NATIONAL GOVERNORS ASSOCIATION

Planning for the Future:
Strategies to Meet State Energy Goals

October 28 - 29, 2020
Day 1

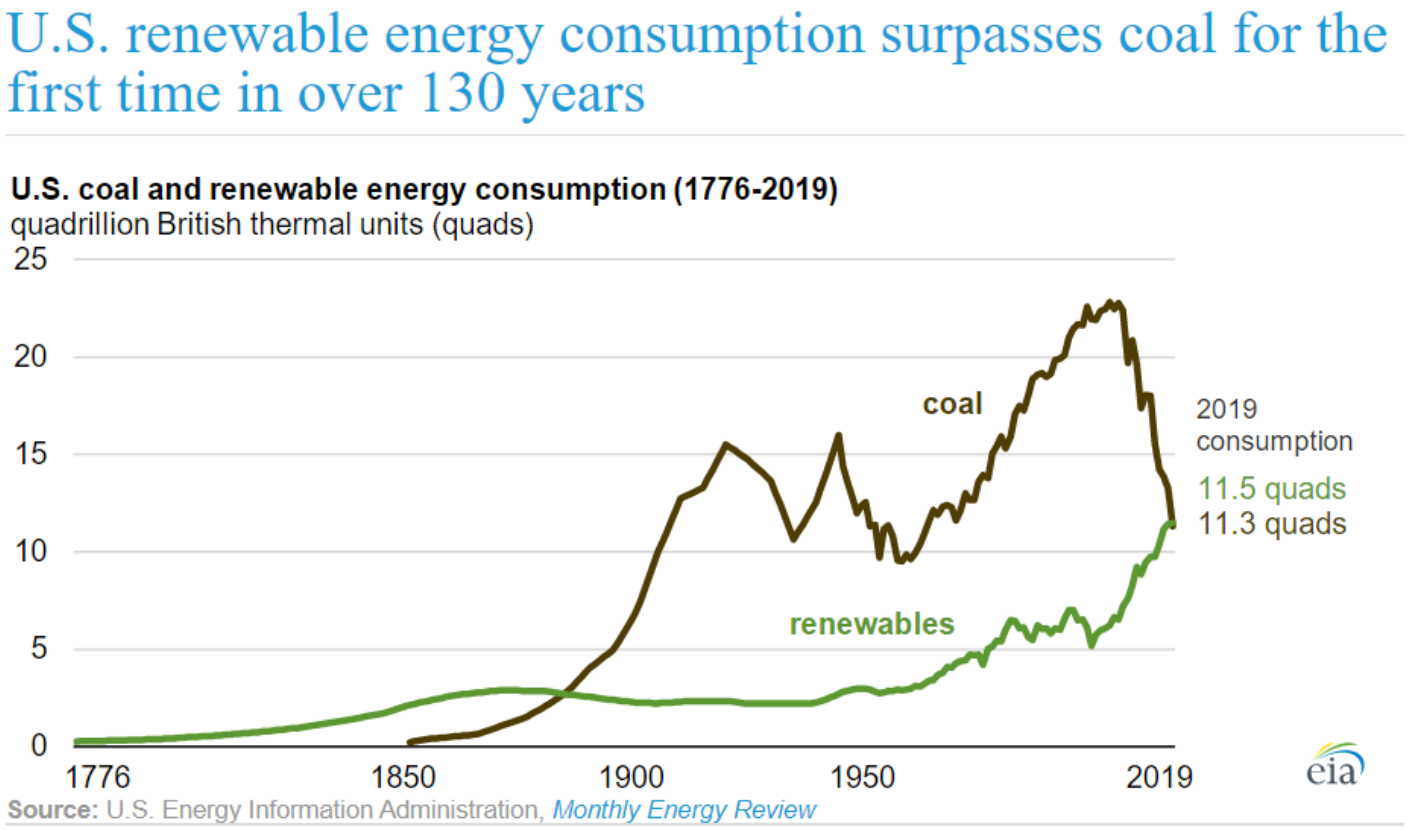
National Governors Association
Center for Best Practices

NATIONAL GOVERNORS ASSOCIATION

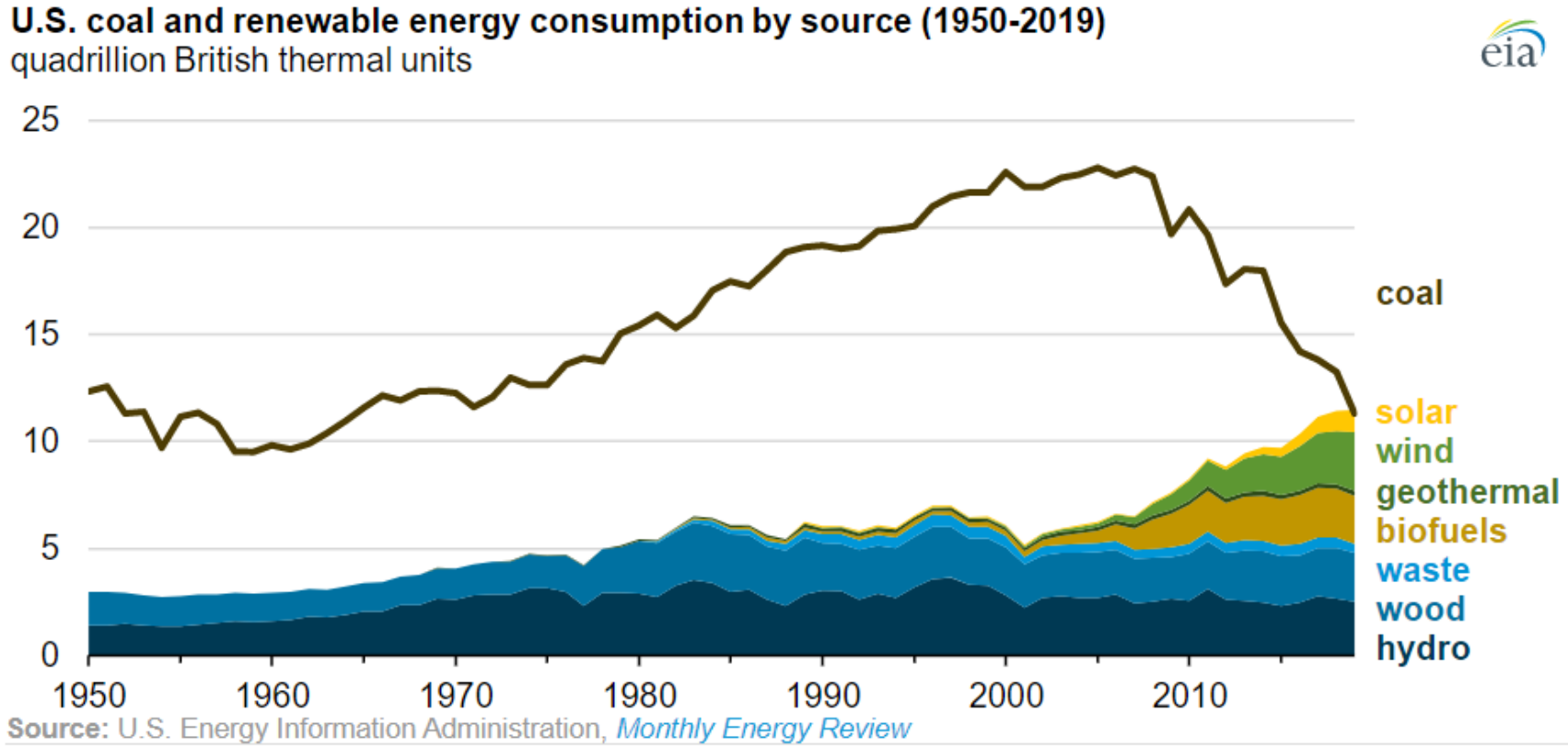
Welcome & Opening Remarks

Jessica Rackley, Program Director, National Governors Association

Recent Energy Trends

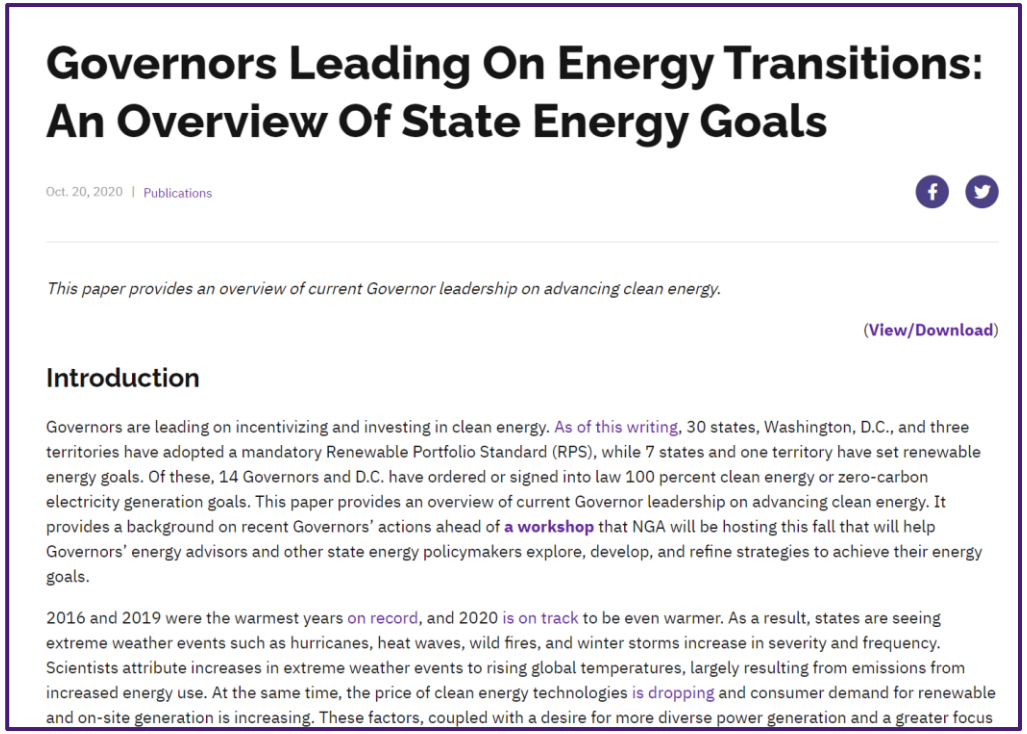


Renewable Trend Details



Latest NGA Resource

- Governors Leading On Energy Transitions: An Overview Of State Energy Goals: https://www.nga.org/center/publications/governors-leading-energy-transitions/



Governors Leading On Energy Transitions: An Overview Of State Energy Goals

Oct. 20, 2020 | Publications

This paper provides an overview of current Governor leadership on advancing clean energy.

(View/Download)

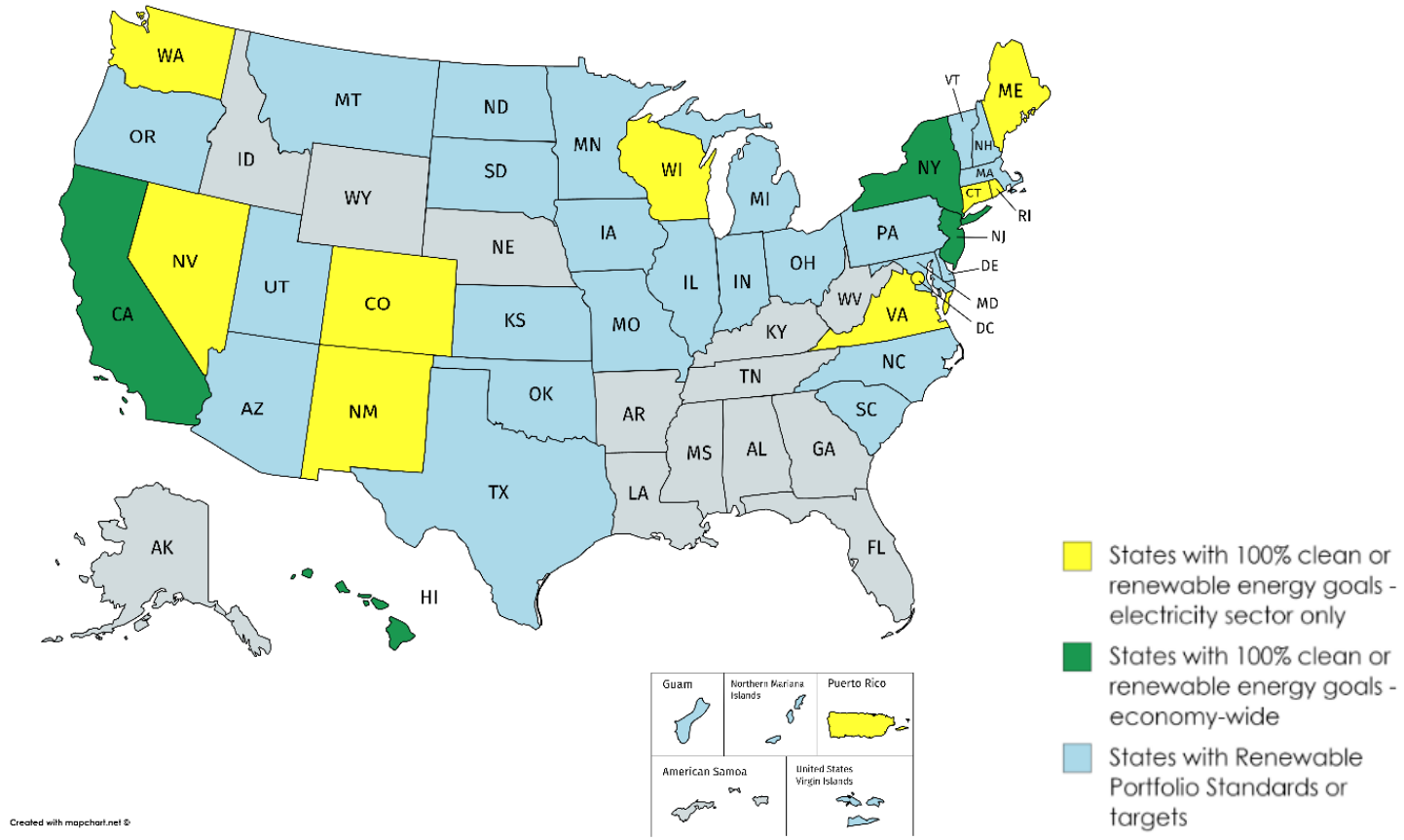
Introduction

Governors are leading on incentivizing and investing in clean energy. As of this writing, 30 states, Washington, D.C., and three territories have adopted a mandatory Renewable Portfolio Standard (RPS), while 7 states and one territory have set renewable energy goals. Of these, 14 Governors and D.C. have ordered or signed into law 100 percent clean energy or zero-carbon electricity generation goals. This paper provides an overview of current Governor leadership on advancing clean energy. It provides a background on recent Governors' actions ahead of **a workshop** that NGA will be hosting this fall that will help Governors' energy advisors and other state energy policymakers explore, develop, and refine strategies to achieve their energy goals.

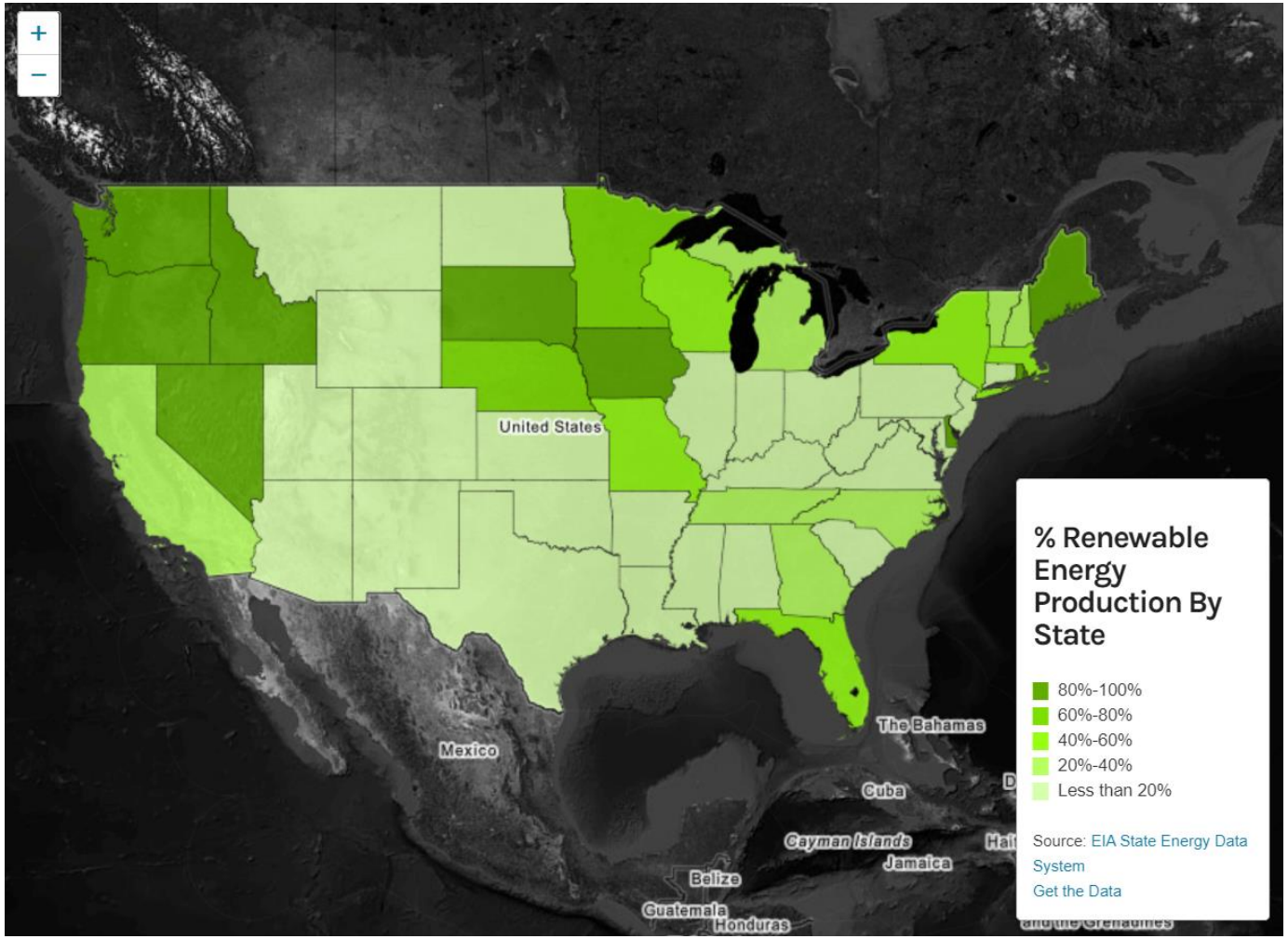
2016 and 2019 were the warmest years on record, and 2020 is on track to be even warmer. As a result, states are seeing extreme weather events such as hurricanes, heat waves, wild fires, and winter storms increase in severity and frequency. Scientists attribute increases in extreme weather events to rising global temperatures, largely resulting from emissions from increased energy use. At the same time, the price of clean energy technologies is dropping and consumer demand for renewable and on-site generation is increasing. These factors, coupled with a desire for more diverse power generation and a greater focus

States with Clean Energy Goals

- Thirty states, Washington, D.C., and three territories have adopted a mandatory Renewable Portfolio Standard (RPS), while 7 states and one territory have set renewable energy goals.
- Fourteen Governors and D.C. have ordered or signed into law 100 percent clean energy or zero-carbon electricity generation goals.



Where States are Now



Source: U.S. Department of Energy based on EIA data

How these Goals are Defined

- Renewable Portfolio Standard (RPS) vs. Clean Energy Standard (CES) or “Zero-Carbon Resource” Standard
- Electricity sector vs. economy-wide
- Timelines (2040 to 2050)

Strategies for Meeting these Goals

- Enhancing clean energy standards, adoption of energy storage targets, and offshore wind targets for coastal states;
- Modernization of electric grid infrastructure to integrate new technologies, balance variable generation with load, and automate systems to improve resilience and performance; and
- Rethinking the traditional regulatory structures and business models under which utilities operate.

Other NGA Resources

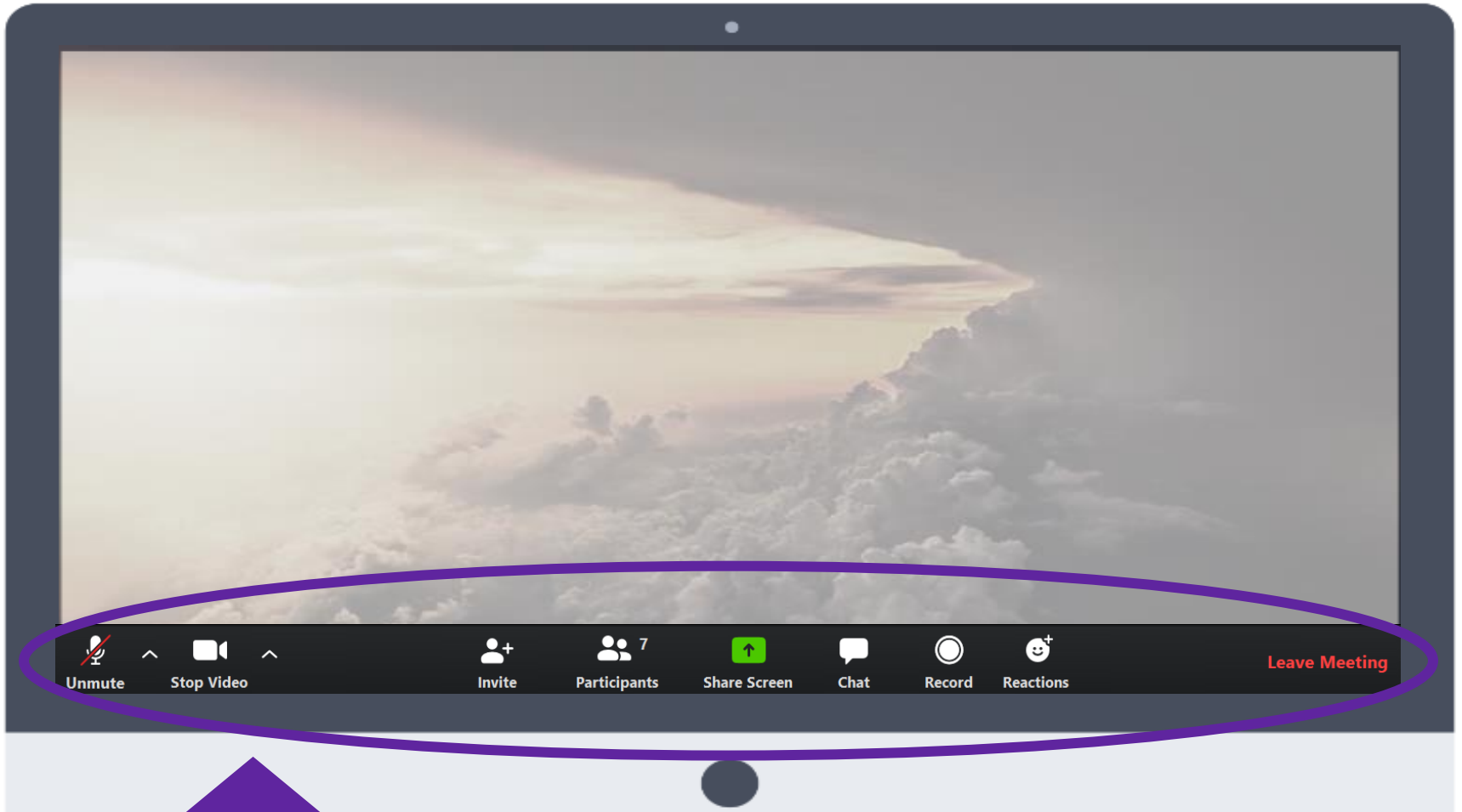
- Governors Leading On Energy Transitions: An Overview Of State Energy Goals: Published in October 2020, this paper offers an outline of how Governors are driving state energy policy around the country.
- Offshore Wind Summit: Held in September and October of this year, this event examined how coastal states – with a particular focus on the Eastern Seaboard – can promote the build-out of offshore wind as a source of affordable, clean and reliable energy that will incentivize billions of dollars in investments throughout the supply chain.
- State Energy Toolkit: Published in late 2019, this interactive tool presents ideas to help governors respond to trends as they take action in their states in four areas — energy efficiency, clean energy, transportation electrification, and cyber and physical protection.

