Natural Gas Demand for the U.S. Power Sector

Forum on Global Energy, Economy, and Security

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Webber Energy Group

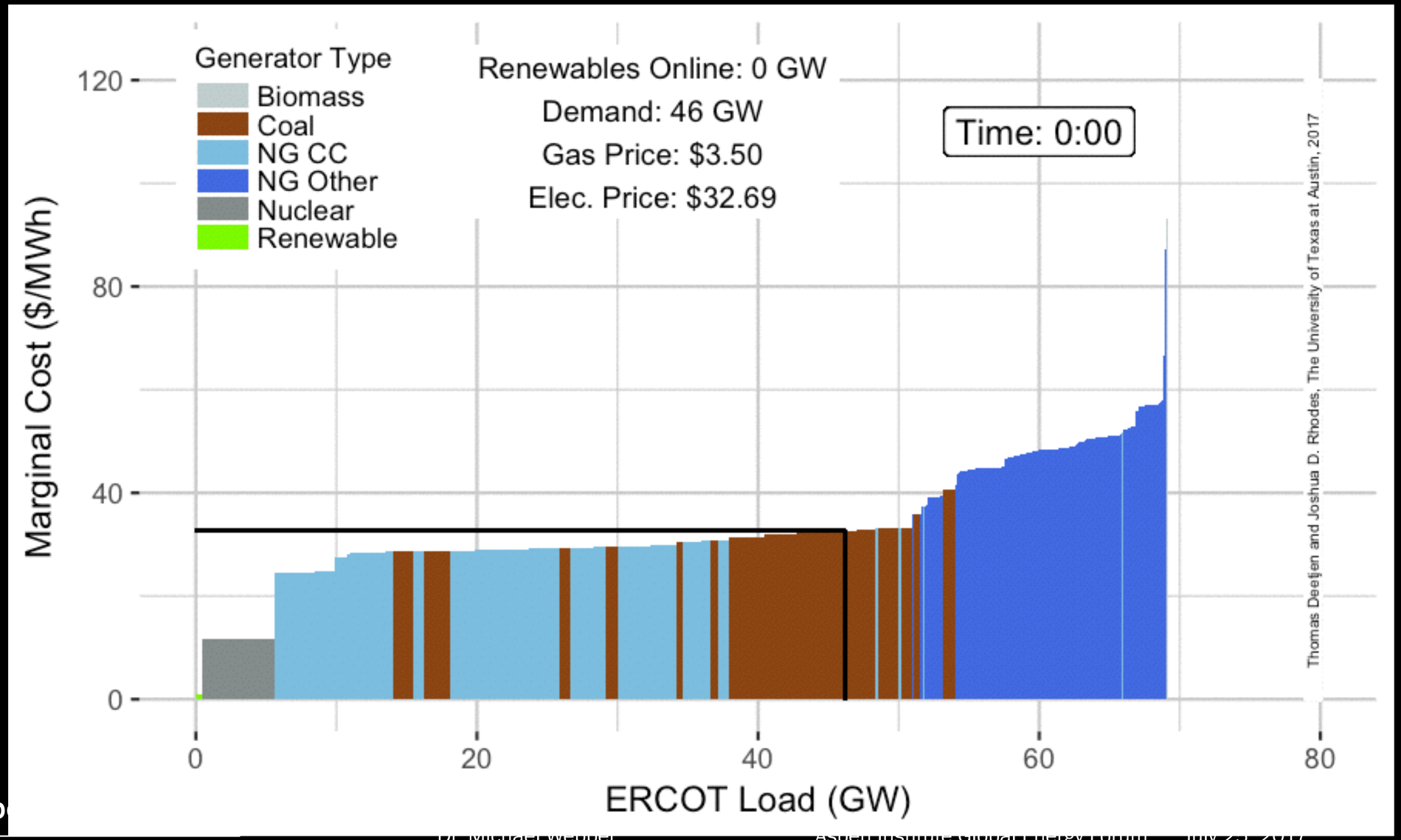
THE UNIVERSITY OF TEXAS AT AUSTIN

The Power Sector Is Changing: Market

- Old products:
  - Power: kW
  - Electricity: kWh
- Markets use an auction
  - Bid stacks arrange power cheapest to most expensive

- New services:
  - Fast ramping
  - Contingency/Supplemental reserves
  - Non-spinning reserves
  - Spinning reserves
  - Regulation up/down
  - Fast responding regulation up/down
  - Primary frequency response
  - Fast frequency response
  - Reactive power management
  - Synchronous inertial response

