

The Dynamics of Utility Planning



Lonnie Bellar, Chief Operating Officer
September 25, 2019



Operational Planning Areas

Generation



Transmission



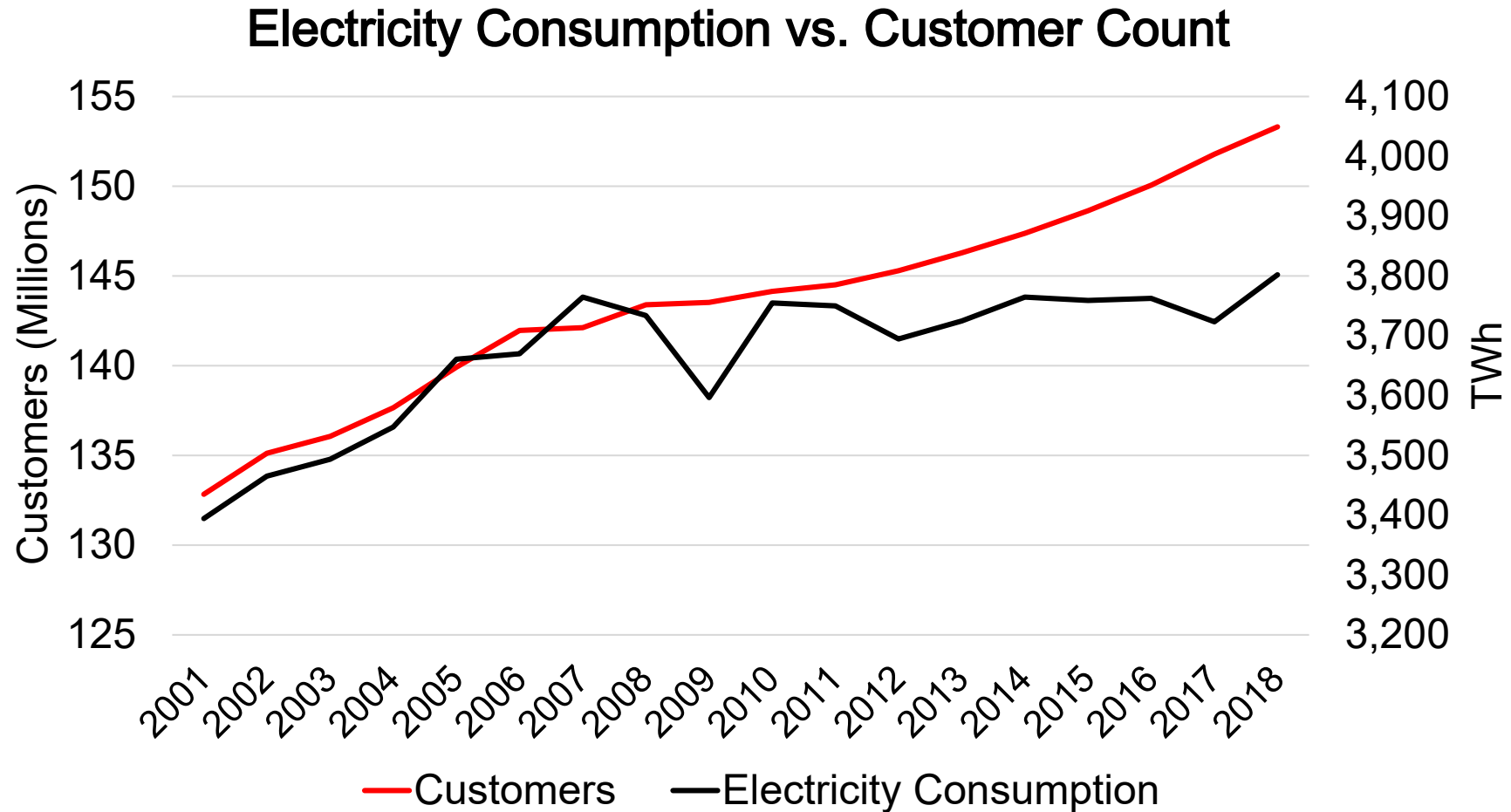
Distribution



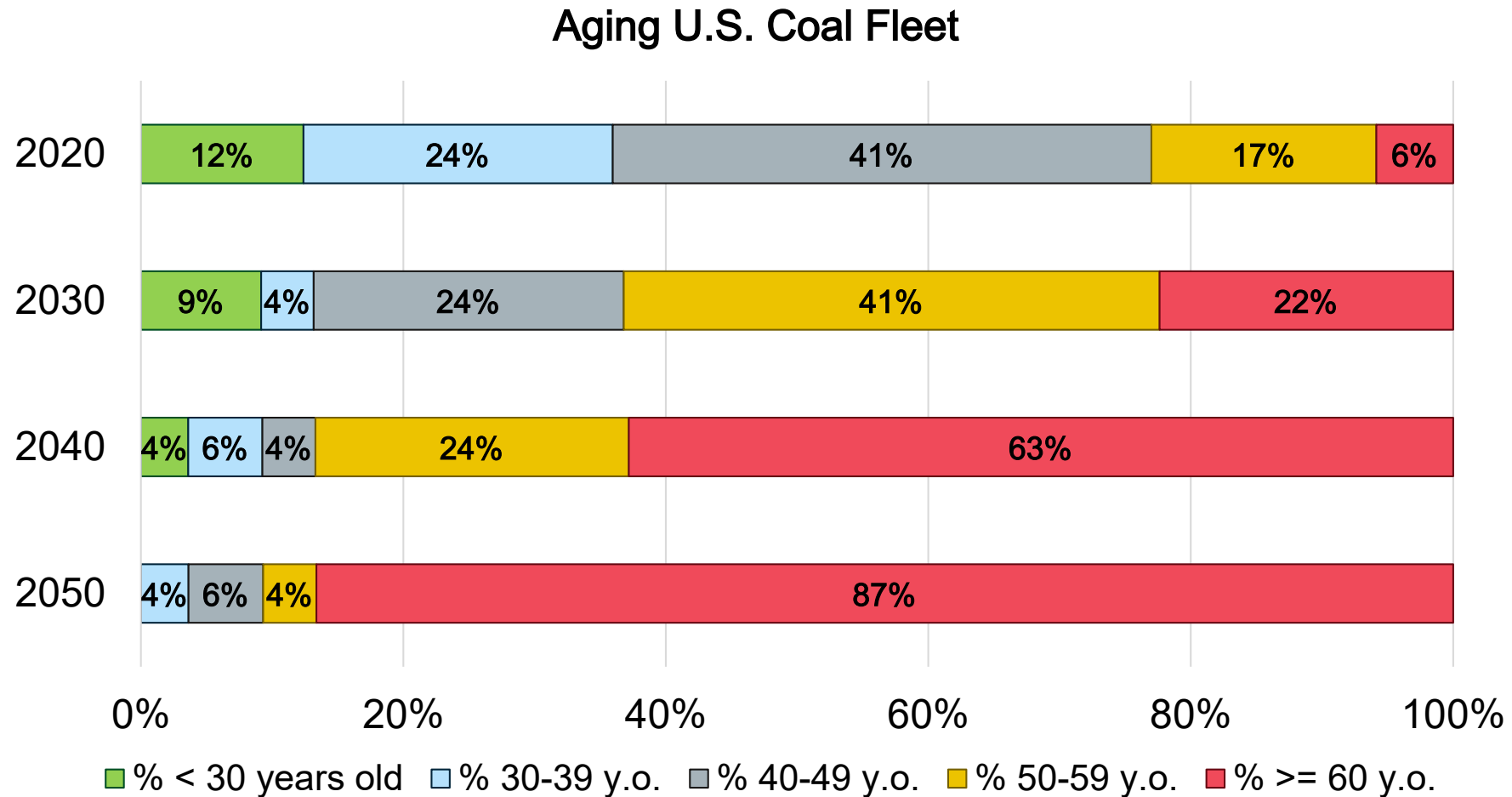
Generation Planning: Balancing Energy Needs, Resources and External Factors

	20 Years Ago	Today
Public Scrutiny	Low	High
New Resource Options	Nuclear Coal Oil Natural Gas Hydro Renewables DSM	Nuclear Coal Oil Natural Gas Hydro Renewables DSM 2.0 Battery Storage
Generation Load	Growing	Flat

