# Stranded Fossil Fuel Infrastructure

## HOW BIG IS THE STRANDED ASSET PROBLEM, AND WHAT SHOULD WE DO ABOUT IT?


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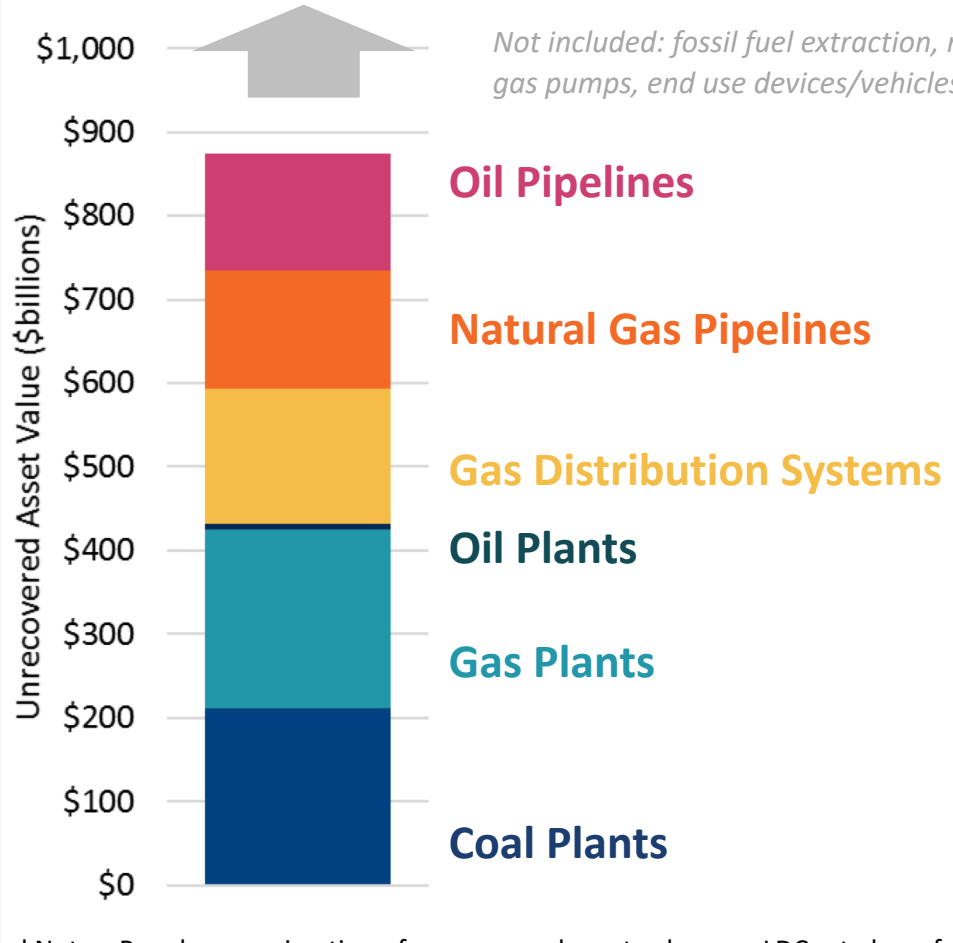
# How big is the stranded asset problem?

**Thought Experiment:**
Some $900 billion in US major fossil fuel infrastructure investments have not yet recovered investment costs

What happens when the US *really* moves on a green economy?

