

# Building on West Virginia's Energy Foundation

*Prof. Joshua P. Fershee*



West Virginia  
Higher Education  
Policy Commission

# Advancement of Science and Engineering for Localized Gas Utilization



**JOSHUA P. FERSHEE**

**Professor &**

**Associate Dean For Research**

**WVU College of Law**

**-- Center for Innovation in Gas Research & Utilization**

**-- Center for Energy & Sustainable Development**

***Joshua.Fershee@mail.wvu.edu***

- Energy Law & Regulation
  - Oil & Gas
  - Hydraulic Fracturing
  - Natural Gas & Renewable Energy
  - Hydrogen Fuels
- Business Entities & Governance
- Social Enterprise & Efficient Regulation



# Center for Innovation and Gas Research Utilization & WV Research Challenge Grant Team

## **STEM TEAM**

### **Natural Gas to Chemicals**

John Hu & Hanjing Tian

Rosalynn Quinones

### **Natural Gas Combustion**

Cosmin Dumetrescu

Slava Akkerman

## **Economic & Community Development TEAM**

Joshua Fershee

Levan Elbakidze

Bingxin Li

Paolo Farrah

# Our Team



**Joshua P. Fershee**

*Professor & Assoc. Dean for Faculty Research & Development*

*College of Law*

- Impacts of laws and regulations
- Assess environmental risks, environmental protection efficiency and effectiveness, and cost-benefit of applicable rules
- Research legal and regulatory challenges and opportunities related to gas utilization and market expansion in utility sector, manufacturing, and other industries



**Bingxin Li**

*Assistant Professor of Finance*

*College of Business & Economics*

- Pricing model of energy derivatives
- Hedging and speculation on the commodity markets
- Energy financial risk management



**Levan Elbakidze**

*Assistant Professor of Resource Economics and Management*

*Davis College*

- Spatial and dynamic modeling of resource utilization and distribution
- Externalities and public goods
- Derived demand for non-market production inputs (water)
- Interdisciplinary research and modeling of natural resource management



**Paolo Davide Farah**

*Assistant Professor of Public Administration*

*Eberly College*

- Public Goods, Non-Trade Concerns and Externalities
- International and Comparative Energy and Environmental Law and Policy, Climate Change Law
- Law and Regulations on Environmental Impact Assessment for Shale Gas Exploration and Exploitation in the World
- Politics and Policy of Shale Gas and Institutional Fragmentation in US, China and EU
- Shale Gas as a Game Changer in the World Energy Market for the Creation of an Energy Mix

# Economic & Community Development Approach

- **Work as it relates to CIGRU mission and vision**

- Why the E&CD team was developed

- **Research priorities**

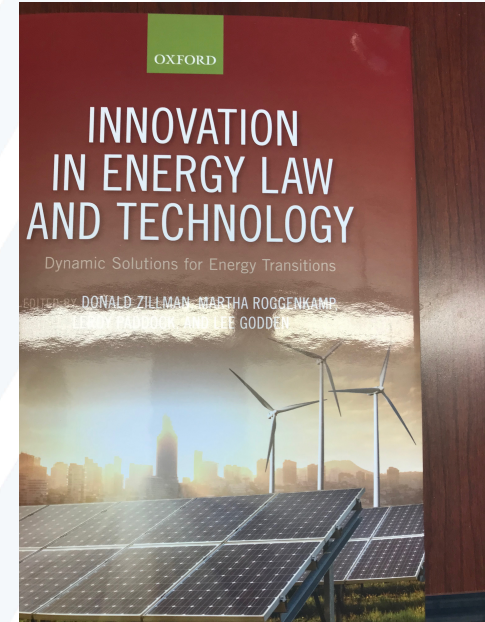
Team's particular focus: *Leverage WVU publication opportunities and thought leadership to give industry, government & communities impartial and factual bases supporting key decisions around gas utilization*

- **Work on the Research Challenge Grant**

- Working with the Advisory Committee to get input
- Working with each other to leverage our existing work and prepare for new projects

