

Regional Energy Resource Council and

Regional Resource Stewardship Council

January 18, 2024



Welcome!

The Meeting will begin at 8:30 ANN Eastern

Welcome



RERC and RRSC Virtual Meeting

- This is a Virtual only meeting for Council Members and the public
- We welcome members of the public who are in listen and view only mode. There will be a Public Listening Session at 1:30 pm for those who have registered to speak. Written comments are always welcomed (tva.com/rerc and tva.com/rrsc).
- RERC and RRSC Members are able to mute and unmute their own line. Council Members may use the raise hand function to be recognized for questions or comments. I will call on you for your question or comment.
- RERC and RRSC Members -- Please speak loudly so that all can hear your comments.



Introductions

Name

Position, Organization



RERC Term 6 Members

Jan Berry Citizens Climate Education

Marquita Bradshaw Sowing Justice

Ron Bunch Bowling Green Chamber of Commerce

Monte Cooper Jackson Energy Authority

Erin Gill * Knoxville Utilities Board

Rebecca Goodman Commonwealth of Kentucky

Rodney Goodman Habitat for Humanity **Chrissy Heard** State of Mississippi

Chelsea Jenkins Commonwealth of Virginia

Candy Johnson Urban League of Greater Chattanooga

Sen. Steve Livingston State of Alabama

Pete Mattheis Tennessee Valley Industrial Committee

Dan Miller Oak Ridge National Laboratory

* RERC Council Chair

Introductions: Name Position, Organization

> **Doug Peters** Tennessee Valley Public Power Association

Boyd Pettit State of Georgia

Erik Schmidt City of Chattanooga

Patricia Sims Drake State Community & Technical College

Alexa Voytek State of Tennessee

Julie Woosley State of North Carolina



RRSC Term 12 Members

Ryan Brown Commonwealth of Virginia

RaeLynn Butler Muscogee (Creek) Nation

Keith Carnahan Meriwether Lewis Electric Cooperative

Alan Gates Pennyrile Electric

Richard Holland Packaging Corp of America

Cline Jones Tennessee River Valley Association

Kim Klinker Klinker Management Ron Lambert Nature Conservancy

Whitney Lipscomb State of Mississippi

Tom Littlepage* ADECA Office of Water Resources

John McConnell McConnell Insurance Commonwealth of Kentucky

Will Nelson Nelson Tractor Co. State of Georgia

Ron Robertson TN Farmer

* RRSC Council Chair

Introductions: Name Position, Organization

> David Salyers State of Tennessee

Sen. Clay Schofield Alabama Senate, District 9

Danette Scudder TN Valley Public Power Association

Bob Sneed Retired, Army Corps of Engineers

Catherine Via TN Farm Bureau Federation

Stacey White Arab Electric Cooperative, AL

Randy Wiggins Cherokee County, NC



Joint RERC & RRSC Meeting

January 18, 2024

All times are Eastern Time

8:30 am	Welcome – Chairs Erin Gill (RERC) and Tom Littlepage (RRSC) Designated Federal Officer (DFO) Melanie Farrell Introductions of Council Members
0.00	Meeting Protocols, Agenda
9:00	DFO Briefing
9:15	Valley Pathways Study
10:00	Break
10:15	Valley Pathways Study (cont.)
11:00	Advice Questions Discussion
12:00 pm	Lunch
1:30	Public Listening Session
1:45	Finalize Advice Statements in Separate Rooms for RERC & RRSC
2:45	Read RERC and RRSC Advice Statements to Combined Group
3:00	Closing Remarks, Adjourn RERC- RRSC Meeting



Agenda

DFO Briefing

Melanie Farrell, Designated Federal Officer (DFO)



Federal Advisory Committee Overview



Structured TVA Stakeholder Engagements

The following describes the objectives of TVA's Federal Advisory Committees versus other needs driven stakeholder engagements and the respective differences in advisement to TVA Executive Leadership and the TVA Board of Directors.