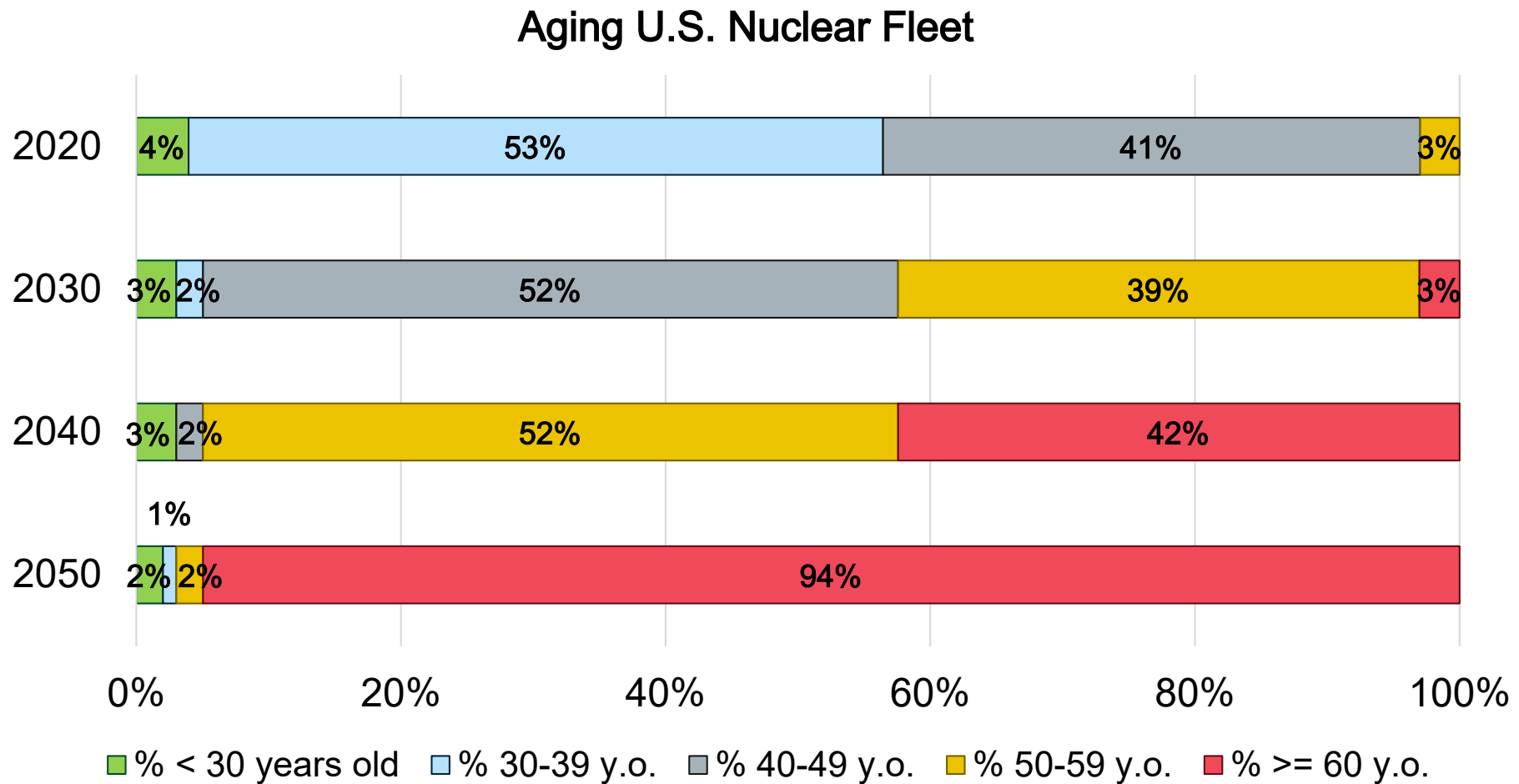
U.S. Electricity Consumption Remains Flat



