

Welcome!

The Meeting will
begin at
1:00 PM Eastern



Regional Energy Resource Council

May 23-24, 2022

2nd Meeting – Term 5

Welcome

RERC Live and Virtual Meeting

- **This is the second meeting of the 5th term of the RERC.**
- **This meeting is being recorded.** A link will be provided on the TVA RERC Website (tva.gov/rerc).
- **We welcome members of the public attending virtually and who are in listen only mode.** For those that pre-registered to make public comments, the meeting host will give you instructions for speaking to the Council at that time. Written comments are always welcomed (tva.gov/rerc).
- **RERC Members who are attending virtually are able to mute and unmute their own line.** RERC Members who are attending virtually may use the raise hand function to be recognized for questions or comments.
- **RERC Members attending in person,** please turn your name plate vertically and I will call on you. I will identify the person I call on so that those attending virtually will be able to identify the speaker. Please speak loudly so that those in the room and those attending virtually can hear your comments.

Safety First!

- **In case of fire or other building emergency**, exit the doors you entered at the back of the room. Go down the stairs and exit the building via the front doors. Turn right and gather outside at Assembly Area 1.
- **In case of severe weather**, exit the doors you entered in the back of the room. Go down the stairs to the first floor. Go to the interior hallway on the first floor.

Introductions

Name

Organization

What are you looking forward to this summer

RERC Term 5* Members

Introductions:
Name
Organization
Looking Forward to this Summer

Michael Butler

Tennessee Wildlife Federation

Dan Miller

Oak Ridge National Laboratory

State of Georgia

TBD – Governor appointment

Erin Gill**

City of Knoxville

Sen. Steve Livingston

State of Alabama

Chrissy Heard

State of Mississippi

Rebecca Goodman

Commonwealth of Kentucky

Pete Mattheis

Tennessee Valley Industrial Committee

Alexa Voytek

State of Tennessee

Rodney Goodman

Habitat for Humanity

Bailey Recktenwald

State of North Carolina

Clay Walker

NETWORKS Sullivan Partnership

Dana Jeanes

Memphis Light, Gas, and Water

Doug Peters

Tennessee Valley
Public Power Association

John Warren

Commonwealth of Virginia

Candy Johnson

Urban League of
Greater Chattanooga

Dr. Kari Babski-Reeves

Mississippi State University

Lloyd Webb

Olin Chlor Alkali

Jonathan Levenshus

Sierra Club

Patrice Robinson

Memphis City Council

*August 1, 2021 – July 31, 2023

** Council Chair

FAC Meeting Requirements

Jennifer Brundige – Attorney, TVA General Counsel Office
May 23, 2022

Federal Advisory Act Meeting Requirements

Agenda

- Prepared and approved by the DFO, or alternate DFO, in consultation with Council Chair
- Distributed to Council and an outline is published in the Federal Register prior to each meeting
- Topics may be submitted for consideration to the DFO by any member of the Council, or non-members, including members of the public

Meeting Minutes

- DFO will ensure that minutes are prepared for each meeting, approved by the Chair, and made available to Council members and the public

Voting

- Any member of the Council may make a motion for a vote
- Quorum is a majority of the seated members of the Council as defined in the bylaws
- Advice requires an affirmative vote of majority of Council members present
- Advice may include minority or dissenting views

Membership

- Balanced Membership
- Professional or personal qualifications to achieve the mission of the Committee
- Broad range of diverse views and interests

Agenda

RERC Meeting – Day 1

May 23, 2022

All times are ET

1:00	Welcome – Designated Federal Officer Melanie Farrell & Chair Erin Gill Safety, Introductions, Meeting Protocols Agenda, Advice Questions
1:35	DFO Briefing
1:55	Transformative Innovation Initiatives
2:30	Break
2:45	Regional Grid Transformation
3:15	Decarbonization Technologies
3:45	Innovation Crossroads
4:15	Summary
4:30	Adjourn RERC Meeting

Agenda

RERC Meeting – Day 2

May 24, 2022

All times are ET

8:15 am	Welcome Day 1 Review
8:30	Public Listening Session
9:00	Discuss Advice Questions
10:00	Break
10:30	Finalize Advice Statement
11:45	Summary
noon	Adjourn RERC Meeting

Advice Questions

Advice Questions

TVA's is committed to being a leader in innovation and decarbonization solutions.

These emerging technologies are essential to TVA's success on the path to decarbonization:

Energy Storage Integration, Electric Vehicle Evolution, Decarbonization Options

Connected Communities, Regional Grid Transformation, and Advanced Nuclear Solutions.

New low-cost and carbon-free technologies can become available only if they are supported by the right investments in research and development.

TVA is pursuing developing emerging technologies by using partnerships and stakeholder coalitions.

- A. What factors should TVA consider when investing in emerging technologies?
- B. What factors should TVA consider in establishing partnerships and stakeholder coalitions in order to develop emerging technologies?

TVA Update

Melanie Farrell, Designated Federal Officer

- May 2022 TVA Board of Directors Meeting Highlights
 - FY21 Sustainability Report
 - Energy Burden
- TVA Board Nominations
- New Nuclear Program
- Memphis Update
- Local Event and Community Response
- Southeast Energy Exchange Market (SEEM)

Today's Purpose

Comprising of members of regional government, customers, academia and advocacy groups, **the Regional Energy Resource Council (RERC)** provides advice on how TVA manages its energy resources against competing objectives and values.



Transformative Innovation Initiatives

Amy Henry, Director Transformative Innovation

May 23, 2022



Carbon Reduction Goals

**TVA aspires to achieve net-zero
carbon emissions by 2050 and to
support broader national efforts to
decarbonize the economy.**

Carbon Reduction Goals

63%

Accomplished

Our Plan

70%

by 2030

Our Path

~80%

by 2035

Our Aspiration

Net-Zero

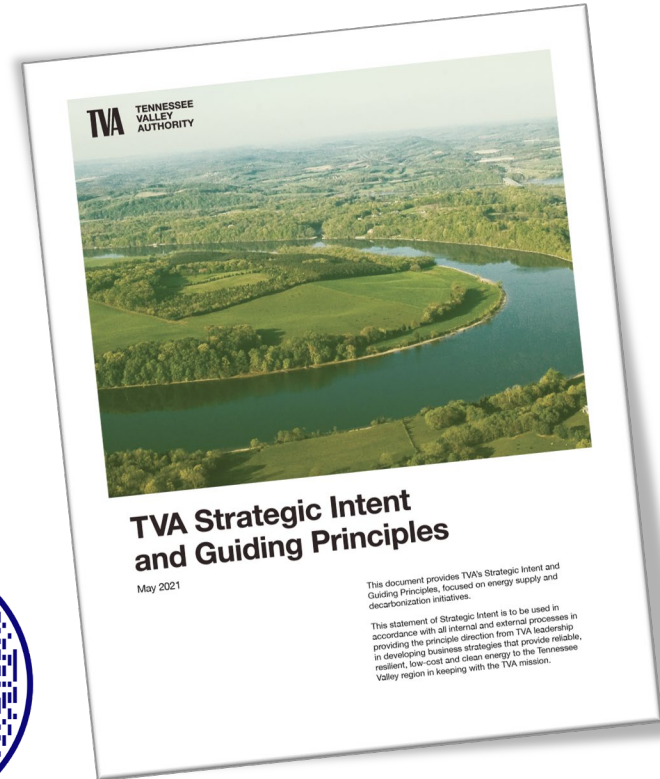
by 2050

Value of Reducing Carbon for our Region

- Strengthens our ability to attract major businesses that create jobs and support economic growth in the Valley
- Enhances partnerships with businesses seeking to meet their own ambitious sustainability goals
- Customer demand
- Possible future climate requirements (legislation or regulation)
- Protects and preserves the environment for future generations

