PREPARED BY:
Alexander Krokus
Policy Research Aide
Oregon Senate District 22
041117-HB 2711

PREPARED FOR:
Chair Representative Ken Helm, Vice-Chair Representative Mark Johnson, Vice Chair Representative Karin Power, Representative Phil Barnhart, Representative Cliff Bentz, Representative Deborah Boone, Representative Paul Holvey, Representative E. Werner Reschke, Representative David Brock Smith

HOUSE COMMITTEE ON ENERGY & ENVIRONMENT

JUSTIFICATION FOR IMMENSE SUPPORT OF HB 2711:

11 April (2017)

VAST RISE OF HYDRAULIC FRACTURING IN THE U.S., AND THE EXTENSIVE ADVERSE ECOLOGICAL CONSEQUENCES AS A RESULT OF FAILED STATE AND FEDERAL REGULATORY ENVIRONMENTAL POLICIES

The quantity of unconventional hydraulic fracturing campaigns has increased immensely, predominantly in the US, over the past decade (Holland and Arnold 2013; Gallegos et al. 2015). Numerous academic scholars of political science and ecology have published substantial research pertaining to the highly probable negative *"environmental and economic consequences"* resulting from this *"rapidly emerging industry"* (Howarth et al. 2011; Osborn et al. 2011; Clark et al. 2012; Davis and Robinson 2012; Warner et al. 2013; Holahan and Arnold 2013). The principal contributor to the negative environmental damage sustained as a result of the hydraulic fracturing process, is that the regulations which administer unconventional horizontal gas drilling, fail to adequately protect against *"potential negative environmental externalities"*, such as the vast polluting and contamination of below ground aquifers, lakes, streams, diminished air quality, and the recent increased frequency and intensity of seismic activity (Soeder and Kappel 2009; Kargbo et al. 2010; Gregory et al. 2011; Chalmers et al. 2012; Vidic et al. 2013; Brittingham et al. 2014; Mauter et al. 2014; Gallegos et al. 2015; USGS 2016a; USGS 2016b).

These adverse biological and ecological impacts are considered to be *"non-point source pollution problems",* which have been created by ineffective regulatory policies, that do not take into consideration the indirect dangers of unconventional gas drilling. Unconventional hydraulic fracturing is predominantly conducted in *"unknown geological conditions",* due to the mass drilling of directional or horizontal wellbores (Chalmers et al. 2012; Holahan and Arnold 2013). Conventional wellbores are placed, on average, approximately 6,000 feet into a permeable rock formation (US EIA 2012), while unconventional horizontal wellbores can be drilled in excess of 13,000 feet below the Earth's surface, and then extending over 10,000 feet horizontally, crossing into highly impermeable rock deep into uncharted geographical territory (Zoback et al. 2010; USGS 2012; Office of the Auditor General of Canada 2012).

A minimum of *"2 million"* gas wells in the US have been *"hydraulically fracture-treated"*, and approximately *"95% of new wells drilled today are hydraulically fractured"*, and *"67%"* of all natural gas production domestically is obtained by unconventional horizontal drilling (US DOE 2013a).