Today's U.S. Coal Fleet Is Aging



U.S. Nuclear Fleet Is Aging, Too



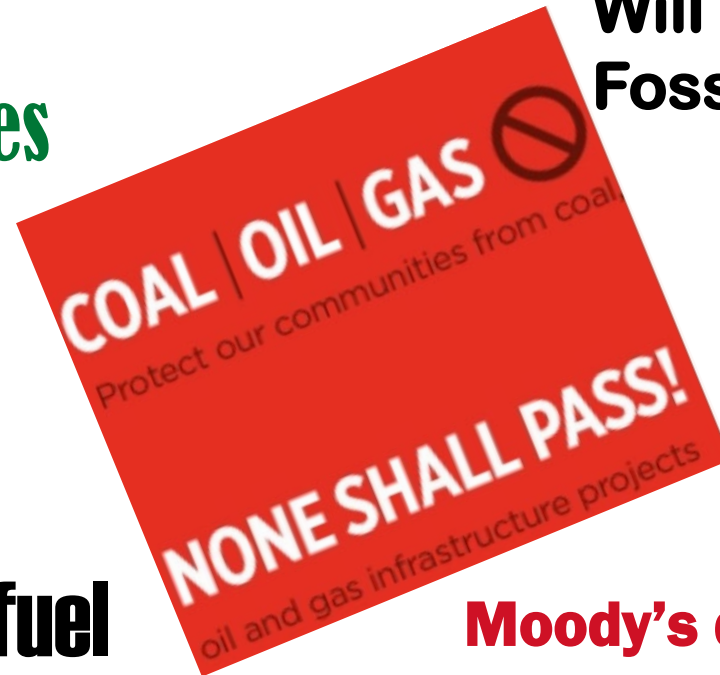
Fossil Fuels Are Under Attack

74 percent of coal can be replaced today at lower cost

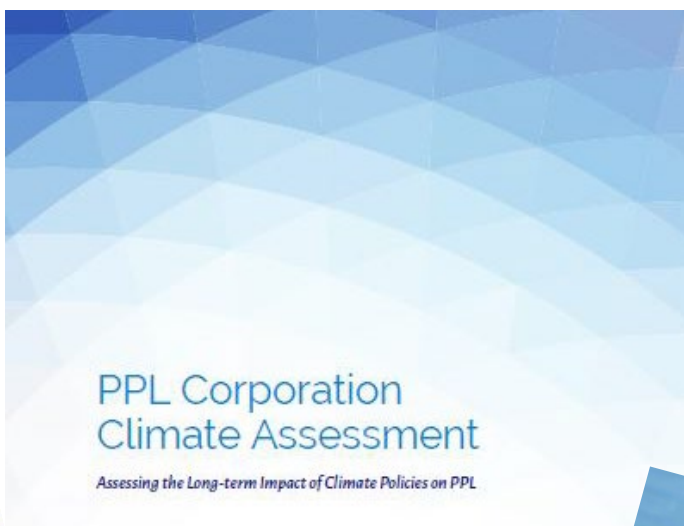
Fossil Fuels, Utilities & Gas Cars To Be Obsolete By 2030

Funding for fossil fuel power plants is drying up

New Report: Renewable Energy Will be Cheaper Than Fossil Fuels by 2020



Moody's developing new system to score companies on carbon transition risk



CO₂ Emissions Decline As Coal Plants Retire and Natural Gas Plants Come Online



The Excitement About Renewables

Google Officially Hits Its 100% Renewable Energy Target

Budweiser's New Symbol Stands For Every Beer Made With 100% Renewable Energy

Apple Now Runs On 100% Green Energy, And Here's How It Got There

100 U.S. Cities are Committed to 100 Percent Clean, Renewable Energy

100% Renewable vs. 100% Renewable (Annual net zero vs. no fossil fuels)

