

Giving the Customer a Faster Horse

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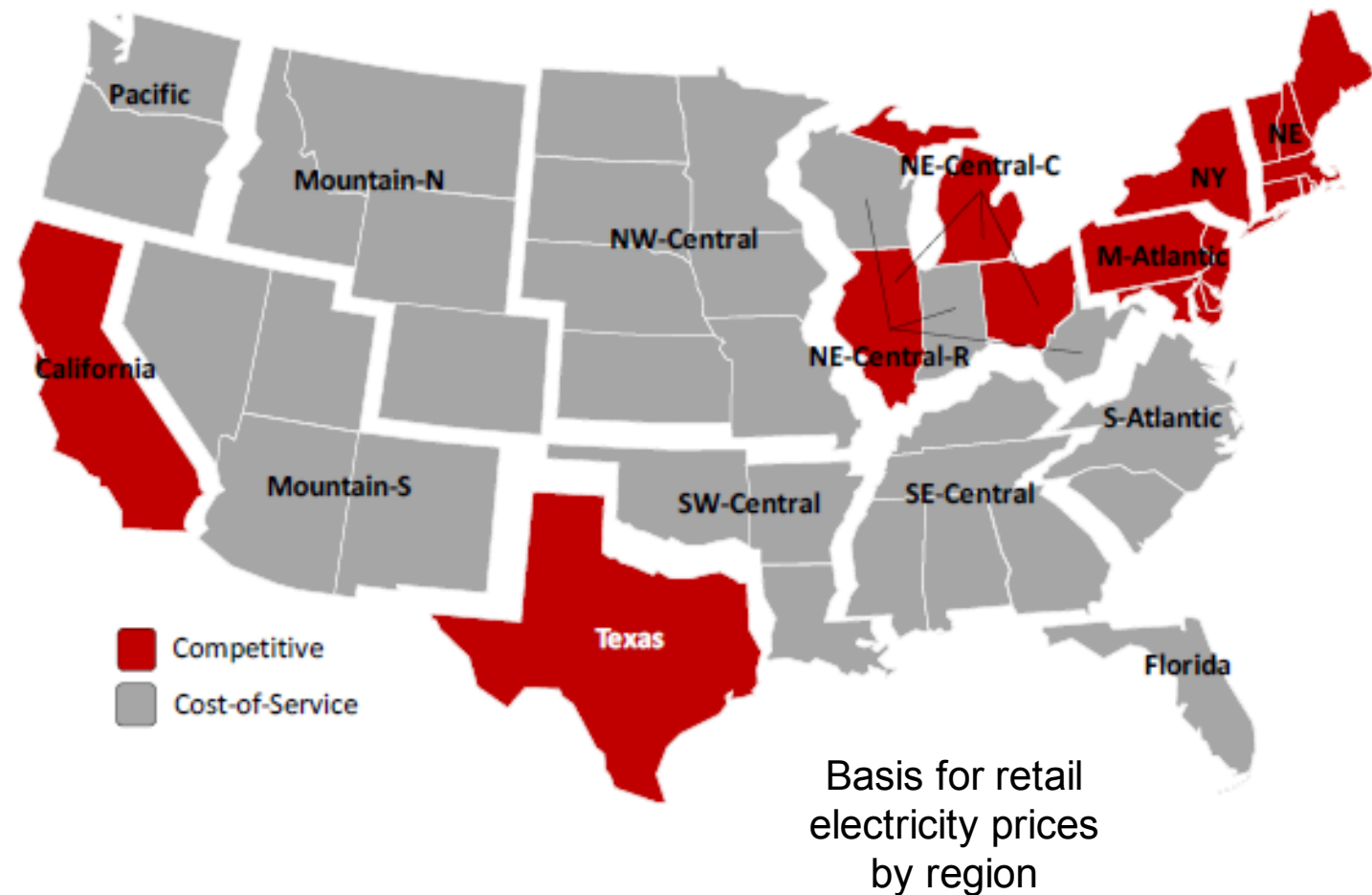
Innovation and The Infamous “Faster Horse” Quote*

- Popular Steve Jobs quote on market research:
 - *Some people say give the customers what they want, but that's not my approach. Our job is to figure out what they're going to want before they do. I think Henry Ford once said, 'If I'd ask customers what they wanted, they would've told me a faster horse.' People don't know what they want until you show it to them. That's why I never rely on market research. Our task is to read things that are not yet on the page.*
 - Caveat #1: There is no evidence that Henry Ford ever said this.
 - Caveat #2: Always interpret quotes from the internet with caution.
- Lyft’s Design VP Katie Dill interpretation in April 19, 2019 Business Insider article:
 - *I agree with the sentiment that we can't just ask for what customers want; they don't always know how to articulate it. But I am a firm believer in the power of understanding our community. I'm a firm believer in the power of user research and qualitative insight gathering.*
- Observation from Matt Blumberg in *Startup CEO* (Wiley, 2013):
 - *Ford’s customers didn’t say that they wanted a “safer” horse or a “more comfortable” horse. They said that they wanted a faster horse. They were perfectly clear about what they wanted: speed*

*Inspiration from Bob Gilbreath’s Medium.com analysis: *That Steve Jobs Research Quote Should RIP*, April 24, 2016.