Prices change with demand



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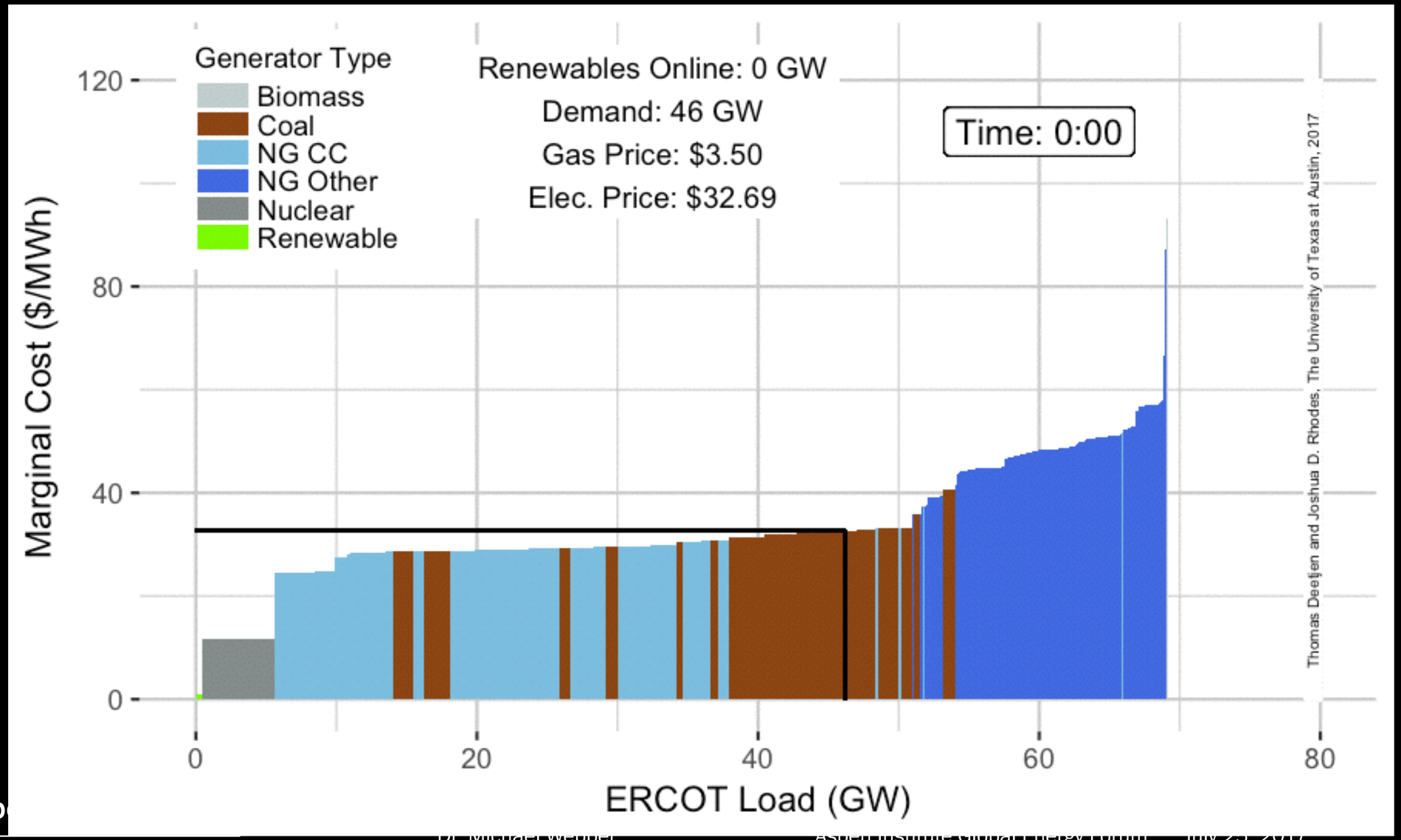
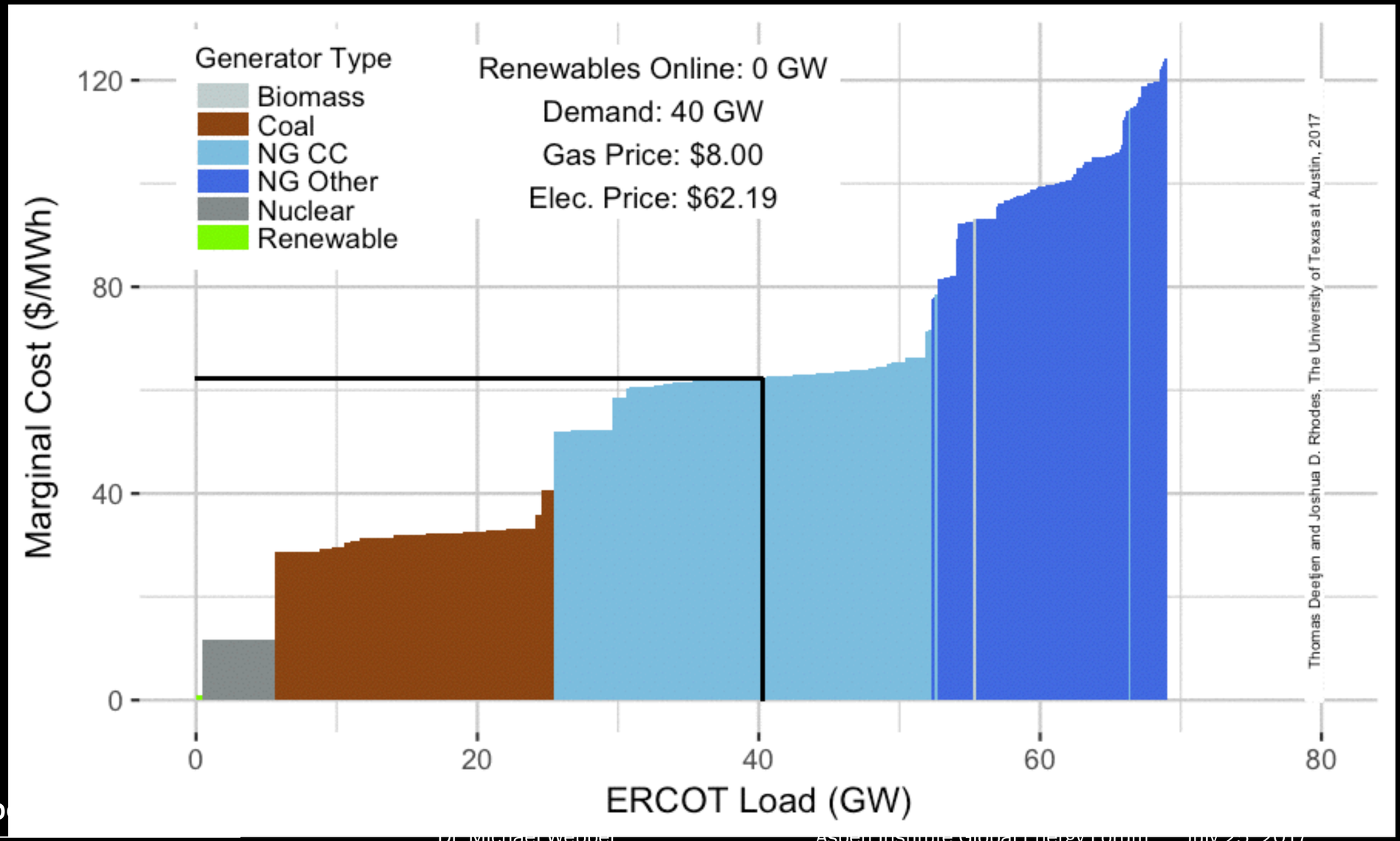


