Utility value of a pay as you save inclusive utility investment program for whole home energy efficiency and electrification upgrades

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Abstract

Inclusive Utility Investment systems such as Pay As You Save® (PAYS®) make it financially feasible and attractive for utilities to capitalize residential energy upgrades to develop efficiency resources and grid flexibility on a scale similar to conventional power plants, rather than managing efficiency programs as cost centres tangential to their core business. This study analysed weather normalized hourly meter data from one of the longest running Inclusive Utility Investment programs, Ouachita Electric Cooperative Corporation's (OECC's) HELP PAYS® energy efficiency and electrification upgrade program based on the Pay As You Save system. Evaluation of billing and utility meter data of participating homes, with subsequent extrapolation to homes that lacked statistically valid weather models, revealed that 369 of the locations in the program's residential portfolio are generating over 1,100,000 kWh of electricity and 250 kW of peak demand reduction per year to the utility (3,200 kWh energy savings and 0.7 kW of peak load reduction per home) with a net present value to the utility of $531,900 ($1,350 per home) over the lifetime of the upgrades. Program design reforms instituted half-way through the evaluated period increased average energy saving by 42 %, peak load reduction by 13 %, and offer acceptance rates from 63 % to 80 %. With these improvements and an increased rate of upgrades per year, the net present value for future upgrades is projected to increase by 70 %. Thus, even after considering the cost of capital and program operation costs, OECC's HELP PAYS investment portfolio is generating energy savings for its participants as well as economic benefits for the utility and all its non-participants and is expected to provide even greater benefits in the future. This paper helps make the business case for all utilities across the globe with an approved tariff to use Inclusive Utility Investment to fund building energy upgrades, increasing the scalability and depth of resource efficiency and electrification.

Introduction

This study examines one of the longest running Inclusive Utility Investment programs using the Pay As You Save® (PAYS®) system in the U.S., evaluating weather-normalized measured electricity reduction (kWh), co-incident peak demand reduction (kW) reduction, utility net present value, and internal rate of return. The program data is drawn from Ouachita Electric Cooperative Corporation's (OECC's) HELP PAYS® energy efficiency and electrification upgrade program operated by EEtility.

Inclusive Utility Investment is the term introduced by the U.S. Environmental Protection Agency (U.S. EPA) for site specific tariffed on-bill investment with site-specific cost recovery, sometimes also referred to as Tariffed On-bill or On-bill Tariff Programs (U.S. EPA, 2022). The original example of Inclusive Utility Investment is the PAYS system developed in 1999 by the Energy Efficiency Institute, Inc. of Vermont, a set of program design rules and strong consumer protections outlined in the PAYS Essential Elements and Minimum Program Requirements (Cillo and Lachman, 1999; EEI, 2021). HELP PAYS is an

Inclusive Utility Investment program that adheres to the PAYS system.

Among U.S. households, more than one-third do not own a home and 40 % cannot cover a $400 unexpected expense and so a significant portion of utility customers and member-owners are effectively disqualified from using loans and rebates to access whole home energy upgrades even when they would yield savings (Federal Reserve, 2019). Globally, more than one third of adults are still unbanked, further deepening the complete exclusion of an entire segment of the world's population from participating in the clean energy economy (World Bank, 2018).

For owner-occupied houses in the United States, there have typically been two paths for delivering whole home energy upgrades – taxpayer or ratepayer funded weatherization programs delivered at no-cost to low-income households, and market rate programs for customers that bear the full cost of the upgrades after incorporating some form of incentives. The scale of the taxpayer and ratepayer funding for no-cost programs has never met the actual need (Carley and Konisky, 2020). In the market rate programs offered with ratepayer funded incentives, most of the rebate and incentive dollars flow to wealthier customers, often for products they were going to purchase anyway, which effectively creates a regressive tax on lower-income rate payers. More than half of U.S. households are either renters or not qualified for consumer credit criteria linked to loans, rendering them ineligible for subsidized energy efficiency loan programs. (US Census, 2017, World Bank, 2018).

Inclusive Utility Investment differs from all other models because it is capitalized by the utility, available to all customers regardless of income, credit score, or rental status, and yields unrivalled acceptance rates (65–90 %) among households receiving a utility's upgrade offer. With Inclusive Utility Investment, the utility pays the upfront cost and recovers its investment through a monthly tariffed charge on the customer or member-owner's bill. The annual cost-recovery charges are significantly less than the estimated annual savings from the upgrade, allowing the participant to enjoy a lower energy bill from day one and a more comfortable and healthy home.

The PAYS form of Inclusive Utility Investment has emerged as a scalable and more equitable solution with strong consumer protections that is rapidly gaining traction. PAYS has been implemented by 23 utilities in 10 states, yielding 6,000 projects completed and $50M in capital invested at customers' homes or businesses. While the first ten U.S. utilities across eight states that pioneered PAYS programs grew largely as bottom-up initiatives with individual rural electric cooperative utilities launching programs, the past three years have seen a sudden flurry of top-down U.S. legislative and commission driven action. Between 2019 and 2021, regulators and legislators in the U.S. states of Missouri, Georgia, Virginia, and Illinois have either ordered or paved the way for utility PAYS programs, with Missouri becoming the first where every investor-owned utility is making site specific investment and cost recovery a core part of their essential services (EEI and LibertyHomes, 2022). Two companion papers in these proceedings document establishment and growth of the system from a utility perspective (Ferguson et al., 2022) and policy perspective (Hummel et al., 2022).

Yet to date, there is only one peer reviewed evaluation quantifying the value of a PAYS programs to the sponsoring utility that uses meter data to calculate average electricity and peak load savings from the upgraded locations (Bickel et. al, 2020). This paper quantifies the value of OECC's HELP PAYS energy efficiency and electrification upgrade program based on the Pay As You Save system, using meter data combined with program and utility financial and operational data to estimate the program net present value and internal rate of return.