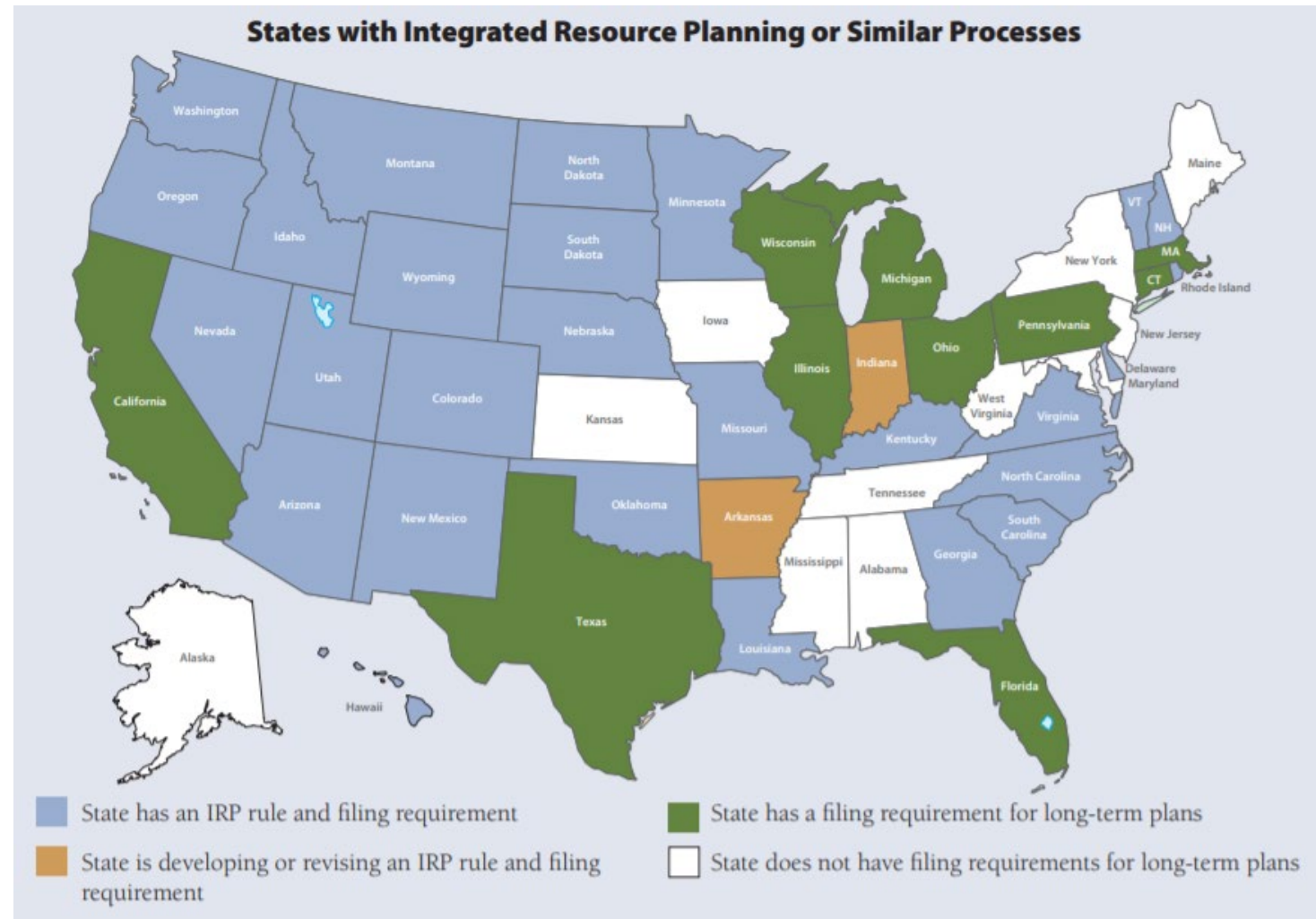
Utilities as a Target Customer Cohort for Fusion

- **One size does NOT fit all**
- US electric utilities are an extremely diverse group
 - Large vs. small
 - Investor-owned vs. public vs. electric cooperatives
 - Regulated vs. de-regulated
 - Vertically integrated
 - Non-operator nuclear owners
- Policies are generally set at the state level
- Markets and grids operate on a regional basis
 - 3 mainland grids: Western, Eastern, and Texas Interconnects
 - 7 wholesale power markets
- Regulation at all levels



What Drives Large Capital Investment by Utilities?

