Pipeline Politics

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Chapter 1: Introduction

What can we do to help local citizens understand the implications of a newly proposed natural gas pipeline in Northampton County?

We might be on the brink of the next "gold rush". Instead of gold, it is natural gas. Americans won't be rushing out West to find this "gold" they will be rushing to the Marcellus Shale. The Marcellus Shale is home to an abundant amount of natural gas. We are a nation that is dependent on oil and natural gas to power energy in this country. Together, oil and natural gas account for half of society's primary energy supply (Carlyle, 2013, p.30). Therefore it should be no surprise that if natural gas pipelines, from the United States alone, were stretched out they could travel from the Earth to Moon seven to eight times (Carlyle, 2013, p.30). With the continuing rise in demand for natural gas, companies in this industry are quickly trying to grab a stake of the Marcellus Shale. PennEast pipeline Company (PennEast) is one of those companies. PennEast has proposed to run a 108-mile length, 36-inch diameter, natural gas gathering pipeline from Wilkes-Barre, Pennsylvania to Trenton, New Jersey. This capstone project for the Engineering Studies program is by Kaitlyn Koch, John Paul Bisciotti, and Daniel Kaufmann. We are members of the Engineering Studies Class of 2015 at Lafayette College. As a part of our capstone project we were devised the research question "what can we do to help local citizens understand the impacts of a pipeline running through Northampton County?" To answer this question we have composed an informative website to help the residents of Northampton County understand the implication and consequences of this pipeline running through their residencies. Our website can be found at https://sites.lafayette.edu/pipelinepolitics/.

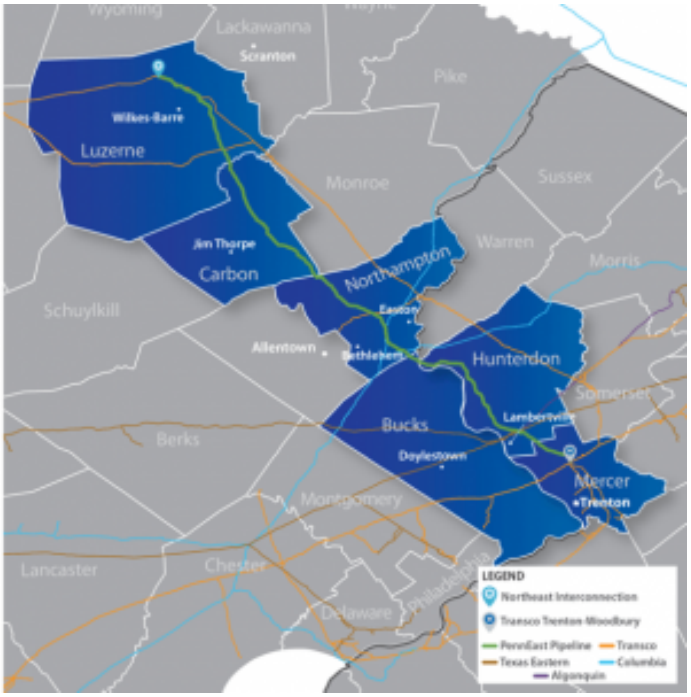

Figure 1. PennEast proposed 108 mile natural gas pipeline route cutting through six counties (PennEast, 2014).

In order to fully understand what a natural gas gathering transmission means to the residents of Northampton County, an explanation is needed for the contexts and analysis of what this proposed pipeline means from start to finish. PennEast Company has proposed to construct a natural gas pipeline in Wilkes-Barre, Pennsylvania. Wilkes-Barre is located in the Northeast area of Pennsylvania, and also located in the Marcellus Shale. Found in the Allegheny Plateau, the Marcellus Shale is a geological formation that holds a vast amount of natural gas (Pritchard, 2013, p.1). The natural gas found in the Marcellus Shale can only be accessed by hydraulic fracturing. Those who support the fracturing of the shale say that the amount of natural gas located in the shale can help the United States reduce its dependence on foreign gas. It is estimated the Marcellus Shale contains between 50 trillion to 500 trillion cubic feet of natural gas (Barnhart, 2014, p. 1). In 2013, the United States consumed about 26 trillion cubic feet of natural gas (Energy Information Administration, 2014). The greatest argument for hydraulic fracturing is that it will bring substantial economic development for the Pennsylvania section of the Marcellus Shale. It is contended the extraction of natural gas in Pennsylvania will bring much-needed revenues to the state, jobs to the community and revenues from leasing to struggling landowners. (Pritchard, 2013, p.1)

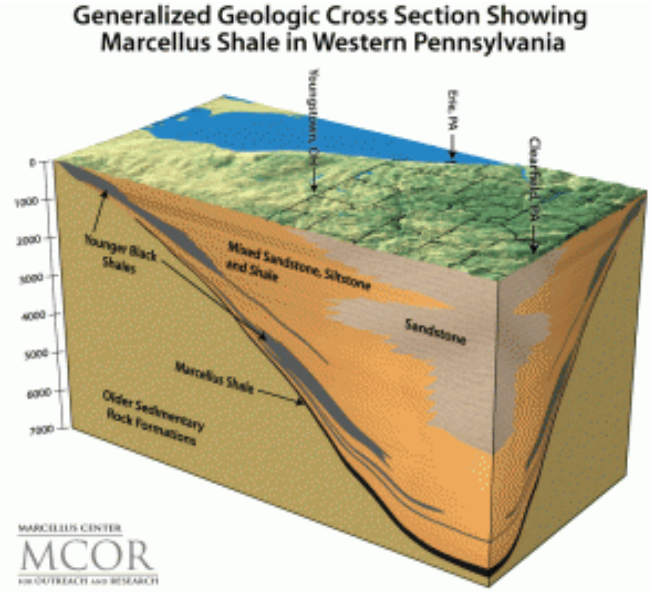

Figure 2. Cross section of the Marcellus Shale in Western Pennsylvania (Marcellus Center Outreach and Research, 2014).

The Marcellus Shale is the reason why PennEast is proposing their pipeline to begin in Wilkes-Barre. Hydraulic fracturing will extract natural gas from the Wilkes-Barre area, the natural gas will then be transported through the pipeline to Trenton, New Jersey. The pipeline is the component of this proposal that will affect Northampton County residents the most. Due to the geographical location of Northampton County, the pipeline will run directly through the county in order to reach its final destination in New Jersey. According to the Pipeline and Hazardous Materials Safety Administration (PHMSA) *gathering pipeline are intended to ”transport gases and liquids from the commodity’s source-like rock formations located far below the drilling site- to a processing facility refinery or a transmission line.” PHMSA stands by that pipelines are still

the safest means of transporting hazardous liquids and natural gas. Pipelines are regulated by all of the following or individually either by the government and states and also the PHMSA.

Due to Northampton County falling right in the middle of this transmission pipeline proposal route, the short term future entails residents having grant permission to PennEast Company survey their land. They will have to negotiate with PennEast over land rights. After permitting and surveying is completed the construction of the pipeline then may begin. In the long term future, residents of Northampton County will have to accept having the pipeline in their land. But they will also have to accept the consequences of the pipeline in their community, the United States and internationally. Understanding the social, policy, economic and technical context and analyses behind the proposal by PennEast for the transmission pipeline, via the website, will allow the residents to form their own educated opinion and understanding of the pipeline.

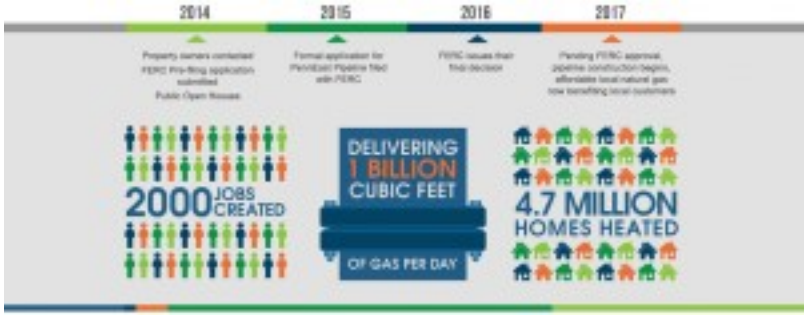

Figure 3. PennEast proposed timeline for the pipeline project and facts presented by PennEast (PennEast, 2014).

The social context behind the pipeline proposal is best explained by the history of energy production in Pennsylvania and the environmental implication of the pipeline. Going back to 1859, Pennsylvania became home to the first oil-drilled well. In 1957 Pennsylvania became home to the nation's first commercial nuclear reactor. Pennsylvania is also a major coal producer, and has provided the nation with energy for many decades. Today, the Marcellus Shale is setting Pennsylvania up to be a major supplier of natural gas to the nation. Over time, coal production became known for, not only the horrible working conditions in the mines, but also the environmental consequences. The Atlantic Sunrise Expansion project, a natural gas pipeline cutting through Pennsylvania, is a year ahead of PennEast and is causing disapproval from residents, especially in Lancaster, PA. If residents of Pennsylvania understand the history of energy production and its consequences, although they have supported energy production in the past, they may help them form an opinion on what type support they want to give to projects like this to shape the future of Pennsylvania.

The economic analysis of the proposal by PennEast has three key stakeholders. These stakeholders are PennEast , FERC, and property owners. For the PennEast their economic cost will entail construction cost, which is approximately $1 billion per a project and also the included cost of jobs. The cost of jobs will entail about 2000 workers for about seven months to a year. The consumers are the residents of New Jersey. The end location for this pipeline is Trenton, NJ. The price for consumers of natural gas in New Jersey will have prices drop from $100 per dekatherm to $4 per dekatherm. For property owners, a long term benefit will be that property taxes will be paid during ongoing constriction of the pipeline. For example the

municipal landowners in Hunterdon County are expected to earn tax revenue of $6.8 million over 5 years. In a larger context of this analysis there are also implications for a new surge in the amount of natural gas being produced for/by the United States in terms of the GDP and total energy production.

The technical analysis PennEast's pipeline proposal must consider including, pipe grade, material, thickness, and more. The temperature and pressure of the natural gas transported through the pipeline are also important factors that determine the pipeline's efficiency and safety. The pipeline could experience a number of technical problems such as natural gas emissions, leakages, and ruptures that could have terrible consequences on public safety and the environment. Another aspect of the technical aspect must be the informative website. Included on the website will be fact sheets which are another component in the technical analysis.Consideration of how the layout will be for the website must be investigated under the technical analysis.

The policy analysis includes determining who, where and what behind this proposal. The supporters of the PennEast pipeline proposal include AGL Resources, NJR Pipeline Company, South Jersey Industries, UGI Energy Services (UGIES), and Public Service Enterprise Group. They support this proposal because of profit from lower natural gas prices for New Jersey and potentially Pennsylvania customers. The Federal Energy Regulatory Commission (FERC) is who has control over the entire PennEast proposal. Without their approval this whole project could be stopped. Another "who" in this project are the residents, property owners, environmentalist, and Federal Energy Regulatory Commission. The Federal Energy Regulatory Commission is who has control over the entire PennEast proposal. Without their approval this whole project could be stopped. Residents play a key role with public health and environmental health. Environmentalist will also have key role with environmental health. Property owners will have a key role with eminent domain, public health and environmental health. The "what" of this process is solving how can problems from the "who" be resolved. Often these answers will be found through education from public organizations and also legal rules.

The social context and the economic, technical and policy analysis of the PennEast Company proposal for the natural gas gathering pipeline will provide critical information for the website. Each of these sections will be used to help structure this website into an informative well developed website and fact sheets.

The bibliography for "Pipeline Politics" can be found under "Bibliography".

Chapter 2: Social Context

The social context of the pipeline proposal is best explained through the history of energy production in Pennsylvania and the environmental implications of the pipeline. Pennsylvania has a deep and long lasting legacy of energy production. The history of energy production in Pennsylvania dates back to over 200 years ago when coal mining began in Pennsylvania (Energy Information Administration, 2014). Pennsylvania is still one of the five largest coal producing states in the nation according to the Energy Information Administration (EIA). The Northeasten region of Pennsylvania has virtually all of the nation's reserves of anthracite coal. The state is a major coal producer, and also exports to states on the East Coast and in the Midwest. Not only does Pennsylvania produce and export coal, but they are still among the nation's major coal consumers. The western half of the state still uses coal to generate electricity and to produce coke for steelmaking.

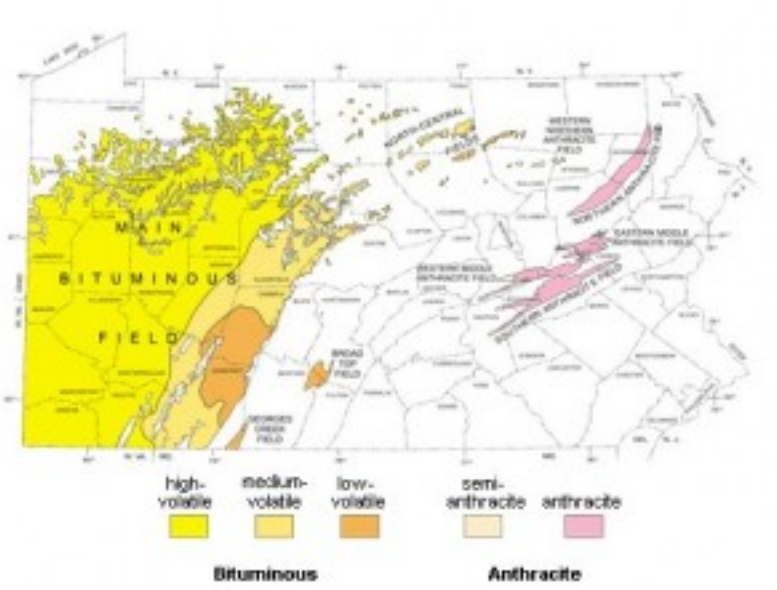

Figure 4. Regions of Pennsylvania with coal resources (US Geological Survey, 2013).