The first section of the paper lays out the history of the HELP PAYS program and its evolution over time. The second section of the paper describes the methods used to analyse the program performance. The results describe the value proposition to the utility, detailing the electricity and peak demand savings with special attention to recent upticks in program performance and value that reflect key program operation changes.

HELP PAYS® Program History

Ouachita Electric Cooperative Corporation (OECC), headquartered in Camden, Arkansas (AR), is one of the 17 rural electric distribution cooperatives in the state. OECC serves 9,408 active meters – 8,547 residential, 843 commercial, and 18 industrial – across 5 counties in the southern Mississippi River delta region of the state. Camden (pop. 11,000), the largest town served by OECC, is 54 % Black or African American, has a median household income of $31,000, and a poverty rate of 31 % (U.S. Census 2017). Much of the housing stock served by OECC was built before building codes (50–100 years old), meaning most structures are poorly insulated and equipped with inefficient heating and cooling equipment. The most common forms of space and water heating are electricity and natural gas, although a small proportion of homes rely on expensive delivered fuels such as propane, while a few use wood. Summers are hot and humid, and space cooling is nearly universal. The net result is that many homes suffer from high heating and or cooling costs that produce high energy costs and very large energy burdens. For families in the 0–30 % area median income bracket that either own or rent their home, the energy burden is as high as 25 % or 30 % (Lin, 2018).

The management of OECC was distressed by the frequency of high bill complaints from its member-owners. In 2013, the co-op launched an on-bill turn-key whole home energy upgrade loan program called the Home Energy Assistance Loan (HEAL) in collaboration with the Clinton Foundation to deliver insulation and air and duct sealing to employees of some local employers. In, 2014, half a dozen Arkansas electric cooperatives backed by the Arkansas State Energy Office, which provided a loan loss reserve funded through the American Recovery and Reinvestment Act, collaborated with OECC, HEAL Program managers, and EEtility (a newly formed public benefit corporation founded by the Clinton Foundation) to launch the Home Energy Loan Program (HELP), an evolution of HEAL that did not depend on employment status and pay-check deductions to secure low loan rates.

Despite these program evolutions, program uptake was low, as most member-owners could not take on debt and when they could, did not want to take out large loans. In 2016, after learning about the Pay As You Save model from Clean Energy Works and seeking validation from Roanoke Electric Cooperative, the OECC Board voted to convert HELP from a loan program to a PAYS utility investment program. The Arkansas Public Service

Table 1. Program Performance Comparison: HELP Loans vs. HELP PAYS® (2015 vs. 2016).

	HELP Loan (4/2015-12/2015)	HELP PAYS (4/2016-12/2016)
Upgraded Locations	70 single-family homes	118 Single family homes 82 Multifamily rental units 2 Commercial properties
Average Investment Per Home	$2,280	$5,600
Total Investment	$500,000	$1,600,000(homes) $ 500,000 (commercial) $2,100,000 Total

Source: (OECC et al, 2020).

Commission unanimously approved Ouachita's Pay As You Save tariff in just three months, and OECC relaunched the program as HELP PAYS® using its own balance sheet capital, which cost 4.5 % at that time.

In 2017–18, OECC requested and received a waiver from National Rural Utilities Cooperative Finance Corporation (CFC), its sole source of capital, so that it could apply for a 0 % interest loan from the U.S. Department of Agriculture's Rural Energy Savings Program (RESP), under the condition that OECC pay CFC 0.5 % of the total approved RESP loan value, annually. RESP is a reimbursable loan product that functions like a line of credit, so OECC only draws on its approved loan after it incurs expenses and requests reimbursement.

In 2019, OECC secured $8 million in reimbursable RESP financing from USDA. OECC also began paying CFC $40,000 annually, which is a charge equal to 0.5 % of the full amount of the approved RESP loan. After securing the RESP loan, OECC reduced the cost-of-capital charged to participating member-owners to 0.5 %, which created more zero-cost upgrade offers and lowered the co-payment for all others, but only generated revenue sufficient to cover a portion of the total CFC fee.

TYPES OF UPGRADES DELIVERED BY HELP PAYS

The great majority of OECC member-owners that accepted an upgrade offer received lighting, weatherization, and HVAC upgrades (HVAC upgrades were not offered under HEAL or HELP loan programs). A minority received only lighting and weatherization upgrades. In all cases, participants received an energy audit that identified cost-effective energy efficiency improvements and assessed health and safety issues, including combustion air, venting bath fans, venting dryers, and furnace safety.

Weatherization and lighting measures included

- Replacement of incandescent or CFL lamps with LEDs
- Envelope air sealing to reduce infiltration identified through blower door testing
- Duct system sealing where indicated by duct blaster testing
- Insulation of attic and knee walls when poorly insulated
- Furnace safety and tune ups, as needed

HVAC upgrades included

- Upgrades of existing heat pumps to more efficient models
- Furnace replacement with high efficiency heat pumps to switch from high-cost propane or oil to high-efficiency electric heat pumps (referred to below as Beneficial Electrification) with electrical panel upgrades as needed; (fuel switching from piped methane to electricity (or vice versa) is prohibited Arkansas and was therefore not available to participants).

In a small number of cases households also received

- Photovoltaic solar panels
- Wi-Fi communicating thermostat with demand response capability

PAY AS YOU SAVE UPTAKE AND IMPACT QUICKLY SURPASSED LOANS

OECC performed a natural experiment when it switched its program model from loans to Pay As You Save. The impact of the change was immediate and dramatic (Table 1). The pace of program participation increased over 275 % and diversified from single-family-only to also include multifamily rental properties, which no longer faced a split incentive, as well as to commercial locations. Average investment per home doubled and customer acceptance of Upgrades of existing heat pumps to more efficient models was now possible due to removal of a $3,500 loan cap and the allowance of participant co-payments for cases where savings were not quite sufficient to cover the full upgrade cost. As a result, overall investment increased more than four-fold (OECC et al., 2020).