- Integrated resource plans (IRPs) describe utility resource needs to meet expected electricity demand
 - 10-20 year planning horizons
 - updated every 2-3 years
- Most states in US require some form of long-range planning, incl. formal IRPs
 - resource additions and retirements
 - cost and performance assumptions

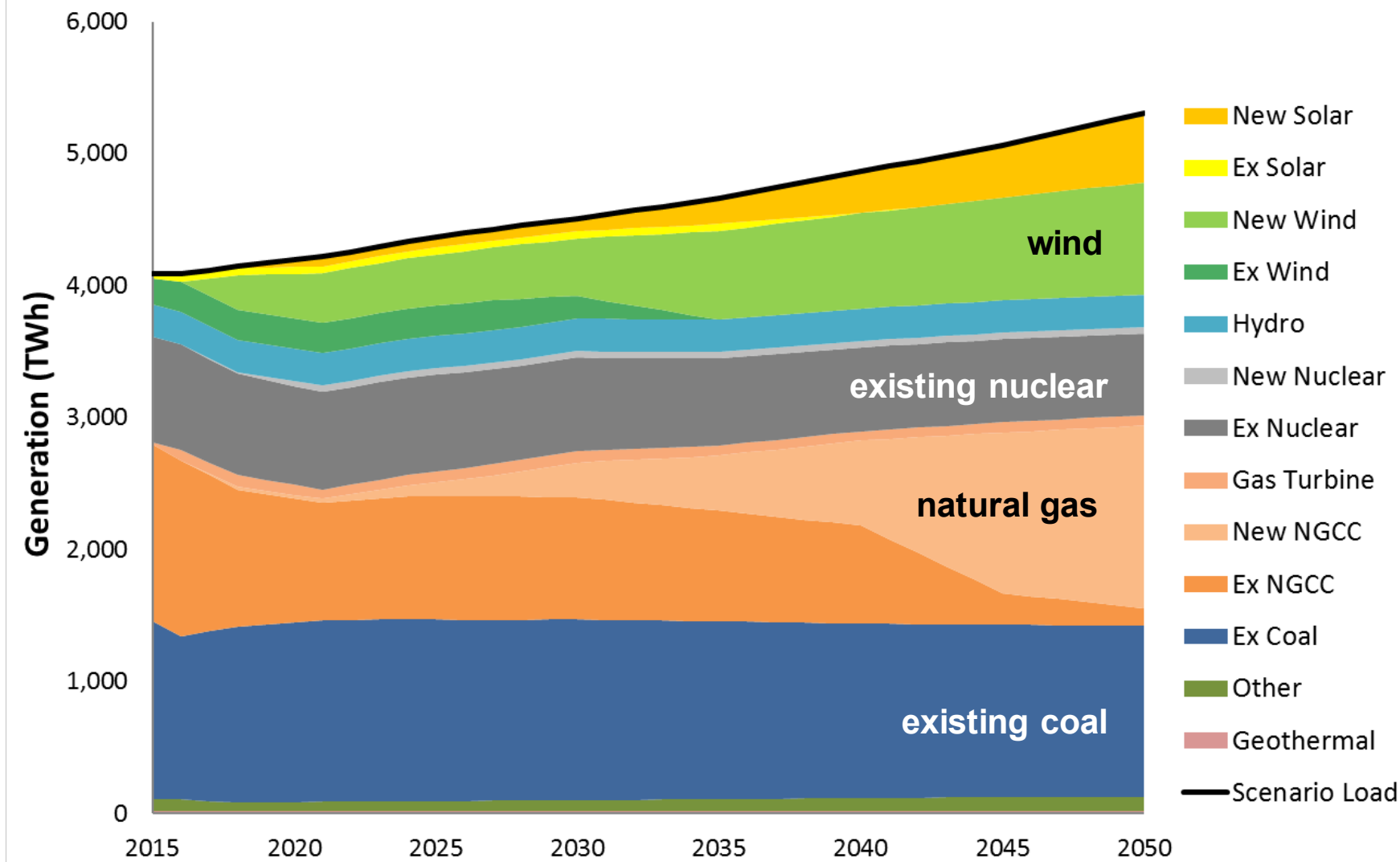


Graphic source: R. Wilson and B. Biewald. Best Practices in Electric Utility Integrated Resource Planning. Regulatory Assistance Project. June 2013.

