•“The disposal of 1.4 trillion gallons of water over the project’s life – over 4 million acre feet; enough water for 16 million people, or all the residents of Wyoming for 30 years.”

–<http://www.wserc.org/alertsandevents.html>

The Need to Find Optimal System

Engineering Designs for Low Impact Drilling and Fracturing

- Conceptual Design for Sensitive Ecosystems
- Low-Impact Logistical Support
- Small Footprint Drilling Rig
- Disappearing Roads
- NOx Air Emissions Studies
- Reduced Fracturing Footprints
- Measuring the Effectiveness
 - The Human Dimension: Societal Acceptance
 - The EFD Scorecard

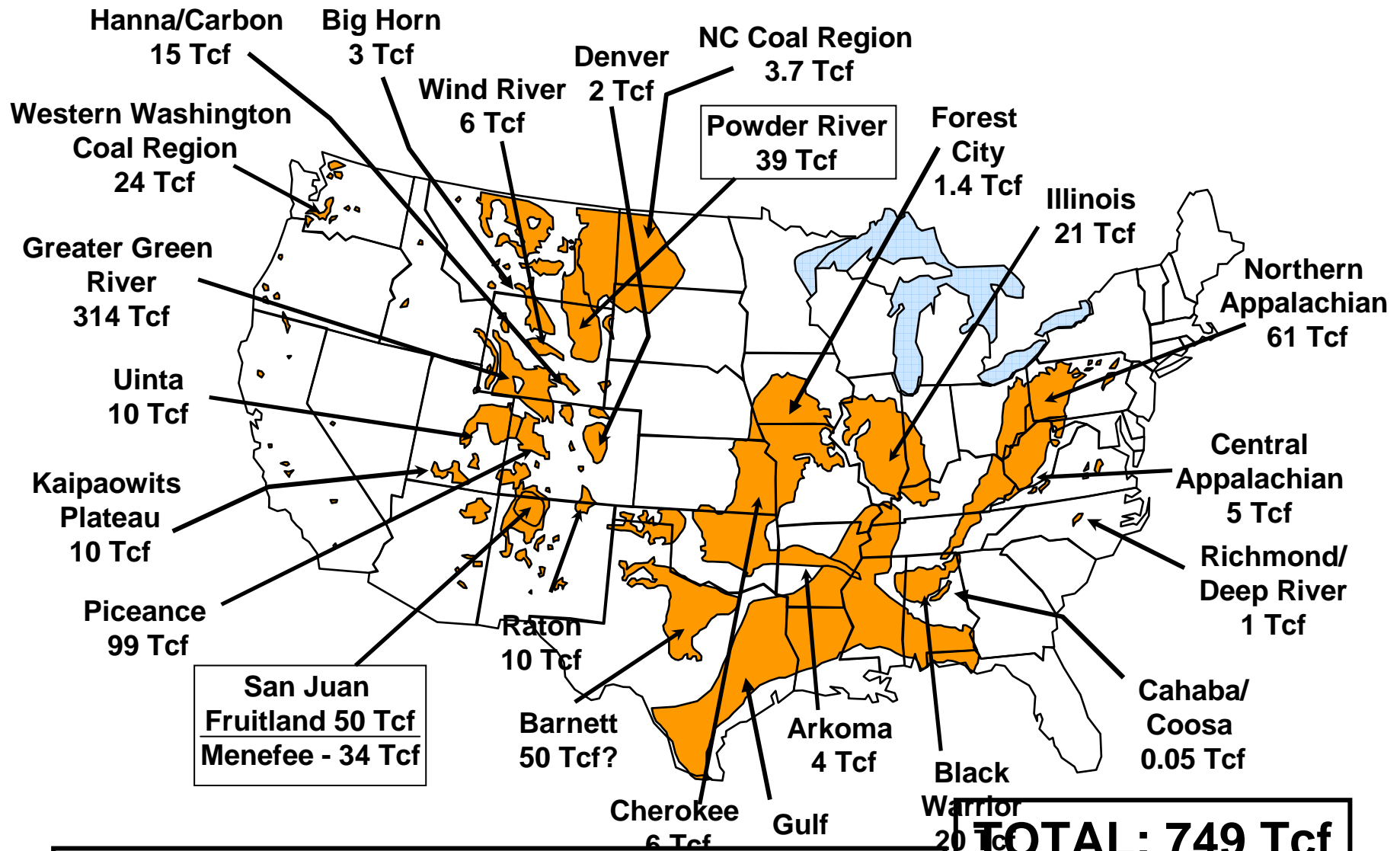


How Does the Industry Answer These Arguments Against Development?

- **(1)** Produce the gas reserves cleanly and efficiently,
- **(2)** reduce – or eliminate the environmental impact of drilling, completion, and production operations, and
- **(3)** provide the public and the policy makers accurate information so they can make intelligent choices.

Accurate Information!

Unconventional Resources



39% Increase in Reserves 2008- 2009

U.S. has 100 Years of Resources in Unconventional Petroleum Resources



1908 Ford Model T



2008 Ford Focus



A 2108 Ford?

Where will technology lead us in 100 years?

Where will Battery Technology Be in 100 years?



1908 Exide Lead Acid



2008 100 Hp NiMH



2108?

Assessing Societal Issues



SPE 115917

Public Perception of the Natural Gas Industry: Insights From Two Barnett Shale Counties

G.L. Theodori, Sam Houston State University

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Abstract

Data collected in a general population survey from a random sample of individuals in two counties located in the Barnett Shale region of Texas were used to empirically explore issues associated with public perception of the natural gas industry. Moderate support was found for the hypothesis that individuals residing in places with diverse levels of energy development exhibit dissimilar perceptions of the energy industry. Bivariate and multivariate logistic regression analyses indicate that residents of the county where the natural gas industry is more mature (Wise County) exhibit somewhat more negative perceptions of the energy industry than do residents of the county where natural gas industry is less established (Johnson County). The results also reveal that mineral rights ownership is a relatively strong and consistent factor associated with public perception of the natural gas industry. Possible implications of these findings for the energy industry are proposed, as are suggestions for future research.

For more Info see:

<http://www.spe.org>

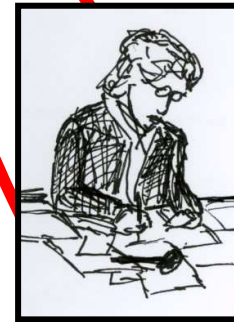
An “Optimal” Drilling System Design Includes----