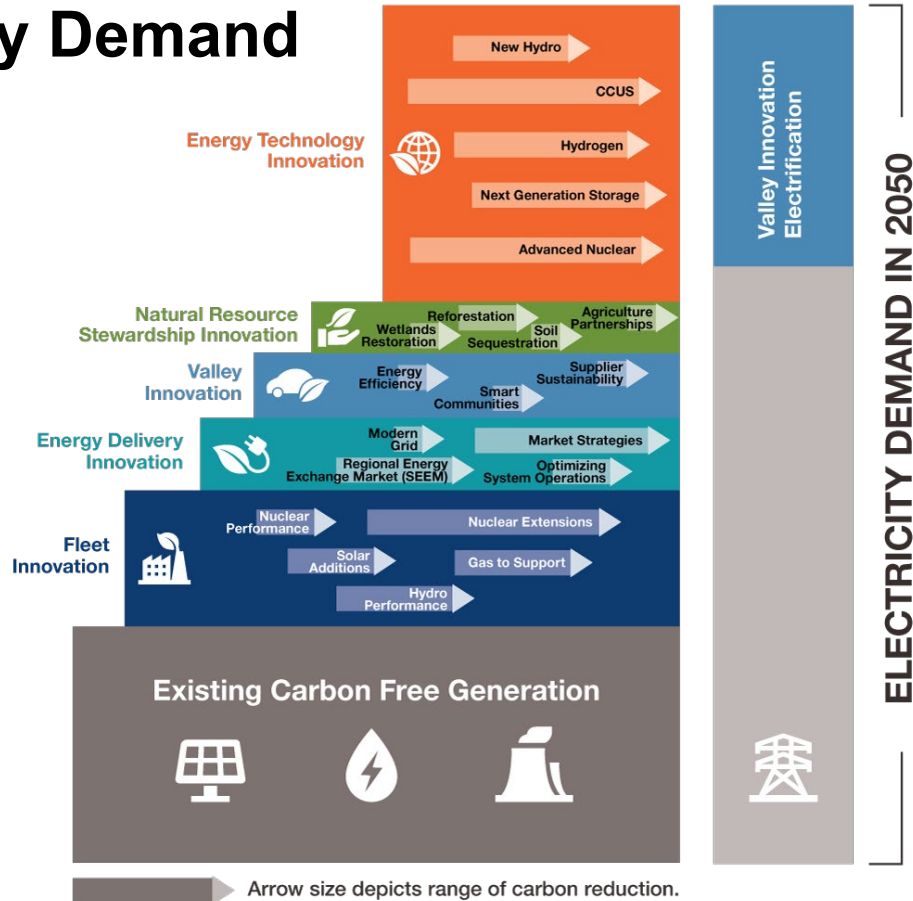
Strategic Intent & Guiding Principles Document

- Endorsed by TVA Board May 6, 2021
- Outlines strategic focus on decarbonization and reliable, low-cost energy supply
- Direction from TVA leadership for developing business strategies
- Guiding principles for carbon reduction
- Ongoing commitments
- Building the energy system of the future
- Document and executive summary at [TVA.com/future](https://www.tva.com/future)



Meeting Electricity Demand

And Deep Decarbonization



Signature Transformative Innovation Initiatives



Igniting
Innovation

Develop feasible technology pathways to achieve the next phases of carbon reductions and offsets



DECARBONIZATION
OPTIONS



CONNECTED
COMMUNITIES

Expand smart technologies with communities to manage energy and services

Develop a reliable, affordable, flexible, and clean generation option with cost and risk shared



ADVANCED
NUCLEAR
SOLUTIONS



ELECTRIC VEHICLE
EVOLUTION

Enable adoption of electric vehicles in the Valley to create load growth and benefits for citizens

Implement a long-term strategy to integrate energy storage for system flexibility and maximizing renewables



STORAGE
INTEGRATION

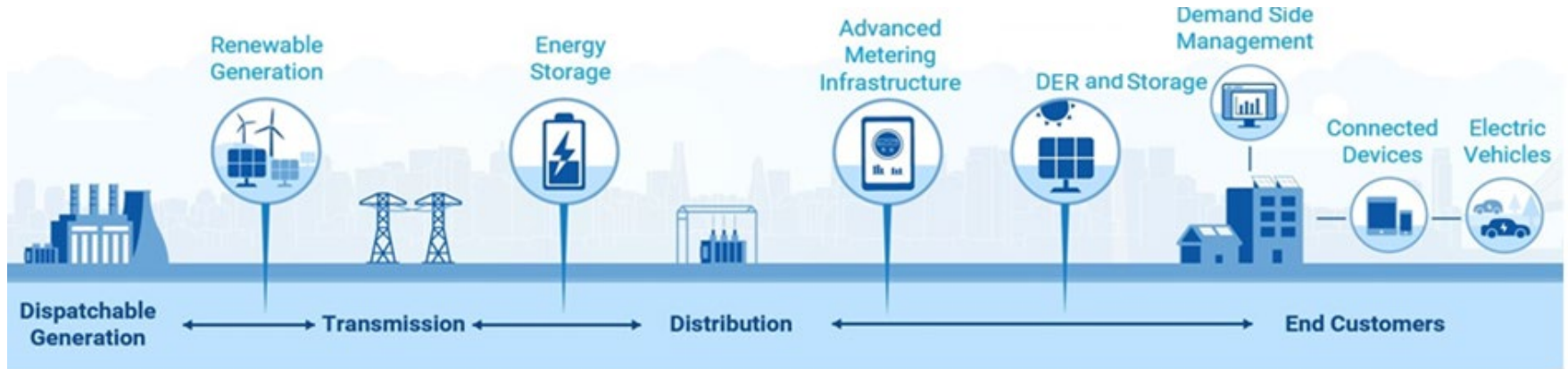


REGIONAL GRID
TRANSFORMATION

Develop an interconnected, intelligent grid able to reliably deliver power as it evolves

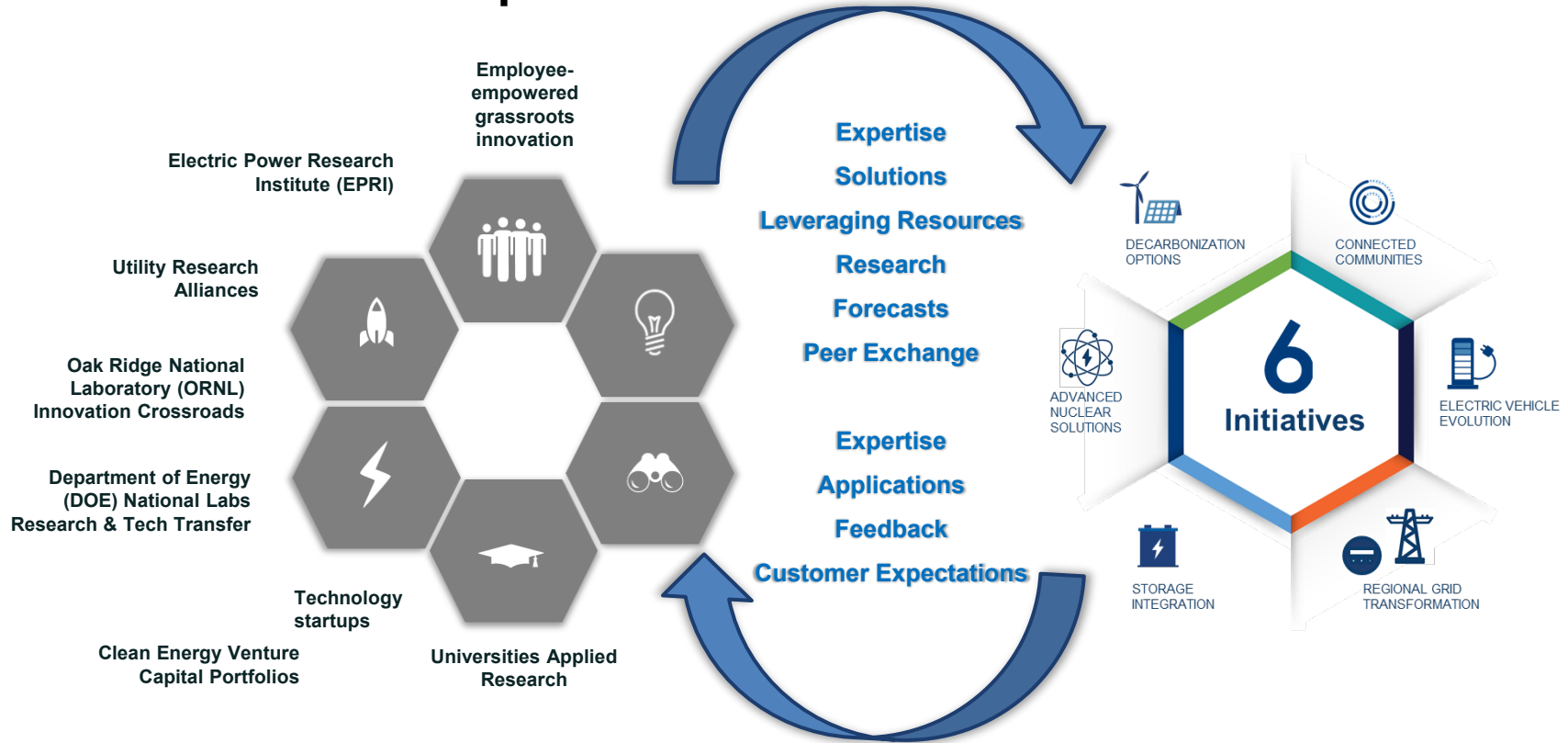
6
Initiatives

Transformation of the System



TVA and LPCs must evolve the public power model together to maintain our unique value proposition for the Valley.

