

# Panel on Hydraulic Fracturing

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28 February 2018 - GEOG 412

# Is fracking fracked up??

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<http://setxind.com/upstream/the-hydraulic-fracking-process-and-how-it-works/>

# Contents of the Presentation

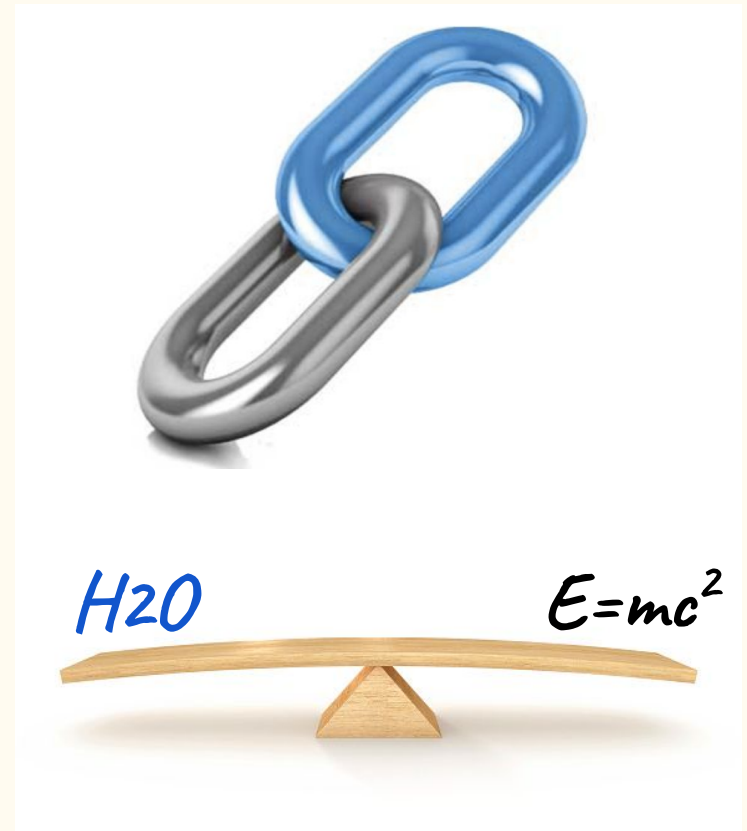
1. Contextualizing Hydraulic Fracturing - Jack
2. Technology and the Economic Facts? - Hriday
- 3.

# The Water-Energy Nexus

“Energy is required to secure, distribute, treat, and deliver water. Conversely, water is used, consumed, and often degraded to develop, process, and deliver energy for production.”

(Scott et al. 2011)

Is the water *used* or *consumed*?



# Defining and Unpacking Hydraulic Fracturing

- Lots of Nicknames:

Hydrofracturing → Hydrofracking → Fracking

- Associated Terms:

Unconventional Oil/Gas, Shale Oil/Gas, Tight Oil/Gas or LTO (Light Tight Oil)

- **Our Simple Definition:** Injecting a mixture of water, chemicals, and sand deep underground to stimulate cracking in a shale rock sedimentary layer.



# Defining and Unpacking Hydraulic Fracturing

## Simple Definition $\neq$ Simple Process

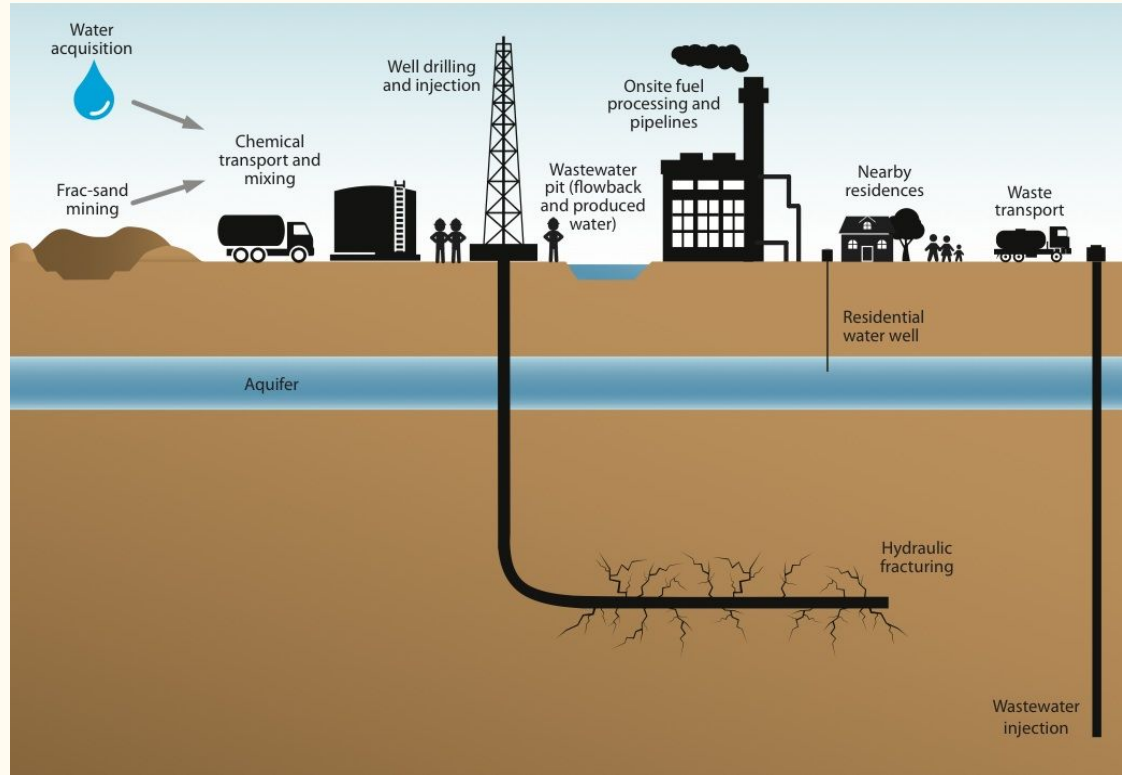


Image Source: <http://theamericanenergynews.com/wp-content/uploads/2015/08/Fracking-CA.png>

## Defining and Unpacking Hydraulic Fracturing

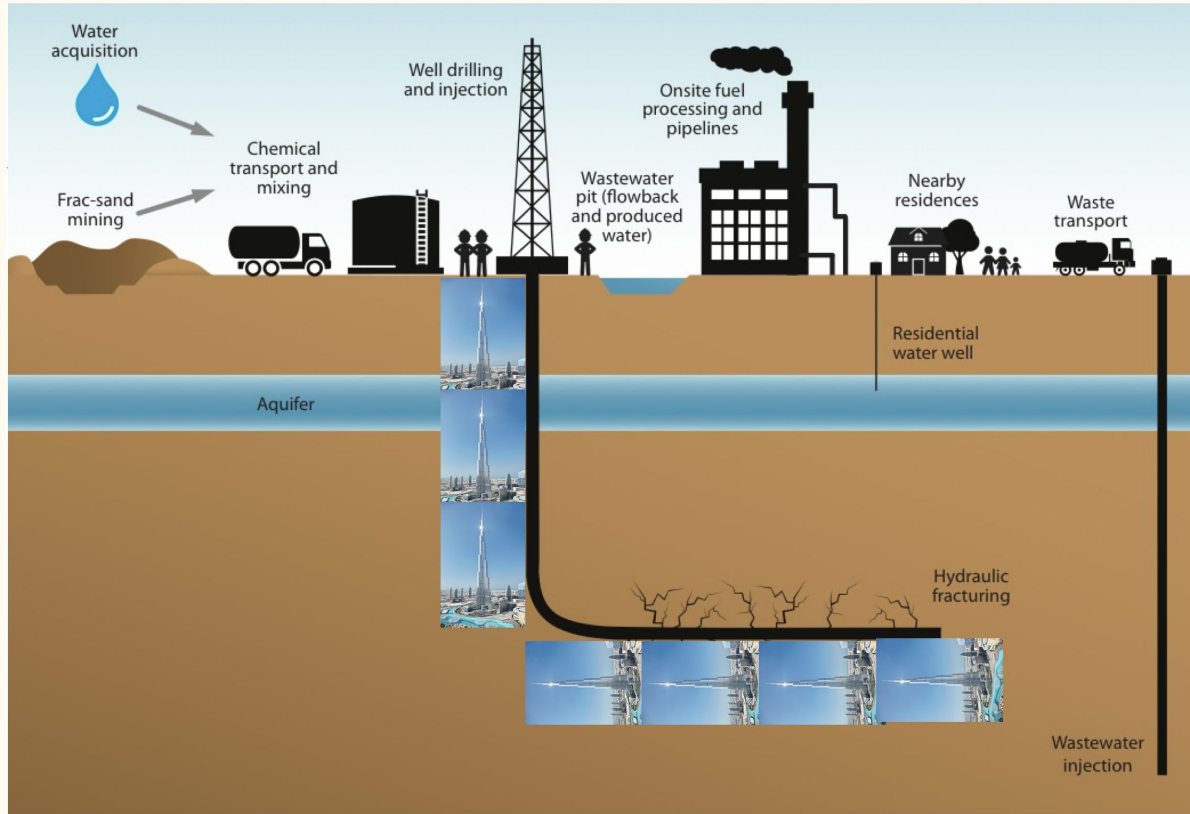
The Burj Khalifa  
(Currently the tallest  
building in the world):



Image Source: <http://www.burjkhalifa.ae/en/the-tower/factsandfigures.aspx>

# Defining and Unpacking Hydraulic Fracturing

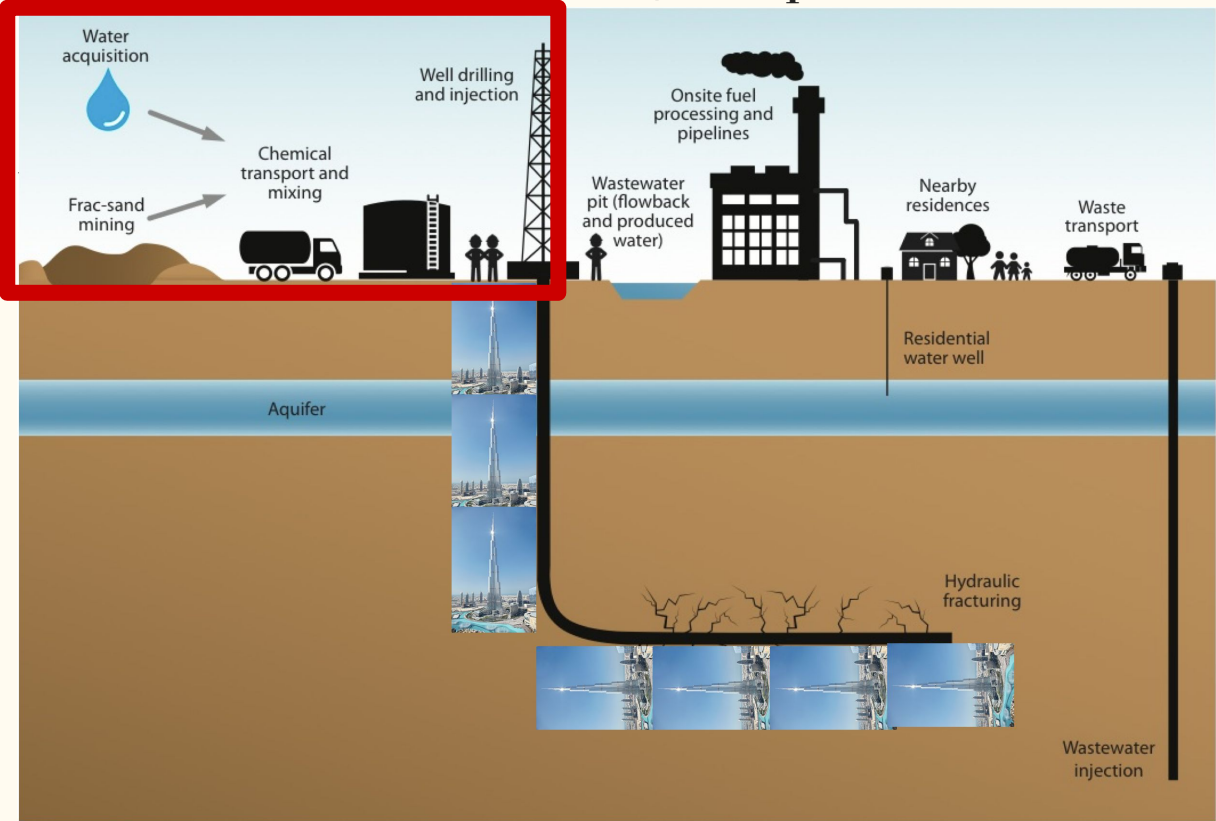
## Simple Definition $\neq$ Simple Process





