

Transforming Energy Assistance Through Innovative Partnerships

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ABSTRACT

As a mission-driven public utility providing wholesale power to 153 municipal and cooperative local power companies (LPC), the Tennessee Valley Authority (TVA) has worked with stakeholders and partnering utilities to design and test new models for energy efficiency programs that hold the promise of helping families who are burdened by high energy costs.

The result of TVA's efforts is a new program called Home Uplift. Through collaboration with multiple partners, Home Uplift provides participants with no-cost energy upgrades – including HVAC, building envelope, windows and doors, and appliances. These upgrades are designed to enhance energy performance, improve indoor air quality, reduce thermal stress¹, and lower utility costs.

TVA developed a funding model that created the Home Uplift Fund – a funding mechanism for sharing the upfront costs for home upgrades. Home Uplift's funding partners include TVA LPCs, local and state governments, community action agencies, non-profit organizations, state and federal lending institutions, and advocacy groups. TVA also has been working with third-party research firm Three³ to evaluate the effects of the Home Uplift Program on participant social determinants of health (SDH) with the objective of building a business case to attract healthcare dollars as an additional funding source.

This paper discusses the Home Uplift Program partnership model in creating a scalable and sustainable solution to address energy equity in the southeast and presents detailed research findings on program impacts for select social determinants of health (SDH).

Introduction

About TVA

Founded as part of President Franklin D. Roosevelt's New Deal, the Tennessee Valley Authority was created to provide navigation and flood control, electricity generation, and economic development to the southeast – a region deeply impacted by the great depression. TVA evolved into the nation's largest public power company with a generating capacity of 37,896 megawatts (Tennessee Valley Authority 2021). TVA's service territory covers approximately 80,000 square miles in the southeastern United States. It generates and transmits wholesale electric power to 10 million residents primarily through a distribution network of 153 municipal and cooperative utility partners known as local power companies (LPCs).² This vast network encompasses the majority of Tennessee and touches parts of six neighboring states: Alabama,

¹ Thermal stress in this context is defined as a condition of extreme heat or cold in the home that can adversely affect the human body. Examples of thermal stress include hypothermia, heat rash, heat cramps, heat exhaustion, and heat stroke.

² TVA directly serves 57 large, energy-intensive industrial customers.

Georgia, Kentucky, Mississippi, North Carolina, and Virginia (Tennessee Valley Authority 2022).³

TVA is a wholly owned corporation of the federal government. The utility's corporate governance consists of a nine-member Board of Directors who are each appointed to a five-year term by the President and confirmed by the United States Senate (Federal Register 2022). Since 1959, TVA has been self-financing; the utility derives revenue primarily from the sale of electricity and bonds.

Since its inception, TVA has been committed to making “life better for the people of the Tennessee Valley region” by providing safe, reliable, and cost-competitive power while at the same time promoting responsible environmental stewardship and advancing economic development opportunities through investment and partnerships with the local communities it serves (Tennessee Valley Authority 2022a).

TVA's EnergyRight® group is responsible for the design, delivery, and deployment – in lockstep with its LPC partners – of energy programs and initiatives⁴ for residential, commercial, and industrial customers. EnergyRight partners with LPCs to help customers “make smart energy decisions and save money” (Tennessee Valley Authority 2022b).

The Need for Energy Assistance in the South

In a joint report, the Southeast Energy Efficiency Alliance (SEEA) and the Texas Energy Poverty Research Institute (TEPRI) recently concluded that, in the south, “more than a third of the region's population has trouble paying their energy bills” (SEEA and TEPRI 2021). Similarly, a study by the American Council for an Energy Efficient Economy (ACEEE) noted that households in the southeast are among the most energy-burdened in the country despite the omnipresence of relatively low electricity rates (Drehobl and Ross 2016).

Household income is a primary driver for energy burdens in the region. Data from the US Census Bureau rank median household income in Alabama, Arkansas, Kentucky, Louisiana, Mississippi, North Carolina, South Carolina, and Tennessee in the bottom quartile (Guzman 2017). Additional contributing factors to energy burdens in the southeast include inefficient mechanical equipment and appliances, inadequate air sealing and insulation of the building envelope, and increased intensity of heating and cooling loads caused by fluctuations in weather conditions (Drehobl and Ross 2016). TVA estimates that approximately 34 percent of its residents meet income eligibility requirements for federal assistance efforts such as the Department of Energy's Weatherization Assistance Program.