Pennsylvania is known for being first in historical milestones of the nation's energy production. According to the Institute for Energy Research, in 1859, Titusville, PA became home to the world's first commercial oil-well drill which played a role in the world's first oil boom. Then in 1957, Shippingport, PA became home to the nation's first commercial nuclear reactor. Today the state has the second-largest nuclear capacity in the nation (Energy Information Administration, 2014). The Marcellus Shale has the potential to be the next big source of energy production for Pennsylvania. This state has been known for its rich endowment of fossil fuels, with substantial reserves of coal and now it has the potential to be known for natural gas from the Marcellus Shale.

"Natural gas production out of Pennsylvania has quadrupled from 2009 to 2011 due to hydraulic fracturing of the Marcellus Shale."- (Energy Information Administration, 2014)

The state is currently ranked among the top 10 producers of natural gas in the nation (Energy Information Administration, 2014). Before production from the Marcellus Shale the state relied on pipelines from the Gulf Coast to supply natural gas. But now the game has been reversed, the state can now control the supply and demand and also produce its own natural gas. Today, according to the EIA, Pennsylvania is the current leading supplier for the East Coast for coal, nuclear power, refined petroleum products and now natural gas to its own industries and the nation. However this comes at a cost for the landowners and residents of the state.

Knowing the history of energy production in Pennsylvania, it may be easy to conclude that natural gas could be the future for Pennsylvania to continue its legacy of energy production. However it is also important to understand the social context of the construction of pipelines for the state and the impacts on landowners and the environment. The PennEast Company is not the only company planning to build a new pipeline through Pennsylvania.

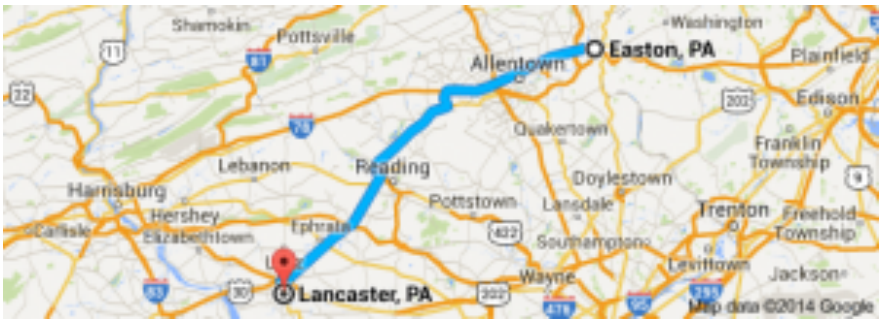

Figure 5. Distance from Easton to Lancaster. (Google Maps, 2014).

The Atlantic Sunrise Expansion project by the Williams Partners is approximately one year ahead of PennEast in terms of permitting and planning (Atlantic Sunrise Expansion, 2014). The Atlantic Sunrise pipeline is proposed to be 177 miles in length, and will cut through 10 counties in the state (Atlantic Sunrise Expansion, 2014). The Williams Partners are still seeking approval from Federal Energy Regulatory Commission (FERC). However the residents of Northampton County could learn important insights about the proposal and planning phases of natural gas pipelines from this project. Lancaster County, only about two hours south of Northampton County, will have a substantial impact from the construction of the Atlantic Sunrise project. In October of this year, an informative meeting was held in Lancaster to help residents develop an educated opinion about the pipeline.

The StateImpact, a division of the National Public Radio, conducted an interview with a Washington D.C.-based attorney, Carolyn Elefant (Cusick, 2014, p. 1). Elefant represents the landowners in Lancaster affected by the Atlantic Sunrise pipeline project. Elefant provides a great insight for landowners on how to properly deal with companies like the William Partners or PennEast Company. When asked about what she wants the landowners to know, she answered those landowners need to do the legwork. The more landowners participate and comply with the rules, the more difficult it will become for FERC to ignore their input (Cusick, 2014, p. 1). Elefant also addressed concerns about property value being affected, saying that the more awareness that has been raised about pipelines and possible dangers of them creates an impression on people (Cusick, 2014, p. 1). This impression of danger is what will impact property values, and landowners should raise this issue to FERC.

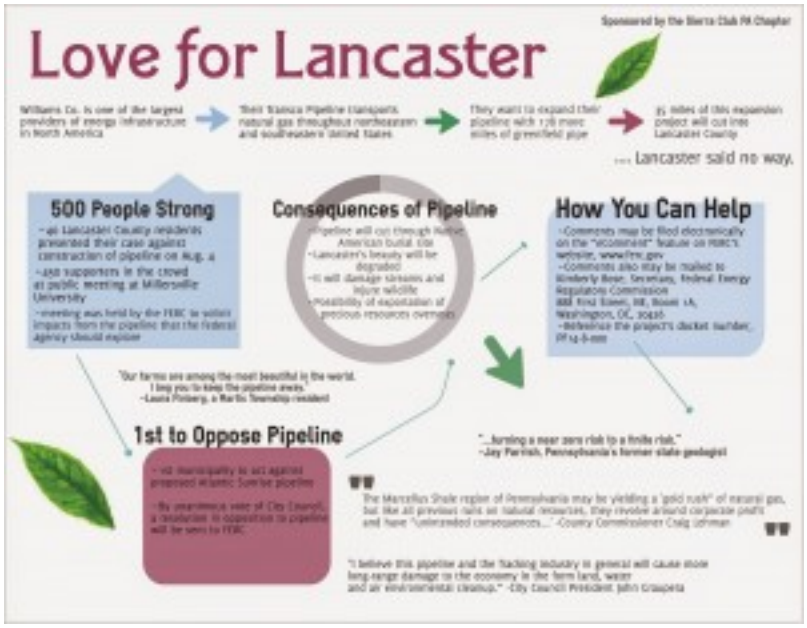

Figure 6. Breakdown chart made for the Atlantic Sunrise Project on how to get involved and who is affected (Sierra Club, 2014).

In this interview the most important question raised pertaining to the social importance and consequences of the pipeline was "so if I'm in this pipeline's pathway, should I get an attorney or consult somebody knowledgeable about these issues?" (Cusick, 2014, p. 2) Elefant's answer came in two components. She said that if you are impacted you should make sure you intervene in the FERC process but also make sure you have an attorney. In particular once a landowner has been approached by the pipeline company with an easement, "you should absolutely have an attorney look at it." Elefant's interview continues on to talk about dealing and past experiences with FERC, however this part will be elaborated upon in the policy analysis section.

How will the PennEast proposal affect landowners? The amount specific to Northampton County is too hard to make a specific estimate at this time. However the pipeline is going to take a direct path through Northampton County, specifically around the Route 33 area in Bethlehem. (Find your house, interactive map.) In total for the project, 861 landowners will be affected by the construction of the PennEast pipeline. This information came to light by the PennEast prefiling FERC. In this report, PennEast identifies landowners, endangered species, wildlife, wetlands and how to deal with the public.

Landowners are not the only inhabitants of the area who will be affected by the construction. PennEast has identified about eleven percent of the proposed route's 400-foot study corridor. Which it surveyed for wetland resources and general habitat. What this means is that a total of 33 wetland complexes and 60 water bodies could potentially be affected by the construction of the pipeline (PennEast, 2014). PennEast also identified that four of the water body crossing are major crossings, meaning greater than 100 feet. Endangered species were also identified in the proposed route study. These endangered species include the Bog Turtle, Indiana Bat, Dwarf Wedge Mussel and the Northern Long-eared Bat (PennEast, 2014). Residents of Northampton County should not only be concerned about their health and well being affected but also their endangered species could be affected.

The FERC prefiling also identified a Public Participation Plan, specifically asking for tools and actions to facilitate stakeholder communications and public information. The Public Participation Program by PennEast consist of:

- informing landowners and other stakeholders about the project through early public notification and regular communication,
- sharing fact-based accurate information, communicating clearly about the proposed project and its potential impacts,
- providing timely opportunities for stakeholders to pose questions or express concerns,
- and taking such input into consideration and as feasible sharing with stakeholders how their input influenced the project.

PennEast has also established an outreach team, to implement the Participation Program by:

- identifying stakeholders with whom PennEast will communicate about the company,
- the proposed project and potential impacts to the community and its citizens,
- designating a single point of contact, establishing a website presence, dedicating a toll free phone number, email address and physical mailing address, identifying hours PennEast will be available,
- conducting consultation meeting with elected officials and other community leaders, hosting open house for landowners elected officials and stakeholders,
- producing and distributing information materials, and supporting on going outreach through the life of the Project, inducing documentation of issues.

In the filing PennEast also went on to list the point of contact, proper phone numbers, mailing addresses, and stakeholder identification. Located on their website is also a community investment section.

All of this information from PennEast, the history of Pennsylvania, and from attorney Carolyn Elefant, allows the public to understand the social context from a state-based perspective. But another important aspect of this social context is to understand what this pipeline means on a national and global level. If pipelines like the one proposed by PennEast are constructed, the United States will have more natural gas available then it ever did before. This means the United States could potentially begin to be a steady exporter of energy. It could potentially also mean the United States would stop being dependent on foreign countries for energy. Natural gas is a cleaner burning fuel than coal; it still does have Carbon Dioxide emissions (i.e., greenhouse gas). It would be a cheaper energy source and would have less of an environmental impact. However the nation then could lose all momentum for green energy, if a cheaper clean fuel (i.e.,natural gas) does become abundant in this nation.

The proposal of pipelines is do not just affect the East Coast, but the entire United States. One of the largest current national debates going on is over the transnational Keystone XL pipeline. According to the Keystone XL website, "Keystone XL Pipeline will be the safest and most advanced oil pipeline operation in North America. It will not only bring essential infrastructure to North American oil producers, but it will also provide jobs, long-term energy independence and an economic boost to Americans" (Keystone XL, 2014).

Figure 7. Proposed route of the Keystone XL pipeline (Transco Pipeline Project, 2014).

The proposal is for a 36-inch diameter crude oil pipeline with a proposed route of 1,179 miles in length running from Hardisty, Alta (Canada) to Steel City, Nebraska (Keystone XL, 2014). The proposal has been in limbo for all of President Obama's time in office due to the severity of the proposal in terms of political, environmental, and economic impacts on the United States.

The State Department is pending a Presidential Permit for the pipeline however they are considering "energy security; environmental, cultural, and economic impacts; foreign policy; and compliance with relevant federal regulations and issues," (Henry, 2014, p. 1). Construction of the pipeline has begun in sections of Texas, Oklahoma and Canada. TransCanada ended up having to use eminent domain on many Texas residents causing many court cases over land rights to arise in the state (Henry, 2014, p. 1). Most recently the legislation for the Keystone XL was defeated by one vote in the Senate. This decision was a major victory for the environmental movements against pipelines (Parker, 2014, p.1). What this vote meant was "how a once-obscure pipeline blew up into a national political battle between environmentalists and the oil industry" (Parker, 2014, p.1). This vote set the stage for future pipeline proposals like the PennEast Company's proposal.

Figure 8. Protest outside the White House in Washington D.C. over the Keystone XL Pipeline (Action Network, 2014).

It is important for Northampton County residents to consider both the Atlantic Sunrise Project and the Keystone XL Pipeline as part of the context when trying to form an educated opinion about the PennEast proposal. Understanding both the local context of how landowners will be affected, how public outreach will work and also the global consequences of allowing this pipeline to be in their community and what it supports, and the legacy of energy production in Pennsylvania, ultimately allows citizens to have the most informed opinion. The more informed the opinion, the better the residents of Northampton County can deal with FERC.

Chapter 3: Policy analysis

About Public Policy and Public Problems

According to *Public Policy: Politics, Analysis, and Alternatives*:

Public policy is what public officials within government, and by extension, the citizens they represent, choose to do or not to do about public problems. Public problems refer to conditions the public widely perceives to be unacceptable and that therefore require intervention. These problems…can be addressed through government action; private action, where individuals or corporations take the responsibility; or a combination of the two (Kraft, 2012)."

Therefore, this page will identify public problems associated with the PennEast Pipeline Project (Project), stakeholders including citizens, government, and corporations associated with the Project, and actions to address these public problems.

Using this page, it will become evident that public problems with the Project are strongly tied and vastly intertwined with environmental and energy policy. However, before discussing environmental and energy policies directly associated with the Project, this page will narrate a history of environmental and energy policy.