Economic Decisioning



Environmental Decisioning



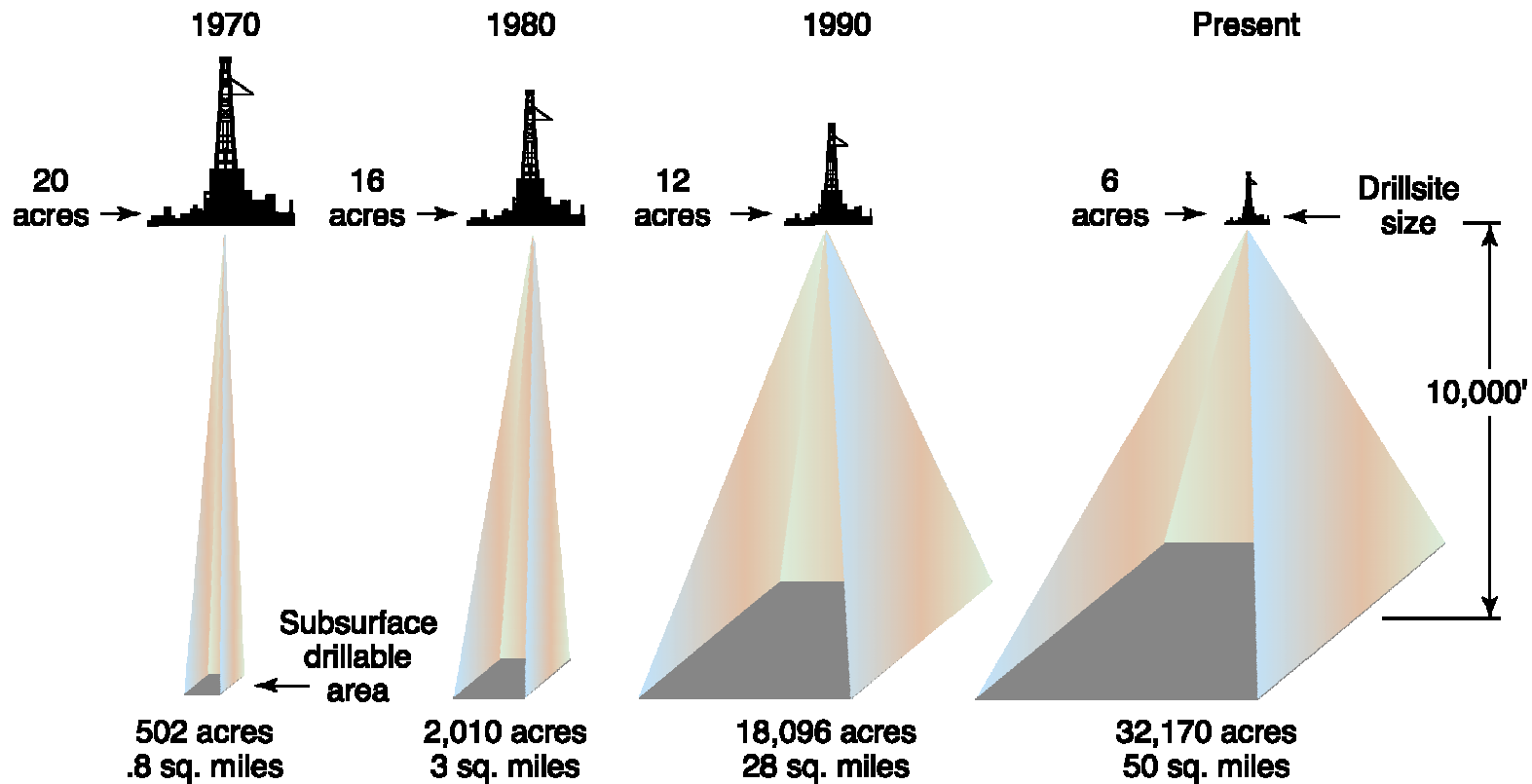
Stakeholder (Public) Decisioning

Well Site Access & Drilling

Access to Environmentally Sensitive Areas