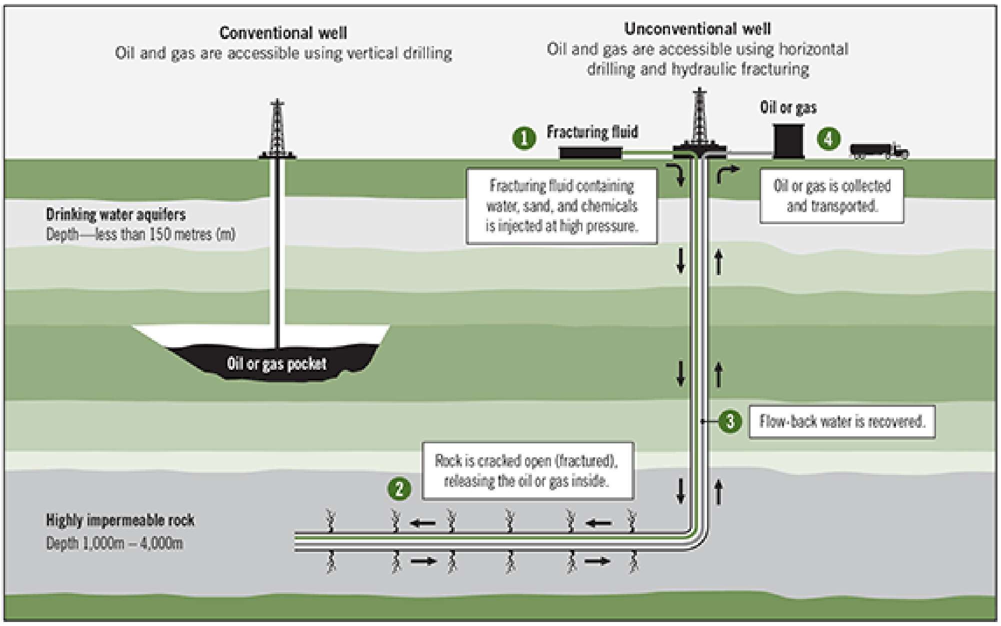

Figure 1: Basic comparison of a conventional vertical hydraulically fractured well versus an unconventional horizontal well. An unconventional directional well would not begin on a vertical decent, it would descend direction, and would most likely become horizontal, once located in impermeable rock formations (Office of the Auditor General of Canada 2012).

Office of the Auditor General of Canada. 2012. Report of the Commissioner of the Environment and Sustainable Development: Chapter 5.71 Hydraulic Fracturing in Canada. Cat. Mo. FA1-2/2012-2-5E-PDF. ISSN 1495-0782.

Regulatory policies which protect human and environmental standards from the unconventional natural gas extraction process, are solely administered by individual state authorities for all oversight and implementation plans (Energy Policy Act of 2005). The US federal government has carelessly granted this authority over to the states, which has enabled the natural gas industry to create their own standard procedures for contaminated waste disposal, and has also warranted their unethical methods pertaining to ecological destructive exploratory methods. The US natural gas industry also receives numerous environmental exemptions that are not granted to other major industrial sectors. The US Congress has exempted the use of all related hazardous fracturing fluid contaminants, by categorizing and protecting this highly profitable industry under the *Resource Conservation and Recovery Act* of 1976 (Energy Policy Act of 2005; Inglis 2015; Ridlington et al. 2015).

The *Energy Policy Act* of 2005 eliminated the EPA's ability to regulate invasive *"sediment runoff"* from hydraulic fracturing sites (Energy Policy Act of 2005; Ridlington et al. 2015), and also allows the industry a "*categorical exclusion"* from the *National Environmental Policy Act*. This enables companies to conduct new drilling operations in existing well sites, without having to engage in an initial environmental assessment before they conduct future operations (Energy Policy Act of 2005). This allows corporations to repeatedly degrade ecosystems which have already been vastly compromised. The *Energy Policy Act* of 2005 also removed vital federal enforcement pertaining to the *Clean Water Act*, and *Safe Drinking Act*, excluding these essential environmental regulations from the hydraulic fracturing industry (Energy Policy Act of 2005; Ridlington et al. 2015).

Oil and gas companies that engage in hydraulic fracturing also receive a special exemption by not having to submit an annual "*Toxic Chemical Release"* form, which is required by other industries regulated by the EPA. The oil and gas industry also claim that a number of their adjuvants contained in their water solution are considered proprietary information, and that *"any disclosure would harm their competitiveness"* in the economic sector (Warner and Shapiro 2013).

The *Energy Policy Act* of 2005 provided complete jurisdiction pertaining to the oil and gas industry to be enforced by individual states, rather than by federal regulatory agencies. This underrepresentation of federal environmental policy makes it exceptionally difficult to regulate this highly controversial industry. Some states decide to grant the legal authority to *"individual regulatory agencies"*, while other states only regulate the *"well-permitting process"*, which unfortunately allows corporations to commit numerous violations, without any oversight, or any obligation to protect the biological safety of nearby communities (Warner and Shapiro 2013). This imprudent decentralized approach enables states the ability to determine the extent of enforcing critical and necessary federal pollution control standards. This substantial loophole in federal regulation makes it extremely difficult to hold any corporation engaging in hydraulic fracturing accountable for continuous acts of environmental injustice.