HELP PAYS CONTINUED TO EVOLVE OVER TIME

The creation of HELP PAYS, however, was not an endpoint in the evolution of OECC's efforts to relieve member-owners with high and unaffordable bills, but rather it was a station in a process of continued program improvement and evolution.

This evaluation encompasses successively improved versions of the program (Table 1). OECC and its program operator EEtility progressively identified sources of potential error or conflict of interest and adjusted the program design to minimize or eliminate them. Program outcomes depend on a variety of factors including occupant choices and behavior, and occasionally by equipment defects or malfunctions, however, the accuracy of pre-upgrade estimates of energy savings, and quality installation of measure installation are critical for assuring that cost-recovery fees are set appropriately, and estimated savings have the potential to be fully realized.

OECC and EEtility made key adjustments to program operations between 2017 and 2018 (Table 2). Prior to 2018 the program used a custom spreadsheet tool called HELPbook to estimate energy savings, and all quality assurance and control

Table 2. Evolution of HELP PAYS® Program Operation.

YEAR(S)	ENERGY ESTIMATION MODEL		ON-SITE DATA	QA/QC	
	Model Used	Generated By	Gathered By	Method	Conducted By
2016	HELPbook*	BPI Cert. Auditor	Contractors and BPI Auditors	On-site (100%)	OECC primary EEtility secondary
2017		EEtility			
2018	OptiMiser**		OECC staff	Remote pre- & post-photos (100%) On-site (10%)	EEtility primary (remote) OECC secondary (on-site)
2019-2020					

**HELPbook energy estimation software tool used 05/2015–07/2018.*
**OptiMiser energy estimation software tool used 04/2018–12/2020.*

Table 3. HELP PAYS Program Upgrades April 2016–April 2020.

Number of Locations Upgraded	406
Total Residential Projects (without solar installations)*	369
Total Locations Used for Savings Analyses	282

**Net metered solar installations confound weather modeling using meter data.*

inspections post-upgrade were conducted only on-site. Beginning in Q2 of 2018, EEtility began to use a commercial field- and National Laboratory-validated physics-based energy estimation software tool, created by OptiMiser, and calibrated estimates for each location with historical billing data specific to that location. EEtility also began using remote, wirelessly transmitted, geo-coded and time-stamped photographs to assure complete and quality installations of the specified scope of work.

The resulting turnkey supervised program operation is similar to that of an energy service company as opposed to more open market systems in which the installation contractor is able to influence the scope of work.

Analytic Approach and Methodology

Period of Analysis: This evaluation characterizes the performance and value of the entire program portfolio, with special attention to the performance of upgrades between April 2018 and April 2020, which is termed the "OptiMiser Period." The period between April 2016 and April 2018 is termed the "HELPbook Period." OECC has upgraded 406locations. Of these, 369 are residential properties that did not also have solar installations. Only 282 residential locations produced statistically valid weather models for analysis as shown in Table 3.

METHODOLOGY

The 282-location sample was broken down into subcategories for further analysis (Table 4). The 46 all-electric homes in the OptiMiser period generated models with the highest confidence because the sample size was just large enough and the data was more complete and because it represents the most evolved version of program design.

The small sample size and missing fuel consumption data for beneficially electrified homes precluded robust savings analysis for homes that were not all-electric. The evaluation did not have access to fuel usage data, so all-electric homes modelled using OptiMiser are the most indicative of future performance.

Measurement & Verification: Hourly AMI and monthly billing data was used in accordance with the CalTRACK Methods, which compares pre- and post-upgrade meter data normalized for weather (Young and Best, 2018). CalTRACK Methods are an open-source standard that was developed through an industry stakeholder process. They define a rigorous, empirically tested, and repeatable version of IPMVP Option C whole-building savings verification (Wilcox and Marion, 2008). Calculations of weather-normalized energy and peak demand reductions were performed using OpenEEmeter software, an open-source Python implementation of the CalTRACK Methods (LF Energy, n.d.).

Calculated Electricity Reduction (kWh): Electricity reduction for upgraded homes was calculated using CalTRACK's "daily" methods, except where AMI data was not available and CalTRACK's "billing" methods were used. Specifically, hourly usage for each upgraded home was totalized into 24-hour bins, where only complete bins were selected for regression. Average daily temperature from a nearby weather station was computed for each daily total. Optimized variable degree-day base regression models (Figure 1) were computed for the pre-improvement and post-improvement periods for each home with separate heating and cooling balance points selected over a range of 30–90 °F (approx. 0–30 °C). Then, 30-year typical meteorological year (TMY3) weather normals were applied to the pre-improvement and post-improvement models to determine pre-improvement and post-improvement normalized annual consumption.

Coincident Peak Demand Reduction (kW): OECC's wholesale power pricing includes demand charges assessed based on an average of the coincident peak demand levels from each of the summer months (June-September). The transmission operator sets OECC's demand charges the following12-months based on this level. Analysis of coincident peak demand re-

Table 4. Samples analysed by program period and fuel-type (n=282).

