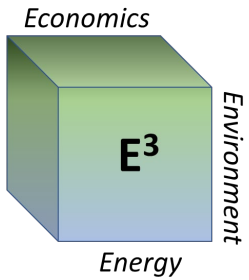


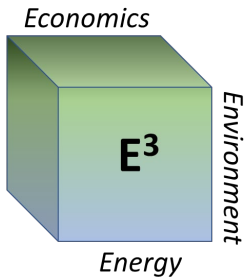
Gas-Electric Coordination and Costs for Providing Reserves

Presented to the PJM RCSTF

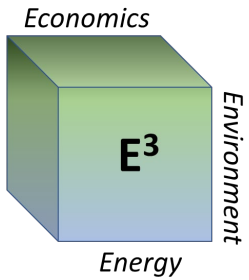
Paul M. Sotkiewicz, Ph.D.

President and Founder, E-Cubed Policy Associates

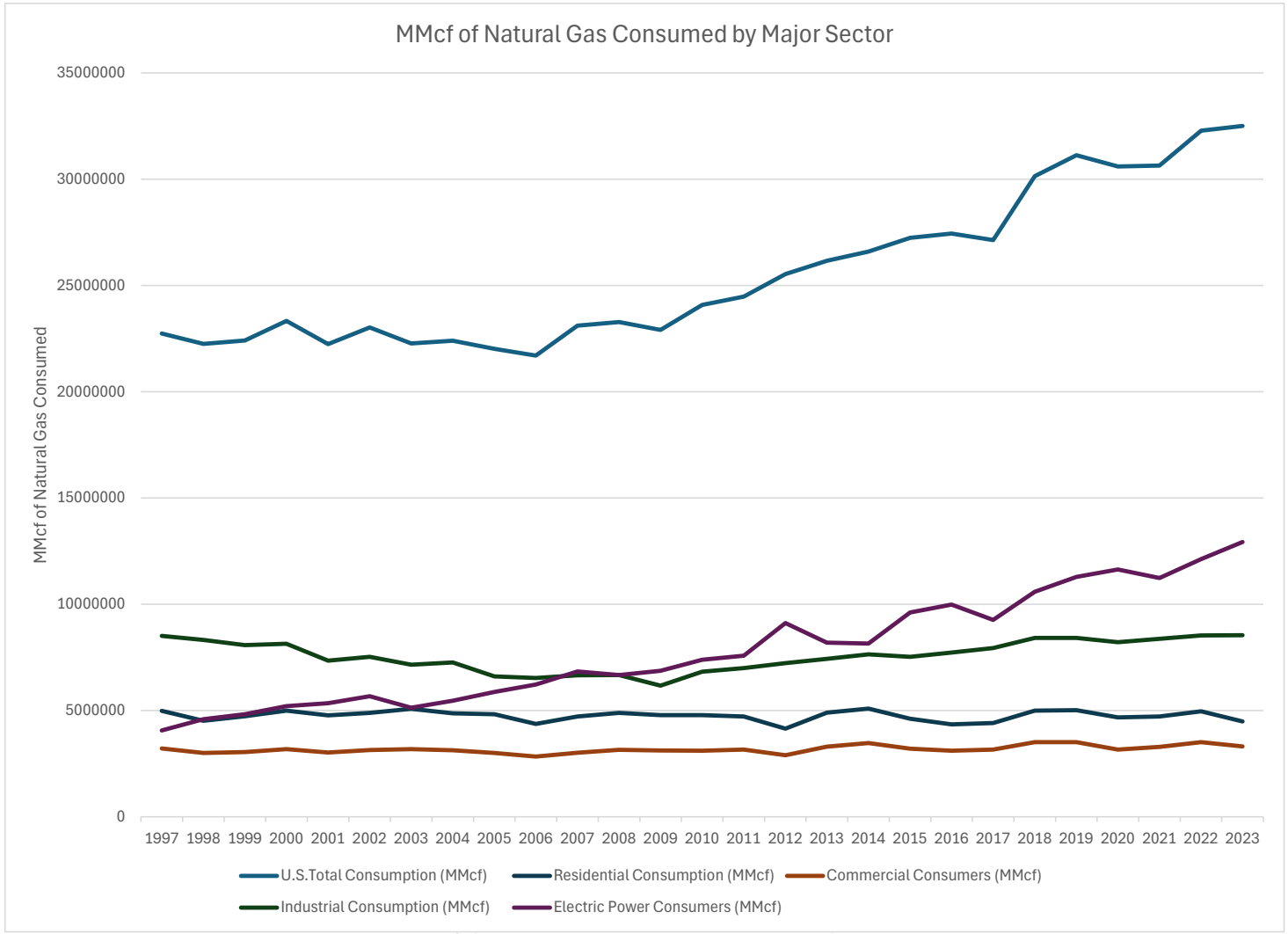
September 17, 2025

