VERMONT SUMMER PROGRAM
2019 TERM 4 1:00 to 4:00 pm--afternoon session
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OIL AND GAS:
PRODUCTION, PIPELINES AND THE ENVIRONMENT

by
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SYLLABUS [6-2-19F]

Welcome to this course! Over the next two weeks, we will survey the world of U.S. oil and gas production and pipeline regulation. We will look at the state conservation regulation that governs oil and gas extraction onshore and discuss local, state and federal regulations enacted to control the externalities of extraction. We will move offshore to look at the federal oil and gas leasing framework, the "cooperative federalism" of the Coastal Zone Management Act, and how safety and environmental issues are addressed offshore after the 2010 Deepwater Horizon disaster in the Gulf of Mexico. We will delve into FERC regulation of both oil and gas pipelines and the use of eminent domain to build new pipelines to serve the shale oil and gas fields. Pipeline permits granted by FERC have led to street protests against FERC in Washington DC and much litigation in the courts.

Broadly stated, the objective of this course is that you gain an understanding of:

- The interplay among federal, state, local, industry, and NGO actors in the regulation of the US oil and gas industry.
- The role of the common law in US oil and gas production: private property rights, tort and contract law.
- Key technical terms used in the petroleum industry. You will watch short video clips on industry processes and also sharpen your skills at reading charts, graphics and statistics rather than just case law.
- Key sources of information, such as Resources for the Future, as well as industry and NGO websites engaged in public dialogue on oil and gas issues.
- Current policy issues so that you are a better educated citizen and voter.
- The kind of work that employers offer in industry, law firms, NGOs, or in government related to oil and gas production, pipelines and the environment.

Vermont is far removed from the sights or smells of an oil or gas field, but what happens at FERC and in U.S. oil and gas fields has impacts extending far beyond the physical location of U.S. wells and pipelines. Indeed, the effects are felt nationally and globally. The class will begin with a global view of the energy industry and the role of U.S. oil and gas production in world geopolitics.

Readings are found in 3 sources: (1) the Coursepack on sale at Barristers; (2) postings on TWEN; and (3) links to websites identified in the syllabus below.

(1) The Vermont Book Store Coursepack contains:

Chapter 4, titled "Oil and Gas Production" from the casebook by Eisen et al, *Energy, Economics and the Environment* (4th ed. 2015). This book is abbreviated as "EEE4" in the Syllabus. (125 pp.)

Chapter 9 of EEE4, titled "Oil & Gas Pipelines: Opening Markets" (85 pp).

This material from EEE4 is copyrighted and permission has been obtained from the publisher to use it for classroom use only. Please do not distribute outside this class.

(2) The VLS TWEN website. Please secure access to the TWEN website before class begins. The syllabus identifies all reading material posted on TWEN as numbered Items, like this: **TWEN Item 1-1 or TWEN Item 7 or Item 10A**

This 2019 Syllabus is posted on TWEN under the "Syllabus" link and as **Item 0.**

(3) Internet source reading or video clips from sites noted in this syllabus. If the syllabus link does not work, copy the title of the document and paste it into your browser. The document should pop up.

Purely optional readings are listed in footnotes for those of you who may do research in other courses or in your careers later. This syllabus ends with Appendix II that lists and describes websites of note about shale development in the U.S., again for your later reference, especially if your community is facing shale development for the first time.

Class reading averages about 35 pages per day over the 8 days (not including visits to websites for information). I may not have accurately gauged the degree of difficulty or amount of discussion engendered by the reading each day. If we do not cover the reading assigned in one day, it will move to the next day. It won't be dropped unless I specifically tell you to delete certain pages.

Class assignment MEMOS to hand in. The syllabus notes when you should provide a short--no more than one page--written memo to me. Put your name on the memo in the first line. These short assignments, called Memos, are based on the class readings. Failure to hand in Memos will decrease your grade by half a point. The Memos are not meant to take more than 20 minutes to write. If you find they are taking more than 20 minutes, then stop at the end of about 20 minutes and turn the Memo into me with a note indicating this. I don't want you to forego doing the rest of the reading for the next class day because the Memo is eating into your time. There is a Memo a day, except for Day 6, when you will prepare to do a scenario role play, as indicated in the Syllabus.

Do not email me your memos or post them to TWEN. **Bring a printed copy of the Memos to class** for me to collect and read. The Memos do not substitute for doing all the readings for that day.

DAY 1:

Come to class with the following information, legibly written on an index card or piece of paper:

- ***Your name, including any nickname you prefer to go by. Give first and last name only***
- ***Your home state or country***
- ***Your home law school***
- ***Your career goal, if known already***
- ***Your undergraduate university and degree(s) with your major field of study***
- ***Any work or practice experience that you have had to date, in any field***
- ***Any special goal that you have for this course or reason for taking it***

Topic 1: The Future of the Energy Industry in an Era of Globalization and Climate Change (first half of class).

In advance of class:

Visit this BP link for an artistic, two-minute overview of BP's energy outlook through 2040: https://www.bp.com/en/global/corporate/energy-economics/energy-outlook/videos.html#animation. What two technologies pop up briefly at the end as solutions to "more energy, less carbon?" Then, scroll to the BP video on reducing carbon emissions (50 seconds long!) at https://www.bp.com/en/global/corporate/energy-economics/energy-outlook/videos.html#carbon-emissions-video. BP's Evolving Transition (ET) scenario projects the path the world will likely follow. BP's Rapid Transition (RT) path to zero carbon emissions aligns with the Paris Agreement goal of keeping global temperature from rising more than 2 degrees (or 1.5 degrees to be on the safe side). Then go to the actual BP Energy Outlook 2019 posted at https://www.bp.com/content/dam/bp/business-sites/en/global/corporate/pdfs/energy-economics/energy-outlook/bp-energy-outlook-2019.pdf and **read pp. 56-67 on Carbon Emissions**. Will the world meet the Paris goal? Compared to its 2018 Outlook, what factors caused the greatest revisions to BP's 2019 Outlook?

BP's Evolving Transition projection of future energy supply and demand is similar to that of other major oil companies and gov't agencies, such as the US Energy Information Administration (EIA) and the Int'l Energy Agency: a consensus forecast of the most likely future.

ExxonMobil (XOM) states in its Energy Outlooks that it uses its projections of the future as the basis of its current business decisions. After reading the selected pages of XOM's 2018 Outlook (indicated below), prepare the answer to this question as **MEMO 1,** due in hard copy on the first class day:

**** * * Memo 1: Some investment analysts warn that citizens and pension funds should not invest in the stocks of oil companies because their assets (which consist largely of proved petroleum reserves in the ground that are economically profitable to recover and produce) will be "stranded" by 2040; that is, these assets will have no value because the world has moved beyond petroleum. XOM (and others) argue to the contrary.***

Question: Why do XOM (and other major oil companies) think that their reserves will not be stranded because of climate change policies? Memo 1 is your answer to this question, due in hard copy at the start of Day 1.