HEATING FUEL CATEGORIES	HELPbook PERIOD (5/2015-7/2018)	OptiMiser PERIOD (4/2018-12/2020)
All-Electric	74	43
Fuel-heat	107	25
Beneficially Electrified	16	8
Unknown	5	4

**Residential homes with thermal efficiency upgrade measures.*

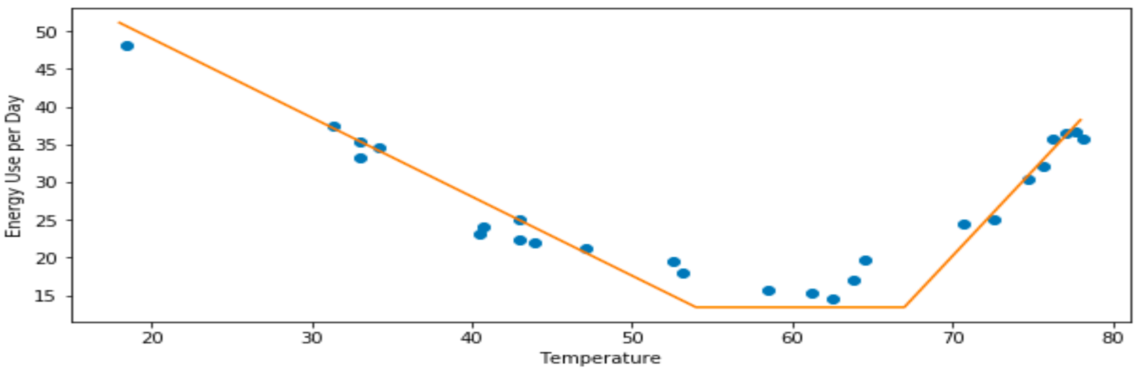

Figure 1. Variable Degree-Day Regression Models for a Program Home. Source: CalTRACK.

duction was conducted using CalTRACK hourly methods, which are derived from Lawrence Berkeley National Labs' Time-of-Week and Temperature model. For each home, separate regression models of usage vs. average temperature plus an hour-of-week term are calculated for each month of the pre-improvement and post-improvement periods. Demand savings is calculated as the average difference between projections of the pre-improvement and post-improvement models onto TMY3 during the peak hour on weekdays during the four summer months. Because there was not enough data about the distribution system demand profile to forecast the specific peak days, the average across all the peak hours was taken as a conservative estimate, and likely understates the true demand savings value by approximately 15 %.

Extrapolations: Saving estimates are extrapolated from the value of average kW and total kWh savings of the subset modelled homes, to all the homes, under the assumption that the modelled homes are a representative sample of the total population. Each program year's realization rate (the ratio of estimated kWh savings pre-upgrade to evaluated kWh savings post-upgrade) is used to calculate the realized savings for any projects that did not have adequate data or model fitness to measure savings. Then, for each program year, a ratio of the average kWh savings to the peak kW demand reduction was calculated and apply to the realized kWh savings for any projects that did not have adequate AMI data to calculate actual peak kW reduction. This approach is applied for all portfolio-wide calculations.

Financial Impact: To calculate the financial value from the utility's perspective, we focused on the electric impacts. There are 260 projects with both pre-project estimated savings and post-project savings calculated through a billing analysis, so those are used to calculate a realization rate (the ratio of measured to estimated savings). The realization rate is aggregated for each combination of program period (HELPbook or OptiMiser) and fuel type, and then applied to other projects of that type that have a pre-project estimated savings but no measured savings. Finally, for the remaining 25 projects that also lacked a pre-project estimated savings values, we simply used the average kWh and kW savings values for projects of that program period and fuel type. A similar process was used for kW demand savings, except that for the 173 projects with valid hourly savings models we calculated a peak kW factor, which is the ratio between peak kW reduction and average kWh/hour savings (i.e., annual kWh/8760). We then estimated demand savings for the remaining projects by applying the average annual kWh per hour by the average peak kW factor from projects with the same program period and fuel type. Through this process, each project was assigned the most accurate possible kWh and kW estimate: either the result of site-specific data analysis or an estimate based on available data about the project and realization rates from similar projects.

Comparison Group Analysis Not Included: A comparison group analysis was considered but not conducted. Exogenous market effects typically represent ~2 % annual change in the baseline, whereas the impact for this program is ~20 % +/- 10 %, so if there is further uncertainty in the modelling of the market effect, it will have a negligible impact on the results.

Results

HELP PAYS HAS SERVED A MEANINGFUL FRACTION OF CUSTOMERS IN DIVERSE BUILDING TYPES AND INJECTED MILLIONS OF DOLLARS INTO THE LOCAL ECONOMY

As of October 1, 2021, OECC has invested $3,137,024, reaching 396 single family homes, and 10 commercial facilities representing 6 % of all customers through HELP PAYS. During the same period, member-owners presented with a PAYS offer have been accepted 63 % of the time (90 % of the time when offers are no-cost), and OECC has recovered 100 % of its investments.

HELP PAYS HAS PRODUCED SUBSTANTIAL ELECTRICITY SAVINGS IN PARTICIPATING HOMES

After EEtility and OECC instituted the improvements described in Table 2, average energy savings per home increased dramatically (Figure 2).

Homes upgraded during the OptiMiser Period saved nearly 1,000 kWh more in absolute terms with a mean annualized reduction in electricity savings of 4,573Wh, a 20 % reduction in electricity use (Table 5). Total *energy* savings to the homes are expected to be higher than calculated in Figure 2 because fuel heated homes and beneficially electrified homes are expected to enjoy a similar degree of fuel savings which could not be quantified due to lack of post-upgrade fuel use data.

Homes using electricity for heating and for cooling both pre- and post-upgrade (All-Electric) during the OptiMiser period are the only homes for which we have complete energy use and savings data and reflect program operations in which all best practices identified prior to 2021 are included. These homes cut their energy consumption by an average of 6,677 kWh/yr., 25 % of their mean annual usage of 26,300 kWh. The entire portfolio of residential homes cut energy consumption by an average of 3,218 kWh/yr., 17 % of their mean annual usage of 18,900 kWh.