Early Partnership Efforts

Understanding the need to address the growing problem of energy affordability within its service area, TVA launched the Smart Communities Extreme Energy Makeovers (EEM) initiative in 2012. As part of a settlement between TVA and the US Environmental Protection Agency, EEM was created to test energy program design and delivery to income-qualified residents utilizing community partners to engage the target market. EEM's objective was to achieve 25 percent energy reduction through energy retrofits in homes at least 20 years old at a

³ A map of TVA's service area is available at: tva.com/energy/public-power-partnerships.

⁴ Energy programs are products(s) and/or services(s) that help utility customers adopt energy efficiency practices, building improvements, and/or smart energy technologies (e.g., renewable energy installations).

cost under \$10.00 per square foot (Tennessee Valley Authority 2014). TVA awarded seven EEM projects in selected LPC communities across four states: Alabama, Georgia, Mississippi and Tennessee. Additional partners included community non-profit organizations, energy program implementers, and local governments. These organizations supported various tasks, such as marketing, recruitment, education, community engagement, and contractor management.

From 2015 to 2017, EEM delivered more than 3,400 whole-home retrofits that produced more than 17 gigawatt hours of projected electric energy savings, generated nearly \$35 million in direct financial impact to local communities, and saved participating homeowners an average of \$500 a year in electricity costs.

EEM's success was rooted in the simplicity of a partnership-based design: fund the community team, set the overarching requirements, offer project-readiness assistance, and provide implementation support. At the outset, TVA encouraged partnership that facilitated community engagements, leveraged the bench strength of TVA's existing trade ally network, and brought significant benefit to participants. By requiring LPCs to be a named project partner, TVA ensured a strong utility-community collaboration. Moreover, project administrators were afforded the flexibility to implement their programs based on existing community needs, provided they met project requirements. As a result, program models varied across the seven EEM projects, ranging from LPC-managed and direct third-party from energy service providers. Project success hinged on the ability of administrators to align partners around project goals and requirements. As a systems and support partner, TVA provided EEM administrators with project management and community engagement resources. TVA facilitated project kick-off meetings in each community to ensure alignment around project objectives and timelines, partner roles and responsibilities, performance and financial tracking, and data collection and reporting.

At the same time EEM projects were getting underway, in 2015, TVA began to regularly convene a group of stakeholders representing diverse industry and geographic interests to better understand energy burden, energy equity, and energy insecurity issues in the Tennessee Valley. The Energy Efficiency Information Exchange (EEIX) brought together LPC representatives, local and state government officials, housing and development leaders, community action agency members, civic and nonprofit organizations, education and research specialists, environmental advocates, and other stakeholders. The EEIX collaboratively created the stated goal in 2016 to develop "a sustainable and equitable low-income energy efficiency and educational model Valley-wide by 2018."

The EEIX has contributed research support, policy insights, program design feedback, and local community perspectives. As a result, TVA has been able to identify long-term, sustainable solutions for low-income residents in need of energy assistance. The EEIX helped TVA serve three key objectives: (1) leverage stakeholder expertise in identifying program design and partnership best practices, (2) develop other low-income initiatives, such as technology solutions and (3) secure partner buy-in from the onset. The EEIX has been instrumental in helping TVA form what is now its flagship low-income program that has, to date, served thousands of households in the Tennessee Valley.

Home Uplift: A Partnership-Driven Program

EEM and EEIX input created the foundation for a new program model using a community-driven partnership approach. TVA named the new program Home Uplift and set out to pilot test it in a geographically and politically representative cross section of the Tennessee Valley, from rural electric cooperatives in western Kentucky and Mississippi to large municipalities in east Tennessee.⁵ Following a successful three-year pilot phase, TVA officially launched the Home Uplift Program across the Tennessee Valley on October 1, 2020.

LPCs choose to participate in the Home Uplift Program through a formal agreement with TVA. LPCs can elect between two different program implementation models: TVA-delivered or LPC-delivered.⁶ Under the former, TVA's 3rd party administrator, CLEAResult, implements Home Uplift on behalf of TVA and LPCs, managing all aspects of program operations. LPCs that deliver Home Uplift manage the programs with TVA support. Program standards, requirements, training, and forms are uniform across both implementation scenarios (Tennessee Valley Authority 2022c). TVA also partnered with a local 501C3 community development financing institution, Pathway Lending, to establish the Home Uplift Fund. This fund enables contributions from a variety of sources that help pay for home upgrades and enable a sustainable funding source for the program. Other partners in Home Uplift include but are not limited to local and state governments (e.g., state energy offices, housing agencies), nonprofit organizations, charitable and philanthropic donors, lending institutions (e.g., Federal Home Loan Bank), and community action agencies.