Innovative Partnerships



* The Centre for Energy Advancement through Technological Innovation (CEATI)

Questions?

Amy Henry, Director Transformative Innovation

May 23, 2022



BREAK

Grid Modernization: Paving the Road to an Integrated Grid

Jason Krupp, Senior Project Manager,
TVA Enterprise Research & Technology Innovation

Regional Energy Resource Council

May 23, 2022

Megatrends are *disrupting* our business and operating environments.



Digitalization of *everything* is increasing the dependance on reliability of electricity

Replacement of Aging Assets presents unique opportunities to redirect capital towards transformative assets



Distributed Energy Resources are becoming increasingly cost-effective options for serving our customers

Extreme and disruptive events have forced critical services to rethink how we need to plan and operate in the future



Other megatrends

DECARBONIZATION • RAPID TECHNOLOGY ADVANCEMENTS • DATA • URBANIZATION • DIGITAL WORKFORCE

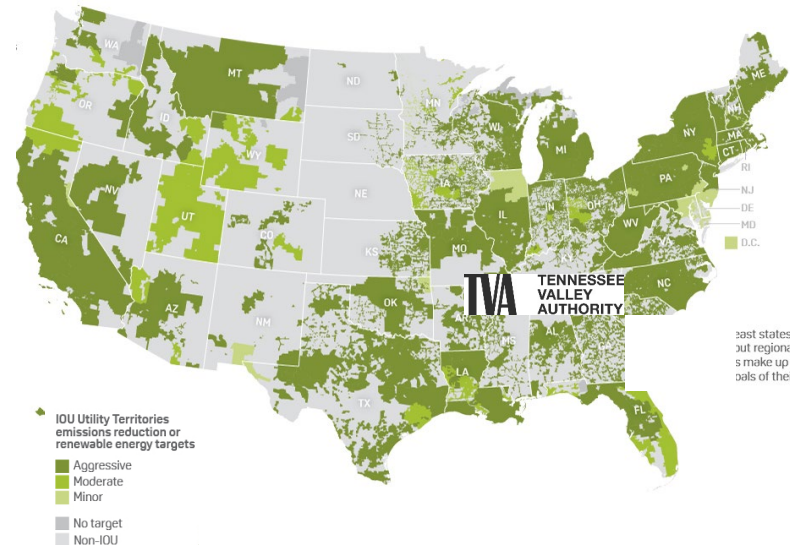
Grid Transformation Drivers

The acceleration is being led by market, regulatory, and environmental drivers.

- 35 out of 51 utility holding companies now have very “aggressive” goals.¹
- Investment in renewable energy, energy storage, and electric vehicles continues to increase.
- One of President Biden’s first executive orders emphasizes the need “to **build a modern and sustainable infrastructure.**”²

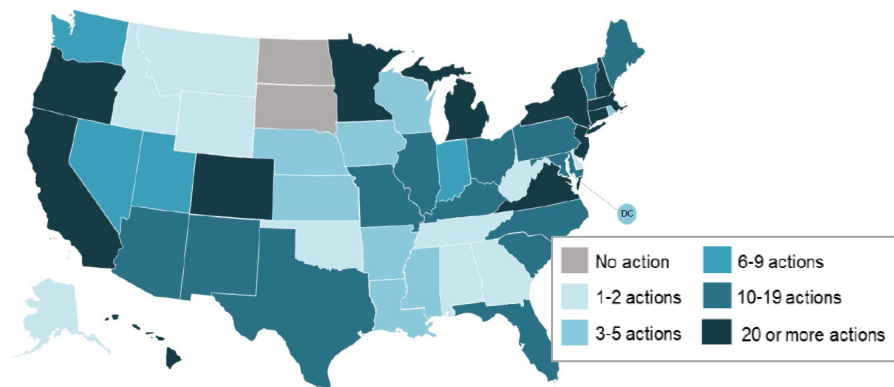
Sources:

1. S&P Global, Utility emissions, renewables goals accelerate, but coal retirements may be too slow, February 25, 2021
2. White House Executive Order on Tackling the Climate Crisis at Home and Abroad, January 27, 2021

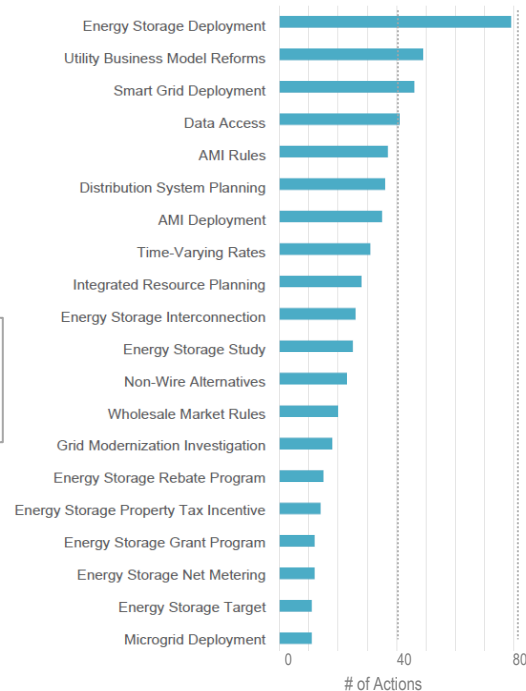


National Grid Transformation in 2020

Nearly all U.S. states took actions related to grid modernization in 2020, totaling 658 actions