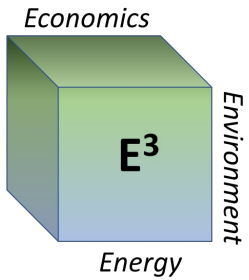


Key Trends and Reliability Implications

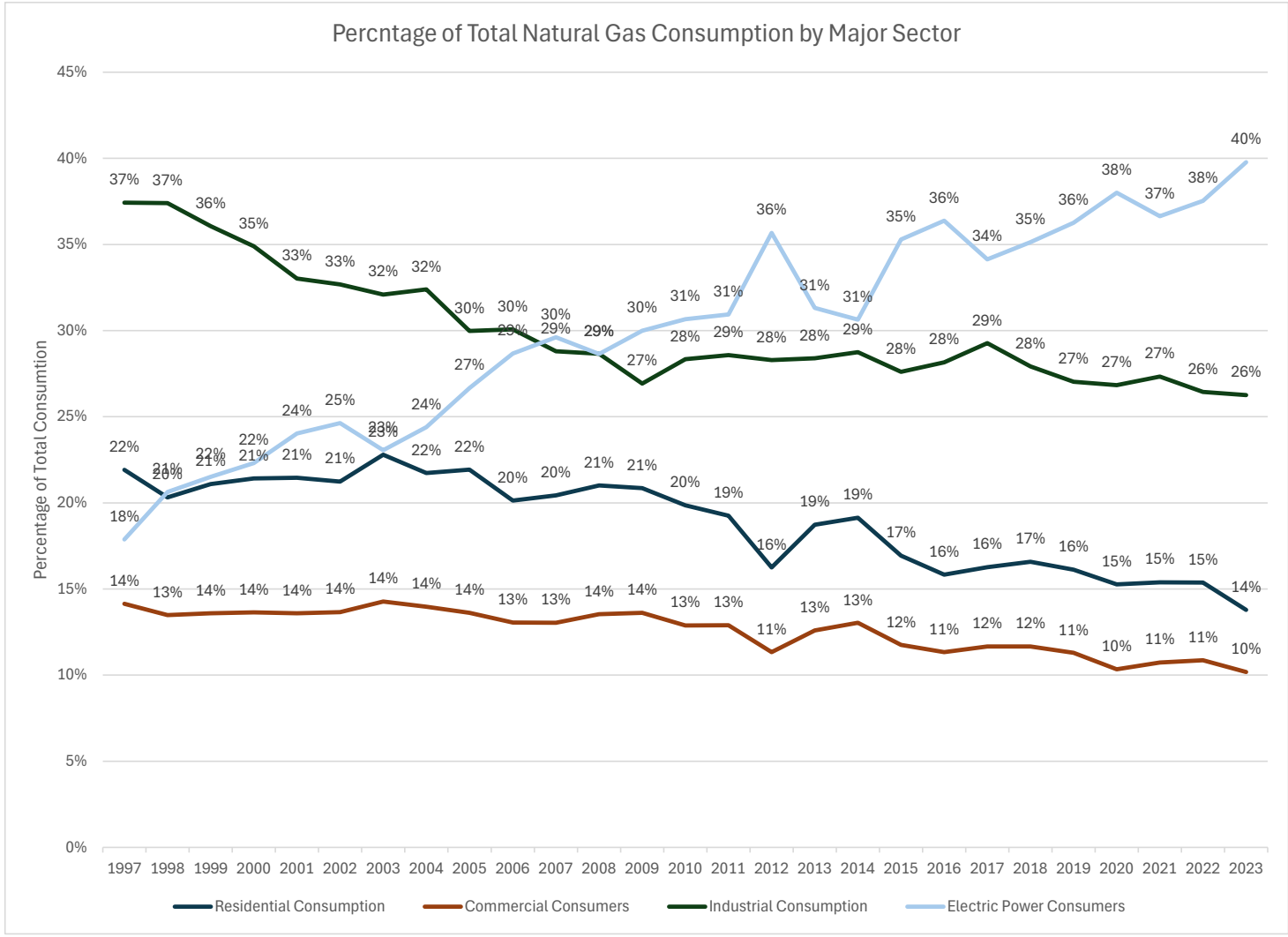


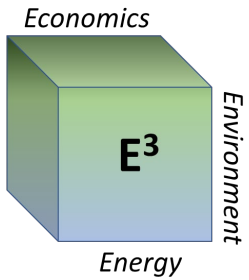
Annual Natural Gas Consumption by Major Sector 1997-2023



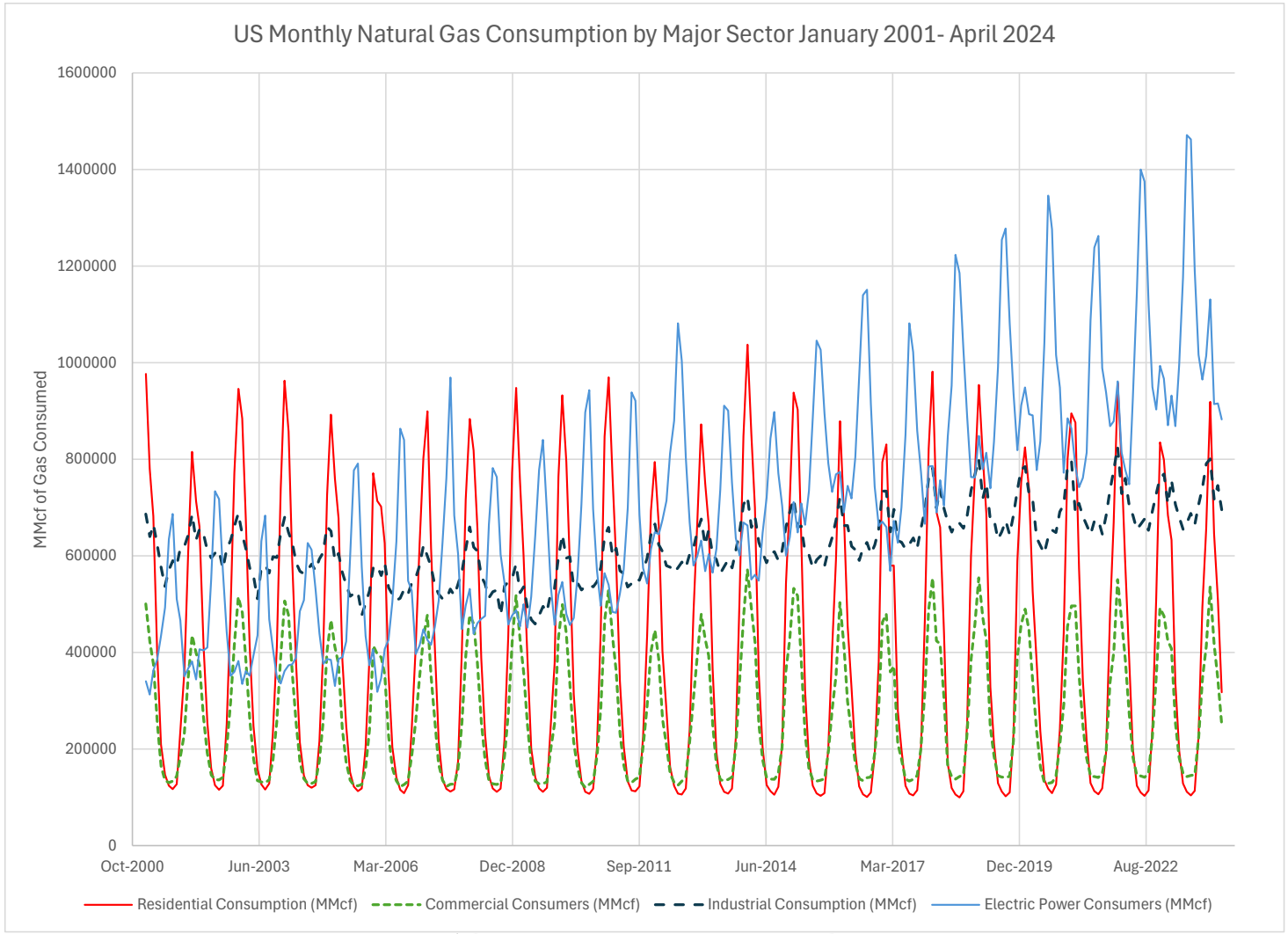


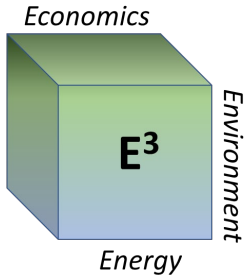
Annual Percentage of Natural Gas Consumption by Major Sector 1997-2003