A departure from its predecessor, EEM, the Home Uplift Program developed a streamlined implementation approach. To achieve this, TVA tasked its residential energy programs implementation partner to create a uniform program delivery model, from outreach and recruitment strategies to home energy evaluation and inspection procedures, installation standards, contractor oversight, financial and data management, and reporting. TVA modeled Home Uplift pilot standards and implementation methodologies after EnergyRight's market-rate offer, the Residential Services Program. This includes use of an integrated, cloud-based platform, known as the Hub, to manage and track all program performance and financial data, including:

- Applications processed, approved, deferred for health and safety, or declined
- Energy evaluations scheduled and performed and their results
- Upgrade installations, including type, cost, and contractors assigned
- Inspections scheduled and performed and their results
- Total cost per home, including administrative expenses, labor, and materials
- Estimated energy savings

Recruitment and Intake

TVA and partnering LPCs conduct community outreach to generate interest and participation in Home Uplift. Although recruitment strategies vary by LPC community, typical outreach and engagement touchpoints consist of media, social media, educational materials (e.g.,

⁵ Home Uplift pilots took place from 2017-2019 in partnership with the following seven LPCs: West Kentucky RECC (KY), Four County EPA (MS), Memphis Light, Gas, and Water (TN), Nashville Electric Service (TN), Huntsville Utilities (AL), Chattanooga EPB (TN), and Knoxville Utilities Board (TN).

⁶ A majority of participating LPCs elect the TVA-delivered model because there is no administrative or cost burden to the LPC.

bill stuffers, postcards), door-to-door canvassing, nonprofit organizations, community action agencies, and word of mouth.

Prospective participants must meet age, occupancy, utility usage, and income eligibility requirements. For example, applicants must be at least 18 years of age, live in the home, have an active utility account with the participating LPC, and present income that is $\leq 200\%$ of federal poverty level based on the number of occupants in this home. Prospective participants complete a program application with demographic, home and income information – along with attending documentation to verify their eligibility in the program.

Applicants are prioritized on a first come, first served basis as program funding allows. They receive notification letters when applications are received, are considered incomplete, approved, ineligible, or put on a waiting list due to restrictions in program funding. Once approved, Home Uplift Program administrators work with applicants to schedule a Home Energy Evaluation to qualify the property for participation. Applicants who do not respond to program administrators after a period of 12 months are required to reapply for the program (Tennessee Valley Authority 2022c).

Home Energy Evaluation

Following successful verification of applicant eligibility, properties undergo a Home Energy Evaluation from a Building Performance Institute trained and certified Home Energy Advisor. Primarily through visual inspection and diagnostic testing, the Home Energy Evaluation ensures the property qualifies to participate in Home Uplift. For example, an applicant's home must be an existing single-family property served by a participating LPC.⁷ The home must have a separate meter with a minimum of one-year active electric service.

During the Home Energy Evaluation, a Home Energy Advisor performs the following activities (Tennessee Valley Authority 2022c):

- Inspects the building envelope and its mechanical systems
- Evaluates the current energy consumption along with the existing condition of the building
- Diagnoses areas of energy waste, health, and safety, and durability problems related to energy conservation
- Conducts diagnostic tests
- Recommends approved energy measures on the TVA Weatherization Priority List
- Projects savings expected from energy measures through the audit tool
- Estimates labor and materials costs for measures
- Diagnoses current and potential health and safety problems and how they may be affected by proposed energy measures
- Provides participant education
- Takes pictures of the home to document evaluation status
- Captures all applicable data into the audit tool, and
- Creates a detailed work order for the home

⁷ Single-family buildings eligible for Home Uplift may include townhomes or duplexes with separate electricity meters. Additionally, modular and manufactured homes qualify for Home Uplift as long as they meet program requirements. Multifamily properties with greater than two units are ineligible

Upgrade Installations and Inspections

When the applicant and home are qualified, program administrators assign Home Uplift Program contractors to install the home energy upgrades identified in the work order created by the Home Energy Advisor during the evaluation. Eligible Home Uplift Program energy upgrades include:

- HVAC tune-up, repair, or replacement
- Water heater replacement
- Air sealing
- Duct sealing
- Attic insulation
- Wall insulation
- Windows
- Doors
- Refrigerators

Contractors must be trained and certified by TVA and its affiliated LPCs to participate in the Home Uplift Program. This ensures the highest levels of professionalism, quality, and expertise. They are required to be members of TVA's trade ally network and must hold applicable local and state business licenses, carry minimum requirements for insurance, and undergo EPA lead-based paint firm certification (for homes built before 1978) and EPA Repair, Renovate, Painting certification.