The History of Environmental and Energy Policy

There are many ways to understand what the "environment" is. Simply put, different fields of study conceive of the environment differently. One field of study might strive to understand the environment as all natural things, living and non-living, another field might define the environment as biological factors and chemical interactions, and moreover, another might reduce the environment to physical exchanges of mass and energy. Of course, this list of perspectives is not exhaustive; it goes on.

Here, we will define the environment as "a set of complex systems that interact in complex ways to supply humans and other species with the necessities of life, such as breathable air, clean water, food, fiber energy, and the recycling of waste" (Kraft, 2012). This definition accurately acknowledges that society interacts with the environment, and that the environment is used for instrumental purposes.

In 1992, global leaders investigated the environment and its relationship with society. At the first international Earth Summit, the United Nations Conference on Environment and Development, more than 100 heads of state convened in Rio de Janeiro, Brazil to address urgent problems of environmental protection and socio-economic development. The assembled leaders signed two agreements dedicated to promoting sustainable development:

- "Convention on Climate Change", to set an overall framework for intergovernmental effort to address challenges posed by climate change, and recognized that the climate system is a shared resource whose stability can be affected by emissions of carbon dioxide and other greenhouse gases.

- "Convention on Biological Diversity", to pursue the conservation of biological diversity, the sustainable use of its components, and the fair and equitable sharing of the benefits arising out of the utilizing of genetic resources.

On an international stage, therefore, sustainable development emphasizes economic growth being compatible with environmental systems and social goals. It investigates "meeting the needs of the present without compromising the ability of future generations to meet their own needs" (Smith, 2012).

Moreover, on a more local stage in Northampton County, business entities such as the Sustainable Energy Fund of Allentown, Pennsylvania incorporate the values of sustainable development into their own mission statements:

Sustainable Energy Fund is a non-profit organization that assists energy users in overcoming educational and financial barriers to a sustainable energy future: a future in which energy is harvest, converted, distributed and utilized in a manner that allows all to meet their energy needs without compromising the ability of their children and grandchildren to meet their needs (Sustainable Energy Fund, 2014)."

In America, environmental and energy policies emerged uniquely in context to United States history:

Prior to the 1970s, energy policy was not a major or sustained concern of government. For the most part it consisted of federal and state regulation of goal, natural gas, and oil, particularly of the prices charged and competition in the private sector. The goal was to stabilize markets and ensure both profits and continuing energy supplies" (Kraft, 2012).

Responding to industrialization of the late 19th century, American citizens of the 1960s participated in environmental movements. At this time, postindustrial social values pervaded concurrently with the growth of economic development and consumerism following World War II (Kraft, 2012).

Citizens' sentiments about environmental and energy policy motivated public officials to enact new laws. In 1963, the Clean Air Act was designed to control air pollution, encouraging breathable air. In 1972, the Clean Water Act was put into effect to govern water pollution. Likewise, the Safe Drinking Water Act of 1974 ensured water quality standards at the federal level. And in 1976, the Resource Conservation and Recovery Act was enacted to manage the disposal of solid and hazardous waste.

American public officials constructed national environmental public policies with multiple purposes in mind. They were motivated to prevent negative economic externalities from pollution, act ethically with the right decisions, and meet public demand for political reelection. Their policies help guarantee citizens with necessary resources like air, water, and waste disposal in American society (Kraft, 2012).

Yet, American public officials came under forceful criticism from business groups, conservatives and economists worrying about the costs policies imposed on society (Kraft, 2012). In constructing American environmental and energy policies, mixed intentions, goals and expectations impact future plans, programs, and decisions in America. Environmental and energy policies in America continue to be contested for a number of reasons:

Public policy is not made in a vacuum. It is affected by social and economic conditions, prevailing political values and the public mood at any given time, the structure of government, and national and local cultural norms, among other variables. Taken together, this environment determines which problems rise to prominence, which policy alternatives receive serious consideration, and which actions are viewed as economically and politically feasible…Presented with conflicting assumption and interpretations, [citizens] need to be aware of the sources of information and judge for themselves which argument is the strongest" (Kraft, 2012).

Stakeholders in the Project

Now, more than ever, it is critical for [stakeholders] to understand how the FERC process works and learn best practices to protect their rights … When a pipeline cuts through a community, it impacts different constituencies in different ways. Each affected stakeholder … represents a unique interest, and plays a unique role in the process." – Law Offices of Carolyn Elefant

Largely, 5 stakeholders comprise the Federal Energy Regulatory Commission (FERC) pipeline certification process of an interstate gas pipeline:

- "State agency carrying out the federal program", which has the authority under federal law to implement the federal program (e.g. Clean Water Act Section 401, Costal Zone Management Act consistency).

- "State agency carrying out the state program", which has authority under state law to ensure compliance with state programs for environmental protection or safety.

- "Counties or municipalities", which are empowered by state law or constitution to carry out county or municipal provisions to protect the environment or safety.

- "Non-governmental organizations", which protect special interests (i.e. the environment, businesses, etc…) that are subject of its charter.

- "Landowners with lands directly affected", who want to protect their property.

One can better understand stakeholders and their roles with respect to intervention, waivable rights by FERC, and preemption, respectively per stakeholder. So, what is intervention, waiver, and preemption?

- "Intervention" is an official right of an intervenor. Intervenors receive the pipeline company's application filings and other FERC documents related to the case and materials filed by other interested parties. Intervenors are able to file briefs, appear at

hearings and be heard by the courts if they choose to appeal FERC's final ruling. However, along with these rights come responsibilities. Intervenors are obligated to mail copies of what they file with FERC to all the other parties at the time of filing. In major cases, there may be hundreds of parties.

- "Waiver" refers to legal waivers. Waivers are legal documents releasing some requirement, giving up some right, or agreeing to hold some entity blameless.

- "Preemption" refers to the result when federal law supersedes or overrides state laws or rules governing the same object due to the Supremacy Clause of the Constitution. "Field preemption" refers to when state law and federal law conflict, and when federal law displaces state law entirely irrespective of any actual conflict. "Conflict preemption" refers to when federal and state authorities share regulatory authority, and when state law must give way. Federal authorities – both FERC and the Department of Transportation – together regulate the field of pipeline safety and displace state regulation.

The following table, which was provided in a document by the Law Offices of Carolyn Elefant, elaborates on intervention, waivers and preemption as they relate to the 5 types of stakeholders involved in a FERC pipeline certification process.

TABLE SHOWING ROLE OF STAKEHOLDERS

	Role	Intervention Required?	Waivable by FERC?	Preempted?
State agency carrying out federal program	Has authority under federal law to implement federal program (*e.g.*, Clean Water Act Section 401, CZMA consistency)	Yes, to challenge FERC Order, no to act on permits.	No, unless state fails to act on permits within deadlines required by federal statute.	No.
State agency carrying out state program	Authority under state law to ensure compliance with state programs for environmental protection or safety.	Yes to challenge FERC order, no to act on permits	No, unless state law provides for waiver.	No if obtaining state permit is condition of FERC certificate; yes, if permit duplicates or conflicts w/ FERC process and requirements.
County or municipality	Empowered by state law or constitution to carry out county or municipal provisions to protect environment or safety.	Yes to challenge FERC order, no to act on permits	No, unless state or local law provides for waiver.	No if complying with local requirements are condition of FERC certificate; yes, if permit duplicates or conflicts with FERC process and requirements.
Non-governmental organization (NGO)	Protects special interests (environment, business, etc…) that are subject of its charter	Yes. But note – some NGOs may not have standing to seek judicial review because of indirect nature of interest.	Intervention and ability to file comments waived if untimely.	N/A
Landowner w/lands directly affected	Protecting property.	Yes to preserve ability to seek rehearing and judicial review.	Intervention and ability to file comments waived if untimely.	State eminent domain preempted.

Figure 9. Table showing role of stakeholders (LOCE, 2014).

According to the document, even though the federal Natural Gas Act (NGA) preempts much of state and local pipeline regulation, preempted stakeholders are not powerless. Stakeholders can intervene in, and participate in the FERC process on issues related to routing, making environmental recommendations and preparing and submitting studies on impacts that may be relevant to FERC's public interest findings. However, FERC is an executive agency, not a legislative body. As such, it is not influenced by letters and petitions in mass urging rejection of pipe.

Stakeholders that intervene in the FERC process can seek rehearing of FERC's certificate and challenge it on judicial review. Thus, stakeholders should intervene in the FERC process to protect their interests and preserve the right to comment and challenge a decision.

Though early maps may suggest that a pipeline route will not cross one's land, landowners in close vicinity of the route should intervene because pipeline routes change frequently during the certification process for various reasons, such as minimizing impacts to environmentally sensitive areas or residential structure. Thus, landowners in close vicinity of the route could see a pipeline re-routed through their property. Only if landowners intervene in a timely manner will they have the ability to challenge a new route configuration.

More Information for Landowners and about Intervention

In an interview with StateImpact Pennsylvania via NPR, Carolyn Elefant, a Washington DC-based attorney who has defended landowners involved in pipeline process, provide the following advice:

- Landowners should retain an attorney if they expect the pipeline will directly affect a part of their property.
- Landowners should always use an attorney if approached by a pipeline company with an easement.
- All citizens should comply with the rules when communicating with FERC to best have their voice be heard.
- For all citizens, participating is the best way not to be ignored during the process.

Elefant stated that citizens who are impacted by a pipeline should intervene. In this document, under "Part IV: Practical Tips", then under section "C. Sample Intervention", the Law Offices of Carolyn Elefant provide a sample form motion to intervene for landowners, private citizens, municipalities, and non-governmental organizations. In addition, FERC explains how to file an intervener status. Moreover, FERC explains the rights and responsibilities of intervention in this document.

More Information about the Interests and Role of FERC

The Federal Energy Regulatory Commission is an independent, Federal agency that regulates the interstate transmission of electricity, natural gas, and oil. FERC also reviews proposals to build liquified natural gas terminals and interstate natural gas pipelines. The Energy Policy Act of 2005 gave FERC additional responsibilities. Since 2005, FERC approves the siting and

abandonment of interstate natural gas pipelines and storage facilities (Mark Gallagher, Princeton Hydro).

FERC would approve the Project in accordance with the National Environmental Policy Act (NEPA). FERC requires PennEast to obtain various permits, reviews, and consultations at federal, state, and local levels. To view anticipated environmental permits, reviews and consultations, please see Exhibit C or view images of Exhibit C below. In addition, see "About Project Policies", which is located on this page below, for elaboration on selected policies.

Anticipated Environmental Permits, Reviews, and Consultations

Agency	Permit/Approval
FEDERAL	
U.S. Fish and Wildlife Service - PA Field Office	Section 7 Threatened and Endangered (T&E) Species Consultation and Clearance
U.S. Fish and Wildlife Service - NJ Field Office	Section 7 Threatened and Endangered (T&E) Species Consultation and Clearance
U.S. Department of Commerce National Oceanic and Atmospheric Administration National Marines Fisheries Service (NMFS)	Section 7 Threatened and Endangered (T&E) Species Consultation and Clearance
U.S. Army Corps of Engineers – Baltimore, Philadelphia, and New York Districts	CWA Section 404/Section 10 Permit(s)
National Park Service	NPS Consultation and Clearance for National Landmarks, National Trails, Wild and Scenic Rivers, and National Historic Sites

Figure 10. Anticipated environmental permits, reviews, and consultations, 1 (PennEast, 2014).

PENNSYLVANIA	
PADEP	General Permit (GP)-05 - Utility Line Stream Crossing GP-08 - Temporary Road Crossings (for Stream Crossings) Section 401 Water Quality Certification (covered under general permit approval) Hydrostatic Testing Discharge General Permit (PAG-10) DEP Submerged Lands License
PA Game Commission (PAGC)	T&E Species Consultation and Clearance
PA Fish and Boat Commission (PAFBC)	T&E Species Consultation and Clearance
PA Department of Conservation and Natural Resources (PADCNR)	T&E Species Consultation and Clearance
PA Historical and Museum Commission (PAHMC)	National Historic Preservation Act, Section 106 Consultation and Clearance

Figure 11. Anticipated environmental permits, reviews, and consultations, 2 (PennEast, 2014).

NEW JERSEY	
NJDEP	NJDEP General Permit No. 5G3 for Stormwater Discharge Associated with Construction Activity
	NJ Wetlands GP or IP
	NJ Green Acres
NJ State Agriculture Development Committee	Farmland Preservation Program & Non-Ag Project Reviews Agricultural Development Areas (ADAs)
NJ State Historic Preservation Office (NJSHPO)	National Historic Preservation Act, Section 106 Consultation and Clearance

Figure 12. Anticipated environmental permits, reviews, and consultations, 3 (PennEast, 2014).

LOCAL	
Luzerne County, PA Conservation District	ESCGP - 2 for Earth Disturbance
Carbon County, PA Conservation District	ESCGP - 2 for Earth Disturbance
Northampton County, PA Conservation District	ESCGP - 2 for Earth Disturbance
Bucks County, PA Conservation District	ESCGP - 2 for Earth Disturbance
Hunterdon County, NJ Conservation District	ESCGP - 2 for Earth Disturbance
Mercer County, NJ Conservation District	ESCGP - 2 for Earth Disturbance
Delaware River Basin Commission (DRBC)	Hydrostatic Testing, Water Withdrawal and Discharge
Susquehanna River Basin Commission (SRBC)	Hydrostatic Testing, Water Withdrawal and Discharge

Figure 13. Anticipated environmental permits, reviews, and consultations, 4 (PennEast, 2014).