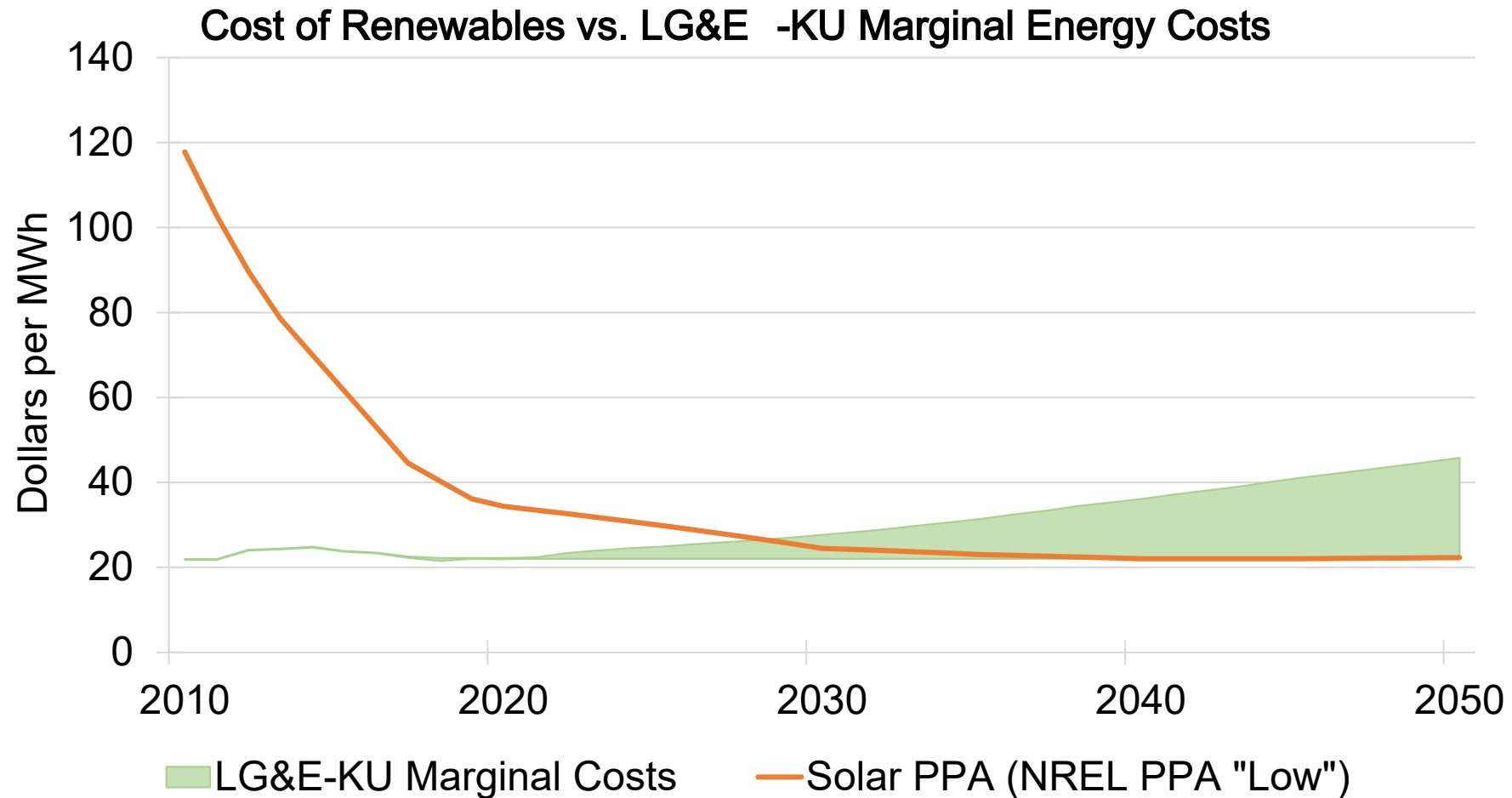


Large Investment To Serve A Small Area



Search: *LG&E and KU Solar Study*

Solar Costs Have Declined



Key Generation Planning Questions

- What amount of renewables can be integrated into the grid without battery storage?
- Will regulations be promulgated to reduce CO₂ emissions or limit the lives of existing generating units?
- What is the future of nuclear generation in the U.S.?
- How much generation will be supplied by the consumer?
- What is the future adoption rate for electric vehicles?