Electricity prices change with natgas prices



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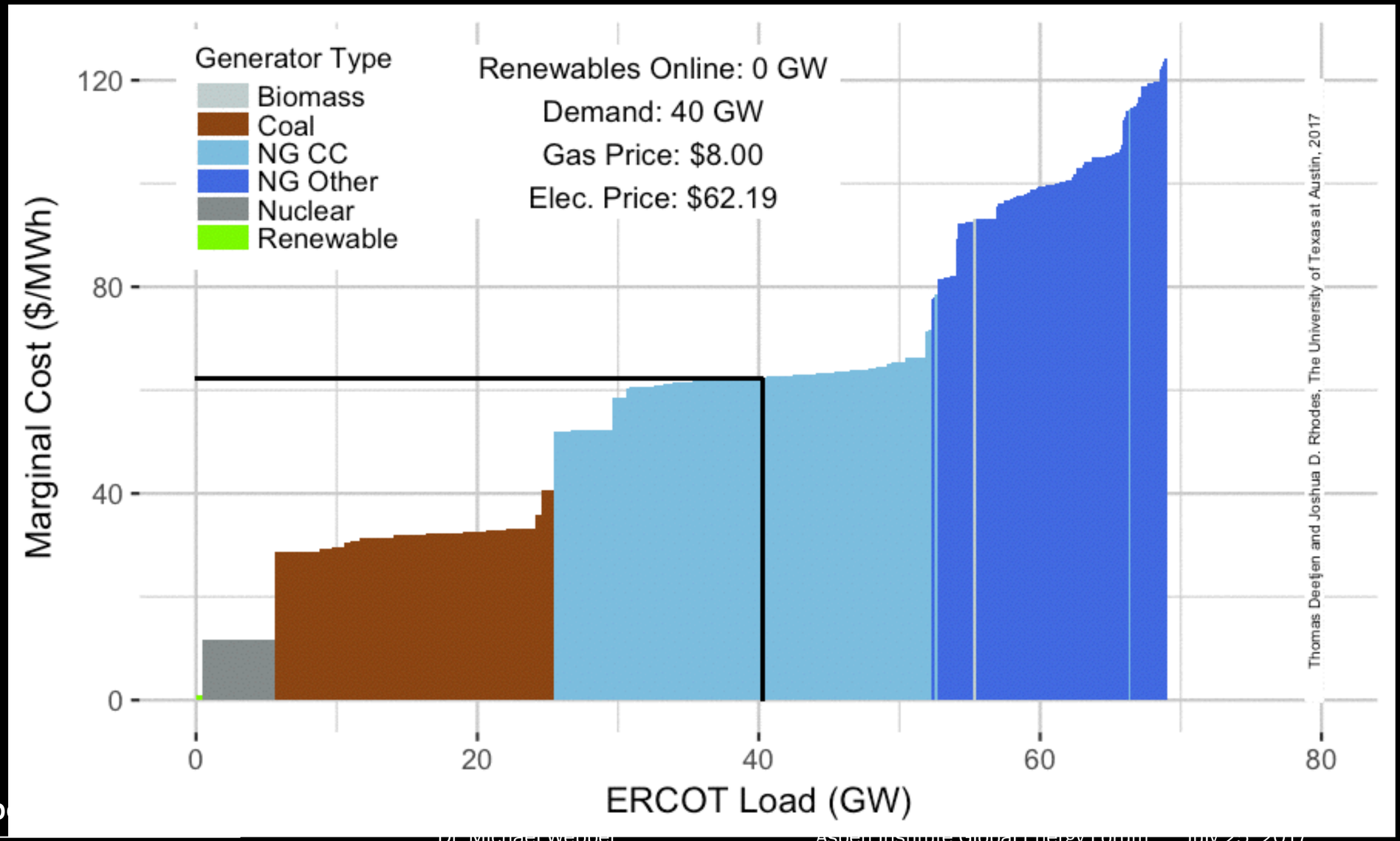
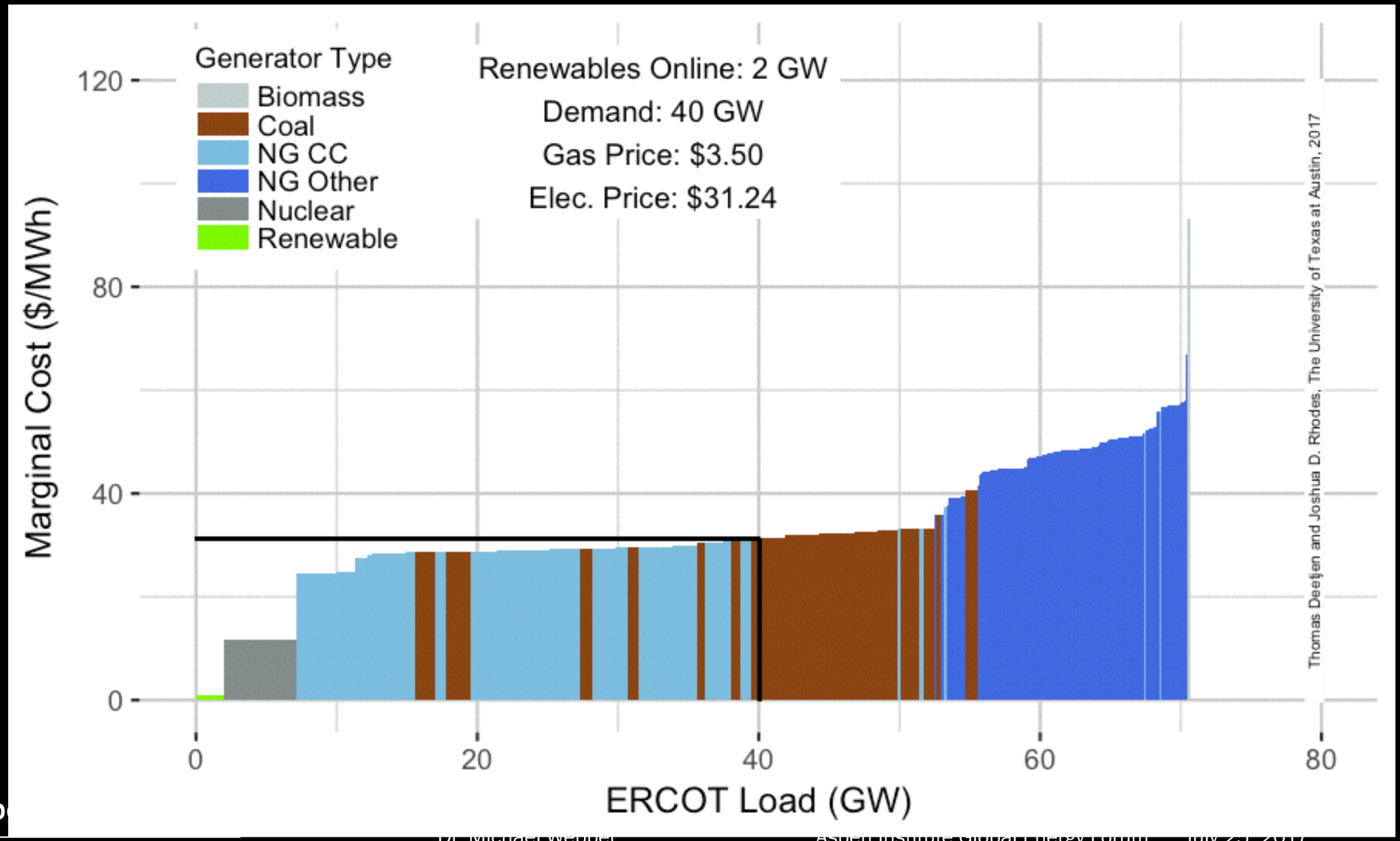