Before writing your Memo 1 answer, go to ExxonMobil's website and open its 2018 Outlook at: **http://cdn.exxonmobil.com/~/media/global/files/outlook-for-energy/2018/2018-outlook-for-energy.pdf,** also posted as **TWEN Item 1-1.** Look at the following pages as background for writing Memo 1:

- P.13. How dependent is the world expected to be on oil, gas and coal in 2040? _____.
- P. 26 on renewables in electricity generation. Note the difference between capacity and utilization. What game-changing technology could alter this projection?
- Pp. 30-31. What is the main driver of increasing carbon emissions? _____What is the main driver decreasing such emissions? _____
- P. 35. What are the projected sources of future world liquids supply? What is "tight oil?" What are "NGLs?" Note that "biofuels" is not the same as "biomass" in XOM's Outlook. Biofuels are advanced technology fuels like ethanol or oil from algae. Are other regions of the world expected to produce tight oil by 2040 to compete with North America? _____
- P. 12 and p. 19: Has global electricity generation shifted away from coal by 2040? ____ Do households still use wood and animal dung (biomass) for heating and cooking? Where in the world does energy demand surge? ____
- P. 36. Is the world running out of recoverable petroleum resources? If all investment in new drilling stopped, what happens to global liquids supplies by 2040? _____
- P. 39. What countries depend on importing gas by pipeline or by LNG tanker? Has North America become a gas exporter? ____ Is Europe free of gas imported from Russia? ____Geopolitics plays an important role here.
- Pp. 42-43: Are EVs (electric vehicles) a game changer by 2040 in this sensitivity analysis? What is the 100% EV impact on carbon emissions, electricity demand, and natgas demand? _____
- Pp. 48-50. Pursuing a 2 degree pathway. XOM compares 13 models of 2 degree scenarios that project the energy mix in 2040. What energy sources will the world use by 2040 if it follows a 2 degree path? Are oil and gas still in the mix? ____[1]

[1] ***Optional:*** A critical assessment by Carbon Tracker of ExxonMobil's position that it can manage the risk of future carbon policies appears at http://www.carbontracker.org/in-the-media/exxon-is-business-as-normal-the-right-strategy/, titled "Response to Exxon: An Analytical Perspective (2014)." The authors think XOM is discounting the risks with an over-optimistic view of the future role of hydrocarbons. CarbonTracker has released a report "2 Degrees of Separation: Transition Risk for Upstream Oil and Gas in a Low Carbon World," which assesses the risks to 69 oil companies of stranded assets in a scenario that posits countries adopt policies to assure earth's temperature does not rise more than 2 degrees. Will governments actually implement policies that achieve this 2 degree goal? What do the XOM and BP outlooks imply?

TWEN Item 1-2: Shell Energy Scenarios to 2050: **Scramble v. Blueprints** (selected pages only). Shell's energy scenarios are purposefully quite different from the typical energy outlooks written by other oil companies or by governments. Rather, the scenarios tell stories, presented as narratives, about possible future paths, based on input from many political schools of thought and from experts in the social sciences, world religions, climate change, and socio-economic trends around the globe (such as rising inequality). This Item 1-2 compares the Scramble path scenario with the Blueprint path. **Read only these pages of the report (citations are to page numbers at the bottom of the report): Foreword on p. 4; Introduction pp. 6-8; pp. 13-15; 20-22; and 25-37**.

This Shell report was written in 2008-2009, before the global financial crisis was in full effect. Oil prices were soaring and it seemed that the world would be short of oil forever. Shell's previous scenario had focused on the effect of 9/11 (the World Trade Center attacks) and the corporate financial scandals of Enron and other large corporations that had seriously tarnished the image of capitalism and free markets. This earlier scenario portrayed three global paths: (1) "Flags" (rising nationalism, closing borders to free flows of labor, capital and technology); (2) "Open Doors" (the opposite of Flags--an embrace of globalization and markets as bringing economic development); and (3) "Low-Trust Globalization" (globalization is inevitable, but is not trusted). The "Scramble" path in the Scenario you are reading represents a Flags approach to solving global energy issues, and the Blueprints path takes a collaborative "Open Doors" approach to such issues, especially climate change.

I will show a Powerpoint that covers the broader geopolitical issues and trends in energy that affect world energy markets today, using material from these three sources and others. We will then discuss in class:

- What implications do the ExxonMobil, BP and Shell future outlooks have for US national energy policy? Do you strongly disagree with any of these projections? Why? What would alter the long-term trends?
- Do you think the consensus forecasts by ExxonMobil, BP and others is BAU (Business as Usual) --an evolutionary change over the next 20+ years, or a revolutionary change?
- What geopolitical events have transpired that you would characterize as evidencing the world is heading down the Scramble versus Blueprint path?

Day 1: (continued) 2d half of class

In the Coursepack: EEE4: "Oil and Gas Chapter 4."

- **Pp. 132-151 (20 pp**) covering terminology,[2] the oil and gas business, early history, and the oil and gas lease.
- Time permitting, we will answer the questions on page 151 (but no Memo required). Who knows what a DUC is?

[2] A good glossary of terms used the oil and gas is available at: **http://www.eia.gov/tools/glossary/.** Look up terms that you do not understand as you read. And, be sure to ask in class if I use a term that you do not understand.

- **TWEN Item 2** is a list of facts about the upstream oil industry. Have a guess at the number of wells drilled in the US/North America in the past 150 years before looking at this item! Read these pages with a cup of coffee sometime during this course.
- **TWEN Item 3** is a typical oil and gas lease used for decades in the U.S. Most case law precedent involving disputes between Lessees and Lessors derived from a lease like this one. More recent leases used in shale plays may have different language for certain provisions, but the basic property right remains the same. For example, several months often pass between the time a well is drilled and the time it is completed (fractured). Suppose the primary term of a lease ends after the well is drilled, but not completed; what will happen to the lease, absent a modification?
- **TWEN Item 4:** The federal OCS lease is even shorter (a mere 3 ½ pages), but it is also a fee simple determinable. Find the provisions that make it so..

DAY 2:

Finish the nature of the property right under a US oil and gas lease, if necessary, including questions on page 151.

- I will show a PPT on Geology that contrasts conventional and unconventional rocks.

EEE4 continued, pp 151-169 (28 pp) covering:

- **Pp 151-59.** Who owns the shale gas rock on split estates?
- **Pp 159-63.** Surface vs mineral estate. Read the lease in **TWEN Item 3** and find provisions that protect the surface. You will have to look hard.

I will show a PPT of Surface accommodation/conflict photos.

- **TWEN Item 5.** After a town called Denton voted to ban fracking in the Barnett Shale near Dallas, the Texas legislature quickly passed H.B. 40, adding a section to the Texas Natural Resources Code, posted as TWEN Item 5.

****Hand in MEMO 2 at start of class on Day 2, answering the following questions:***

1. *List the provisions in the Texas lease in Item 3 that protect the surface of the leased tract.*
2. *Summarize the effect of H.B. 40 on the rights of cities to limit fracking operations.*

- **Pp 163-169.** The common law Rule of Capture.

DAY 3:

The maps in the link below are part of your class reading to do before coming to class on Day 3:

- **Maps of shale plays in the U.S**. Go to this link, https://www.eia.gov/maps/maps.htm#shaleplay, to find links to six "Summary Maps" of Natural Gas in the Lower 48 States and North America (at the top of the page). Open each of the 6 links and view the maps. One includes offshore gas production. Know where the Bakken, Eagle Ford and Marcellus basins are. Many more shale plays exist in the Permian Basin, Colorado, Ohio and Louisiana. The Permian Basin is the hottest play today.