The EPA estimates that *"25,000-30,000 new wells were drilled and hydraulically fractured annually"*, just in the US, from 2011 to 2014 (EPA 2015). The EPA also proclaims that preexisting injection wells that are *"more than one year old",* were *"also likely fractured"*. Half of all US hydraulic fracturing wells are located in the state of Texas. Because Texas does not possess the available surface water to enable the ability to successfully conduct fracturing activities, they primarily use groundwater to support the entire process (EPA 2015).

Due that unconventional hydraulic fracturing requires directional or horizontal drilling, the possibility of illegally invading nearby landowners property without their consent, is considered a common occurrence. Residents of communities negatively impacted by unconventional fracturing exploration are exceptionally concerned with the fear of unknown contamination in their water supply. This is a direct result of the industry's reluctance to disclose proprietary information pertaining to the harmful contents of their water solution. According to the EPA, chemicals used in the fracturing process usually only *"comprise a small percentage"* of the solution, approximately *"2%"* (EPA 2015). If you consider that each individual hydraulically fractured well requires an average of over five million gallons of water for injection, which is approximately thirty times higher than in the year 2000, that 2% is equivalent to over 100,000 gallons of chemicals at the low end of the spectrum, with the ability to produce an astounding 316,000 gallons of chemicals per well, for each fracturing session, which can transpire multiple times annually, for decades (Gregory et al. 2011; EPA 2015).

Hydraulic fracturing wells located in the US injected a grand total of "*250 billion gallons of water"*, along with 5 billion gallons of toxic chemicals into unstable wellbores between 2005-2012 (Inglis 2015). A majority of these highly hazardous chemicals are stored on-site for easy access. In the state of Pennsylvania, the frequency of hydraulic fracturing chemical spills is approximately 6.3 spills (0.4 -12.2) per 100 wells (EPA 2015). During the year of 2015, there were 136,036 active wells located in PA. These wells could be considered to possess the potential ability to create 8,570 toxic chemical spills into their natural environment (Kelso 2015).