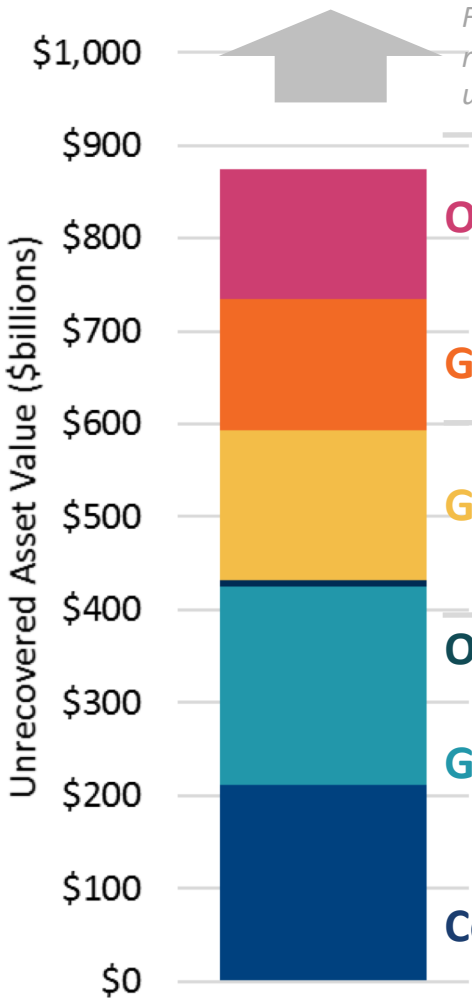
## Approximate Unrecovered Investment Costs In Fossil Fuel Infrastructure




Sources and Notes: Rough approximation of unrecovered asset value, gas LDC rate base from SNL rate cases; pipeline rate base from FERC Form 6; approximate generator unrecovered asset value based on approximate plant costs and remaining life.

# And what happens when fossil infrastructure becomes stranded?

| Fossil Infrastructure | Who pays? | What's to be done about it? |
|---|---|---|
| *Fossil fuel extraction, refining, gas pumps, end use devices/vehicles…* | **Investors** | Reposition for the green economy (or go out of business) |
| **Oil Pipelines**<br>**Gas Pipelines** | **Pipeline Owners & Shippers** | Up to a point: Re-negotiate or file for higher rates, cut operating costs<br><br>When shipping volumes drop too low: shutter pipelines & investors absorb remaining costs |
| **Gas Distribution** | **Notionally: Gas Ratepayers**<br>*(But this is not sustainable as the only answer…)* | New policy framework is badly needed |
| **Oil Plants**<br>**Gas Plants**<br>**Coal Plants** | **Regulated Assets: Electricity Ratepayers** | Limit going-forward spend on potentially stranded assets (existing and new). New cost recovery strategies for accelerated retirements |
| | **Merchant Assets: Investors** | Investors: Reposition for the green economy<br><br>Markets: Catch up to policy & customer demand for green energy |



# Gas Distribution Systems

## How to address stranded LDC costs in states aiming to cut gas consumption by 80%?

Potential strategies that may emerge:

- New phase of integrated planning for efficiency, electrification retrofits, and safe gas system decommissioning
- Moratorium/ban on new gas expansions or customer connections
- Utilize incentives and strategies such as gas demand response to limit cost of infrastructure expansion
- Some possibility of gas system repurposing (but electrification looks to be more feasible and cost-competitive for some time)
- Cost recovery reforms including accelerated depreciation and recovery across smaller sales volumes
  - But there is a limit: the last 20% of gas customers cannot be asked to pay all of these costs, especially if the last remaining gas customers are low-income. Cost recovery may have to be partially funded through public investment and/or electricity rates

### STATES & CITIES RETHINKING GAS

| | State-Wide | City | | | |
|---|---|---|---|---|---|
| State | Proceeding on Future Role of Natural Gas | Proposed Gas Bans | Enacted Gas Bans | Enacted Moratoriums | Electrification Reach Codes |
| California | ✓ | | ✓ | | ✓ |
| Oregon | ✓ | | ✓ | | |
| Washington | ✓ | ✓ | ✓ | | |
| New York | ✓ | | | ✓ | ✓ |
| Massachusetts | ✓ | ✓ | ✓ | | |
| Colorado | ✓ | ✓ | | | ✓ |

Note: Massachusetts gas ban struck down by state's Attorney General in July 2020.