Virtual Meeting Housekeeping

- ***For Technical Support:***

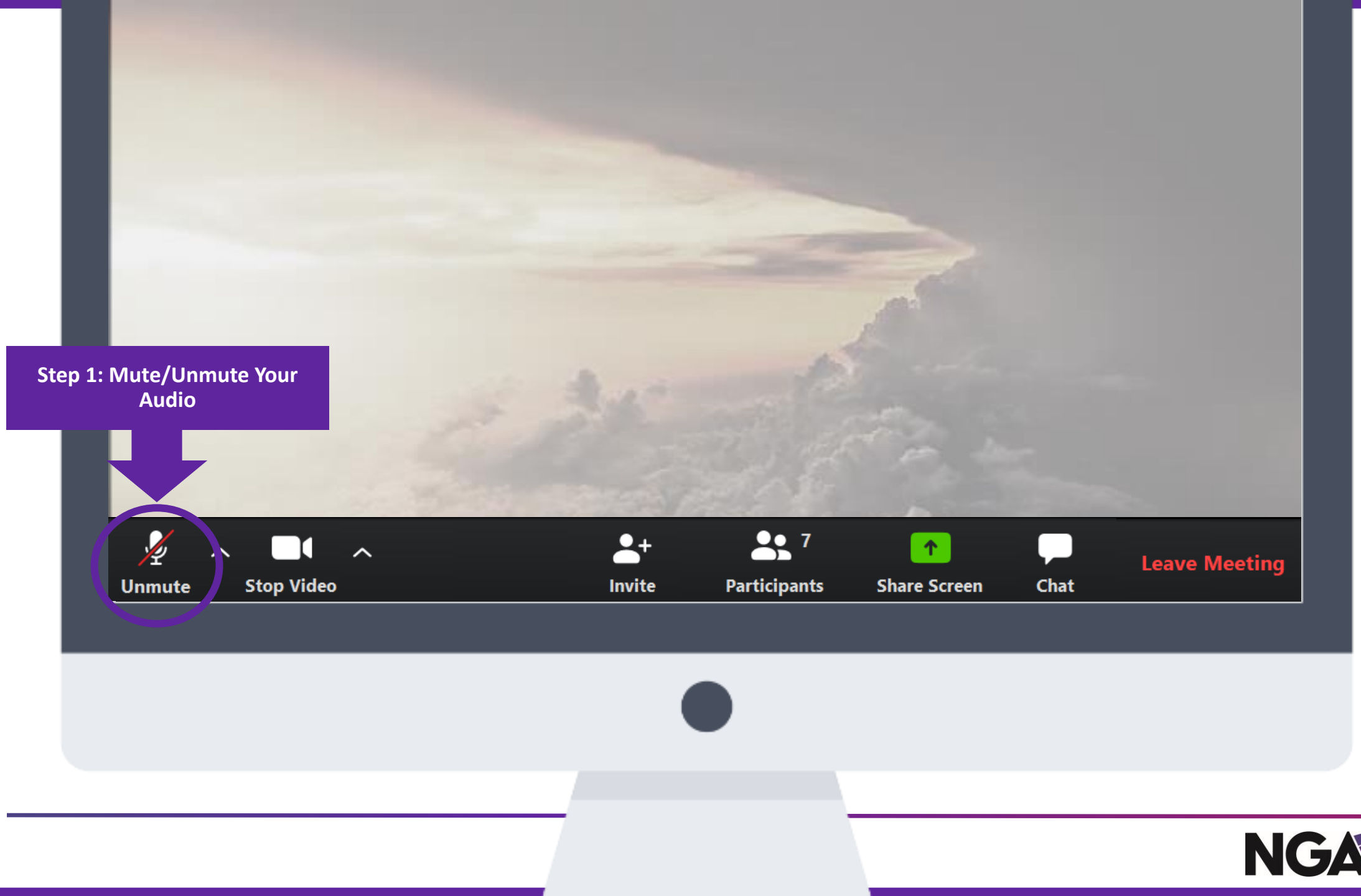
Please chat or contact Bob Masciarelli (bmasciarelli@nga.org) if you have any technical questions or call/text at 410-279-2634.

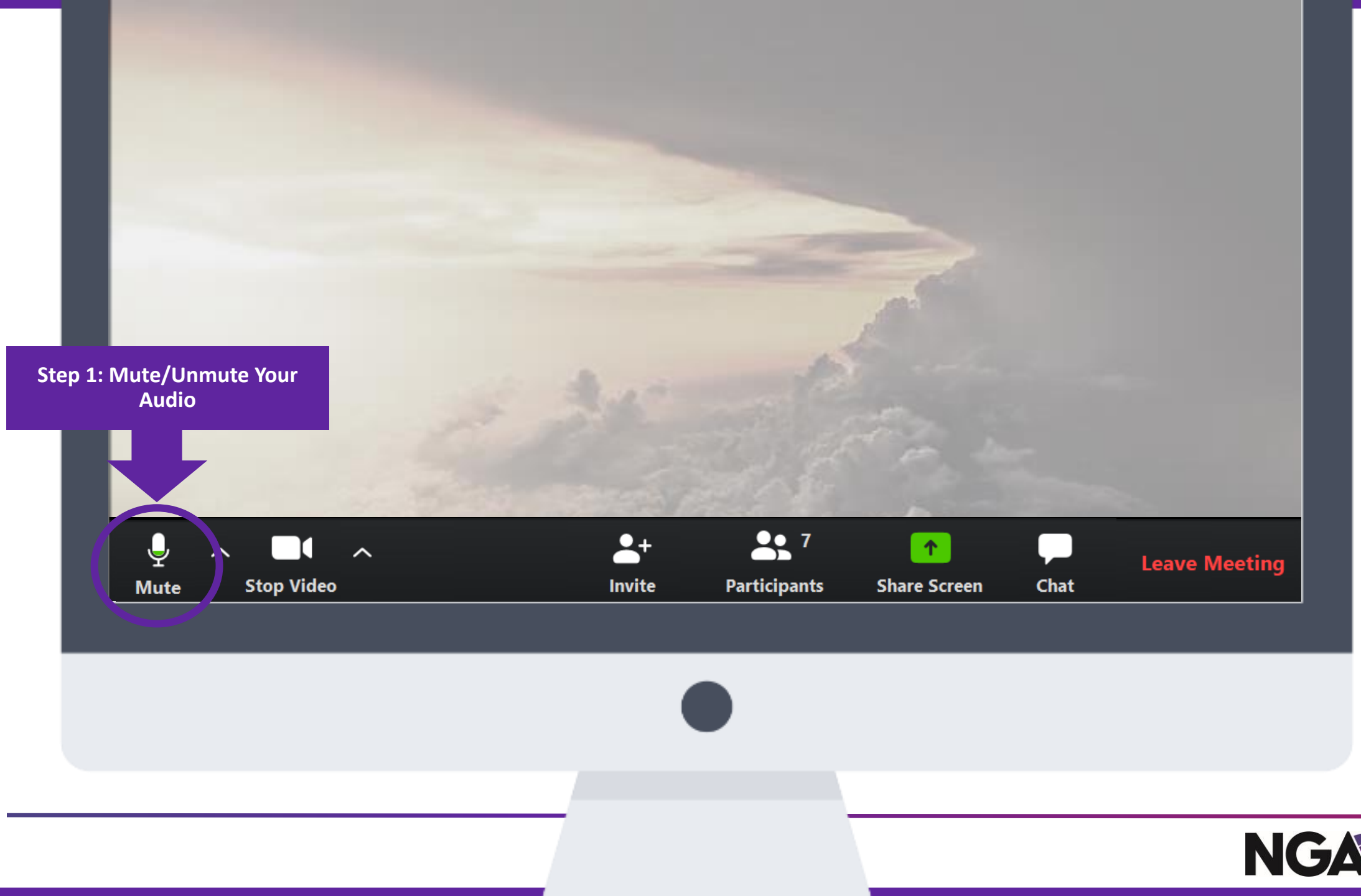
Today's Virtual Meeting: Zoom Controls



The Zoom menu bar appears at the bottom of the Zoom window once the meeting begins.

If you don't see the menu bar, move your mouse slightly and the bar will appear.


Step 1: Mute/Unmute Your Audio
Unmute
Stop Video
Invite
7
Participants
Share Screen
Chat
Leave Meeting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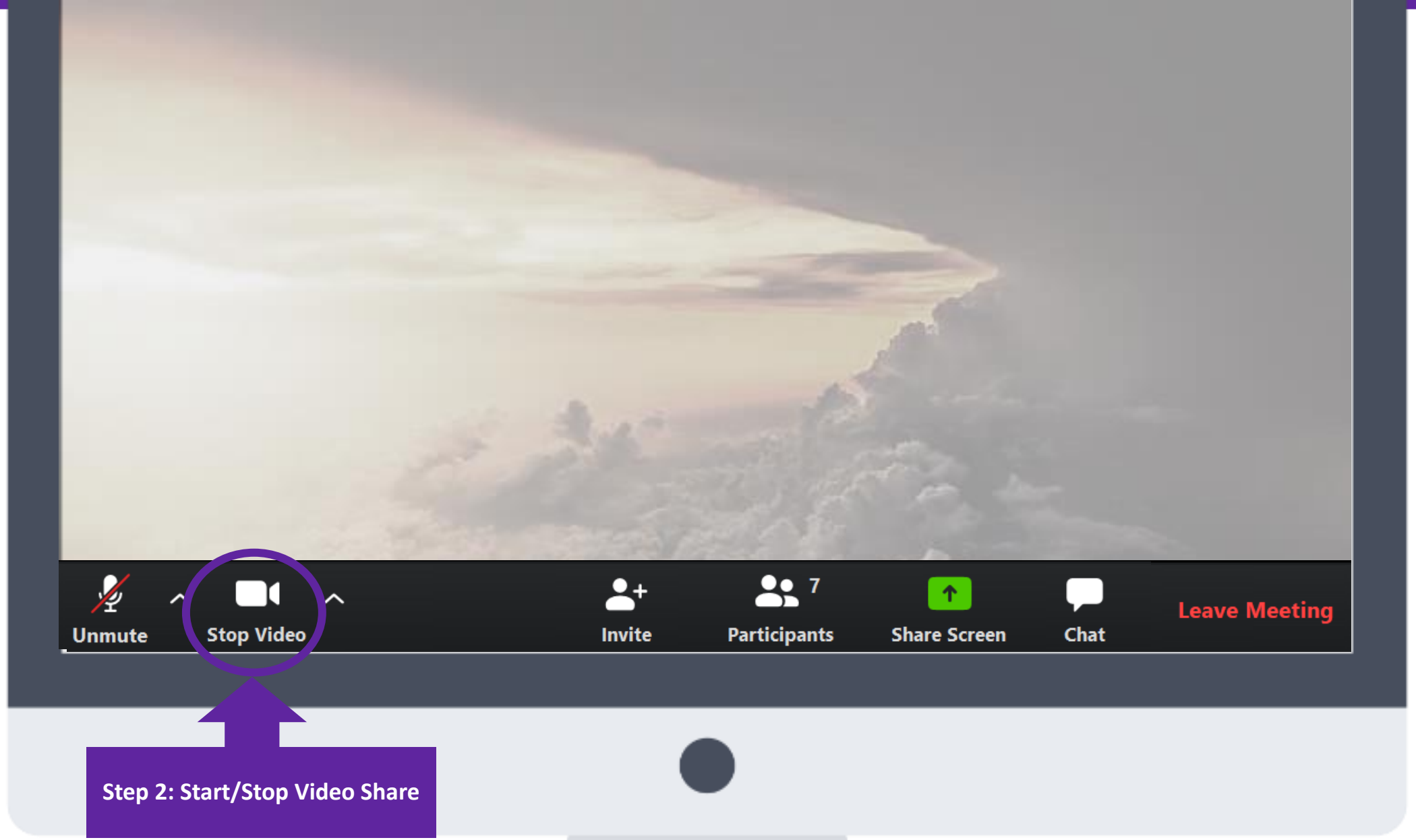
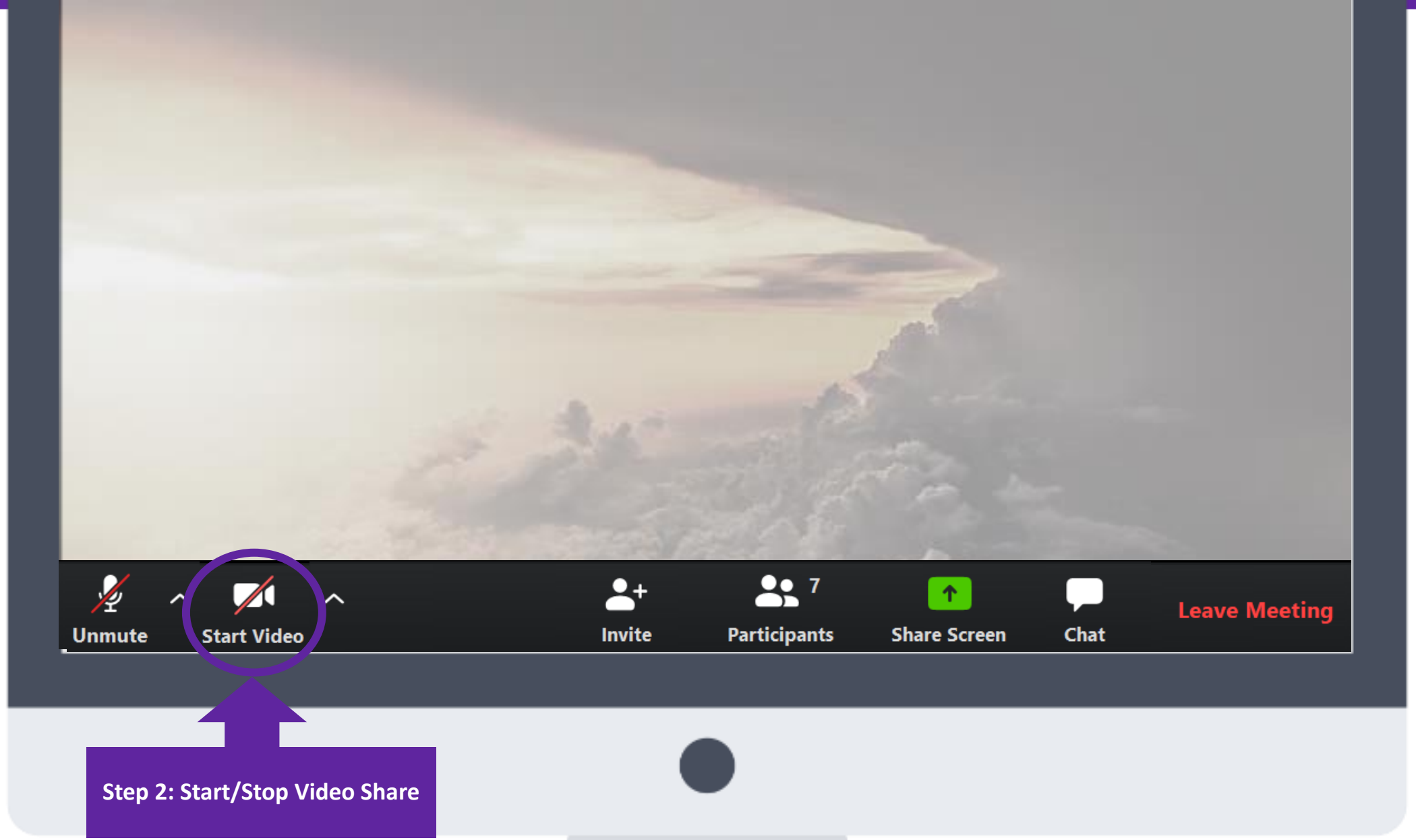


Step 2: Start/Stop Video Share



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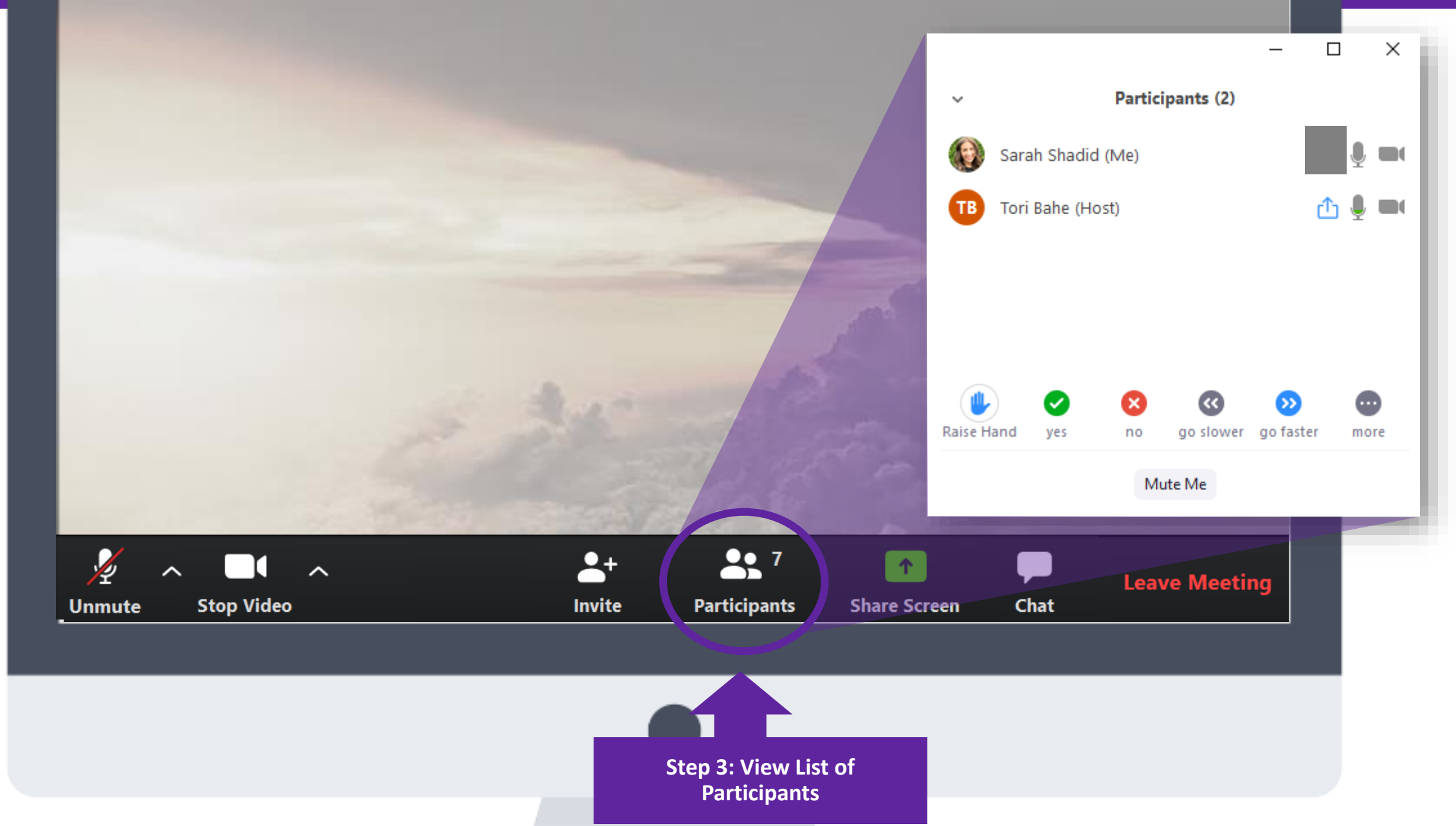
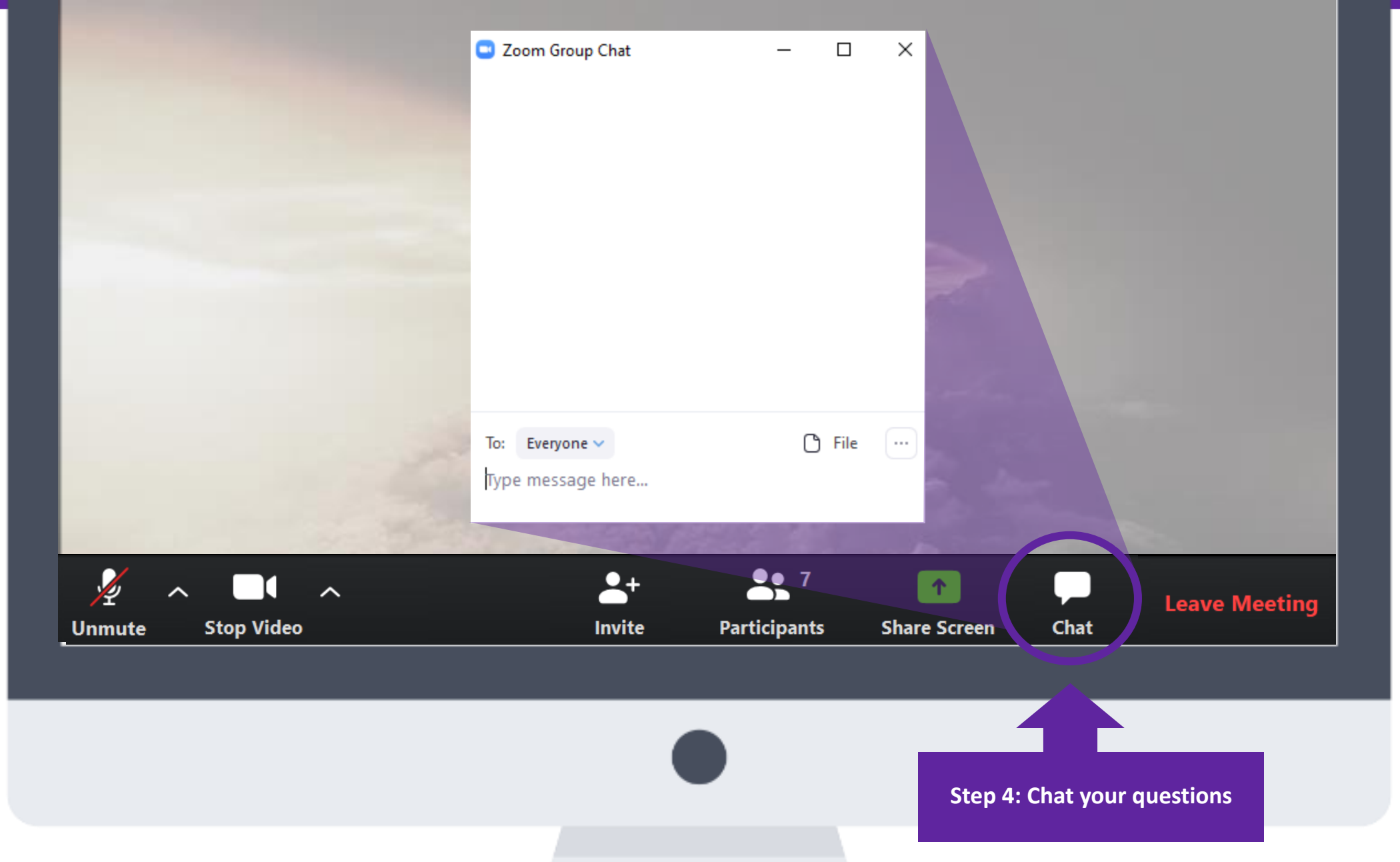