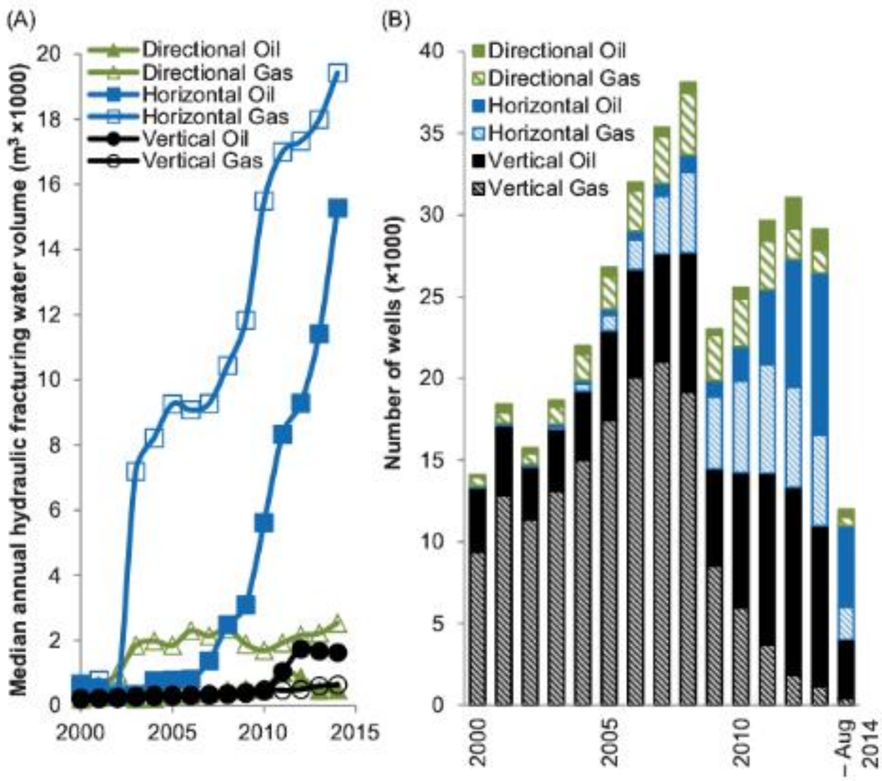

Figure 2: (A) Displays immense increase in the requirements for water volume necessary for unconventional hydraulic fracturing in the US from 2000 to 2014. The average water volume required per fracturing cycle, per well, in 2000 was approximately 177,000 gallons. In 2014, due to the rise of unconventional direction or horizontal drilling, that number climbed to over 5 million gallons per well for unconventional hydraulic fracturing (Gallegos et al. 2015).

Gallegos T, Varela B, Haines S, Engle M. 2015. Hydraulic fracturing water use variability in the United States and potential environmental implications. US Geological Survey, Eastern Energy Resource Center. US Geological Survey, Central Resource Center. Water Resour. Res. (51)5839-5845.

In Pennsylvania, hydraulic fracturing corporations continuously violate laws established to protect the ecological environment, and *"human health on virtually a daily basis"*. From January 2011 to August 2014, *"the top 20 offending fracking companies"* had *"an average of 1.5 violations per day"* (Inglis 2015). The actual number is considered to be exceptionally higher, due to the fact that Pennsylvania inspectors primarily elect to decline the enforcement of violations, if companies decide to *"voluntarily agree to fix"* the problem. This type of relaxed regulation has been documented by other studies observing safety standards pertaining to other states involved with hydraulic fracturing, which reveals repeated violations of federal health and safety laws threatening the human security of millions of US citizens (Inglis 2015). One example, *Chief Oil & Gas*, was cited in 2012 for illegally dumping *"4,700 gallons of hydrochloric acid"* into Towanda Creek. Leroy township, where this unethical environmental infraction occurred, had a similar accident transpire just one year earlier. A *Chesapeake Energy* well *"suffered a 10,000 gallon fracking fluid blowout"* in 2011, in the same exact township of PA (Detrow 2012a).

Hydrochloric acid has an essential role in the hydraulic fracturing process. It is used to *"clear our cement debris left over from the drilling stage, and to help open up the underground shale fractures"* (Detrow 2012b). Hydrochloric acid fumes are considered medically to be fatal to humans through the act of inhalation at exposures of *"1,300 to 2,000 ppm"* (Reed Group 2016). The toxic waste ponds that contain excess fracking wastewater laced with hydrochloric acid, have systematically failed to protect communities and the natural environment from contamination (Ridlington et al. 2015). Faulty well construction has led to the abundance of *"methane"* and numerous other chemicals, that have penetrated and contaminated precious groundwater supplies (Cadmus Group 2009; NYDEC 2011; Ridlington et al. 2015). An average of 6.5% *"of all fracking wells develop leaks shortly after being drilled"*, which has the potential to contaminate local wells and aquifers, jeopardizing the biological safety of all nearby living organisms (Ingraffea 2013; Ridlington et al. 2015).

The PA Department of Environmental Protection (DEP) has released the identity of 85 hazardous chemicals used by the hydraulic fracturing process (PA DEP 2010). Environmental regulators from the state of NY have also provided a potential list of 235 various chemicals which can be contained in the fracturing fluid (NYSDEC 2011). An analysis conducted by the NY State Department of Environmental Conservation (DEC) confirmed that contaminated flowback released from fracturing wells, is comprised of hazardous materials such as *"arsenic, antimony, barium, cadmium, chromium, cobalt, copper, iron, lead, molybdenum, nickel, silver, strontium, thallium, and titanium"* (NYSDEC 2011). Credible quantitative scientific studies have discovered in excess of 632 various hazardous pollutants comprised in the hydraulic fracturing water solution, by compiling extensive government statistics, along with analyzing MSDS sheets that *"accompany each product"* used for the fracturing process (Colborn et al. 2001).