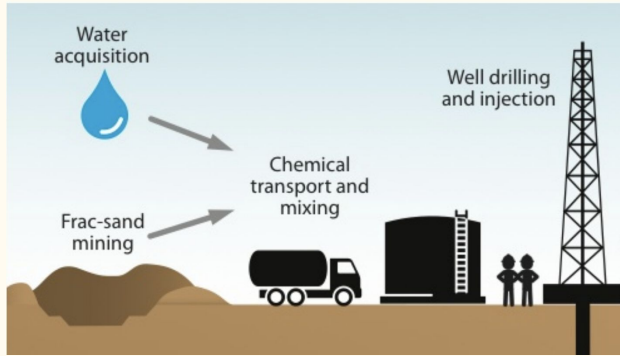
# Unpacking Water's Role

## Simple Definition $\neq$ Simple Process



## Unpacking Water's Role

# Fracking Fluid: ~ 100 billion gallons injected each year in the United States



**Table 2**  
Volumetric composition and purposes of the typical constituents of hydraulic fracturing fluid.  
Source: Gregory et al. [32].

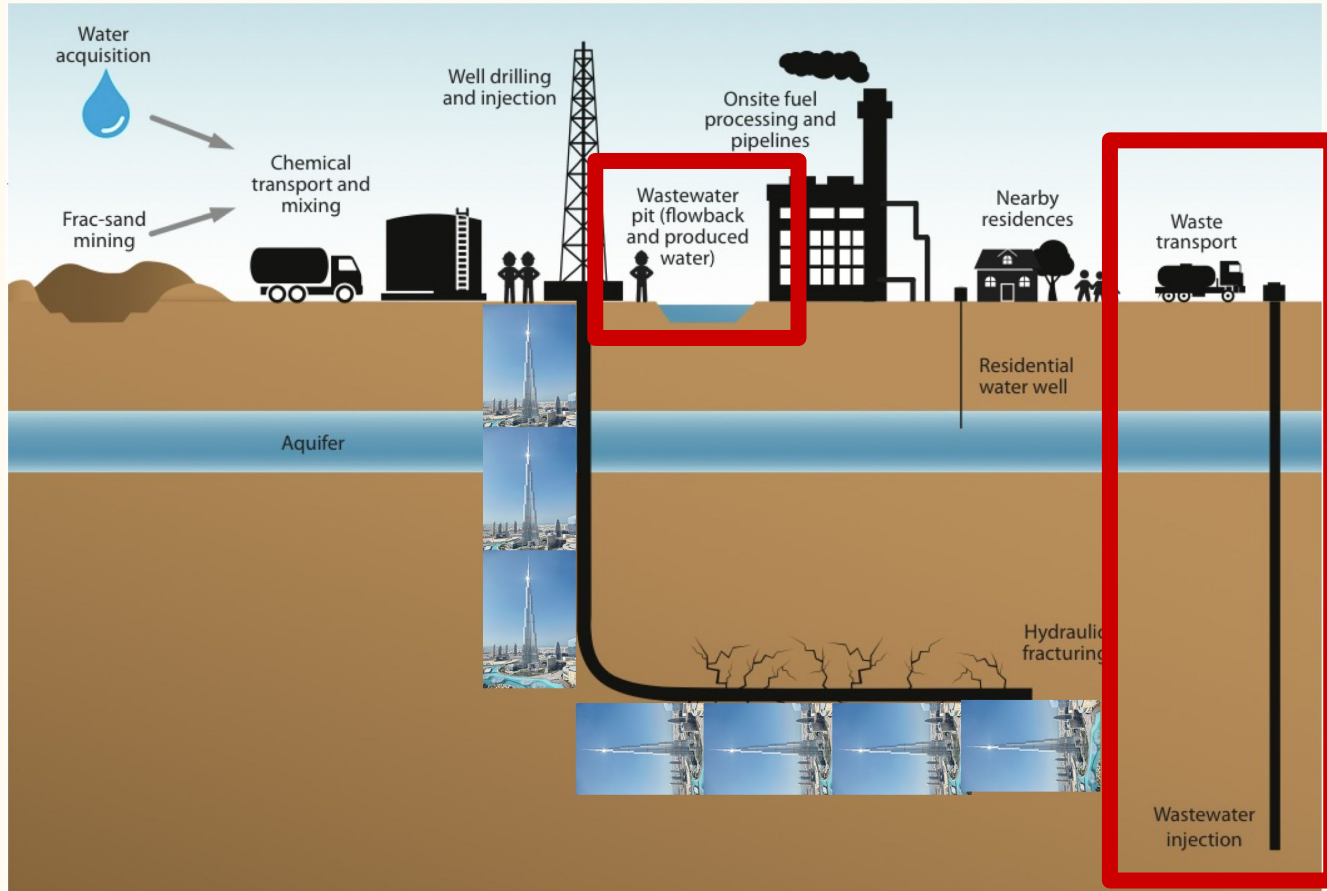
Constituent	Composition by volume (%)	Example
Water and sand	99.50	Sand suspension
Acid	0.123	Hydrochloric or muriatic acid
Friction reducer	0.088	Polyacrylamide or mineral oil
Surfactant	0.085	Isopropanol
Salt	0.06	Potassium chloride
Scale inhibitor	0.043	Ethylene glycol
pH-adjusting agent	0.011	Sodium or potassium carbonate
Iron control	0.004	Citric acid
Corrosion inhibitor	0.002	<i>n,n</i> -Dimethyl formamide
Biocide	0.001	Glutaraldehyde

\*Table from Sovacool (2014) reading

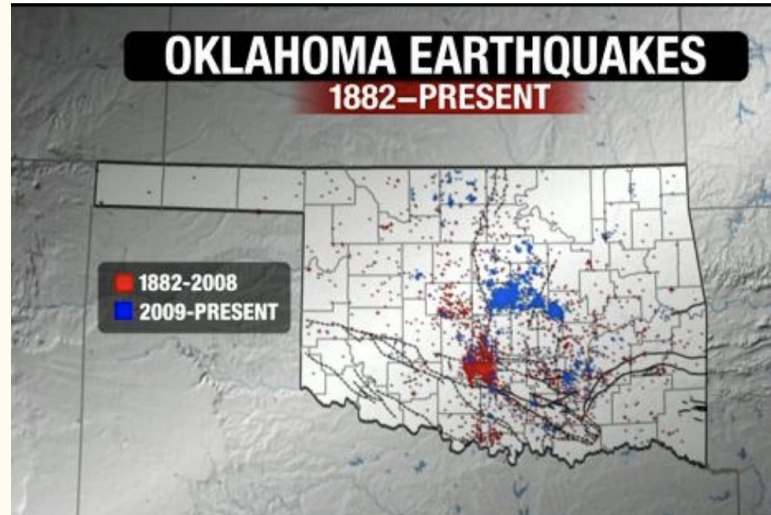
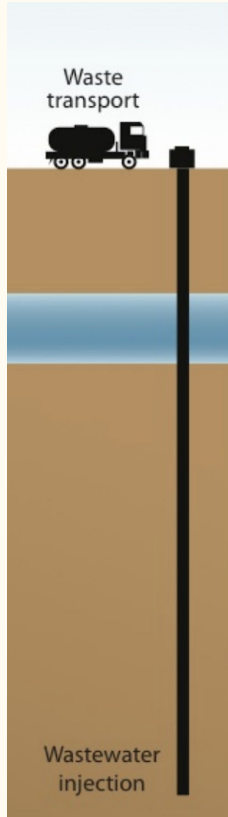


Image Source: <https://environmentalenergetics.com/tag/fracking-fluid/>

# Unpacking Water's Role: Flowback → Wastewater → Disposal or Treatment



# Unpacking Water's Role - Disposal



# Unpacking Water's Role - Disposal

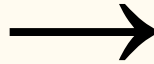
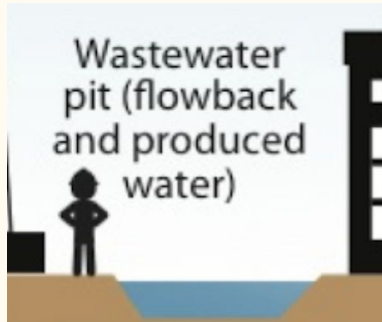


Image source: <https://www.ecowatch.com/analysts-conclude-fracking-wastewater-poses-substantial-risk-to-drinki-1881634819.html>



## Unpacking Water's Role - Treatment

- Not a common practice due to high cost
- Water treatment plants can fail to treat the types of chemicals in fracking fluid

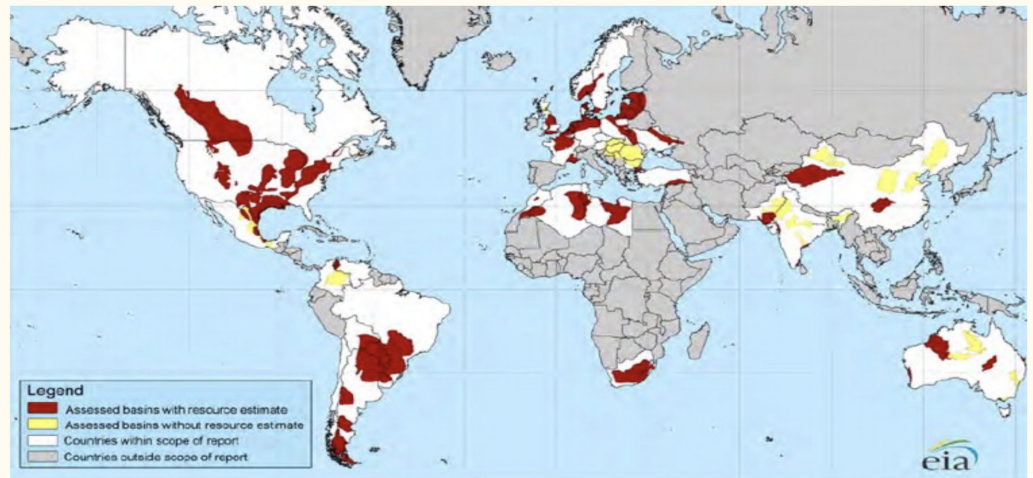
Before vs. After



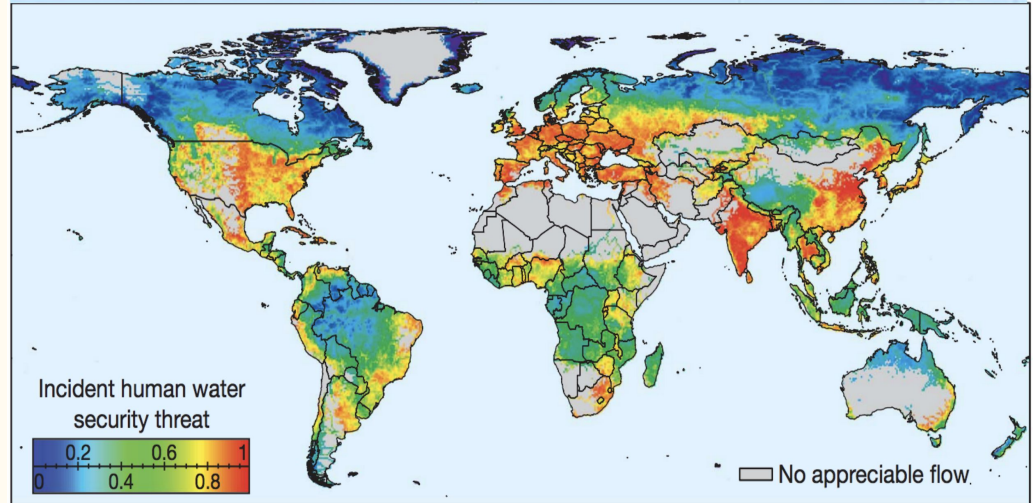
Image source: <http://www.zdnet.com/article/hydrofracking-drives-new-water-treatment-solutions/>

# Looking Ahead Globally

\* Global shale rock formations (assessed in 2011 shown in red)



\*Global human water security



Top Image from Sovacool (2014) reading. Bottom Image from Vorosmarty, et al. (2010) reading.