When completed, Home Energy Advisors perform a quality assurance check on the upgrade installations and coordinate project close out with participating homeowners and contractor payments. Through the inspection, Home Energy Advisors perform the following activities:

- Confirm that specified upgrades are installed
- Inspect the work to ensure that workmanship and materials meet TVA and LPC standards
- Make sure all required permits have been obtained and any applicable codes inspections have taken place
- Perform final blow door/pressure pan readings
- Ensure the job site is clean
- Review all completed work with the participant
- Review and provide all manufacturer warranties and certificates to the participant
- Confirm that the participant is satisfied with the work through signature of a form

The failure of any measure to meet program standards results in the failure of the inspection, rendering the home upgrade incomplete. Program administrators provide contractors with written reports that include photographic evidence and corrective actions the contractor needs to take to pass inspection. Home Uplift contractors are allowed 48 hours to correct the deficiencies (Tennessee Valley Authority 2022c).⁸

⁸ On average, the total duration of homeowner participation in the Home Uplift Program, from evaluation to quality assurance inspection, is two weeks for urban communities and four weeks for rural communities.

Partnership-Driven Funding Model

Home Uplift is innovative in its partnership-driven funding model that leverages multiple funding sources from diverse partners. Funding sources include LPC contributions (monetary and in-kind), local and state government grants, and charitable contributions. Through its annual budget process,⁹ TVA then provides matching funding to widen program outcomes. To streamline accounting, non-TVA funds are managed by TVA's third-party Community Development Financial Institution partner, Pathway Lending, in a repository appropriately named the Home Upfit Fund.

The funding process usually starts at the community level. Through a formal agreement, LPCs indicate the level of their contribution to the Home Uplift Fund for the federal fiscal year and submits the contribution to Pathway Lending for deposit into the Home Uplift Fund. TVA works with its LPC partners at the beginning of each fiscal year to determine funding allocations, which are based on a percentage of the LPC's electric revenues from the prior year. In most cases, TVA is able to match LPC funding at 100 percent to double Home Uplift Program outcomes in the participating community.

Alternative Home Uplift Program funding sources include philanthropic contributions, state/federal grants, and large corporate donations that align with HUP's objectives and TVA's mission of service. Third-party contributions are intended to augment, not replace, LPC funding from electric system revenues. They are subject to TVA's approval and allocated according to donor/grant requirements, LPC enrollment status, and availability of funds in EnergyRight's annual Home Uplift Program budget (Tennessee Valley Authority 2022c).

The Home Uplift program model supports TVA and LPC collaboration in working with local agencies as potential funding partners on affordable housing projects (e.g., Section 8 housing). In 2019, TVA, Huntsville Utilities and Huntsville Housing Authority partnered to upgrade HVAC units, replace water heaters, and make lighting enhancements in the Northwoods housing community. The upgrades were made possible through an initial investment from HHA, matching funds by TVA, and project management support from Huntsville Utilities. Through Home Uplift, HHA was able to use more of its limited funding to address other weatherization and structural improvement needs.

Program Results

Program outcomes, including those achieved during the pilot study, have clearly demonstrated Home Uplift's potential as a sustainable and scalable solution for energy equity in the southeast. Since program inception, TVA and its partners have leveraged nearly \$40million to complete 3,948 home energy upgrades in 40 participating LPC communities. These upgrades have generated average annual electricity savings of approximately 3,400 kilowatt hours per home¹⁰ and driven improvements in SDH measures for those homes' occupants.

Although it remains an independent utility-based program, Home Uplift is intended to complement existing federal energy assistance programs, such as the Department of Health and Human Services' Low-Income Home Energy Assistance Program (LIHEAP) and the U.S.

⁹ The budget for Home Uplift is approved by the TVA board of directors in its annual budget process. All TVA funds come from power sales to its LPC customers, directly served industries and large federal customers, and sales to designated trading partners.

¹⁰ Energy savings are initially projected through TVA's energy modeling software and confirmed through formal third-party evaluation, measurement, and verification.

Department of Energy's Weatherization Assistance Program. While LIHEAP and other bill assistance programs are important to countless households that struggle to pay their utility bills, they do not represent a long-term solution for energy affordability. And although WAP delivers customers significant energy and non-energy benefits, program funding relative to the overall need limits the number of households that can be served in any given year. In Knoxville, for example, a geographic information systems analysis of census and property tax data indicate that there are approximately 9,000 homes in need of weatherization whose occupants would likely qualify for income-eligible energy efficiency programs (IBM 2013).

Research on Social Determinants of Health

TVA has been working to measure Home Uplift Program outcomes beyond traditional utility evaluation, measurement, and verification. EnergyRight has partnered with Knoxville-based research firm Three³ to study the non-energy impacts on program participants attributable to Home Uplift. The goal of the study is to analyze and measure reported changes in health, wellness, affordability and dwelling quality. that can be attributed to Home Uplift Program.