Step 3: View List of Participants



Step 4: Chat your questions

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Renewable Energy Trends Overview

Speakers:

Brian Selinger, Director, Iowa Energy Office

Kirsten Sheeren, Office of Oregon Governor Kate Brown

Moderated by:

Emma Cimino, Senior Policy Analyst, National Governors Association

Iowa's Renewable Energy Landscape & Leadership

NGA Workshop – Governor's Clean Energy Goals – October 28, 2020

Brian Selinger | Iowa Energy Office
Iowa Economic Development Authority

Iowa Energy Office

Division of Iowa Econ. Dev. Authority

Manage a diverse mix of state, federal & utility-funded programs & initiatives

- Programs & initiatives that **provide energy-economic benefits** for Iowa's citizens, businesses & organizations

Led the development of policy reports / action plans

- December 2016 – Iowa Energy Plan
- August 2018 – Biomass Conversion Action Plan
- February 2019 – EV Infrastructure Report
- May 2019 – Energy Storage Action Plan


IOWA ENERGY PLAN
PROGRESS REPORT
JULY 2018
BIOMASS CONVERSION
ACTION PLAN
AUGUST 2018
CHARGING FORWARD:
IOWA'S OPPORTUNITIES FOR ELECTRIC
VEHICLE INFRASTRUCTURE SUPPORT
FEBRUARY 2019
ELECTRIC VEHICLE CHARGING STATION
ENERGY STORAGE
ACTION PLAN
MAY 2019
IOWA
energy office

IOWA'S NEARLY 5,100 WIND TURBINES GENERATED 42% OF THE STATE'S ELECTRICITY IN 2019,
THE HIGHEST WIND POWER SHARE FOR ANY STATE

SOURCE: ENERGY INFORMATION ADMINISTRATION

Iowa is the nation's largest fuel ethanol and biodiesel producer, **accounting for one-fourth of U.S. fuel ethanol production capacity and one-fifth of biodiesel manufacturing capacity.**

SOURCE: ENERGY INFORMATION ADMINISTRATION

Iowa's Supportive Energy Policies

Iowa' Energy Leadership – Over the Years

In 1983, Governor Terry Branstad signed into law the nation's first renewable portfolio standard (RPS)

Provided numerous supportive policies, tax credits, grant & loan offerings

2016, IA Energy Plan developed & led by then-Lt. Governor Reynolds

Iowa Energy Plan…continued

Diverse, collaborative & transparent policy dev. / action plans

- Energy efforts can spark sensitivities, agendas…being inclusive can help to find shared outcomes, build relationships, breaking down barriers

Iowa's focus / priority is energy-economic dev.

- Maximize & capitalize on our local renewable resources (wind, solar, biofuels), environmental gains by way of energy-econ. dev.

Polices and strategies clear, actionable, but not mandates

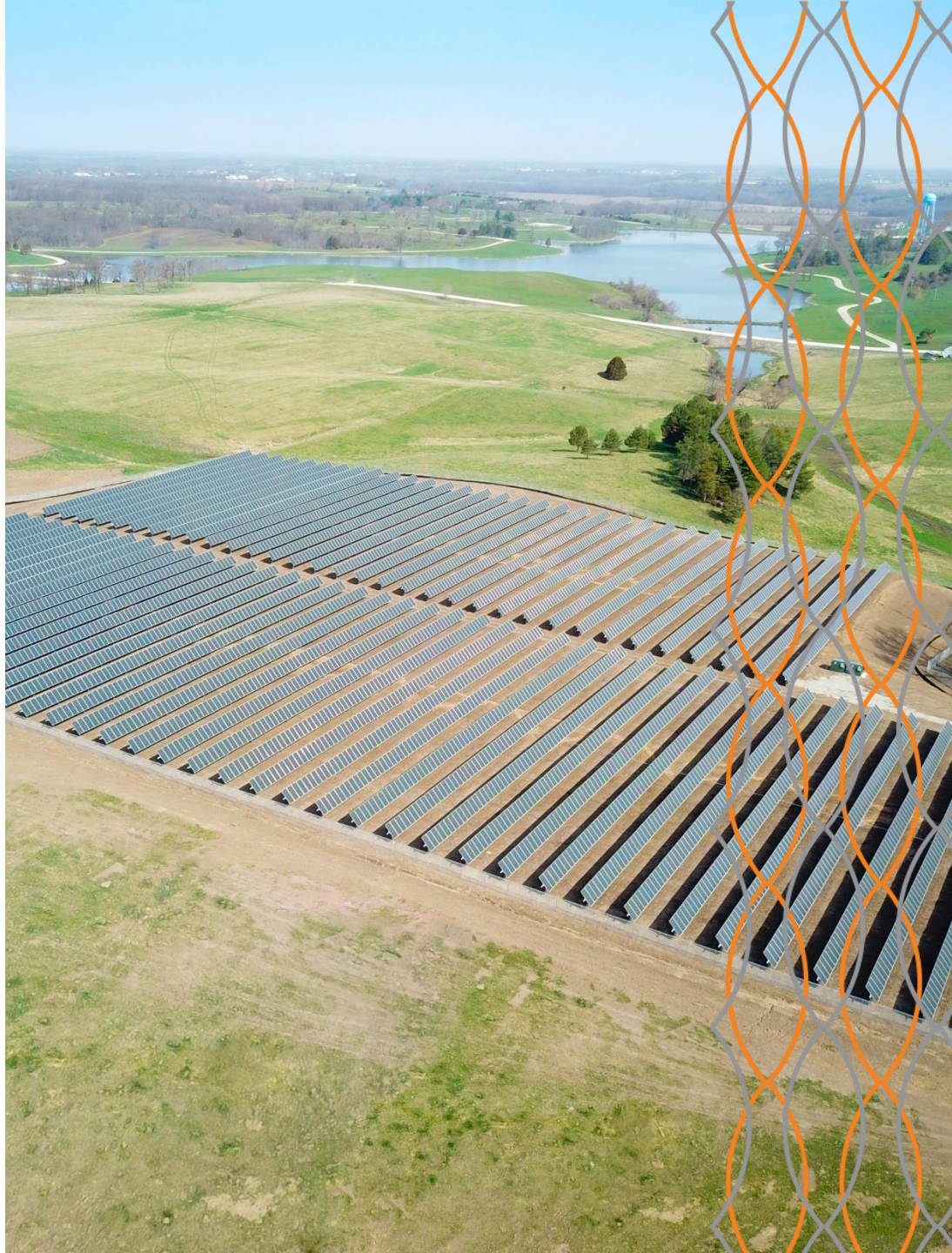
- Iowans have made clear that they'd prefer continued renewable energy investments & advancements but not forced mandates

NOW WORKING ON...

Energy Storage Action

Pilot-scale and Replicable Projects

- Decorah Battery Project (Alliant & U.S. DOE)
- Maharishi Uni. Solar + Storage
- Agri-Industrial Plastics Solar + Storage
- MiEnergy Cooperative Residential Storage
- ISU Mobile Solar + Storage Crate



Mobile Energy Storage System

- Dolf Ivener, Founder, SunCrate - Sioux City
- Mobile solar + storage resiliency resource
- Deployed during natural disasters (e.g., tornados, flooding)

SunCrate

IOWA ARMY NATIONAL GUARD

PowerFilm SOLAR
MADE IN THE USA

IOWA STATE UNIVERSITY
OF SCIENCE AND TECHNOLOGY

IOWA economic development

Renewable Energy Efforts…continued

Gov. Reynolds was 2019 Chair of Midwestern Gov.'s Assoc.

- Chair's Agenda: collaborative effort to establish regional grid vision

Investigating potential to develop renewable hydrogen

- Energy Office grant to investigate the potential of renewable hydrogen development in IA, with a pilot project

Investigating & investing in the Ag-Water-Energy Nexus

- As productive agriculture state, IA has great potential to benefit economically & environmentally by further realizing the value-added attributes of biomass in the development of bioenergy, biofuels, bioproducts, biochemicals

IOWA economic development

IOWA FINANCE AUTHORITY

iowaeda.com

IowaEconomicDevelopment

BusinessIowa

Brian Selinger | Team Leader, Iowa Energy Office
Iowa Economic Development Authority
brian.selinger@iowaeda.com | 515.348.6220

Clean Energy Oregon: Progress & Next Steps

Kristen Sheeran Ph.D.

Climate and Energy Advisor to Governor Kate Brown

Director, Carbon Policy Office

Oregon's Climate Goals

Statewide GHG Goals

- ✓ **By 2010** - arrest the growth of Oregon's greenhouse gas emissions and begin to reduce greenhouse gas emissions.
- ❑ **By 2020** - achieve greenhouse gas levels that are 10 percent below 1990 levels.
- ❑ **By 2035** – achieve greenhouse gas levels that are 45 percent below 1990 levels
- ❑ **By 2050** - achieve greenhouse gas levels that are at least 75 percent below 1990 levels.

Related Goals

Oregon has joined the U.S. Climate Alliance to meet the Paris goals:

- ❑ **By 2025** – achieve greenhouse gas levels that are 26-28 percent below 2005 levels by 2025.

Transportation electrification goal:

- ❑ **By 2025** – achieve greenhouse gas levels that are 26-28 percent below 2005 levels by 2025.

Land based carbon goals – coming 2021

State Strategy

Achieve state emissions goals & prepare our communities and economy for climate change:

- Decarbonize the electricity sector
- Hasten the pace of transition to electricity and biofuels in our transportation sector
- Expand energy efficiency opportunities
- Create new jobs and invest in clean technology & infrastructure
- Protect and enhance the capacities of our natural and working landscapes to draw down carbon and adapt to climate change
- Cap and reduce emissions from major emitting sectors

Recent Energy Progress

Coal

- ***In-state coal:***
  - Last in-state plant retired 20 years early in 2020
- ***Out-of-state coal:***
  - Coal to Clean Bill removes coal from Oregon electricity rates by date certain

Clean Energy

- ***50% Renewable Portfolio Standard by 2040***
- ***Community Solar***
- ***Vehicle Electrification***
- ***Building Codes:***
  - New state-owned buildings carbon neutral in 2022;
  - New residential buildings “zero energy ready” starting in 2023.
  - All new buildings solar ready.

Executive Order 20-04 – Energy

- Cap and reduce emissions from end-use natural gas consumption
- Reduce energy consumption by new buildings by at least 60% by 2030.
- Update efficiency standards for appliances to match or exceed West Coast jurisdictions.
- Establishes that rapid decarbonization of electricity grid consistent with state goals is in the public interest, and should be considered in energy sector planning and investments.
- Facilitates utility investments in TE and alternative fuel vehicles; TE planning.
- Requires new wildfire risk mitigation planning.

NATIONAL GOVERNORS ASSOCIATION

Clean Energy Lightning Talks

Speakers:

Alyse Taylor-Anyikire, PhD, National Governors Association

Todd Allen, University of Michigan

Lee Beck, Clean Air Task Force

Moderated by:

Jessica Rackley, Program Director, National Governors Association

Landmark FERC Orders Affecting Distributed Energy Resources (DERs)

Alyse Taylor-Anyikire, PhD

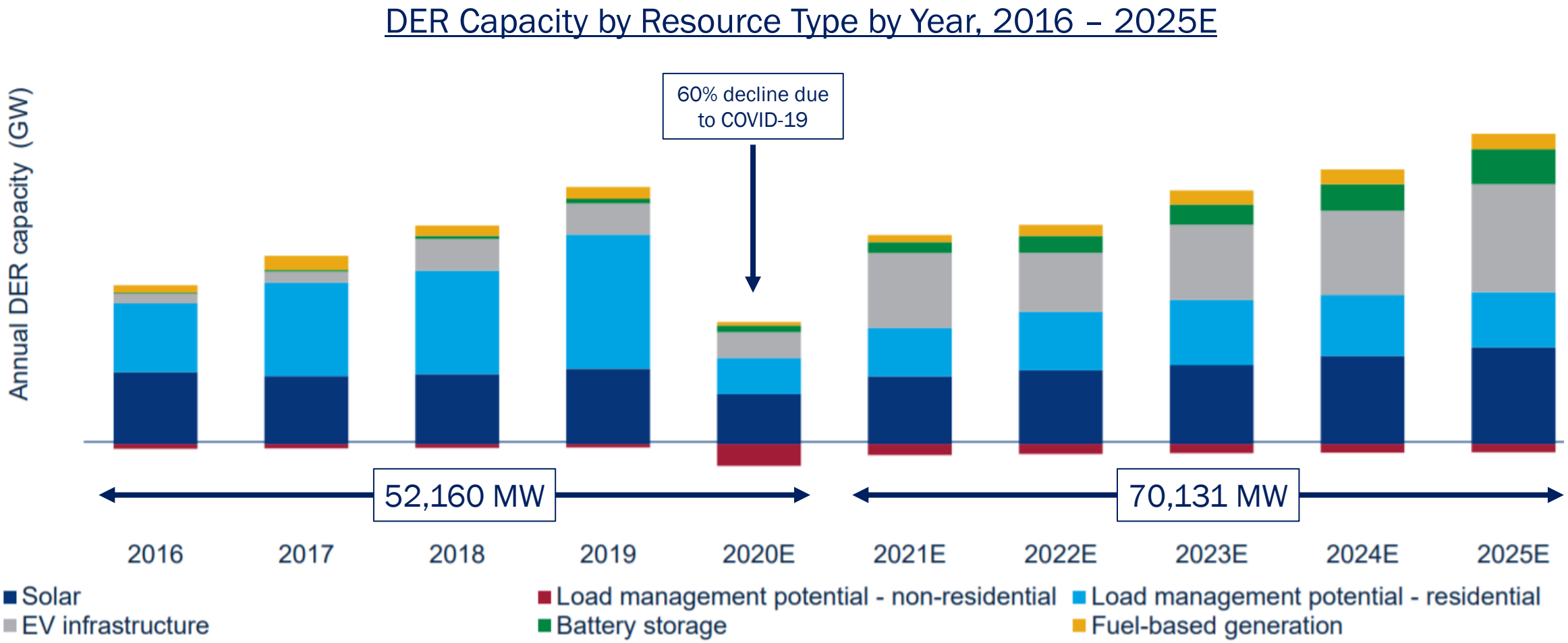
Senior Policy Analyst

National Governors Association

DER's can include

- Resources in front of the meter OR behind the meter
- Demand response
- Energy efficiency
- Electric storage
- Thermal storage
- Intermittent generation
- Distributed generation
- Electric vehicles
- Electric vehicle supply equipment

DER capacity will increase 34% from 2020 to 2025



Source: Wood Mackenzie Energy Storage Service, Grid Edge Service, and US Distributed Solar Service

FERC Order 841

- Issued in February 2018; legal battle concluded in July 2020

- Requires markets to change their tariffs to allow energy storage resources to participate, including resource aggregators
  - ✓Energy
  - ✓Capacity
  - ✓Ancillary services (e.g. voltage control, frequency control, load following)

FERC Order 2222

- Passed September 2020

- Requires markets to change their tariffs to allow distributed energy resource (DER) aggregators to participate
  - ✓Energy
  - ✓Capacity
  - ✓Ancillary services (e.g. voltage control, frequency control, load following)

How will this work?

- Must detail how they will coordinate with distribution utilities
- Markets will spell out requirements to prevent double counting of services
- Minimum size requirement will be 100kW or less
- Can mix and match resources from different locations
- Small utilities, less than 4M MWh, can choose to opt-in or out

Why is this important for clean energy development?

- Access to wholesale markets brings new revenue sources

- Add diversity, capacity & new energy sources to regional energy mix
- Catalyst for bringing new technologies and clean resources online
- Potential to drive down costs
- Can make the grid more flexible

21ST CENTURY NUCLEAR ENERGY

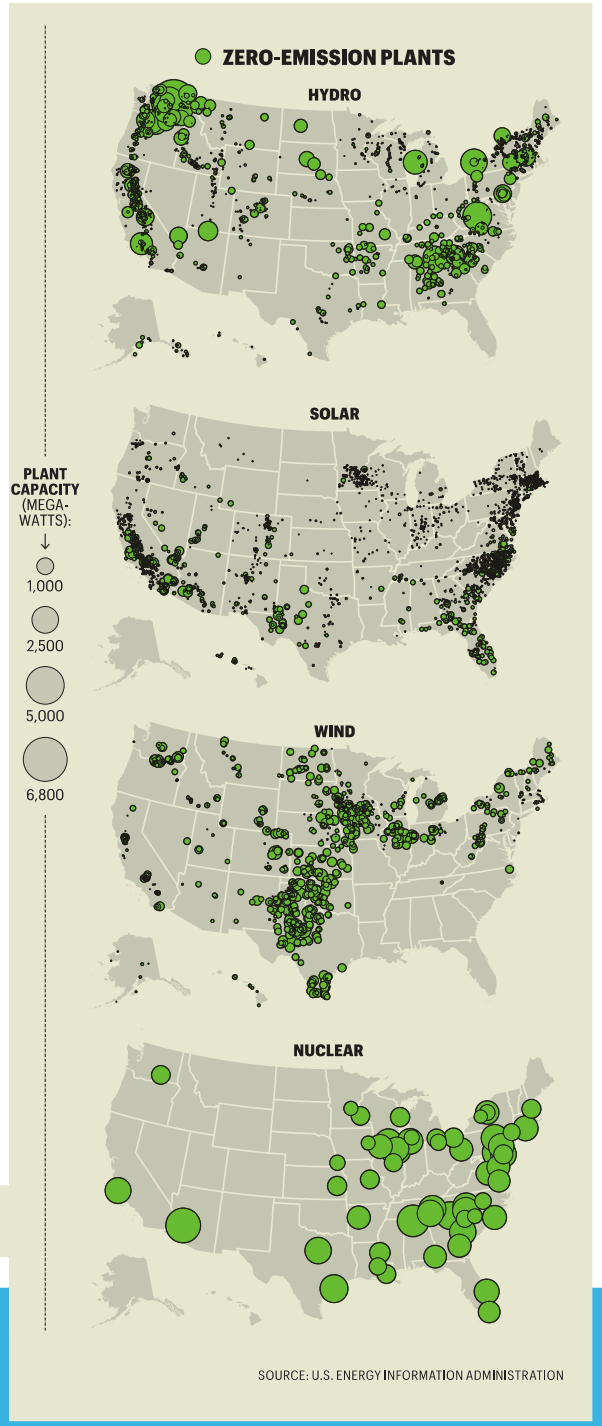
OCTOBER 2020, TODD ALLEN, PROFESSOR & SENIOR FELLOW

FASTEST PATH TO ZERO
UNIVERSITY OF MICHIGAN

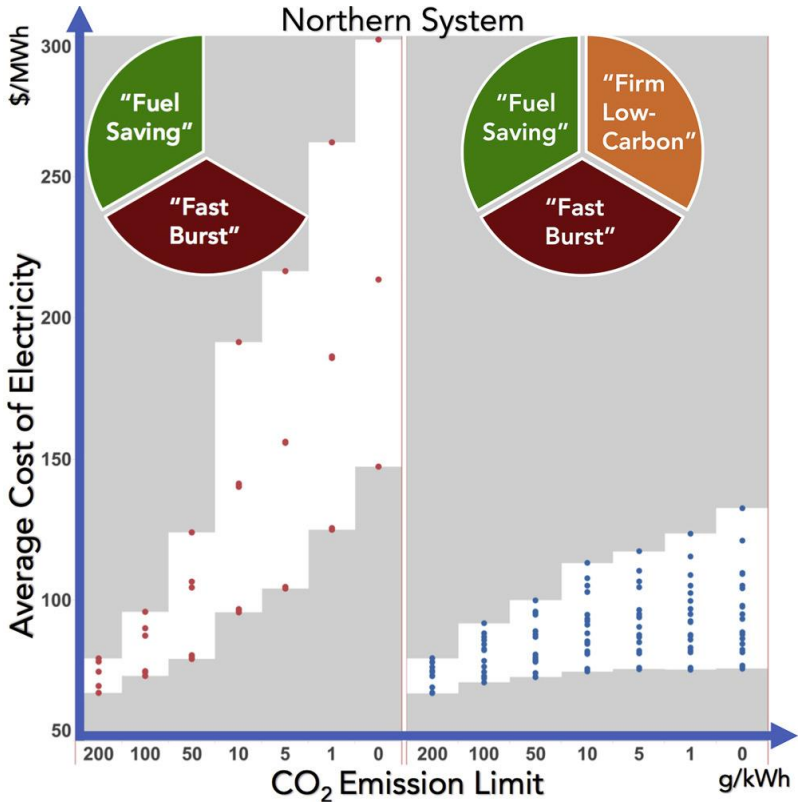
NUCLEAR ENERGY IS A BIG DEAL

~20% of US electricity

~55% of the carbon-free electricity

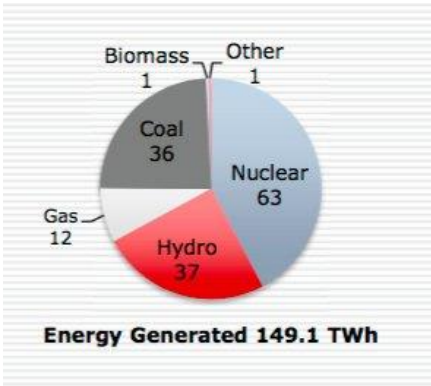


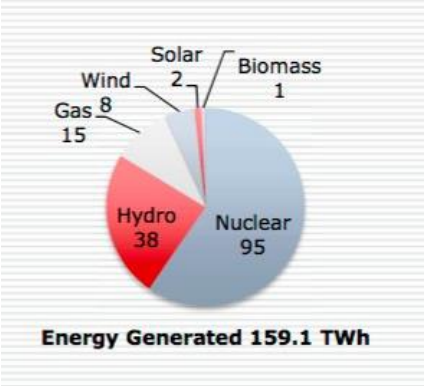
THE EMISSIONS REDUCTION IMPERATIVE



Sepulveda et al. Joule 2018

Models indicate that overall system cost is lower if a mix of zero carbon production sources are combined





Ontario Transition from Coal

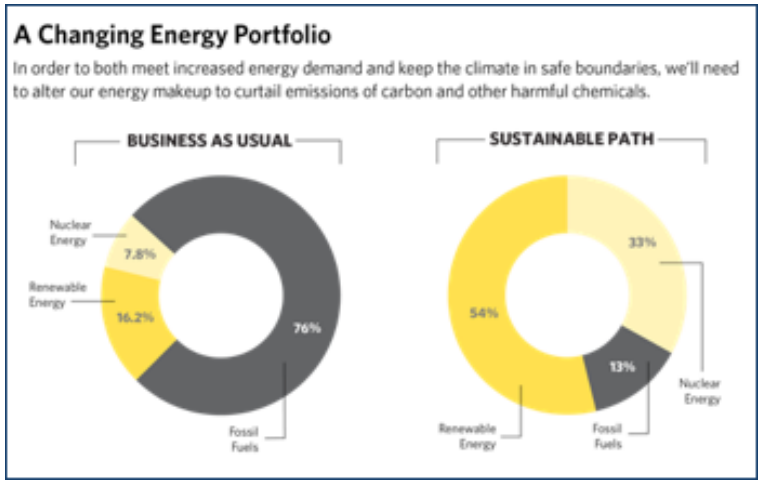
THE SUPPLY CHAIN IMPERATIVE

£1 trillion international new-build and decommissioning market over the next 10 years

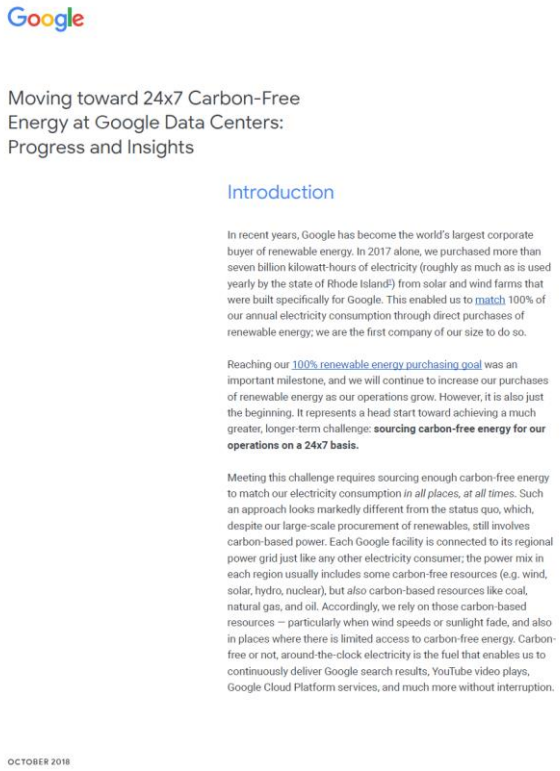
The WNA estimates that the value of global investment in new reactor build will be of the order US$1.5 trillion (£0.93 trillion), with significant international procurement expected to be approximately US$530bn (£330bn), US$40bn (£25bn) per year through 2025.

