haggerty\_ENERGY\_gdp\_script

**TITLE PAGE**

Good evening….

My name is Larry Haggerty, Data Analytics Student at Nashville Software School.

My presentation this evening is titled “ENERGY to GDP per CAPITA Comparison”

During this presentation….I would ask that if you have questions….Please hold them until the end and we will address them as time permits.

**AGENDA**

This is tonight’s agenda…..I will give everyone a second to look it over before moving on.

**INTRODUCTION**

There has been a consistent axiom since the beginning of the industrial revolution that ENERGY drives commerce.

The primary goal of this project was to compare ENERGY CONSUMPTION and PRODUCTION to GDP per CAPITA at the state and national level while understanding the nation’s shift away from FOSSIL FUELS and if / how this relates to the nation’s leading fiscal metric.

My motivation for this project stems from growing up as a child during the “ENERGY Crisis” of the 1970s. I have been impressed with the move away from FOSSIL FUELS and adoption of renewable ENERGY over the last few decades and looked forward to studying the topic for my Capstone.

**DESCRIPTION / DEFINITIONS**

My analysis included datasets from Bureau of Economic Analysis, US Census Bureau, ENERGY Information Agency, & International Energy Agency and data for the years 1970, 1980, 1990, 2000, 2010, & 2020.

And a few definitions before we get started…..   
  
 - GDP…..Total value for goods and services for a country / state within a specific period

* GDP per CAPITA: GDP / Population
* The values listed for FOSSIL FUELS includes Coal, Crude Oil, and Natural Gas combined.
* NUCLEAR ENERGY is only counted under CONSUMPTION…..
* The values listed for RENEWABLES combines the values for Biofuels, Geo Thermal, Hydro, Solar, Wind, Wood, & Biomass Waste

And with that out of the way we will transition to the…..

**INITIAL COMPARISON**

To start my observations I wanted to compare CONSUMPTION and PRODUCTION to GDP per CAPITA…..

Utilizing this SCATTER CHART I was able to view the relative values for GDP per CAPITA by year and noticed:

* Up to 5M (BN Btu) for CONSUMPTION and PRODUCTION covered most of the states

Considering 2020…..

* TX & CA were outliers for CONSUMPTION and WA, MA, & NY had significantly higher GDP per CAPITA than their peers.
* And for PRODUCTION I noted TX as my outlier

I also wanted to look at how CONSUMPTION compared among the MIX of ENERGY TYPES….

* From the review of FOSSIL FUEL to NUCLEAR it was clear that the greatest CONSUMPTION of NUCLEAR fell to IL, PA, & SC
* When reviewing FOSSIL FUEL to RENEWABLES I was surprised to find TX in the lead for RENEWABLE CONSUMPTION
* Additionally, I noted most states with less than 200K (BN Btu) across all years considered.

Taking this a step further I wanted to look compare the MIX of ENERGY to GDP per CAPITA….

* These charts remained generally consistent with the overall CONSUMPTION chart

Next, I wanted to look at GDP per CAPITA across the country…..

* Diving into the values I noticed the minimum GDP per CAPITA was MS with $3.3K in 1970 which was approximately $1.7K below the national average of $5K
* NY had the highest single GDP per CAPITA with $86.2K in 2020 which was almost 23K higher than the national average.

And from here I wanted to investigate how the values for ENERGY changed over the years…

**INVESTIGATING CHANGE**

To start my comparison for change I took an average of all 50 states and looked at the shift in AMOUNTS for CONSUMPTION and PRODUCTION….

Considering CONSUMPTION….

* It looked like 1980vs1990 was the highest year for NUCLEAR CONSUMPTION
* 1990vs2000 was the highest year for FOSSIL FUEL with a significant decline after 2000
* While RENEWABLES began their increase at the same time

Considering PRODUCTION….

* FOSSIL FUEL took its biggest hit for 1990vs2000
* RENEWABLES showed increasing gains with 2010vs2020 being the biggest year

Next I wanted to review the changes by PERCENT of CHANGE…..Once again using an average of all 50 states….