More Information about the Interests and Role of PennEast

The General Project Description of a PennEast Resource Report indicates the following public problem:

The lack of a new pipeline with access to sources in Pennsylvania will continue to create dramatic seasonal price fluctuations in Pennsylvania and New Jersey with higher gas and electric rates and an increased potential for energy shortages during peak demand, resulting in threats to business continuity, public safety, and national security."

According to a announcement from PennEast,natural gas prices in New Jersey traded as high as $100 per dekatherm this past winter. Natural gas in the area that PennEast will access traded in the range of $3 to $4 per dekatherm. The proposed pipeline will help reduce this price volatility to the benefit of New Jersey's nearly 3 million gas consumers. Still, PennEast reports:

The Project will provide additional opportunities to buy and sell supplies and to transport natural gas to where it is needed and valued most."

According to our research, the problem stated by PennEast, which is closely tied to economic growth, must also consider environmental health and societal acceptability to rise to prominence and be compatible with environmental systems and social goals.

About Project Policies

On November 20, 2014 at the Nurture Nature Center of Easton, Pennsylvania, Mark Gallagher of Princeton Hydro said the following were key federal regulations applicable to the PennEast Pipeline:

- The Natural Gas Act

- The National Environmental Policy Act
- The Endangered Species Act
- The Wild and Scenic River Act
- The National Historic Preservation Act
- The Clean Water Act Section 404 Wetlands
- The Clean Water Act Section 401 Water Quality Certifications
- The Clean Water Act Section 303 Water Quality Standards

"Natural Gas Act" enacts direct federal regulation of the natural gas industry. Under NGA, FERC is responsible for setting just and reasonable rates for the transmission or sale of natural gas in interstate commerce. Also under NGA, FERC grants certificates allowing construction and operation of facilities used in interstate gas transmission and authorizing the provision of service. Moreover, FERC must issue a "Certificate of Public Convenience and Necessity" to permit pipeline companies to charge customers for some of the expense incurred in pipeline construction and operation. Under NGA, FERC must approve the abandonment of any pipeline facility or service.

"National Environmental Policy Act" states federal agencies shall to the fullest extent possible interpret and administer the policies, regulations, and public laws of the United States in accordance with the policies set forth in NEPA and in these regulations. In addition, federal agencies shall to the fullest extent possible assess the reasonable alternatives to proposed actions that will avoid or minimize adverse effects of these actions upon the quality of the human environment. Thus, FERC must consider project alternatives, as well as a wide range of potential impacts, including socio-economic and cumulative impacts. Cumulative impacts result from the proposed action as well as past, present and foreseeable actions, which may be minor individually but collectively, are significant.

"Endangered Species Act" protects endangered and threatened species and their habitats, and recovers imperiled species and the ecosystems upon which they depend so they no longer need protection under the Act. Section 7 of the Act requires Federal agencies to use their legal authorities to promote the conservation purposes of the Act and to consult with Fish & Wildlife Services (FWS) and National Marine Fisheries Services (NMFS), as appropriate, to ensure that effects of actions they authorize, fund or carry out are not likely to jeopardize the continued existence of listed species. FWS or NMFS can offer reasonable and prudent alternatives about how the proposed action could be modified to avoid jeopardy.

"Wild and Scenic River Act" was constructed to preserve certain rivers with outstanding natural, cultural, and recreational values. Because protection of the river is provided through voluntary stewardship by landowners and river users and through regulation and programs of federal, state, local or tribal government, the Act encourages river management that crosses political boundaries and promotes public participation in developing goals for river protection. Each river is administered by either a federal or state agency, and designated segments need not include the entire river and may include tributaries. The Act limits how much land the federal government is allowed to acquire from willing sellers.

"National Historic Preservation Act" declares that the historical and cultural foundations of the United States should be preserved as a living part of our community life and development in order to give a sense of orientation to the American people. In 1966, the Act acknowledged, in the face of ever-increasing extensions of urban centers, highways, and residential, commercial, and industrial developments, the government and non-governmental historical preservation programs were inadequate to insure future generations a genuine opportunity to appreciate and enjoy the rich heritage of the United States. Thus, the Act advocates increased knowledge of our historic resources, the establishment of better means of identifying and administering them, and the encouragement of their preservation to improve the planning and executing of Federal and federally assisted projects, and to assist economic growth and development.

"Clean Water Act" regulates pollutants: priority pollutants including various toxic pollutants, conventional pollutants that are amenable to treatment by a municipal sewage treatment plant, and non-conventional pollutants that are not identified as either conventional or priority. "Section 404" states the Secretary may issue permits, after notice and opportunity for public hearing, for the discharge of dredged or fill material into navigable waters at specified disposal sites. "Section 401" states that any applicant for Federal license or permit must provide, for any activity that may result in any discharge into navigable waters, a certification from the State in which the discharge originates or will originate or if appropriate, from the interstate water pollution control agency having jurisdiction over the navigable waters. "Section 303" details various Water Quality Standards and Implementation Plans that could have material effects on the Project.

Next

Next is the Technical Analysis.

Chapter 4: Technical analysis

Pipeline

Natural Gas Pipelines Overview

Natural gas pipelines enter the story of natural gas energy production after the hydraulic fracturing process is complete. The raw natural gas is pumped out of the wellhead and into the gathering pipeline system, which is composed of low pressure, small diameter pipes used to transport the gas to the processing plant. After the natural gas is processed it is transported to a distribution center through the transmission pipeline system at pressures ranging from 200 to 1,500 psi. Transmission pipes can measure between 6 and 48 inches but most are between 24 and 36 inches. Lateral pipes, used to deliver natural gas to or from the mainline, tend to measure between 6 and 16 inches in diameter (The transportation of natural gas, 2013). Gathering, transmission, and lateral pipelines are all made of an engineered carbon steel alloy. Along the transmission pipeline system, there must be at least one compressor station to pressurize the gas. From the distribution center, the natural gas is pumped directly to customer through the distribution pipeline system that consists of small pipes that may even be made of highly advanced plastic materials.

PennEast Pipeline Technical Details

The PennEast pipeline is planned to be approximately 108.8 miles and 36 inches in diameter, originating in Luzerne County, PA, and terminating in Mercer County, NJ. The Hellertown lateral pipeline was added in the final draft of PennEast's Resource Report 01 (2014) that was posted on November 10th. It is planned to be approximately 2.1 miles and 24 inches in diameter located in Northampton County, PA. The proposed right-of-way (ROW) corridor will be 100 feet during construction with a 50-ft permanent easement. According to the final draft of PennEast's Resource Report 01 (2014), 30 feet of the 50-ft permanent ROW will remain cleared in non-wetland resource areas while a 10-ft cleared corridor will be maintained in wetland resource areas. The system is rated for a maximum allowable operating pressure (MAOP) of 1,480 pounds per square inch gauge. The gas in the PennEast pipeline will be pressurized by the UGI HAZ compressor station, which will be located on a 47.7 acre property near Blakeslee in Kidder Township, Carbon County, PA. The compressor station will include 3 Taurus 70 units rated at 10,915 horsepower each under ISO conditions for a total of 32,745 available horsepower. The pipeline will have a total of 51 access roads with a total length of 22.1 miles, 11 of which will be located in Northampton County, PA. The PennEast pipeline will have four major waterbody crossings, meaning greater than 100 feet, including the Susquehanna, Lehigh, and Delaware rivers and the Beltzville Lake.

PennEast Construction Plan

According to the final draft of PennEast's Resource Report 01 (2014), the typical pipeline construction process consists of the following steps:

1. Survey/demarcate the route and approved workspace.

2. Centerline survey of existing or proposed pipelines.
3. Clearing – remove vegetation from construction work area (CWA); installation of erosion and sediment controls.
4. Additional protection of adjacent pipeline, as necessary; grading to establish safe workspace; completion of installation of erosion and sediment controls.
5. Trenching – pipeline trench excavation to design depths.
6. Stringing – placement of pipe joints along the trench line.
7. Bending – bending pipe joints, as needed, for route and terrain.
8. Weld pipe.
9. Pipe integrity – visual inspection, non-destructive examination (NDE) of welds.
10. Weld coating – corrosion protection and waterproofing.
11. Pipe placement – pipe placed in trench, tied to previously laid sections, backfilled.
12. Hydrostatic testing – confirmation of pipeline segments.
13. In-line tool inspection of new pipeline segments.
14. Tie-in to existing pipeline, purge, pack new section with gas.
15. Grade restore of CWA to previous contours.
16. Final clean-up, restoration, and seeding.

Potential Risks of the PennEast Pipeline

Due to the enormous volume of natural gas moving through the pipeline at high pressure, there is a significant chance that the pipeline will leak. The probability of a leak or rupture also depends on the chemical composition of the gas traveling through the pipeline and how corrosive it is. Unfortunately, when pipelines fail there can be disastrous consequences (see Figure 14 and Figure 15).

PHMSA Pipeline Incidents: (1994-2013)
Incident Type: All Reported **System Type:** GAS TRANSMISSION **State:** (All Column Values) **Offshore Flag :** ONSHORE

Calendar Year	Number	Fatalities	Injuries	Property Damage As Reported
1994	52	0	15	41,386,306
1995	41	0	7	6,818,250
1996	62	1	5	10,947,086
1997	58	1	5	10,056,885
1998	72	1	11	34,165,324
1999	41	2	8	14,726,834
2000	65	15	16	15,206,371
2001	67	2	5	12,095,165
2002	57	1	4	15,879,093
2003	81	1	8	45,456,172
2004	83	0	2	10,697,343
2005	106	0	5	190,703,949
2006	108	3	3	31,383,314
2007	87	2	7	43,579,858
2008	93	0	5	111,977,088
2009	92	0	11	43,988,350
2010	84	10	61	399,994,584
2011	106	0	1	83,617,537
2012	88	0	7	39,397,079
2013	95	0	2	37,787,078
Grand Total	**1,538**	**39**	**188**	**1,199,863,666**

Figure 14. PHMSA onshore gas transmission pipelines all reported incidents from 1994 to 2013 (PHMSA, 2014).

PHMSA Pipeline Incidents: Multi-Year Averages (1994-2013)
Incident Type: All Reported **System Type:** GAS TRANSMISSION **State:** (All Column Values) **Offshore Flag :** ONSHORE

	Incident Count
3 Year Average - (2011-2013)	96
5 Year Average - (2009-2013)	93
10 Year Average - (2004-2013)	94

	Fatalities
3 Year Average	0
5 Year Average	2
10 Year Average	2

	Injuries
3 Year Average	3
5 Year Average	16
10 Year Average	10

	Property Damage
3 Year Average	$53,600,565
5 Year Average	$120,956,926
10 Year Average	$99,312,618

	2014 Year-To-Date
Incidents	89
Fatalities	1
Injuries	1

Figure 15. PHMSA onshore gas transmission pipelines all reported incidents multi-year averages 1994-2013 (PHMSA, 2014).

As shown in Figure 14 and Figure 15, pipeline incidents tend to be result in few fatalities and injuries, but the amount of property damage is significant. It is also important to consider the diameter of the pipeline when assessing its risk of failure. Wang and Duncan (2014) found that larger diameter pipelines pose a significantly greater risk of failure than smaller ones because the average fatality and injury rates for larger diameter pipelines are much greater than those for smaller diameter pipelines. The PennEast pipeline is planned to have a diameter of 36 inches, which is relatively large, so its risk of failure is much greater.

According to the final draft of PennEast's Resource Report 01 (2014):

“Potential cumulative impacts may include increased sediment into nearby wetlands and waterbodies, increased traffic due to lane or road closures, impacts of businesses, noise impacts from heavy machinery and construction, decreased air quality, removal of natural trees and vegetation, spread of invasive species, impacts to wildlife and fisheries, and impact to visual resources.”

The impacted sites in Northampton County, PA are the Lehigh River Eastern Gateway Redevelopment and the Easton Waterfront Development. Based on the initial field surveys, a total of 33 wetland complexes and 60 waterbodies have been identified that may potentially be affected. These resources consist of only freshwater-influenced systems.

In general, natural gas pipelines negatively impact the environment by causing natural habitat loss and fragmentation, changes in species movement, sedimentation, and air emissions (Johnson, Gagnolet, Ralls, & Stevens, 2011). The pipeline right-of-way corridor can fragment large patches of forest into smaller ones, reducing forest interior spaces. The open space of the corridor inhibits the movement of some species, like forest interior nesting birds, tend to avoid open spaces where they are more exposed to predators (Bennett, 2003). While right-of-way corridors may inhibit the movement of some species, they can also facilitate that of others, both native and invasive (Transportation Research Board, 2004). While the exact repercussions of this effect on species movement are unclear, it is certainly an unintended consequence of pipeline construction.