Increasing Renewables Lowers Electricity Prices



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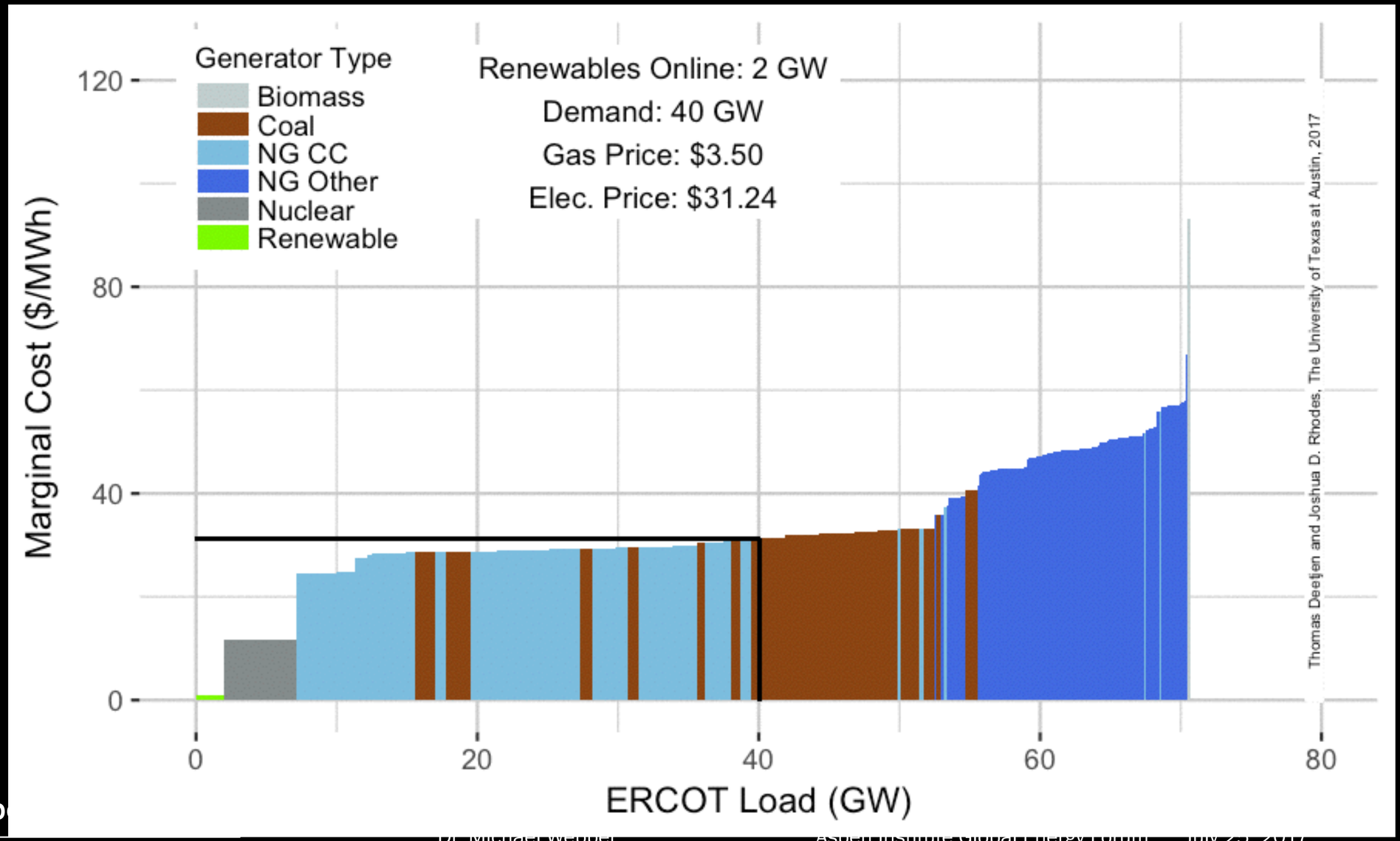
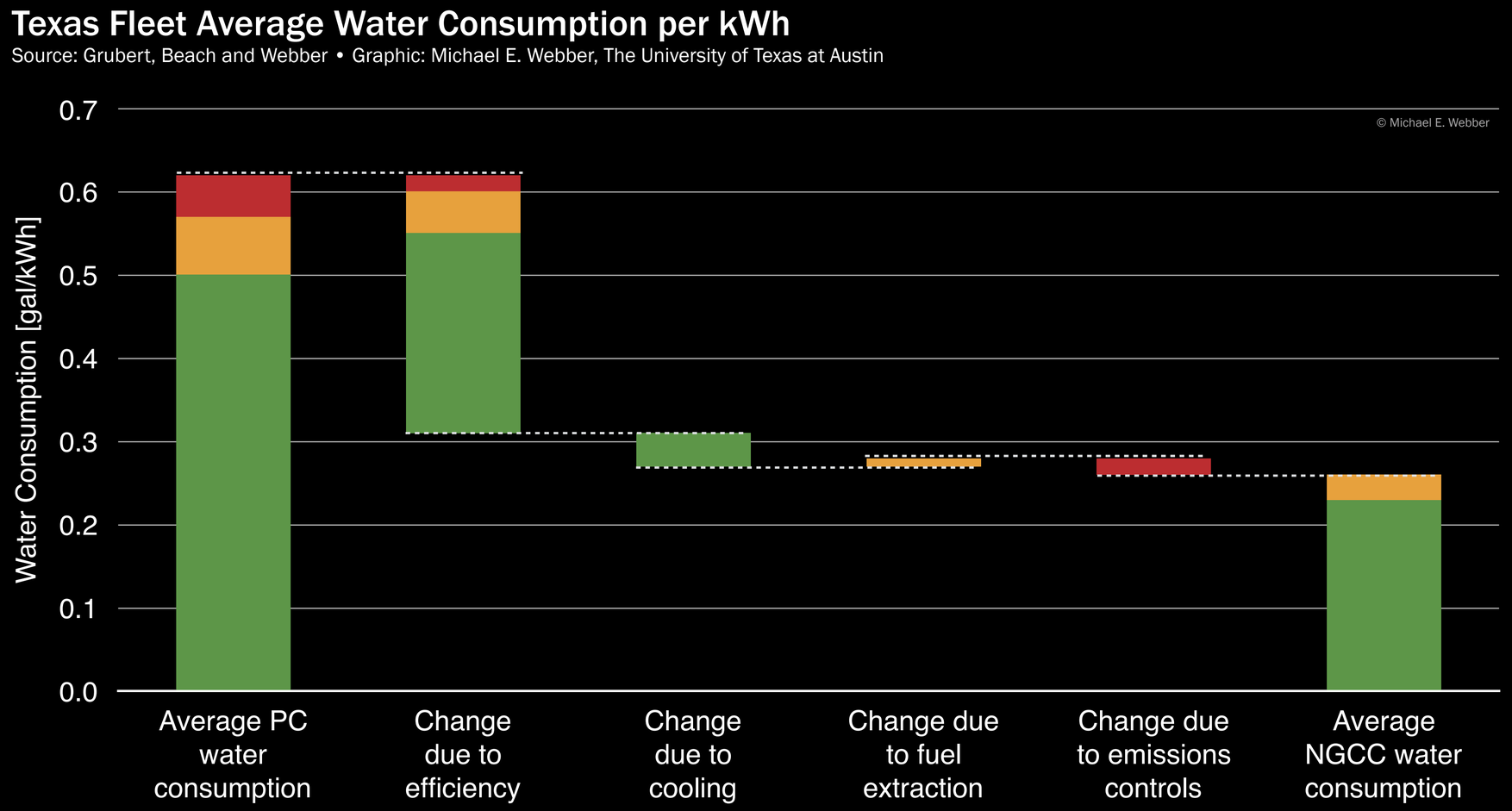