From 2000 to 2013, almost *"9.4 million people"* in the US resided only within *"one mile of a hydraulically fractured well"*. This exceptionally irresponsible regulatory policy has the potential to negatively alter the contents of approximately *"6,800 sources of drinking water"* in the US (EPA 2015). Between 2011 and 2012, the total share of actual water usage specifically allocated for the hydraulic fracturing process was *"10%-50% or more"* of the entire county water supply, for 9.7% of all US counties involved in hydraulic fracturing (EPA 2015).

Hydraulic fracturing is the drilling, and injection of fluids, deep below the Earth's surface, which is applied at an immensely high pressure, to release the natural gas that is trapped. Millions of gallons of water laced with dangerous chemicals are deployed violently into each single well. The *Horn River Shale* in British Columbia, Canada, uses an astounding *"15.8 million gallons"* per well, and the *Marcellus Shale* site located in Pennsylvania uses *"4.5 million gallons"* per well (USGS 2012), which is unfortunately obtained by acquiring vital surface water (EPA 2015).

The primary source linked to the mass manifestation of seismic activity resulting from hydraulic fracturing, has been clearly observed during the fracturing fluid reinjection process. Concerns associated with seismic activity are related to the violent disposal of fracturing wastewater, which is pumped back into geologically unstable wells during unconventional hydraulic fracturing, rather than from the impacts from the initial drilling of these horizontal, directional wellbores (Eddington 2011; Liu and Kaplan 2011; Ausbrooks 2012).

During the time period from 1973–2008, an average of *"21 earthquakes of magnitude three and larger in the central and eastern United States"* was observed annually (USGS 2016a). In 2014, this value increased to *"over 600 earthquakes"* of a magnitude three or over. One year later that number rose to more than *"1000"*, forty-eight times the fifty-year average. From January 2016 to August 2016, *"over 500"* earthquakes of a magnitude three or over have been already been observed and recorded by the USGS in central and eastern US regions (USGS 2016a).

Geological faults have the natural ability to *"sustain high stress without slipping because natural tectonic stress"*. The injection of contaminated fracturing solution *"counteracts the frictional forces on* *fault"*, and *"pries them apart"*, causing seismic activity to occur (USGS 2016b). On January 7, 2015, north Texas experienced 11 earthquakes in a single day. According to a geophysicist from the USGS, this seismic activity was the *"largest since the earthquakes started happening"*, just one year earlier (Lindgren 2015).

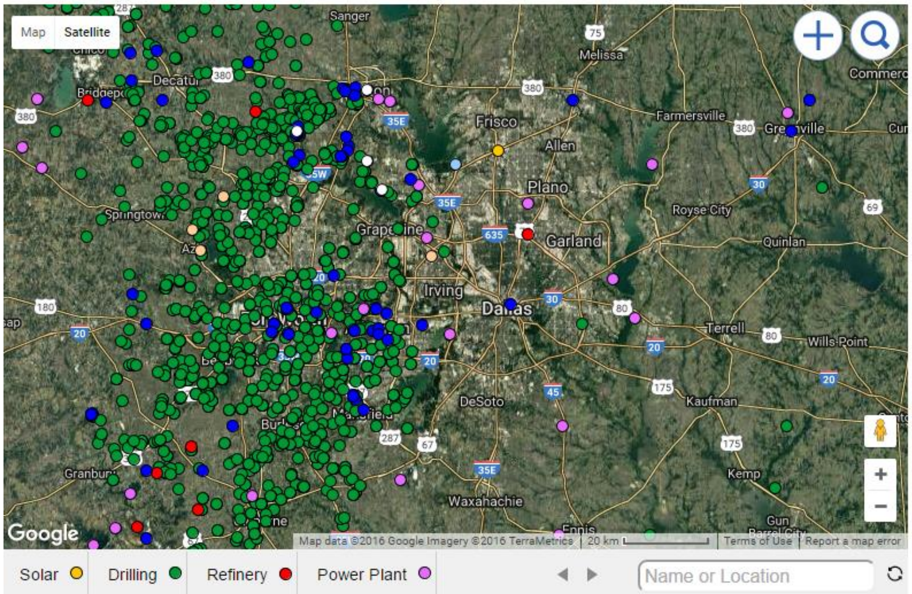

Figure 3: Map of hydraulic fracturing sites (green) located in North Texas (Drilling Maps 2016)