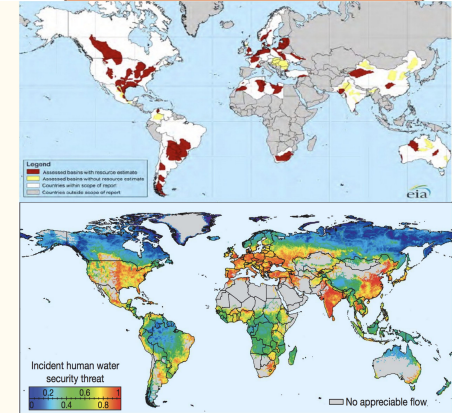
# The Water-Energy Nexus in Hydraulic Fracturing

## The Quantifiable Nexus

- I pump X amount water down and I get Y amount of energy.
  - Thus quantifiable with a much smaller degree of uncertainty compared to other energy sources.

## Going Forward: Consider The Big Trade-Offs

- National energy security vs. National water security
- Individual economic gain vs. Local water quality





# The Economics & Role of Technology in Fracking



# Economic Facts? of Fracking

- Conflicting statistics, projections
  - Check credibility of authors, research methods, scope of study
- Who commissioned the study?
- Understanding economic impact analysis
  - Multiplier effect, Wealth concentration of capital, Private vs. Public benefit
- Externalities?

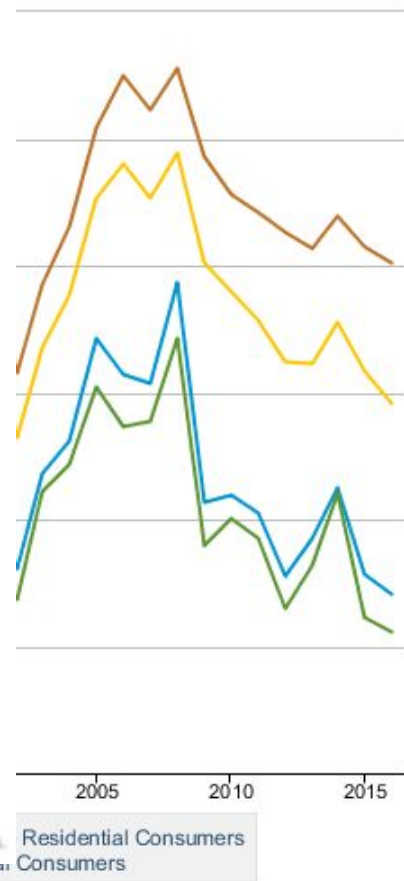
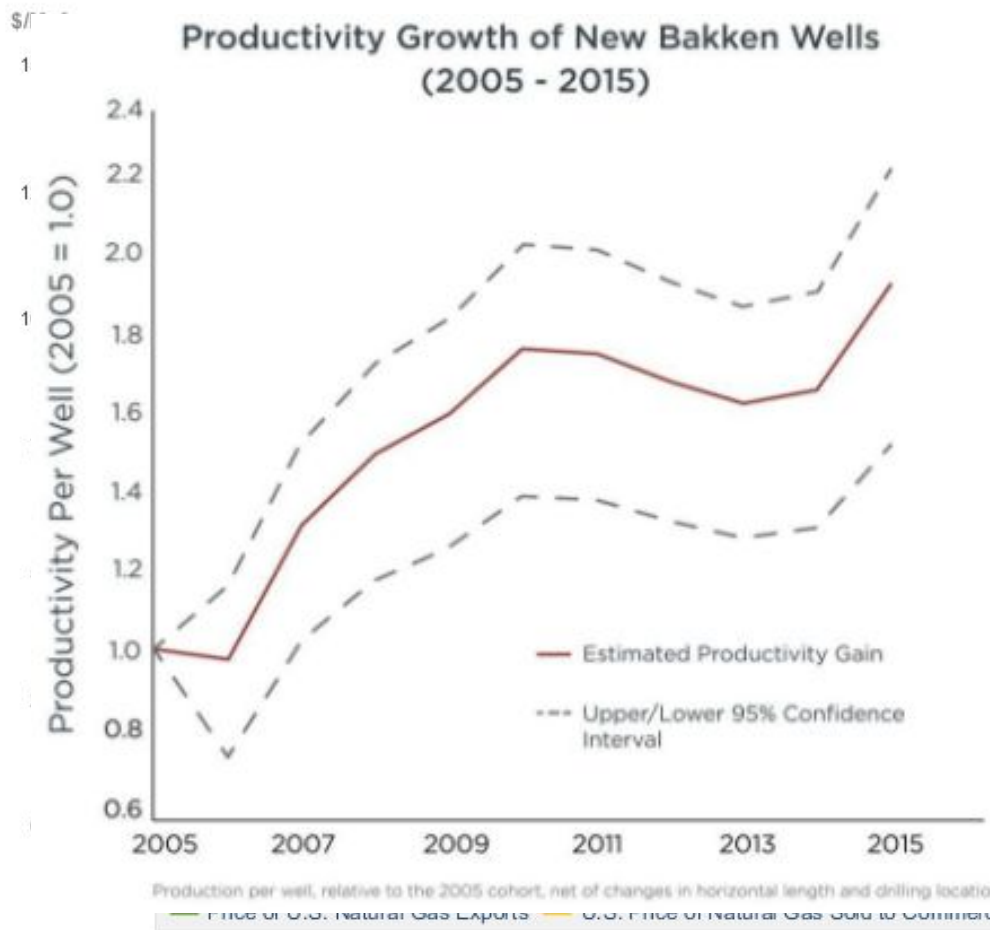
# Economic Benefits

- There is an overall decrease in local energy costs
- There is an increase in number of jobs
- Increase in wages especially in rural areas where previous high paying jobs have been lost
- Modest local economic stimulus, growth in supporting sectors, services

# Public Costs

- Irreparable environmental/water quality damage
- Decreased local agricultural productivity
- Geospatial disjoint in economic benefits and cost to area
  - Local compliance bodies, monitoring
- Economic externalities not accounted for by drilling companies
  - Reduced tax contribution, disparate insecure jobs, overstated economic benefits

# Did fracking really reduce the cost of energy?



# Role of Technology

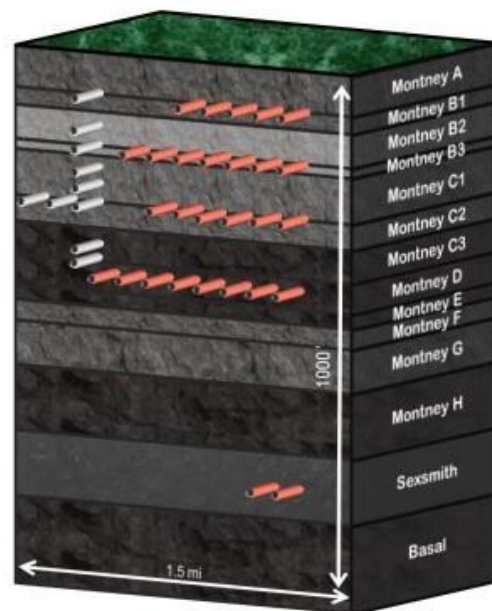
- Mid-2000's beginning of horizontal mining
- Is technology increasing safety?
- New drilling methods
  - Cube drilling
- Impact of increased efficiency

# DEVELOPING THE CUBE

## Montney Cube

- Multiple proven Montney benches on ECA lands
- New Dawson South 4-well pad confirming expectations
  - Averaged >525 bbls/d liquids and >2,600 BOE/d IP30
  - Expect additional up-side with implementation of advanced completions
- Starting to flow the Tower North cube with 28 wells in 5 benches
- Tower South cube currently drilling 20 wells in 4 benches
- 2017 Montney cube developments will flow to new plants, on track for Q4 2017 start-up
- Montney cubes utilize multiple rigs and frac crews
- Pacesetter Q2 Montney cube <\$3.5 MM D&C cost for 9,000' lateral

### 28 Well Tower Cube Development



- Existing Wells
- New Wells

Are the economic  
benefits worth the  
social and  
environmental costs?