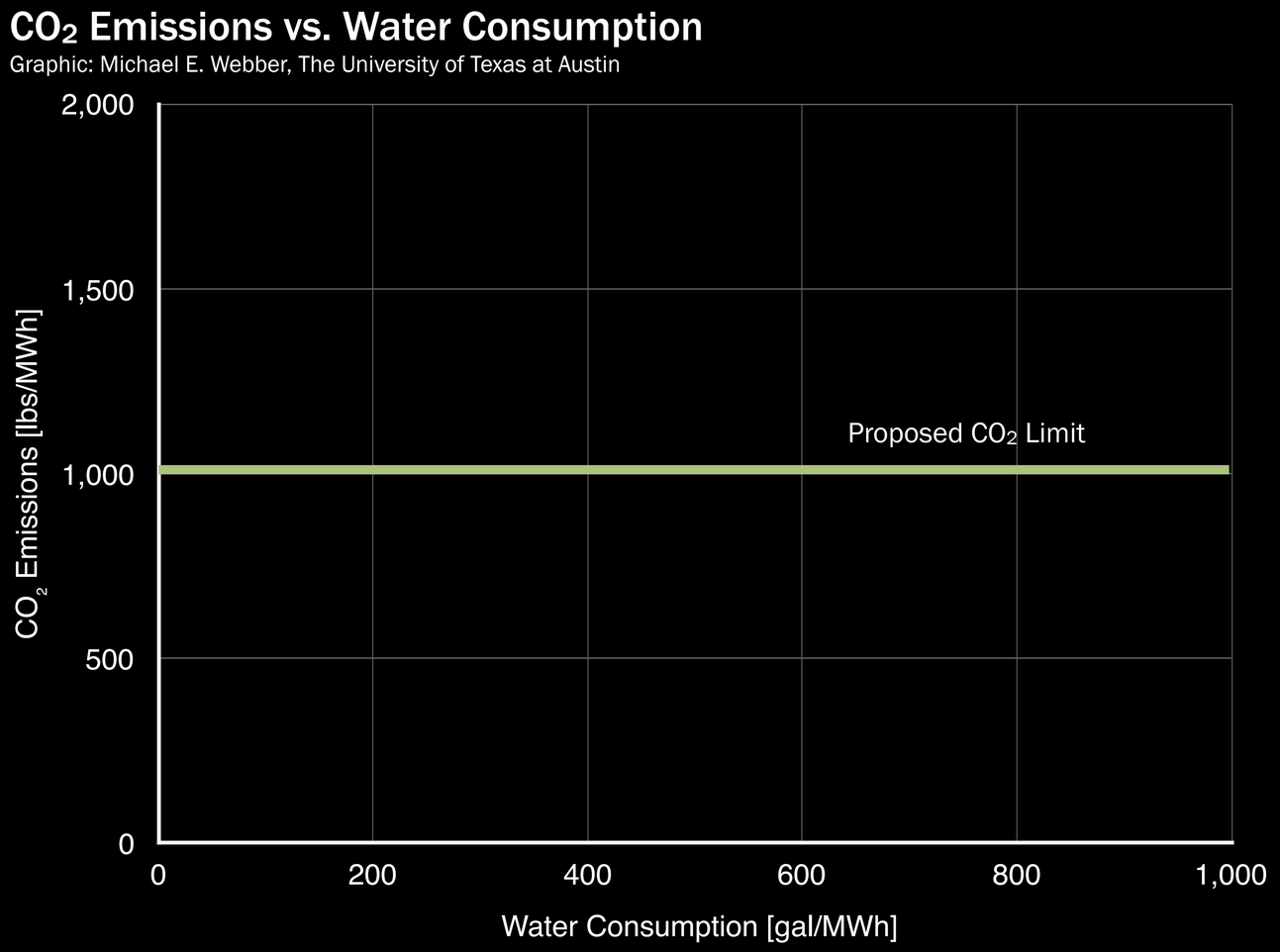
The Power Sector Is Changing: Environment

