PENNSYLVANIA'S ENDURING IMPACTS OF MINING

Joshua L. Adams – jla481@psu.edu

Department of Earth and Mineral Science, the Pennsylvania State University (PSU)

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Advisor: Dr. James O'Brian

INTRODUCTION

- Live in the DC Metropolitan Area
- 22 Years Military and Government Service
- National Geospatial-Intelligence Agency (NGA) – Economic Security Analyst and GEOINT standards engineer
- 2018 – 2022 Penn State GIS Master Studies Program
    - Penn State GIS Post-Bach

BACKGROUND

Since the 1800s, Pennsylvania has provided its local population and the U.S. with vast amounts of energy. Pennsylvania has been a home to hundreds of coal mines, Natural gas and oil.

These mines have provided the state with a great amount of wealth, been a source of income for many families, to include a bearer of ill health, water contamination, emissions and more.

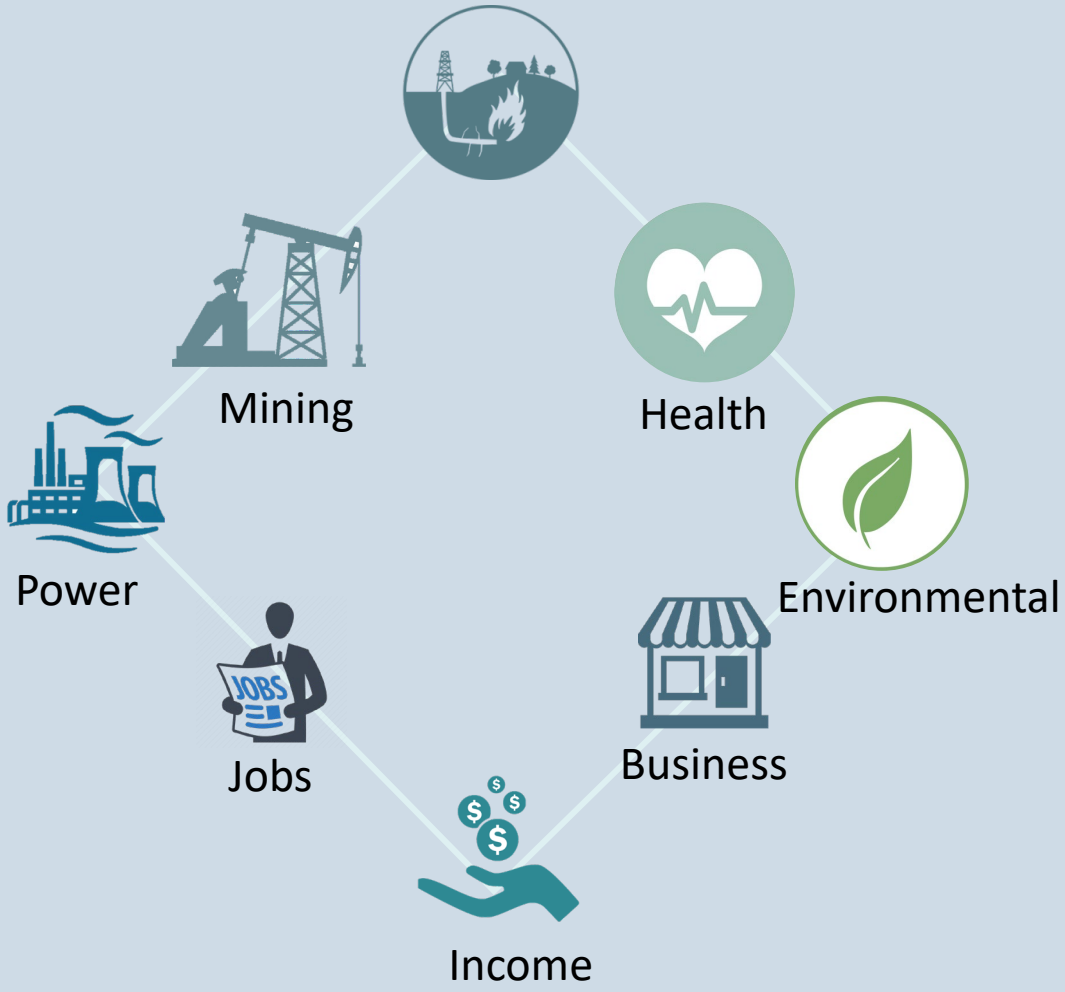
While there is no doubt that mining for energy has economic benefits, we can not continue to solely focus on today. The world, to include Pennsylvania needs to make greater investments towards our future if we wish to comfortably inhabit the only home we have.