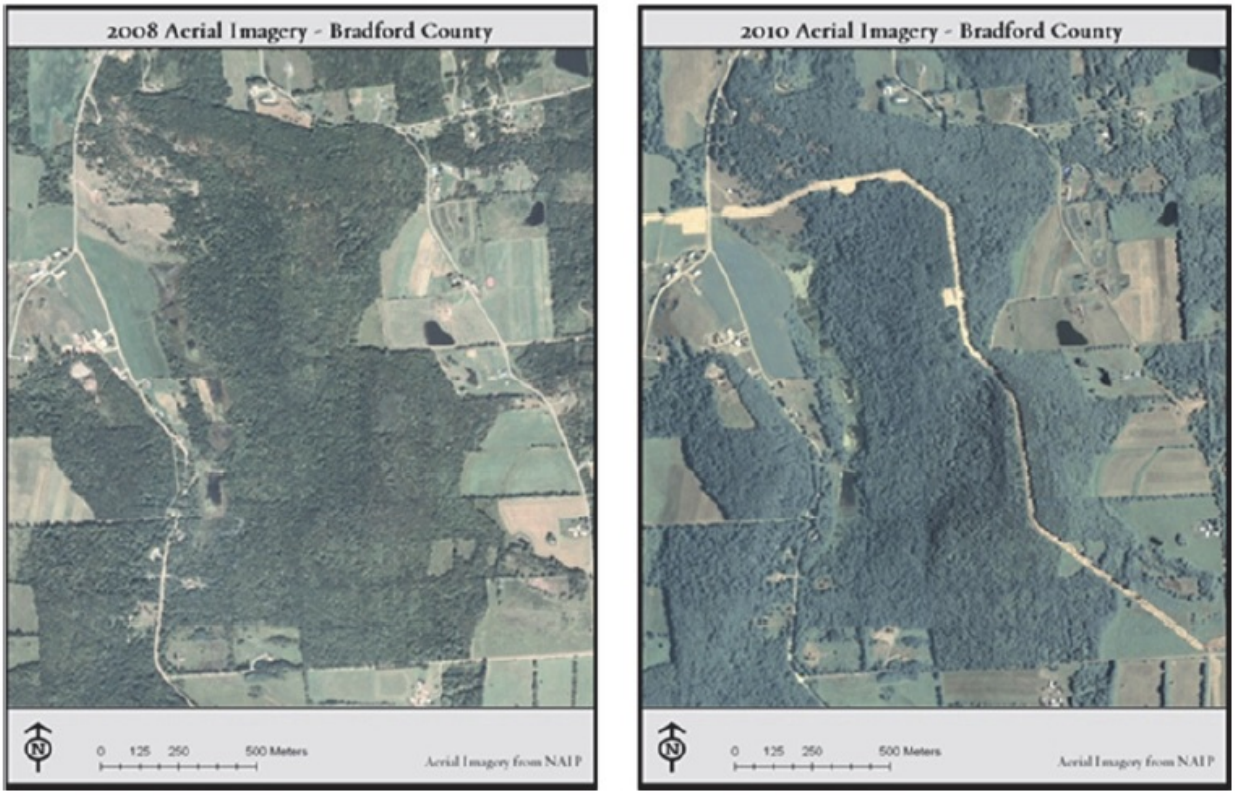

Figure 16. A right-of-way cleared for a gathering natural gas pipeline in Bradford County, PA. (Aerial imagery from USDA National Agriculture Imagery Program)

As shown in Figure 16, a swath is cut through forests and wetlands during pipeline construction. When constructing a pipeline, a large amount of soil is disturbed, increasing the risk of problems with erosion and sedimentation. This can lead to a number of negative consequences including safety concerns and surface water contamination. It can also be exacerbated by other factors, such as steep terrain, nearby bodies of surface water, and heavy rain events (Johnson et al., 2011). For example, the heavy rains during two tropical storms in August and September 2011 caused the erosion and sediment controls on pipelines under construction in north central Pennsylvania to fail (Tanfani & McCoy, 2011). According to Tanfani and McCoy (2011), this resulted in dangerous mudslides that contaminated a nearby stream.

Pipelines and compressor stations emit several pollutants into the air including methane, ethane, benzene, tolulene, xylene, carbon monoxide, ozone and more, but short-term monitoring in north central Pennsylvania detected only some of these pollutants and they were at low enough levels that they would not trigger public health concerns (DEP, 2011). However, some of these pollutants were detected near pipelines and compressor stations in the Barnett Shale region of Texas at high levels that sometimes exceeded human health standards (Armedariz, 2009). While the safety risk of air emissions from pipelines and compressor stations may not be clear, these pollutants can still have an impact on the environment at low levels.

Website

Figure 17. Pipeline politics website screenshot.

In order to educate those affected by the pipeline or interested in it, we have constructed a website to provide an easily accessible and understandable source of information on the subject. This website is a Lafayette site with an administrator account shared with the Nurture Nature Center. It will be managed by volunteers associated with the Nurture Nature Center who will ensure that it is properly maintained and updated as new developments arise with the PennEast pipeline. These updates will be crucial because the project is only in its preliminary stages and new information will be released frequently. There should be at least one update each month when PennEast submits a monthly progress report to FERC online. The homepage of the website consists of a concise introduction, conveying the purpose of the website and an overview of the PennEast pipeline project. Along the top of the webpage is a list of clearly visible tabs connecting to other pages of the website. Each tab focuses on a different dimension of the issue

including the historical context with social and policy elements and information on the pipeline itself with a technical and economic analysis. Each tab provides a comprehensive explanation of a wide range of topics relevant to its context or analysis. Each tab heading page includes a brief summary of the related content and a drop-down menu linking to its subsections. This allows readers to quickly and easily locate specific topics. Additionally, the context and analysis pages contain links to fact sheets with empirical data presented through infographics. Each fact sheet is one page long and focus on a specific topic. However, there is not a fact sheet for every topic and tab because some topics cannot be explained through empirical data.

Chapter 5: Economic analysis

Introduction to historical pipeline construction cost analysis

Most of the following research is from "Historical Pipeline Construction Cost Analysis" by Zhenhua Rui, Paul A. Metz, Doug B. Reynolds, Gang Chen, and Xiyu Zhou of the University of Alaska Fairbanks.

Pipelining is an important and economical method to transport large quantities of oil and natural gas in the petroleum industry. The first pipeline in the USA, two-inch in diameter and over 8 km long, was built in 1865. By 2008, US had a total of 793,285 km of pipelines, among which 224, 260 km was for petroleum product and 548,685 was for natural gas (Rui, 2011)."

To understand pipeline construction costs, pipeline data — such as pipeline diameters, lengths, capacity, year of completion, and location — are analyzed. The PennEast Pipeline's dimensions are expected to be as follows:

- Diameter of 36 inches, which is 3 feet
- Length of 108 miles, which is 570,240 feet [1]
- Capacity of 4,030,789 cubic feet [2]
- Completed in year 2017
- Located in the Northeast [3]

To further understand pipeline construction costs, the following cost components cost components are analyzed:

- Material costs: the cost of line pipe, pipeline coating, and cathodic protection
- Labor: the cost of pipeline construction labor
- Miscellaneous: a composite cost of surveying, engineering, supervision, contingencies, telecommunications equipment, freight, taxes, allowances for funds used during construction, administration and overhead, and regulatory fees
- Right of Way (ROW): the cost of ROW and allowances for damages
- Total: the sum of material, labor, miscellaneous, and ROW costs

Distribution and share data

In this section, PennEast Pipeline distribution, share and cost data has been compared to those of 412 pipelines recorded between 1992 and 2008 in the *Oil and Gas* [4].

Diameter

Diameters of the 412 pipelines recorded between 1992 and 2008 range from 4 inches to 48 inches and value of diameters is even. From low values to high, data shows that values of pipeline diameter are left-skewed. For example, there are only 24 (5.8% of the total) pipelines with diameters between 4 inches and 10 inches, while 218 (52.9% of the total) pipelines with diameter between 30-inch and 48-inch, like the 36-inch PennEast Pipeline. Data being left-

skewed indicates that more larger-diameter pipelines have been constructed than smaller-diameter pipelines in the last two-decades. At 36 inches, PennEast Pipeline would be a larger-diameter pipeline, which is more common.

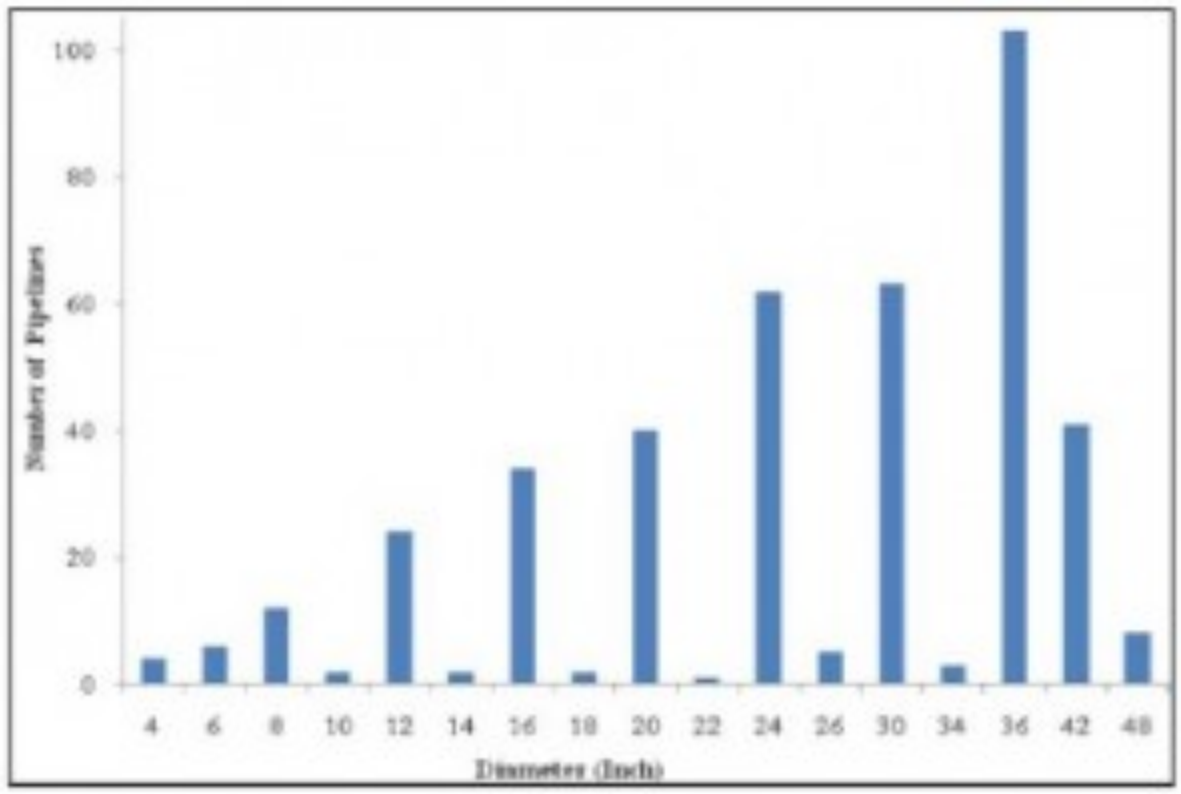

Figure 18. Histogram of pipelines in diameters (Rui, 2011).

Length

Lengths of the 412 pipelines recorded between 1992 and 2008 range from 0.01 miles to 713 miles. The distribution is right-skewed. From low to high, data shows that values of pipeline lengths are right-skewed. For example, there are 258 (62.6% of the total) pipelines in the 0 to 10 mile group, and 65 pipelines in the 10 to 20 mile group, but on 30 (7.3% of the total) of pipelines are longer than 60 miles, like the 108-mile PennEast Pipeline. Data being right-skewed indicates that the majority of reported pipelines are shorter pipelines. At 108 miles, PennEast Pipeline would be longer, which is less common.

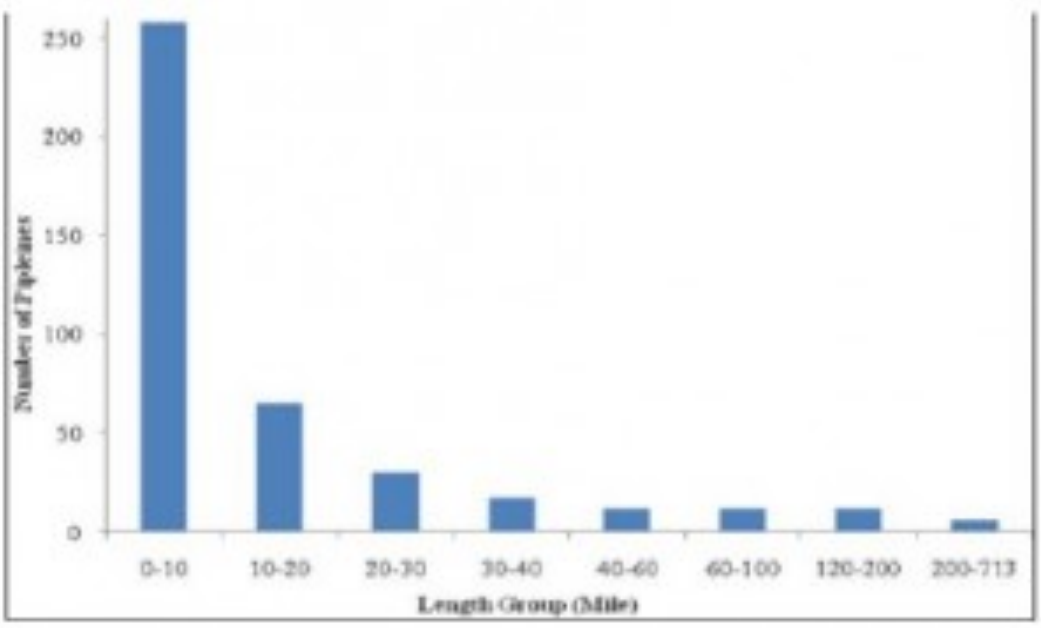

Figure 19. Histogram of pipelines grouped in lengths (Rui, 2011).