- Now--scroll down the list of maps available to the **"Fort Worth Basin, Barnett History Animation: Barnett Shale Drilling 1981-2010."** Click and open the zip file and watch the red and black dots grow rapidly over time, depicting the move from vertical to horizontal wells and the scale of the drilling. The link looks like this:

  Ft. Worth Basin, Texas
  History animation: Barnett Shale Drilling, 1981-2010 (6/1/2011) ZIP [3]
- **Watch this YouTube video by the EIA on** the productivity of U.S. shale drilling (2 mins): https://www.youtube.com/watch?v=XCUVEoSV82A.

******Hand in Memo 3—first part***. *Summarize this EIA video in no more than 2 sentences. Then continue:*

- **Watch the YouTube video by Marathon Oil on fracturing (6.36 mins) at** https://www.youtube.com/watch?v=VY34PQUiwOQ.

******Hand in Memo 3—second part--based on the Marathon video:*** Answer these questions:

- *What is the kick off point?*
- *What is a perforating gun?*
- *What is casing?*
- *What percentage of the fluid pumped underground consists of water and sand? How many years might a horizontal, fractured well produce?*
- *Finally, explain how the well drilling/fracturing process is designed to prevent groundwater pollution.*[4]

EEE4 reading (cont'd) (20 pp total):

- State Conservation Regulation: Prorationing, pooling, unitization. Pp 169-186.
- Fracking and Trespass, pp. 186-91. In 2018, a Pennsylvania appellate court refused to follow the Texas precedent on tres-frac in *Coastal v. Garza*.

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DAY 4:

- **Regulating Externalities, pp. 191-201**.
- **TWEN Item 6.** EDF Methane emission studies (4 pp).

Summary of the research that EDF has done jointly with universities on methane emissions from oil and gas sites. Emissions appear to be significantly underestimated; note the "super-emitters" findings. The Obama administration sought to regulate

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[3] ***Optional:*** A similar animated map shows the rapid rise in drilling in the Eagle Ford shale, for oil rather than gas. Go to "Texas-Louisiana Salt Basin, History Animation: Eagle Ford shale production, 2006-2010." The outpouring of oil from this field stunned many in the industry and rendered most forecasts of future U.S. oil production obsolete.

[4] ***Optional:*** if you want to watch more details on drilling and production, see the six videos produced by Chesapeake Energy, two of which include: Hydraulic Fracturing and Horizontal Drilling at https://www.youtube.com/watch?v=qjP-K1VaI1k; and https://www.youtube.com/watch?v=fBQCQ6HL2Yw. Additional videos in the series include preparation of the well pad that will remain on the surface of the tract for many years if the wells are commercial. Under the Texas oil and gas lease that you read, did the lessor retain any control over where the well pad could be located?

methane emissions more tightly under the Clean Air Act (by revising the Quad 0 NSPS standard for new wells and starting the process of collecting data to regulate existing wells). The Trump administration has stopped or slowed many such initiatives. If more than 4% of natgas produced in US is emitted as methane rather than being burned, the climate benefits of gas vs. coal disappear over a 20-year time frame. Over a 100-year time frame, the leakage rate would have to be greater than 8%. Later you will review RFF's Issue Brief on Shale and Climate Change (2 pp) summarizing the research evidence of methane leakage rates to date.

- **TWEN Item 7.** If externalities are not regulated to protect health and safety, tort law may provide a common law remedy to those harmed.[5] "Frack-tort" cases are collected by Prof. Blake Watson (currently updated through April 2019), in his "Fracturing Tort Litigation Summary," available at: https://udayton.edu/directory/law/documents/watson/blake_watson_hydraulic_fracturing_primer.pdf Read **pp 38-42 only, the Fiorentino v. Cabot case, recaptioned Ely v. Cabot.** These pages summarize the litigation brought by the Ely plaintiffs in Dimock, PA in 2009 and resulting in a trial and jury verdict of $4.24 million in March 2016, which was then overturned by a motion granting a new trial. The case finally closed in late 2017 with a settlement. Few families have the resources to engage in prolonged litigation like this. Of the 44 original plaintiffs, only four remained to the end. Many other tort claims and litigation are ongoing, related to pollution, earthquake damage (mostly caused by wastewater injection wells rather than fracking itself), noise pollution and many other issues.
- **TWEN Item 8. City of Broomfield's Comprehensive Development Plan (CDP)** signed with Extraction O&G, Executive Summary (2018) (20 pp). ***Read only pp. 3-4; pp. 6-7 on Participation in the Public Process; and pp 11-13, the Charts of Provisions in the CDP***. This Item is the first 20 pages of the 1,465-page Comprehensive Drilling Plan for the Broomfield Project that Extraction O&G submitted to the City and County of Broomfield in 2018. Broomfield lies northwest of Denver and has 55,000 residents. Extensive negotiations preceded the 6-4 vote by the City Council to enter into this agreement. Here is a partial list of some of the Best Management Practices (BMPs) that Extraction O&G committed to perform:
  - using quieter drilling equipment and fracking gear;
  - installing pipelines to reduce truck traffic and on-site storage;
  - longer setbacks;
  - consolidating 12 sites into 4;
  - plugging and abandoning 30 old wells and storage tanks in neighborhoods;
  - landscaping improvements before operations begin to conceal the well pads from view;
  - a cap of 84 new wells along the northwest parkway, down from 140;
  - limits on the number of wells in proximity to a planned reservoir development;

[5] Much litigation is ongoing on public lands, challenging the Trump initiatives to roll back regulations and increase energy development. A website called "Law of the Land," at https://lawofthelandproject.org/ organizes and updates the major cases.

- Extraction O&G also agreed to convey the surface of 39 acres of property to the city for an open space trail system.

The City negotiated with Extraction O&G from what may appear to be a relatively weak position. The Colorado Supreme Court had earlier ruled that most local regulation of oil and gas is preempted by Colorado Oil & Gas Conservation Comm'n (COGCC) rules.[6] Indeed, Extraction O&G originally submitted all of its Best Management Practices on official COGCC forms. Because many BMPs exceeded local, state and federal regs, COGCC requested that the BMPs be removed from the forms, fearing that the agency might not have jurisdiction to approve them. Therefore, Extraction attached a copy of the Broomfield Agrement to the COGCC permit applications and noted that "we cannot control how the COGCC processes our application." The citizens of neighboring Adams County were not happy that 49 of Extraction's wells were moved closer to homes in their county.

After the fall 2018 elections, the Colorado legislature voted to change the state's conservation laws and the structure of the COGCC to prioritize health and safety. Additional information on Colorado's reform will be provided to the class.

