

Teaching and Research for Our Future Energy Needs

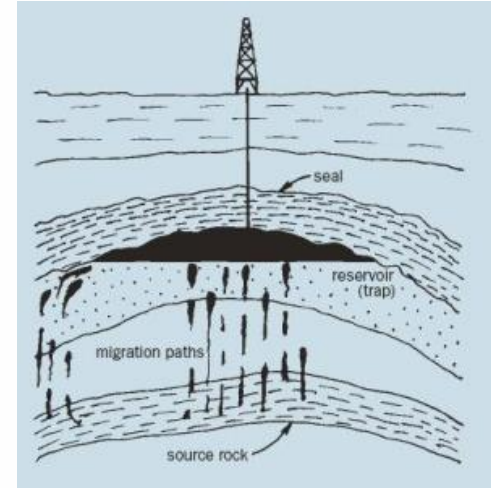
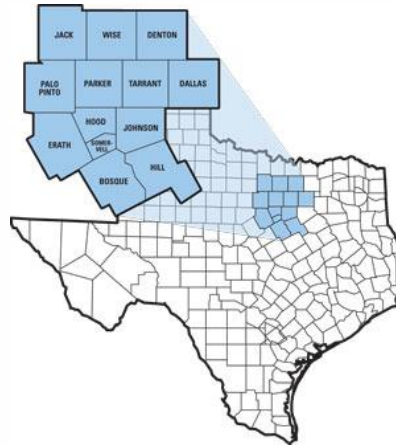
Let's Go Domestic Energy!!

****The Energy Driver's Seat****

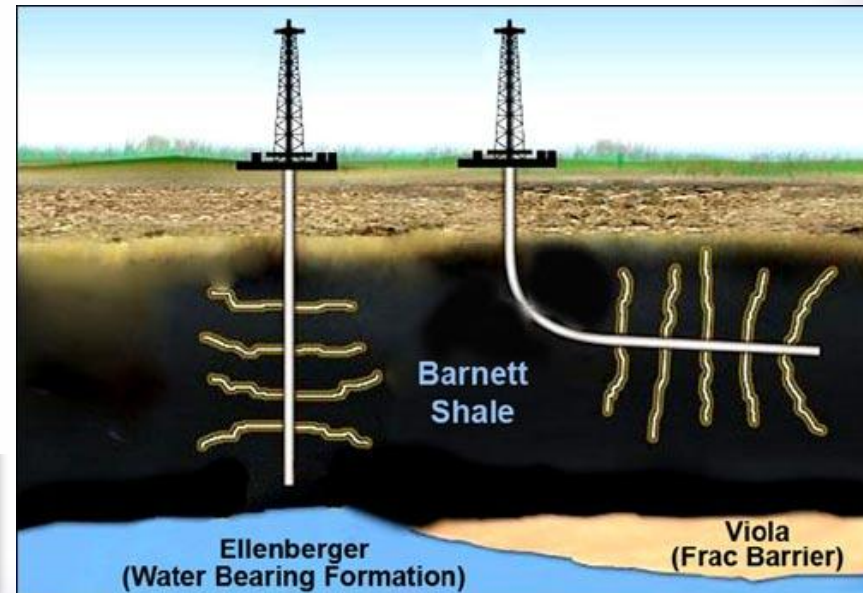
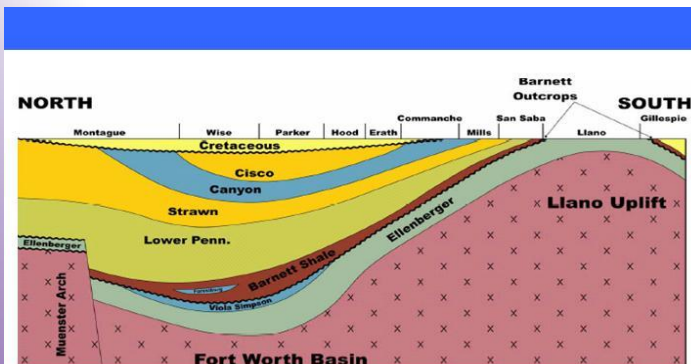
- U.S = 100 Q-BTUs
85% FF, 8% Nuclear, 7% Renewables
- World = 500 Quads
20% U.S., 17% China (2x), 16% Europe
- 2030....600 Quads!!!
- U.S. Oil Imports....\$1 Billion A Day!!
- For 50 years...
Oil and OPEC in The Driver's Seat!!