Valley Pathways Study: Building a Competitive, Clean Economy

Laura Duncan, TVA Senior Project Manager, Environment & Energy Policy

Dr. Charles Sims, TVA Distinguished Professor of Energy & Environmental Policy, UT Baker School

January 18, 2024



Overview

- The Valley Pathways Study kicked off in February 2023 in partnership with the University of Tennessee Baker School of Public Policy & Public Affairs
- Objective is to quantify sources of greenhouse gas (GHG) emissions from across the entire Valley and evaluate pathways for the Valley to reach Net Zero GHG emissions by 2050.
- Technical modeling was executed in parallel with stakeholder engagement, driving support and ownership of the study and its results across all economic sectors and diverse perspectives.
- Next steps are focused on sharing preliminary findings, continued stakeholder engagement and how to support, coordinate, and move toward Valley-wide action.



Study Partnership & Stakeholder Collaboration





Study Partnership & Support



Mission is to address *critical energy and environmental challenges* by creating policy-relevant research and educational opportunities that integrate natural, physical, and social science.



Mission is to serve the people of the Tennessee Valley to make life better, with a focus on Energy, Environment, and Economic Development.



Significant, ongoing TVA experience working on major initiatives & engaging stakeholders



Experience conducting economywide decarbonization pathways modeling Guidehouse and VEIC are uniquely positioned to understand decarbonization pathways for the Valley and drive stakeholder alignment.

Massachusetts 2050 Decarbonization Roadmap
 Duke Energy Carolinas Carbon Plan



Be Part of the Solution

At the Baker School, our mission is to educate skilled problem solvers, prepare them to take public leadership roles, and help our country solve the biggest challenges of our time.

Our faculty conduct research and work with policymakers to resolve major public policy challenges, and our students have the opportunities inside and outside the classroom to

Rooted in the legacy of Howard Baker Jr.

- Understanding and holding confidence in America's institutions.
- Respect for opposing viewpoints as a hallmark of leadership
- Mastering the art of the possible to solve complex problems.



PUBLIC POLICY AND PUBLIC AFFAIRS

HOWARD H. BAKER

CENTER FOR ENERGY, TRANSPORTATION & ENVIRONMENTAL POLICY

CETEP is an interdisciplinary network of scholars and partners extending across UT and to every level of government, the nonprofit sector, ORNL, TVA, and industry.

Housed within UT Baker School of Public Policy & Public Affairs

Joint faculty with Haslam College of Business and UT Institute of Agriculture

Integrating natural, physical, and social science to address:

- Energy consumption and conservation
- Nuclear energy
- Renewable energy
- Air and water pollution
- Ecosystem services
- Climate change

ENERGY & TRANSPORTATION TECHNOLOGY INNOVATION

We tackle critical energy and environmental challenges by creating policy-relevant research, educational opportunities, and public outreach.

TVA's Mission

To serve the people of the Tennessee Valley to make life better.

Delivering on Our Mission

Energy | Environment | Economic Development



Provide affordable, reliable power.



Steward the Valley's natural resources.



Partner for economic growth.



Guidehouse

Guidehouse is partnering with VEIC to provide combined capabilities to deliver this Valley-wide, economy-wide, decarbonization pathways study. Together, Guidehouse and VEIC are uniquely positioned to understand decarbonization pathways for the Valley and drive stakeholder alignment.





Guidehouse is a global company headquartered in Washington, DC, that provides management, technology and risk consulting to clients with more than 15,000 professionals in over 50 locations throughout the world. https://www.guidehouse.com/



Significant, ongoing TVA experience working on major initiatives & engaging stakeholders

Experience includes:

- Massachusetts 2050 Decarbonization Roadmap
- **Duke Energy Carolinas Carbon Plan** •

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Vermont Energy Investment Corporation (VEIC) provides energy consulting services to states, utilities, Federal agencies, nonprofit organizations, and businesses. We have a significant market presence in North America with work across 25 states and provinces.

https://www.veic.org/

Experience conducting economy-wide decarbonization pathways modeling











Economy-Wide Study, Economy-Wide Stakeholders

- Decarbonization touches every household, building, and business in the Valley.
- Stakeholder representation must be similarly broad and must start early.