Ernst & Young LLP, “Creating confident investors and competitive advantage for the UK nuclear supply chain” November 2017

THE SOCIAL IMPERATIVE



Source: The Nature Conservancy, The Science of Sustainability, 2018


Google

Moving toward 24x7 Carbon-Free Energy at Google Data Centers: Progress and Insights

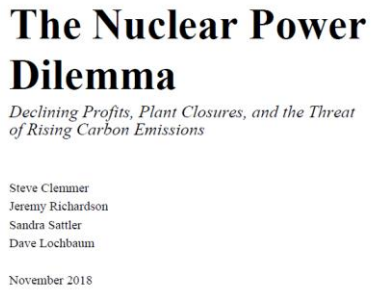
Introduction

In recent years, Google has become the world's largest corporate buyer of renewable energy. In 2017 alone, we purchased more than seven billion kilowatt-hours of electricity (roughly as much as is used yearly by the state of Rhode Island[1]) from solar and wind farms that were built specifically for Google. This enabled us to match 100% of our annual electricity consumption through direct purchases of renewable energy; we are the first company of our size to do so.

Reaching our 100% renewable energy purchasing goal was an important milestone, and we will continue to increase our purchases of renewable energy as our operations grow. However, it is also just the beginning. It represents a head start toward achieving a much greater, longer-term challenge: **sourcing carbon-free energy for our operations on a 24x7 basis.**

Meeting this challenge requires sourcing enough carbon-free energy to match our electricity consumption *in all places, at all times*. Such an approach looks markedly different from the status quo, which, despite our large-scale procurement of renewables, still involves carbon-based power. Each Google facility is connected to its regional power grid just like any other electricity consumer; the power mix in each region usually includes some carbon-free resources (e.g. wind, solar, hydro, nuclear), but also carbon-based resources like coal, natural gas, and oil. Accordingly, we rely on those carbon-based resources — particularly when wind speeds or sunlight fade, and also in places where there is limited access to carbon-free energy. Carbon-free or not, around-the-clock electricity is the fuel that enables us to continuously deliver Google search results, YouTube video plays, Google Cloud Platform services, and much more without interruption.

OCTOBER 2018


The Nuclear Power Dilemma

Declining Profits, Plant Closures, and the Threat of Rising Carbon Emissions

Steve Clemmer
Jeremy Richardson
Sandra Sattler
Dave Lochbaum

November 2018

It's Time for Environmentalists and the Energy Industry to Work Together (Time Magazine, October 12, 2018)

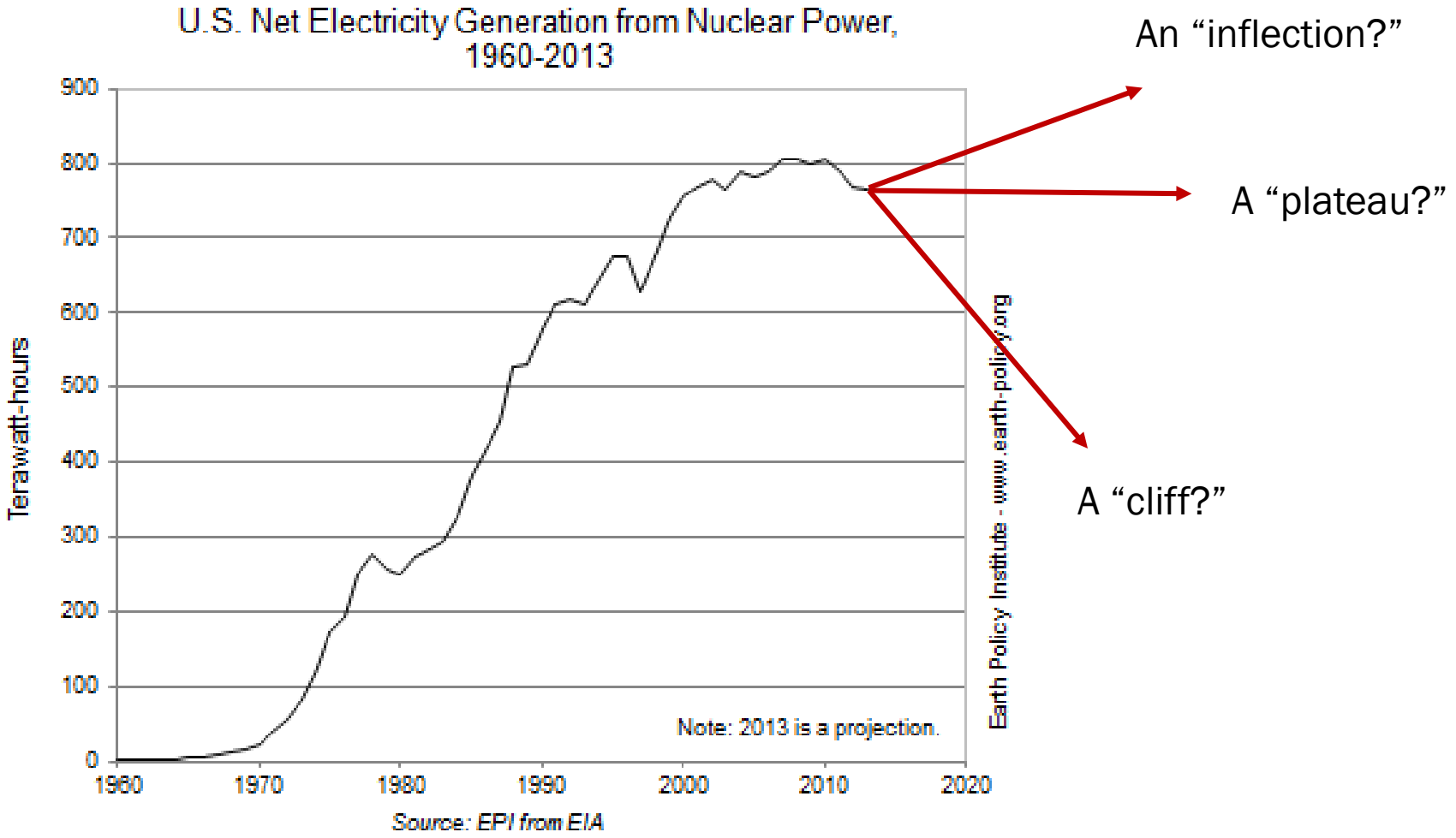
MacArthur Foundation

Exelon

Union of Concerned Scientists

NICE Future
Nuclear Innovation: Clean Energy Future

TRAJECTORY OF ATOMS FOR PEACE GENERATION



http://www.earth-policy.org/plan_b_updates/2013/update116

ENERGY REIMAGINED

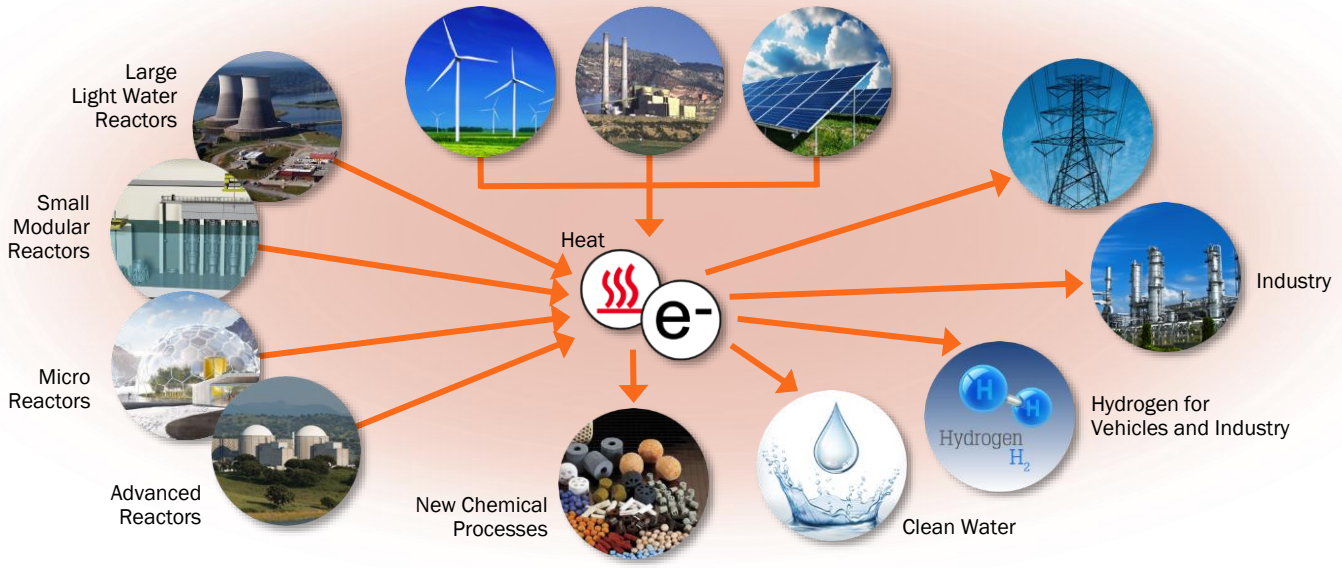
Maximizing energy utilization, generator profitability, and grid reliability and resilience through novel systems integration and process design

Today

Electricity-only focus

Potential Future Energy System

Integrated grid system that leverages contributions from nuclear fission beyond electricity sector

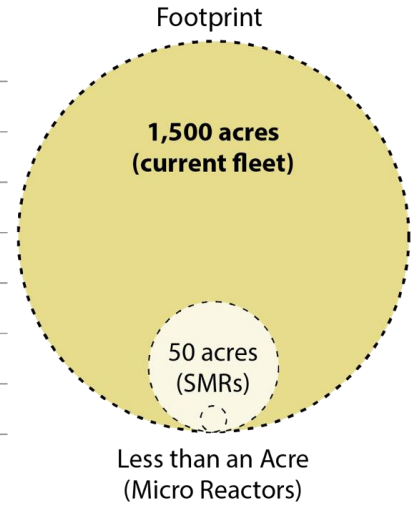


Flexible Generators ❖ Advanced Processes ❖ Revolutionary Design

Courtesy Shannon Bragg-Sitton, Ph.D., Idaho National Laboratory

EXISTING NUCLEAR REACTORS

Number in operation:	**98 in U.S.**
Timeframe:	**Built in the 1950s-1980s**
Products:	**Electricity**
Megawatts:	**1,000+ megawatts**
Customers:	**Large utilities**
Emergency zone:	**10 miles**
Construction:	**Custom built on site**
Scalability:	**Difficult due to size and cost**



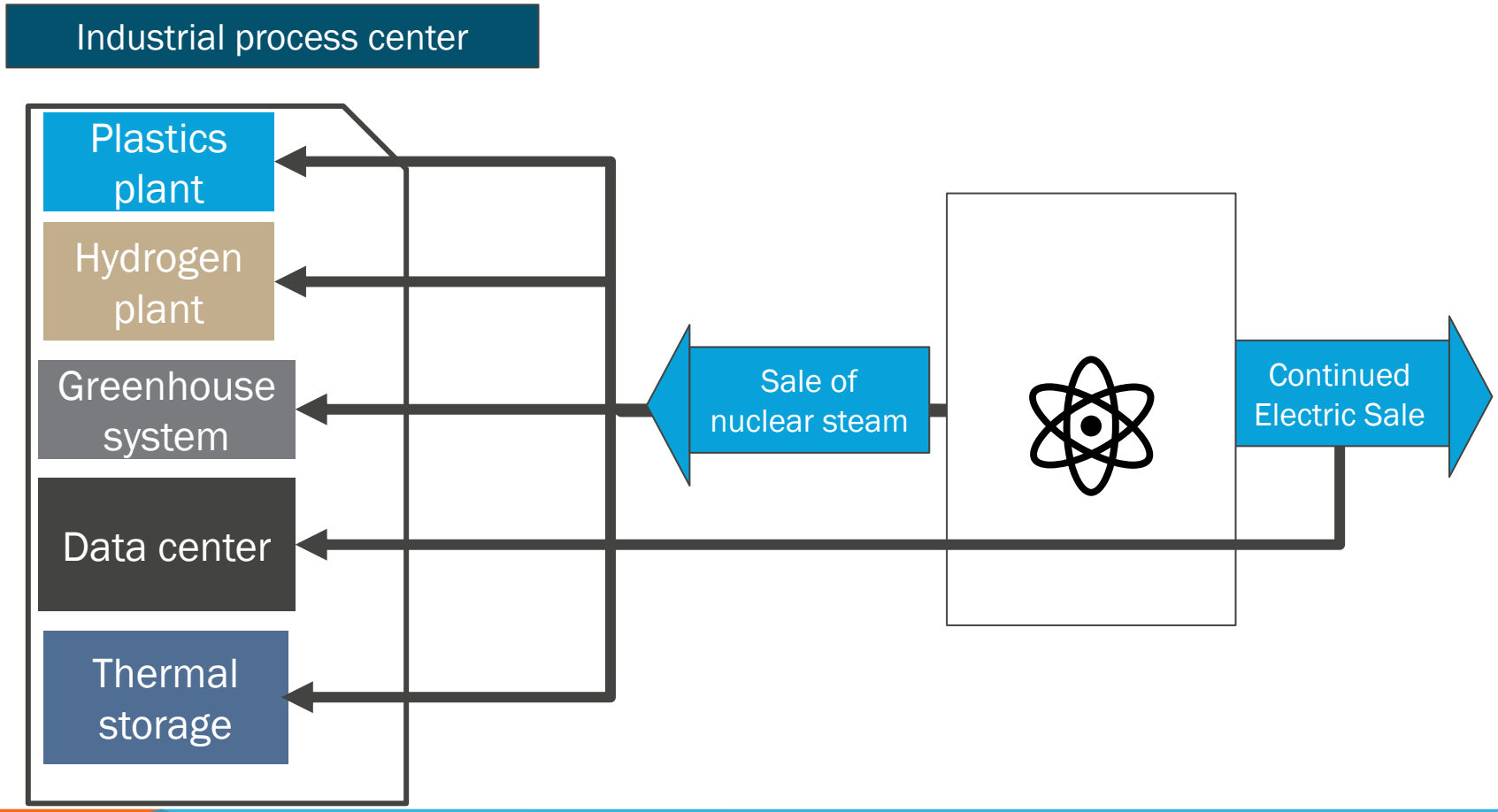
Applications:
Baseload electricity; 24/7

Did you know? In November 2018, the Union of Concerned Scientists recommended federal and state governments adopt policies to preserve the low-carbon electricity the current fleet of nuclear reactors provides.

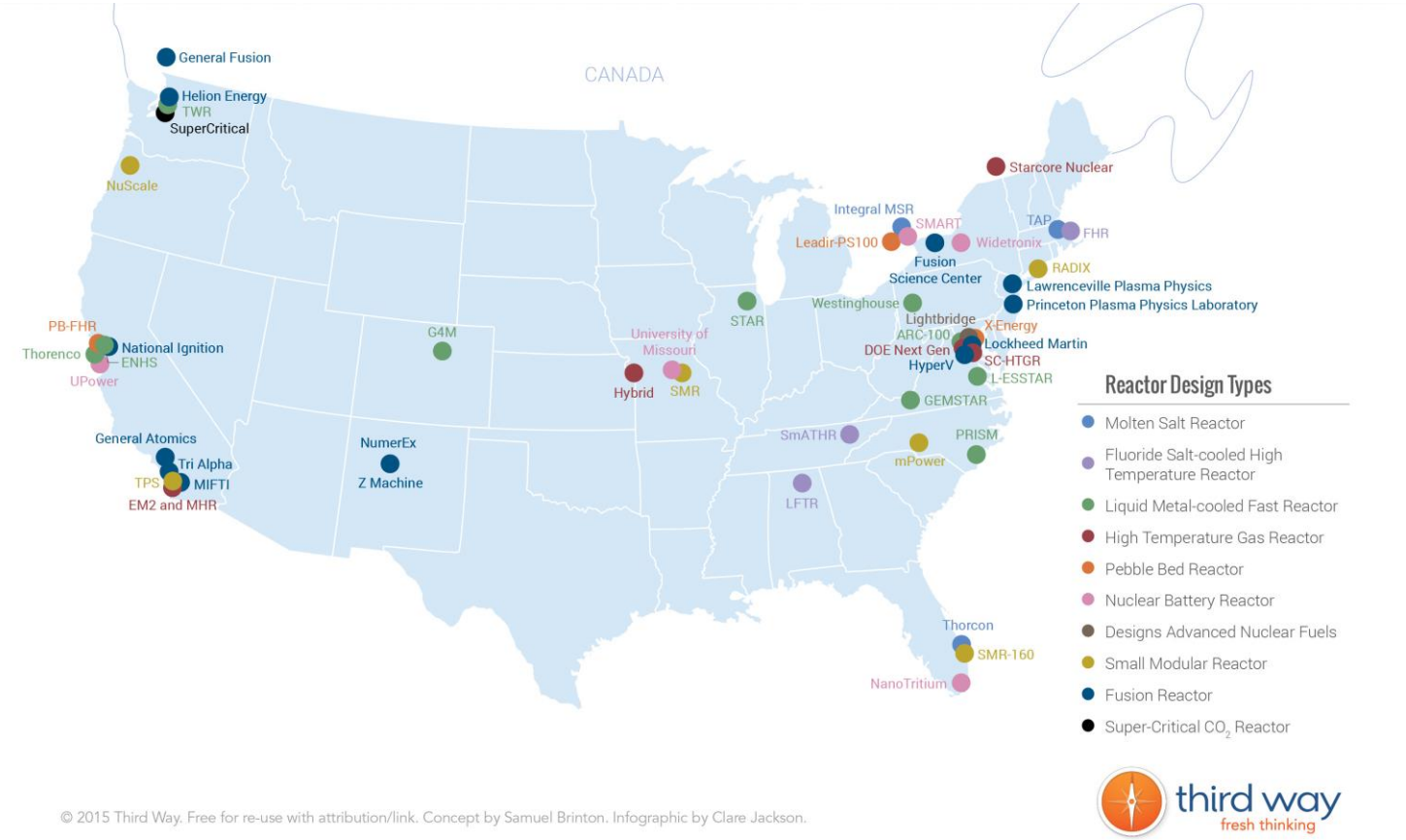
Courtesy Shannon Bragg-Sitton, Ph.D., Idaho National Laboratory

NUCLEAR REPURPOSING

Reconfigure one or more of Exelon's nuclear plants to sustainably enhance their long-term value, by producing new products – not just electricity; for example, by providing steam to industrial partners.