2002- Shale Plays

Mitchell Energy Led the Way

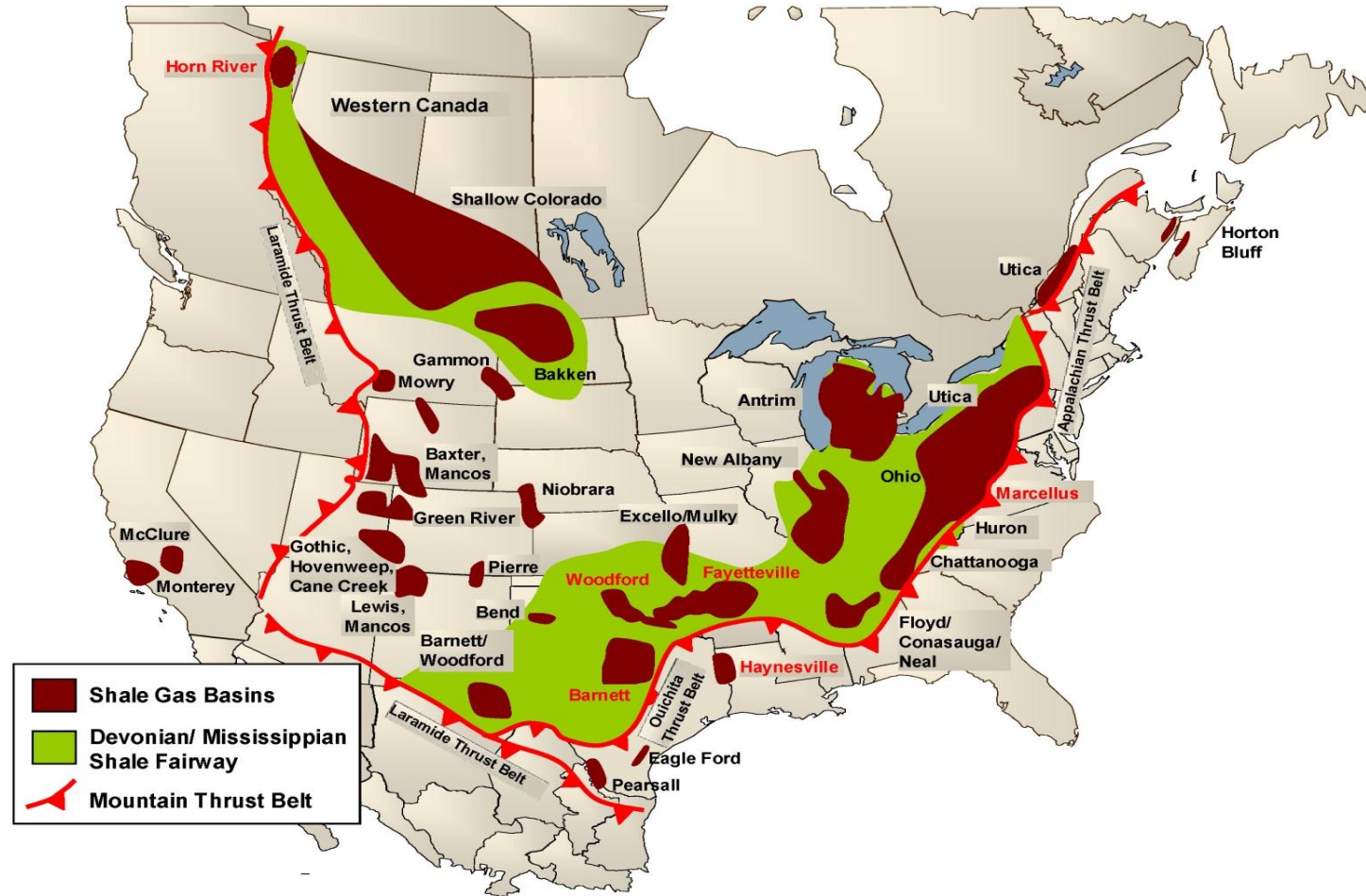


- 1950's-1990's.. George Mitchell produces gas from Ft. Worth Basin
- "small" oil & gas wells for many years
- The "source"--Barnett Shale--"Mother Lode"
- It was under "everything" for 5,000 sq mi!!



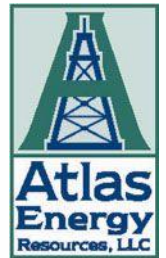
Gas Shales!!

- 100+ years of cleaner burning natural gas



So....Who's in the Fracking Driver's Seat???

Domestic Independent Producers ??



Shale Discoveries = Barnett, Haynesville, Fayetteville, Marcellus, Bakken, Eagle Ford, Niobrara, Antrim, etc



“The Big Boys”

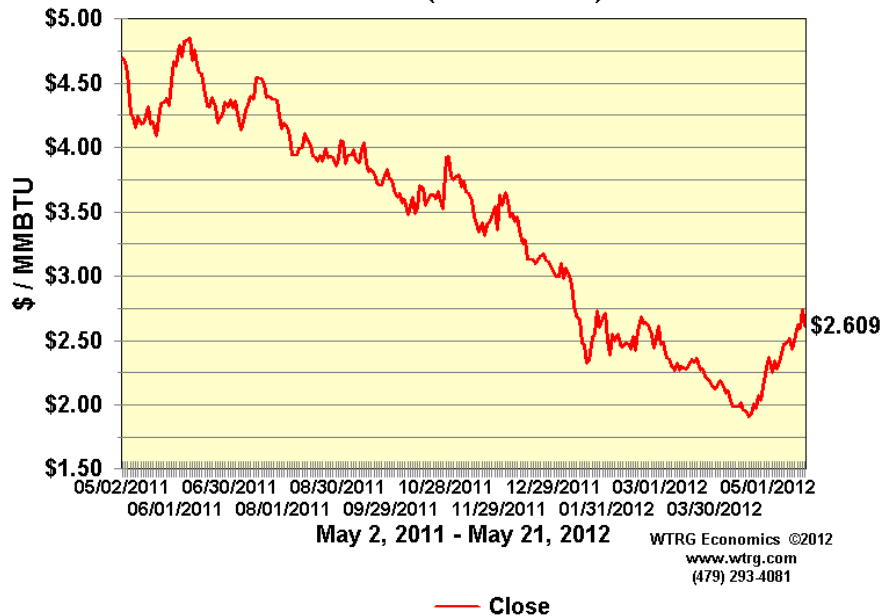
- Jan ‘10..TOTAL & Chesapeake—Now #3, \$2.5 Billion!
- March 10’...Exxon-Mobil & XTO Energy—\$41 Billion!!
- May ‘10..Quicksilver Resources partners with ENI (Italy)
- May ‘10...Shell...\$4.7 B! buys East Resources (Marcellus)
- Nov ‘10...Chevron acquires Atlas Energy \$4B! (Marcellus)
- Dec ‘10...CNOOC....1B! in Chesapeake Energy-Barnett
- Jan ’11..Quicksilver lease agreement-Reliance Energy (India)
- Feb 1 ‘11...CNOOC-1/3 of Niobrara (Colo) with CHK
- May 5 ‘11...Chevron Buys Chief O&G in Marcellus
- Jan 2012...Marubeni (Japan) in Eagle Ford (52,000 acres)

Are “The Big Boys” now “In the Driver’s Seat” ?