Preliminary List of Key Topics and Stakeholder Groups							
Municipal sustainability	Economic development						
Rural sustainability	Equity & environmental justice						
Agriculture	Local Power Companies						
Manufacturing and industry	Organized labor and vocational education						
Elected officials (federal, state, local)	State energy offices						
Universities and research agencies	Seven states comprising the Valley						
Internal TVA stakeholders (e.g., IRP)	Energy efficiency programs						
Environmental NGOs	Transportation and mobility						



Economy-Wide Study, Economy-Wide Stakeholders

- Ford Motor Company
- City of Knoxville
- Oak Ridge National Laboratory
- Southeast Energy Efficiency Alliance
- WestRock
- BrightRidge
- Tennessee State University
- University of Tennessee Chattanooga
- The Nature Conservancy
- Redstone Arsenal
- Tennessee Farm Bureau Federation
- Tennessee Interfaith Power and Light
- Tennessee Advanced Energy Business Council
- Tennessee Department of Economic Development
- Nashville Electric Service
- City of Chattanooga
- Tennessee Valley Public Power Association
- Middle Tennessee Natural Gas Utility District
- City of Florence Electricity
- UT Center for Transportation Research
- Tennessee Valley Industrial Committee
- Tennessee Department of Environment and Conservation
- Commonwealth of Kentucky Energy and Environment Cabinet
- Memphis and Shelby County Division of Planning and Development





Study Overview



What is a Pathways Study?

A Pathways Study uses scenario-based analysis to compare several possible visions of the future to help determine the timing, scale, and effects of achieving greenhouse gas targets.

What paths are most feasible for the Valley to get to <u>net zero by 2050?</u>



What <u>impacts</u> will these paths have on the Valley as a whole?





Utilities, States and Cities on this Path







Virginia Greenhouse Gas Inventory - 2018 Virginia Department of Environmental Quality

Issued November 2021

Summary and Overview

This report summarizes results of the economy-wide Virginia Department of Environmental Quality (DEQ methodologies.

Released from a broad range of human activities, G include carbon dioxide (CO₂), methane (CH₄), nitrou Solar radiation in the lower atmosphere acts like a g

sq.nc.gov/GHGinventory

Clean Energy, Efficiency, a This paper presents National greenhouse gas emissions c affordability and customer d together provide a clear patt way we all relate to energy. I on this pressing and critical

EXECUTIVE SUMMARY

Climate change threatens or temperature increases more emissions in developed cou Commitments to reduce GH New York and all New Engla Kingdom, and in other U.S.

The Northeast has emerge the way. 2015 emissions fi energy efficiency, conversion electricity. The most recent da reduction below 1990 levels businesses as well as inclusi efficiency and oil-to-gas con emissions still at 1990 levels











North Carolina **Greenhouse Gas** Inventory (1990-2030)

January 2022



PATHWAY 2045

Update to the Clean Power and Electrification Pathway November 2019

EXECUTIVE SUMMARY

By 2045. California will undergo a remarkable evolution. Supported by its residents, the state will achieve carbon neutrality to reduce the threat of climate change. This will require substantial decarbonization of all sectors of the economy and will necessitate rigorous planning to keep energy safe, reliable and affordable.