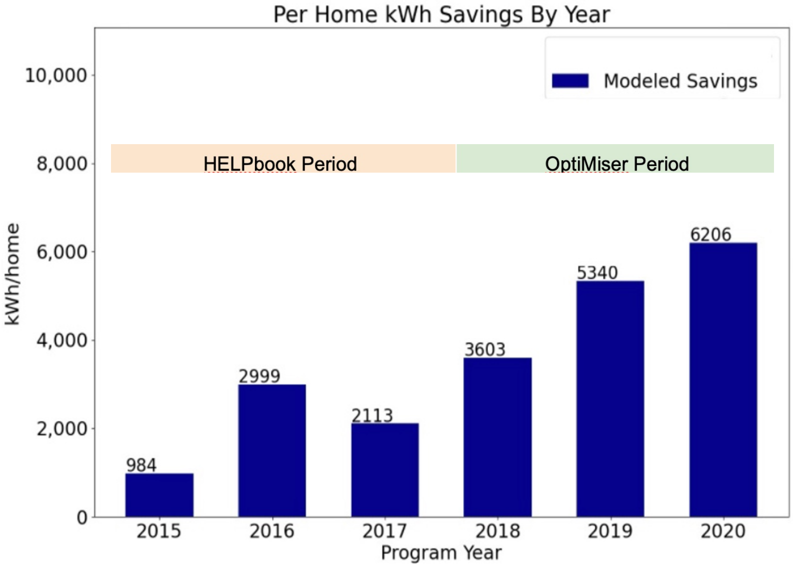

Figure 2. Average Savings kWh Per Upgraded Home by Year, 2015–2020.

Table 5. Average Annualized Electricity Savings for HELP PAYS Upgraded Homes.

	OPTIMISER PERIOD HOMES[1]					HELPbook PERIOD HOMES	**ALL HOMES**
	All-Electric	Fuel Heated	Beneficially Electrified	Unknown	**All Fuel Types[2]**	All Fuel Types[2]	**All Fuel Types****
Sample Size	43	25	8	4	**93**	276	**369**
Average Annualized Electricity Savings (kWh)	6,687	2,254	3,761	§	**4,573**	2,778	**3,218**
Average Annual Pre-Upgrade Electricity Use (kWh)	26,281	17,570	18,899	§	**22,400**	17,100	**18,600**
Average Percent Savings	25%	13%	20%	§	**20%**	15%	**17%**
Annual Peak Load Savings (kW)[3]	0.87	0.71	1.18	§	**0.79**	0.67	**0.70**
Average OECC Investment Per Upgrade	$6,136	$5,089	$8,911	§	**$6,074**	$5,528	**$5,665**

[1]Weather normalized models; [2]Full period and portfolio values reflect extrapolations for accounts that did not produce valid models using appropriate realization-rates or average-by-category savings; §Not reported due to small sample size.

The increase in percent savings between the HELPbook and OptiMiser periods is smaller than would be expected from the absolute difference in kWh saved because the OptiMiser period also had higher average annual pre-upgrade energy use against which the percent savings is calculated (22,400 kWh/yr. vs. 17,100 kWh/yr.). Average annual energy use for participants increased in the OptiMiser period due to active program marketing to high energy using households with high energy intensity. The larger entire portfolio sample set contains several low energy usage homes that were enrolled due to repeated high bill complaints rather than high energy use and intensity.

HELP PAYS UPGRADES PRODUCED SIGNIFICANT PEAK LOAD SAVINGS

Seasonal load impacts of the HELP PAYS upgrades were evaluated for all-electric homes and fuel heated homes. Seasonal load shapes for HELP PAYS homes that were electrically heated and cooled both pre- and post-upgrade, considering only homes with hourly meter data pre- and post-upgrade (n=59), reduce OECC summer peak load by an average of 0.87 kW per home, with similar magnitude load reduction in winter, and small but meaningful reductions in the Fall (Figure 3).

Homes that were fuel heated and electrically cooled both pre and post upgrade (n=62) generated average summer peak load