The Future!!

NYMEX Natural Gas Futures
Close (Front Month)



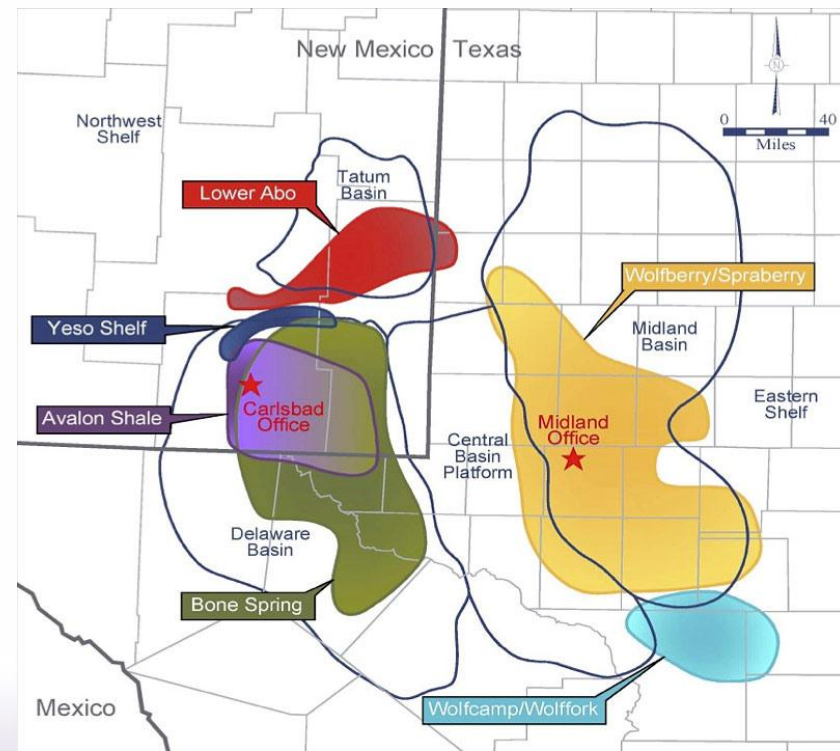
Nat Gas Prices

Alaska...Shublik Shale!

The Wolfberry!
15 Bbbl O & G!!



Shale Oil



Expanding NG Markets!!



Back-UP Fuel



Base Fuel



CNG
Transportation Fuel
LNG

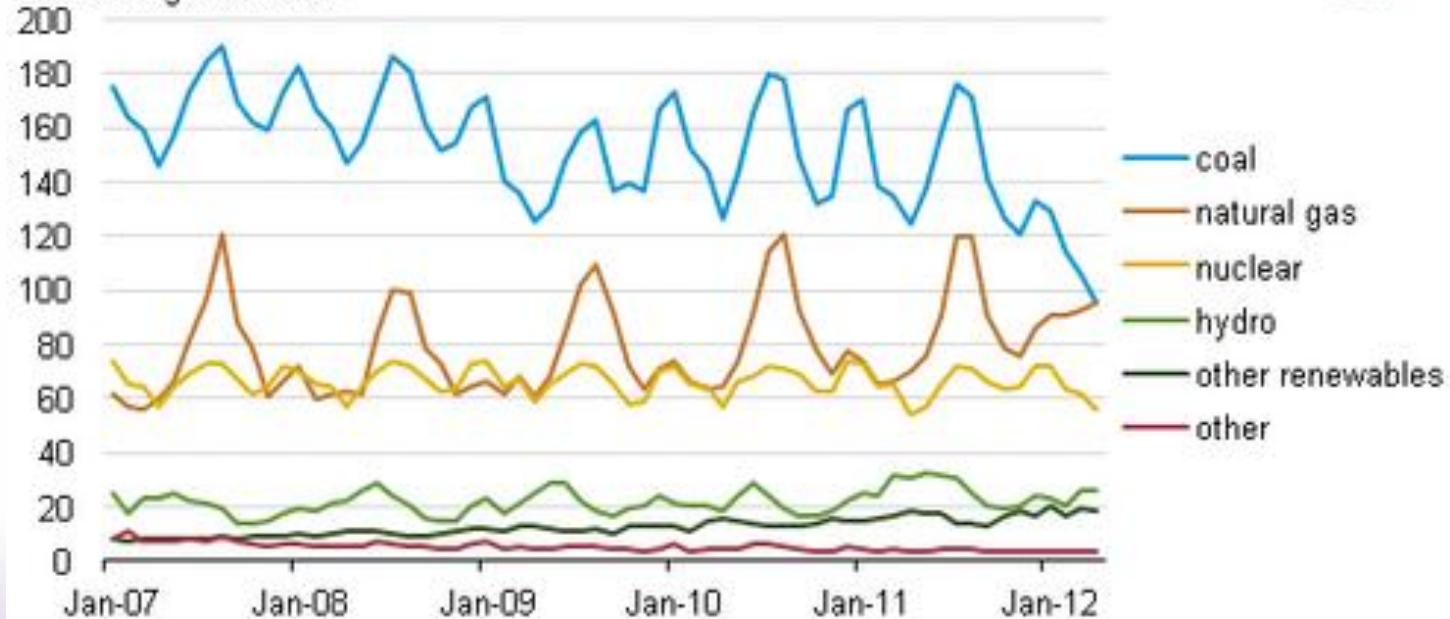


Hydrogen Source

Nat Gas Catches Coal!!