Pathway 2045 examines the energy implications of California's longterm decarbonization goals on both the economy and the electric ector and maps out a feasible and low-cost path to meeting these pals. Pathway 2045 builds on The Clean Power and Electrification arhway," Southern California Edison's 2017 analysis of what will be duired to meet 2030 interim goals.

way 2045 concludes that the changes required across fornia's economy are profound: Decarbonization is achieved ugh powering 100% of retail sales* with carbon-free electricity, ectrifying transportation and buildings and using low-carbon fuels. chnologies that are not viable for electrification

emaining carbon is sequestered to reach carbon neutrality are 1). Emerging technologies and practices will be required to he most economical method to remove carbon at this scale.

ectric sector: To economically meet both the 2030 and 2045. reportation poals, the electric sector needs to decarbonize e duickly than currently required. By 2045, significant. crification of the state's economy combined with population and momic growth will result in a 60% increase in electricity sales from end and a 40% increase in peak load.

signwatts (GW) of new utility-scale clean generation and W of utility-scale energy storage will be required in the next ars. Energy storage will be essential because the most costwe, carbon-free generation sources -- wind and solar -- are ittent. Thirty additional GW of generation capacity and 10 of storage will come from distributed energy resources (DERs) uding up to 50% of single-family homes in California which, driven improved economics, building codes and supportive but equitable des, are projected to have customer-sited solar by 2045.

he grid: The grid must have sufficient capacity and continue to demize to harness the full potential of DERs. Electrification will er increase customers' reliance on the grid, underscoring need to build in additional resilience to withstand the more quent and severe weather conditions due to climate change acts. Grid hardening efforts today along with system designs accommodate increasing flexibility and more monitoring should duce these risks. At the same time, California's leadership in deep ecarbonization can be a global model that helps mitigate the other threats of climate change.



CARBON NEUTRALITY BY 2045 Figure 1: Decarbonization is required across the California economy



are a electricity used by individual customers (as opposed to whole use electricity that is bought, sold and traded in markets)

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Valley Pathways Study

Pathways studies are designed to evaluate what a Net Zero economy looks like

- Technical Approach
 - Begin with analysis of current greenhouse gas emissions (the Valley's "baseline").
 - Build inventory of key facilities, equipment, and activities comprising the Valley's economy.
 - Forecast future changes to population, technology, and infrastructure.
 - Detailed evaluation of the regional energy system to evaluate changing energy needs.
- Key Outcomes
 - There is not a unique "right answer" to get to Net Zero.
 - Every pathway trades off success, cost, or some other variable compared to another area.
 - Comparing and contrasting pathways highlights key "no regrets" actions, as well as fundamental forks in the road.
 - Findings arm <u>the Valley</u> with critical information to weigh options in future planning and actions across the economy.

Valley Pathways Study

A study to understand what economic sectors, such as transportation, industry, agriculture and buildings, might do throughout the Valley in the coming years to reduce carbon emissions and grow the economy.

TVA's Integrated Resource Plan

Sets strategic direction for how TVA will meet the electricity load needed in the future in a least cost, reliable and responsible manner.

Carbon Capture

Gas

Hydrogen

Utility-Scale Solar

Energy Storage

Utility-Scale Wind Nuclear/SMRs

Hydro

Energy Efficiency

Demand Response

Key Components

GHG Baseline for the Valley

Tennessee Valley 2019 Greenhouse Gas Emissions (estimated). Commissioned by TVA and UTK Baker Center. Prepared by Guidehouse and VEIC. Draft, Nov. 2023.

Key Insights

- 200 MMTCO2e is ~3% of US GHG emissions the Tennessee Valley is home to about 10 million people, or about 3% of US population.
- Transportation is, by far, the largest source of greenhouse gas emissions in the Valley.
- Emissions from Buildings and Industry look small, but these sectors demand nearly 100% of the electricity that is generated for the Valley.
- Agriculture represents only energy consumed; methane emissions related to agriculture are in Non-Energy alongside refrigerants and flame retardants.