* Looking at this chart gave me a feeling that there is actually a PARADIGM SHIFT occurring…..
* We can see the 70’s and 80’s were good years for NUCLEAR
* FOSSIL FUELS indicate an overall decline
* While RENEWABLES displays a positive incline over the last twenty years

I also wanted to observe these changes at the state level and reviewed charts for the TOP 5 & BOTTOM 5 across CONSUMPTION, PRODUCTION, and ENERGY MIX….

Starting with a review of AMOUNT of CHANGE for the TOP 5 & BOTTOM 5 States for CONSUMPTION

* I noted TX as the Top consumer with a MAX of 13.5M (BN Btu)
* And of the TOP 5 NY had the greatest decline from 1970 to 2020
* For the BOTTOM 5 VT had the lowest overall CONSUMPTION for all years reviewed

Moving over to the TOP 5 & BOTTOM 5 for PRODUCTION….

* TX remains the King for both PRODUCTION and CONSUMPTION significantly outpacing their peers
* LA showed the greatest decline in PRODUCTION capacity with an overall decline 5.6M (BN Btu) from 1970 to 2020
* Of the BOTTOM 5 Delaware was the only state with an overall decline in PRODUCTION

Now moving to PERCENT CHANGE for the TOP 5 & BOTTOM 5for PRODUCTION….

* First I noticed a shift in the states listed….
* Looking at the values the feeling of a “PARADIGM SHIFT” for ENERGY is re-emphasized
* Similar to the overall Percent of Change slide….the CONSUMPTION slide demonstrates a similar shift in FOSSIL FUEL and NUCLEAR values vs RENEWABLES.
* This shift remains consistent for Percent of Change in RENEWABLES PRODUCTION

**PAUSE PAUSE PAUSE PAUSE**

My Key Thesis Starting this Project was that I would readily find a correlation between GDP per CAPITA to ENERGY CONSUMPTION…..My thought was that CONSUMPTION means Commerce which means Money, and More Commerce would equal More Money….and a higher GDP per Capita

However, my assumption was incorrect…

As you can see from the charts….

The wide dispersion observed in the charts for GDP per CAPITA to CONSUMPTION Indicates a lack of correlation.

Using the Data, I made the same comparison using Population to CONSUMPTION and realized that this a much stronger correlation than GDP per CAPITA correlation.

Additionally….I conducted a review utilizing the values for Total Expenditure for ENERGY (since this is closely related to CONSUMPTION) and received the same tight groupings indicating a strong correlation

While this was contrary to my thesis it clearly demonstrates “The Simplest Answer is Usually the Best One”

Population not GDP per CAPITA is the better predictor of ENERGY CONSUMPTION.

With this out of the way…..We will look at some stats for…..

**TECHNOLOGY / FUTURE GROWTH**

A Key Driver for Innovation is Funding….With this thought in mind I conducted a review of Government and Private Industry funding for Renewable Research & Development.

Utilizing a 10-year period from 2005 through 2015 we can see an overall investment of approximately $15B

* 2009 was the highest year for Private Industry investing $3B and 2012 was the highest year for the US Government investing $1.9B
* With the median investment from Private Industry at $1.2B while our Government’s contribution sits at $786M

Now who were the winners from this type of investment?

* As we can see from this slide Solar is the clear leader in forecasted adoption with a MAX contribution to the ENERGY market for 2050 forecast at 1.7M (BN Btu)
* Overall, we can expect approximately 16.6M (BN Btu) from RENEWABLE ENERGY sources

And what about the future….I believe we are heading in the right direction…..

* Looking at our current Stated Policies” for ENERGY we can expect our use of RENEWABLES to grow to 35% of our Total ENERGY Supply
* If we hold to our “Announced Pledges” we can reach a level of almost 61% of our Total ENERGY Supply coming from RENEWABLES
* And as for our GDP per CAPITA it is expected to remain on its current trajectory…

**SUMMARY**

**READ SLIDE**

**THANK YOU**