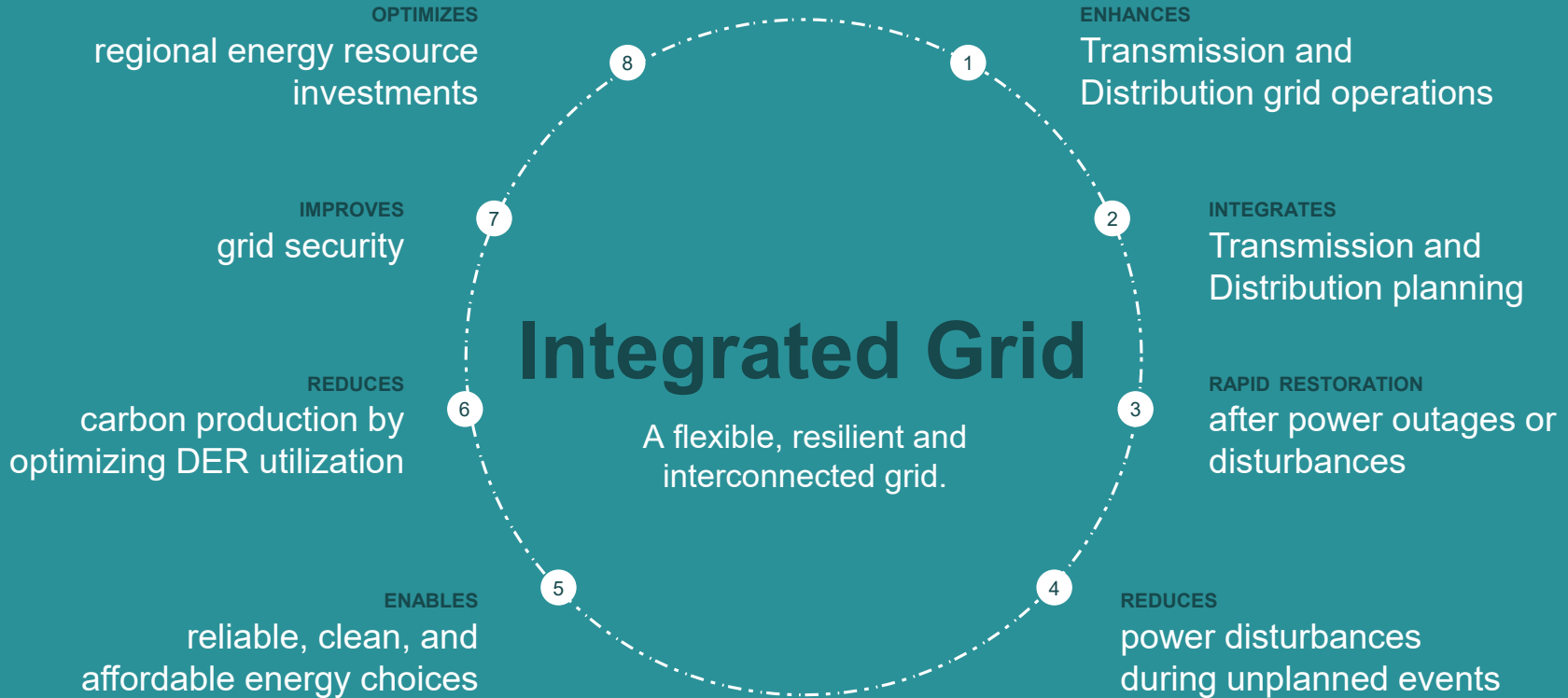


Source: NC Clean Energy Technology Center, April 2021

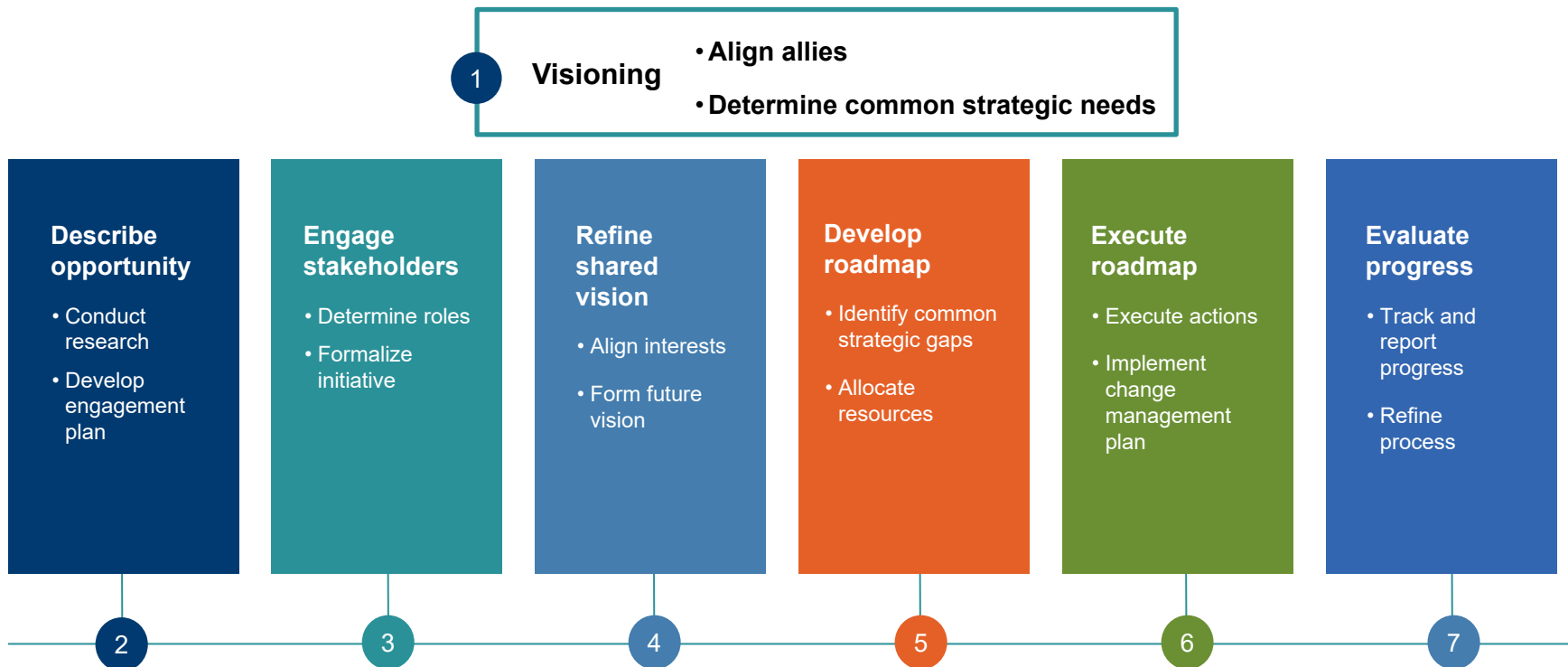


Integrated Grid

A flexible, resilient and interconnected grid.



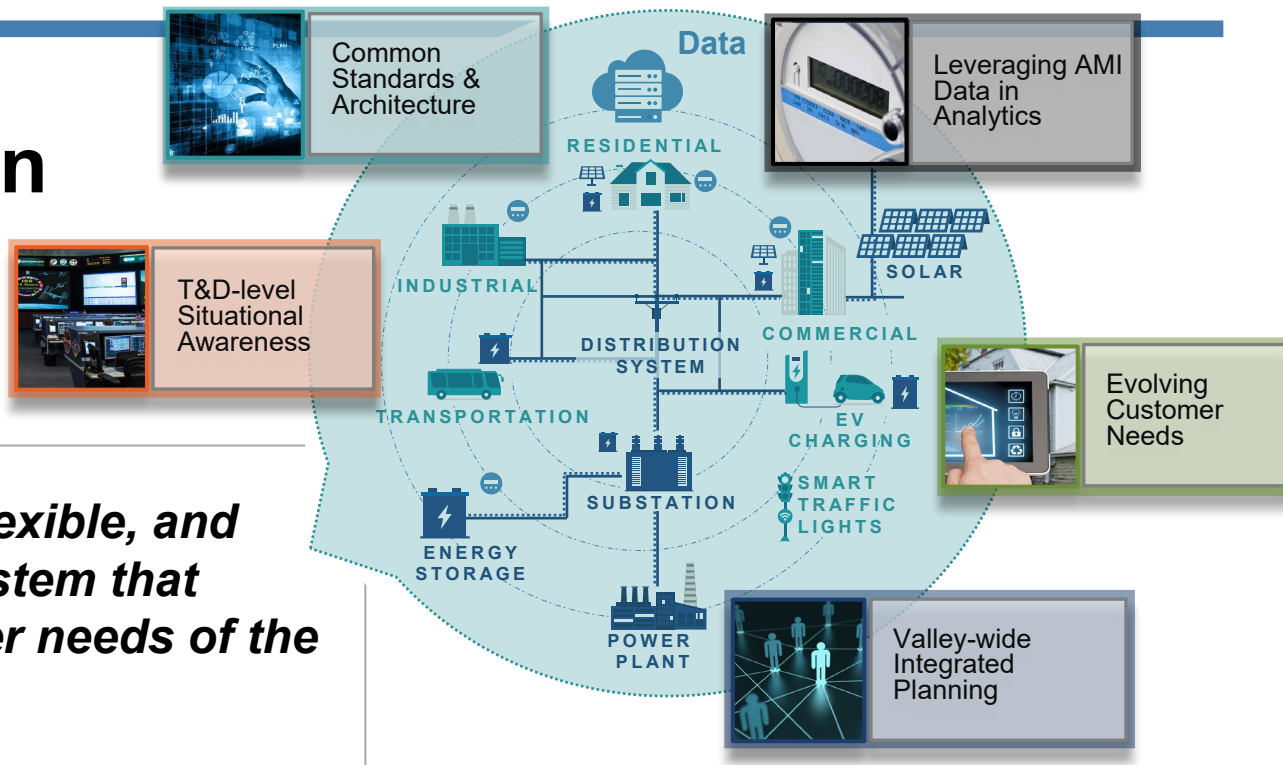
Stakeholder Engagement for Transformative Innovation



This process is customizable to meet the needs of each opportunity.

Regional Grid Transformation Vision

Building a resilient, flexible, and integrated electric system that meets Valley customer needs of the future.