This analysis will use data provided by Pennsylvania Department of Environmental Protection (DEP), US Census data and data provided by energy exploration companies. The analysis will create a series of quantitative datasets to enable scientists, academia and decisions makers make informed decisions. Refraining from any bias or political ideology. Enabling a reliable source for decisions makers with various perspectives.

AGENDA

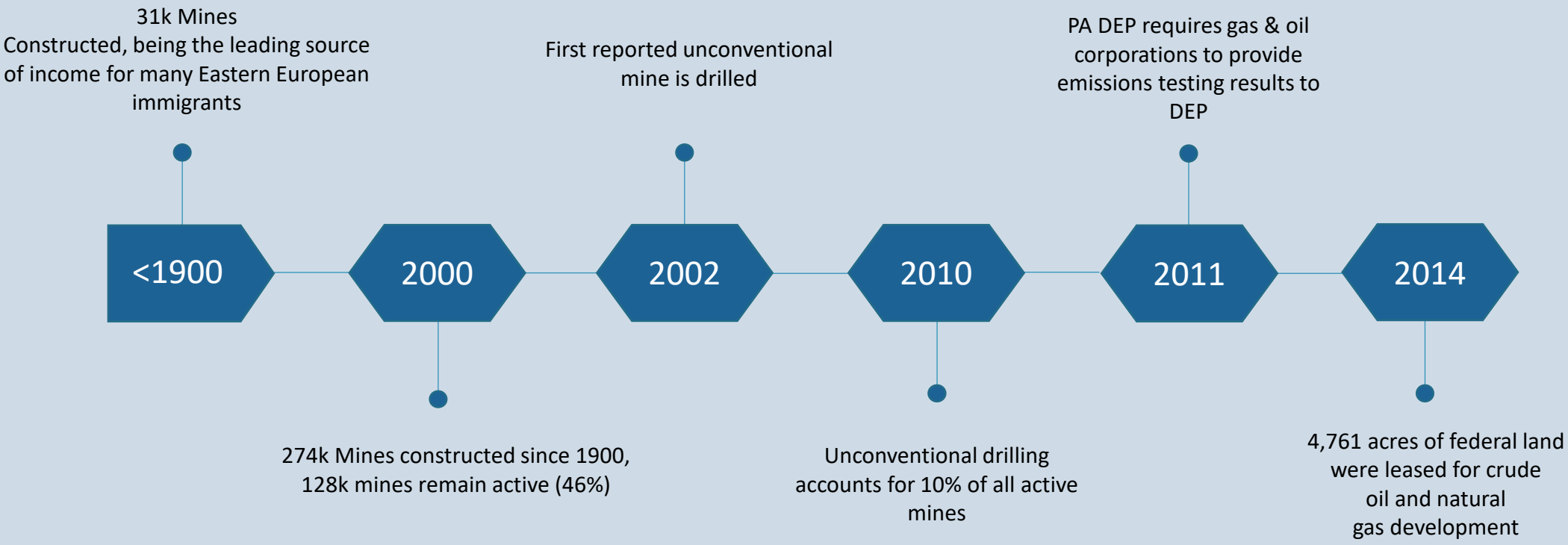
- Background
- Research Objective
- Events
- Public Arguments
- Area of Study
- Key Intelligence Questions
- Research Questions
- Foundation Data
- Quantitative Data
- Sample Studies
- Precautions – Using Critical Thinking
- Research Workflow
- Research Roadmap
- Academic and Municipal Sources

OBJECTIVES



A quantitative study of Pennsylvania's mining and energy practices, creating a series of datasets to enable scientists, academia and politicians to make informed decisions.

EVENTS


31k Mines Constructed, being the leading source of income for many Eastern European immigrants
<1900
274k Mines constructed since 1900, 128k mines remain active (46%)
2000
First reported unconventional mine is drilled
2002
Unconventional drilling accounts for 10% of all active mines
2010
PA DEP requires gas & oil corporations to provide emissions testing results to DEP
2011
4,761 acres of federal land were leased for crude oil and natural gas development
2014

PUBLIC ARGUMENTS

Pro: Increasing reliance on natural gas, rather than coal, is indisputably increasing public health benefits, as the burning of natural gas produces fewer harmful particles in the air.

Con: Natural gas is not a purely clean and renewable source of energy, and so its benefits are only relative. It is not the answer to truly cleaning up our air, and in fact could give pause to a much-needed and well-thought-out transition to wind, solar, geothermal, and other sources that produce fewer or no harmful airborne fine particulates.