<https://www.raonline.org/wp-content/uploads/2016/05/rapsynapse-wilsonbiewald-bestpracticesinirp-2013-jun-21.pdf>

Default Picture: Limited Competitiveness of High-Cost Generation in U.S. Without Durable Policy, Market and Cost Drivers

Reference Policies, Reference Gas Prices, No Policy Change, \$5000/kWe New Generation (nuclear here)

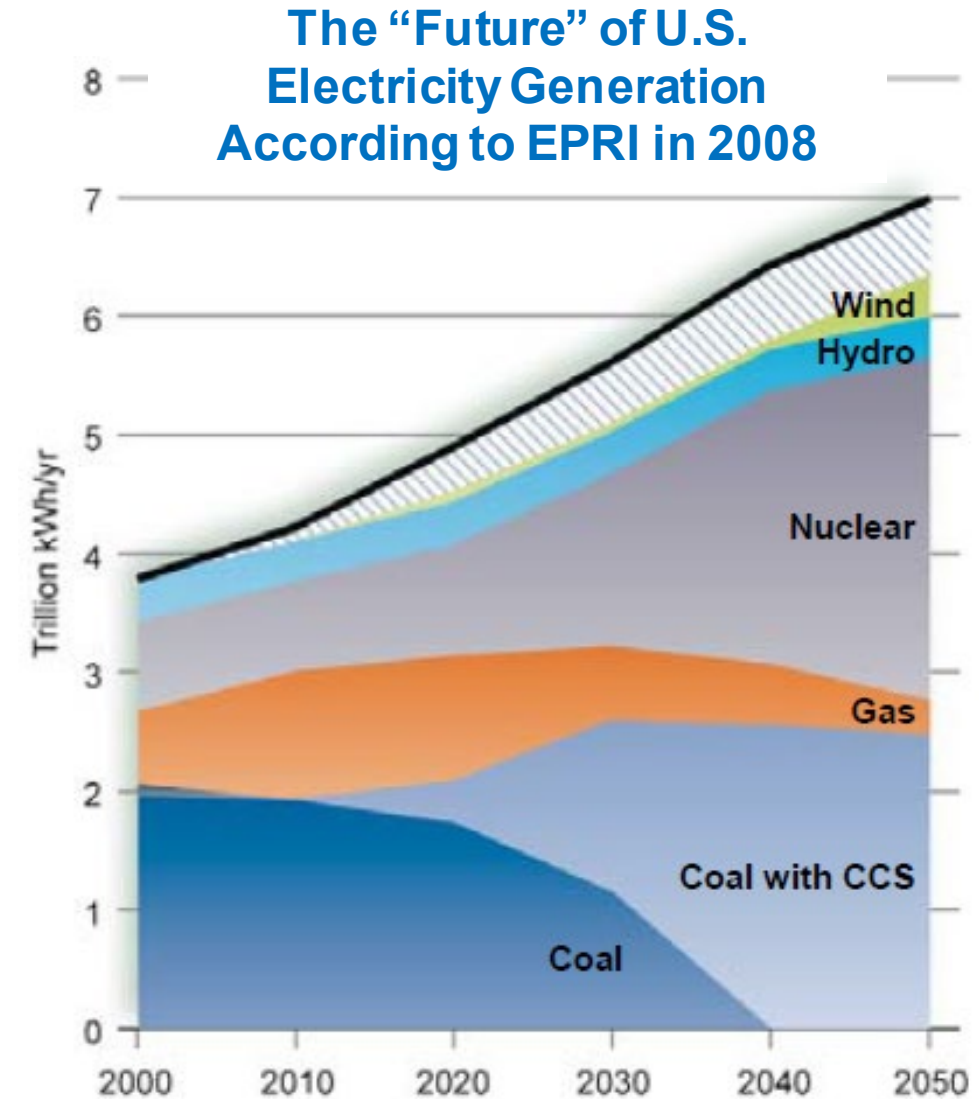


Absent policy, other drivers...

