

# Example of thesis on fracking regulation and agenda setting: an analysis of the f...

[Environment](#), [Nature](#)



## **Senate Bill 4.**

### ABBREVIATIONS AND ACRONYMS

Btus British thermal units

CA California

CASB 4 California Senate Bill 4

Chapt. Chapter

CIPA California Independent Petroleum Association

EIA Energy Information Agency

MWh Megawatt hours

SB Senate Bill

Sect. Section

US United States

USA United States of America

USGS United States Geological Survey

### Introduction

On Friday, September 20, 2013 California Governor Jerry Brown signed into law the Senate Bill 4 (CASB 4) that sets up the organization of a permitting system for hydraulic fracking using the technique of fossil fuel well drilling and establishes the definitions applicable to fracking. California Senate Bill No. 4 Chapter 313 (Sect. 1a) sets out the legislation which describes hydraulic fracturing and other stimulation technologies. The purpose of the legislation ostensibly has been to regulate the strategy of hydraulic fracturing which is widely used to increase fossil fuel production from shale type rock formations underground.

## **Statement of the Problem**

CASB Sect. 2a states that “ insufficient information is available to fully assess the science . . . including environmental, occupational, and public health hazards and risks” (2013 CASB 4 Sect. 1b) Even though a full scientific assessment has not been done as noted in the preceding quote, CASB Sect. 1e (2013) states that the use or reuse of treated, untreated or produced water is encouraged by the legislature for “ well stimulation treatments and well stimulation treatment-related activities.” The trusting nature of the legislature presents a contradiction; the impacts of hydraulic fracturing which relies of the fluids pumped through the drilling system have not been adequately understood but the use of hydraulic fluids that make fracturing possible has been approved as demonstrated by the passing of CASB 4. These seemingly contradictory statements raise questions about who are the stakeholders in the fracking issue and who are the most influential stakeholders. Definitions and some different perspectives are discussed below after which natural gas and hydraulic fracking specifically in California are discussed. Examples of the nature of the controversy over the bill have been included. Next the research question and the aims of the research are offered.

## **Background**

Hydraulic fracking is popularly referred to as ‘ fracking’ and involves drilling a vertical well and then drilling horizontally in order to fracture the geological layer of rock where natural gas (and crude oil) might be trapped; the rock formations of shale-type geology have been demonstrated to offer the most

natural gas (King, p. 1). The California Independent Petroleum Association (CIPA) defines hydraulic fracturing as “ a type of ‘ completion’ technique where high pressure water, sand, and chemicals are injected usually thousands of feet below the surface into low permeability rock to create microscopic fractures that allow oil and natural gas trapped in small pores to migrate to the wellbore and be produced” (Zierman, p. 1). The definition agreed upon by the California Senate and written into CASB 4 (3152) is that “. . . Hydraulic fracturing means a well stimulation treatment that, in whole or in part, includes the pressurized injection of hydraulic fracturing fluid or fluids into an underground geologic formation in order to fracture or with the intent to fracture the formation, thereby causing or enhancing, for the purposes of this division, the production of oil or gas from a well.”

CASB 4 (3157) lists hydraulic fracking under the category of “ well stimulation treatment.” The bill describes well stimulation treatment as any “ treatment of a well designed t enhance oil and gas production or recovery by increasing the permeability of the formation” (CASB3157a). Acid well stimulation treatments are included in the same category as fracking. Although the bill generally accepts other types of well stimulation techniques none are listed; instead a list of what does not fall in the category is listed (CASB3157a). The types of treatments that are not considered in the same category as hydraulic fracking do not change the rock structure like fracking does.

Natural gas is the hydrocarbon methane; it is also called shale gas because it is found in very small pockets of shale rock formations. The amounts of fossil fuel trapped in the rock pores are in tiny reservoirs that cannot be reached economically or practically with vertical drilling. Therefore a vertical well is

drilled 8000 to 1000 feet into the ground and then drilling is done horizontally to the surface (Scott, 2013). The technique allows many horizontal shafts to radiate from the vertical drill hole. (See fig. 1) The fracturing is accomplished by forcing hydraulic fluids down the bore hole causing the shale rock to crack into fractures. The fractures that are cracked open allow access to methane pockets (the reservoirs of natural gas) and then the natural gas flows to the surface along the pathway provided by the hydraulic fluids. The hydraulic fluids consist mainly of water and sand; the balance of the fluids contains a gelling agent and other chemicals. The gelling agent or proppant makes the fluids more viscous so the sand will flow better under high-pressure.