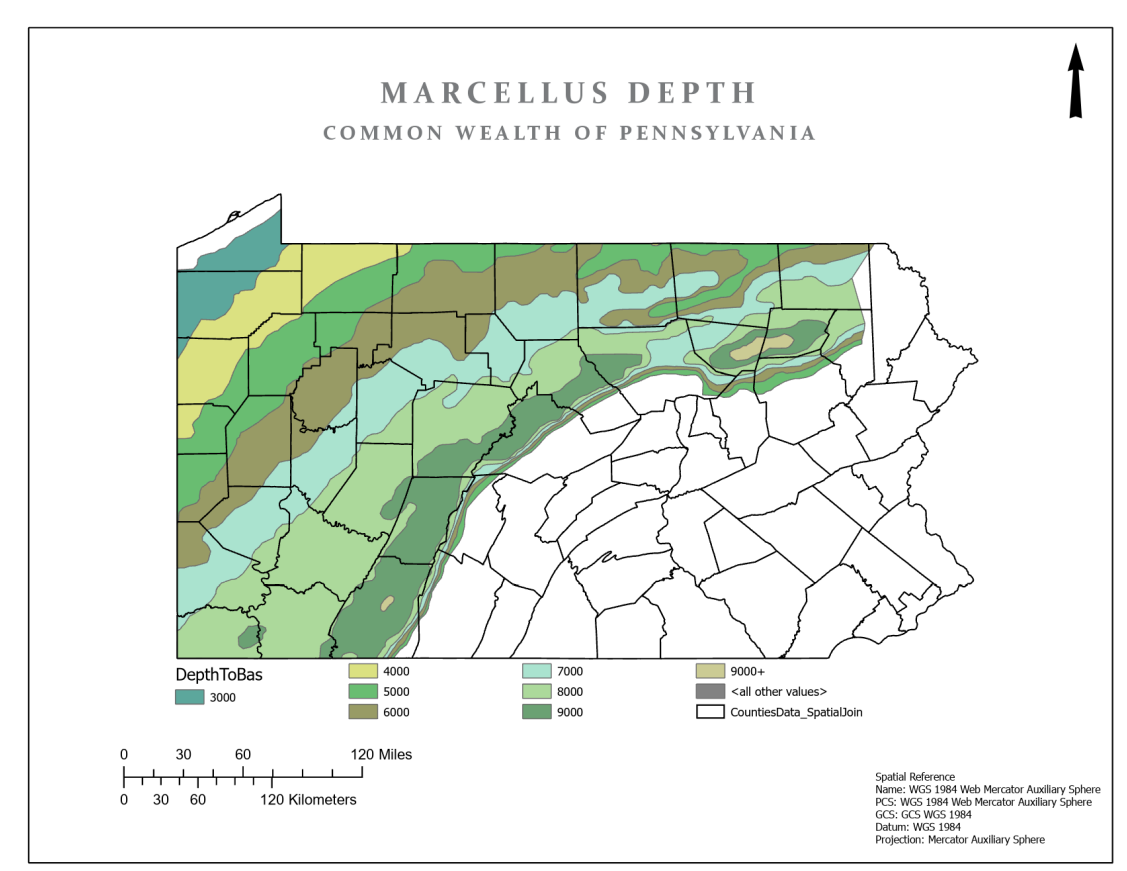
Pro: We know that, at the power plant level, natural gas produces only somewhere between 44 and 50 percent of the greenhouse gas emissions compared with burning of coal.

Con: Air quality dynamics around fracking operations are not fully understood, and cumulative health impacts of fracking for nearby residents and workers remain largely unknown.

Pro: Coal made up about 50 percent of U.S. electricity generation in 2008, 37 percent by 2012; meanwhile, natural gas went from about 20 percent to about 30 percent during that same period. Nitrogen oxide and sulfur dioxide emissions have been reduced dramatically.

Pro: Some research that claims methane is so harmful uses a 20-year time horizon; but over a 100-year time horizon – the way we generally measure global warming potential – methane is not nearly so harmful as claimed. Thus, methane's impact is potent but relatively brief compared with impacts of increased carbon dioxide emissions. The number-one priority must be to reduce the reliance on coal, the biggest threat to the atmosphere right now.

AREA OF STUDY



The Marcellus Shale has historically been, and continues to be, home to an abundant array of energy resources like oil, gas and coal.

