

# HYDRAULIC FRACTURING

is a revolutionary exploration and production process which has grown drastically over the last decade.

This high pressure technique extracts oil and gas in previously inaccessible areas in a distinctly different way from conventional, horizontal wells.

Projections by the Energy Information Administration show potential growth of up to 50% of U.S. production by 2019

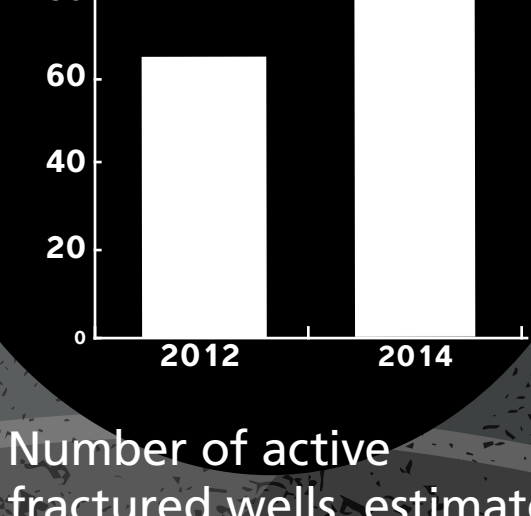
23%

12%

Enabling tremendous production in tight oil and shale formations with growth from 12% to 35% of total U.S. production

35%

15%



Number of active fractured wells, estimated at 82K in 2012, expected to near 95K by the end of Q1 2015.



## EACH LAYER OF REGULATION

CREATES A COMPLEX

REPORTING LANDSCAPE.