Transmission Planning: Rules, Regulations and More



Transmission Risks and Challenges

- Cyber and physical security
- Extreme weather
- Geomatic events, or solar storms
- Electromagnetic pulse events



Shots in the Dark

A look at the April 16 attack on PG&E's Metcalf Transmission Substation

1	2	3	4	5	6	7
12:58 a.m., 1:07 a.m. Attackers cut telephone cables	1:31 a.m. Attackers open fire on substation	1:41 a.m. First 911 call from power plant operator	1:45 a.m. Transformers all over the substation start crashing	1:50 a.m. Attack ends and gunmen leave	1:51 a.m. Police arrive but can't enter the locked substation	3:15 a.m. Utility electrician arrives

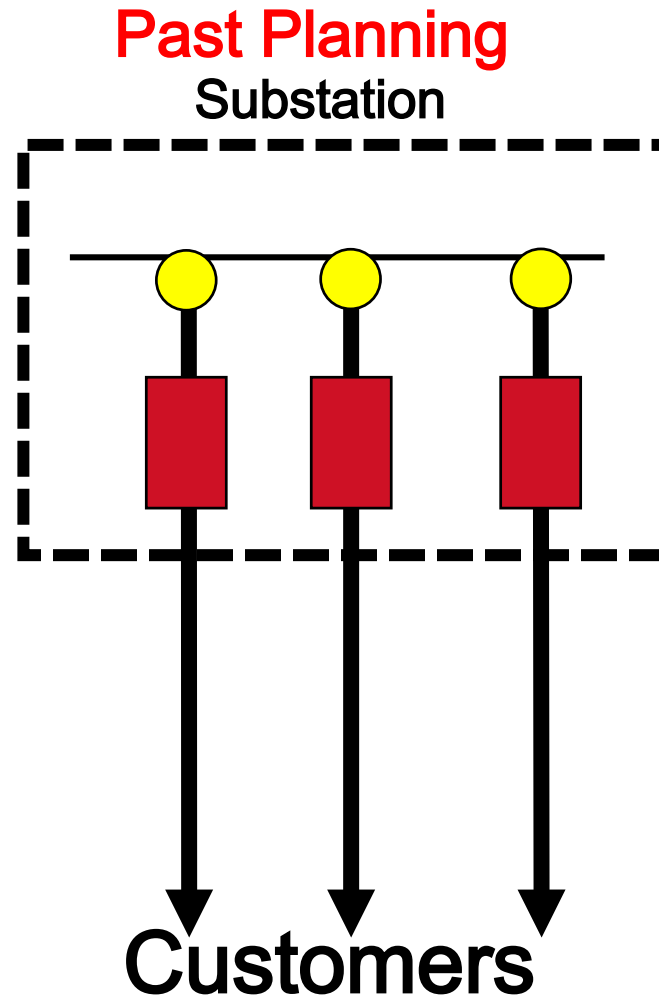


Reliability and Resiliency = Industry Priority

- Enhanced physical security at critical substations
- Increased spare inventory
- Mobile control houses
- Electric Power Research Institute
- Electromagnetic Pulse research
- Emergency-response drills: the national GridEx
- RESTORE equipment-sharing initiative