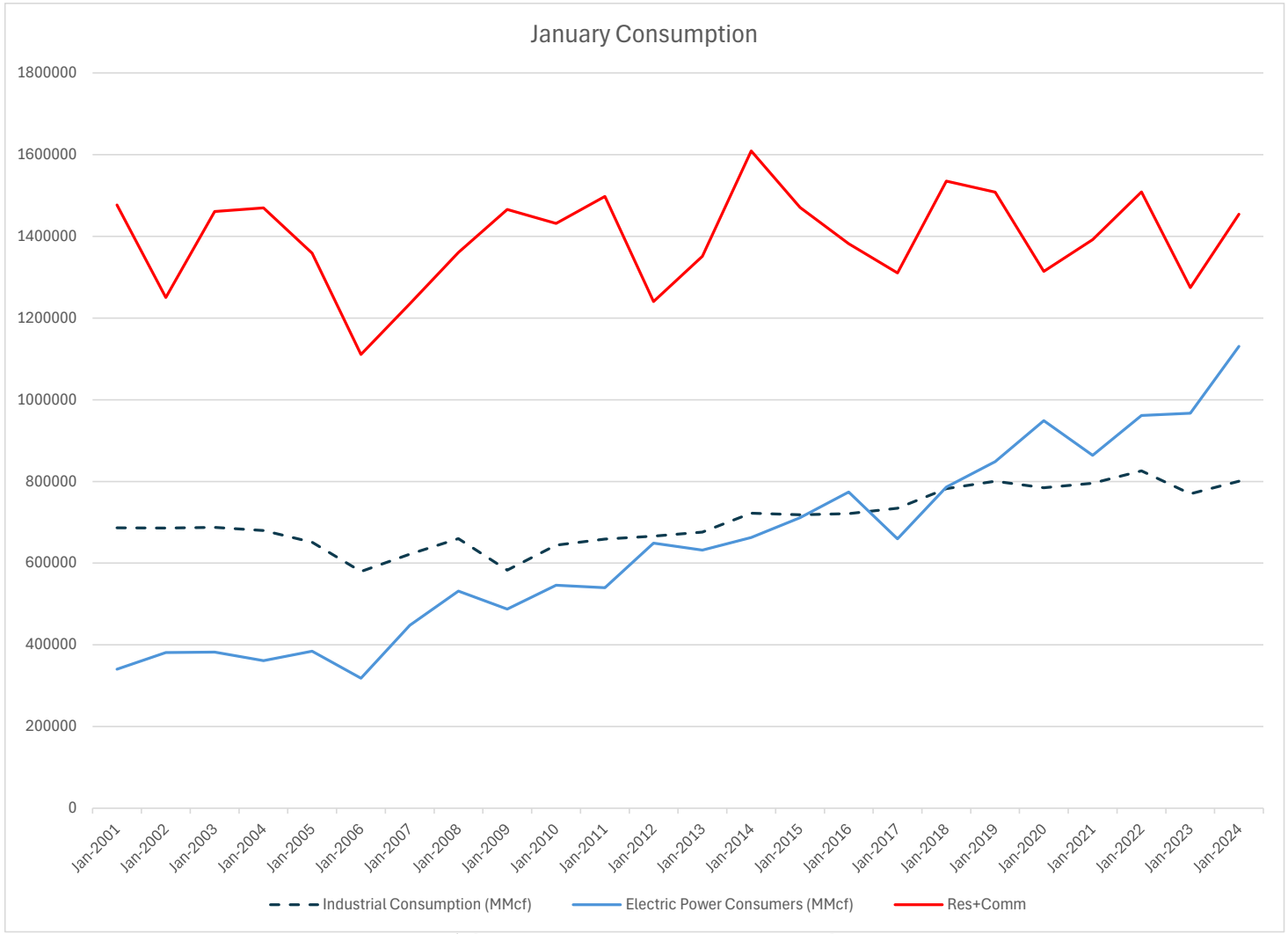


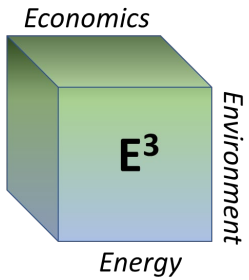
Monthly Natural Gas Consumption by Major Sector January 2021 to April 2024