Megatrends are disrupting our traditional business and operating environments:

DECARBONIZATION • RAPID TECHNOLOGY ADVANCEMENTS • AUTOMATION • URBANIZATION • DIGITAL WORKFORCE

AGING ASSETS

DIGITALIZATION

DER
INTEGRATION

EXTREME
DISRUPTION

TVA
TENNESSEE
VALLEY
AUTHORITY

Regional Grid Transformation *Capabilities*

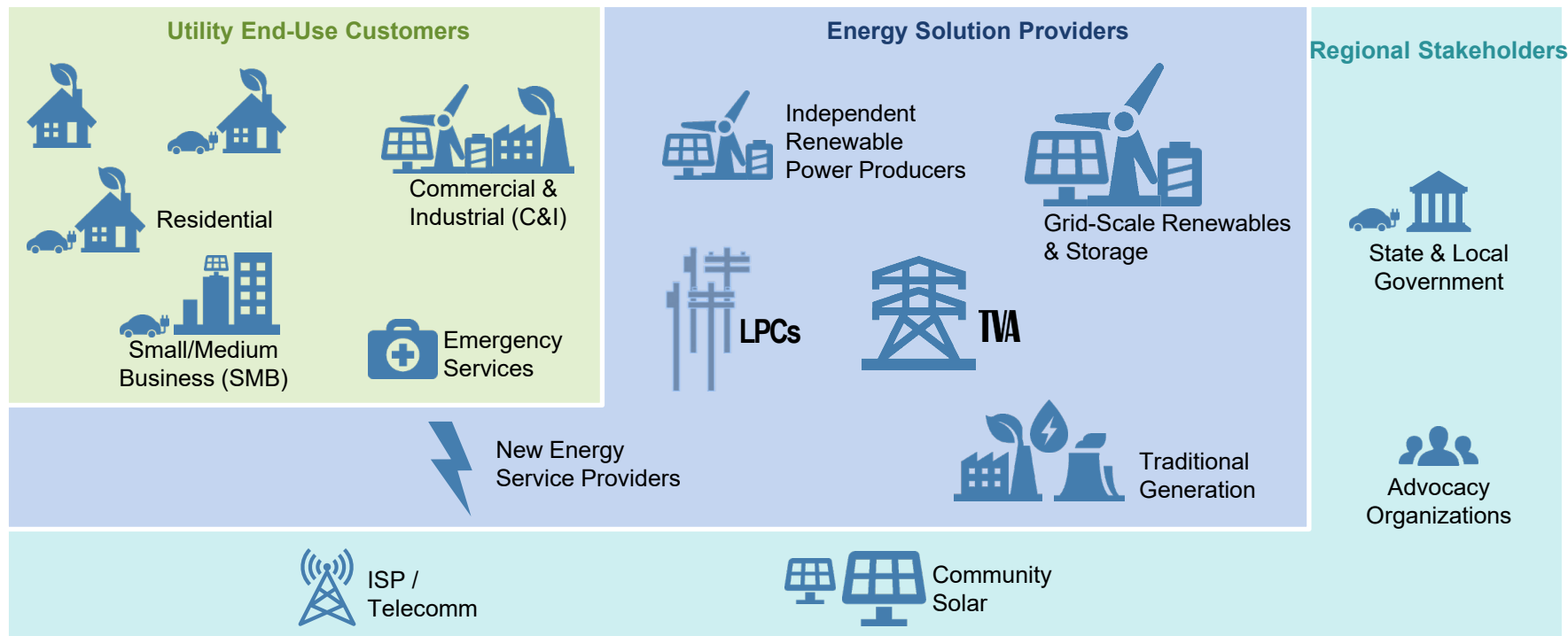
Five capability areas below capture a set of key elements that enable grid transformation.

EXCEPTIONAL END-USER* EXPERIENCE	INTEGRATED PLANNING
Draw Insights from End-Use Customer* Data	Perform Advanced Forecasting & Planning
Engage with Targeted End-Use Customers	Collect, Standardize, & Analyze Data
Manage Home & Business Energy Usage & Costs	Build & Manage Intelligence
Customize Energy Experience through Advanced Programs & Pricing	Optimize Regional Investments
ENHANCED T&D OPERATIONS	REGIONAL POLICY GUIDELINES
Operate Grid with Coordination & Resiliency	Align Strategic Goals
Utilize Advanced Grid Management	Transform Policy & Regulatory Design
Coordinate Symbiotic Third-Party Engagement	Engage Stakeholders throughout Process
GRID TRANSFORMATION ENABLING	
Data, foundational technology, change management	

*End-user' in this context is used interchangeably with the terms 'end-use customer' or 'customer', meaning end-use consumer of energy.

Applicability to the Valley

The RGT vision of the future end-state is integrated, reliable, resilient, safe, and sustainable.



The Value of an Integrated Grid



Efficient

An integrated, automated and intelligent energy supply managed with effective forecasting, planning and operations.



Resilient

An adaptable, dynamic and flexible energy network with regional visibility to the grid edge.



Reliable

A safe and secure energy transmission and distribution system with responsive, optimized, real-time awareness for faster power restoration.



Clean

An integrated system that enhances energy choices, reduces carbon emissions, advances sustainability goals, and furthers community resilience.



Affordable

A modernized grid that simplifies energy management, reduces peak demand and costs, keeps rates low, optimizes capital and positions the Valley to grow.

On the Horizon: Where the Roadmap Takes Us

Key capabilities areas unlocked through our strategic road mapping and planning





Questions?

Jason Krupp
Senior Project Manager
Innovation & Research

jakrupp@tva.gov



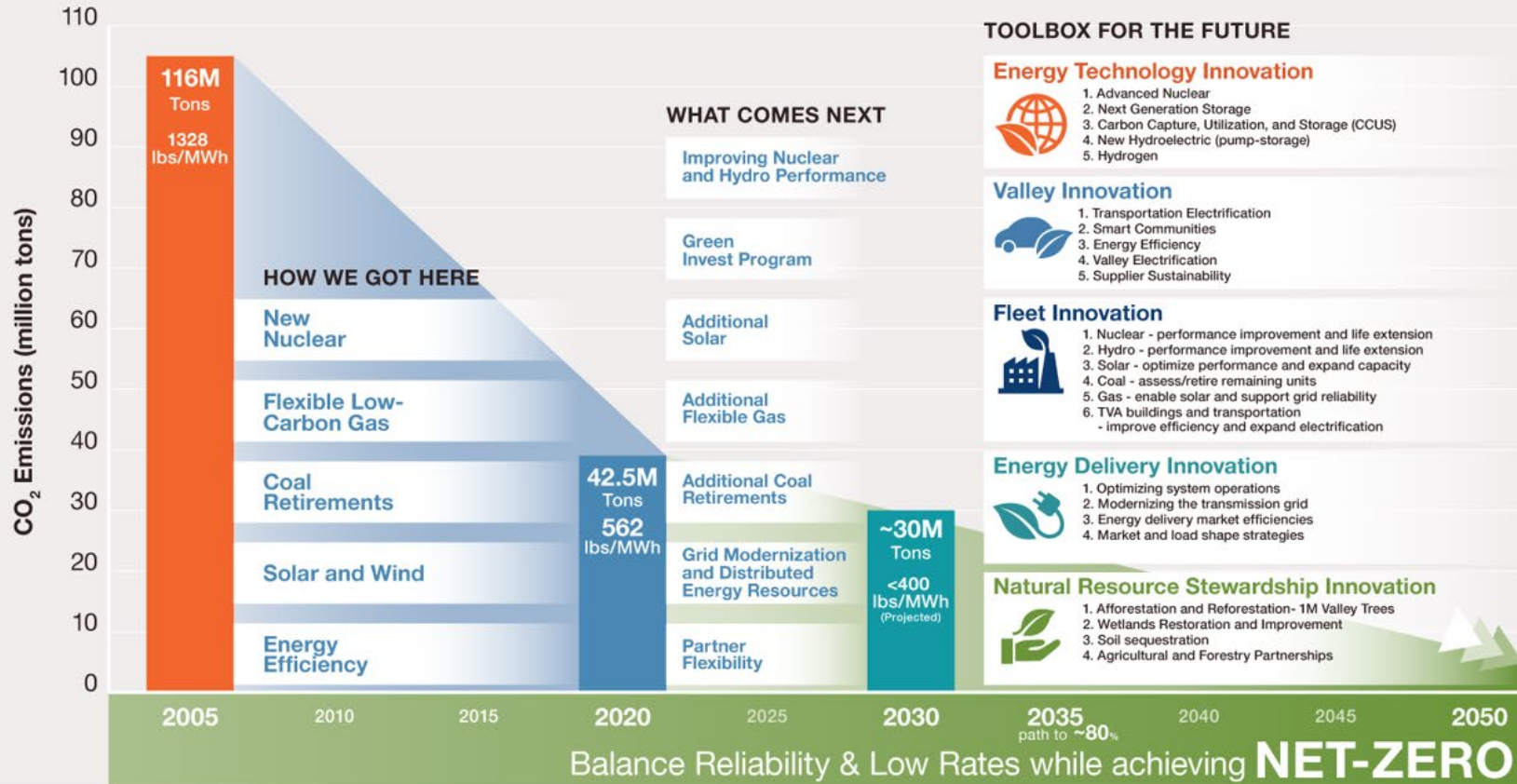
Decarbonization Technologies

Andrew Campbell, Senior Project Manager, TVA
Enterprise Research & Technology Innovation