During this past legislative session in Oregon, *SB 1547* became a law, requiring Oregon energy companies to allocate 50% of its electricity generation from renewable energy by 2040. To accomplish this task, PGE has provided a 2016 Integrated Resource Plan, displaying how this energy transition will be accomplished. PGE strongly advocates for extracting *"natural gas"* as one of their fundamental strategies to supplement coal, during the renewable energy transition (Law 2016; PGE 2016). Since *"95%"* of all new natural gas wellbores are hydraulically fractured, one could assume that Oregon will soon engage in hydraulic fracturing due to the passage of this bill, which would directly and indirectly contribute extensive environmental and ecological damage as a result of this transitional process to clean renewable energy (US DOE 2013a; PGE 2016). If the Oregon state legislature is unable to successfully ban unconventional gas extraction during this legislative session, our legal ability to protect the human and environmental health of our entire state will be greatly diminished, and extensive negative consequences will be certain to transpire.

State and federal energy policies must include provisions that promote the mass implementation of onshore wind farms. This would drastically offset the catastrophic effects of global climate change. More than "*40%"* of Denmark's domestic energy supply is created by wind generated energy, and their goal is to achieve *"50% by 2020"* (DEA 2015). A 2015 US Department of Energy report entitled *"Enabling Wind Power Nationwide"*, addresses that the *"next generation of wind turbines could make reliable, cost-effective wind power a reality in all 50 states"* (US DOE 2013b). This reality can be achieved by implementing new *"advanced wind turbines"*, which utilize taller towers and longer blades, that rely on consistent wind patterns found *"high above the ground"*. This technology has the potential to access an additional *"700,000 square miles, roughly one-fifth of the land area of the US"*, which could be used for constructing minimally invasive, cost effective, and highly efficient, renewable onshore wind energy farms (US DOE 2013b).

The state of Rhode Island recently became the first state in the US to implement and integrate an offshore wind farm into their domestic energy supply. Five 600 feet wind turbines, located fifteen miles off of the coast, were developed to power 17,000 residential units, by producing 150 megawatts of energy (Deepwater Wind 2017). Local residents *"pay a premium at peak times (of) nearly 60 cents per kilowatt"* (Duncan 2016). By establishing this minimally invasive offshore wind farm, the cost for electricity is predicted to be only *"24 cents"* per kilowatt.

The evolution of wind power generation has made substantial advances regarding technological development, and is now labeled globally as *"among the fastest, cheapest and most reliable energy technologies in the market"* (GWEC 2015*)*. Unconventional hydraulic fracturing is an illogical and impractical approach for acquiring energy independence. It is exceptionally imperative for rapid regulatory change to transpire now, so that we can ensure human security to all future generations of Oregonians.