- **TWEN Item 9** (15 pp). Summary of RFF's research on "WHIMBY: What's Happening in My Backyard?" RFF's "Community Risk-Benefit Matrix of Unconventional Oil and Gas Development" identifies areas of concern, such as health effects, seismicity, housing values, etc. and then reviews and assesses the quality of all the research literature on that topic to date. RFF's also conducts its own research studies on these impacts, as listed on pp 13-14. RFF then ranks the quality of the literature as to how trustworthy it was in terms of accuracy, data used, and methodology and color-codes the quality of the research as higher, medium, or lower quality. RFF also indicates whether the studies show a positive, negative, or mixed (heterogeneous) association with a given impact, such as community health or education. The color codes and key notations are listed on page 2 of the document's internal pagination (p. 4 of the e-document).

Class reading assigned for discussion tomorrow: After reading the color codes and keys on p. 4, go to any one issue in the 15-page article that interests you most: health impacts, housing values, etc. *Be prepared to report in class on what RFF concluded about the state of the research on that topic.*

- **** * * Memo 4 for Day 4 is as follows:***

[6] The City of Longmont's attempt to ban hydraulic fracturing and open-pit storage of solid or liquid wastes from fracturing was overturned by the Colorado Supreme Court in *City of Longmont v. Colorado Oil & Gas Ass'n,* 369 P.3d 573 (Colo. 2016). The court determined that the state interest in efficient and responsible oil and gas development included a "strong interest in the uniform regulation of fracking." Under Colorado law, when a home-rule ordinance conflicts with a state law in a matter of either statewide concern or of mixed state and local concern, the state law supersedes the conflicting ordinance. In May 2018, the Longmont City Council voted 6 to 1 to approve a $3 million agreement with TOP Operating and Cub Energy to end oil and gas drilling from the surfaces of properties within the city and on city-owned properties east of Longmont. Under the agreement, TOP will plug and abandon eight active wells, relinquish 11 drill sites, abandon 80 potential well permits and amend their leases to include a no-surface disturbance provisions. Cub Energy agreed to relinquish any right to drill inside city limits or on city-owned property, conditional on the state approving its proposed well locations in Weld County.

Visit the Center for Responsible Shale Gas Development (CRSD), originally called the Center for Sustainable Shale Gas Development (CSSD) at http://www.responsibleshaledevelopment.org. This Center developed 15 performance standards for shale development in the Appalachian basin that are often higher than the state or federal regulations that exist in this basin. A company that operates under the CRSD standards can earn a certificate if third-party auditors find that the company is in compliance with all the CRSD standards. A PDF of the standards (19 pp) can be accessed at: http://www.responsibleshaledevelopment.org/what-we-do/performance-standards. Or go directly to: http://www.responsibleshaledevelopment.org/wp-content/uploads/2018/01/Performance-Standards-v.1.5.pdf. They are also posted as **TWEN Item 10A.** A Comparison Table of the CRSD standards with the standards used by regulators in Pennsylvania, West Virginia and Ohio also appears at this link and is posted as **TWEN Item 10B**. Why do you think the member companies of CSSD voluntarily agreed to these higher standards? Hint: have you watched the movie *Gasland*?

******Hand in Memo 4: Read two of the 15 performance standards set by the CRSD. Choose the standards based on what you are most interested in: air quality, water quality, impoundment pits, or groundwater. Then answer these two questions:***

- ***Summarize your two performance standards and then check the Comparison Table and note how your selected standards compare with the state regulations. Do they require more than the state requires?***
- ***Do you feel comfortable assessing whether the CRSD standards are the best and most sustainable possible? Explain why or why not.***

We will discuss your memos for a few minutes at the start of the class.

Under Trump's EPA and DOI, federal efforts to limit methane emissions from oil and gas operations on both private and public lands have been stopped or slowed.[7] Eight oil companies signed a set of Guiding Principles (GPs) on "Reducing Methane Emissions across the Natural Gas Value Chain." The GPs were developed collaboratively with several NGOs (like EDF) and int'l associations. Some companies have set specfic % targets for methane reduction and are replacing pneumatic valves (that bleed methane) with no-bleed valves. Why are firms voluntarily doing this?

- **Final readings and review on Shale and Externalities**: Read the ***RFF Issue Briefs on Climate Change, Groundwater (Water Quality), Health Impacts; Seismicity: Local Governments; and Subnational Economies (2 pp. each) on the SHARC website.*** RFF migrated its shale research to the Shale Research Clearinghouse, or "SHARC," at www.rff.org/sharc. This curated website is a one-stop shop for

[7] RFF conducted a data-intensive cost-benefit analysis of whether the methane rule should stay or go. Here is its conclusion: "Using our baseline calculation, repealing EPA's methane rule would yield net costs to society in 2020 and 2025. The benefits forgone, however, are highly sensitive to the choice of the social cost of methane. When the social cost of methane is significantly lowered, as it is for the Trump administration's domestic estimate, from the global estimate used in the original RIA [Regulatory Impact Analysis), there are net benefits to society of repeal." See http://www.rff.org/research/publications/epa-s-2016-methane-rule-should-it-stay-or-should-it-go.

comprehensive, rigorous and current informaton on the environmental, socioeconomic and other impacts of oil and gas development. Users can access summaries of peer-reviewed research on the impacts of oil and gas development in many areas. SHARC provides:

1. Issue Briefs (2 pp. each)(a little shark icon identifies topics with an Issue Brief or a Literature Review Summary).

2. Literature Review summaries (15-20 pp. each).

3. A searchable bibliography that accesses the underlying peer-reviewed research. Read only the Issue Briefs noted above.

Start Offshore Oil and Gas in EEE4:

- **Pp 201-22 Offshore Oil and Gas** (21 pp). The OCS federal leasing process, NEPA and the CZMA. Optional videos are in footnote below.[8]
- **TWEN Item 11:** PPT on OCS leasing, including chart of 4 stages of leasing and NEPA and CZMA reviews.

DAY 5:

- **EEE4 Offshore oil (cont'd), pp. 222 -30.** Offshore wastes and the Clean Water Act.
- **EEE4 pp 230-56**. Spills, blowouts and SEMS. Also read the one-page Titanic scenario on page 17 of this Syllabus.

The SEMS readings introduce you to a kind of "government" regulation that uses accredited Third Party auditors, not govt inspectors, to assess safety practices in high-hazard industries. How effective are govt inspectors? The EPA Office of Special Counsel announced on June 14, 2018 that the lead paint inspection program in EPA's Southeast Region 4 "created a substantial and specific danger to public health and safety" because "none of the individuals conducting [the] inspections . . . met training or credentialing requirements, and so should not have been conducting inspections." EENewsPM, 6-14-2018. Many reports by committees of the National Academy of Sciences had concluded that MMS/BSEE inspections had little value: they were "tick the box" exercises that did not assess the safety practices or culture on an installation.

I will show a PPT on the changes in regulation in the Gulf of Mexico after the BP/Deepwater Horizon/Macondo oil spill. It will focus on the SEMS rule and the Center for Offshore Safety (COS), discussed in the EEE4 reading. A SEMS system is (or should

[8] ***Optional:*** You may have already watched the *Deepwater Horizon* movie; the offshore facility used in the movie is quite realistic. A good video of an offshore drillship, also called a MODU (Mobil Offshore Drilling Unit) (7.50 mins), is at: https://www.youtube.com/watch?v=9PNMDV2v9oA. The video is produced by JAMSTEC, the Japan Agency for Marine-Earth Science and Technology and is called "Deep-sea Drilling Vessel Chikyu." This drillship is doing scientific research into the earth's mantle, not searching for oil, but the process of drilling is the same. There are new terms here, like what a "riser" is. The offshore industry sees entire "cities" of subsea oil and gas facilities, manned by robots, in its future.. ***Very optional and very fun***: YouTube video of subsea ROV working to release a chain….and a big whale appears: https://www.youtube.com/watch?v=IWNP4Nb9WfM.

be) an integral part of any industrial facility that operates with hazardous and combustible materials, such as petrochemical plants, refineries, and pipelines. COS created the credentialling standards used by the fed govt today to accredit third-party auditors to perform the now-required SEMS safety audits. COS also fosters peer-to-peer learnings among offshore operators.