May 23, 2022



TVA'S DECARBONIZATION JOURNEY



Decarbonization Options Initiative



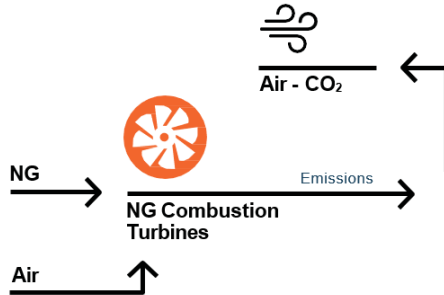
Advance a suite of technologies to cost-effectively reduce TVA's carbon footprint to net-zero.

- **CARBON CAPTURE, SEQUESTRATION & UTILIZATION**
- **ALTERNATIVE FUELS**
- **RENEWABLES + STORAGE**
- **ELECTRIFICATION**
- **ADVANCED NUCLEAR**

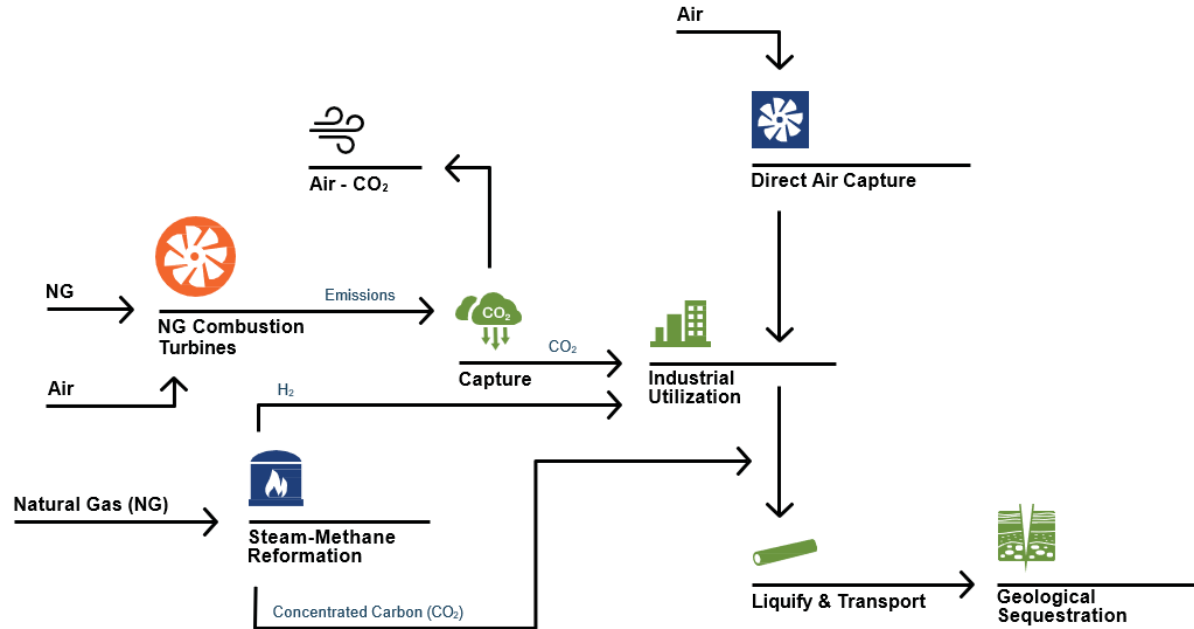


Alternative Technologies to Fuel a Carbon Free Future

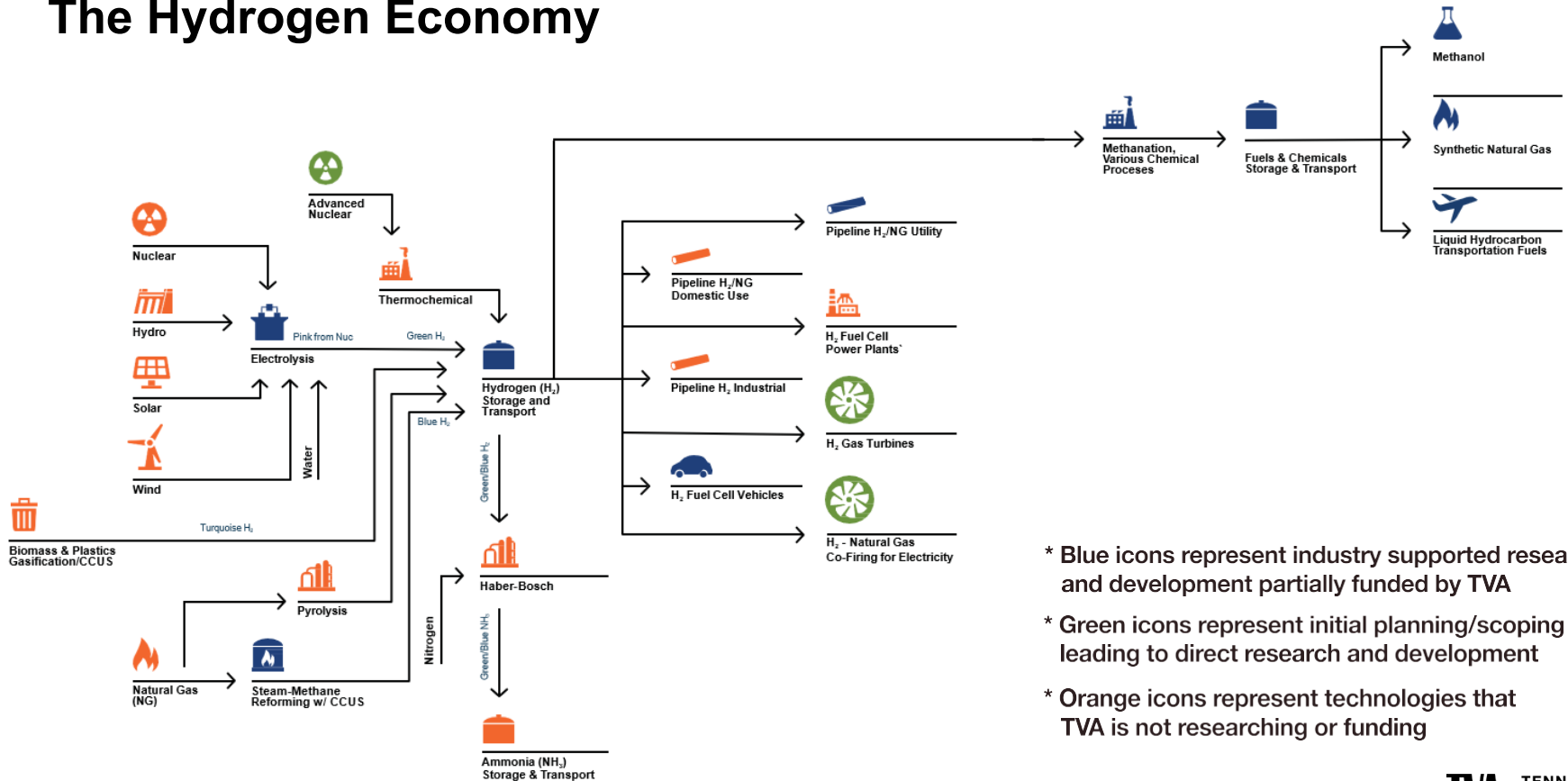
Today



Working to a Future with Capture Utilization & Storage



The Hydrogen Economy



- * Blue icons represent industry supported research and development partially funded by TVA
- * Green icons represent initial planning/scoping leading to direct research and development
- * Orange icons represent technologies that TVA is not researching or funding