U.S. monthly net electric power generation, January 2007 – April 2012

million megawatthours



NGVs: The Real “Green Vehicles”

- Natural Gas vehicles..



Reduce CO₂ emissions

20-30%

Reduce CO emissions

70-90%

Reduce NO_x emissions

75-95%

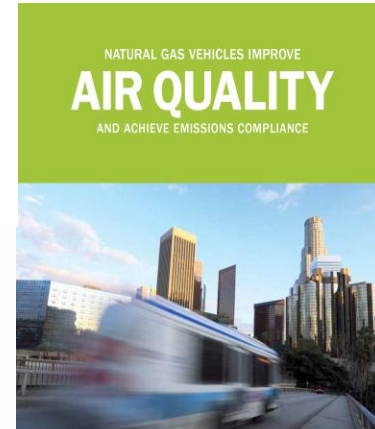
Reduce Particulate Matter emissions

90%

Reduce VOC emissions

89%

...compared to gasoline or diesel





Another Approach – Driving The Market!

Metroplex *NGV* Consortium



Barnett Shale
Energy Education Council



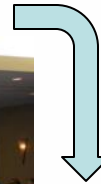
- Altech Eco
- American Honda Motor Co
- American Lung Association
- ANGI-Energy Systems
- Atmos Energy
- AT&T, Fleet Operations
- BAF Technologies
- Barnett Shale Energy Education Council
- Burns & McDonnell Engineering
- Chesapeake Energy
- City of Fort Worth
- Clean Energy Fuels
- Coalition, Inc
- CoServe Inc
- Cygnet Inc
- Dale Gas Partners
- Dallas Transit—DART
- Devon Energy
- DFW Clean Cities
- Dillon Transport
- Encana Oil & Gas
- Enterprise Rent-A-Car
- Emissions Solutions, Inc
- EOG Resources
- EWI Risk Services
- Fort Worth Chamber
- Fort Worth Transit Authority (The “T”)
- Freese & Nichols engineering
- Garland ISD
- IPAA –Ind. Petrol. Assoc of America
- Jetta Operating Company
- Jack B. Kelly, Inc
- J-W Power Company
- Marriott Hotels, USA
- NASCO (A) North America SuperCorridor
- National Fuel Marketing
- Navistar, Inc
- North Central Texas Council of Gov’ts
- NGV America
- NGV Texas
- PACCAR Inc
- Pioneer Resources
- Pinnacle CNG Systems, LLC
- Purple Land Management
- Pioneer Resources
- Quicksilver Resources
- Republic Services, Inc
- Smith Family Investments
- SWEPCO USA
- TCU Energy Institute
- TCU Institute for Environmental Studies
- Tandy Center For Executive Leadership
- Texas Gas Association
- Trillium, USA
- UPS
- Vista Sand
- Western Production Co.
- Wynne Motor Coaches
- XTO Energy
- Zeit Energy

Promote Natural Gas Transportation Markets!!

NGVs in Austin



Meeting



Demo



ALA!!!



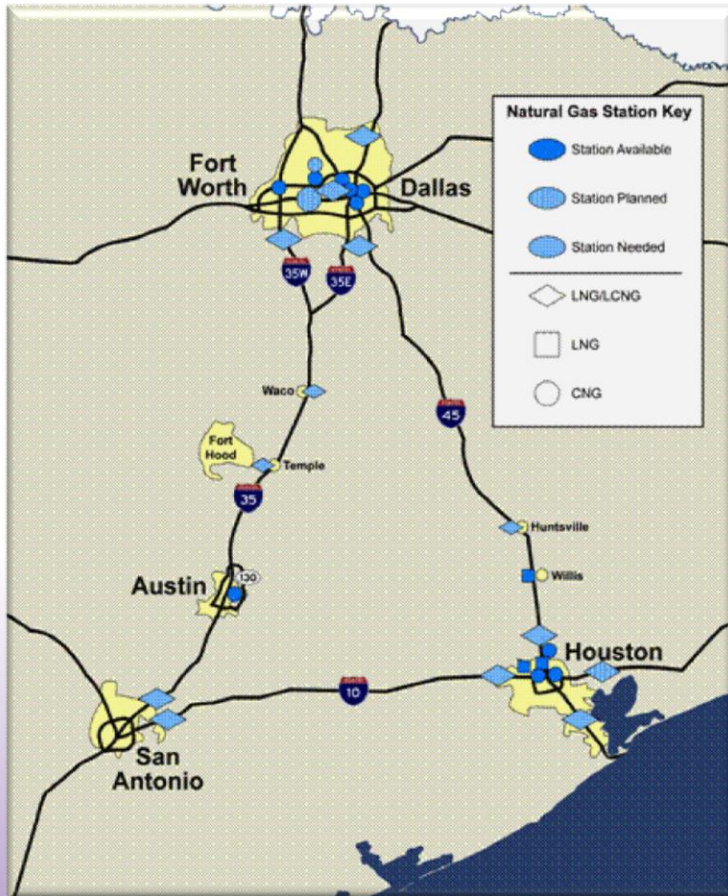
State
Capitol



Clean Air-Clean Fuel For Texas!!