455 Measures have passed at the state, county, or local level to ban or limit Hydraulic Fracturing as of January 2015

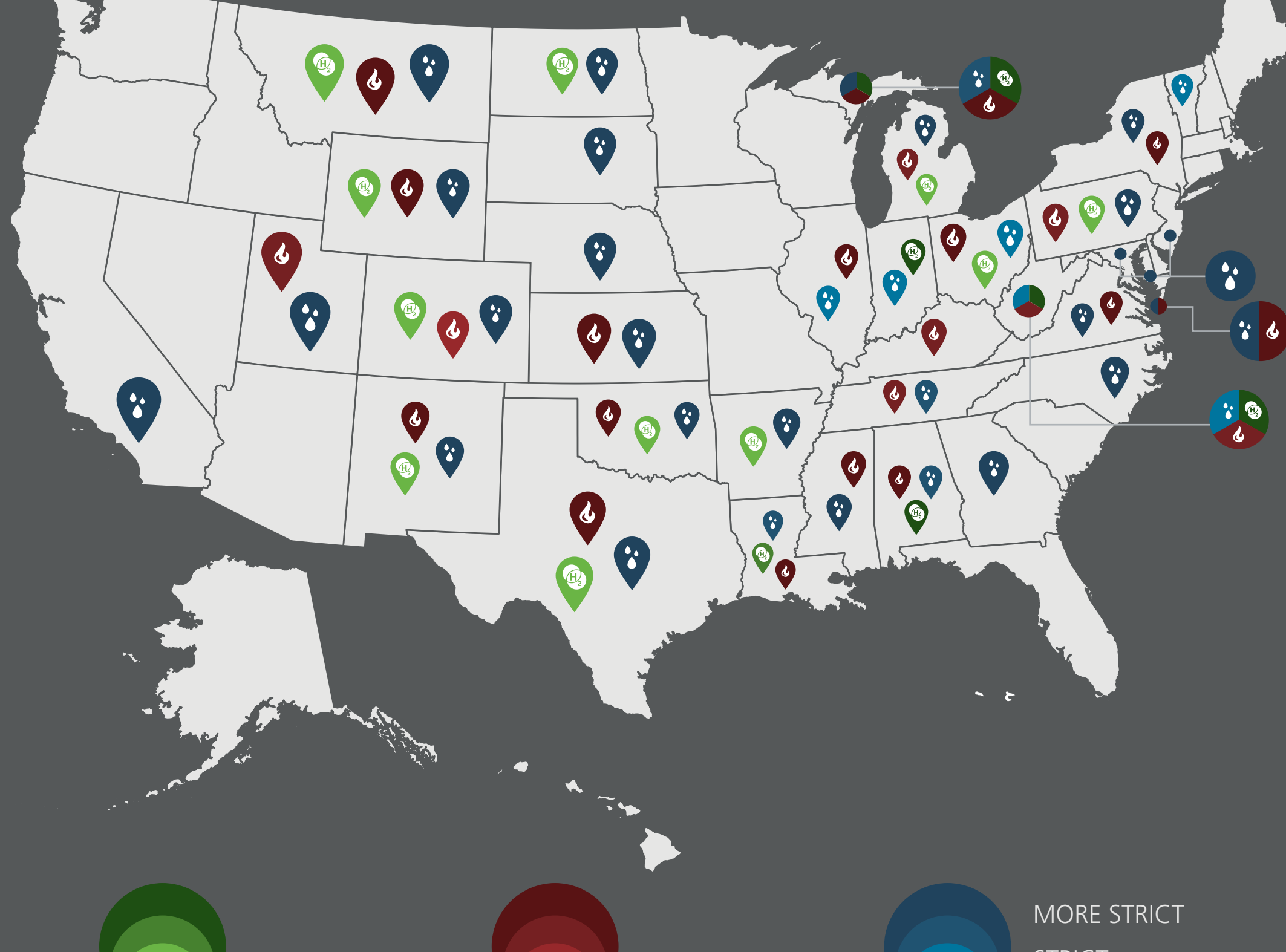


Municipalities in 24 separate states have **banned** Hydraulic Fracturing of some kind



Local municipalities in Texas and Pennsylvania have also begun their own form of regulation against fracking and fracking related activities

## THE EPA STUDY OF HYDRAULIC FRACTURING STATUS



CHEMICAL DISCLOSURE REQUIREMENTS



FLARING CONSTRAINTS



MORE STRICT  
STRICT  
LESS STRICT

WATER WITHDRAWAL LIMITATIONS

## PENNSYLVANIA CASE STUDY

Pennsylvania is a great representation of the current environment – with divided public opinion, rapid growth in natural gas, and changing regulations.

**1985 Oil & Gas Act** - operator responsible if pollution of water within 6 months of drilling within 1,000 ft of well.

**2012 Amendment** – Increased area to 2,500 ft for unconventional wells.

New wastewater rules require all unconventional well that transport wastewater to maintain **five year records** of: water usage, who transported the fluids away from the well, and the location where wastewater fluids were disposed.

Regulatory requirements **hold** well operators responsible for prevention, preparedness, and contingency plan (PPC Plans)

**Oil & Gas Act penalties** include the possibility of **incarceration** together with daily penalties until the problem is fixed.

## NEXT BIG THING IN EUROPE ?

European countries are eager to lessen their dependence on foreign (especially Russian) gas. Hydraulic fracturing is seen as a **clear answer**, but health and safety concerns have stalled the development of shale gas plays among the **EU member nations**.



US operators have the most experience with and best technologies for developing shale gas. **European energy companies want to tap into that knowledge.**



Similarly, with little or no experience in shale gas development, **Europe's governing bodies are looking toward the United States as a potential model for its nascent regulatory framework.**

At least 19 EU Directives and Regulations exist that are relevant to shale gas exploration with emphasis on environmental impact and water safety

France has imposed a moratorium on hydraulic fracturing and other member nations are instituting their own regulations, further complicating the regulatory landscape

Hydraulic Fracturing is not referenced directly in EU regulations, but new proposals are being made to ensure its inclusion

Regulatory gaps exist between Member States jurisdictions. The ambiguity and can lead to high E&P transactions costs for the operators



Estimated total European recoverable shale gas reserves of 639 Tcf

The dual layered regulatory landscape of the EU (Union and National) has been a **major contributing factor** to the fact that **no commercial production** has been achieved by any of the member nations.



### Poland

Largest shale gas reserves in Europe. Extensive fracking concessions and drilling. No commercial production.



### UK, Bulgaria, Spain, Germany, Netherlands, Norway, Sweden, Denmark

Recoverable gas reserves. Minimal fracking activity including exploratory wells. No commercial production.



### France

2nd largest shale gas reserves in Europe. Moratorium on hydraulic fracturing



The industry has turned to self-regulation in response to public concerns and to avoid potential federal regulation.

### CURRENT PRACTICE

**FracFocus:** Voluntary, industry supported, hydraulic fracturing chemical registry. It has been adopted by a number of states as a means of official state chemical disclosure.

**FracFocus** disclosure allows for exclusion of trade secrets or proprietary information at operators' discretion.

Chemical Formulations recorded as unstructured data in unsecured format with well operators free to change formulas at will.

This industry self-regulation is seen as too relaxed by many the scientific community and the general public, making it more likely that operators in the US can expect that more **rigor** and **transparency** will be required around Hydraulic Fracturing **fluid disclosures**.

### POTENTIAL REQUIREMENTS

Fluid formulation pre-approval and full disclosure

Standardized formulation reporting format

Tighter restrictions around on-site formulation changes

Regulated minimum quality standards

## A REGULATED FUTURE

As **Hydraulic Fracturing** continues to grow in the US and abroad there will only be more **scrutiny** and **regulation** in the industry. Well operators need to be prepared to collect, track, and report their **fluid formulation data**.

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