Advanced Nuclear Solutions Initiative



Provide reliable, affordable, flexible and clean generation options

Small Modular Reactor

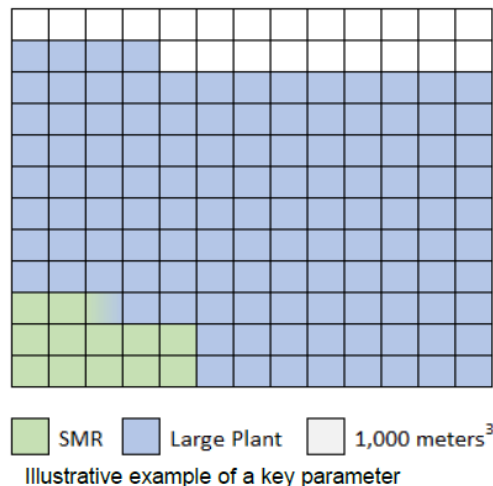
- Zero Carbon Emissions
- Benefits of nuclear with lower capital cost
- Operational Flexibility & Grid Stability
- Price Stability
- Little or no fuel cycle risk
- Smaller footprint and reduced emergency planning zone

Advanced Nuclear

Why Advanced Reactors Are Different

- Smaller size – less concrete and steel; smaller project to manage
- Simplified designs – fewer components to operate and maintain
- Easier Integration – smaller increments of cost and generation
- Enhanced safety – lower risk profile; more passive safety features

Nuclear Island Concrete



TVA Timeline for Advanced Nuclear Technologies

2009 – 2014



Single Design Phase

- Focus on B&W mPower
- Initiated Clinch River site characterization
- Early NRC engagement
- Reimbursement of some cost through B&W mPower
- B&W shut down program, vendor off-ramp

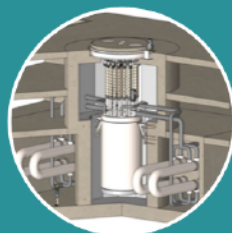
2014 – 2019



Site Development Phase

- Finished site characterization, engineering and analysis
- NRC Early Site Permit (ESP) approved
- Siting and emergency preparedness risk reduction
- Reimbursement of 50% of cost from 2015 – 2020

2019 – 2020



Advanced Technology Evaluation Phase

- Screened and evaluated LWR and non-LWR designs
- LWR designs ready for demonstration
- Non-LWR designs hold promise, need further development
- Partnerships necessary to reduce cost and risk

2021 – 2025



Detailed Planning Phase

- Detailed planning and licensing
- Identify and characterize additional sites
- Monitor Advanced Reactors Supply chain development
- Workforce development

2026 and beyond



Construction Phase

- Pending multiple decision gates, construction could begin as early as FY26
- First construction project at Clinch River
- Licensing of additional sites

TVA Continues to Support Advancement of Nuclear Options for the Future

TVA's New Nuclear Approach

Our goal is to have a reliable, affordable, flexible and clean advanced reactor option available by 2032, without adversely affecting our customers.

- Use a disciplined approach for Clinch River
- Use a systematic approach to consider Advanced Reactors and potential future locations
- Partner with utilities and government agencies to mitigate costs and risks associated with a first-of-a-kind deployment
- Work with universities and research institutions to leverage technology innovations and lessons learned



Questions

Andrew Campbell, Senior Project Manager

May 23, 2022



Engaging Universities, Industry Groups and Labs



Low Carbon Research Consortiums

- Low-Carbon Resources Initiative (LCRI)
- National Carbon Capture Center



Focused Industry Research & Development

- Electric Power Research Institute (EPRI)
- Center for Energy Advancement through Technology Innovation (CEATI)



University Research Partnerships

- University of Tennessee
- University of Tennessee Chattanooga
- Mississippi State
- Tennessee Tech University
- University of Kentucky
- University of Memphis
- Vanderbilt



Department of Energy

- National Engineering Technology Laboratory
- Water Power Technology Office
- Grid Modernization Laboratory Consortium

Engaging Startups & Venture Capital



EPRI Incubatenergy Labs

- Ameren
- AEP
- Duke Energy
- Enel
- Fortis BC
- Con Edison
- First Energy
- Green Mountain Power

Industry of the Future Technology Accelerator

- Oak Ridge National Lab
- University of Tennessee
Research Foundation
- Innov865 Alliance

Strategic Investments

- Clean Energy Ventures
- Blackhorn Ventures
- Activate Capital
- Energy Impact Partners
- G2VP
- The Ecosystem Integrity
Fund

Innovation Crossroads

- Oak Ridge National Lab
- Knoxville Entrepreneur
Ecosystem

SPARK Clean Tech Accelerator

- University of Tennessee
- Knoxville Entrepreneur
Ecosystem

INNOVATION CROSSROADS

OAK RIDGE NATIONAL LABORATORY

Innovation Crossroads Overview

May 2022

Oak Ridge National Laboratory is managed by UT-Battelle for the U.S. Department of Energy.

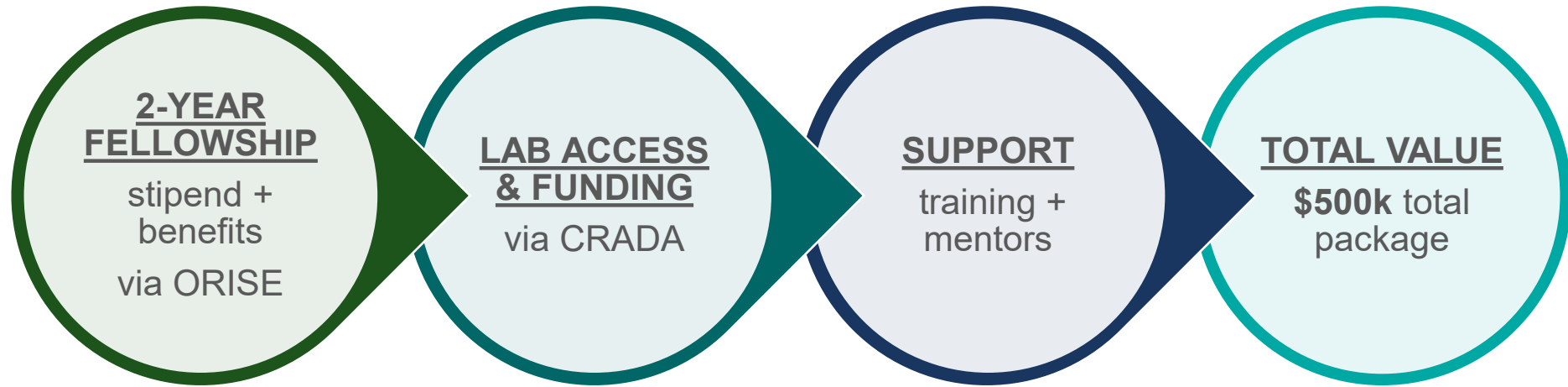
Innovation Crossroads is a public-private partnership founded by Oak Ridge National Laboratory and supported by the DOE Office of Energy Efficiency and Renewable Energy's Advanced Manufacturing Office and the Tennessee Valley Authority.



U.S. DEPARTMENT OF
ENERGY



World Class Support for Startups



COHORT 1

- 2017-2019
- 4 Innovators / 3 companies
- Sponsors: AMO, ORNL



COHORT 2

- 2018-2020
- 5 Innovators
- Sponsors: AMO, ORNL



COHORT 3

- 2019-2021
- 7 Innovators
- Sponsors: AMO, ORNL, TVA



COHORT 4

- 2020-2022
- 5 Innovators
- Sponsors: AMO, ORNL, TVA



COHORT 5

- 2021-2023
- 6 Innovators
- Sponsors: AMO, ORNL, TVA, BTO

Program Sponsors

Sponsors

Mission



Energy Efficiency &
Renewable Energy



INNOVATION
CROSSROADS



Clean Energy & Global Security

Mission: Deliver scientific discoveries and technical breakthroughs that will accelerate the development and deployment of solutions in clean energy and global security.



Energy & Advanced Manufacturing

Mission: Catalyze research, development and adoption of advanced manufacturing technologies and practices to drive U.S. economic competitiveness and energy productivity.



Building Efficiency & Energy Cost Reduction

Mission: Support research and development, validation, and integration of affordable, energy-saving technologies, techniques, tools, and services, to enable industry and others to develop and deploy technologies that can improve the efficiency and reduce the energy costs of the nation's homes, offices, schools, hospitals, and other commercial and residential buildings in both the new and existing buildings markets.