- Regulations seek to reduce environmental impact
  - —Emissions: CO_2, NO_x, SO_x, Hg, $PM_{2.5}$, PM_{10},…
  - —Water: fuel production, power plant cooling,…
- Winners: wind, solar, natural gas

Despite Water Needs of Hydraulic Fracturing, Switching From Coal to Natural Gas Combined Cycle Saves Water



There is Tension Between CO_2 and H_2O in the Power Sector



[Source: NETL, DoE, Webber]

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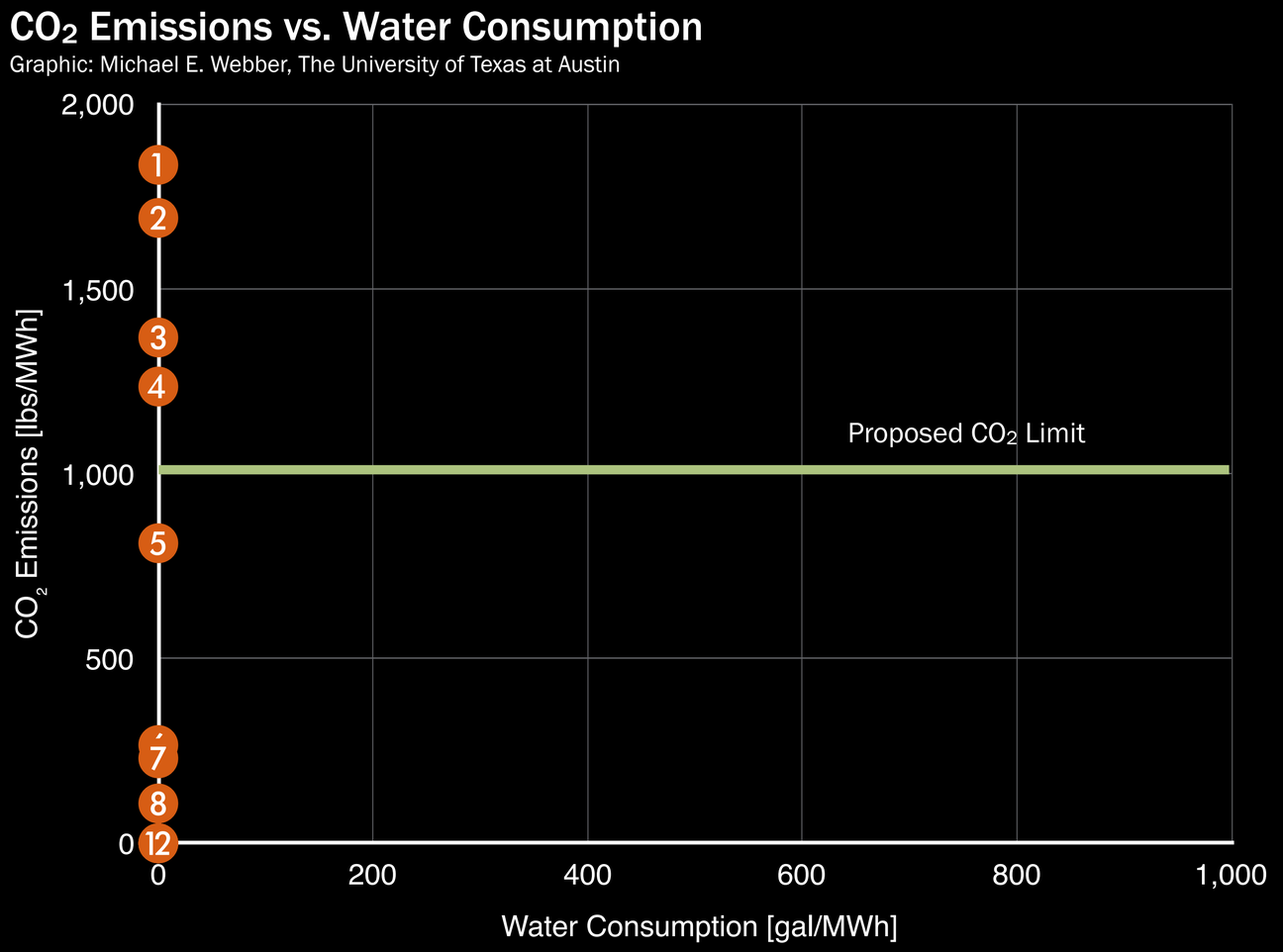

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2	Coal, IGCC
3	Natural Gas Combustion Turbine
4	Natural Gas Steam Generator
5	Natural Gas Combined Cycle
6	Coal w/capture
7	Coal, IGCC w/capture
8	Natural Gas Combined Cycle w/capture
9	Solar CSP
10	Nuclear (typ. Gen II)
11	Nuclear Small Modular Reactor
12	Solar PV, Wind

[Source: NETL, DoE, Webber]