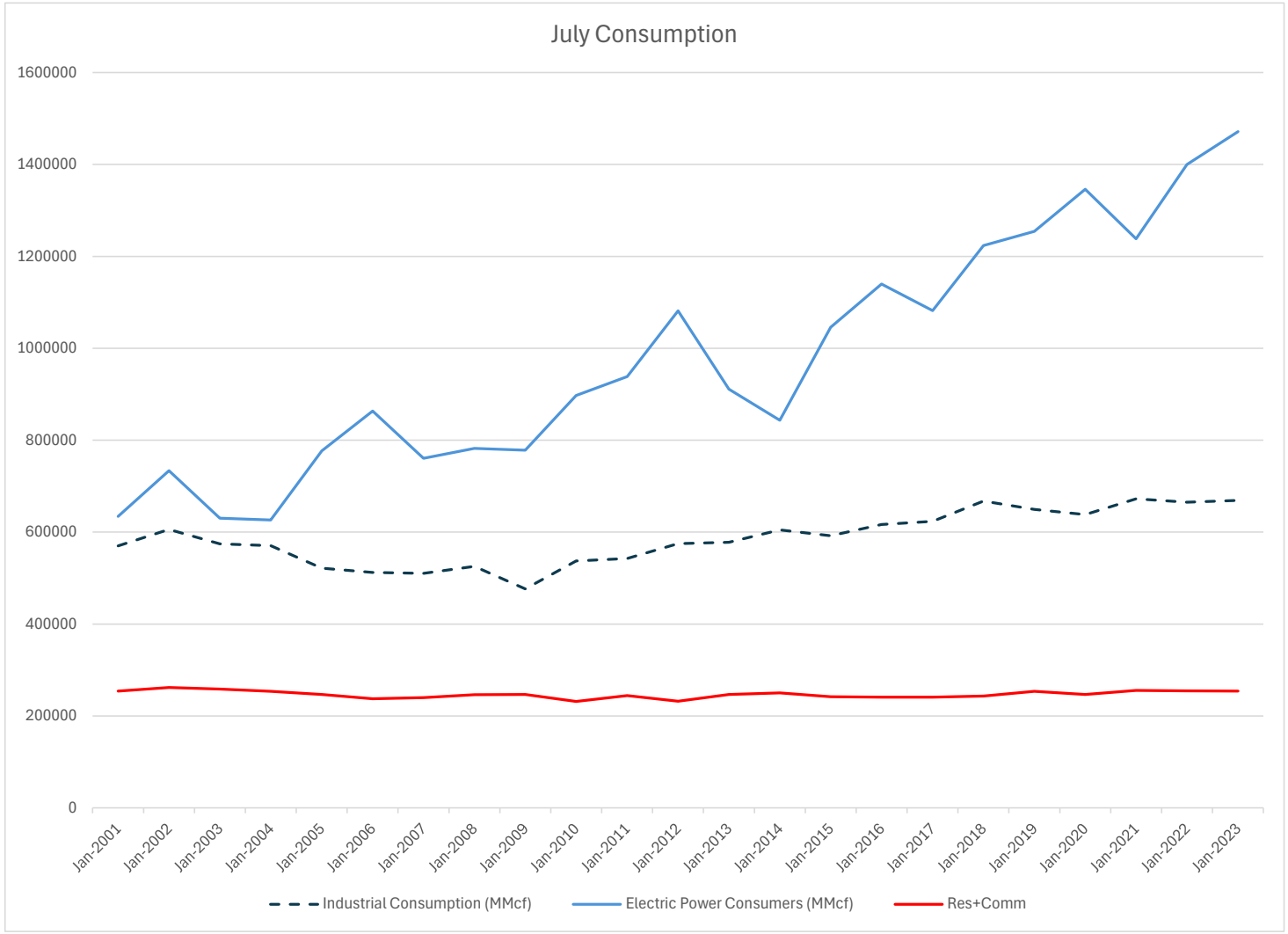


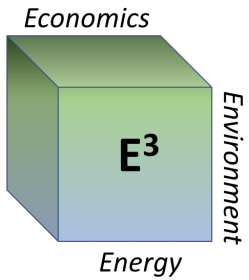
Comparison of January Natural Gas Consumption Across Major Sectors 2001-2024





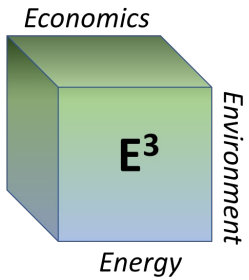
Comparison of July Natural Gas Consumption Across Major Sectors 2001-2023





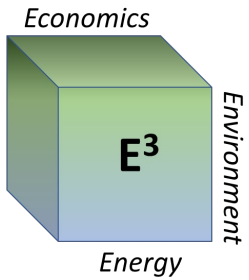
Key Observations

1. While the electric power industry has become the single largest sector for overall gas consumption at 40 percent, the more traditional residential, commercial and industrial customer base for which the natural gas pipelines system had been built out still retains a 60 percent share of the market and likely directly holds most of the firm transportation on the pipelines.
2. While the peak consumption of gas between the combined residential, commercial, and industrial sectors (winter heating loads) is countercyclical to consumption by power generation, the growth of consumption for power generation has increased by over 3 times in the past 23 years and is the driver of higher winter peak consumption over time.
3. Summer peak gas consumption for electric power generation has more than doubled in the past 23 years and is the largest contributor to the overall increase in peak summer usage that is approaching the winter peak levels seen in the early to mid 2000s.
4. Shoulder period (spring and fall) gas consumption has increased substantially over the past 23 years, and this also is due to the increased consumption of gas for power generation.

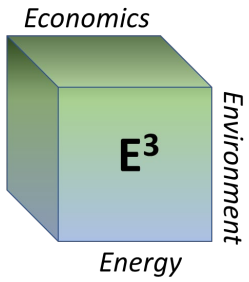


Implications for Power System Reliability

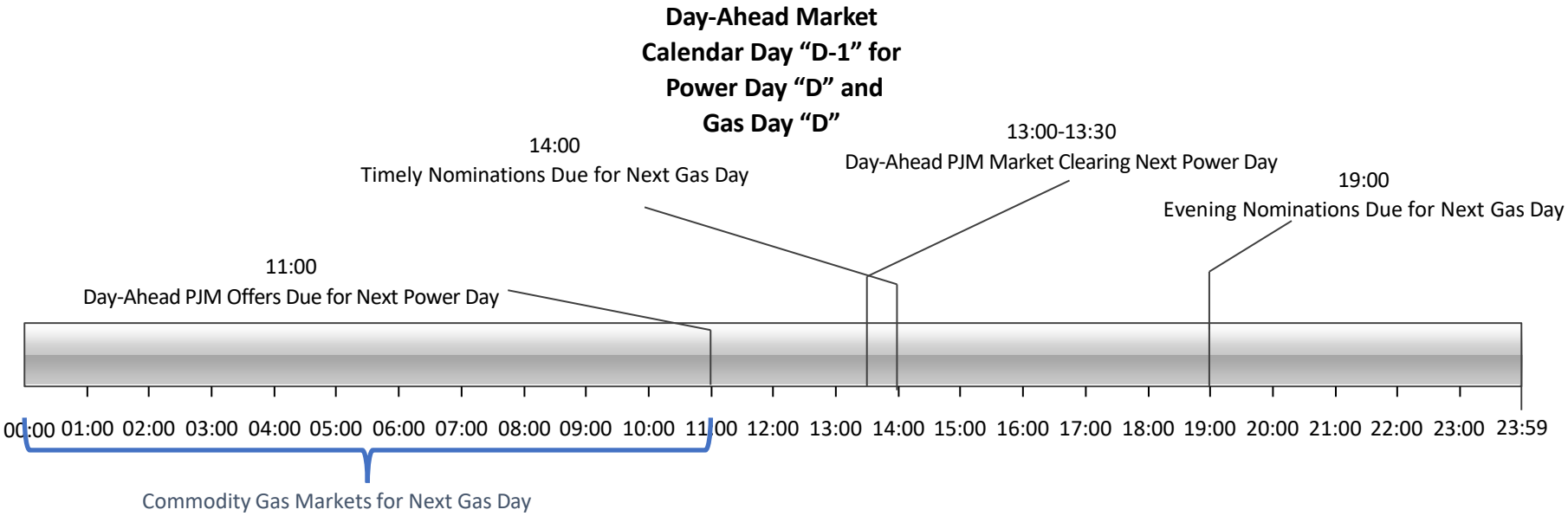
1. Winter peak seasons will become even more challenging operationally with increased competition for gas and the associated pipeline transportation in winter months over and above what has been observed to date.
2. Summer peak seasons and possibly shoulder periods of the spring and fall may become more operationally challenging as pipelines undertake maintenance in their systems outside of the winter peak season as gas demand increases during these periods.
3. As much as the power industry would like to drive changes in the gas industry, both with the gas market itself, and with pipelines, traditional customers still have an overall 60 percent share and are the more traditional customers for gas pipelines and the gas commodity on its own.