The Texas NGV Clean Transportation Triangle—10% of US Business Transportation Sector



Texas SB-20

- 20% of TERP Money (Texas Emissions Reduction Plan)--\$20-\$30 million
- 20% for new stations offering public LNG and CNG—grants for **20 new stations**
- 80% for government rebates for fleet owners for HDVs-**500 Trucks!**

Clean Air-Clean Fuel For Texas!!



Metroplex NGV Consortium



NGVs = Should we go there!!



1.8 b gal/yr



Detroit—GM, Ford Chrysler

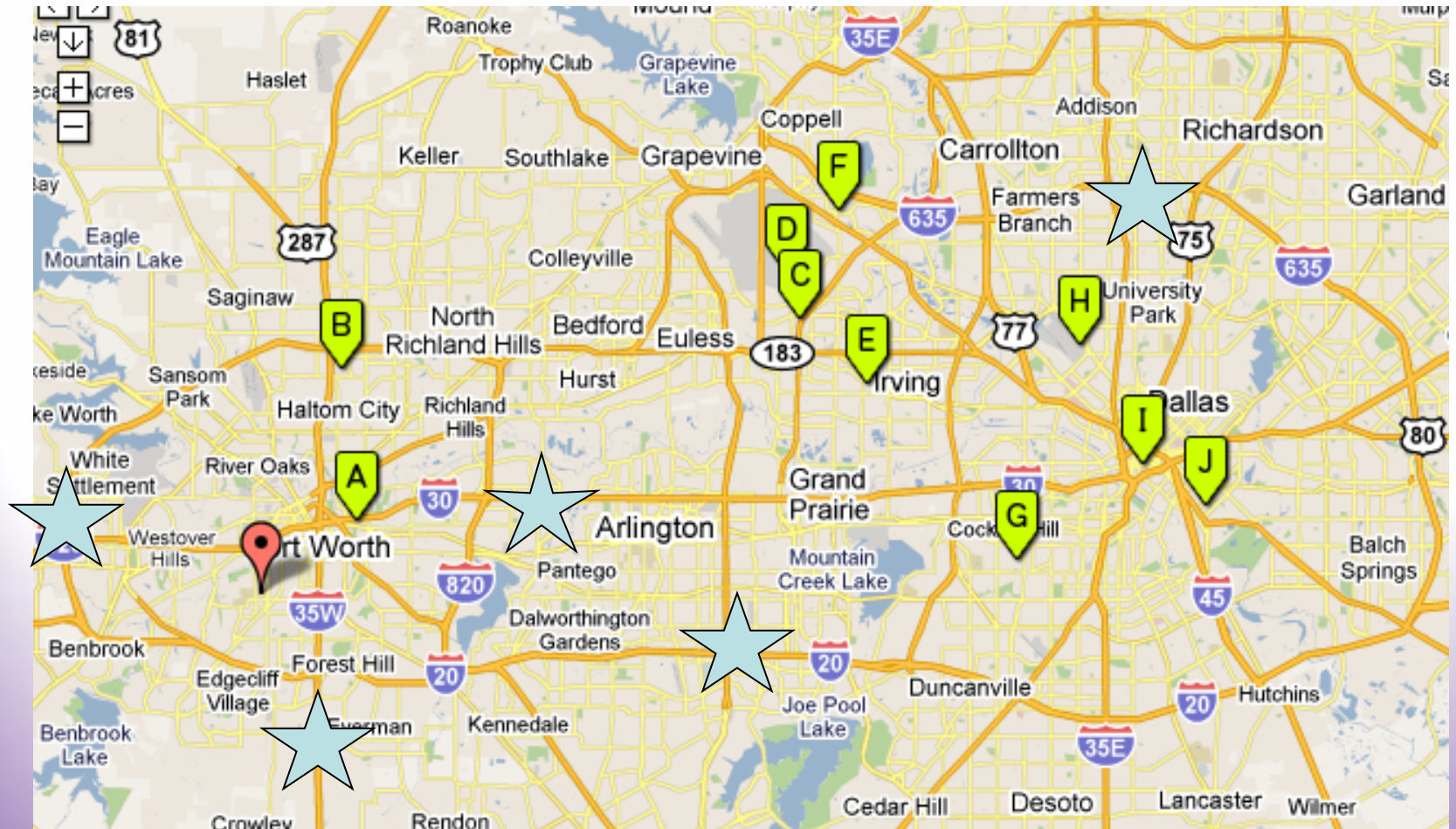


Change for 2012-13!!



DFW NG Public Stations Map

Average Price per equivalent gallon = \$2.10!!



Web site: www.cngconnect.org

National NGV Stations

Pilot Flying J to Get Natural Gas Fueling Outlets

Leading the Pack!!



150 New NGV
Travel Stations!!



Shell & TA Centers!

Shell Oil and truck stop chain TravelCenters of America agreed to build and operate at least **100 natural gas fueling stations** for heavy-duty trucks along U.S. Interstates.



GE & Chesapeake "CNG In A Box" 8' X 20' & 8' X 40'



****GE Home Refueling Unit--\$500!!**
60 million homes already have Nat Gas!



3M to Make Fuel Tanks for Natural Gas Vehicles

The manufacturing giant, intends to develop less-expensive, higher-performance, lighter, and higher-capacity fuel tanks—which it hopes will jump-start the market for natural gas-fueled vehicles.

Carbon Fiber and new Nanoparticles for extra strength

Up to 20% lighter and 20% greater capacity

13 Governors Support NGVs



April 27, 2012

RE: Request for Information - Multi-State Natural Gas Vehicle Procurement

For many Americans, high gasoline prices create a financial strain in an already difficult economic environment. As governors, we share the concerns of citizens and are committed to finding solutions. A bipartisan partnership between governors and auto manufacturers in the U.S. makes sense and has the potential to create new options for alternative fuel vehicles and transportation fuel diversity.