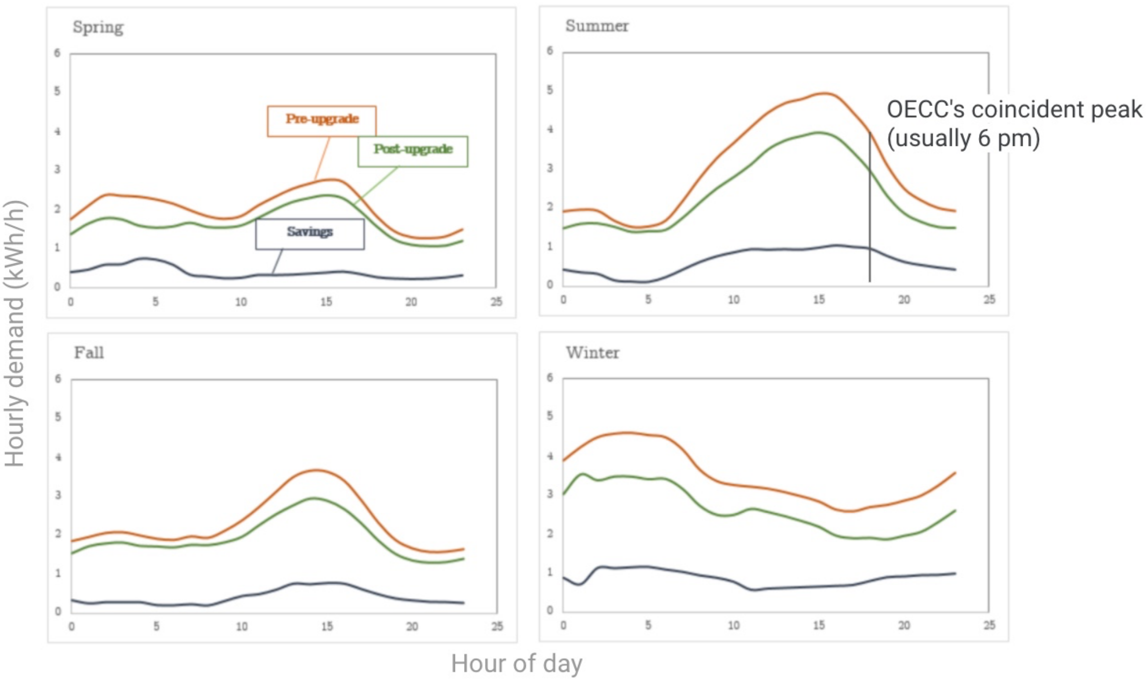

Figure 3. Seasonal load shapes and impact of upgrades in All-electric homes.

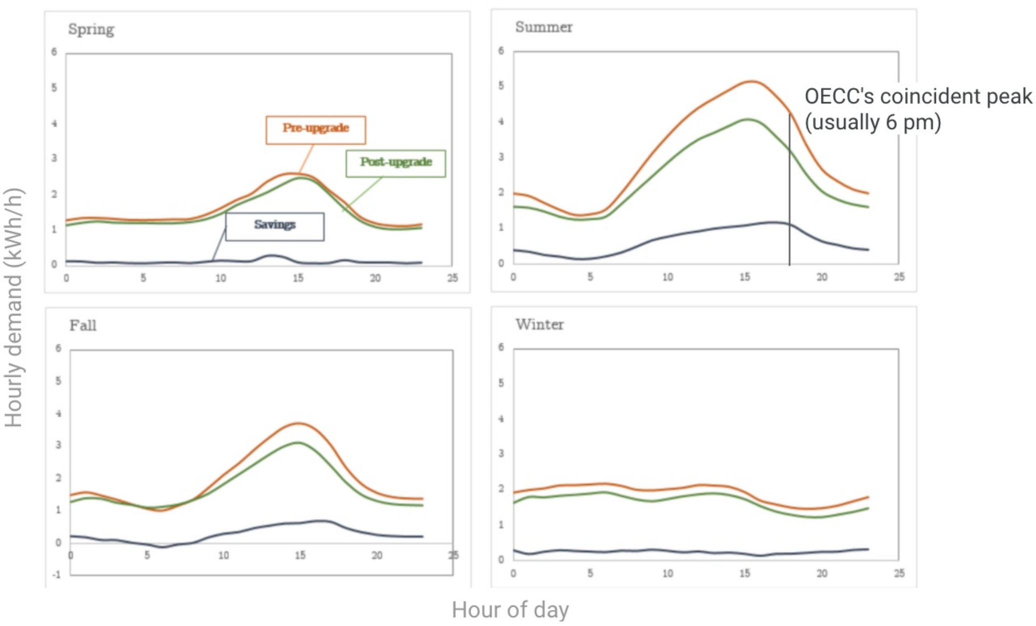

Figure 4. Seasonal load shapes and impact of upgrades in Fuel-heat.

reductions equal to those of the all-electric homes, with similar magnitude of load reduction in Fall (Figure 4).

HELP PAYS UPGRADES ALSO PRODUCED SIGNIFICANT PEAK LOAD SAVINGS

OECC is a summer peaking utility. The bottom row in Table 5 shows the summer peak savings for OptiMiser period upgrades by fuel type and average summer peak savings for the entire portfolio and HELPbook Period homes.

HELP PAYS savings are expected to accumulate and persist over time

The energy and demand savings across all 369 HELP PAYS residential locations are expected to accumulate over time to produce large persistent energy and demand savings for OECC. As of the end of 2020, the cumulative energy savings were 1.1 million kWh and 250 kW of demand savings. Were the program to have made no new upgrades after 2020, OECC would continue to enjoy 1,100,000 kWh and 250 kW of savings annually for the next 12–15 years or more. The lower incremental savings in 2018, 2019, and 2020 reflect lower volumes of participants compared to 2016 and 2017 and not a reduction in savings per upgrade. There are additional savings from upgraded commercial properties as well as local transmission & distribution benefits that were not quantified due to lack of data.

Figures 5 and 6 show each program year delivering annual electric energy kWh and demand kW savings, respectively, across the life of the measures. As described in the methods, these results are extrapolated from the value of average kW and total kWh savings of the subset modelled homes, to all the homes, under the assumption that the modelled homes are a representative sample of the total population.

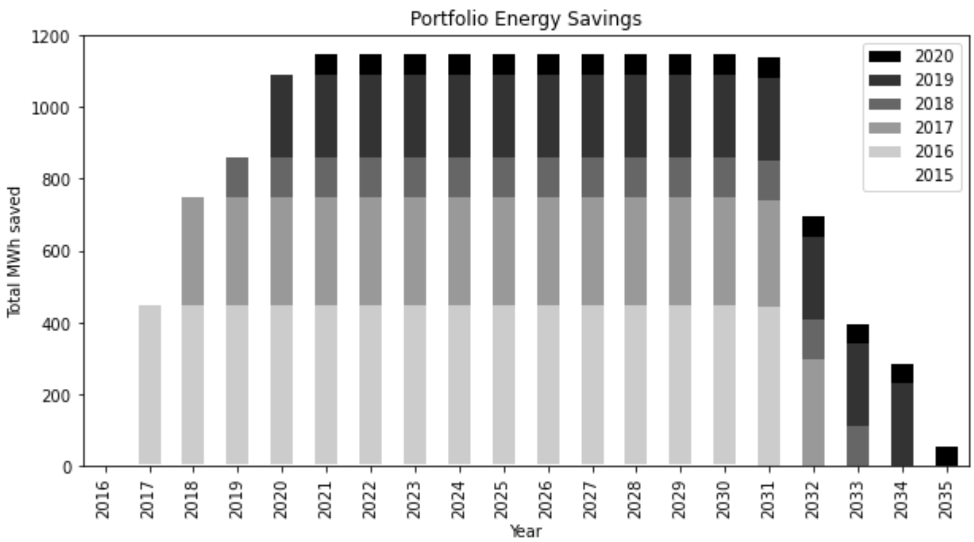

Figure 5. Cumulative Program Electricity Savings by Year, Extrapolated from Measured Savings, n=394.

