

# Energy Economics

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ENERGY SECURITY AND DATA ANALYSIS WORKSHOP

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# Quick Overview of the Economics of Energy

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In 2017, the BEA estimates that \$1.1 trillion was spent on energy in the US, or 5.8% of the GDP.

The US consumes 17% of annual global energy with just 5% of the population.

Job multiplier of roughly 4.4 – for every new energy job created, there are an additional 3.4 jobs created supporting that new position.

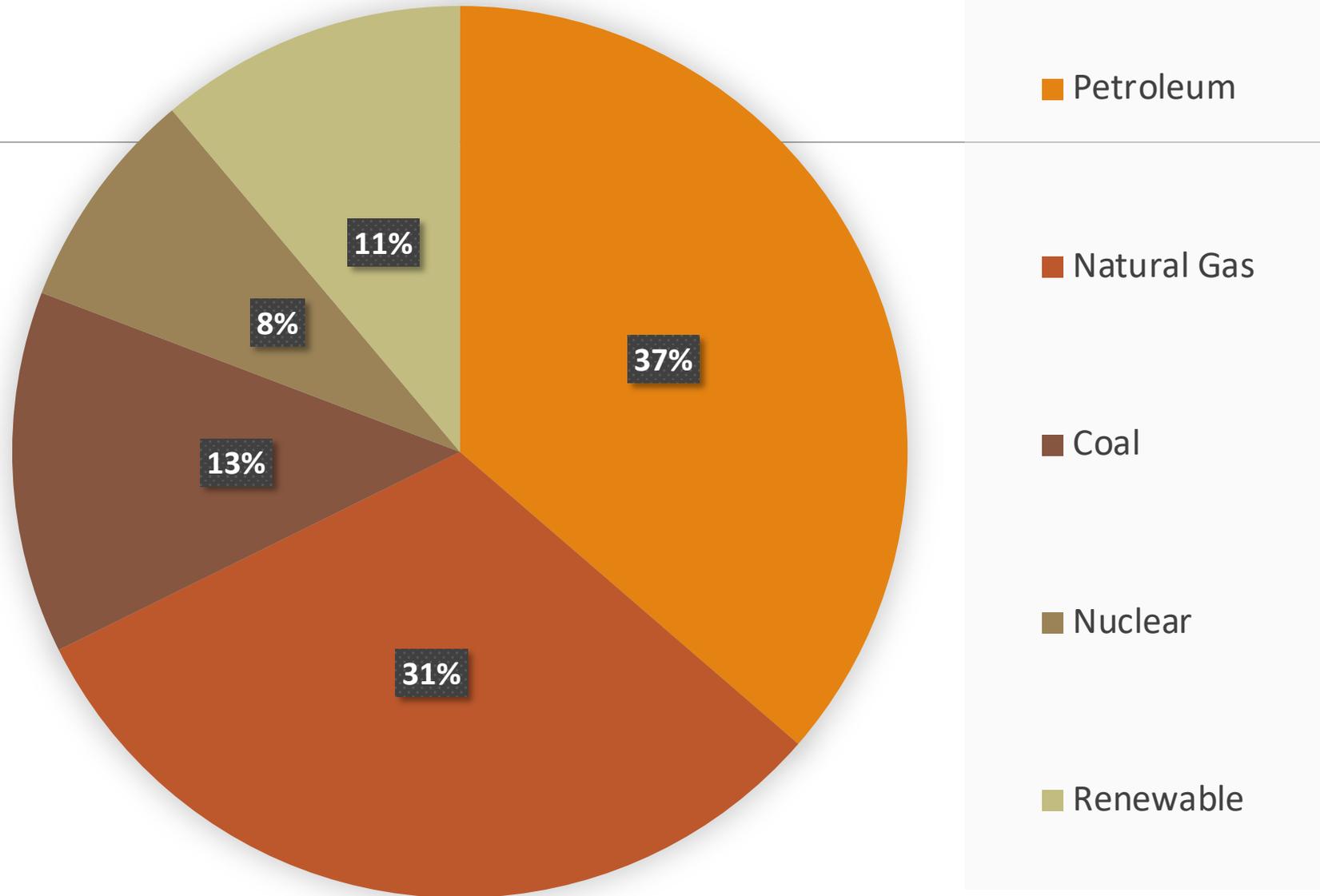
The output multiplier for energy is 1.70. That means for every dollar expended through energy in the economy, it produces \$1.70 of economic output within the economy.

But energy's true impact is more far-reaching: everything depends on energy

Industry-wide, energy has one of the largest economic effects on the economy.

DOE produced in the Quadrennial Energy review that energy drives the \$18.6 trillion GDP and significantly influences global economic activity.

# US Primary Energy Consumption by Source, 2018



# What could put energy in jeopardy?

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## Attacks on the infrastructure:

- Cyber
- Physical
- Psychological

## Limited amounts of resources

- Oil/gasoline
- Natural gas
- Uranium
- Rare-earth elements

## Weather events

## Geopolitical events

# What happens if that energy is put in jeopardy?

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Energy security is the uninterrupted availability of energy sources at an affordable price.