# 40% of the coal fleet is already retiring

## Addressing massive stranded coal asset problem is well underway…

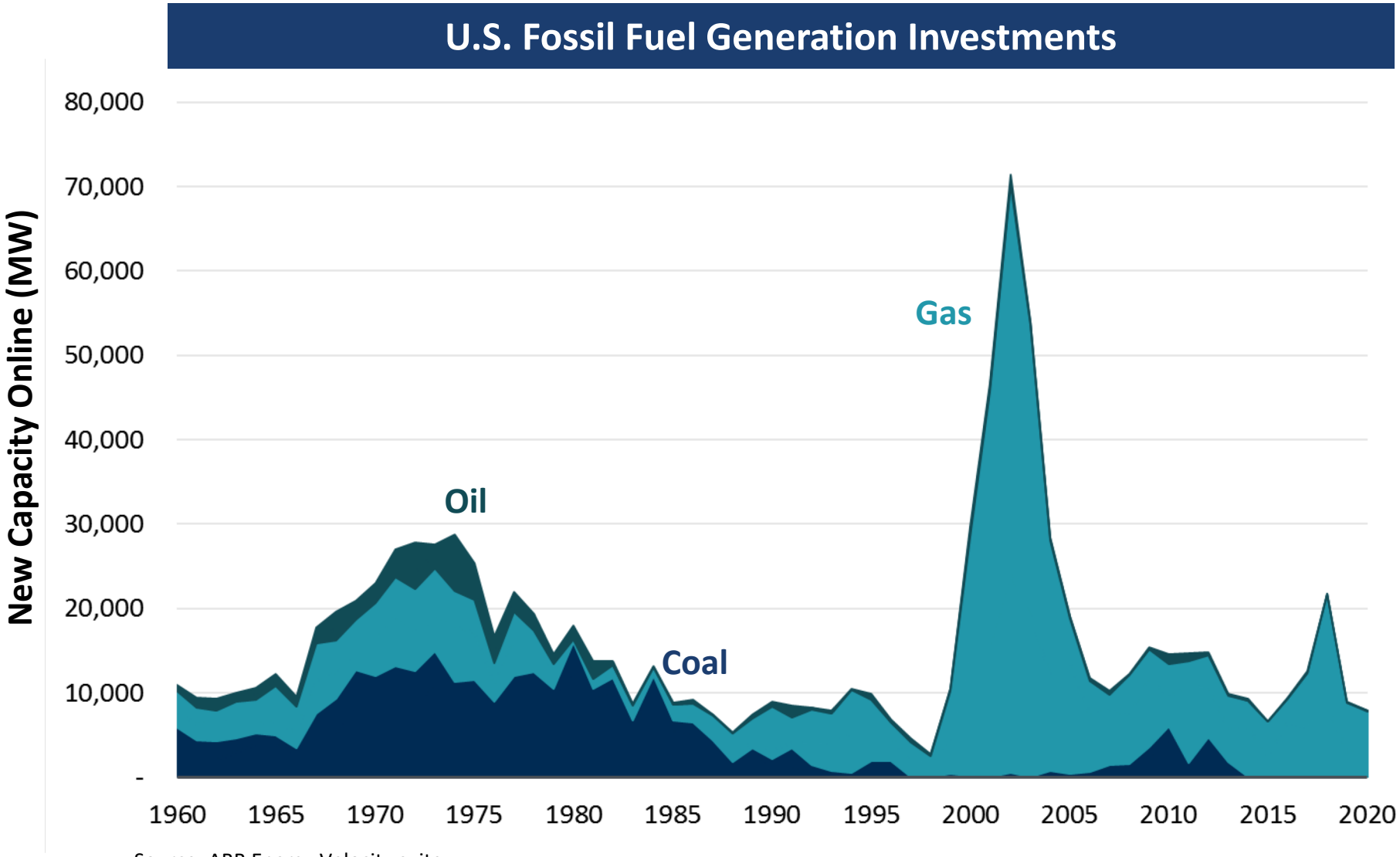
- Many coal assets are more costly to maintain/retrofit than building new renewables or gas
- Since 2011, 87 GW of coal has already retired, and another 33 GW is announced to retire by 2025
- **Regulated Coal Plants:** Customers pay the stranded asset costs (but costs are partly mitigated by early retirement)
- **Merchant Coal Plants:** Investors must absorb cost and reposition themselves