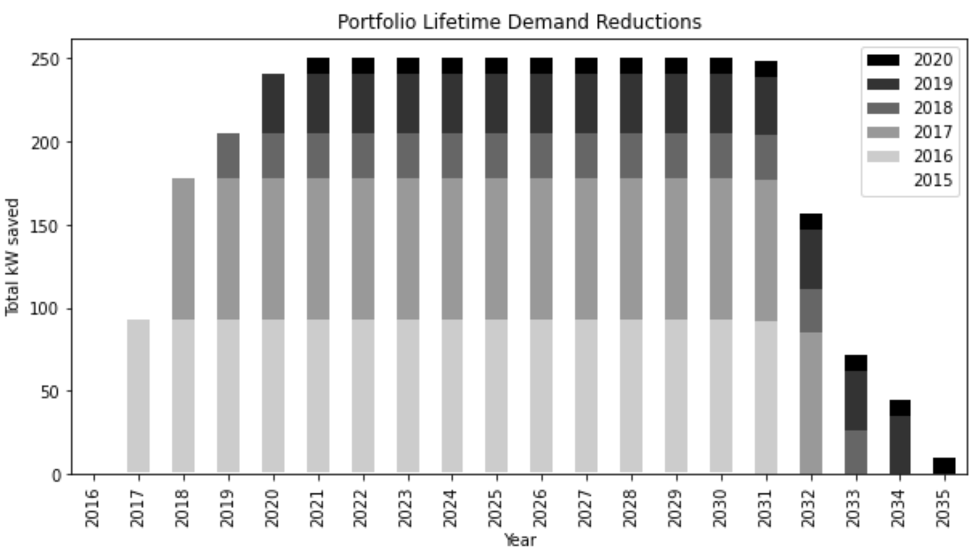

Figure 6. Cumulative Program Demand Savings by Year, Extrapolated from Measured Savings, n=394.

HELP PAYS PRODUCES A POSITIVE RETURN ON INVESTMENT FOR OECC

Considering all program costs and some of the benefit streams, each HELP PAYS upgrade during the study period has produced an average net present value of $1,387 to OECC, which equates to $546,478 and an internal rate of return of 6.29 % (Table 6). There are additional savings from upgraded commercial properties not captured in the utility value model as well as local transmission & distribution benefits that were not quantified due to lack of data.

The substantial revenue from its markup on capital is an anomaly of program evolution. In 2016, OECC anticipated borrowing capital with a cost of 4.5 % from its banking partner and carried this anticipated cost of capital into its program terms for participants. OECC instituted a new 0.5 % cost of capital charge policy in 2019 when it was approved for the 0 % RESP loan. It also shortened the maximum cost recovery to 10 years per the requirements of the federal statute authorizing the RESP program.

Despite the loss of the revenue due to a lower cost of capital, OECC will see an increased program performance and value per upgraded home in the future, because, on average, future upgrades will reflect the higher energy and peak demand savings of the OptiMiser period. These existing improvements in program operation will reduce wholesale electricity costs per home by 42 % more (4,573 kwh/year vs 3,218 kWh/year), wholesale demand costs by 13 % per home (0.79 kW/home vs 0.70 kW/home), and costs of uncovered offers by 46 % (20 % vs 37 %). By increasing program volumes, OECC can increase labour utilization rates, which in turn will lower its internal program costs to ~$1,044/home, in line with similar programs run by other cooperatives. Under this scenario the future program will generate $2,402 per home, at an internal rate of return of 7.50 %, producing $1.3M in total cash flow over the lifetime of the upgrades with a net present value of nearly $1M.

We have not burdened the project with the full cost of the $40,000/year CFC fee because OECC has indicated it plans to rapidly draw down the funds and invest them with a cost of capital sufficient to cover all the net present value of the fees for the 20-year period so that there is at least no negative financial impact to the utility.

A more dynamic view of the program's cash flow, shown in Figure 7, consists of costs to the utility to finance the projects and operate the programs accruing in the year when the project was completed and revenues accruing from the first full year of operations through the end of the projects' cost-recovery terms; avoided energy and demand benefits continue to accrue through the end of the projects' useful life. Fixed costs are currently consuming roughly half of the lifetime benefit, while the number of projects per year varied from 10 to 145. If the program were able to maintain closer to the full capacity of these resources or if it could share the cost with other applications during lighter years, the impact of these fixed costs on the lifetime net proceeds would be considerably smaller.

Table 6. HELP PAYS Program Cash Flows, Net Present Value, and Internal Rate of Return.