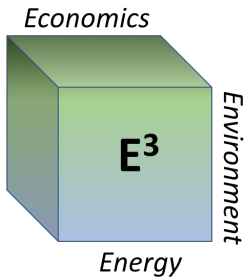


Operational Considerations Overview

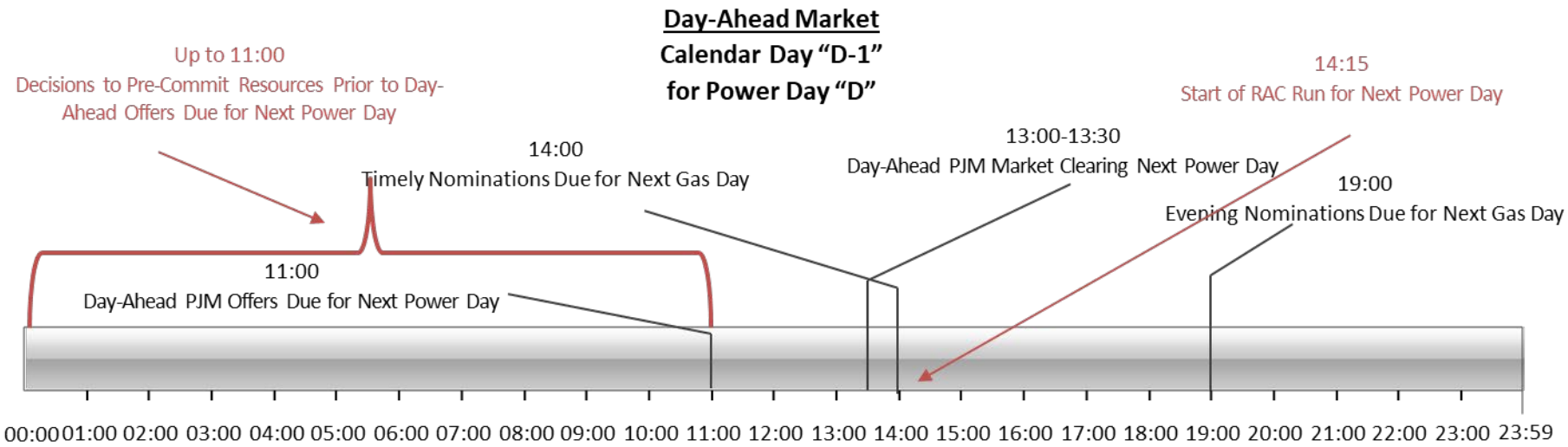


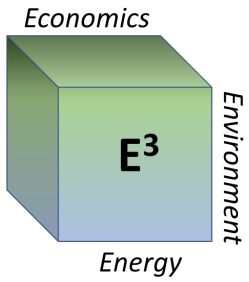
Day-Ahead Market and Gas Nomination Timing for Gas-Fired Generation Commitments



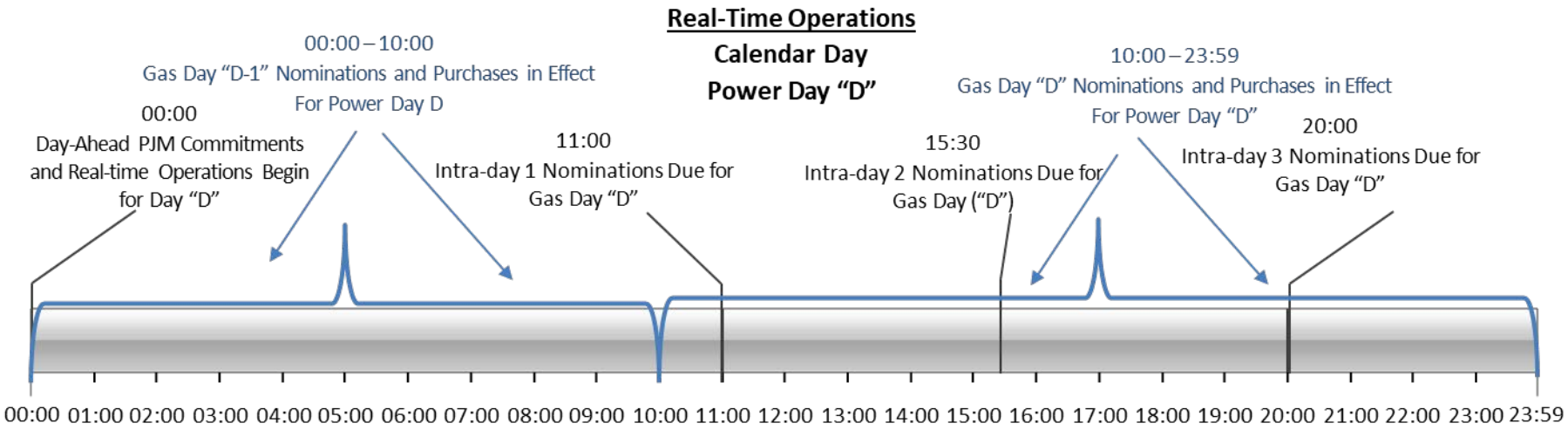


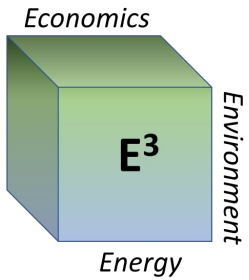
Timeline of DA Market Clearing, RAC Run, and Gas Nominations