**PRIMARY REGULATORY TREATMENT OF UNDEPRECIATED COAL ASSETS**

| Treatment | Description | No. of cases, 2010-2020 | |
|---|---|---|---|
| Regulatory asset | Plant is retired, and utility continues to receive return on and of investment; takes effect upon retirement | 20 | Rate based |
| Accelerated depreciation | Plant's depreciation schedule is changed to match the period until retirement; put in place in anticipation of retirement | 7 | Rate based |
| Securitization | Recovery of stranded assets through ratepayer-backed bonds with low interest rates | 3 | Not rate based |
| Partial Disallowance | Part of the undepreciated cost or return on that balance is removed | 2 | Not rate based |

Compiled by Dr. Metin Celebi, The Brattle Group.

# …but what if the gas plants become uneconomic?




Source: ABB Energy Velocity suite.

# Are merchant markets the answer (or are they making things worse)?

**Audience Poll: Why did investors sink $5 billion into new gas plants?**

*Multiple choice:*

A. Gas plants are just that cheap
B. It made sense 2 years ago
C. Investors don't believe in the green energy future
D. Dumb money
E. The market's broken
F. The market's working
G. All of the above

## Case Study: Last Week's PJM Capacity Auction

### CAPACITY PRICES ($/MW-DAY)

| Rest of RTO | MAAC |
|---|---|
| $50.00 | $95.79 |

**Compare to CC Net CONE**
$24-170/MW-day depending on location

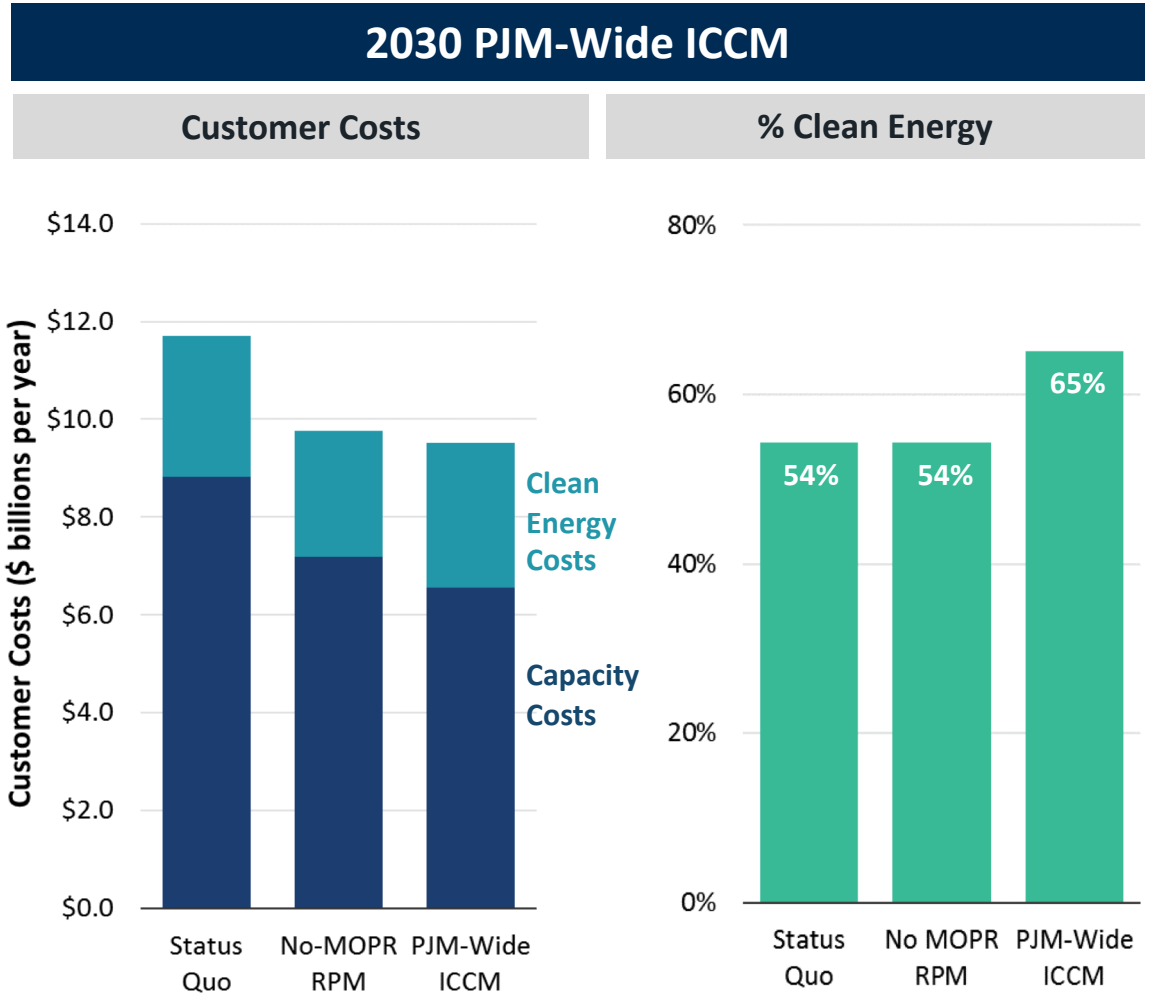
### NEW GAS PLANT INVESTMENTS (ICAP MW)