	Historical Program (Upgrades through 2020)		Future Program (If all Upgraded in 2021)		Difference in Future Value
Cost and Revenue Categories*	Average per Home	Total Residential Portfolio	Average per Home	Total Residential Portfolio	Assumes: OptiMiser Period energy & peak demand performance and use of RESP loan funds and term
Number of Projects	1	394	1	394	
Avoided Energy Costs	$1,778	$700,532	$2,899	$1,142,206	kWh savings/home (+42%)
Avoided Demand Costs	$1,566	$617,004	$2,052	$808,488	kW savings/home (+13%)
Capital Cost Charge, Participant	$1,380	$543,846	$166	$65,404	0.5% cost of capital
Recovery of Capital Investment	$5,558	$2,190,039	$6,004	$2,365,576	Average investment (+8%)
Utility Retrofit Investment	$(5,558)	$(2,190,039)	$(6,004)	$(2,365,576)	Average investment (+8%)
Utility Cost of Capital (CFC Fee)	$(177)	$(69,738)	$(166)	$(65,404)	0.5%, 10 years, all projects
Program Operation Cost					
Direct Upgrade Fees	$(491)	$(193,454)	$(510)	$(200,940)	Program operator cost (+4%)
Unconverted Offers Fees	$(287)	$(113,078)	$(128)	$(50,432)	Unconverted offers (-46%)
Internal Costs	$(1,872)	$(737,568)	$(1,044)	$(411,336)	Labor utilization (-44%)
Total Cash Flow	$1,898	$747,938	$3,269	$1,287,986	
NPV	**$1,387**	**$546,478**	**$2,402**	**$946,388**	
IRR	**6.29%**		**7.50%**		

**CFC Fee prorated to amount of RESP funds invested; Savings are evaluated at a 1.79 % 20-year U.S. Treasury bill discount rate and assume both wholesale and retail rate escalation at 2 % per the Energy Information Administration.*

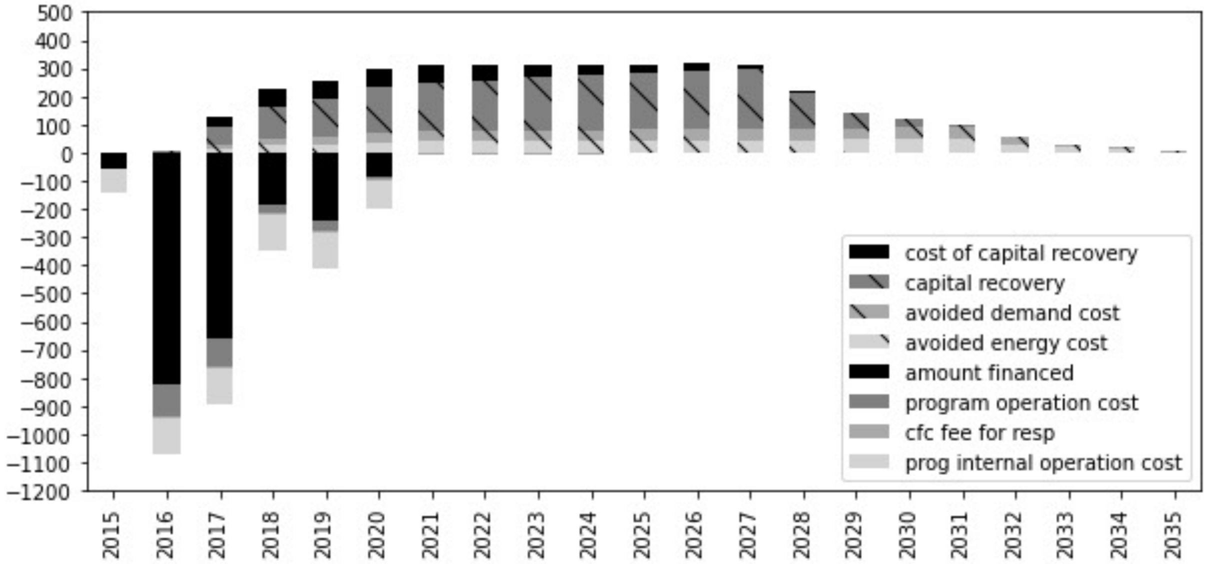

Figure 7. Historical and Projected Cash Flow for HELP PAYS Portfolio, n=394.

Conclusions

This study represents only the second published peer-reviewed value proposition for the utility and its governing body. This analysis verifies that Ouachita Electric Cooperative Corporation's HELP PAYS program implemented by EEtility substantially cuts the electricity use and peak electricity demand of participating households. Over 400 cooperative member-owners who would not have sought an energy efficiency upgrade – or been able to pay for one – received cost-effective whole home energy upgrades with no upfront cost. OECC has invested $3,137,024, reaching 396 single family homes, and 10 commercial facilities representing 6 % of all customers. During the same period, member-owners presented with a PAYS offer have accepted 63 % of the time (90 % of the time when offers are no-cost), and OECC has recovered 100 % of its investments.

Considering residential upgrades that got weatherization and/or HVAC upgrades and that did not also receive solar photovoltaics upgrades, OECC will recover not only its initial investment in the residential upgrades and its program operation costs, over the lifetime of the measures, but it will also generate positive cash flows with a net present value of $546,478 ($1,387/home). This value represents only a portion of the total program value to the utility because it will receive additional savings from the commercial upgrades and from local transmission & distribution benefits that were not quantified in this analysis. Thus, even without fully quantifying all benefits streams, this analysis shows that OECC's HELP PAYS investment portfolio is generating substantial economic benefits for the utility.

Program energy savings and peak load reduction results improved by 42 % and 13 % respectively during the second half of the program period (the OptiMiser Period). These improvements combined with an increased offer acceptance rate (80 % vs 63 %), and a higher program volume that distribute fixed internal costs distributed over a greater volume of upgrades completed in a shorter period would increase the average value of each participating home by over 70 % to $2,402/home. Producing the historical volume of upgrades in a single year would produce nearly $1.3M in cash flow over the lifetime of the measures with a net present value nearly $1M.

The improved energy and demand savings results followed a suite of reforms by the program operator including transition to using the extensively field-tested OptiMiser energy estimation software system, use of in-house expert staff to conduct the energy estimation, removal of the installation contractor from data gathering and energy estimation process, and institution of rigorous post upgraded quality control and assurance procedures.

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