# Social Effects of Hydraulic Fracturing

By: Lia Newman

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# Overview

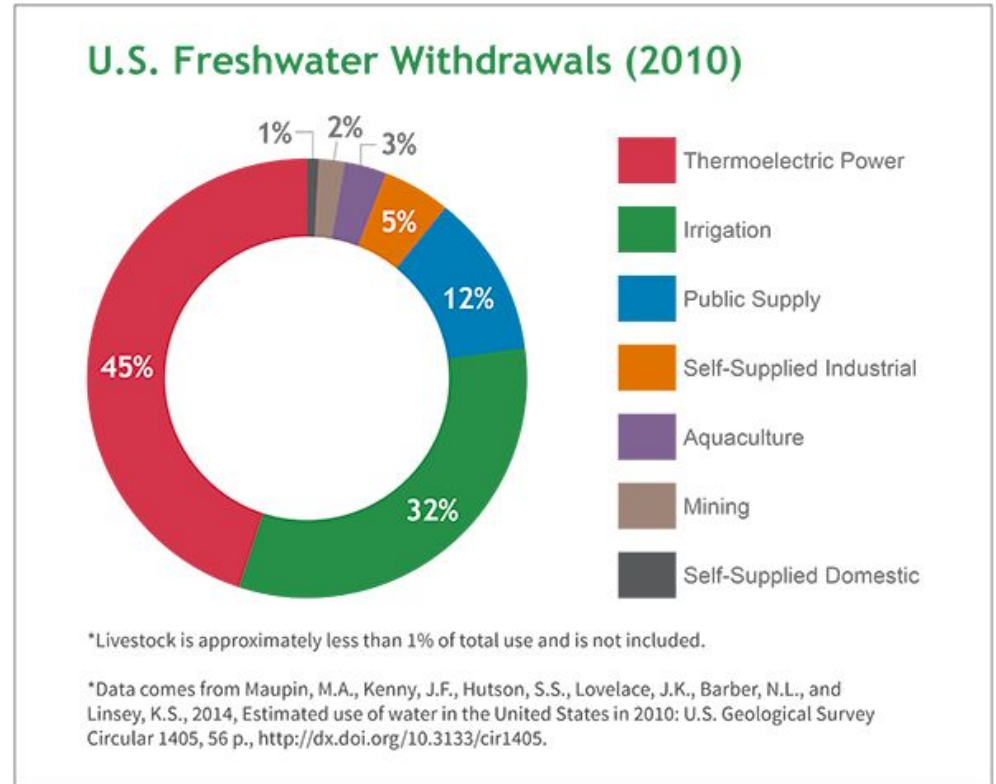
-Water quantity

-Health impacts

-Environmental Justice

# US Water Use Context

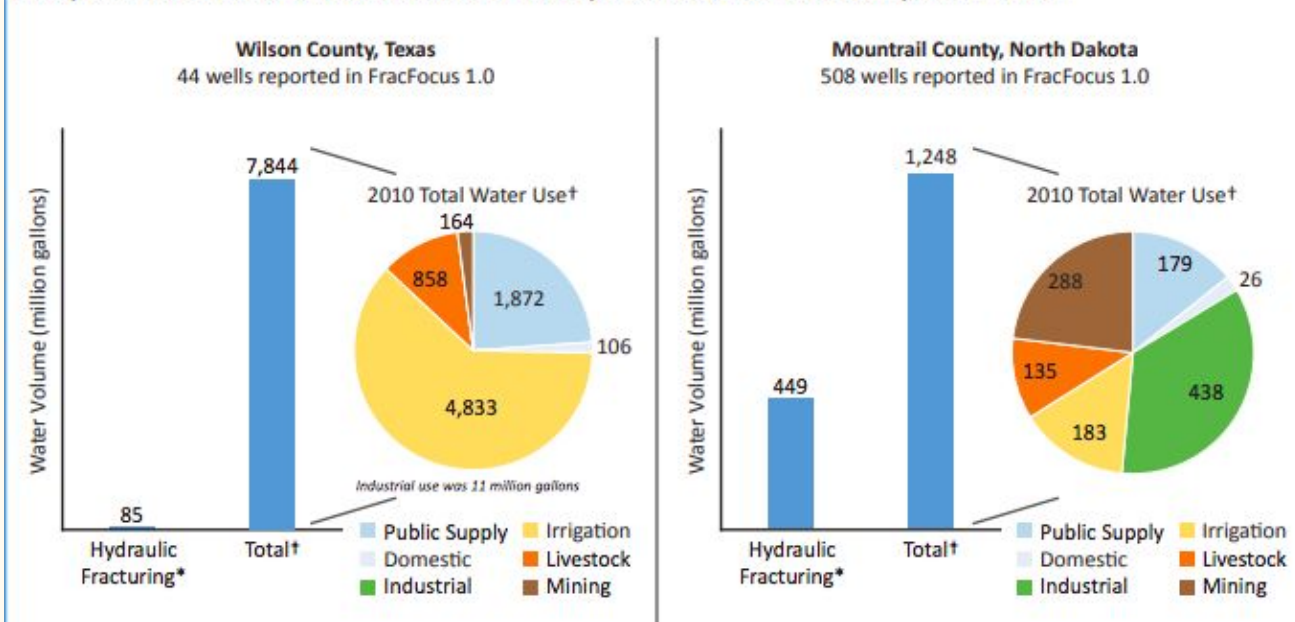
- Less than 1% of annual water consumption
- Perception of enormous water usage can be due to increased energy production



# Water Quantity is a Local Issue

- Over half of all fracking operations in the US since 2011 in high or extremely high water stressed areas
- 55% in areas experiencing drought
- Dimmit County, Texas: 25% of water used towards fracking
- Causing tension in the community amongst different stakeholders, stress, lifestyle changes
- Poses water competition challenges between agriculture, industry, and municipal use

Examples of Water Use in Two Counties: Wilson County, Texas, and Mountrail County, North Dakota



# Health Effects: Differing Camps

## NO IMPACT

- 2016: EPA controversially did not find evidence of “widespread, systemic impacts on drinking water” in US in its six-year study although admits research gaps
- Definitional concern, should be looking at impacted populations
- American Petroleum Institute backs this claim “absence of a direct correlation between hydraulic fracturing and impairments to drinking water quality”

## HARMFUL IMPACT

- Physicians for Social Responsibility, Concerned Health Professionals of NY, Agency for Toxic Substances and Disease Registry, Science Advisory Board
- Cases of groundwater and surface water contamination of drinking water wells have occurred through routine activities and accidents:
  - Wyoming: toxic or carcinogenic compounds in fracking fluid found in drinking wells
  - PE and NY: methane contamination rose with proximity
  - JHU study: PE with highest exposure had higher rates of migraines, nasal problems, fatigue

# Widespread Health Effects

Regional: Respiratory, cardiovascular effects, stress

Local: Highest risk area, includes also nervous system impacts, birth defects, blood disorders, cancer, reproductive issues, mental health, stress of unknown effects and lack of transparency, noise and light pollution

Occupational Hazard: additional exposure to silica sand, which can cause silicosis (lung disease). National Institute of Occupational Safety and Health issued a hazard alert after finding elevated levels of silica in air at fracking sites in multiple states

**YES: FRACKING NEGATIVELY  
IMPACTS HUMAN HEALTH**

# Environmental Justice

**Definition:** defined by US EPA as “fair treatment and meaningful involvement of all people regardless of race, color, national origin, or income with respect to the development, implementation and enforcement of environmental laws, regulations, and policies” (US EPA: Environmental Justice).

-Fracking has a disproportionate impact on **poor, rural communities** in the US who are pressured by the industry to sell their land, more incentivized by economic profit, hold less power than their wealthier counterparts, but rarely reap the economic benefits.<sup>10</sup>

-**First Nations** living in NE BC affected, not fully consulted about developments on their traditional lands. Their Treaty 8 rights are not fully respected.



# LOCATION, LOCATION, LOCATION

- large volume of water used increases water stress, social stress, tension between stakeholders dependent on local context
- numerous data, anecdotal accounts, and reporting to substantiate negative health effects
- environmental justice concerns

# Politics of Hydraulic Fracturing

By Shakti Ramkumar

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## 1. Rules and regulations governing fracking extraction:

- Who makes and influences **decisions** about fracking?
- How is fracking **regulated**? What are the challenges of regulating hydraulic fracturing?

## 2. Geopolitics and Energy Security

- What are the global **political impacts** of fracking expansion?

## 1. Rules and regulations

Who makes and influences **decisions** about fracking?



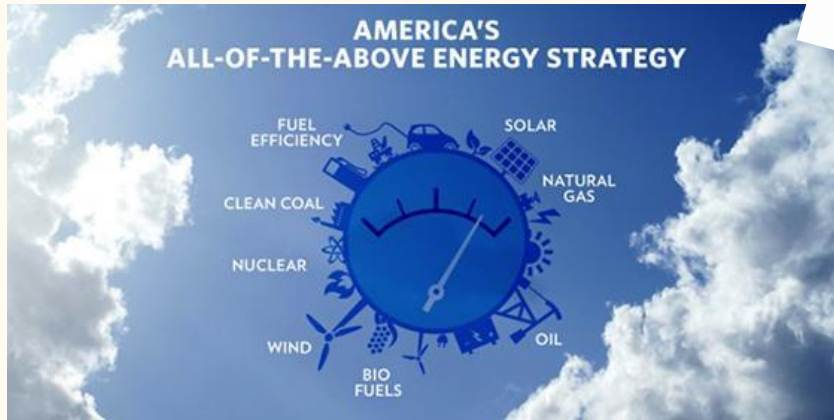
## Governance of fracking influenced by:

- The political ideologies of the government in power
- Scientific research and data
- Vocal support or opposition from environmental activists, NGOs, general public
- Industry lobbyists

# 1. Rules and regulations

## Who makes and influences **decisions** about fracking?

The University of Texas at Austin, for example, endured a **major public relations crisis** in July, when it came to light that Chip Groat, a professor at the Jackson School of Geosciences at UT-Austin and one of the authors of a report on the risks of fracking, had **undisclosed financial ties to the oil and gas industry**. Published under the auspices of UT's Energy Institute, the **February 2012 report** found little evidence of groundwater contamination from fracking—a controversial finding that was immediately embraced by industry and fracking supporters. UT **promotes** **as independent academic research**. And Groat was frequently quoted in



Source: <https://obamawhitehouse.archives.gov/energy/securing-american-energy>

**How Hillary Clinton's State Department Sold Fracking to the World**  
A trove of secret documents details the US government's global push for shale gas.

# 1. Rules and regulations

## Who makes and influences **decisions** about fracking?

The top 10 fossil fuel firms reported a total of 19,517 lobbying contacts with BC public office holders between 2010 and 2016. That's an average of 14 lobbying contacts per business day.

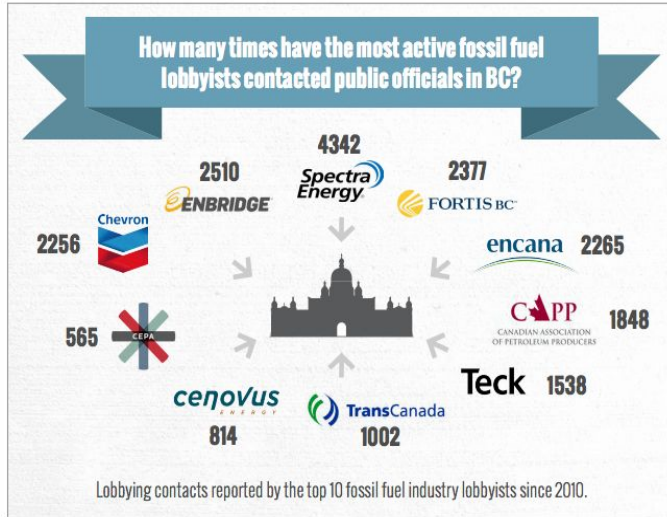


Table 1: Top 10 fossil fuel industry donors to the BC Liberals and BC NDP, 2008–15

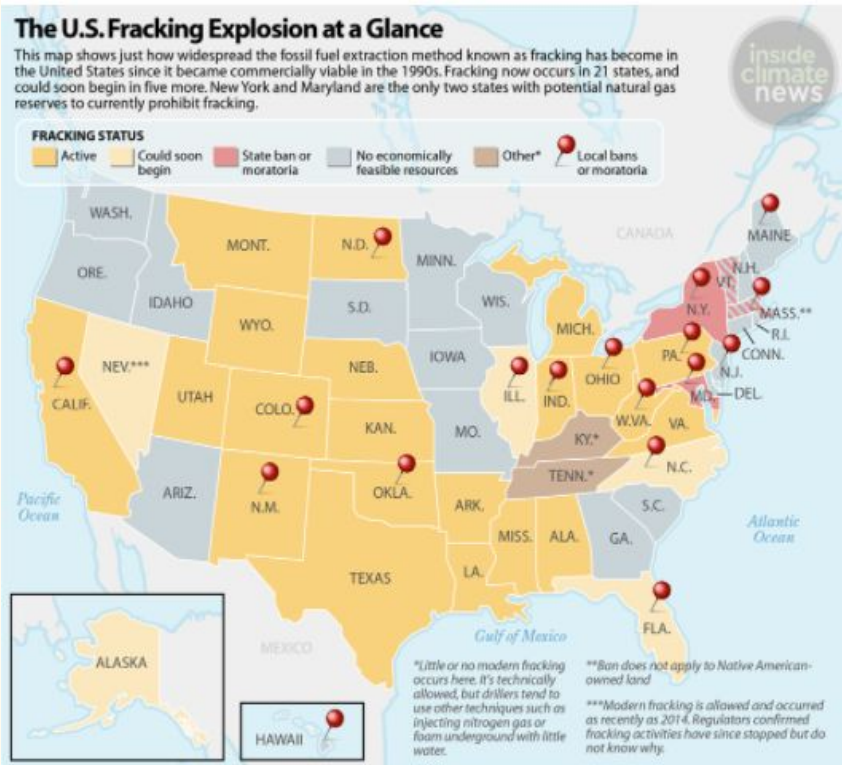
Company/Organization	BC Liberals (\$)	BC NDP (\$)	Total (\$)	Headquarters	Primary activity
Teck Resources	1,502,444	60,090	1,562,534	Vancouver, BC	Mining (diversified)
Encana	896,466	63,775	960,241	Calgary, AB	Oil and gas production
Spectra Energy	232,955	51,725	284,680	Houston, TX	Oil and gas pipelines
FortisBC	210,073	56,440	266,513	Surrey, BC	Gas distribution
Canadian Natural Resources Ltd.	242,000	5,500	247,500	Calgary, AB	Oil and gas production
Enbridge	198,415	12,650	211,065	Calgary, AB	Oil and gas transport
Chevron Canada	140,363	9,675	150,038	Calgary, AB & Vancouver, BC	Oil and gas production and retail
Pristine Power (Veresen)	137,475	0	137,475	Calgary, AB	Gas transport and distribution
Canadian Association of Petroleum Producers (CAPP)	101,950	10,375	112,325	Calgary, AB	Oil and gas lobby
Imperial Oil	111,790	0	111,790	Calgary, AB	Oil and gas production and retail
<b>Top 10 total donations</b>	<b>\$3,773,931</b>	<b>\$270,230</b>	<b>\$4,044,161</b>		

Source: Elections BC's Financial Reports and Political Contributions (FRPC) System.