| Delivery Year | CT/GT | Combined Cycle |
|---|---|---|
| 2015/2016 | 1,382.5 | 5,914.5 |
| 2016/2017 | 171.1 | 4,994.5 |
| 2017/2018 | 131.0 | 5,010.0 |
| 2018/2019 | 1,032.5 | 2,352.3 |
| 2019/2020 | 167.0 | 6,145.0 |
| 2020/2021 | | 2,410.0 |
| 2021/2022 | | |
| 2022/2023 | 14.0 | 5,626.8 |

Source: PJM 2022/23 BRA results & parameters.

# Next generation of competitive wholesale markets can reflect policy & consumer demand for a green electricity supply

- Primary options include enhanced carbon pricing, forward clean energy market (FCEM), and integrated clean capacity market (ICCM)
- All of these options would shift investment signals away from fossil plants, toward attracting/retaining clean energy
- Maintaining/expanding merchant business model into green energy investments limits consumers' exposure if some assets become uneconomic




Note: Preliminary results subject to change with finalized study assumptions; comprehensive analysis will be posted within the NJ BPU Resource Adequacy Docket.

# Thoughts on next steps:

- **Private investments:** Reposition for the green economy
- **Policy changes for rate-regulated assets:**
  - Limit additional spending on potentially stranded generation and gas distribution assets (some investments are unavoidable to maintain reliability and public safety)
  - Rethink cost recovery for gas distribution systems considering equity and total energy burden, may require shifting some cost recovery to public sector or electricity ratepayers
  - Expand the role of competitive investments to drive clean energy transition
- **Next phase of market design:**
  - Reflect consumer and policymaker demand for clean energy transition into wholesale markets (carbon pricing, competitive clean energy markets)
  - Modernize competitive retail markets to truly enable new technologies, business models, and consumer-oriented services (including electrification, vehicle-to-grid services, flexible customers, distributed resources)
  - Remove barriers to entry for emerging technologies and business models

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Dr. Kathleen Spees is a Principal at The Brattle Group with expertise in designing and analyzing wholesale electric markets and environmental policies. Dr. Spees has worked with market operators, transmission system operators, and regulators in more than a dozen jurisdictions globally to improve their market designs for capacity investments, scarcity and surplus event pricing, ancillary services, renewable integration, and enabling new technologies. She has worked with U.S. and international regulators to design and evaluate policy alternatives for achieving electricity sector and economy-wide decarbonization objectives reliably and affordably. She conducts advanced modeling analyses of wholesale power markets in the context of the future clean grid to support clients in making investment decisions, designing policies, and refining wholesale electricity market designs.

Dr. Spees earned her PhD in Engineering and Public Policy within the Carnegie Mellon Electricity Industry Center and her MS in Electrical and Computer Engineering from Carnegie Mellon University. She earned her BS in Physics and Mechanical Engineering from Iowa State University.