Abundant, affordable, clean-burning natural gas presents a tremendous opportunity for America to realize an energy future using domestic resources to fuel our nation's transportation needs. To that end, we are committed to explore the aggregation of our annual state fleet vehicle procurements to provide an incentive to manufacture affordable, functional natural gas vehicles. In coordination with this letter, we are releasing to all auto manufacturers in the U.S. a request for information (RFI) intended to assist our states in gathering the necessary information for developing a multi-state solicitation.

Recently, automakers announced several new original equipment manufactured natural gas vehicles. We believe this multi-state effort can create even more momentum. We appreciate your thoughtful evaluation of our upcoming RFI and the opportunity to work together to make American energy security a reality.

Sincerely,

Mary Fallin
Governor, State of Oklahoma

John Hickenlooper
Governor, State of Colorado

Matthew H. Mead
Governor, State of Wyoming

Tom Corbett
Governor, State of Pennsylvania

Gary R. Herbert
Governor, State of Utah

Paul R. LePage
Governor, State of Maine

Susana Martinez
Governor, State of New Mexico

Earl Ray Tomblin
Governor, State of West Virginia

Steven L. Beshear
Governor, State of Kentucky

Rick Perry
Governor, State of Texas

John R. Kasich
Governor, State of Ohio

Phil Bryant
Governor, State of Mississippi

Bobby Jindal
Governor, State of Louisiana

General Dempsey-Chair, Joint Chiefs of Staff June 27, 2012—Ft. Worth



Domestic Military Bases

Growth of NGVs

- There are about 140,000 NGVs on U.S. roads today and more than 14.8 million worldwide.
- According to the American Public Transit Association, nearly one-fifth of all transit buses were run by compressed natural gas (CNG) or liquid natural gas (LNG) in 2012.
- The fastest growing NGV segment is waste collection and transfer vehicles.
- More than 35 airports in the U.S. have natural gas vehicles in their own fleets.
- NGV Global estimates there will be more than 50 million natural gas vehicles worldwide within the next 10 years, or about 9% of the world transportation fleets

Source: NGV America

Today

Change??

Tomorrow??

Imports

Oil



Opec--\$1B/day

Rare Earth Elements
“Green Technologies”



China...97%



Batteries, Magnets, Control Rods, Lasers

Natural Gas Exports??



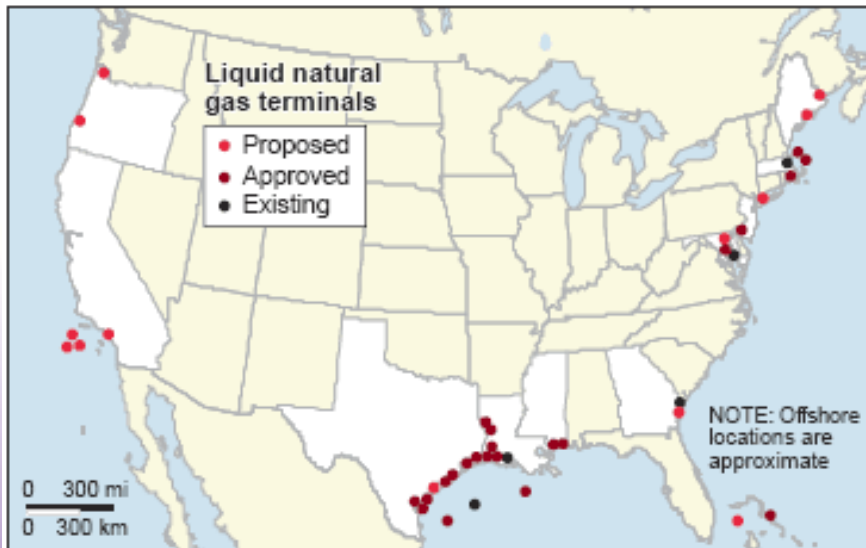
Louisiana
Cheniere Energy

It's a Global Play
Canada? Australia?



More LNG terminals going online

Energy companies have propped 35 new liquid natural gas terminals, 22 of which have been approved by regulators.



SOURCES: Federal Energy Regulatory Commission; ESRI

AP

Markets??
China, Europe, Japan??

So, For Domestic Gas...Who's in the Driver's Seat????



We ARE!!!!

1. Grass Roots NGV Organizations in U.S.
2. Fleet Conversions-Large and Small Companies
3. Infrastructure/Vehicles--Detroit
4. Future-Jobs, Business Growth

That's what happened
100 years ago!



1909 Model T



TCU ENERGY INSTITUTE

Dr. Ken Morgan, Director
www.energyinstitute.tcu.edu

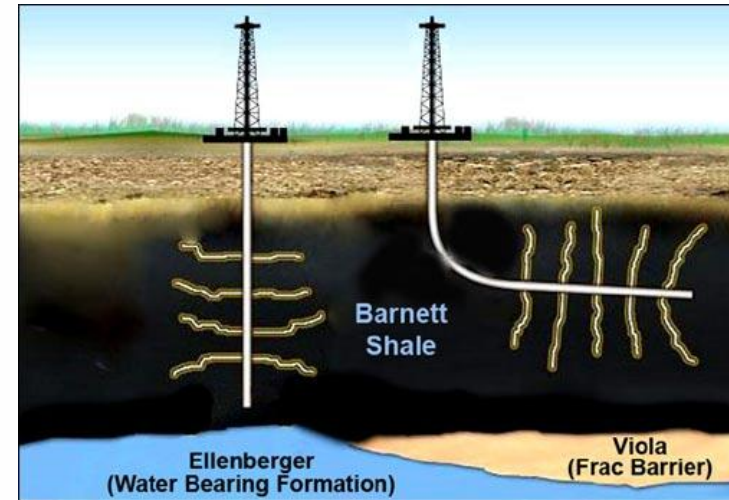


Go Domestic Energy...Go Domestic Natural Gas & Oil!!