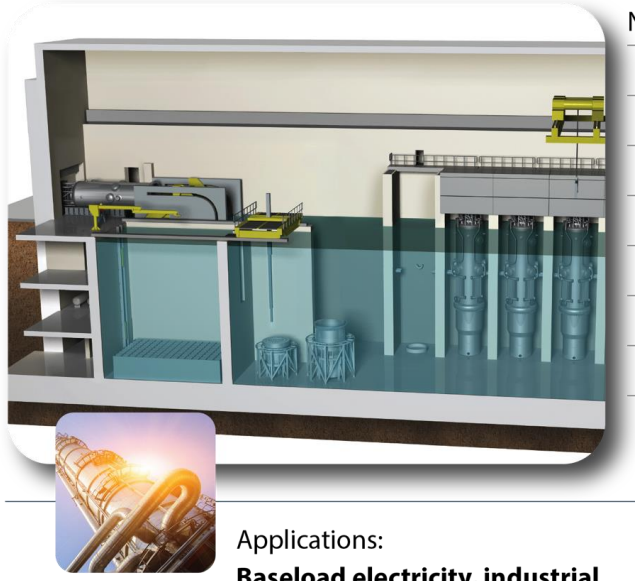


U.S. NUCLEAR

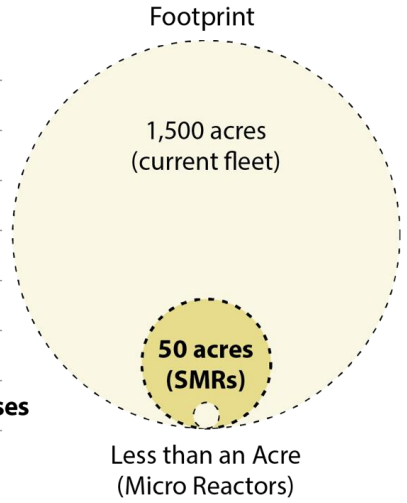


Advanced Reactor Companies

SMALL MODULAR REACTORS



Number in operation:	**None***
Timeframe:	**first reactors expected by 2024**
Products:	**Electricity, heat, and steam**
Megawatts:	**60-300 megawatts per module**
Customers:	**Large utilities; municipalities; industry**
Emergency zone:	**.19 miles**
Construction:	**Factory built; assembled on site**
Scalability:	**Reactor modules added as demand increases**

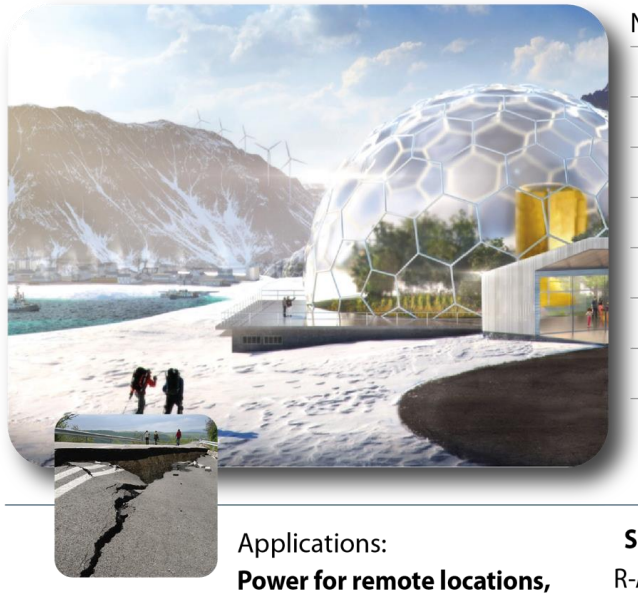


Applications:
Baseload electricity, industrial electricity, industrial processes such as hydrogen production

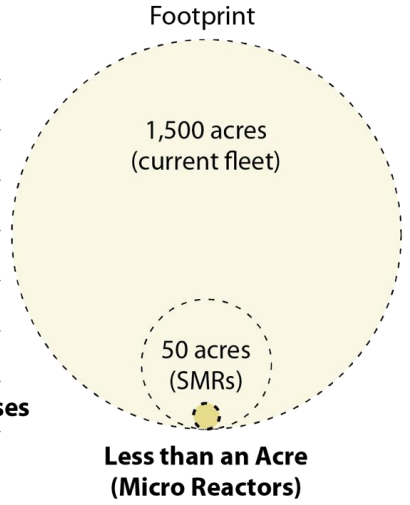
**First SMR in U.S. is currently going through regulatory approval and siting process; UAMPS proposing 12-module SMR in Idaho using NuScale technology.*

Courtesy Shannon Bragg-Sitton, Ph.D., Idaho National Laboratory

MICROREACTORS



Number in operation:	**None in the U.S.**
Timeframe:	**first reactors expected by 2025**
Products:	**Electricity, heat, and steam**
Megawatts:	**20 megawatts or less**
Customers:	**Military; municipalities; industry**
Emergency zone:	**less than .19 miles**
Construction:	**Factory built; assembled on site**
Scalability:	**Reactor modules added as demand increases**



Less than an Acre
(Micro Reactors)

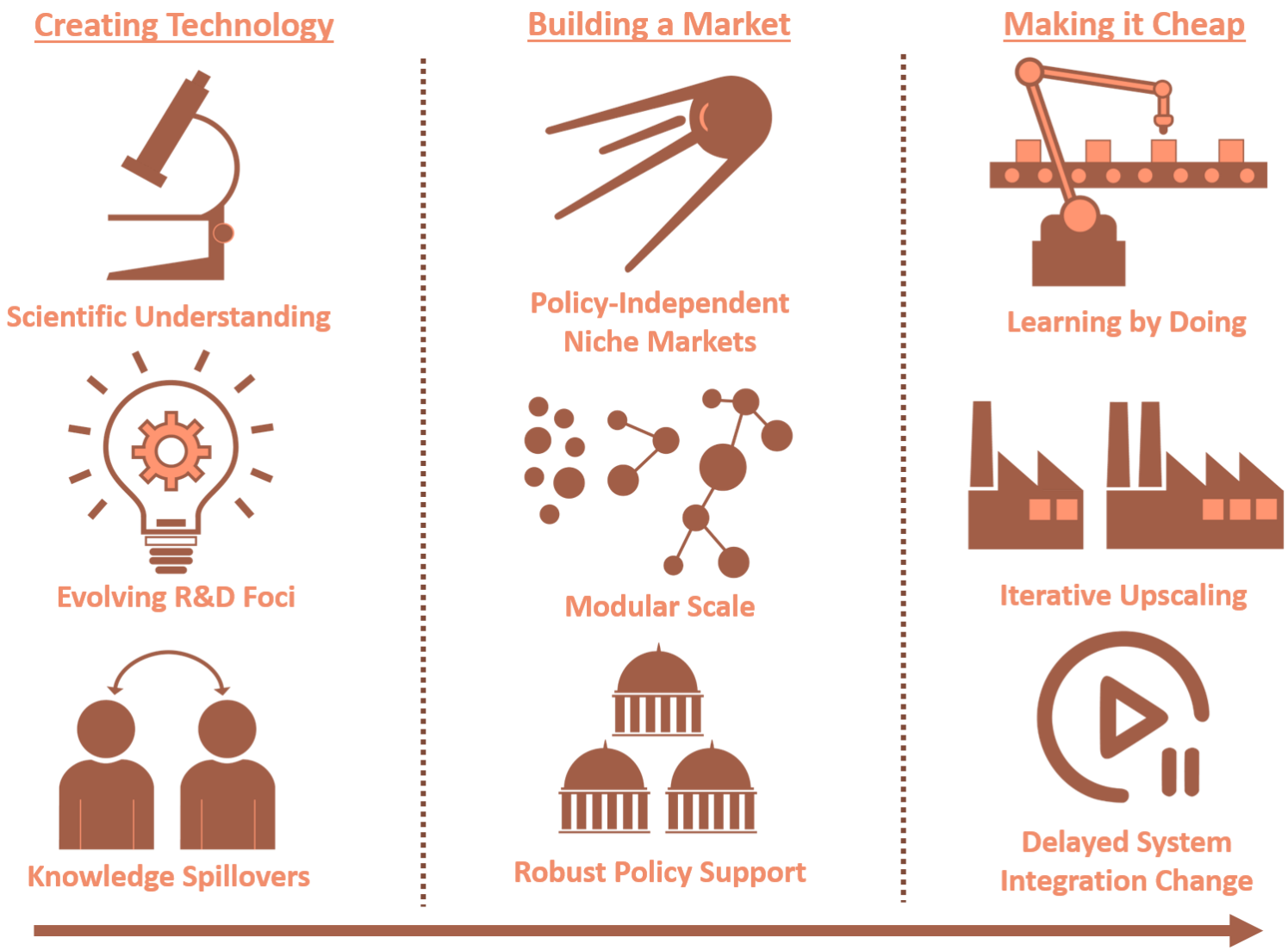
Applications:
Power for remote locations, maritime shipping, military installations, mining, space missions, desalination, disaster relief

Sen. Lisa Murkowski, R-Alaska, April 14, 2019 Op-Ed in the Anchorage Daily News.

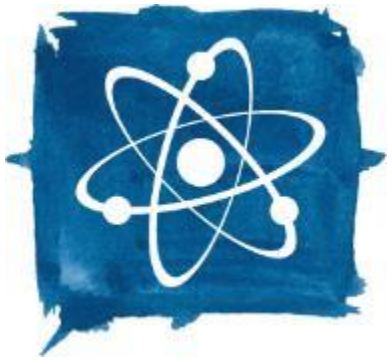
Improvements in nuclear technology "are enabling the emergence of so-called "microreactors" that could be a perfect fit throughout our state. As the name suggests, these smaller reactors can be right-sized for dozens of Alaska communities and will have off-grid capability that could solve the challenge of providing clean, affordable energy in our remote areas."

Courtesy Shannon Bragg-Sitton, Ph.D., Idaho National Laboratory

ACCELERATING THE PV MODEL



Source: Nemet (2019). *How Solar Became Cheap: A Model for Low-Carbon Innovation*, Routledge.



ADVANCED NUCLEAR CAMPAIGN

Todd Allen

Senior Fellow, Third Way

tallen@thirdway.org

CLEAN AIR TASK FORCE

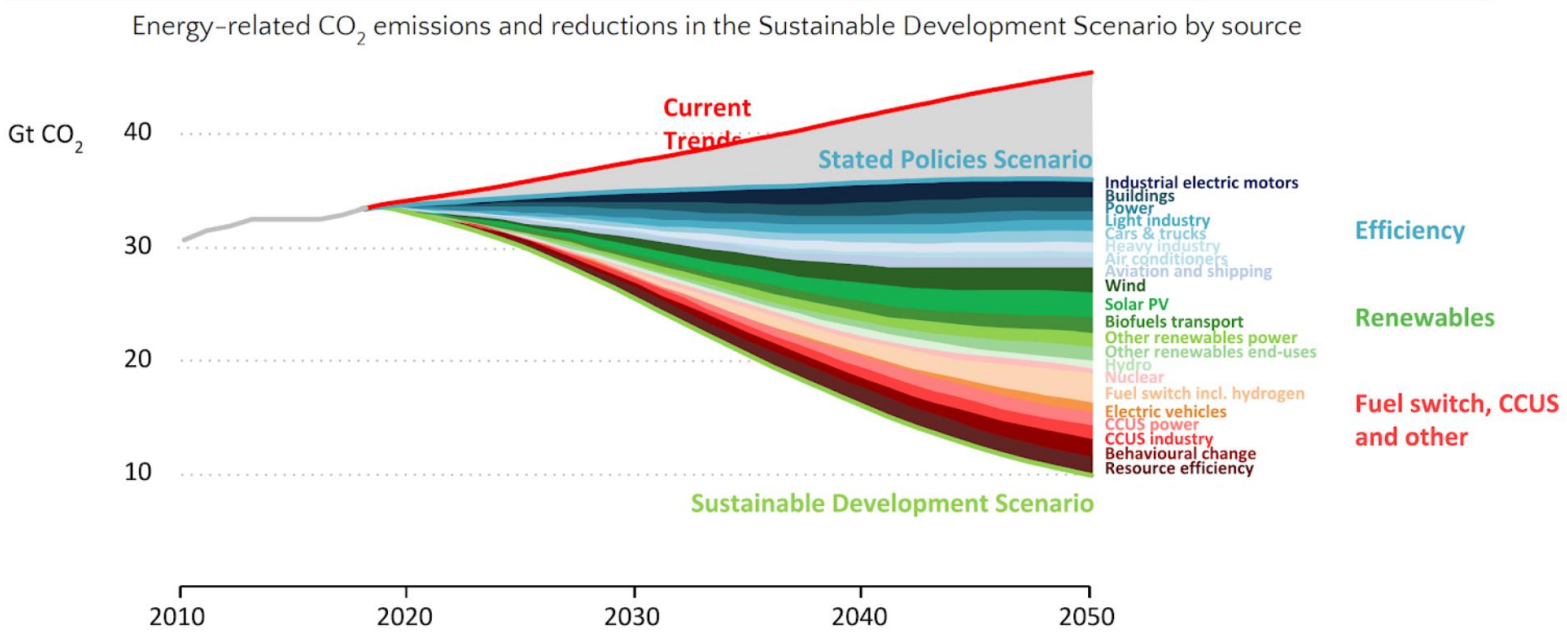
NGA's Planning for the Future Workshop: Strategies to Meet Governor's Clean Energy Goals

Lee Beck, CCUS Policy Innovation Director, lbeck@catf.us

October 28, 2020

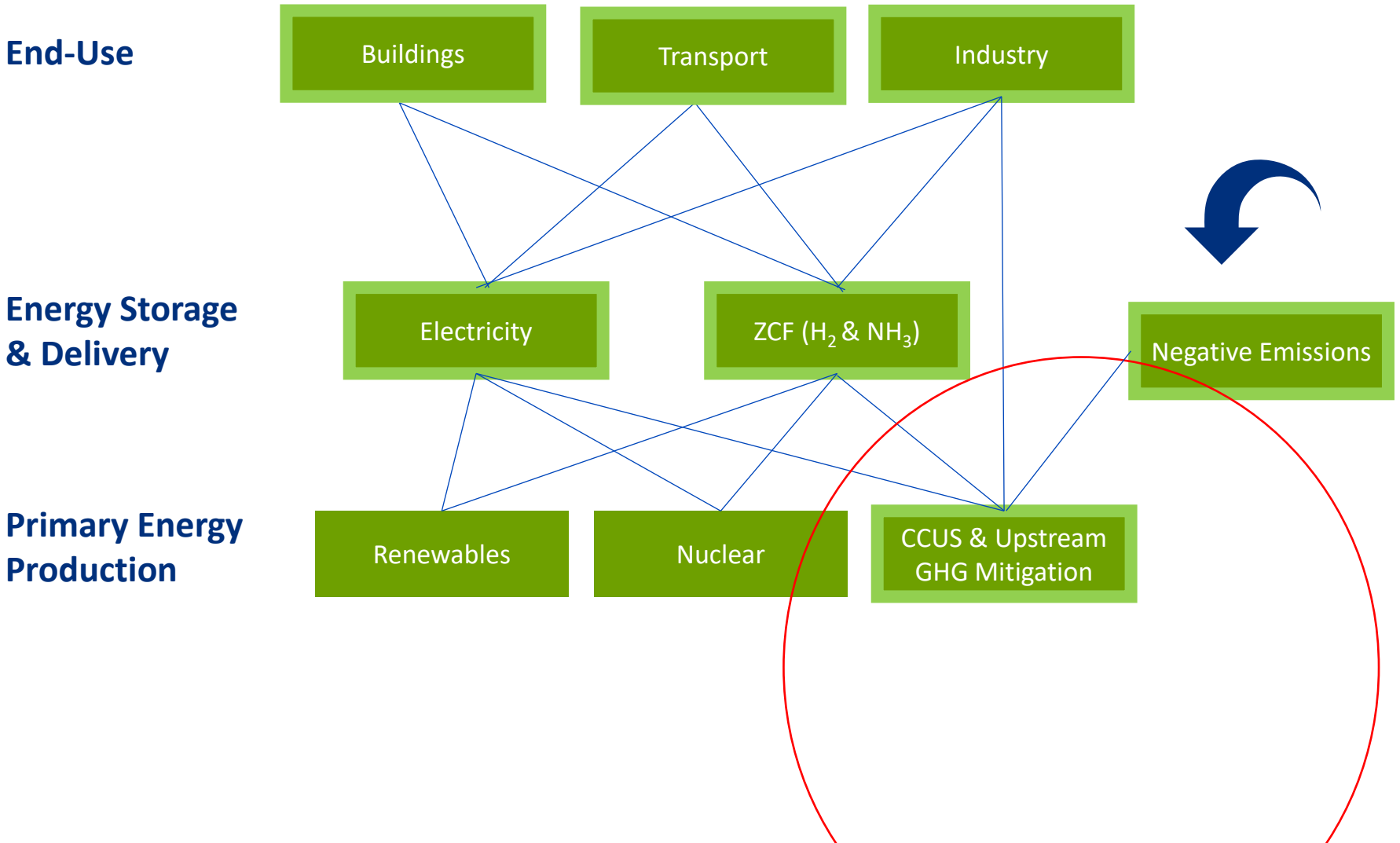
What Is Carbon Capture?

- Carbon capture technologies capture, transport and store CO_2 from energy-intensive industries and the air. It hence address both the
  - Flow of CO_2 by capturing emissions from power plants and industrial facilities
  - Stock of CO_2 by capturing CO_2 directly from the atmosphere



More than **2000 carbon capture facilities** are needed by 2050

What A Net-Zero Carbon Energy System Looks Like



The Current Policy Landscape

- The 45Q amendments create a robust business case for investment in CCS and provide the policy confidence that investors require, CATF is also proposing a PTC for natural gas with carbon capture
- The California LCFS CCS Protocol also makes carbon capture eligible for credits that reduce the lifecycle emissions from fuels or directly from the air

TYPE OF CO_2 STORAGE/USE	MINIMUM SIZE OF ELIGIBLE CARBON CAPTURE PLANT BY SIZE ($KtCO_2$/YR)			RELEVANT LEVEL OF TAX CREDIT GIVEN IN OPERATIONAL YEAR (USD/tCO_2)									
	POWER PLANT	OTHER INDUSTRIAL FACILITY	DIRECT AIR CAPTURE	2018	2019	2020	2021	2022	2023	2024	2025	2026	LATER
DEDICATED GEOLOGICAL STORAGE	500	100	100	28	31	34	36	39	42	45	47	50	
STORAGE VIA EOR	500	100	100	17	19	22	24	26	28	31	33	35	INDEX LINKED
OTHER UTILISATION PROCESSES*	25	25	25	17	19	22	24	26	28	31	33	35	

*Each CO_2 source cannot be greater than 500 $ktCO_2$/yr. Any credit will only apply to the portion of the converted CO_2 that can be shown to reduce overall emissions.

Source: Global CCS Institute

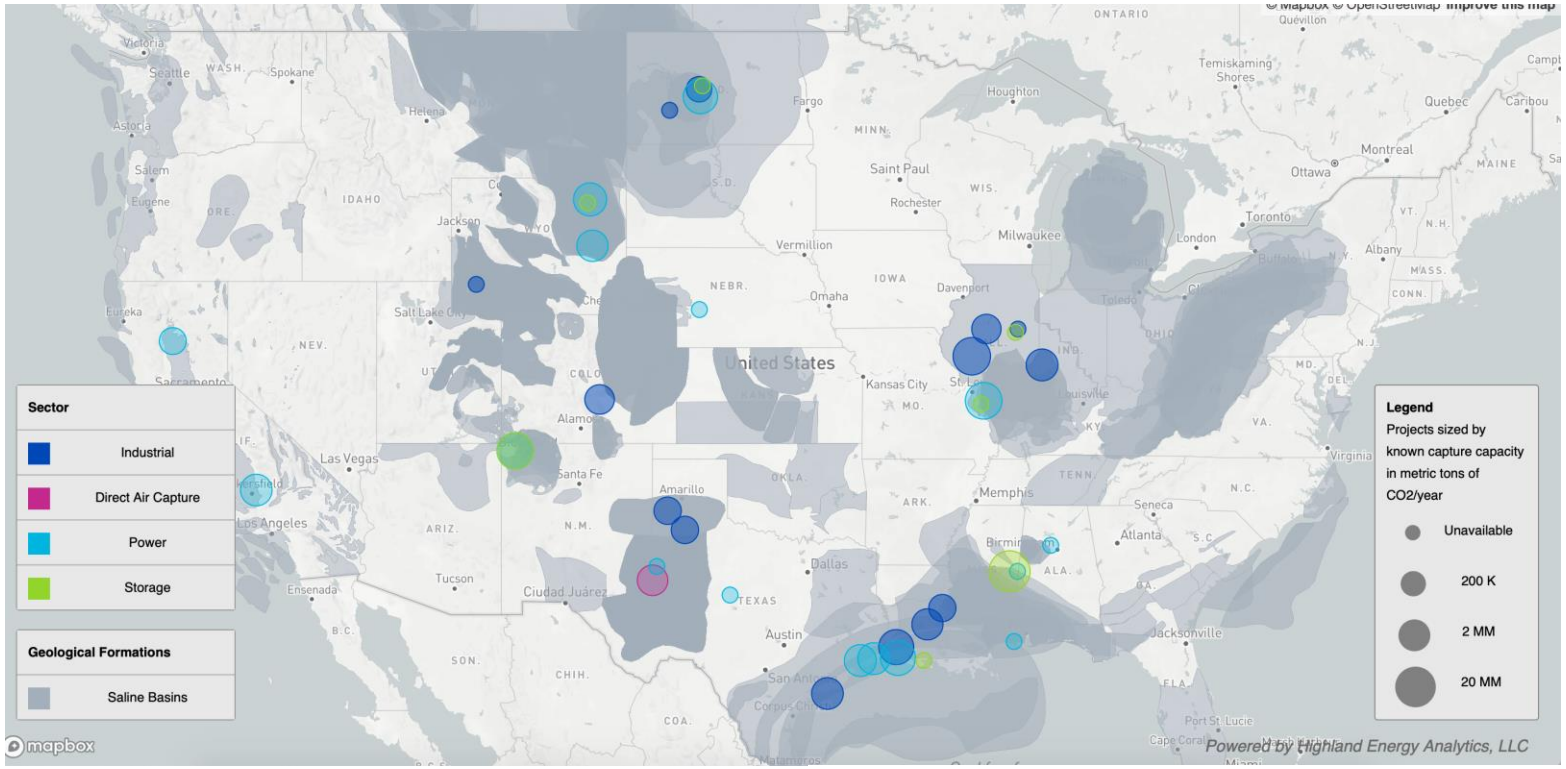
Current Legislative Landscape

45Q and DOE-support have led to a significant increase of carbon capture projects in planning over the past two years, with more than **30 projects in various** stages of development through the US. To improve the chances of success for these projects and a continued, healthy growth of the project pipeline, CATF enactment of these existing legislative proposals:

- **45Q Optimization:** 10-year Extension and Direct Pay
- **Permitting:** Appropriations for Class VI Well Permits and State Primacy Applications; $25M at Agency, $50M for primacy, for five years
- **Commercial Demonstration (Sec.503, HB2):** $7.5B Advanced Carbon Capture*, $1.25B for FEED studies, $1.25 B for Direct Air Capture, $2.5 B for Geologic Storage development for five years
- **R&D (FERD/EFFECT-LEADING):** $2.15B for carbon capture, DAC, and geologic storage over five years (*reflects FERD funding levels*)
- **USE IT:** DAC concept creation prize, infrastructure permitting efficiency

*Goal is commercial demonstration of at least three advanced carbon capture technologies through 3rd of a kind level