Read the Titanic disaster scenario on page 17 of this Syllabus before coming to class. We will relate the lessons learned from the Macondo disaster to the Titanic disaster. Most disasters have the same root causes.

*** ***Hand in Memo 5, based on COS website visit:*** Visit the home page of the Center for Offshore Safety (COS) at http://www.centerforoffshoresafety.org. COS was created after the Macondo disaster and is another example of an industry-led center of excellence in safety and environmental practices (like the CRSD) with voluntary membership. However, COS has a far more active and integral role in U.S. offshore regulation. Answer (a)-(d) below in Memo 5 and prepare for class discussion on (e) and (f).

(a) *How many companies are members of COS and what kind of companies are they?*

(b) *Look at the list of companies that have received a COS Certificate. What does this Certificate signify that companies voluntary seek it?*
What company received the first certificate in November 2013?

(c) *Click on the COS Safety Shares link on the Home page. Select any three of the hair-raising titles of safety incidences that are being shared publicly by operators, such as "Breathing Welding Gas Instead of Air." Read any three of these one-page long postings. Write a few sentences about why you think these Safety Shares are or are not useful. How could they be used by regulators? By entrepreneurs? By offshore operators? By the public? Or are they largely useless, and why?*

(d) *Click on the link to the COS Annual Performance Report for 2016,* also posted as **TWEN Item 12).**

- Look at pp 9-10, the Executive Summary and graphic showing Tier 1 and Tier 2 PSE (Process Safety Events). Events in these two tiers are the scary-bad events (called "major hazards") that had or *could have had* very serious consequences.[9] Does the data show continuous improvement in reducing the occurrence of these Tier 1 and 2 Events over the past 4 years? _____

[9] Page 17 of the Report explains the standardized classification of safety incidents; SPIs numbered 1-5 are the assessed major hazards confronted in the offshore industry, that is, the really scary-bad events. Section 5 of the COS 2016 Annual Report consists of 25 pages of "Learning from Incidents." These pages are like the Safety Shares now featured on the home page of COS--nightmarish events that help you understand how dangerous offshore work can be if managers do not focus relentlessly on safety. Much of the Annual Report presents charts and data in standardized reporting formats that allow quantitative assessments of offshore safety practices of the COS members that submitted the data.

- Page 13: Read Fig. 3.5 on "Areas for Improvement" (AFIs). Note the vertical column on the left that groups the AFIs according to whether People, Processes or Physical Equipment Failures caused the safety incidents.
    - What Area most needs improvement? _____
    - What AFIs increased in 2016, alerting operators and regulators that more focus is needed here? _____
- Page 14: Look at Fig. 3.6, the data that 10 operators voluntarily shared with COS, showing deficiencies[10] found during the safety audits required by the SEMS rule.
    - What is the leading area of deficiency? _____
      Remember that this audit deficiency data is from COS members only; BSEE has not (yet) released a report summarizing its findings from the audits that all offshore operators (about 90) must submit under the SEMS rule.

(e) For class discussion: *On the COS home page, click on the link to "Guidelines for a Robust Safety Culture" (April 2018)(15 pp.). Read only the sections indicated:*

- Sections 1.1 to 1.2 on **pp. 1-2**. Section 1.1 copies the BSEE Safety Culture Policy Statement and its 9 key characteristics. Because 3 of these 9 were being covered extensively in other industry work, the COS Guidelines focus on only 6 characteristics, listed in Section 3.0 on **p. 3**. ***Read this list of 6 and pick any one of these 6.*** Go to the section of the Guidelines that explains this characteristic: why it is important, how it can be successfully implemented, and what obstacles inhibit its successful use in the workplace. No written memo is required for (e), but be prepared to discuss in class your personal assessment of the role of COS as a complement to federal regulation in the quest to continuously improve offshore safety.

(f) Revisit the Titanic scenario at the end of this Syllabus for class discussion. *As a ship owner's risk management officer, how many lifeboats do you order on the Titanic? Why?*

DAY 6:

We will start by discussing Memo 5 and your view on how COS initiatives (like peer-to-peer Safety Shares) can improve safety as a supplement/alternative to regulation, especially under the Trump administration.[11] Then, we will discuss your Titanic decision on risk management.

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[10] COS defines a "deficiency" as either a Nonconformity, meaning less than satisfactory fulfillment of a requirement, or a Concern, which is a condition that marginally meets requirements but could lead to a Nonconformity if sufficient controls are not in place to maintain the management system. Id. at 57.

[11] BSEE and the Coast Guard reported in December 2017 at a public meeting of the National Offshore Safety Advisory Committee that some crews were totally untrained and unprepared to operate fire suppression equipment; others didn't know how to evacuate the platform or whom to call in an emergency. One company's lifeboats had not been tested in over a year and the crew didn't know how to do the test. When BSEE and the Coast Guard tested one boat, it took on a foot of water in the engine compartment even when the engine wasn't running. EnergyWire, Dec. 14, 2017.

The head of EPA's Office of Enforcement and Compliance Assurance publicly expressed "shock" at the level of noncompliance with environmental laws and warned that cutting corners to save money is bad business. Greenwire, Apr. 23, 2018.

Start on Pipelines and FERC:

- Read **Appendix** I to this Syllabus on ratemaking (one page long). If you have had a course on electricity ratemaking by public utilities, the concepts are very similar for pipelines.
- **EEE4 Ch 9, pp 539-572 (33 pp).** FERC regulation of natural gas pipelines through 2005: price controls on gas, and the use of take-or-pay and long-term gas supply contracts; FERC restructuring of gas pipelines in Order 636 on Open Access; rate design; shortages. If you have had a course on regulated industries or on electricity, this material will be familiar because the NGA of 1938 was modeled on the earlier Federal Power Act that regulates interstate electricity transmission and sales.

There is no MEMO due on Day 6, but we will role play the scenario described on pp. 552-53 of EEE4 (with Transco, SpotCo, pipelines that have TOP contracts with Transco, customers who want cheaper gas, and FERC as key players), so be prepared to participate in this. Why is each player unhappy? Think about why each player has an incentive to change the old regulatory regime and what they will propose to FERC. If you are asked to take the role of FERC, be prepared to grant or disapprove the proposals that come to you from the industry players. The roleplaying should be guided by what FERC actually did implement, as explained in the EEE4 reading.