Capacity

Capacities of the 412 pipelines recorded between 1992 and 2008 range from 13,270 cubic feet to 5,215,691,727 cubic feet. Capacities range from 13,270 cubic feet to 5,215,691,727 cubic feet, and the average pipeline capacity is 86,511,969 cubic feet with standard deviation of 15,840,088 cubic feet. The distribution of pipeline capacity is right-skewed. For example, there are 59.29% of pipelines' capacities less than 30,000,000 cubic feet, and only 3.64 of pipelines' capacities larger than 400,000,000 cubic feet. At 4,030,789 cubic feet, PennEast pipeline would be smaller, which is more common.

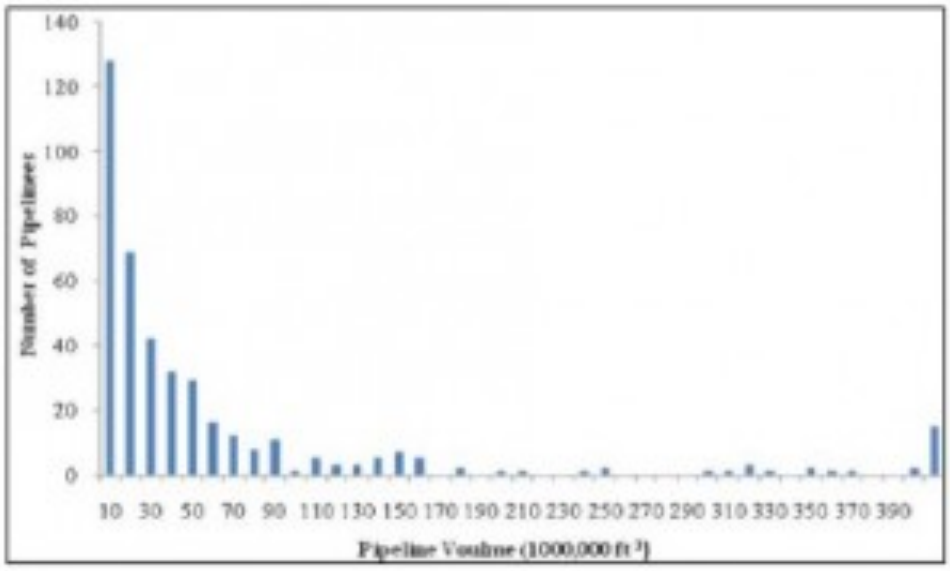

Figure 20. Histogram of pipeline capacity (Rui, 2011).

Location

There are 157 pipelines located in the Northeast region, which is 40% of US pipelines for the region with the greatest number of pipelines. In the Northeast, Pennsylvania is the state with the most pipelines at 72.5, which is 17.60% of US pipelines and 46.18% of Northeast pipelines. The fewest number of pipelines was located in the Southwest region, which had 30 pipelines, 7.5% of US pipelines. The number of pipelines in other regions is between 48. As stated earlier, PennEast Pipeline is located in the Northeast region, in the state of Pennsylvania, which is the most common location for a pipeline.

Figure 21. US natural gas pipeline region map (Rui, 2011).

Unit cost data [5]

Generally, labor and material cost dominate the pipeline cost. Labor cost has the highest share of 40% of total cost. Material has the second highest share of 31% of total cost.

Material

For all 412 pipelines, material cost on average is second highest. The average unit cost in material was $18 per cubic feet, 31% of total average unit cost. This cost tended to change more gradually and was more stable compared to other components.

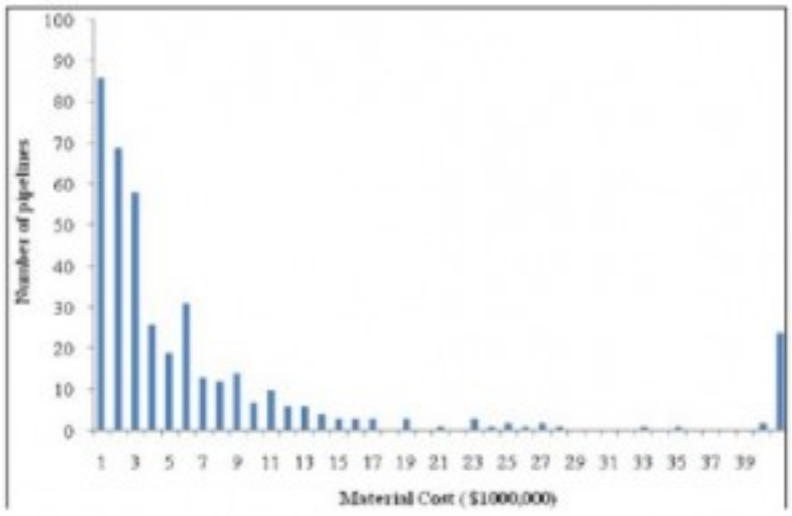

Figure 22. Histogram of material cost (Rui, 2011).

PennEast Pipeline would be located in the Northeast region. With a diameter of 36 inches, a length of 108 miles, and a location in the NorthEast, the diameter of PennEast Pipeline is in the range of 34 to 48 inches, and the length is in the range of 60 to 160 miles. For pipelines located in the Northeast, material costs tend to be 24% of total. In addition, for pipelines in the mentioned ranges of diameter and length,material costs tend to be 34% and 31%, respectively. Therefore, in terms of its location, diameter, and length, the material cost of PennEast Pipeline would be between 24% and 34% of its total construction cost.

Regarding material cost trends, values of length and diameter that are higher tend to be associated with higher material cost percentages. To reiterate, PennEast Pipeline would be a larger in terms of diameter and length, meaning material cost percentages would be higher. On the other hand, the Northeast region is associated with the lowest material unit cost percentage, and PennEast Pipeline would be located in the Northeast.

Labor

For all 412 pipelines, labor cost on average is highest. The average unit cost in labor was $24 per cubic feet, 40% of total average unit cost. This cost tended to fluctuate widely with miscellaneous cost.

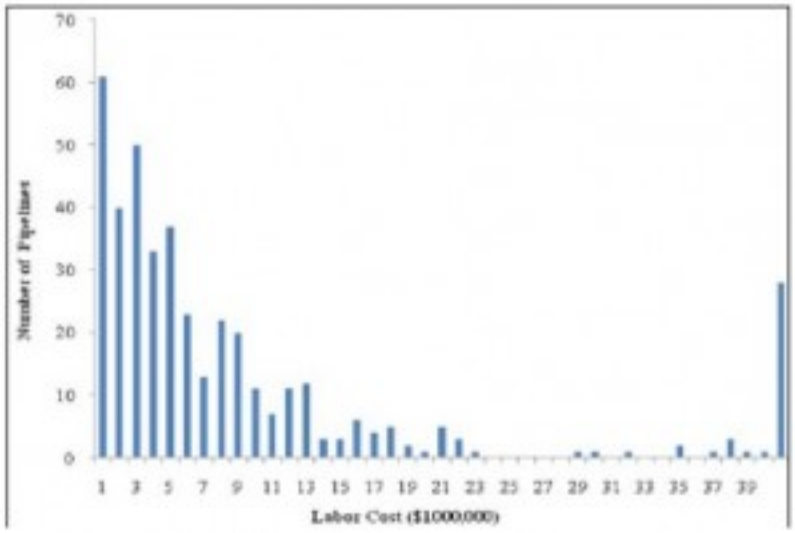

Figure 23. Histogram of labor cost (Rui, 2011).

Given the 3 groups in terms of diameter, length, and location, associated with the PennEast Pipeline, associated labor cost percentages are 40%, 39%, and 43%. This means labor costs for PennEast Pipeline would range from 39% to 43% of total pipeline construction cost. As the length of pipelines increase in construction, labor cost percentages tend to decrease. The Northeast, where the PennEast Pipeline would be constructed, is associated with the highest labor cost.

Miscellaneous

For all 412 pipelines, miscellaneous cost is second lowest. The average unit cost in miscellaneous was $14 per cubic feet, 23% of total average unit cost. This cost tended to fluctuate widely with labor cost.

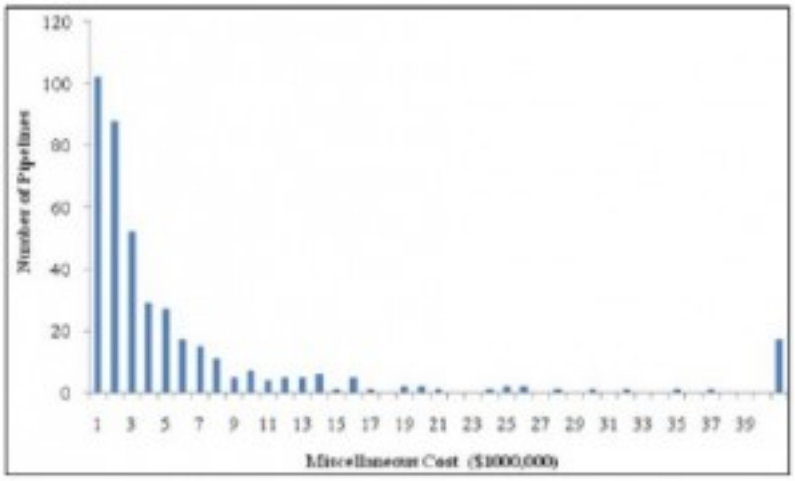

Figure 24. Histogram of miscellaneous cost (Rui, 2011).

Given the 3 groups in terms of diameter, length, and location, associated with the PennEast Pipeline, associated miscellaneous cost percentages are 20%, 23%, and 27%. This means the labor cost of the PennEast Pipeline would be between 20% and 27% of total pipeline construction cost. As the diameter or length of pipelines increase in construction, miscellaneous cost percentages tend to decrease. The Northeast, where the PennEast Pipeline would be constructed, is associated with the second highest labor cost.

ROW

For all 412 pipelines, ROW cost is lowest. The average unit cost in ROW was $5 per cubic feet, 7% of total average unit cost. This cost tended to change more gradually and were more stable compared to other components.

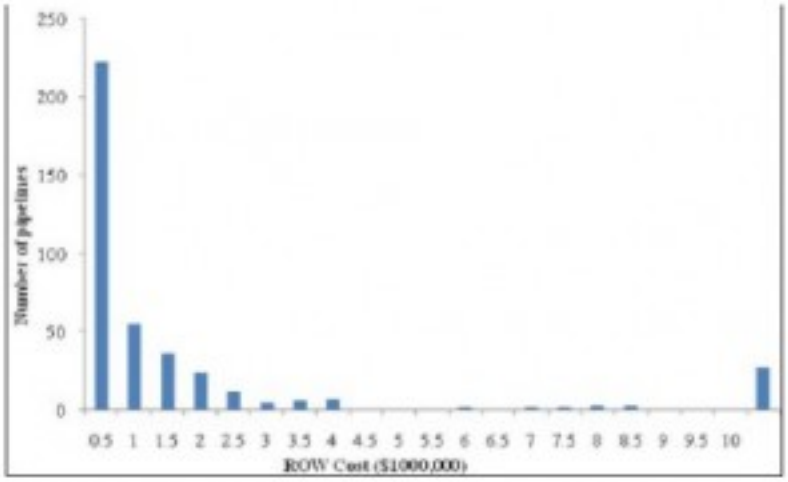

Figure 25. Histogram of ROW cost (Rui, 2011).

Given the 3 groups associated with the PennEast Pipeline in terms of diameter, length, and region, ROW cost percentages for are 6%, 7%, and 6%. Labor cost percentages tended to decrease by diameter, and the Northeast had a relatively typical ROW cost.

Average unit cost trends over time

Before 1998

All cost components changed slowly before 1998, similar to the change in constructed pipeline volume.