KEY INTELLIGENCE QUESTIONS (KIQs)

1. Natural gas production nationwide was responsible for 47% of methane emissions by industry in 2018
2. The Pennsylvania Department of Environmental Protection has identified 8,500 unplugged abandoned oil and gas wells and estimates approximately 200,000 older undocumented wells, many of which may be leaking methane. Multiple studies suggest that methane leaks are undercutting natural gas's ability to dramatically contribute to emissions reduction as a "transition fuel."
3. Correlations between production rates and state income
4. Methane, mostly released into the atmosphere by livestock, landfills, and biomass burning, is also released during the production of coal and natural gas. Although the overall methane emissions from the coal and natural gas sectors have decreased over the past 20 years, they still account for over 30% of anthropogenic methane emissions in the United States. New methane restrictions could have impact on drilling in Pittsburgh area, requiring a 30% cut in methane emissions in the next nine years.
5. Illnesses associated with emissions
6. Consumption of available clean water, public land usage, county proximity

RESEARCH QUESTION

1	2	3	4	5	6
Average tonnage of CO2 and Methane put out per year since 2011 and percentage it contributes to overall emissions	Conventional and unconventional well violations	What percentage of the state's median-income is attributed to gas & oil	Rate of decline or incline in fossil fuel production	Well proximity to water sources	Mining water usage
Uncapped mines – coal seam fires and emissions		Rate of drill by year	Volume of coal generated plants vs natural gas	Correlation to well proximity and reported tributary contamination	Public land usage
			Unconventional wells produce larger quantities of gas? Reduce footprint of conventional wells?	Marcellus depths and thickness	Which counties are most impacted by wells

METHODOLOGY

Research Questions

- Average tonnage of CO2 and Methane put out per year since 2011 and percentage it contributes to overall emissions
- Uncapped mines – coal seam fires and emissions
- Rate of drill growth since 2000
- Volume of coal generated plants vs natural gas
- What percentage of the state's median-income is attributed to gas & oil
- Conventional and unconventional well violations
- Mining water usage
- Rate of decline or incline in fossil fuel production
- Unconventional wells produce larger quantities of gas? Reduce footprint of conventional wells?
- Marcellus depths and thickness
- Correlation to well proximity and reported tributary contamination
- Well proximity to water sources
- Which counties are most impacted by wells
- Public land usage