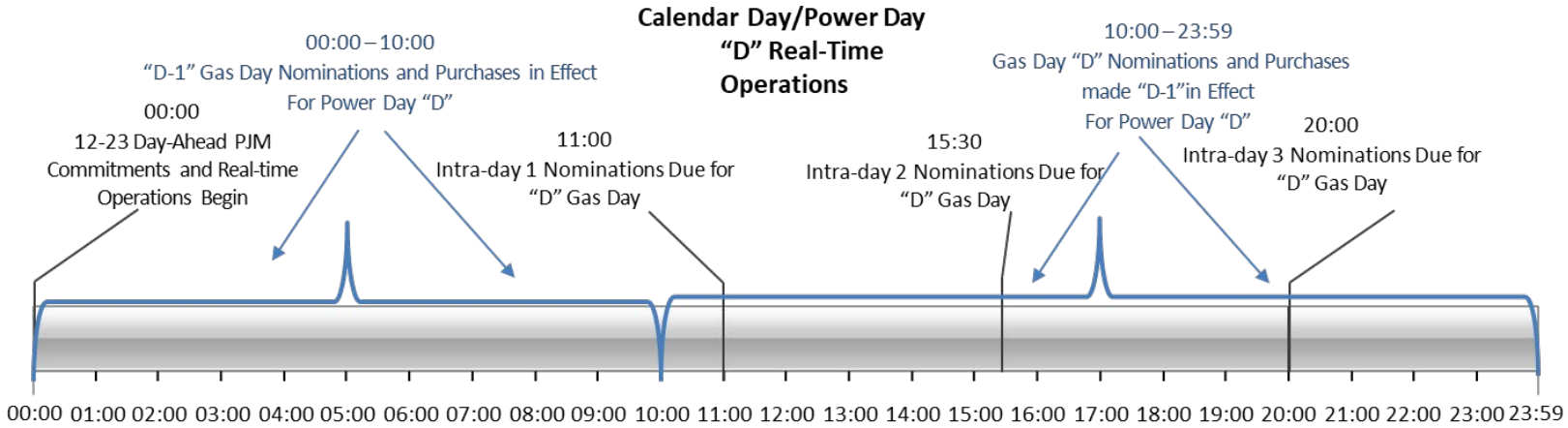


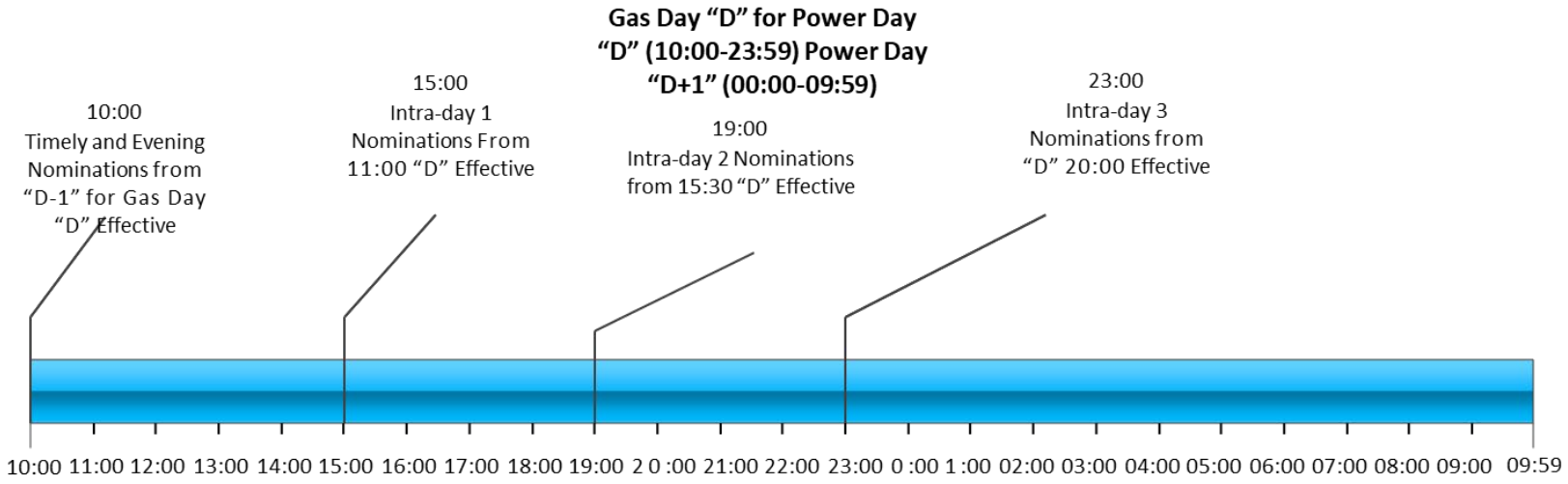
Timing of Gas Flows by Nomination Timing and Intra-Day Gas Pipeline Nomination Cycles in the Context of the PJM Operating Day.

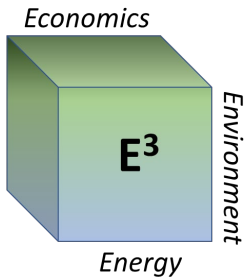




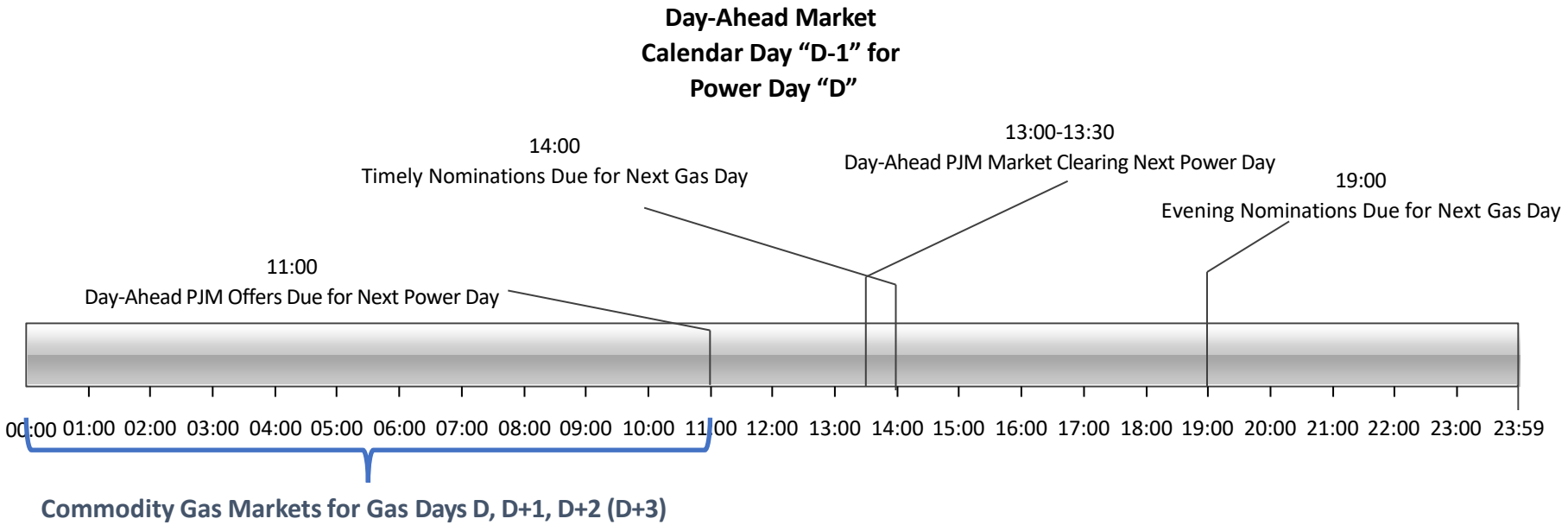
Overlap of PJM Operating Day with the Intra-day Gas Nomination and Flow Cycles