DAY 7:

- **Pp. 572-88. FERC regulation today (16 pp), but substitute TWEN Item 13 (**8 pp) for the 9th Circuit opinion in *Oneok v. Learjet* in the CB at pp 577-83. The US Supreme Court decided *Oneok v. Learjet* after the CB went to print. **Item 13** is an edited version of the Court's opinion in *Oneok v. Learjet*. The issue is whether the states are preempted by FERC jurisdiction from bringing state antitrust claims against market manipulators using the infamous Enron practices in the newly deregulated electricity market in California. [An ***optional*** 4-page analysis of the preemption issue by Robert Ballentine is posted as **TWEN Item 14**.]
- **Pp. 588- 606**. Oil Pipelines. Ratemaking (18 pp).

******Hand in Memo 7--the answers to questions in CB reading Note 2 (a) and (b) on page 603. We will discuss the answers to (c) and (d) in class.***

DAY 8: Make up or review any pipeline material not covered adequatelybefore starting Day 8.

Finish EEE4 Chapter 9 (18 pp):

- **Pp 606-624.** Siting pipelines; eminent domain; crude by rail. (18 pp).
- **TWEN Item 15**. It is not often that FERC denies a certificate for a gas pipeline, but FERC did so in 154 FERC Para. 61,190 (March 11, 2016), Jordan Cove Energy Project L.P and Pacific Connector Gas Pipeline L.P., Docket Nos. CP 13-483-000 and CP 13-492-000.

**** * * Hand in Memo 8:*** *Read only the following paragraphs of this docket case and write a memo summarizing why FERC did not approve this proposed gas pipeline*

connected with the proposed Jordan Cove LNG terminal planned in Oregon. ***Read Paragraphs (not page numbers): 1-7 (the facts); 23, 28-29, 38-41, and 45-47.***

- **TWEN Item 16.** The East Coast Pipeline "Cheat Sheet" with a map of 10 pipelines and a summary of legal issues confronting each (8 pp).[12]
- **TWEN Item 17A.** Memo on FERC pipeline issues and 2018 NOI on pipeline certification (selected pages of 24-page memo).[13]

FINAL EXAM PREVIEW:
The Final Exam will be administered as follows, so please plan accordingly.

The exam will have 3 parts, two of which are completed as an in-class exam, administered on Saturday August 3 from 1:00 pm to 3:30 pm.

Important rules for the exam:

- Laptop users must use ExamSoft (or the VLS equivalent) for part of the exam. Be sure you have installed it. VLS will provide Bluebooks for handwriters.
- Please see the appropriate Vice Dean at least a week before the exam to secure approval for an exam accommodation allowed under VLS policies.
- You must use your student ID number as identification on both the in-class part of the exam and the take-home question/answer that you will bring to class on the Saturday of the exam, August 3. No names, please!

Content/format of the exam:

Part I: Short-answer questions (***not*** multiple choice) that require only a few sentences to answer, such as defining terms, acronyms and the relationship between terms. You will answer these short questions directly on the hard copy of the exam that I will hand out in class, i.e., no ExamSoft). This part of the exam is **Closed Book** and will take 40 minutes or so at the start of exam session. Use only your exam # on the exam.

Part II: Focused essay questions, one of which will cover the bigger picture view of shale development (pros and cons, weaknesses in regulation, problem areas, etc.) to show that you can pull together the material covered in the CB, the TWEN readings, and class discussion, including Powerpoints. ***You may bring the bound EEE CB purchased at the Bookstore to class for this part of the exam, but no printed or internet source material may be accessed during the exam. You may use only this bound version during the exam.*** You may have written notes on the pages of your EEE CB copy, but no other material may be brought into the exam.

Part III Take Home: I will hand out an essay question on pipelines at the end of our last class, for you to complete as a take-home, open book question, but your answer **must be** restricted to the material in the class reading. ***Bring your answer to class,***

[12] **Optional TWEN Item 17C** are maps of the controversial US-Canadian pipelines: the Keystone XL pipeline and the Dakota Access pipeline (showing where Standing Rock is, the site of a long protest by Native Americans).
[13] **Optional TWEN Item 17B** is FERC's 2018 NOI on pipeline certification policy.

printed in hard copy, with only your student ID number as identification, on the Saturday of the in-class exam. The in-class part of the exam will not cover this part of the reading in the EEE CB.

Scoring system:

- The questions in the three parts will vary in point value, from short answers (5 points each) to essays worth 10 to 30 points. The exam will total 200 points: 150 points for the in-class part and 50 points for the take-home part (on pipelines).
- Remember that your grade may be adjusted for failure to do the class memos.

BEST ADVICE: Do not expect that you will have time to find and read the material in the EEE CB as you write your exam. Please keep up with the reading, take notes in class, and outline the material over the course of these two weeks.

Titanic Scenario:
You are the Risk Management Compliance Officer for the Titanic's Owner.
What lessons from the Macondo/Deepwater Horizon Disaster are applicable?

The factual background:

- The Titanic carried 2,224 people on board its maiden voyage, but it had lifeboat seats for only 1,178 people. It was the largest and most modern ship ever built at that time for passenger cruises on oceans. It was a technical wonder that was deemed to be unsinkable unless an abnormally (unthinkably) large number of compartments flooded due to a hole in its hull.
- The existing UK regulations of the Board of Trade at that time required all vessels above 10,000 metric tons to carry 16 lifeboats. The Titanic weighed 46,000 tons.
- Titanic had 20 lifeboats, which exceeded the minimum number (16) required under the UK Board's regulations.
- If the Titanic sank slowly, the 20 lifeboats could probably shuttle all passengers to other ships that travelled in that well-used sea lane without loss of life.
- There had been no loss of a passenger ship at sea for 40 years (since 1873; the Titanic was built in 1912).
- The shipbuilder recommended that the ship owner require the ship to be designed to hold 48 lifeboats to accommodate all persons if so required by the regulator. Doing so in the design stage meant that providing lifeboats for all would cost very little, if required, compared to retrofitting the ship later.
- The UK Board did not amend its regulations for the Titanic.

Questions:

1. ***As the ship owner's risk management expert***, what would you recommend? Design for 48 lifeboats and install them if required? Install them even if not required?

- What safety standard would you use? To reduce major hazards to "as low as reasonably practical"—the "ALARP" standard used in the offshoreNorth Sea oil industry?
- Is your recommendation affected by the regulator's decision? Why or why not?

2. ***As a consumer of cruise services***: Imagine a Center for Safety at Sea that grants certificates to ships that meet higher standards for passenger safety than the regulator has set. Would you trust these certificates to guide your decision as to which ship to charter a cruise of a lifetime for your entire family? Or would you expect the regulator to know best? Would you trust the certificate to reflect an effectively enforced higher standard?

3. ***As a shipping industry trade organization***, would you lobby against any absolute rule that required lifeboat seats for all persons, regardless of circumstances, cost and the low probability that passenger ships would ever sink quickly? Would you argue for a SEMS rule that allowed each ship owner to develop its own safety management system that allowed the owner to decide how much safety was enough to assure no loss of life at sea and how this safety level would be met? What elements should be in the SEMS rule?

Appendix I: Ratemaking for Public Utilities:

Although the process varies from state to state and in different contexts at the federal level, most public utility regulation imposes the following general requirements:

1) **Certificate of Convenience and Necessity:** The business must obtain permission to enter into and operate within the regulated market. This is achieved by securing a "certificate of convenience and necessity."