Timeline & Accomplishments

INITIATIVE	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	ост	NOV	DEC
Identify key stakeholders and engage Stakeholder Team											
Develop Valley GHG Baseline							 St. Es De 	akeholder (stablished G eveloped Sc	Group Colla HG Baseli cenarios &	iboration ne Modeling (Pa	athwavs)
Begin to engage key stakeholders and define Pathway scenarios							• Dr	aft Prelimin	ary Finding	gs Report	,
Develop, execute, and iterate modeling											
Develop Preliminary Report											
Stakeholder Meetings						\bigstar	${}$	☆		\bigstar	
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BAKER SCHOOL

Questions?

BREAK

Analysis & Pathways Development

GHG Baseline for the Valley

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Defining Pathway Scenarios: model different rates of technology adoption, other drivers, answer questions

Example Scenario Questions

What does the Net Zero Valley-wide economy look like IF:

- Vehicle electrification happens quickly? Slowly?
- Advanced EV battery manufacturing plants are sited in the Valley?
- Population and/or GDP grow at a certain rate?
- Bioenergy resources are available at scale and low-cost?

Key Variables							
Technology Inventory	Economic Drivers						
 Furnaces Boilers Cars Trucks Offices Factories Airports Farm equipment Clean and fossil power plants 	 Population and households Workforce and economic development Production of goods Freight Commuting Key policy initiatives 						

Disaggregating "The Economy" into sets of activities and technologies

Illustrative data – does not reflect actual Valley fleet, nor anticipated EV adoption.















fuel consumption will change dramatically





Pathways to Net Zero – Scenarios

Scenarios align to "Pillars of Decarbonization"

Initial pathways scenarios focused on three critical strategies, often referred to as "pillars of decarbonization" – efficiency, electrification, and low-carbon fuels. A fourth pathway tests the synergies of combining those levers.

Community Resiliency

Accelerated Electrification

Low-Carbon Breakthrough

Combined Scenario



A future where more demands – for energy, goods, and services – throughout the economy are met and funded locally. Denser communities, both urban and rural, allow for less driving. 5

A future where almost everything in the Valley is electrified. This scenario explores the upper bound of how much electricity demand growth might be expected in a Net Zero economy. 85

A future in which the pace and I magnitude of electrification is more limited. Instead, innovation allows new lowcarbon fuel alternatives to be deployed beyond just niche applications.



A future where the Valley strives for a combination of the three strategies. This scenario takes an "all of the above" approach matching decarbonization strategies to their most impactful sectors.





Preliminary Findings



High-Level Model Results



Valley-Wide Gross GHG Emissions

2005 Back-Cast 2019 Baseline 2050 Reference

Community Resiliency

Accelerated

Electrification

Low-Carbon Combined Breakthrough Scenario





Emissions

100%

GHG Baseline – Electricity Demand by Sector



Tennessee Valley 2019 Greenhouse Gas Emissions (estimated). Commissioned by TVA and UT Baker School. Prepared by Guidehouse and VEIC. Draft, Nov. 2023.





Buildings, Electrification & Load-Growth

- The Valley has high electric HVAC penetration in residential and commercial buildings.
- This limits opportunity in residential and commercial buildings.
- "TVA-preferred" heat pumps can reduce electricity demands by >50%, save hundreds of dollars per month, and ease peak demand.
- Key energy efficiency measures for buildings can limit new electricity demands for buildings – especially in comparison to load growth to meet electric vehicle needs.



Industrial, Residential & Commercial Demand Transportation Demand



Transportation Sector Decarbonization

- Transportation emissions are largest source of emissions in baseline – and largest opportunity for reductions.
- Passenger vehicles represent majority of transportation emissions – about 25% of Valley-wide emissions.
- Electrification offers the largest emissions reductions opportunity, although reducing VMT can help to limit grid impacts.
- Low-carbon fuels will be important for nonpassenger vehicle modes.



Transportation Energy Demand

Industrial Decarbonization

- No single industrial sub-sector dominates the Valley.
- Accordingly, a range of solutions will be needed for industrial decarbonization.