# Publications: Business & Energy Law & Policy

- ❑ The Hydrogen Economy in the United States and the European Union (Academic Advisory Group--2018 Energy Innovation Book (Oxford, UK, Oxford University Press) (with Ruven Fleming))
- ❑ **Social Enterprise Laws and Director Primacy's Demise: Risks to Governance and Growth** (Transactions Business Journal & Columbia Blue Sky Blog)
- ❑ Light Duty Vehicles: Electric, Hybrid, Hydrogen and Internal Combustion Vehicles Legal Pathways to Deep Decarbonization (Washington, DC:, Environmental Law Institute, John Dernbach and Michael B. Gerrard, eds.) (with Amy L. Stein)



# Overview: Natural Gas in the Energy Future



- Natural Gas is here for the long haul
- Natural Gas is the choice for new electricity generation and use as a firming resource to support renewables
- Natural Gas can impact the transportation sector, without being the transportation fuel



# Natural Gas Prices Changed the Assumptions

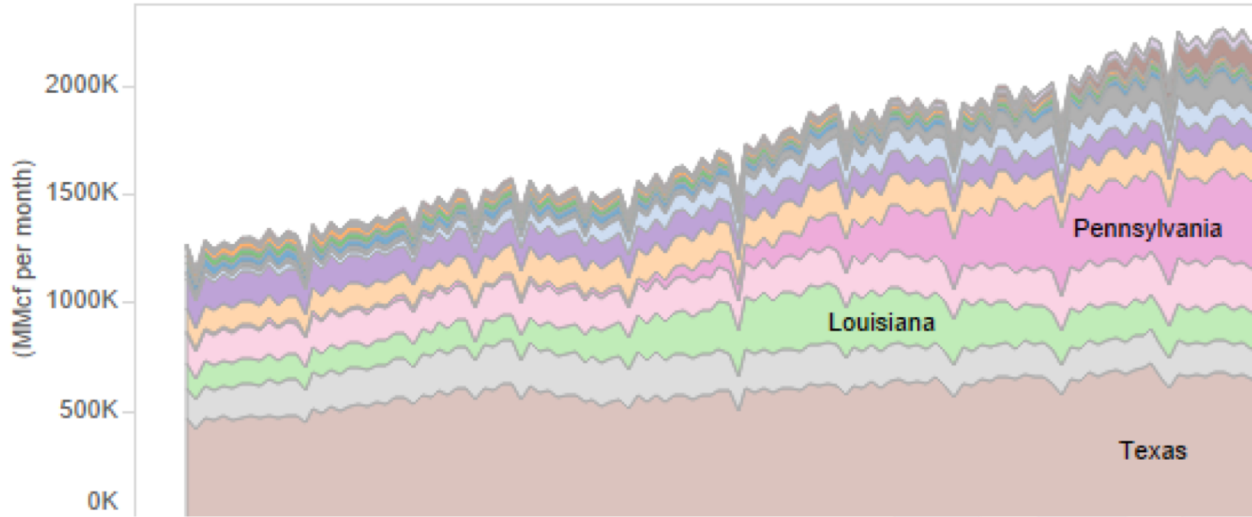
Wellhead natural gas prices, per thousand cubic feet, have change dramatically:

- 2007: \$6.25
- 2008: \$7.97
- 2009: \$3.67
- 2010: \$4.48
- 2011: \$3.95
- 2012: \$2.66
- March 20, 2017: \$2.93
- Apr. 19, 2018: \$2.71

***\*\*Lower prices (should) change what's possible.\*\****

# Gas Production Continues, Despite Low Prices

Natural gas production



# Sources of Electricity Generation Are Evolving

Annual Total	Coal	Natural Gas	Renewables
2006	48.97%	20.09%	2.36%
2007	48.51%	21.57%	2.52%
2008	48.21%	21.43%	3.04%
2009	44.45%	23.31%	3.63%
2010	44.78%	23.94%	4.02%
2011	42.28%	24.72%	4.69%
2012	37.40%	30.29%	5.29%
2013	38.89%	27.66%	6.01%
2014	38.64%	27.52%	6.39%
2015	33.18%	32.66%	6.65%