2) **Monopoly Franchise:** As part of this licensing process, the government often creates a monopoly by establishing an exclusive geographic franchise. Within this service area, the utility has the right to serve the market without competition.

3) **Duty to Serve:** In return for this exclusive service territory, the government often requires the utility to provide a certain level of service to all customers within the service territory. The utility has a duty to serve customers and cannot selectively choose its customer base for its own private gain.

4) **Price Regulation:** The regulatory body will allow the utility to charge only "just and reasonable" rates to customers. This is normally done on the basis of the cost of providing service to each class of customers.

The cost-of-service ratemaking formula for public utilities is:

R = O + (B x **r)** where:

R is the utility's revenue requirement—the total amount needed to cover its costs.
O is operating costs, such as fuel and labor that vary with the level of production.
B is its rate base, or its capital investment in plant and other assets.
r is the rate of return allowed by regulators, earned on the capital invested in the rate base.

As a much-simplified example, consider the following:

- Assume that PUC Co. builds a power plant and transmission lines at a cost of $250,000,000 in order to provide 28,000,000 kilowatts per hour (kwh) of service to a single class of residential customers in a given year.

- PUC Co. incurs $10,000,000 in operating expenses per year.

- The average cost of PUC Co.'s various sources of capital (such as the interest it pays on its debt and the rate of return on its equity) is 10%.

PUC Co.'s revenue requirement is then: $10,000,000 + ($250,000,000 x 0.10), or $35,000,000. The Public Service Commission will set the residential rate for this class of consumer at $35,000,000 / 28,000,000 kwh, or $1.25 per kilowatt-hour.

APPENDIX II:
Websites of Note for Shale Development Issues

1. Websites of Non-profits and Academic Institutions:

- **The Resources for the Future (RFF) website** has extensive reports, based on empirical data and often written by interdisciplinary teams, on shale gas impacts in the US. RFF also researches current issues in climate change, grid resiliency, offshore regulations, public lands and other energy/envtl issues. RFF is staffed with energy economists and statisticians who are well-trained in doing cost-benefit analysis of policy proposals and evaluating the strengths and weaknesses of empirical studies by others. It reaches out to academic experts in particular fields, such as epidemiology, to work on targeted research. More information on RFF is provided in the Note at the end of this Appendix of Websites.

  RFF has migrated its shale research to the Shale Research Clearinghouse, or "SHARC," at www.rff.org/sharc. This curated website serves as a one-stop shop for comprehensive, rigorous and current informaton on the environmental, socioeconomic and other impacts of oil and gas development. Users can access summaries of peer-reviewed research on the impacts of oil and gas development in many areas. SHARC offers tools like these:

  1. Issue Briefs (2 pages long)(a little shark icon identifies topics with an Issue Brief or a Literature Review Summary).
  2. Literature Review summaries (15-20 pp. long).
  3. A searchable bibliography that accesses the underlying peer-reviewed research.

- **The Pipeline Safety Trust at www.pstrust.org.** This website focuses on the safety of pipelines rather than the well drilling and production process. It commissions technical studies on pipeline safety, submits comments to federal rulemaking on this issue and provides Guides to Landowners and to Local Governments on Pipeline Safety. Many parallels exist between pipeline safety and offshore drilling safety.The Trust was formed after a gas line owned by Olympic Pipeline in Bellingham, Washington exploded in 1999, killing three young men. On June 18, 2003, a US District Judge ordered that $4 million of the criminal fines imposed as a result of the tragedy be awarded to endow the Trust and advised the pipeline industry to work with the Trust to avoid future tragedies. The Trust has become a significant force in advocating for pipeline safety.

- **The Local Land Use Collaborative: Local Land Use Planning for Hydraulic Fracturing**. A joint research project from Harvard, Yale and Pace universities surveyed local community impacts, ordinances and scientific literature and then developed a database of 33 local impacts, including social and environmental impacts, which face communities in areas of fracking operations. The database allows users to click on links to communities that have addressed these impacts. E.g., the City of Arlington has an extensive ordinance that controls the design and siting of frack ponds in the city (which is located in the Barnett Shale), among other regs. The

database is a valuable resource for local communities of all kinds, whether rural or urban, or located in the west, the east or the middle part of the country.
The database is at http://bit.ly/frackingdatabase (insert into your browser) or: http://50.87.248.60/~trevorw4/collaborative/fracking-database/.
An article summarizing the project appears at: Grace Heuser, Allison Sloto & Joshua Galperin, *Defining and Closing the Hydraulic Fracturing Governance Gap*, 95 Denver L. Rev. 191 (2017), also available at SSRN as ID2926682. The objective of the study is to provide communities with regulatory structures that will not be preempted by the state because they focus on traditional land use concerns and still allow carefully controlled fracking. The article describes four examples of what local govts are doing that appear to be successful:

- Erie, Colo: negotiated a Memorandum of Agreement with Encana and Anadarko that requires many mitigation measures and collaboration with the companies.
- McKenzie County, ND: zoning process used to develop a Comprehensive Plan and Zoning Ordinance, with collaboration from 18 other counties and entities to form a Vision West ND plan for infrastructure needs, locating man camps of workers, traffic control, post-leasing reconstruction, etc. Essentially, the Vision is a planned regional growth initiative to accommodate the boom.
- Peters Township, Pa: heavily residential and wealthy area created a Mineral Extraction Overlay Zone that allows drilling in areas over 40 acres that are accessible via an existing road, with all drilling zoned as industry use; detailed setbacks, noise limits, pre- and post- water testing, etc.
- Arlington TX: comprehensive zoning ordinance with clear rules combined with collaboration between oil and gas operators and enforcement staff. Drillers must get a Special Use Permit in a multi-step process that includes neighborhood meetings, a gas well permit application and a public City Council meeting. Drill zones set up for multiple well sites. A permanent three-person fracking team does on-site inspections and reviews documents and responds to citizen complaints daily.

More information on fracking for local communities to use can be found at the Harvard Law School's Environmental Policy Initiative, directed by Kate Konschnik.

2. Industry/State Regulator Websites of Note:

- **STRONGER** is the State Review of Oil and Natural Gas Environmental Regulations. STRONGER is an alliance of state regulators that does peer reviews of other states' regulations to develop "diverse perspectives and consensus solutions" to better practices. E.g., STRONGER published its review of the Alaskan Oil & Gas Conservation Commission's Hydraulic Fracturing Regulations in January 2016, led by a review team comprised of a member of the Oklahoma Comm'n, Lois Epstein of the Wilderness Society and Justin Furnace of Hilcorp Energy Co. The US EPA and BLM provided Official Observers and public participation was part of the process.

- The **Interstate Oil & Gas Compact Commission** (http://iogcc.publishpath.com/) is composed of members from oil and gas producing states. This group develops model laws, reports on topics of mutual interest to its member states, such as induced seismicity, and provides links to many other sources of oil and gas regulation. E.g., IOGCC published a report on Horizontal Well Development: Pooling, Spacing and Unitization: A Regulatory Toolbox for Key Policy, Regulatory and Statutory Considerations (June 2015).