Data Acquisition

- Foundation Data
- Quantitative Data

Analysis

- Regression Analysis
- Inferential Analysis
- Descriptive Statistics

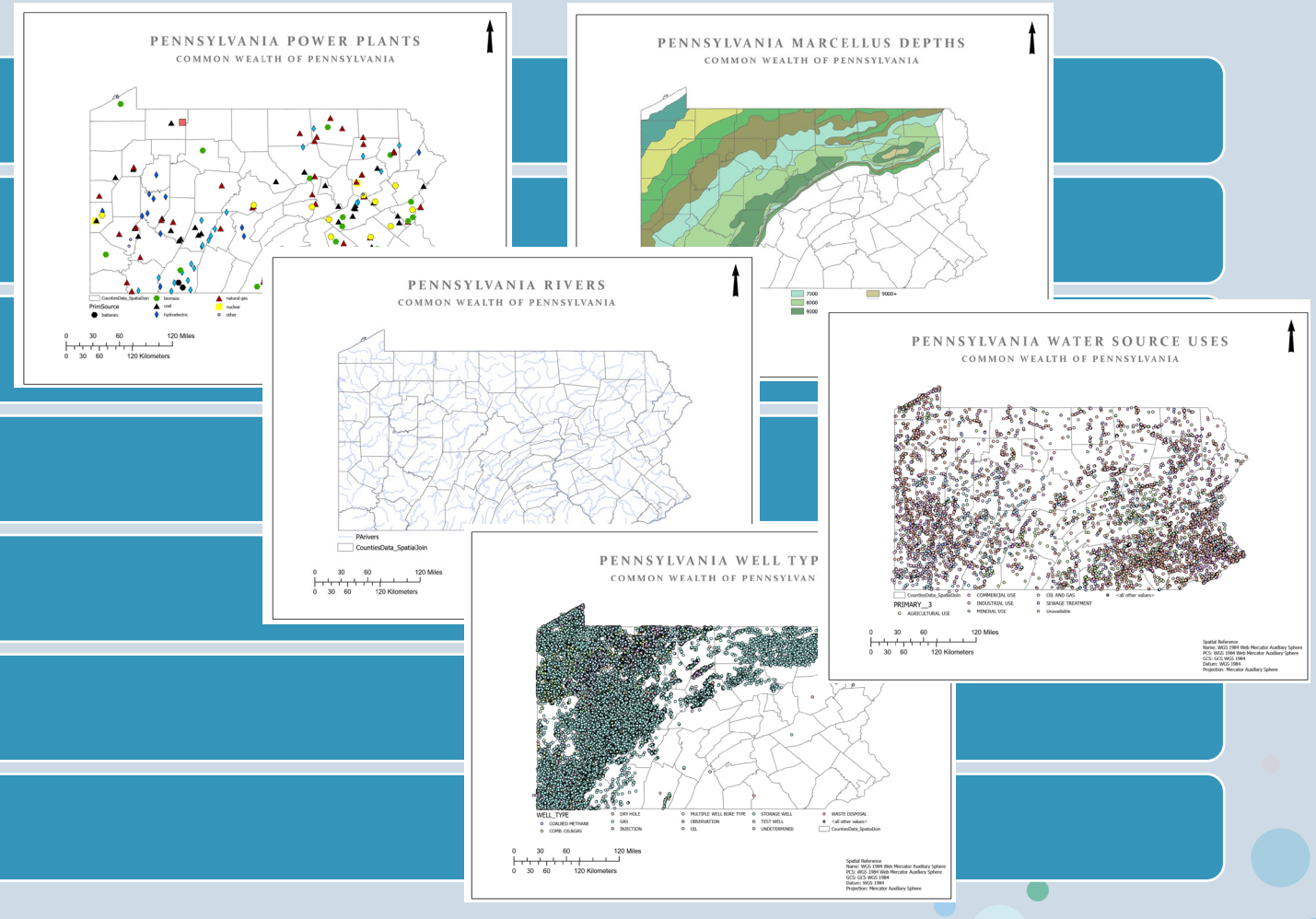
Report

Comprehensive analysis/ report, providing a non-bias study on the effects of Pennsylvania's mining of coal, gas and oil:

- Commerce
- Income
- Health
- Environmental

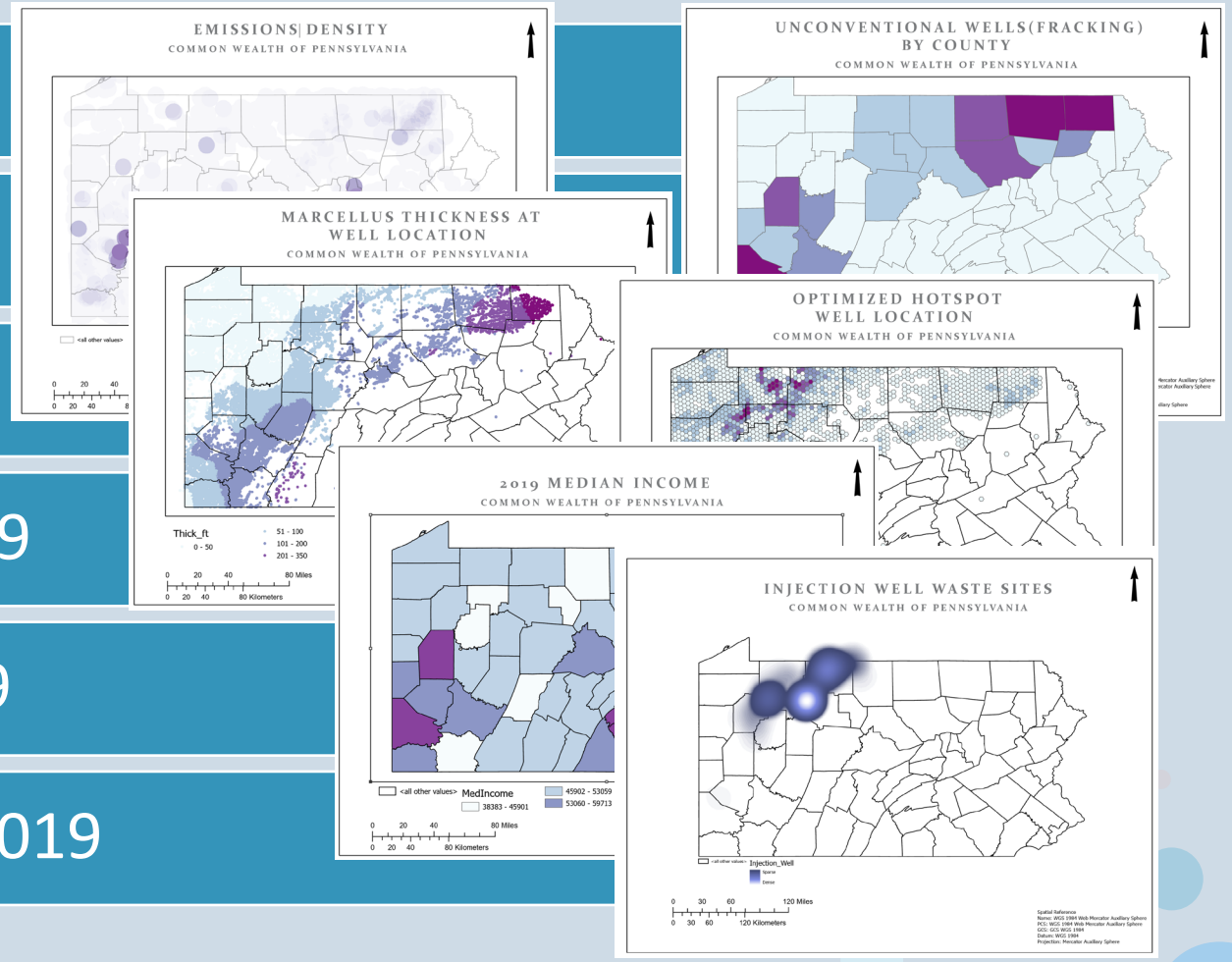
FOUNDATION DATA

- Pennsylvania Power Plants
- Pennsylvania Marcellus Shale
- Pennsylvania Counties
- Pennsylvania Mines
- Pennsylvania Tributaries
- Pennsylvania Watersheds
- Pennsylvania Public Lands