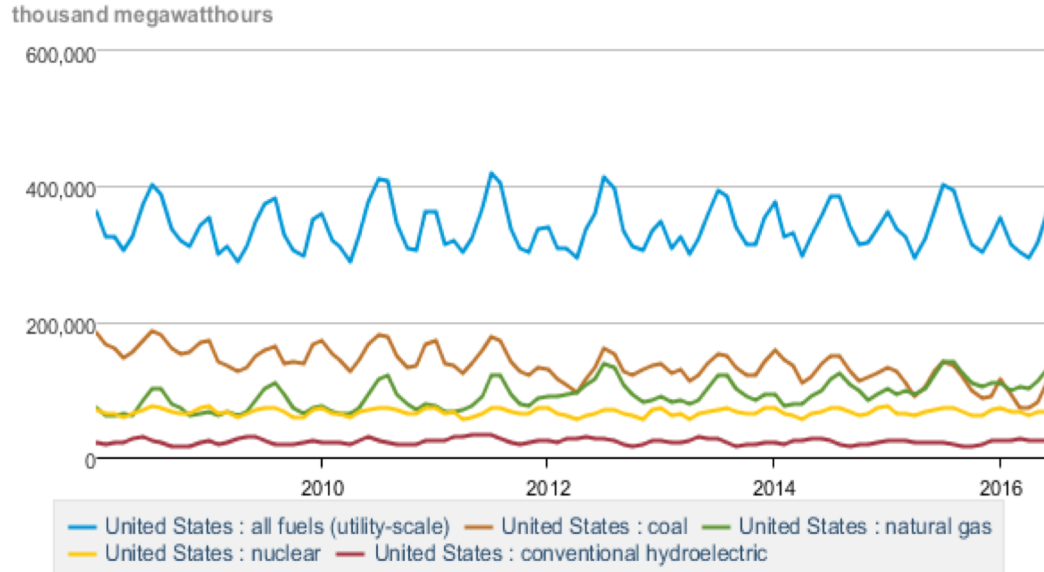
## U.S. Electricity Generation, by fuel

- Coal begins to fall modestly in 2006, then drops from 48.21% in 2008 to 33.18% in 2015.
- Coal lost 15.03% of the market, while natural gas increased 11.23% over those years.
- Renewable sources (not including solar and hydropower) increased 3.63% to 6.65% overall.
- That means that natural gas and renewables picked up 14.84% of the market -- or 98.7% of the reductions in the coal market.

# Natural Gas is the Choice for New Generation



Net generation for all sectors, monthly

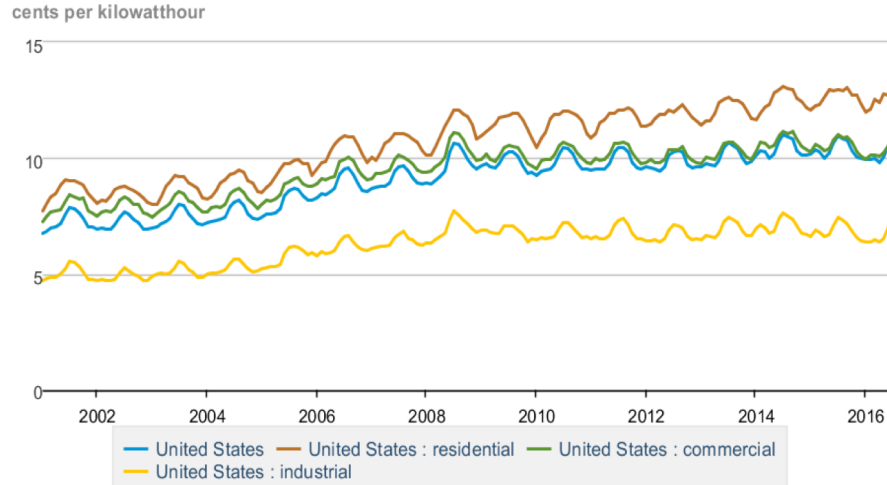


Data source: U.S. Energy Information Administration

# Electricity Prices Have Not Dropped



Average retail price of electricity, monthly



 Source: U.S. Energy Information Administration



## But emissions have . . .

- The increased use of shale gas led to U.S. carbon emission reductions of 12% between 2007 and 2012.
- This was greater than Europe's, which had a GHG emission reduction policy.



# What does this mean for law and policy research?



- Electricity: Gas + Wind + Solar
  - Few, if any, saw this decline for coal and nuclear
  - What do we really need? For Reliability? Cost?
- Jobs & Manufacturing: Storage Hub? Infrastructure? Permitting?
- How Do We Balancing Economic, Environmental & Social Impacts?



# What's Next?

- Regulators and legislators need to evolve like (and with) the companies in the sector
- Markets are actually working in many places
  - But, market outcomes are not always predictable
- Building for the future, means building infrastructure properly