Source: Graham, N., Daub, S., & Carroll, B. (2017). *Mapping Political Influence*. Canadian Centre for Policy Alternatives. p6 and 15

# 1. Rules and regulations

## How is fracking regulated?



1. **Jurisdictional discrepancies:** Federal and regional governments may have conflicting interests in fracking, or different regulatory authority and capacity
2. **North America:** Little federal regulation, most regulations left up to the state or province
  - Regulation left to the states or provinces leads to significant **variations** in fracking practices and governance across the country
  - Some municipalities and counties have issued local bans or moratoria, even if their state allows it

# 1. Rules and regulations How is fracking **regulated**?

## 3 Regulatory Pathways:



### **Full ban or moratorium**

Decision made based on preventative principle, **precautionary principle**, or strong public opposition



### **Permitted, with regulations that address fracking**

Includes legislation created to address fracking and its impacts specifically.



### **Permitted, using existing regulations with minimum revisions to address fracking-specific impacts**

Governments can simply apply existing oil and gas regulations to fracking. A minimal revision might be limited to requiring or encouraging companies to disclose chemicals used in fracking.



## 2. Geopolitics and Energy Security



### Political implications of increasing fracked oil and gas production

#### PROS:

- Greater energy independence for big oil importing countries
- Valuable commodity for export and economic growth
- Switching to natural gas to phase out coal power could help reduce national GHG emissions

#### CONS:

- Oversupply of shale oil and gas resources leads to global price drop
- Depressed prices make it harder for North American shale resources to compete in the global market
- Doesn't address the issue of overconsumption of energy and resources

## Some things to consider moving forward:

- What are the core values that we hold as a society, or the values held by powerful institutions in our society that inform our decision-making when it comes to fracking?
  - What are some of the similarities and differences in values on either side of the fracking debate?
-

Ecological

Impacts

By: Mihika Shetty

# Ground Water

- Inconclusive studies on contamination however, the possibility exists!
- Fracking in addition with other water uses has depleted groundwater
  - In Pennsylvania that of the nearly 40,000 oil and gas wells (conventional and unconventional) drilled since 2011, three-quarters were located in areas where water is already scarce and 55% were in areas experiencing periodic or chronic drought.

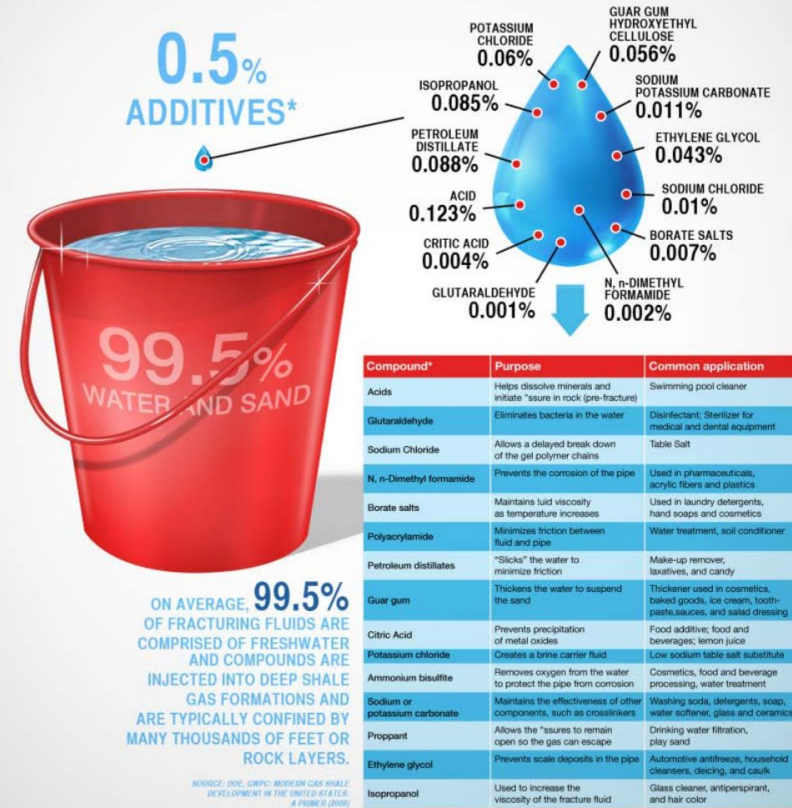
# Surface Water

## Fracking:

- contaminates the water with pollutants
- disrupts sedimentation in streams
  - “Evaluations of fracturing operations in central Arkansas found that surface water–quality violations at site operations were caused by erosion (22%), illegal discharges (10%), and spills (10%)”
- Water contamination can adversely affect wildlife populations through:
  - Habitat degradation
  - Bioaccumulation

[https://www.google.ca/search?q=fracking+intentional+venting&client=firefox-b-ab&dcr=0&source=lnms&tbn=isch&sa=X&ved=0ahUKUkwjkaWsj8fZAhUT7GMKHcDaDFwQ\\_AUICvgC&biw=1813&bih=809#imgrc=qJc\\_VCyNwul4pM](https://www.google.ca/search?q=fracking+intentional+venting&client=firefox-b-ab&dcr=0&source=lnms&tbn=isch&sa=X&ved=0ahUKUkwjkaWsj8fZAhUT7GMKHcDaDFwQ_AUICvgC&biw=1813&bih=809#imgrc=qJc_VCyNwul4pM)

## A FLUID SITUATION: TYPICAL SOLUTION\* USED IN HYDRAULIC FRACTURING



# Quality vs. Quantity

- Taking water from small streams will concentrate contaminants
- Cumulative Effects: Fracking + Agriculture
  - Can lead to water shortages
  - In Michigan, irrigation purposes increased between 2010 and 2012 from 85 541 million gallons to 159 552 million gallons (Figure 3). During that same period, HVHF water withdrawals increased from 10 million to 55 million gallon
  -

# The Air Quality Dilemma

- Fracking produces a greater ecological footprint than coal

However...

- The switch from coal to natural gas for electricity generation will reduce sulfur, nitrogen, mercury, and particulate air pollution (reduce air pollution overall)
- Air emissions differ regionally depending on natural gas and oil composition, separation requirements, and different state regulations

# Wildlife Impacts

- The environmental impact begins long before fracking even starts
  - Construction of sites and roads lead to habitat fragmentation
  
- Noise pollution and lights can affect feeding and breeding of local wildlife



# Mitigation Efforts

## **RAIN (River Alert Information Network)**

- The goal is to establish a multiple barrier approach for drinking water protection
- Implements these goals by installing monitoring equipment at appropriate locations and providing operational training
- Provides information and tools to aid water suppliers in making decisions and improving communication between water suppliers about water-quality events

## **Green Completion**

- Profitable for companies
- Natural Gas is separated from water and is then placed into a pipeline to be sold

# Environmental Sustainability

By Adele Therias

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# Hydraulic Fracturing: the Bridge to a Clean Energy Future?

Water - Emissions - Coal - Renewables

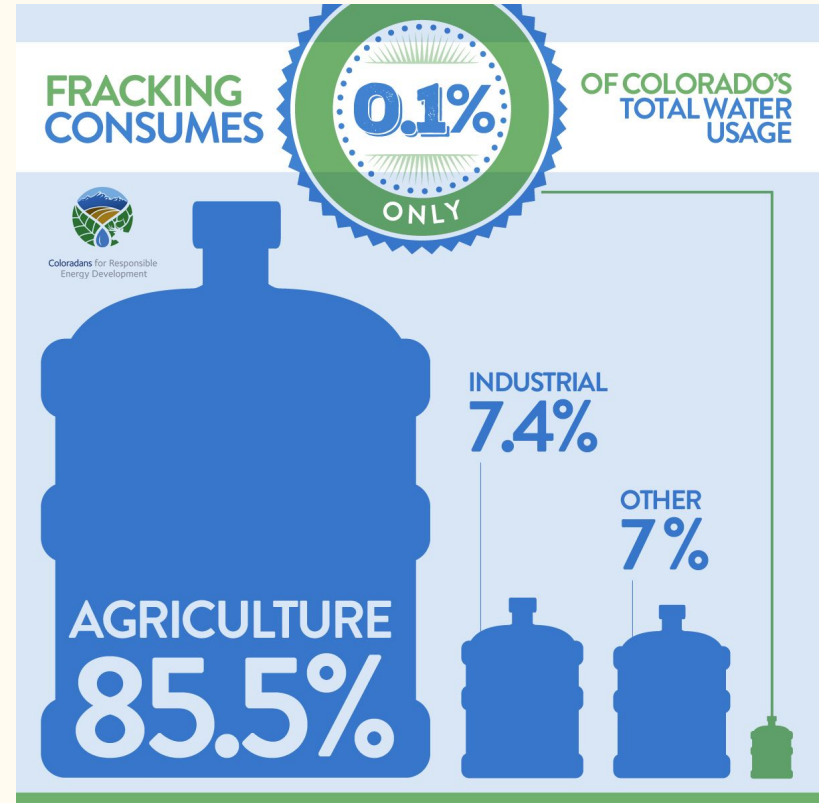
# The Bridge to a Clean Energy Future?



[America's Natural Gas Alliance](#), 2011

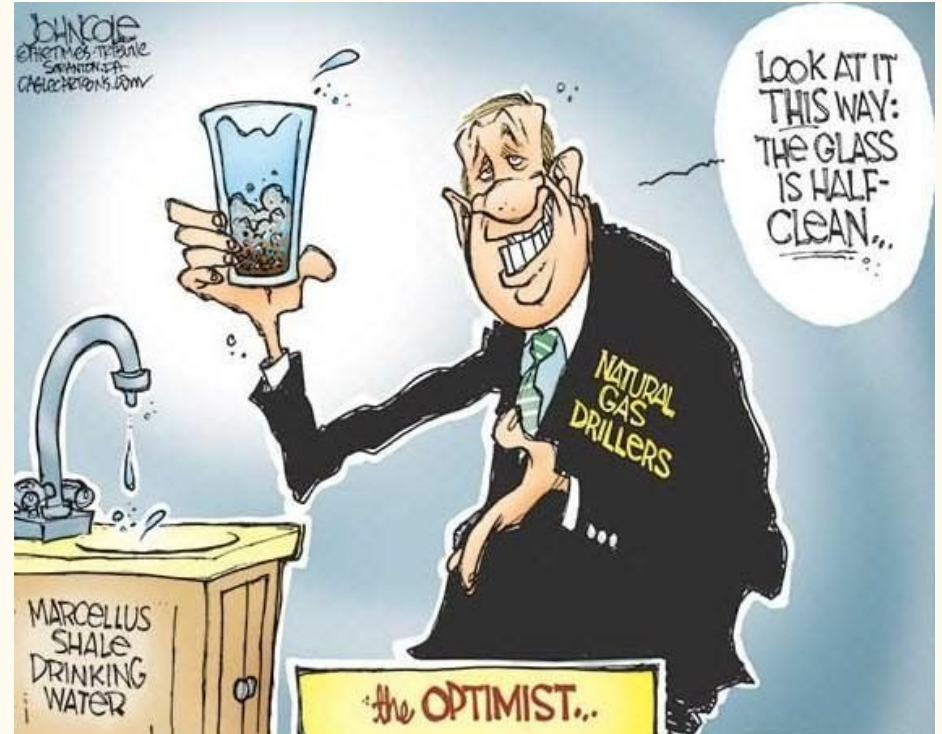
## Water Usage

- Each hydraulic fracturing well uses between **8,000-80,000 m<sup>3</sup>** (2-20 million gallons) of water.
- Compared to Shale Gas extraction:
  - Coal = **2x** more intensive
  - Nuclear = **3x** more intensive
  - Oil = **10x** more intensive
  - Biofuels = up to **1000x** more intensive.