- Natural gas dominates, filling load gap from nuclear retirements and increased demand
- Renewables also fail to penetrate regions with low gas prices

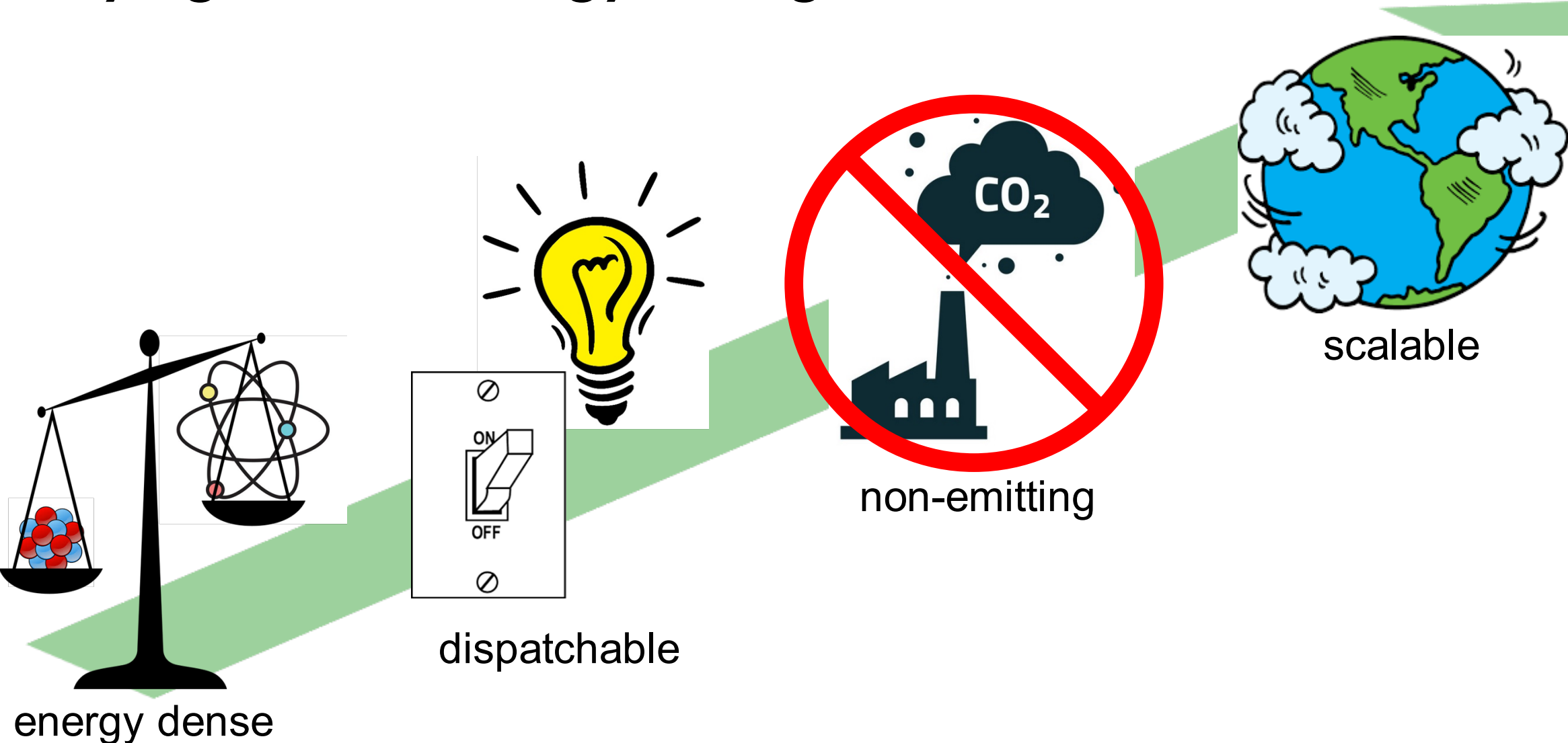
Uncertainty as a Key Obstacle...and a Driver

- What will the price of natural gas be?
- What will the price of carbon be?
- What will the technology competition be?
OR what technology won't be ready?
 - Natural gas with CCS?
 - Renewables with grid-scale energy storage?
- What will be the next shale gas revolution?
 - *Unknown unknowns are usually the disruptors.*



EPRI 2008. The Power to Reduce CO2 Emissions: The Full Portfolio.