US Carbon Capture Projects Map



NEGATIVE EMISSIONS

INDUSTRIAL CARBON CAPTURE

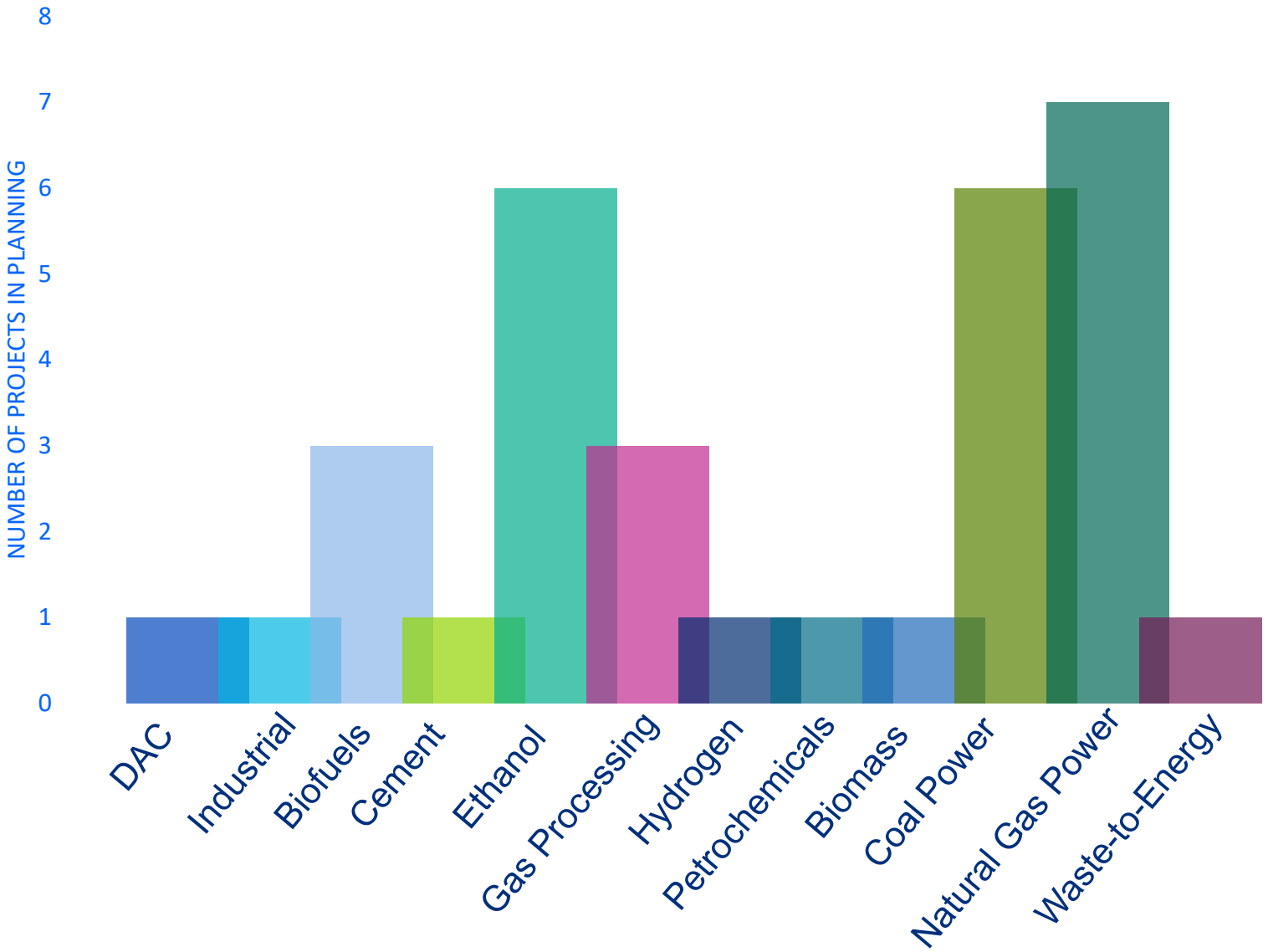
NEW BUSINESS MODELS

HUBS & CLUSTERS

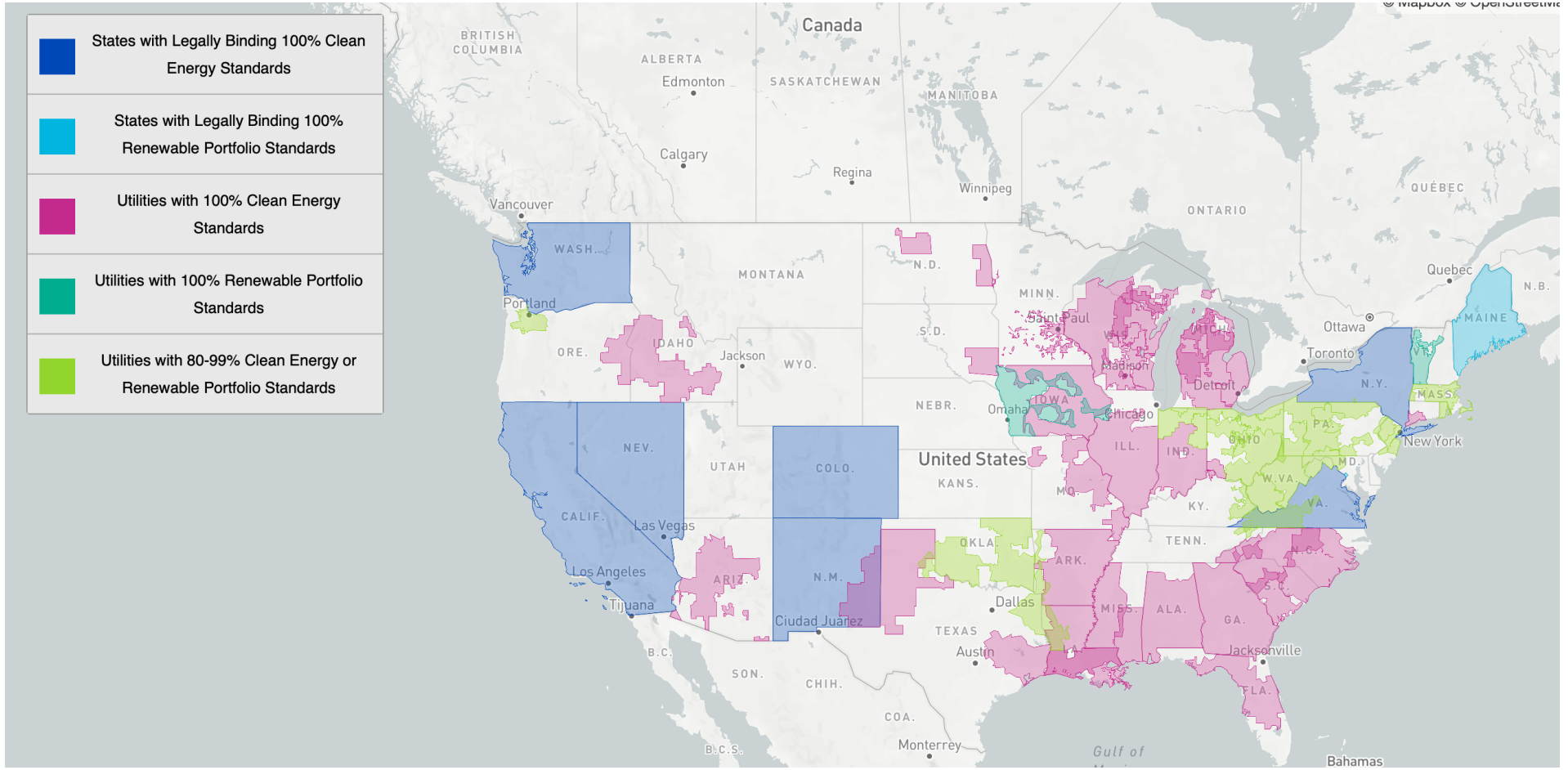
UTILIZATION

NEW PARTNERSHIPS

Project Tracker: Diversity of Applications



US State and Utility Commitments



Other State Policy Options

- **Clean Energy Standards:** allowing carbon capture electricity to contribute to state's clean energy goals
- **Investment Tax Credits** for carbon capture equipment
- **Permitting:** Class VI Well State Primacy Applications; North Dakota, Wyoming completed, Louisiana, Texas in progress
- **Infrastructure:** Kansas, Pennsylvania, Louisiana, Maryland, Montana, Oklahoma and Wyoming signed a memorandum of understanding (MOU) expressing a commitment to establish and implement a regional CO2 transport infrastructure plan
- **State-specific resources:** https://carboncaptureready.betterenergy.org

The Path Towards Commercialization

Innovation Criteria

- Reduce cost
- Compress deployment timeline
- Affordable Financing
- Build Ecosystem (saline storage & CO_2 transport)

Policies & Models

- PTC for natural gas power power
- Financing & grants for CO_2 transportation infrastructure
- Geologic Storage Utilities
- Geologic Storage & Storage Clusters
- Offshore Storage of CO2

Lee Beck

CCUS Policy Innovation Director

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Boston, MA 02109

NATIONAL GOVERNORS ASSOCIATION

Modernizing the Grid to Incorporate Diverse Generation Resources

Speakers:

Prithpal Khajuria, IOT Products and Solutions, Intel Corporation

Scott Glenn, Chief Energy Officer, Hawai'I State Energy Office

Moderated by:

Dan Lauf, Program Director, National Governors Association

Modernizing the Grid to Incorporate Diverse Resources

National Governors Association

October 28, 2020

Scott Glenn

Chief Energy Officer

HAWAII STATE Energy Office

7 AFFORDABLE AND CLEAN ENERGY

Hawai‘i Revised Statutes §269-92 Renewable Portfolio Standards

(a) Each electric utility company that sells electricity for consumption in the State shall establish a renewable portfolio standard of:

(1) 10% of its net electricity sales by December 31, 2010;

(2) 15% of its net electricity sales by December 31, 2015;

(3) 30% of its net electricity sales by December 31, 2020;

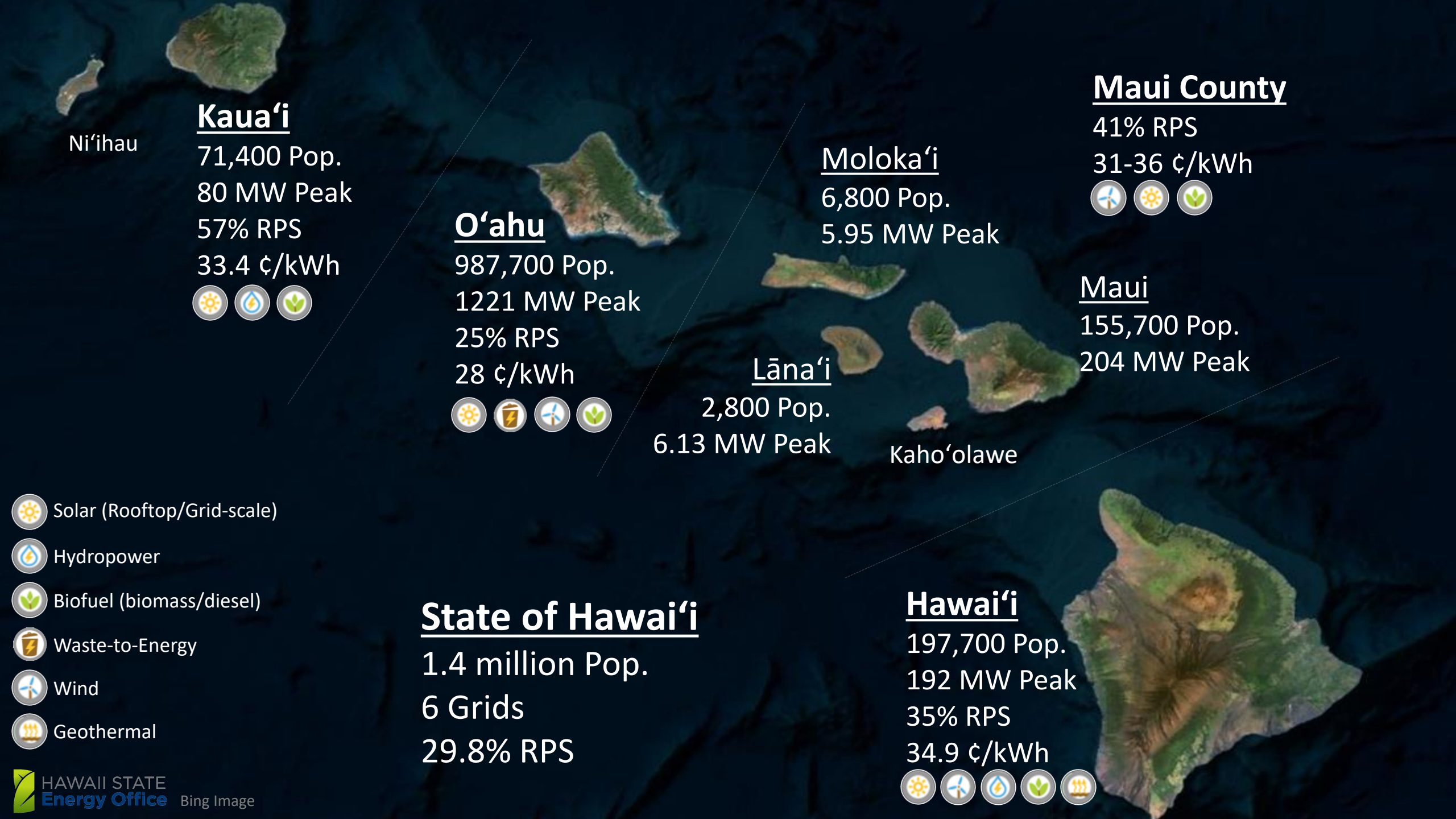
(4) 40% of its net electricity sales by December 31, 2030;

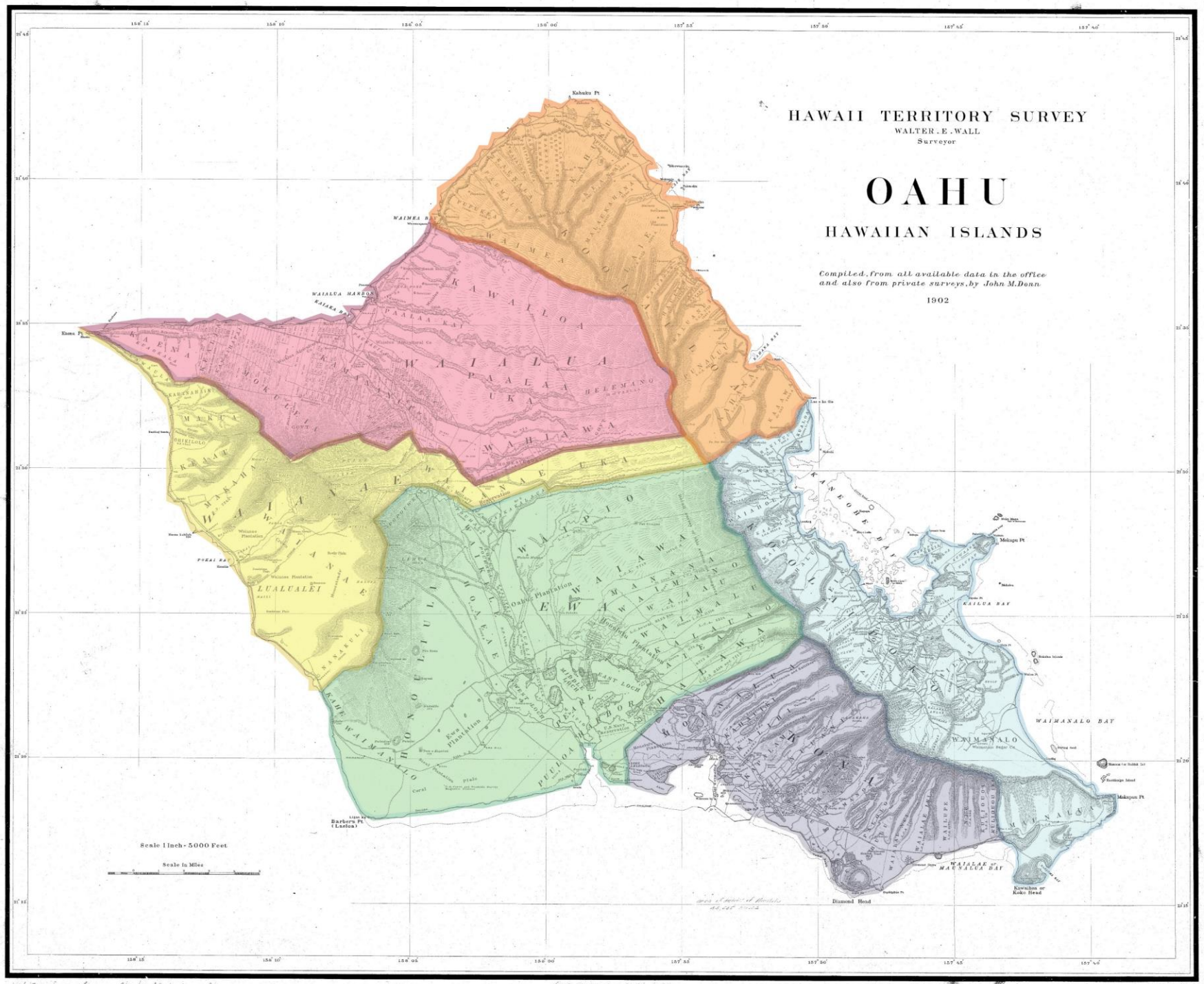
(5) 70% of its net electricity sales by December 31, 2040; and

(6) 100% of its net electricity sales by December 31, 2045.

Hawai‘i Revised Statutes §225P-5
Zero Emission Clean Economy Target

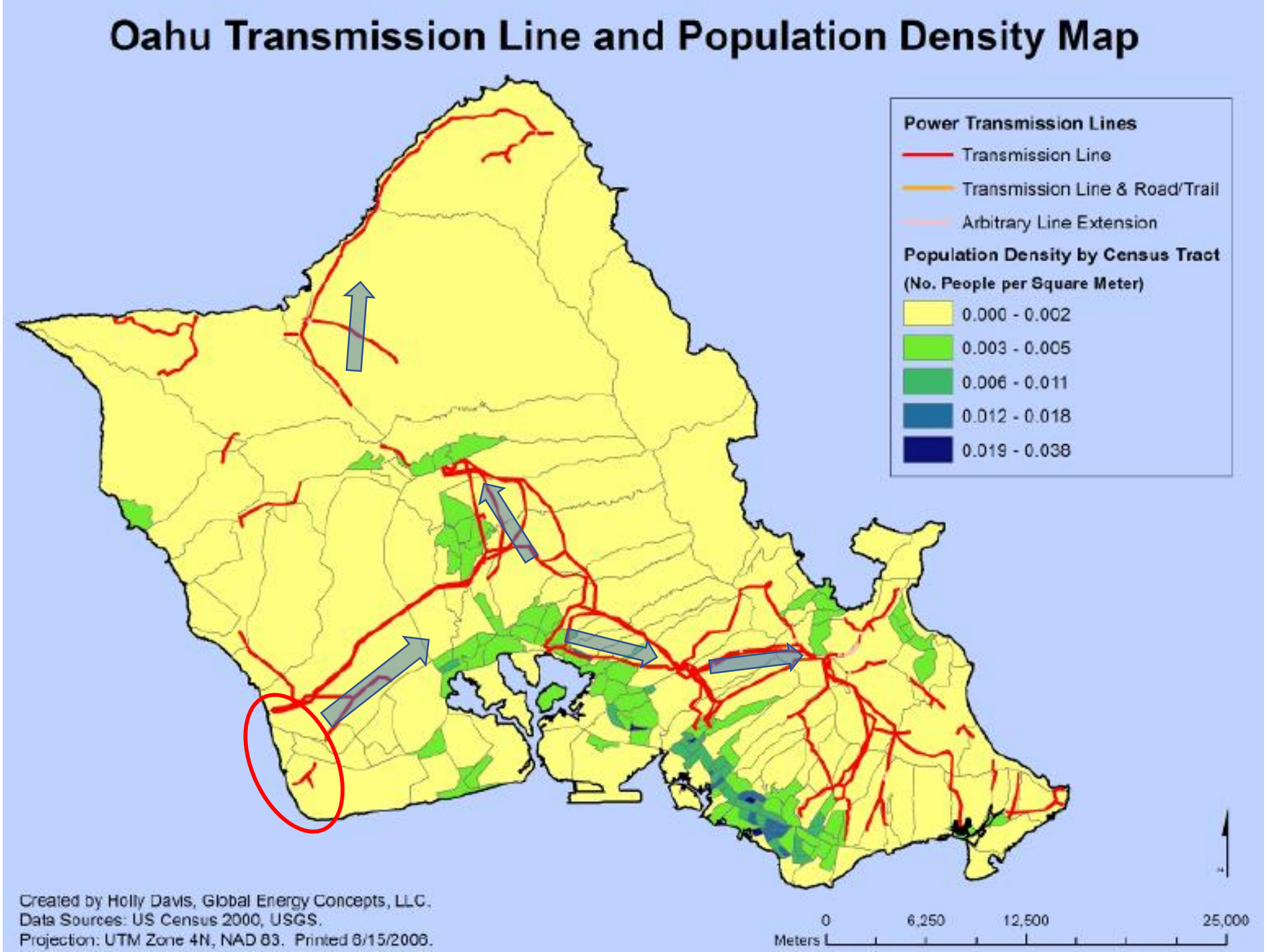
(a) Considering both atmospheric carbon and greenhouse gas emissions as well as offsets from the local sequestration of atmospheric carbon and greenhouse gases through long-term sinks and reservoirs, a statewide target is hereby established to **sequester more** atmospheric **carbon and greenhouse gases than emitted within the State as quickly as practicable, but no later than 2045**.