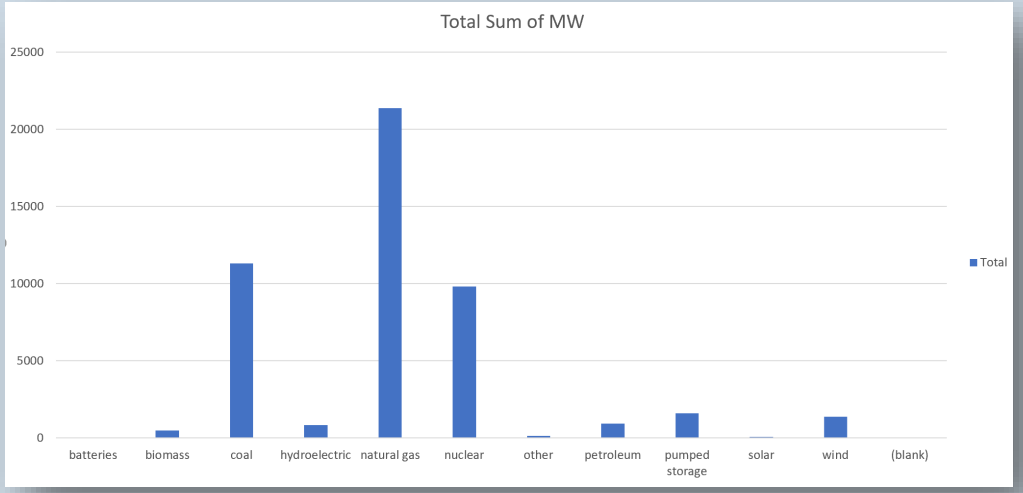


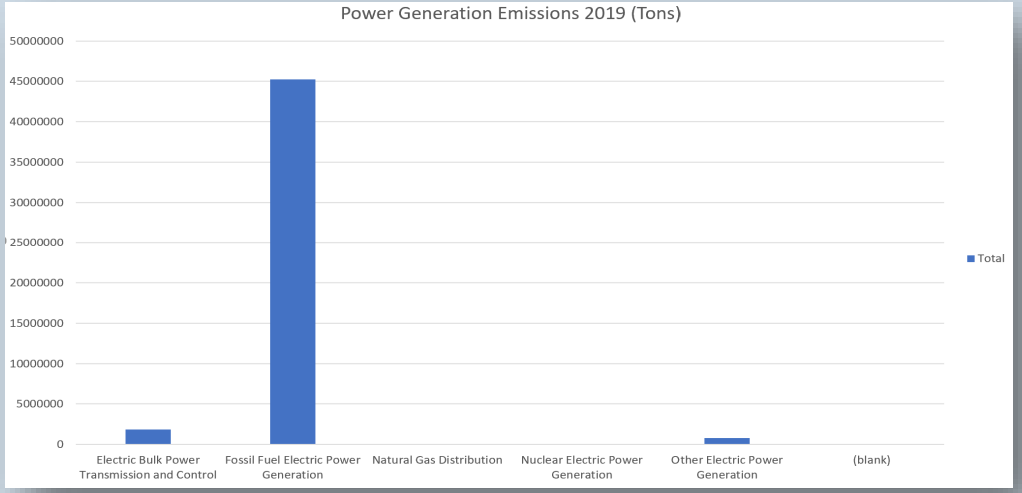
QUANTITATIVE DATA

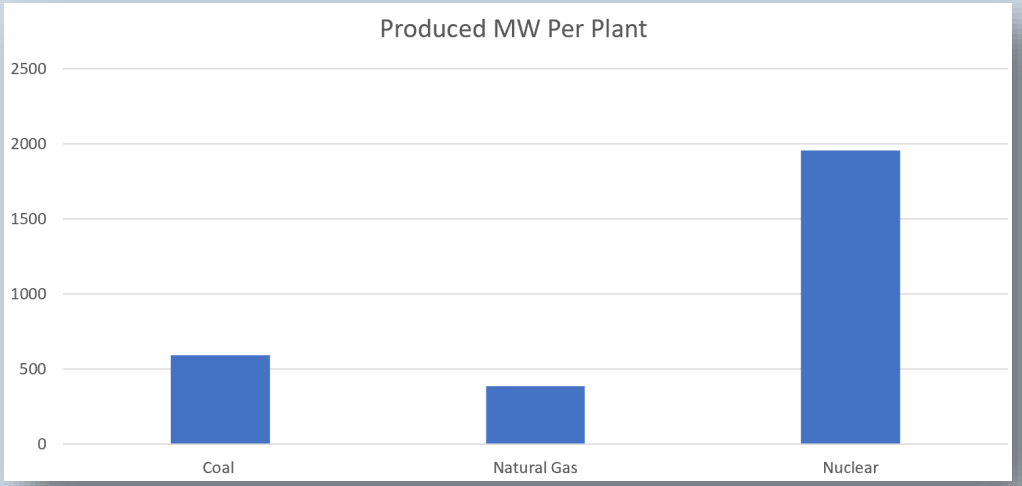
- Pennsylvania Census 2000-2019
- Pennsylvania land-leases 2000-2019
- Pennsylvania emissions 2011-2019
- Pennsylvania water quality 2000-2019
- Pennsylvania mine depths 2000-2019
- Pennsylvania median-income 2000-2019