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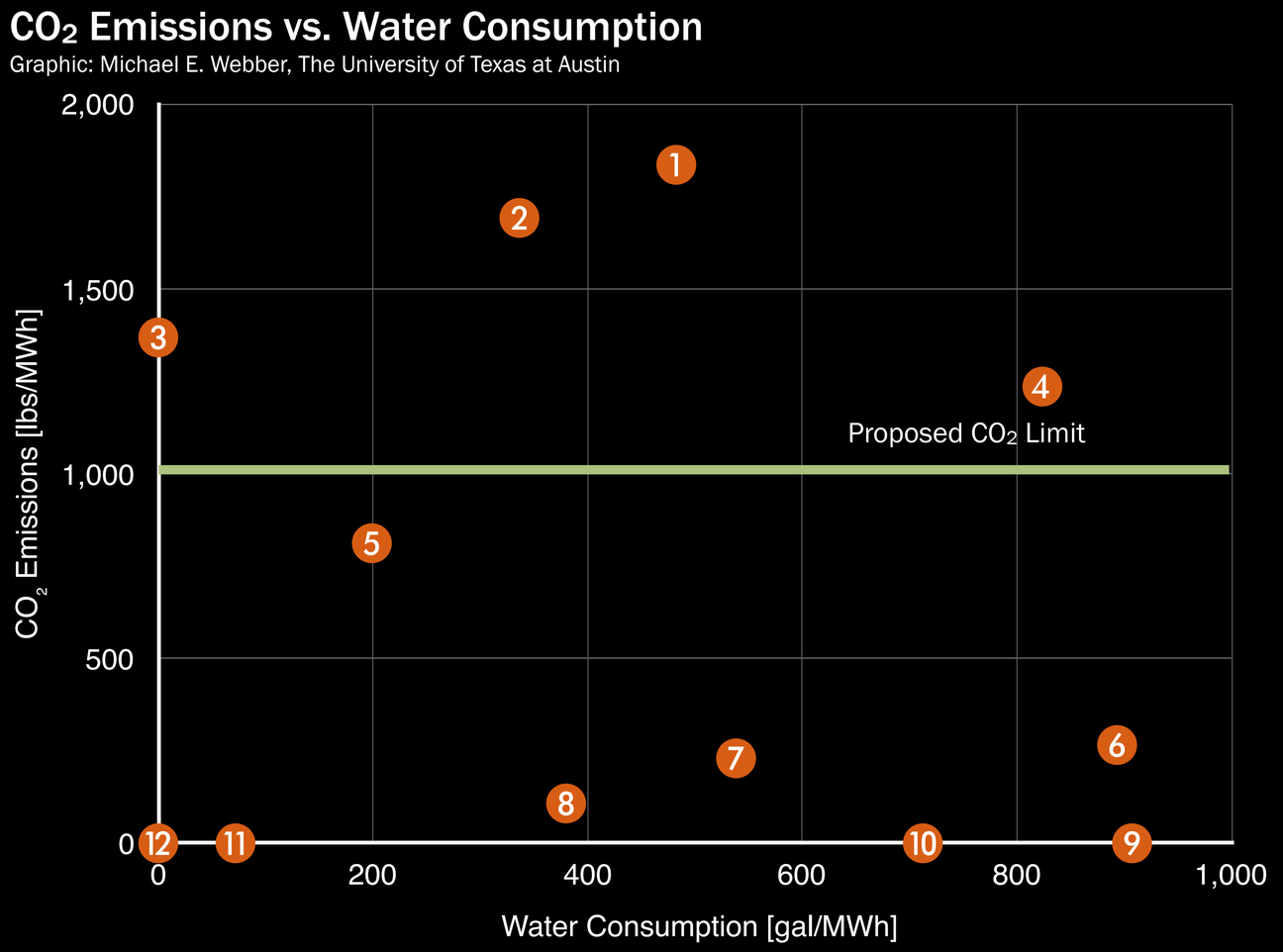

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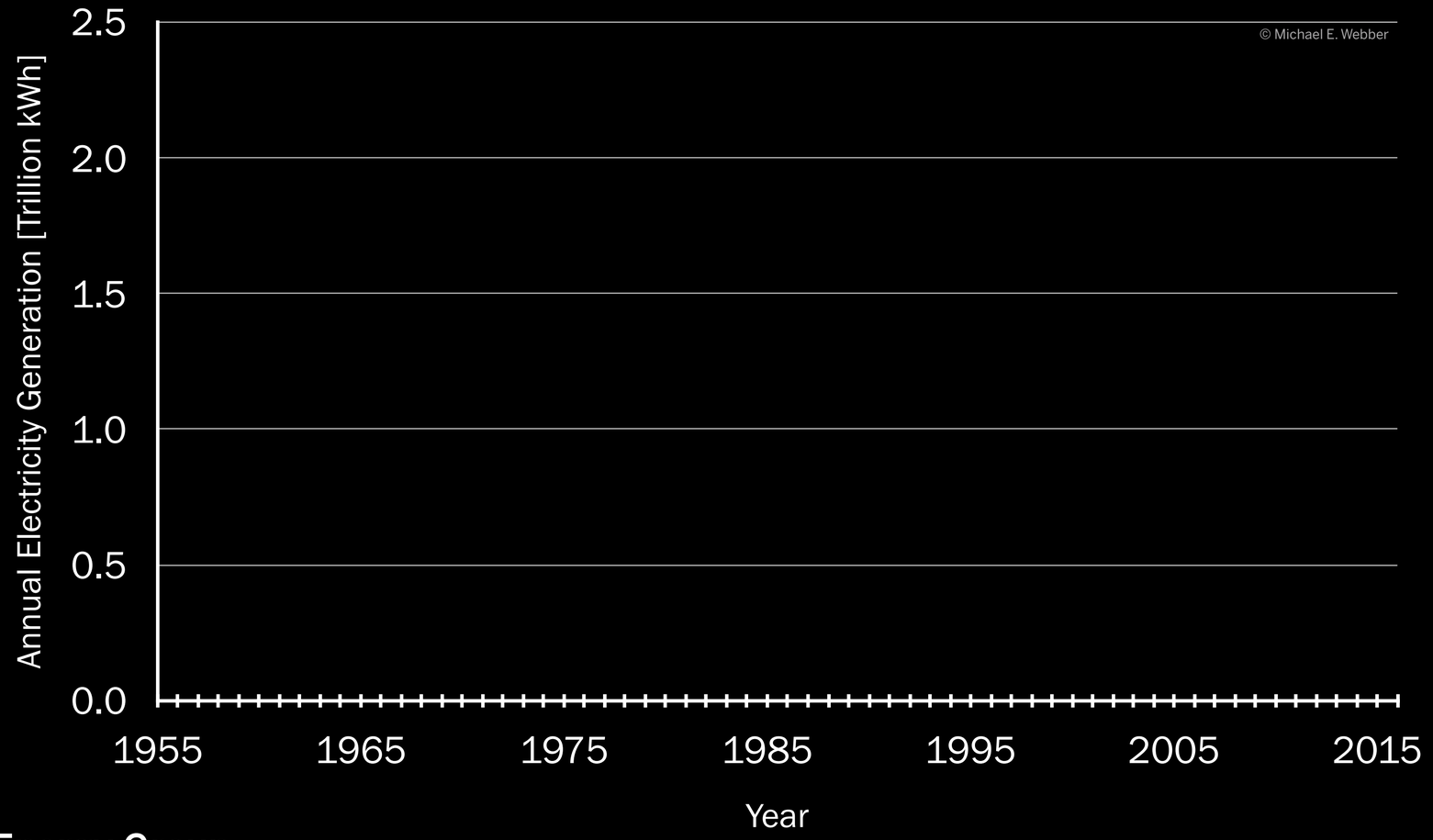
Market winners: solar, wind and natural gas