## Water Usage

- **10-40 %** of water injected at a well site returns as flowback water.
- **95%** of wastewater produced from hydraulic fracturing in the US is injected underground.
- Innovation in water recycling and treatment: is that enough?

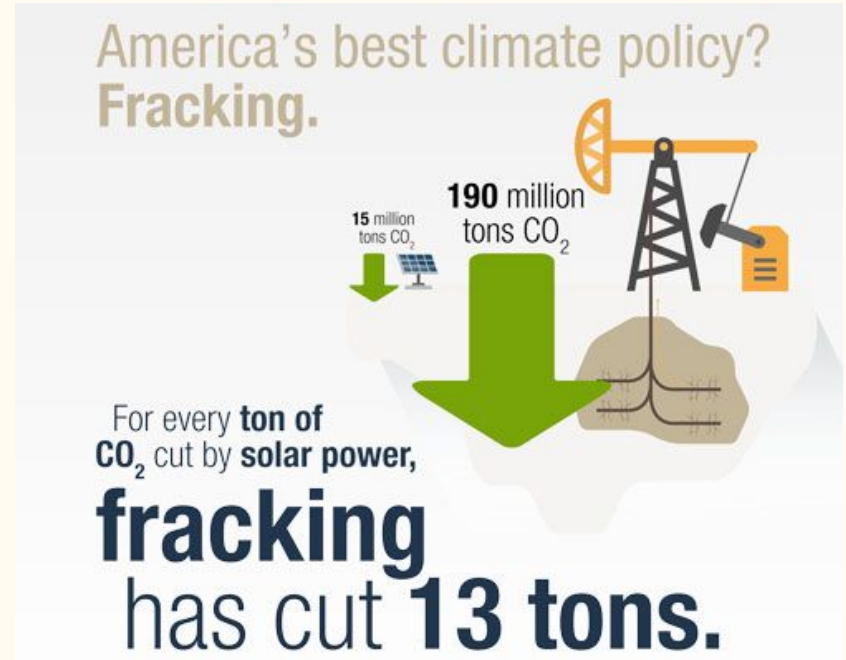


Emily Dee, 2011

# The Bridge to a Lower-Carbon Future?

## GHG Emissions from Combustion

- Natural Gas generates lower **Carbon Dioxide** and **local pollutants** per unit of energy produced than other fossil fuels.
- “Replacing coal with natural gas in power plants [...] **reduces the plants’ greenhouse emissions** by up to **50%**” (Engelder, 2011 as cited in Sovacool, 2014, p. 253)



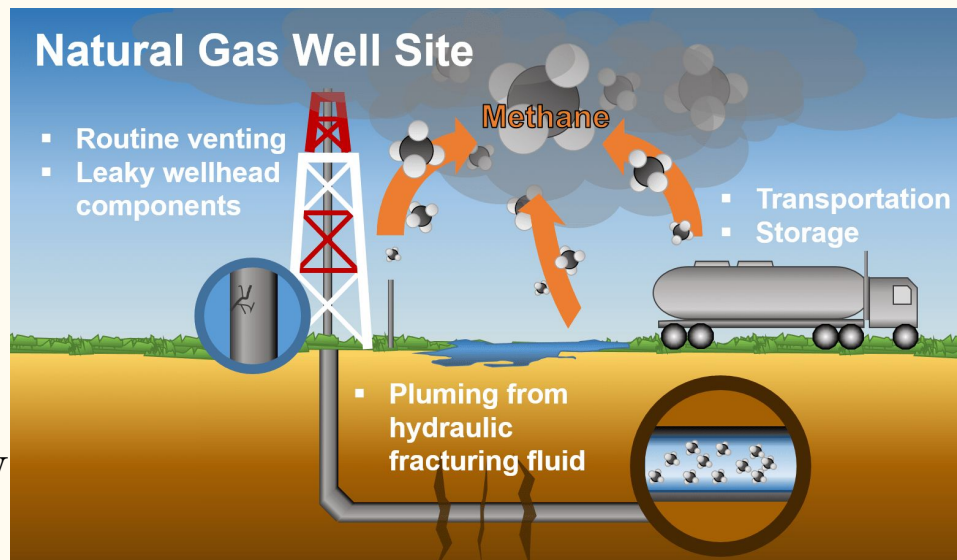
Natural Gas Now, 2015

## GHG Emissions from Production

**Methane** escapes during extraction and processing, wastewater storage, through leaks in system, and during flaring.

~ **83%** of emitted methane is released via intentional venting

- Between 2005 and 2014: **6648** spills reported across Colorado, New Mexico, North Dakota, and Pennsylvania (**over 47,000 cubic metres**)



Wierbowski, 2015



## GHG Emissions from Production

- EPA estimate: fracking leaks account for **0.2-1.5%** of gross natural gas production.
- Impact on climate change **130-200%** greater than conventional natural gas.
- Green completion required at new wells by 2012 EPA New Source Performance Standards

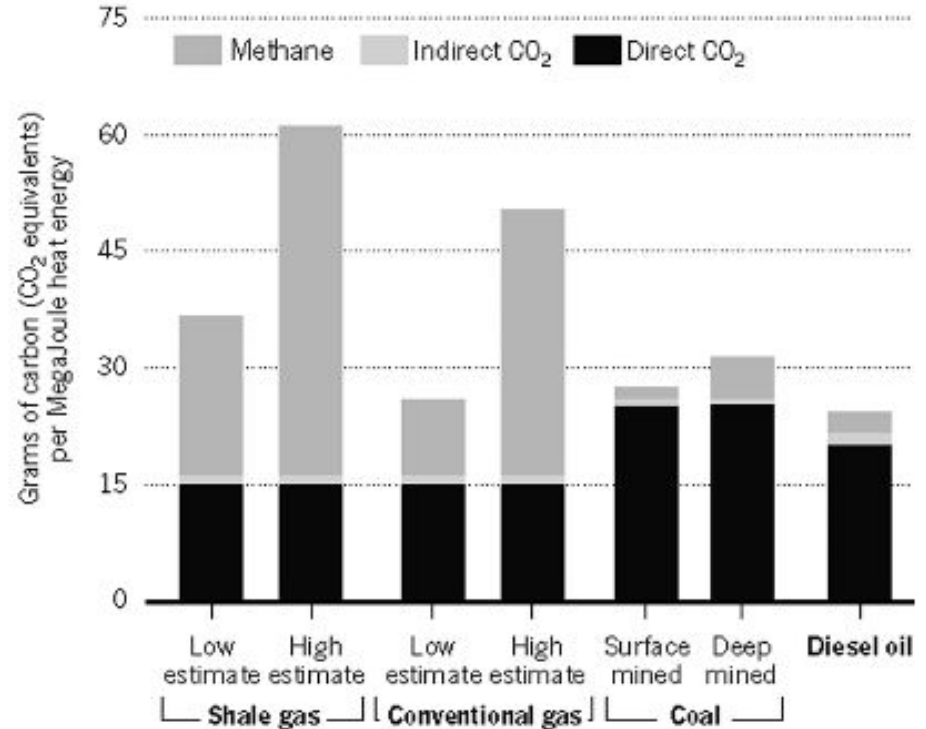


Fig. 9. Greenhouse gas emissions from shale gas, conventional gas and coal. Source: Howarth and Ingraffea [38].

# The Bridge to a Lower-Carbon Future?

## Replacing Coal

“Historically, coal supplied almost half of the [US]’s electricity. Yet, as of April 2012, **natural gas and coal were virtually tied**, with each providing **32% of total generation**. Dozens of existing coal plants have been shuttered, and over a hundred new plants have been cancelled”

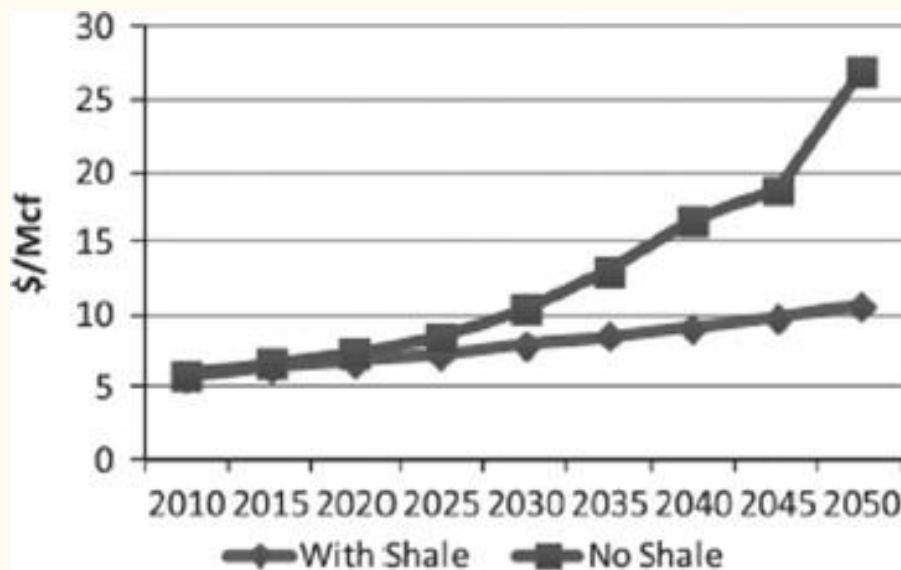
(Parenteau & Barnes, 2013, as cited in Sovacool, 2014, p. 253)

- Local impacts turn Global: US export of coal linked to increase in coal combustion in Europe 2012-2013.

# The Bridge to a Lower-Carbon Future?

## Impact on Renewable Energy Sector

- Natural Gas plants can **rapidly ramp up and down** and complement variable energy sources.
- EIA predicts that natural gas plants will account for **63%** of new electricity between 2014 and 2040, vs **31%** for renewables, **3%** for coal and **3%** for nuclear [10].



Expected natural gas prices for the United States, 2010–2050. *Source:* Jacoby et al. (in Sovacool, 2014)

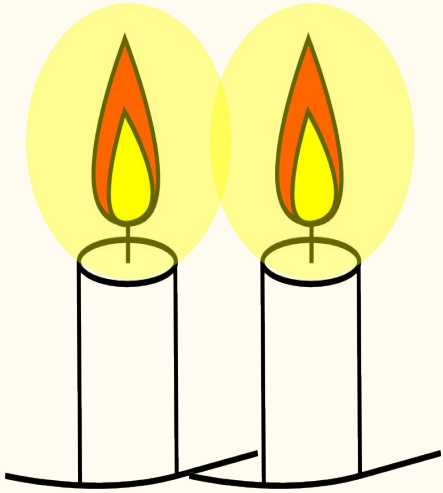
“Unconventional fuels are no solution for global energy problems. At best they offer a viable bridge for conversion of the energy system, at worst they perpetuate existing use paths.”