Shale Plays: What to do?

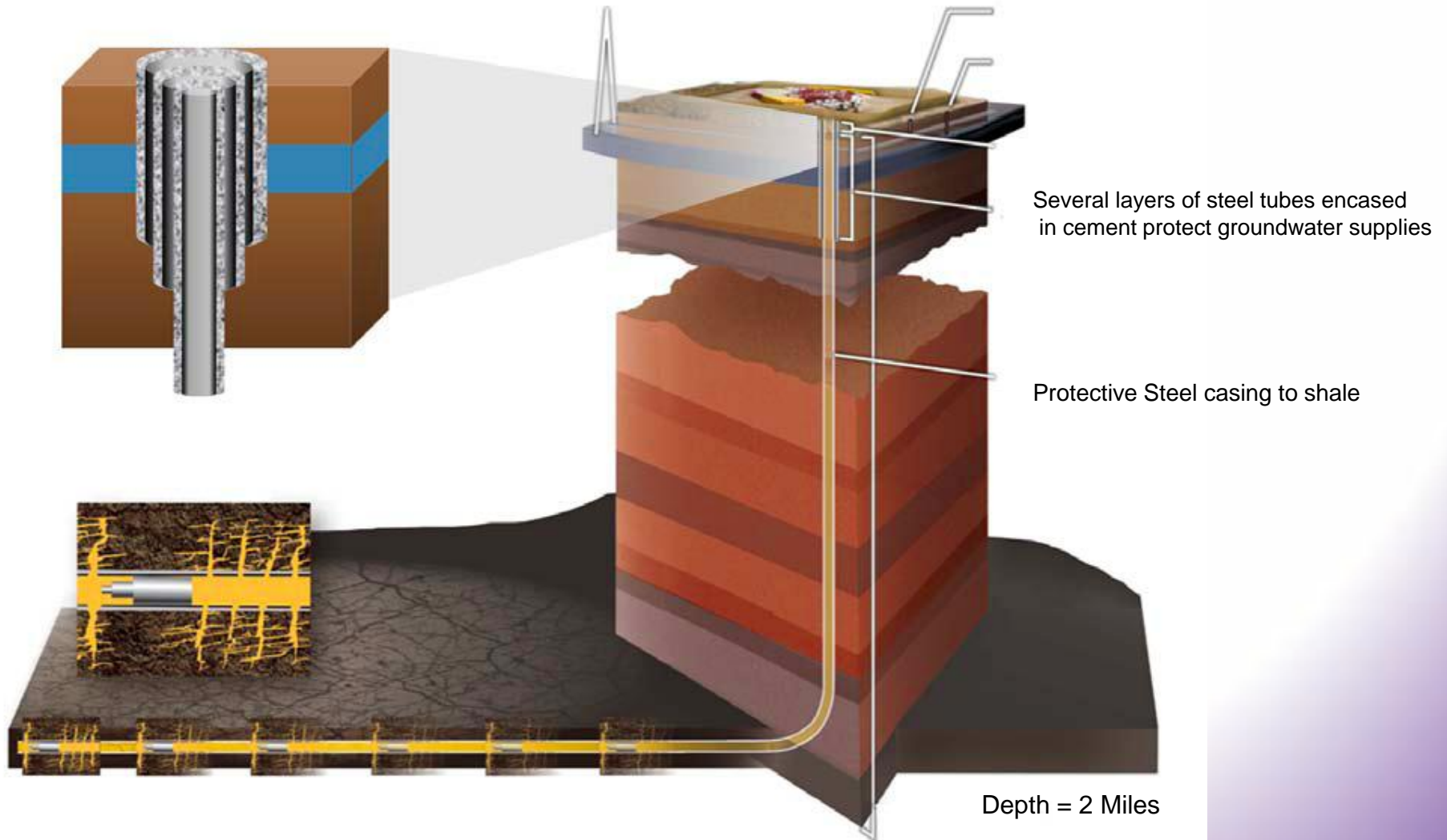
Regulation or Incentives?

- Water Use & Recycling
- Size of Fracking Operations
- Methane Emissions
- Disposal & Earthquakes
- Well Casing & Cement Design
- Other



Remember: It's Domestic!