Integrated Grid

Mission: Support investments in technologies to achieve an integrated grid: a power system that is highly flexible, resilient, and connected and that optimizes energy production, delivery, and use.

Driving Impact by Embedding Entrepreneurs at ORNL

INNOVATION
CROSSROADS

26

startups
supported

\$33
million

grant/award
funding
received

84

jobs
created

\$21.9
million

venture
funding raised

8

products
launched

\$1.7
million

in sales
revenue

Retaining Alumni Companies in Region

COHORT 1 ALUMNI

May 2017 – May 2019

*2 of 3 companies
remain in region*



COHORT 2 ALUMNI

May 2018 – August 2020

*3 of 5 companies
remain in region*



COHORT 3 ALUMNI

June 2019 – June 2021

*6 of 7 companies
remain in region*



Developing an Entrepreneurial Ecosystem

Incubators & Accelerators



2017



2020

techstars_
Industries of the Future
Accelerator

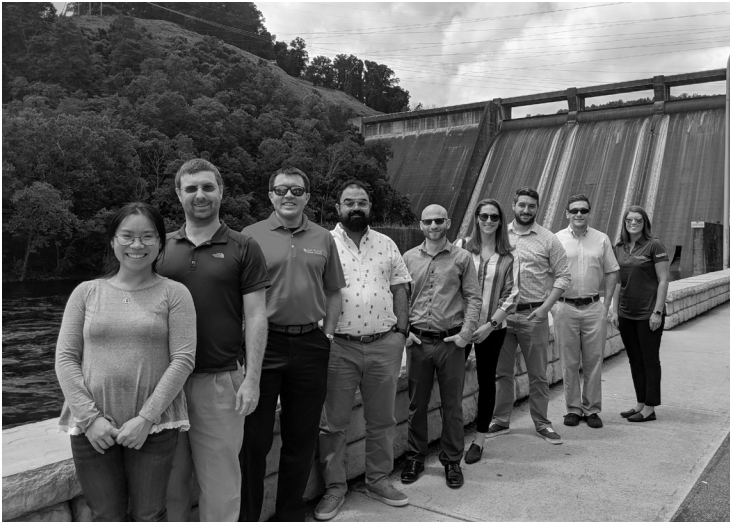
2022

Local Supporters



TVA's broad impact on our ecosystem

- Fully funded 4 innovators
- Engaged with 16 innovators
- Featured 6 innovators in TVA Innovation and Research Seminar Series
- Collaborating with SkyNano on DOE project
- Aided Quantum Lock with the Electric Power Board (EPB) project
- Engaging Becq in potential radiation shielding project (Browns Ferry)
- Partnering with Unbound Water Technologies on coal ash project



INNOVATION CROSSROADS

OAK RIDGE NATIONAL LABORATORY

Alumni Spotlight

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U.S. DEPARTMENT OF
ENERGY



Cohort 1 Alumni Spotlight: Anna Douglas

- SkyNano founded a low-cost manufacturing technique for high value carbon materials derived from CO₂
- Named 2019 Forbes 30 Under 30 in Energy
- Secured \$200,000 DOE STTR Phase I to partner with ORNL's Battery Manufacturing Group on project titled "Conductive Carbons by Design: Electrochemically Tailored Carbon Nanotube Conductive Additives for High-Rate Battery Electrodes"
- Secured \$2.5M DOE Office of Fossil Energy R&D Award
- 2021 R&D 100 Award Winner

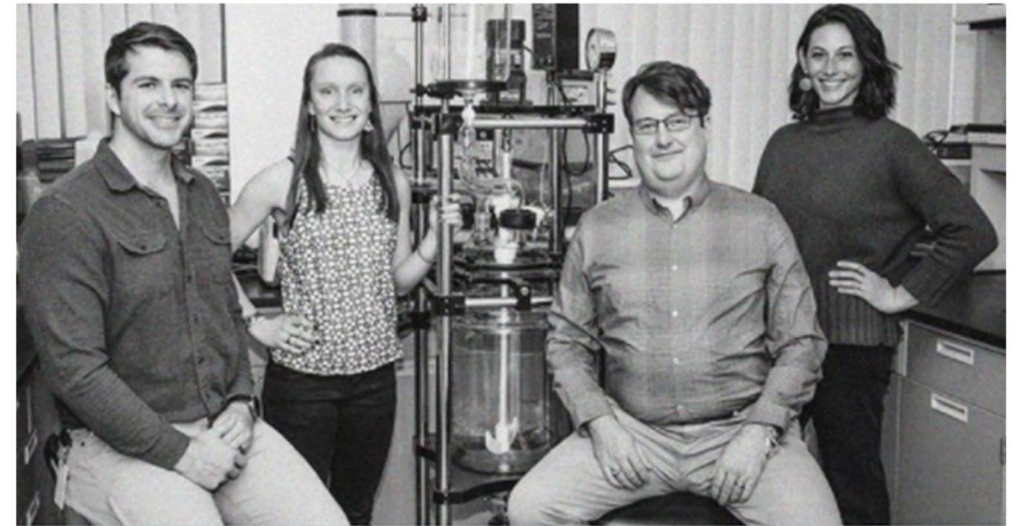


Cohort 2 Alumni Spotlight: Megan O'Connor

- Nth Cycle founded a recycling technology that extracts critical metals from batteries, e-waste, low-grade ore, and mine tailings so they can be reused to make new clean energy products
- Named 2019 Forbes 30 Under 30 in Energy
- Secured \$3.2M in funding from investors led by climate tech venture capital firm Clean Energy Ventures (October 2020)
- Closed a \$13M Series A round, led by Clean Energy Venture (February 2022)
- The investments by Clean Energy Venture will allow Nth Cycle to scale its metal processing technology, an alternative to pyrometallurgy and hydrometallurgy processes
- Won a \$976K National Science Foundation (NSF) SBIR – Phase II award to continue working with ORNL on an electrochemical recycling technology for recovery of critical battery cathode metals



NTH CYCLE



Nth Cycle Secures \$3.2 million in Seed Funding for electro-extraction
Nth Cycle uses an environmentally-friendly process called electro-extraction to recover critical minerals for the clean energy transition.
cleanenergyventures.com

Cohort 2 Alumni Spotlight: Matthew Smith

- TCPoly founded a new class of high thermal conductivity plastic composite materials aim to improve heat dissipation, allowing for metal replacement and light-weighting, cost and component reductions, and improved performance and reliability
- Named Technology Association of Georgia (TAG) 2020 Top 10 Innovative Companies
- Secured \$1M NSF SBIR Phase II
- Has 4 products currently available for purchase
- TCPoly generated more than \$400,000 in sales revenue in 2020



Cohort 3 Alumni Spotlight: Alex Lewis

- Advancing technology founded at Oak Ridge National Laboratory with partner Abhijeet Borole
- Developing a process known as microbial electrolysis, which leverages a robust microbial community that grows as a biofilm on an electrode and can actually produce electrons and protons directly from almost any organic waste stream
- Secured \$1.4M seed investment to further advance technology
- Secured \$1M DOE EERE SBIR Phase II with industry partner Southern Company



electro-active
technologies



INNOVATION CROSSROADS

OAK RIDGE NATIONAL LABORATORY

Questions?

Innovation Crossroads Overview

Dan Miller

May 2022

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U.S. DEPARTMENT OF
ENERGY



Advice Questions

- A. What factors should TVA consider when investing in emerging technologies?
- B. What factors should TVA consider in establishing partnerships and stakeholder coalitions in order to develop emerging technologies?

**Meeting begins
at 8:15 am
tomorrow**

Welcome!

The Meeting will
begin at
8:15 AM Eastern



Regional Energy Resource Council

May 23-24, 2022

2nd Meeting – Term 5

Welcome

Day 1 Review

Agenda

RERC Meeting – Day 2

May 24, 2022

All times are ET

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noon	Adjourn

Public Comment

**This is a listening
session; responses
are typically not
provided**



Thank You

Advice Questions - Discussion

- A. What factors should TVA consider when investing in emerging technologies?
- B. What factors should TVA consider in establishing partnerships and stakeholder coalitions in order to develop emerging technologies?

BREAK

Finalize Advice Statement

Summary

Next RERC Meetings

October 3 - 4 Chattanooga

November 2 - 3 Nashville

Joint Meeting with Regional Resource Stewardship Council (RRSC)

Thank You



TENNESSEE
VALLEY
AUTHORITY