Niʻihau
Kauaʻi
71,400 Pop.
80 MW Peak
57% RPS
33.4 ¢/kWh
Oʻahu
987,700 Pop.
1221 MW Peak
25% RPS
28 ¢/kWh
Molokaʻi
6,800 Pop.
5.95 MW Peak
Lānaʻi
2,800 Pop.
6.13 MW Peak
Kahoʻolawe
Maui County
41% RPS
31-36 ¢/kWh
Maui
155,700 Pop.
204 MW Peak
Solar (Rooftop/Grid-scale)
Hydropower
Biofuel (biomass/diesel)
Waste-to-Energy
Wind
Geothermal
State of Hawaiʻi
1.4 million Pop.
6 Grids
29.8% RPS
Hawaiʻi
197,700 Pop.
192 MW Peak
35% RPS
34.9 ¢/kWh
HAWAII STATE Energy Office
Bing Image



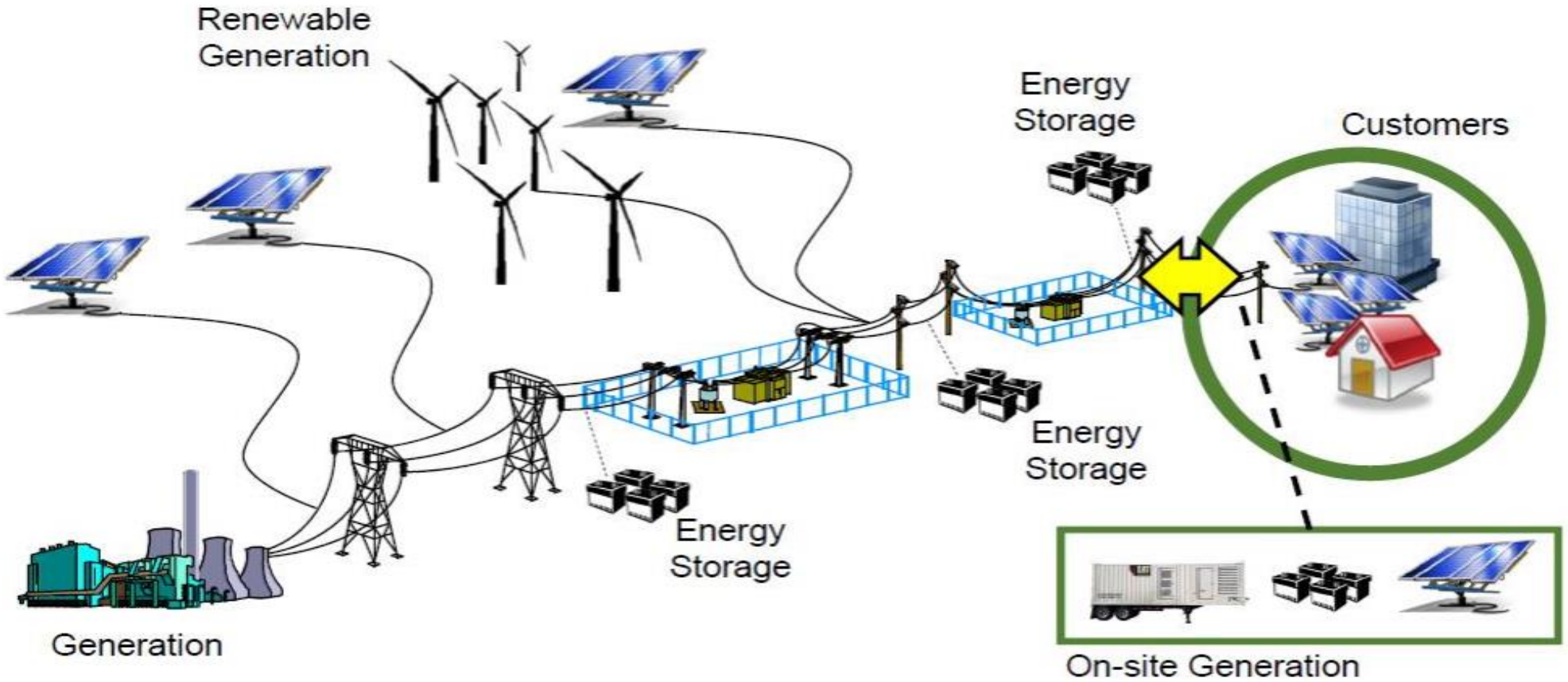
HAWAII STATE
Energy Office

Oahu Transmission Line and Population Density Map



HAWAII STATE Energy Office

Power System Overview



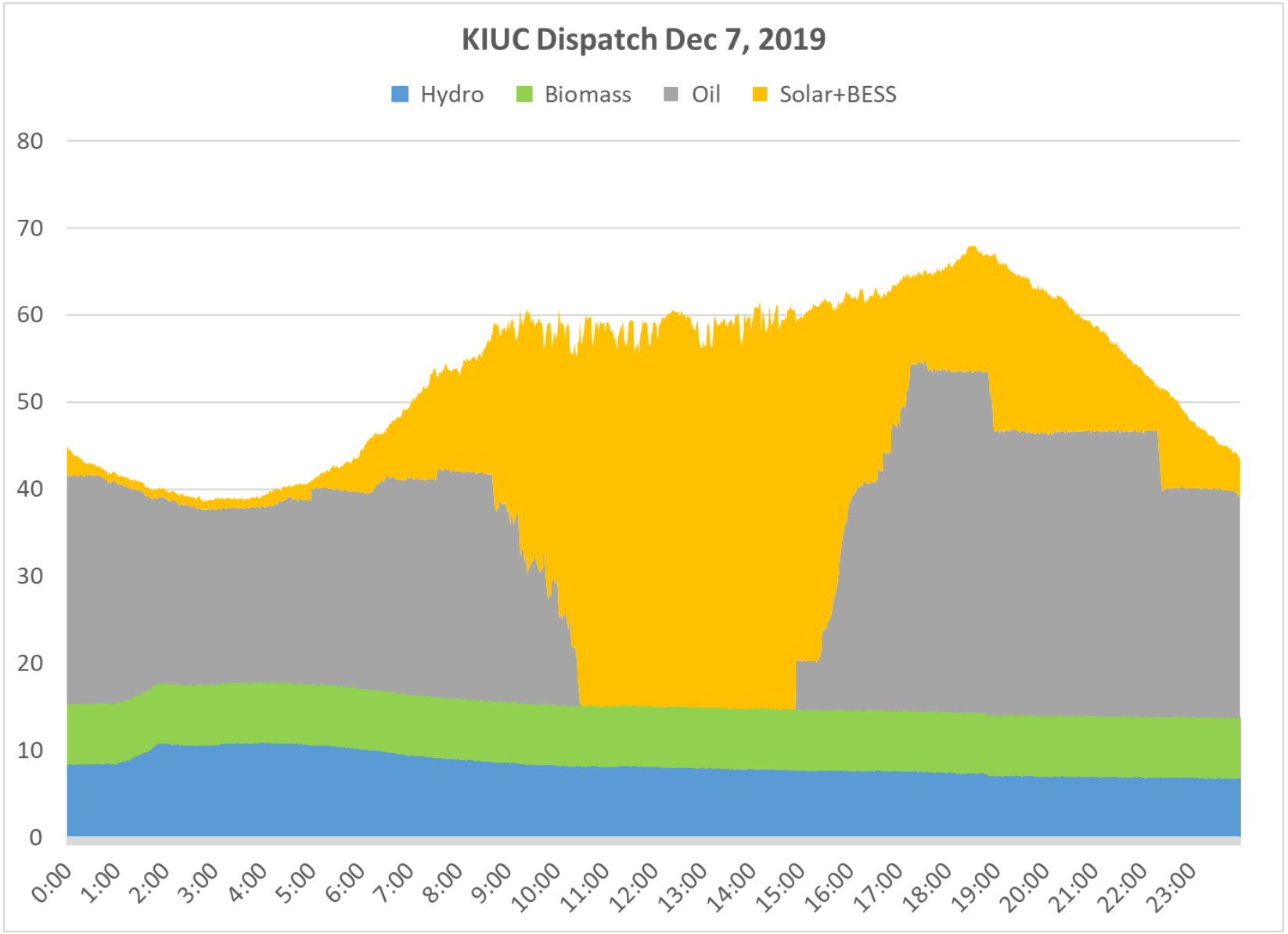
Koʻolaupoko Resiliency – Energy Working Group

- **Improve reliability and resiliency**
- **Extensive community conversations and education**
- **Critical community clusters**
- **Sectionalize circuits**
- **Smart devices in homes, businesses, and on grid**

HAWAII STATE Energy Office

HAWAII STATE
Energy Office

Kauai Consistently Operates 100% Renewable in Midday



HAWAII STATE Energy Office

Mahalo

Scott Glenn
Chief Energy Officer
Hawaii State Energy Office
scott.glenn@hawaii.gov

HAWAII STATE
Energy Office

NATIONAL GOVERNORS ASSOCIATION

Technology Deep Dive: Battery Storage Technology

Speaker:

Daniel Finn-Foley, Head of Energy Storage, Wood-MacKenzie

Moderated by:

Timothy Schoonhoven, Policy Analyst, National Governors Association

The next phase of state-driven energy storage

Dan Finn-Foley
Head of Energy Storage
Daniel.Finn-Foley@woodmac.com
@DanFinnFoley

Wood Mackenzie

About Wood Mackenzie

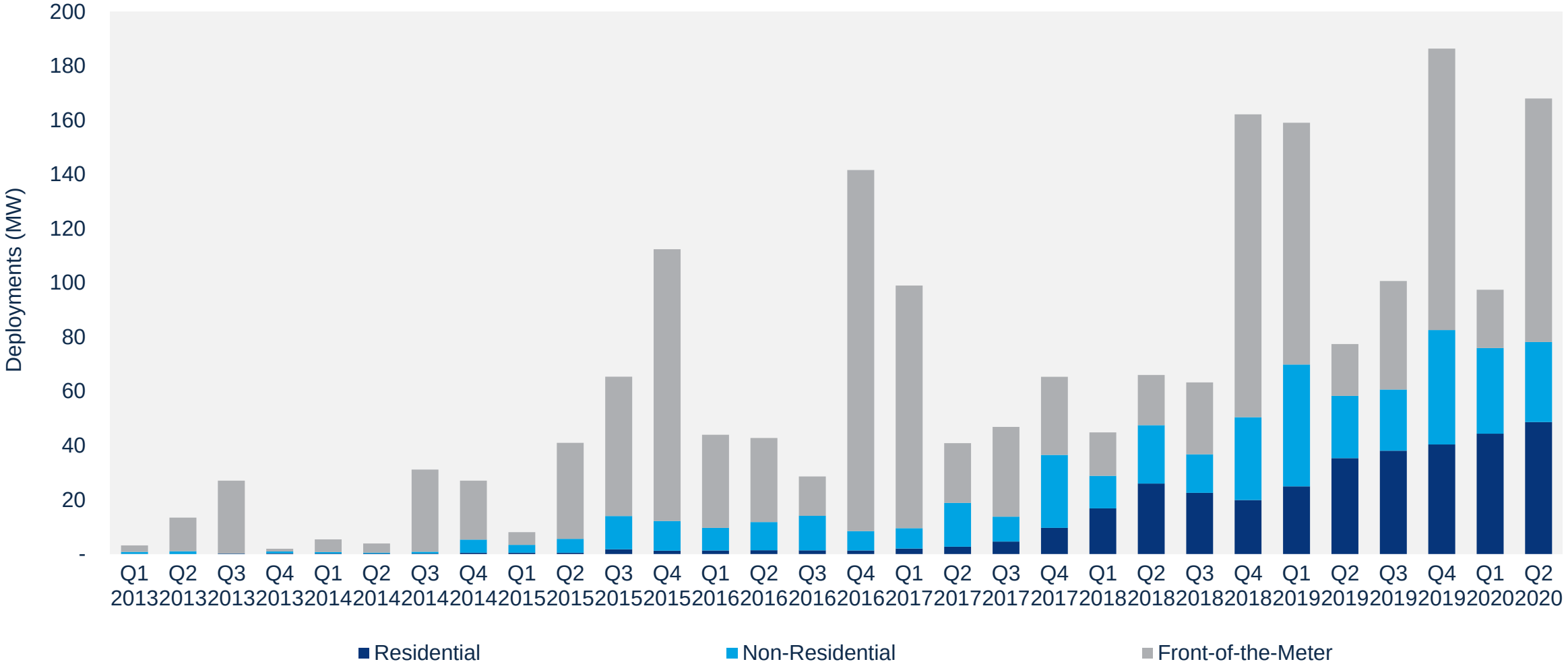
We provide commercial insight and access to our experts leveraging our integrated proprietary metals, energy and renewables research platform

Wood Mackenzie is ideally positioned to support consumers, producers and financers of the new energy economy.

- Acquisition of MAKE and Greentech Media (GTM)
- Leaders in renewables, EV demand and grid-connected storage
- Over 500 sector-dedicated analysts and consultants globally, including 75 specifically to power and renewables
- Located close to clients and industry contacts

U.S. Q2 2020 deployments reached 168 MW

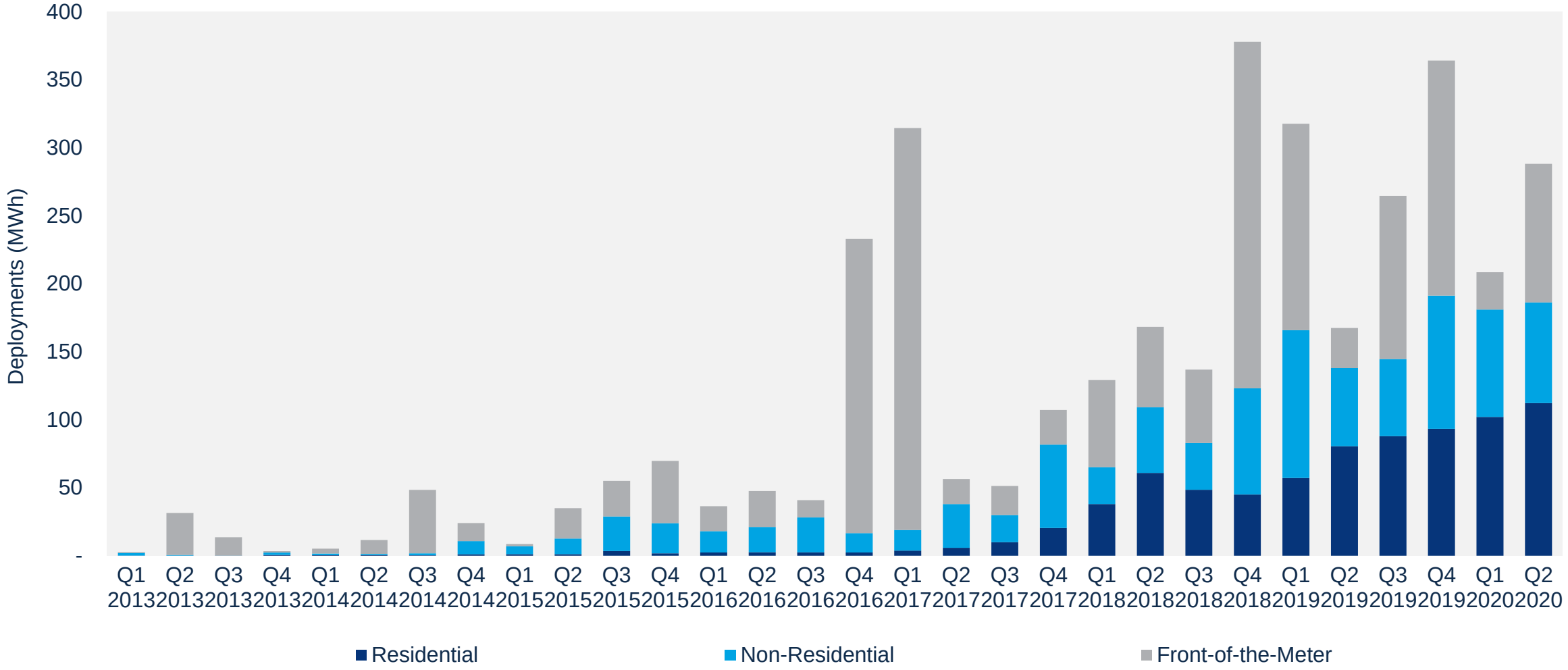
The strongest Q2 on record for deployments; Covid-19 pandemic has not hampered the downstream market



Source: Wood Mackenzie Power & Renewables

U.S. market deployed 288 MWh in Q2 2020

Shorter-duration systems resulted in a MWh total that is still the fifth-highest on record



Source: Wood Mackenzie Power & Renewables

Key state-level initiatives driving storage now and for decades to come

A wide array of approaches are driving key markets

Short-term

- California's Self Generation Incentive Program – aimed at distributed energy and now refocused on resiliency.
- New York's Bridge Incentive – a cash incentive boost aimed to jump start the market
- Massachusetts's SMART program – storage made a key component of solar initiatives

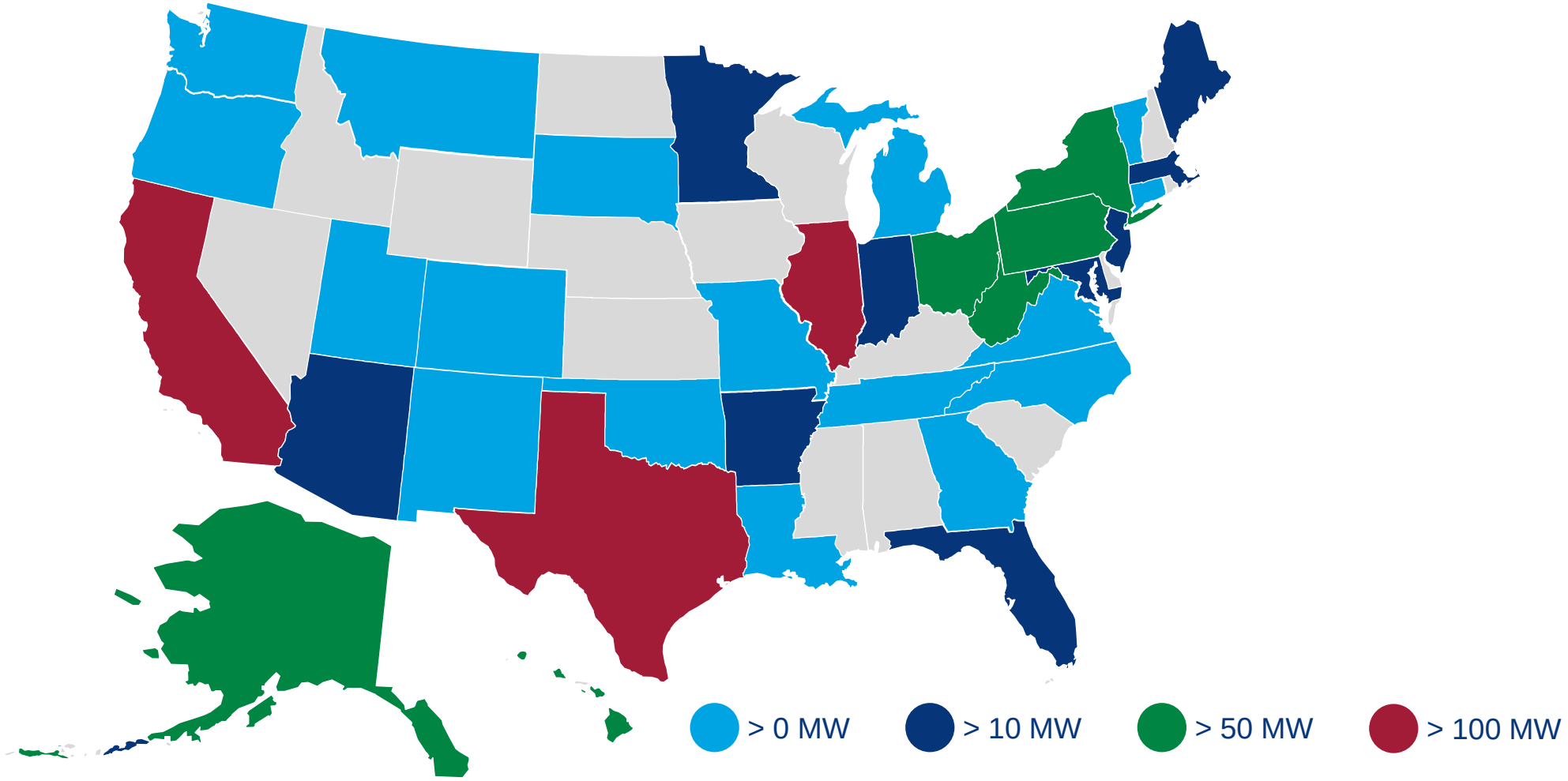
Mid-term

- Massachusetts's Clean Peak Standard – a targeted approach to incentivize clean energy during peak periods by creating time-based renewable credits
- State level planning and modeling (multiple) – ensures value recognition and eligibility along with setting up clear road maps as signals to the market

Long-term

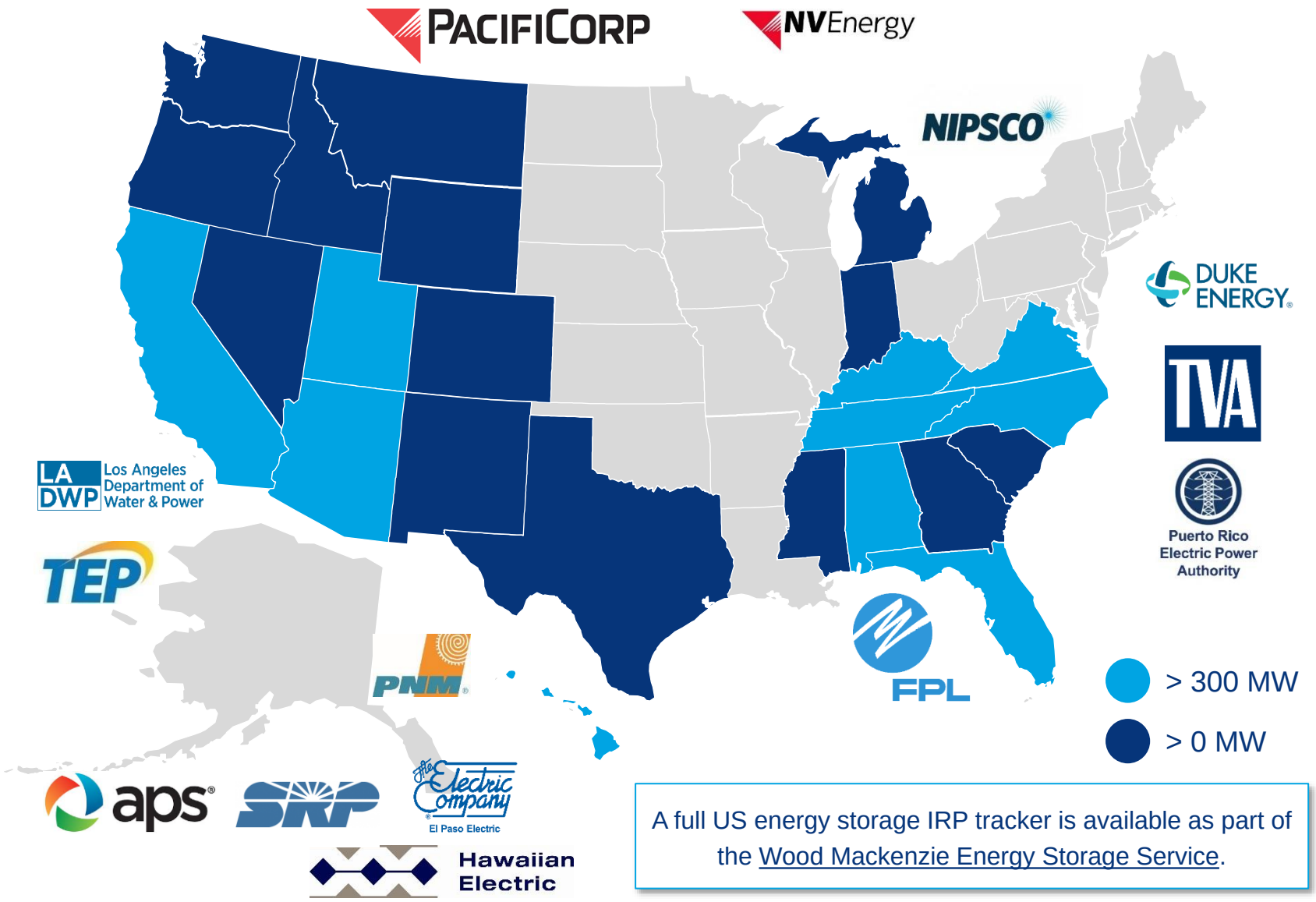
- Clean energy targets (multiple) – 100% clean or renewable mandates effective require storage. Effects of these mandates or goals are seen particularly in utility resource planning.
- Energy storage mandates (multiple) – mandates that come paired with regulations or policies to ease and incentivize storage yield results, otherwise the nascent market lacks direction.

In focus: A snapshot of active FTM projects in the U.S. at the end of 2019



A full global project database is available as part of the Wood Mackenzie Energy Storage Service.