When energy supply is in jeopardy, economic outflow is also jeopardized.

- It has the potential to disrupt the \$18.6 trillion US economy

Disruptions happen in a more regional basis.

- Recent events:
  - Hurricane Harvey
  - California wildfires
  - Midwest blizzards of 2014
  - Polar vortex
  - Bombogenesis
  - Extreme drought (Texas, California)
  - Philadelphia refinery explosion
  - Tornados

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On April 4, 2018, there was a coordinated cyberattack on a shared data network which four of the natural gas pipelines utilize, shutting it down.

This attack did not interrupt service, but interrupted consumer transactions.

It has been theorized that Russia was behind the attack.

Testing the robustness of the pipeline companies' security

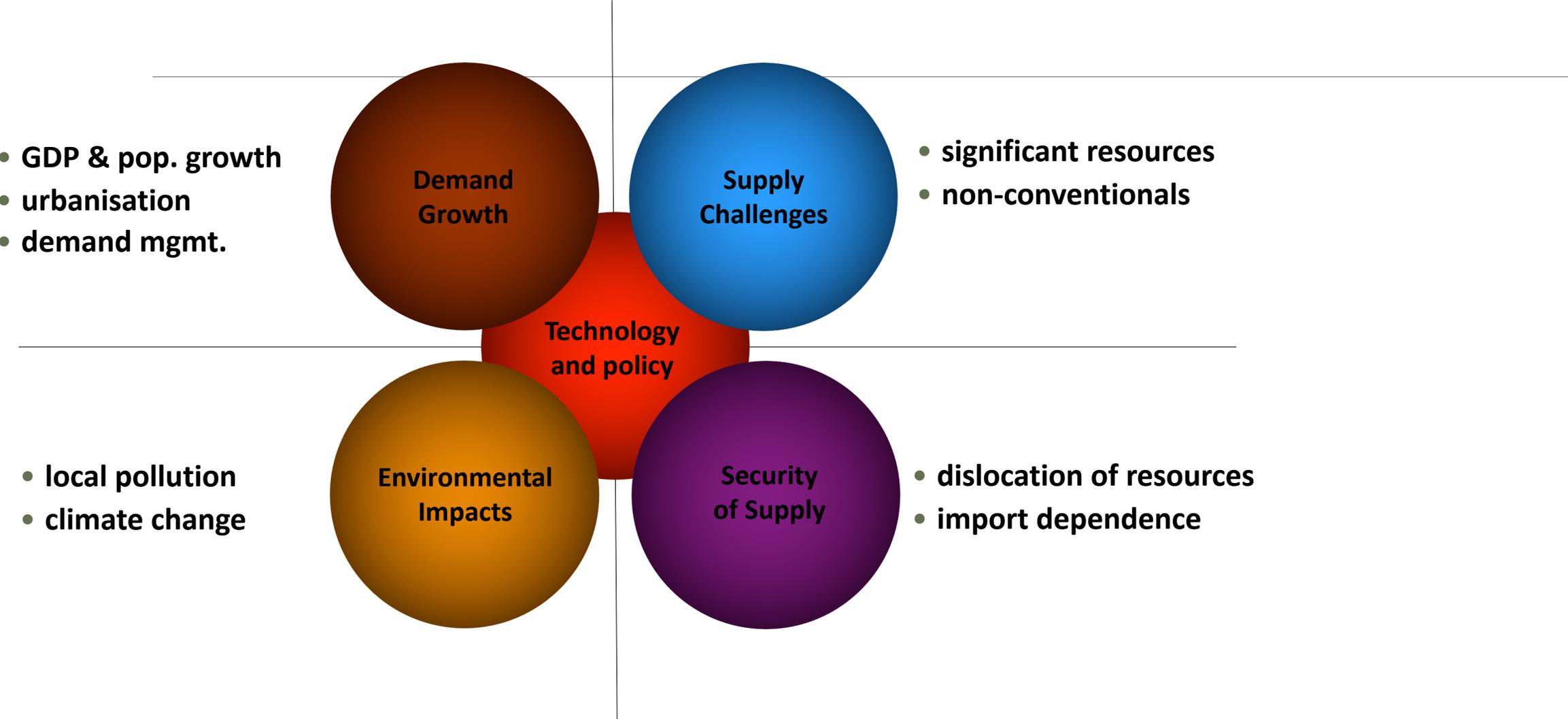
Challenging Russia's dominance of the European natural gas market with LNG

Attacks on Saudi Arabia and Ukraine have happened in the past

Most of the focus on energy has been on the grid, not pipelines, upstream, or downstream



# Key drivers of the energy future



# Opportunities to enhance security

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Non-wire alternatives

Large scale battery technology

Energy saving (EnergyStar) appliances

Decrease reliance on foreign energy

Moderating “Peak Load”

Smaller, “Microgrids” to focus on a certain area

Flexibility for generation

Better communication between consumers, producers, technology

Modernization of grid, transmission, etc.

Figure 3.2. Net Generation Capacity Additions and Retirements<sup>123</sup>

National Capacity Additions (MW)