(Westphal, as cited in Sovacool, 2014, p. 259)

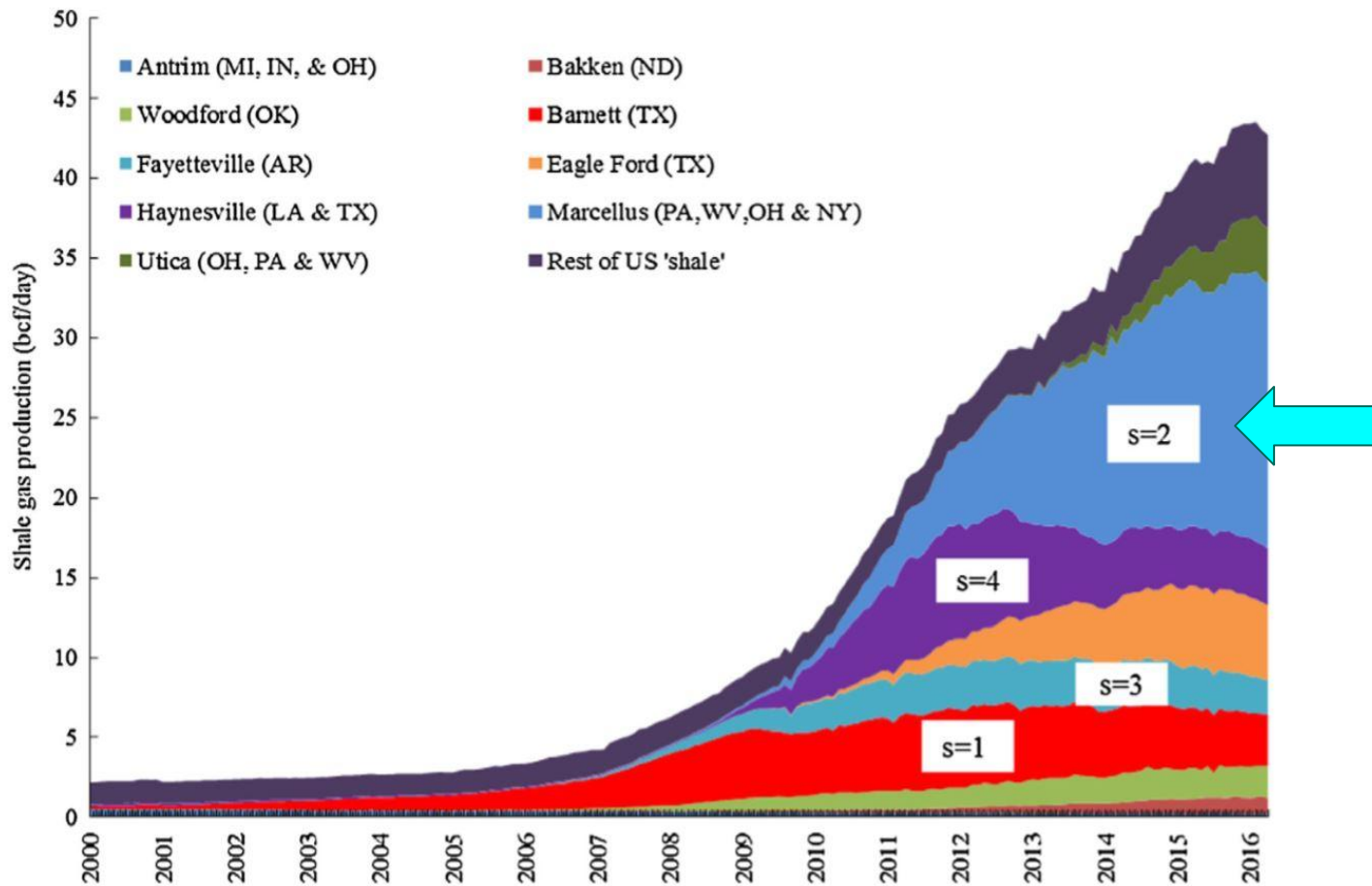
# Marcellus

- the “Saudi Arabia of natural gas”









**Fig. 1.** Monthly shale gas production in the US.

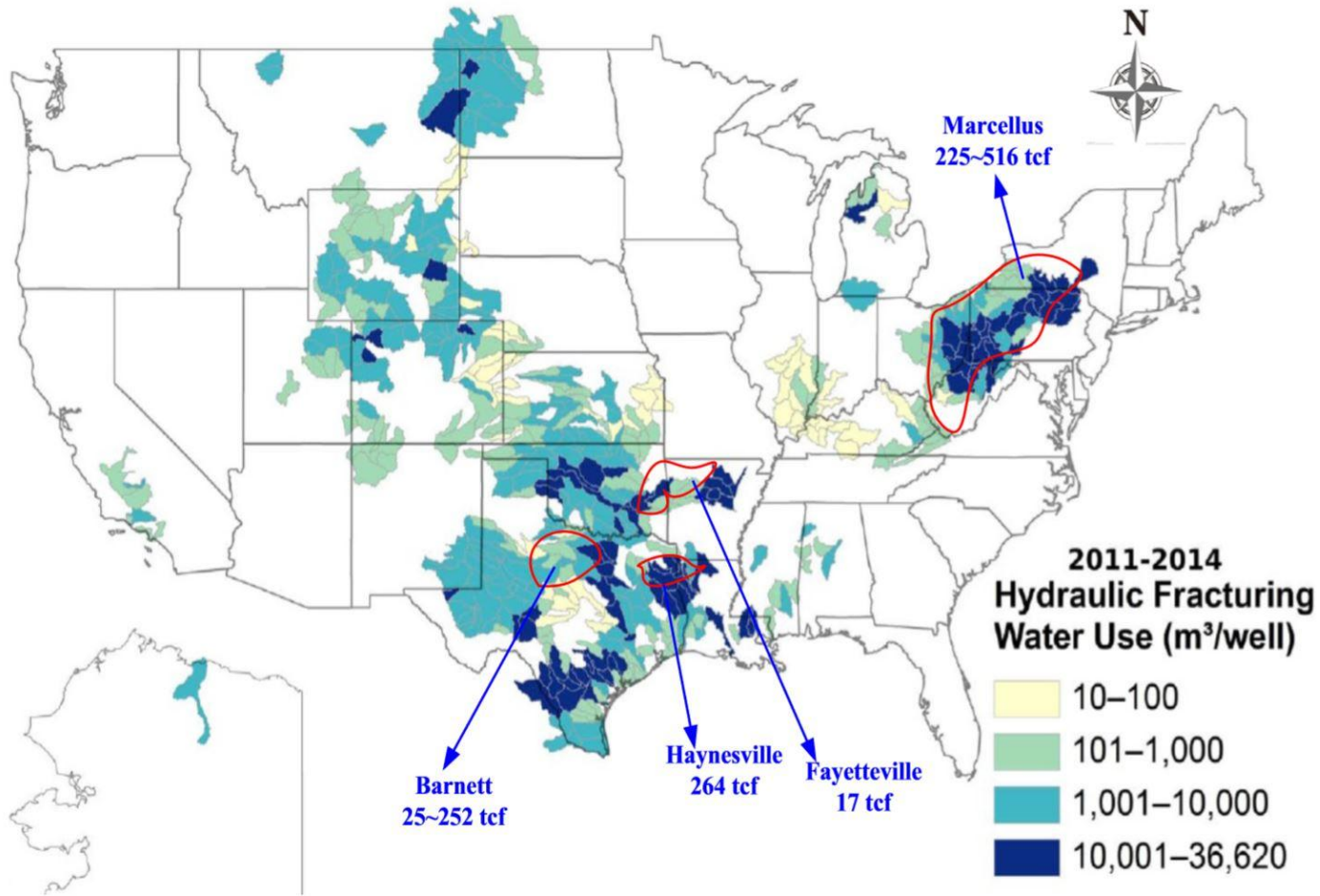


Fig. 2. The major shale gas basins of the US with estimated gas reserves.

Most extensive shale formation

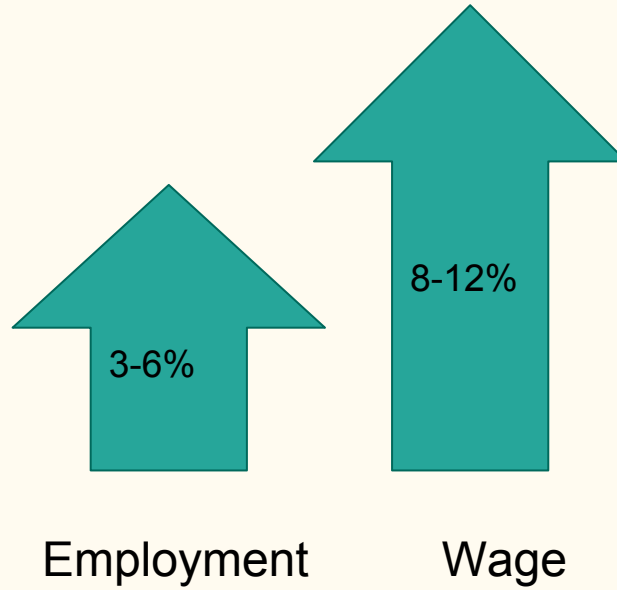
Depth-  
4000-8000 ft

Thickness -  
50-200 ft

14-25 million hectares



# Economics - benefits



# Economics - uncertain future

- Over-estimation?
  - Did not take into account land use features
  - Accessibility?
    - 30-40% not accessible due to regulations, land use, and geographical features

# Environmental - Wastewater

- High in radioactive compounds
- High cost of water treatment
- Reuse???
- Leaks and blowouts

# Environmental - deforestation

- Fragmentation - Edge Effect
- Bradford County:
  - 2000-2012, 13,000 ha forest gone (=4.3% area of county)

>5,500 wells within 1km of wetlands in

Horizontal structures most detrimental



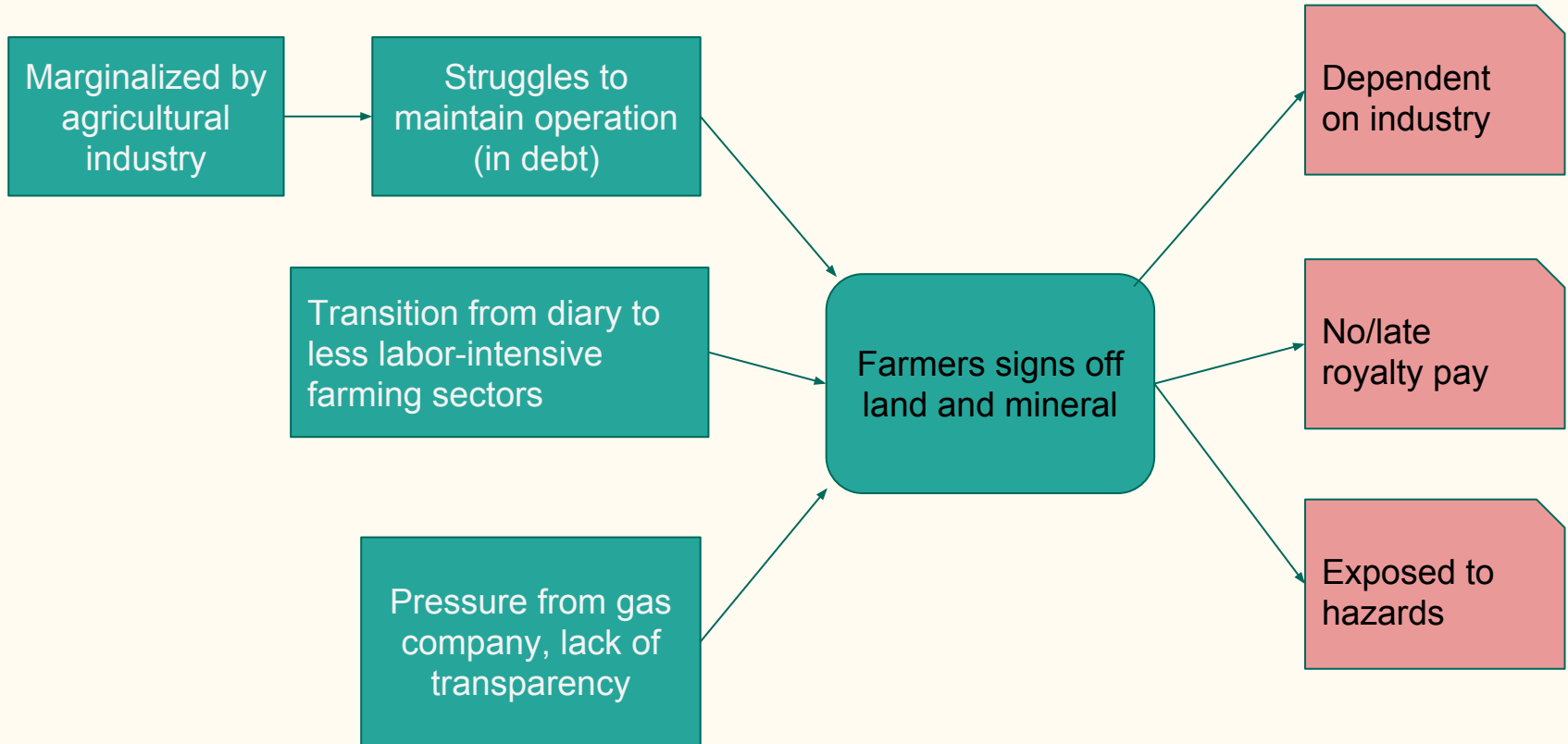




# Social - policy...

- Hydraulic fracturing has many exemptions from state (and some federal) regulations
  - Safe Drinking Water Act exempts “underground injection of fluids . . . pursuant to hydraulic fracturing operations related to oil, [and] gas”, leaving it to the state to set standard for wastewater guidelines
- Gas company violations
  - Such as permitting issues, sedimentation issues, does not maintain best practice, pollution incidents
- State failure
  - 55% of well inspection missed