Figure 1 shows the main elements of the hydraulic fracturing process, starting at the top left and moving around the drawing the following features are pointed out by the grey lines. Those are (a) treatable groundwater aquifers, (b) private wells, (c) an example of a municipal water well located at less than 1, 000 feet, (e) additional steel casing and cement to protect groundwater, (f) protective steel casing, and (g) a measure of the approximate distance from the surface of about 8000 feet. On the left bottom the inset drawing demonstrates how the fractures radiate from the drilling bore hole; the purpose of hydraulic fracturing is to cause the cracking. (See fig. 1) The injection of the fluids under high pressure causes the rock to fracture, and then the proppant holds open fractures allowing a route for the methane to move to the surface.

Figure 1 Schematic of hydraulic fracturing with horizontal drilling.

(Hydraulic Fracturing Process, Chesapeake Energy)

## **Benefits and Disadvantages**

An important benefit to using natural gas has been that it replaces coal for energy. Coal creates air pollution that adds to the problem of greenhouse gasses because carbon dioxide enters the atmosphere. In April 2012 the amount of energy produced from coal and the amount produced from natural gas were almost equal for the first time data has been gathered; each resource accounted for about 32 percent of the energy produced in the USA (EIA 2012). “ Many have described fracking as the bridge between the carbon-based energy systems of the past and a cleaner, greener future” (Scott, 2013). On the other hand Brooks (2013) described the hydraulic fluids as containing water, sand, lubricating agents, chemicals toxic to bacteria that clogs the pipes, and hydrochloric acid as a way to dissolve surplus cement in the pipes.

Not all of the perspectives of fracking for natural gas are positive. Balaba and Smart (2012) reported that in fracking more than 650 types of fluid with potential cancer-causing ingredients have been used. US safety regulations have been changed so that hydraulic fracturing projects have exemptions such as not reporting the types and amount of toxic chemicals annually (Center, 2013). The ingredients of hydraulic fluids are considered ‘ trade secrets; meanwhile every ingredient used for household cleaning must be made public (Lauver, 2012).

Another disadvantage of methane is that although underground it is odorless and non-toxic once it reaches the atmosphere the methane concentration is high enough that the methane will burn (King and Hein, 2012, p. 5). Shale gas extraction has grown so much in the USA that the increased amount of

available natural gas has been described as a “ a disruptive technology” in the development of alternative energy sources (King, 2012, p. 1). George E. King (2012) of the Apache Corporation gave a presentation at the Society of Petroleum Engineers (SPE) pointed out that the “ introduction of such a disruptive force as shale gas will invariably draw resistance, both monetary and political, to attack the disruptive source, or its enabler, hydraulic fracturing.”

Concerns have been raised about the potential risk for fracking to start an earthquake. A review of the available literature was undertaken by Davies, Foulger, Bindley and Styles (p. 3) and presents their results in a positive light stating their results found that felt earthquakes are caused by more important mechanisms than hydraulic fracturing. Another result from the literature review is that “ Fault reactivation due to hydraulic fracturing is well known and readily detected” (Davies et al., p. 3). Lastly the research by Davies (et al., p. 3) concludes rather ambiguously that fracking has the potential for inducing felt seismicity and felt seismicity will probably occur in the future. Mark Zoback (2012) Benjamin M. Page Professor of Earth Sciences and Professor of Geophysics at Stanford University and a member of President Obama’s administration, stated in a written testimony to the Committee on Energy and Natural Resources of the United States Senate that

“ . . . extremely small microseismic events occur during hydraulic fracturing operations. These microseismic events affect a very volume of rock and release, on average, about the same amount of energy as a gallon of milk falling off a kitchen counter.”

## California Facts

The gas and oil industry has been using fracking to extract natural gas from underground shale formations in the USA and globally. California is one of the four states along with Texas, Wyoming and Pennsylvania where the highest density of fracking wells are located. Figure 1 depicts the number of natural gas wells per county across the US. In California the large green rectangle represents 501 to 2000 wells per county, the lighter green represents 21 to 100 wells per county and the very light blue-grey shapes evident throughout most of California represent 1 to 20 wells per county. (See fig. 1) The map of continental USA shows how the wells are located throughout a very large section of California and how California compares to other states. (See fig. 1) California uses more energy than any other state except for Texas, but on the other hand the state “ has one of the lowest per capita total energy consumption levels in the country” (EIA). The EIA reported that in 2011 the California natural gas production has declined over two decades, 8 percent of the California produced natural gas is consumed in the state. (EIA, 2011). The amount of marketed production of natural gas in California in 2011 was about 246, 822 million cubic feet (EIA).

Figure 2 Number of fracking wells per county across the USA.