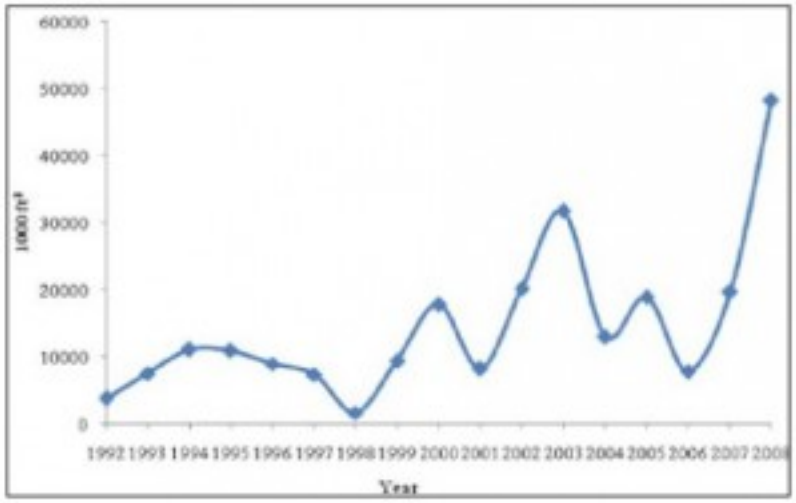

Figure 26. Annual constructed pipeline volumes (Rui, 2011).

After 1998

After 1998, the change was dramatic. The years of 1999, 2002, and 2007 were the three-major peak years in unit total cost. The highest unit total cost was reached $109 per cubic foot in 1999, which was almost three-times as high as the bottom point of $39 per cubic foot in 1998

These three-peak years in unit total cost occurred all one year before the peak years in constructed volume. This evidence indicates that expectation of increased pipeline construction induced an increase in the current unit cost.

Material suppliers would raise prices with expectation for more demand the next year. The higher expected demand in *labor* would cause labor shortage, and the competitive salary and benefits had to be paid in order to hire or keep more skilled laborers. Miscellaneous cost also increased due to more demand

All these factors together resulted in high cost one year before the peak year in constructed pipeline volume.

Estimating PennEast Pipeline cost components

Using unit cost of components and pipeline length

As previously stated, unit costs in material, labor, miscellaneous, and ROW are on $18, $24, $14, and $5 per cubic foot. Using the length of the PennEast Pipeline, the following cost components can be calculated in 2008 dollars:

- Material cost of $10,264,320
- Labor cost of $13,685,760
- Miscellaneous cost of $7,983,360
- ROW cost of $2,851,640
- Total cost of $34,784,640

Using cost percentage of components and estimated total pipeline cost

As previous stated, average percentages in material, labor, miscellaneous, and ROW are 31%, 41%, 23%, and 7%. Using the $1-billion estimated total cost of the PennEast Pipeline, the following cost components can be calculated:

- Material cost of $295,081,967.21
- Labor cost of $393,442,622.95
- Miscellaneous cost of $229,508,196.72
- ROW cost of $81,967,213.11
- Total cost of $1,000,000,000.00

Using component cost equations and plots from another study

Using "Natural Gas Transmission Pipe Costs to Estimate Hydrogen Pipeline Costs" by Nathan Park of the University of California at Davis Institute of Transportation Studies, construction costs of natural gas, oil, and petroleum product transmission pipelines were analyzed. It provided equations and plots to estimate PennEast Pipeline cost components according to its length and diameter.

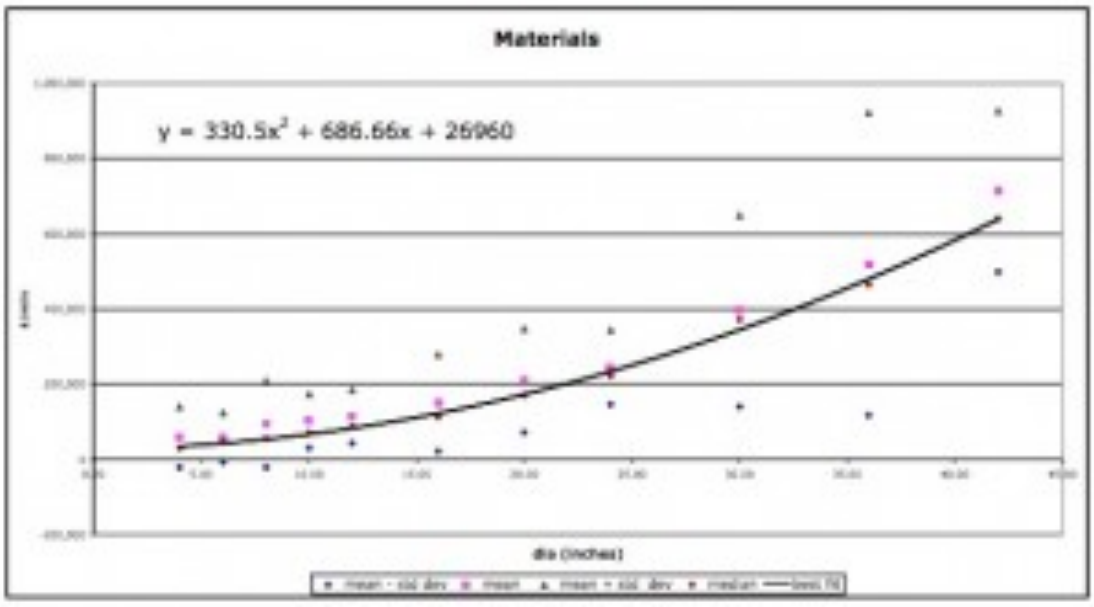

Figure 27. Quadratic equation and plot of materials (Park, 2004).

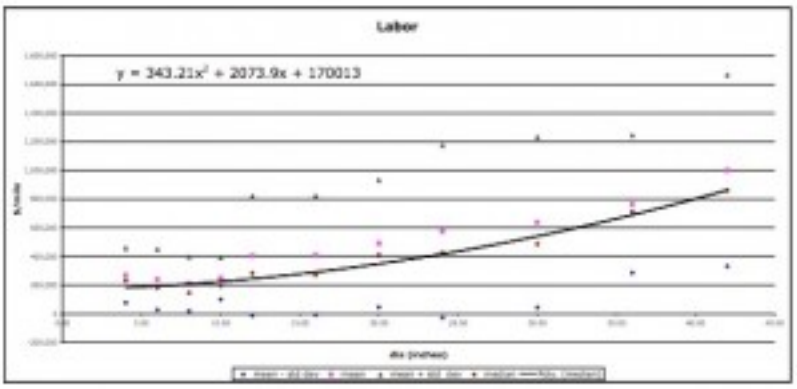

Figure 28. Quadratic equation and plot of labor (Park, 2004).

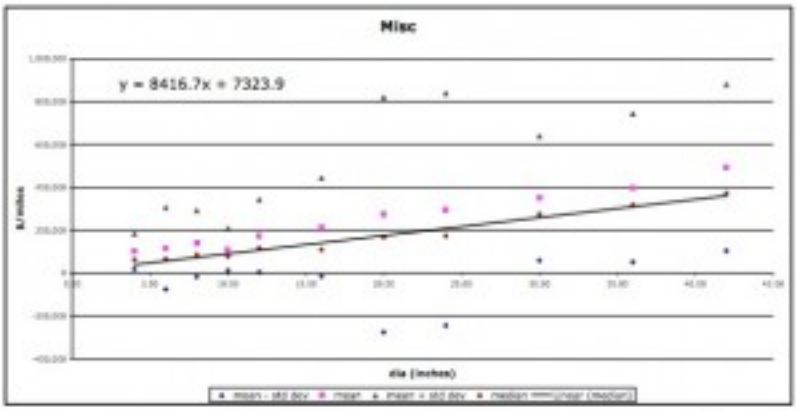

Figure 29. Quadratic equation and plot of materials (Park, 2004).

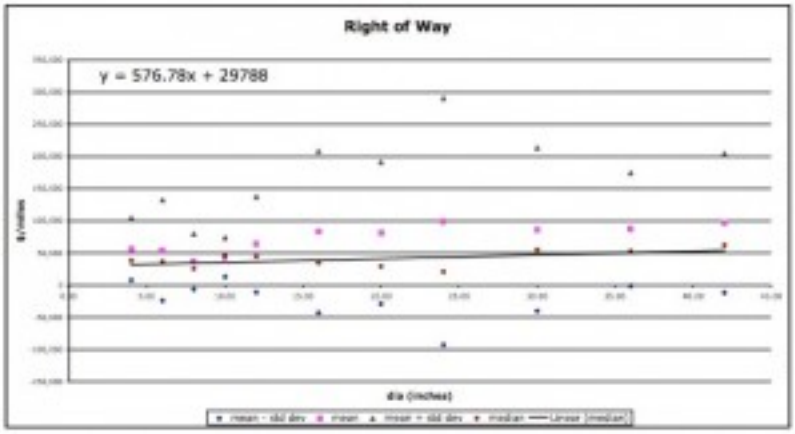

Figure 30. Quadratic equation and plot of Right of Way (Park, 2004).

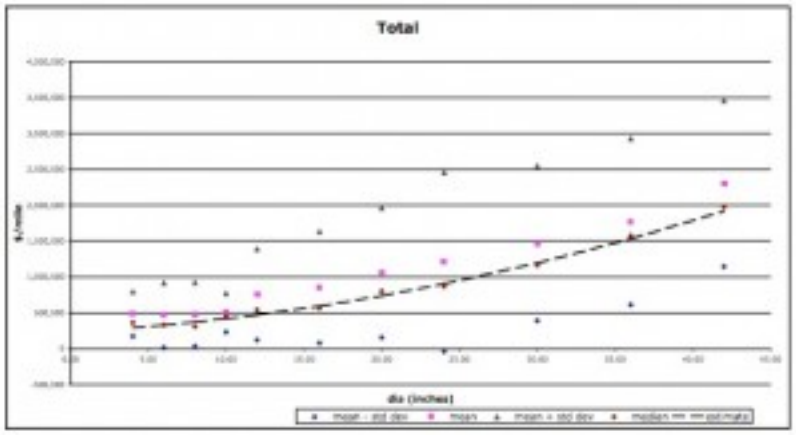

Figure 31. Quadratic equation and plot of total (Park, 2004).

According to equations:

- Material cost of $51,877,160
- Labor cost of $74,619,140
- Miscellaneous cost of $33,611,288
- ROW cost of $83,987,847
- Summed total cost of $244,095,435
- Total cost of $165,724,164

According to plots:

- Material cost of $41,000,000
- Labor cost of $50,000,000
- Miscellaneous cost of $20,000,000
- ROW cost of $5,000,000
- Summed total cost of $116,000,000
- Total cost of $165,000,000

The Takeaway in Estimating PennEast Pipeline cost components

Four methods were used to estimate the construction cost of PennEast Pipeline according to cost components like material, labor, miscellaneous, and ROW, as well as total cost. The cost components varied widely. What is more, summed amounts of estimates for a study tended not to equal estimated total amounts.

The takeaway is this: cost estimation is complex. Many factors need to be taken into consideration, more than pipeline diameter, length, capacity, location, and time. Using only these factors might be the reason why cost estimates varied so widely. Hence, the research on this page supposes that cost estimations should be taken as what they are: estimates. Time shall tell the actual cost of pipeline construction if the pipeline is constructed as planned.

Gas Prices

The General Project Description of a PennEast Resource Report indicates the following public problem:

The lack of a new pipeline with access to sources in Pennsylvania will continue to create dramatic seasonal price fluctuations in Pennsylvania and New Jersey with higher gas and electric rates and an increased potential for energy shortages during peak demand, resulting in threats to business continuity, public safety, and national security."

To understand this problem better, please view the chart below, which is provided by PennEast:

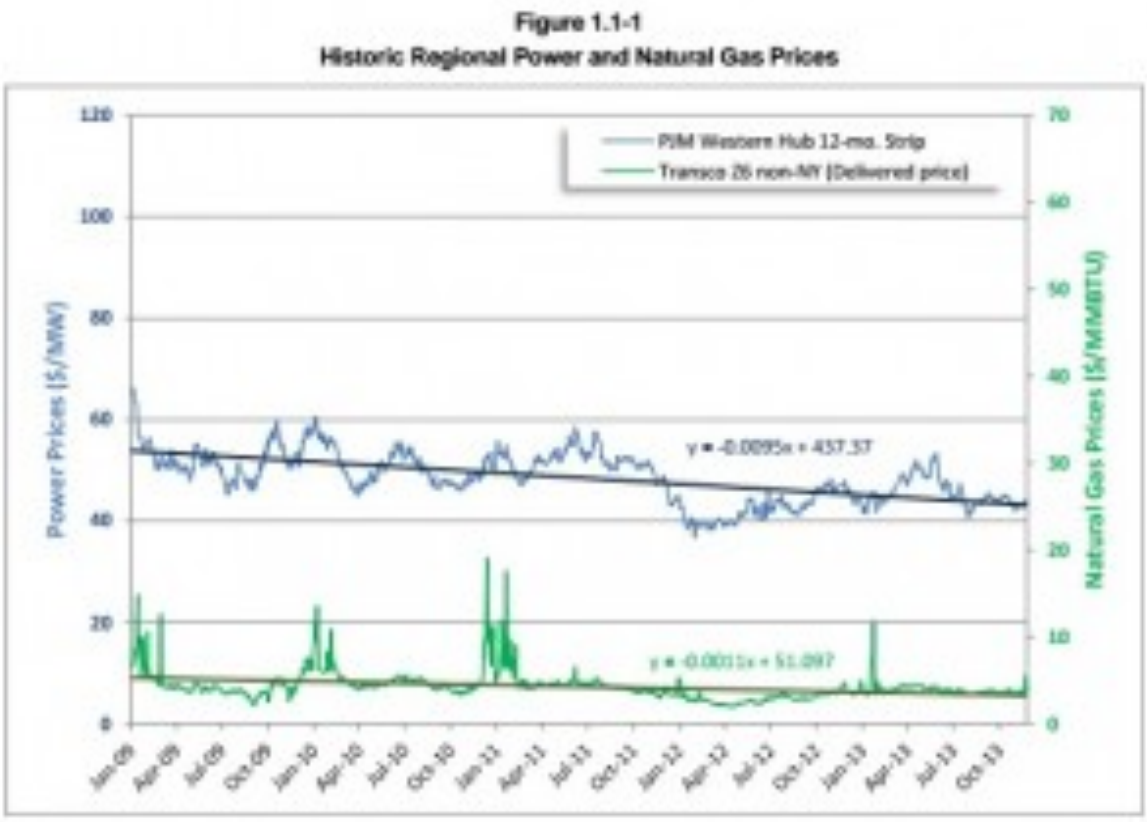

Figure 32. Historical regional power and natural gas prices (PennEast, 2014).