U.S. FTM snapshot: Energy storage in integrated resource plans

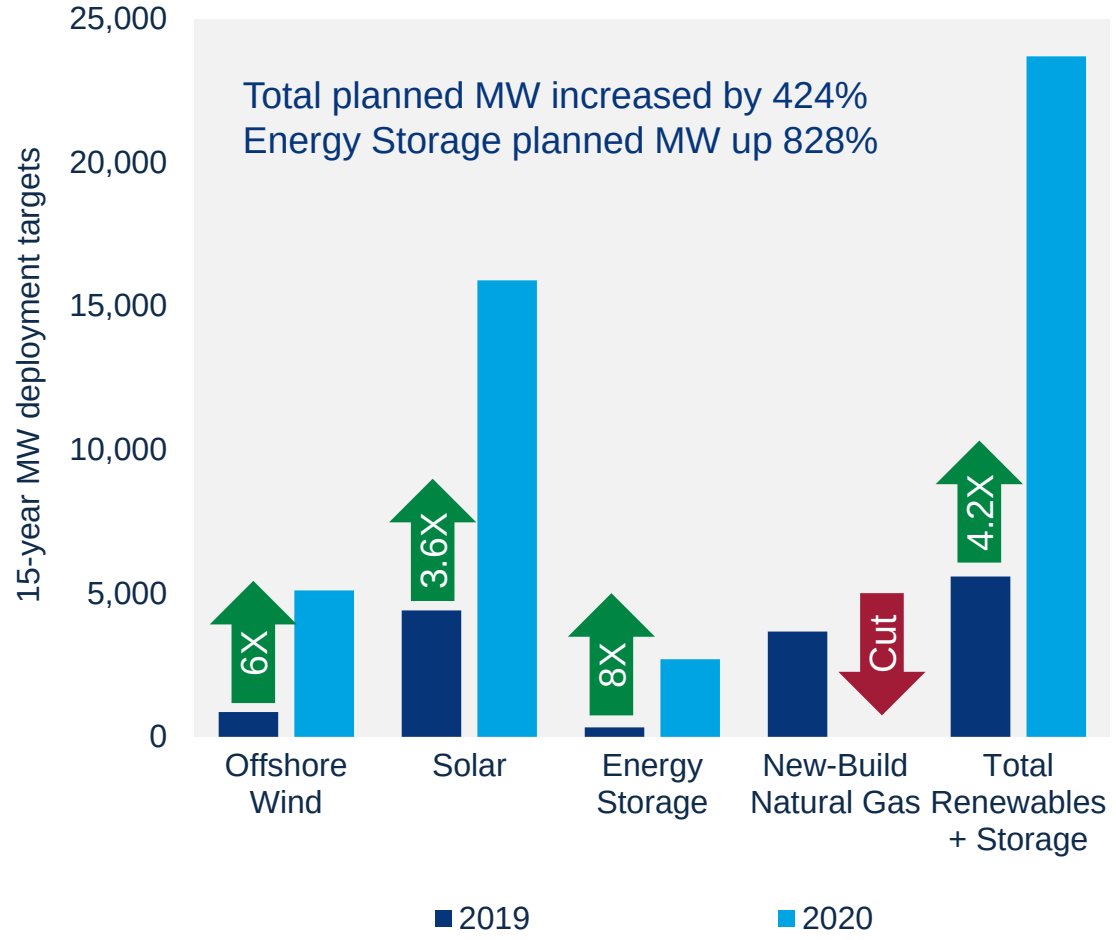


A full US energy storage IRP tracker is available as part of the Wood Mackenzie Energy Storage Service.

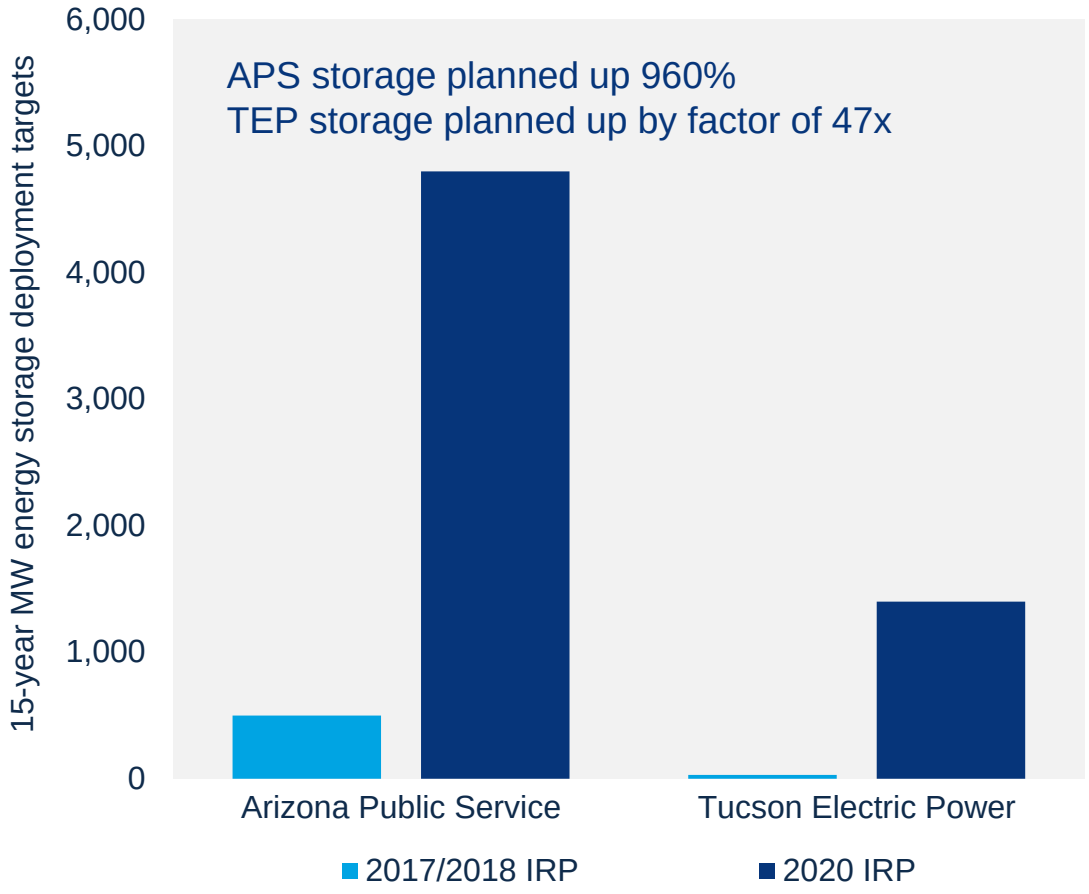
Turning point – utility resource planning meets the era of storage

A sea change has occurred in utility modeling over the past 2-3 years

Dominion Energy IRP – 2019 vs. 2020



APS and TEP integrated resource plan changes, 2017 vs. 2020

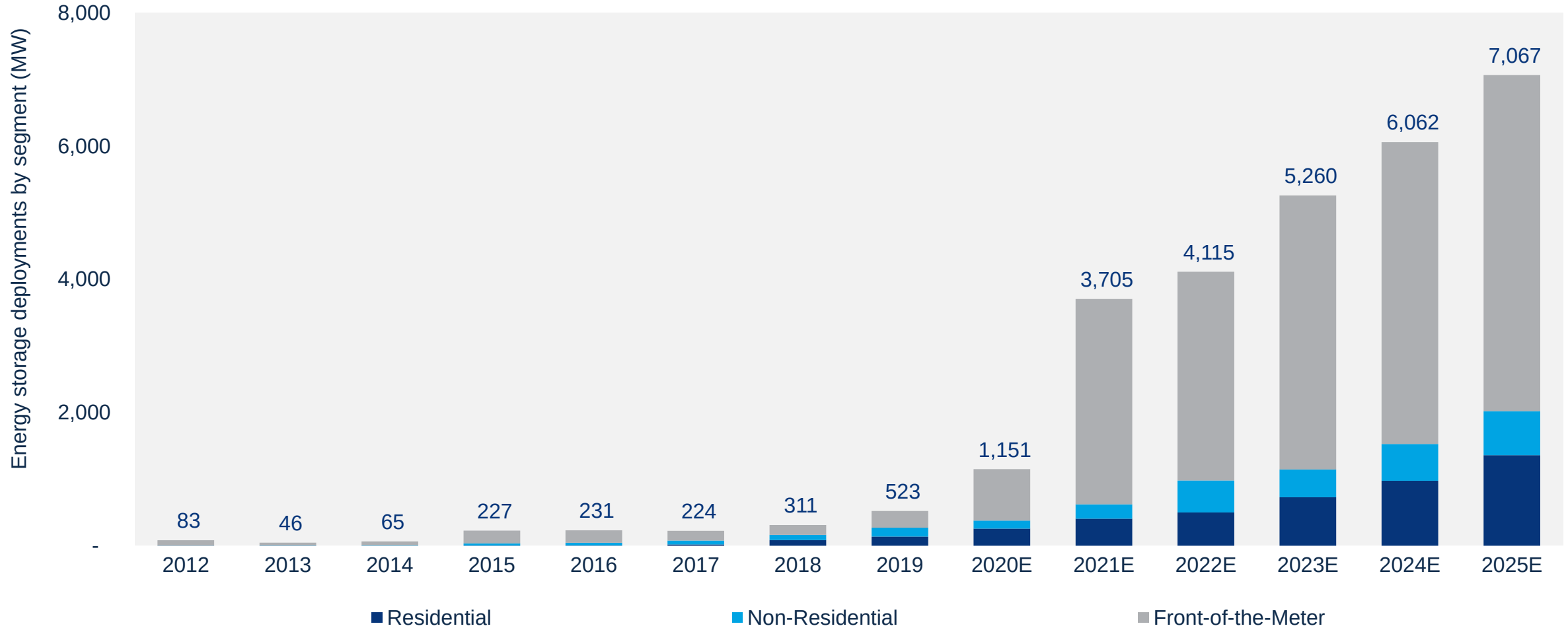


Source: Wood Mackenzie, utility resource plans

U.S. energy storage deployments will reach nearly 7 GW annually in 2025

Covid-19 creates near-term downside due to customer-acquisition issues, installation/interconnection delays

U.S. energy storage annual deployment forecast, 2012-2025E (MW)

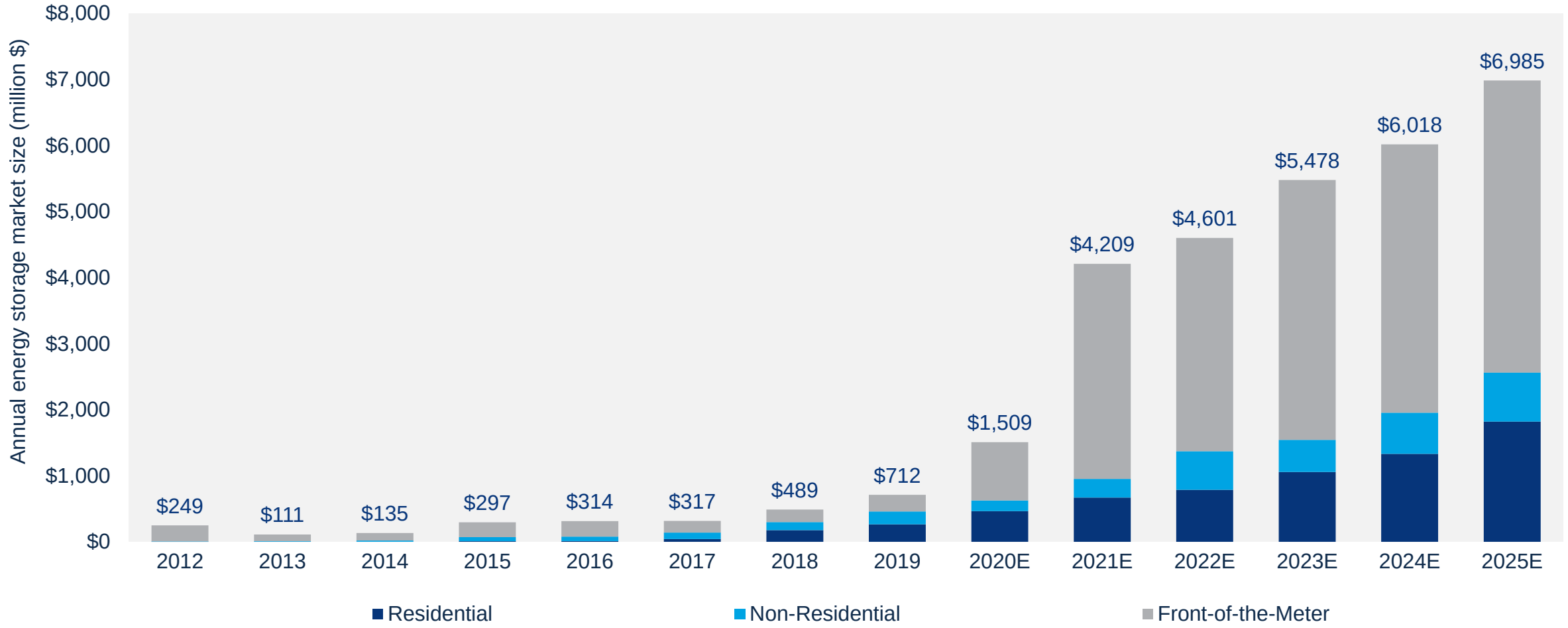


Source: Wood Mackenzie Power & Renewables

U.S. energy storage will be a $6.9 billion annual market in 2025

Market crosses $1 billion annual threshold in 2020 even with Covid-19 impacts

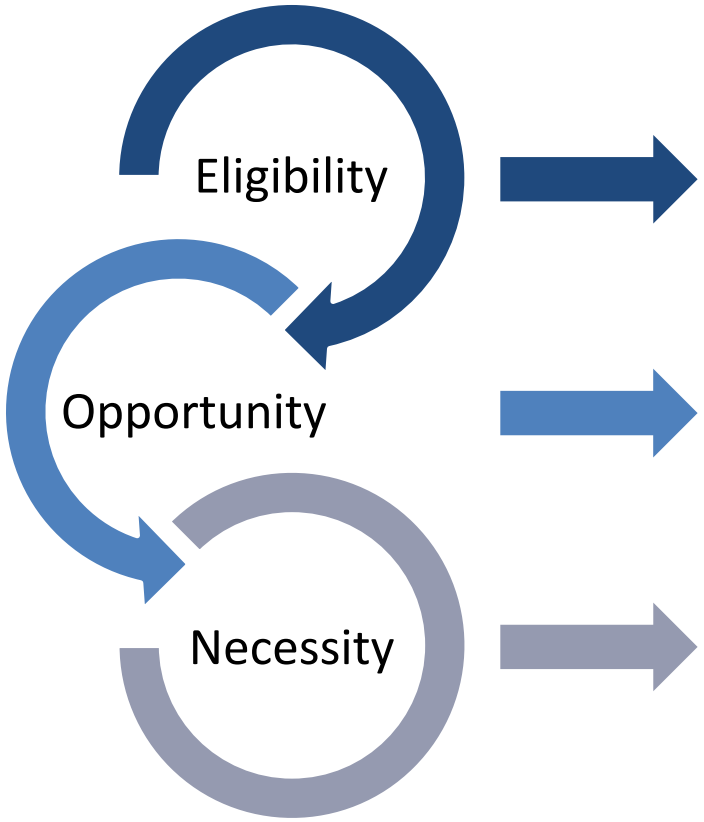
U.S. annual energy storage market size, 2012-2025E (million $)



Source: Wood Mackenzie Power & Renewables. *Note: Market size is reported as energy storage system deployment revenue (product of deployments and installed system prices).*

Opportunity and strategy surrounding energy storage shifts dramatically as the market moves from capturing value to the necessity of flexibility

Adaptation -> Transition -> Transformation



Adapt to new market forces
• Capture early market, establish scale, recognize value • Diversify or specialize markets and offerings? • Supply chain uncertainty (de-globalization efforts, Covid)
Transition technology to new system needs
• Reinvest, acquire, innovate applications, capture value • Scale solutions to needs, ensure flexibility of offerings • Mature and de-risk supply chain (commodities, EVs)
Transform the way electricity is delivered
• Decentralization • Deep decarbonization • Disrupt at the grid edge

Post-COVID scenarios – Wood Mac analysis shows that “what’s next” may vary

Subject matter experts across Wood Mackenzie collaborated in May to construct three scenarios for a post-Covid recovery as a framework for discussing the new reality for the energy industry.

Full recovery

- A “V”-shaped recovery where GDP rapidly returns to pre-pandemic levels, which most closely resembles the base-case used for this report’s forecast.
- States and cities continue to expand renewable efforts after the “new normal” sets in.
- Minor disruption would be anticipated for FTM energy storage deployments while BTM markets recover in 2021.
- **Outlook for storage through 2025 remains relatively unchanged.**

Go it Alone

- Further retreat from globalization, supply chains under heavy tariffs, high persistent unemployment.
- Federal policy, rather than encouraging energy storage deployments, potentially becomes hostile to clean energy and international supply chains.
- States pull back on climate policy.
- Interest in project financing shrinks.
- High unemployment and longer recovery particularly affect BTM market interest.
- **Potential significant effects on the storage market through 2022-2023.**

Greener Growth

- Climate-forward policy at the state and federal level is pursued as an infrastructure and clean-tech based post-pandemic stimulus effort.
- Federal efforts dovetail with state and local plans launched through the 2010s to dramatically accelerate the transition to a green economy.
- Storage friendly policies at the state and federal level drive storage growth to higher levels, including incentives for customer-sited projects.
- **Storage market scales up as incentives come online in 2021-2023.**

NATIONAL GOVERNORS ASSOCIATION

Modernizing the Energy Sector: State Breakout Discussions

Jessica Rackley, Program Director, National Governors Association
Emma Cimino, Senior Policy Analyst, National Governors Association
Dan Lauf, Program Director, National Governors Association

NATIONAL GOVERNORS ASSOCIATION

NuScale Virtual Tour

Jessica Rackley, Program Director, National Governors Association

NUSCALE™
Power for all humankind

Introduction to NuScale Facilities

National Governors Association Planning for the Future Workshop

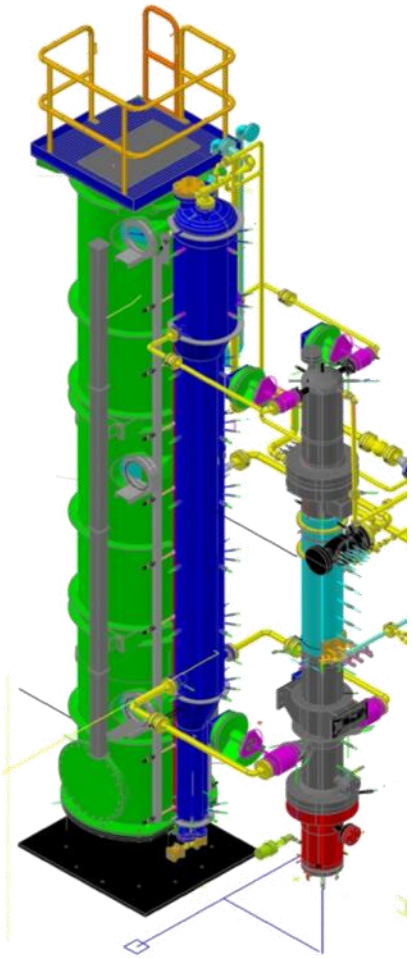
October 28, 2020

Dr. José N. Reyes
Co-founder and Chief Technology Officer

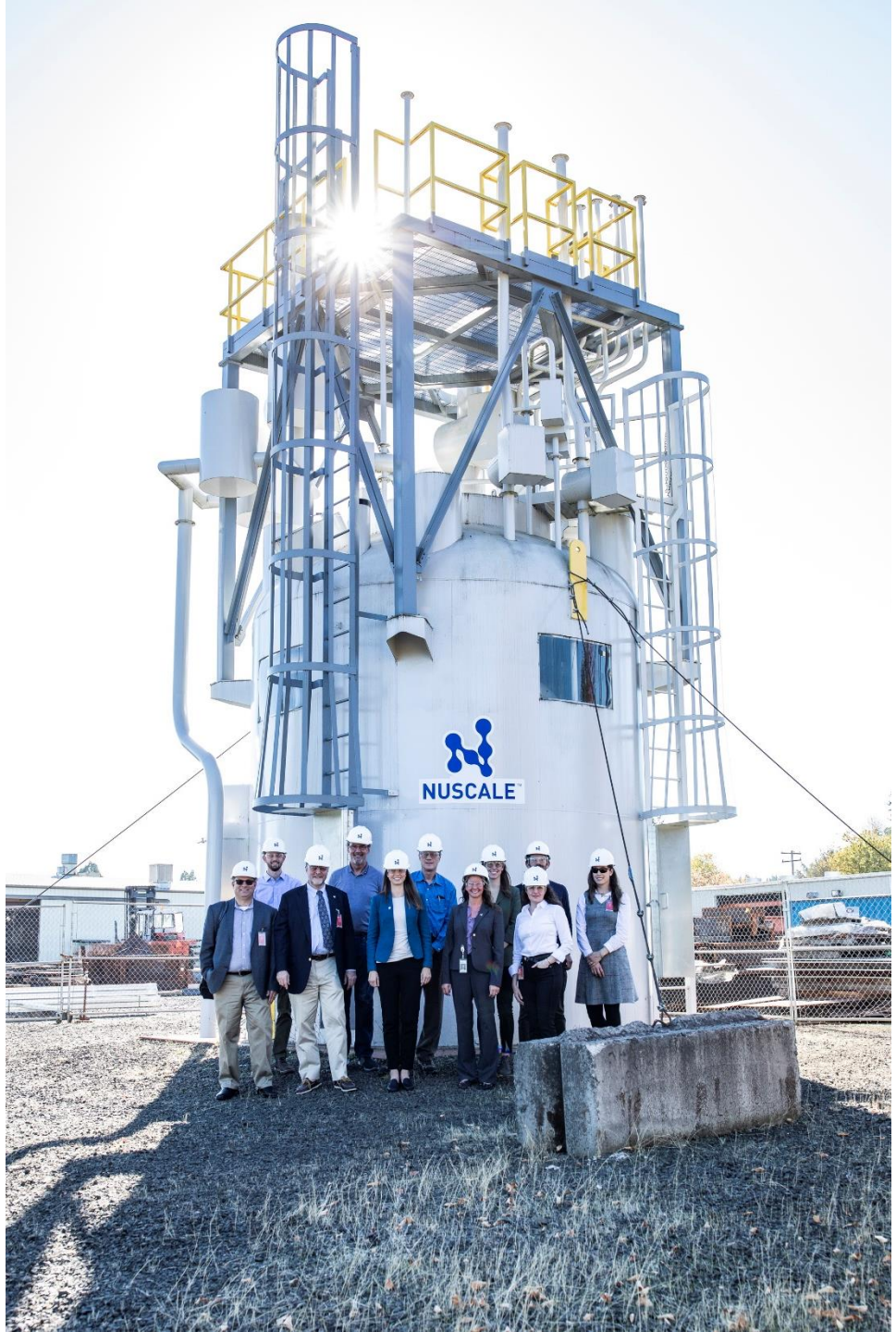
NuScale Control Room Simulator

- Integrated System Validation (ISV) completed using simulator
  - Verifies the integrated system that supports safe operation (NUREG-0711)
  - Performance based evaluation of hardware, software, and personnel using three crews of six licensed operators
    - Operators trained similar to an operating plant license class
    - 12 full-scope, evaluated scenarios over 11 weeks
  - NRC audited ISV activities
  - Demonstrated reduced operator staffing model feasibility
- Approved as per the NuScale Final Safety Analysis Report to be incorporated into 10 CFR 52

NIST-2 Integral Systems Test



- Integral Systems Test to obtain large-scale real-time integral effects data for code validation
- One-third scale, full pressure and temperature
- Includes integral reactor vessel and internals, containment vessel, reactor pool and safety systems
- Major $2M facility upgrade in 2015
- DCA testing completed:
  - Loss of coolant accident (LOCA)
  - Flow stability
  - Non-LOCA
  - Long-term cooling
- DCA supplementary testing ongoing
- Test inspected & audited by NRC
- NuScale Advanced Thermal Hydraulic Safety Analysis computer codes approved by the NRC.



Upper Module Mock-up

- Full-scale mockup of upper portion of module to validate maintenance and inspection capabilities
- Helps guide design finalization in upper head region
- Fabricated at Oregon Iron Works (now Vigor) in Vancouver, WA and currently located in Corvallis, OR

NUSCALE™
Power for all humankind

Virtual Tour of NuScale Facilities

National Governors Association Planning for the Future Workshop

October 28, 2020

Link to view the NuScale Virtual Tour:
https://vimeo.com/442502658/6d36080885

Dr. José N. Reyes
Co-founder and Chief Technology Officer
jreyes@nuscalepower.com

See you tomorrow!