Shale Plays: Aquifer Protection



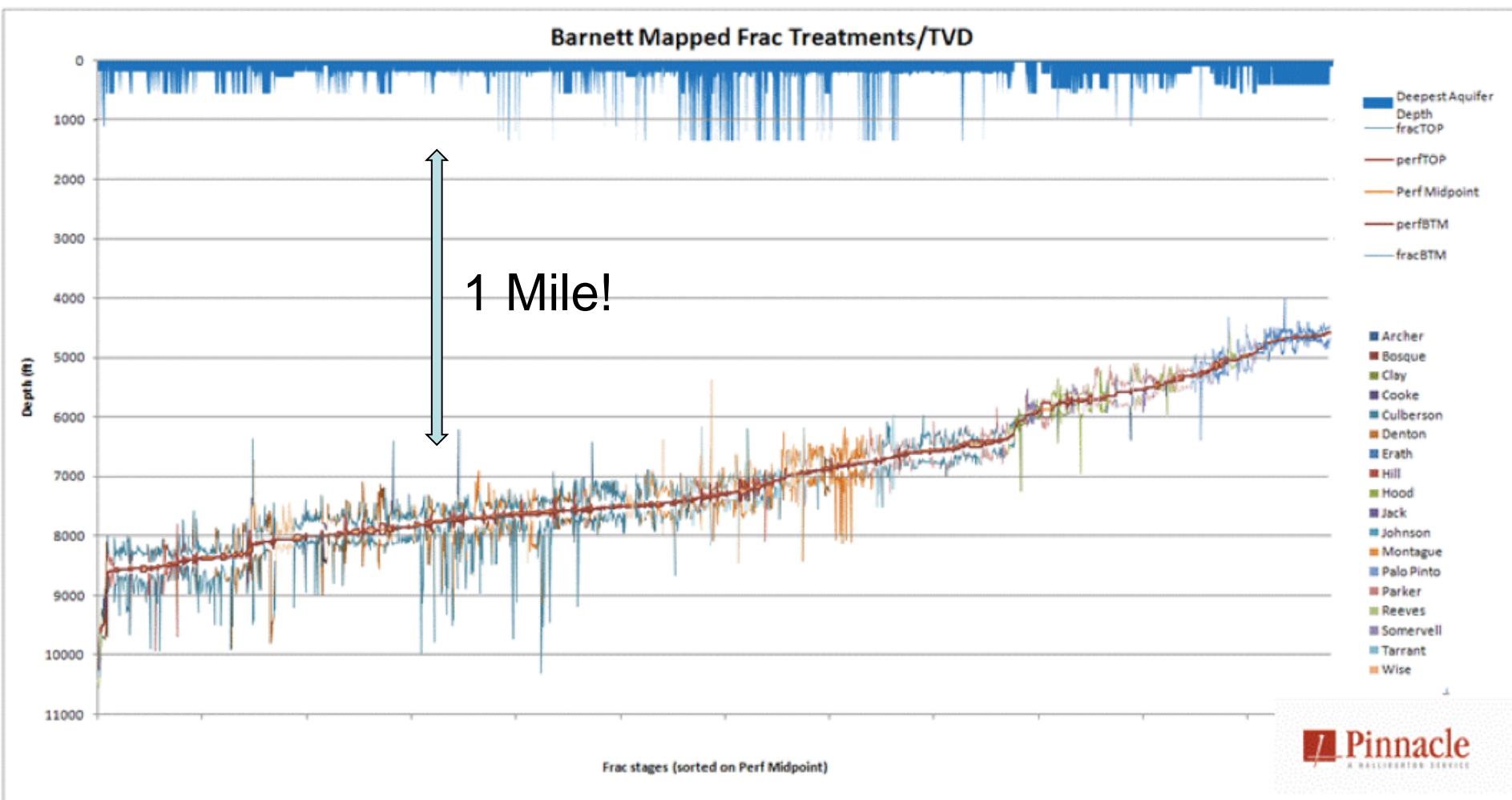
Water Use & Recycling

- DFW Barnett Activities Water Use: < 2% of Total Water Use.
- The Real Problem: Waste & Leaks accounted for 30% of Total Water Use...TWDB, 2011.



Recycling Pond
Pennsylvania

Depth of Affected Region Affected by Hydraulic Fracturing

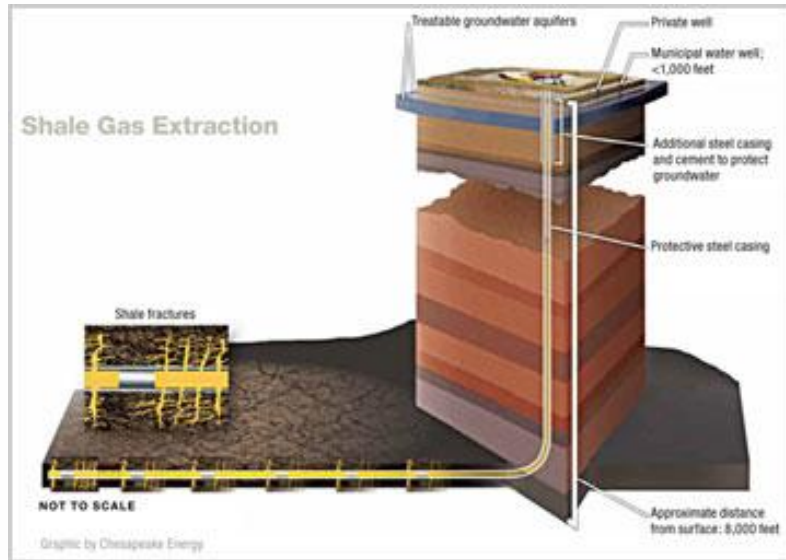


Fisher (2010)

<http://nwis.waterdata.usgs.gov/nwis/inventory>

Shale Gas Development

UT-Austin & Environmental Defense Fund Study, March 2012



Tone of Media Coverage			
	Negative	Neutral	Positive
National Newspapers	64%	25%	12%
Local Newspapers	65%	23%	12%
National Television & Radio	64%	19%	18%
Local Television	70%	27%	3%
Online News	63%	30%	7%

Key Findings: Over 1 Million Fractured Wells in U.S. since 1960

1. Many reports of **groundwater contamination** occur in conventional oil and gas operations **NOT FRACKING**.
2. **Methane** found in water wells in some shale gas areas DUE TO NATURAL SOURCES... **NOT FRACKING**
3. **Surface spills** of fracturing fluids appear to pose greater risks to groundwater sources.....**NOT FRACKING**
4. **Poor Cement Casing** appears to be an issue in some shale wells.....**NOT FRACKING**