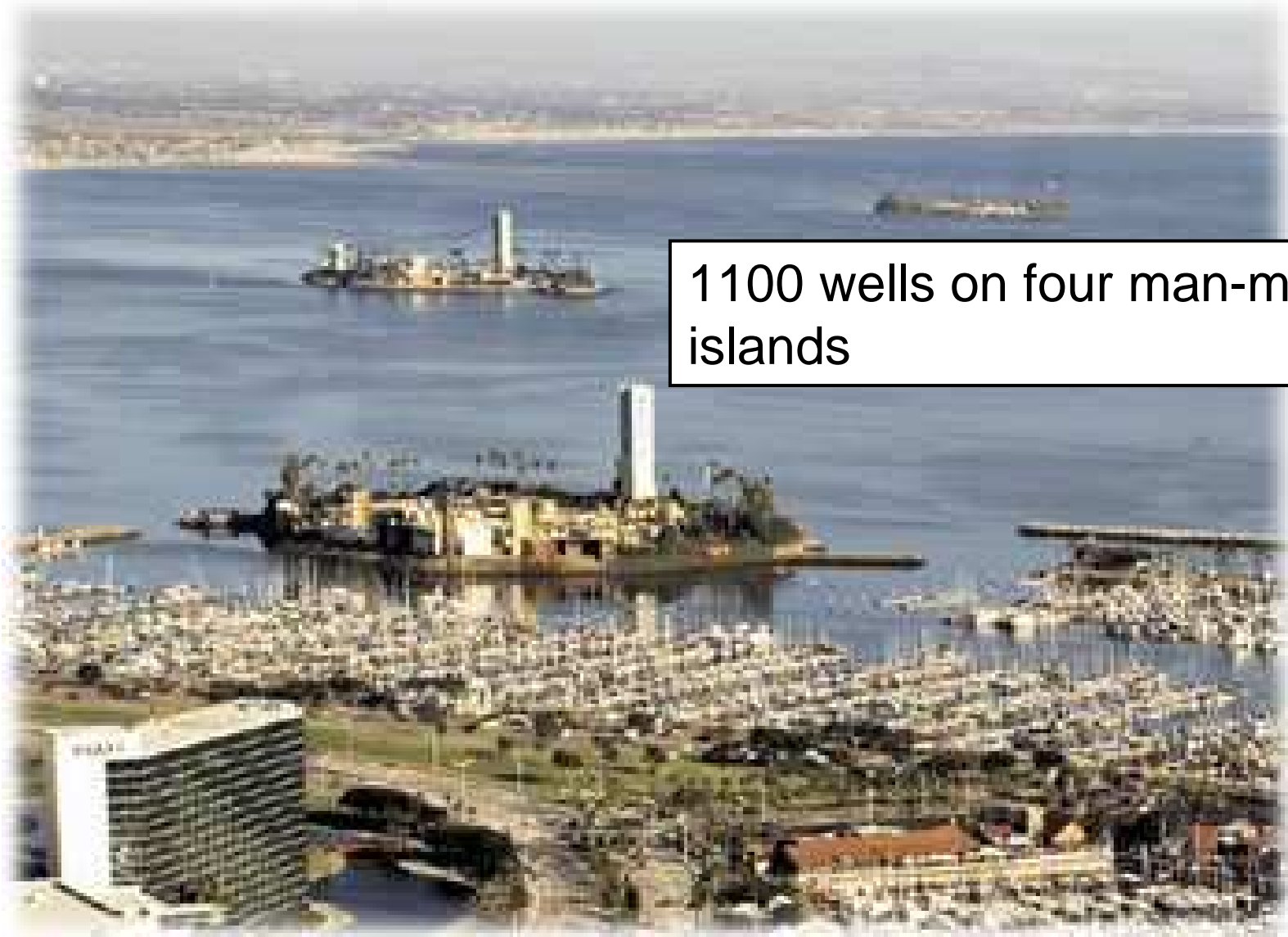
- How to access with minimal impact
- How to measure effect of low-impact practices

Questar using
"Pod" drilling
(1 acre per well.)