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PREPARED BY:
Alexander Krokus
Policy Research Aide
Oregon Senate District 22
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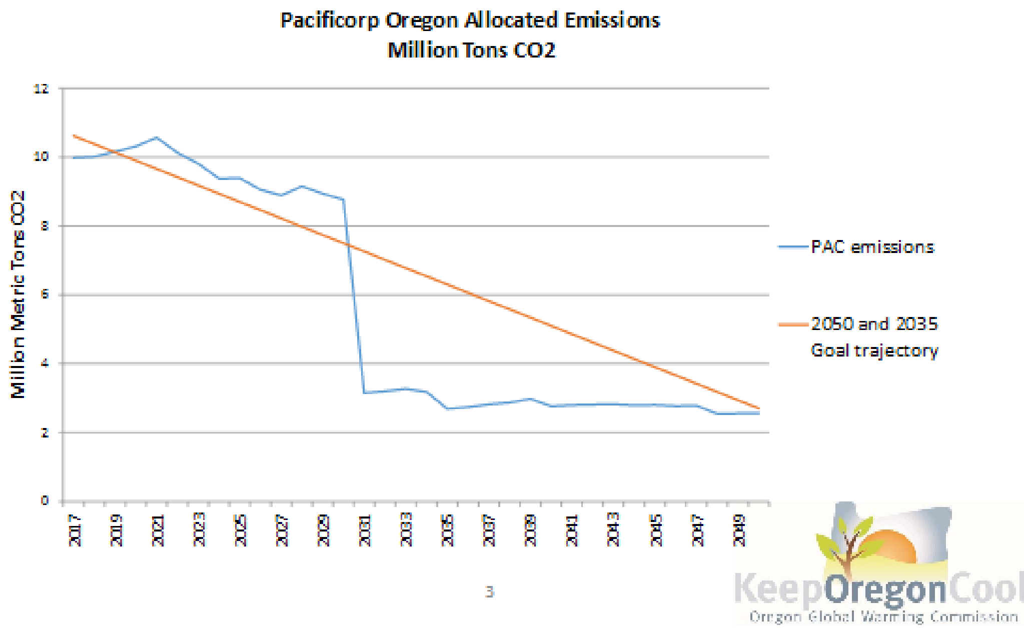
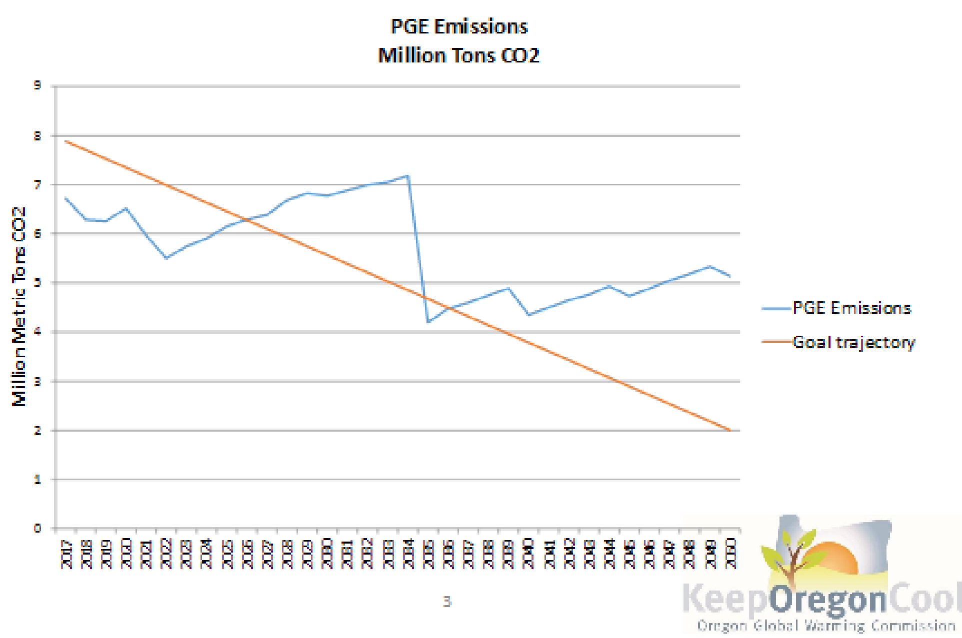
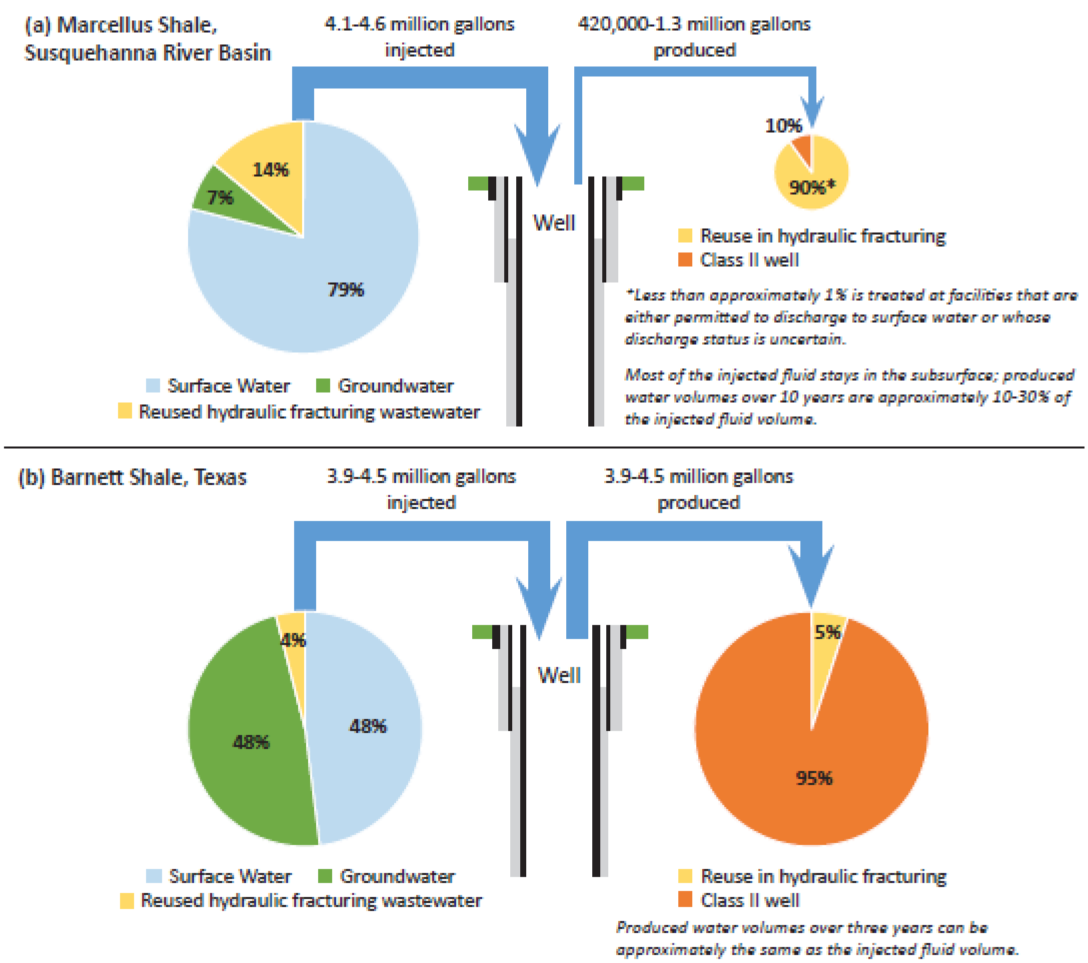
Oregon Global Warming Commission: Senate Committee on Energy and Natural Resources
December 12, 2016
Angus Duncan: OGWC Chair

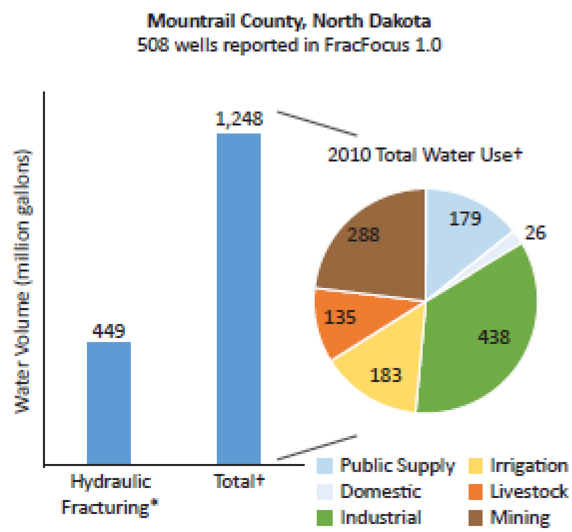
Pacificorp Oregon Emissions Projection



PGE Emissions Projection







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