# Social - Farmer's' Dilemma - “Devil’s Bargain”



# Summary



Economical boost

Abundant source of energy



Economical dependency

Environmental impact

Incomplete policy



# Images

<http://climatechange101.blogspot.ca/2010/04/trip-to-marcellus-outcrop-with-sara.html>

<http://www.clker.com/cliparts/H/K/q/s/0/z/candle-hi.png>

<https://www.usnews.com/dims4/USNEWS/e3acce9/2147483647/resize/652x%3E/quality/85/?url=%2Fcmsmedia%2Fc6%2F1ded0843cb64f84eabb34ee2f03839%2F498-16>

<http://www.yim778.com/WDF-823324.html>

<https://www.xconomy.com/wordpress/wp-content/images/2015/05/Pile-of-money-stock-image.jpg>

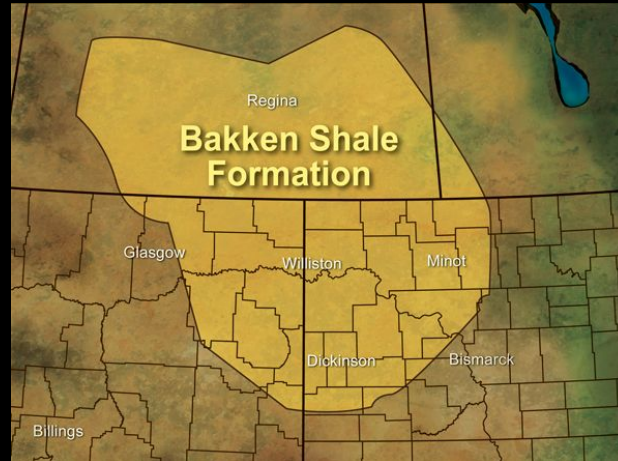
<http://cooper.edu/sites/default/files/HFb1.png>

<https://static01.nyt.com/images/2011/09/27/business/FLARE/FLARE-articleLarge.jpg>

[http://1.bp.blogspot.com/-KvEpsO\\_zR4U/UTEG37RXUFI/AAAAAAAAAF-0/T3IY05BlaFo/s1600/Smiley-Face.jpg](http://1.bp.blogspot.com/-KvEpsO_zR4U/UTEG37RXUFI/AAAAAAAAAF-0/T3IY05BlaFo/s1600/Smiley-Face.jpg)

<https://www.polyvore.com/cgi/img-thing?.out=jpg&size=l&tid=55458054>

# Bakken- North Dakota



# Outline

1. Introduction
2. The environment
3. Social (Williston and the MHA Nation)
4. Presentation conclusion

# Introduction

- Located in **North Dakota**, **Montana**, **Saskatchewan** and **Manitoba**
- 91%** of North Dakota's oil production
- North Dakota **2nd** biggest oil producer in the U.S.
- MHA Nation** reservation is located at the heart of the Bakken Formation

# Environment-Spills

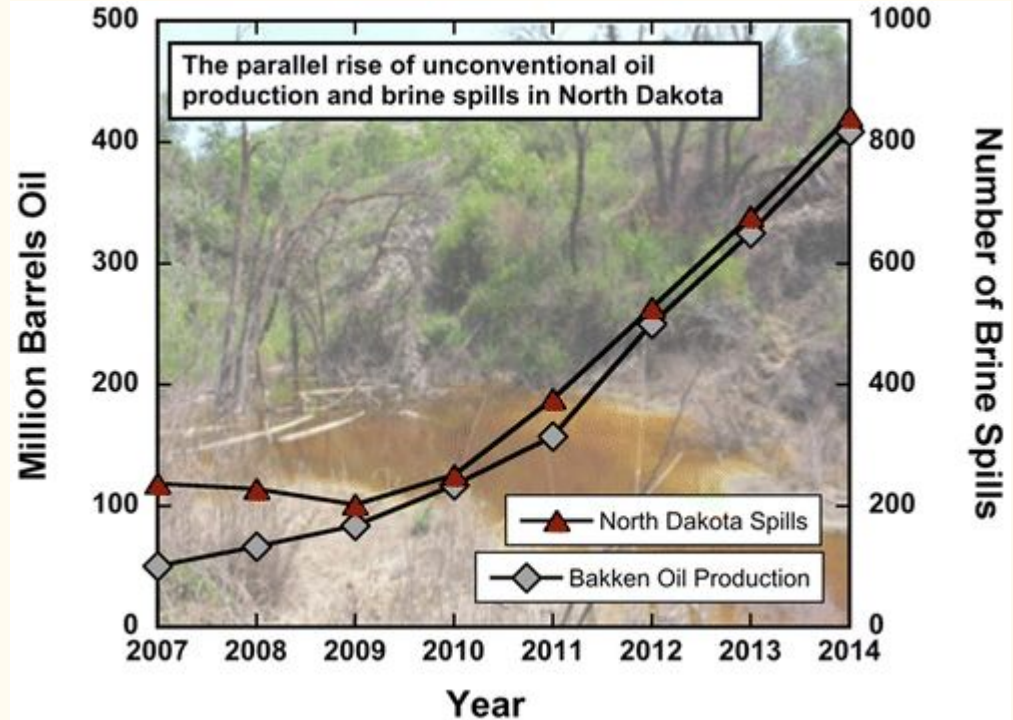
Brine= salty water that is naturally occurring, but brought to the surface in the process of fracking

-Risk associated with disposing wastewater

-Concerns of water contamination



<https://phys.org/news/2016-04-contamination-north-dakota-linked-fracking.html>



(Lauer N., Harkness J., & Vengosh A., 2016)

# Environment- Landscape

Study by Christie, K., Jensen F. and Boyce, S.:

- Pronghorn habitat fragmentation
- Well pads on high value habitat
- Roads and fences interrupt critical migration



Pronghorn Antelope (North Dakota)

Copyright 2007 - Monte M. Taylor

[http://www.tsuru-bird.net/a\\_species/antelope\\_pronghorn/index.html](http://www.tsuru-bird.net/a_species/antelope_pronghorn/index.html)

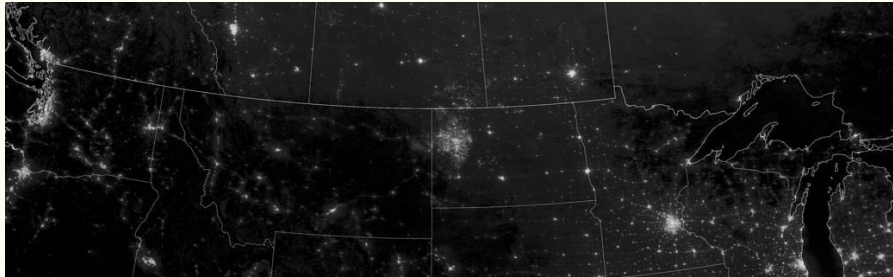
# Environment-Flaring

”**Flaring**”- Burning off natural gas that is “bubbled up” from at the fracking site. It is less profitable, and requires more infrastructure to bring it to market.

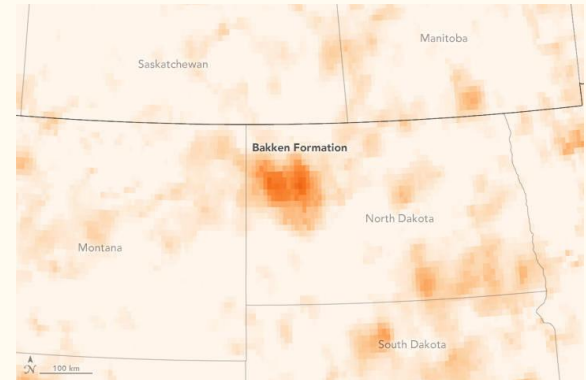
-Releases GHG

-Legal, but loose restrictions in place.

-Flaring has decreased as pipelines increase



<https://www.nasa.gov/feature/goddard/2016/nasa-scientists-scrutinize-arctic-gas-flaring-pollution>



Nitrogen Dioxide Satellite Data-NASA

# Environment- Groundwater Contamination

- Little research into how fracking affects groundwater in North Dakota
- One study by McMahon et al. (2015) found no contamination of groundwater due to “energy-development activities”
  - study not conclusive
- Another study by S. Flewelling & M. Sharma (2013) found that upward migration of fracking brine and fluids is unlikely



# Social- Williston aka “Boomtown USA”

- Fastest growing “micropolitan area” in the US in 2012-2013
- Law enforcement and social services overstretched
- Housing crisis, increased cost of living
- Violence, drugs, sexual abuse



<http://evstudio.com/building-boom-in-williston-north-dakota/>

# Social- MHA Nation

- A portion of fracking in the Bakken formation takes place on the **Fort Berthold Indian Reservation**, home of the **Mandan Hidatsa Arikara (MHA) Nation**
- Garrison Dam built in 1940s displaced hundreds of MHA Nation families, flooding their land.



<http://lib.nhsc.edu/FortBerthold/MIIndex.asp>



[https://www.mhanation.com/main2/departments/fish&wildlife/media/media\\_pictures.html](https://www.mhanation.com/main2/departments/fish&wildlife/media/media_pictures.html)

# Extractivism

“A mechanism of colonial and neocolonial plunder and appropriation...exploitation of the raw materials essential for the industrial development and prosperity”(Acosta 2011)

# Social- MHA Nation

-**“Oil runners”**- conned Tribal members in to signing cheap leases before the oil boom. Tribal members did not know the market value of their land.

-Corrupt leadership of Tribal Chairman Tex “Red-Tipped Arrow” Hall

# Social- MHA Nation

## Advantages

- Economic benefit: millions of dollars in tribal tax revenues
- Tribally-owned oil production companies brings local revenue and jobs- **advanced sovereignty**
- “The People’s Fund”- investment policy

## Disadvantages

- Bi-annual payment to tribal members over 21 is \$1,000
- Loss of the cultural home and culture of MHA Nation
- Increased crime rates, human trafficking, drugs, cost of living, noise and light pollution, and population growth
- Health risks (known and unknown)

# Conclusion

Bakken formation exemplifies the **environmental, social, political, and economical** issues that my colleagues raised today. It also highlights the **water-energy nexus**, the problem that drives our conversation today.

Is hydraulic fracturing  
worth it?

# Questions for the Class:

1. Do the economic benefits of hydraulic fracturing outweigh the environmental or social impacts?
2. To what extent should we consider the small proportion of those affected by the impacts of energy production in comparison to the nation-wide economic benefits?
3. Do you think energy production should be controlled by the government and if so at what scales of government?
4. In what ways can fracking be a means to advance sovereignty of First Nations? Can the cultural and health impacts be reconciled by economic prosperity?
5. Given a region that is water-rich and has shale oil/gas deposits below, is hydraulic fracturing a good or bad option for energy consumption? Why?