Source: William Harrison, Kansas Geological Survey

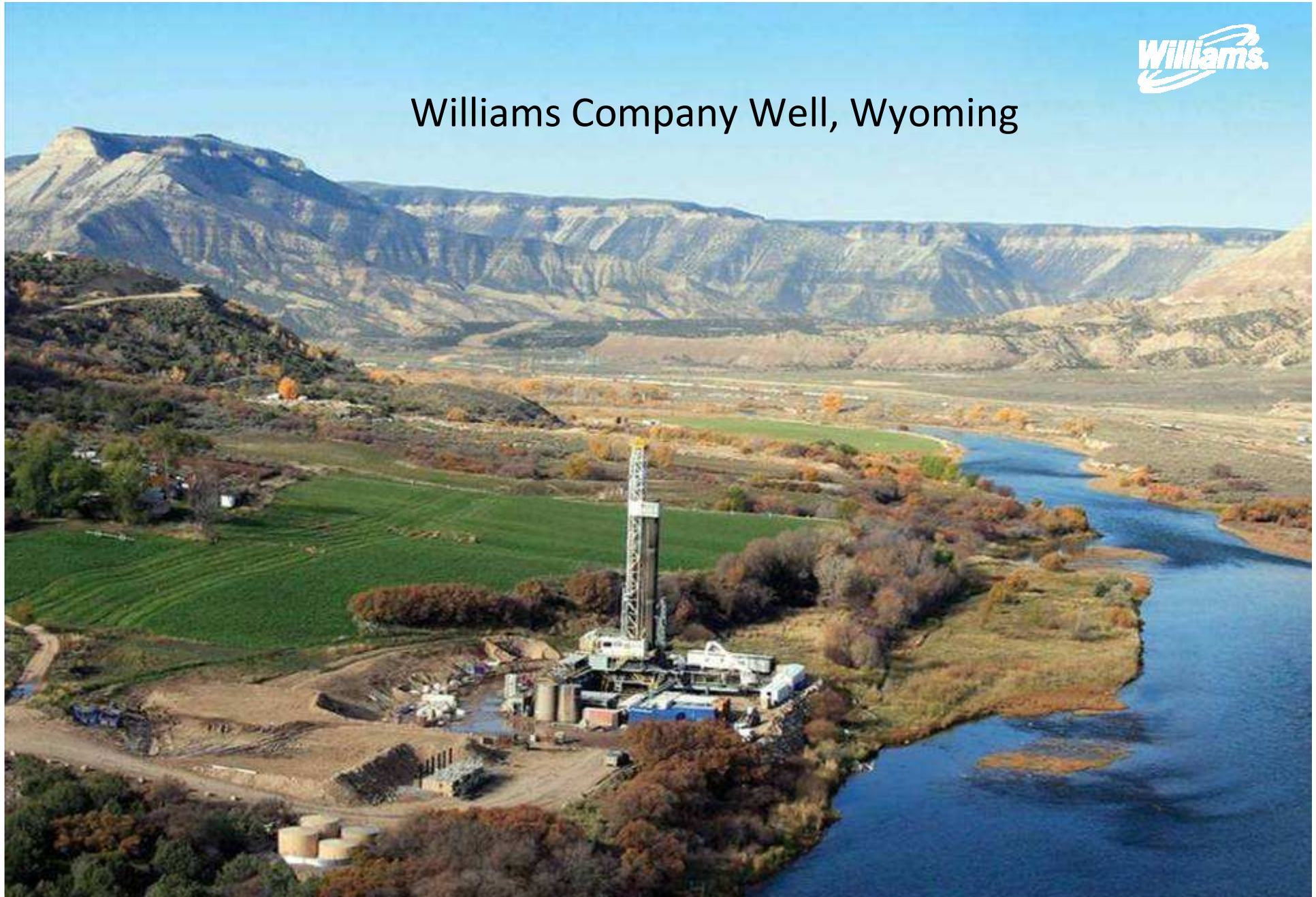
Long Beach Harbor 2009



1100 wells on four man-made islands



Williams Company Well, Wyoming



LA SALLE COUNTY RANCH - A Bird Hunter's Paradise !!!



This ranch has been owned and operated by the same family since 1938. It is covered with typical South Texas brush including mesquite, huisache, black brush, granjeno, and prickly pear.

LaSalle County Eagle Ford
Shale Gas Reserves
More than \$100 Million Value - -

HARC, Texas A&M University Launch Alliance to Promote Low Impact Drilling

NEWS RELEASE

Houston Advanced Research Center

4800 Research Forest Drive

The Woodlands, TX 77381

<http://www.harc.edu>

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David Burnett at 979-845-2274 or Burnett@pe.tamu.edu

(The Woodlands, TX, February, 2009) The Houston Advanced Research Center (HARC) and the Harold Vance Department of Petroleum Engineering at Texas A&M University announce the creation of a major research consortium to promote advanced technology for low-impact oil and gas drilling.

The new University/National Laboratories Alliance, established as part of the Environmentally Friendly Drilling (EFD) Program, will fund and transfer critical new technologies that can accelerate development of domestic reserves in a safe and environmentally-friendly manner.