Methodology

From 2018-2019, Three³ conducted telephone interviews of a randomized sample of Home Uplift participants and a recruited group of similar households for the control group residing in the five major metropolitan areas served by TVA: Chattanooga, Tennessee; Huntsville, Alabama; Knoxville, Tennessee; Memphis, Tennessee; and Nashville, Tennessee. The last round of 12-month follow-up interviews were conducted in the first quarter of federal fiscal year 2021.

The treatment group included 701 pre-upgrade participants and 572 post-upgrade participants. The control group featured 300 pre-upgrade interviews and 222 post-upgrade interviews. Interviews focused on five main categories: indoor air temperature, health & wellbeing, dwelling quality & safety, energy affordability & tradeoffs, and community & resilience. Table 1 shows the data attributes collected from the interviews.

Table 1. Attributes of Home Uplift participant primary research data collected by Three3

Category	Indoor Air Temperature	Health & Wellbeing	Dwelling Quality & Safety	Energy Affordability & Trade Offs	Community & Resilience
Data Attributes	Thermal Stress ¹¹ Medical Treatment Attribution (heating & cooling equipment, etc.)	Mental Health			
		Physical Health & Activity			
		Asthma & COPD	Mold & Moisture		
		Lead Poisoning	Pests	Energy Security & Assistance	Social Cohesion
		Blood Pressure & Cholesterol	Drafts & Dust	Food Security	Preparedness
		Low Infant Birthweight	Noise	Use of Short-Term Loans	Pride
		Arthritis	Lighting	Trade Offs (e.g., prescription use)	Crime
		Diabetes	Fires		Neighborhood Quality
		Oral Health	Carbon Monoxide		
		Trips & Falls	Food Illness		
		Quality of Life			

Preliminary Research Findings

The Home Uplift Program appears to have a statistically significant effect on improving participant social determinants of health. Topline research findings show hundreds of participating households reporting that they no longer find it difficult to pay their energy bills. Participants report substantial reduction to exposure of extreme temperatures after the home energy upgrades were installed. Lastly, the total number of medical interventions decreased more

¹¹Thermal stress in this context is defined as a condition of extreme heat or cold in the home that can adversely affect the human body. Examples of thermal stress include hypothermia, heat rash, heat cramps, heat exhaustion, and heat stroke.

than the control group at a statically significant level. Table 2 shows the effects of Home Uplift participant SDH and well-being.

Table 2. Pre- and Post-Weatherization Findings for Treatment Group¹²

Category	Pre-weatherization Survey (n =701)	12-month Post-weatherization Survey (n=570)
Home is cold or very cold in winter	57.7%	17.5%
Home is hot or very hot in summer	46.7%	9.9%
Home is at an unsafe temperature all or some months	22.4%	7.7%
Worried (during the summer) would not have electricity of cooling	35.9%	15.1%
Worried (during the winter) would not have electricity	38.8%	17.0%

Future Research

TVA and Three³ have begun working with the State of Tennessee to overlay Tennessee-based Home Uplift consenting survey participants with the State's TennCare¹³ database to analyze pre- and post-weatherization healthcare interventions and costs for select diagnostic codes. Additionally, TVA and Three³ will research Home Uplift Program effects on SDH in Tennessee's distressed rural counties and will again collaborate with the State of Tennessee to compare participation in Home Uplift with medical interventions and costs associated with TennCare.

Conclusion

The Home Uplift Program promises to transform the energy assistance paradigm in the energy-burdened southeast through its innovative, community-based partnership model. As a mission-driven public power producer, TVA remains committed to engaging partners at the community level and beyond, to provide critical energy assistance resources to those most in need. This commitment is reflected in TVA's annual budget for the Home Uplift Program and in

¹² While the control group saw reductions for each question above, the differences from Year 1 to Year 2 ranged from 5.4% to 9.6%. The changes were either not statistically significant or presented only a statistically significant difference of $p < 0.05$ or $p < 0.01$.

¹³ TennCare is the State of Tennessee's Medicaid program. TennCare provides health care for approximately 1.5 million people, covering approximately 20% of the State's population. For more information, visit tn.gov.tennicare/information-staticist/tenncare-overview.html

TVA’s continued efforts to grow its network of partners. Given its measurable results, the Home Uplift Program is challenging the way utilities view traditional business models and customer engagement practices. TVA shares the aspirational vision for all of its customers to live in homes that are more equitable, affordable, comfortable, and healthy. Home Uplift is a step in realizing this vision for countless families in the Tennessee Valley and beyond.

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