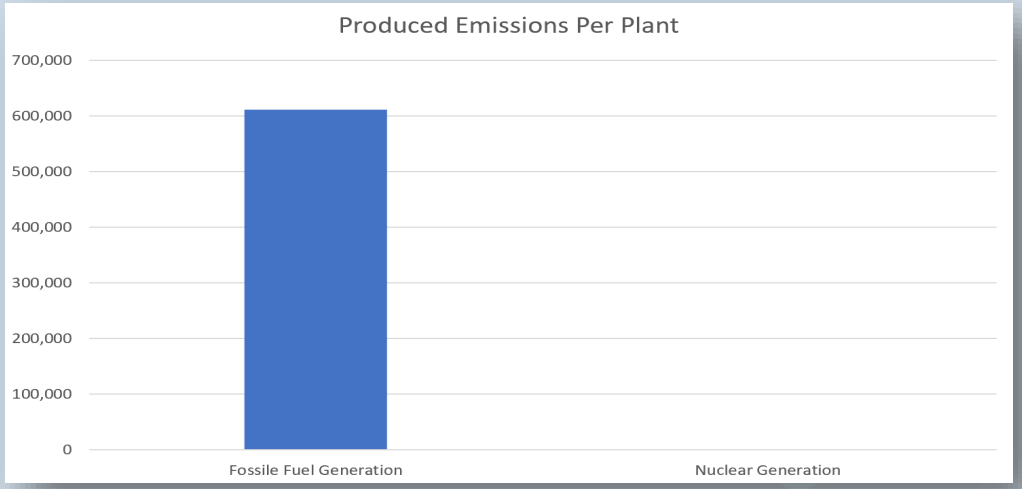


POWER PLANT ENGERY PRODUCTION



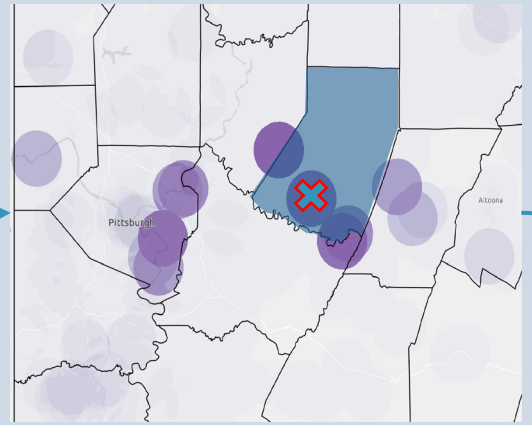


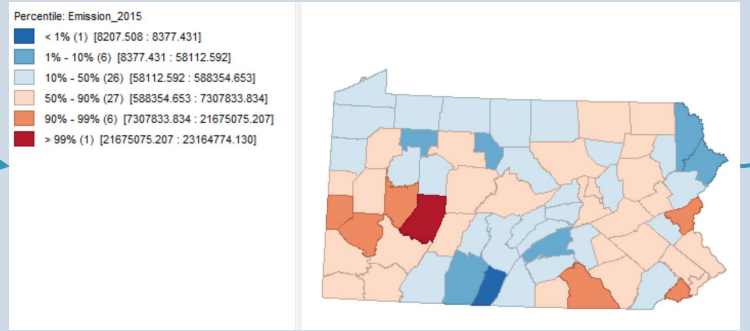




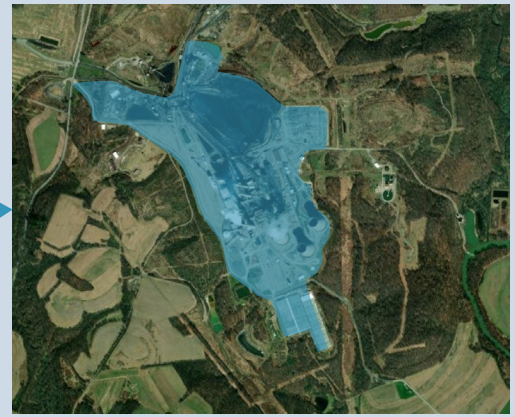
Critical Thinking – Contributions to Emissions

Emission_2000	Emission_2001	Emission_2002	Emission_2003
8685.982	7704.1698	7376.9627	8326.4838
1772.3268	1959.8303	1940.1733	2375.9597
22516.7234	8700.2634	8150.3713	7471.5885
2063.1319	1775.8426	3589.9614	2857.3815
1131.0079	1092.9654	968.0097	965.8953
4406.3219	3230.2134	3125.7114	3473.6757
30896.7955	31541.0916	28319.5573	25226.9157
260.9477	133.4449	200.9048	209.3239
6961.4587	8248.7311	7639.0788	6961.04
4005.7538	4833.6215	5579.7524	5151.0551
1286.8371	951.0351	848.2573	1058.1807



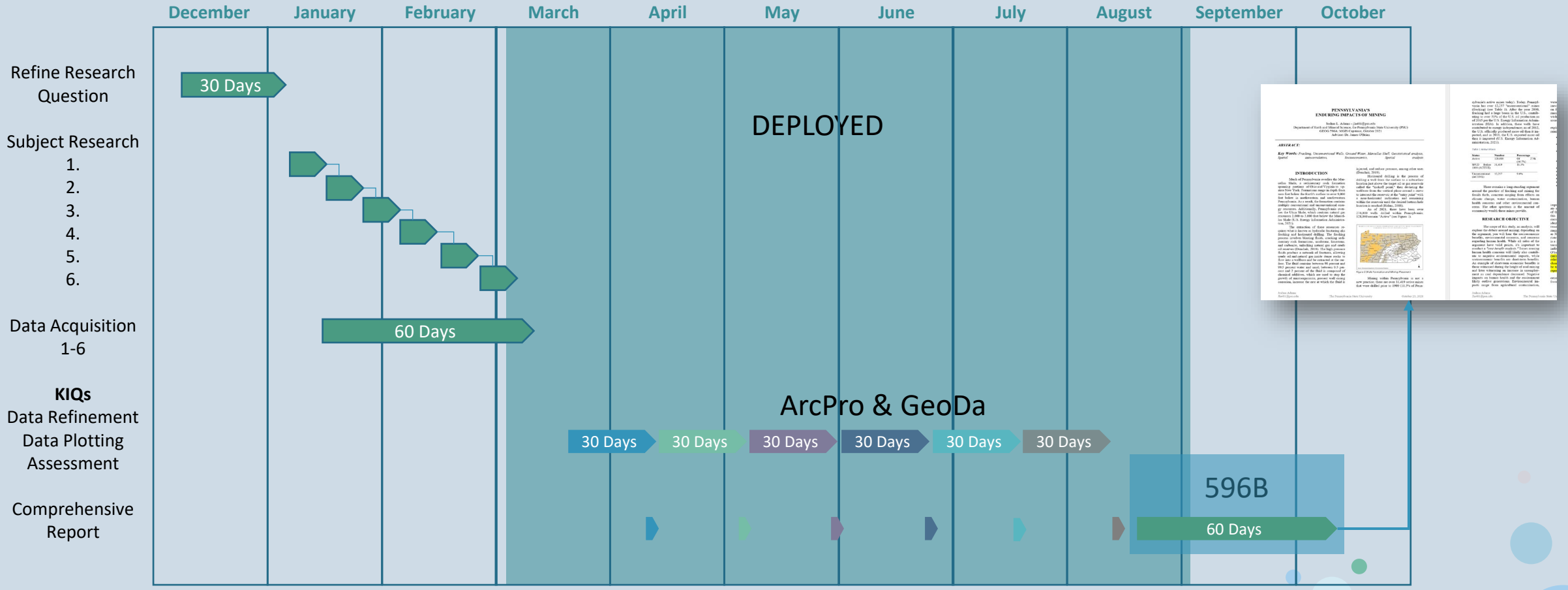


Keystone Power Plant



PROJECT ROADMAP

****Expected delay due to commitments made outside of academics: OCONUS from late February until the end of September.**



QUESTIONS?

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