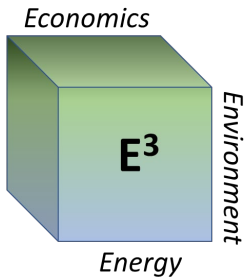




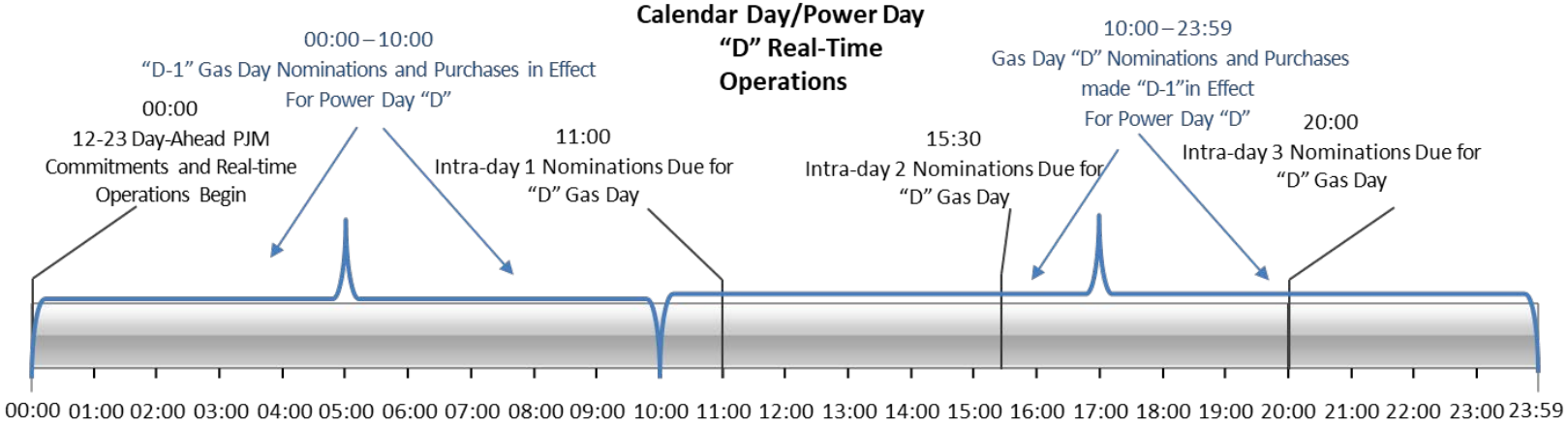
Day-Ahead Market and Gas Nomination Timing for Gas-Fired Generation Commitments for a Weekend (or Holiday Weekend)



The commodity gas market is unregulated (but for futures under CFTC oversight) and operates as marketers/traders wish to conduct business.

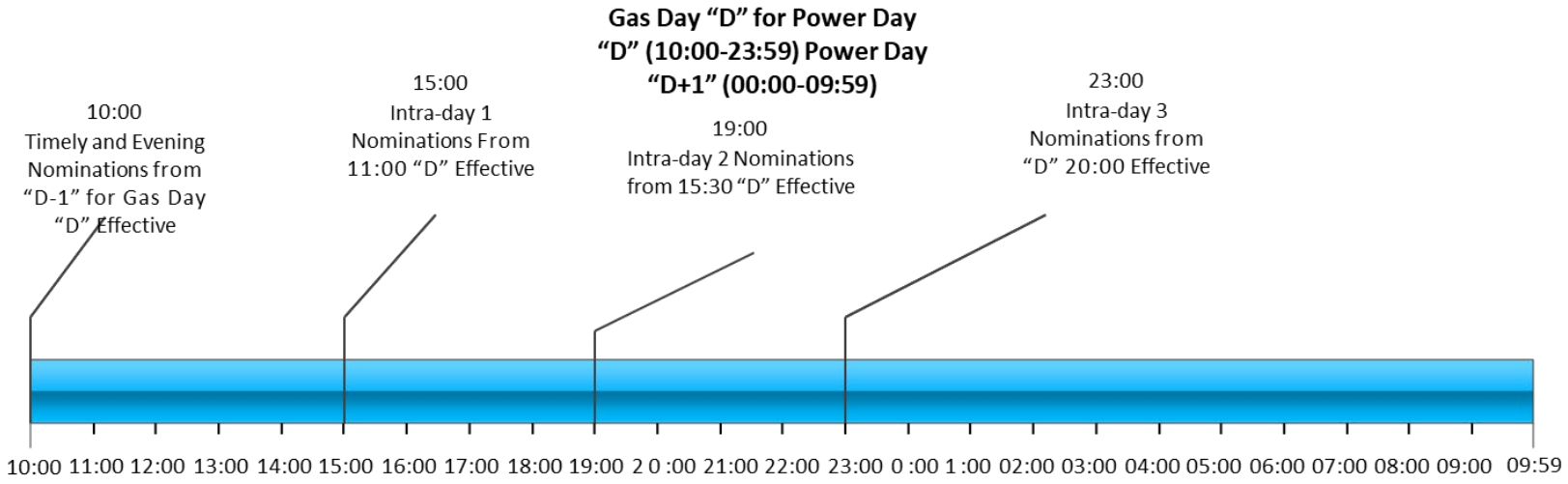


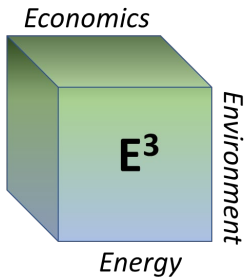
Overlap of PJM Operating Day with the Intra-day Gas Nomination and Flow Cycles…this does not change on a daily basis during weekends



Power markets remain on a daily cycle but gas costs are locked in for all weekend gas and power days.

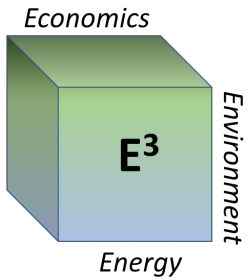
Gas nominations remain on a daily cycle despite commodity markets clearing for all weekend gas days.





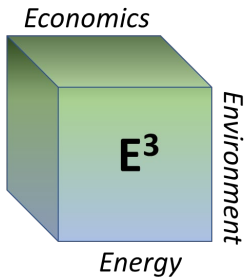
Realities and mismatch between Gas Pipeline and PJM Tariffs

1. While gas-fired generation can in theory start quickly, it must have gas purchased, nominated and flowing otherwise they may not be available when needed
   - Pipeline will only allow operations outside of nomination and flow times if pipeline conditions permit…but there is no set criteria in the FERC-approved Gas Pipeline Tariffs. The pipeline can enforce this at anytime.
2. PJM's default parameter limits in OA Schedule 1, Section 6.6 for cost-based offers fail to recognize the FERC Approved Gas Pipeline default unless a Capacity Market Seller asks for a Temporary Exception.



Realities and mismatch between Gas Pipeline and PJM Tariffs

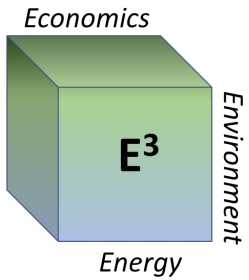
- This means committing gas-fired resources in accordance with the nomination and flow timelines and not assuming that gas fired resources can start immediately
- There are reliability implications for gas pipelines and other gas fired resources if gas units without purchased and nominated gas take gas off the pipeline…it can reduce pressures causing other gas-fired resources to trip which is the reason gas pipelines use Operational Flow Orders (OFOs)



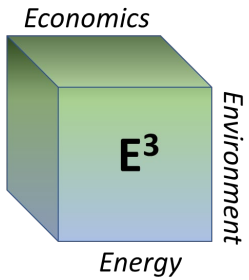
Market Implications

- Load forecast error and renewable output forecast error are observationally equivalent. As many RTOs have done this calls for a need for additional reserves that are available with access to gas immediately.
  - This is the entire point of the RCSTF.
  - There are services available from Gas Pipelines, but these are not free

- There are costs associated with reliability in the form of committing resources in advance and holding them in reserve, and these should be recognized and generators allowed to recover such costs.