The blue is PJM Western Hub prices, which we believe represents aggregate energy prices. The green line is TRANSCO National Gas Line prices, which we believe is supposed to be likened to potential gas prices that would result following PennEast Pipeline Construction. That is, because the green line is below the blue line, natural gas prices would fall. Estimates provided by PennEast state constructing the Pipeline would decrease natural gas prices from $100 per dekatherm to $3 or $4 per dekatherm.

Both lines show decreasing slopes, meaning the prices of energy and natural gas, respectively, will decrease over time. The blue line tends to peak cyclically in summertime and winter, which would make sense because of increased demand for heating and cooling. The green line tends to

peak during the winter, which would make sense because of increased demand for heating. These peaks would be what PennEast referred to in their literature.

According to a announcement from PennEast,natural gas prices in New Jersey traded as high as $100 per dekatherm this past winter. Natural gas in the area that PennEast will access traded in the range of $3 to $4 per dekatherm. The proposed pipeline will help reduce this price volatility to the benefit of New Jersey's nearly 3 million gas consumers. Still, PennEast reports:

The Project will provide additional opportunities to buy and sell supplies and to transport natural gas to where it is needed and valued most."

Citizens who support the pipeline might be interest in lowered gas rates. In addition, Pipeline Construction is expected to produce 2000 temporary jobs during the construction process, which is expected to last between 7 months and one year. Moreover, Pipeline Construction might produce externalities like industrial and economic development in the region.

According to our research, the problem stated by PennEast, which is closely tied to economic growth, must also consider environmental health and societal acceptability to rise to prominence and be compatible with environmental systems and social goals.

Next

Next is the Conclusion.

Footnotes

[1] Pipeline length was converted from miles to feet such that 1 mile is 5280 feet

[2] Pipeline Capacity was calculated using the equations V = S*L and S = pi*(D/2)^2 where:

- V is pipeline capacity or volume in cubic feet
- S is pipeline cross-sectional area square feet
- L is pipeline length in feet
- Pi is approximated to be 3.1415926535
- D is pipeline diameter in feet

[3] Energy Information Administration (EIA) breaks down the USA natural gas pipelines network into six regions: Northeast, Southeast, Midwest, Southwest, Central, and Western. Northeast consists of states from as far south as Virginia to as far north as Maine.

[4] Cost data collected was adjusted to 2008 dollars with the chemical engineering plant cost index (CEPCI) – a widely used index for adjust process plants' construction cost to 2008 dollars. Pipe index and construction labor index of CEPCI are used to adjust pipeline material and labor costs. CE index is applied to pipeline miscellaneous and ROW costs.

[5] The unit component costs of pipeline are an important parameter for estimating pipeline costs. Unit cost is calculated by dividing cost by volume.

[6] Considered diameter ranges include 4-20 inches, 22-30 inches, and 34-48 inches; length ranges include 0-60 miles, 60-160 miles, 160-713 miles; regions include all six, which excludes Alaska and Hawaii.

Chapter 6: Conclusion

Summary

The purpose of this project was to create a website to help local citizens understand the implications of the recently proposed PennEast natural gas pipeline in Northampton County. The Marcellus Shale has the ability to provide an abundant supply of natural gas to not only the United States but also the rest of the world. Due to this PennEast Pipeline Company has proposed a transmission pipeline, starting from the Marcellus Shale, to bring this commodity to the market. However, the PennEast pipeline proposal is not the first of its kind. The Atlantic Sunrise pipeline was proposed by the Williams Partners and is about a year ahead of the PennEast pipeline in permitting and planning, but the Federal Energy Regulatory Commission (FERC) has yet to approve the plan. The Keystone XL pipeline is a transnational pipeline that has caused major national debates and has set precedents with the national government in terms of votes on pipelines. In its own way, PennEast intends to inform communities about the pipeline. They even submitted a Public Participation Plan in their FERC pre-filing document, showing that they intend to reach out to stakeholders.

Environmental policy is the main obstruction to pipeline construction and a tool that landowners often use in negotiations with pipeline companies. Much of the environmental policy in the United States today stems from the movement that began in the 1960s that led to the Clean Air Act in 1963 and the Clean Water Act in 1972. This legislation still affects pipelines today. One of the most important policy elements related to pipelines is the FERC approval process which is currently ongoing. It requires PennEast to submit a detailed plan of the permitting and construction processes along with a set of Environmental Resource Reports. FERC has also created a document that explains the pipeline construction process and outlines the responsibilities of affected landowners. There are a number of policies relevant to pipelines and they are important to understand because they can have a substantial effect on the approval process.

PennEast plans to construct a 36-inch diameter pipeline stretching across 108.8 miles from Luzerne County, PA to Mercer County, NJ. They also plan to construct a lateral pipeline in Northampton County terminating in Hellertown. PennEast has reported that they will clear a 100-ft right of way (ROW) corridor during construction, 50 feet of which will remain as a permanent easement around the pipeline. This ROW may have serious environmental impacts including erosion and sedimentation that could affect nearby surface water quality as well as forest fragmentation that could harm wildlife. Additionally, pipelines and compressor stations release harmful pollutants into the air including methane, which is a greenhouse gas. However, it is unclear whether these pollutants are released at levels dangerous to human health or not. Pipeline incidents, such as leaks and ruptures, have resulted in significant property damage as well as some injuries and even deaths. Pipelines and their construction have many potentially adverse impacts on the environment and human health, but they are built to provide economic benefits.

The PennEast pipeline may generate a numerous jobs for its operation and maintenance as well as the temporary influx of jobs and money to the surrounding areas during construction. It is also

anticipated to lower the price of natural gas significantly. It will likely be a very costly project for PennEast. We performed several analyses of the cost of construction and found that the total cost of the project could be around $35 million, $166 million, or, as stated by PennEast, $1 billion. These analyses account for the cost of materials, labor, surveying, engineering, supervision, contingencies, telecommunications equipment, freight, taxes, allowances for funds used during construction, administration and overhead, regulatory fees, ROW, and allowances for damages. Clearly, PennEast will be investing a large amount of money in this pipeline and it may provide substantial economic benefits.

Next Steps

The main issue for the future of our project is the maintenance of the website. In order for the website to continue to be a useful educational tool, it must be updated frequently. This is because the PennEast pipeline issue is still in its early stages and is experiencing rapid developments. To ensure that the website remains up to date, each semester a student intern should maintain it as a semester-long project. This student intern should work under the guidance and supervision of Engineering Studies professors and the Nurture Nature Center. The administrator account for this website should be shared between Lafayette College and the Nurture Nature Center to make this possible.

Future areas of consideration for the updates include the social, policy, technical, and economic developments of the PennEast Pipeline issue. The intern must add information on new advocacy groups and events, changes in relevant policies that may affect the pipeline, policy actions related to the pipeline, and FERC approval or rejection of the proposal. News of advocacy events and policy actions should be added to the website's news feed, while new policies or changes to current policy would necessitate the adjustment of the Policy Analysis section of the website. Updates should also include new research on the potential environmental risks of the PennEast pipeline or natural gas pipelines in general, new developments in pipeline technology or construction techniques that PennEast plans to use, and new economic details for the estimate of costs and benefits. In the future, more information will be available on the environmental and economic effects of the pipeline so the Technical and Economic Analysis sections of the website may need to be updated. The website should also be altered accordingly if there are any important changes in the United States economy or natural gas market. The maintenance of this website will be a large project that should continue for years unless PennEast becomes unable to construct the pipeline.

There are some possible limitations of student intern administrators. Due to the intern changing each semester, there may be problems with the consistency of the website. While the supervision of the Engineering Studies professors should help reduce this problem, future student interns will have to be very careful about any changes they make. Updates should conform to the style of the rest of the website and may be best included as new fact sheets or small additions to a specific section depending on the situation. As some information on the website becomes obsolete, it may need to be replaced or removed. This is a challenging issue because it involves the deletion of others' work. Student interns must understand that much of the website's content will likely need to be revised as new information is available, including their own contributions. To ensure that all work on this website survives, any changes should be recorded on an archives page. This page

will not only preserve the work of all prior contributors, but will also provide a timeline depicting how the website and pipeline issue developed over time.

Final Statement

Energy consumption and production is a global public problem for modern day society. The PennEast Company proposal breaks down that global public problem into a local problem, specifically for residents of Northampton County. The website we have created will serve as an informative and educational tool that will help residents of Northampton County. The website provides information ranging to historical context to technical details of the proposal. Members of advocacy groups, or any interested individuals, may choose to visit the website to learn more and tell others about it. Both Lafayette College and the Nurture Nature Center can help to increase public awareness of the website by spreading the news. While updates and awareness pose significant challenges, if they are overcome the website will help the public understand the issue of the PennEast pipeline, stay informed as it progresses, and develop their own opinions.

Bibliography

Capstone Bibliography

Armendariz, A. (2009). Emissions from natural gas production in the Barnett shale area and opportunities for cost-effective improvements. Retrieved from: http://energy.wilkes.edu/PDFFiles/Issues/Air%20Pollution%20barnett%20shale.pdf.

Bennett, A. F. (2003). Linkages in the landscape: The role of corridors and connectivity in wildlife conservation. Retrieved from: https://portals.iucn.org/library/efiles/documents/FR-021.pdf.

Carlyle, Ryan. "The top five facts everyone should know about oil exploration." *TCE: The Chemical Engineer.* 1 May. 2013: 30-33.

Barnhart, Shaunna. "Marcellus Shale" *Salem Press Encyclopedia*. Jan. 2013. Research Starters.

Elefant, C. (2010). *Knowing and Protecting Your Rights When a Interstate Natural Gas Pipeline Comes to Your Community*. Washington D.C.: Law Offices of Carolyn Elefant.

Johnson, N., Gagnolet, T., Ralls, R., & Stevens, J. (2011). Natural gas pipelines: Excerpt from report 2 of the Pennsylvania energy impacts assessment. Retrieved from: http://www.nature.org/ourinitiatives/regions/northamerica/unitedstates/pennsylvania/ng-pipelines.pdf.

Kraft, M., & Furlong, S. (2012). *Public Policy: Politics, Analysis, and Alternatives, 4th Edition*. CQ Press.

Parker, N. (2004). *Using natural gas transmission pipeline costs to estimate hydrogen pipeline costs*. Davis, Calif.: Institute of Transportation Studies, University of California, Davis.

PHMSA (2014). Pipeline incident 20 year trends. Retrieved from: http://www.phmsa.dot.gov/pipeline/library/datastatistics/pipelineincidenttrends.

Rui, Z., Metz, P.A., Reynolds, D., Chen, G. and Zhou, X. (2011) 'Historical pipeline construction cost analysis', Int. J. Oil, Gas and Coal Technology, Vol. 4, No. 3, pp.244–263.

(2013). The transportation of natural gas. Retrieved from: http://naturalgas.org/naturalgas/transport/.

Pritchard, Joshua. "Fracking Overview." *Salem Press Encyclopedia*. Oct. 2013. Research Starters.

United States Energy Information Administration. *Natural Gas Consumption in the United States.* EIA, 2014. Web.

United States Energy Information Administration. *Today in Energy.* EIA, 2014. Web.

United States Energy Information Administration. *Pennsylvania.* EIA, 2014. Web.

Institute for Energy Research. *Pennsylvania: An Energy and Economic Analysis.* IER, 2014. Web.

Parker, Ashley. "Senate Defeats Bill on Keystone XL Pipeline in Narrow Vote." *New York Times.* 18 Nov. 2014. Web.

Henry, Terrence. "Keystone XL Will Impact Climate Change, But Isn't a Make or Break for Senate." *State Impact NPR.* 31 Jan. 2014. Web.

Cusick, Marie. "Attorneys advise landowners to get involved in pipeline plan" *State Impact NPR.* 17 Oct. 2014. Web.

PennEast Pipeline Company. "Bringing low-cost local natural gas to Pennsylvania and New Jersey families and businesses." 2014. Web.

U.S Department of Transportation. Pipeline Hazardous Materials Safety Administration. DOT. 2014. Web.

Atlantic Sunrise Expansion Project. "Project Vision." 2014. Web.