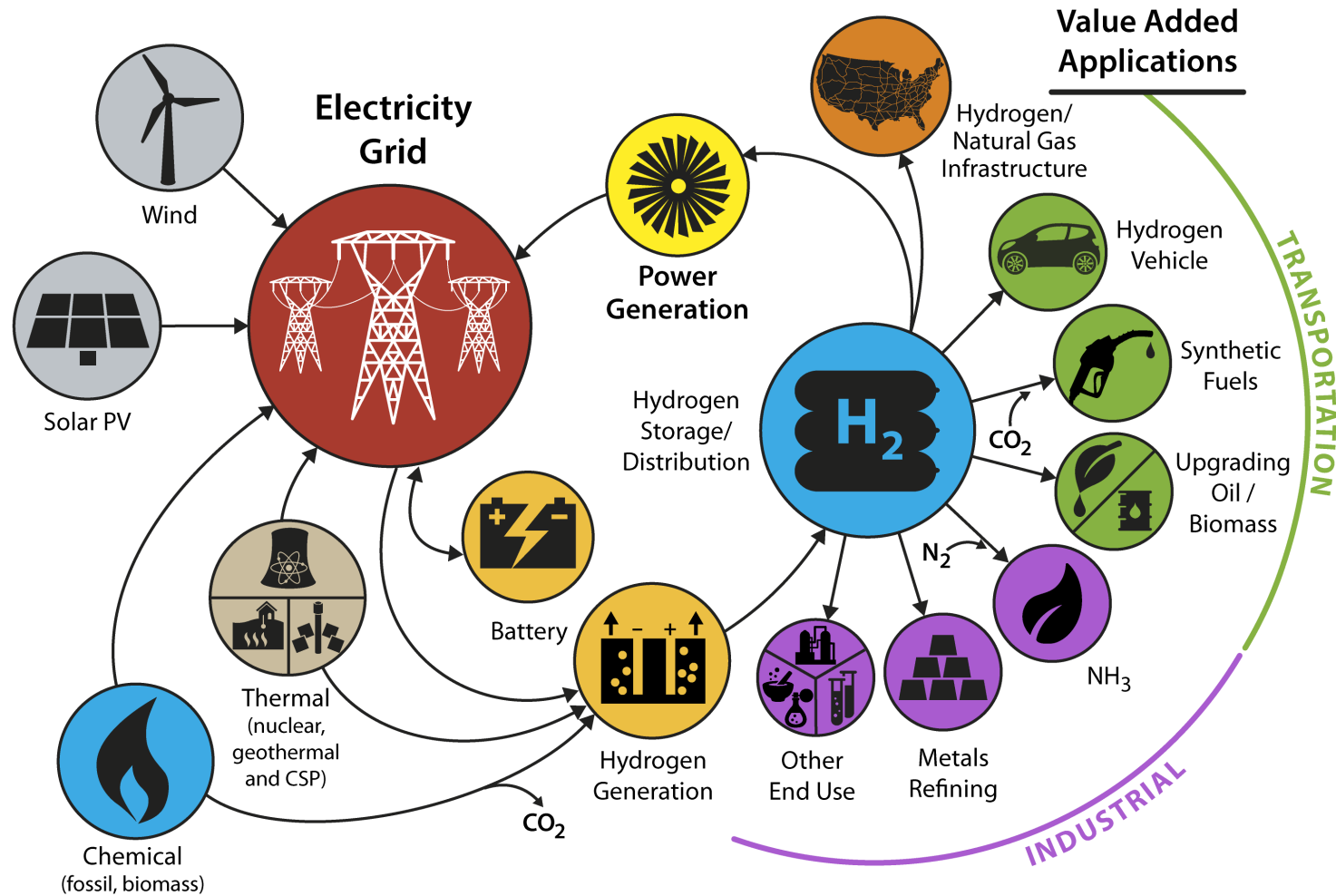
Playing to Technology Strengths



Four fundamental attributes fusion (and fission) uniquely offer in one package

Market Transformation from Hydrogen

The Other Energy Carrier

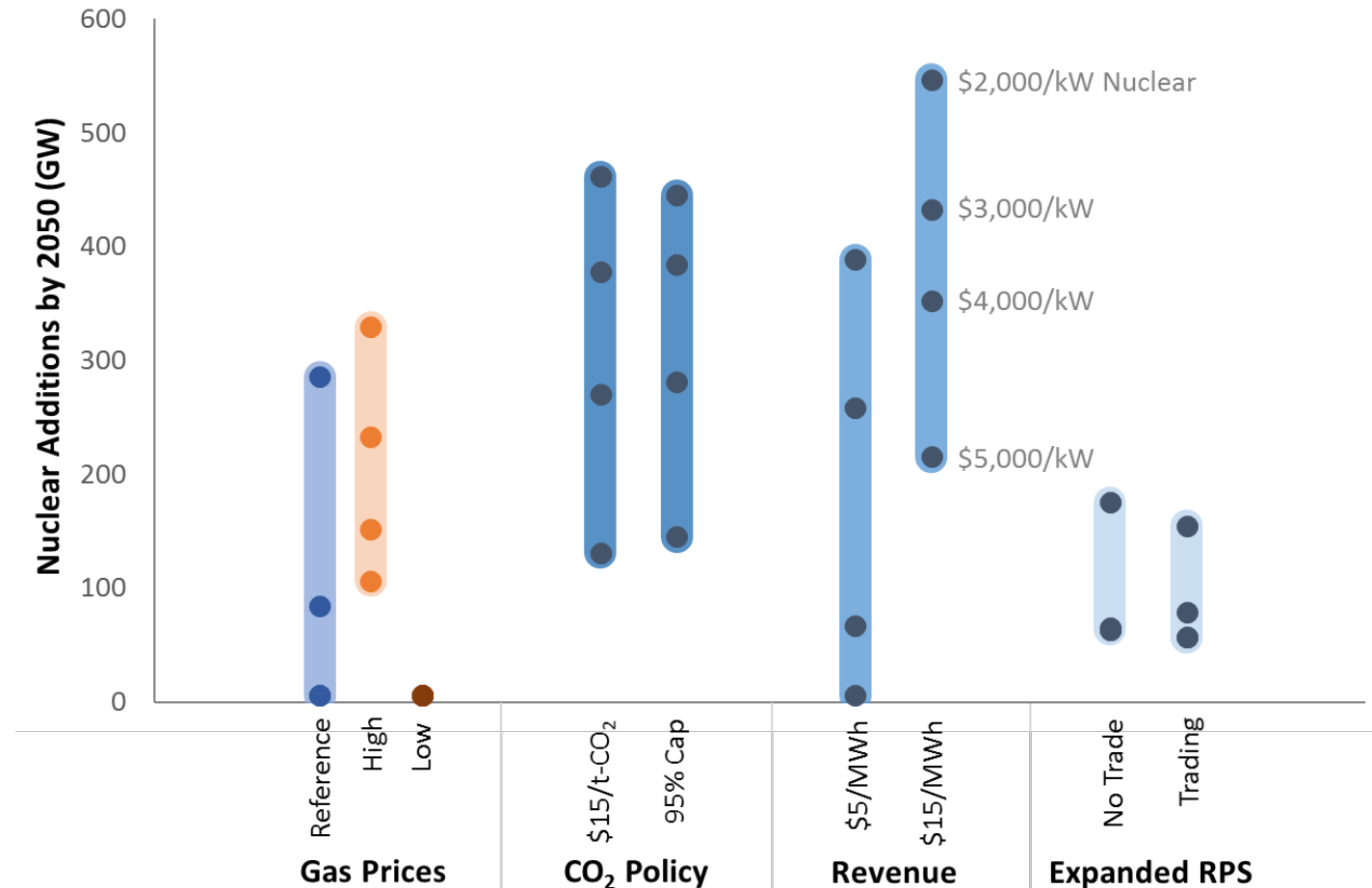


Graphic courtesy of USDOE

Growth potential of hydrogen market by 2050 could be 16X or higher - chemicals and fuels synthesis, steel manufacturing, ammonia-based fertilizers and fuels

Economics and Competitiveness of Advanced Generation

Exploring the Role of Advanced Nuclear in Future Energy Markets. March 2018, Report 3002011803



Key drivers influencing deployment:

- Competition (technology)
- Capital costs
- Revenue
- Regional factors
- Energy and environmental policies

Future fusion deployment will be driven by multiple factors...not just cost.

What will it take to bring fusion to market?

- Technologies that are:
 - mature (demonstration)
 - compelling (new attributes and capabilities, worth the risk)
 - competitive (cost and value)
- Customers who:
 - understand (informed and engaged)
 - believe (evidence of performance)
 - need (business case)

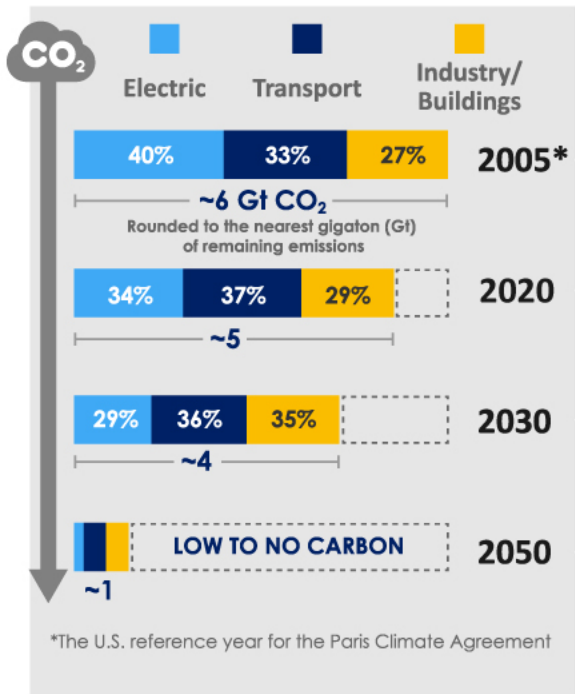


Enduring counter-narrative: “Commercial fusion power is likely 30 years away” – title of a fusion friendly article!