- Low marginal price: solar, wind
  - –Cheap wind and solar beat everything
  - –Cheap gas beats coal, nuclear
- Ancillary services: natural gas
- Environmental impact: wind, solar, natural gas
  - –Nuclear good for emissions, bad for water

In 2016, natural gas exceeded coal for the first time in the U.S. electricity generation mix

1955–2016 U.S. Electricity Net Generation by Source

Source: U.S. Energy Information Administration / *January 2017 Monthly Energy Review (7.2a)* • Graphic: Michael E. Webber, The University of Texas at Austin



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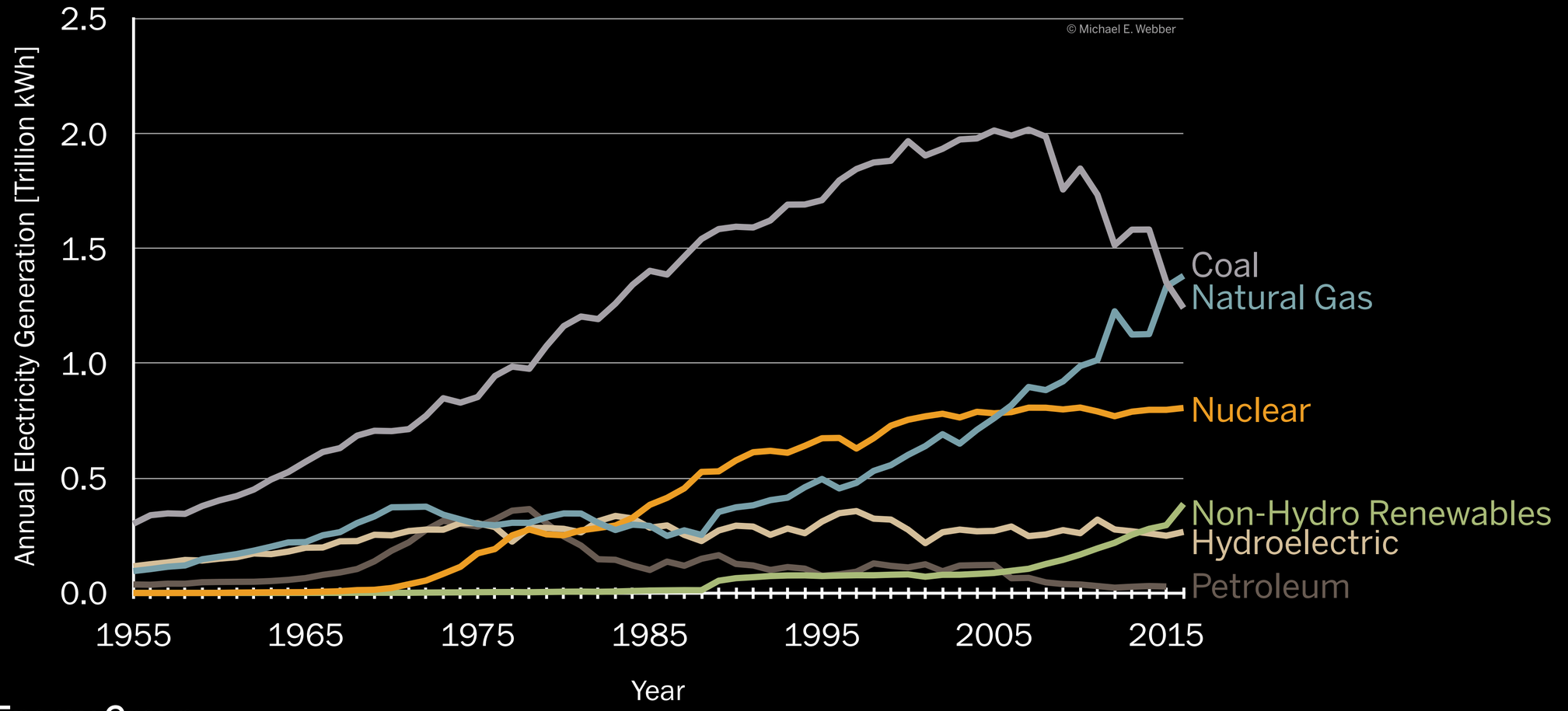

Natural Gas Faces Headwinds to Further Adoption In the U.S. Power Sector

- Renewables will get cheaper
- Leak at Aliso Canyon
- Gas is low carbon but it is not zero carbon
- Public resistance to fracking is not declining
- Demand from other sectors such as chemicals or exports give upward price pressure
- Price volatility
  - —Lack of long-term fixed price contract
  - —Oscar Wyatt

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