Industrial

Decarbonization

Electrification

Optimization & Efficiency Process

Substitution

CCS

GHG Emissions from Industrial Subsectors



Low-Carbon

Fuels

Non-Energy & Agriculture Emissions

- Non-energy sector is relatively small today, but the most difficult to decarbonize.
- Sector accounts for about 25% of 2005 emissions, but about 50% of 2050 emissions.
- Phase-out of HFCs (refrigerants) drives majority of reductions.
- Farming practices are already mostly no-till, limiting further opportunities to abate emissions from cropland.
- Limited opportunities to reduce emissions from livestock (and human) effluence.



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Foundations of a Clean, Competitive Economy Critical Actions

The pathways modeling conducted in this study highlight several critical actions and transitions that will be core building blocks for a Net Zero economy.







ENNESSEE

Progress in Action & Stakeholder Priorities



Barriers & Opportunities for Foundational Actions

Foundational activities face critical barriers but highlight key areas where concerted action or investment could unlock new progress.





Stakeholder Priorities for Longer-Term Action

The final stakeholder meeting of this phase of VPS focused on actions already underway throughout the Valley. Stakeholders have identified lack of a central authority to coordinate myriad actors as a key gap in achieving Net Zero





TENNESSEE VALLEY

AUTHORITY

Next Steps: Information Sharing & Path Forward





Summary



Valley Pathways Study



Valley Pathways Initiative

Study > Actions > Results

- Publish Preliminary Findings Report
- Public Webinar
- Stakeholder Information Sharing & Feedback
- Opportunities to grow programs and initiatives aligned with critical actions
- A Competitive, Clean Economy



Questions?



Advice Questions Discussion



Introduction for Advice Questions

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TVA is a clean energy leader and committed to reducing carbon emissions and supporting a thriving clean energy economy. The University of Tennessee Baker School for Public Policy and Public Affairs integrates natural, physical, and social science to understand human-technology interactions in energy systems.

TVA and the Baker School formed a partnership to conduct a first of its kind study for the Tennessee Valley region, recognizing that a collaborative, economy-wide effort is needed to achieve net-zero emissions Valley-wide by 2050.

Preliminary findings of the Study show significant progress in reducing emissions in the electricity sector and agriculture sectors (approximately 50% for each since 2005) which has resulted in a 30% economy-wide reduction across the region.

The Study's preliminary findings identified critical components needed to build a competitive, clean economy. These are actions that should be taken now and align with many programs and initiatives already supported by a diverse group of stakeholders in the Valley, including TVA.

These programs and initiatives include an economic development focus on EV manufacturing, charging infrastructure deployment, supporting companies' sustainability goals, a research and development focus on innovative technology assets, investments in energy efficiency, and natural resources initiatives.



Advice Questions

- 1. What feedback or suggestions, including additional analysis, do you have to ensure the Valley Pathways Initiative moves toward actionable results?
- 2. Are there certain types of programs or initiatives in your communities that have been effective in encouraging greenhouse gas emission reductions and that the Valley Pathways Initiative should consider coordinating with in the future?
- 3. How can the Valley Pathways Initiative encourage focus on partnerships and investments in innovative technologies?



LUNCH BREAK

Meeting resumes at 1:30 PM EST



Public Comment



This is a listening session; responses are typically not provided



Thank You

See Chat for link to go to either RERC or RRSC room for Finalizing the Advice Statement Discussion



FAC Meeting Requirements

Jennifer Brundige, Attorney, TVA General Counsel Office

Cliff Beach, Assistant General Counsel, TVA General Counsel Office

January 18, 2024



Federal Advisory Committee 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



Finalize Advice Statement



Go to Original Meeting Link

for reading of the Final Advice Statements



Welcome



RERC Advice Statement



RRSC Advice Statement



Closing Remarks


TENNESSEE VALLEY AUTHORITY