- The **American Petroleum Institute** (API) has published two documents relevant to industry interactions with local communities and available on its website. The first is an industry recommended practice on Community Engagement Guidelines, ANSI/API Bulletin 100-3 (July 2014, 1st ed.). Its 15 pages of guidelines "outline what local communities and other key stakeholders can expect from operators," (id. at 1) using a five-phase development model (from entering a community to exiting it). The second is titled "Energy and Communities: Prioritizing Safety, Health and Environmental Stewardship" (June 2017) that serves more as a promotional piece for the industry.

- Another industry website, **FracFocus,** collects well-by-well data, by state, on the chemicals (and sometimes amount of water) used in fracturing a well. Some states require operators to file their well data at FracFocus as part of that state's regulatory framework. https://fracfocus.org/. The website has data on over 110,000 wells as of June 2016. It has a "find a well" link for the public to use and is upgrading to a searchable database.

- **Energy In Depth (EID)** is an industry website that responds quickly to any critical reports about fracking or related oil and gas operations. It was created by the IPAA, the Independent Petroleum Association of America. https://www.energyindepth.org. EID is a vocal presence in social media and speaks with an industry bias.

Note: The value of having an expert think tank, like RFF, that can review technical documents and provide clear economic analysis and reports to the public is evident in the following event:

On December 14, 2017, a headline appeared in the ***Washington Post*** and the *Houston Chronicle* reading "Study says fracking sites raise the risk of low-weight babies." The news reports described a newly released study by researchers at Princeton, UCLA and the University of Chicago finding that women who lived within half a mile of a hydraulic fracturing well site were 25% more likely to give birth to low-weight infants than pregnant mothers living further away. No health impacts to newborns were found for mothers living more than 2 miles away. Mothers living between a half mile and two miles from a well site had lower birth weights, but not as low as those within the half mile radius. The study covered 1.1 million births in Pennsylvania over five years.[14] The report received much attention in the broader media.

[14] The study was also reported in EnergyWire, 12-14-2017, with a link to the journal *Science Advances* where it appeared.

Energy In Depth quickly responded with a posting on its website titled "Why You Shouldn't Believe a New Study Linking Fracking to Infant Health Problems."

RFF quickly posted a 4-page comment on RFF's blog titled "What to Make of the Newest Study Linking Fracking to Low Birth Weight." The blog carefully analyzed the strengths and weaknesses of the study's data and its analysis of the statistical results. RFF judged the study to be of high quality, but noted that the study did not identify the mechanisms (such as air pollution from truck traffic or sleep disturbance from noise and light) that could impact newborn health. Thus, policymakers could not target specific measures to mitigate the observed statistical correlation. Further, a close look at the data showed some puzzling questions about the data results.

RFF then looked at the Energy In Depth (EID) posting and found that it misled readers by wrongly criticizing the quality of the data used by the researchers. Other EID arguments to ignore the study were questionable at best. RFF's own assessment of the study was that it provided valuable data analysis that should be a "yellow flag" to policymakers, companies and citizens. It is unrealistic to expect to find "bulletproof causal linkages" between shale development and human health because the "gold standard" of randomized, controlled trials are impractical and probably unethical to do.

The RFF website also posts a matrix of reports on its research on impacts of shale development on local communities. They include:

- **Induced Seismicity Impacts of Unconventional Oil and Gas Development**
  Jun 23, 2017 | Alan J. Krupnick, Isabel Echarte| 30 pp. This report provides an overview of the existing state of research on induced seismicity related to both unconventional and conventional oil and gas development in the United States.

- **Local Government Impacts of Unconventional Oil and Gas Development**
  Jun 23, 2017 | Alan J. Krupnick, Isabel Echarte, Lucija Anna Muehlenbachs | 17 pp.
  This report reviews the academic literature analyzing the effect of unconventional oil and gas development on local public finance outcomes including a review on the truck traffic literature, a specific subset of these local government outcomes.

- **Housing Market Impacts of Unconventional Oil and Gas Development**
  June 23, 2017 | Alan J. Krupnick, Isabel Echarte| 19 pp.
  This report reviews the housing market impacts of unconventional oil and gas development, focusing on studies that assess changes in home prices related to proximity to development, lease clauses, rental rates, farm values, and tax base changes.

- **Health Impacts of Unconventional Oil and Gas Development**
  Jun 23, 2017 | Alan J. Krupnick, Isabel Echarte| 29 pp.
  This report reviews the academic literature analyzing the effect of unconventional oil and gas development on health outcomes, focusing on epidemiological studies. RFF reviewed 32 studies that covered impacts such as birth outcomes, cancers, asthma, and other health effects, including migraines and hospitalization. Most of the studies were found to have weaknesses and many had significant shortcomings because of the nature of the data and

research methodologies. The studies were not able to assess the causal mechanisms of any health impacts (i.e., whether a certain impact is caused by air pollution, stress, water pollution, or some other burden).

- **Public Education Impacts of Unconventional Oil and Gas Development**
  Jun 23, 2017 | Laura Zachary, Nathan Ratledge | 16 pp.
  This report reviews the economic literature examining the effect of unconventional oil and gas development on public education via three main channels—student population, school finances, and the labor market.

- **Economic Impacts of Unconventional Oil and Gas Development**
  Jun 23, 2017 | Alan J. Krupnick, Isabel Echarte| 29 pp.
  This report reviews the literature that analyzes the local economic impacts of an increase in unconventional oil and gas development, including impacts on wages and royalty income, employment, and the effects on long-term growth and economic development.

RFF's WHIMBY research is valuable as the United States (and other countries) continue to develop current and new shale plays. Its careful analysis of the qualitative and quantitative studies of development impacts can help communities plan better and perhaps avoid mistakes made in the first shale plays. Still, the RFF reports sometimes fail to capture what people actually see and experience when visiting shale areas during both the boom cycle and the bust cycle of the shale plays. Here are some of the headlines that have appeared in the E&E e-newsletters about small towns caught up in an oil boom:

- ***Bakken Shale: N.D. lawmaker says retired general called oil towns a "war zone."*** Energywire 9-29-14. Retired general David Petraeus likened the man camps and oil patch communities in the Bakken to scenes from a battle zone after visiting the field with a state legislator. The ND legislature was addressing the problem of over-worked law enforcement and emergency services, packed classrooms in schools, and congested roads.
- ***Bakken Shale: Overtime, burnout: Public interviews illustrate struggles of life in the oil patch boo***m, 8-8-2013 (spikes in crime & 911 phone calls, deteriorating sense of community ("people used to wave;" "I won't let my younger sister walk to the store by herself; nasty people hang out there."); police salaries not able to compete with pay in the oilfields).
- ***Oil patch confronts drug trade,*** Houston Chronicle 4-13-2014. Large meth ring found in quiet backyard in Williston, ND; growing trade in meth, heroin, cocaine and marijuana spurs violence; Mexican cartels making inroads.
- ***A terrible price: troubling rise in traffic deaths tied to Texas oil and gas boom merits legislative action,*** Houston Chron. 10-5-2017 (reporting traffic deaths linked to commercial vehicle crashes up 51% between 2009-2013).

The oil busts that follow the booms when prices fall cause their own types of stress and distress: unemployment, closed businesses, empty hotels and man camps—and many broken dreams.