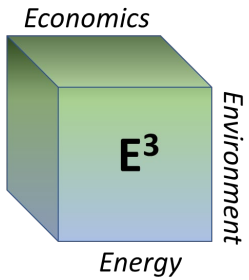


Implications for A World with Increasing Variable and Intermittent Resources



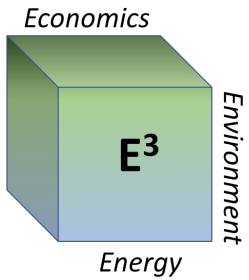
The Need for Additional Reserves for Ramping and Uncertainty Come at a Cost

- Gas-fired resources must be able to cover costs of nominating and having gas available to meet ramping events and net load forecast error.
- Gas pipelines offer services, at a cost, that must be considered in holding fast ramping gas resources to meet these challenges.
  - Park and Loan
  - Storage
  - Line pack
  - No-notice service
  - Costs for carrying gas imbalances on the pipeline
- The power industry (and system operators in particular) have become too comfortable with gas pipelines allowing, though they are not required to do so, gas resources to start up without commodity and nominations during much of the year

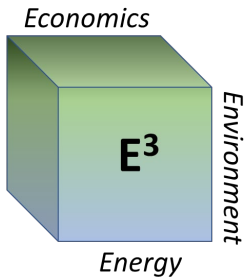


Market Rules and Designs will Need to Adapt to the Realities of the Gas Pipeline and Commodity Operations

- Allow for the costs of holding gas and paying for additional services to be reflected in reserve costs and pricing which has implications for energy market pricing with co-optimization of energy and ancillary services.
- Allow gas resources to reflect as a default the timing of gas nominations and flows in their operating parameters consistent with FERC approved gas tariffs
- In a sense, to meet the challenges of increasing variable and intermittent resources we will need to view gas-fired resources as needing to be “postured” to be ready to respond when needed in much the same way hydro resources are postured.

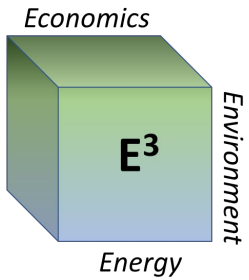


Pipeline Services that Can Aid in Ensuring Gas Resources Can Provide Reserves



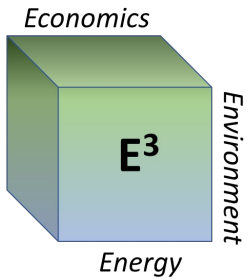
Park and Loan

- Interruptible only service that can used if pipeline conditions permit
- Allows a shipper to “park” gas in the form of buying gas and not burning it until a later time
- Allows a shipper to “borrow” gas in the form of taking gas and burning it to replace at a later time.
- Rates are in addition to the commodity gas prices in $/Dth ($/mmBtu).
- Park and loan services are currently permitted in a cost-based offer.



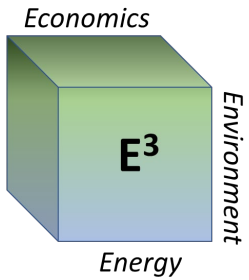
Park and Loan to Facilitate Reserves

- What is the value if it is only interruptible?
- Parking scenario:
  - Buy gas and park it. Pay for the gas plus the parking service.
  - How much gas to buy for how long a run?
  - Parking rates are about $0.40/Dth…for a 10 mmBtu/MWh CT this adds the cost of gas plus $4.00 to ensure reserves.
- Loan scenario:
  - Buy service and only take the gas when called upon?
  - What happens if the pipeline cannot deliver on gas after this has been done?
  - This is “lower cost” but is it as secure?



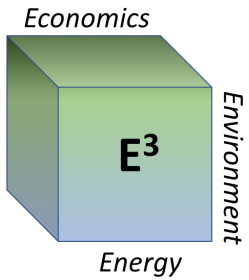
Tariff Balancing Services and Operational Balancing Agreements (OBAs)

- Tariff balancing services are interruptible only service that can used if pipeline conditions permit
- Allows a shipper to take more or less gas than nominated up to a contracted quantity of “balancing service”
- Rates are in addition to the commodity gas prices in $/Dth ($/mmBtu).
  - Can consist of multiple parts
  - Can allow for authorized “overruns” beyond balancing quantities.
- Tariff balancing services are currently permitted in a cost-based offer.
- OBAs are specific arrangements between the pipeline and shipper
  - Manual 15 and OA Schedule 2 or the OA are silent on the treatment of OBAs.



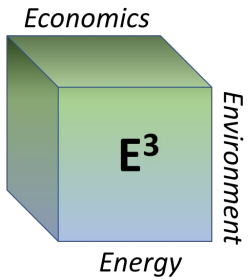
Tariff Balancing Services and Operational Balancing Agreements (OBAs) to Facilitate Reserves

- Rates depend on pipeline
  - For example, on ANR the costs in ML-7 add up to about $0.30/Dth not accounting for any overruns.
  - If overruns are incurred it is another $0.3899/Dth on ANR
- Not all pipelines offer specific tariff balancing services but rather lump it all into park and loan



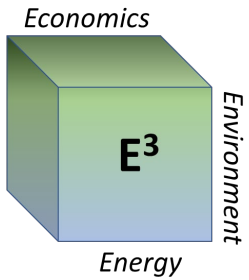
No Notice or “short-notice” Services

- Can be a “separate service” or embedded within a form of transportation service.
- As a separate service I needs to be paired with another service
  - For example, on ANR it must be paired with Firm Storage Service.
  - The reservation charge is the majority of costs



No Notice Services to Facilitate Reserves

- Question for separate NNS is how this can be accounted for in an energy or reserve offer?
  - How to allocate over time?
  - Technically this is not needed for capacity, it needs to be in energy or reserves.
- If paired with storage then what?
  - What is the basis cost of gas to be used if called upon?
  - What about counting the costs of storage reservations? How to allocate over time.
- What if no-notice is embedded in Firm Transportation service?
  - What part of reservation charge is for “Capacity”?
  - What part is for providing reserves needed by the system?



Concluding Thoughts

- The costs of gas pipeline services and any associated gas costs need to be included in the cost of providing reserves
- These costs are real, and power systems cannot expect these services will be provided at a zero cost
- There are clear mismatches in the FERC Gas Pipeline Tariffs and the PJM Tariff and Operating agreement that need to be rectified.