(Source: US Environmental Protection Agency, 2012)

The EIA (2011) reported that the largest resource for California energy was the consumption of over 2, 225 trillion British thermal units (Btus) natural gas. (See fig. 3) California has 1, 423 natural gas producing wells, about 0. 3 percent of the natural gas producing wells in the USA (EIA) ). The amount of marketed production of natural gas in California in 2011 was about 246, 822



million cubic feet (EIA). Natural gas provides 1, 634 thousand MWh for California (11. 6 percent of the natural gas providing energy) EIA). The amount of natural gas used specifically for home heating was about 66. 2 percent of that used to generate energy in 2011. Natural gas provides 1, 634 thousand Megawatt hours (MWh) for California (11. 6 percent of the natural gas providing energy) EIA). The amount of natural gas used specifically for home heating was about 66. 2 percent of that used to generate energy in 2011.

Figure 3 California Energy Consumption Estimates for 2011

(EIA State Energy Data System 2011)

California SB 4 was signed into law on September 20, 2013 by Governor Brown but interestingly lawsuits from both the petroleum industry and environmentalists are expected (Mills and Guiao, 2013). The technique of hydraulic fracturing is “ one of the most controversial issues of 2013” (Sedgwick LLP). The industry sector does not agree with the inclusion of “ other types of well stimulation techniques, including acid well treatments, and creating a permitting scheme that subjects each decision to stimulate a new well to the California Environmental Quality Act” (Seifried, 2013). At the same time organizations that are concerned for the environment and protection of the population are not satisfied; for example, the Center for Biological Diversity cannot be satisfied unless a moratorium on the strategy is enacted (Seifried).

Another point of conflict is how to interpret the data from studies that report the amount of methane concentrations at hydraulic fracking well sites. The project leader of a literature review published in 2011, environmental

engineer Radisav Vidic of the University of Pittsburgh, has suggested that the baseline concentrations of methane reported by the US Geological Service (USGS) were not exceeded due to hydraulic drilling ( Biello, 2013). But the leader of the USGS project, Robert Jackson an environmental scientist at Duke University, does not agree and says of the Vidic led literature review " This review is a mixed bag. Its call for additional monitoring makes perfect sense. Its dismissal of all environmental concerns doesn't" (Biello, 2013). The controversy over the scientific research on the environmental impacts of hydraulic fracturing coupled with the passing of CASB 4 brings to mind the question of why the law was passed in its current form and why now.

## **Research Question**

What are the legitimate origins and developments that led to S. B. 4?

## **Aim**

Objectives

- Identify the stakeholders of the fracking involved in the CASB 4 debate.

## **Scope**

The research was motivated by the political and scientific controversies that surround the use of hydraulic fracturing even though the technique is being used to extract natural gas with a combination of vertical and horizontal drilling. The impacts to the environment and to the citizens in the vicinity of the drilling have been reported within the spectrum of ' no impacts' to the other side of the spectrum ' serious health and safety issues.' Therefore this

research has looked at the origins of the movement for the passage of a law to set definitions and permitting regulations for hydraulic fracturing in California. The research has identified the stakeholders in the political movement to establish the law and their influence on the passage of the law in the form of CASB 4. The research should be of interest to policy makers, the California public, the government agencies involved in regulating fracking (both state and federal), and the scientific community. The research has established the major stakeholders in the political movement to pass a fracking law in California, the less involved stakeholders and the attitudes and motivations of all the stakeholders. The origins of the movement will be described and the development of the policy to pass California legislation on hydraulic fracking will be evaluated.

## **Chapter Summaries**

Chapter 1 introduces the basics of CASB 4. The definitions in the bill and from other sources of hydraulic fracking and other commonly used terms used when referring to the technique have been shared so a comparison is possible. A schematic of the fracking drilling process has been included. The way that the fracturing of the rock layer located at up to depths of 10, 000 feet for the purpose of extracting natural gas has been described. Various perspectives have been given as examples to show the controversial aspects of SB 4 fall within a large range of opinion from the fossil fuel industry's point of view to the point of view of environmentalists interested in guaranteeing the safety of the environment and people living in the area. Discussions on the facts and figures that demonstrate the importance of natural gas to

California have been reported because the extraction of natural gas is the purpose for hydraulic fracturing. Next the research question, aims and scope of the research are offered.

**Chapter 2 is the literature review with references that address hydraulic fracturing from the different perspectives of the various stakeholders.**

Chapter 3 contains the methodology used during the research. The methodology is qualitative. The methodology section has included a chart of the steps taken to carry out the research. A detailed discussion of the sources, references and the search terms used has been included. The methodology used to evaluate the results has been explained. (SWOT and PESTEL analysis?)

**Chapter 4 reports the results in tables.**

Chapter 5 discusses the implications of the results, the limitations of the research and suggests future areas of study.

Chapter 6 concludes with a summary of the research and the degree of success in meeting the goals set in Chapter 1.

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