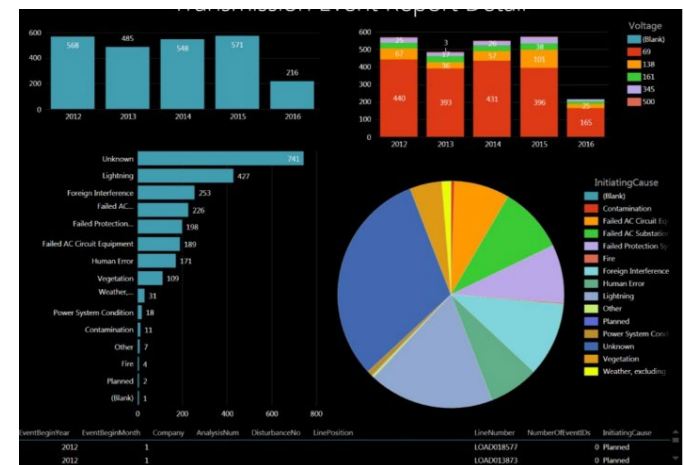


Distribution Planning: Changing With The Times

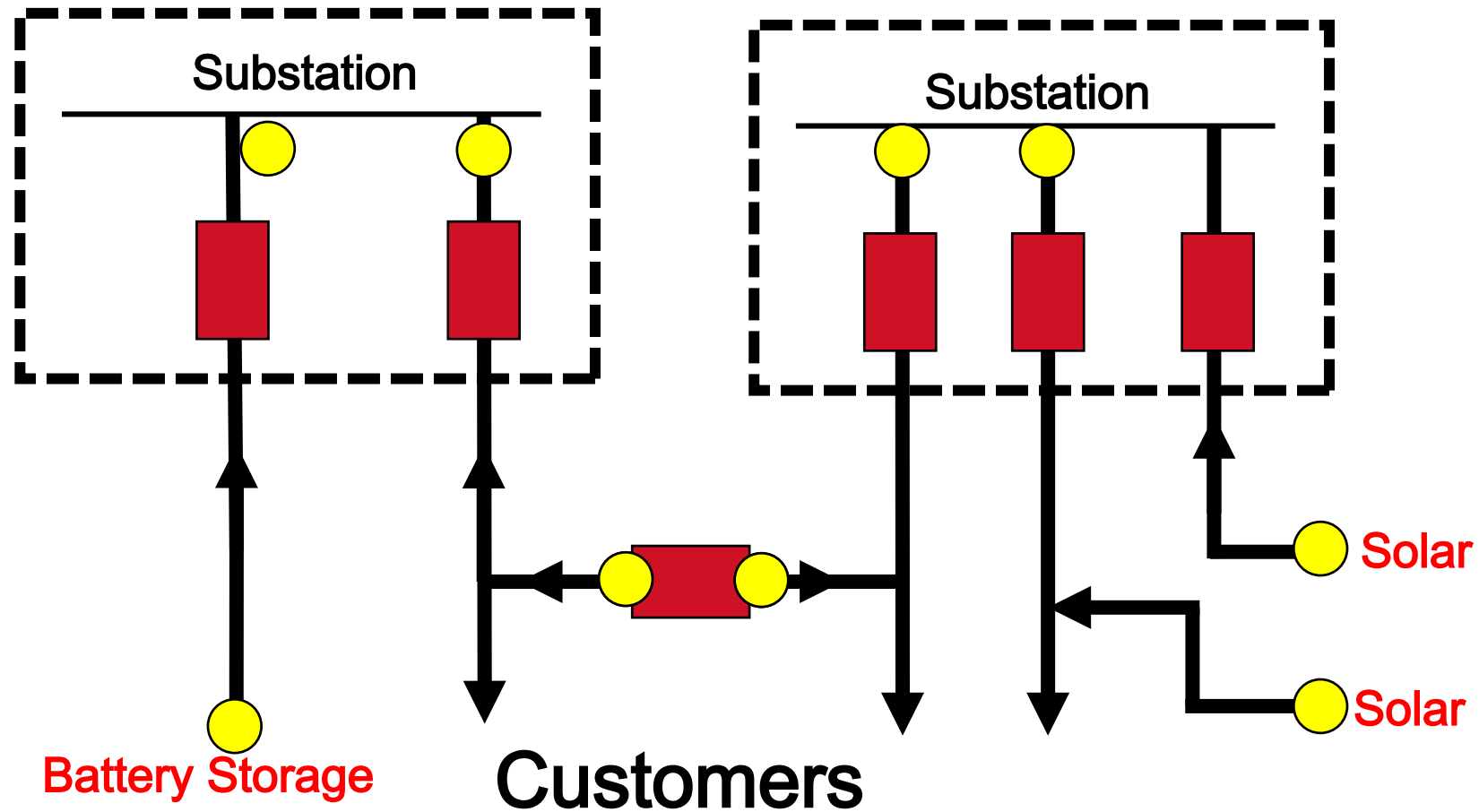


Distribution Planning: Changing With The Times

- Technological advancements
 - Advanced metering
 - Electric vehicles
 - Battery storage
- Load data collection
- Energy efficiency
- Distributed energy resources
 - Rooftop solar
- Increased urbanization
- Customer experience
- Reliability solutions
- Business analytics



Distribution Planning: Today and The Future



Effective Planning For The Future Utility

- The industry continues to be ever-changing and complex
- New and old challenges are a part of doing business
 - Regulations
 - Renewable resource development/technological advancements
 - Environmental sensitivities/public scrutiny
 - Energy efficiency
 - Economic changes
 - Long-term requirements of effective planning
- New analytical tools help to better address challenges
- Savvy planners; innovative, analytical thinking; and flexibility will continue to drive success.