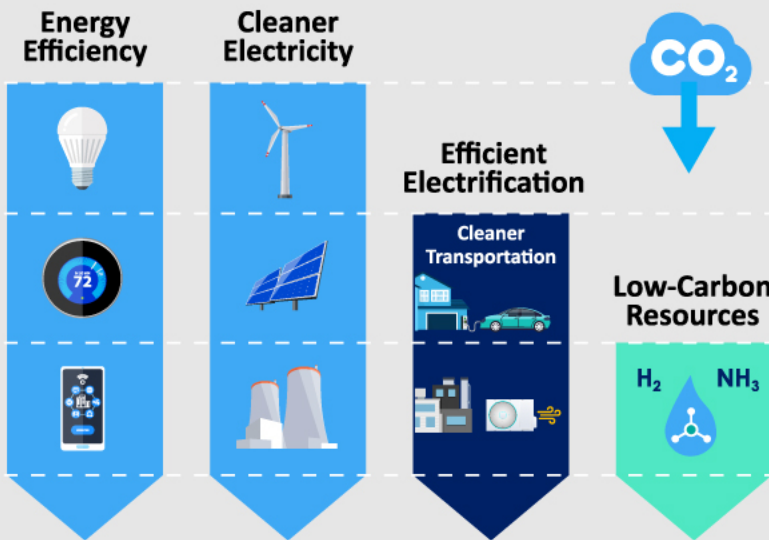
C. Krause. Special to **The Oak Ridger**, Oak Ridge, TN. Posted Apr 18, 2019.



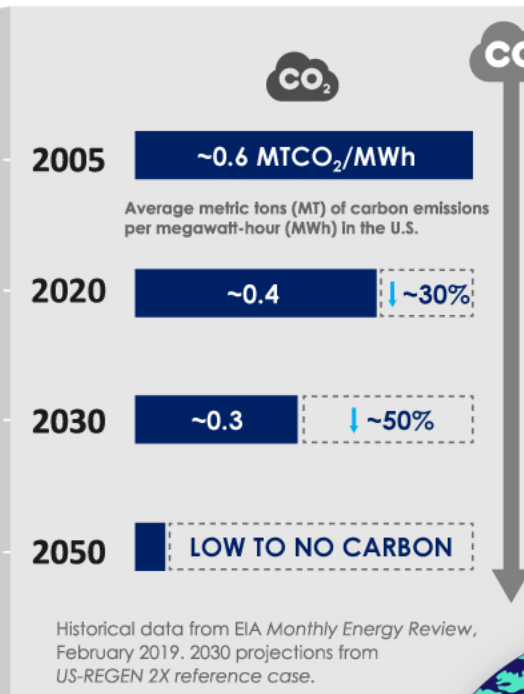
U.S. Energy-Related CO₂ Emissions



The Carbon Reduction Technology Timeline



Cleaner Electricity Generation



Next Steps: Expanding Low-Carbon R&D

The Path to 2030: Accelerating Demonstration and Deployment

20% of vehicle miles traveled are EVs

30 GW of flexible resources (2-4 hours)

- #### Accelerating Electric Vehicle (EV) Adoption and Grid Modernization
- Renewable/EV-Ready Integrated Grid
 - EV Charging Infrastructure and Customer Behavior
 - 30 GW of Grid Flexibility, Including Energy Storage
 - Fleet Electrification

The Path to 2050: Creating Affordable, Low-Carbon Options

- #### Hydrogen and related, low-carbon resources
- Low-Carbon Power Generation**
Advanced Nuclear and Renewables | CCUS
 - Low-Carbon Resource Production**
Hydrogen | Biofuels
 - Transmission, Delivery, and Storage**
Existing and New Infrastructure | Pipeline Blending
 - End Use**
Industrial | Buildings | Hydrogen Turbines | Heavy-Duty Transportation



EPRI – GTI Low-Carbon Resources Initiative

Aug 10, 2020

Palo Alto, Calif. (Aug. 10, 2020) -- The Electric Power Research Institute (EPRI) and Gas Technology Institute (GTI) are embarking on a five-year initiative to accelerate the development and demonstration of low-carbon energy technologies. With increasingly ambitious decarbonization goals from private companies and governments alike, existing technology is not enough to achieve those targets.



<https://www.epri.com/lcri>

Coming Soon...

- EPRI is considering formation of a fusion interest group for increased community engagement with relevant EPRI programs and member perspectives

EPRI – Nonprofit Collaborative R&D

- 450+ participants in more than 30 countries
- EPRI members generate approximately 90% of the electricity in the United States
- International funding – nearly 40 countries participate in EPRI's overall research, development, and demonstrations



RESEARCH AREAS

